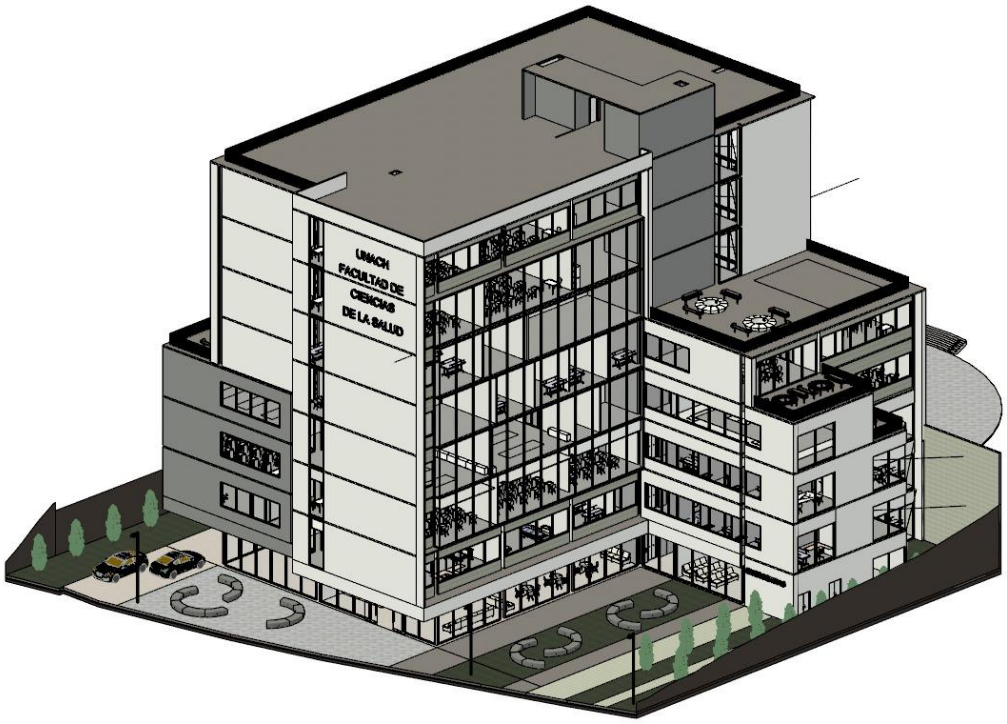
MEMORIA DE CÁLCULO

INGENIERÍA ESTRUCTURAL



EDIFICIO DE LA FACULTAD DE CIENCIAS DE LA SALUD

ELABORADO POR

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JUNIO DE 2024

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DISEÑO ESTRUCTURAL

EDIFICIO DE LA FACULTAD DE CIENCIAS DE LA SALUD

1. INTRODUCCIÓN

En la presente sinopsis se detalla el procedimiento de análisis estructural, desarrollado como parte de la "*CONSULTORIA PARA LOS ESTUDIOS DEFINITIVOS DE LA CONSTRUCCION DEL EDIFICIO DE LA FACULTAD DE CIENCIAS DE LA SALUD DE LA UNACH CAMPUS EDISON RIERA Y DEL EDIFICIO ADMINISTRATIVO Y POSGRADO DE LA UNACH CAMPUS DOLOROSA, AÑO 2023*", particularmente del Edificio Administrativo y Posgrado ubicado la ciudad de Riobamba, provincia de Chimborazo.

La estructura tiene las siguientes características:

1.1. GEOMETRÍA:

La estructura está constituida por: 8 niveles destinados laboratorios y aulas de la facultad de ciencias de la salud; las dimensiones aproximadas en planta son de 43.97 m x 40.20 m y una altura máxima que incluye la cubierta de 32.00 m.

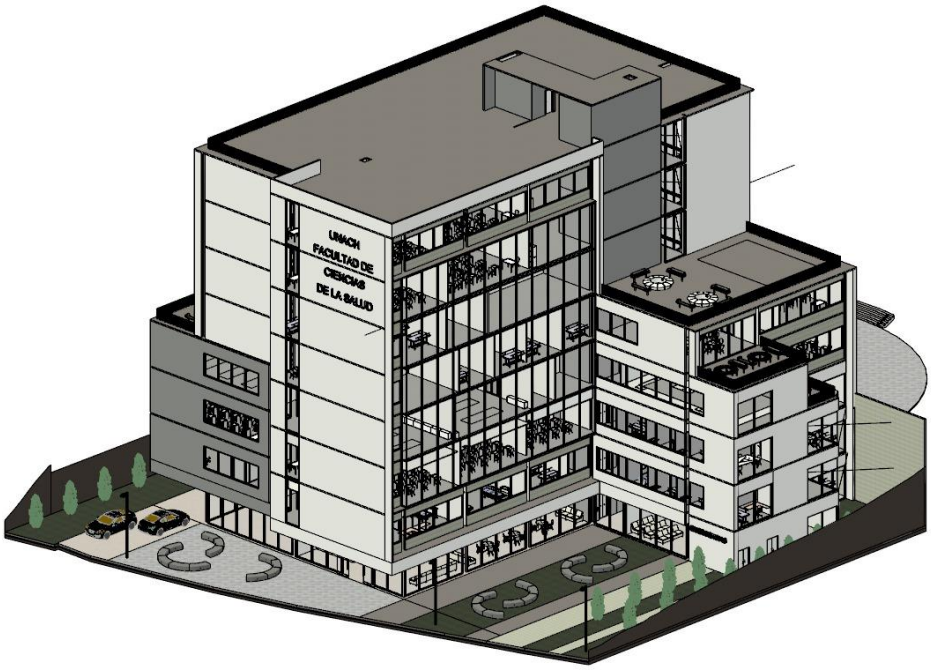


Ilustración 1. Modelo General

2. ASPECTOS DEL DISEÑO ESTRUCTURAL

2.1. SUBESTRUCTURA

La subestructura está conformada por zapatas aisladas y zapatas corridas, diseñada tomando en cuenta las conclusiones y recomendaciones del Estudio de Suelos realizado por el Ing. Alfonso Fernández, SISMOTERRA, con fecha mayo 2024.

- Perfil de suelo especificado en el estudio de suelos corresponde al tipo "C". Según NEC-SE-DS-2015.
- Zona sísmica V, Z=0.40g.
- Fa=1.20, Fd=1.30, Fs=1.30; NEC-SE-DS-2015, Capitulo 3.2.2, Tablas 3, 4, 5.

2.2. SUPERESTRUCTURA

Se establece la filosofía de diseño estructural del ANSI/AISC 360-10 y sus previsiones sísmicas ANSI/AISC 341-16, las cuales son: Limitar los daños, mantener la función a la estructura, prever una fácil reparación y comportamiento dúctil ante el sismo de diseño, una estructura que cumple la evaluación **LRFD** de estados límites de servicio (derivas, deflexiones y vibraciones) y estados límites de resistencia.

El diseño de elementos metálicos del edificio se realizó por el método de factores de carga LRFD, se utiliza el manual vigente de diseño de Edificios de Acero ANSI/AISC 360-10 y Provisiones Sísmicas para Edificios de Acero ANSI/AISC 341-16.

Las secciones de los elementos estructurales principales: vigas y columnas metálicas se modelarán como secciones de alta ductilidad y resistencia, material de baja aleación ASTM A572 Grado 50, elementos capaces de desarrollar esfuerzos plásticos, propiedades de sección según tabla D1.1 (ANSI/AISC 341-16).

El sistema estructural resistente que se utilizó para modelar la estructura es del tipo sistema dual Steel Special Moment Frame - Concentrically Braced Frame (SCBF), descrito en el capítulo F2, ANSI/AISC 341-16. Para este sistema estructural, el pórtico a momento debe ser capaz de resistir al menos el 25% de las fuerzas sísmicas de diseño, de tal forma que la combinación de los pórticos a momento y los pórticos arriostrados, sean capaces de resistir toda la fuerza sísmica con secciones de perfiles de alta ductilidad, para combinaciones de cargas según ASCE/SEI 7-10, capítulo 2, 2.3.2. (BASIC COMBINATIONS).

El diseño de vigas de acero se realizó según los capítulos E, F, G, H. (DESIGN FOR FLEXURE – AISC 360-16 LRFD), se considera (LTB) lateral torsional Buckling y el desarrollo de momento plástico $\Phi M_n = ZF_y$ y la aplicación de las ecuaciones de interacción: (H1-1a, H1-1b). Para las secciones compuestas según el capítulo J (DESIGN OF COMPOSITE MEMBERS – AISC 360-16 LRFD).
El diseño de columnas de acero tipo cajón (con relleno) se realizó según el capítulo I del ANSI/AISC 360-16, relacionado con los literales de tubos rellenos de hormigón (CFT), y los requerimientos de diseño del ANSI/AISC 341-16 para secciones compuestas de alta ductilidad.

La provisión sísmica, AISC 341-16 Sección D Tabla D.1.1 para las relaciones límites de ductilidad para secciones sísmicas de alta ductilidad:

Secciones	Altamente dúctiles	
Elementos de pared rectangular rellena	$1.48\sqrt{\frac{E}{R_yF_y}}$	
Alas de perfil tipo i	$0.32\sqrt{\frac{E}{R_yF_y}}$	
Almas de perfil tipo i en flexión o flexión y axial usadas como columnas.	$C_a \le 0.114$ $2.57\sqrt{\frac{E}{R_yF_y}}(1-1.04C_a)$	$C_a > 0.114$ $0.88\sqrt{\frac{E}{R_yF_y}}(2.68-C_a) \ge 1.57\sqrt{\frac{E}{R_yF_y}}$

Tabla 1. Esbeltez local

Se asume empotramiento perfecto en pie de columnas, restricción de los 6 grados de libertad en traslación (x, y, z) y rotación (θx, θy, θz). Se utilizó conexiones apernadas de momento, capaces de mantener el ángulo de rotación entre miembros de intersección a menos de 0.04 radianes deformación inelástica; como se describe en las Especificaciones AISC 341-16 (Welded Unreinforced Flange-Welded Web (WUF-W) (Moment Connection) y capitulo 9.2 (Seismic provision for structural steel).

El sistema de losa que se utilizó se compone de envigados secundarios que sustentan placas colaborantes steel deck con apuntalamiento temporal, espesor (0.75mm) de 50 mm de peralte y

malla de acero de refuerzo para momento negativo y temperatura fundidos con hormigón simple de relleno; para garantizar la conexión de losa y envigados metálicos de piso, se utilizará conectores de corte tipo, calculados para generar sección compuesta del sistema de losa posterior al fraguado final de la misma.

3. ASPECTOS DE LA MODELACIÓN

Para la modelación tridimensional de la estructura se utilizó el programa de diseño estructural por elementos finitos ETABS 20.3.0, a los cuales, se ingresaron parámetros de diseño según los códigos enlistados a continuación en el numeral 4.

Se realizó un modelo matemático de la estructura donde se incluyó la distribución espacial de rigideces y masas de todo el sistema estructural resistente, con la finalidad de representar de la manera más aproximada la estructura que se va a estudiar por el método de elementos finitos.

3.1. EL ANÁLISIS DINÁMICO ESPECTRAL, se realizó considerando lo siguiente:

Para cada sentido de análisis, se considerará el número de modos de vibratorios que abarquen como mínimo un 90% de la masa participante de la estructura.

La superposición modal espectral, se realizó mediante el método CQC (combinación cuadrática completa), con una razón de amortiguamiento uniforme para todos los modos de vibrar del 5%.

Para la reducción de respuesta elástica de los parámetros de diseño, se aplicará el capítulo 6.2.2 del código NEC-SE-DS-2015. (Procedimientos no lineales de cálculo de las fuerzas sísmicas), el cual estipula que la reducción del cortante basal dinámico debe ser con respecto al corte basal de diseño estático.

En la determinación de torsión accidental en planta se aplicará lo estipulado en capítulo 6.3.6 del código NEC-SE-DS-2015.

Finalmente, de obtenerse una estructura acoplada, esto es, si el corte basal indirecto es superior al 20% del corte directo, los valores de diseño considerarán como efecto sísmico, el 100% del efecto de la dirección de análisis más el 30% del efecto de la otra dirección (combinación 100+30) según el capítulo 3.5 del código NEC-SE-DS-2015.

Para realizar el análisis modal de la estructura se consideraron las siguientes masas: Masa propia correspondiente a los elementos estructurales modelados efectivamente dentro del programa (vigas, columnas y muros).

Masa muerta correspondiente en cada nivel: losas compuestas, paredes divisorias, acabados, instalaciones.

Por lo tanto, la masa sísmica de la estructura utilizada para el cálculo de los modos de vibración corresponde a:

$M_{(traslacional)}$ = (Masa propia + Masa muerta)
$M_{(rotacional)} = M_{(traslacional)} (Ix + I_y) / A$

Para el análisis se consideró que en cada nivel donde existía losa ésta se comportaba como un diafragma infinitamente rígido para los movimientos en sus planos (traslaciones X, Y y rotación alrededor al eje Z), e infinitamente flexible para los movimientos fuera de él.
Se utilizó la fórmula de superposición modal espectral, se hará mediante el método CQC (combinación cuadrática completa), con una razón del 5% amortiguamiento uniforme para todos los modos de vibrar.

3.2. PARA EL ANÁLISIS ESTÁTICO, se consideró lo siguiente:

Diseño basado en fuerzas DBF según el capítulo 6.3 NEC-SE-DS-2015.
El cortante basal de diseño se calculará según el capítulo 6.3.2 NEC-SE-DS-2015.
Las cargas horizontales sísmicas producto del análisis por el método de fuerza sísmica equivalente fueron distribuidas en cada piso y en toda la altura de la estructura.
Se considerará torsión accidental al desplazar el punto de aplicación de carga lateral o centro de masas desplazado en cada estación y generar una excentricidad de por lo menos el 5% respecto del centro de rigideces.

4. CÓDIGOS DE DISEÑO:

Los diseños y detalles se harán en conformidad con los códigos que se detallan a continuación:

- **NEC-SE:** Norma Ecuatoriana de la Construcción:
  - NEC-SE-AC: Estructuras de Acero.
  - NEC-SE-DS: Peligro Sísmico Diseño Sismo Resistente.
- **ASCE/SEI:** American Society of Civil Engineers:
  - ASCE/SEI 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- **AISC:** American National Standard:
  - AISC 341-16: Seismic Provisions for Structural Steel Buildings.
  - AISC 358-16: Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.
  - AISC 360-16: Specification for Structural Steel Buildings.

- **ACI:** American Concrete Institute:
  - ACI 318-19: Building Code Requirements for Structural Concrete.
- **AWS:** American Welding Society
  - AWS D1.1: Structural Welding Code.
- **ASTM:** American Society for Testing and Materials

5. DETERMINACIÓN DE PARAMETROS ESPECTRALES Y ESPECTRO DE RESPUESTA.

5.1. PARÁMETROS DEL ESPECTRO DE DISEÑO:

Aceleración máxima efectiva en roca esperada para el sismo de diseño Z

Z= 0.40g, (Tabla 1, Fig.1→ NEC-2015).

Perfil de Suelo
Tipo C, según (Tabla 2 → NEC-2015, Part.3.2)

Coeficientes de amplificación dinámica del perfil de suelo F_a, F_v y F_s.
(Tablas 3, 4, 5 → NEC-2015, Part.3.2.2)

F_a=1.20 (períodos cortos)
F_d=1.11 (períodos intermedios)
F_s=1.11 (comportamiento inelástico del suelo)

Coeficiente de configuración estructural en elevación Φ_E = 0.90 (Tabla 14) → NEC-2015, Part.5.3.3).

Coeficiente de configuración estructural en planta Φ_P = 0.90 (Tabla 13) → NEC-2015, Part.5.3.3).

Factor de importancia: tipo de uso, destino e importancia I

I = 1.30, (Tabla 6 → NEC-2015, Part.4.1)

Coeficiente de reducción de respuesta estructural R

R=7.0 (Tabla 13 → NEC-2016, Part.6.3.4). SISTEMAS DUALES. Pórticos de acero laminado en caliente con diagonales rigidizadoras (excéntricas o concéntricas) o con muros estructurales de hormigón armado.

R=7.0 (Tabla 12.2.1 → ASCE 7-22, ANSI/AISC 341-16) SISTEMAS DUALES. Steel Special Concentrically braced frames (SCBF).

R=7.0 (Adoptado).

5.2. CURVAS DEL ESPECTRO ELÁSTICO DE DISEÑO NEC-2015

$$S_a = \eta Z F_a \qquad \text{para } 0 \le T \le T_C$$

$$S_a = \eta Z F_a \left(\frac{T_c}{T}\right)^r \qquad \text{para } T > T_C$$

$$T_C = 0.55\ Fs \left(\frac{Fd}{Fa}\right)$$

$$T_L = 2.4\ Fd$$

$$T = C_t\ h_n{}^{\alpha}$$

T_c= 0.55(1.11)(1.11)/(1.20)
T_c= 0.565 s

5.3. DETERMINACIÓN DEL PERÍODO DE VIBRACIÓN (NEC-2016, PART.6.3.3)

Método 1

Para pórticos de acero con arriostramiento:

$T= 0.073\ h_n{}^{0.75}$
$T= 0.073(32.00)^{0.75}$= 0.98 s.
Tmax= 1.3*T= 1.278 s.

Método 2

T≈ 0.651 s (Análisis Modal Espectral)
$T_{máx}$=0.99 s → NEC-2016, Part.6.3.3

T(0.651) > T_c(0.565)

$$\text{PARA} \quad T \ge Tc$$

$$Sa = \eta * Z * \left(\frac{Tc}{T}\right)^r$$

S_a= 2.48 (0.40g) $(0.565/0.99)^1$
S_a= 0.679 g/s

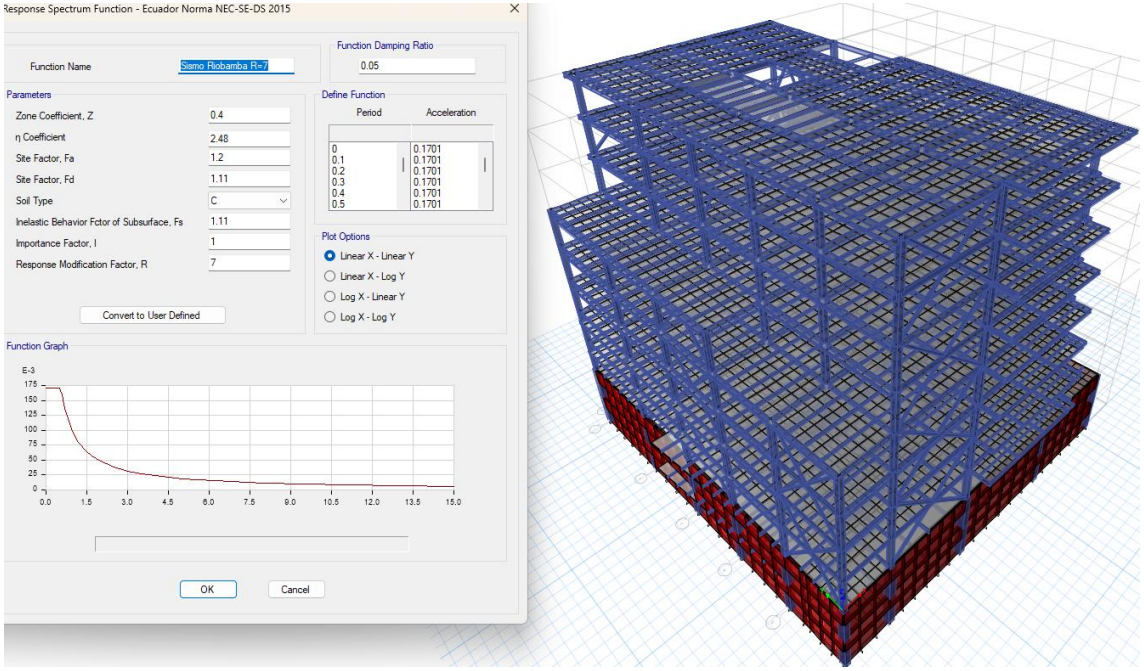


Figura N.02.- Espectro de Respuesta Inelástica NEC-SE-DS 2015.

Según el capítulo 4.3.2 del (NEC-SE-DS-2016, Tabla 09, Niveles de amenaza sísmica) define al sismo de diseño nivel 3, que tiene una probabilidad del 10% de ser excedido en 50 años, equivalente a un período de retorno de 475 años, determinado bien a partir de un análisis de la peligrosidad sísmica del sitio de emplazamiento de la estructura (PSHA), o a partir de un mapa de peligro sísmico.

Los parámetros de respuesta elástica pueden ser reducidos de acuerdo con el capítulo 6.2.2 (NEC-SE-DS-2016), para propósitos de diseño con el limitante de que en ningún caso podrán reducirse los parámetros de respuesta dinámicos elásticos a valores menores que el 80% del cortante basal obtenido por el método estático para estructuras regulares y no menor al 90% para estructuras irregulares.

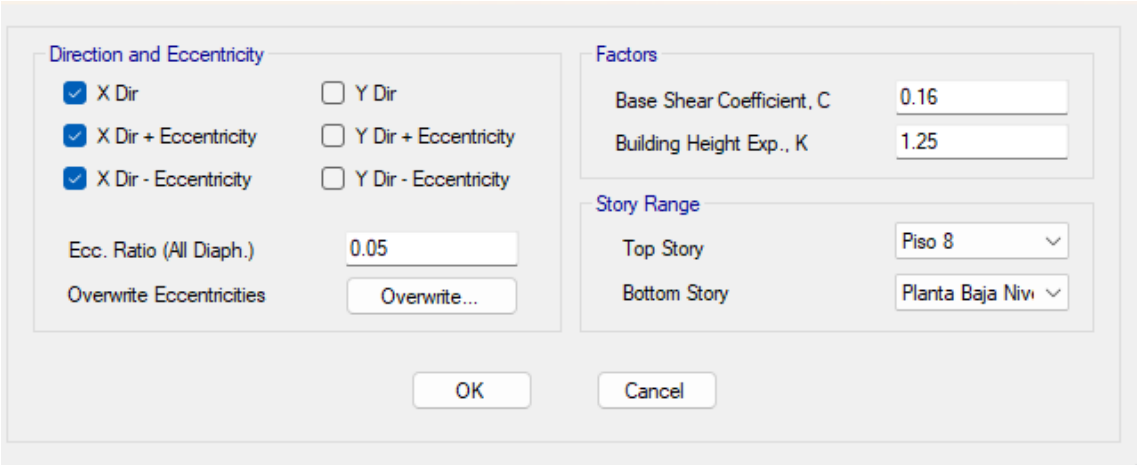
6. CÁLCULO DEL CORTE BASAL ESTÁTICO:

$$V = \frac{I * Sa}{R * \phi p * \phi e} * W$$

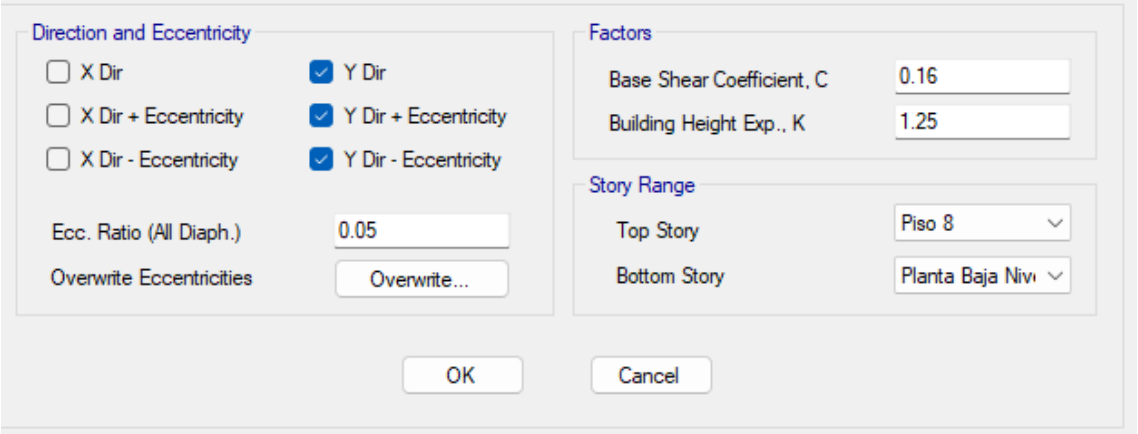
R=7.00 (ASCE 7-16, Dual System. Steel Special Concentrically Braced Frames).

$$V = \frac{(1.30)(0.679)}{(7.00)(0.90)(0.90)}$$

V= 0.1557 W



Coeficiente Cortante Basal Estático en X



Coeficiente Cortante Basal Estático en Y

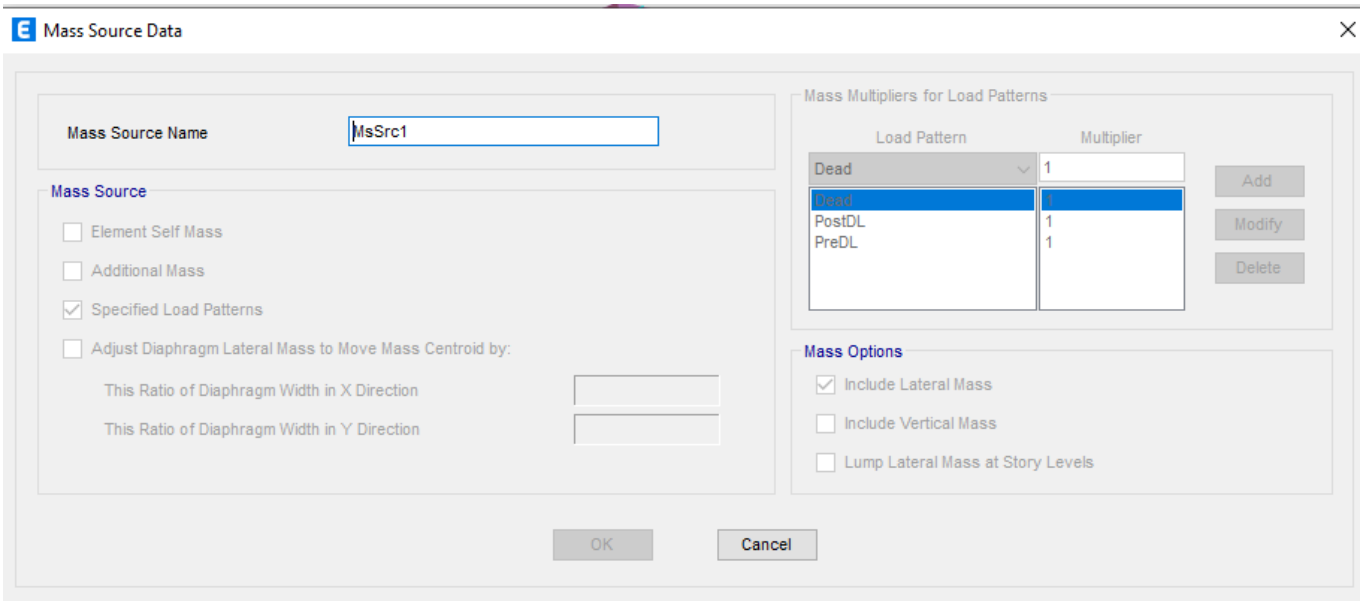
Componente vertical del sismo de diseño NEC-2015:

$$F_{ver} = \frac{2}{3} I\,(\eta\, Z\, F_a)\, W_p$$

F_{ver}= 2/3(1.3)(2.48*0.40*1.2)

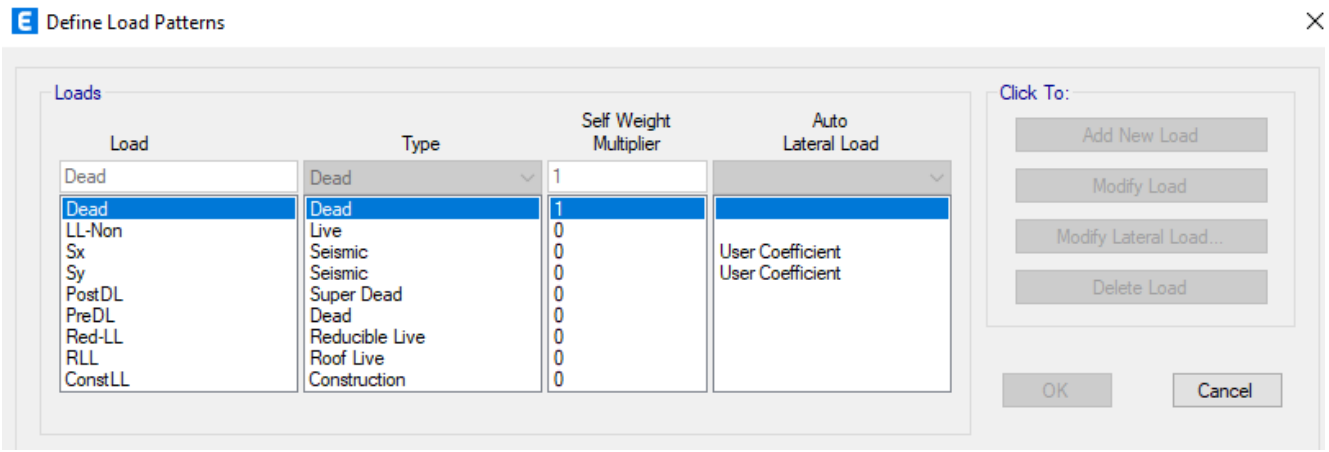
F_{ver}= 1.031 W_p

7. MASA REACTIVA:



Masa Reactiva Total

8. PATRONES DE CARGA:



Definición de los Patrones de carga

9. CARGAS VERTICALES:

ALMACEN LIGERO

Uniform Load Set Name: ALMACEN LIGERO

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
LL-Non	4.707
PostDL	2.256
ConstLL	0.686

AULAS ASIENTOS

Uniform Load Set Name: AULAS ASIENTOS

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
Red-LL	1.961

AULAS SIN ASIENTOS

Uniform Load Set Name: AULAS SIN ASIENTOS

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.746
ConstLL	0.686
Red-LL	3.923

COMEDOR

Uniform Load Set Name: COMEDOR

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.452
ConstLL	0.686
LL-Non	4.707

CORREDOR 1ERPISO

Uniform Load Set Name: CORREDOR 1ERPISO

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
LL-Non	4.707

LOBBY

Uniform Load Set Name: LOBBY

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	1.961
ConstLL	0.686
LL-Non	4.707

OFICINA

Uniform Load Set Name: OFICINA

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
Red-LL	2.354

PARQUEADERO

Uniform Load Set Name: PARQUEADERO

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	1.961
ConstLL	0.686
Red-LL	1.961

PLAZA ACCESO

Uniform Load Set Name: PLAZA ACCESO

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.452
ConstLL	0.686
LL-Non	4.707

SALA OP, LABORATORIO NOMAM

Uniform Load Set Name: SALA OP, LABOF

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
Red-LL	2.942

SALA RECUPERACION NOMAM

Uniform Load Set Name: SALA RECUPERA

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
Red-LL	1.961

TAPAGRADAS

Uniform Load Set Name: TAPAGRADAS

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	0.49
ConstLL	0.686
Red-LL	0.981

TECHO

Uniform Load Set Name: TECHO

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	1.961
ConstLL	0.686
RLL	2.942

TERRAZA ACCESIBLE

Uniform Load Set Name: TERRAZA ACCESI

Load Set Loads

Load Pattern	Load Value (kN/m²)
PreDL	0.49
PostDL	2.256
ConstLL	0.686
RLL	4.707

El peso propio de la estructura (vigas, columnas y Steel deck), son calculados automáticamente por el programa en la opción **Define Load Patterns (Peso propio= 1)**

10. FACTORES Y COMBINACIONES DE CARGA:

ANSI/AISC 360-10, 341-16. Método de diseño LRFD.

DSTL1: 1.4PP + 1.4CM
DSTL2: 1.2PP + 1.2CM + 1.6CV
DSTL3: 1.2PP + 1.2CM + 1.0CV + 1.0Vx
DSTL4: 1.2PP + 1.2CM + 1.0CV - 1.0Vx
DSTL5: 1.2PP + 1.2CM + 1.0CV + 1.0Vy
DSTL6: 1.2PP + 1.2CM + 1.0CV - 1.0Vy
DSTL7: 0.9PP + 0.9CM + 1.0Vx
DSTL8: 0.9PP + 0.9CM - 1.0Vx
DSTL9: 0.9PP + 0.9CM + 1.0Vy
DSTL10: 0.9PP + 0.9CM - 1.0Vy

ACI 318-14. Diseño hormigón armado última resistencia.

DCON1: 1.4PP + 1.4CM
DCON2: 1.2PP + 1.2CM + 1.6CV
DCON3: 1.2PP + 1.2CM + 1.0CV + 1.0Vx
DCON4: 1.2PP + 1.2CM + 1.0CV - 1.0Vx
DCON5: 1.2PP + 1.2CM + 1.0CV + 1.0Vy
DCON6: 1.2PP + 1.2CM + 1.0CV - 1.0Vy
DCON7: 0.9PP + 0.9CM + 1.0Vx
DCON8: 0.9PP + 0.9CM - 1.0Vx
DCON9: 0.9PP + 0.9CM + 1.0Vy
DCON10: 0.9PP + 0.9CM - 1.0Vy

11. LÍMITES DE DEFLEXIONES:

Elementos cargados por carga viva: L/360 → (ASCE- SEI 7-16)

Elementos de piso cargados por carga viva más carga muerta: L/240 → (ASCE- SEI 7-16)

12. DERIVAS DE PISO ADMISIBLES:

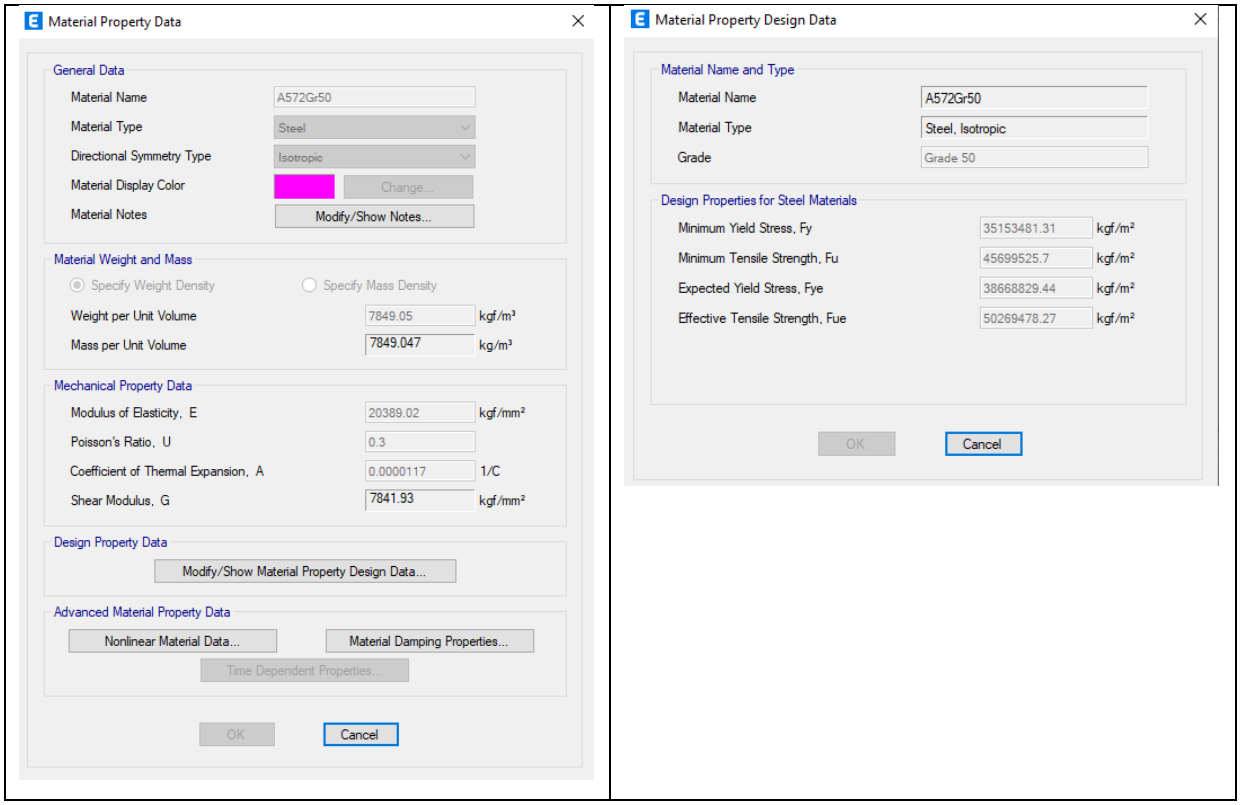
$\Delta_{máx}=0.75R\Delta_E$ → Ecuación 2-29; (NEC-SE-DS, 2016)

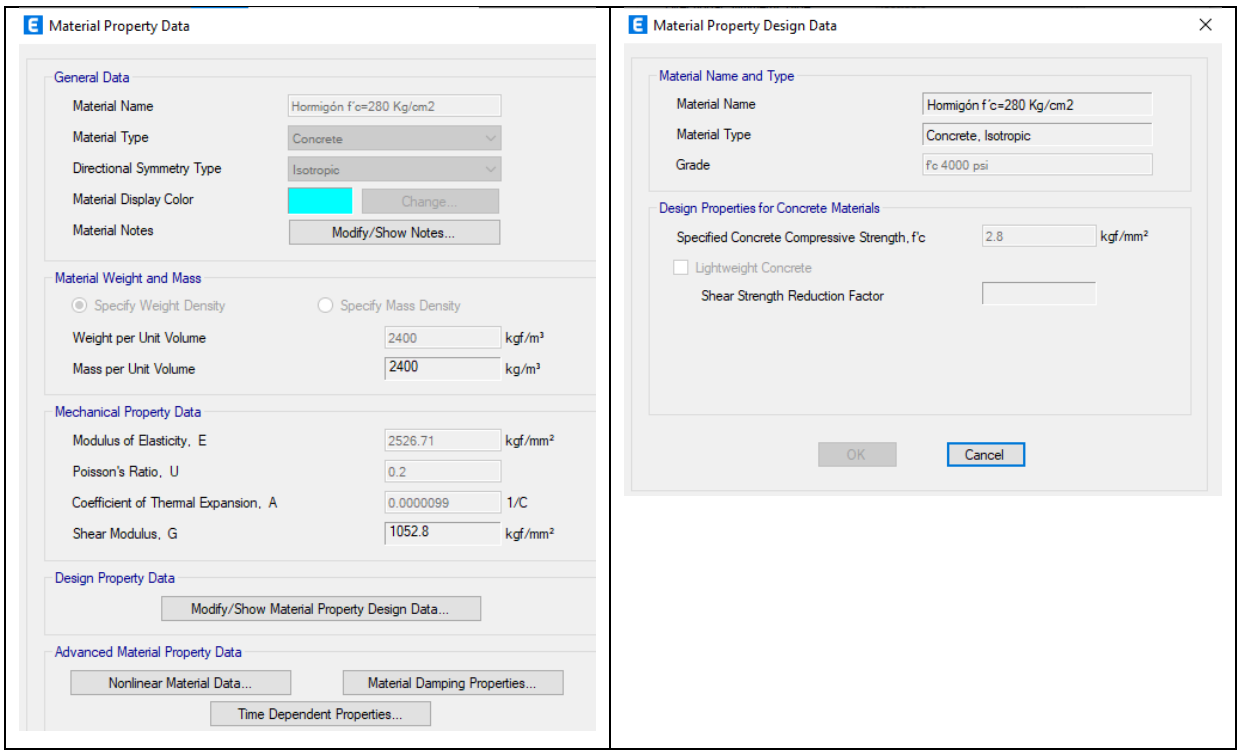
13. MATERIALES:

- Columnas y vigas metálicas principales (built up) con material ASTM A572 G50.
- Vigas secundarias metálicas (built up) con material ASTM A572 G50.
- Placas de momento y corte, material ASTM A572 G50
- Pernos de anclaje de material F1554 Gr. 36
- Steel deck calibre22, G90.
- Conectores de corte tipo stud.
- Malla electrosoldada para losas 1Φ6mm@0.10m, INEN 2209, Fy=420MPa.
- Acero de refuerzo. ASTM A-615 Grado 60, F_y= 420MPa
- Resistencia del Hormigón a los 28 días; mínimo 28MPa losa de cimentación.
- Resistencia del Hormigón a los 28 días; mínimo 24MPa losa de piso.

Propiedades mecánicas asignadas en el programa ETABS:

- **Estructura metálica:**





14. RESULTADOS:

14.1. MODELO CON SECCIONES.

Frame Section Property Definitions - Summary

File Edit Format-Filter-Sort Select Options

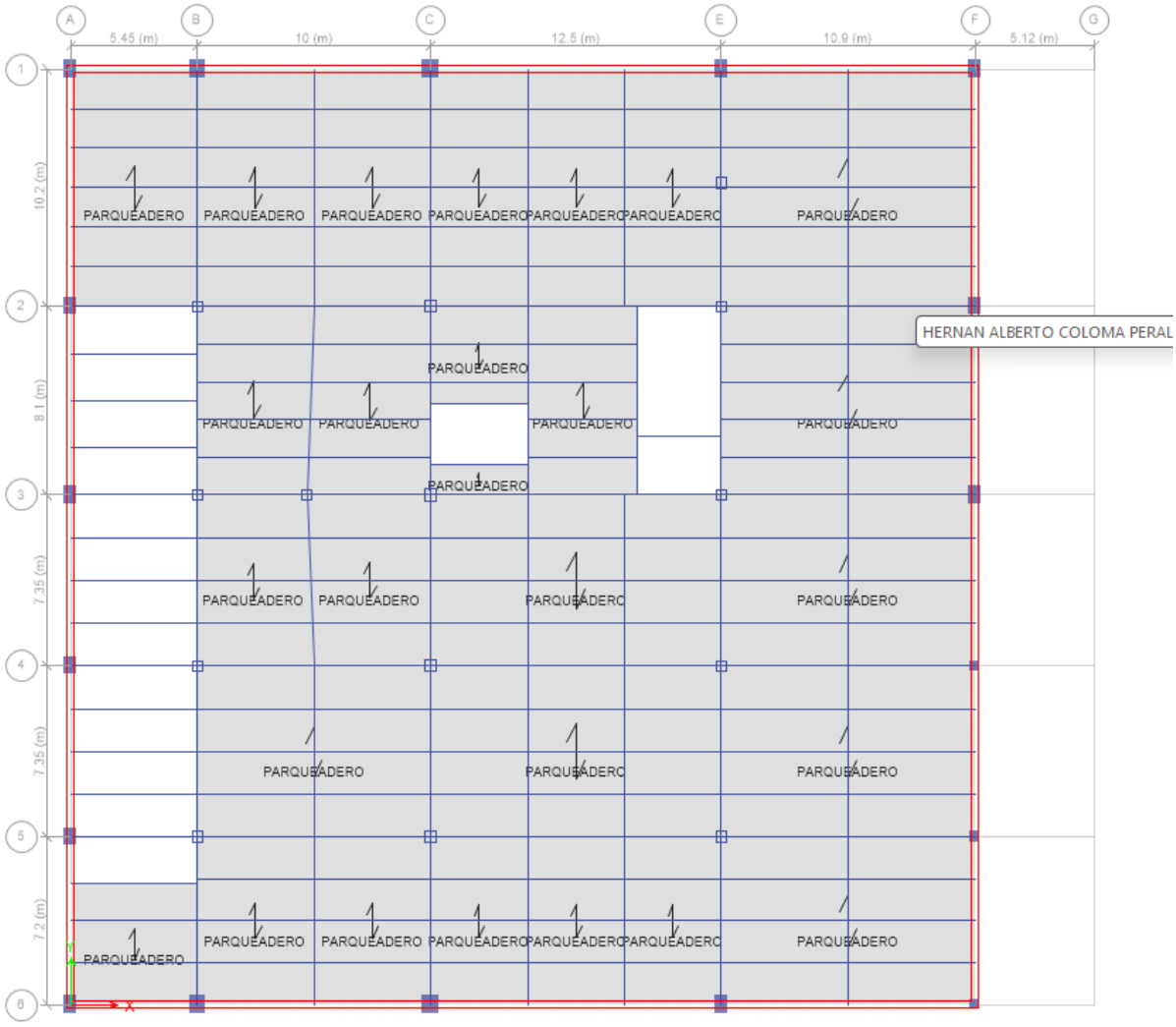
Units: As Noted Hidden Columns: No Sort: None
Filter: None

Frame Section Property Definitions - Summary

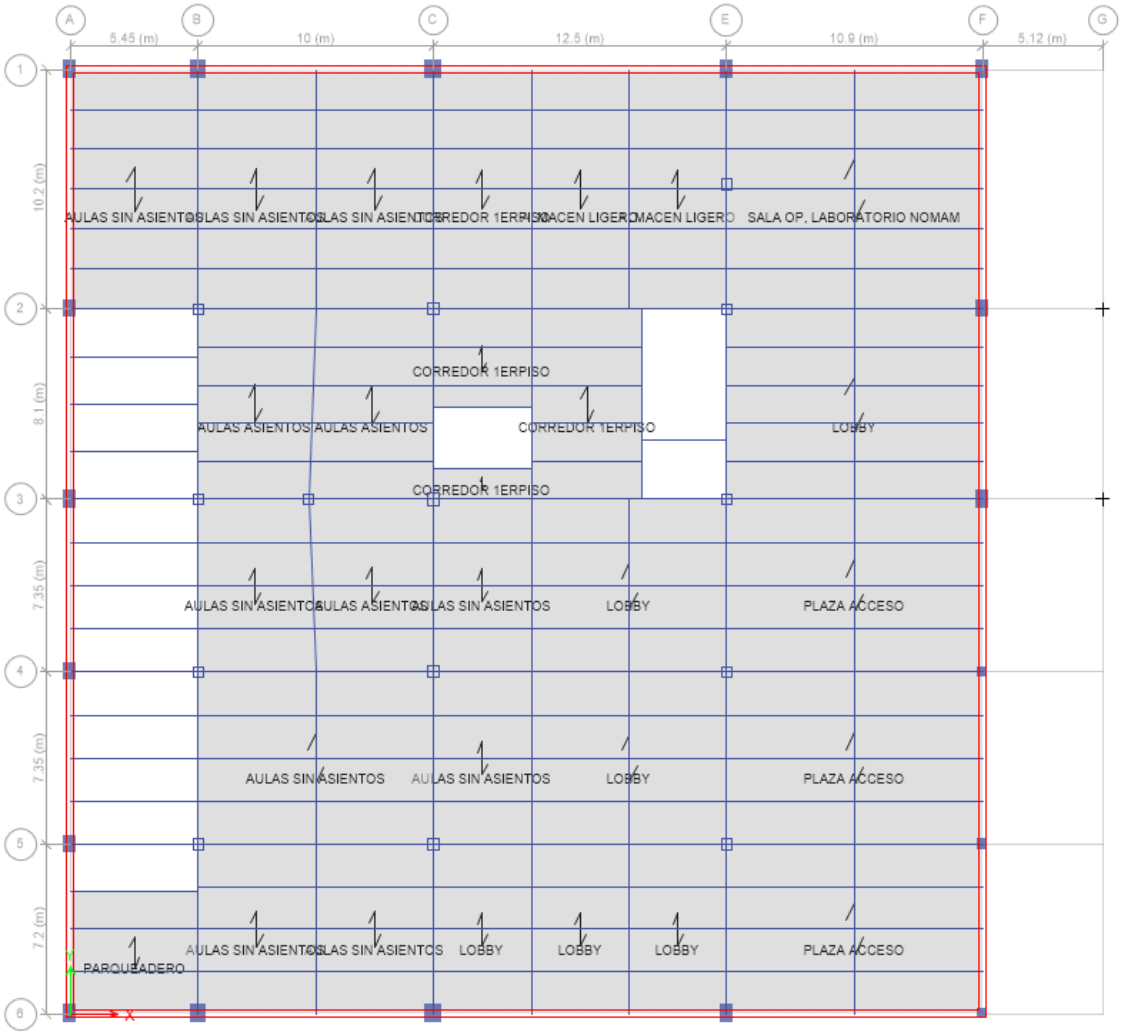
Name	Material	Shape	Color	Area cm²	J cm⁴	I33 cm⁴	I22 cm⁴	As2 cm²	As3 cm²	S33Pos cm³	S33Neg cm³	S22Pos cm³	S22Neg cm³	Z33 cm³	Z22 cm³	R33 mm	R22 mm
COL 45X45 14FI14	f'c 240 kg/cm2	Concrete Rectangular	Magenta	2025	577504.7	341718.8	341718.8	1687.5	1687.5	15187.5	15187.5	15187.5	15187.5	22781.3	22781.3	129.9	129.9
COL 75x55 16FI18	f'c 240 kg/cm2	Concrete Rectangular	Yellow	4125	2284055.9	1039843.8	1933593.8	3437.5	3437.5	37812.5	37812.5	51562.5	51562.5	56718.8	77343.8	158.8	216.5
COL 75X55 22FI20	f'c 240 kg/cm2	Concrete Rectangular	Green	4125	2284055.9	1039843.8	1933593.8	3437.5	3437.5	37812.5	37812.5	51562.5	51562.5	56718.8	77343.8	158.8	216.5
COL 75X70 26FI22	f'c 240 kg/cm2	Concrete Rectangular	Cyan	5250	3851743.3	2143750	2460937.5	4375	4375	61250	61250	65625	65625	91875	98437.5	202.1	216.5
COL K450*15	A572Gr50	Filled Steel Tube	Gray8Dark	463.4	187536.6	112161.8	112161.8	329.5	329.5	4985	4985	4985	4985	6384.3	6384.3	155.6	155.6
COL K450*20	A572Gr50	Filled Steel Tube	Blue	536.9	220665.2	133255.9	133255.9	368.7	368.7	5922.5	5922.5	5922.5	5922.5	7527.9	7527.9	157.5	157.5
COL K500*15	A572Gr50	Filled Steel Tube	Gray8Dark	544.4	270038.7	160848.1	160848.1	392.8	392.8	6433.9	6433.9	6433.9	6433.9	8272.2	8272.2	171.9	171.9
COL K500*20	A572Gr50	Filled Steel Tube	Yellow	626.8	316517.4	190521.1	190521.1	434.3	434.3	7620.8	7620.8	7620.8	7620.8	9707.9	9707.9	174.3	174.3
HI200-4-4*100	A572Gr50	Steel IWide Flange	Blue	15.7	0.8	1004.4	66.8	7.8	7.2	100.4	100.4	13.4	13.4	115.3	20.8	80	20.6
HI250-4-5*120	A572Gr50	Steel IWide Flange	Gray8Dark	21.2	1.5	2062.6	144.1	9.6	10.8	171.9	171.9	24	24	193.9	36.9	98.6	26.1
HI300-4-5*120	A572Gr50	Steel IWide Flange	Yellow	23.6	1.6	3424	144.2	11.8	10.8	228.3	228.3	24	24	261.1	37.2	120.5	24.7
K160*10 R	A572Gr50	Steel Tube	Red	60	3375	2260	2260	31.2	31.2	282.5	282.5	282.5	282.5	338	338	61.4	61.4
K180*12 R	A572Gr50	Steel Tube	Magenta	80.6	5690	3812.7	3812.7	42.1	42.1	423.6	423.6	423.6	423.6	508.9	508.9	68.8	68.8
K200*12 R	A572Gr50	Steel Tube	Cyan	90.2	7973.6	5337.4	5337.4	46.4	46.4	533.7	533.7	533.7	533.7	637.1	637.1	76.9	76.9
K220*15 R	A572Gr50	Steel Tube	Red	123	12922.7	8661.2	8661.3	64.3	64.3	787.4	787.4	787.4	787.4	947.3	947.3	83.9	83.9
VP HI 450-8-12*150	A572Gr50	Steel IWide Flange	Blue	70.1	24.8	22424.2	676.8	35.6	34.8	996.6	996.6	90.2	90.2	1151.4	141.8	178.9	31.1
VP HI 500-15-12*170 R	A572Gr50	Steel IWide Flange	Green	112.2	74.5	37776.9	996	72.4	43.6	1511.1	1511.1	117.2	117.2	1845.2	200.2	183.5	29.8
VP HI 500-15-15*180 R	A572Gr50	Steel IWide Flange	Cyan	124.5	95.1	44743.4	1471.2	73	55.9	1789.7	1789.7	163.5	163.5	2137.9	269.4	189.6	34.4
VP HI 500-8-15*200	A572Gr50	Steel IWide Flange	Magenta	97.6	53.3	42216.5	2002	39.9	53.9	1688.7	1688.7	200.2	200.2	1896.8	307.5	208	45.3
VP HI 500-8-20*250	A572Gr50	Steel IWide Flange	Yellow	136.8	141.5	64122.4	5210.3	39.6	89.4	2564.9	2564.9	416.8	416.8	2823.2	632.4	216.5	61.7
VP HI-600-10-20*250	A572Gr50	Steel IWide Flange	Red	156	152.7	98768	5213	59.7	89.8	3292.3	3292.3	417	417	3684	639	251.6	57.8
VP HI-600-10-25*250	A572Gr50	Steel IWide Flange	Gray8Dark	180	279.6	117250	6515	60.5	112	3908.3	3908.3	521.2	521.2	4350	795	255.2	60.2
VPS HI 500-5-15*200	A572Gr50	Steel IWide Flange	Cyan	93.3	77.8	44340.6	2333.8	25	62.5	1616.4	1964.7	233.4	233.4	1910.3	352.9	218.1	50
VPS HI 500-5-20*220	A572Gr50	Steel IWide Flange	Blue	110.9	131.6	54512.5	3241.8	25.2	79.2	2185.8	2175.3	294.7	294.7	2369.8	464.9	221.7	54.1
VPS HI300-4-12*170	A572Gr50	Steel IWide Flange	Green	51.8	20.2	9166	982.7	11.9	36.4	611.1	611.1	115.6	115.6	663.7	174.5	133	43.5
VPS HI400-5-10*170	A572Gr50	Steel IWide Flange	Magenta	53	13	15217.7	819.2	20.2	30.5	760.9	760.9	96.4	96.4	843.5	146.9	169.4	39.3

14.2. EVIDENCIA DE CARGAS VIVA Y MUERTA:

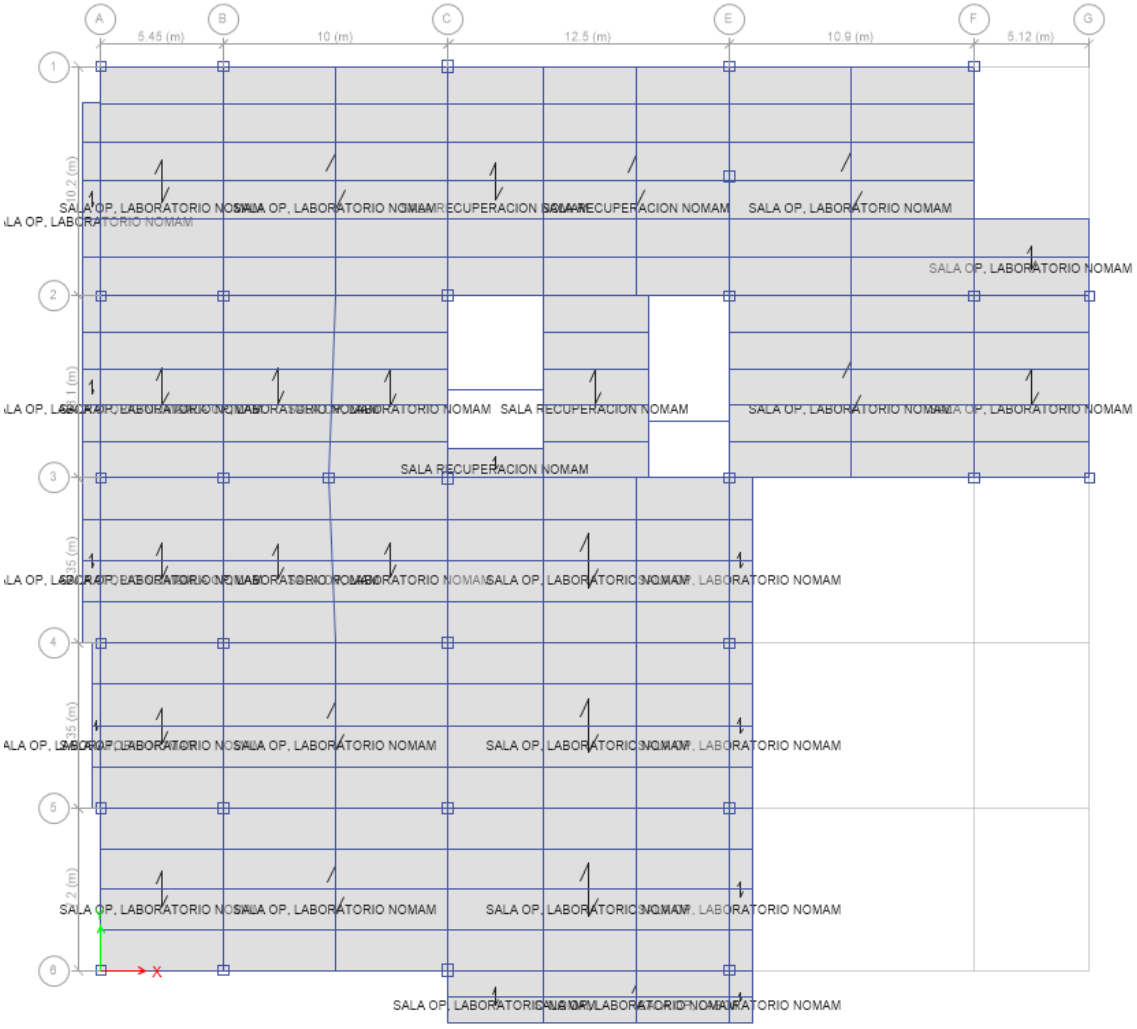
Patron de cargasen Elementos Tipo Shell (Losas)



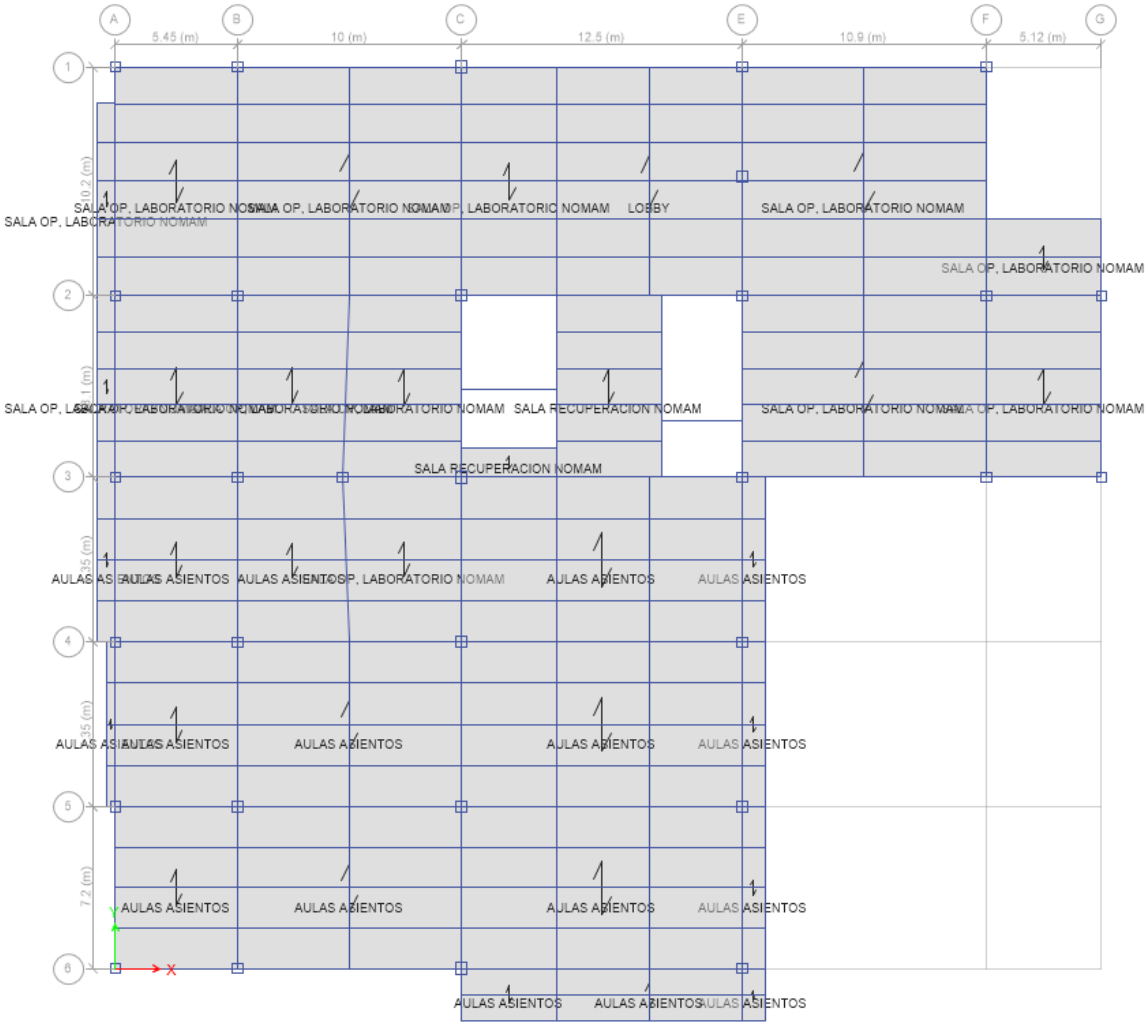
Nivel -4.08 m. Unidades: T, m



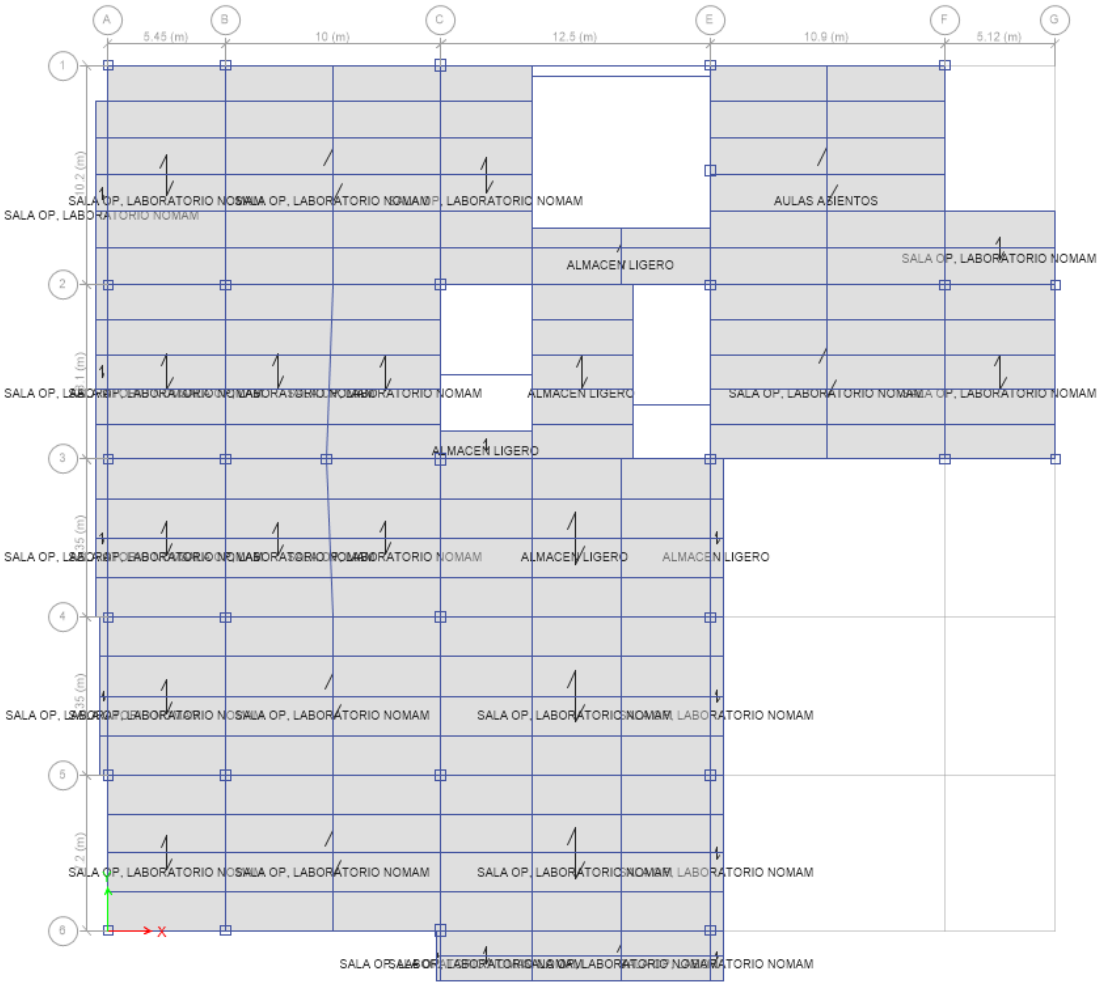
Nivel -0.00 m. Unidades: T, m



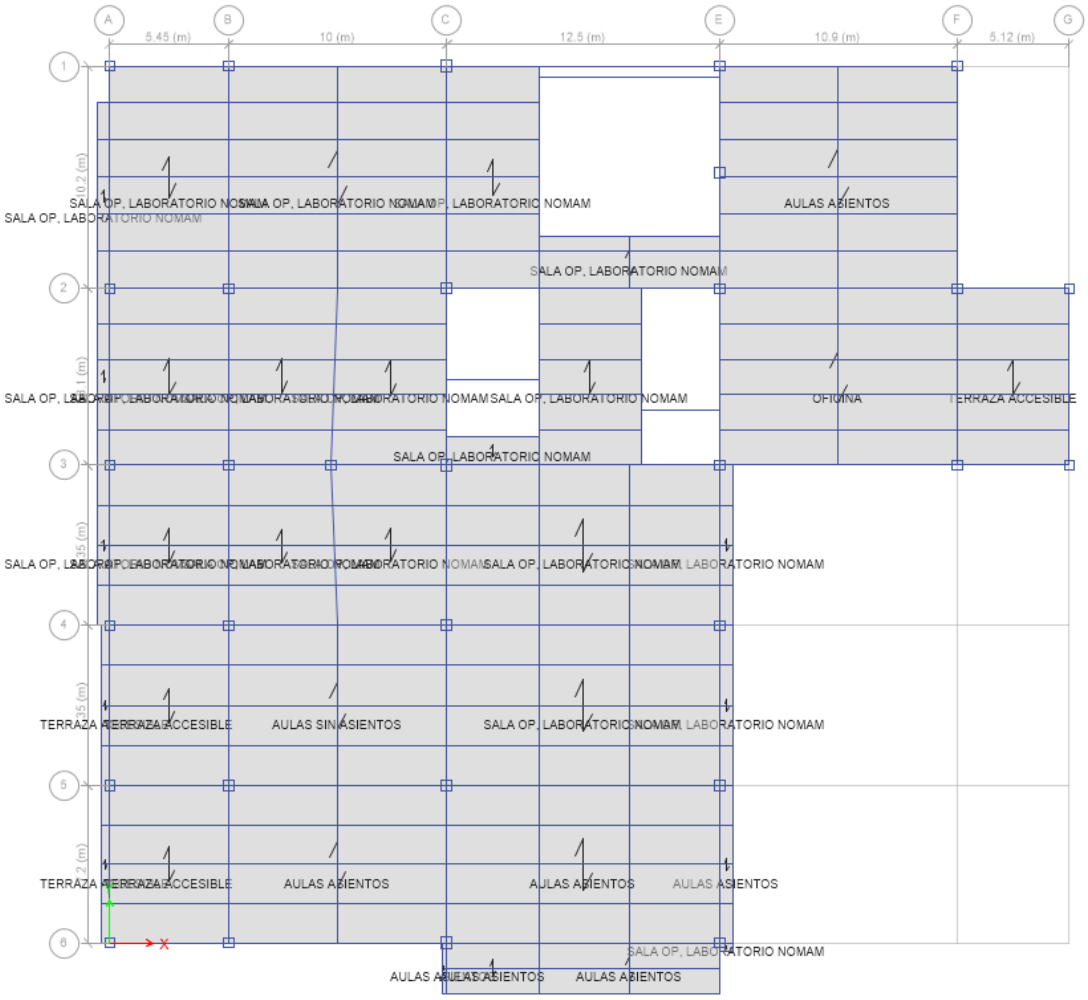
Nivel 4.08 m. Unidades: T, m



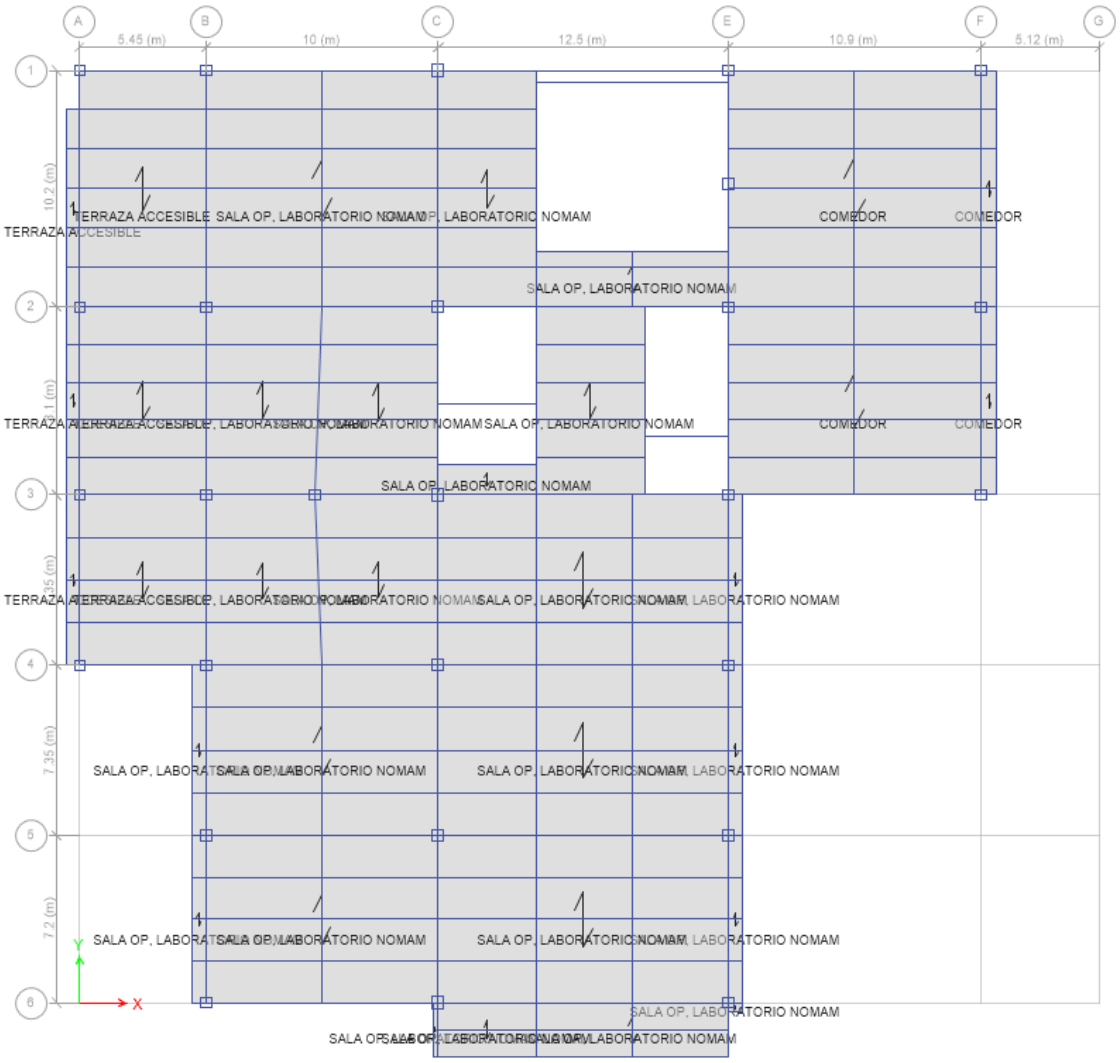
Nivel 8.16 m. Unidades: T, m



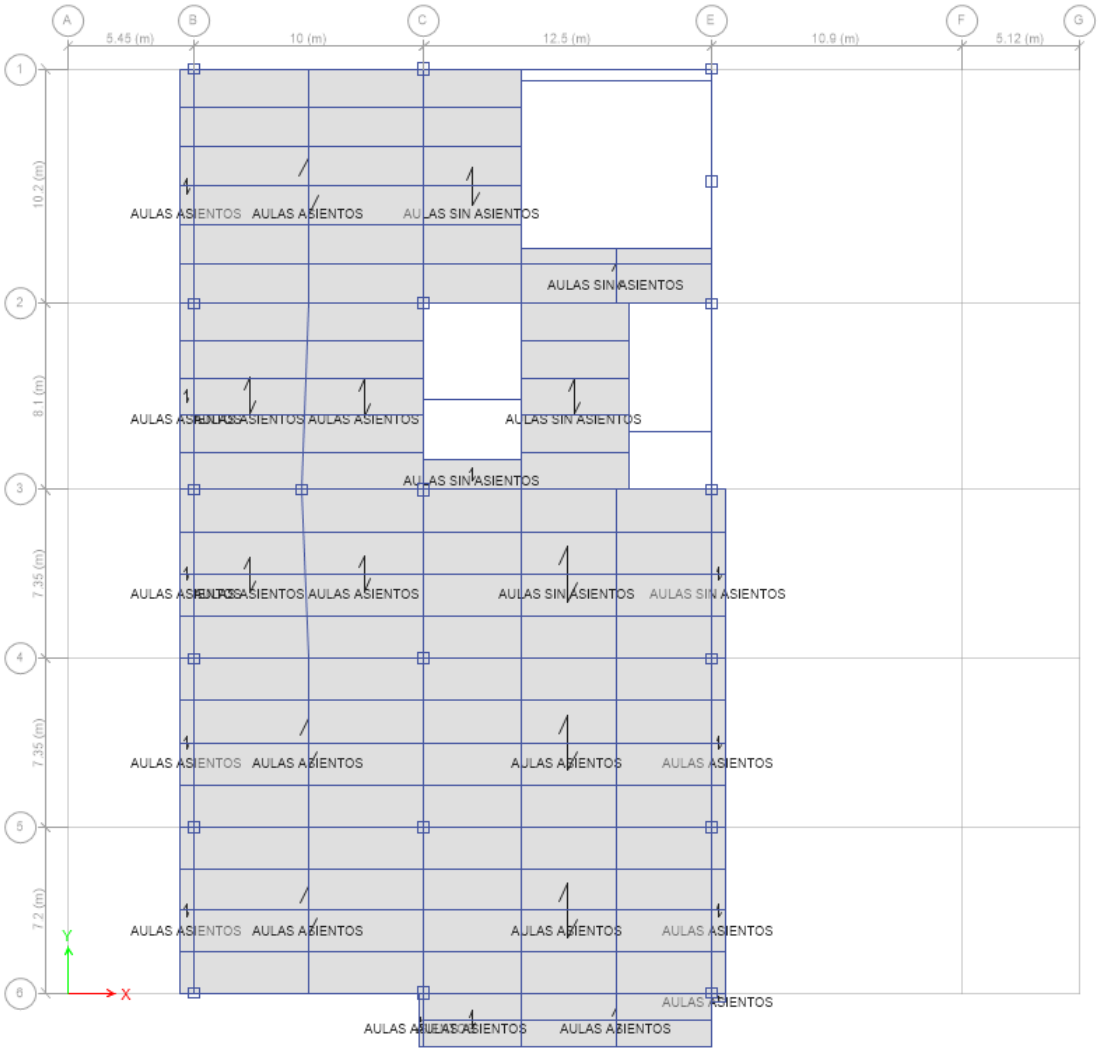
Nivel 12.24 m. Unidades: T, m



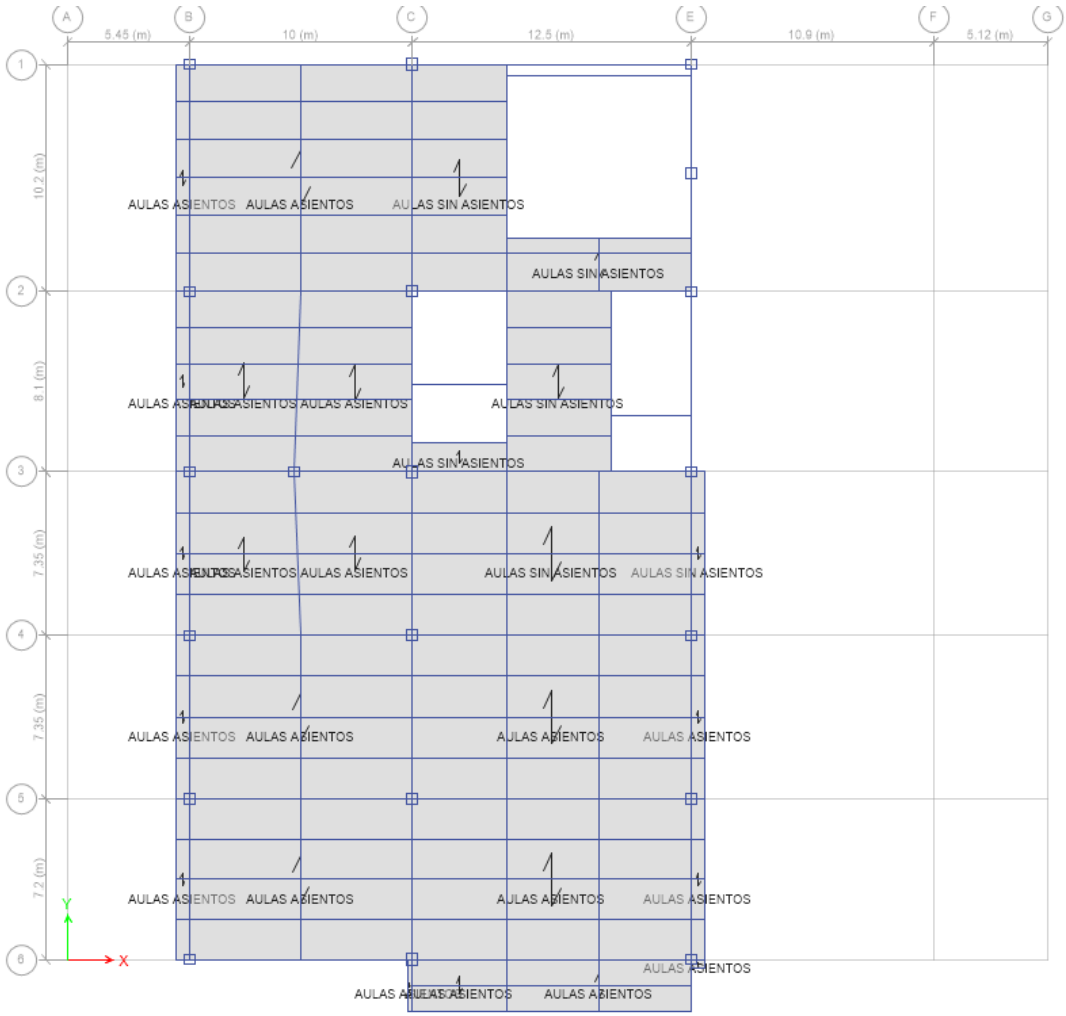
Nivel 16.32 m. Unidades: T, m



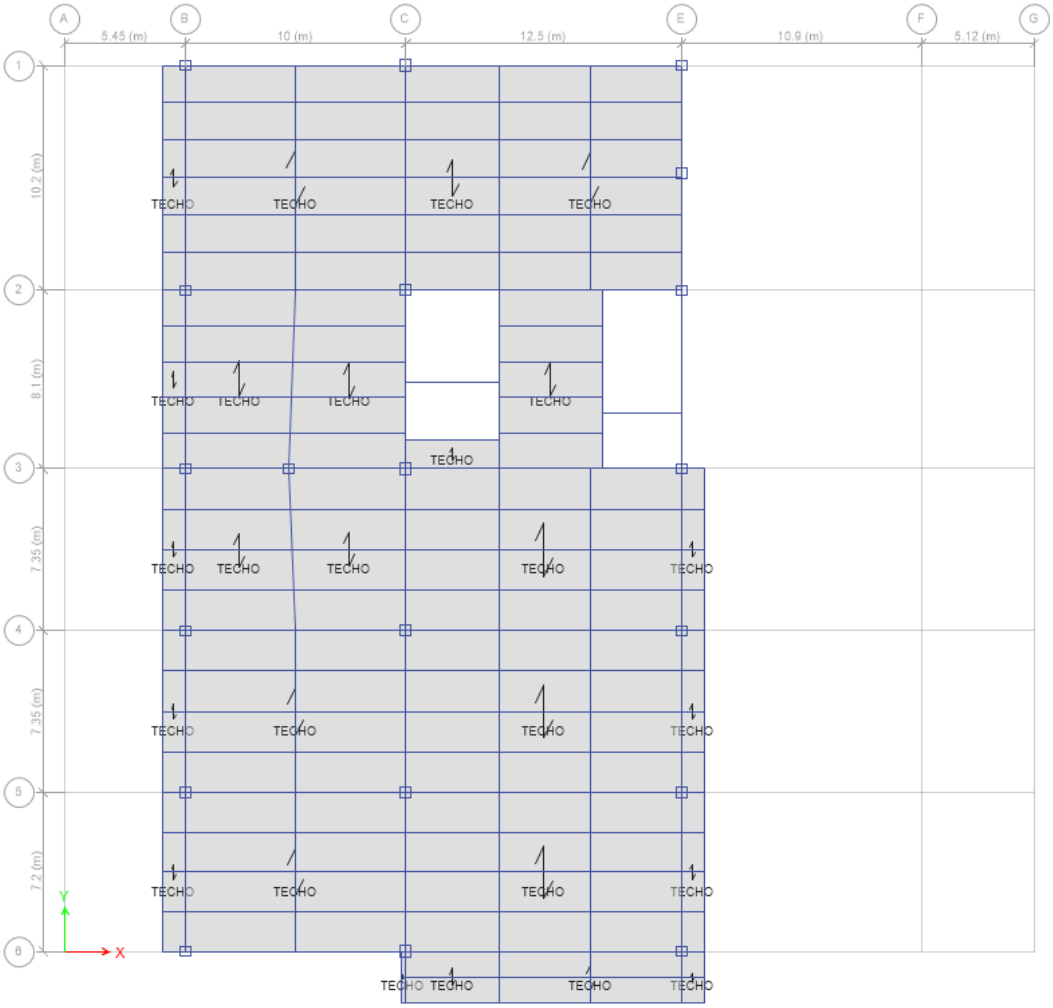
Nivel 20.40 m. Unidades: T, m



Nivel 24.48 m. Unidades: T, m



Nivel 28.56 m. Unidades: T, m



Nivel 32.64 m. Unidades: T, m

14.3. EVIDENCIA DE PESO POR NIVELES (MATERIAL LIST BY STORY)

Material List by Story

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None
Filter: None

	Story	Object Type	Material	Weight kgf	Floor Area cm²	Unit Weight kgf/cm²	Number Pieces	Number Studs
▶	Piso 8	Column	A572Gr50	47301.56	9426836.4	0.005	20	
	Piso 8	Beam	A572Gr50	37877.93	9426836.4	0.004	187	0
	Piso 8	Brace	A572Gr50	3965.21	9426836.4	0.0004	12	
	Piso 8	Floor	f'c 240 kg/cm2	195153.94	9426836.4	0.0207		
	Piso 7	Column	A572Gr50	47225.7	8512104.1	0.0055	20	
	Piso 7	Beam	A572Gr50	36013.62	8512104.1	0.0042	180	0
	Piso 7	Brace	A572Gr50	3965.21	8512104.1	0.0005	12	
	Piso 7	Floor	f'c 240 kg/cm2	176217.19	8512104.1	0.0207		
	Piso 6	Column	A572Gr50	47225.7	8512104.1	0.0055	20	
	Piso 6	Beam	A572Gr50	36013.62	8512104.1	0.0042	180	0
	Piso 6	Brace	A572Gr50	3965.21	8512104.1	0.0005	12	
	Piso 6	Floor	f'c 240 kg/cm2	176217.19	8512104.1	0.0207		
	Piso 5	Column	A572Gr50	63183.43	12000581.6	0.0053	27	
	Piso 5	Beam	A572Gr50	47808.56	12000581.6	0.004	236	0
	Piso 5	Brace	A572Gr50	4749.28	12000581.6	0.0004	14	
	Piso 5	Floor	f'c 240 kg/cm2	248435.5	12000581.6	0.0207		
	Piso 4	Column	A572Gr50	72305.19	13051099.1	0.0055	31	
	Piso 4	Beam	A572Gr50	49738.94	13051099.1	0.0038	239	0
	Piso 4	Brace	A572Gr50	6076.85	13051099.1	0.0005	18	
	Piso 4	Floor	f'c 240 kg/cm2	270183.26	13051099.1	0.0207		
	Piso 3	Column	A572Gr50	72970.16	13229364.1	0.0055	31	
	Piso 3	Beam	A572Gr50	51089.16	13229364.1	0.0039	238	0
	Piso 3	Brace	A572Gr50	6740.61	13229364.1	0.0005	18	
	Piso 3	Floor	f'c 240 kg/cm2	273873.7	13229364.1	0.0207		
	Piso 2	Column	A572Gr50	77211.27	14011535.1	0.0055	31	
	Piso 2	Beam	A572Gr50	51478.73	14011535.1	0.0037	242	0
	Piso 2	Brace	A572Gr50	6740.61	14011535.1	0.0005	18	
	Piso 2	Floor	f'c 240 kg/cm2	290066.16	14011535.1	0.0207		
	Piso 1	Column	A572Gr50	77278.61	14011535.1	0.0055	31	
	Piso 1	Beam	A572Gr50	51329.51	14011535.1	0.0037	242	0
	Piso 1	Brace	A572Gr50	6740.61	14011535.1	0.0005	18	
	Piso 1	Floor	f'c 240 kg/cm2	290066.16	14011535.1	0.0207		
	Planta Baja Nivel	Column	A572Gr50	35104.7	15235019.3	0.0023	14	
	Planta Baja Nivel	Column	f'c 240 kg/cm2	65687.04	15235019.3	0.0043	18	
	Planta Baja Nivel	Beam	A572Gr50	44880.81	15235019.3	0.0029	197	0
	Planta Baja Nivel	Brace	A572Gr50	2136.83	15235019.3	0.0001	8	
	Planta Baja Nivel	Wall	f'c 240 kg/cm2	464434.55	15235019.3	0.0305		
	Planta Baja Nivel	Floor	f'c 240 kg/cm2	313338.96	15235019.3	0.0206		

	Subsuelo 1	Column	A572Gr50	35697.78	15235019.3	0.0023	14	
	Subsuelo 1	Column	f'c 240 kg/cm2	65813.04	15235019.3	0.0043	18	
	Subsuelo 1	Beam	A572Gr50	40110.02	15235019.3	0.0026	197	0
	Subsuelo 1	Brace	A572Gr50	2136.83	15235019.3	0.0001	8	
	Subsuelo 1	Wall	f'c 240 kg/cm2	464434.55	15235019.3	0.0305		
	Subsuelo 1	Floor	f'c 240 kg/cm2	313338.96	15235019.3	0.0206		
	Sum	Column	A572Gr50	575504.1	123225198.4	0.0047	239	
	Sum	Column	f'c 240 kg/cm2	131500.08	123225198.4	0.0011	36	
	Sum	Beam	A572Gr50	446340.89	123225198.4	0.0036	2138	0
	Sum	Brace	A572Gr50	47217.26	123225198.4	0.0004	138	
	Sum	Wall	f'c 240 kg/cm2	928869.1	123225198.4	0.0075		
	Sum	Floor	f'c 240 kg/cm2	2546891.03	123225198.4	0.0207		
	Total	All	All	4676322.46	123225198.4	0.0379	2551	0

14.4. EVIDENCIA DE MATERIAL LIST

Material List by Section Property

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Material List by Section Property
Filter: None

	Section	Object Type	Number Pieces	Length cm	Weight kgf	Number Studs
▶	VPS HI400-5-...	Beam	85	61604.896	25552.73	0
	COL 75x55 1...	Column	14	5712	51796.8	
	COL K450*15	Column	113	46104	253888.88	
	VP HI 450-8-1...	Beam	282	146155.724	74499.32	0
	VPS HI300-4-...	Beam	35	19576	7965.37	0
	K200*12 R	Brace	20	12906.804	9141.86	
	VP HI-600-10-...	Beam	16	19840	23365.59	0
	VP HI 500-8-1...	Beam	28	29110	21271.77	0
	VP HI 500-8-2...	Beam	64	71830	73873.98	0
	VP HI-600-10-...	Beam	16	19590	26607.09	0
	COL K450*20	Column	70	28560	168159.77	
	COL 75X55 2...	Column	8	3264	32313.6	
	COL 75X70 2...	Column	8	3264	36464.4	
	K160*10 R	Brace	59	29371.596	13832.34	
	COL 45X45 1...	Column	6	2448	10925.28	
	HI300-4-5*120	Beam	217	117991	21856.36	0
	HI250-4-5*120	Beam	735	362627.5	60341.14	0
	HI200-4-4*100	Beam	515	142405.728	17523.68	0
	VP HI 500-15-...	Beam	53	34845	28515.87	0
	VP HI 500-15-...	Beam	16	16000	14892.63	0
	VPS HI 500-5-...	Beam	71	62825.554	45818.83	0
	K220*15 R	Brace	12	7744.083	7476.39	
	K180*12 R	Brace	47	26489.824	16766.66	
	COL K500*20	Column	20	8160	57132.58	
	COL K500*15	Column	36	14688	96322.87	
	VPS HI 500-5-...	Beam	5	4890	4256.55	0
	RAMPA	Floor			52557.82	
	Kubilosa 0.76 ...	Floor			2494333.21	
	Muro sotano ...	Wall			928869.1	

14.5. EVIDENCIA DEL PESO TOTAL (PP+CM+CV).

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'ConstLL' OR [Output Case] = 'Dead' OR [Output Case] = 'Live' OR [Output Case] = 'PostDL' OR [Output Case] = 'PreDL' OR [Ou = 'RLL')

	Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m	X m	Y m	Z m
	Dead	LinStatic			0	0	4674.2342	94420.9858	-83673.6767	0	0	0	-8.16
	Live	LinStatic			0	0	569.092	12564.1651	-15606.8472	0	0	0	-8.16
	PostDL	LinStatic			0	0	2739.6442	55078.0509	-49114.2628	0	0	0	-8.16
	RLL	LinStatic			0	0	416.6767	8120.121	-5724.8028	0	0	0	-8.16
	ConstLL	LinStatic			0	0	842.6977	16903.416	-15146.8202	0	0	0	-8.16
	PreDL	LinStatic			0	0	601.9269	12073.8686	-10819.1573	0	0	0	-8.16
▶	Red-LL	LinStatic			0	0	2562.4385	52076.1041	-43647.5256	0	0	0	-8.16

14.6. EVIDENCIA CARGA SÍSMICA (CARGA TOTAL).

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'Dx' OR [Output Case] = 'Dy' OR [Output Case] = 'Sx' OR [Output Case] = 'Sy')

	Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m	X m	Y m	Z m
▶	Sx	LinStatic	Step By ...	1	-869.8737	0	0	0	-26644.1162	17064.4688	0	0	-8.16
	Sx	LinStatic	Step By ...	2	-869.8737	0	0	0	-26644.1162	18915.3426	0	0	-8.16
	Sx	LinStatic	Step By ...	3	-869.8737	0	0	0	-26644.1162	15213.5949	0	0	-8.16
	Sy	LinStatic	Step By ...	1	0	-869.8737	0	26644.1162	0	-14687.0431	0	0	-8.16
	Sy	LinStatic	Step By ...	2	0	-869.8737	0	26644.1162	0	-16125.2161	0	0	-8.16
	Sy	LinStatic	Step By ...	3	0	-869.8737	0	26644.1162	0	-13248.8701	0	0	-8.16
	Dx	LinRespSpec	Max		816.9214	23.2571	0	666.0251	17862.3538	15926.91	0	0	-8.16
	Dy	LinRespSpec	Max		23.7983	831.7786	0	18170.963	644.414	15120.4364	0	0	-8.16

14.7. EVIDENCIA AUTO SEISMIC LOAD.

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'Dx' OR [Output Case] = 'Dy' OR [Output Case] = 'Sx' OR [Output Case] = 'Sy')

	Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m	X m	Y m	Z m
▶	Sx	LinStatic	Step By Step	1	-869.8737	0	0	0	-26644.1162	17064.4688	0	0	-8.16
	Sx	LinStatic	Step By Step	2	-869.8737	0	0	0	-26644.1162	18915.3426	0	0	-8.16
	Sx	LinStatic	Step By Step	3	-869.8737	0	0	0	-26644.1162	15213.5949	0	0	-8.16
	Sy	LinStatic	Step By Step	1	0	-869.8737	0	26644.1162	0	-14687.0431	0	0	-8.16
	Sy	LinStatic	Step By Step	2	0	-869.8737	0	26644.1162	0	-16125.2161	0	0	-8.16
	Sy	LinStatic	Step By Step	3	0	-869.8737	0	26644.1162	0	-13248.8701	0	0	-8.16
	Dx	LinRespSpec	Max		816.9214	23.2571	0	666.0251	17862.3538	15926.91	0	0	-8.16
	Dy	LinRespSpec	Max		23.7983	831.7786	0	18170.963	644.414	15120.4364	0	0	-8.16

14.8. REVISIÓN DE PARTICIPACIÓN DE MASAS.

Modal Participating Mass Ratios

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Modal Participating Mass Ratios
Filter: None

Case	Mode	Period sec	UX	UY	UZ	SumUX	SumUY	SumUZ	RX	RY	RZ	SumRX	SumRY	SumRZ
Modal	1	0.993	0.5031	0.004	0	0.5031	0.004	0	0.0046	0.5095	0.0033	0.0046	0.5095	0.0033
Modal	2	0.967	0.0049	0.4722	0	0.5081	0.4761	0	0.5277	0.0045	0.0083	0.5323	0.514	0.0116
Modal	3	0.611	0.0035	0.0053	0	0.5116	0.4814	0	0.0021	0.0001	0.4047	0.5344	0.5141	0.4163
Modal	4	0.353	0.0001	0.133	0	0.5116	0.6144	0	0.0423	4.742E-05	0.0067	0.5767	0.5142	0.4229
Modal	5	0.333	0.1186	1.941E-05	0	0.6302	0.6144	0	1.416E-05	0.0775	0.0005	0.5767	0.5917	0.4235
Modal	6	0.242	0.0002	0.0048	0	0.6305	0.6192	0	0.0025	0.0002	0.1188	0.5792	0.5919	0.5423
Modal	7	0.184	0.0338	0.0004	0	0.6643	0.6196	0	0.0002	0.0137	0.0001	0.5795	0.6057	0.5423
Modal	8	0.182	0.0002	0.0379	0	0.6645	0.6575	0	0.0209	0.0001	0.0032	0.6003	0.6057	0.5456
Modal	9	0.134	0.001	0.0045	0	0.6655	0.662	0	0.0031	0.0009	0.0242	0.6034	0.6066	0.5698
Modal	10	0.127	0.0004	0.015	0	0.6659	0.677	0	0.0134	0.0004	0.0083	0.6169	0.607	0.5781
Modal	11	0.124	0.0174	1.453E-05	0	0.6833	0.677	0	2.907E-05	0.0135	0.0038	0.6169	0.6205	0.5819
Modal	12	0.101	0.0009	0.0119	0	0.6842	0.6889	0	0.0075	0.0005	0.0022	0.6243	0.621	0.5842
Modal	13	0.098	0.0094	0.0013	0	0.6936	0.6902	0	0.0008	0.0057	0.0011	0.6251	0.6267	0.5853
Modal	14	0.088	0.0007	0.0004	0	0.6943	0.6906	0	0.0002	0.0005	0.0172	0.6253	0.6272	0.6024
Modal	15	0.081	0.0081	0.0002	0	0.7024	0.6908	0	0.0001	0.0065	0.0002	0.6254	0.6336	0.6026
Modal	16	0.078	0.0002	0.009	0	0.7026	0.6998	0	0.0063	0.0002	3.839E-06	0.6316	0.6338	0.6026
Modal	17	0.072	0.0002	0.0004	0	0.7028	0.7001	0	0.0003	0.0001	0.0057	0.6319	0.634	0.6083
Modal	18	0.069	0.0001	0.0048	0	0.7029	0.7049	0	0.0034	0.0001	0.0011	0.6353	0.634	0.6094
Modal	19	0.066	0.0051	0.0001	0	0.7079	0.705	0	0.0001	0.0036	0.0007	0.6354	0.6376	0.6102
Modal	20	0.063	0.0029	1.406E-05	0	0.7109	0.705	0	1.068E-05	0.0022	0.0001	0.6354	0.6398	0.6103
Modal	21	0.059	2.869E-05	0.0044	0	0.7109	0.7094	0	0.0037	2.047E-05	0.0039	0.6391	0.6398	0.6142
Modal	22	0.059	3.942E-05	0.0018	0	0.7109	0.7112	0	0.0013	2.768E-05	0.0064	0.6404	0.6398	0.6206
Modal	23	0.045	0.0001	0.0002	0	0.7111	0.7115	0	0.0003	0.0001	0.0025	0.6407	0.64	0.6231
Modal	24	0.041	0.2581	0.0002	0	0.9692	0.7117	0	0.0002	0.2776	0.0001	0.6409	0.9175	0.6232
Modal	25	0.04	0.0002	0.2573	0	0.9694	0.969	0	0.2765	0.0002	0.0105	0.9174	0.9177	0.6337
Modal	26	0.027	0.0001	0.001	0	0.9695	0.9701	0	0.0015	0.0001	0.313	0.9189	0.9178	0.9466
Modal	27	0.017	0.0247	0.0013	0	0.9941	0.9714	0	0.0036	0.067	4.862E-05	0.9226	0.9848	0.9467
Modal	28	0.017	0.0015	0.024	0	0.9956	0.9954	0	0.0655	0.004	0.0012	0.9881	0.9888	0.9479
Modal	29	0.01	0.0013	0.0012	0	0.997	0.9967	0	0.0036	0.0036	0.0005	0.9917	0.9925	0.9484
Modal	30	0.007	0.0011	0.0014	0	0.9981	0.998	0	0.0039	0.003	0.0052	0.9956	0.9955	0.9536

Análisis de resultados:

- El período fundamental de vibración es igual a 0.993 s, +/- 10% de variación por iteraciones.
- Según el Análisis Modal Eigen vectores, en el modo 26 se consigue más del 90% de participación modal. Representan movimientos traslacionales en los dos primeros modos de vibración y torsión en el tercer modo.
- Según la recomendación del NEC-SE-DS Capítulo 5.2.3, tabla 13, tipología 1, y ASCE-SEI 7, tabla 12.3-1, evaluaremos la irregularidad torsión en planta para el sentido de análisis en X y Y por el Método de Fuerzas Horizontales Equivalentes.

Story Max Over Avg Drifts

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None tory Max Over Avg Drifts
Filter: ([Output Case] = 'Sx')

Story	Output Case	Case Type	Step Type	Direction	Max Drift m	Avg Drift m	Ratio
Piso 8	Sx	LinStatic	Step By Step	X	0.008251	0.007858	1.05
Piso 8	Sx	LinStatic	Step By Step	X	0.008239	0.00786	1.048
Piso 8	Sx	LinStatic	Step By Step	X	0.009022	0.007857	1.148
Piso 7	Sx	LinStatic	Step By Step	X	0.010323	0.009567	1.079
Piso 7	Sx	LinStatic	Step By Step	X	0.010233	0.009735	1.051
Piso 7	Sx	LinStatic	Step By Step	X	0.011408	0.009399	1.214
Piso 6	Sx	LinStatic	Step By Step	X	0.011793	0.010941	1.078
Piso 6	Sx	LinStatic	Step By Step	X	0.011186	0.010868	1.029
Piso 6	Sx	LinStatic	Step By Step	X	0.013036	0.011014	1.184
Piso 5	Sx	LinStatic	Step By Step	X	0.012222	0.011451	1.067
Piso 5	Sx	LinStatic	Step By Step	X	0.011837	0.011465	1.032
Piso 5	Sx	LinStatic	Step By Step	X	0.01335	0.011436	1.167
Piso 4	Sx	LinStatic	Step By Step	X	0.012387	0.011973	1.035
Piso 4	Sx	LinStatic	Step By Step	X	0.01233	0.011922	1.034
Piso 4	Sx	LinStatic	Step By Step	X	0.013261	0.012025	1.103
Piso 3	Sx	LinStatic	Step By Step	X	0.01074	0.010434	1.029
Piso 3	Sx	LinStatic	Step By Step	X	0.010844	0.010455	1.037
Piso 3	Sx	LinStatic	Step By Step	X	0.011414	0.010413	1.096
Piso 2	Sx	LinStatic	Step By Step	X	0.010517	0.01022	1.029
Piso 2	Sx	LinStatic	Step By Step	X	0.010586	0.010171	1.041
Piso 2	Sx	LinStatic	Step By Step	X	0.011277	0.010268	1.098
Piso 1	Sx	LinStatic	Step By Step	X	0.007199	0.006961	1.034
Piso 1	Sx	LinStatic	Step By Step	X	0.007345	0.006989	1.051
Piso 1	Sx	LinStatic	Step By Step	X	0.007538	0.006911	1.091
Planta Baja Nivel	Sx	LinStatic	Step By Step	X	0.00019	0.00019	1.004
Planta Baja Nivel	Sx	LinStatic	Step By Step	X	0.000197	0.000191	1.031
Planta Baja Nivel	Sx	LinStatic	Step By Step	X	0.000196	0.000188	1.039
Subsuelo 1	Sx	LinStatic	Step By Step	X	0.000123	0.000121	1.011
Subsuelo 1	Sx	LinStatic	Step By Step	X	0.000126	0.000121	1.034
Subsuelo 1	Sx	LinStatic	Step By Step	X	0.000128	0.000121	1.056

Análisis con el 5% de torsión accidental, Sismo X

Story Max Over Avg Drifts

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None ory Max Over Avg Drifts
Filter: ([Output Case] = 'Sy')

Story	Output Case	Case Type	Step Type	Direction	Max Drift m	Avg Drift m	Ratio
Piso 8	Sy	LinStatic	Step By Step	Y	0.010502	0.009922	1.058
Piso 8	Sy	LinStatic	Step By Step	Y	0.01018	0.009867	1.032
Piso 8	Sy	LinStatic	Step By Step	Y	0.010824	0.009977	1.085
Piso 7	Sy	LinStatic	Step By Step	Y	0.01364	0.012539	1.088
Piso 7	Sy	LinStatic	Step By Step	Y	0.012776	0.012232	1.044
Piso 7	Sy	LinStatic	Step By Step	Y	0.014699	0.012943	1.136
Piso 6	Sy	LinStatic	Step By Step	Y	0.014581	0.013648	1.068
Piso 6	Sy	LinStatic	Step By Step	Y	0.014104	0.013556	1.04
Piso 6	Sy	LinStatic	Step By Step	Y	0.015057	0.01374	1.096
Piso 5	Sy	LinStatic	Step By Step	Y	0.012079	0.011611	1.04
Piso 5	Sy	LinStatic	Step By Step	Y	0.012353	0.011702	1.056
Piso 5	Sy	LinStatic	Step By Step	Y	0.012757	0.011821	1.079
Piso 4	Sy	LinStatic	Step By Step	Y	0.010052	0.009467	1.062
Piso 4	Sy	LinStatic	Step By Step	Y	0.009581	0.009572	1.001
Piso 4	Sy	LinStatic	Step By Step	Y	0.010542	0.009363	1.126
Piso 3	Sy	LinStatic	Step By Step	Y	0.009245	0.008689	1.064
Piso 3	Sy	LinStatic	Step By Step	Y	0.0088	0.008777	1.003
Piso 3	Sy	LinStatic	Step By Step	Y	0.00969	0.008601	1.127
Piso 2	Sy	LinStatic	Step By Step	Y	0.009217	0.008705	1.059
Piso 2	Sy	LinStatic	Step By Step	Y	0.008835	0.008798	1.004
Piso 2	Sy	LinStatic	Step By Step	Y	0.009672	0.008613	1.123
Piso 1	Sy	LinStatic	Step By Step	Y	0.006262	0.005957	1.051
Piso 1	Sy	LinStatic	Step By Step	Y	0.006219	0.006085	1.022
Piso 1	Sy	LinStatic	Step By Step	Y	0.006573	0.005938	1.107
Planta Baja Nivel	Sy	LinStatic	Step By Step	X	4.6E-05	1.8E-05	2.579
Planta Baja Nivel	Sy	LinStatic	Step By Step	Y	0.000202	0.000175	1.155
Planta Baja Nivel	Sy	LinStatic	Step By Step	Y	0.000195	0.000173	1.129
Planta Baja Nivel	Sy	LinStatic	Step By Step	X	5.2E-05	1.9E-05	2.778
Planta Baja Nivel	Sy	LinStatic	Step By Step	Y	0.00021	0.000178	1.181
Subsuelo 1	Sy	LinStatic	Step By Step	Y	0.000119	9.4E-05	1.258
Subsuelo 1	Sy	LinStatic	Step By Step	Y	0.000113	9.2E-05	1.219
Subsuelo 1	Sy	LinStatic	Step By Step	Y	0.000124	9.6E-05	1.296

Análisis con el 5% de torsión accidental, Sismo Y

ANÁLISIS DE RESULTADOS:

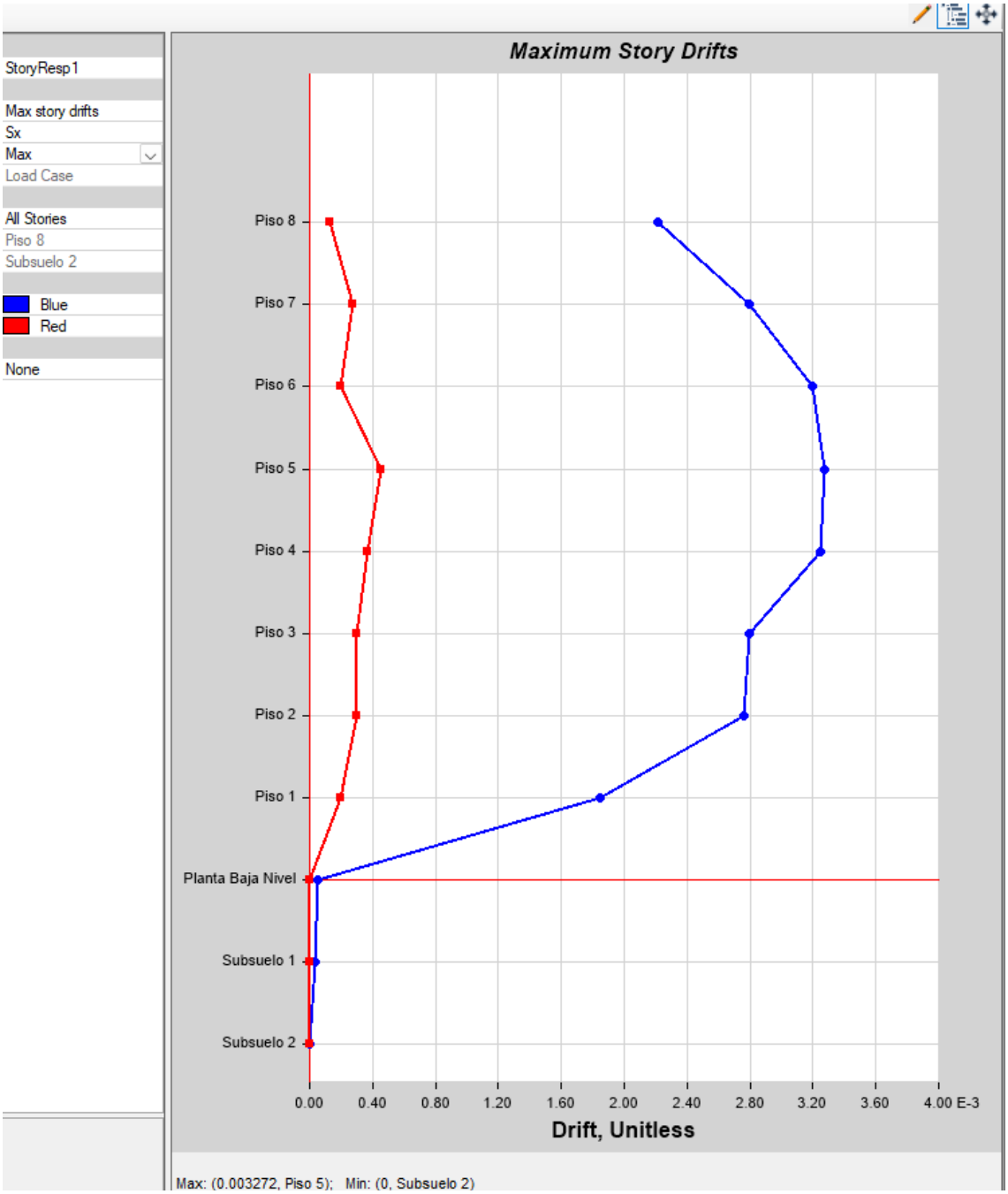
- Se obtienen valores inferiores a 1.20 en la relación deriva máx. / deriva promedio en sentido X, según NEC-2015 y ASCE-SEI 7, no califica irregularidad torsional en planta ni se debe afectar al corte basal mediante un factor menor a la unidad cuando se supera dicha relación.
- Se obtienen valores inferiores a 1.20 en la relación deriva máx. / deriva promedio en sentido Y, según NEC-2015 y ASCE-SEI 7, no califica irregularidad torsional en planta ni se debe afectar al corte basal mediante un factor menor a la unidad cuando se supera dicha relación.

14.9. REVISIÓN DE DERIVAS INELÁSTICAS DE PISO

El análisis se realizará según las siguientes ecuaciones:

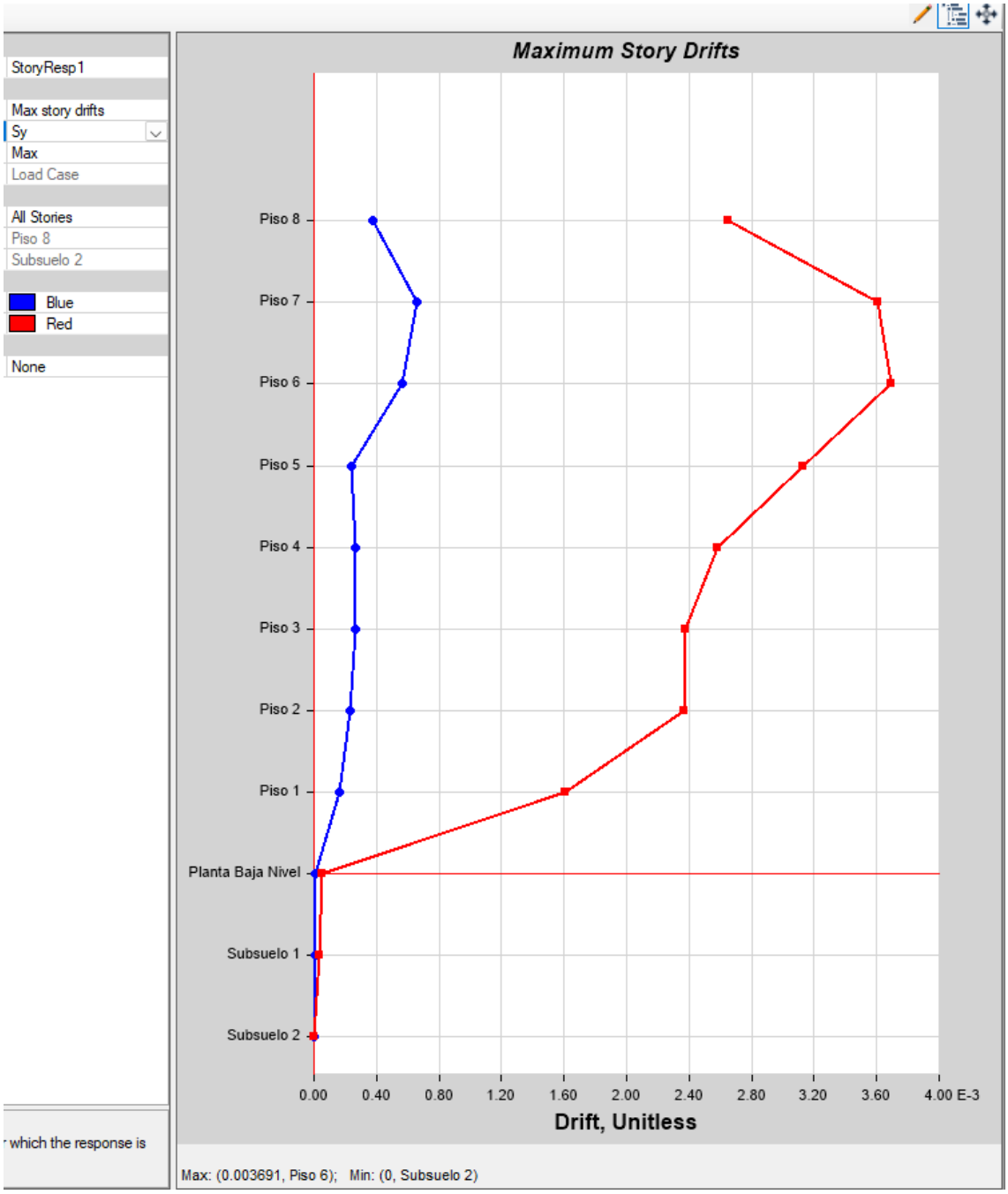
$\Delta_{máx}=0.75R\Delta_E$ → Ecuación 2-29; (NEC-SE-DS, 2016)

Δ_E= deriva en el sentido analizado



Deriva Inelástica sismo en X = 0.002658

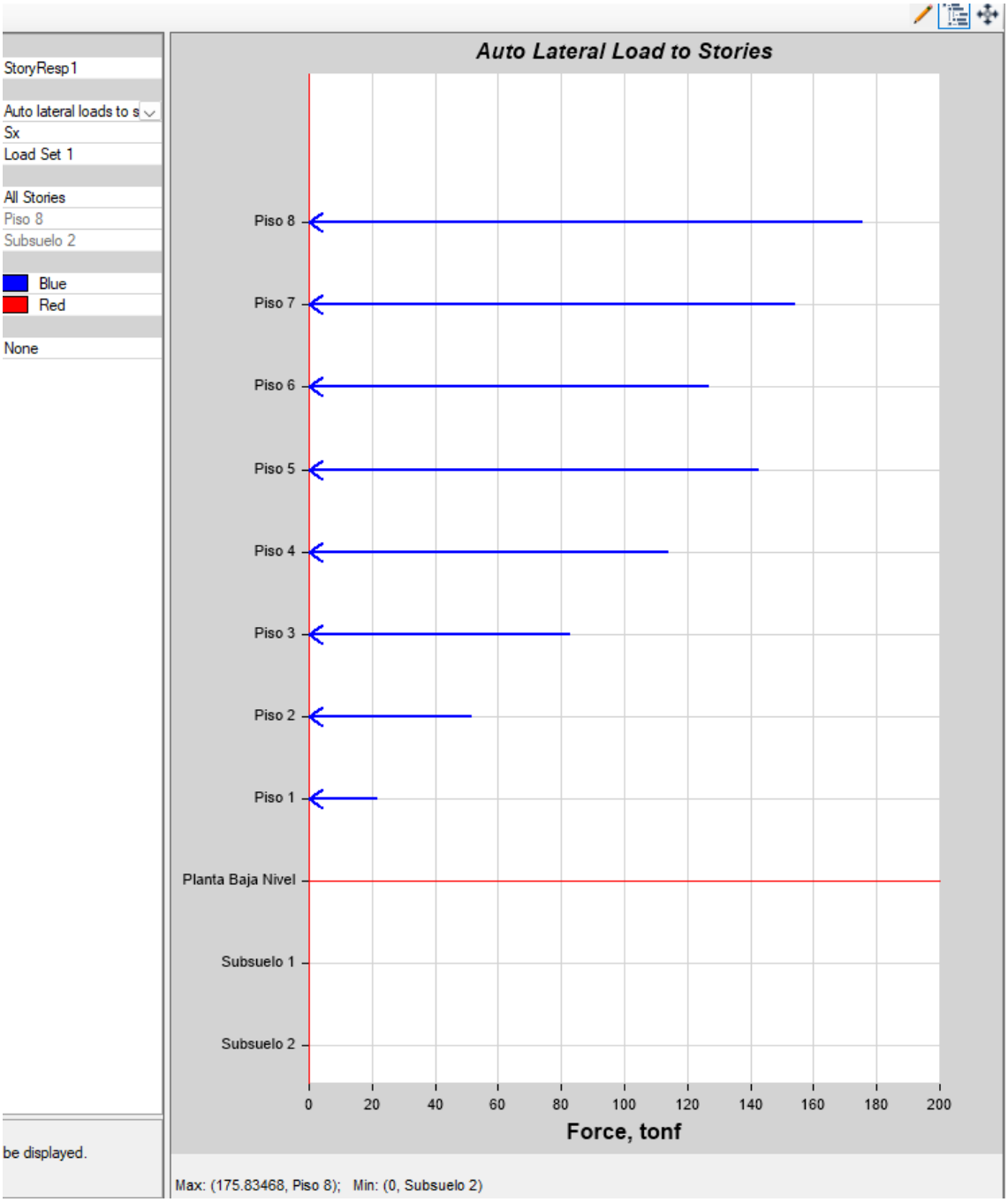
0.003272x0.75 x 7 = 0.0171718; **1.72%< 2.00% ok.**



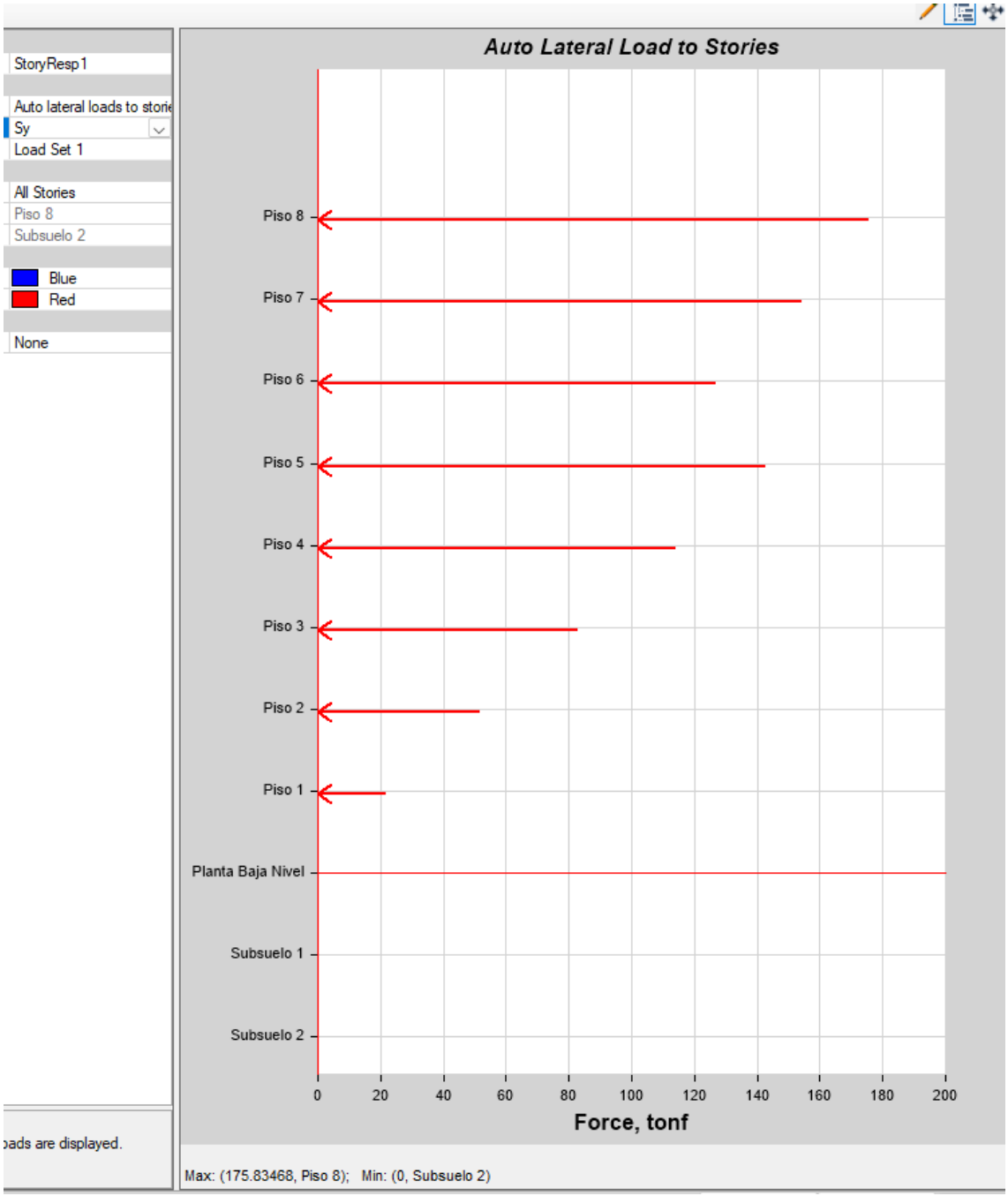
Deriva Inelástica sismo en Y = 0.002658

0.003691x0.75 x 7 = 0.01937; **1.93%< 2.00% ok.**

14.10. REVISIÓN CARGA SÍSMICA POR PISO



SISMO EN X


StoryResp1
Auto lateral loads to storie
Sy
Load Set 1
All Stories
Piso 8
Subsuelo 2
Blue
Red
None
oads are displayed.
Auto Lateral Load to Stories
Piso 8
Piso 7
Piso 6
Piso 5
Piso 4
Piso 3
Piso 2
Piso 1
Planta Baja Nivel
Subsuelo 1
Subsuelo 2
0
20
40
60
80
100
120
140
160
180
200
Force, tonf
Max: (175.83468, Piso 8); Min: (0, Subsuelo 2)

SISMO EN Y

14.11. REVISIÓN RELACIÓN CORTANTE ESTÁTICO Y DINÁMICO

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

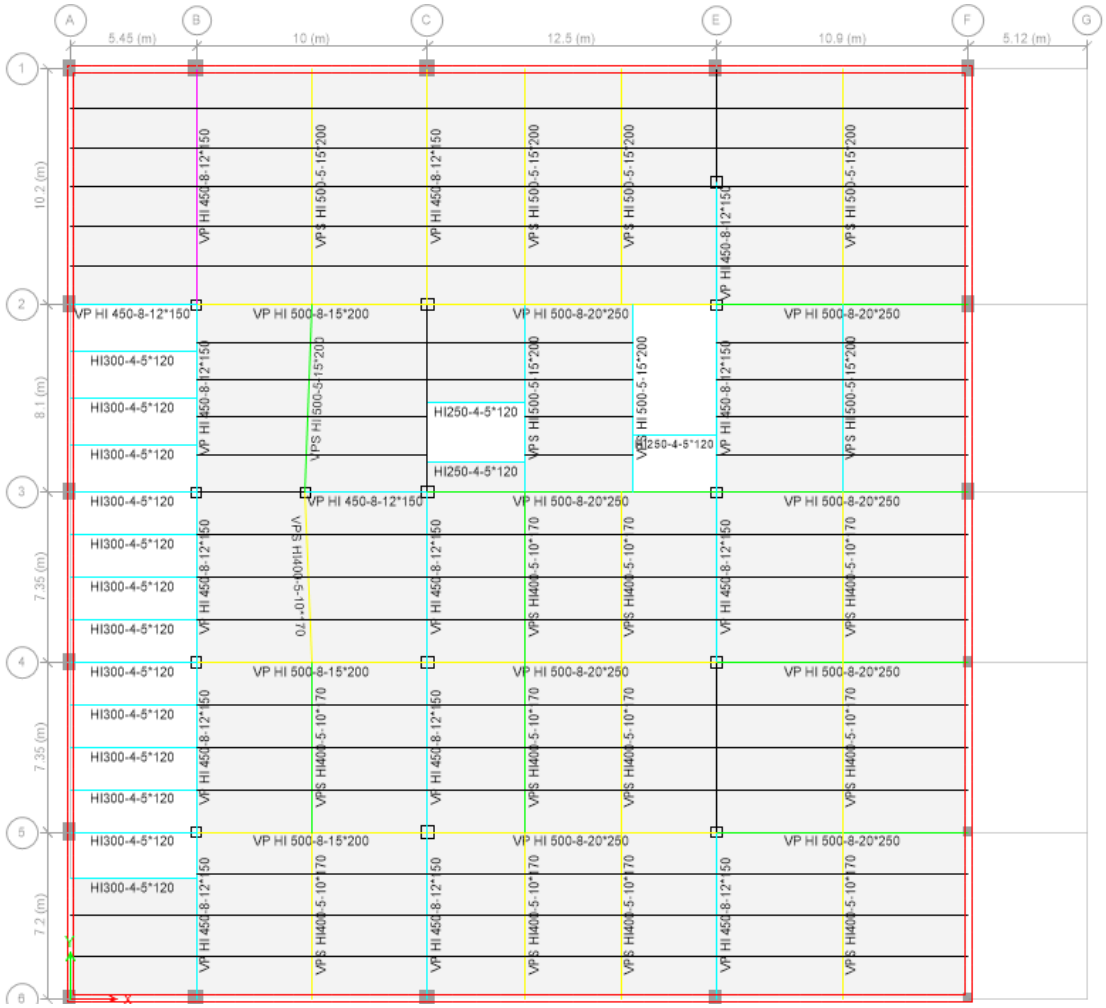
Filter: ([Output Case] = 'Dx' OR [Output Case] = 'Dy' OR [Output Case] = 'Sx' OR [Output Case] = 'Sy')

	Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m	X m	Y m	Z m
▶	Sx	LinStatic	Step By Step	1	-869.8737	0	0	0	-26644.1162	17064.4688	0	0	-8.16
	Sx	LinStatic	Step By Step	2	-869.8737	0	0	0	-26644.1162	18915.3426	0	0	-8.16
	Sx	LinStatic	Step By Step	3	-869.8737	0	0	0	-26644.1162	15213.5949	0	0	-8.16
	Sy	LinStatic	Step By Step	1	0	-869.8737	0	26644.1162	0	-14687.0431	0	0	-8.16
	Sy	LinStatic	Step By Step	2	0	-869.8737	0	26644.1162	0	-16125.2161	0	0	-8.16
	Sy	LinStatic	Step By Step	3	0	-869.8737	0	26644.1162	0	-13248.8701	0	0	-8.16
	Dx	LinRespSpec	Max		816.9214	23.2571	0	666.0251	17862.3538	15926.91	0	0	-8.16
	Dy	LinRespSpec	Max		23.7983	831.7786	0	18170.963	644.414	15120.4364	0	0	-8.16

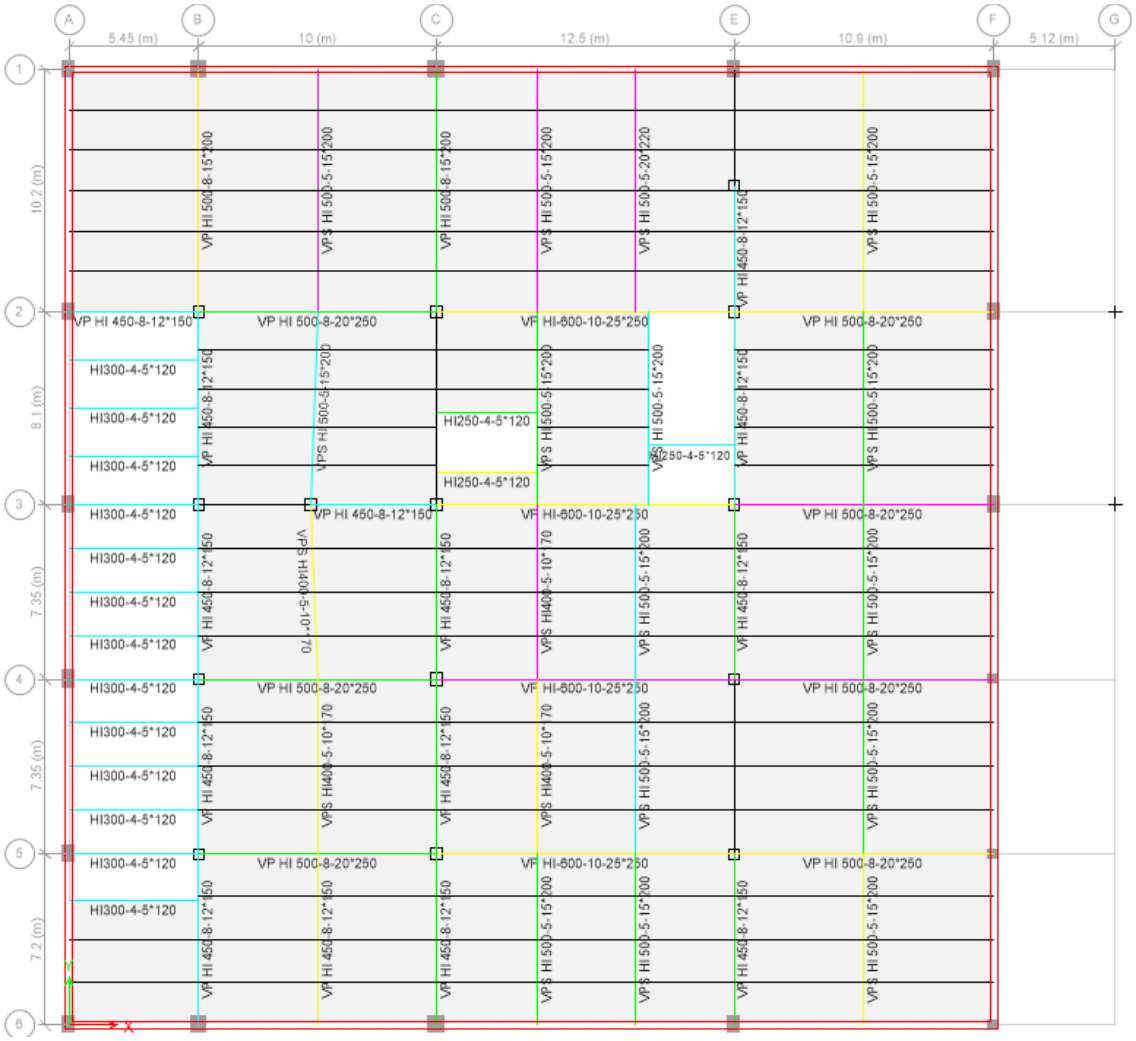
Se tienen valores para el cual valor de cortante dinámico es 85% del cortante estático obtenido.

14.12. REVISIÓN RADIOS DE CAPACIDAD/VIGAS PRINCIPALES/VIGAS SECUNDARIAS:

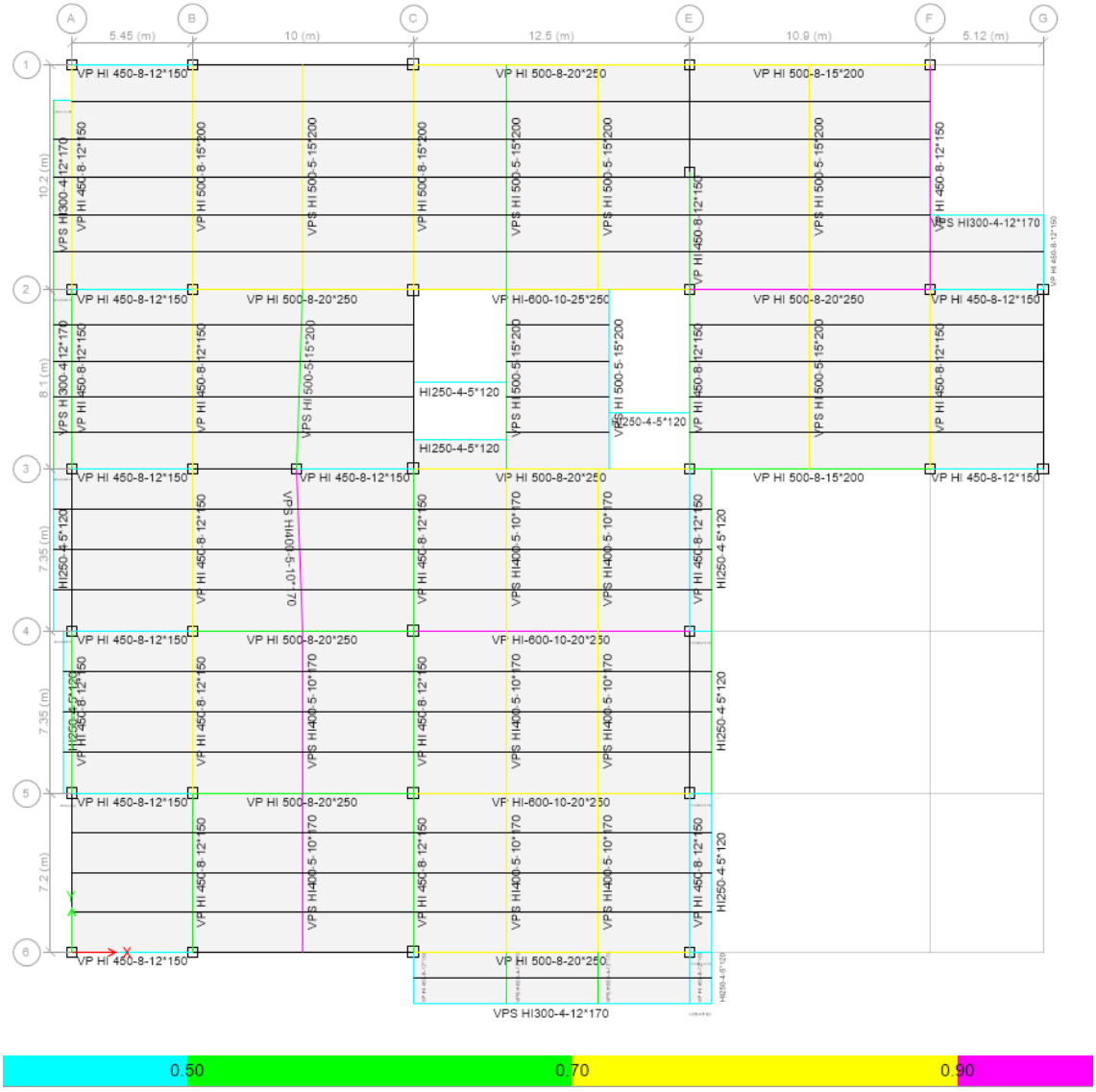
VIGAS PRINCIPALES



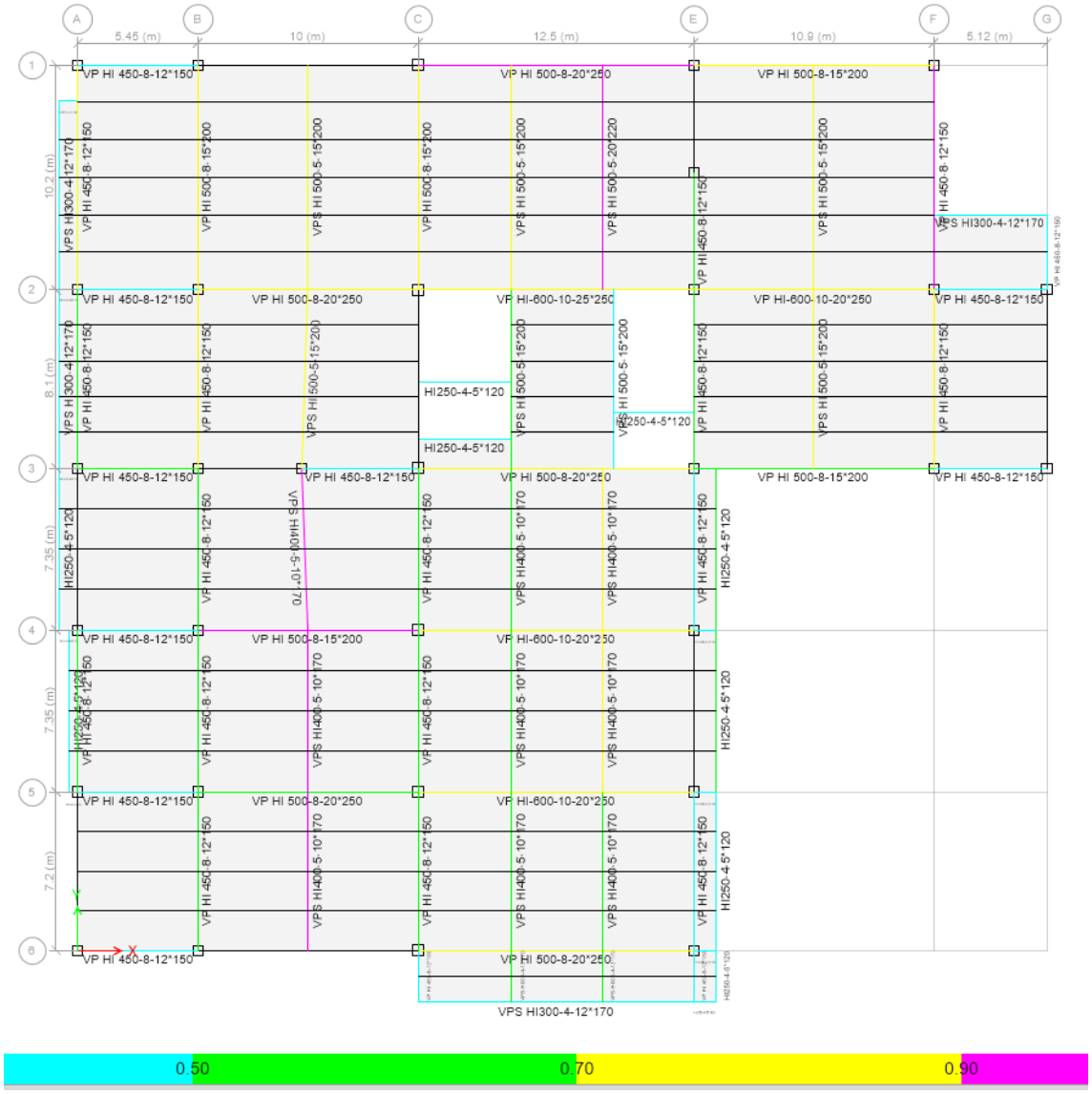
Nv. -4.08 m (Vigas principales)



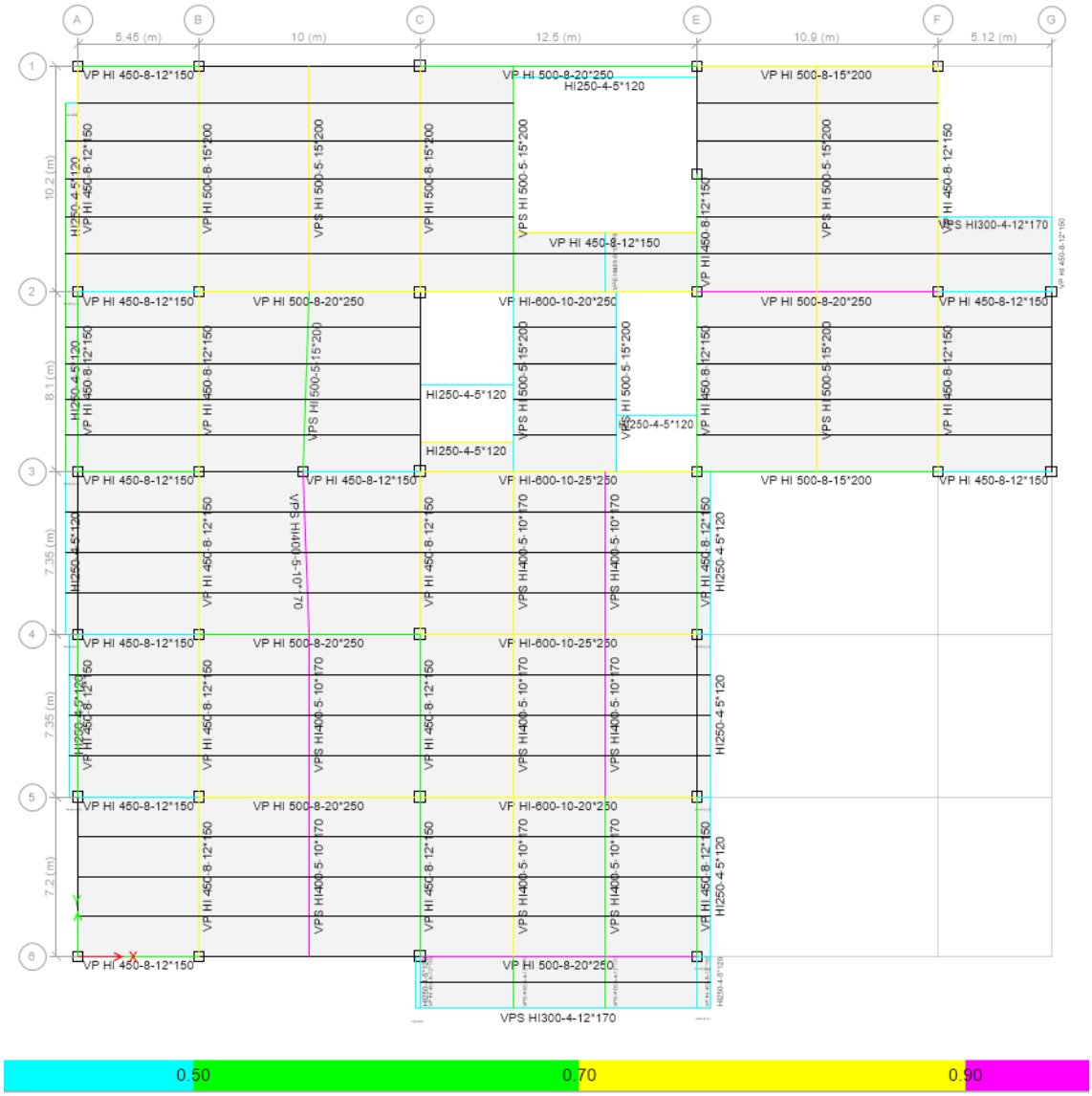
Nv. 0.00 m (Vigas principales)



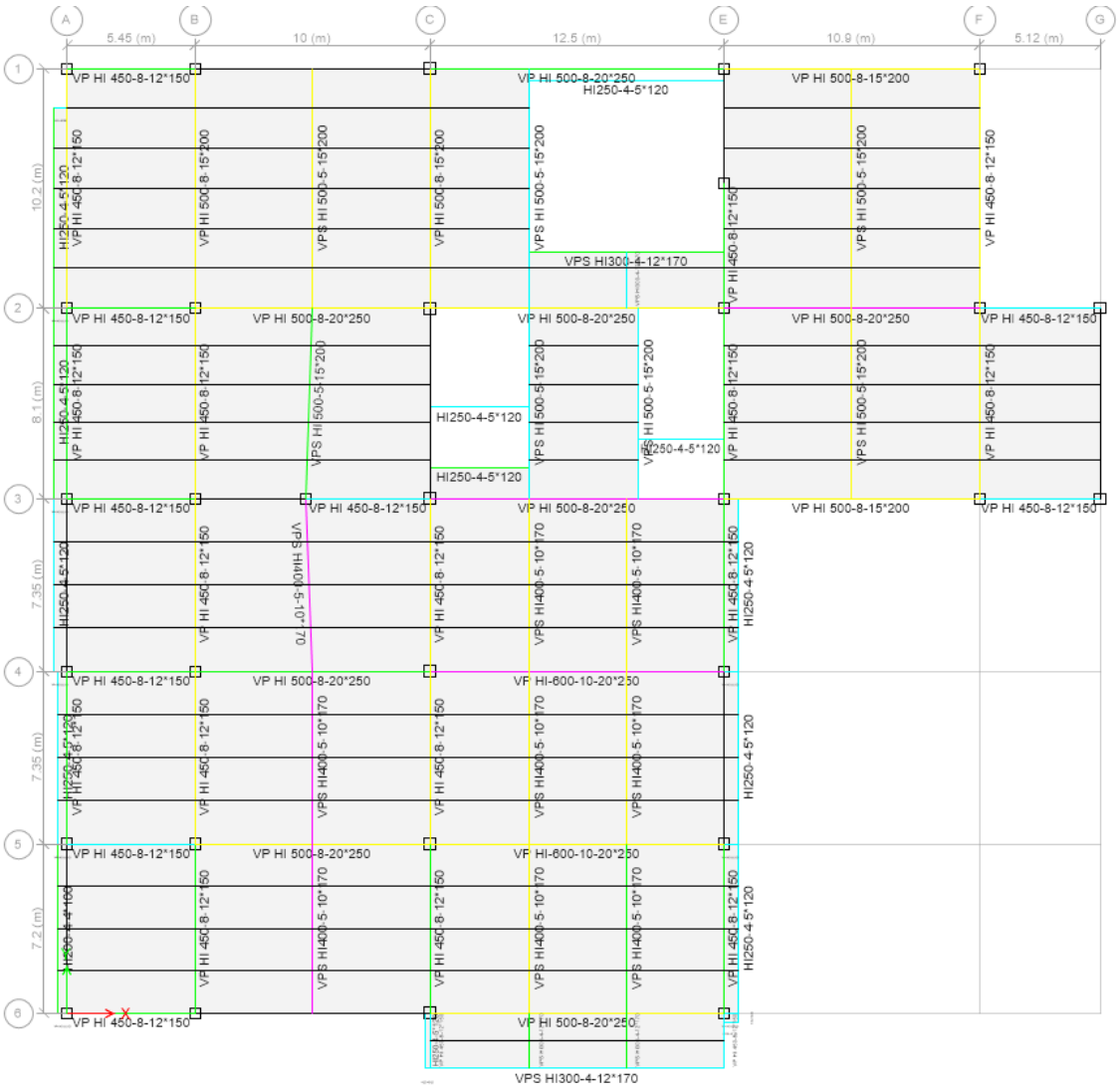
Nv. 4.08 m (Vigas principales)



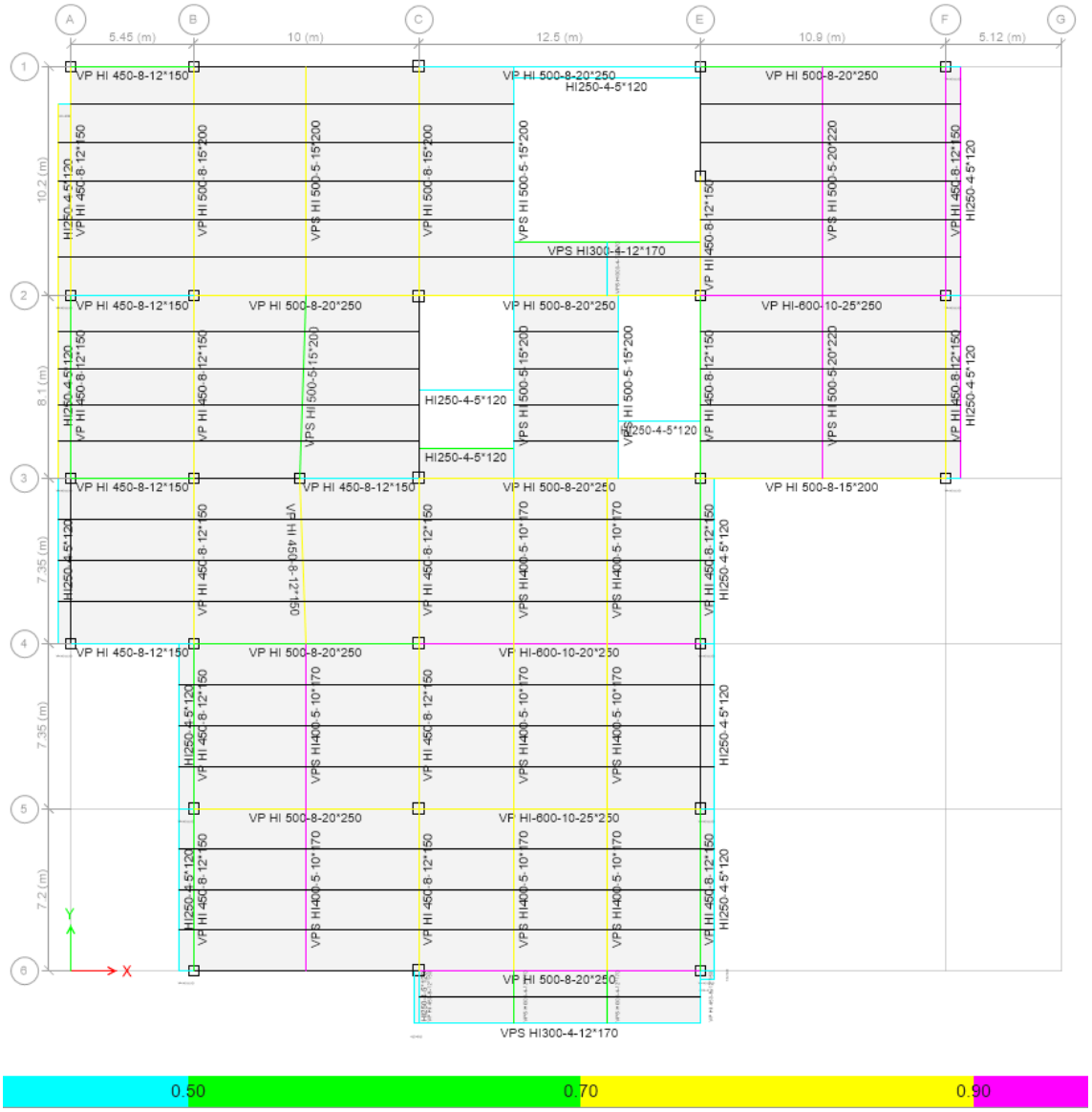
Nv. 8.16 m (Vigas principales)



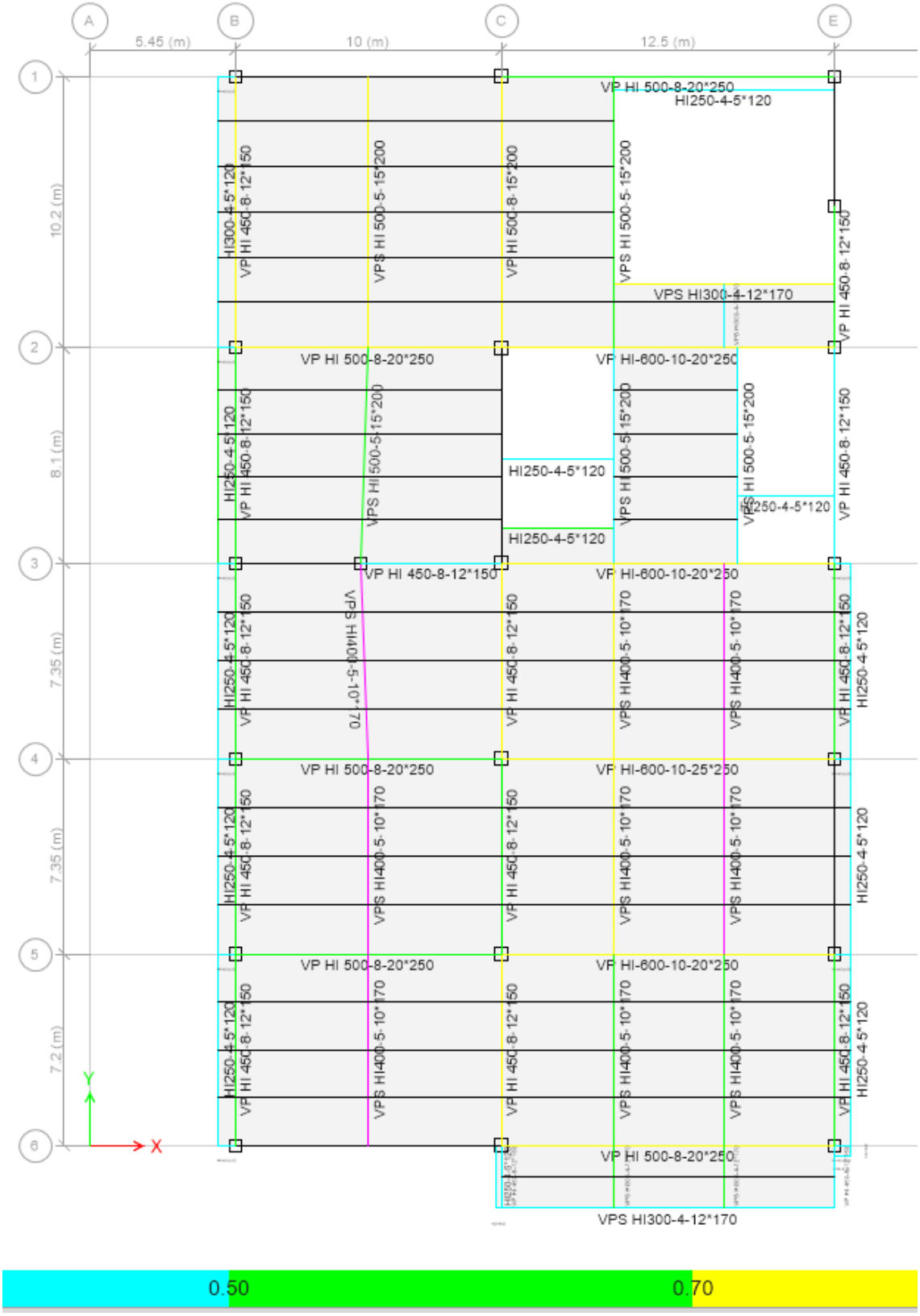
Nv. 12.24 m (Vigas principales)



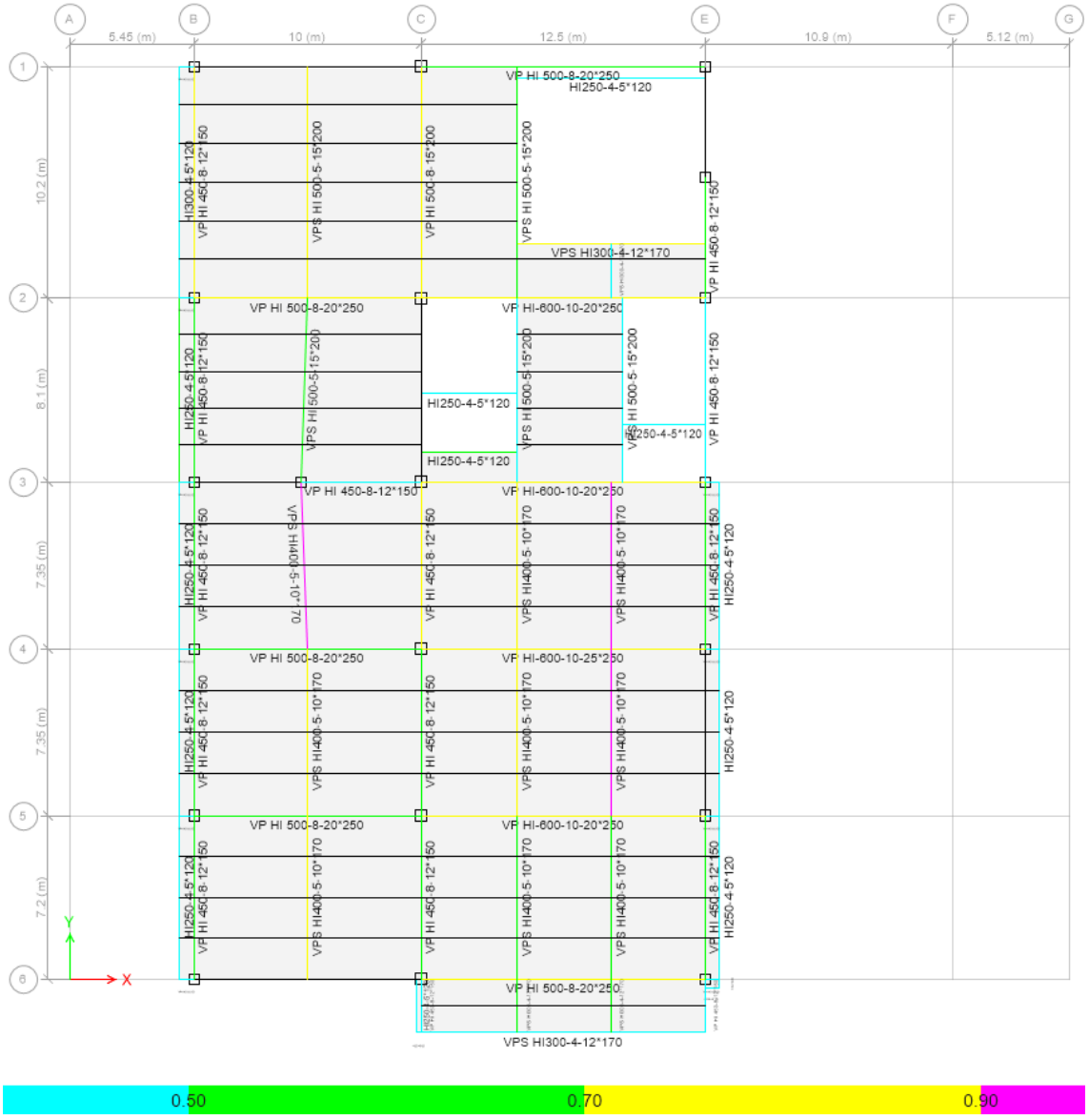
Nv. 16.32 m (Vigas principales)



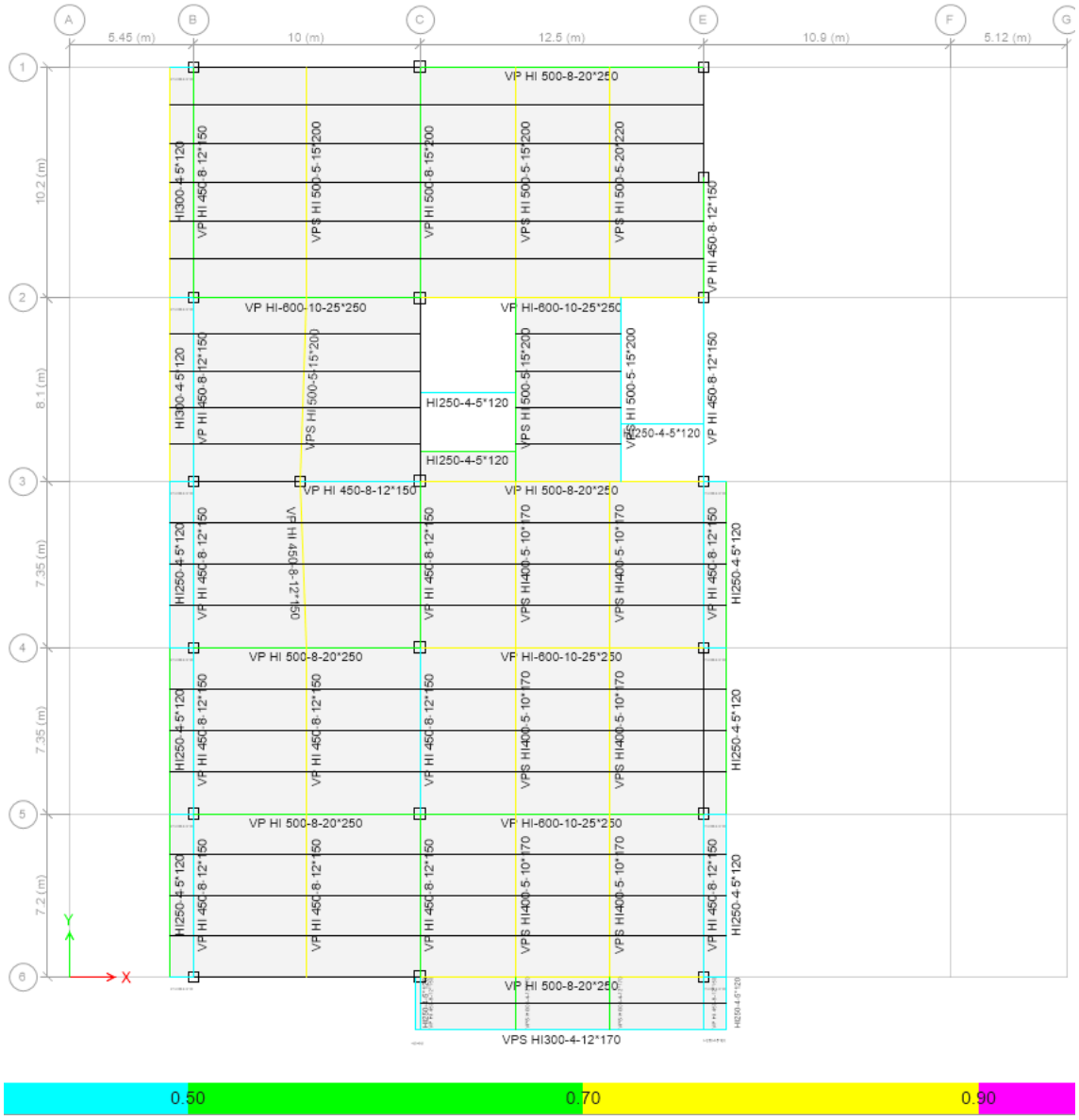
Nv. 20.40 m (Vigas principales)



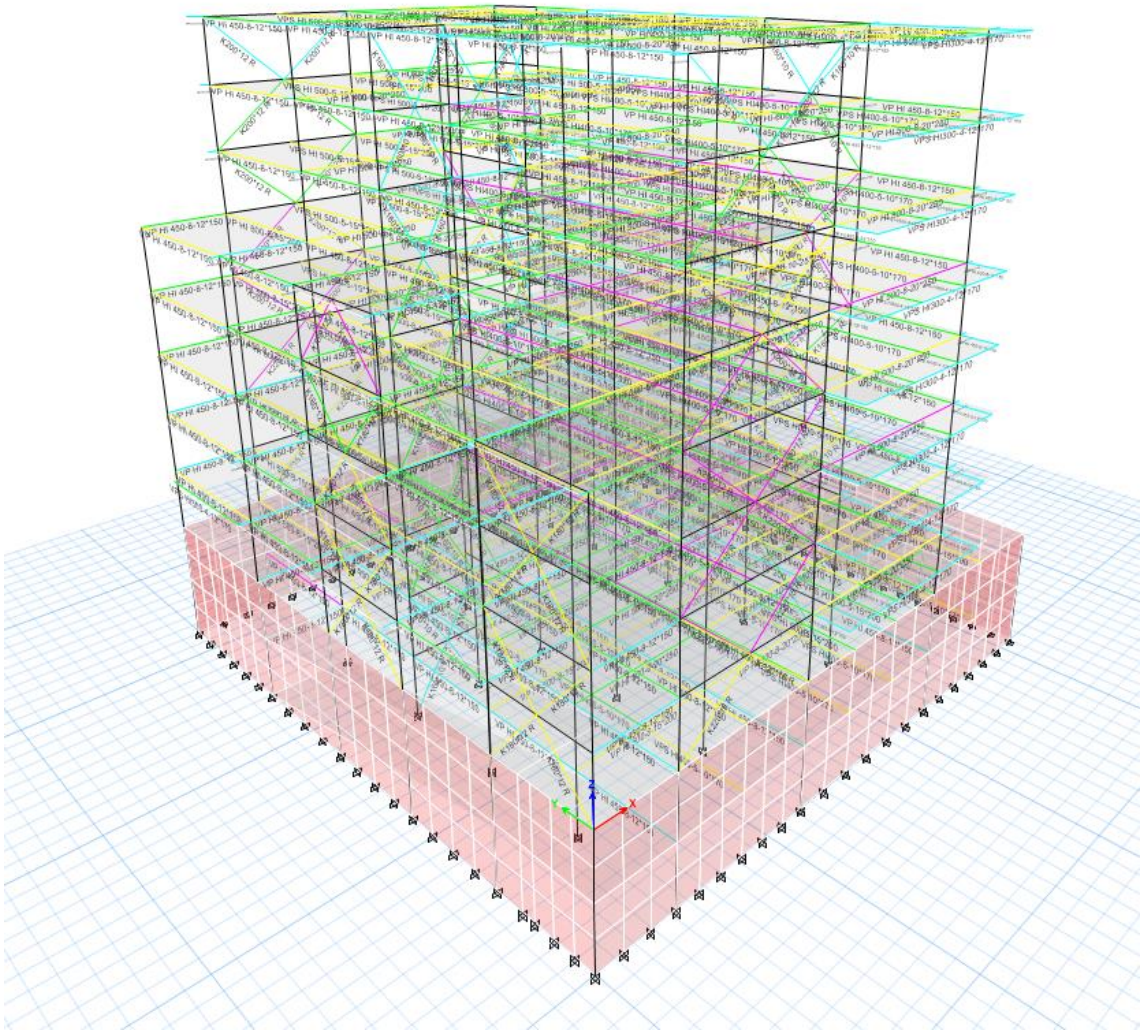
Nv. 24.48 m (Vigas principales)



Nv. 28.56 m (Vigas principales)

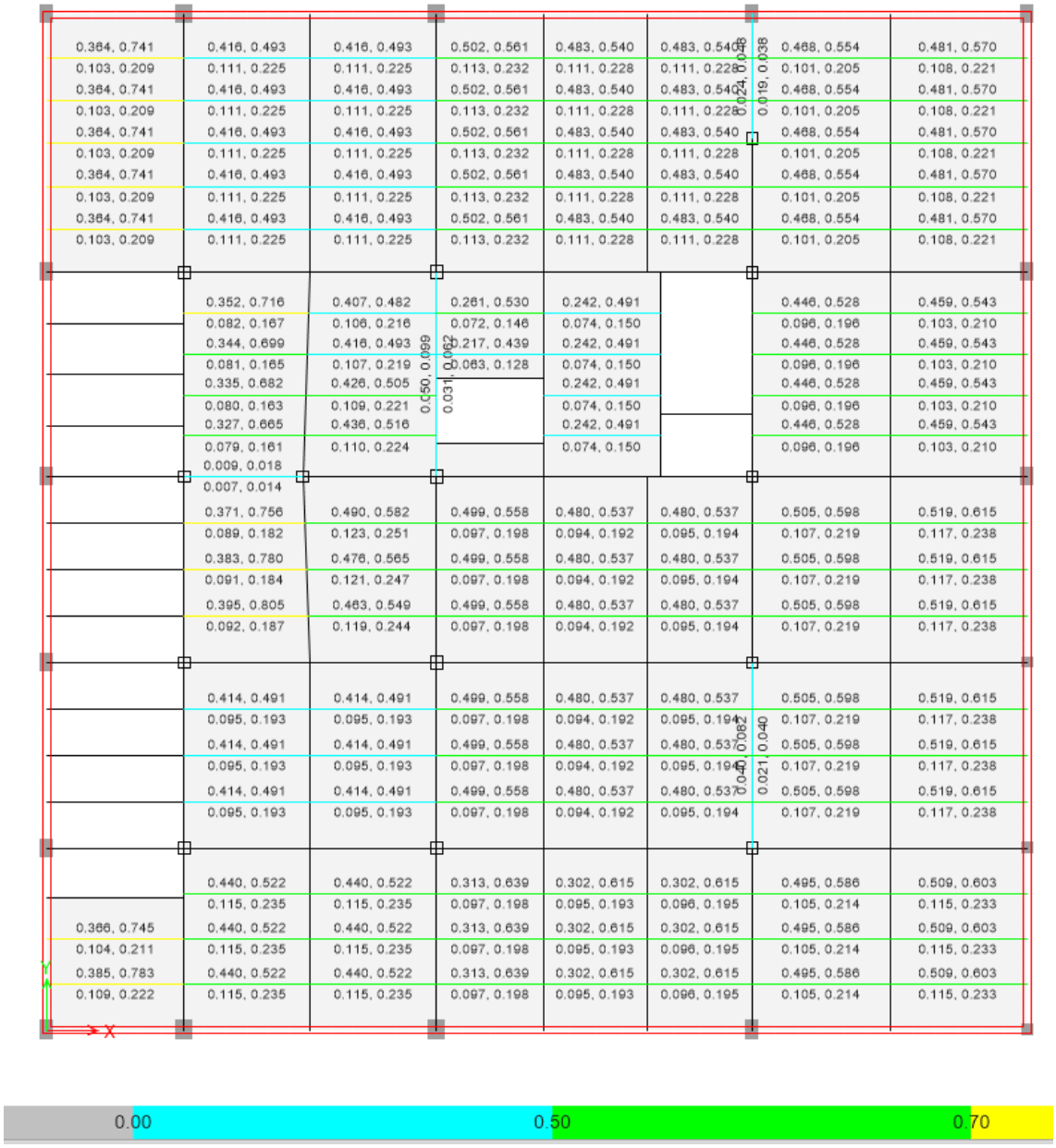


Nv. 32.64 m (Vigas principales)

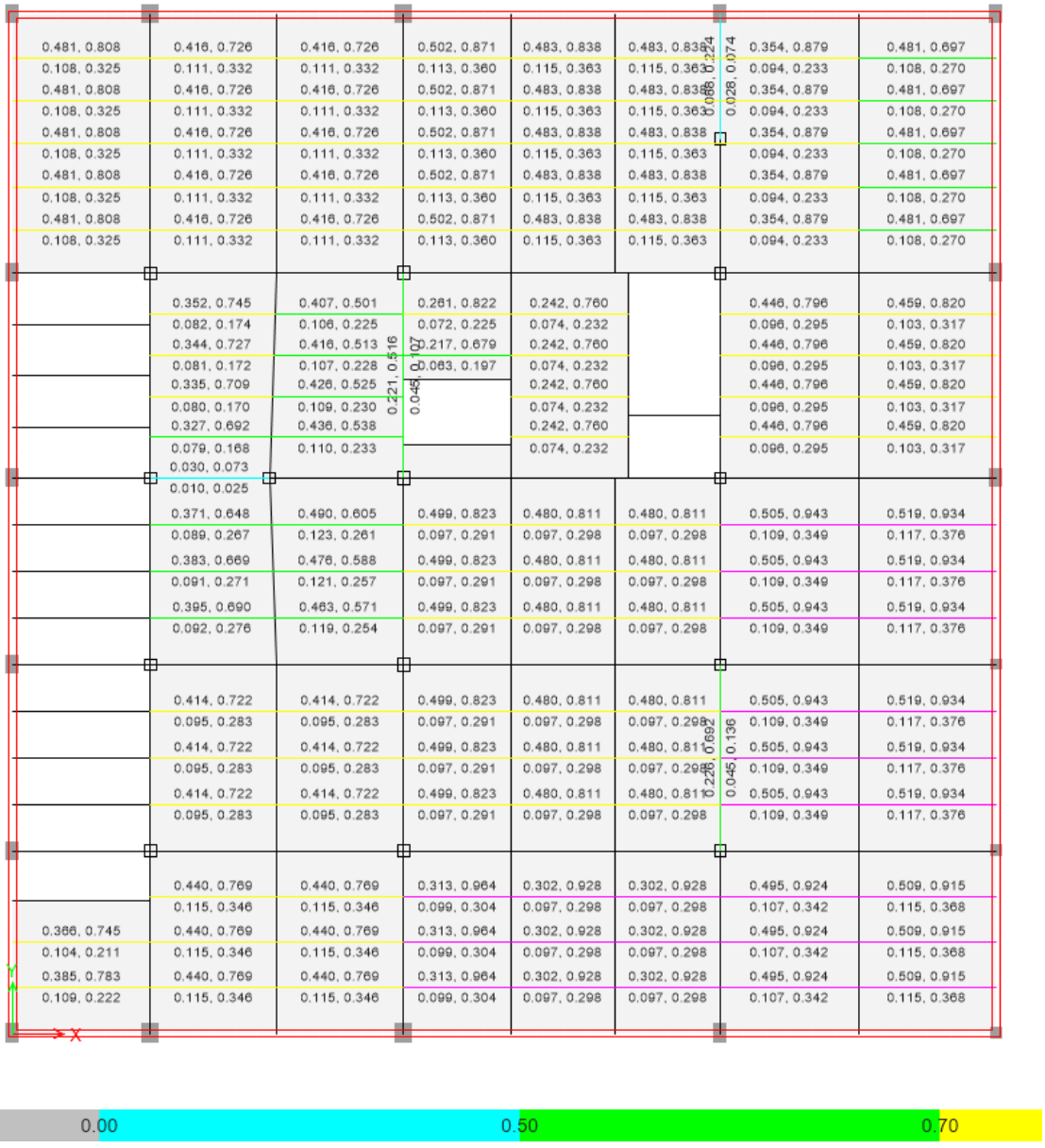


Relaciones demanda capacidad (Vista 3D)

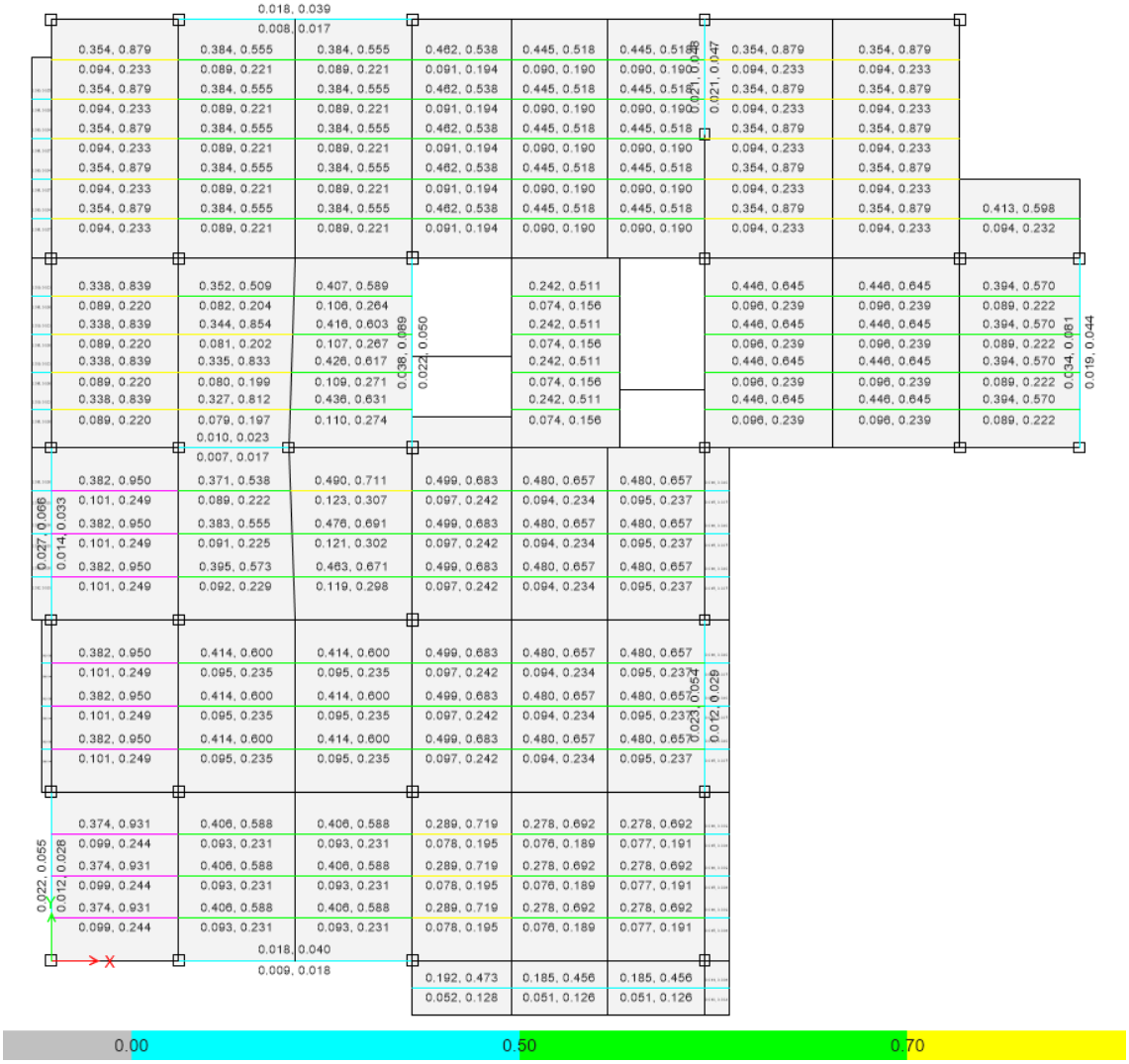
VIGAS SECUNDARIAS



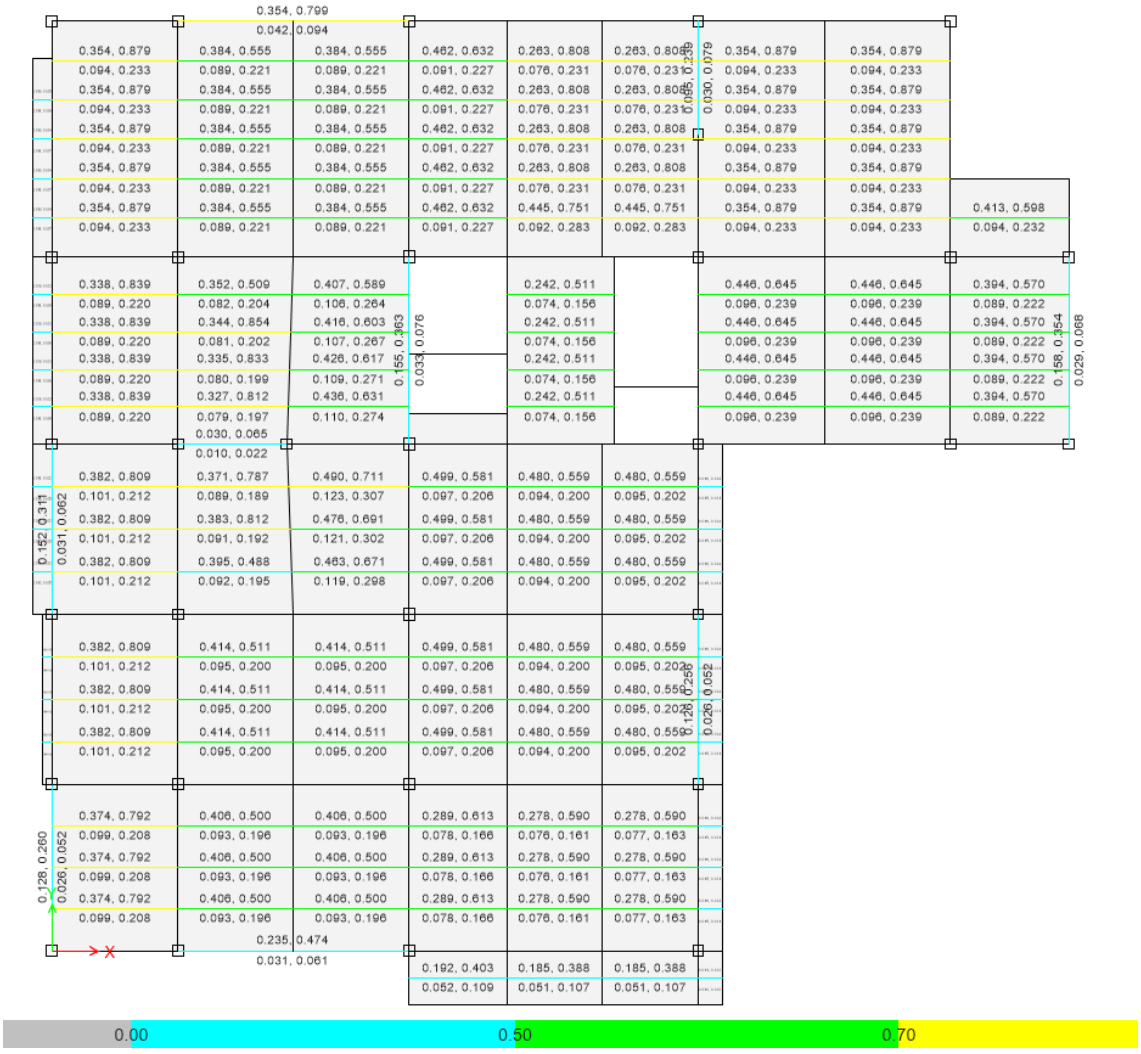
Nv. -4.08 m (Vigas secundarias)



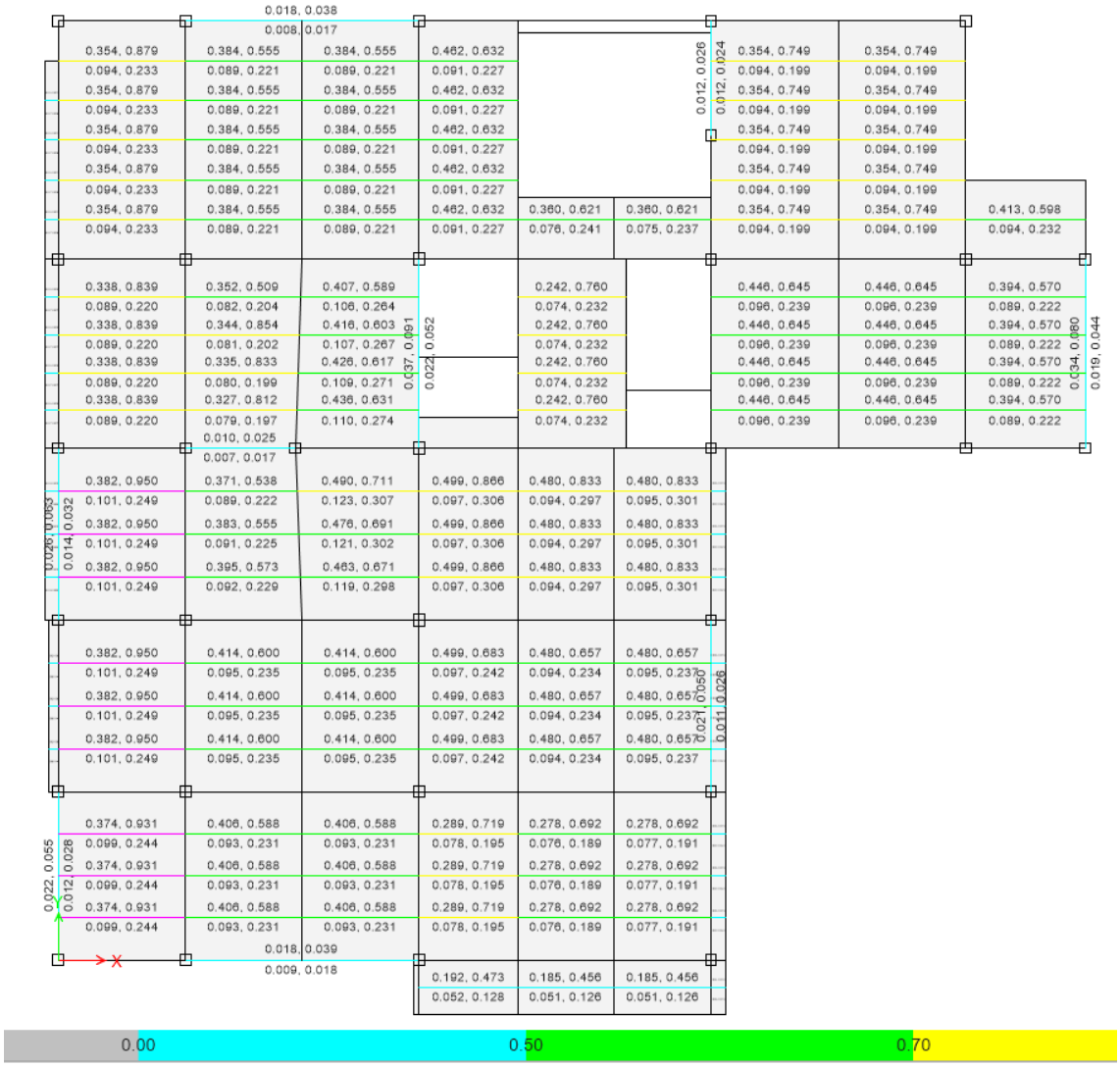
Nv. 0.00 m (Vigas secundarias)



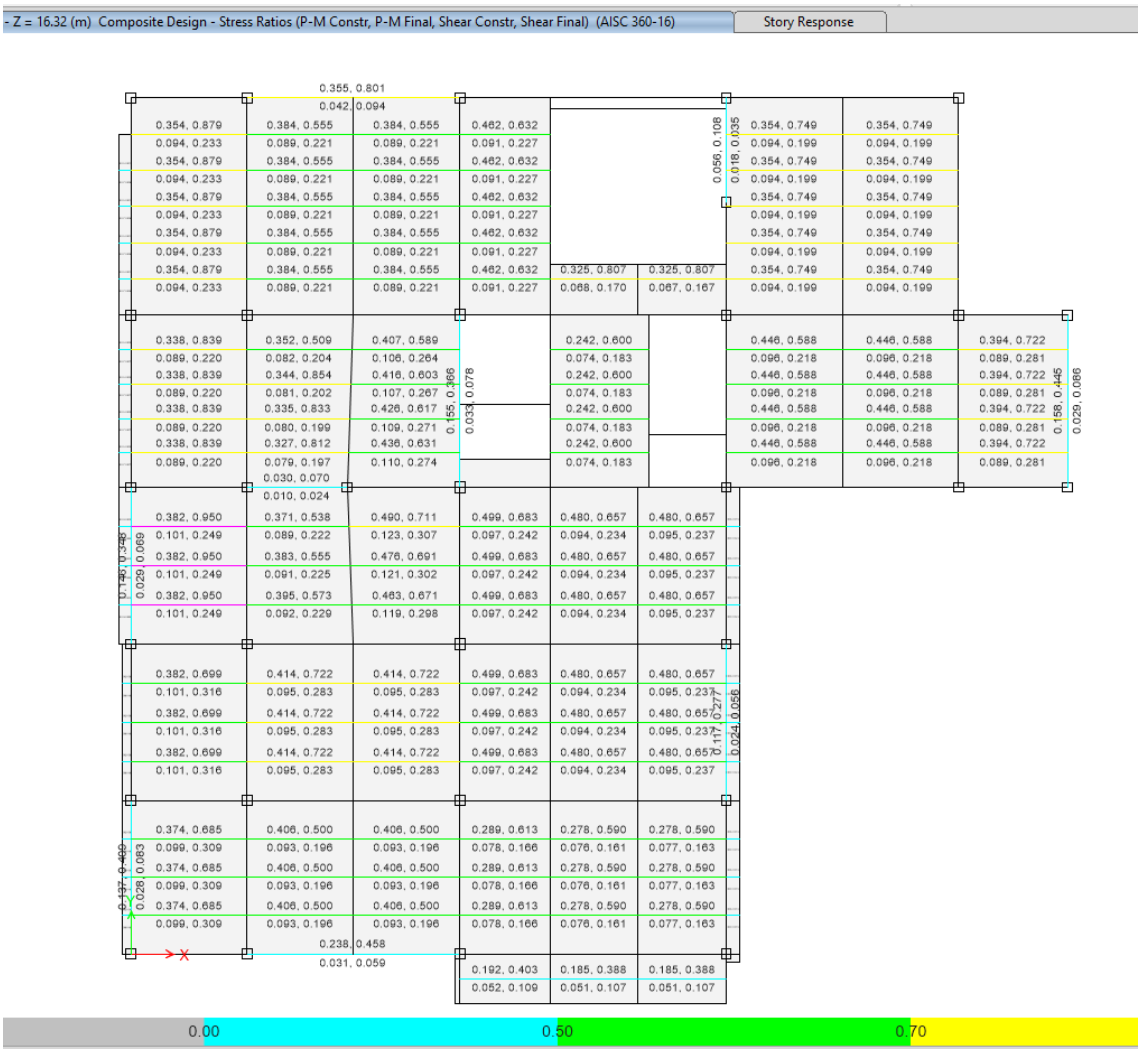
Nv. 4.08 m (Vigas secundarias)



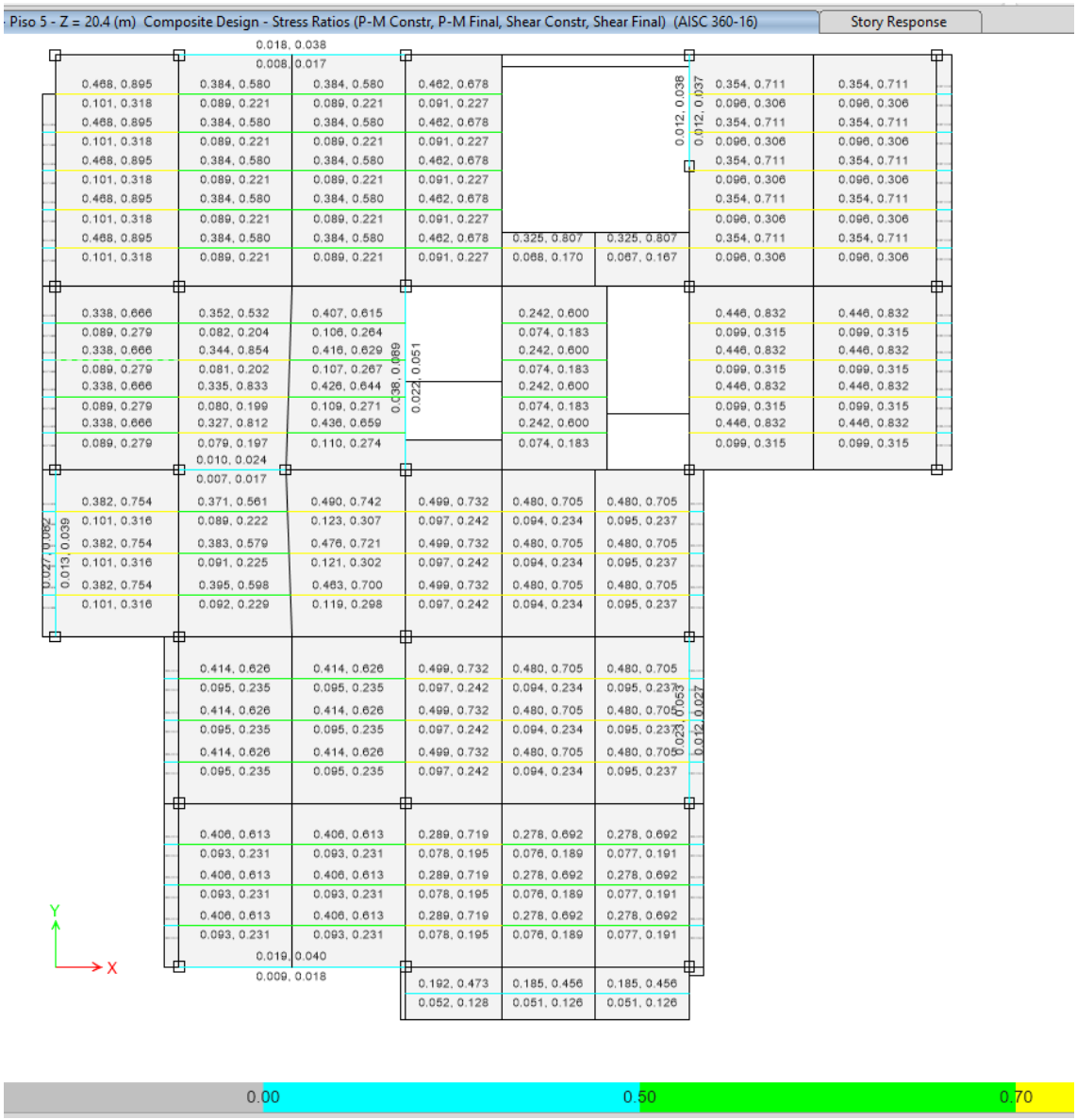
Nv. 8.16 m (Vigas secundarias)



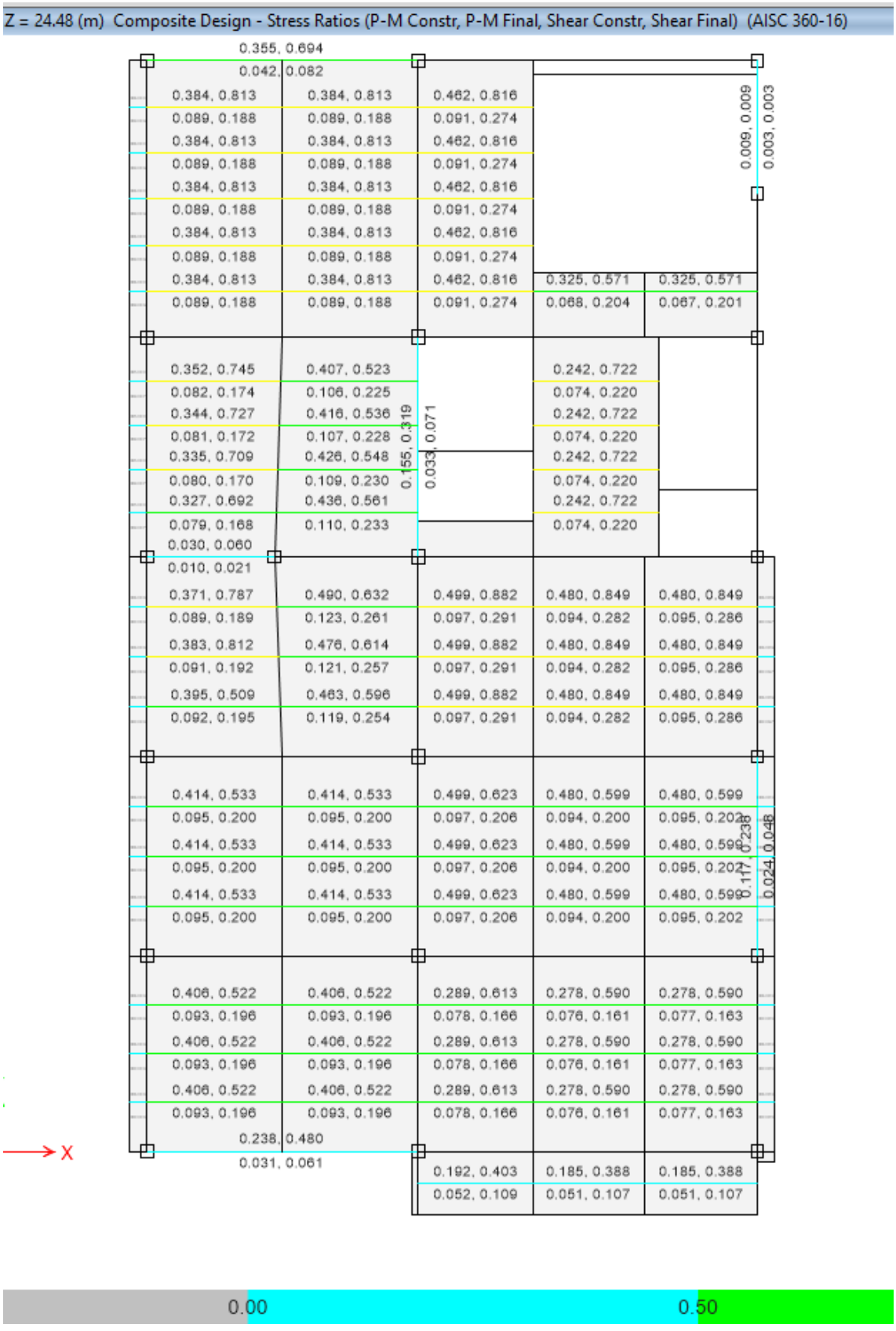
Nv. 12.24 m (Vigas secundarias)



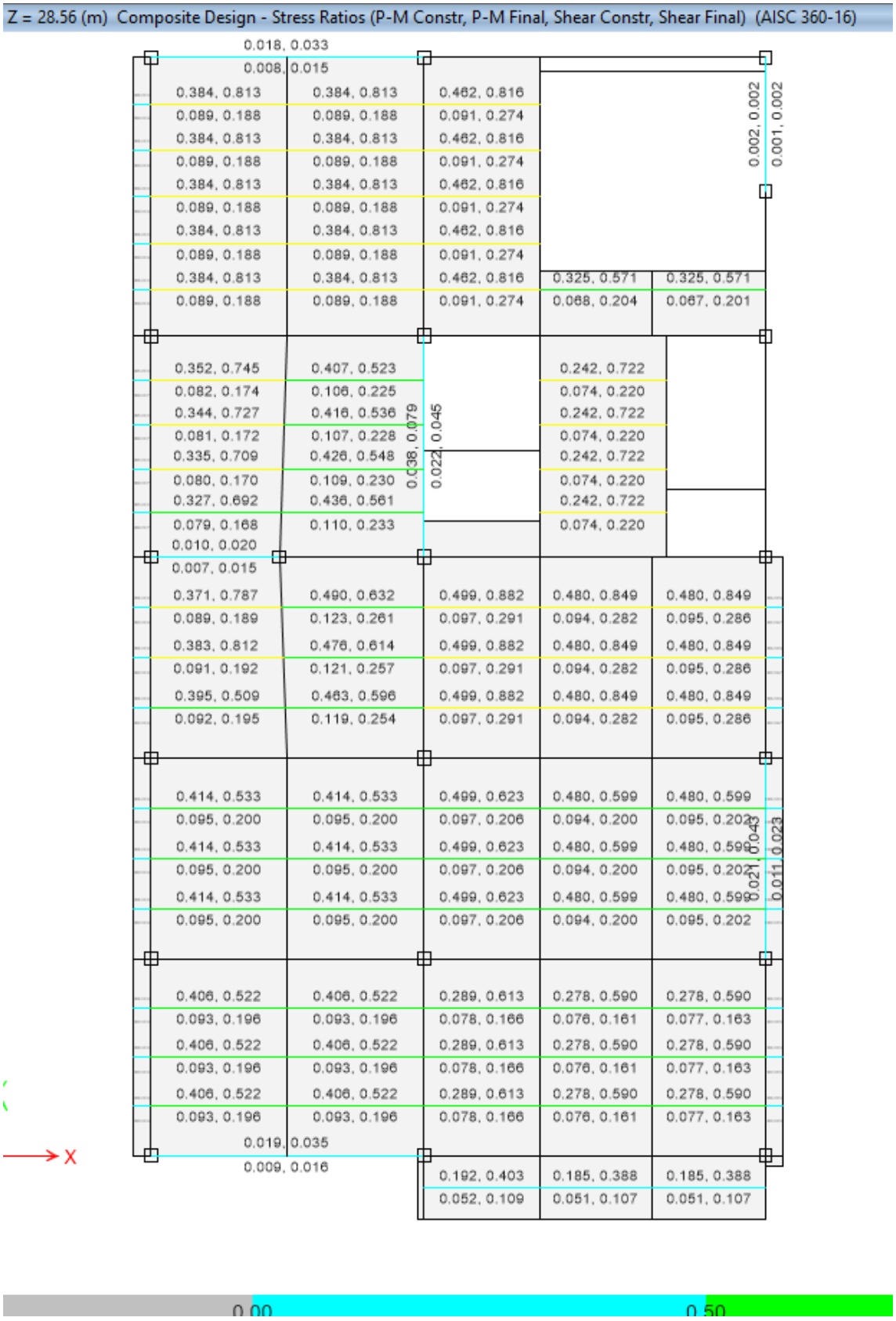
Nv. 16.32 m (Vigas secundarias)



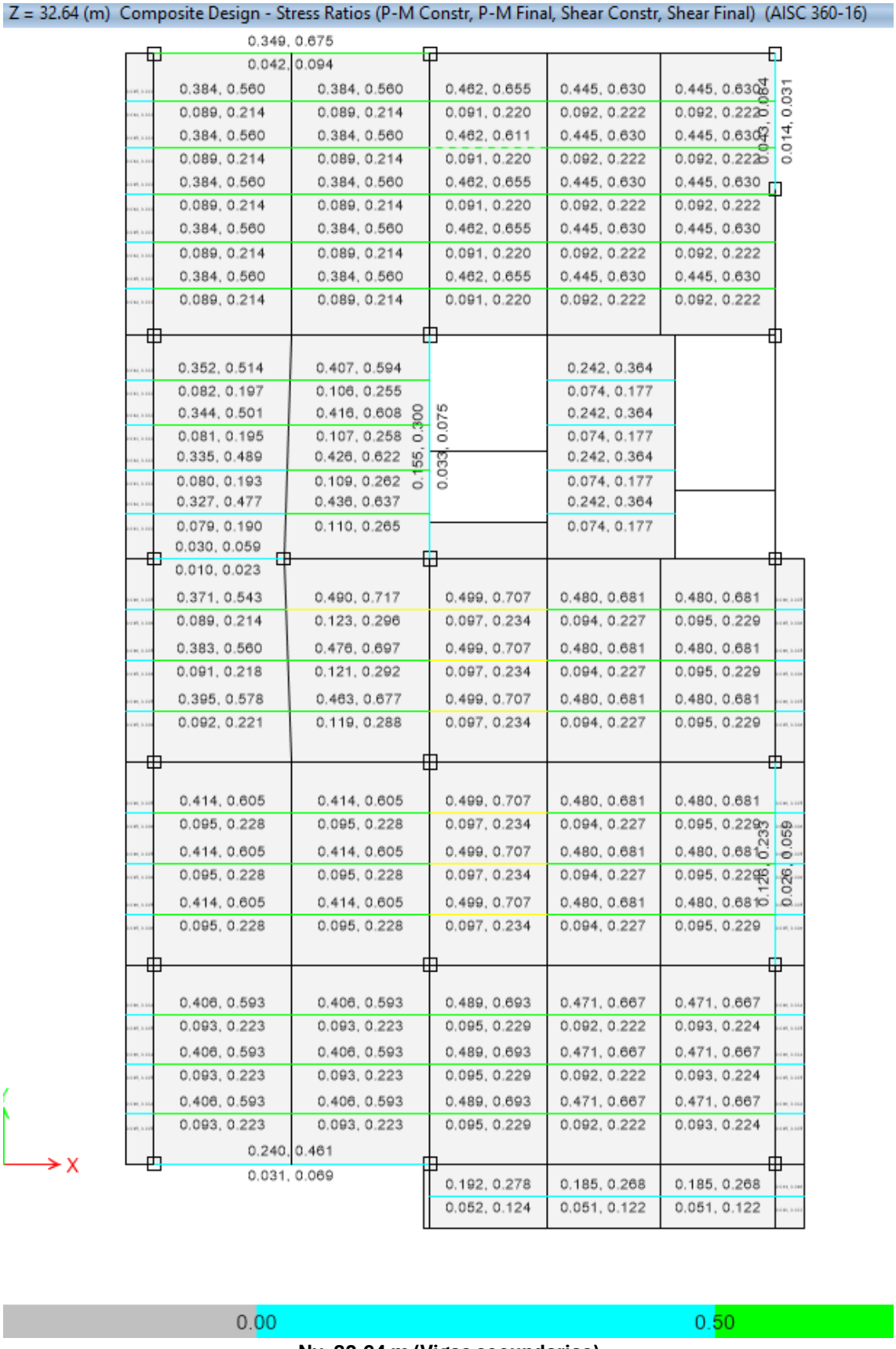
Nv. 20.40 m (Vigas secundarias)



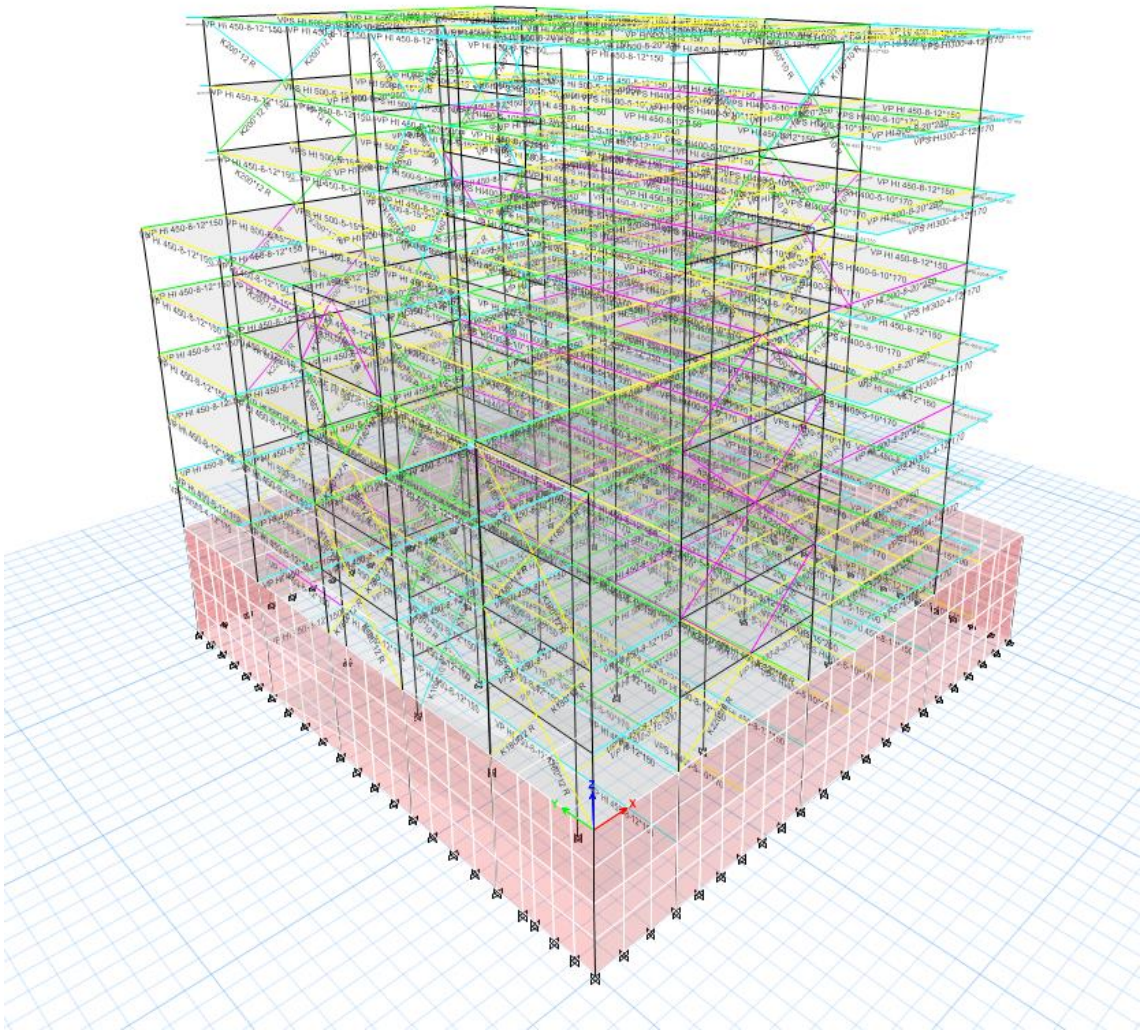
Nv. 24.48 m (Vigas secundarias)



Nv. 28.56 m (Vigas secundarias)

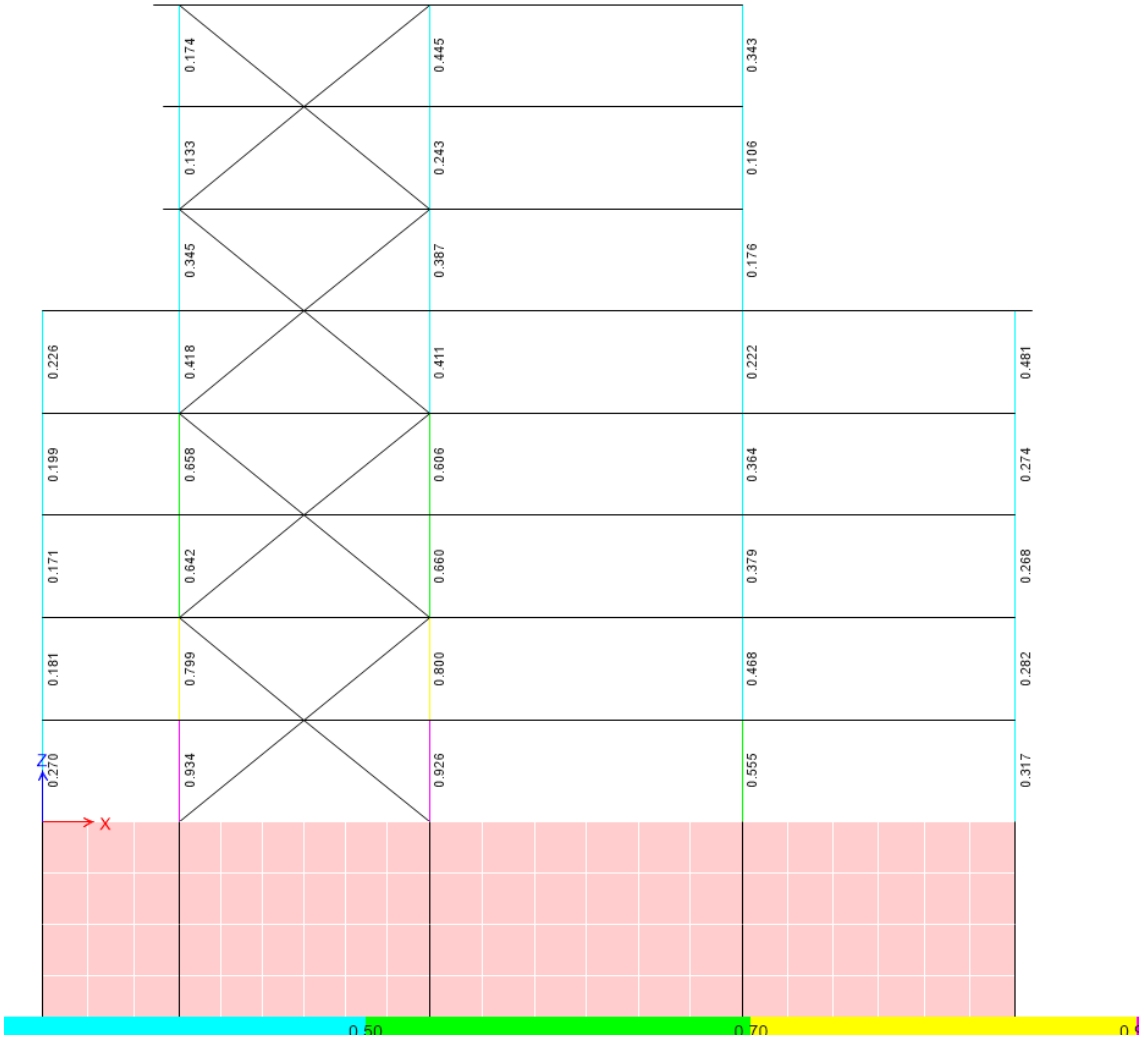


Nv. 32.64 m (Vigas secundarias)

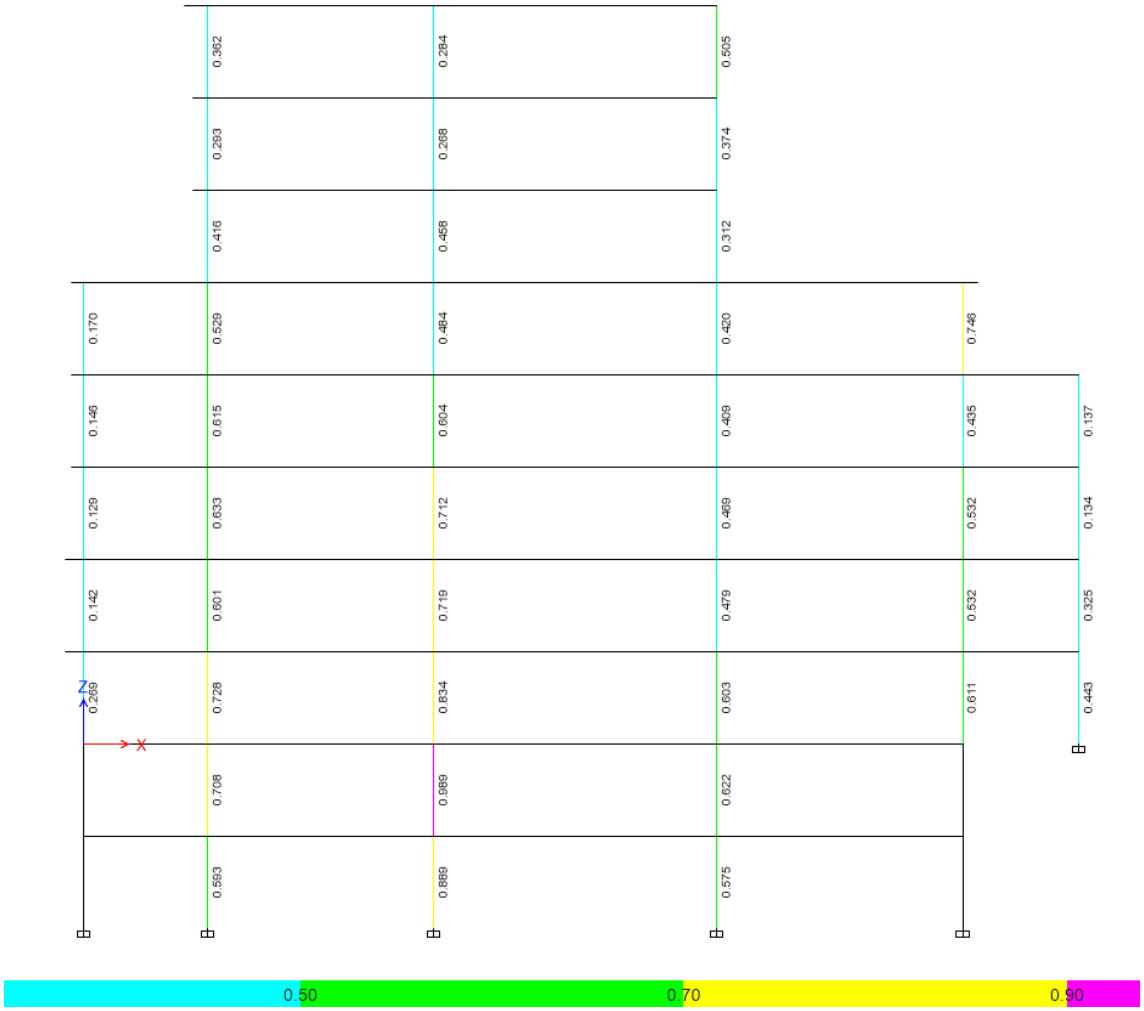


Relaciones demanda capacidad (Vista 3D)

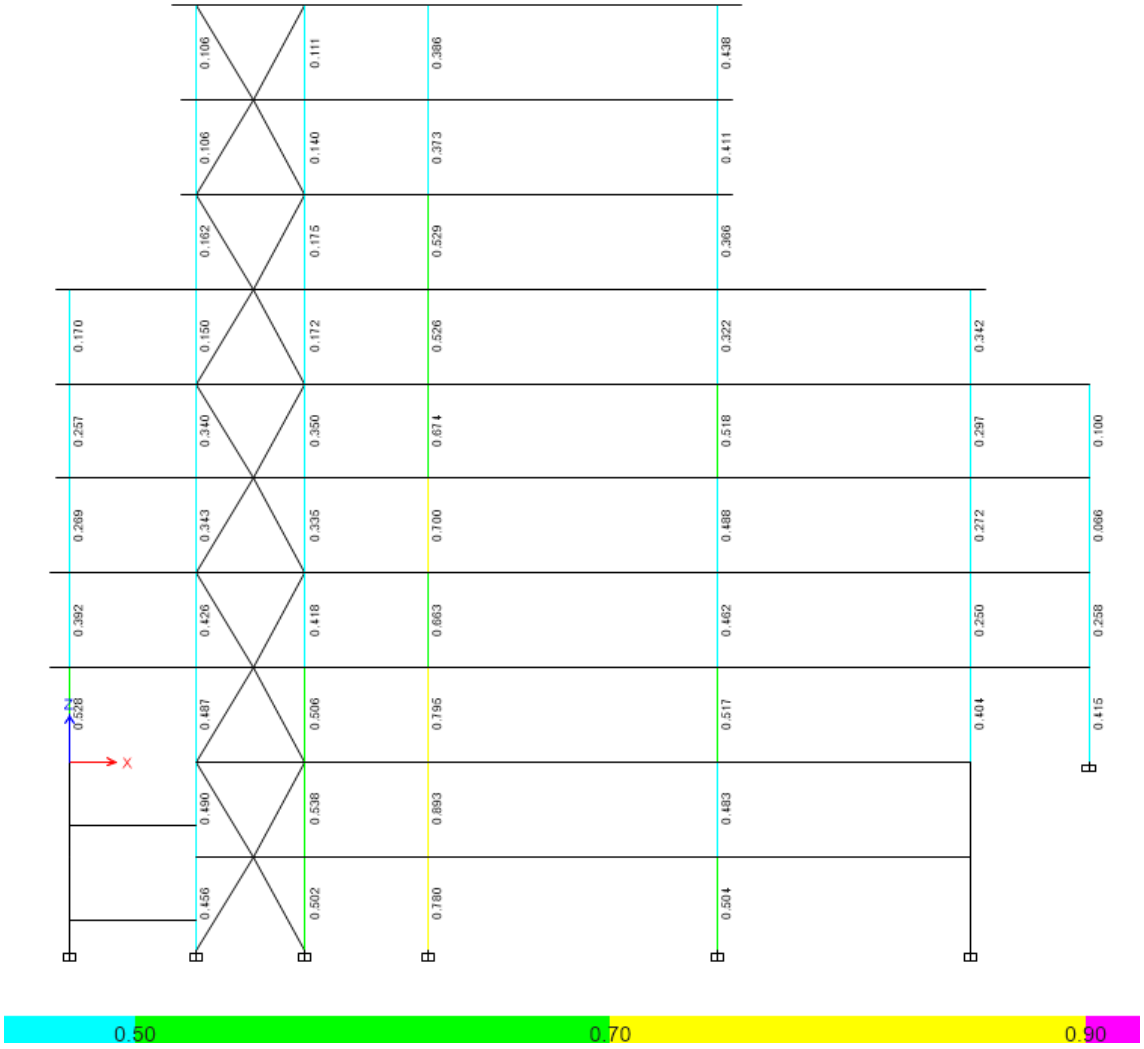
1.14 REVISIÓN RADIOS DE CAPACIDAD/COLUMNAS:



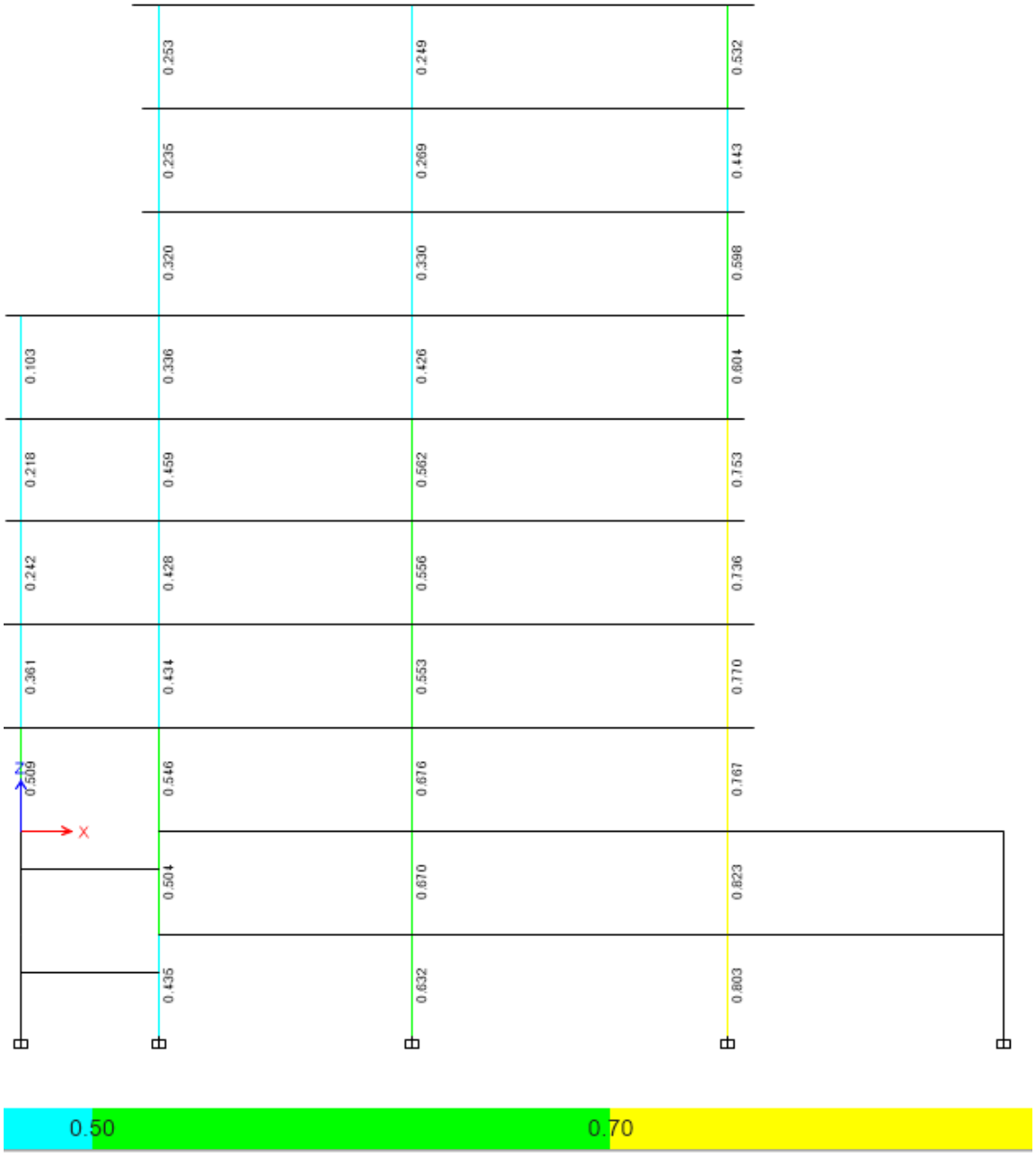
PÓRTICO 1


0.362
0.284
0.505
0.293
0.266
0.374
0.416
0.458
0.312
0.170
0.529
0.484
0.420
0.746
0.146
0.615
0.604
0.409
0.435
0.137
0.129
0.633
0.712
0.469
0.532
0.134
0.142
0.601
0.719
0.479
0.532
0.325
Z
X
0.269
0.728
0.634
0.603
0.611
0.443
0.708
0.969
0.622
0.593
0.889
0.575
0.50
0.70
0.90

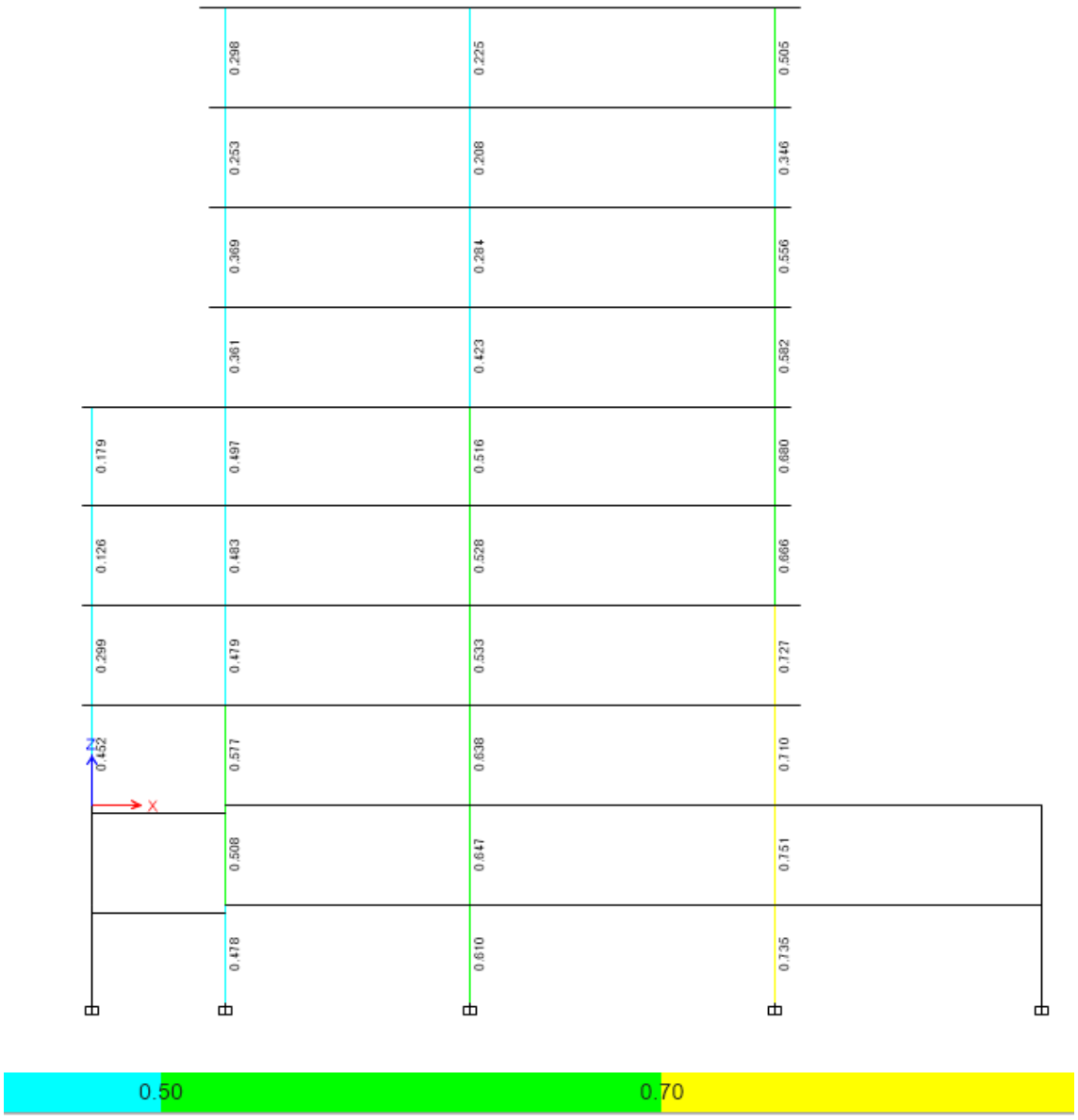
PÓRTICO 2


0.106
0.111
0.386
0.438
0.106
0.140
0.373
0.411
0.162
0.175
0.529
0.366
0.170
0.150
0.172
0.526
0.322
0.342
0.257
0.340
0.350
0.674
0.518
0.297
0.100
0.289
0.343
0.335
0.700
0.488
0.272
0.066
0.392
0.426
0.418
0.663
0.462
0.250
0.258
0.528
0.487
0.506
0.795
0.517
0.404
0.415
0.490
0.538
0.893
0.483
0.456
0.502
0.780
0.504
Z
X
0.50
0.70
0.90

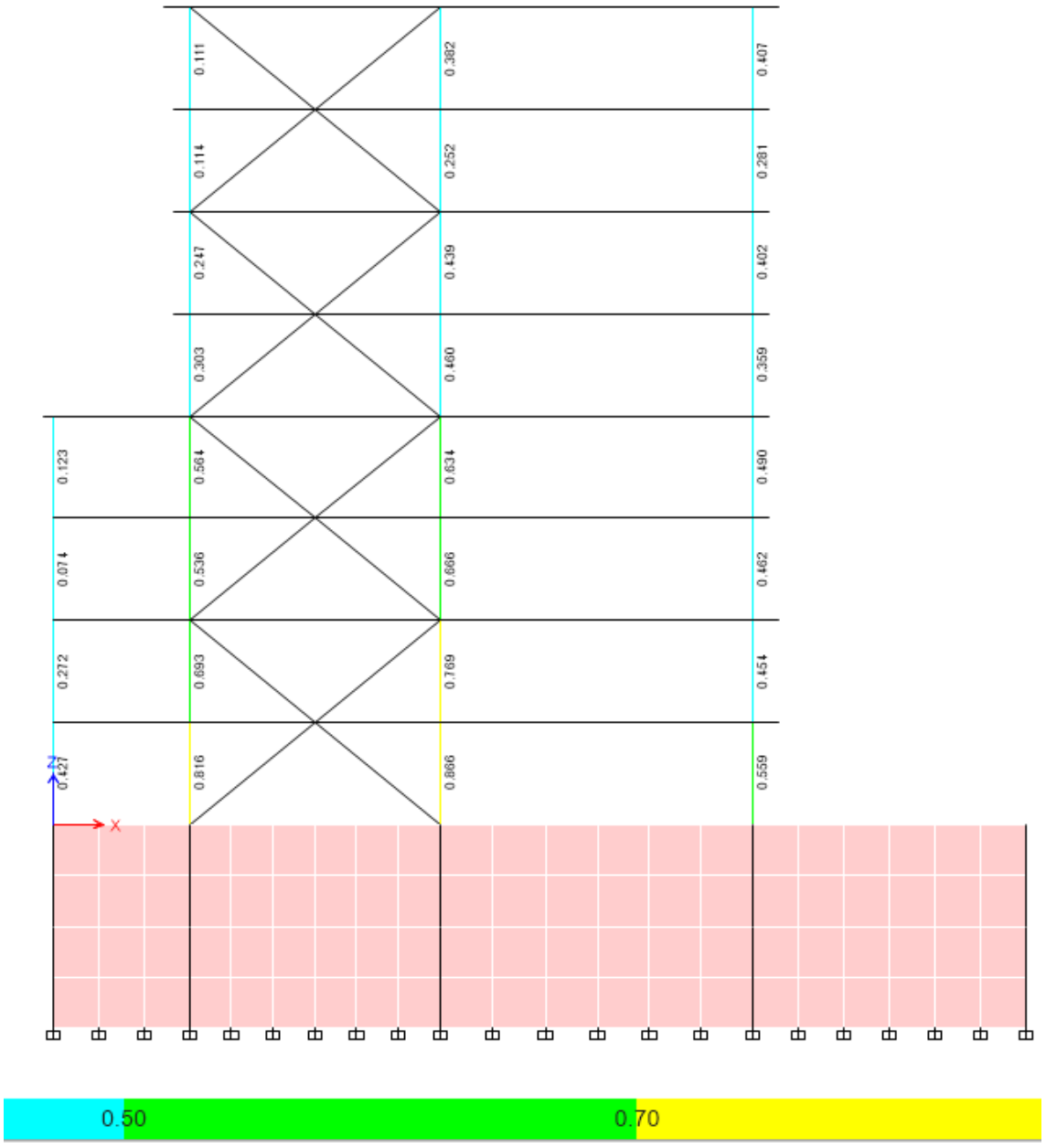
PÓRTICO 3


0.253
0.249
0.532
0.235
0.269
0.443
0.320
0.330
0.598
0.103
0.336
0.426
0.604
0.218
0.459
0.562
0.753
0.242
0.428
0.556
0.736
0.361
0.434
0.553
0.770
0.509
0.546
0.676
0.767
0.504
0.670
0.823
0.435
0.632
0.803
Z
X
0.50
0.70

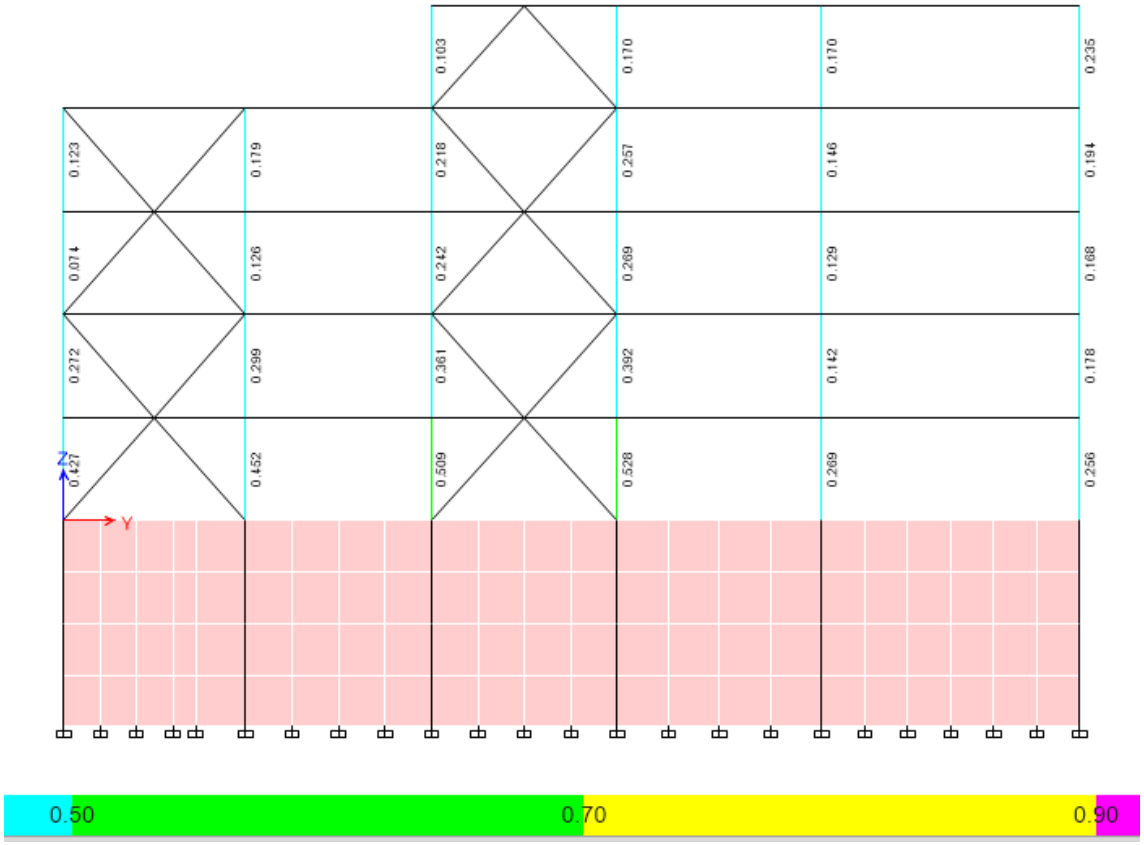
PÓRTICO 4


0.298
0.225
0.505
0.253
0.208
0.346
0.369
0.284
0.556
0.361
0.423
0.582
0.179
0.497
0.516
0.680
0.126
0.483
0.528
0.666
0.299
0.479
0.533
0.727
0.452
0.577
0.638
0.710
0.508
0.647
0.751
0.478
0.610
0.735
Z
X
0.50
0.70

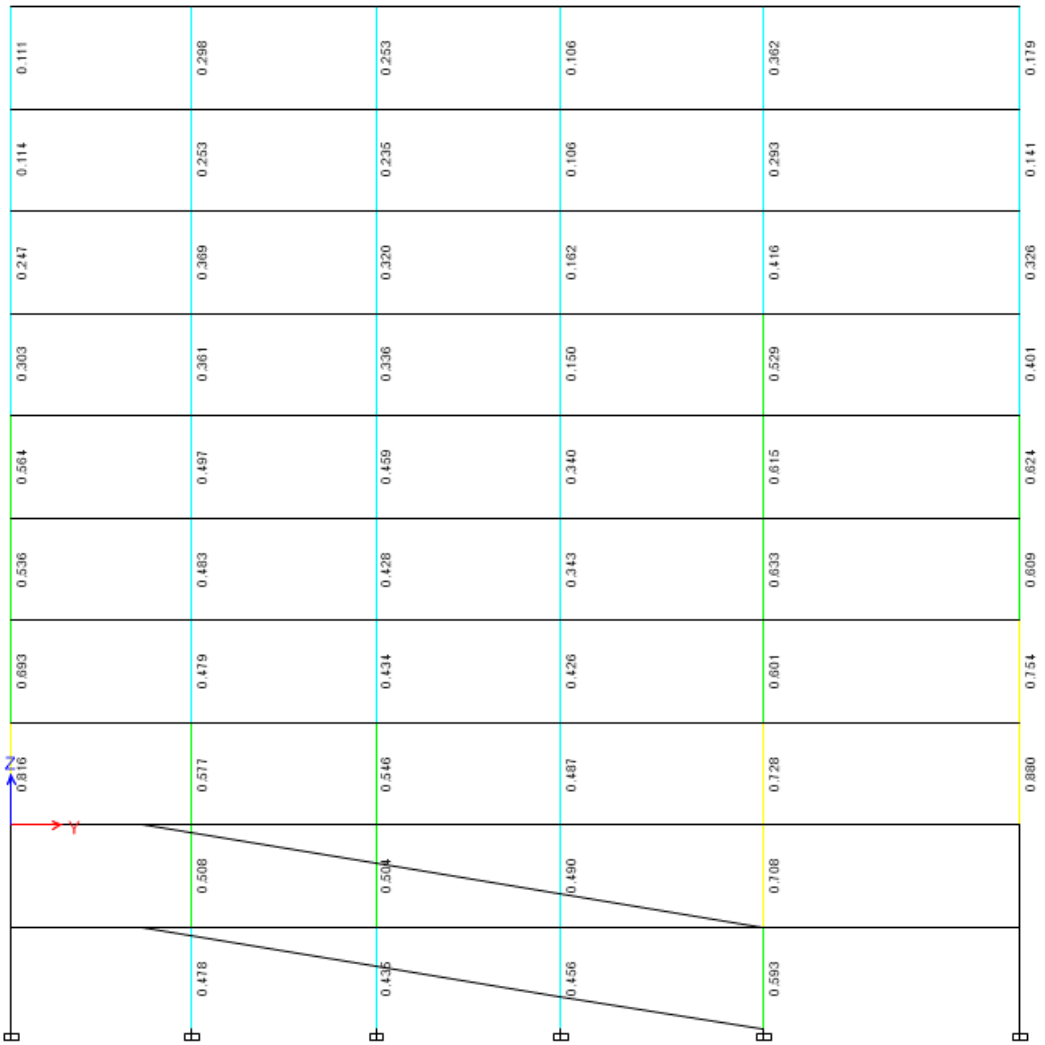
PÓRTICO 5


0.111
0.382
0.407
0.114
0.252
0.281
0.247
0.439
0.402
0.303
0.460
0.359
0.123
0.564
0.634
0.490
0.074
0.536
0.666
0.462
0.272
0.693
0.769
0.454
0.427
0.816
0.866
0.559
Z
X
0.50
0.70

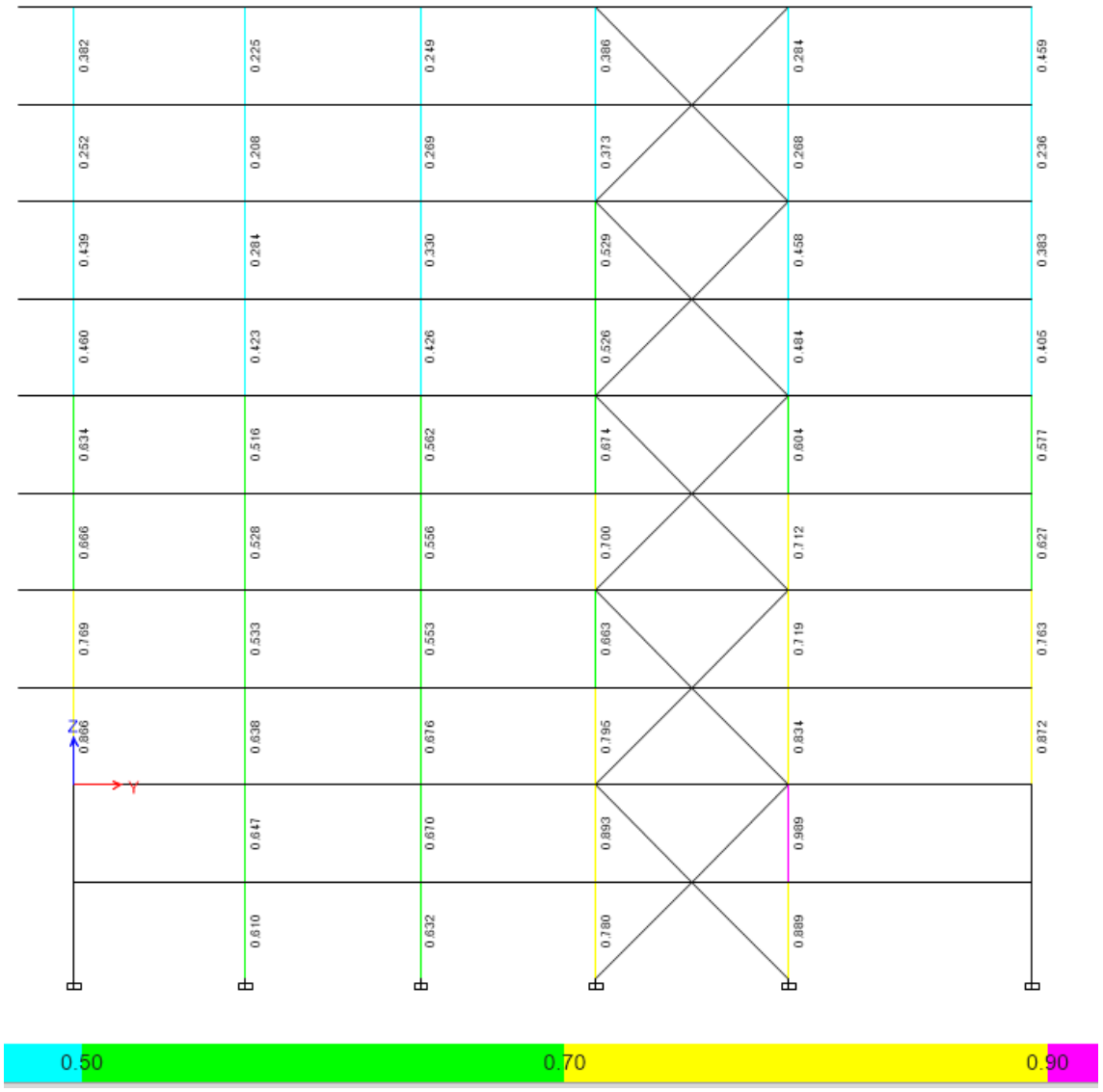
PÓRTICO 6


0.103
0.170
0.170
0.235
0.123
0.179
0.218
0.257
0.146
0.194
0.071
0.126
0.242
0.269
0.129
0.168
0.272
0.299
0.361
0.392
0.142
0.178
0.427
0.452
0.509
0.528
0.269
0.256
Z
Y
0.50
0.70
0.90

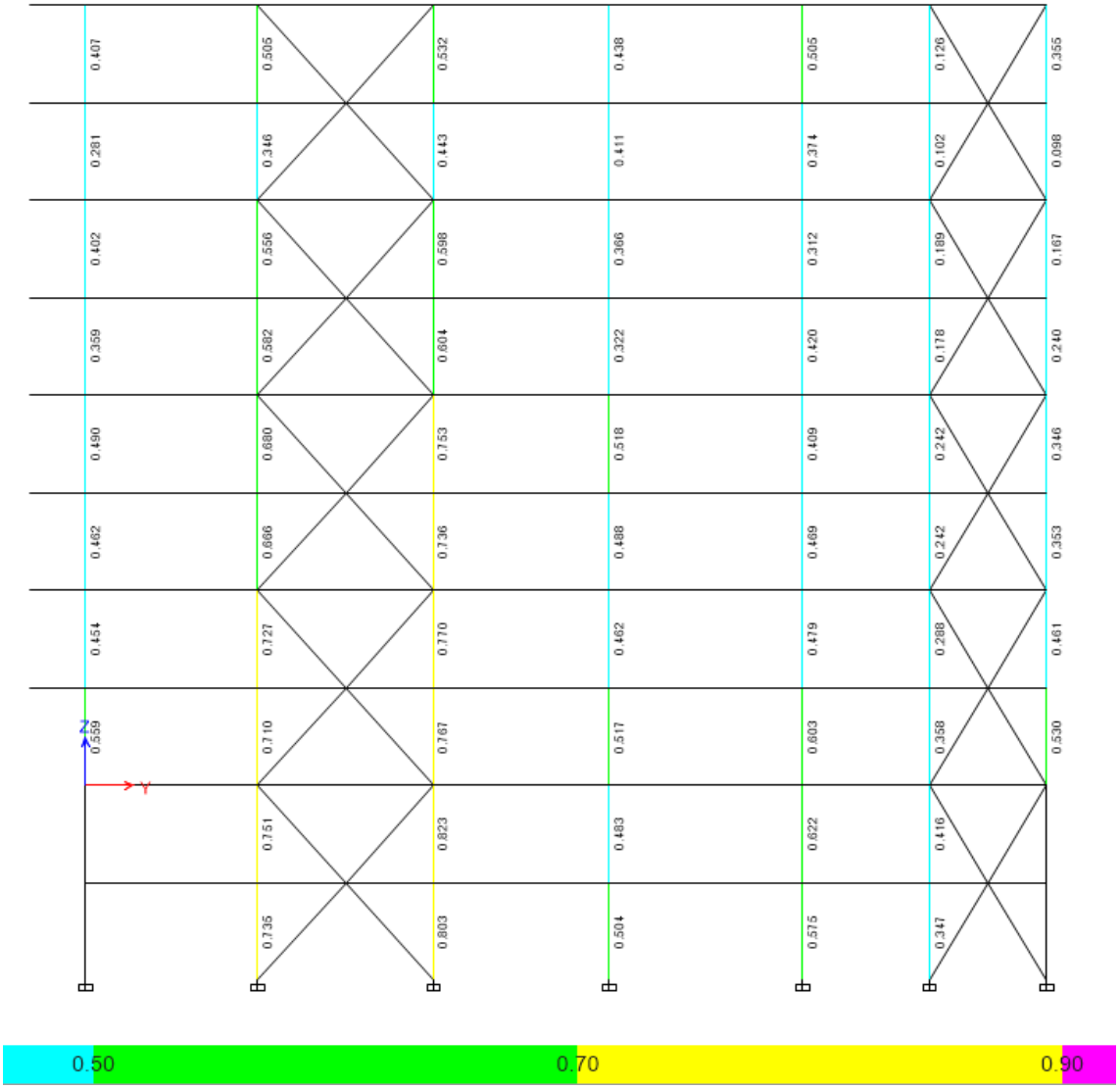
PÓRTICO A


0.111
0.298
0.253
0.106
0.362
0.179
0.114
0.253
0.235
0.106
0.293
0.141
0.247
0.369
0.320
0.162
0.416
0.326
0.303
0.361
0.336
0.150
0.529
0.401
0.564
0.497
0.459
0.340
0.615
0.624
0.536
0.483
0.428
0.343
0.633
0.609
0.893
0.479
0.434
0.426
0.601
0.754
0.816
0.577
0.546
0.487
0.728
0.880
0.508
0.504
0.490
0.708
0.478
0.435
0.456
0.593
Z
Y

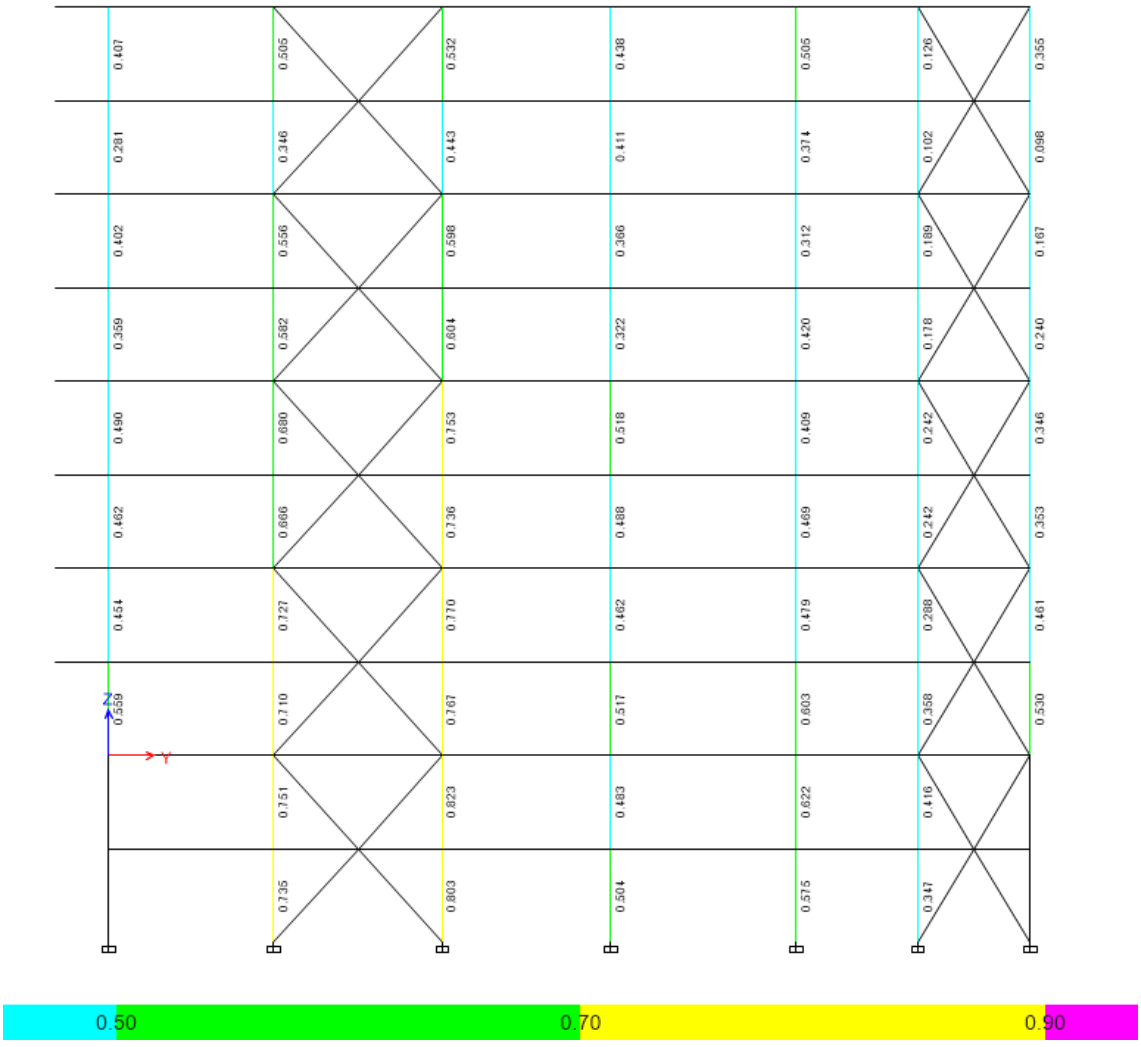
PÓRTICO B


0.382
0.225
0.249
0.386
0.284
0.459
0.252
0.208
0.269
0.373
0.268
0.236
0.439
0.284
0.330
0.529
0.458
0.383
0.460
0.423
0.426
0.526
0.484
0.405
0.634
0.516
0.562
0.674
0.604
0.577
0.666
0.528
0.556
0.700
0.712
0.627
0.769
0.533
0.553
0.663
0.719
0.763
0.866
0.638
0.676
0.795
0.834
0.872
0.647
0.670
0.893
0.989
0.610
0.632
0.780
0.889
Z
Y
0.50
0.70
0.90

PÓRTICO C



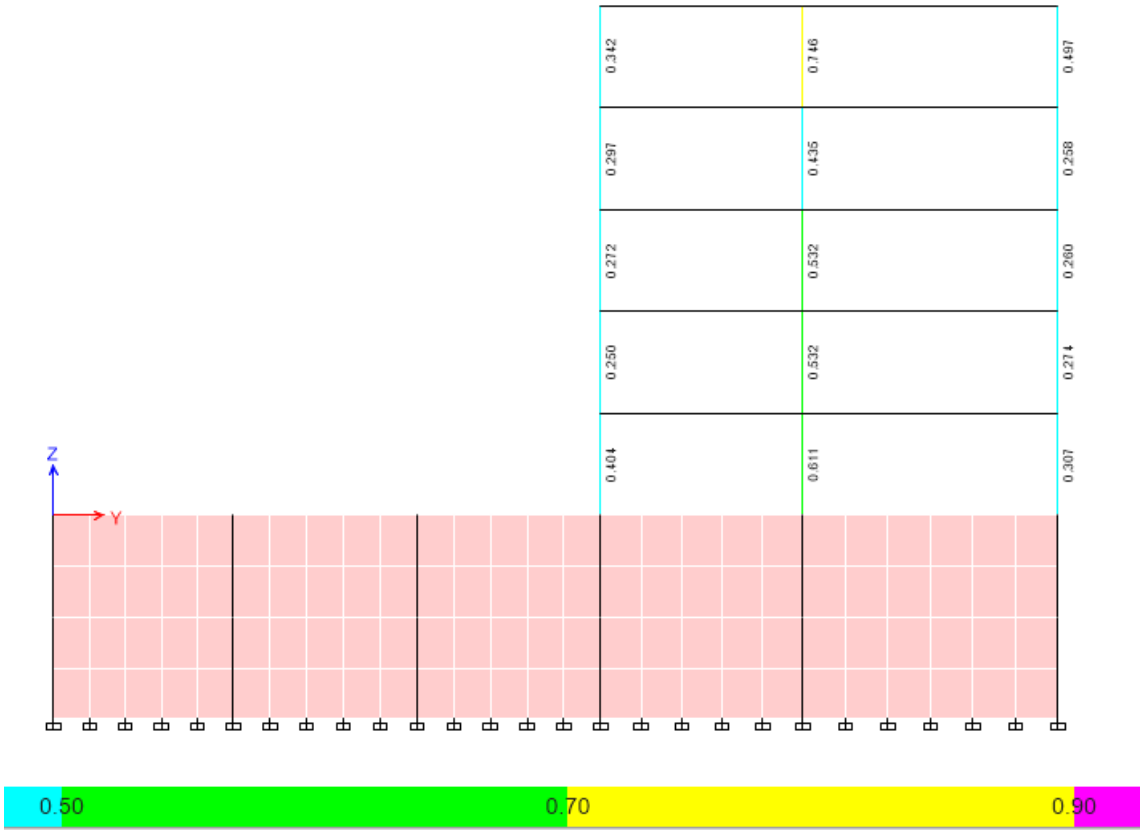
PÓRTICO D



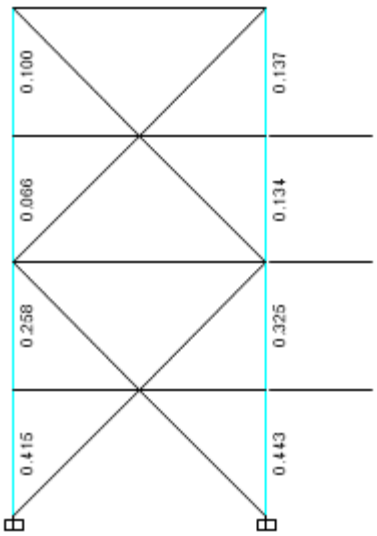
PÓRTICO E

Oficina Quito
José Raygada y C. Alonso de Torres
Quito, Ecuador 170132

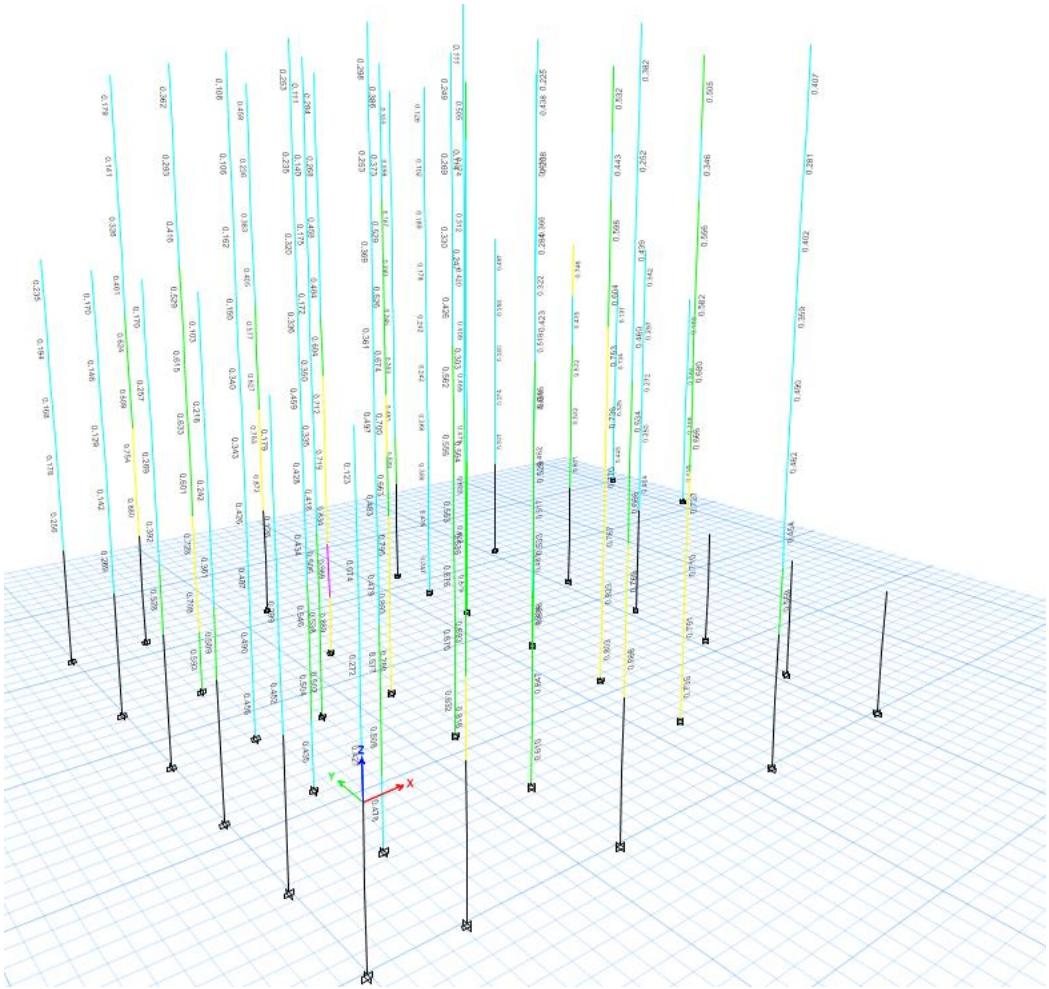
hercoloma89@gmail.com
Teléfono: +593 999 741 718



PÓRTICO F

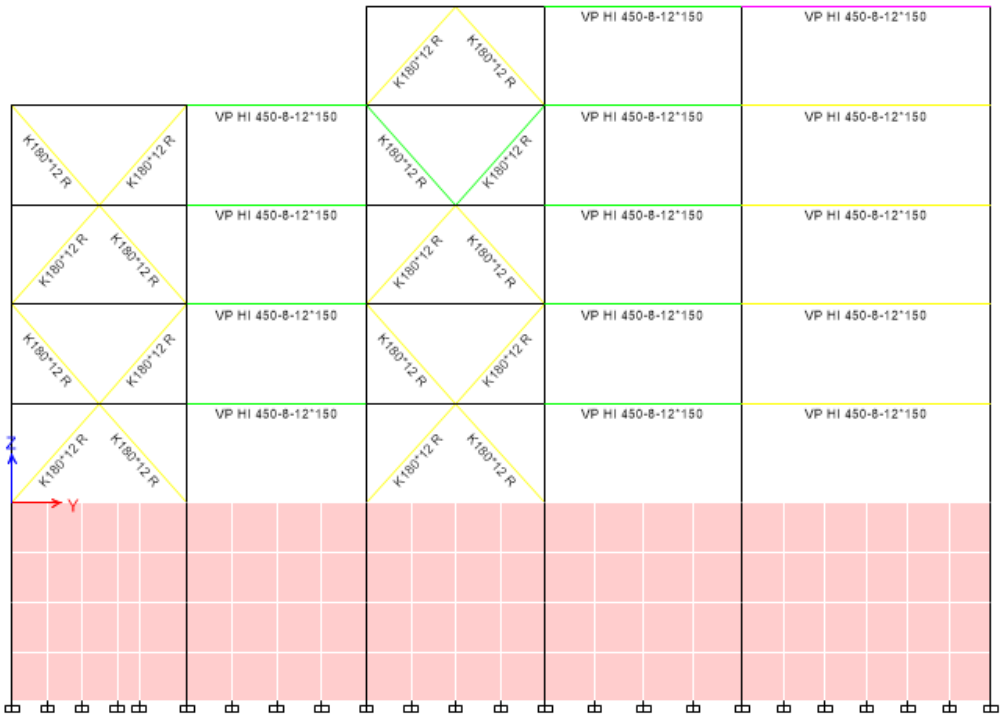


PÓRTICO G

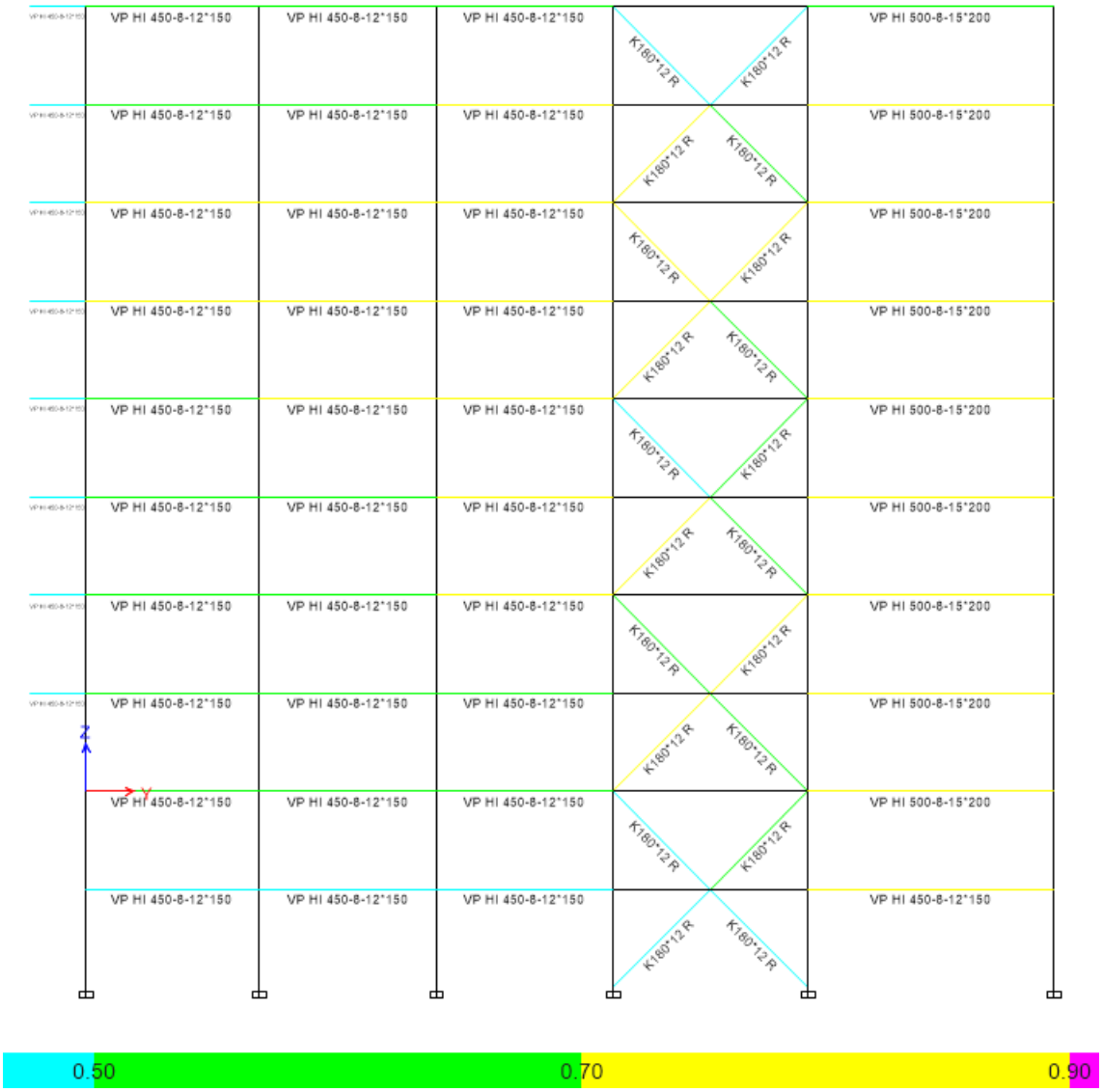


Relaciones demanda capacidad (Vista 3D)

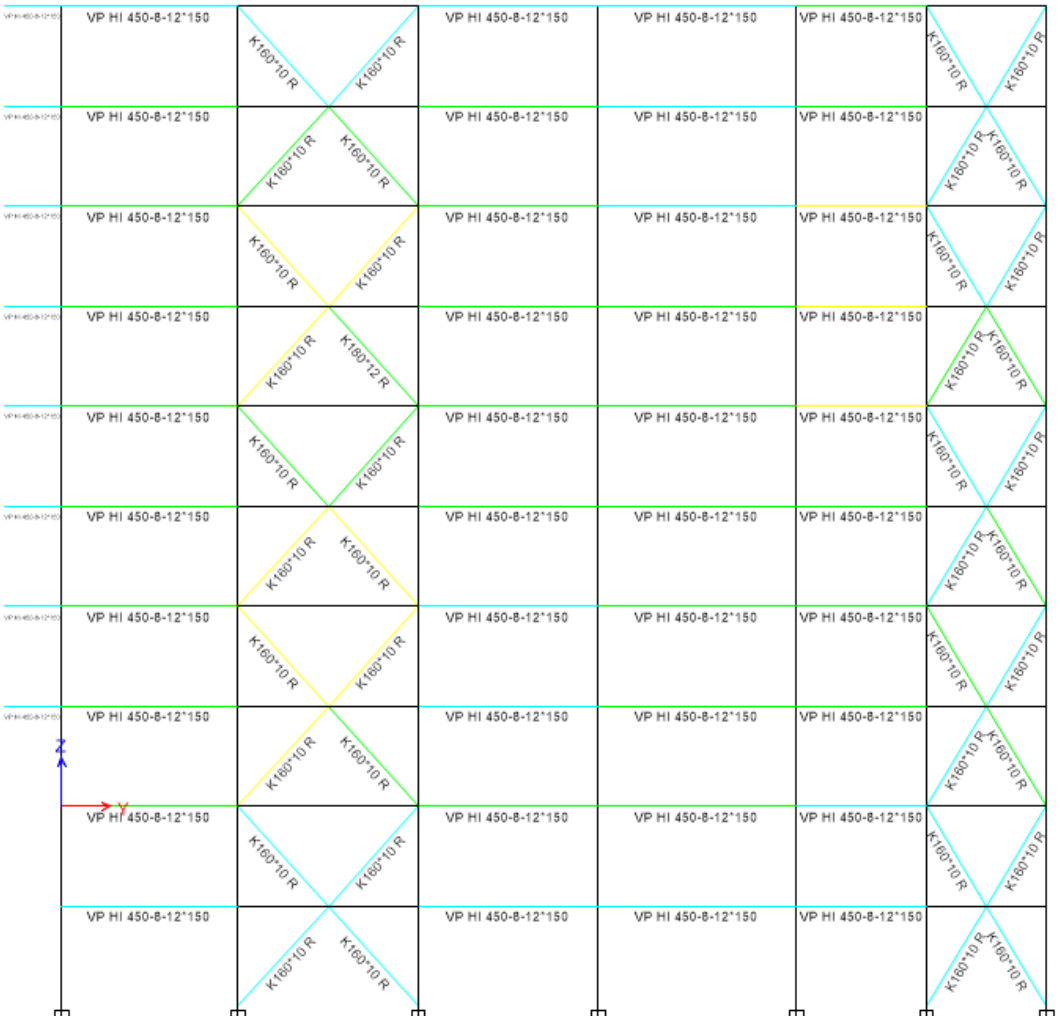
14.13. EVIDENCIA DISEÑO DE DIAGONALES



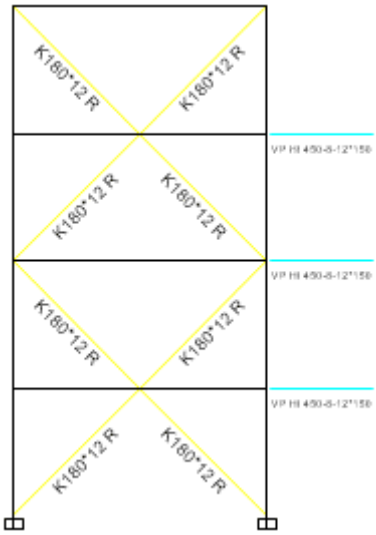
PORTICO A



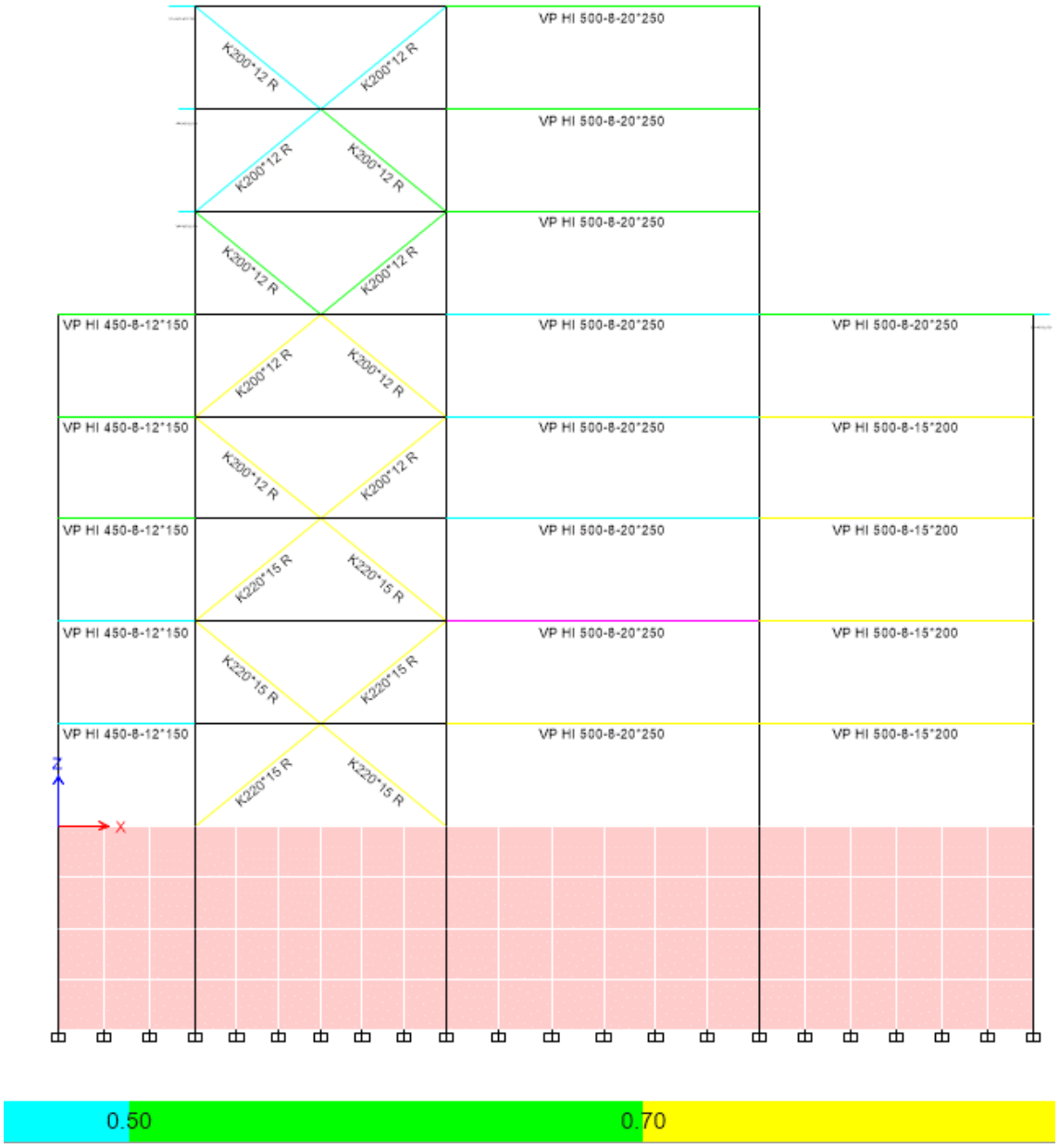
PORTICO C



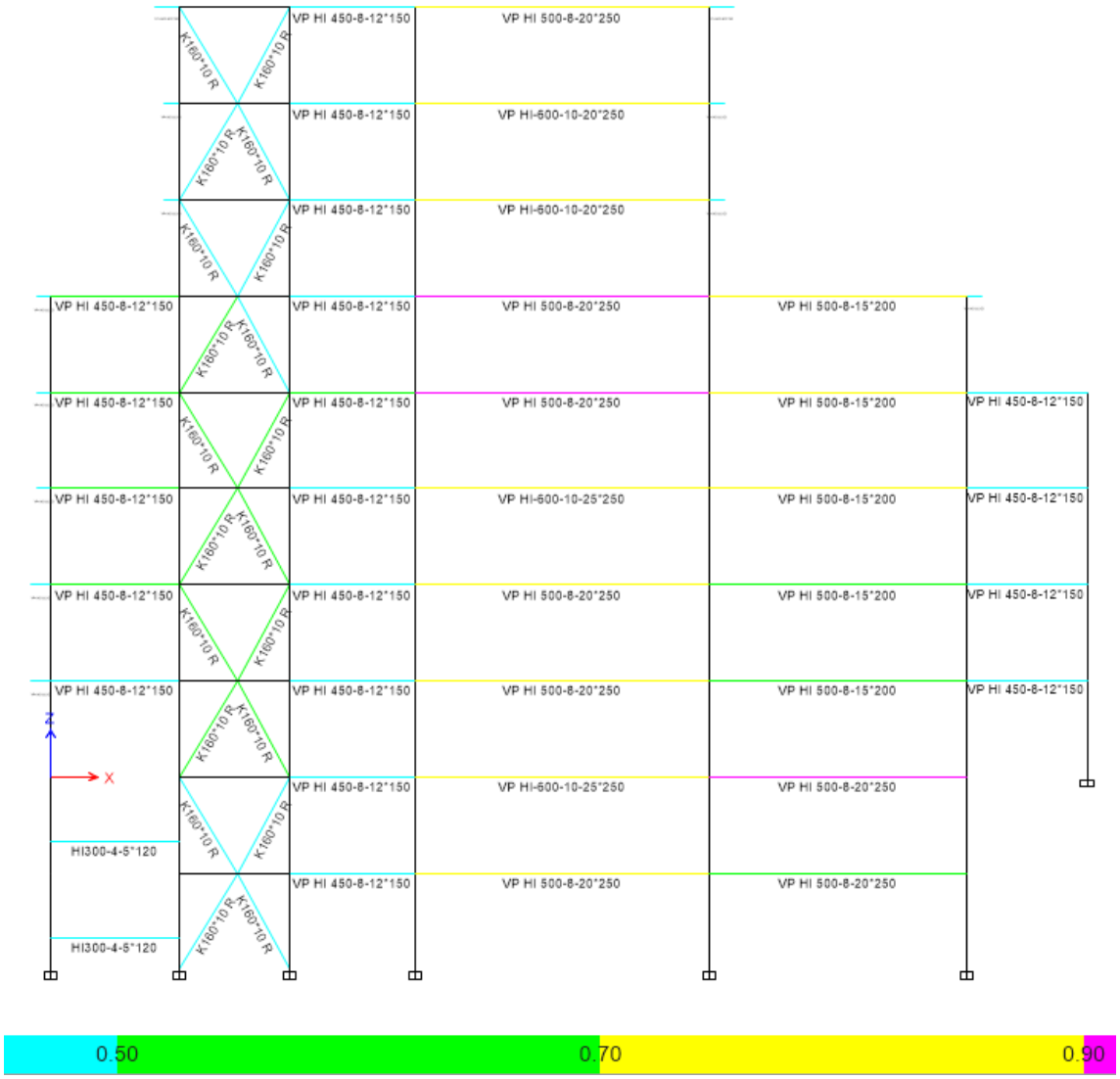
PORTICO E



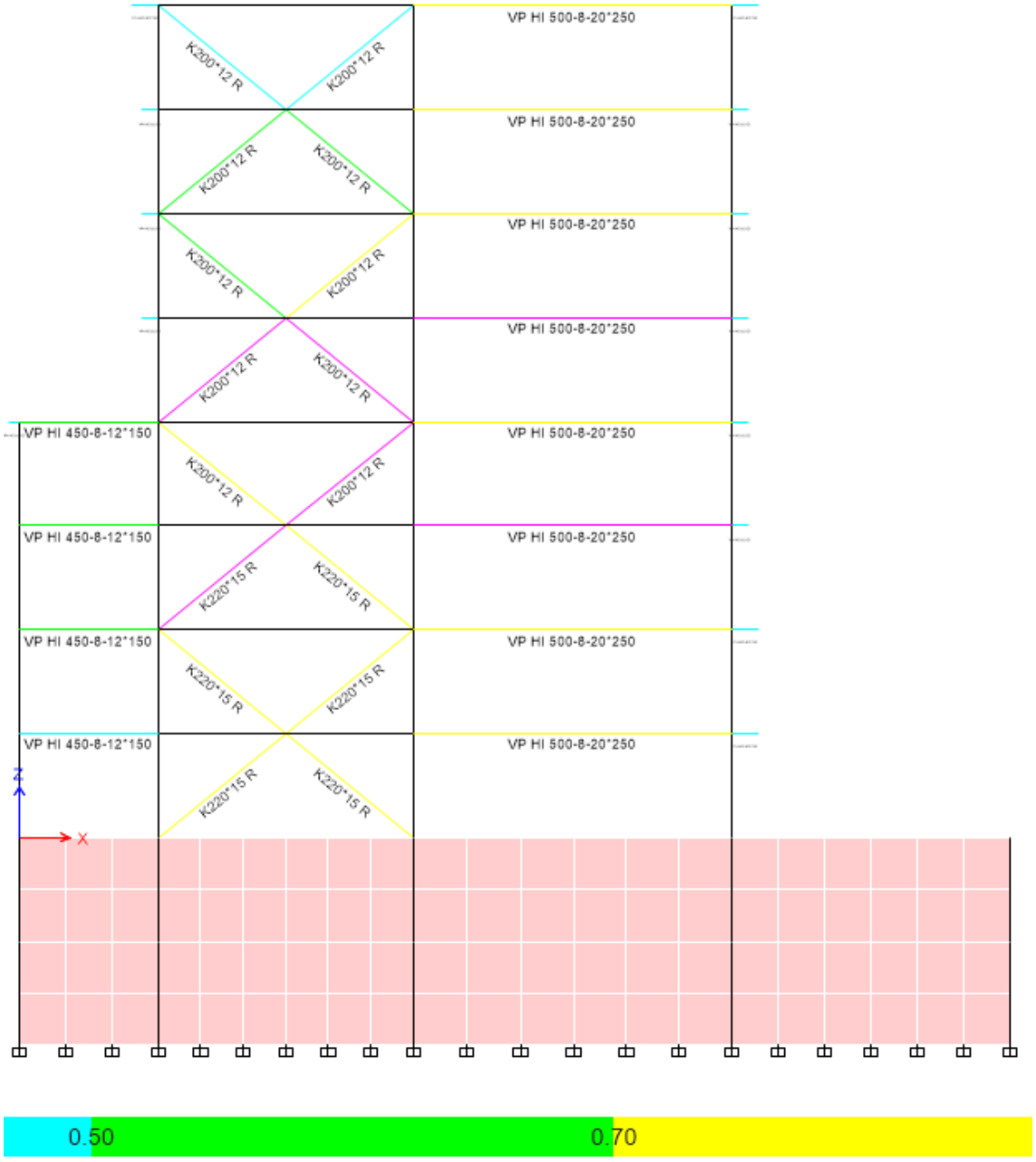
PORTICO G


VP HI 500-8-20*250
VP HI 450-8-12*150
VP HI 500-8-15*200
K200*12 R
K220*15 R
Z
X
0.50
0.70

PORTICO 1


VP HI 450-8-12*150
VP HI 500-8-20*250
VP HI-600-10-20*250
VP HI 500-8-15*200
VP HI-600-10-25*250
K160*10 R
HI300-4-5*120
Z
X
0.50
0.70
0.90

PORTICO 3



PORTICO 6

14.14. COMPROBACIÓN DE LAS DIAGONALES

Se comprueba con las tablas generadas en ETABS que las diagonales o arriostramientos absorban al menos el 75% del corte en los dos sentidos (X, Y), para la comprobación se tomo el cortante basal a nivel de planta baja.

Base Reactions

File Edit Format-Filter-Sort Select Options

Units: As Noted Hidden Columns: No Sort: None Base Reactions

Filter: ([Output Case] = 'Sx' OR [Output Case] = 'Sy')

	Output Case	Case Type	Step Type	Step Number	FX tonf	FY tonf	FZ tonf	MX tonf-m	MY tonf-m	MZ tonf-m	X m	Y m	Z m
▶	Sx	LinStatic	Step By Step	1	-815.4762	0	0	0	-24978.3155	15998.8412	0	0	-8.16
	Sx	LinStatic	Step By Step	2	-815.4762	0	0	0	-24978.3155	17732.0742	0	0	-8.16
	Sx	LinStatic	Step By Step	3	-815.4762	0	0	0	-24978.3155	14265.6082	0	0	-8.16
	Sy	LinStatic	Step By Step	1	0	-815.4762	0	24978.3155	0	-13770.58	0	0	-8.16
	Sy	LinStatic	Step By Step	2	0	-815.4762	0	24978.3155	0	-15117.3259	0	0	-8.16
	Sy	LinStatic	Step By Step	3	0	-815.4762	0	24978.3155	0	-12423.8342	0	0	-8.16

El 75% es igual a las 611.60 Ton.

TABLE: Joint Reactions

Story	Label	Unique Name	Output Case	Case Type	Step Number	FX	FY	FZ
						tonf	tonf	tonf
Planta Baja Nivel	1	2391	Sx	LinStatic	1	0.9287	1.3231	-9.0498
Planta Baja Nivel	2	1895	Sx	LinStatic	1	-138.379	-0.068	-572.575
Planta Baja Nivel	6	2393	Sx	LinStatic	1	0.9145	2.8592	-36.0365
Planta Baja Nivel	7	1894	Sx	LinStatic	1	-40.3796	-0.019	-334.589
Planta Baja Nivel	8	2392	Sx	LinStatic	1	0.925	1.2435	-5.523
Planta Baja Nivel	10	2390	Sx	LinStatic	1	0.9495	2.6995	-26.4529
Planta Baja Nivel	12	1911	Sx	LinStatic	1	-146.443	0.0333	-626.016
Planta Baja Nivel	13	1896	Sx	LinStatic	1	-142.021	-0.07	628.6617
Planta Baja Nivel	23	1899	Sx	LinStatic	1	0.5756	0.7639	19.3471
Planta Baja Nivel	28	1900	Sx	LinStatic	1	-0.3767	-0.0331	5.2711
Planta Baja Nivel	35	1901	Sx	LinStatic	1	-134.325	0.0347	579.4496
Planta Baja Nivel	265	2066	Sx	LinStatic	1	0.0439	-0.6492	12.0087
Planta Baja Nivel	271	1903	Sx	LinStatic	1	0.2637	-1.492	31.6425
Planta Baja Nivel	273	1902	Sx	LinStatic	1	0.2901	-0.0915	14.8703
Planta Baja Nivel	15	2415	Sx	LinStatic	1	0.8519	-3.6106	31.3453
Planta Baja Nivel	16	2416	Sx	LinStatic	1	0.863	-2.3848	2.4259
Planta Baja Nivel	742	1689	Sx	LinStatic	1	-35.9259	-0.0012	322.8118
Planta Baja Nivel	17	2065	Sx	LinStatic	1	1.7227	-0.415	-4.1822
					Total	**-637.473**	**Ton**	

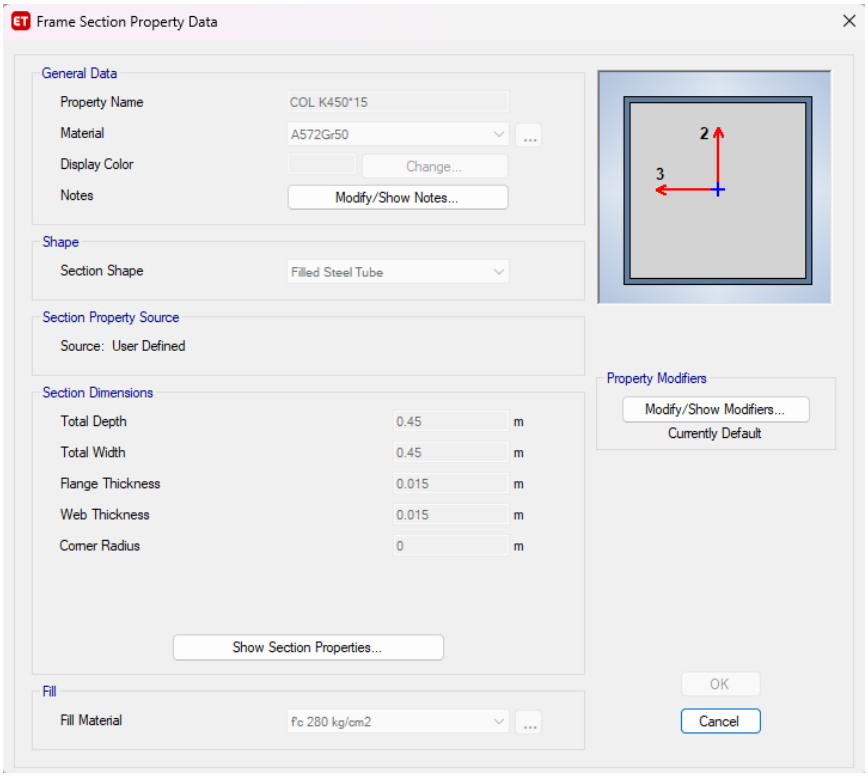
La sumatoria es de 637 Ton en el sentido X absorbe más del 75% de cortante basal.

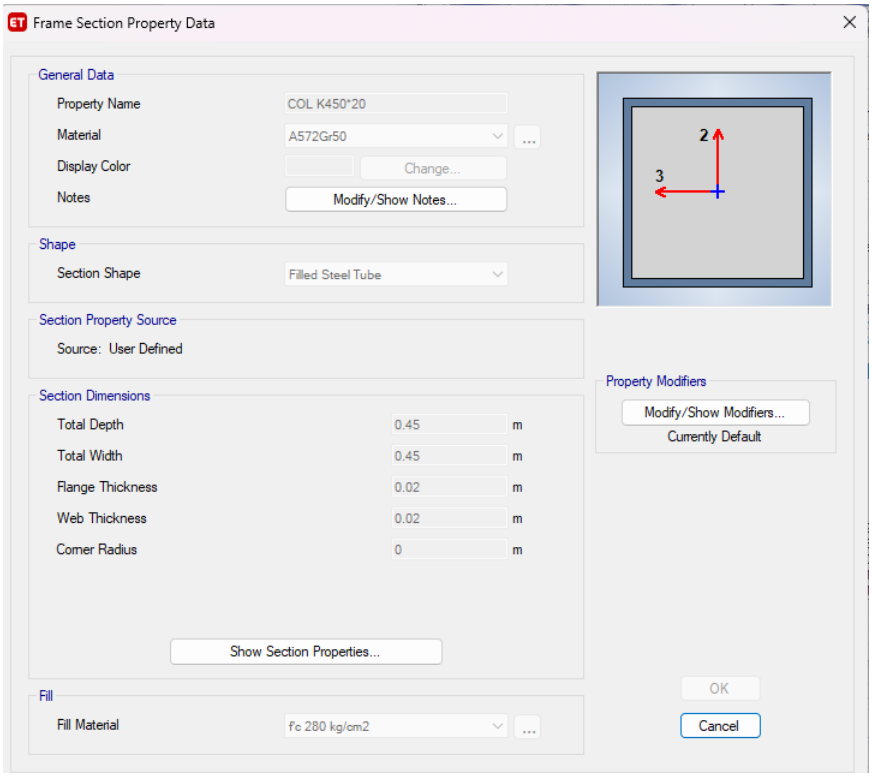
Story	Label	Unique Name	Output Case	Case Type	Step Number	FX	FY	FZ
						tonf	tonf	tonf
Planta Baja Nivel	1	2391	Sy	LinStatic	1	0.0348	-66.7464	-318.0577
Planta Baja Nivel	2	1895	Sy	LinStatic	1	-5.6885	0.8601	-26.252
Planta Baja Nivel	6	2393	Sy	LinStatic	1	-0.0591	-68.1011	369.3189
Planta Baja Nivel	7	1894	Sy	LinStatic	1	-0.2857	0.5748	-0.72
Planta Baja Nivel	8	2392	Sy	LinStatic	1	0.0543	-68.1231	-369.0559
Planta Baja Nivel	10	2390	Sy	LinStatic	1	-0.0487	-66.9976	310.2903
Planta Baja Nivel	12	1911	Sy	LinStatic	1	5.9079	1.0194	23.0931
Planta Baja Nivel	13	1896	Sy	LinStatic	1	7.2304	1.6316	-58.3178
Planta Baja Nivel	23	1899	Sy	LinStatic	1	-0.0043	-68.3538	-467.597
Planta Baja Nivel	28	1900	Sy	LinStatic	1	-0.1354	-68.8224	479.4293
Planta Baja Nivel	35	1901	Sy	LinStatic	1	-6.8311	1.5149	58.038
Planta Baja Nivel	265	2066	Sy	LinStatic	1	-0.0258	-31.4931	318.9303
Planta Baja Nivel	271	1903	Sy	LinStatic	1	0.073	-46.6101	353.1501
Planta Baja Nivel	273	1902	Sy	LinStatic	1	-0.0616	-46.6579	-354.0513
Planta Baja Nivel	15	2415	Sy	LinStatic	1	0.0447	-63.1165	277.0333
Planta Baja Nivel	16	2416	Sy	LinStatic	1	-0.0427	-63.1048	-276.7082
Planta Baja Nivel	742	1689	Sy	LinStatic	1	-0.0954	0.9603	-5.4033
Planta Baja Nivel	17	2065	Sy	LinStatic	1	0.0401	-31.241	-285.8881
						Total	**-682.806**	**Ton**

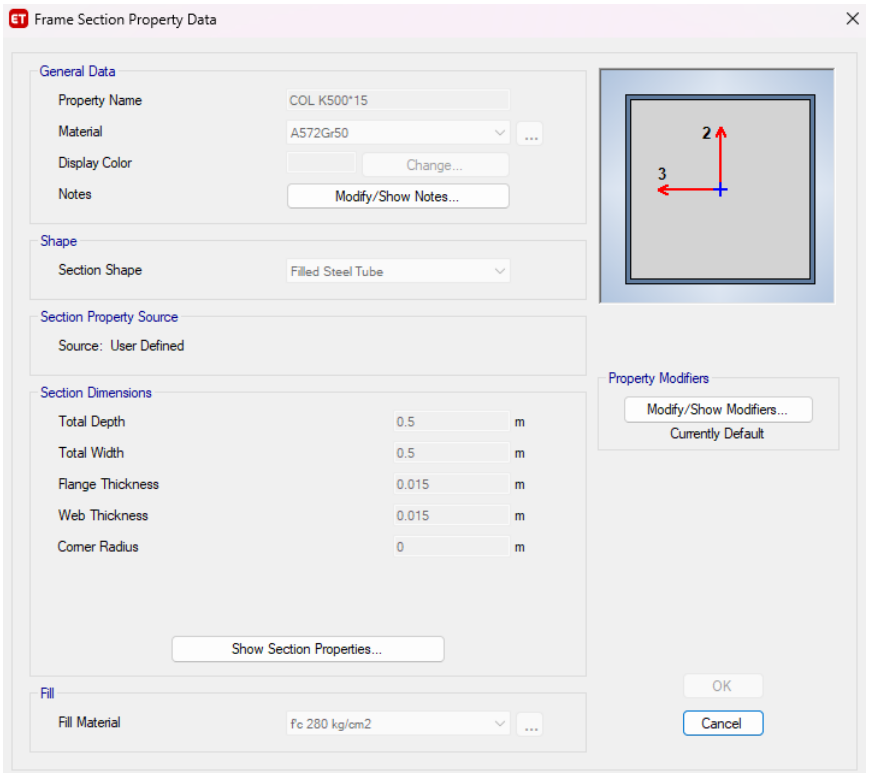
La sumatoria es de 682 Ton en el sentido Y absorbe más del 75% de cortante basal.

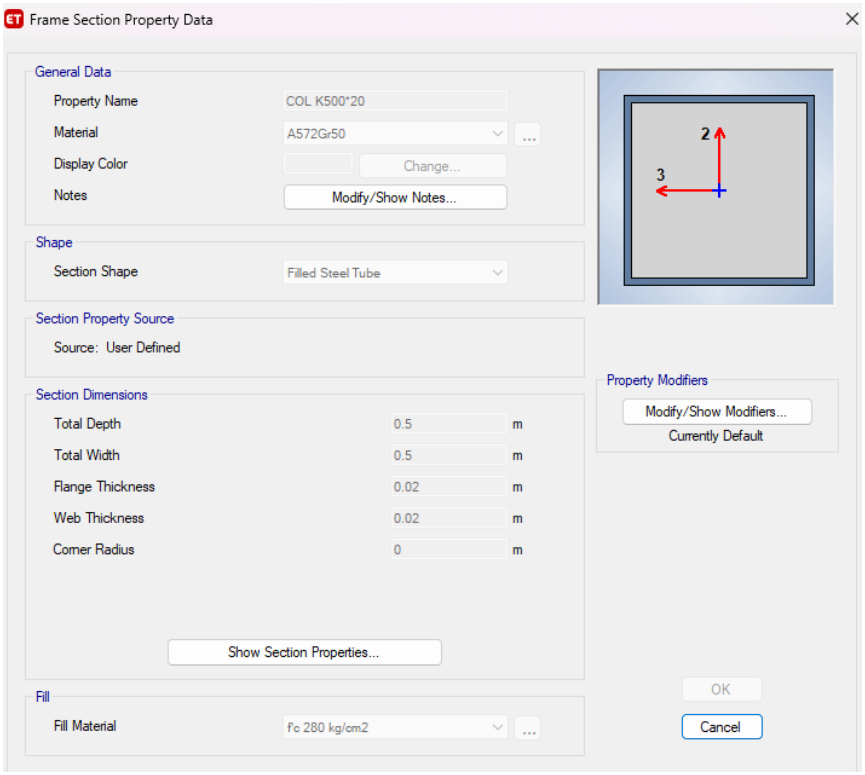
14.15. SECCIONES UTILIZADAS EN EL DISEÑO

14.15.1. COLUMNAS



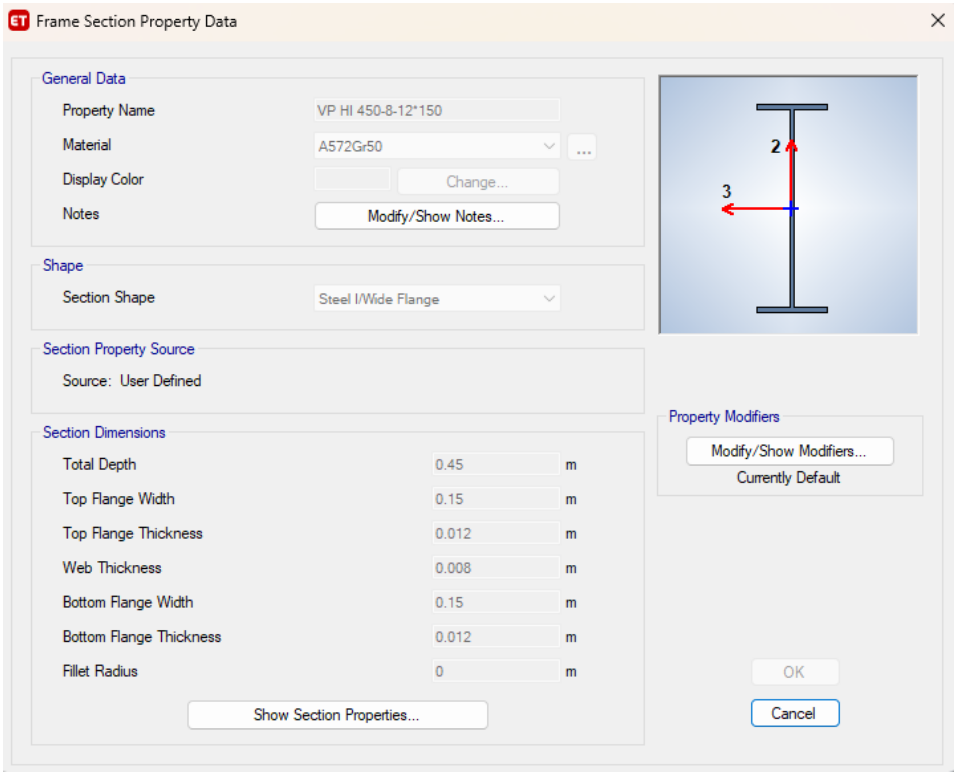

Frame Section Property Data
General Data
Property Name
COL K450*20
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Filled Steel Tube
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.45
m
Total Width
0.45
m
Flange Thickness
0.02
m
Web Thickness
0.02
m
Corner Radius
0
m
Show Section Properties...
Fill
Fill Material
fc 280 kg/cm2
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

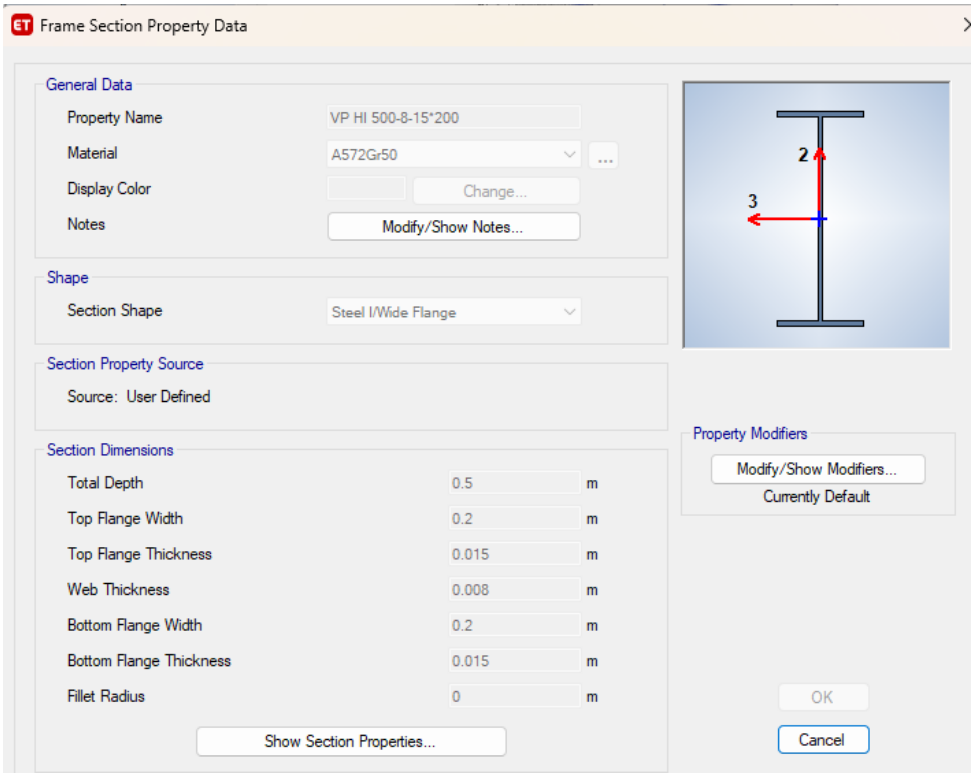

Frame Section Property Data
General Data
Property Name
COL K500*15
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Filled Steel Tube
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Total Width
0.5
m
Flange Thickness
0.015
m
Web Thickness
0.015
m
Corner Radius
0
m
Show Section Properties...
Fill
Fill Material
fc 280 kg/cm2
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

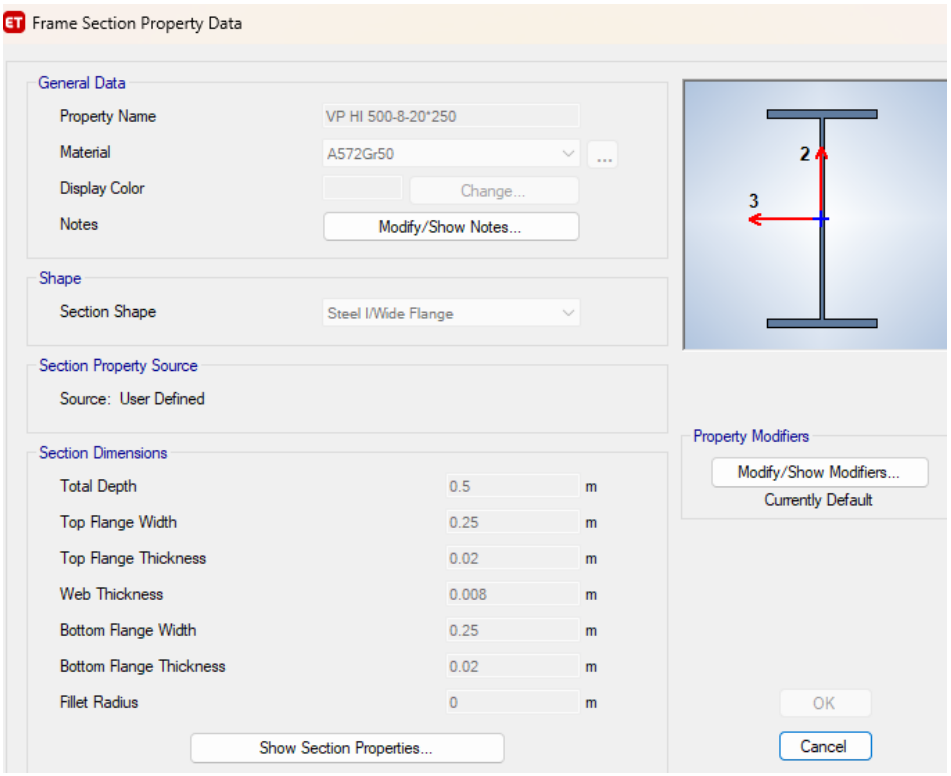


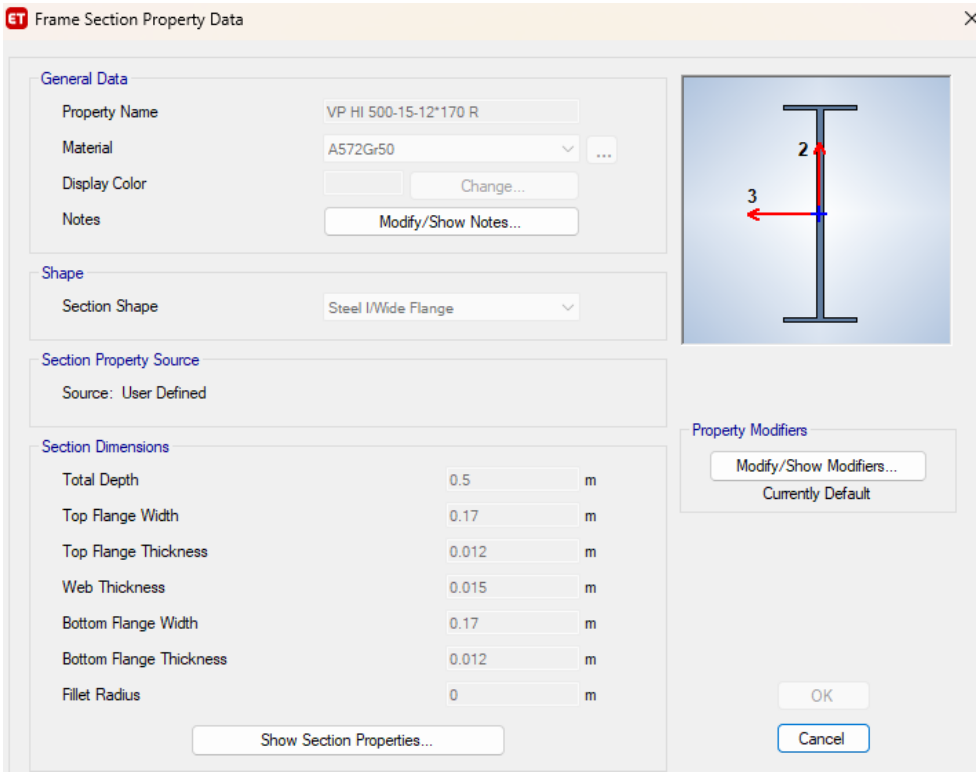
14.15.2. VIGAS

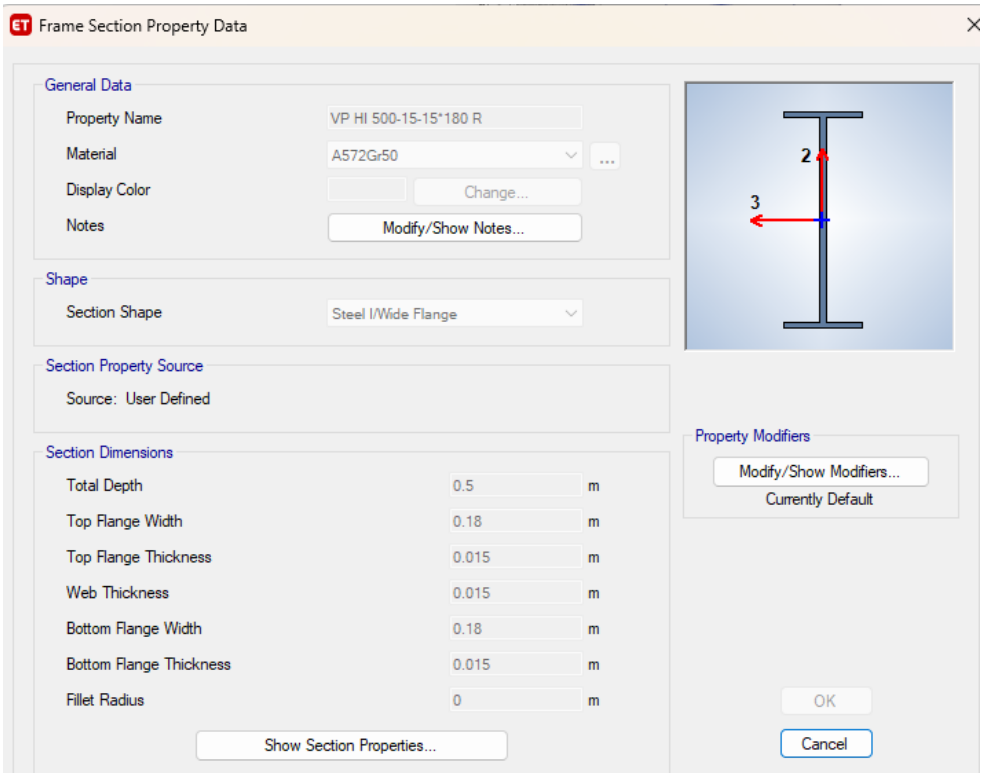
- Vigas principales

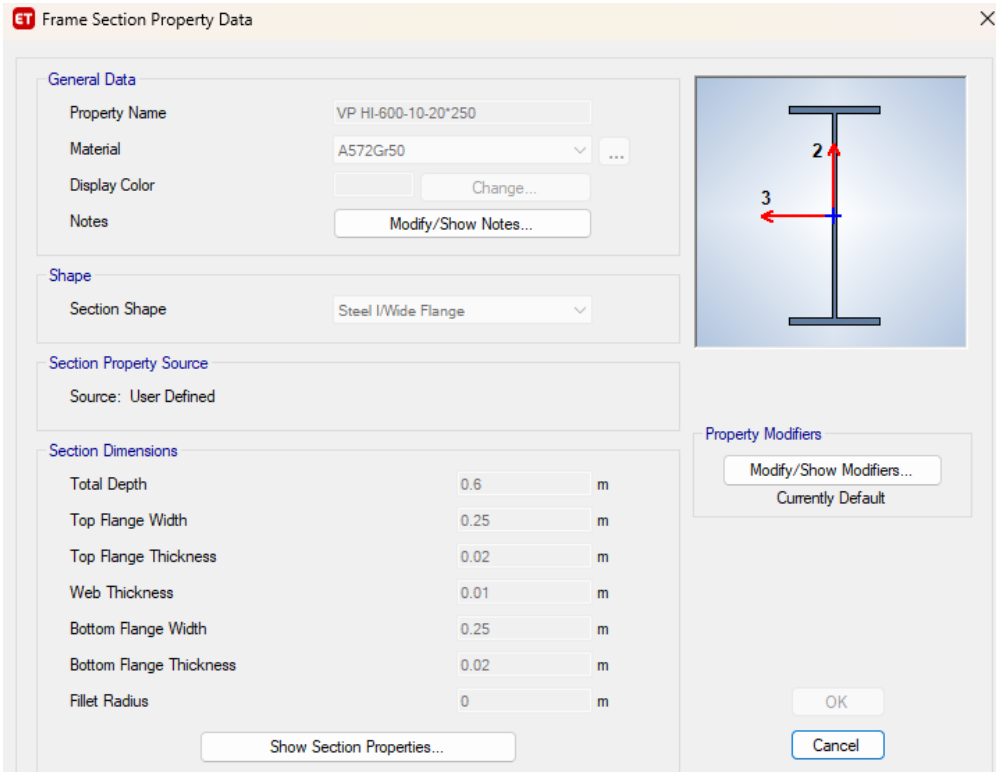


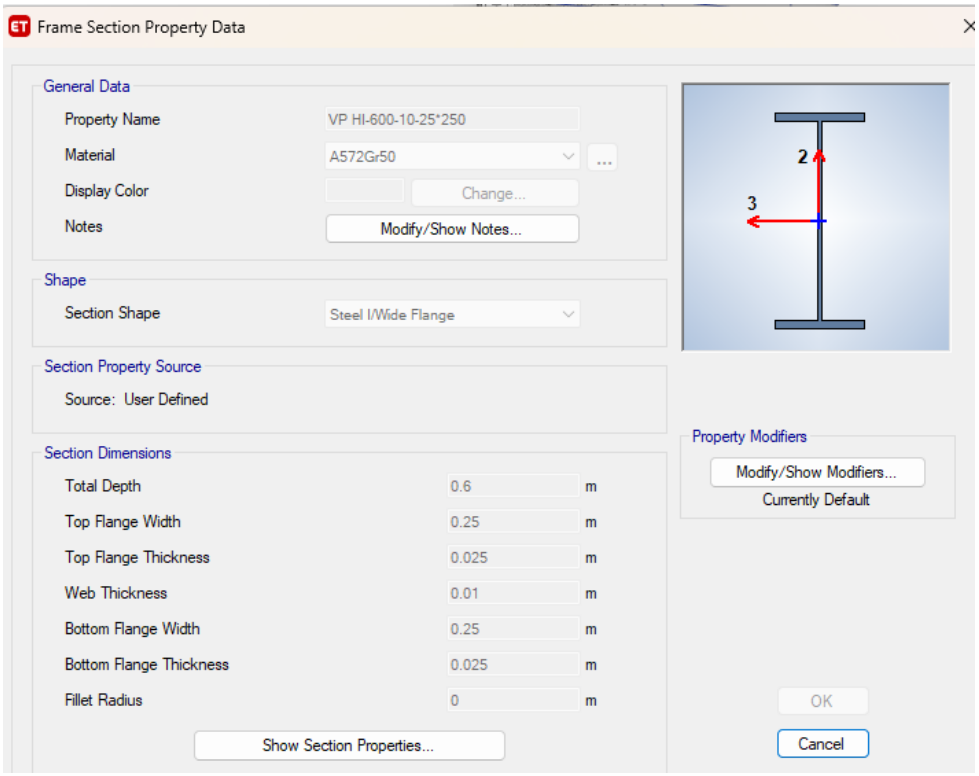

Frame Section Property Data
General Data
Property Name
VP HI 500-8-15*200
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.2
m
Top Flange Thickness
0.015
m
Web Thickness
0.008
m
Bottom Flange Width
0.2
m
Bottom Flange Thickness
0.015
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel


Frame Section Property Data
General Data
Property Name
VP HI 500-8-20*250
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.25
m
Top Flange Thickness
0.02
m
Web Thickness
0.008
m
Bottom Flange Width
0.25
m
Bottom Flange Thickness
0.02
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

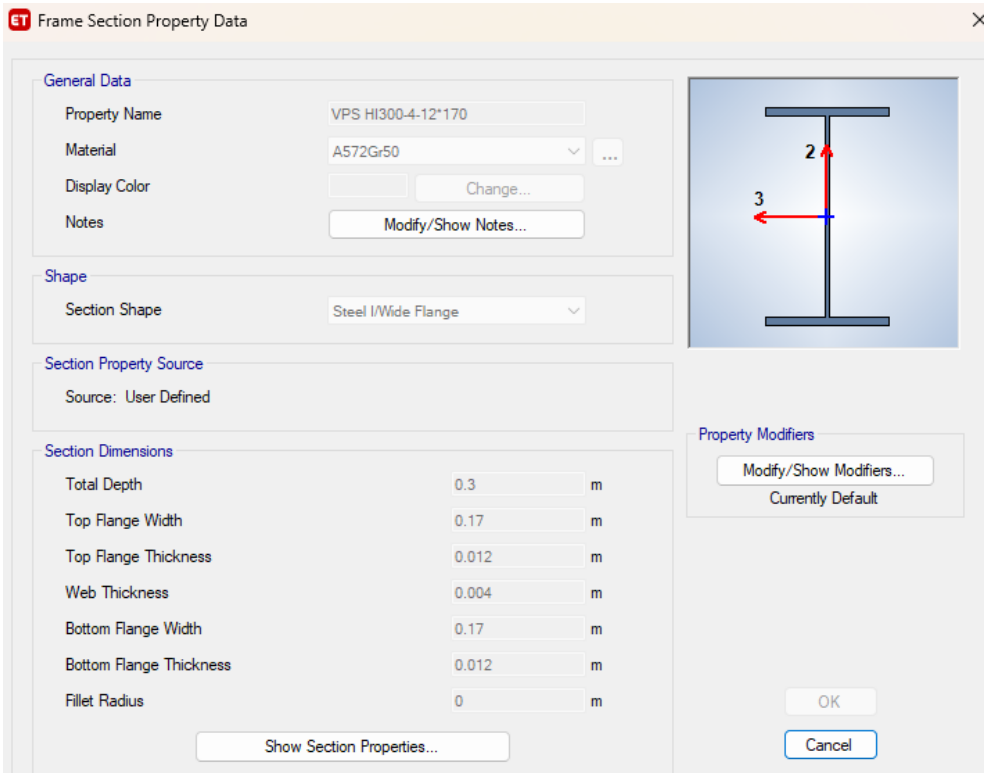

Frame Section Property Data
General Data
Property Name
VP HI 500-15-12*170 R
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.17
m
Top Flange Thickness
0.012
m
Web Thickness
0.015
m
Bottom Flange Width
0.17
m
Bottom Flange Thickness
0.012
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

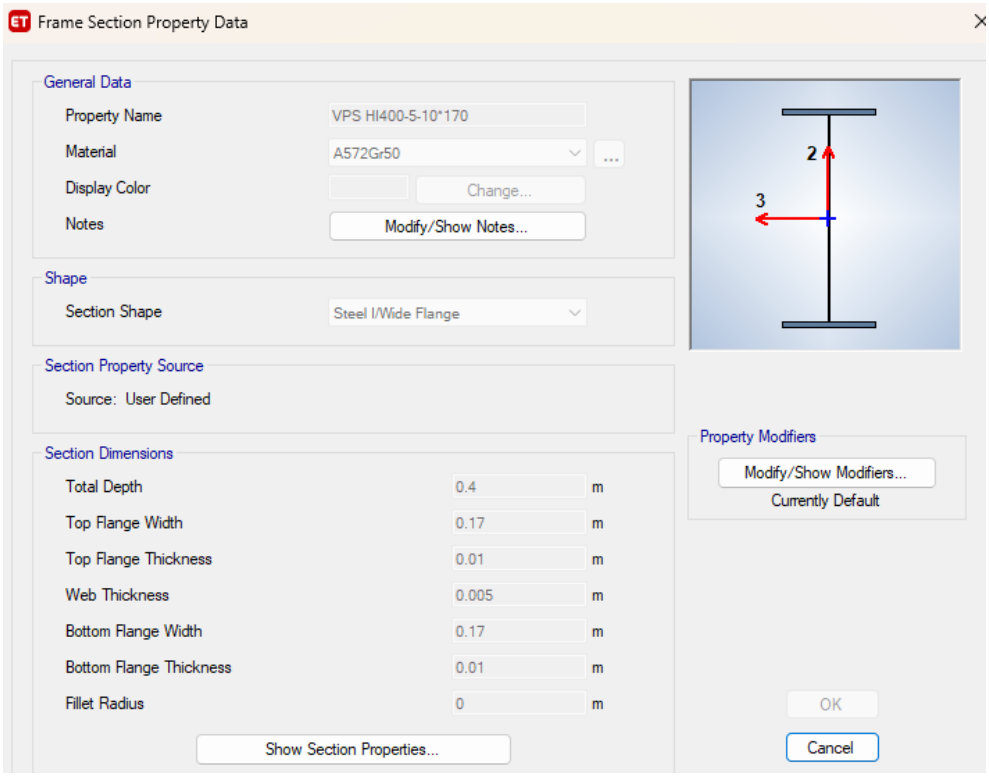

Frame Section Property Data
General Data
Property Name
VP HI 500-15-15*180 R
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.18
m
Top Flange Thickness
0.015
m
Web Thickness
0.015
m
Bottom Flange Width
0.18
m
Bottom Flange Thickness
0.015
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

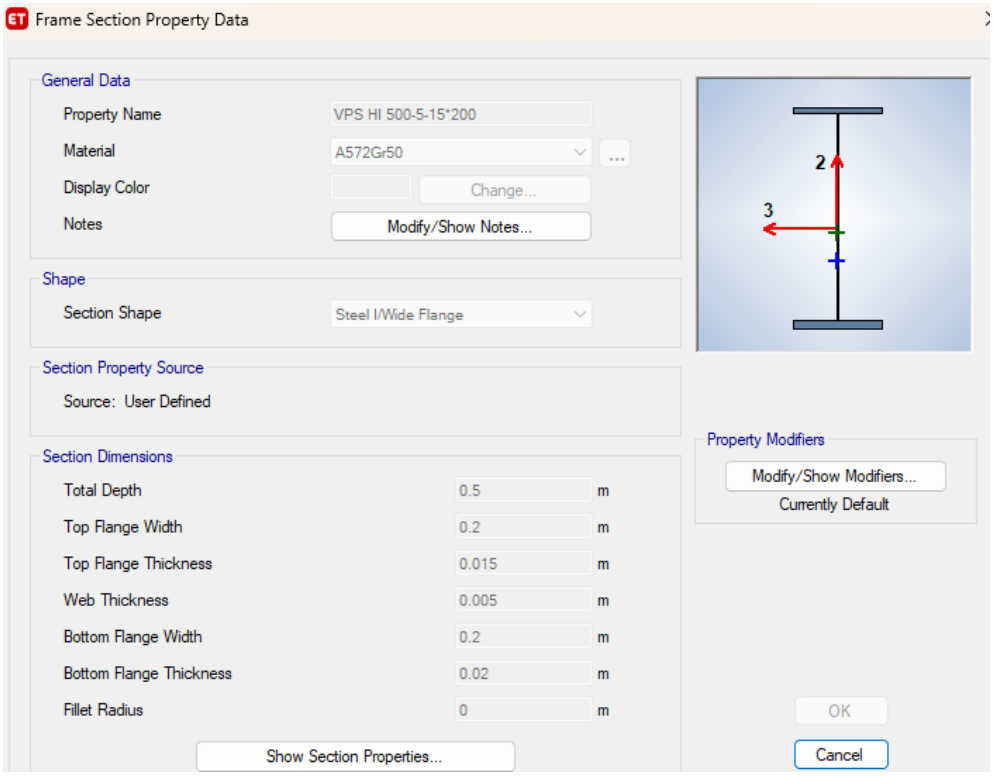

Frame Section Property Data
General Data
Property Name
VP HI-600-10-20*250
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth 0.6 m
Top Flange Width 0.25 m
Top Flange Thickness 0.02 m
Web Thickness 0.01 m
Bottom Flange Width 0.25 m
Bottom Flange Thickness 0.02 m
Fillet Radius 0 m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

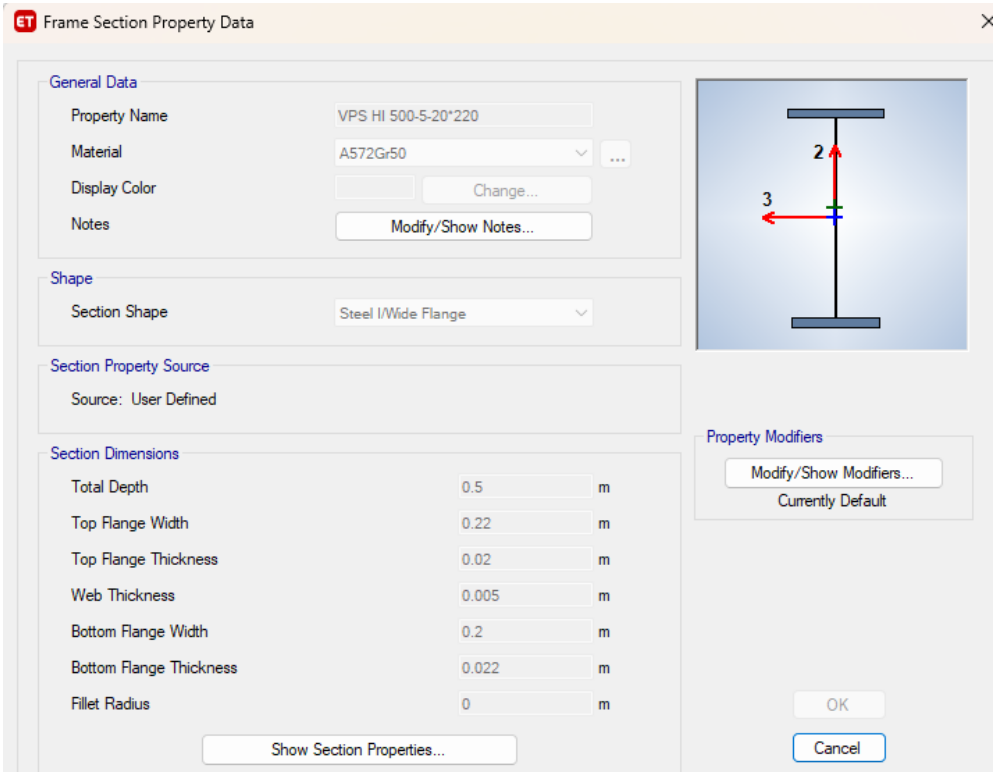

Frame Section Property Data
General Data
Property Name
VP HI-600-10-25*250
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth 0.6 m
Top Flange Width 0.25 m
Top Flange Thickness 0.025 m
Web Thickness 0.01 m
Bottom Flange Width 0.25 m
Bottom Flange Thickness 0.025 m
Fillet Radius 0 m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

- Vigas secundarias

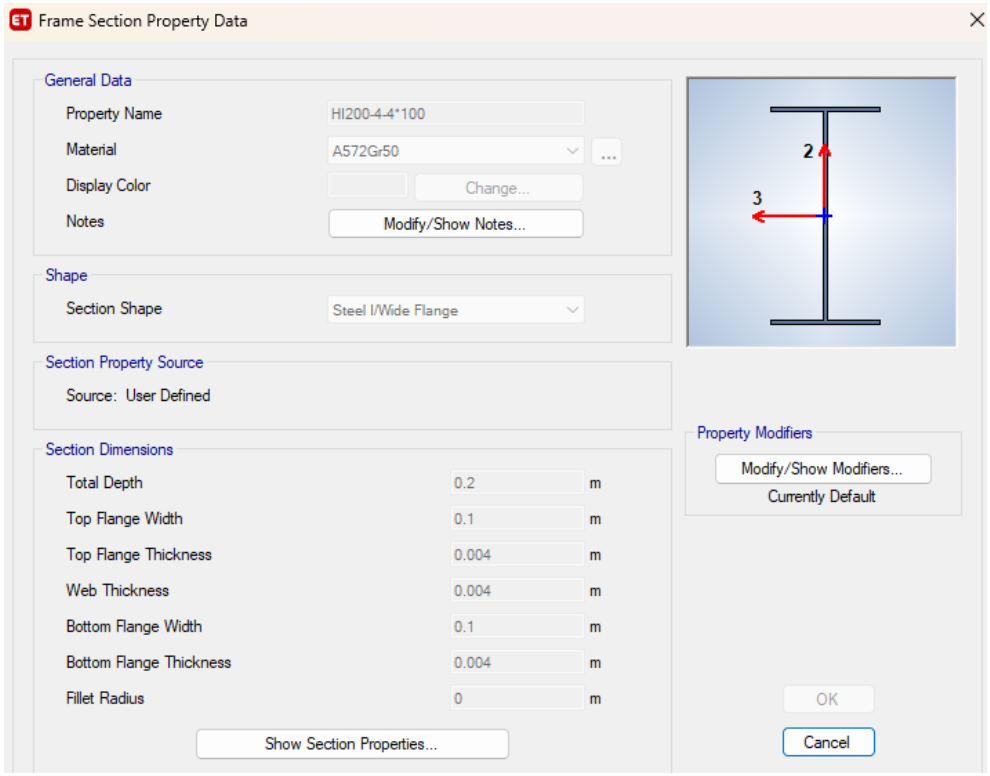


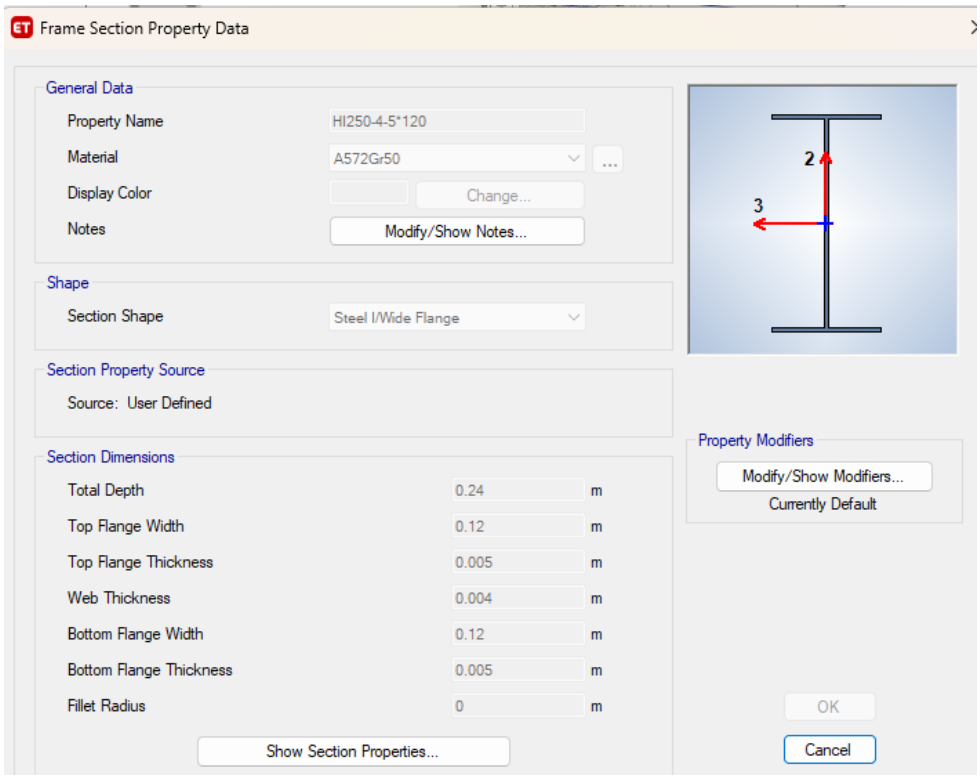


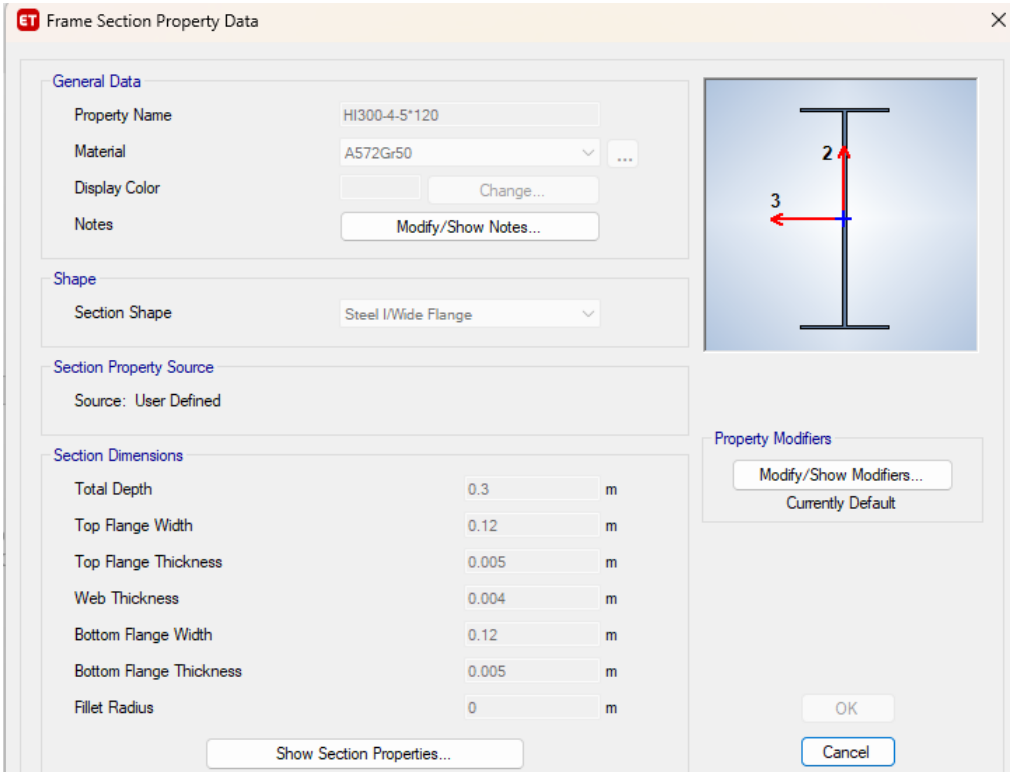

Frame Section Property Data
General Data
Property Name
VPS HI 500-5-15*200
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.2
m
Top Flange Thickness
0.015
m
Web Thickness
0.005
m
Bottom Flange Width
0.2
m
Bottom Flange Thickness
0.02
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel


Frame Section Property Data
General Data
Property Name
VPS HI 500-5-20*220
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel I/Wide Flange
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.5
m
Top Flange Width
0.22
m
Top Flange Thickness
0.02
m
Web Thickness
0.005
m
Bottom Flange Width
0.2
m
Bottom Flange Thickness
0.022
m
Fillet Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel

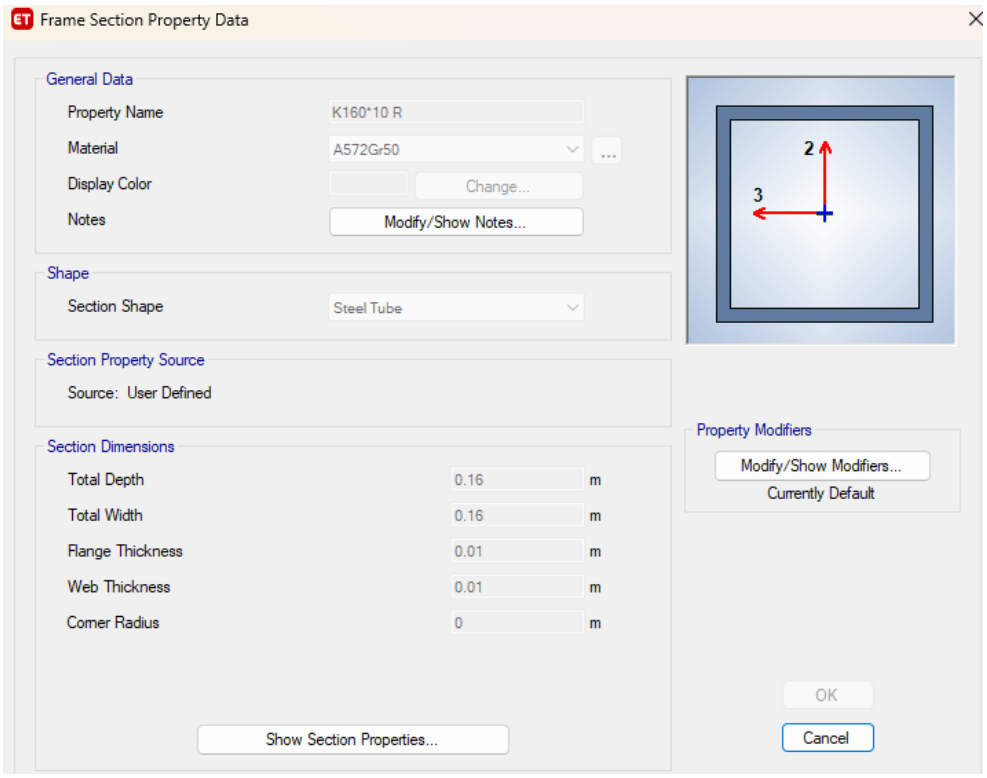
- Vigas de piso

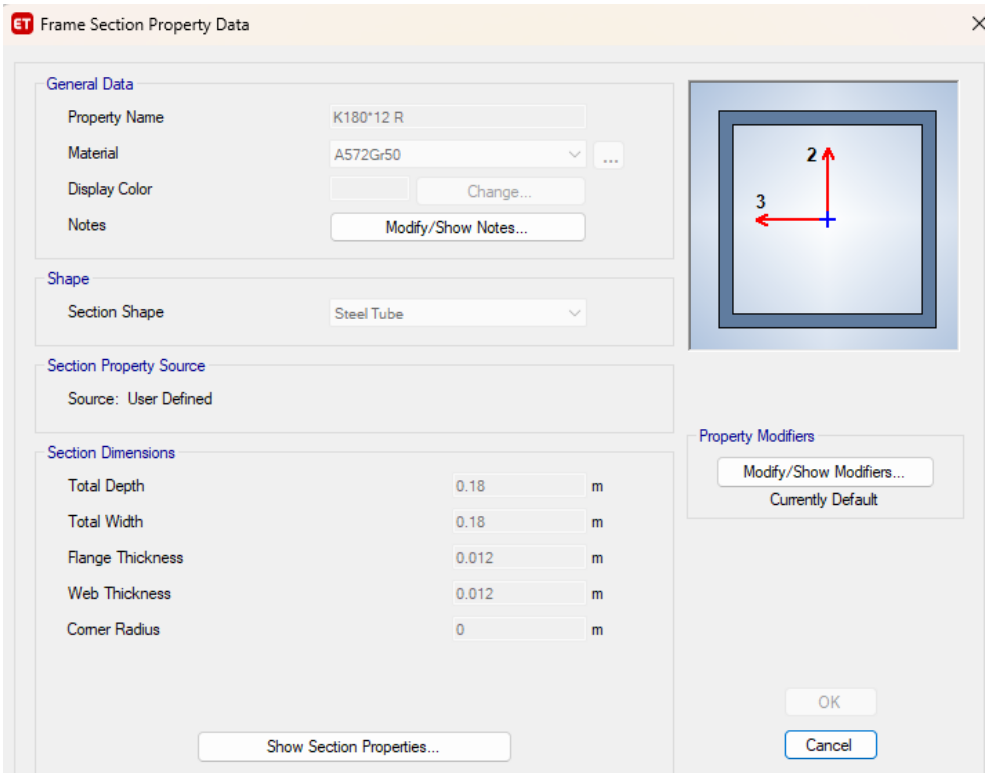


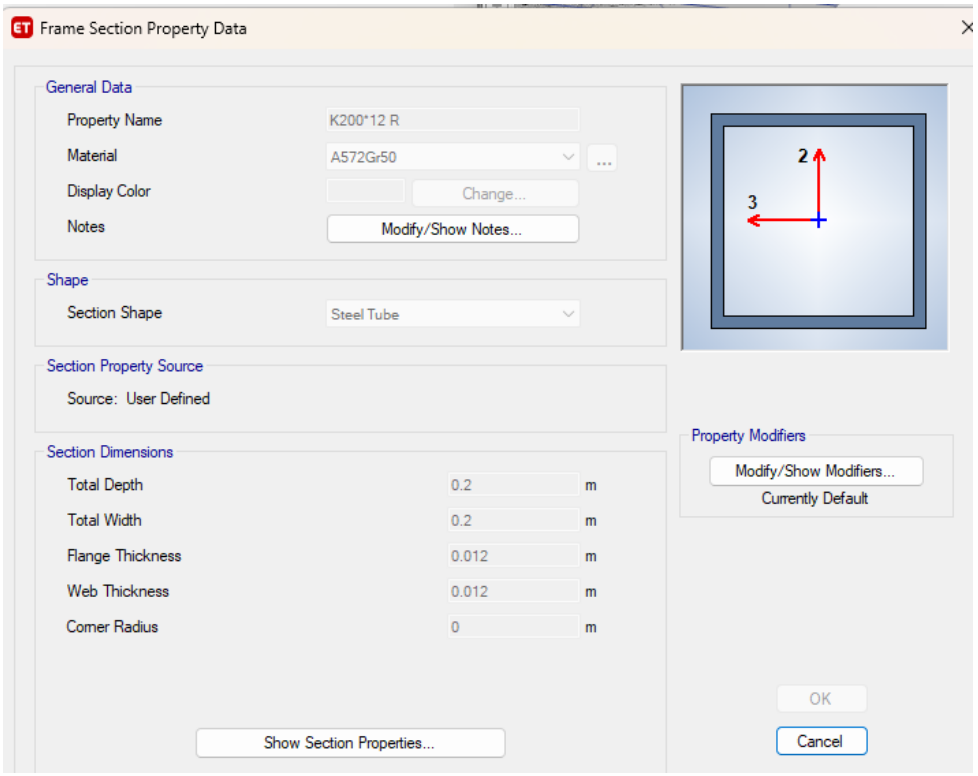


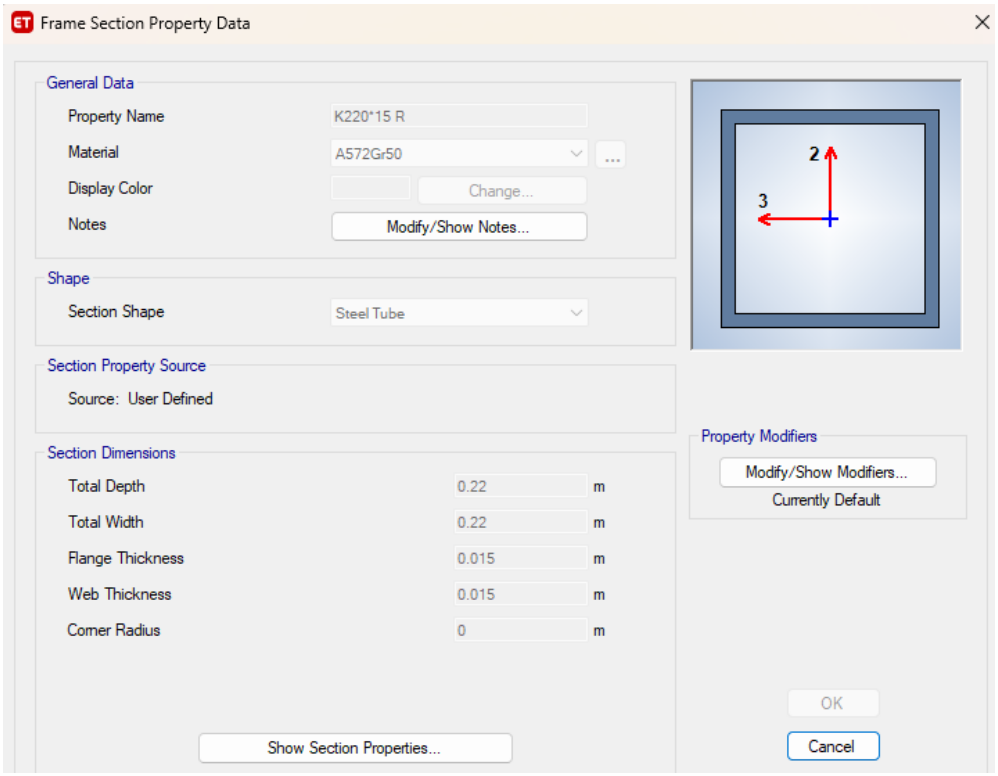


14.15.3. ARRIOSTRAMIENTOS/DIAGONALES




Frame Section Property Data
General Data
Property Name
K180*12 R
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel Tube
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.18
m
Total Width
0.18
m
Flange Thickness
0.012
m
Web Thickness
0.012
m
Corner Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel


Frame Section Property Data
General Data
Property Name
K200*12 R
Material
A572Gr50
Display Color
Change...
Notes
Modify/Show Notes...
Shape
Section Shape
Steel Tube
Section Property Source
Source: User Defined
Section Dimensions
Total Depth
0.2
m
Total Width
0.2
m
Flange Thickness
0.012
m
Web Thickness
0.012
m
Corner Radius
0
m
Show Section Properties...
2
3
Property Modifiers
Modify/Show Modifiers...
Currently Default
OK
Cancel



14.16. COMPROBACIÓN DUCTILIDAD DE ELEMENTOS

14.16.1. VIGAS

VP HI 450-8-12*150

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	450.0	150.0	12.0	426.0	8.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
53.25	6.3	59.0	90.9	7.3	9.2	HD	HD

VP HI 500-8-15*200

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	500.0	200.0	15.0	470.0	8.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
58.75	6.7	59.0	90.9	7.3	9.2	HD	HD

VP HI 500-8-20*250

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	500.0	250.0	125.0	460.0	8.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
57.5	6.3	59.0	90.9	7.3	9.2	HD	HD

VP HI 500-8-20*250

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	500.0	250.0	20.0	460.0	8.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
57.5	6.3	59.0	90.9	7.3	9.2	HD	HD

VP HI 500-15-15*180

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	500.0	180.0	15.0	470.0	15.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
31.33333	6.0	59.0	90.9	7.3	9.2	HD	HD

VP HI 600-10-20*250

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	600.0	250.0	20.0	550.0	10.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
56	6.3	59.0	90.9	7.3	9.2	HD	HD

VP HI 600-10-25*250

E (GPa)	F_y (MPa)	F_u (MPa)	d (mm)	b_f (mm)	t_f (mm)	h (mm)	t_w (mm)
200	345	449	600.0	250.0	25.0	550.0	10.0

Factores de Esbeltez Local según AISC 341-16

		Alma		Ala			
		alta	moderada	alta	moderada		
h/t_w	$b_f/2t_f$	λ_{hdw}	λ_{mdw}	λ_{hdf}	λ_{mdf}	Alma (HD/MD)	Patines (HD/MD)
55	5.0	59.0	90.9	7.3	9.2	HD	HD

14.16.2. COLUMNAS

COL K450*15

COMPACIDAD COLUMNAS - AISC 341-16 - Tabla D1.1 - Compuestas		
E	29000	ksi
Tipo	ASTM A572 Gr. 50	
Fy	50	ksi
Ry	1.1	
b/t	**33.98**	
B	45	cm
H	45	cm
t	1.50	cm
b	42	-
b/t	**28**	
OBS.	**OK**	
Altamente Dúctil		

COL K450*20

COMPACIDAD COLUMNAS - AISC 341-16 - Tabla D1.1 - Compuestas		
E	29000	ksi
Tipo	ASTM A572 Gr. 50	
Fy	50	ksi
Ry	1.1	
b/t	**33.98**	
B	45	cm
H	45	cm
t	2.00	cm
b	41	-
b/t	**20.5**	
OBS.	**OK**	
Altamente Dúctil		

COL K500*15

COMPACIDAD COLUMNAS - AISC 341-16 - Tabla D1.1 - Compuestas		
E	29000	ksi
Tipo	ASTM A572 Gr. 50	
Fy	50	ksi
Ry	1.1	
b/t	**33.98**	
B	50	cm
H	50	cm
t	1.50	cm
b	47	-
b/t	**31.33333333**	
OBS.	**OK**	
Altamente Dúctil		

COL K500*20

COMPACIDAD COLUMNAS - AISC 341-16 - Tabla D1.1 - Compuestas		
E	29000	ksi
Tipo	ASTM A572 Gr. 50	
Fy	50	ksi
Ry	1.1	
b/t	**33.98**	
B	50	cm
H	50	cm
t	2.00	cm
b	46	-
b/t	**23**	
OBS.	**OK**	
Altamente Dúctil		

14.16.3. RIOSTRAS

Arriostramiento K 160*10 R

Datos		
E	2038901.92	kg/cm2
Fy	3515.35	kg/cm2
Ry	1.1	
B	160	mm
H	160	mm
tf	10	mm
tw	10	mm
b	140	mm
h	140	mm
b/t	14.000	(adim)
h/t	14.000	(adim)
Altamente dúctil	14.926	**Relaciones AISC**
Moderadamente dúctil	17.451	
Altamente dúctil		

Arriostramiento K 180*12 R

Datos		
E	2038901.92	kg/cm2
Fy	3515.35	kg/cm2
Ry	1.1	
B	180	mm
H	180	mm
tf	12	mm
tw	12	mm
b	156	mm
h	156	mm
b/t	13.000	(adim)
h/t	13.000	(adim)
Altamente dúctil	14.926	**Relaciones AISC**
Moderadamente dúctil	17.451	
Altamente dúctil		

Arriostramiento K 200*12 R

Datos		
E	2038901.92	kg/cm2
Fy	3515.35	kg/cm2
Ry	1.1	
B	200	mm
H	200	mm
tf	12	mm
tw	12	mm
b	176	mm
h	176	mm
b/t	14.666	(adim)
h/t	14.666	(adim)
Altamente dúctil	14.926	**Relaciones AISC**
Moderadamente dúctil	17.451	
Altamente dúctil		

Arriostramiento 220x15

Datos		
E	2038901.92	kg/cm2
Fy	3515.35	kg/cm2
Ry	1.1	
B	220	mm
H	220	mm
tf	15	mm
tw	15	mm
b	190	mm
h	190	mm
b/t	12.666	(adim)
h/t	12.666	(adim)
Altamente dúctil	14.926	**Relaciones AISC**
Moderadamente dúctil	17.451	
Altamente dúctil		

15. CHEQUEO DEFLEXIONES

Deflexiones en vigas principales

La deflexión máxima permitida:

Carga Viva	L/360
Carga Muerta + Carga Viva	L/240

Para verificación de deflexiones, se tomará en cuenta a las luces más largas en planta:

La viga más larga del proyecto es de 12.5 m, a luz libre:

Carga Viva	34.72 mm
Carga Muerta + Carga Viva	52.08 mm

ETABS Steel Frame Design

AISC 360-16 Steel Section Check (Deflection Details)

Element Details

Level	Element	Unique Name	Location (m)	Combo	Element Type	Section
Piso 8	B189	1688	6.088	DStlD2	Special Concentrically Braced Frame	VP HI 500-8-20*250

LLRF and Demand/Capacity Ratio

L (m)	LLRF	Stress Ratio Limit
12.50000	0.708	1.005

DEFLECTION DESIGN (Combo DStlD2)

Type	Consider	Deflection m	Limit m	Ratio	Status
Dead Load	Yes	0.01388	0.10417	0.133	OK
Super DL + Live Load	Yes	0.00571	0.10417	0.055	OK
Live Load	Yes	0.00021	0.03472	0.006	OK
Total Load	Yes	0.01388	0.05208	0.267	OK
Total - Camber	Yes	0.01388	0.05208	0.267	OK

Deflexiones en vigas de piso

La deflexión máxima permitida:

Carga Viva	L/360
Carga Muerta + Carga Viva	L/240

Para verificación de deflexiones, se tomará en cuenta a las luces más largas en planta:

La viga más larga del proyecto es de 5.45 m, a luz libre:

Carga Viva	15.14 mm
Carga Muerta + Carga Viva	22.71 mm

16. EVIDENCIA DE DISEÑO DE CONEXIONES

Global Parameters - Description:

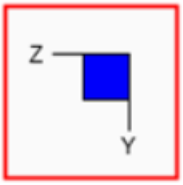
Project Title	Consultoria UNACH H. Coloma
Company	R-SPECTRUM
Designer	A. Robalino
Job Number	01
Notes	

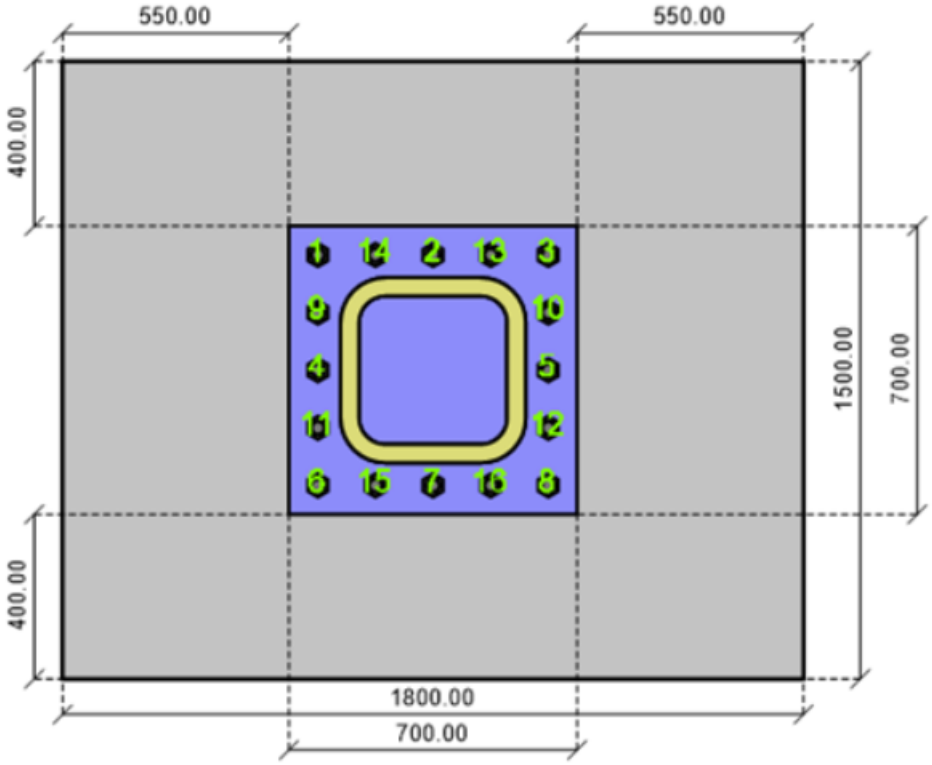
Global Parameters - Solution:

Design Method	AISC 15th (360-16): LRFD
Bolt Group Analysis Method	Center of Rotation
Weld Analysis Method	Elastic
Consider Bolt Hole Deformation?	Yes
Check Rotational Ductility?	Yes
Check Weld Filler Metal Matching?	Yes
Full Shear Eccentricity Considered?	Yes
Panel-Zone Shear Deformation Considered?	Yes
Check Weld Base Material Thickness?	Yes
Reduce Available Bolt Strength by Prying Effects Factor Q?	No

1. Salud-BP-1: 2D Views Report

Top view

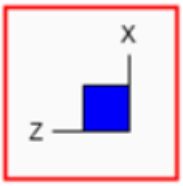


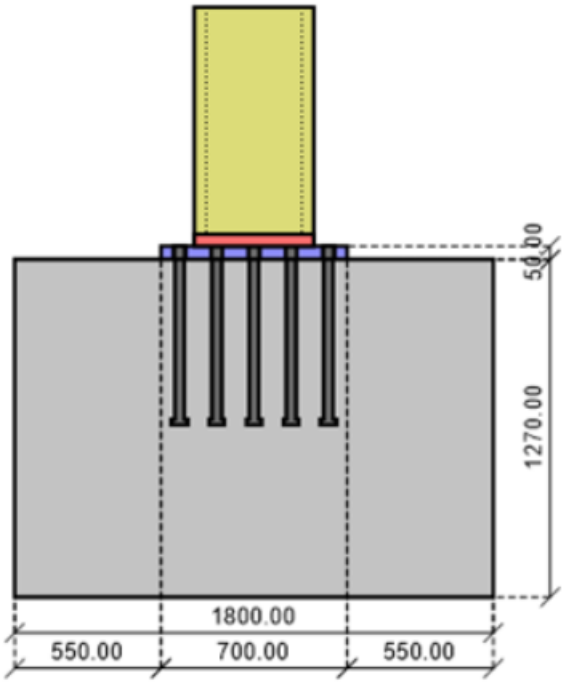


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1. Salud-BP-1: 2D Views Report (continued):

Side view

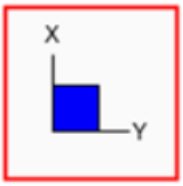


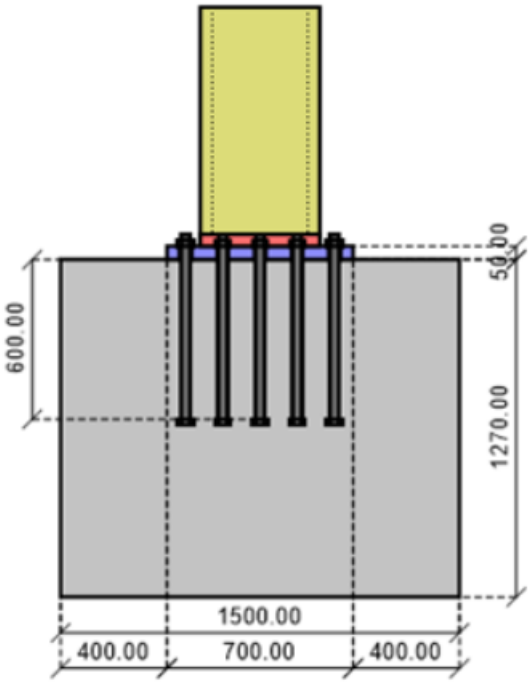


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1. Salud-BP-1: 2D Views Report (continued):

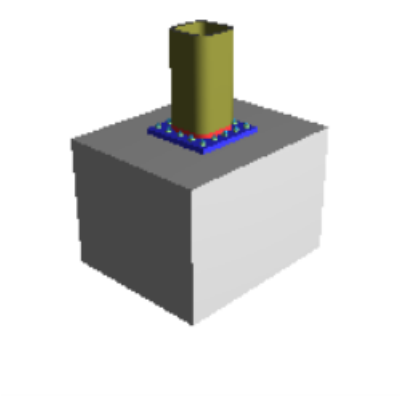
Left view





1. Salud-BP-1: Summary Report

Single Column Base Plate Connection



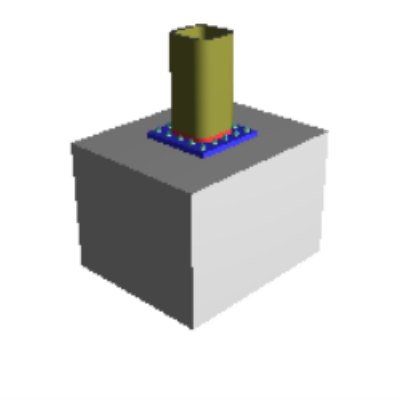
Material Properties:				
Column	K450*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x700.00x700.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**0.95**	**PASS**

1. Salud-BP-1: Base Plate Report

Single Column Base Plate Connection



Material Properties:				
Column	K450*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x700.00x700.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	70.00 mm	*Min edge distance y*		
e_z	70.00 mm	*Min edge distance z*		
ED_{allow}	44.45 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	70.00 mm	*Max edge distance y*		
d_z	70.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	50.00 mm	*Thickness of base plate*		
Check Anchor Bolt Encroachment on Column	**Pass**			
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	600.00 kN-m	*User input strong axis moment*		
P_u	7500.00 kN	*User input axial load*		
N	700.00 mm	*Plate length*		
B	700.00 mm	*Plate width*		
ϕR_n	30.94 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	21.66 kN/mm	*Bearing force = φR_n*B*		
e	80.00 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		

continued on next page...

1. Salud-BP-1: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
e_{crit}	176.85 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	540.00 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	7500.00 kN	*User input axial load*		
N	700.00 mm	*Plate length*		
B	700.00 mm	*Plate width*		
ϕR_n	30.94 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	21.66 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = |(M_{uy} /P_u)|*		
e_{crit}	176.85 mm	*Critical eccentricity = (B/2) - P_u /(2*q_{max})*		
Y_z	700.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Concrete Bearing			**0.64**	**PASS**
R_n = 0.85 * f'$_c$ * α		**ϕ = 0.65**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'$_c$	28.00 MPa	*Concrete compressive strength*		
P_u	7500.00 kN	*Axial load on the column*		
N	700.00 mm	*Plate length*		
B	700.00 mm	*Plate width*		
A_1	490000.00 mm^2	*Plate area = B*N*		
L	1500.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1500.00 mm	*Effective concrete support length*		
W'	1500.00 mm	*Effective concrete support width*		
A_2	2250000.00 mm^2	*Effective concrete support area = L' * W'*		
α	2.00	*Bearing stress increase factor = min(2, (A_2 / A_1)$^{0.5}$)*		
ϕR_n	30.94 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: f_{py} <= φR_n*		
Design with small moment				
Y_y	540.00 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	19.84 MPa	*Required bearing stress = P_u / (B * Y_y)*		
UC_y	0.64	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: f_{pz} <= φR_n*		
Design with small moment				
Y_z	700.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	15.31 MPa	*Required bearing stress = P_u / (N * Y_z)*		
UC_z	0.49	*Unity check for Weak Axis*		
Lateral Slip			**0.06**	**PASS**
V_n = μ * P_u <= min[0.2 * f'$_c$* A_c , (0.8 ksi) * A_c]		**ϕ = 0.75**	(ACI 318-14 Table 22.9.4.4)	
V_{uy}	100.00 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		

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1. Salud-BP-1: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	100.00 kN	*Resultant shear force*		
Check Strong Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{py}	19.84 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_y	540.00 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
B	700.00 mm	*Plate width*		
A_c	377999.33 mm^2	*Area of concrete section resisting shear transfer = Y_y * B*		
P_u	7500.00 kN	*Axial compressive force = f_{py} * Y_y * B*		
μ	0.55	*Static friction coefficient*		
f'_c	28.00 MPa	*Concrete compressive strength*		
ϕV_n	1563.73 kN	*Allowable static friction*		
Check Weak Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{pz}	15.31 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_z	700.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
N	700.00 mm	*Plate length*		
A_c	490000.00 mm^2	*Area of concrete section resisting shear transfer = Y_z * N*		
P_u	7500.00 kN	*Axial compressive force = f_{pz} * Y_z * N*		
ϕV_n	2027.06 kN	*Allowable static friction*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.18 kN-m/mm	0.19 kN-m/mm	**0.95**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	50.00 mm	*Thickness of base plate*		
ϕM_n	0.19 kN-m/mm	*Base plate bending capacity per unit width*		
N	700.00 mm	*Base plate length*		
B	700.00 mm	*Base plate width*		
f_p	19.84 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	540.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	450.00 mm	*Column depth*		
b	450.00 mm	*Column width*		
m	136.25 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	136.25 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.18 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.18 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.18 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.14 kN-m/mm	0.19 kN-m/mm	**0.73**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	50.00 mm	*Thickness of base plate*		
ϕM_n	0.19 kN-m/mm	*Base plate bending capacity per unit width*		
N	700.00 mm	*Base plate length*		
B	700.00 mm	*Base plate width*		

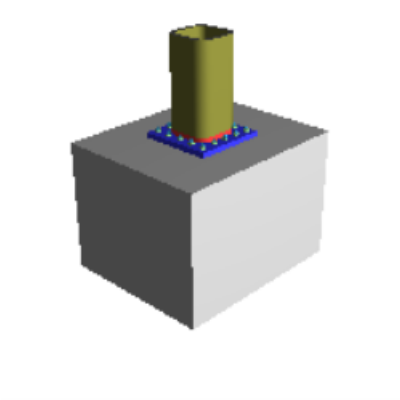
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1. Salud-BP-1: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
f_p	15.31 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	700.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	450.00 mm	*Column depth*		
b	450.00 mm	*Column width*		
m	136.25 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	136.25 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.14 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.14 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * β$*		
M_{pl}	0.14 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			

1. Salud-BP-1: Anchorage Design Report

Single Column Base Plate Connection



Material Properties:				
Column	K450*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x700.00x700.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

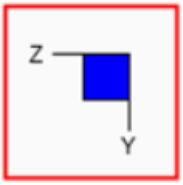
Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

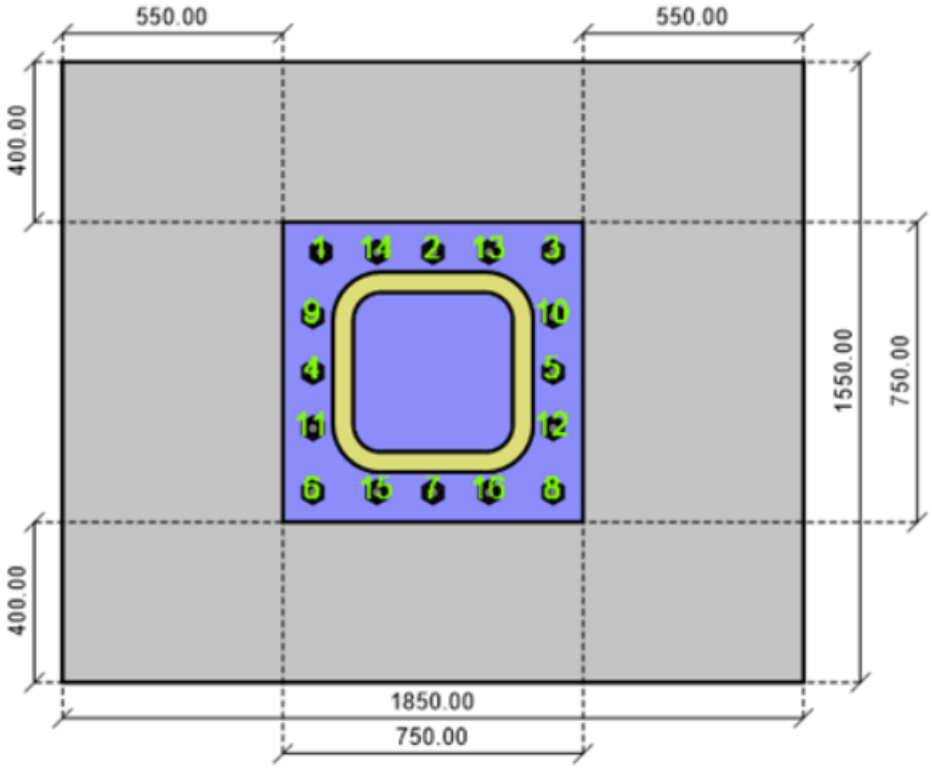
Note: Unless specified, all code references are from ACI 318-19 (22)

Limit State	Required	Available	Unity Check	Result
Custom bolt layout is not supported at the moment. Please choose from one of the three provided default bolt layout options.				**No Calc**

2. Salud-BP-2: 2D Views Report

Top view

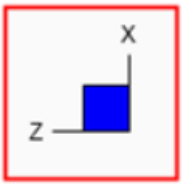


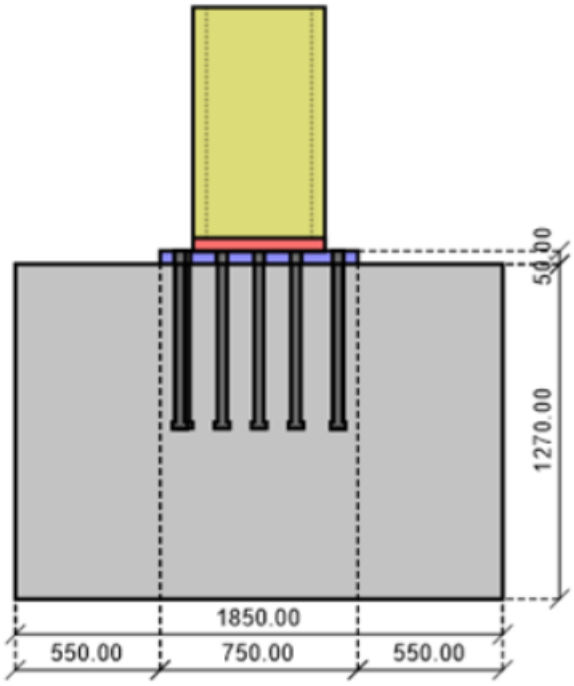


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2. Salud-BP-2: 2D Views Report (continued):

Side view

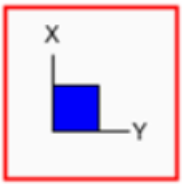


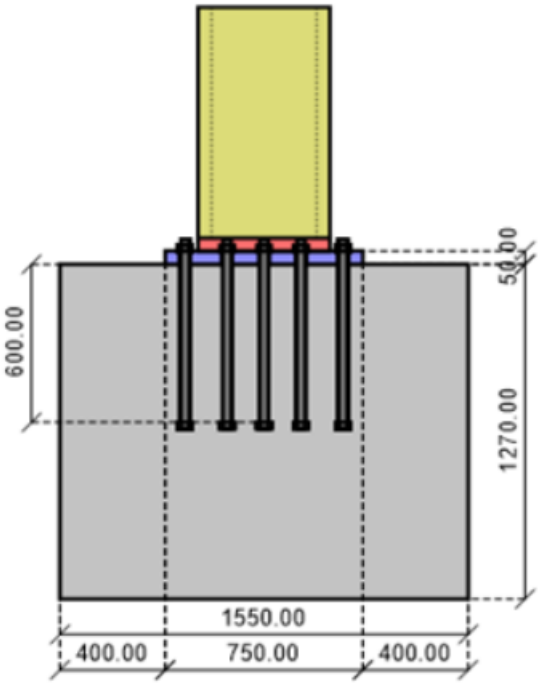


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2. Salud-BP-2: 2D Views Report (continued):

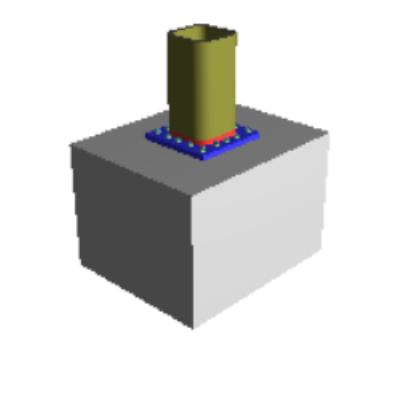
Left view





2. Salud-BP-2: Summary Report

Single Column Base Plate Connection



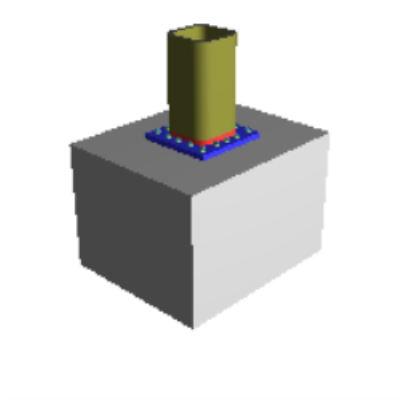
Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x750.00x750.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**0.83**	**PASS**

2. Salud-BP-2: Base Plate Report

Single Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x750.00x750.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	75.00 mm	*Min edge distance y*		
e_z	75.00 mm	*Min edge distance z*		
ED_{allow}	44.45 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	75.00 mm	*Max edge distance y*		
d_z	75.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	50.00 mm	*Thickness of base plate*		
Check Anchor Bolt Encroachment on Column	**Pass**			
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	600.00 kN-m	*User input strong axis moment*		
P_u	7500.00 kN	*User input axial load*		
N	750.00 mm	*Plate length*		
B	750.00 mm	*Plate width*		
ϕR_n	30.94 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.20 kN/mm	*Bearing force = φR_n*B*		
e	80.00 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		

continued on next page...

2. Salud-BP-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
e_{crit}	213.40 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	590.00 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	7500.00 kN	*User input axial load*		
N	750.00 mm	*Plate length*		
B	750.00 mm	*Plate width*		
ϕR_n	30.94 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.20 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = |(M_{uy} /P_u)|*		
e_{crit}	213.40 mm	*Critical eccentricity = (B/2) - P_u /(2*q_{max})*		
Y_z	750.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Concrete Bearing			**0.55**	**PASS**
R_n = 0.85 * f'$_c$ * α		**ϕ = 0.65**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'$_c$	28.00 MPa	*Concrete compressive strength*		
P_u	7500.00 kN	*Axial load on the column*		
N	750.00 mm	*Plate length*		
B	750.00 mm	*Plate width*		
A_1	562500.00 mm^2	*Plate area = B*N*		
L	1550.00 mm	*Concrete support length*		
W	1850.00 mm	*Concrete support width*		
L'	1550.00 mm	*Effective concrete support length*		
W'	1550.00 mm	*Effective concrete support width*		
A_2	2402500.00 mm^2	*Effective concrete support area = L' * W'*		
α	2.00	*Bearing stress increase factor = min(2, (A_2 / A_1)$^{0.5}$)*		
ϕR_n	30.94 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: f_{py} <= φR_n*		
Design with small moment				
Y_y	590.00 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	16.95 MPa	*Required bearing stress = P_u / (B * Y_y)*		
UC_y	0.55	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: f_{pz} <= φR_n*		
Design with small moment				
Y_z	750.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	13.33 MPa	*Required bearing stress = P_u / (N * Y_z)*		
UC_z	0.43	*Unity check for Weak Axis*		
Lateral Slip			**0.05**	**PASS**
V_n = μ * P_u <= min[0.2 * f'$_c$* A_c , (0.8 ksi) * A_c]		**ϕ = 0.75**	(ACI 318-14 Table 22.9.4.4)	
V_{uy}	100.00 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		

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2. Salud-BP-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	100.00 kN	*Resultant shear force*		
Check Strong Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{py}	16.95 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_y	590.00 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
B	750.00 mm	*Plate width*		
A_c	442499.28 mm^2	*Area of concrete section resisting shear transfer = Y_y * B*		
P_u	7500.00 kN	*Axial compressive force = f_{py} * Y_y * B*		
μ	0.55	*Static friction coefficient*		
f'_c	28.00 MPa	*Concrete compressive strength*		
ϕV_n	1830.56 kN	*Allowable static friction*		
Check Weak Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{pz}	13.33 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_z	750.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
N	750.00 mm	*Plate length*		
A_c	562500.00 mm^2	*Area of concrete section resisting shear transfer = Y_z * N*		
P_u	7500.00 kN	*Axial compressive force = f_{pz} * Y_z * N*		
ϕV_n	2326.98 kN	*Allowable static friction*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.16 kN-m/mm	0.19 kN-m/mm	**0.83**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	50.00 mm	*Thickness of base plate*		
ϕM_n	0.19 kN-m/mm	*Base plate bending capacity per unit width*		
N	750.00 mm	*Base plate length*		
B	750.00 mm	*Base plate width*		
f_p	16.95 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	590.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	137.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	137.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.16 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.16 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.16 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.13 kN-m/mm	0.19 kN-m/mm	**0.65**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	50.00 mm	*Thickness of base plate*		
ϕM_n	0.19 kN-m/mm	*Base plate bending capacity per unit width*		
N	750.00 mm	*Base plate length*		
B	750.00 mm	*Base plate width*		

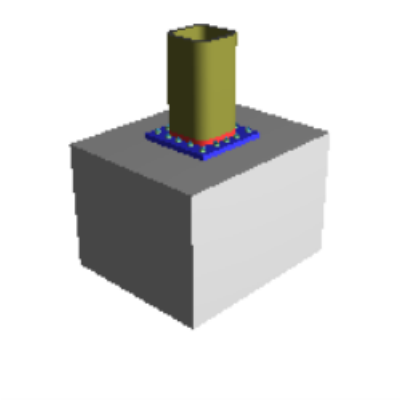
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2. Salud-BP-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
f_p	13.33 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	750.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	137.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	137.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.13 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.13 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * β$*		
M_{pl}	0.13 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			

2. Salud-BP-2: Anchorage Design Report

Single Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P50.00x750.00x750.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

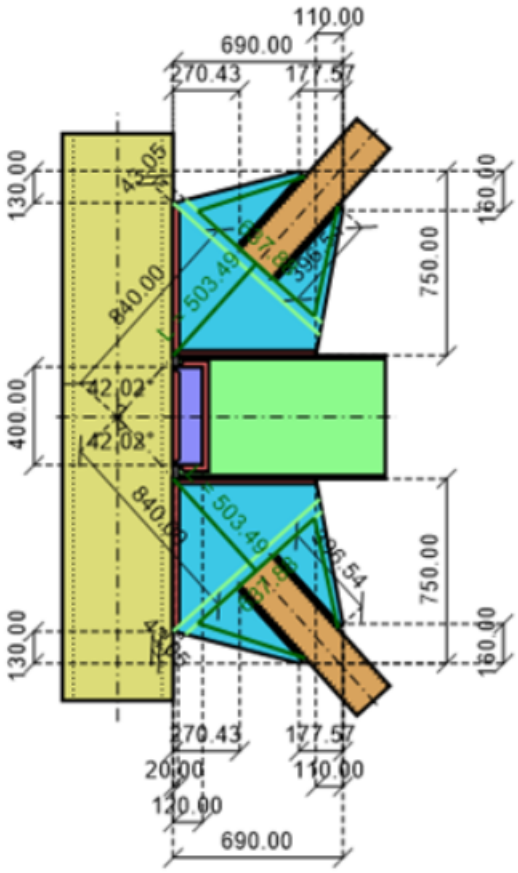
Input Data:		
Axial	7500.00 kN	*Axial load on the column*
Strong Axis Shear	100.00 kN	*Shear load on the column that causes strong axis bending*
Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Strong Axis Moment	600.00 kN-m	*Column moment about the strong axis*
Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from ACI 318-19 (22)

Limit State	Required	Available	Unity Check	Result
Custom bolt layout is not supported at the moment. Please choose from one of the three provided default bolt layout options.				**No Calc**

3. Salud EJEA-AR3-C3/C4: 2D Views Report

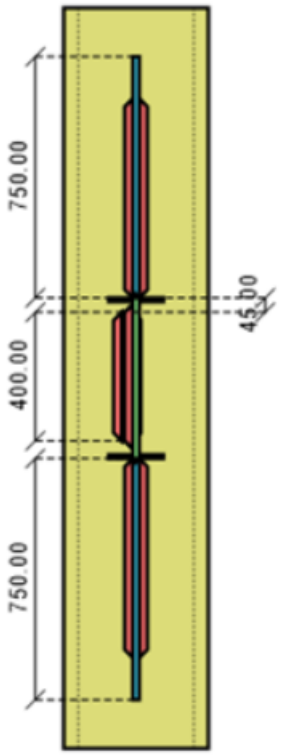
Side view



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3. Salud EJEA-AR3-C3/C4: 2D Views Report (continued):

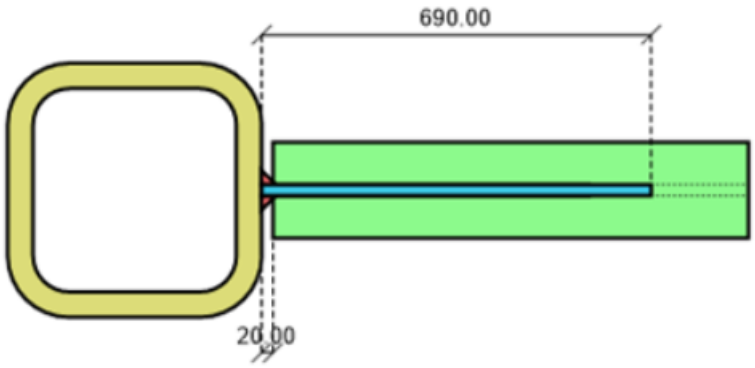
Front view



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3. Salud EJEA-AR3-C3/C4: 2D Views Report (continued):

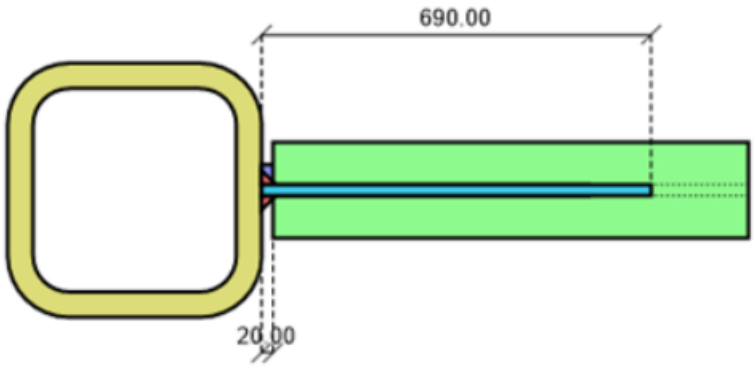
Top view



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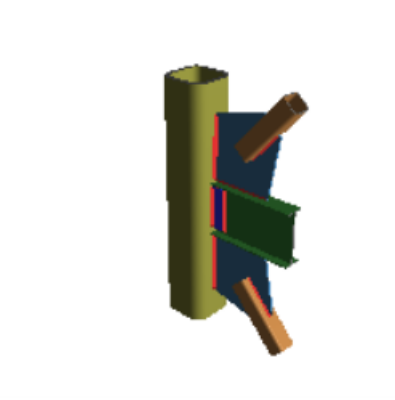
3. Salud EJEA-AR3-C3/C4: 2D Views Report (continued):

Bottom view



3. Salud EJEA-AR3-C3/C4: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

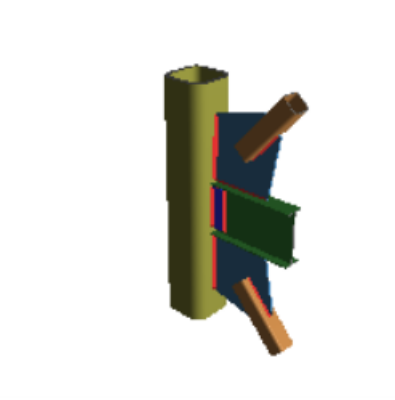
Shear Load	75.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-3613.96 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	2242.70 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-3613.96 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	2242.70 kN	*Design compressive load in bottom brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	2*t_p	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Plate Flexural Yield	**1.00**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.58**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.58**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.60**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.60**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.99**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.99**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.66**	**PASS**

3. Salud EJEA-AR3-C3/C4: Beam/Column Report



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Compression)	1998.29 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-1848.29 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1099.51 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	2062.99 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment due ecc	203.93 kN-m	*Calculated Maximum Moment due Eccentricity (SD3)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	35.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		

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3. Salud EJEA-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
D	25.00 mm	*Weld size*		
L_{min}	400.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{max}	33.41 mm	*Max Size Allowed*		
t	35.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	100.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	1998.29 kN	2068.43 kN	**0.97**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	10000.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	2068.43 kN	*Shear yield strength*		
Plate Shear Yield	1998.29 kN	2895.80 kN	**0.69**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	14000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2895.80 kN	*Shear yield strength*		
Beam Shear Rupture	1998.29 kN	2016.72 kN	**0.99**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	10000.00 mm^2	*Net area subject to shear*		
ϕR_n	2016.72 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	1998.29 kN	2823.40 kN	**0.71**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	14000.00 mm^2	*Net area subject to shear*		
ϕR_n	2823.40 kN	*Shear rupture strength*		
Beam Axial Yield	1099.51 kN	4219.59 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		

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3. Salud EJEA-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Axial Yield	1099.51 kN	4343.70 kN	**0.25**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	14000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4343.70 kN	*Tensile yield strength*		
Beam Tension Rupture	1099.51 kN	3828.40 kN	**0.29**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	11390.00 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	13600.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.84	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.70	*Shear lag factor (lower bound)*		
U	0.84	*Governing shear lag factor, $U = max(U_{D3.1}, U_{Bound})$*		
ϕR_n	3828.40 kN	*Tensile rupture strength*		
Plate Tension Rupture	1099.51 kN	4705.67 kN	**0.23**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	14000.00 mm^2	*Net area subject to tension*		
ϕR_n	4705.67 kN	*Tensile rupture strength*		
Plate Flexural Yield			**1.00**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1099.51 kN	*Calculated axial load*		
V_r	1998.29 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	14000.00 mm^2	*Gross area of the plate*		
Z_{pl}	1400000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4343.70 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2895.80 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	203.93 kN-m	*Calculated moment*		
M_c	434.37 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	1.00	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.95**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1099.51 kN	*Calculated axial load*		
V_r	1998.29 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	14000.00 mm^2	*Net area of the plate*		
Z_{net}	1400000.00 mm^3	*Plastic modulus of net section*		
P_c	4705.67 kN	*Available tensile strength (see check 'Tension Rupture')*		

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3. Salud EJEA-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
V_c	2823.40 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	203.93 kN-m	*Calculated moment*		
M_c	470.56 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.95	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because $Lb*d/tp^2 <= 0.08*E/Fy$				
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	20.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		
t_p	35.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column	5.18 kN/mm	7.68 kN/mm	**0.67**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	5.00 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.38 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	5.18 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	7.68 kN/mm	*Weld strength*		
Weld at Beam	3.46 kN/mm	3.84 kN/mm	**0.90**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	20.00 mm	*Base material thickness (beam)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	3.46 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	3.84 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	512.62 kN	5095.21 kN	**0.10**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		

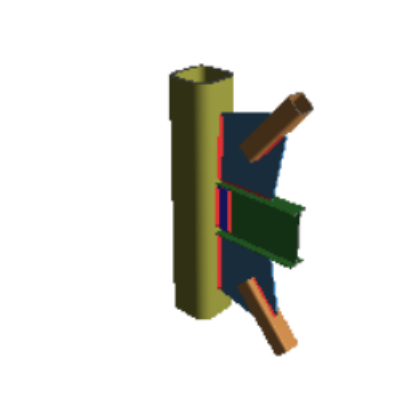
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3. Salud EJEA-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	112.50 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	167.50 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9 -5)*		
c	35.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5095.21 kN	*Transverse plastification strength*		

3. Salud EJEA-AR3-C3/C4: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	838.40 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	736.49 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1351.03 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1186.80 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1798.27 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	6.41 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1351.03 kN	2399.38 kN	**0.56**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2399.38 kN	*Shear yield strength*		
Plate Shear Rupture	1351.03 kN	2339.39 kN	**0.58**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11600.00 mm^2	*Net area subject to shear*		
ϕR_n	2339.39 kN	*Shear rupture strength*		
Plate Axial Yield	1186.80 kN	3599.06 kN	**0.33**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3599.06 kN	*Tensile yield strength*		

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3. Salud EJEA-AR3-C3/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Tension Rupture	1186.80 kN	3898.99 kN	**0.30**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area subject to tension*		
ϕR_n	3898.99 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1186.80 kN	*Calculated axial load*		
V_r	1351.03 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1682000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3599.06 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2399.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	6.41 kN-m	*Calculated moment*		
M_c	521.86 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1186.80 kN	*Calculated axial load*		
V_r	1351.03 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area of the plate*		
Z_{net}	1682000.00 mm^3	*Plastic modulus of net section*		
P_c	3898.99 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2339.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	6.41 kN-m	*Calculated moment*		
M_c	565.35 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1186.80 kN	3998.96 kN	**0.30**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-3)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		

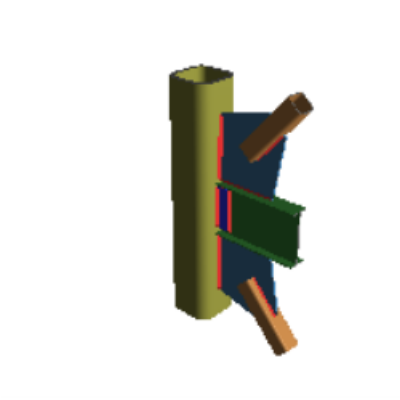
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3. Salud EJEA-AR3-C3/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	580.00 mm	*Length of bearing*		
ϕR_n	3998.96 kN	*Beam web local yielding*		
Beam Web Crippling	736.49 kN	13100.37 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$		**ϕ = 0.75**	(J10-4)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.16	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	580.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	13100.37 kN	*Beam web crippling capacity*		

3. Salud EJEA-AR3-C3/C4: Bot Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	838.40 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	736.49 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-1351.03 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-1186.80 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1798.27 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	6.41 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1351.03 kN	2399.38 kN	**0.56**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2399.38 kN	*Shear yield strength*		
Plate Shear Rupture	1351.03 kN	2339.39 kN	**0.58**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11600.00 mm^2	*Net area subject to shear*		
ϕR_n	2339.39 kN	*Shear rupture strength*		
Plate Axial Yield	1186.80 kN	3599.06 kN	**0.33**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3599.06 kN	*Tensile yield strength*		

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3. Salud EJEA-AR3-C3/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Tension Rupture	1186.80 kN	3898.99 kN	**0.30**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area subject to tension*		
ϕR_n	3898.99 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1186.80 kN	*Calculated axial load*		
V_r	1351.03 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1682000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3599.06 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2399.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	6.41 kN-m	*Calculated moment*		
M_c	521.86 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1186.80 kN	*Calculated axial load*		
V_r	1351.03 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area of the plate*		
Z_{net}	1682000.00 mm^3	*Plastic modulus of net section*		
P_c	3898.99 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2339.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	6.41 kN-m	*Calculated moment*		
M_c	565.35 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1186.80 kN	3998.96 kN	**0.30**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-3)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		

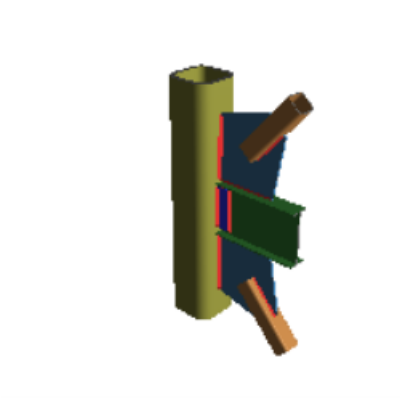
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3. Salud EJEA-AR3-C3/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	580.00 mm	*Length of bearing*		
ϕR_n	3998.96 kN	*Beam web local yielding*		
Beam Web Crippling	736.49 kN	13100.37 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$		**ϕ = 0.75**	(J10-4)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.16	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	580.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	13100.37 kN	*Beam web crippling capacity*		

3. Salud EJEA-AR3-C3/C4: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	929.64 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	662.84 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1498.05 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1068.12 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1839.85 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-5.94 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	620.00 mm	*Min weld segment length*		

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3. Salud EJEA-AR3-C3/C4: Top Gusset/Col Report (continued):

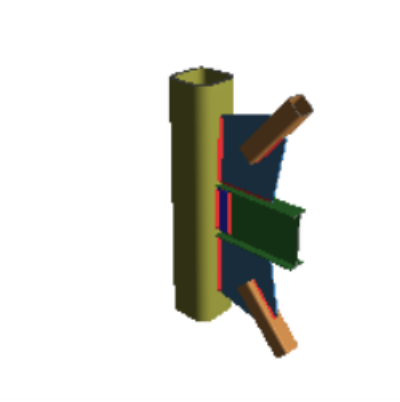
Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1498.05 kN	2564.85 kN	**0.58**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12400.00 mm^2	*Gross area subject to shear*		
ϕR_n	2564.85 kN	*Shear yield strength*		
Plate Shear Rupture	1498.05 kN	2500.73 kN	**0.60**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12400.00 mm^2	*Net area subject to shear*		
ϕR_n	2500.73 kN	*Shear rupture strength*		
Plate Axial Yield	1068.12 kN	3847.28 kN	**0.28**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area subject to tension*		
ϕR_n	3847.28 kN	*Tensile yield strength*		
Plate Tension Rupture	1068.12 kN	4167.88 kN	**0.26**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area subject to tension*		
ϕR_n	4167.88 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.42**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1068.12 kN	*Calculated axial load*		
V_r	1498.05 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area of the plate*		
Z_{pl}	1922000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3847.28 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2564.85 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	5.94 kN-m	*Calculated moment*		
M_c	596.32 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1068.12 kN	*Calculated axial load*		
V_r	1498.05 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area of the plate*		
Z_{net}	1922000.00 mm^3	*Plastic modulus of net section*		
P_c	4167.88 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2500.73 kN	*Available shear strength (see check 'Shear Rupture')*		

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3. Salud EJEA-AR3-C3/C4: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	5.94 kN-m	*Calculated moment*		
M_c	646.02 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	3.02 kN/mm	6.14 kN/mm	**0.49**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	1498.05 kN	*Shear Load*		
P	-1068.12 kN	*Axial Load*		
M	-5.94 kN-m	*Moment*		
e_{eff}	3.23 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.42 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.82 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	3.02 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	5.94 kN-m	1109.16 kN-m	**0.01**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	620.00 mm	*Plate length*		
M_e	-5.94 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1109.16 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	1068.12 kN	5819.84 kN	**0.18**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	620.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5819.84 kN	*Transverse plastification strength*		

3. Salud EJEA-AR3-C3/C4: Bot Gusset/Col Report



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1498.05 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	662.84 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-929.64 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1068.12 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1839.85 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-5.94 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	620.00 mm	*Min weld segment length*		

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3. Salud EJEA-AR3-C3/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1498.05 kN	2564.85 kN	**0.58**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12400.00 mm^2	*Gross area subject to shear*		
ϕR_n	2564.85 kN	*Shear yield strength*		
Plate Shear Rupture	1498.05 kN	2500.73 kN	**0.60**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12400.00 mm^2	*Net area subject to shear*		
ϕR_n	2500.73 kN	*Shear rupture strength*		
Plate Axial Yield	1068.12 kN	3847.28 kN	**0.28**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area subject to tension*		
ϕR_n	3847.28 kN	*Tensile yield strength*		
Plate Tension Rupture	1068.12 kN	4167.88 kN	**0.26**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area subject to tension*		
ϕR_n	4167.88 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.42**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1068.12 kN	*Calculated axial load*		
V_r	1498.05 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area of the plate*		
Z_{pl}	1922000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3847.28 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2564.85 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	5.94 kN-m	*Calculated moment*		
M_c	596.32 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.43**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1068.12 kN	*Calculated axial load*		
V_r	1498.05 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area of the plate*		
Z_{net}	1922000.00 mm^3	*Plastic modulus of net section*		
P_c	4167.88 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2500.73 kN	*Available shear strength (see check 'Shear Rupture')*		

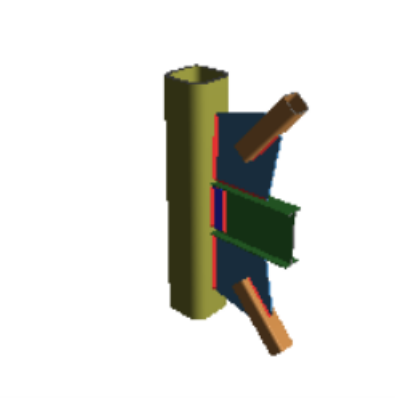
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3. Salud EJEA-AR3-C3/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	5.94 kN-m	*Calculated moment*		
M_c	646.02 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.43	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	3.02 kN/mm	6.14 kN/mm	**0.49**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	1498.05 kN	*Shear Load*		
P	-1068.12 kN	*Axial Load*		
M	-5.94 kN-m	*Moment*		
e_{eff}	3.23 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.42 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.82 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	3.02 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	3.69 kN-m	1109.16 kN-m	**0.00**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	620.00 mm	*Plate length*		
M_e	3.69 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1109.16 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	662.84 kN	5819.84 kN	**0.11**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	620.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5819.84 kN	*Transverse plastification strength*		

3. Salud EJEA-AR3-C3/C4: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

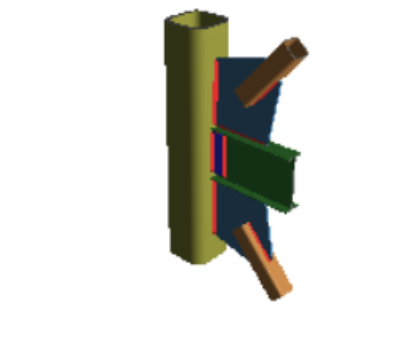
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	396.54 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	396.54 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3958.24 kN	**0.91**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12757.64 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	637.88 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3958.24 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4288.09 kN	**0.84**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		

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3. Salud EJEA-AR3-C3/C4: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
L_w	637.88 mm	*Whitmore tensile width*		
A_n	12757.64 mm^2	*Net area of plate*		
ϕR_n	4288.09 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	2242.70 kN	3444.52 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	503.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	251.74 mm	*Effective length, L_c=K*L*		
L_c/r	43.60	*Plate slenderness check from J4-6*		
F_{cr}	300.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12757.64 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3444.52 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1997.31 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6229.80 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1997.31 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3653.54 kN	**0.99**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (top brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	396.54 mm	*Weld length*		
ϕRn	3653.54 kN	*Weld strength*		

3. Salud EJEA-AR3-C3/C4: Bot Gusset/Brace Report



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	396.54 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	396.54 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3958.24 kN	**0.91**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12757.64 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	637.88 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3958.24 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4288.09 kN	**0.84**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		

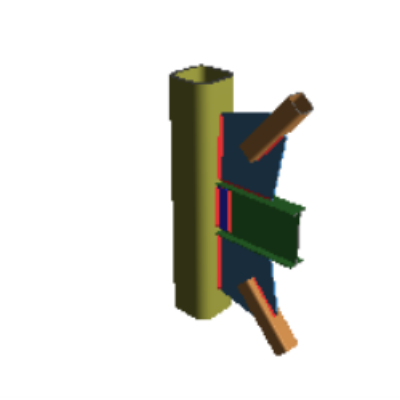
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3. Salud EJEA-AR3-C3/C4: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
L_w	637.88 mm	*Whitmore tensile width*		
A_n	12757.64 mm^2	*Net area of plate*		
ϕR_n	4288.09 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	2242.70 kN	3444.52 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	503.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	251.74 mm	*Effective length, L_c=K*L*		
L_c/r	43.60	*Plate slenderness check from J4-6*		
F_{cr}	300.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12757.64 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3444.52 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1997.31 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6229.80 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1997.31 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3653.54 kN	**0.99**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (bottom brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	396.54 mm	*Weld length*		
ϕRn	3653.54 kN	*Weld strength*		

3. Salud EJEA-AR3-C3/C4: Seismic Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-top}}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-top}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-top}}$	8064.00 mm^2	*Area of the top brace*		
$P_{exp\text{-t-top}}$	3613.96 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-bot}}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-bot}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-bot}}$	8064.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-t-bot}}$	3613.96 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*Length of the top brace*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	68.76 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}top}/r_y)^2$*		
$F_{cre\text{-}top}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}top}$	2242.70 kN	*Top brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}top}$*		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = $K_{bot}*L_{bot}$*		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	68.76 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}bot}/r_y)^2$*		
$F_{cre\text{-}bot}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}bot}$	2242.70 kN	*Bottom brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}bot}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-3613.96 kN	*Design tensile load in top brace member = $P_{exp\text{-}t\text{-}top}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-3613.96 kN	*Design tensile load in bottom brace member = $P_{exp\text{-}t\text{-}bot}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	2242.70 kN	*Design compressive load in top brace member = $P_{exp\text{-}ci\text{-}top}/\alpha_s$*		
$P_{des\text{-}ci\text{-}bot}$	2242.70 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}ci\text{-}bot}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	672.81 kN	*Design compressive load in top brace member = $P_{exp\text{-}cii\text{-}top}/\alpha_s$*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{des\text{-}cii\text{-}bot}$	672.81 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}cii\text{-}bot}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-3613.96 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-3613.96 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	672.81 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	2242.70 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-3613.96 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	672.81 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-3613.96 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-3613.96 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-3613.96 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	2242.70 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-3613.96 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = $SF_{SD1}/2$ (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-1498.05 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-1068.12 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	-5.94 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-1186.80 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-1351.03 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	6.41 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-929.64 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	662.84 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	3.69 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	736.49 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	838.40 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$M_{bmSD1\text{-}bot}$	-3.98 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD1}	-1848.29 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD1\text{-}top}$ - $V_{bmSD1\text{-}bot}$*		
H_{bcSD1}	-512.62 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD1}$ + $H_{bmSD1\text{-}top}$ + $H_{bmSD1\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-3613.96 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	672.81 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-3613.96 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	672.81 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	672.81 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-3613.96 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection = SF_{SD2}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-1498.05 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-1068.12 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	-5.94 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-1186.80 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-1351.03 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	6.41 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-278.89 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	198.85 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	1.11 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	220.95 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	251.52 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	-1.19 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-1332.75 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD2\text{-}top}$ - $V_{bmSD2\text{-}bot}$*		
H_{bcSD2}	-1099.51 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD2}$ + $H_{bmSD2\text{-}top}$ + $H_{bmSD2\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{top-SD3}$	2242.70 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		
$P_{bot-SD3}$	-3613.96 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	2242.70 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-3613.96 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-3613.96 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	2242.70 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = $SF_{SD3}/2$ (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	929.64 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	662.84 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	3.69 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	736.49 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	838.40 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	-3.98 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	1498.05 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-1068.12 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	-5.94 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-1186.80 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-1351.03 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	6.41 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	1998.29 kN	*Beam/column vertical load per AISC 15th, page 13-5 = $V_{bm} + V_{bmSD3-top} - V_{bmSD3-bot}$*		
H_{bcSD3}	-512.62 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm-SD3} + H_{bmSD3-top} + H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	672.81 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-3613.96 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	672.81 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-3613.96 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-3613.96 kN	*Assumed opposite side top brace force*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$O_{bot-SD4}$	672.81 kN	*Assumed opposite side bottom brace force*		
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD4}	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4-top}$	278.89 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4-top}$	198.85 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4-top}$	1.11 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4-top}$	220.95 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4-top}$	251.52 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4-top}$	-1.19 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4-bot}$	1498.05 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4-bot}$	-1068.12 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4-bot}$	-5.94 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4-bot}$	-1186.80 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4-bot}$	-1351.03 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4-bot}$	6.41 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	1482.75 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4-top}$ - $V_{bmSD4-bot}$*		
H_{bcSD4}	-1099.51 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD4} + $H_{bmSD4-top}$ + $H_{bmSD4-bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	929.64 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	662.84 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1498.05 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1068.12 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1839.85 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-5.94 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	1498.05 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	662.84 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-929.64 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1068.12 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1839.85 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-5.94 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	838.40 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	736.49 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1351.03 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1186.80 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1798.27 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	6.41 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	838.40 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	736.49 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-1351.03 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-1186.80 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1798.27 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	6.41 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	1998.29 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-1848.29 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1099.51 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	2062.99 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	203.93 kN-m	*Maximum moment (loading direction SD3 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	68.76 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	79.99	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	68.76 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	79.99	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	35.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	54.34 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	68.25 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	43.05 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	20.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	40.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	80.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	43.05 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	20.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	40.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	80.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	23.80	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	156.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	12.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.30	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	156.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	12.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.30	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		

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Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	396.54 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6229.80 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8881.89 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	396.54 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6229.80 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

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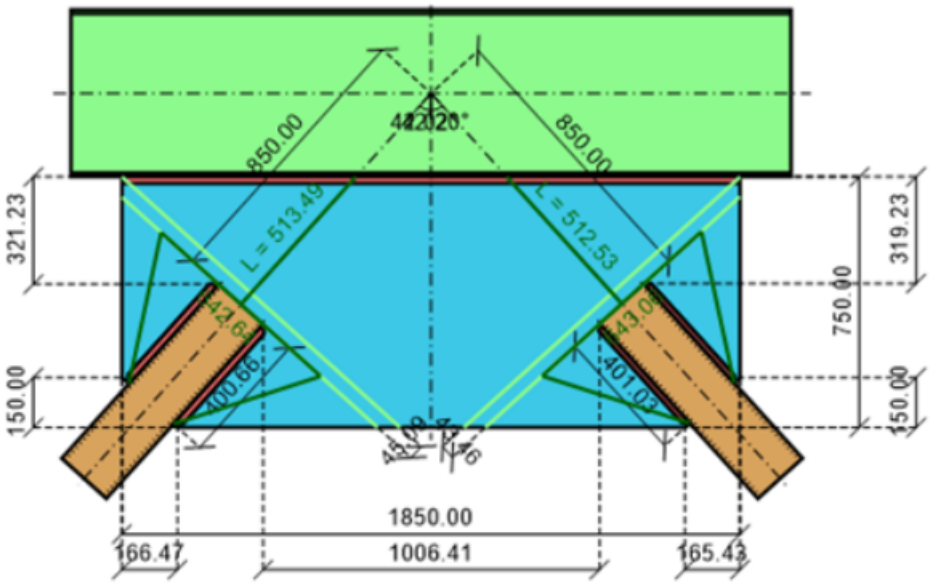
3. Salud EJEA-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8881.89 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	4702.23 kN	7140.06 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	620.00 mm	*Weld length*		
ϕR_n	7140.06 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	4702.23 kN	7140.06 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	620.00 mm	*Weld length*		
ϕR_n	7140.06 kN	*Weld strength*		

4. Salud Chev-EJEA-AR3-VS2/VM2: 2D Views Report*

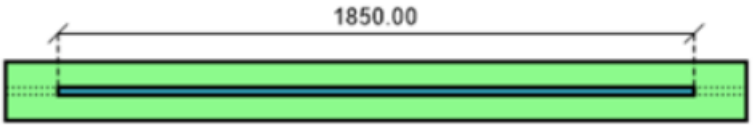
Left view



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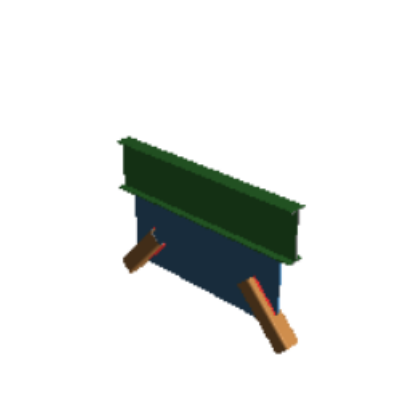
4. Salud Chev-EJEA-AR3-VS2/VM2: 2D Views Report (continued):*

Bottom view



4. Salud Chev-EJEA-AR3-VS2/VM2: Summary Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

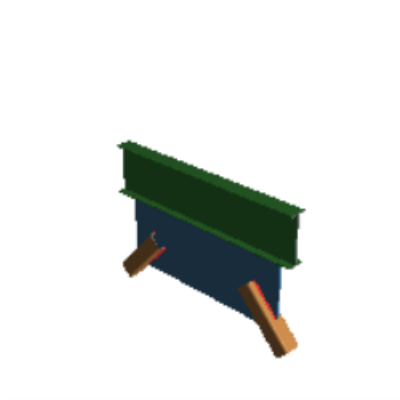
Input Data:		
Left Brace Axial (Tension)	-3613.96 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	2242.70 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-3613.96 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	2242.70 kN	*Design compressive load in right brace*

Seismic Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.53**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.98**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.98**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Beam Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-3925.61 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	3928.81 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-2186.43 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	982.20 kN-m	*Maximum moment at section a-a (SD3)*
Shear(Tension, Section b-b)	-1377.39 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	1375.30 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-988.60 kN	*Maximum axial due to tension at section b-b (SD4)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-114.35 kN-m	*Maximum moment at section b-b (SD4)*
Beam Moment	-982.20 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: $-d_{beam} <= WP_h <= d_{beam}$*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: $-0.5*d_{beam} <= WP_v <= d_{beam}$*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	3928.81 kN	7653.18 kN	**0.51**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	37000.00 mm^2	*Gross area subject to shear*		
ϕR_n	7653.18 kN	*Shear yield strength*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
Plate Shear Rupture (Section a-a)	3928.81 kN	7461.85 kN	**0.53**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	37000.00 mm^2	*Net area subject to shear*		
ϕR_n	7461.85 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	2186.43 kN	11479.77 kN	**0.19**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	37000.00 mm^2	*Gross area subject to tension*		
ϕR_n	11479.77 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	2186.43 kN	12436.42 kN	**0.18**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	37000.00 mm^2	*Net area subject to tension*		
ϕR_n	12436.42 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.40**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-2186.43 kN	*Calculated axial load*		
V_r	3928.81 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	37000.00 mm^2	*Gross area of the plate*		
Z_{pl}	17112500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	11479.77 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	7653.18 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	982.20 kN-m	*Calculated moment*		
M_c	5309.36 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.40	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.40**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-2186.43 kN	*Calculated axial load*		
V_r	3928.81 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	37000.00 mm^2	*Net area of the plate*		
Z_{net}	17112500.00 mm^3	*Plastic modulus of net section*		
P_c	12436.42 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	7461.85 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	982.20 kN-m	*Calculated moment*		
M_c	5751.81 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.40	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield (Section b-b)	1377.39 kN	3102.64 kN	**0.44**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	15000.00 mm^2	*Gross area subject to shear*		
ϕR_n	3102.64 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	1377.39 kN	3025.08 kN	**0.46**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	15000.00 mm^2	*Net area subject to shear*		
ϕR_n	3025.08 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	988.60 kN	4653.96 kN	**0.21**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4653.96 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	988.60 kN	5041.79 kN	**0.20**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15000.00 mm^2	*Net area subject to tension*		
ϕR_n	5041.79 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.32**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-988.60 kN	*Calculated axial load*		
V_r	1377.39 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15000.00 mm^2	*Gross area of the plate*		
Z_{pl}	2812500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4653.96 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3102.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-114.35 kN-m	*Calculated moment*		
M_c	872.61 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.32	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.31**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-988.60 kN	*Calculated axial load*		
V_r	1377.39 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15000.00 mm^2	*Net area of the plate*		
Z_{net}	2812500.00 mm^3	*Plastic modulus of net section*		
P_c	5041.79 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3025.08 kN	*Available shear strength (see check 'Shear Rupture')*		

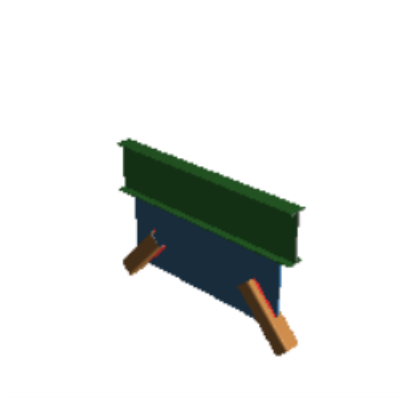
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4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
M_r	-114.35 kN-m	*Calculated moment*		
M_c	945.33 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.31	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	2186.43 kN	12755.30 kN	**0.17**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1850.00 mm	*Length of bearing*		
ϕR_n	12755.30 kN	*Beam web local yielding*		

4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Left Brace Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	400.66 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	400.66 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3987.78 kN	**0.91**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12852.85 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	642.64 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3987.78 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4320.09 kN	**0.84**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	642.64 mm	*Whitmore tensile width*		
A_n	12852.85 mm^2	*Net area of plate*		
ϕR_n	4320.09 kN	*Plate tensile rupture strength*		

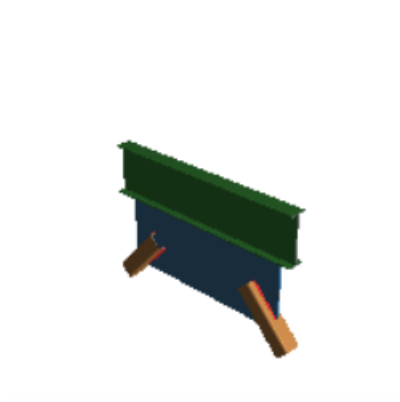
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4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Left Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2242.70 kN	3123.26 kN	**0.72**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	513.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	333.77 mm	*Effective length, L_c=K*L*		
L_c/r	57.81	*Plate slenderness check from J4-6*		
F_{cr}	270.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12852.85 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3123.26 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	2001.53 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6242.95 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2001.53 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3699.17 kN	**0.98**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (left brace)*		
α	0.75	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	400.66 mm	*Weld length*		
ϕRn	3699.17 kN	*Weld strength*		

4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Right Brace Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	401.03 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	401.03 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3990.40 kN	**0.91**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12861.29 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	643.06 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3990.40 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4322.93 kN	**0.84**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	643.06 mm	*Whitmore tensile width*		
A_n	12861.29 mm^2	*Net area of plate*		
ϕR_n	4322.93 kN	*Plate tensile rupture strength*		

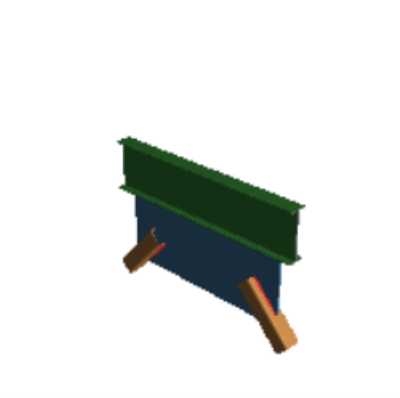
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4. Salud Chev-EJEA-AR3-VS2/VM2: Gusset/Right Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2242.70 kN	3128.15 kN	**0.72**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	512.53 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	333.14 mm	*Effective length, L_c=K*L*		
L_c/r	57.70	*Plate slenderness check from J4-6*		
F_{cr}	270.25 MPa	*Flexural buckling stress (E3-2)*		
A_g	12861.29 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3128.15 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	2001.90 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6244.10 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2001.90 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3694.89 kN	**0.98**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (right brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	401.03 mm	*Weld length*		
ϕRn	3694.89 kN	*Weld strength*		

4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	8064.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	3613.96 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	8064.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	3613.96 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	68.76 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$F_{cre\text{-}left}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}left}$	2242.70 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	68.76 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	2242.70 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-3613.96 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-3613.96 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	2242.70 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	2242.70 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	672.81 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	672.81 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-3613.96 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	2242.70 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$P_{left\text{-}SD2}$	-3613.96 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	672.81 kN	*Right brace design load per loading direction SD2*		
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	2242.70 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-3613.96 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	672.81 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-3613.96 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3613.96 kN	*Left brace design load per loading direction*		
P_{right}	2242.70 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2684.85 kN	*Vertical component of left brace*		
P_{Hleft}	-2419.15 kN	*Horizontal component of left brace*		
P_{Vright}	1661.40 kN	*Vertical component of right brace*		
P_{Hright}	-1506.47 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1023.45 kN	*Axial force at section a-a*		
V_{aa}	-3925.61 kN	*Shear force at section a-a*		
M_{aa}	-981.40 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.55 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-2.12 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.72 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-456.34 kN	*Axial force at section b-b*		
V_{bb}	-1377.39 kN	*Shear force at section b-b*		
M_{bb}	-48.54 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3613.96 kN	*Left brace design load per loading direction*		
P_{right}	672.81 kN	*Right brace design load per loading direction*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
P_{Vleft}	-2684.85 kN	*Vertical component of left brace*		
P_{Hleft}	-2419.15 kN	*Horizontal component of left brace*		
P_{Vright}	498.42 kN	*Vertical component of right brace*		
P_{Hright}	-451.94 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-2186.43 kN	*Axial force at section a-a*		
V_{aa}	-2871.09 kN	*Shear force at section a-a*		
M_{aa}	-717.77 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.18 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.55 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.26 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-983.60 kN	*Axial force at section b-b*		
V_{bb}	-1009.66 kN	*Shear force at section b-b*		
M_{bb}	-109.14 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	2242.70 kN	*Left brace design load per loading direction*		
P_{right}	-3613.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	1666.13 kN	*Vertical component of left brace*		
P_{Hleft}	1501.24 kN	*Horizontal component of left brace*		
P_{Vright}	-2677.24 kN	*Vertical component of right brace*		
P_{Hright}	2427.57 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1011.11 kN	*Axial force at section a-a*		
V_{aa}	3928.81 kN	*Shear force at section a-a*		
M_{aa}	982.20 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.55 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	2.12 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.72 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-463.16 kN	*Axial force at section b-b*		
V_{bb}	1375.30 kN	*Shear force at section b-b*		
M_{bb}	-55.66 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	672.81 kN	*Left brace design load per loading direction*		
P_{right}	-3613.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	499.84 kN	*Vertical component of left brace*		
P_{Hleft}	450.37 kN	*Horizontal component of left brace*		
P_{Vright}	-2677.24 kN	*Vertical component of right brace*		
P_{Hright}	2427.57 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-2177.40 kN	*Axial force at section a-a*		
V_{aa}	2877.94 kN	*Shear force at section a-a*		
M_{aa}	719.48 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.18 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.56 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.26 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-988.60 kN	*Axial force at section b-b*		
V_{bb}	1005.17 kN	*Shear force at section b-b*		
M_{bb}	-114.35 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-3925.61 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	3928.81 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-2186.43 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	982.20 kN-m	*Maximum moment (loading direction SD3 governs)*		
Section (b-b) Forces				
Shear (Tension)	-1377.39 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	1375.30 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-988.60 kN	*Maximum tension axial force (loading direction SD4 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-114.35 kN-m	*Maximum moment (loading direction SD4 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	68.76 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	79.99	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	68.76 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	79.99	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	45.09 mm	*Distance from end of left brace to hinge line*		
t_g	20.00 mm	*Thickness of gusset plate*		
$2*t_g$	40.00 mm	*Lower limiting thickness of the gusset plate*		
$4*t_g$	80.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	43.46 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

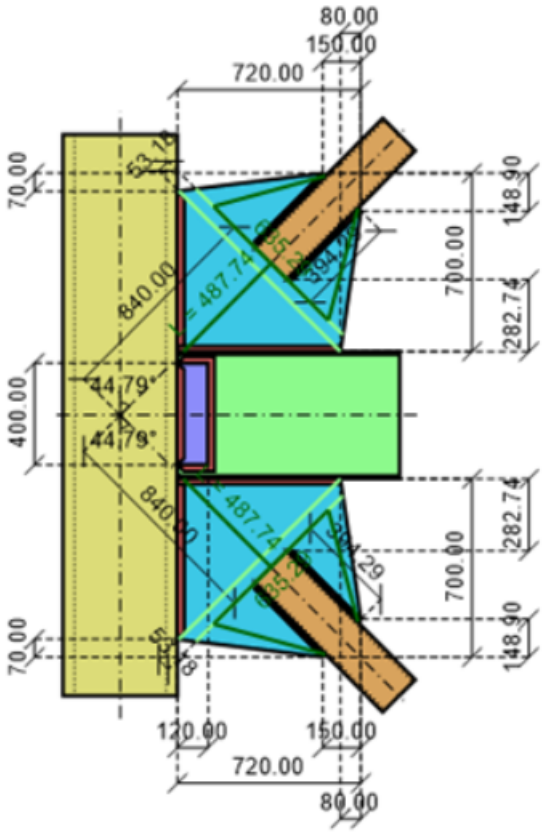
Limit State	Required	Available	Unity Check	Result
Ratio	23.80	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}left}$	156.00 mm	*Inside dimension of left brace tube*		
$t_{br\text{-}left}$	12.00 mm	*Left brace tube wall thickness*		
$E_{br\text{-}left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
$R_{y\text{-}left}$	1.30	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}left}/t_{br\text{-}left}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}left}/(R_{y\text{-}left} * F_{ybr\text{-}left}))^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}right}$	156.00 mm	*Inside dimension of right brace tube*		
$t_{br\text{-}right}$	12.00 mm	*Right brace tube wall thickness*		
$E_{br\text{-}right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y\text{-}right}$	1.30	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}right}/t_{br\text{-}right}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}right}/(R_{y\text{-}right} * F_{ybr\text{-}right}))^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	400.66 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars $=(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars $=A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6242.95 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		

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4. Salud Chev-EJEA-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8902.81 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	401.03 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =(A_g+A_r)-2*$(t_p$+2*gap)*t_{des}*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =A_g-2*$(t_p$+2*gap)*t_{des}*		
A_e	6244.10 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8904.64 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

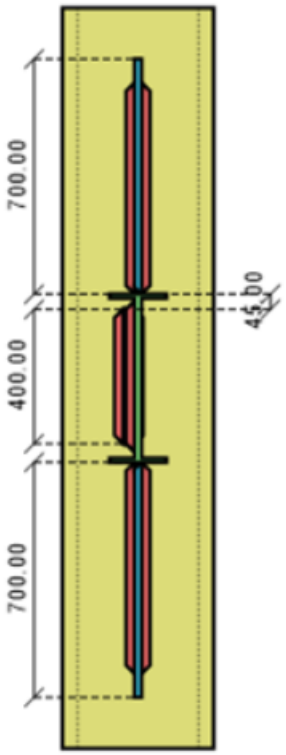
Side view



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5. Salud EJEC/G-AR3-C3/C4: 2D Views Report (continued):

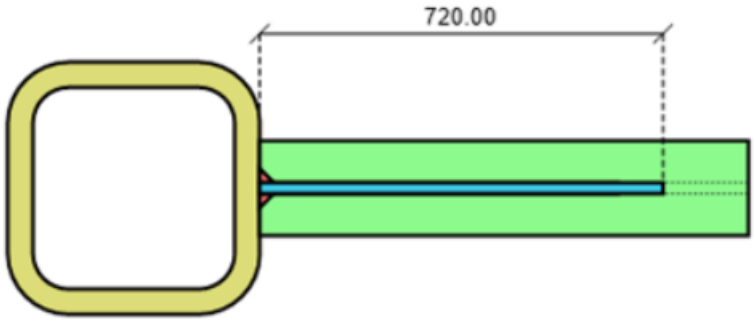
Front view



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5. Salud EJEC/G-AR3-C3/C4: 2D Views Report (continued):

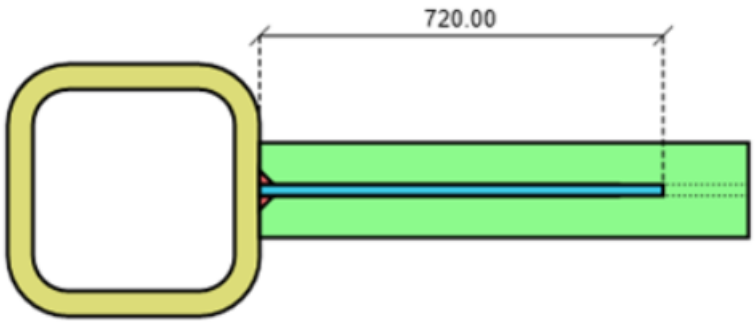
Top view



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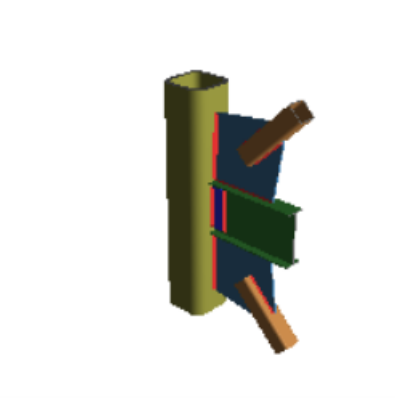
5. Salud EJEC/G-AR3-C3/C4: 2D Views Report (continued):

Bottom view



5. Salud EJEC/G-AR3-C3/C4: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

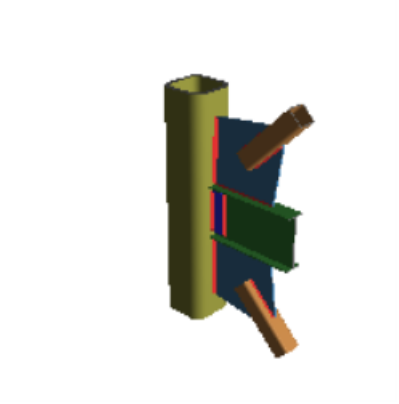
Shear Load	-150.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-3613.96 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	2242.70 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-3613.96 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	2242.70 kN	*Design compressive load in bottom brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	2*t_p	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Beam Shear Rupture	**1.00**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.59**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.59**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.56**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.56**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.99**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.99**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.66**	**PASS**

5. Salud EJEC/G-AR3-C3/C4: Beam/Column Report



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1714.91 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-2014.91 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1229.19 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	2094.82 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment due ecc	-199.32 kN-m	*Calculated Maximum Moment due Eccentricity (SD1)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	35.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		

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5. Salud EJEC/G-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
D	25.00 mm	*Weld size*		
L_{min}	400.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{max}	33.41 mm	*Max Size Allowed*		
t	35.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	120.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	2014.91 kN	2068.43 kN	**0.97**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	10000.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	2068.43 kN	*Shear yield strength*		
Plate Shear Yield	2014.91 kN	3185.38 kN	**0.63**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	379.21 MPa	*Minimum yield stress of material*		
A_{gv}	14000.00 mm^2	*Gross area subject to shear*		
ϕR_n	3185.38 kN	*Shear yield strength*		
Beam Shear Rupture	2014.91 kN	2016.72 kN	**1.00**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	10000.00 mm^2	*Net area subject to shear*		
ϕR_n	2016.72 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	2014.91 kN	3040.59 kN	**0.66**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	482.63 MPa	*Minimum tensile stress of material*		
A_{nv}	14000.00 mm^2	*Net area subject to shear*		
ϕR_n	3040.59 kN	*Shear rupture strength*		
Beam Axial Yield	1229.19 kN	4219.59 kN	**0.29**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		

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5. Salud EJEC/G-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Axial Yield	1229.19 kN	4778.07 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	379.21 MPa	*Minimum yield stress of material*		
A_g	14000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4778.07 kN	*Tensile yield strength*		
Beam Tension Rupture	1229.19 kN	3952.20 kN	**0.31**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	11758.33 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	13600.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.86	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.70	*Shear lag factor (lower bound)*		
U	0.86	*Governing shear lag factor, $U = max(U_{D3.1}, U_{Bound})$*		
ϕR_n	3952.20 kN	*Tensile rupture strength*		
Plate Tension Rupture	1229.19 kN	5067.65 kN	**0.24**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	482.63 MPa	*Minimum tensile stress of material*		
A_n	14000.00 mm^2	*Net area subject to tension*		
ϕR_n	5067.65 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.85**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1229.19 kN	*Calculated axial load*		
V_r	2014.91 kN	*Calculated shear load*		
F_y	379.21 MPa	*Minimum yield stress of material*		
A_g	14000.00 mm^2	*Gross area of the plate*		
Z_{pl}	1400000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4778.07 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3185.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	199.32 kN-m	*Calculated moment*		
M_c	477.80 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.85	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.84**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1229.19 kN	*Calculated axial load*		
V_r	2014.91 kN	*Calculated shear load*		
F_u	482.63 MPa	*Minimum tensile stress of material*		
A_n	14000.00 mm^2	*Net area of the plate*		
Z_{net}	1400000.00 mm^3	*Plastic modulus of net section*		
P_c	5067.65 kN	*Available tensile strength (see check 'Tension Rupture')*		

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5. Salud EJEC/G-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
V_c	3040.59 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	199.32 kN-m	*Calculated moment*		
M_c	506.76 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.84	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because $Lb*d/tp^2 <= 0.08*E/Fy$				
F_y	379.21 MPa	*Minimum yield stress of plate material*		
L_b	0.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		
t_p	35.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column	5.27 kN/mm	7.68 kN/mm	**0.69**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	5.04 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.54 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	5.27 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	7.68 kN/mm	*Weld strength*		
Weld at Beam	3.30 kN/mm	3.84 kN/mm	**0.86**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	20.00 mm	*Base material thickness (beam)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	3.30 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	3.84 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	573.09 kN	5095.21 kN	**0.11**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		

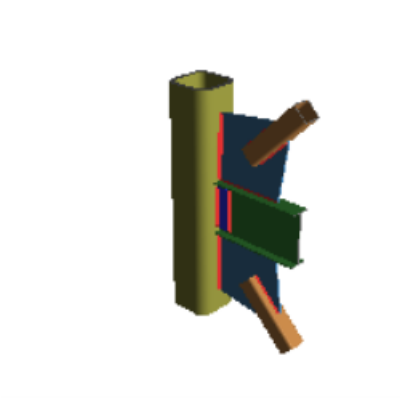
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5. Salud EJEC/G-AR3-C3/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	112.50 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	167.50 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9 -5)*		
c	35.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5095.21 kN	*Transverse plastification strength*		

5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	937.29 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	714.13 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1510.37 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1150.78 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1898.82 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-9.34 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1510.37 kN	2647.59 kN	**0.57**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12800.00 mm^2	*Gross area subject to shear*		
ϕR_n	2647.59 kN	*Shear yield strength*		
Plate Shear Rupture	1510.37 kN	2581.40 kN	**0.59**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12800.00 mm^2	*Net area subject to shear*		
ϕR_n	2581.40 kN	*Shear rupture strength*		
Plate Axial Yield	1150.78 kN	3971.38 kN	**0.29**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12800.00 mm^2	*Gross area subject to tension*		
ϕR_n	3971.38 kN	*Tensile yield strength*		

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5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Tension Rupture	1150.78 kN	4302.33 kN	**0.27**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12800.00 mm^2	*Net area subject to tension*		
ϕR_n	4302.33 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.42**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1150.78 kN	*Calculated axial load*		
V_r	1510.37 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12800.00 mm^2	*Gross area of the plate*		
Z_{pl}	2048000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3971.38 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2647.59 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	9.34 kN-m	*Calculated moment*		
M_c	635.42 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.42**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1150.78 kN	*Calculated axial load*		
V_r	1510.37 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12800.00 mm^2	*Net area of the plate*		
Z_{net}	2048000.00 mm^3	*Plastic modulus of net section*		
P_c	4302.33 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2581.40 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	9.34 kN-m	*Calculated moment*		
M_c	688.37 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1150.78 kN	4412.65 kN	**0.26**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-3)	
d_{end}	320.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		

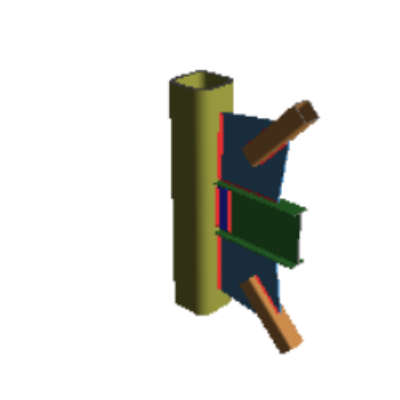
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5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	640.00 mm	*Length of bearing*		
ϕR_n	4412.65 kN	*Beam web local yielding*		
Beam Web Crippling	714.13 kN	14295.91 kN	**0.05**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$		**ϕ = 0.75**	(J10-4)	
d_{end}	320.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.28	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	640.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	14295.91 kN	*Beam web crippling capacity*		

5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	937.29 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	714.13 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-1510.37 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-1150.78 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1898.82 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-9.34 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1510.37 kN	2647.59 kN	**0.57**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12800.00 mm^2	*Gross area subject to shear*		
ϕR_n	2647.59 kN	*Shear yield strength*		
Plate Shear Rupture	1510.37 kN	2581.40 kN	**0.59**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12800.00 mm^2	*Net area subject to shear*		
ϕR_n	2581.40 kN	*Shear rupture strength*		
Plate Axial Yield	1150.78 kN	3971.38 kN	**0.29**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12800.00 mm^2	*Gross area subject to tension*		
ϕR_n	3971.38 kN	*Tensile yield strength*		

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5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Tension Rupture	1150.78 kN	4302.33 kN	**0.27**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12800.00 mm^2	*Net area subject to tension*		
ϕR_n	4302.33 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.42**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1150.78 kN	*Calculated axial load*		
V_r	1510.37 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12800.00 mm^2	*Gross area of the plate*		
Z_{pl}	2048000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3971.38 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2647.59 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	9.34 kN-m	*Calculated moment*		
M_c	635.42 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.42**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1150.78 kN	*Calculated axial load*		
V_r	1510.37 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12800.00 mm^2	*Net area of the plate*		
Z_{net}	2048000.00 mm^3	*Plastic modulus of net section*		
P_c	4302.33 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2581.40 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	9.34 kN-m	*Calculated moment*		
M_c	688.37 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1150.78 kN	4412.65 kN	**0.26**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-3)	
d_{end}	320.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		

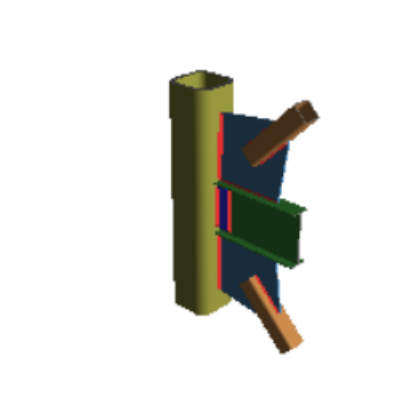
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5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	640.00 mm	*Length of bearing*		
ϕR_n	4412.65 kN	*Beam web local yielding*		
Beam Web Crippling	714.13 kN	14295.91 kN	**0.05**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$		**ϕ = 0.75**	(J10-4)	
d_{end}	320.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.28	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	640.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	14295.91 kN	*Beam web crippling capacity*		

5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	877.50 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	642.72 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1414.03 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1035.70 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1752.75 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	8.09 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	630.00 mm	*Min weld segment length*		

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5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1414.03 kN	2606.22 kN	**0.54**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2606.22 kN	*Shear yield strength*		
Plate Shear Rupture	1414.03 kN	2541.06 kN	**0.56**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12600.00 mm^2	*Net area subject to shear*		
ϕR_n	2541.06 kN	*Shear rupture strength*		
Plate Axial Yield	1035.70 kN	3909.33 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3909.33 kN	*Tensile yield strength*		
Plate Tension Rupture	1035.70 kN	4235.11 kN	**0.24**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12600.00 mm^2	*Net area subject to tension*		
ϕR_n	4235.11 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.37**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1035.70 kN	*Calculated axial load*		
V_r	1414.03 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1984500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3909.33 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2606.22 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	8.09 kN-m	*Calculated moment*		
M_c	615.72 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.37	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.38**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1035.70 kN	*Calculated axial load*		
V_r	1414.03 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12600.00 mm^2	*Net area of the plate*		
Z_{net}	1984500.00 mm^3	*Plastic modulus of net section*		
P_c	4235.11 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2541.06 kN	*Available shear strength (see check 'Shear Rupture')*		

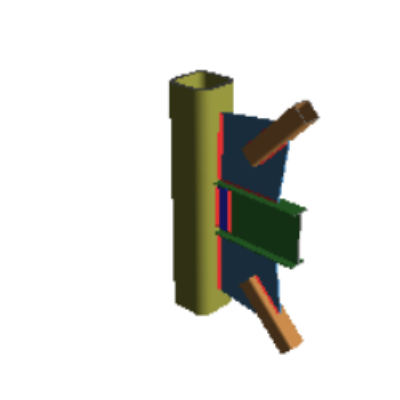
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5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	8.09 kN-m	*Calculated moment*		
M_c	667.03 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.38	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	2.86 kN/mm	6.14 kN/mm	**0.46**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	1414.03 kN	*Shear Load*		
P	-1035.70 kN	*Axial Load*		
M	8.09 kN-m	*Moment*		
e_{eff}	4.62 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.24 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.77 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.86 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	8.09 kN-m	1145.23 kN-m	**0.01**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	630.00 mm	*Plate length*		
M_e	8.09 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1145.23 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	1035.70 kN	5867.17 kN	**0.18**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	630.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5867.17 kN	*Transverse plastification strength*		

5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Compression)	1414.03 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	642.72 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-877.50 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1035.70 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1752.75 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	8.09 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	630.00 mm	*Min weld segment length*		

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5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1414.03 kN	2606.22 kN	**0.54**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2606.22 kN	*Shear yield strength*		
Plate Shear Rupture	1414.03 kN	2541.06 kN	**0.56**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12600.00 mm^2	*Net area subject to shear*		
ϕR_n	2541.06 kN	*Shear rupture strength*		
Plate Axial Yield	1035.70 kN	3909.33 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3909.33 kN	*Tensile yield strength*		
Plate Tension Rupture	1035.70 kN	4235.11 kN	**0.24**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12600.00 mm^2	*Net area subject to tension*		
ϕR_n	4235.11 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.37**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1035.70 kN	*Calculated axial load*		
V_r	1414.03 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1984500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3909.33 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2606.22 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	8.09 kN-m	*Calculated moment*		
M_c	615.72 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.37	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.38**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1035.70 kN	*Calculated axial load*		
V_r	1414.03 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12600.00 mm^2	*Net area of the plate*		
Z_{net}	1984500.00 mm^3	*Plastic modulus of net section*		
P_c	4235.11 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2541.06 kN	*Available shear strength (see check 'Shear Rupture')*		

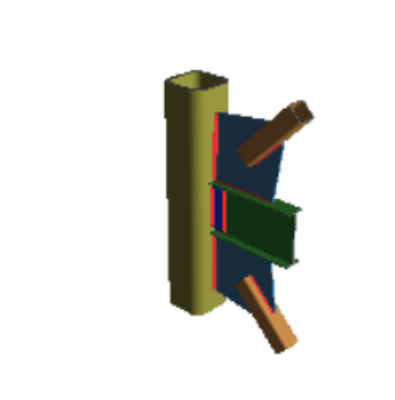
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5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	8.09 kN-m	*Calculated moment*		
M_c	667.03 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.38	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	2.86 kN/mm	6.14 kN/mm	**0.46**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	1414.03 kN	*Shear Load*		
P	-1035.70 kN	*Axial Load*		
M	8.09 kN-m	*Moment*		
e_{eff}	4.62 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.24 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.77 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.86 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	5.02 kN-m	1145.23 kN-m	**0.00**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	630.00 mm	*Plate length*		
M_e	-5.02 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1145.23 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	642.72 kN	5867.17 kN	**0.11**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	630.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5867.17 kN	*Transverse plastification strength*		

5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	394.29 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	394.29 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3942.17 kN	**0.92**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12705.85 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	635.29 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3942.17 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4270.68 kN	**0.85**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		

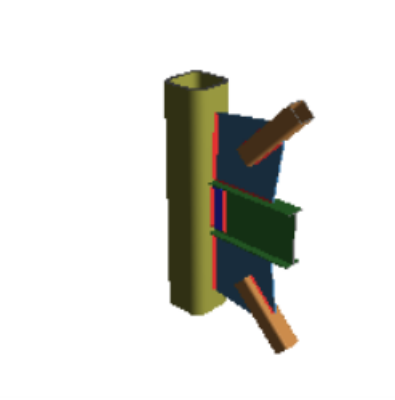
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5. Salud EJEC/G-AR3-C3/C4: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
L_w	635.29 mm	*Whitmore tensile width*		
A_n	12705.85 mm^2	*Net area of plate*		
ϕR_n	4270.68 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	2242.70 kN	3460.04 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	487.74 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	243.87 mm	*Effective length, L_c=K*L*		
L_c/r	42.24	*Plate slenderness check from J4-6*		
F_{cr}	302.58 MPa	*Flexural buckling stress (E3-2)*		
A_g	12705.85 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3460.04 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1994.98 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6222.53 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1994.98 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3632.88 kN	**0.99**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (top brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	394.29 mm	*Weld length*		
ϕRn	3632.88 kN	*Weld strength*		

5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	394.29 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	394.29 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3942.17 kN	**0.92**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12705.85 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	635.29 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3942.17 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4270.68 kN	**0.85**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		

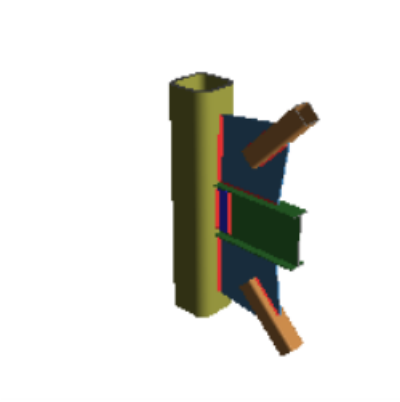
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5. Salud EJEC/G-AR3-C3/C4: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
L_w	635.29 mm	*Whitmore tensile width*		
A_n	12705.85 mm^2	*Net area of plate*		
ϕR_n	4270.68 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	2242.70 kN	3460.04 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	487.74 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	243.87 mm	*Effective length, L_c=K*L*		
L_c/r	42.24	*Plate slenderness check from J4-6*		
F_{cr}	302.58 MPa	*Flexural buckling stress (E3-2)*		
A_g	12705.85 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3460.04 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1994.98 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6222.53 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1994.98 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3632.88 kN	**0.99**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (bottom brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	394.29 mm	*Weld length*		
ϕRn	3632.88 kN	*Weld strength*		

5. Salud EJEC/G-AR3-C3/C4: Seismic Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P35.00x120.00x400.00	A572 Gr.55	F_y = 379.21 MPa	F_u = 482.63 MPa
Top Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Top Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Bottom Gusset	P20.00x700.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-top}}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-top}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-top}}$	8064.00 mm^2	*Area of the top brace*		
$P_{exp\text{-t-top}}$	3613.96 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-bot}}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-bot}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-bot}}$	8064.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-t-bot}}$	3613.96 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*Length of the top brace*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	68.76 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}top}/r_y)^2$*		
$F_{cre\text{-}top}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}top}$	2242.70 kN	*Top brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}top}$*		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = $K_{bot}*L_{bot}$*		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	68.76 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}bot}/r_y)^2$*		
$F_{cre\text{-}bot}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}bot}$	2242.70 kN	*Bottom brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}bot}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-3613.96 kN	*Design tensile load in top brace member = $P_{exp\text{-}t\text{-}top}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-3613.96 kN	*Design tensile load in bottom brace member = $P_{exp\text{-}t\text{-}bot}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	2242.70 kN	*Design compressive load in top brace member = $P_{exp\text{-}ci\text{-}top}/\alpha_s$*		
$P_{des\text{-}ci\text{-}bot}$	2242.70 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}ci\text{-}bot}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	672.81 kN	*Design compressive load in top brace member = $P_{exp\text{-}cii\text{-}top}/\alpha_s$*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{des\text{-}cii\text{-}bot}$	672.81 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}cii\text{-}bot}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-3613.96 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-3613.96 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	672.81 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	2242.70 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-3613.96 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	672.81 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-3613.96 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-3613.96 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	-150.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-3613.96 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	2242.70 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	2242.70 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-3613.96 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = $SF_{SD1}/2$ (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-1414.03 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-1035.70 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	8.09 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-1150.78 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-1510.37 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	-9.34 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-877.50 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	642.72 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	-5.02 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	714.13 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	937.29 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$M_{bmSD1\text{-}bot}$	5.80 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD1}	-2014.91 kN	*Beam/column vertical load per AISC 15th, page 13-5 =* $V_{bm} + V_{bmSD1\text{-}top} - V_{bmSD1\text{-}bot}$		
H_{bcSD1}	-573.09 kN	*Beam/column horizontal load per AISC 15th, page 13-5 =* $P_{bm\text{-}SD1} + H_{bmSD1\text{-}top} + H_{bmSD1\text{-}bot}$		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-3613.96 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	672.81 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	-150.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-3613.96 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	672.81 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	672.81 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-3613.96 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection =* $SF_{SD2}/2$ *(Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-1414.03 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-1035.70 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	8.09 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-1150.78 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-1510.37 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	-9.34 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-263.25 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	192.82 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	-1.51 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	214.24 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	281.19 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	1.74 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-1515.02 kN	*Beam/column vertical load per AISC 15th, page 13-5 =* $V_{bm} + V_{bmSD2\text{-}top} - V_{bmSD2\text{-}bot}$		
H_{bcSD2}	-1229.19 kN	*Beam/column horizontal load per AISC 15th, page 13-5 =* $P_{bm\text{-}SD2} + H_{bmSD2\text{-}top} + H_{bmSD2\text{-}bot}$		
Seismic Load Distribution (Loading Direction SD3)				**n/a**

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{top-SD3}$	2242.70 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		
$P_{bot-SD3}$	-3613.96 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	-150.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	2242.70 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-3613.96 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-3613.96 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	2242.70 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = $SF_{SD3}/2$ (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	877.50 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	642.72 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	-5.02 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	714.13 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	937.29 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	5.80 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	1414.03 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-1035.70 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	8.09 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-1150.78 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-1510.37 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	-9.34 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	1714.91 kN	*Beam/column vertical load per AISC 15th, page 13-5 = $V_{bm} + V_{bmSD3-top} - V_{bmSD3-bot}$*		
H_{bcSD3}	-573.09 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm-SD3} + H_{bmSD3-top} + H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	672.81 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-3613.96 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	-150.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	672.81 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-3613.96 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-3613.96 kN	*Assumed opposite side top brace force*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$O_{bot-SD4}$	672.81 kN	*Assumed opposite side bottom brace force*		
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD4}	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4-top}$	263.25 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4-top}$	192.82 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4-top}$	-1.51 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4-top}$	214.24 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4-top}$	281.19 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4-top}$	1.74 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4-bot}$	1414.03 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4-bot}$	-1035.70 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4-bot}$	8.09 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4-bot}$	-1150.78 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4-bot}$	-1510.37 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4-bot}$	-9.34 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	1215.02 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4-top}$ - $V_{bmSD4-bot}$*		
H_{bcSD4}	-1229.19 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD4} + $H_{bmSD4-top}$ + $H_{bmSD4-bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	877.50 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	642.72 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1414.03 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1035.70 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1752.75 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	8.09 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	1414.03 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	642.72 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-877.50 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1035.70 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1752.75 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	8.09 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	937.29 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	714.13 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1510.37 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1150.78 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1898.82 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-9.34 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	937.29 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	714.13 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-1510.37 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-1150.78 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1898.82 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-9.34 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	1714.91 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-2014.91 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1229.19 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	2094.82 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-199.32 kN-m	*Maximum moment (loading direction SD1 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	68.76 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	79.99	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	68.76 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	79.99	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	35.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	54.34 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	66.82 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	53.18 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	20.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	40.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	80.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	53.18 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	20.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	40.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	80.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	23.80	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	156.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	12.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.30	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	156.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	12.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.30	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		

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5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	394.29 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6222.53 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8870.33 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	394.29 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6222.53 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

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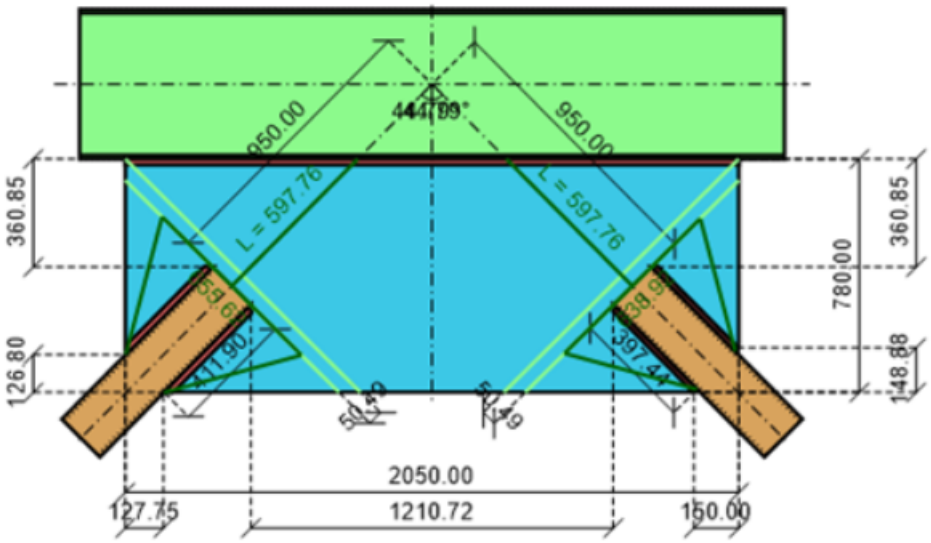
5. Salud EJEC/G-AR3-C3/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8870.33 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	4778.07 kN	7255.22 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	630.00 mm	*Weld length*		
ϕR_n	7255.22 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	4778.07 kN	7255.22 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	630.00 mm	*Weld length*		
ϕR_n	7255.22 kN	*Weld strength*		

6. Salud Chev-EJEC/G-AR3-VS2/VM2: 2D Views Report*

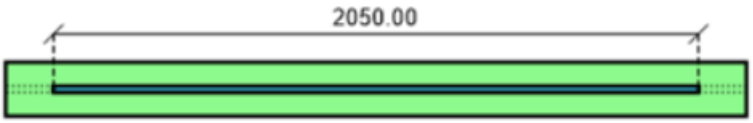
Left view



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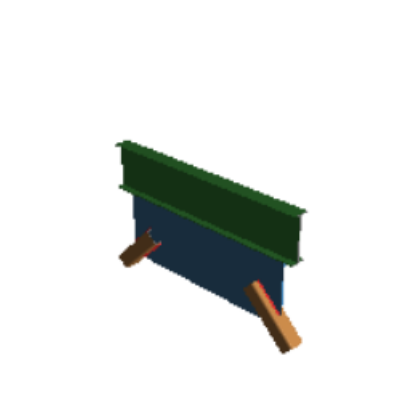
6. Salud Chev-EJEC/G-AR3-VS2/VM2: 2D Views Report (continued):*

Bottom view



6. Salud Chev-EJEC/G-AR3-VS2/VM2: Summary Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x780.00x2050.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

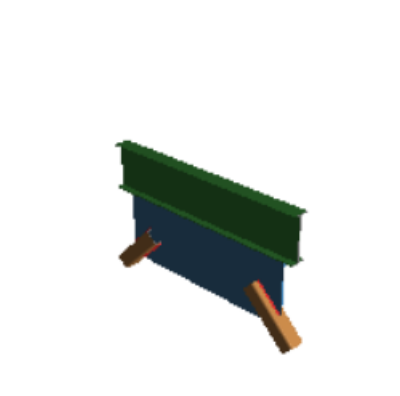
Input Data:		
Left Brace Axial (Tension)	-3613.96 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	2242.70 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-3613.96 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	2242.70 kN	*Design compressive load in right brace*

Seismic Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.50**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.95**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.99**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Beam Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x780.00x2050.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-4125.79 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	4125.79 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-2087.46 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	-1031.44 kN-m	*Maximum moment at section a-a (SD1)*
Shear(Tension, Section b-b)	-1323.64 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	1323.64 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-1035.96 kN	*Maximum axial due to tension at section b-b (SD2)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-128.10 kN-m	*Maximum moment at section b-b (SD2)*
Beam Moment	1031.44 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: $-d_{beam} <= WP_h <= d_{beam}$*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: $-0.5*d_{beam} <= WP_v <= d_{beam}$*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	4125.79 kN	8480.55 kN	**0.49**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	41000.00 mm^2	*Gross area subject to shear*		
ϕR_n	8480.55 kN	*Shear yield strength*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
Plate Shear Rupture (Section a-a)	4125.79 kN	8268.54 kN	**0.50**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	41000.00 mm^2	*Net area subject to shear*		
ϕR_n	8268.54 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	2087.46 kN	12720.83 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	41000.00 mm^2	*Gross area subject to tension*		
ϕR_n	12720.83 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	2087.46 kN	13780.90 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	41000.00 mm^2	*Net area subject to tension*		
ϕR_n	13780.90 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.34**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-2087.46 kN	*Calculated axial load*		
V_r	4125.79 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	41000.00 mm^2	*Gross area of the plate*		
Z_{pl}	21012500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	12720.83 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	8480.55 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	1031.44 kN-m	*Calculated moment*		
M_c	6519.39 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.34	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.34**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-2087.46 kN	*Calculated axial load*		
V_r	4125.79 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	41000.00 mm^2	*Net area of the plate*		
Z_{net}	21012500.00 mm^3	*Plastic modulus of net section*		
P_c	13780.90 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	8268.54 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	1031.44 kN-m	*Calculated moment*		
M_c	7062.67 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.34	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield (Section b-b)	1323.64 kN	3226.75 kN	**0.41**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	15600.00 mm^2	*Gross area subject to shear*		
ϕR_n	3226.75 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	1323.64 kN	3146.08 kN	**0.42**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	15600.00 mm^2	*Net area subject to shear*		
ϕR_n	3146.08 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	1035.96 kN	4840.12 kN	**0.21**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4840.12 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	1035.96 kN	5243.46 kN	**0.20**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15600.00 mm^2	*Net area subject to tension*		
ϕR_n	5243.46 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.29**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1035.96 kN	*Calculated axial load*		
V_r	1323.64 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15600.00 mm^2	*Gross area of the plate*		
Z_{pl}	3042000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4840.12 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3226.75 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-128.10 kN-m	*Calculated moment*		
M_c	943.82 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.29	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.28**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1035.96 kN	*Calculated axial load*		
V_r	1323.64 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15600.00 mm^2	*Net area of the plate*		
Z_{net}	3042000.00 mm^3	*Plastic modulus of net section*		
P_c	5243.46 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3146.08 kN	*Available shear strength (see check 'Shear Rupture')*		

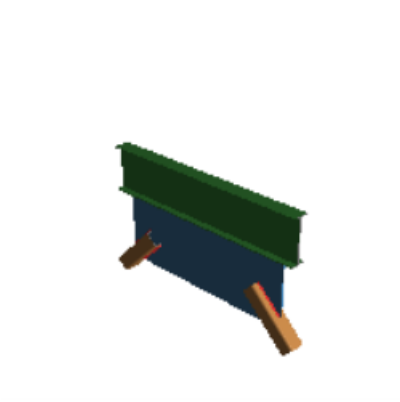
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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
M_r	-128.10 kN-m	*Calculated moment*		
M_c	1022.47 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.28	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	2087.46 kN	14134.25 kN	**0.15**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	2050.00 mm	*Length of bearing*		
ϕR_n	14134.25 kN	*Beam web local yielding*		

6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Left Brace Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x780.00x2050.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

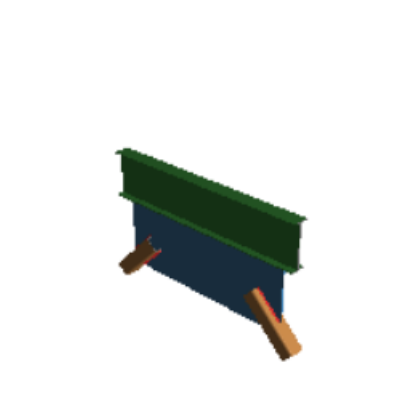
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	411.90 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	411.90 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	4068.31 kN	**0.89**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	13112.41 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	655.62 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	4068.31 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4407.34 kN	**0.82**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	655.62 mm	*Whitmore tensile width*		
A_n	13112.41 mm^2	*Net area of plate*		
ϕR_n	4407.34 kN	*Plate tensile rupture strength*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Left Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2242.70 kN	2921.45 kN	**0.77**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	597.76 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	388.54 mm	*Effective length, L_c=K*L*		
L_c/r	67.30	*Plate slenderness check from J4-6*		
F_{cr}	247.56 MPa	*Flexural buckling stress (E3-2)*		
A_g	13112.41 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2921.45 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	2012.59 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6277.46 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.84	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.84	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2012.59 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3802.94 kN	**0.95**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	12.00 mm	*Base material thickness (left brace)*		
α	0.75	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	411.90 mm	*Weld length*		
ϕRn	3802.94 kN	*Weld strength*		

6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Right Brace Report*



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x780.00x2050.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3613.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2242.70 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	397.44 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	397.44 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3613.96 kN	3964.69 kN	**0.91**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12778.45 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	638.92 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3964.69 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3613.96 kN	4295.08 kN	**0.84**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	638.92 mm	*Whitmore tensile width*		
A_n	12778.45 mm^2	*Net area of plate*		
ϕR_n	4295.08 kN	*Plate tensile rupture strength*		

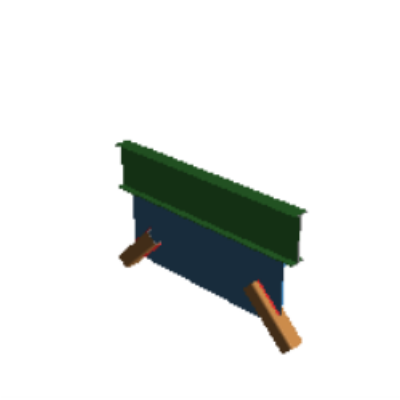
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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Gusset/Right Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2242.70 kN	2847.04 kN	**0.79**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	597.76 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	388.54 mm	*Effective length, L_c=K*L*		
L_c/r	67.30	*Plate slenderness check from J4-6*		
F_{cr}	247.56 MPa	*Flexural buckling stress (E3-2)*		
A_g	12778.45 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2847.04 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1998.24 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6232.69 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7507.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1998.24 kN	*Tensile rupture strength*		
Brace Weld Strength	3613.96 kN	3661.84 kN	**0.99**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (right brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	397.44 mm	*Weld length*		
ϕRn	3661.84 kN	*Weld strength*		

6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Right Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x780.00x2050.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	8064.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	3613.96 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.30	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	8064.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	3613.96 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	68.76 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$F_{cre\text{-}left}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}left}$	2242.70 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	68.76 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	243.96 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	2242.70 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	672.81 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-3613.96 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-3613.96 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	2242.70 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	2242.70 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	672.81 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	672.81 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-3613.96 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	2242.70 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$P_{left\text{-}SD2}$	-3613.96 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	672.81 kN	*Right brace design load per loading direction SD2*		
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	2242.70 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-3613.96 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	672.81 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-3613.96 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	176.12 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	176.12 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	450.85 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3613.96 kN	*Left brace design load per loading direction*		
P_{right}	2242.70 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2564.98 kN	*Vertical component of left brace*		
P_{Hleft}	-2545.89 kN	*Horizontal component of left brace*		
P_{Vright}	1591.74 kN	*Vertical component of right brace*		
P_{Hright}	-1579.89 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-973.24 kN	*Axial force at section a-a*		
V_{aa}	-4125.79 kN	*Shear force at section a-a*		
M_{aa}	-1031.44 kN-m	*Moment at section a-a*		
S_g	14008333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.47 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-2.01 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.47 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-483.00 kN	*Axial force at section b-b*		
V_{bb}	-1323.64 kN	*Shear force at section b-b*		
M_{bb}	-59.73 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	176.12 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	176.12 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	450.85 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3613.96 kN	*Left brace design load per loading direction*		
P_{right}	672.81 kN	*Right brace design load per loading direction*		

continued on next page...

6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
P_{Vleft}	-2564.98 kN	*Vertical component of left brace*		
P_{Hleft}	-2545.89 kN	*Horizontal component of left brace*		
P_{Vright}	477.52 kN	*Vertical component of right brace*		
P_{Hright}	-473.97 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-2087.46 kN	*Axial force at section a-a*		
V_{aa}	-3019.86 kN	*Shear force at section a-a*		
M_{aa}	-754.96 kN-m	*Moment at section a-a*		
S_g	14008333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.02 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.47 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.08 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-1035.96 kN	*Axial force at section b-b*		
V_{bb}	-968.84 kN	*Shear force at section b-b*		
M_{bb}	-128.10 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	176.12 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	176.12 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	450.85 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	2242.70 kN	*Left brace design load per loading direction*		
P_{right}	-3613.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	1591.74 kN	*Vertical component of left brace*		
P_{Hleft}	1579.89 kN	*Horizontal component of left brace*		
P_{Vright}	-2564.98 kN	*Vertical component of right brace*		
P_{Hright}	2545.89 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-973.24 kN	*Axial force at section a-a*		
V_{aa}	4125.79 kN	*Shear force at section a-a*		
M_{aa}	1031.44 kN-m	*Moment at section a-a*		
S_g	14008333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.47 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	2.01 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.47 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-483.00 kN	*Axial force at section b-b*		
V_{bb}	1323.64 kN	*Shear force at section b-b*		
M_{bb}	-59.73 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**

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6. Salud Chev-EJEC/G-AR3-VS2/VM2*: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Centerline Eccentricities				
Δ_{left}	176.12 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	176.12 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	450.85 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	672.81 kN	*Left brace design load per loading direction*		
P_{right}	-3613.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	477.52 kN	*Vertical component of left brace*		
P_{Hleft}	473.97 kN	*Horizontal component of left brace*		
P_{Vright}	-2564.98 kN	*Vertical component of right brace*		
P_{Hright}	2545.89 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-2087.46 kN	*Axial force at section a-a*		
V_{aa}	3019.86 kN	*Shear force at section a-a*		
M_{aa}	754.96 kN-m	*Moment at section a-a*		
S_g	14008333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.02 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.47 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.08 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-1035.96 kN	*Axial force at section b-b*		
V_{bb}	968.84 kN	*Shear force at section b-b*		
M_{bb}	-128.10 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-4125.79 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	4125.79 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-2087.46 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-1031.44 kN-m	*Maximum moment (loading direction SD1 governs)*		
Section (b-b) Forces				
Shear (Tension)	-1323.64 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	1323.64 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1035.96 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-128.10 kN-m	*Maximum moment (loading direction SD2 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		

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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	68.76 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	79.99	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	68.76 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	79.99	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	50.49 mm	*Distance from end of left brace to hinge line*		
t_g	20.00 mm	*Thickness of gusset plate*		
$2*t_g$	40.00 mm	*Lower limiting thickness of the gusset plate*		
$4*t_g$	80.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	50.49 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		

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Limit State	Required	Available	Unity Check	Result
Ratio	23.80	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}left}$	156.00 mm	*Inside dimension of left brace tube*		
$t_{br\text{-}left}$	12.00 mm	*Left brace tube wall thickness*		
$E_{br\text{-}left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
$R_{y\text{-}left}$	1.30	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}left}/t_{br\text{-}left}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}left}/(R_{y\text{-}left} * F_{ybr\text{-}left}))^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}right}$	156.00 mm	*Inside dimension of right brace tube*		
$t_{br\text{-}right}$	12.00 mm	*Right brace tube wall thickness*		
$E_{br\text{-}right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y\text{-}right}$	1.30	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br\text{-}right}/t_{br\text{-}right}$*		
Limit	13.73	*Limiting ratio, $0.65*(E_{br\text{-}right}/(R_{y\text{-}right} * F_{ybr\text{-}right}))^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	411.90 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.84	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars $=(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7507.80 mm^2	*Net area without reinf bars $=A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6277.46 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		

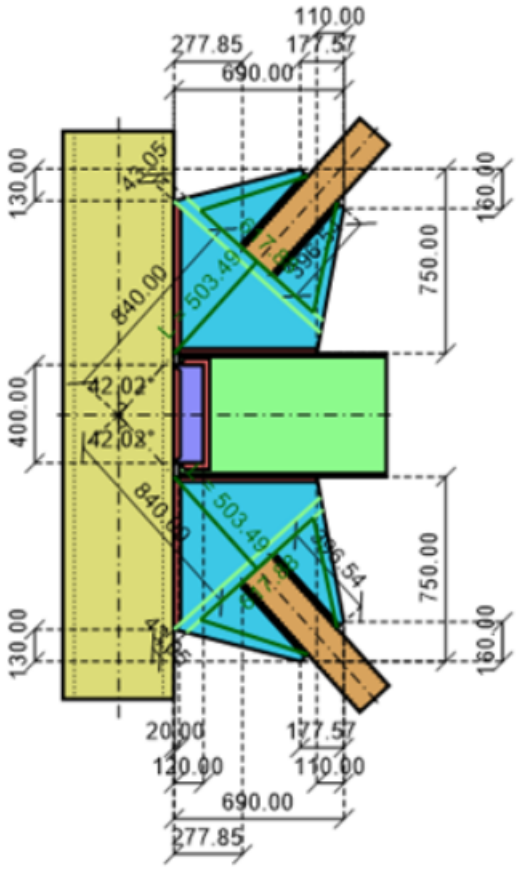
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6. Salud Chev-EJEC/G-AR3-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8957.72 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	397.44 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7507.80 mm^2	*Net area with reinf bars =(A_g+A_r)-2*$(t_p$+2*gap)*t_{des}*		
A_{no}	7507.80 mm^2	*Net area without reinf bars =A_g-2*$(t_p$+2*gap)*t_{des}*		
A_e	6232.69 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3187.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	10915.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8886.50 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

7. Salud EJE E-AR4-C3/C4 EJE 4-5: 2D Views Report

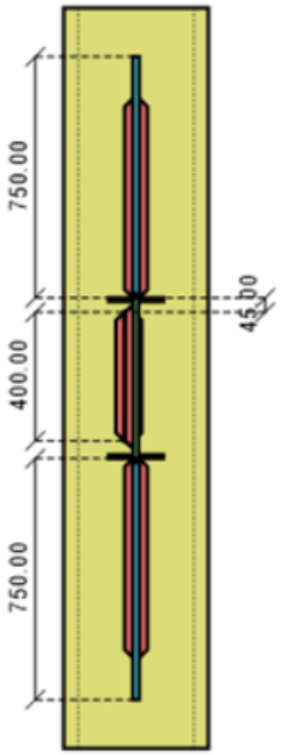
Side view



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7. Salud EJE E-AR4-C3/C4 EJE 4-5: 2D Views Report (continued):

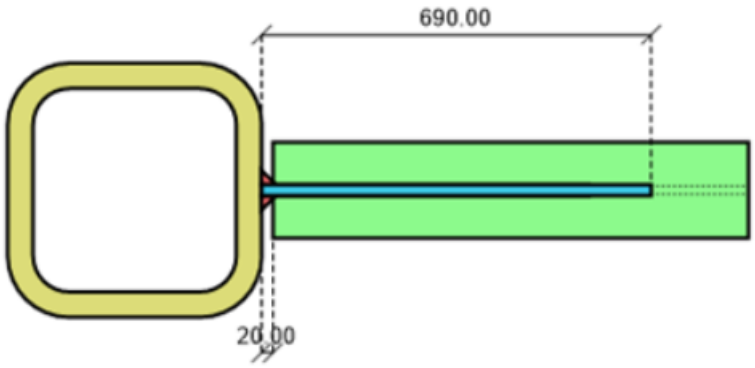
Front view



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7. Salud EJE E-AR4-C3/C4 EJE 4-5: 2D Views Report (continued):

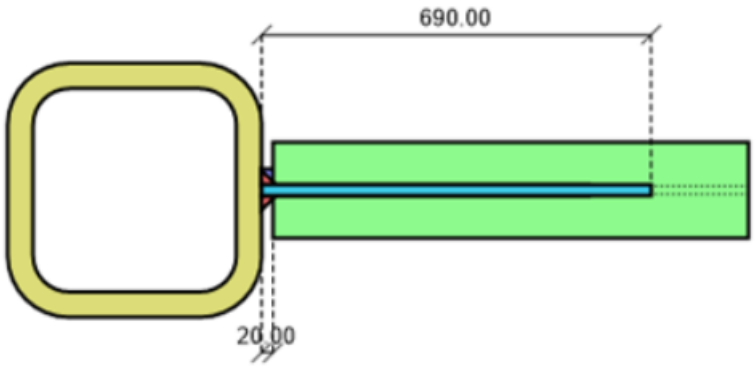
Top view



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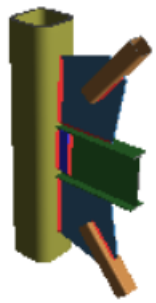
7. Salud EJE E-AR4-C3/C4 EJE 4-5: 2D Views Report (continued):

Bottom view



7. Salud EJE E-AR4-C3/C4 EJE 4-5: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear Load	75.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-2585.53 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	1414.76 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-2585.53 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	1414.76 kN	*Design compressive load in bottom brace*

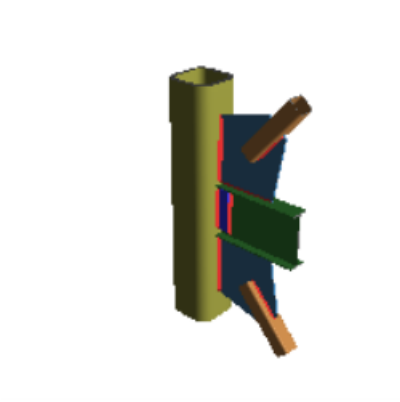
Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	2*t_p	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Beam Shear Rupture	**0.92**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.41**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.41**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.43**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.43**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.81**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.81**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.66**	**PASS**

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Beam/Column Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1388.67 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-1238.67 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-807.90 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	1456.01 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment due ecc	141.31 kN-m	*Calculated Maximum Moment due Eccentricity (SD3)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	30.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L_{min}	400.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \le 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{max}	28.41 mm	*Max Size Allowed*		
t	30.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \ge 4*D$ per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	100.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \le 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	1388.67 kN	1551.32 kN	**0.90**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	7500.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	1551.32 kN	*Shear yield strength*		
Plate Shear Yield	1388.67 kN	2482.11 kN	**0.56**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2482.11 kN	*Shear yield strength*		
Beam Shear Rupture	1388.67 kN	1512.54 kN	**0.92**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	7500.00 mm^2	*Net area subject to shear*		
ϕR_n	1512.54 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	1388.67 kN	2420.06 kN	**0.57**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12000.00 mm^2	*Net area subject to shear*		
ϕR_n	2420.06 kN	*Shear rupture strength*		
Beam Axial Yield	807.90 kN	3481.16 kN	**0.23**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11220.00 mm^2	*Gross area subject to tension*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	3481.16 kN	*Tensile yield strength*		
Plate Axial Yield	807.90 kN	3723.17 kN	**0.22**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area subject to tension*		
ϕR_n	3723.17 kN	*Tensile yield strength*		
Beam Tension Rupture	807.90 kN	3098.43 kN	**0.26**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	9218.25 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11220.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.82	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.64	*Shear lag factor (lower bound)*		
U	0.82	*Governing shear lag factor, U = max($U_{D3.1}$, U_{Bound})*		
ϕR_n	3098.43 kN	*Tensile rupture strength*		
Plate Tension Rupture	807.90 kN	4033.43 kN	**0.20**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area subject to tension*		
ϕR_n	4033.43 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.67**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-807.90 kN	*Calculated axial load*		
V_r	1388.67 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area of the plate*		
Z_{pl}	1200000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3723.17 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2482.11 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	141.31 kN-m	*Calculated moment*		
M_c	372.31 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.67	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.63**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-807.90 kN	*Calculated axial load*		
V_r	1388.67 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area of the plate*		
Z_{net}	1200000.00 mm^3	*Plastic modulus of net section*		
P_c	4033.43 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2420.06 kN	*Available shear strength (see check 'Shear Rupture')*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	141.31 kN-m	*Calculated moment*		
M_c	403.34 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.63	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because $Lb*d/tp^2 <= 0.08*E/Fy$				
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	20.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		
t_p	30.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column	3.67 kN/mm	7.68 kN/mm	**0.48**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ **(AISC 15th Eqn 8-2a)**				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	3.47 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.18 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	3.67 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	7.68 kN/mm	*Weld strength*		
Weld at Beam	2.45 kN/mm	3.02 kN/mm	**0.81**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ **(AISC 15th Eqn 8-2a)**				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	15.00 mm	*Base material thickness (beam)*		
α	0.79	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	2.45 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	3.02 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	437.68 kN	4982.63 kN	**0.09**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		

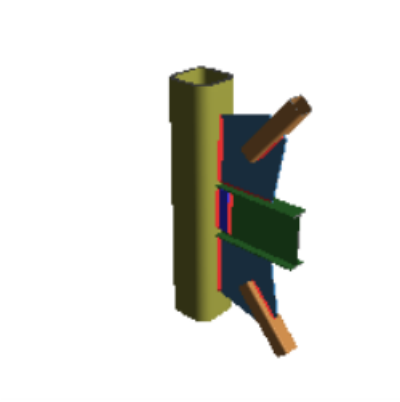
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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	120.00 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	165.00 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9 -5)*		
c	30.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	4982.63 kN	*Transverse plastification strength*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	528.89 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	464.60 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-966.57 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-849.07 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1286.54 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	4.59 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	966.57 kN	2399.38 kN	**0.40**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2399.38 kN	*Shear yield strength*		
Plate Shear Rupture	966.57 kN	2339.39 kN	**0.41**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11600.00 mm^2	*Net area subject to shear*		
ϕR_n	2339.39 kN	*Shear rupture strength*		
Plate Axial Yield	849.07 kN	3599.06 kN	**0.24**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3599.06 kN	*Tensile yield strength*		
Plate Tension Rupture	849.07 kN	3898.99 kN	**0.22**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11600.00 mm^2	*Net area subject to tension*		
ϕR_n	3898.99 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.22**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-849.07 kN	*Calculated axial load*		
V_r	966.57 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1682000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3599.06 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2399.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	4.59 kN-m	*Calculated moment*		
M_c	521.86 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-849.07 kN	*Calculated axial load*		
V_r	966.57 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area of the plate*		
Z_{net}	1682000.00 mm^3	*Plastic modulus of net section*		
P_c	3898.99 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2339.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	4.59 kN-m	*Calculated moment*		
M_c	565.35 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	849.07 kN	2999.22 kN	**0.28**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	580.00 mm	*Length of bearing*		
ϕR_n	2999.22 kN	*Beam web local yielding*		

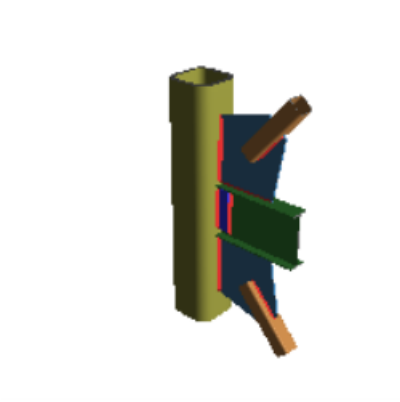
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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	464.60 kN	5878.07 kN	**0.08**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.16	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	580.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	5878.07 kN	*Beam web crippling capacity*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	528.89 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	464.60 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-966.57 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-849.07 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1286.54 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	4.59 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	966.57 kN	2399.38 kN	**0.40**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2399.38 kN	*Shear yield strength*		
Plate Shear Rupture	966.57 kN	2339.39 kN	**0.41**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11600.00 mm^2	*Net area subject to shear*		
ϕR_n	2339.39 kN	*Shear rupture strength*		
Plate Axial Yield	849.07 kN	3599.06 kN	**0.24**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area subject to tension*		
ϕR_n	3599.06 kN	*Tensile yield strength*		
Plate Tension Rupture	849.07 kN	3898.99 kN	**0.22**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11600.00 mm^2	*Net area subject to tension*		
ϕR_n	3898.99 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.22**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-849.07 kN	*Calculated axial load*		
V_r	966.57 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11600.00 mm^2	*Gross area of the plate*		
Z_{pl}	1682000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3599.06 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2399.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	4.59 kN-m	*Calculated moment*		
M_c	521.86 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-849.07 kN	*Calculated axial load*		
V_r	966.57 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	11600.00 mm^2	*Net area of the plate*		
Z_{net}	1682000.00 mm^3	*Plastic modulus of net section*		
P_c	3898.99 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2339.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	4.59 kN-m	*Calculated moment*		
M_c	565.35 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	849.07 kN	2999.22 kN	**0.28**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	580.00 mm	*Length of bearing*		
ϕR_n	2999.22 kN	*Beam web local yielding*		

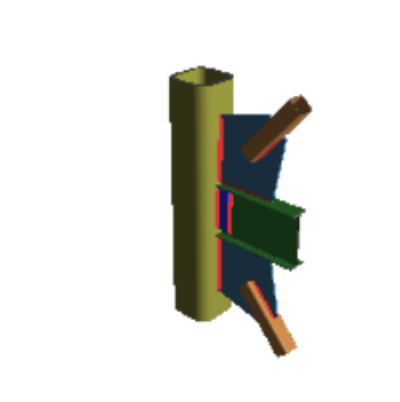
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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	464.60 kN	5878.07 kN	**0.08**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	270.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.16	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	580.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	5878.07 kN	*Beam web crippling capacity*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	586.44 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	418.14 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1071.75 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-764.16 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1316.28 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-4.25 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	620.00 mm	*Min weld segment length*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Col Report (continued):

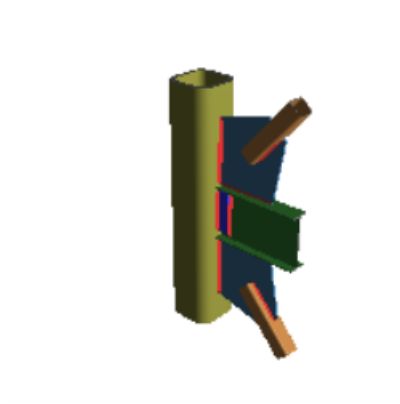
Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1071.75 kN	2564.85 kN	**0.42**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12400.00 mm^2	*Gross area subject to shear*		
ϕR_n	2564.85 kN	*Shear yield strength*		
Plate Shear Rupture	1071.75 kN	2500.73 kN	**0.43**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12400.00 mm^2	*Net area subject to shear*		
ϕR_n	2500.73 kN	*Shear rupture strength*		
Plate Axial Yield	764.16 kN	3847.28 kN	**0.20**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area subject to tension*		
ϕR_n	3847.28 kN	*Tensile yield strength*		
Plate Tension Rupture	764.16 kN	4167.88 kN	**0.18**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area subject to tension*		
ϕR_n	4167.88 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-764.16 kN	*Calculated axial load*		
V_r	1071.75 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area of the plate*		
Z_{pl}	1922000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3847.28 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2564.85 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	4.25 kN-m	*Calculated moment*		
M_c	596.32 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-764.16 kN	*Calculated axial load*		
V_r	1071.75 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area of the plate*		
Z_{net}	1922000.00 mm^3	*Plastic modulus of net section*		
P_c	4167.88 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2500.73 kN	*Available shear strength (see check 'Shear Rupture')*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	4.25 kN-m	*Calculated moment*		
M_c	646.02 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	2.16 kN/mm	6.14 kN/mm	**0.35**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	1071.75 kN	*Shear Load*		
P	-764.16 kN	*Axial Load*		
M	-4.25 kN-m	*Moment*		
e_{eff}	3.23 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.73 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.30 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.16 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	4.25 kN-m	1109.16 kN-m	**0.00**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	620.00 mm	*Plate length*		
M_e	-4.25 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1109.16 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	764.16 kN	5819.84 kN	**0.13**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	620.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5819.84 kN	*Transverse plastification strength*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Col Report



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1071.75 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	418.14 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-586.44 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-764.16 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1316.28 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-4.25 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	620.00 mm	*Min weld segment length*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1071.75 kN	2564.85 kN	**0.42**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12400.00 mm^2	*Gross area subject to shear*		
ϕR_n	2564.85 kN	*Shear yield strength*		
Plate Shear Rupture	1071.75 kN	2500.73 kN	**0.43**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12400.00 mm^2	*Net area subject to shear*		
ϕR_n	2500.73 kN	*Shear rupture strength*		
Plate Axial Yield	764.16 kN	3847.28 kN	**0.20**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area subject to tension*		
ϕR_n	3847.28 kN	*Tensile yield strength*		
Plate Tension Rupture	764.16 kN	4167.88 kN	**0.18**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area subject to tension*		
ϕR_n	4167.88 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-764.16 kN	*Calculated axial load*		
V_r	1071.75 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12400.00 mm^2	*Gross area of the plate*		
Z_{pl}	1922000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3847.28 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2564.85 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	4.25 kN-m	*Calculated moment*		
M_c	596.32 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-764.16 kN	*Calculated axial load*		
V_r	1071.75 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12400.00 mm^2	*Net area of the plate*		
Z_{net}	1922000.00 mm^3	*Plastic modulus of net section*		
P_c	4167.88 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2500.73 kN	*Available shear strength (see check 'Shear Rupture')*		

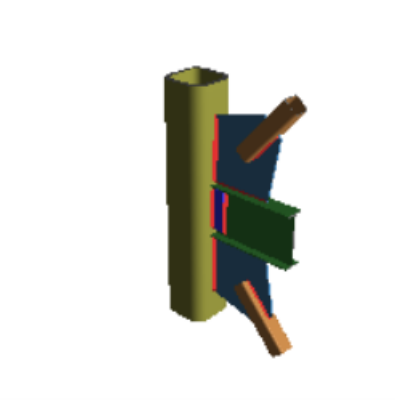
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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	4.25 kN-m	*Calculated moment*		
M_c	646.02 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.22	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	2.16 kN/mm	6.14 kN/mm	**0.35**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	1071.75 kN	*Shear Load*		
P	-764.16 kN	*Axial Load*		
M	-4.25 kN-m	*Moment*		
e_{eff}	3.23 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.73 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.30 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.16 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	2.33 kN-m	1109.16 kN-m	**0.00**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	620.00 mm	*Plate length*		
M_e	2.33 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	1109.16 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	418.14 kN	5819.84 kN	**0.07**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	620.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5819.84 kN	*Transverse plastification strength*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	396.54 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	396.54 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3834.13 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12357.64 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	617.88 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3834.13 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4153.64 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	617.88 mm	*Whitmore tensile width*		

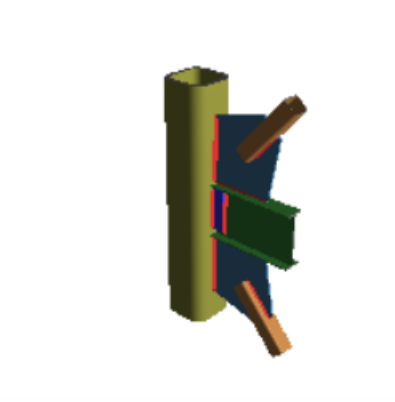
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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	12357.64 mm^2	*Net area of plate*		
ϕR_n	4153.64 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	3336.52 kN	**0.42**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	503.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	251.74 mm	*Effective length, L_c=K*L*		
L_c/r	43.60	*Plate slenderness check from J4-6*		
F_{cr}	300.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12357.64 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3336.52 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1579.35 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4698.77 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1579.35 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3198.55 kN	**0.81**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (top brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	396.54 mm	*Weld length*		
ϕRn	3198.55 kN	*Weld strength*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

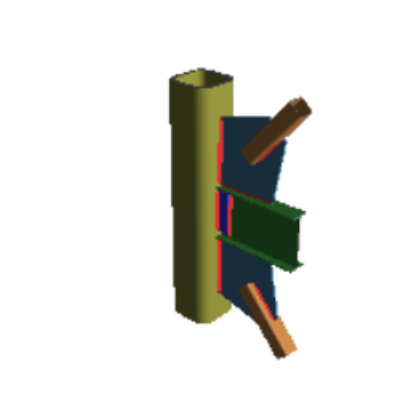
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	396.54 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	396.54 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3834.13 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12357.64 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	617.88 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3834.13 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4153.64 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	617.88 mm	*Whitmore tensile width*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	12357.64 mm^2	*Net area of plate*		
ϕR_n	4153.64 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	3336.52 kN	**0.42**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	503.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	251.74 mm	*Effective length, L_c=K*L*		
L_c/r	43.60	*Plate slenderness check from J4-6*		
F_{cr}	300.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12357.64 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3336.52 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1579.35 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4698.77 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1579.35 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3198.55 kN	**0.81**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (bottom brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	396.54 mm	*Weld length*		
ϕRn	3198.55 kN	*Weld strength*		

7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x750.00x690.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-}top}$	6000.00 mm^2	*Area of the top brace*		
$P_{exp\text{-}t\text{-}top}$	2585.53 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-}bot}$	6000.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-}t\text{-}bot}$	2585.53 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*Length of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	61.37 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2 * E)/(L_{c\text{-}top}/r_y)^2$*		
$F_{cre\text{-}top}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}top}$	1414.76 kN	*Top brace expected strength in compression = min($R_y * F_y * A_{br}$, $1.14 * F_{cre} * A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	424.43 kN	*Post-buckling expected compressive strength = $0.3 * P_{exp\text{-}ci\text{-}top}$*		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = $K_{bot} * L_{bot}$*		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	61.37 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2 * E)/(L_{c\text{-}bot}/r_y)^2$*		
$F_{cre\text{-}bot}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}bot}$	1414.76 kN	*Bottom brace expected strength in compression = min($R_y * F_y * A_{br}$, $1.14 * F_{cre} * A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	424.43 kN	*Post-buckling expected compressive strength = $0.3 * P_{exp\text{-}ci\text{-}bot}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-2585.53 kN	*Design tensile load in top brace member = $P_{exp\text{-}t\text{-}top}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-2585.53 kN	*Design tensile load in bottom brace member = $P_{exp\text{-}t\text{-}bot}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	1414.76 kN	*Design compressive load in top brace member = $P_{exp\text{-}ci\text{-}top}/\alpha_s$*		
$P_{des\text{-}ci\text{-}bot}$	1414.76 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}ci\text{-}bot}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	424.43 kN	*Design compressive load in top brace member = $P_{exp\text{-}cii\text{-}top}/\alpha_s$*		
$P_{des\text{-}cii\text{-}bot}$	424.43 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}cii\text{-}bot}/\alpha_s$*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-2585.53 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	424.43 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-2585.53 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	1414.76 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = SF_{SD1}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-1071.75 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-764.16 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	-4.25 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-849.07 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-966.57 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	4.59 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-586.44 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	418.14 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	2.33 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	464.60 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	528.89 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}bot}$	-2.51 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{bcSD1}	-1238.67 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD1\text{-}top}$ - $V_{bmSD1\text{-}bot}$*		
H_{bcSD1}	-437.68 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD1}$ + $H_{bmSD1\text{-}top}$ + $H_{bmSD1\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	424.43 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	424.43 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection = SF_{SD2}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-1071.75 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-764.16 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	-4.25 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-849.07 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-966.57 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	4.59 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-175.93 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	125.44 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	0.70 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	139.38 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	158.67 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	-0.75 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-913.45 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD2\text{-}top}$ - $V_{bmSD2\text{-}bot}$*		
H_{bcSD2}	-807.90 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD2}$ + $H_{bmSD2\text{-}top}$ + $H_{bmSD2\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{bot-SD3}$	-2585.53 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	1414.76 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	1414.76 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = SF_{SD3}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	586.44 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	418.14 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	2.33 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	464.60 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	528.89 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	-2.51 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	1071.75 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-764.16 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	-4.25 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-849.07 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-966.57 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	4.59 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	1388.67 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD3-top}$ - $V_{bmSD3-bot}$*		
H_{bcSD3}	-437.68 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD3} + $H_{bmSD3-top}$ + $H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	424.43 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-2585.53 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	424.43 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD4}$	424.43 kN	*Assumed opposite side bottom brace force*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD4}$	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4\text{-}top}$	175.93 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}top}$	125.44 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}top}$	0.70 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4\text{-}top}$	139.38 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}top}$	158.67 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}top}$	-0.75 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4\text{-}bot}$	1071.75 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}bot}$	-764.16 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}bot}$	-4.25 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4\text{-}bot}$	-849.07 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}bot}$	-966.57 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}bot}$	4.59 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	1063.45 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4\text{-}top}$ - $V_{bmSD4\text{-}bot}$*		
H_{bcSD4}	-807.90 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD4}$ + $H_{bmSD4\text{-}top}$ + $H_{bmSD4\text{-}bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	586.44 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	418.14 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1071.75 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-764.16 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1316.28 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-4.25 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	1071.75 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	418.14 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-586.44 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-764.16 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1316.28 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-4.25 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	528.89 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	464.60 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-966.57 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-849.07 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1286.54 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	4.59 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	528.89 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	464.60 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-966.57 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-849.07 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1286.54 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	4.59 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	1388.67 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-1238.67 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-807.90 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	1456.01 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	141.31 kN-m	*Maximum moment (loading direction SD3 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	61.37 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	89.62	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	61.37 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	89.62	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	30.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	54.34 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	58.50 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	43.05 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	20.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	40.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	80.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	43.05 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	20.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	40.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	80.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	140.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	10.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	140.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	10.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		

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7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	396.54 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4698.77 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.83	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6658.14 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	396.54 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4698.77 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

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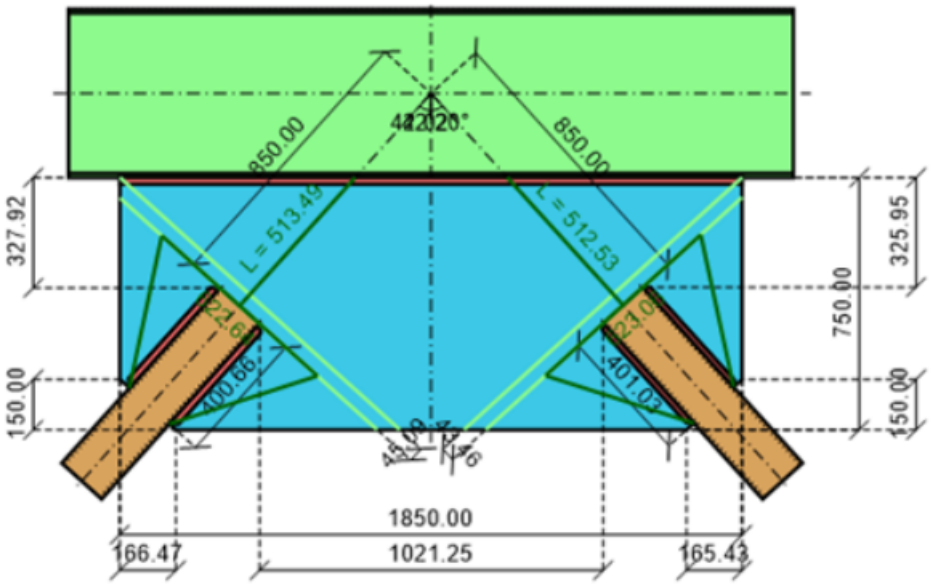
7. Salud EJE E-AR4-C3/C4 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.83	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6658.14 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	4702.23 kN	7140.06 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	620.00 mm	*Weld length*		
ϕR_n	7140.06 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	4702.23 kN	7140.06 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	620.00 mm	*Weld length*		
ϕR_n	7140.06 kN	*Weld strength*		

8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: 2D Views Report

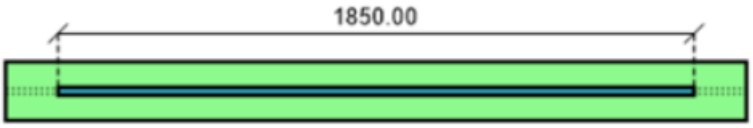
Left view



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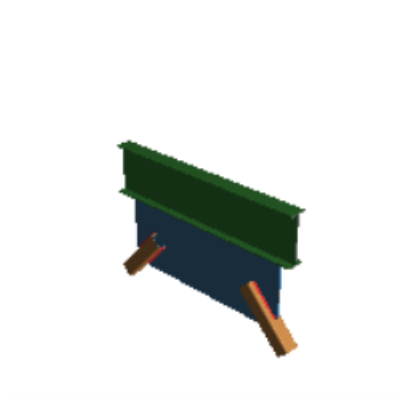
8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: 2D Views Report (continued):

Bottom view



8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Summary Report

Vertical Brace Chevron Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

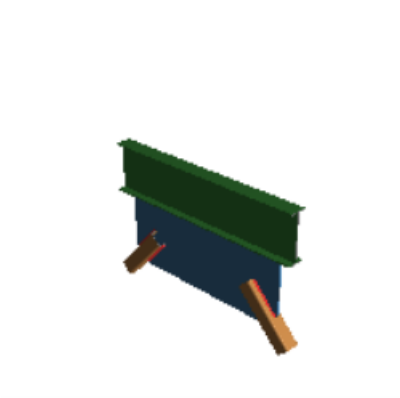
Left Brace Axial (Tension)	-2585.53 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	1414.76 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-2585.53 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	1414.76 kN	*Design compressive load in right brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.36**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.80**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.80**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Beam Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-2681.05 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	2683.78 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-1606.41 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	670.94 kN-m	*Maximum moment at section a-a (SD3)*
Shear(Tension, Section b-b)	-940.98 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	939.20 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-726.32 kN	*Maximum axial due to tension at section b-b (SD4)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-83.94 kN-m	*Maximum moment at section b-b (SD4)*
Beam Moment	-670.94 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: -d_{beam}<=WP_h<=d_{beam}*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: -0.5*d_{beam}<=WP_v<=d_{beam}*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	2683.78 kN	7653.18 kN	**0.35**	**PASS**
R_n = 0.6 *F_y*A_{gv}		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	37000.00 mm^2	*Gross area subject to shear*		
ϕR_n	7653.18 kN	*Shear yield strength*		
Plate Shear Rupture (Section a-a)	2683.78 kN	7461.85 kN	**0.36**	**PASS**
R_n = 0.6 *F_u*A_{nv}		**ϕ = 0.75**	(J4-4)	

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	37000.00 mm^2	*Net area subject to shear*		
ϕR_n	7461.85 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	1606.41 kN	11479.77 kN	**0.14**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	37000.00 mm^2	*Gross area subject to tension*		
ϕR_n	11479.77 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	1606.41 kN	12436.42 kN	**0.13**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	37000.00 mm^2	*Net area subject to tension*		
ϕR_n	12436.42 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.19**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1606.41 kN	*Calculated axial load*		
V_r	2683.78 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	37000.00 mm^2	*Gross area of the plate*		
Z_{pl}	17112500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	11479.77 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	7653.18 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	670.94 kN-m	*Calculated moment*		
M_c	5309.36 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.19	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.19**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1606.41 kN	*Calculated axial load*		
V_r	2683.78 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	37000.00 mm^2	*Net area of the plate*		
Z_{net}	17112500.00 mm^3	*Plastic modulus of net section*		
P_c	12436.42 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	7461.85 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	670.94 kN-m	*Calculated moment*		
M_c	5751.81 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, φ=0.75*		
UC	0.19	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Shear Yield (Section b-b)	940.98 kN	3102.64 kN	**0.30**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Beam Report (continued):

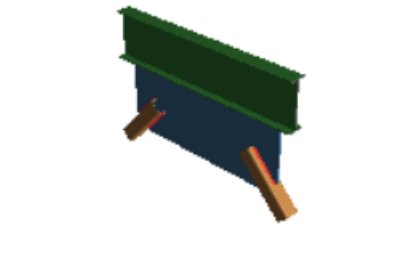
Limit State	Required	Available	Unity Check	Result
A_{gv}	15000.00 mm^2	*Gross area subject to shear*		
ϕR_n	3102.64 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	940.98 kN	3025.08 kN	**0.31**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	15000.00 mm^2	*Net area subject to shear*		
ϕR_n	3025.08 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	726.32 kN	4653.96 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4653.96 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	726.32 kN	5041.79 kN	**0.14**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15000.00 mm^2	*Net area subject to tension*		
ϕR_n	5041.79 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.16**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-726.32 kN	*Calculated axial load*		
V_r	940.98 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15000.00 mm^2	*Gross area of the plate*		
Z_{pl}	2812500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4653.96 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3102.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-83.94 kN-m	*Calculated moment*		
M_c	872.61 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.16	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.15**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-726.32 kN	*Calculated axial load*		
V_r	940.98 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15000.00 mm^2	*Net area of the plate*		
Z_{net}	2812500.00 mm^3	*Plastic modulus of net section*		
P_c	5041.79 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3025.08 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	-83.94 kN-m	*Calculated moment*		
M_c	945.33 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
UC	0.15	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1606.41 kN	9566.48 kN	**0.17**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1850.00 mm	*Length of bearing*		
ϕR_n	9566.48 kN	*Beam web local yielding*		

8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Left Brace Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

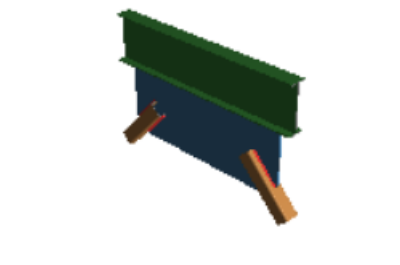
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	400.66 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	400.66 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3863.67 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12452.85 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	622.64 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3863.67 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4185.65 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	622.64 mm	*Whitmore tensile width*		
A_n	12452.85 mm^2	*Net area of plate*		
ϕR_n	4185.65 kN	*Plate tensile rupture strength*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Left Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3026.06 kN	**0.47**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	513.49 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	333.77 mm	*Effective length, L_c=K*L*		
L_c/r	57.81	*Plate slenderness check from J4-6*		
F_{cr}	270.00 MPa	*Flexural buckling stress (E3-2)*		
A_g	12452.85 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3026.06 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1582.25 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4707.39 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1582.25 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3231.80 kN	**0.80**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (left brace)*		
α	0.66	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	400.66 mm	*Weld length*		
ϕRn	3231.80 kN	*Weld strength*		

8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Right Brace Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	401.03 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	401.03 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3866.29 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12461.29 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	623.06 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3866.29 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4188.48 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	623.06 mm	*Whitmore tensile width*		
A_n	12461.29 mm^2	*Net area of plate*		
ϕR_n	4188.48 kN	*Plate tensile rupture strength*		

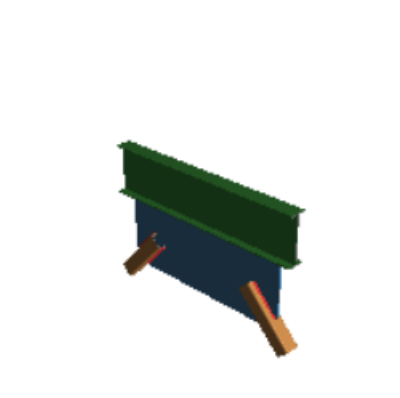
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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Gusset/Right Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3030.87 kN	**0.47**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	512.53 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	333.14 mm	*Effective length, L_c=K*L*		
L_c/r	57.70	*Plate slenderness check from J4-6*		
F_{cr}	270.25 MPa	*Flexural buckling stress (E3-2)*		
A_g	12461.29 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3030.87 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1582.50 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4708.15 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1582.50 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3234.75 kN	**0.80**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (right brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	401.03 mm	*Weld length*		
ϕRn	3234.75 kN	*Weld strength*		

8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x750.00x1850.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	6000.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	2585.53 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	6000.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	2585.53 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	61.37 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		
$F_{cre\text{-left}}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		

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Limit State	Required	Available	Unity Check	Result
$P_{exp\text{-}ci\text{-}left}$	1414.76 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	61.37 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	1414.76 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-2585.53 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-2585.53 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	1414.76 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	1414.76 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	424.43 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	424.43 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-2585.53 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	1414.76 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		
$P_{left\text{-}SD2}$	-2585.53 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	424.43 kN	*Right brace design load per loading direction SD2*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	1414.76 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-2585.53 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	424.43 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-2585.53 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	1414.76 kN	*Right brace design load per loading direction*		
P_{Vleft}	-1920.82 kN	*Vertical component of left brace*		
P_{Hleft}	-1730.73 kN	*Horizontal component of left brace*		
P_{Vright}	1048.06 kN	*Vertical component of right brace*		
P_{Hright}	-950.32 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-872.76 kN	*Axial force at section a-a*		
V_{aa}	-2681.05 kN	*Shear force at section a-a*		
M_{aa}	-670.26 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.47 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.45 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.18 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-390.21 kN	*Axial force at section b-b*		
V_{bb}	-940.98 kN	*Shear force at section b-b*		
M_{bb}	-42.05 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	424.43 kN	*Right brace design load per loading direction*		
P_{Vleft}	-1920.82 kN	*Vertical component of left brace*		
P_{Hleft}	-1730.73 kN	*Horizontal component of left brace*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
P_{Vright}	314.42 kN	*Vertical component of right brace*		
P_{Hright}	-285.10 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1606.41 kN	*Axial force at section a-a*		
V_{aa}	-2015.83 kN	*Shear force at section a-a*		
M_{aa}	-503.95 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.87 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.09 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-0.88 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-722.82 kN	*Axial force at section b-b*		
V_{bb}	-709.01 kN	*Shear force at section b-b*		
M_{bb}	-80.28 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	1414.76 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	1051.04 kN	*Vertical component of left brace*		
P_{Hleft}	947.02 kN	*Horizontal component of left brace*		
P_{Vright}	-1915.38 kN	*Vertical component of right brace*		
P_{Hright}	1736.76 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-864.34 kN	*Axial force at section a-a*		
V_{aa}	2683.78 kN	*Shear force at section a-a*		
M_{aa}	670.94 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.47 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.45 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.18 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-394.87 kN	*Axial force at section b-b*		
V_{bb}	939.20 kN	*Shear force at section b-b*		
M_{bb}	-46.91 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	167.35 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Δ_{right}	167.93 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	418.37 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	424.43 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	315.31 kN	*Vertical component of left brace*		
P_{Hleft}	284.11 kN	*Horizontal component of left brace*		
P_{Vright}	-1915.38 kN	*Vertical component of right brace*		
P_{Hright}	1736.76 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1600.06 kN	*Axial force at section a-a*		
V_{aa}	2020.86 kN	*Shear force at section a-a*		
M_{aa}	505.21 kN-m	*Moment at section a-a*		
S_g	11408333.33 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.86 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.09 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	0.89 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-726.32 kN	*Axial force at section b-b*		
V_{bb}	705.71 kN	*Shear force at section b-b*		
M_{bb}	-83.94 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-2681.05 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	2683.78 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1606.41 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	670.94 kN-m	*Maximum moment (loading direction SD3 governs)*		
Section (b-b) Forces				
Shear (Tension)	-940.98 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	939.20 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-726.32 kN	*Maximum tension axial force (loading direction SD4 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-83.94 kN-m	*Maximum moment (loading direction SD4 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: $F_y <= 50$ ksi (345 Mpa) (AISC 341-16, A3.1)*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	61.37 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	89.62	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	61.37 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	89.62	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	45.09 mm	*Distance from end of left brace to hinge line*		
t_g	20.00 mm	*Thickness of gusset plate*		
$2*t_g$	40.00 mm	*Lower limiting thickness of the gusset plate*		
$4*t_g$	80.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	43.46 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		

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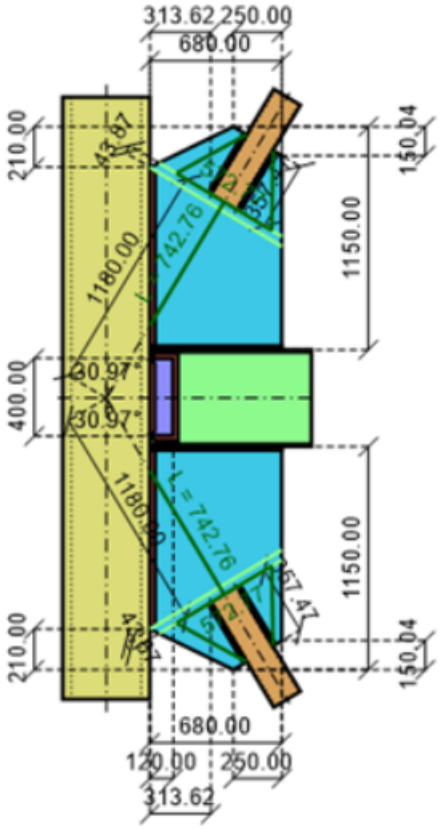
Limit State	Required	Available	Unity Check	Result
Limit	36.05	*Limiting ratio, max(0.88*(E_b/(R_{yb}*F_{yb}))$^{0.5}$*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))$^{0.5}$)*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}left}$	140.00 mm	*Inside dimension of left brace tube*		
$t_{br\text{-}left}$	10.00 mm	*Left brace tube wall thickness*		
$E_{br\text{-}left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
$R_{y\text{-}left}$	1.25	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}left}/t_{br\text{-}left}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br\text{-}left}$/($R_{y\text{-}left}$ * $F_{ybr\text{-}left}$))$^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}right}$	140.00 mm	*Inside dimension of right brace tube*		
$t_{br\text{-}right}$	10.00 mm	*Right brace tube wall thickness*		
$E_{br\text{-}right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y\text{-}right}$	1.25	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}right}/t_{br\text{-}right}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br\text{-}right}$/($R_{y\text{-}right}$ * $F_{ybr\text{-}right}$))$^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	400.66 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =(A_g+A_r)-2*(t_p+2*gap)*t_{des}*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =A_g-2*(t_p+2*gap)*t_{des}*		
A_e	4707.39 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		

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8. Salud Chev-EJE E-AR4-VS2/VM2 EJE 4-5: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.84	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6671.70 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	401.03 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4708.15 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.84	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6672.89 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

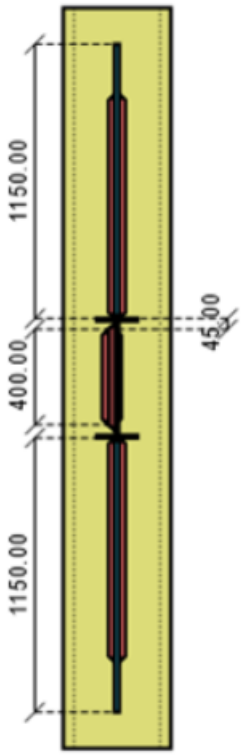
Side view



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9. Salud EJE E-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

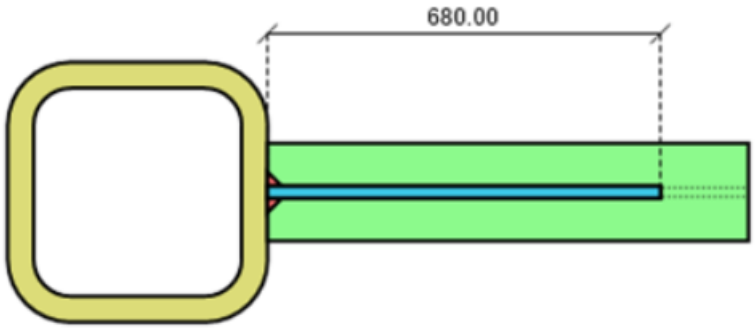
Front view



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9. Salud EJE E-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

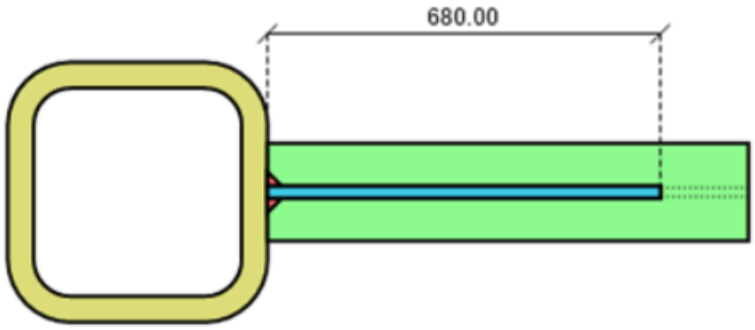
Top view



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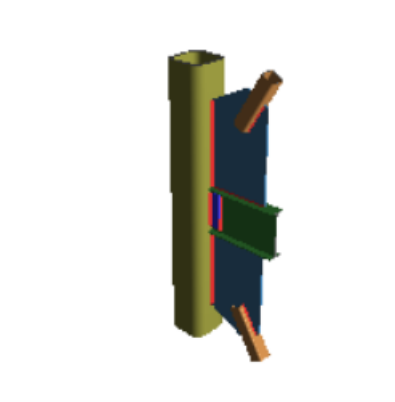
9. Salud EJE E-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

Bottom view



9. Salud EJE E-AR4-C3/C4 EJE 1-2: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear Load	75.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-2585.53 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	1414.76 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-2585.53 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	1414.76 kN	*Design compressive load in bottom brace*

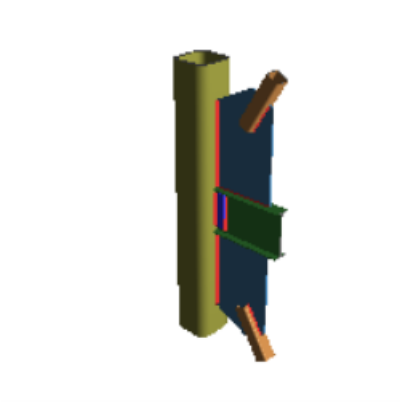
Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Beam Shear Rupture	**0.75**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.26**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.26**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.40**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.40**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.90**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.90**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.66**	**PASS**

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Beam/Column Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1133.28 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-983.28 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-597.53 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	1178.61 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment due ecc	108.88 kN-m	*Calculated Maximum Moment due Eccentricity (SD3)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	30.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L_{min}	400.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{max}	28.41 mm	*Max Size Allowed*		
t	30.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	120.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	1133.28 kN	1551.32 kN	**0.73**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	7500.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	1551.32 kN	*Shear yield strength*		
Plate Shear Yield	1133.28 kN	2482.11 kN	**0.46**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2482.11 kN	*Shear yield strength*		
Beam Shear Rupture	1133.28 kN	1512.54 kN	**0.75**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	7500.00 mm^2	*Net area subject to shear*		
ϕR_n	1512.54 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	1133.28 kN	2420.06 kN	**0.47**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12000.00 mm^2	*Net area subject to shear*		
ϕR_n	2420.06 kN	*Shear rupture strength*		
Beam Axial Yield	597.53 kN	3481.16 kN	**0.17**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11220.00 mm^2	*Gross area subject to tension*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	3481.16 kN	*Tensile yield strength*		
Plate Axial Yield	597.53 kN	3723.17 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area subject to tension*		
ϕR_n	3723.17 kN	*Tensile yield strength*		
Beam Tension Rupture	597.53 kN	3210.57 kN	**0.19**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	9551.87 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11220.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.64	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, U = max($U_{D3.1}$, U_{Bound})*		
ϕR_n	3210.57 kN	*Tensile rupture strength*		
Plate Tension Rupture	597.53 kN	4033.43 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area subject to tension*		
ϕR_n	4033.43 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.41**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-597.53 kN	*Calculated axial load*		
V_r	1133.28 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area of the plate*		
Z_{pl}	1200000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3723.17 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2482.11 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	108.88 kN-m	*Calculated moment*		
M_c	372.31 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.41	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.39**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-597.53 kN	*Calculated axial load*		
V_r	1133.28 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area of the plate*		
Z_{net}	1200000.00 mm^3	*Plastic modulus of net section*		
P_c	4033.43 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2420.06 kN	*Available shear strength (see check 'Shear Rupture')*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	108.88 kN-m	*Calculated moment*		
M_c	403.34 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.39	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because Lb*d/tp^2 <= 0.08*E/Fy				
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	0.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		
t_p	30.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column	2.96 kN/mm	7.68 kN/mm	**0.39**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	2.83 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-0.87 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.96 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	7.68 kN/mm	*Weld strength*		
Weld at Beam	1.86 kN/mm	3.02 kN/mm	**0.61**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	15.00 mm	*Base material thickness (beam)*		
α	0.79	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	1.86 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	3.02 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	323.71 kN	4982.63 kN	**0.06**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		

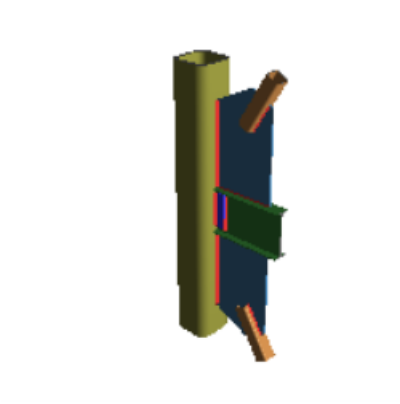
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	120.00 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	165.00 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9 -5)*		
c	30.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	4982.63 kN	*Transverse plastification strength*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	391.17 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	374.28 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-714.88 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-684.01 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	989.40 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	53.84 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	714.88 kN	2813.06 kN	**0.25**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	13600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2813.06 kN	*Shear yield strength*		
Plate Shear Rupture	714.88 kN	2742.73 kN	**0.26**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13600.00 mm^2	*Net area subject to shear*		
ϕR_n	2742.73 kN	*Shear rupture strength*		
Plate Axial Yield	684.01 kN	4219.59 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Tension Rupture	684.01 kN	4571.22 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	13600.00 mm^2	*Net area subject to tension*		
ϕR_n	4571.22 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-684.01 kN	*Calculated axial load*		
V_r	714.88 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area of the plate*		
Z_{pl}	2312000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4219.59 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2813.06 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	53.84 kN-m	*Calculated moment*		
M_c	717.33 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-684.01 kN	*Calculated axial load*		
V_r	714.88 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13600.00 mm^2	*Net area of the plate*		
Z_{net}	2312000.00 mm^3	*Plastic modulus of net section*		
P_c	4571.22 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2742.73 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	53.84 kN-m	*Calculated moment*		
M_c	777.10 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	684.01 kN	3516.33 kN	**0.19**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	680.00 mm	*Length of bearing*		
ϕR_n	3516.33 kN	*Beam web local yielding*		

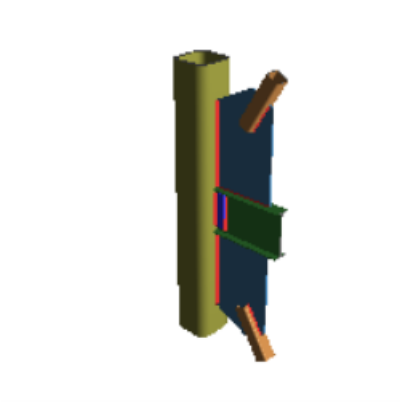
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	374.28 kN	6718.69 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.36	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	680.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	6718.69 kN	*Beam web crippling capacity*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	391.17 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	374.28 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-714.88 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-684.01 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	989.40 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	53.84 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	714.88 kN	2813.06 kN	**0.25**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	13600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2813.06 kN	*Shear yield strength*		
Plate Shear Rupture	714.88 kN	2742.73 kN	**0.26**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13600.00 mm^2	*Net area subject to shear*		
ϕR_n	2742.73 kN	*Shear rupture strength*		
Plate Axial Yield	684.01 kN	4219.59 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Tension Rupture	684.01 kN	4571.22 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	13600.00 mm^2	*Net area subject to tension*		
ϕR_n	4571.22 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-684.01 kN	*Calculated axial load*		
V_r	714.88 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area of the plate*		
Z_{pl}	2312000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4219.59 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2813.06 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	53.84 kN-m	*Calculated moment*		
M_c	717.33 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-684.01 kN	*Calculated axial load*		
V_r	714.88 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13600.00 mm^2	*Net area of the plate*		
Z_{net}	2312000.00 mm^3	*Plastic modulus of net section*		
P_c	4571.22 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2742.73 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	53.84 kN-m	*Calculated moment*		
M_c	777.10 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	684.01 kN	3516.33 kN	**0.19**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	680.00 mm	*Length of bearing*		
ϕR_n	3516.33 kN	*Beam web local yielding*		

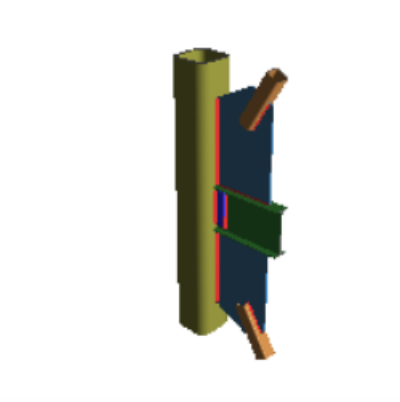
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	374.28 kN	6718.69 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.36	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	680.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	6718.69 kN	*Beam web crippling capacity*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	838.79 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	336.85 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1532.92 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-615.61 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1651.92 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-55.57 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	940.00 mm	*Min weld segment length*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1532.92 kN	3888.64 kN	**0.39**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	18800.00 mm^2	*Gross area subject to shear*		
ϕR_n	3888.64 kN	*Shear yield strength*		
Plate Shear Rupture	1532.92 kN	3791.43 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	18800.00 mm^2	*Net area subject to shear*		
ϕR_n	3791.43 kN	*Shear rupture strength*		
Plate Axial Yield	615.61 kN	5832.97 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area subject to tension*		
ϕR_n	5832.97 kN	*Tensile yield strength*		
Plate Tension Rupture	615.61 kN	6319.05 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area subject to tension*		
ϕR_n	6319.05 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-615.61 kN	*Calculated axial load*		
V_r	1532.92 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area of the plate*		
Z_{pl}	4418000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	5832.97 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3888.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	55.57 kN-m	*Calculated moment*		
M_c	1370.74 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.18	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-615.61 kN	*Calculated axial load*		
V_r	1532.92 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area of the plate*		
Z_{net}	4418000.00 mm^3	*Plastic modulus of net section*		
P_c	6319.05 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3791.43 kN	*Available shear strength (see check 'Shear Rupture')*		

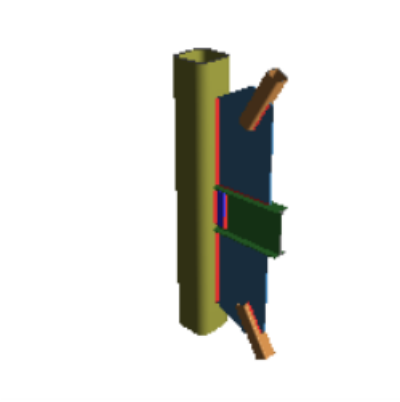
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	55.57 kN-m	*Calculated moment*		
M_c	1484.97 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.18	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	1.93 kN/mm	6.14 kN/mm	**0.31**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	1532.92 kN	*Shear Load*		
P	-615.61 kN	*Axial Load*		
M	-55.57 kN-m	*Moment*		
e_{eff}	33.64 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.63 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.03 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	1.93 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	55.57 kN-m	2549.57 kN-m	**0.02**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	940.00 mm	*Plate length*		
M_e	-55.57 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2549.57 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	615.61 kN	7334.35 kN	**0.08**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	940.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7334.35 kN	*Transverse plastification strength*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1532.92 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	336.85 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-838.79 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-615.61 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1651.92 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-55.57 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	940.00 mm	*Min weld segment length*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1532.92 kN	3888.64 kN	**0.39**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	18800.00 mm^2	*Gross area subject to shear*		
ϕR_n	3888.64 kN	*Shear yield strength*		
Plate Shear Rupture	1532.92 kN	3791.43 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	18800.00 mm^2	*Net area subject to shear*		
ϕR_n	3791.43 kN	*Shear rupture strength*		
Plate Axial Yield	615.61 kN	5832.97 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area subject to tension*		
ϕR_n	5832.97 kN	*Tensile yield strength*		
Plate Tension Rupture	615.61 kN	6319.05 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area subject to tension*		
ϕR_n	6319.05 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-615.61 kN	*Calculated axial load*		
V_r	1532.92 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area of the plate*		
Z_{pl}	4418000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	5832.97 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3888.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	55.57 kN-m	*Calculated moment*		
M_c	1370.74 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.18	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-615.61 kN	*Calculated axial load*		
V_r	1532.92 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area of the plate*		
Z_{net}	4418000.00 mm^3	*Plastic modulus of net section*		
P_c	6319.05 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3791.43 kN	*Available shear strength (see check 'Shear Rupture')*		

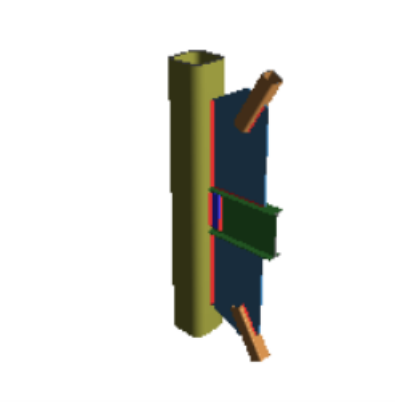
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	55.57 kN-m	*Calculated moment*		
M_c	1484.97 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.18	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	1.93 kN/mm	6.14 kN/mm	**0.31**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	1532.92 kN	*Shear Load*		
P	-615.61 kN	*Axial Load*		
M	-55.57 kN-m	*Moment*		
e_{eff}	33.64 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.63 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.03 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	1.93 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	30.41 kN-m	2549.57 kN-m	**0.01**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	940.00 mm	*Plate length*		
M_e	30.41 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2549.57 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	336.85 kN	7334.35 kN	**0.05**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	940.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7334.35 kN	*Transverse plastification strength*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	357.47 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	357.47 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3554.19 kN	**0.73**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	11455.36 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	572.77 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3554.19 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	3850.37 kN	**0.67**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	572.77 mm	*Whitmore tensile width*		

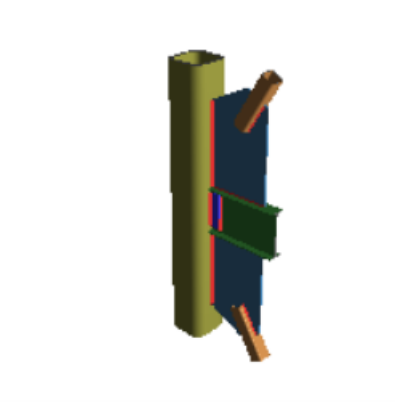
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11455.36 mm^2	*Net area of plate*		
ϕR_n	3850.37 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	2626.34 kN	**0.54**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	742.76 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	371.38 mm	*Effective length, L_c=K*L*		
L_c/r	64.32	*Plate slenderness check from J4-6*		
F_{cr}	254.74 MPa	*Flexural buckling stress (E3-2)*		
A_g	11455.36 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2626.34 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1548.57 kN	**0.65**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4607.21 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1548.57 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	2883.40 kN	**0.90**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (top brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	357.47 mm	*Weld length*		
ϕRn	2883.40 kN	*Weld strength*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	357.47 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	357.47 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3554.19 kN	**0.73**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	11455.36 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	572.77 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3554.19 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	3850.37 kN	**0.67**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	572.77 mm	*Whitmore tensile width*		

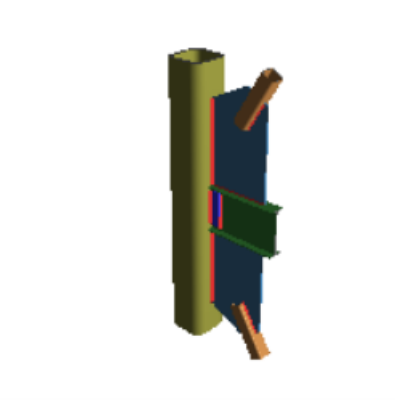
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11455.36 mm^2	*Net area of plate*		
ϕR_n	3850.37 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	2626.34 kN	**0.54**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	742.76 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	371.38 mm	*Effective length, L_c=K*L*		
L_c/r	64.32	*Plate slenderness check from J4-6*		
F_{cr}	254.74 MPa	*Flexural buckling stress (E3-2)*		
A_g	11455.36 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2626.34 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1548.57 kN	**0.65**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4607.21 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1548.57 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	2883.40 kN	**0.90**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (bottom brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	357.47 mm	*Weld length*		
ϕRn	2883.40 kN	*Weld strength*		

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-top}}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-top}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-top}}$	6000.00 mm^2	*Area of the top brace*		
$P_{exp\text{-t-top}}$	2585.53 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-bot}}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-bot}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-bot}}$	6000.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-t-bot}}$	2585.53 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*Length of the top brace*		
$L_{c\text{-top}}$	550.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	61.37 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) =* $(\pi^2 * E)/(L_{c\text{-}top}/r_y)^2$		
$F_{cre\text{-}top}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) =* $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$		
$P_{exp\text{-}ci\text{-}top}$	1414.76 kN	*Top brace expected strength in compression =* $\min(R_y * F_y * A_{br}, 1.14 * F_{cre} * A_{br})$		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	424.43 kN	*Post-buckling expected compressive strength =* $0.3 * P_{exp\text{-}ci\text{-}top}$		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace =* $K_{bot} * L_{bot}$		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	61.37 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) =* $(\pi^2 * E)/(L_{c\text{-}bot}/r_y)^2$		
$F_{cre\text{-}bot}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) =* $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$		
$P_{exp\text{-}ci\text{-}bot}$	1414.76 kN	*Bottom brace expected strength in compression =* $\min(R_y * F_y * A_{br}, 1.14 * F_{cre} * A_{br})$		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	424.43 kN	*Post-buckling expected compressive strength =* $0.3 * P_{exp\text{-}ci\text{-}bot}$		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-2585.53 kN	*Design tensile load in top brace member =* $P_{exp\text{-}t\text{-}top}/\alpha_s$ *(negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-2585.53 kN	*Design tensile load in bottom brace member =* $P_{exp\text{-}t\text{-}bot}/\alpha_s$ *(negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	1414.76 kN	*Design compressive load in top brace member =* $P_{exp\text{-}ci\text{-}top}/\alpha_s$		
$P_{des\text{-}ci\text{-}bot}$	1414.76 kN	*Design compressive load in bottom brace member =* $P_{exp\text{-}ci\text{-}bot}/\alpha_s$		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	424.43 kN	*Design compressive load in top brace member =* $P_{exp\text{-}cii\text{-}top}/\alpha_s$		
$P_{des\text{-}cii\text{-}bot}$	424.43 kN	*Design compressive load in bottom brace member =* $P_{exp\text{-}cii\text{-}bot}/\alpha_s$		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-2585.53 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	424.43 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-2585.53 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	1414.76 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = SF_{SD1}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-1532.92 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-615.61 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	-55.57 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-684.01 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-714.88 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	53.84 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-838.79 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	336.85 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	30.41 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	374.28 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	391.17 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}bot}$	-29.46 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{bcSD1}	-983.28 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD1\text{-}top}$ - $V_{bmSD1\text{-}bot}$*		
H_{bcSD1}	-323.71 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD1}$ + $H_{bmSD1\text{-}top}$ + $H_{bmSD1\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	424.43 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	424.43 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection = SF_{SD2}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-1532.92 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-615.61 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	-55.57 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-684.01 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-714.88 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	53.84 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-251.64 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	101.05 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	9.12 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	112.28 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	117.35 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	-8.84 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-721.29 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD2\text{-}top}$ - $V_{bmSD2\text{-}bot}$*		
H_{bcSD2}	-597.53 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD2}$ + $H_{bmSD2\text{-}top}$ + $H_{bmSD2\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{bot-SD3}$	-2585.53 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	1414.76 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	1414.76 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = SF_{SD3}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	838.79 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	336.85 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	30.41 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	374.28 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	391.17 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	-29.46 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	1532.92 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-615.61 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	-55.57 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-684.01 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-714.88 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	53.84 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	1133.28 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD3-top}$ - $V_{bmSD3-bot}$*		
H_{bcSD3}	-323.71 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD3} + $H_{bmSD3-top}$ + $H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	424.43 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-2585.53 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	424.43 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD4}$	424.43 kN	*Assumed opposite side bottom brace force*		

continued on next page...

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD4}$	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4\text{-}top}$	251.64 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}top}$	101.05 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}top}$	9.12 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4\text{-}top}$	112.28 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}top}$	117.35 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}top}$	-8.84 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4\text{-}bot}$	1532.92 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}bot}$	-615.61 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}bot}$	-55.57 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4\text{-}bot}$	-684.01 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}bot}$	-714.88 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}bot}$	53.84 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	871.29 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4\text{-}top}$ - $V_{bmSD4\text{-}bot}$*		
H_{bcSD4}	-597.53 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD4}$ + $H_{bmSD4\text{-}top}$ + $H_{bmSD4\text{-}bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	838.79 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	336.85 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1532.92 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-615.61 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1651.92 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-55.57 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	1532.92 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	336.85 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-838.79 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-615.61 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1651.92 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-55.57 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

continued on next page...

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	391.17 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	374.28 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-714.88 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-684.01 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	989.40 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	53.84 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	391.17 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	374.28 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-714.88 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-684.01 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	989.40 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	53.84 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	1133.28 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-983.28 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-597.53 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	1178.61 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	108.88 kN-m	*Maximum moment (loading direction SD3 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

continued on next page...

9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	61.37 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	89.62	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	61.37 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	89.62	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	30.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	59.77 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	58.50 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	43.87 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	20.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	40.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	80.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	43.87 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	20.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	40.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	80.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $\max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	140.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	10.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	140.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	10.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		

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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	357.47 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4607.21 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6514.10 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	357.47 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4607.21 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

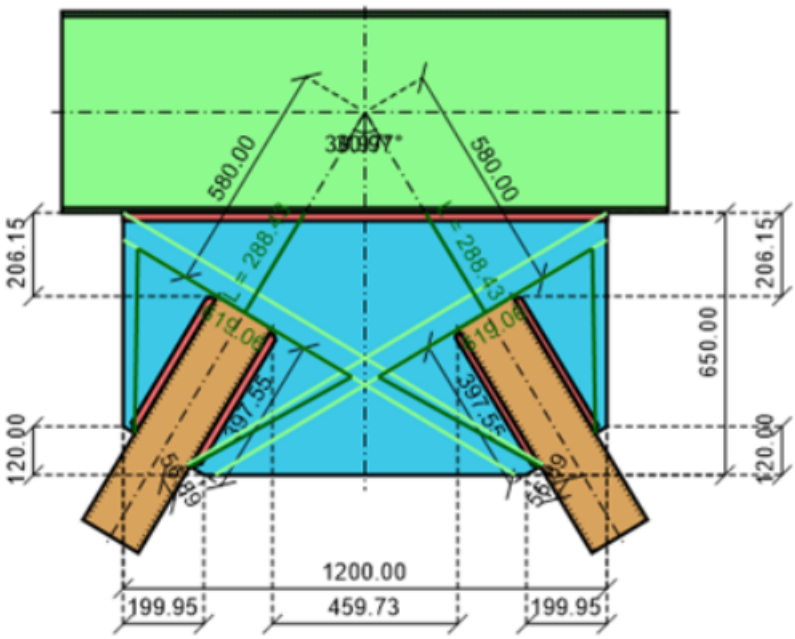
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9. Salud EJE E-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6514.10 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	7129.18 kN	10825.25 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	940.00 mm	*Weld length*		
ϕR_n	10825.25 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	7129.18 kN	10825.25 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	940.00 mm	*Weld length*		
ϕR_n	10825.25 kN	*Weld strength*		

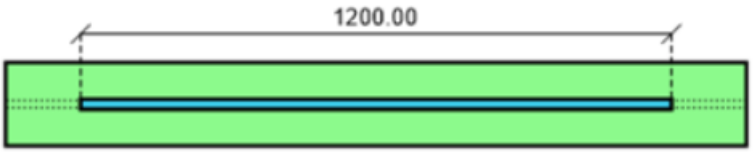
Left view



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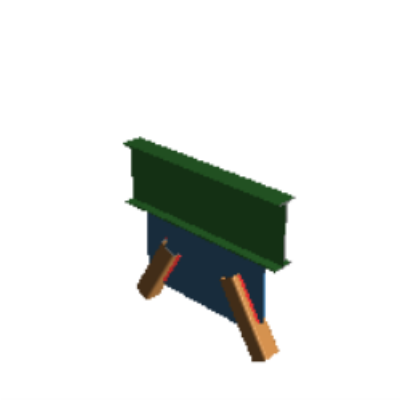
A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: 2D Views Report (continued):

Bottom view



A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Summary Report

Vertical Brace Chevron Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

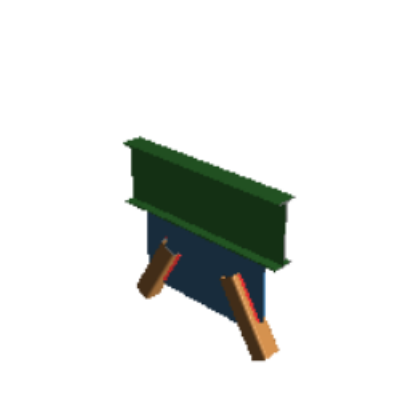
Left Brace Axial (Tension)	-2585.53 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	1414.76 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-2585.53 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	1414.76 kN	*Design compressive load in right brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.43**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.81**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.81**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Beam Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-2058.51 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	2058.51 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-1853.01 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	-514.62 kN-m	*Maximum moment at section a-a (SD1)*
Shear(Tension, Section b-b)	-1071.71 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	1071.71 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-556.04 kN	*Maximum axial due to tension at section b-b (SD2)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-41.77 kN-m	*Maximum moment at section b-b (SD4)*
Beam Moment	514.62 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: $-d_{beam} <= WP_h <= d_{beam}$*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: $-0.5*d_{beam} <= WP_v <= d_{beam}$*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	2058.51 kN	4964.23 kN	**0.41**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	24000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4964.23 kN	*Shear yield strength*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Rupture (Section a-a)	2058.51 kN	4840.12 kN	**0.43**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	24000.00 mm^2	*Net area subject to shear*		
ϕR_n	4840.12 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	1853.01 kN	7446.34 kN	**0.25**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area subject to tension*		
ϕR_n	7446.34 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	1853.01 kN	8066.87 kN	**0.23**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area subject to tension*		
ϕR_n	8066.87 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.40**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1853.01 kN	*Calculated axial load*		
V_r	2058.51 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area of the plate*		
Z_{pl}	7200000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7446.34 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4964.23 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	514.62 kN-m	*Calculated moment*		
M_c	2233.89 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.40	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.38**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1853.01 kN	*Calculated axial load*		
V_r	2058.51 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area of the plate*		
Z_{net}	7200000.00 mm^3	*Plastic modulus of net section*		
P_c	8066.87 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4840.12 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	514.62 kN-m	*Calculated moment*		
M_c	2420.05 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.38	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		

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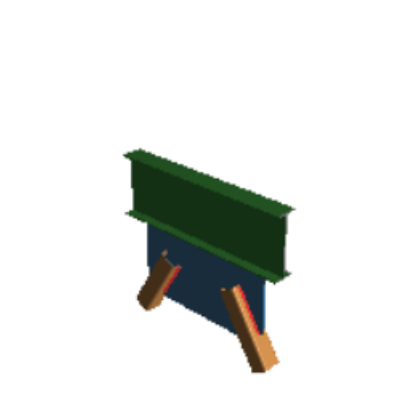
Limit State	Required	Available	Unity Check	Result
Plate Shear Yield (Section b-b)	1071.71 kN	2688.96 kN	**0.40**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	13000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2688.96 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	1071.71 kN	2621.73 kN	**0.41**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13000.00 mm^2	*Net area subject to shear*		
ϕR_n	2621.73 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	556.04 kN	4033.43 kN	**0.14**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4033.43 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	556.04 kN	4369.55 kN	**0.13**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13000.00 mm^2	*Net area subject to tension*		
ϕR_n	4369.55 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.20**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-556.04 kN	*Calculated axial load*		
V_r	1071.71 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13000.00 mm^2	*Gross area of the plate*		
Z_{pl}	2112500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4033.43 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2688.96 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-41.77 kN-m	*Calculated moment*		
M_c	655.43 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.20	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.20**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-556.04 kN	*Calculated axial load*		
V_r	1071.71 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13000.00 mm^2	*Net area of the plate*		
Z_{net}	2112500.00 mm^3	*Plastic modulus of net section*		
P_c	4369.55 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2621.73 kN	*Available shear strength (see check 'Shear Rupture')*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	-41.77 kN-m	*Calculated moment*		
M_c	710.05 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.20	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1853.01 kN	6205.28 kN	**0.30**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1200.00 mm	*Length of bearing*		
ϕR_n	6205.28 kN	*Beam web local yielding*		

A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Left Brace Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

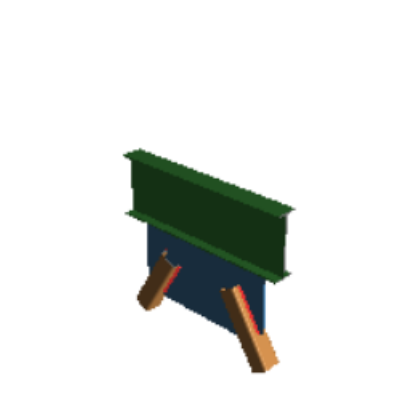
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	397.55 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	397.55 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3841.42 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12381.12 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	619.06 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3841.42 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4161.54 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	619.06 mm	*Whitmore tensile width*		
A_n	12381.12 mm^2	*Net area of plate*		
ϕR_n	4161.54 kN	*Plate tensile rupture strength*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Left Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3556.37 kN	**0.40**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	288.43 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	187.48 mm	*Effective length, L_c=K*L*		
L_c/r	32.47	*Plate slenderness check from J4-6*		
F_{cr}	319.16 MPa	*Flexural buckling stress (E3-2)*		
A_g	12381.12 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3556.37 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1580.07 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4700.92 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1580.07 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3206.75 kN	**0.81**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (left brace)*		
α	0.66	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	397.55 mm	*Weld length*		
ϕRn	3206.75 kN	*Weld strength*		

A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Right Brace Report



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	397.55 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	397.55 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3841.42 kN	**0.67**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12381.12 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	619.06 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3841.42 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4161.54 kN	**0.62**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	619.06 mm	*Whitmore tensile width*		
A_n	12381.12 mm^2	*Net area of plate*		
ϕR_n	4161.54 kN	*Plate tensile rupture strength*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Gusset/Right Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3556.37 kN	**0.40**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	288.43 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	187.48 mm	*Effective length, L_c=K*L*		
L_c/r	32.47	*Plate slenderness check from J4-6*		
F_{cr}	319.16 MPa	*Flexural buckling stress (E3-2)*		
A_g	12381.12 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3556.37 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1580.07 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4700.92 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1580.07 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3206.75 kN	**0.81**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (right brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	397.55 mm	*Weld length*		
ϕRn	3206.75 kN	*Weld strength*		

A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Seismic Report

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	6000.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	2585.53 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	6000.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	2585.53 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	61.37 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		
$F_{cre\text{-left}}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{exp\text{-}ci\text{-}left}$	1414.76 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	61.37 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	1414.76 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-2585.53 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-2585.53 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	1414.76 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	1414.76 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	424.43 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	424.43 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-2585.53 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	1414.76 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		
$P_{left\text{-}SD2}$	-2585.53 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	424.43 kN	*Right brace design load per loading direction SD2*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	1414.76 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-2585.53 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	424.43 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-2585.53 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	128.65 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	128.65 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	295.89 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	1414.76 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2216.93 kN	*Vertical component of left brace*		
P_{Hleft}	-1330.49 kN	*Horizontal component of left brace*		
P_{Vright}	1213.06 kN	*Vertical component of right brace*		
P_{Hright}	-728.02 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1003.87 kN	*Axial force at section a-a*		
V_{aa}	-2058.51 kN	*Shear force at section a-a*		
M_{aa}	-514.62 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.84 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.72 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-2.14 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-301.24 kN	*Axial force at section b-b*		
V_{bb}	-1071.71 kN	*Shear force at section b-b*		
M_{bb}	-22.63 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	128.65 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	128.65 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	295.89 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	424.43 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2216.93 kN	*Vertical component of left brace*		
P_{Hleft}	-1330.49 kN	*Horizontal component of left brace*		

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Limit State	Required	Available	Unity Check	Result
P_{Vright}	363.92 kN	*Vertical component of right brace*		
P_{Hright}	-218.41 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1853.01 kN	*Axial force at section a-a*		
V_{aa}	-1548.89 kN	*Shear force at section a-a*		
M_{aa}	-387.22 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.54 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.29 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.61 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-556.04 kN	*Axial force at section b-b*		
V_{bb}	-806.40 kN	*Shear force at section b-b*		
M_{bb}	-41.77 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	128.65 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	128.65 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	295.89 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	1414.76 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	1213.06 kN	*Vertical component of left brace*		
P_{Hleft}	728.02 kN	*Horizontal component of left brace*		
P_{Vright}	-2216.93 kN	*Vertical component of right brace*		
P_{Hright}	1330.49 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1003.87 kN	*Axial force at section a-a*		
V_{aa}	2058.51 kN	*Shear force at section a-a*		
M_{aa}	514.62 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.84 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.72 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	2.14 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-301.24 kN	*Axial force at section b-b*		
V_{bb}	1071.71 kN	*Shear force at section b-b*		
M_{bb}	-22.63 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	128.65 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Δ_{right}	128.65 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	295.89 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	424.43 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	363.92 kN	*Vertical component of left brace*		
P_{Hleft}	218.41 kN	*Horizontal component of left brace*		
P_{Vright}	-2216.93 kN	*Vertical component of right brace*		
P_{Hright}	1330.49 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1853.01 kN	*Axial force at section a-a*		
V_{aa}	1548.89 kN	*Shear force at section a-a*		
M_{aa}	387.22 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.54 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.29 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.61 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-556.04 kN	*Axial force at section b-b*		
V_{bb}	806.40 kN	*Shear force at section b-b*		
M_{bb}	-41.77 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-2058.51 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	2058.51 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1853.01 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-514.62 kN-m	*Maximum moment (loading direction SD1 governs)*		
Section (b-b) Forces				
Shear (Tension)	-1071.71 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	1071.71 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-556.04 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-41.77 kN-m	*Maximum moment (loading direction SD4 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: $F_y <= 50$ ksi (345 Mpa) (AISC 341-16, A3.1)*		

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A10. Salud Chev-EJE E-AR4-VS2/VM2 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	61.37 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	89.62	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	61.37 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	89.62	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	56.89 mm	*Distance from end of left brace to hinge line*		
t_g	20.00 mm	*Thickness of gusset plate*		
$2*t_g$	40.00 mm	*Lower limiting thickness of the gusset plate*		
$4*t_g$	80.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	56.89 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		

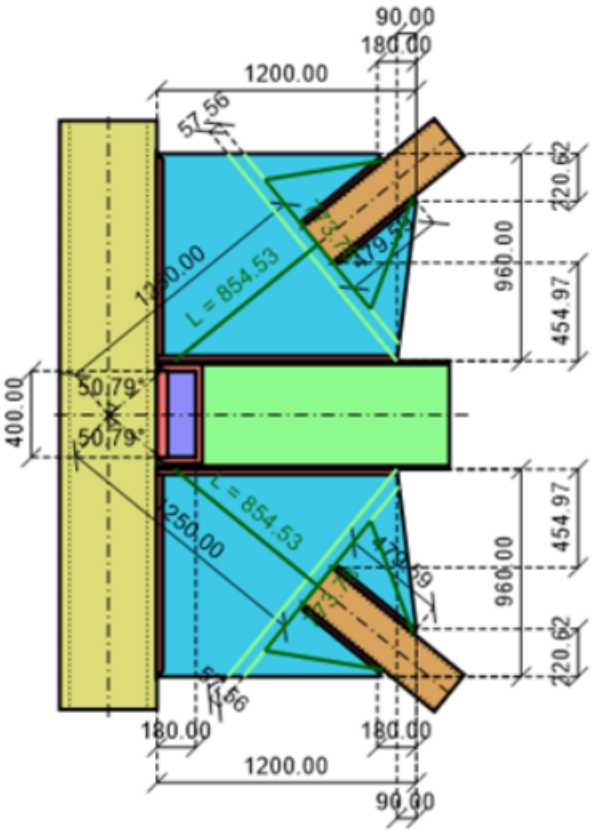
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Limit State	Required	Available	Unity Check	Result
Limit	36.05	*Limiting ratio, max(0.88*(E_b/(R_{yb}*F_{yb}))$^{0.5}$*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))$^{0.5}$)*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}left}$	140.00 mm	*Inside dimension of left brace tube*		
$t_{br\text{-}left}$	10.00 mm	*Left brace tube wall thickness*		
$E_{br\text{-}left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
$R_{y\text{-}left}$	1.25	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}left}/t_{br\text{-}left}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br\text{-}left}$/($R_{y\text{-}left}$ * $F_{ybr\text{-}left}$))$^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}right}$	140.00 mm	*Inside dimension of right brace tube*		
$t_{br\text{-}right}$	10.00 mm	*Right brace tube wall thickness*		
$E_{br\text{-}right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y\text{-}right}$	1.25	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}right}/t_{br\text{-}right}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br\text{-}right}$/($R_{y\text{-}right}$ * $F_{ybr\text{-}right}$))$^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	397.55 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =(A_g+A_r)-2*(t_p+2*gap)*t_{des}*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =A_g-2*(t_p+2*gap)*t_{des}*		
A_e	4700.92 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		

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Limit State	Required	Available	Unity Check	Result
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.84	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6661.51 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	397.55 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4700.92 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.84	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6661.51 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

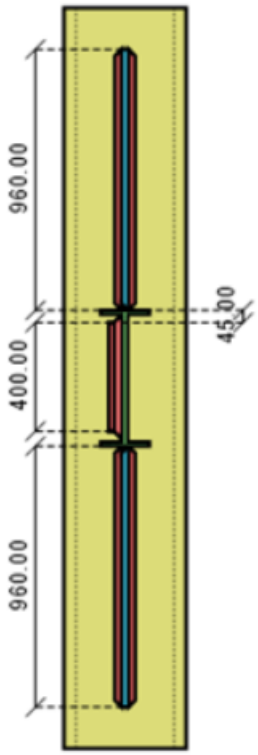
Side view



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A11. Salud EJE6/1-AR1-C1/C4: 2D Views Report (continued):

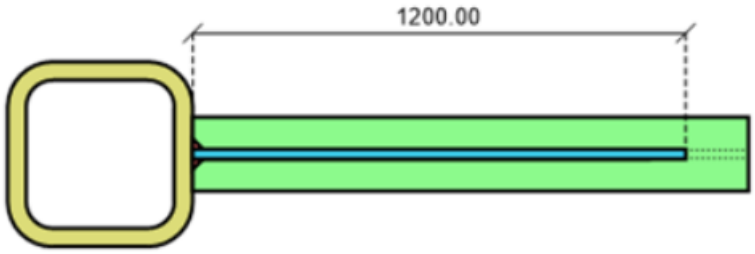
Front view



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A11. Salud EJE6/1-AR1-C1/C4: 2D Views Report (continued):

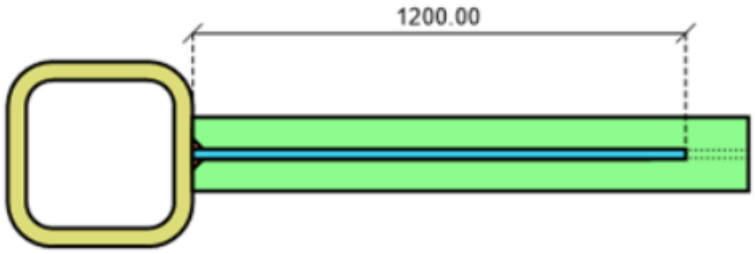
Top view



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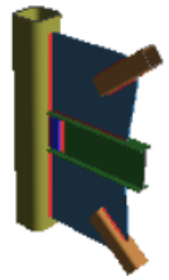
A11. Salud EJE6/1-AR1-C1/C4: 2D Views Report (continued):

Bottom view



A11. Salud EJE6/1-AR1-C1/C4: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear Load	75.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-5300.35 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	3025.66 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-5300.35 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	3025.66 kN	*Design compressive load in bottom brace*

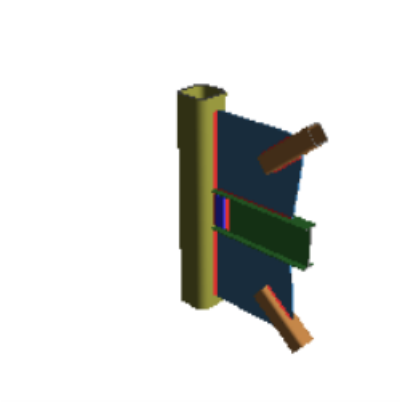
Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	730.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	730.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	2*t_p	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Beam Shear Rupture	**1.00**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.54**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.54**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.44**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.44**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.91**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.91**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.82**	**PASS**

A11. Salud EJE6/1-AR1-C1/C4: Beam/Column Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	2008.76 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-1858.76 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-2485.38 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	2911.69 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD4)*
Moment due ecc	269.50 kN-m	*Calculated Maximum Moment due Eccentricity (SD3)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	30.00 mm	*Weld size*		
D_{max}	48.41 mm	*Max Size Allowed*		
t	50.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	30.00 mm	*Weld size*		

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A11. Salud EJE6/1-AR1-C1/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	30.00 mm	*Weld size*		
L_{min}	180.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	30.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	2008.76 kN	2068.43 kN	**0.97**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	10000.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	2068.43 kN	*Shear yield strength*		
Plate Shear Yield	2008.76 kN	4136.85 kN	**0.49**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	20000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4136.85 kN	*Shear yield strength*		
Beam Shear Rupture	2008.76 kN	2016.72 kN	**1.00**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	10000.00 mm^2	*Net area subject to shear*		
ϕR_n	2016.72 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	2008.76 kN	4033.43 kN	**0.50**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	20000.00 mm^2	*Net area subject to shear*		
ϕR_n	4033.43 kN	*Shear rupture strength*		
Beam Axial Yield	2485.38 kN	4591.91 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	14800.00 mm^2	*Gross area subject to tension*		
ϕR_n	4591.91 kN	*Tensile yield strength*		
Plate Axial Yield	2485.38 kN	6205.28 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	20000.00 mm^2	*Gross area subject to tension*		
ϕR_n	6205.28 kN	*Tensile yield strength*		
Beam Tension Rupture	2485.38 kN	4433.04 kN	**0.56**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	13188.89 mm^2	*Effective net area, $A_e = A_n * U$*		

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A11. Salud EJE6/1-AR1-C1/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	14800.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.89	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.64	*Shear lag factor (lower bound)*		
U	0.89	*Governing shear lag factor, U = max($U_{D3.1}$, U_{Bound})*		
ϕR_n	4433.04 kN	*Tensile rupture strength*		
Plate Tension Rupture	2485.38 kN	6722.39 kN	**0.37**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	20000.00 mm^2	*Net area subject to tension*		
ϕR_n	6722.39 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.93**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-2485.38 kN	*Calculated axial load*		
V_r	2008.76 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	20000.00 mm^2	*Gross area of the plate*		
Z_{pl}	2000000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	6205.28 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4136.85 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	269.50 kN-m	*Calculated moment*		
M_c	620.52 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.93	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.84**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-2485.38 kN	*Calculated axial load*		
V_r	2008.76 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	20000.00 mm^2	*Net area of the plate*		
Z_{net}	2000000.00 mm^3	*Plastic modulus of net section*		
P_c	6722.39 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4033.43 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	269.50 kN-m	*Calculated moment*		
M_c	672.23 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, φ=0.75*		
UC	0.84	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because $Lb*d/tp^2 <= 0.08*E/Fy$				
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	0.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		

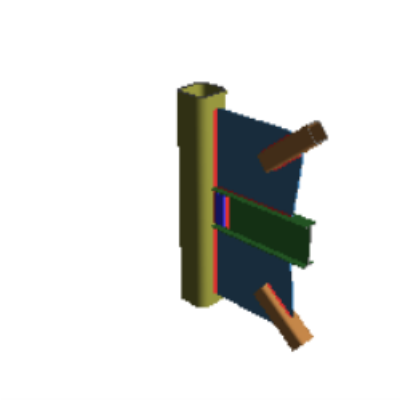
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A11. Salud EJE6/1-AR1-C1/C4: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
t_p	50.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Weld at Beam	3.97 kN/mm	4.03 kN/mm	**0.98**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD4				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	20.00 mm	*Base material thickness (beam)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	30.00 mm	*Weld fillet size*		
r_u	3.97 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	4.03 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	1287.03 kN	5422.08 kN	**0.24**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} +L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	97.50 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	167.50 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9-5)*		
c	50.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	5422.08 kN	*Transverse plastification strength*		

A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1711.93 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	702.72 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-2998.96 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1231.03 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	3241.79 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-66.52 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	2998.96 kN	5739.89 kN	**0.52**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	27750.00 mm^2	*Gross area subject to shear*		
ϕR_n	5739.89 kN	*Shear yield strength*		
Plate Shear Rupture	2998.96 kN	5596.39 kN	**0.54**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	27750.00 mm^2	*Net area subject to shear*		
ϕR_n	5596.39 kN	*Shear rupture strength*		
Plate Axial Yield	1231.03 kN	8609.83 kN	**0.14**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	27750.00 mm^2	*Gross area subject to tension*		
ϕR_n	8609.83 kN	*Tensile yield strength*		
Plate Tension Rupture	1231.03 kN	9327.32 kN	**0.13**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	27750.00 mm^2	*Net area subject to tension*		
ϕR_n	9327.32 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.30**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1231.03 kN	*Calculated axial load*		
V_r	2998.96 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	27750.00 mm^2	*Gross area of the plate*		
Z_{pl}	7700625.00 mm^3	*Plastic modulus of the shear plate*		
P_c	8609.83 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	5739.89 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	66.52 kN-m	*Calculated moment*		
M_c	2389.21 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.30	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.31**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1231.03 kN	*Calculated axial load*		
V_r	2998.96 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	27750.00 mm^2	*Net area of the plate*		
Z_{net}	7700625.00 mm^3	*Plastic modulus of net section*		
P_c	9327.32 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	5596.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	66.52 kN-m	*Calculated moment*		
M_c	2588.31 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.31	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1231.03 kN	7653.18 kN	**0.16**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-2)	
d_{end}	555.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1110.00 mm	*Length of bearing*		
ϕR_n	7653.18 kN	*Beam web local yielding*		

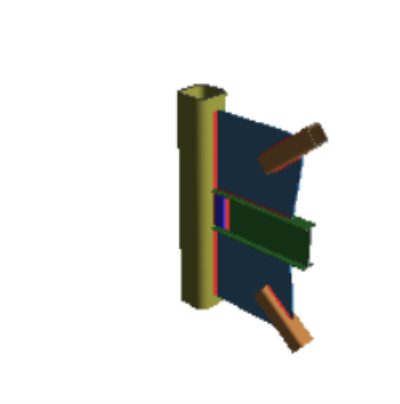
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A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	702.72 kN	19419.67 kN	**0.04**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	555.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	2.22	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	15.00 mm	*Beam flange thickness*		
l_b	1110.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	19419.67 kN	*Beam web crippling capacity*		

A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1711.93 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	702.72 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-2998.96 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-1231.03 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	3241.79 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-66.52 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	2998.96 kN	5739.89 kN	**0.52**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	27750.00 mm^2	*Gross area subject to shear*		
ϕR_n	5739.89 kN	*Shear yield strength*		
Plate Shear Rupture	2998.96 kN	5596.39 kN	**0.54**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	27750.00 mm^2	*Net area subject to shear*		
ϕR_n	5596.39 kN	*Shear rupture strength*		
Plate Axial Yield	1231.03 kN	8609.83 kN	**0.14**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	27750.00 mm^2	*Gross area subject to tension*		
ϕR_n	8609.83 kN	*Tensile yield strength*		
Plate Tension Rupture	1231.03 kN	9327.32 kN	**0.13**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	27750.00 mm^2	*Net area subject to tension*		
ϕR_n	9327.32 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.30**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1231.03 kN	*Calculated axial load*		
V_r	2998.96 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	27750.00 mm^2	*Gross area of the plate*		
Z_{pl}	7700625.00 mm^3	*Plastic modulus of the shear plate*		
P_c	8609.83 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	5739.89 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	66.52 kN-m	*Calculated moment*		
M_c	2389.21 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.30	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.31**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1231.03 kN	*Calculated axial load*		
V_r	2998.96 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	27750.00 mm^2	*Net area of the plate*		
Z_{net}	7700625.00 mm^3	*Plastic modulus of net section*		
P_c	9327.32 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	5596.39 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	66.52 kN-m	*Calculated moment*		
M_c	2588.31 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.31	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1231.03 kN	7653.18 kN	**0.16**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-2)	
d_{end}	555.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1110.00 mm	*Length of bearing*		
ϕR_n	7653.18 kN	*Beam web local yielding*		

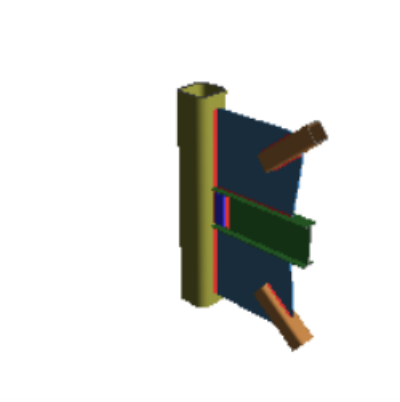
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A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	702.72 kN	19419.67 kN	**0.04**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	555.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	2.22	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	20.00 mm	*Beam web thickness*		
t_f	15.00 mm	*Beam flange thickness*		
l_b	1110.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	19419.67 kN	*Beam web crippling capacity*		

A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1209.99 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	632.45 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-2119.66 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1107.93 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	2391.75 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	54.88 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	960.00 mm	*Min weld segment length*		

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A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	2119.66 kN	4964.23 kN	**0.43**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	24000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4964.23 kN	*Shear yield strength*		
Plate Shear Rupture	2119.66 kN	4840.12 kN	**0.44**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	24000.00 mm^2	*Net area subject to shear*		
ϕR_n	4840.12 kN	*Shear rupture strength*		
Plate Axial Yield	1107.93 kN	7446.34 kN	**0.15**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area subject to tension*		
ϕR_n	7446.34 kN	*Tensile yield strength*		
Plate Tension Rupture	1107.93 kN	8066.87 kN	**0.14**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area subject to tension*		
ϕR_n	8066.87 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.21**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1107.93 kN	*Calculated axial load*		
V_r	2119.66 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area of the plate*		
Z_{pl}	5760000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7446.34 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4964.23 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	54.88 kN-m	*Calculated moment*		
M_c	1787.11 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.21	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1107.93 kN	*Calculated axial load*		
V_r	2119.66 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area of the plate*		
Z_{net}	5760000.00 mm^3	*Plastic modulus of net section*		
P_c	8066.87 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4840.12 kN	*Available shear strength (see check 'Shear Rupture')*		

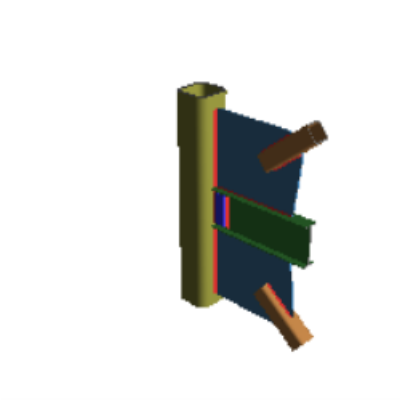
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A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	54.88 kN-m	*Calculated moment*		
M_c	1936.04 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	2.68 kN/mm	6.14 kN/mm	**0.44**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	2119.66 kN	*Shear Load*		
P	-1107.93 kN	*Axial Load*		
M	54.88 kN-m	*Moment*		
e_{eff}	22.95 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.21 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.51 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.68 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	54.88 kN-m	2659.22 kN-m	**0.02**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	960.00 mm	*Plate length*		
M_e	54.88 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2659.22 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	1107.93 kN	7532.12 kN	**0.15**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	960.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	145.00 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	145.00 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7532.12 kN	*Transverse plastification strength*		

A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	2119.66 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	632.45 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-1209.99 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-1107.93 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	2391.75 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	54.88 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	960.00 mm	*Min weld segment length*		

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A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	2119.66 kN	4964.23 kN	**0.43**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	24000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4964.23 kN	*Shear yield strength*		
Plate Shear Rupture	2119.66 kN	4840.12 kN	**0.44**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	24000.00 mm^2	*Net area subject to shear*		
ϕR_n	4840.12 kN	*Shear rupture strength*		
Plate Axial Yield	1107.93 kN	7446.34 kN	**0.15**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area subject to tension*		
ϕR_n	7446.34 kN	*Tensile yield strength*		
Plate Tension Rupture	1107.93 kN	8066.87 kN	**0.14**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area subject to tension*		
ϕR_n	8066.87 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.21**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1107.93 kN	*Calculated axial load*		
V_r	2119.66 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area of the plate*		
Z_{pl}	5760000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7446.34 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4964.23 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	54.88 kN-m	*Calculated moment*		
M_c	1787.11 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.21	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1107.93 kN	*Calculated axial load*		
V_r	2119.66 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area of the plate*		
Z_{net}	5760000.00 mm^3	*Plastic modulus of net section*		
P_c	8066.87 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4840.12 kN	*Available shear strength (see check 'Shear Rupture')*		

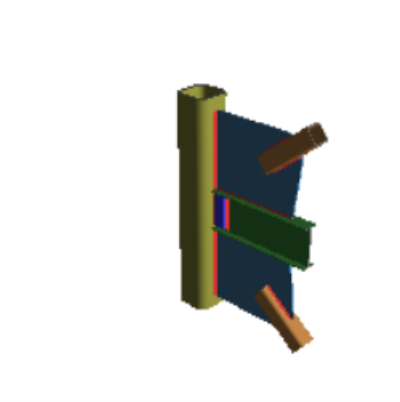
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A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	54.88 kN-m	*Calculated moment*		
M_c	1936.04 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.22	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	2.68 kN/mm	6.14 kN/mm	**0.44**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	2119.66 kN	*Shear Load*		
P	-1107.93 kN	*Axial Load*		
M	54.88 kN-m	*Moment*		
e_{eff}	22.95 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	2.21 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.51 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.68 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	31.33 kN-m	2659.22 kN-m	**0.01**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	960.00 mm	*Plate length*		
M_e	-31.33 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2659.22 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	632.45 kN	7532.12 kN	**0.08**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	960.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	145.00 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	145.00 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7532.12 kN	*Transverse plastification strength*		

A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-5300.35 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	3025.66 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	479.59 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	479.59 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	5300.35 kN	6001.91 kN	**0.88**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	19344.50 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	773.78 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	6001.91 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	5300.35 kN	6502.06 kN	**0.82**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	773.78 mm	*Whitmore tensile width*		

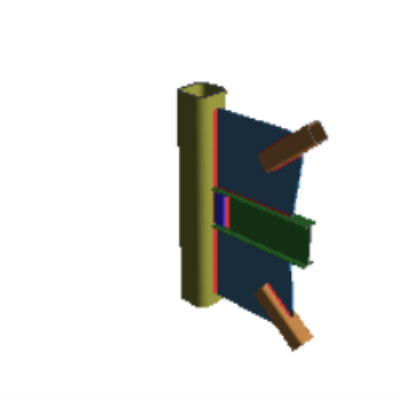
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A11. Salud EJE6/1-AR1-C1/C4: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	19344.50 mm^2	*Net area of plate*		
ϕR_n	6502.06 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	3025.66 kN	4645.01 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	854.53 mm	*Unbraced length*		
r	7.22 mm	*Radius of gyration*		
L_c	427.27 mm	*Effective length, L_c=K*L*		
L_c/r	59.20	*Plate slenderness check from J4-6*		
F_{cr}	266.80 MPa	*Flexural buckling stress (E3-2)*		
A_g	19344.50 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	4645.01 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	3816.25 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12300.00 mm^2	*Gross area subject to tension*		
ϕR_n	3816.25 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	3187.85 kN	**0.31**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	9484.27 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11454.75 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	3187.85 kN	*Tensile rupture strength*		
Brace Weld Strength	5300.35 kN	5802.67 kN	**0.91**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	15.00 mm	*Base material thickness (top brace)*		
α	0.98	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	479.59 mm	*Weld length*		
ϕRn	5802.67 kN	*Weld strength*		

A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-5300.35 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	3025.66 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	479.59 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	479.59 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	5300.35 kN	6001.91 kN	**0.88**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	19344.50 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	773.78 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	6001.91 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	5300.35 kN	6502.06 kN	**0.82**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	773.78 mm	*Whitmore tensile width*		

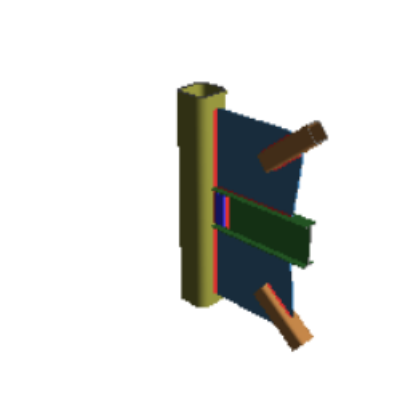
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A11. Salud EJE6/1-AR1-C1/C4: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	19344.50 mm^2	*Net area of plate*		
ϕR_n	6502.06 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	3025.66 kN	4645.01 kN	**0.65**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	854.53 mm	*Unbraced length*		
r	7.22 mm	*Radius of gyration*		
L_c	427.27 mm	*Effective length, L_c=K*L*		
L_c/r	59.20	*Plate slenderness check from J4-6*		
F_{cr}	266.80 MPa	*Flexural buckling stress (E3-2)*		
A_g	19344.50 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	4645.01 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	3816.25 kN	**0.26**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12300.00 mm^2	*Gross area subject to tension*		
ϕR_n	3816.25 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	3187.85 kN	**0.31**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	9484.27 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11454.75 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	3187.85 kN	*Tensile rupture strength*		
Brace Weld Strength	5300.35 kN	5802.67 kN	**0.91**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	15.00 mm	*Base material thickness (bottom brace)*		
α	0.98	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	479.59 mm	*Weld length*		
ϕRn	5802.67 kN	*Weld strength*		

A11. Salud EJE6/1-AR1-C1/C4: Seismic Report

Vertical Brace Diagonal Connection



Material Properties:				
Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P50.00x180.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K220*15	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P25.00x960.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{top}	730.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	730.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-}top}$	12300.00 mm^2	*Area of the top brace*		
$P_{exp\text{-}t\text{-}top}$	5300.35 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-}bot}$	12300.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-}t\text{-}bot}$	5300.35 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	730.00 cm	*Length of the top brace*		
$L_{c\text{-}top}$	730.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	83.91 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	260.76 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2 * E)/(L_{c\text{-}top}/r_y)^2$*		
$F_{cre\text{-}top}$	215.78 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}top}$	3025.66 kN	*Top brace expected strength in compression = min($R_y * F_y * A_{br}$, $1.14 * F_{cre} * A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	907.70 kN	*Post-buckling expected compressive strength = $0.3 * P_{exp\text{-}ci\text{-}top}$*		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	730.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	730.00 cm	*Effective length of the bottom brace = $K_{bot} * L_{bot}$*		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	83.91 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	260.76 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2 * E)/(L_{c\text{-}bot}/r_y)^2$*		
$F_{cre\text{-}bot}$	215.78 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}bot}$	3025.66 kN	*Bottom brace expected strength in compression = min($R_y * F_y * A_{br}$, $1.14 * F_{cre} * A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	907.70 kN	*Post-buckling expected compressive strength = $0.3 * P_{exp\text{-}ci\text{-}bot}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-5300.35 kN	*Design tensile load in top brace member = $P_{exp\text{-}t\text{-}top}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-5300.35 kN	*Design tensile load in bottom brace member = $P_{exp\text{-}t\text{-}bot}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	3025.66 kN	*Design compressive load in top brace member = $P_{exp\text{-}ci\text{-}top}/\alpha_s$*		
$P_{des\text{-}ci\text{-}bot}$	3025.66 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}ci\text{-}bot}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	907.70 kN	*Design compressive load in top brace member = $P_{exp\text{-}cii\text{-}top}/\alpha_s$*		
$P_{des\text{-}cii\text{-}bot}$	907.70 kN	*Design compressive load in bottom brace member = $P_{exp\text{-}cii\text{-}bot}/\alpha_s$*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-5300.35 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	3025.66 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-5300.35 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	907.70 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	3025.66 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-5300.35 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	907.70 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-5300.35 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-5300.35 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	3025.66 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-5300.35 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	3025.66 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	3025.66 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-5300.35 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = SF_{SD1}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-2119.66 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-1107.93 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	54.88 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-1231.03 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-2998.96 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	-66.52 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-1209.99 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	632.45 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	-31.33 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	702.72 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	1711.93 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}bot}$	37.97 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{bcSD1}	-1858.76 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD1\text{-}top}$ - $V_{bmSD1\text{-}bot}$*		
H_{bcSD1}	-1287.03 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD1}$ + $H_{bmSD1\text{-}top}$ + $H_{bmSD1\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-5300.35 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	907.70 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-5300.35 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	907.70 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	907.70 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-5300.35 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection = SF_{SD2}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-2119.66 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-1107.93 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	54.88 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-1231.03 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-2998.96 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	-66.52 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-363.00 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	189.74 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	-9.40 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	210.82 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	513.58 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	11.39 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-1366.85 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD2\text{-}top}$ - $V_{bmSD2\text{-}bot}$*		
H_{bcSD2}	-2485.38 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD2}$ + $H_{bmSD2\text{-}top}$ + $H_{bmSD2\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
$P_{top\text{-}SD3}$	3025.66 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{bot-SD3}$	-5300.35 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	3025.66 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-5300.35 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-5300.35 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	3025.66 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = SF_{SD3}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	1209.99 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	632.45 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	-31.33 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	702.72 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	1711.93 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	37.97 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	2119.66 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-1107.93 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	54.88 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-1231.03 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-2998.96 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	-66.52 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	2008.76 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD3-top}$ - $V_{bmSD3-bot}$*		
H_{bcSD3}	-1287.03 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD3} + $H_{bmSD3-top}$ + $H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	907.70 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-5300.35 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	907.70 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-5300.35 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-5300.35 kN	*Assumed opposite side top brace force*		
$O_{bot-SD4}$	907.70 kN	*Assumed opposite side bottom brace force*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD4}$	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4\text{-}top}$	363.00 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}top}$	189.74 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}top}$	-9.40 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4\text{-}top}$	210.82 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}top}$	513.58 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}top}$	11.39 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4\text{-}bot}$	2119.66 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}bot}$	-1107.93 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}bot}$	54.88 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4\text{-}bot}$	-1231.03 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}bot}$	-2998.96 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}bot}$	-66.52 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	1516.85 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4\text{-}top}$ - $V_{bmSD4\text{-}bot}$*		
H_{bcSD4}	-2485.38 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD4}$ + $H_{bmSD4\text{-}top}$ + $H_{bmSD4\text{-}bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	1209.99 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	632.45 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-2119.66 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1107.93 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	2391.75 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	54.88 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	2119.66 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	632.45 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-1209.99 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1107.93 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	2391.75 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	54.88 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	1711.93 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	702.72 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-2998.96 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-1231.03 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	3241.79 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-66.52 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	1711.93 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	702.72 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-2998.96 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-1231.03 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	3241.79 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-66.52 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	2008.76 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-1858.76 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-2485.38 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	2911.69 kN	*Maximum resultant shear force (loading direction SD4 governs)*		
Moment	269.50 kN-m	*Maximum moment (loading direction SD3 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	730.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	730.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	83.91 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	86.99	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	730.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	730.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	83.91 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	86.99	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	50.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	93.59 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	97.50 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	57.56 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	25.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	50.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	100.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	57.56 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	25.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	50.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	100.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	90.00 mm	*Half of beam flange width*		
t_{bf}	15.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	6.00	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	470.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	23.50	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $\max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	190.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	15.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	12.67	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	190.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	15.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	12.67	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	25.00 mm	*Thickness of gusset plate*		

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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	15.00 mm	*Brace wall thickness*		
L	479.59 mm	*Length of brace to gusset connection*		
B	220.00 mm	*Depth of brace member*		
H	220.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	82.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	12300.00 mm^2	*Gross area of brace*		
A_n	11454.75 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	11454.75 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	9484.27 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	4858.25 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	50.80 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	90.23 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	16616.03 mm^2	*Adjusted net area of the composite section*		
A_e'	13489.87 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	5161.28 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	25.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	15.00 mm	*Brace wall thickness*		
L	479.59 mm	*Length of brace to gusset connection*		
B	220.00 mm	*Depth of brace member*		
H	220.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	82.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	12300.00 mm^2	*Gross area of brace*		
A_n	11454.75 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	11454.75 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	9484.27 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	4858.25 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	50.80 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

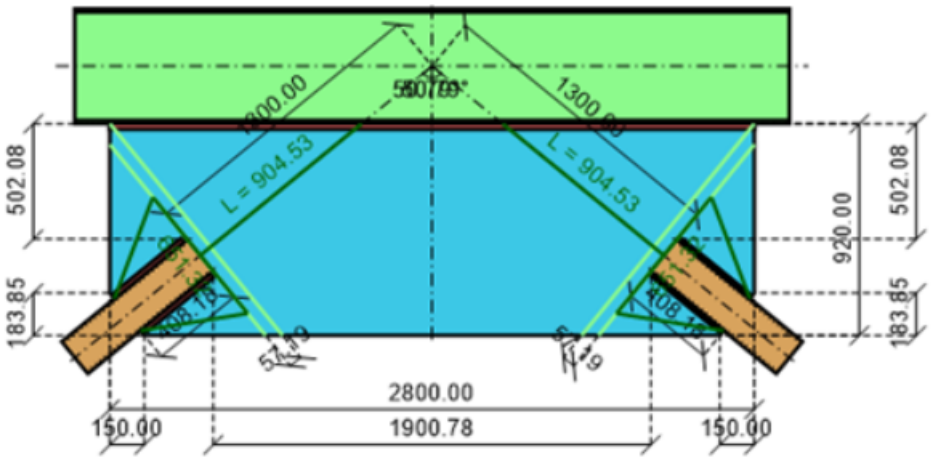
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A11. Salud EJE6/1-AR1-C1/C4: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	90.23 mm	*Eccentricity of the composite section*		
U'	0.81	*Adjusted shear lag factor for composite section*		
A_n'	16616.03 mm^2	*Adjusted net area of the composite section*		
A_e'	13489.87 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	5161.28 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	9101.08 kN	11055.58 kN	**0.82**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	25.00 mm	*Gusset plate thickness*		
L	960.00 mm	*Weld length*		
ϕR_n	11055.58 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	9101.08 kN	11055.58 kN	**0.82**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	25.00 mm	*Gusset plate thickness*		
L	960.00 mm	*Weld length*		
ϕR_n	11055.58 kN	*Weld strength*		

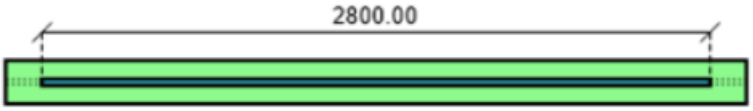
Left view



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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: 2D Views Report (continued):*

Bottom view



A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Summary Report*

Vertical Brace Chevron Connection



Material Properties:

Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P25.00x920.00x2800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Left Brace Axial (Tension)	-3474.96 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	2207.48 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-3474.96 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	2207.48 kN	*Design compressive load in right brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.31**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.88**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.92**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Beam Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P25.00x920.00x2800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-4402.95 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	4402.95 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-1778.10 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	-1100.73 kN-m	*Maximum moment at section a-a (SD1)*
Shear(Tension, Section b-b)	-1206.44 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	1206.44 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-1089.69 kN	*Maximum axial due to tension at section b-b (SD4)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-151.35 kN-m	*Maximum moment at section b-b (SD2)*
Beam Moment	1100.73 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: $-d_{beam} <= WP_h <= d_{beam}$*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: $-0.5*d_{beam} <= WP_v <= d_{beam}$*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	4402.95 kN	14478.99 kN	**0.30**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	70000.00 mm^2	*Gross area subject to shear*		
ϕR_n	14478.99 kN	*Shear yield strength*		
Plate Shear Rupture (Section a-a)	4402.95 kN	14117.02 kN	**0.31**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	70000.00 mm^2	*Net area subject to shear*		
ϕR_n	14117.02 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	1778.10 kN	21718.49 kN	**0.08**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	70000.00 mm^2	*Gross area subject to tension*		
ϕR_n	21718.49 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	1778.10 kN	23528.36 kN	**0.08**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	70000.00 mm^2	*Net area subject to tension*		
ϕR_n	23528.36 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.12**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1778.10 kN	*Calculated axial load*		
V_r	4402.95 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	70000.00 mm^2	*Gross area of the plate*		
Z_{pl}	49000000.02 mm^3	*Plastic modulus of the shear plate*		
P_c	21718.49 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	14478.99 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	1100.73 kN-m	*Calculated moment*		
M_c	15202.85 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.12**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1778.10 kN	*Calculated axial load*		
V_r	4402.95 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	70000.00 mm^2	*Net area of the plate*		
Z_{net}	49000000.02 mm^3	*Plastic modulus of net section*		
P_c	23528.36 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	14117.02 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	1100.73 kN-m	*Calculated moment*		
M_c	16469.75 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, φ=0.75*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Shear Yield (Section b-b)	1206.44 kN	4757.38 kN	**0.25**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
A_{gv}	23000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4757.38 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	1206.44 kN	4638.45 kN	**0.26**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	23000.00 mm^2	*Net area subject to shear*		
ϕR_n	4638.45 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	1089.69 kN	7136.07 kN	**0.15**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	23000.00 mm^2	*Gross area subject to tension*		
ϕR_n	7136.07 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	1089.69 kN	7730.75 kN	**0.14**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	23000.00 mm^2	*Net area subject to tension*		
ϕR_n	7730.75 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.12**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1089.69 kN	*Calculated axial load*		
V_r	1206.44 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	23000.00 mm^2	*Gross area of the plate*		
Z_{pl}	5290000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7136.07 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4757.38 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-151.35 kN-m	*Calculated moment*		
M_c	1641.29 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.12**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1089.69 kN	*Calculated axial load*		
V_r	1206.44 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	23000.00 mm^2	*Net area of the plate*		
Z_{net}	5290000.00 mm^3	*Plastic modulus of net section*		
P_c	7730.75 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4638.45 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	-151.35 kN-m	*Calculated moment*		
M_c	1778.06 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1778.10 kN	19305.32 kN	**0.09**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	20.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	2800.00 mm	*Length of bearing*		
ϕR_n	19305.32 kN	*Beam web local yielding*		

A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Left Brace Report*



Material Properties:				
Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P25.00x920.00x2800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3474.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2207.48 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	408.18 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	408.18 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3474.96 kN	5052.03 kN	**0.69**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	16283.00 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	651.32 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	5052.03 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3474.96 kN	5473.03 kN	**0.63**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	651.32 mm	*Whitmore tensile width*		
A_n	16283.00 mm^2	*Net area of plate*		
ϕR_n	5473.03 kN	*Plate tensile rupture strength*		

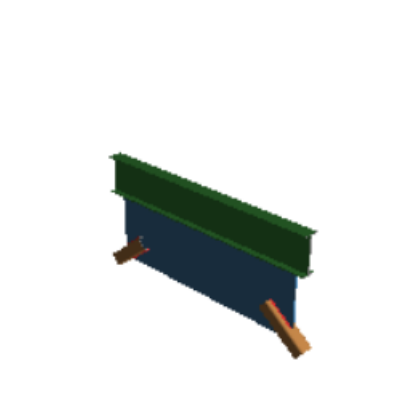
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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Left Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2207.48 kN	3109.63 kN	**0.71**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	904.53 mm	*Unbraced length*		
r	7.22 mm	*Radius of gyration*		
L_c	587.95 mm	*Effective length, L_c=K*L*		
L_c/r	81.47	*Plate slenderness check from J4-6*		
F_{cr}	212.19 MPa	*Flexural buckling stress (E3-2)*		
A_g	16283.00 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3109.63 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	2072.54 kN	**0.48**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	6166.08 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7387.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2072.54 kN	*Tensile rupture strength*		
Brace Weld Strength	3474.96 kN	3950.90 kN	**0.88**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (left brace)*		
α	0.79	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	408.18 mm	*Weld length*		
ϕRn	3950.90 kN	*Weld strength*		

A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Right Brace Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P25.00x920.00x2800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-3474.96 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	2207.48 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	408.18 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	408.18 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	3474.96 kN	5052.03 kN	**0.69**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	16283.00 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	651.32 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	5052.03 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	3474.96 kN	5473.03 kN	**0.63**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	651.32 mm	*Whitmore tensile width*		
A_n	16283.00 mm^2	*Net area of plate*		
ϕR_n	5473.03 kN	*Plate tensile rupture strength*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Gusset/Right Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	2207.48 kN	3109.63 kN	**0.71**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	904.53 mm	*Unbraced length*		
r	7.22 mm	*Radius of gyration*		
L_c	587.95 mm	*Effective length, L_c=K*L*		
L_c/r	81.47	*Plate slenderness check from J4-6*		
F_{cr}	212.19 MPa	*Flexural buckling stress (E3-2)*		
A_g	16283.00 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3109.63 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	2501.97 kN	**0.40**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	2072.54 kN	**0.48**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	6166.08 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7387.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2072.54 kN	*Tensile rupture strength*		
Brace Weld Strength	3474.96 kN	3760.76 kN	**0.92**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (right brace)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	408.18 mm	*Weld length*		
ϕRn	3760.76 kN	*Weld strength*		

A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-20-180-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K180*12	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P25.00x920.00x2800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	8064.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	3474.96 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	8064.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	3474.96 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	68.76 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		
$F_{cre\text{-left}}$	240.13 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$P_{exp\text{-}ci\text{-}left}$	2207.48 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	662.24 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	68.76 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	308.44 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	240.13 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	2207.48 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	662.24 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-3474.96 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-3474.96 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	2207.48 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	2207.48 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	662.24 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	662.24 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-3474.96 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	2207.48 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		
$P_{left\text{-}SD2}$	-3474.96 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	662.24 kN	*Right brace design load per loading direction SD2*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	2207.48 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-3474.96 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	662.24 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-3474.96 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	193.71 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	193.71 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	550.13 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3474.96 kN	*Left brace design load per loading direction*		
P_{right}	2207.48 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2196.75 kN	*Vertical component of left brace*		
P_{Hleft}	-2692.52 kN	*Horizontal component of left brace*		
P_{Vright}	1395.49 kN	*Vertical component of right brace*		
P_{Hright}	-1710.43 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-801.26 kN	*Axial force at section a-a*		
V_{aa}	-4402.95 kN	*Shear force at section a-a*		
M_{aa}	-1100.73 kN-m	*Moment at section a-a*		
S_g	32666666.68 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.29 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.57 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-0.84 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-491.04 kN	*Axial force at section b-b*		
V_{bb}	-1206.44 kN	*Shear force at section b-b*		
M_{bb}	-68.20 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	193.71 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	193.71 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	550.13 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-3474.96 kN	*Left brace design load per loading direction*		
P_{right}	662.24 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2196.75 kN	*Vertical component of left brace*		
P_{Hleft}	-2692.52 kN	*Horizontal component of left brace*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
P_{Vright}	418.65 kN	*Vertical component of right brace*		
P_{Hright}	-513.13 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1778.10 kN	*Axial force at section a-a*		
V_{aa}	-3205.64 kN	*Shear force at section a-a*		
M_{aa}	-801.41 kN-m	*Moment at section a-a*		
S_g	32666666.68 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.64 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.14 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-0.61 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-1089.69 kN	*Axial force at section b-b*		
V_{bb}	-878.37 kN	*Shear force at section b-b*		
M_{bb}	-151.35 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	193.71 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	193.71 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	550.13 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	2207.48 kN	*Left brace design load per loading direction*		
P_{right}	-3474.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	1395.49 kN	*Vertical component of left brace*		
P_{Hleft}	1710.43 kN	*Horizontal component of left brace*		
P_{Vright}	-2196.75 kN	*Vertical component of right brace*		
P_{Hright}	2692.52 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-801.26 kN	*Axial force at section a-a*		
V_{aa}	4402.95 kN	*Shear force at section a-a*		
M_{aa}	1100.73 kN-m	*Moment at section a-a*		
S_g	32666666.68 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.29 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.57 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	0.84 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-491.04 kN	*Axial force at section b-b*		
V_{bb}	1206.44 kN	*Shear force at section b-b*		
M_{bb}	-68.20 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	193.71 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Δ_{right}	193.71 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	550.13 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	662.24 kN	*Left brace design load per loading direction*		
P_{right}	-3474.96 kN	*Right brace design load per loading direction*		
P_{Vleft}	418.65 kN	*Vertical component of left brace*		
P_{Hleft}	513.13 kN	*Horizontal component of left brace*		
P_{Vright}	-2196.75 kN	*Vertical component of right brace*		
P_{Hright}	2692.52 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1778.10 kN	*Axial force at section a-a*		
V_{aa}	3205.64 kN	*Shear force at section a-a*		
M_{aa}	801.41 kN-m	*Moment at section a-a*		
S_g	32666666.68 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.64 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.14 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	0.61 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-1089.69 kN	*Axial force at section b-b*		
V_{bb}	878.37 kN	*Shear force at section b-b*		
M_{bb}	-151.35 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-4402.95 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	4402.95 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1778.10 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-1100.73 kN-m	*Maximum moment (loading direction SD1 governs)*		
Section (b-b) Forces				
Shear (Tension)	-1206.44 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	1206.44 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1089.69 kN	*Maximum tension axial force (loading direction SD4 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-151.35 kN-m	*Maximum moment (loading direction SD2 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: $F_y <= 50$ ksi (345 Mpa) (AISC 341-16, A3.1)*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	68.76 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	79.99	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	68.76 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	79.99	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	57.19 mm	*Distance from end of left brace to hinge line*		
t_g	25.00 mm	*Thickness of gusset plate*		
$2*t_g$	50.00 mm	*Lower limiting thickness of the gusset plate*		
$4*t_g$	100.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: $2*t_g$ <= d_h <= $4*t_g$ (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	57.19 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	90.00 mm	*Half of beam flange width*		
t_{bf}	15.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	6.00	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	470.00 mm	*Clear distance between beam flanges*		
t_{bw}	20.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	23.50	*Width to thickness ratio, h_b/t_{bw}*		

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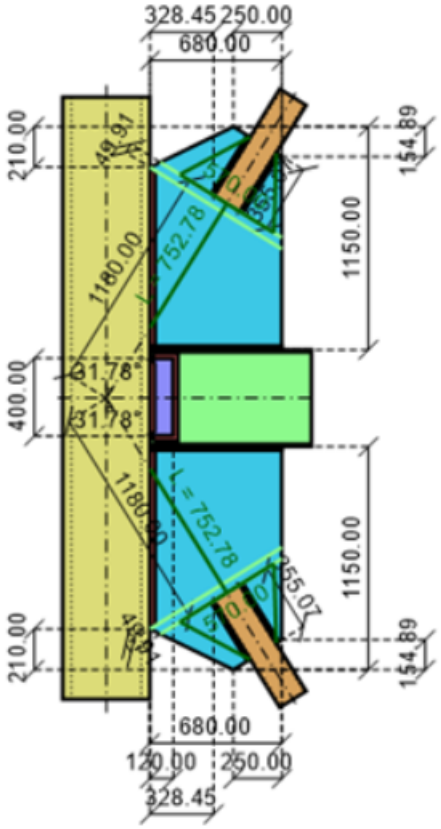
Limit State	Required	Available	Unity Check	Result
Limit	36.05	*Limiting ratio, max(0.88*(E_b/(R_{yb}*F_{yb}))$^{0.5}$*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))$^{0.5}$)*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br-left}$	156.00 mm	*Inside dimension of left brace tube*		
$t_{br-left}$	12.00 mm	*Left brace tube wall thickness*		
$E_{br-left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
R_{y-left}	1.25	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr-left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br-left}/t_{br-left}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br-left}$/(R_{y-left} * $F_{ybr-left}$))$^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br-right}$	156.00 mm	*Inside dimension of right brace tube*		
$t_{br-right}$	12.00 mm	*Right brace tube wall thickness*		
$E_{br-right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y-right}$	1.25	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr-right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	13.00	*Width to thickness ratio, $b_{br-right}/t_{br-right}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br-right}$/($R_{y-right}$ * $F_{ybr-right}$))$^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	25.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	408.18 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7387.80 mm^2	*Net area with reinf bars =(A_g+A_r)-2*(t_p+2*gap)*t_{des}*		
A_{no}	7387.80 mm^2	*Net area without reinf bars =A_g-2*(t_p+2*gap)*t_{des}*		
A_e	6166.08 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3307.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		

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A12. Salud Chev-EJE6/1-AR1-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	10795.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8841.57 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	25.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	12.00 mm	*Brace wall thickness*		
L	408.18 mm	*Length of brace to gusset connection*		
B	180.00 mm	*Depth of brace member*		
H	180.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	67.50 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	8064.00 mm^2	*Gross area of brace*		
A_n	7387.80 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	7387.80 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	6166.08 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	3307.16 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	41.27 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	73.86 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	10795.05 mm^2	*Adjusted net area of the composite section*		
A_e'	8841.57 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	3407.25 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

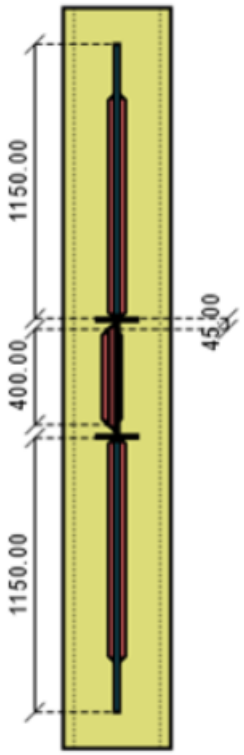
Side view



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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

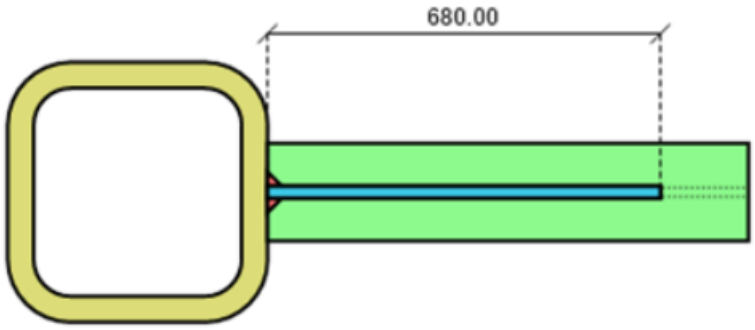
Front view



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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

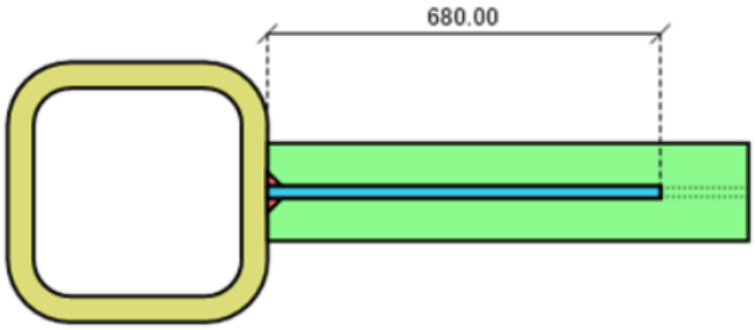
Top view



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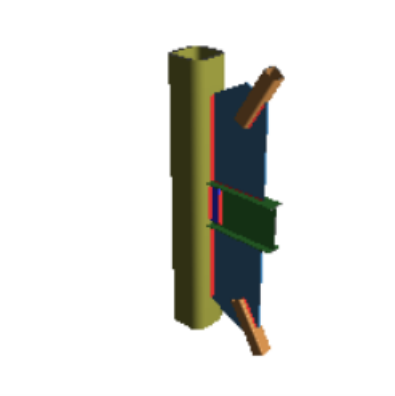
A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: 2D Views Report (continued):

Bottom view



A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Summary Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear Load	75.00 kN	*User Input Shear Load*
Beam Story Force	0.00 kN	*Design maximum beam story force*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*
Top Brace Axial (Tension)	-2585.53 kN	*Design tensile load in top brace*
Top Brace Axial(Compression)	1414.76 kN	*Design compressive load in top brace*
Bot Brace Axial (Tension)	-2585.53 kN	*Design tensile load in bottom brace*
Bot Brace Axial(Compression)	1414.76 kN	*Design compressive load in bottom brace*

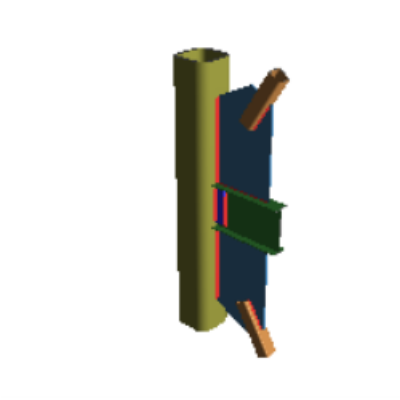
Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	2*t_p	*Gusset Hinge Line Method for Brace Buckling Check*

Connection	Required	Max Unity Check	Result
Beam/Column connection	Beam Shear Rupture	**0.75**	**PASS**
Top Gusset/Beam connection	Plate Shear Rupture	**0.27**	**PASS**
Bottom Gusset/Beam connection	Plate Shear Rupture	**0.27**	**PASS**
Top Gusset/Column connection	Plate Shear Rupture	**0.40**	**PASS**
Bottom Gusset/Column connection	Plate Shear Rupture	**0.40**	**PASS**
Top Gusset/Brace connection	Brace Weld Strength	**0.90**	**PASS**
Bottom Gusset/Brace connection	Brace Weld Strength	**0.90**	**PASS**
Seismic Calculations	Seismic Weld Strength at Column (Top)	**0.66**	**PASS**

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Beam/Column Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1136.05 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	0.00 kN	*Calculated Axial due to Compression Brace Loading*
Shear(Tension)	-986.05 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-622.27 kN	*Calculated Axial due to Tension Brace Loading (SD2)*
Resultant Force	1185.01 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment due ecc	109.08 kN-m	*Calculated Maximum Moment due Eccentricity (SD3)*
Column Force	4500.00 kN	*User Input Column Force*
Column Moment	200.00 kN-m	*User Input Column Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	30.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L_{min}	400.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{max}	28.41 mm	*Max Size Allowed*		
t	30.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	120.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	25.00 mm	*Weld size*		
L_{max}	400.00 mm	*Max weld segment length*		
Beam Shear Yield	1136.05 kN	1551.32 kN	**0.73**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 1.00$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	7500.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	1551.32 kN	*Shear yield strength*		
Plate Shear Yield	1136.05 kN	2482.11 kN	**0.46**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	12000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2482.11 kN	*Shear yield strength*		
Beam Shear Rupture	1136.05 kN	1512.54 kN	**0.75**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	7500.00 mm^2	*Net area subject to shear*		
ϕR_n	1512.54 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	1136.05 kN	2420.06 kN	**0.47**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	12000.00 mm^2	*Net area subject to shear*		
ϕR_n	2420.06 kN	*Shear rupture strength*		
Beam Axial Yield	622.27 kN	3481.16 kN	**0.18**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	11220.00 mm^2	*Gross area subject to tension*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	3481.16 kN	*Tensile yield strength*		
Plate Axial Yield	622.27 kN	3723.17 kN	**0.17**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area subject to tension*		
ϕR_n	3723.17 kN	*Tensile yield strength*		
Beam Tension Rupture	622.27 kN	3210.57 kN	**0.19**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	9551.87 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11220.00 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (Table D3.1, Case 2)*		
U_{Bound}	0.64	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, U = max($U_{D3.1}$, U_{Bound})*		
ϕR_n	3210.57 kN	*Tensile rupture strength*		
Plate Tension Rupture	622.27 kN	4033.43 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area subject to tension*		
ϕR_n	4033.43 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.42**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-622.27 kN	*Calculated axial load*		
V_r	1136.05 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12000.00 mm^2	*Gross area of the plate*		
Z_{pl}	1200000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	3723.17 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2482.11 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	109.08 kN-m	*Calculated moment*		
M_c	372.31 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.42	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.40**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-622.27 kN	*Calculated axial load*		
V_r	1136.05 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	12000.00 mm^2	*Net area of the plate*		
Z_{net}	1200000.00 mm^3	*Plastic modulus of net section*		
P_c	4033.43 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2420.06 kN	*Available shear strength (see check 'Shear Rupture')*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	109.08 kN-m	*Calculated moment*		
M_c	403.34 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.40	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Buckling				**n/a**
In accordance with AISC Specifications Sect.F11.2(a), the check does not apply because $Lb*d/tp^2 <= 0.08*E/Fy$				
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	0.00 mm	*Unbraced length*		
d	400.00 mm	*Plate depth*		
t_p	30.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
Weld at Column	2.98 kN/mm	7.68 kN/mm	**0.39**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	2.84 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-0.91 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	2.98 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	7.68 kN/mm	*Weld strength*		
Weld at Beam	1.87 kN/mm	3.02 kN/mm	**0.62**	**PASS**
$\phi Rn = C_1 * \alpha * 1.392 * D_{16}$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	15.00 mm	*Base material thickness (beam)*		
α	0.79	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	25.00 mm	*Weld fillet size*		
r_u	1.87 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	3.02 kN/mm	*Weld strength*		
HSS Column Transverse Plastification	337.11 kN	4982.63 kN	**0.07**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	400.00 mm	*Length of shear plate*		

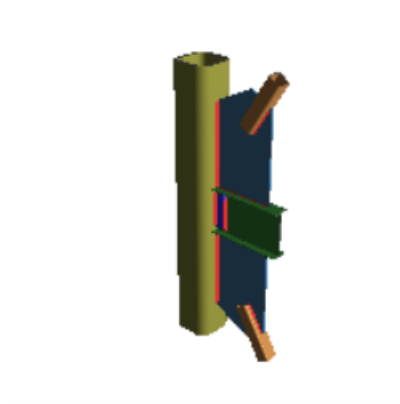
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Beam/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	120.00 mm	*Distance from left side to edge of shear plate (AISC 15th Fig.9-5)*		
b	165.00 mm	*Distance from right side to edge of shear plate (AISC 15th Fig.9-5)*		
c	30.00 mm	*Width of shear plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	4982.63 kN	*Transverse plastification strength*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	407.36 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	375.25 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-744.48 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-685.80 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1012.21 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	47.05 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	744.48 kN	2813.06 kN	**0.26**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	13600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2813.06 kN	*Shear yield strength*		
Plate Shear Rupture	744.48 kN	2742.73 kN	**0.27**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13600.00 mm^2	*Net area subject to shear*		
ϕR_n	2742.73 kN	*Shear rupture strength*		
Plate Axial Yield	685.80 kN	4219.59 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Tension Rupture	685.80 kN	4571.22 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report (continued):

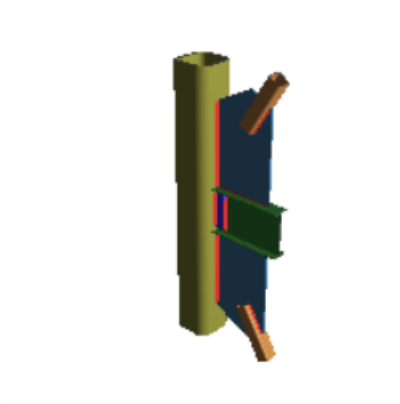
Limit State	Required	Available	Unity Check	Result
A_n	13600.00 mm^2	*Net area subject to tension*		
ϕR_n	4571.22 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-685.80 kN	*Calculated axial load*		
V_r	744.48 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area of the plate*		
Z_{pl}	2312000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4219.59 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2813.06 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	47.05 kN-m	*Calculated moment*		
M_c	717.33 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-685.80 kN	*Calculated axial load*		
V_r	744.48 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13600.00 mm^2	*Net area of the plate*		
Z_{net}	2312000.00 mm^3	*Plastic modulus of net section*		
P_c	4571.22 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2742.73 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	47.05 kN-m	*Calculated moment*		
M_c	777.10 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	685.80 kN	3516.33 kN	**0.20**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	680.00 mm	*Length of bearing*		
ϕR_n	3516.33 kN	*Beam web local yielding*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	375.25 kN	6718.69 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.36	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	680.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	6718.69 kN	*Beam web crippling capacity*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	407.36 kN	*Calculated Shear due to Compression Brace Loading (SD1)*
Axial(Compression)	375.25 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-744.48 kN	*Calculated Shear due to Tension Brace Loading (SD3)*
Axial(Tension)	-685.80 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1012.21 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	47.05 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	744.48 kN	2813.06 kN	**0.26**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	13600.00 mm^2	*Gross area subject to shear*		
ϕR_n	2813.06 kN	*Shear yield strength*		
Plate Shear Rupture	744.48 kN	2742.73 kN	**0.27**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13600.00 mm^2	*Net area subject to shear*		
ϕR_n	2742.73 kN	*Shear rupture strength*		
Plate Axial Yield	685.80 kN	4219.59 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area subject to tension*		
ϕR_n	4219.59 kN	*Tensile yield strength*		
Plate Tension Rupture	685.80 kN	4571.22 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	13600.00 mm^2	*Net area subject to tension*		
ϕR_n	4571.22 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-685.80 kN	*Calculated axial load*		
V_r	744.48 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13600.00 mm^2	*Gross area of the plate*		
Z_{pl}	2312000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4219.59 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2813.06 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	47.05 kN-m	*Calculated moment*		
M_c	717.33 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.12**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-685.80 kN	*Calculated axial load*		
V_r	744.48 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13600.00 mm^2	*Net area of the plate*		
Z_{net}	2312000.00 mm^3	*Plastic modulus of net section*		
P_c	4571.22 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2742.73 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	47.05 kN-m	*Calculated moment*		
M_c	777.10 kN-m	*Available moment $M_c= \varphi*(F_u* Znet)$, $\varphi=0.75$*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	685.80 kN	3516.33 kN	**0.20**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_w$		**ϕ = 1.00**	(J10-3)	
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
d_{col}	500.00 mm	*Beam depth*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	680.00 mm	*Length of bearing*		
ϕR_n	3516.33 kN	*Beam web local yielding*		

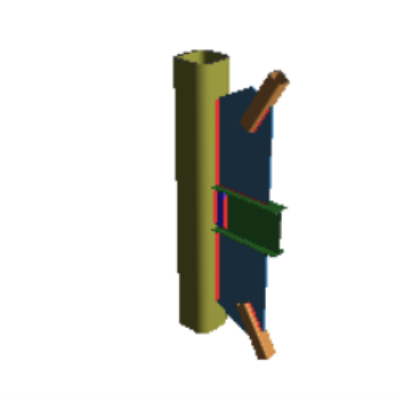
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Beam Report (continued):

Limit State	Required	Available	Unity Check	Result
Beam Web Crippling	375.25 kN	6718.69 kN	**0.06**	**PASS**
$R_n = 0.8*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f$	**ϕ = 0.75**	(J10-4)		
d_{end}	340.00 mm	*Distance from concentrated force to the edge of beam*		
l_b/d_{col}	1.36	*Bearing length to beam depth ratio*		
d_{col}	500.00 mm	*Beam depth*		
t_w	15.00 mm	*Beam web thickness*		
t_f	12.00 mm	*Beam flange thickness*		
l_b	680.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
E	199948.01 MPa	*Modulus of elasticity of beam*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	6718.69 kN	*Beam web crippling capacity*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	827.40 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	337.73 kN	*Calculated Axial due to Compression Brace Loading (SD3)*
Shear(Tension)	-1512.11 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-617.22 kN	*Calculated Axial due to Tension Brace Loading (SD1)*
Resultant Force	1633.22 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD1)*
Moment Load	-50.13 kN-m	*Calculated Maximum Moment (SD1)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	940.00 mm	*Min weld segment length*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1512.11 kN	3888.64 kN	**0.39**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	18800.00 mm^2	*Gross area subject to shear*		
ϕR_n	3888.64 kN	*Shear yield strength*		
Plate Shear Rupture	1512.11 kN	3791.43 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	18800.00 mm^2	*Net area subject to shear*		
ϕR_n	3791.43 kN	*Shear rupture strength*		
Plate Axial Yield	617.22 kN	5832.97 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area subject to tension*		
ϕR_n	5832.97 kN	*Tensile yield strength*		
Plate Tension Rupture	617.22 kN	6319.05 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area subject to tension*		
ϕR_n	6319.05 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.17**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-617.22 kN	*Calculated axial load*		
V_r	1512.11 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area of the plate*		
Z_{pl}	4418000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	5832.97 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3888.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	50.13 kN-m	*Calculated moment*		
M_c	1370.74 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.17	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-617.22 kN	*Calculated axial load*		
V_r	1512.11 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area of the plate*		
Z_{net}	4418000.00 mm^3	*Plastic modulus of net section*		
P_c	6319.05 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3791.43 kN	*Available shear strength (see check 'Shear Rupture')*		

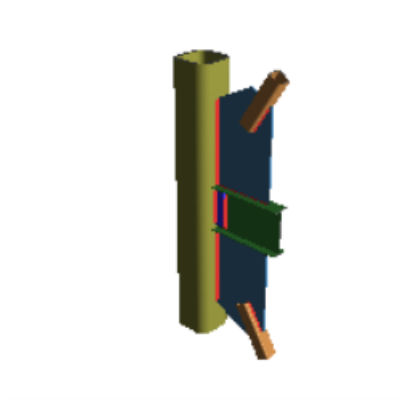
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	50.13 kN-m	*Calculated moment*		
M_c	1484.97 kN-m	*Available moment* $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$		
UC	0.18	*Unity check per interaction equation,* $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$		
Column Weld Strength	1.89 kN/mm	6.14 kN/mm	**0.31**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD1				
V	1512.11 kN	*Shear Load*		
P	-617.22 kN	*Axial Load*		
M	-50.13 kN-m	*Moment*		
e_{eff}	30.70 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.61 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.00 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	1.89 kN/mm	*Resultant force* $r_{3d} = (r_u^2 + r_0^2)^{0.5}$		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	50.13 kN-m	2549.57 kN-m	**0.02**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	940.00 mm	*Plate length*		
M_e	-50.13 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2549.57 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	617.22 kN	7334.35 kN	**0.08**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	940.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7334.35 kN	*Transverse plastification strength*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Shear(Compression)	1512.11 kN	*Calculated Shear due to Compression Brace Loading (SD3)*
Axial(Compression)	337.73 kN	*Calculated Axial due to Compression Brace Loading (SD1)*
Shear(Tension)	-827.40 kN	*Calculated Shear due to Tension Brace Loading (SD1)*
Axial(Tension)	-617.22 kN	*Calculated Axial due to Tension Brace Loading (SD3)*
Resultant Force	1633.22 kN	*Calculated Maximum Resultant Force due to Brace Loading (SD3)*
Moment Load	-50.13 kN-m	*Calculated Maximum Moment (SD3)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	344.74 MPa	*Column yield strength*		
t	45.00 mm	*Column wall thickness*		
B	450.00 mm	*Column face width*		
b	315.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	33.72	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	25.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	25.00 mm	*Weld size*		
L_{min}	940.00 mm	*Min weld segment length*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	1512.11 kN	3888.64 kN	**0.39**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	18800.00 mm^2	*Gross area subject to shear*		
ϕR_n	3888.64 kN	*Shear yield strength*		
Plate Shear Rupture	1512.11 kN	3791.43 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	18800.00 mm^2	*Net area subject to shear*		
ϕR_n	3791.43 kN	*Shear rupture strength*		
Plate Axial Yield	617.22 kN	5832.97 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area subject to tension*		
ϕR_n	5832.97 kN	*Tensile yield strength*		
Plate Tension Rupture	617.22 kN	6319.05 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area subject to tension*		
ϕR_n	6319.05 kN	*Tensile rupture strength*		
Plate Flexural Yield			**0.17**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-617.22 kN	*Calculated axial load*		
V_r	1512.11 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	18800.00 mm^2	*Gross area of the plate*		
Z_{pl}	4418000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	5832.97 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3888.64 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	50.13 kN-m	*Calculated moment*		
M_c	1370.74 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.17	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.18**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-617.22 kN	*Calculated axial load*		
V_r	1512.11 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	18800.00 mm^2	*Net area of the plate*		
Z_{net}	4418000.00 mm^3	*Plastic modulus of net section*		
P_c	6319.05 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3791.43 kN	*Available shear strength (see check 'Shear Rupture')*		

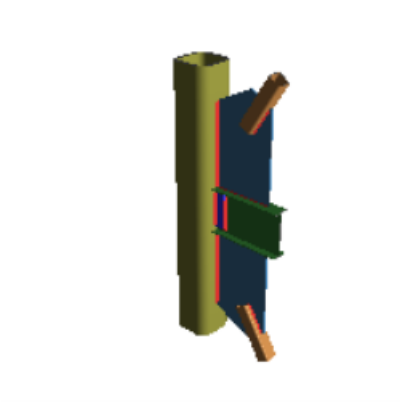
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Col Report (continued):

Limit State	Required	Available	Unity Check	Result
M_r	50.13 kN-m	*Calculated moment*		
M_c	1484.97 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.18	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Column Weld Strength	1.89 kN/mm	6.14 kN/mm	**0.31**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
Governing Loading Direction SD3				
V	1512.11 kN	*Shear Load*		
P	-617.22 kN	*Axial Load*		
M	-50.13 kN-m	*Moment*		
e_{eff}	30.70 mm	*Effective eccentricity*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	45.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	25.00 mm	*Weld fillet size*		
r_u	1.61 kN/mm	*Required strength of the weld for in-plane force*		
r_0	-1.00 kN/mm	*Required strength of the weld for out-of-plane force (tensile)*		
r_{3d}	1.89 kN/mm	*Resultant force $r_{3d} = (r_u^2 + r_0^2)^{0.5}$*		
ϕRn	6.14 kN/mm	*Weld strength*		
HSS Punching Shear	27.43 kN-m	2549.57 kN-m	**0.01**	**PASS**
$M_n = 0.2*F_u*t*l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	427.48 MPa	*Column tensile strength*		
t	45.00 mm	*Column wall thickness*		
l_p	940.00 mm	*Plate length*		
M_e	27.43 kN-m	*Calculated moment at Column/Gusset per unlimited method*		
ϕM_n	2549.57 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	337.73 kN	7334.35 kN	**0.05**	**PASS**
$R_n = (0.5*t^2*F_y) * ((a+b)*(4*((T*a*b)/(a+b))^{0.5} + L)/(a*b))*Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	344.74 MPa	*Minimum yield stress of column material*		
B	450.00 mm	*Column width*		
t	45.00 mm	*Column wall thickness*		
L	940.00 mm	*Length of gusset plate*		
T	315.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	147.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	147.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7334.35 kN	*Transverse plastification strength*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	355.07 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	355.07 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3537.00 kN	**0.73**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	11399.97 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	570.00 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3537.00 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	3831.75 kN	**0.67**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	570.00 mm	*Whitmore tensile width*		

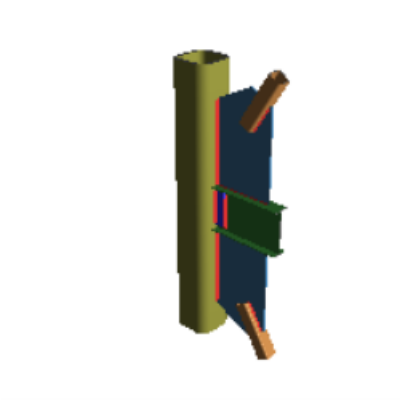
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Top Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11399.97 mm^2	*Net area of plate*		
ϕR_n	3831.75 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	2592.25 kN	**0.55**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	752.78 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	376.39 mm	*Effective length, L_c=K*L*		
L_c/r	65.19	*Plate slenderness check from J4-6*		
F_{cr}	252.66 MPa	*Flexural buckling stress (E3-2)*		
A_g	11399.97 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2592.25 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1546.46 kN	**0.65**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4600.94 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1546.46 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	2864.05 kN	**0.90**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (top brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	355.07 mm	*Weld length*		
ϕRn	2864.05 kN	*Weld strength*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Brace Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	355.07 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	355.07 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3537.00 kN	**0.73**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	11399.97 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	570.00 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3537.00 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	3831.75 kN	**0.67**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	570.00 mm	*Whitmore tensile width*		

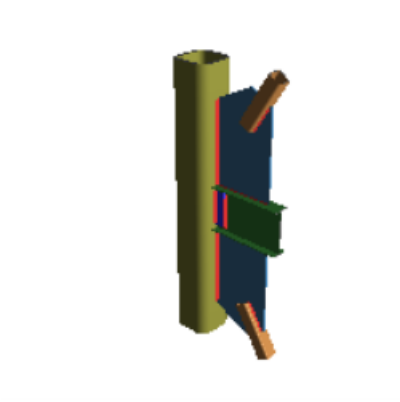
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Bot Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
A_n	11399.97 mm^2	*Net area of plate*		
ϕR_n	3831.75 kN	*Plate tensile rupture strength*		
Gusset Plate Compression (Whitmore)	1414.76 kN	2592.25 kN	**0.55**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.50	*Effective length factor*		
L	752.78 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	376.39 mm	*Effective length, L_c=K*L*		
L_c/r	65.19	*Plate slenderness check from J4-6*		
F_{cr}	252.66 MPa	*Flexural buckling stress (E3-2)*		
A_g	11399.97 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	2592.25 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1546.46 kN	**0.65**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4600.94 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.83	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.83	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1546.46 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	2864.05 kN	**0.90**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (bottom brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	355.07 mm	*Weld length*		
ϕRn	2864.05 kN	*Weld strength*		

A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report

Vertical Brace Diagonal Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Column	K450*20-eq	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Plate	P30.00x120.00x400.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Top Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Bottom Gusset	P20.00x1150.00x680.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{top}	550.00 cm	*User Input Clear Span of Top Brace*
L_{bottom}	550.00 cm	*User Input Clear Span of Bottom Brace*
K_{top}	1.00	*User Input Effective Length Factor of Top Brace*
K_{bottom}	1.00	*User Input Effective Length Factor of Bottom Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*
Gusset Hinge Line	$2*t_p$	*Gusset Hinge Line Method for Brace Buckling Check*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Top Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ratio of expected yield stress to minimum yield stress of the top brace material*		
$A_{br\text{-}top}$	6000.00 mm^2	*Area of the top brace*		
$P_{exp\text{-}t\text{-}top}$	2585.53 kN	*Top brace expected strength in tension = $R_y*F_y*A_{br}$*		
Bottom Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ratio of expected yield stress to minimum yield stress of the bottom brace material*		
$A_{br\text{-}bot}$	6000.00 mm^2	*Area of the bottom brace*		
$P_{exp\text{-}t\text{-}bot}$	2585.53 kN	*Bottom brace expected strength in tension = $R_y*F_y*A_{br}$*		
Top Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*Length of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = $K_{top}*L_{top}$*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
E_{top}	199948.01 MPa	*Elastic modulus of the top brace material*		
$r_{y\text{-}top}$	61.37 mm	*Radius of gyration about the weak axis of the top brace*		
$F_{e\text{-}top}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) =* $(\pi^2 * E)/(L_{c\text{-}top}/r_y)^2$		
$F_{cre\text{-}top}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) =* $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$		
$P_{exp\text{-}ci\text{-}top}$	1414.76 kN	*Top brace expected strength in compression =* $\min(R_y * F_y * A_{br}, 1.14 * F_{cre} * A_{br})$		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}top}$	424.43 kN	*Post-buckling expected compressive strength =* $0.3 * P_{exp\text{-}ci\text{-}top}$		
Bottom Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*Length of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace =* $K_{bot} * L_{bot}$		
E_{bot}	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$r_{y\text{-}bot}$	61.37 mm	*Radius of gyration about the weak axis of the bottom brace*		
$F_{e\text{-}bot}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) =* $(\pi^2 * E)/(L_{c\text{-}bot}/r_y)^2$		
$F_{cre\text{-}bot}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) =* $R_y * F_y * (0.658^{((R_y * F_y)/F_e)})$		
$P_{exp\text{-}ci\text{-}bot}$	1414.76 kN	*Bottom brace expected strength in compression =* $\min(R_y * F_y * A_{br}, 1.14 * F_{cre} * A_{br})$		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}bot}$	424.43 kN	*Post-buckling expected compressive strength =* $0.3 * P_{exp\text{-}ci\text{-}bot}$		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}top}$	-1000.00 kN	*User input tensile axial load in top brace*		
$P_{br\text{-}t\text{-}bot}$	-1000.00 kN	*User input tensile axial load in bottom brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}top}$	-2585.53 kN	*Design tensile load in top brace member =* $P_{exp\text{-}t\text{-}top}/\alpha_s$ *(negative for tension)*		
$P_{des\text{-}t\text{-}bot}$	-2585.53 kN	*Design tensile load in bottom brace member =* $P_{exp\text{-}t\text{-}bot}/\alpha_s$ *(negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}top}$	1000.00 kN	*User input compressive axial load in top brace*		
$P_{br\text{-}c\text{-}bot}$	1000.00 kN	*User input compressive axial load in bottom brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}top}$	1414.76 kN	*Design compressive load in top brace member =* $P_{exp\text{-}ci\text{-}top}/\alpha_s$		
$P_{des\text{-}ci\text{-}bot}$	1414.76 kN	*Design compressive load in bottom brace member =* $P_{exp\text{-}ci\text{-}bot}/\alpha_s$		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}top}$	424.43 kN	*Design compressive load in top brace member =* $P_{exp\text{-}cii\text{-}top}/\alpha_s$		
$P_{des\text{-}cii\text{-}bot}$	424.43 kN	*Design compressive load in bottom brace member =* $P_{exp\text{-}cii\text{-}bot}/\alpha_s$		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Top brace in tension, bottom brace in compression (i)*		
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace design load per loading direction SD1*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace design load per loading direction SD1*		
Loading Direction SD2		*Top brace in tension, bottom brace in compression (ii)*		
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace design load per loading direction SD2*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace design load per loading direction SD2*		
Loading Direction SD3		*Top brace in compression (i), bottom brace in tension*		
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace design load per loading direction SD3*		
$P_{bot\text{-}SD3}$	-2585.53 kN	*Bottom brace design load per loading direction SD3*		
Loading Direction SD4		*Top brace in compression (ii), bottom brace in tension*		
$P_{top\text{-}SD4}$	424.43 kN	*Top brace design load per loading direction SD4*		
$P_{bot\text{-}SD4}$	-2585.53 kN	*Bottom brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
$P_{top\text{-}SD1}$	-2585.53 kN	*Top brace load per loading direction SD1, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace load per loading direction SD1, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD1}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD1}$	1414.76 kN	*Bottom brace expected strength in compression (i)*		
$O_{top\text{-}SD1}$	1414.76 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD1}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD1}	0.00 kN	*Story force at beam level for loading direction SD1 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD1}$	0.00 kN	*Axial force in beam at connection = SF_{SD1}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD1\text{-}top}$	-1512.11 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}top}$	-617.22 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}top}$	-50.13 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD1\text{-}top}$	-685.80 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}top}$	-744.48 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}top}$	47.05 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD1\text{-}bot}$	-827.40 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD1\text{-}bot}$	337.73 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD1\text{-}bot}$	27.43 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD1\text{-}bot}$	375.25 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD1\text{-}bot}$	407.36 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD1\text{-}bot}$	-25.75 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{bcSD1}	-986.05 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD1\text{-}top}$ - $V_{bmSD1\text{-}bot}$*		
H_{bcSD1}	-337.11 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD1}$ + $H_{bmSD1\text{-}top}$ + $H_{bmSD1\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
$P_{top\text{-}SD2}$	-2585.53 kN	*Top brace load per loading direction SD2, see "Seismic Loading Directions"*		
$P_{bot\text{-}SD2}$	424.43 kN	*Bottom brace load per loading direction SD2, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top\text{-}SD2}$	-2585.53 kN	*Top brace expected strength in tension*		
$G_{bot\text{-}SD2}$	424.43 kN	*Bottom brace expected strength in compression (ii)*		
$O_{top\text{-}SD2}$	424.43 kN	*Assumed opposite side top brace force*		
$O_{bot\text{-}SD2}$	-2585.53 kN	*Assumed opposite side bottom brace force*		
SF_{SD2}	0.00 kN	*Story force at beam level for loading direction SD2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD2}$	0.00 kN	*Axial force in beam at connection = SF_{SD2}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD2\text{-}top}$	-1512.11 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}top}$	-617.22 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}top}$	-50.13 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD2\text{-}top}$	-685.80 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}top}$	-744.48 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}top}$	47.05 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD2\text{-}bot}$	-248.22 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD2\text{-}bot}$	101.32 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD2\text{-}bot}$	8.23 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD2\text{-}bot}$	112.58 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD2\text{-}bot}$	122.21 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD2\text{-}bot}$	-7.72 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD2}	-723.37 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD2\text{-}top}$ - $V_{bmSD2\text{-}bot}$*		
H_{bcSD2}	-622.27 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD2}$ + $H_{bmSD2\text{-}top}$ + $H_{bmSD2\text{-}bot}$*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
$P_{top\text{-}SD3}$	1414.76 kN	*Top brace load per loading direction SD3, see "Seismic Loading Directions"*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
$P_{bot-SD3}$	-2585.53 kN	*Bottom brace load per loading direction SD3, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD3}$	1414.76 kN	*Top brace expected strength in compression (i)*		
$G_{bot-SD3}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD3}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD3}$	1414.76 kN	*Assumed opposite side bottom brace force*		
SF_{SD3}	0.00 kN	*Story force at beam level for loading direction SD3 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
P_{bm-SD3}	0.00 kN	*Axial force in beam at connection = SF_{SD3}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD3-top}$	827.40 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-top}$	337.73 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-top}$	27.43 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD3-top}$	375.25 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-top}$	407.36 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-top}$	-25.75 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD3-bot}$	1512.11 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD3-bot}$	-617.22 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD3-bot}$	-50.13 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD3-bot}$	-685.80 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD3-bot}$	-744.48 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD3-bot}$	47.05 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD3}	1136.05 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD3-top}$ - $V_{bmSD3-bot}$*		
H_{bcSD3}	-337.11 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = P_{bm-SD3} + $H_{bmSD3-top}$ + $H_{bmSD3-bot}$*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
$P_{top-SD4}$	424.43 kN	*Top brace load per loading direction SD4, see "Seismic Loading Directions"*		
$P_{bot-SD4}$	-2585.53 kN	*Bottom brace load per loading direction SD4, see "Seismic Loading Directions"*		
V_{bm}	75.00 kN	*User-input shear force in beam*		
Beam Story Force:				
$G_{top-SD4}$	424.43 kN	*Top brace expected strength in compression (ii)*		
$G_{bot-SD4}$	-2585.53 kN	*Bottom brace expected strength in tension*		
$O_{top-SD4}$	-2585.53 kN	*Assumed opposite side top brace force*		
$O_{bot-SD4}$	424.43 kN	*Assumed opposite side bottom brace force*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
SF_{SD4}	0.00 kN	*Story force at beam level for loading direction SD4 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
$P_{bm\text{-}SD4}$	0.00 kN	*Axial force in beam at connection = SF_{SD4}/2 (Per AISC Seismic Design Manual Example 5.3.5 methodology)*		
Top Gusset/Column Connection:				
$V_{colSD4\text{-}top}$	248.22 kN	*Top gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}top}$	101.32 kN	*Top gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}top}$	8.23 kN-m	*Top gusset/column moment per AISC 15th, p. 13-10*		
Top Gusset/Beam Connection:				
$V_{bmSD4\text{-}top}$	112.58 kN	*Top gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}top}$	122.21 kN	*Top gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}top}$	-7.72 kN-m	*Top gusset/beam moment per AISC 15th, p. 13-10*		
Bottom Gusset/Column Connection:				
$V_{colSD4\text{-}bot}$	1512.11 kN	*Bottom gusset/column vertical load per AISC 15th, eqn. (13-2)*		
$H_{colSD4\text{-}bot}$	-617.22 kN	*Bottom gusset/column horizontal load per AISC 15th, eqn. (13-3)*		
$M_{colSD4\text{-}bot}$	-50.13 kN-m	*Bottom gusset/column moment per AISC 15th, p. 13-10*		
Bottom Gusset/Beam Connection:				
$V_{bmSD4\text{-}bot}$	-685.80 kN	*Bottom gusset/beam vertical load per AISC 15th, eqn. (13-4)*		
$H_{bmSD4\text{-}bot}$	-744.48 kN	*Bottom gusset/beam horizontal load per AISC 15th, eqn. (13-5)*		
$M_{bmSD4\text{-}bot}$	47.05 kN-m	*Bottom gusset/beam moment per AISC 15th, p. 13-10*		
Beam /Column Connection:				
V_{bcSD4}	873.37 kN	*Beam/column vertical load per AISC 15th, page 13-5 = V_{bm} + $V_{bmSD4\text{-}top}$ - $V_{bmSD4\text{-}bot}$*		
H_{bcSD4}	-622.27 kN	*Beam/column horizontal load per AISC 15th, page 13-5 = $P_{bm\text{-}SD4}$ + $H_{bmSD4\text{-}top}$ + $H_{bmSD4\text{-}bot}$*		
Seismic Load Distribution (Governing)				**n/a**
Top Gusset/Column Connection:				
Shear (Compression)	827.40 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	337.73 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-1512.11 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-617.22 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1633.22 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	-50.13 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Column Connection:				
Shear (Compression)	1512.11 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	337.73 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-827.40 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-617.22 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1633.22 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	-50.13 kN-m	*Maximum moment (loading direction SD3 governs)*		
Top Gusset/Beam Connection:				

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Shear (Compression)	407.36 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	375.25 kN	*Maximum compressive axial force (loading direction SD3 governs)*		
Shear (Tension)	-744.48 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-685.80 kN	*Maximum tension axial force (loading direction SD1 governs)*		
Resultant force	1012.21 kN	*Maximum resultant shear force (loading direction SD1 governs)*		
Moment	47.05 kN-m	*Maximum moment (loading direction SD1 governs)*		
Bottom Gusset/Beam Connection:				
Shear (Compression)	407.36 kN	*Maximum compressive shear force (loading direction SD1 governs)*		
Axial (Compression)	375.25 kN	*Maximum compressive axial force (loading direction SD1 governs)*		
Shear (Tension)	-744.48 kN	*Maximum tension shear force (loading direction SD3 governs)*		
Axial (Tension)	-685.80 kN	*Maximum tension axial force (loading direction SD3 governs)*		
Resultant force	1012.21 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	47.05 kN-m	*Maximum moment (loading direction SD3 governs)*		
Beam/Column Connection:				
Shear (Compression)	1136.05 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Shear (Tension)	-986.05 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Axial (Tension)	-622.27 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Resultant force	1185.01 kN	*Maximum resultant shear force (loading direction SD3 governs)*		
Moment	109.08 kN-m	*Maximum moment (loading direction SD3 governs)*		
Seismic Joint Fasteners				**PASS**
All column fasteners must be the same type, AISC 341-16 section D2.2(b)				
Top Gusset to Column Fastener	Welded			
Beam to Column Fastener	Welded			
Bot Gusset to Column Fastener	Welded			
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: D_{wv} <= $d_{beam}/10$*		
D_{wv}	0.00 mm	*Distance from beam centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: D_{wh} <= $d_{beam}/10$*		
D_{wh}	0.00 mm	*Distance from column centerline to workpoint*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
$F_{y\text{-}col}$	344.74 MPa	*Minimum yield stress of the column material*		
Check Max Yield Stress of the Top Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Max Yield Stress of the Bottom Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Seismic Brace Slenderness				**PASS**
Check Top Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{top}	1.00	*Effective length factor of the top brace*		
L_{top}	550.00 cm	*User-entered span of the top brace*		
$L_{c\text{-}top}$	550.00 cm	*Effective length of the top brace = K_{top}*L_{top}*		
$r_{y\text{-}top}$	61.37 mm	*Weak axis radius of gyration of the top brace*		
$L_{c\text{-}top}/r_{y\text{-}top}$	89.62	*Slenderness ratio of the top brace*		
Check Bottom Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{bot}	1.00	*Effective length factor of the bottom brace*		
L_{bot}	550.00 cm	*User-entered span of the bottom brace*		
$L_{c\text{-}bot}$	550.00 cm	*Effective length of the bottom brace = K_{bot}*L_{bot}*		
$r_{y\text{-}bot}$	61.37 mm	*Weak axis radius of gyration of the bottom brace*		
$L_{c\text{-}bot}/r_{y\text{-}bot}$	89.62	*Slenderness ratio of the bottom brace*		
Seismic Rotational Ductility				**PASS**
Check Beam/Col Rot. Ductility	**Pass**	*AISC 341-16 F2.6b(a)*		
$t_{b/c}$	30.00 mm	*Thickness of beam to column connector*		
$t_{max\text{-}weld}$	59.77 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}plate}$	58.50 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Top Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}top}$	49.91 mm	*Distance from end of top brace to hinge line*		
$t_{g\text{-}top}$	20.00 mm	*Thickness of top gusset plate*		
$2*t_{g\text{-}top}$	40.00 mm	*Lower limiting thickness of the top gusset plate*		
$4*t_{g\text{-}top}$	80.00 mm	*Upper limiting thickness of the top gusset plate*		
Check Bottom Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}bot}$	49.91 mm	*Distance from end of bottom brace to hinge line*		
$t_{g\text{-}bot}$	20.00 mm	*Thickness of bottom gusset plate*		
$2*t_{g\text{-}bot}$	40.00 mm	*Lower limiting thickness of the bottom gusset plate*		
$4*t_{g\text{-}bot}$	80.00 mm	*Upper limiting thickness of the bottom gusset plate*		
Seismic Column Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Column	**Pass**	*Condition: Ratio <= Limit*		
b_c	360.00 mm	*Inside dimension of column tube*		
t_c	45.00 mm	*Column tube wall thickness*		
E_c	199948.01 MPa	*Elastic modulus of the column material*		
R_{yc}	1.30	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of the column material*		
Ratio	8.00	*Width to thickness ratio, b_c/t_c*		
Limit	13.73	*Limiting ratio, $0.65*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		
Limit	36.05	*Limiting ratio, $max(0.88*(E_b/(R_{yb}*F_{yb}))^{0.5}*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))^{0.5})$*		
Seismic Top Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Top Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}top}$	140.00 mm	*Inside dimension of top brace tube*		
$t_{br\text{-}top}$	10.00 mm	*Top brace tube wall thickness*		
$E_{br\text{-}top}$	199948.01 MPa	*Elastic modulus of the top brace material*		
$R_{y\text{-}top}$	1.25	*Ration of expected yield stress to minimum yield stress of the top brace material*		
$F_{ybr\text{-}top}$	344.74 MPa	*Minimum yield stress of the top brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}top}/t_{br\text{-}top}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}top}/(R_{y\text{-}top} * F_{ybr\text{-}top}))^{0.5}$*		
Seismic Bottom Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Bottom Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br\text{-}bot}$	140.00 mm	*Inside dimension of bottom brace tube*		
$t_{br\text{-}bot}$	10.00 mm	*Bottom brace tube wall thickness*		
$E_{br\text{-}bot}$	199948.01 MPa	*Elastic modulus of the bottom brace material*		
$R_{y\text{-}bot}$	1.25	*Ration of expected yield stress to minimum yield stress of the bottom brace material*		
$F_{ybr\text{-}bot}$	344.74 MPa	*Minimum yield stress of the bottom brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br\text{-}bot}/t_{br\text{-}bot}$*		
Limit	14.00	*Limiting ratio, $0.65*(E_{br\text{-}bot}/(R_{y\text{-}bot} * F_{ybr\text{-}bot}))^{0.5}$*		
Check Seismic Top Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: $A_e >= A_g$, AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		

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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	355.07 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4600.94 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6504.23 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Bottom Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	355.07 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.83	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4600.94 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		

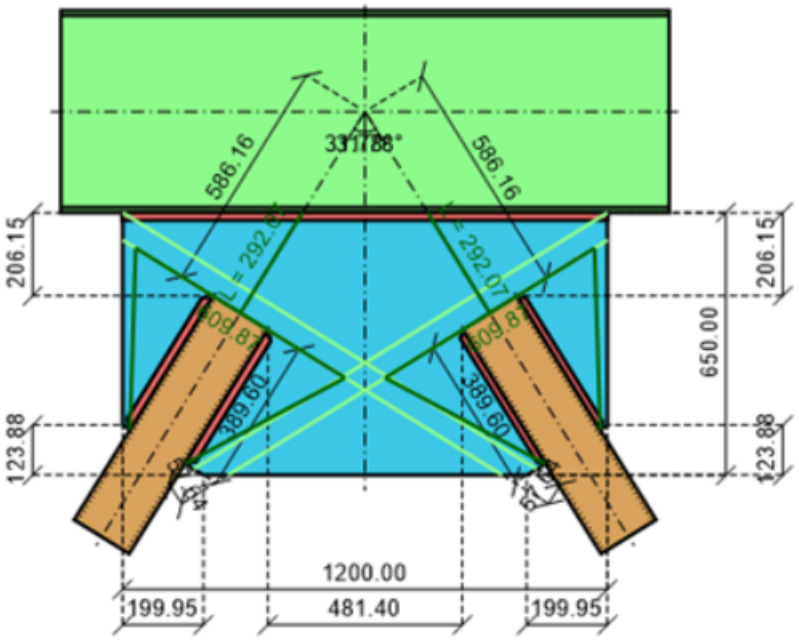
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A13. Salud EJE 3-AR4-C3/C4 EJE 1-2: Seismic Report (continued):

Limit State	Required	Available	Unity Check	Result
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.82	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6504.23 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

Seismic Weld Strength at Column (Top)	7129.18 kN	10825.25 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	940.00 mm	*Weld length*		
ϕR_n	10825.25 kN	*Weld strength*		
Seismic Weld Strength at Column (Bottom)	7129.18 kN	10825.25 kN	**0.66**	**PASS**
$\phi * R_n = \phi * 2 * 1.5 * 0.6 * F_{EXX} * 0.707 * w * L >= R_y * F_y * t_p * L$		**$\phi = 0.75$**	(AISC Seismic Design Manual, page 5-357)	
F_{EXX}	482.63 MPa	*Filler metal classification strength*		
w	25.00 mm	*Fillet weld size*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress of the plate material*		
F_y	344.74 MPa	*Minimum yield stress of the plate material*		
t_p	20.00 mm	*Gusset plate thickness*		
L	940.00 mm	*Weld length*		
ϕR_n	10825.25 kN	*Weld strength*		

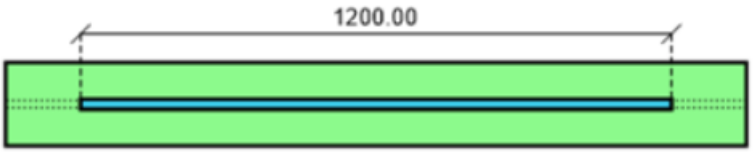
Left view



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A14. Salud Chev-EJE 3-AR4-VS2/VM2: 2D Views Report (continued):*

Bottom view



A14. Salud Chev-EJE 3-AR4-VS2/VM2: Summary Report*

Vertical Brace Chevron Connection



Material Properties:

Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Left Brace Axial (Tension)	-2585.53 kN	*Design tensile load in left brace*
Left Brace Axial(Compression)	1414.76 kN	*Design compressive load in left brace*
Right Brace Axial (Tension)	-2585.53 kN	*Design tensile load in right brace*
Right Brace Axial (Compression)	1414.76 kN	*Design compressive load in right brace*

Seismic Input Data:

Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Connection	Required	Max Unity Check	Result
Gusset/Beam connection	Plate Shear Rupture (Section a-a)	**0.44**	**PASS**
Gusset/Left Brace connection	Brace Weld Strength	**0.82**	**PASS**
Gusset/Right Brace connection	Brace Weld Strength	**0.82**	**PASS**
Seismic Calculations	Seismic Workpoint Limitations		**PASS**

A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Beam Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear(Tension, Section a-a)	-2106.79 kN	*Maximum shear due to tension at section a-a (SD1)*
Shear(Comp, Section a-a)	2106.79 kN	*Maximum shear due to compression at section a-a (SD3)*
Axial(Tension, Section a-a)	-1837.11 kN	*Maximum axial due to tension at section a-a (SD2)*
Axial(Comp, Section a-a)	0.00 kN	*Maximum axial due to compression at section a-a*
Moment Load (Section a-a)	-526.69 kN-m	*Maximum moment at section a-a (SD1)*
Shear(Tension, Section b-b)	-1041.90 kN	*Maximum shear due to tension at section b-b (SD1)*
Shear(Comp, Section b-b)	1041.90 kN	*Maximum shear due to compression at section b-b (SD3)*
Axial(Tension, Section b-b)	-569.08 kN	*Maximum axial due to tension at section b-b (SD4)*
Axial(Comp, Section b-b)	0.00 kN	*Maximum axial due to compression at section b-b*
Moment Load (Section b-b)	-51.66 kN-m	*Maximum moment at section b-b (SD4)*
Beam Moment	526.69 kN-m	*Maximum moment at beam (not used for design)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Workpoint Horiz. Offset	**Pass**	*Condition: -d_{beam}<=WP_h<=d_{beam}*		
WP_h	0.00 mm	*Horizontal brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Check Workpoint Vert. Offset	**Pass**	*Condition: -0.5*d_{beam}<=WP_v<=d_{beam}*		
WP_v	0.00 mm	*Vertical brace workpoint offset*		
d_{beam}	500.00 mm	*Depth of beam*		
Plate Shear Yield (Section a-a)	2106.79 kN	4964.23 kN	**0.42**	**PASS**
R_n = 0.6 *F_y*A_{gv}		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	24000.00 mm^2	*Gross area subject to shear*		
ϕR_n	4964.23 kN	*Shear yield strength*		
Plate Shear Rupture (Section a-a)	2106.79 kN	4840.12 kN	**0.44**	**PASS**
R_n = 0.6 *F_u*A_{nv}		**ϕ = 0.75**	(J4-4)	

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	24000.00 mm^2	*Net area subject to shear*		
ϕR_n	4840.12 kN	*Shear rupture strength*		
Plate Axial Yield (Section a-a)	1837.11 kN	7446.34 kN	**0.25**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area subject to tension*		
ϕR_n	7446.34 kN	*Tensile yield strength*		
Plate Tension Rupture (Section a-a)	1837.11 kN	8066.87 kN	**0.23**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area subject to tension*		
ϕR_n	8066.87 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section a-a)			**0.41**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-1837.11 kN	*Calculated axial load*		
V_r	2106.79 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	24000.00 mm^2	*Gross area of the plate*		
Z_{pl}	7200000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7446.34 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4964.23 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	526.69 kN-m	*Calculated moment*		
M_c	2233.89 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, φ=0.90*		
UC	0.41	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section a-a)			**0.39**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-1837.11 kN	*Calculated axial load*		
V_r	2106.79 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	24000.00 mm^2	*Net area of the plate*		
Z_{net}	7200000.00 mm^3	*Plastic modulus of net section*		
P_c	8066.87 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4840.12 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	526.69 kN-m	*Calculated moment*		
M_c	2420.05 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, φ=0.75*		
UC	0.39	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Shear Yield (Section b-b)	1041.90 kN	2688.96 kN	**0.39**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
A_{gv}	13000.00 mm^2	*Gross area subject to shear*		
ϕR_n	2688.96 kN	*Shear yield strength*		
Plate Shear Rupture (Section b-b)	1041.90 kN	2621.73 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	13000.00 mm^2	*Net area subject to shear*		
ϕR_n	2621.73 kN	*Shear rupture strength*		
Plate Axial Yield (Section b-b)	569.08 kN	4033.43 kN	**0.14**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13000.00 mm^2	*Gross area subject to tension*		
ϕR_n	4033.43 kN	*Tensile yield strength*		
Plate Tension Rupture (Section b-b)	569.08 kN	4369.55 kN	**0.13**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13000.00 mm^2	*Net area subject to tension*		
ϕR_n	4369.55 kN	*Tensile rupture strength*		
Plate Flexural Yield (Section b-b)			**0.20**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-569.08 kN	*Calculated axial load*		
V_r	1041.90 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	13000.00 mm^2	*Gross area of the plate*		
Z_{pl}	2112500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4033.43 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	2688.96 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	-51.66 kN-m	*Calculated moment*		
M_c	655.43 kN-m	*Available moment $M_c = \varphi * (F_y * Z)$, $\varphi = 0.90$*		
UC	0.20	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$*		
Plate Flexural Rupture (Section b-b)			**0.20**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-569.08 kN	*Calculated axial load*		
V_r	1041.90 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	13000.00 mm^2	*Net area of the plate*		
Z_{net}	2112500.00 mm^3	*Plastic modulus of net section*		
P_c	4369.55 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	2621.73 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	-51.66 kN-m	*Calculated moment*		
M_c	710.05 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Beam Report (continued):*

Limit State	Required	Available	Unity Check	Result
UC	0.20	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Beam Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Beam)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Yielding	1837.11 kN	6205.28 kN	**0.30**	**PASS**
$R_n = (5 * k + l_b) * F_y * t_w$		**$\phi = 1.00$**	(J10-2)	
F_y	344.74 MPa	*Minimum yield stress of beam*		
t_w	15.00 mm	*Beam web thickness*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	1200.00 mm	*Length of bearing*		
ϕR_n	6205.28 kN	*Beam web local yielding*		

A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Left Brace Report*



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

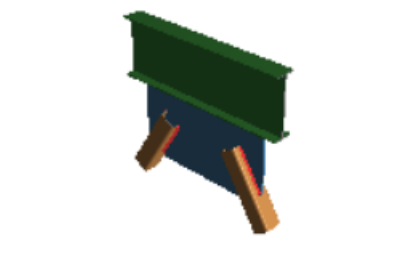
Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	389.60 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	389.60 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3784.43 kN	**0.68**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12197.45 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	609.87 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3784.43 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4099.80 kN	**0.63**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	609.87 mm	*Whitmore tensile width*		
A_n	12197.45 mm^2	*Net area of plate*		
ϕR_n	4099.80 kN	*Plate tensile rupture strength*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Left Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3496.77 kN	**0.40**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	292.07 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	189.84 mm	*Effective length, L_c=K*L*		
L_c/r	32.88	*Plate slenderness check from J4-6*		
F_{cr}	318.53 MPa	*Flexural buckling stress (E3-2)*		
A_g	12197.45 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3496.77 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1574.34 kN	**0.64**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4683.86 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1574.34 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3142.60 kN	**0.82**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (left brace)*		
α	0.66	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	389.60 mm	*Weld length*		
ϕRn	3142.60 kN	*Weld strength*		

A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Right Brace Report*



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Input Brace Tension	-1000.00 kN	*User-input Tensile Load in Brace*
Input Brace Compression	1000.00 kN	*User-input Compressive Load in Brace*
Brace Axial (Tension)	-2585.53 kN	*Design Tensile Load in Brace*
Brace Axial(Compression)	1414.76 kN	*Design Compressive Load in Brace*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	15.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	15.00 mm	*Weld size*		
L_{min}	389.60 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	15.00 mm	*Weld size*		
L_{max}	389.60 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	2585.53 kN	3784.43 kN	**0.68**	**PASS**
$R_n = F_y*A_g$		**ϕ = 0.9**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	12197.45 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	609.87 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3784.43 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	2585.53 kN	4099.80 kN	**0.63**	**PASS**
$R_n = F_u*A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	609.87 mm	*Whitmore tensile width*		
A_n	12197.45 mm^2	*Net area of plate*		
ϕR_n	4099.80 kN	*Plate tensile rupture strength*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Gusset/Right Brace Report (continued):*

Limit State	Required	Available	Unity Check	Result
Gusset Plate Compression (Whitmore)	1414.76 kN	3496.77 kN	**0.40**	**PASS**
$P_n = F_{cr} * A_g$		**ϕ = 0.9**	(E3-1)	
K	0.65	*Effective length factor*		
L	292.07 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration*		
L_c	189.84 mm	*Effective length, L_c=K*L*		
L_c/r	32.88	*Plate slenderness check from J4-6*		
F_{cr}	318.53 MPa	*Flexural buckling stress (E3-2)*		
A_g	12197.45 mm^2	*Gross area of plate (Whitmore section)*		
ϕP_n	3496.77 kN	*Gusset plate compressive strength*		
Brace Tensile Yield	1000.00 kN	1861.58 kN	**0.54**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	1000.00 kN	1574.34 kN	**0.64**	**PASS**
$R_n = F_u * A_e$		**ϕ = 0.75**	(D2-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_e	4683.86 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.85	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.85	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1574.34 kN	*Tensile rupture strength*		
Brace Weld Strength	2585.53 kN	3142.60 kN	**0.82**	**PASS**
ϕRn = 4 * C_1 * α * 1.392 * D_{16} * L				
Single Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (right brace)*		
α	0.88	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	15.00 mm	*Weld fillet size*		
L	389.60 mm	*Weld length*		
ϕRn	3142.60 kN	*Weld strength*		

A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report*

Vertical Brace Chevron Connection



Material Properties:				
Beam	HI500-15-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Left Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Right Brace	K160*10	A1085	F_y = 344.74 MPa	F_u = 448.16 MPa
Gusset	P20.00x650.00x1200.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Seismic System	SCBF	*User Input Seismic System*
L_{left}	550.00 cm	*User Input Clear Span of Left Brace*
L_{right}	550.00 cm	*User Input Clear Span of Right Brace*
K_{left}	1.00	*User Input Effective Length Factor of Left Brace*
K_{right}	1.00	*User Input Effective Length Factor of Right Brace*
Ca Beam Ratio	1.00	*User-Input Ratio of Required Strength to Available Strength*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Controlling Load Calculation				**n/a**
Left Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-left}}$	344.74 MPa	*Minimum yield stress of the left brace material*		
$R_{y\text{-left}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the left brace material*		
$A_{br\text{-left}}$	6000.00 mm^2	*Area of the left brace*		
$P_{exp\text{-t-left}}$	2585.53 kN	*Left brace expected strength in tension = $R_y*F_y*A_{br}$*		
Right Brace Exp. Ten. Strength		*AISC 341-16 section F2.6c(1)*		
$F_{y\text{-right}}$	344.74 MPa	*Minimum yield stress of the right brace material*		
$R_{y\text{-right}}$	1.25	*Ratio of expected yield stress to minimum yield stress of the right brace material*		
$A_{br\text{-right}}$	6000.00 mm^2	*Area of the right brace*		
$P_{exp\text{-t-right}}$	2585.53 kN	*Right brace expected strength in tension = $R_y*F_y*A_{br}$*		
Left Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*Length of the left brace*		
$L_{c\text{-left}}$	550.00 cm	*Effective length of the left brace = $K_{left}*L_{left}$*		
E_{left}	199948.01 MPa	*Elastic modulus of the left brace material*		
$r_{y\text{-left}}$	61.37 mm	*Radius of gyration about the weak axis of the left brace*		
$F_{e\text{-left}}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-left}}/r_y)^2$*		
$F_{cre\text{-left}}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$P_{exp\text{-}ci\text{-}left}$	1414.76 kN	*Left brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}left}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}left}$*		
Right Brace Exp. Comp. Strength		*AISC 341-16 section F2.3*		
Analysis Method (i)				
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*Length of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = $K_{right}*L_{right}$*		
E_{right}	199948.01 MPa	*Elastic modulus of the right brace material*		
$r_{y\text{-}right}$	61.37 mm	*Radius of gyration about the weak axis of the right brace*		
$F_{e\text{-}right}$	245.72 MPa	*Elastic buckling stress per AISC 360-16 eqn. (E3-4) = $(\pi^2*E)/(L_{c\text{-}right}/r_y)^2$*		
$F_{cre\text{-}right}$	206.84 MPa	*Critical stress per AISC 360-16 eqn. (E3-2) = $R_y*F_y*(0.658^{((R_y*F_y)/F_e)})$*		
$P_{exp\text{-}ci\text{-}right}$	1414.76 kN	*Right brace expected strength in compression = min($R_y*F_y*A_{br}$, $1.14*F_{cre}*A_{br}$)*		
Analysis Method (ii)				
$P_{exp\text{-}cii\text{-}right}$	424.43 kN	*Post-buckling expected compressive strength = $0.3*P_{exp\text{-}ci\text{-}right}$*		
Governing Brace Strength in Tension		*AISC 341-16 section F2.6c(1)*		
$P_{br\text{-}t\text{-}left}$	-1000.00 kN	*User input tensile axial load in left brace*		
$P_{br\text{-}t\text{-}right}$	-1000.00 kN	*User input tensile axial load in right brace*		
α_s	1.00	*Force level adjustment factor*		
$P_{des\text{-}t\text{-}left}$	-2585.53 kN	*Design tensile load in left brace member = $P_{exp\text{-}t\text{-}left}/\alpha_s$ (negative for tension)*		
$P_{des\text{-}t\text{-}right}$	-2585.53 kN	*Design tensile load in right brace member = $P_{exp\text{-}t\text{-}right}/\alpha_s$ (negative for tension)*		
Governing Brace Strength in Compression		*AISC 341-16 section F2.6c(2)*		
$P_{br\text{-}c\text{-}left}$	1000.00 kN	*User input compressive axial load in left brace*		
$P_{br\text{-}c\text{-}right}$	1000.00 kN	*User input compressive axial load in right brace*		
Analysis Method (i)				
$P_{des\text{-}ci\text{-}left}$	1414.76 kN	*Design compressive load in left brace member = $P_{exp\text{-}ci\text{-}left}/\alpha_s$*		
$P_{des\text{-}ci\text{-}right}$	1414.76 kN	*Design compressive load in right brace member = $P_{exp\text{-}ci\text{-}right}/\alpha_s$*		
Analysis Method (ii)				
$P_{des\text{-}cii\text{-}left}$	424.43 kN	*Design compressive load in left brace member = $P_{exp\text{-}cii\text{-}left}/\alpha_s$*		
$P_{des\text{-}cii\text{-}right}$	424.43 kN	*Design compressive load in right brace member = $P_{exp\text{-}cii\text{-}right}/\alpha_s$*		
Seismic Loading Directions				**n/a**
Loading Direction SD1		*Left brace in tension, right brace in compression (i)*		
$P_{left\text{-}SD1}$	-2585.53 kN	*Left brace design load per loading direction SD1*		
$P_{right\text{-}SD1}$	1414.76 kN	*Right brace design load per loading direction SD1*		
Loading Direction SD2		*Left brace in tension, right brace in compression (ii)*		
$P_{left\text{-}SD2}$	-2585.53 kN	*Left brace design load per loading direction SD2*		
$P_{right\text{-}SD2}$	424.43 kN	*Right brace design load per loading direction SD2*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Loading Direction SD3		*Left brace in compression (i), right brace in tension*		
$P_{left\text{-}SD3}$	1414.76 kN	*Left brace design load per loading direction SD3*		
$P_{right\text{-}SD3}$	-2585.53 kN	*Right brace design load per loading direction SD3*		
Loading Direction SD4		*Left brace in compression (ii), right brace in tension*		
$P_{left\text{-}SD4}$	424.43 kN	*Left brace design load per loading direction SD4*		
$P_{right\text{-}SD4}$	-2585.53 kN	*Right brace design load per loading direction SD4*		
Seismic Load Distribution (Loading Direction SD1)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	131.66 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	131.66 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	302.83 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	1414.76 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2197.90 kN	*Vertical component of left brace*		
P_{Hleft}	-1361.70 kN	*Horizontal component of left brace*		
P_{Vright}	1202.65 kN	*Vertical component of right brace*		
P_{Hright}	-745.09 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-995.25 kN	*Axial force at section a-a*		
V_{aa}	-2106.79 kN	*Shear force at section a-a*		
M_{aa}	-526.69 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.83 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.76 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-2.19 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-308.30 kN	*Axial force at section b-b*		
V_{bb}	-1041.90 kN	*Shear force at section b-b*		
M_{bb}	-27.98 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD2)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	131.66 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	131.66 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	302.83 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	-2585.53 kN	*Left brace design load per loading direction*		
P_{right}	424.43 kN	*Right brace design load per loading direction*		
P_{Vleft}	-2197.90 kN	*Vertical component of left brace*		
P_{Hleft}	-1361.70 kN	*Horizontal component of left brace*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
P_{Vright}	360.80 kN	*Vertical component of right brace*		
P_{Hright}	-223.53 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1837.11 kN	*Axial force at section a-a*		
V_{aa}	-1585.22 kN	*Shear force at section a-a*		
M_{aa}	-396.30 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.53 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	-1.32 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	-1.65 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-569.08 kN	*Axial force at section b-b*		
V_{bb}	-783.97 kN	*Shear force at section b-b*		
M_{bb}	-51.66 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD3)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	131.66 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		
Δ_{right}	131.66 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	302.83 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	1414.76 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	1202.65 kN	*Vertical component of left brace*		
P_{Hleft}	745.09 kN	*Horizontal component of left brace*		
P_{Vright}	-2197.90 kN	*Vertical component of right brace*		
P_{Hright}	1361.70 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-995.25 kN	*Axial force at section a-a*		
V_{aa}	2106.79 kN	*Shear force at section a-a*		
M_{aa}	526.69 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-0.83 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.76 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	2.19 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-308.30 kN	*Axial force at section b-b*		
V_{bb}	1041.90 kN	*Shear force at section b-b*		
M_{bb}	-27.98 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Loading Direction SD4)				**n/a**
Brace Centerline Eccentricities				
Δ_{left}	131.66 mm	*Perpendicular eccentricity between left brace centerline and section a-a centerline*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
Δ_{right}	131.66 mm	*Perpendicular eccentricity between right brace centerline and section a-a centerline*		
Δ'_{left}	302.83 mm	*Perpendicular eccentricity between left brace centerline and section b-b centerline*		
Brace Force Components				
P_{left}	424.43 kN	*Left brace design load per loading direction*		
P_{right}	-2585.53 kN	*Right brace design load per loading direction*		
P_{Vleft}	360.80 kN	*Vertical component of left brace*		
P_{Hleft}	223.53 kN	*Horizontal component of left brace*		
P_{Vright}	-2197.90 kN	*Vertical component of right brace*		
P_{Hright}	1361.70 kN	*Horizontal component of right brace*		
Section (a-a) Forces		*See Help file for reference equations*		
N_{aa}	-1837.11 kN	*Axial force at section a-a*		
V_{aa}	1585.22 kN	*Shear force at section a-a*		
M_{aa}	396.30 kN-m	*Moment at section a-a*		
S_g	4800000.00 mm^3	*Elastic section modulus of the gusset plate*		
n_p	-1.53 kN/mm	*Vertical force distribution due to axial force at section a-a*		
n_v	1.32 kN/mm	*Horizontal force distribution due to shear force at section a-a*		
n_m	1.65 kN/mm	*Vertical force distribution due to moment at section a-a*		
Section (b-b) Forces		*See Help file for reference equations*		
N_{bb}	-569.08 kN	*Axial force at section b-b*		
V_{bb}	783.97 kN	*Shear force at section b-b*		
M_{bb}	-51.66 kN-m	*Moment at section b-b*		
Seismic Load Distribution (Governing)				**n/a**
Section (a-a) Forces				
Shear (Tension)	-2106.79 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	2106.79 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-1837.11 kN	*Maximum tension axial force (loading direction SD2 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-526.69 kN-m	*Maximum moment (loading direction SD1 governs)*		
Section (b-b) Forces				
Shear (Tension)	-1041.90 kN	*Maximum tension shear force (loading direction SD1 governs)*		
Shear (Compression)	1041.90 kN	*Maximum compressive shear force (loading direction SD3 governs)*		
Axial (Tension)	-569.08 kN	*Maximum tension axial force (loading direction SD4 governs)*		
Axial (Compression)	0.00 kN	*Maximum compressive axial force (no compressive force)*		
Moment	-51.66 kN-m	*Maximum moment (loading direction SD4 governs)*		
Seismic Workpoint Limitations				**PASS**
Check Vertical Workpoint Ecc.	**Pass**	*Condition: $\|D_{wv}\| <= d_{beam}/10$*		
D_{wv}	0.00 mm	*Workpoint vertical offset*		
d_{beam}	500.00 mm	*Beam depth*		
Check Horizontal Workpoint Ecc.	**Pass**	*Condition: $\|D_{wh}\| <= d_{beam}/10$*		
D_{wh}	0.00 mm	*Workpoint horizontal offset*		
d_{beam}	500.00 mm	*Beam depth*		
Seismic Yield Stress Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: $F_y <= 50$ ksi (345 Mpa) (AISC 341-16, A3.1)*		

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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

Limit State	Required	Available	Unity Check	Result
$F_{y\text{-}bm}$	344.74 MPa	*Minimum yield stress of the beam material*		
Check Max Yield Stress of the Left Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa) (AISC 341-16, A3.1)*		
$F_{y\text{-}left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Check Max Yield Stress of the Right Brace	**Pass**	*Condition: F_y <= 50 ksi (345 Mpa)*		
$F_{y\text{-}right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Seismic Brace Slenderness				**PASS**
Check Left Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{left}	1.00	*Effective length factor of the left brace*		
L_{left}	550.00 cm	*User-entered span of the left brace*		
$L_{c\text{-}left}$	550.00 cm	*Effective length of the left brace = K_{left}*L_{left}*		
$r_{y\text{-}left}$	61.37 mm	*Weak axis radius of gyration of the left brace*		
$L_{c\text{-}left}/r_{y\text{-}left}$	89.62	*Slenderness ratio of the left brace*		
Check Right Brace Slenderness	**Pass**	*Condition: L_c/r <= 200 per AISC 341-16 section F2.5b*		
K_{right}	1.00	*Effective length factor of the right brace*		
L_{right}	550.00 cm	*User-entered span of the right brace*		
$L_{c\text{-}right}$	550.00 cm	*Effective length of the right brace = K_{right}*L_{right}*		
$r_{y\text{-}right}$	61.37 mm	*Weak axis radius of gyration of the right brace*		
$L_{c\text{-}right}/r_{y\text{-}right}$	89.62	*Slenderness ratio of the right brace*		
Seismic Gusset Rotation Capacity/Clearance				**PASS**
Check Left Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}left}$	57.64 mm	*Distance from end of left brace to hinge line*		
t_g	20.00 mm	*Thickness of gusset plate*		
2*t_g	40.00 mm	*Lower limiting thickness of the gusset plate*		
4*t_g	80.00 mm	*Upper limiting thickness of the gusset plate*		
Check Right Brace Buckling	**Pass**	*Condition: 2*t_g <= d_h <= 4*t_g (AISC 341-16 F2.6c(3)(b))*		
$d_{h\text{-}right}$	57.64 mm	*Distance from end of right brace to hinge line*		
Seismic Beam Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	85.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Elastic modulus of the beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of the beam material*		
Ratio	7.08	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
h_b	476.00 mm	*Clear distance between beam flanges*		
t_{bw}	15.00 mm	*Beam web thickness*		
Ca_b	1.00	*User-input ratio of required strength to available strength*		
Ratio	31.73	*Width to thickness ratio, h_b/t_{bw}*		

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Limit State	Required	Available	Unity Check	Result
Limit	36.05	*Limiting ratio, max(0.88*(E_b/(R_{yb}*F_{yb}))$^{0.5}$*(2.68-Ca_b),1.57*(E_b/(R_{yb}*F_{yb}))$^{0.5}$)*		
Seismic Left Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Left Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br-left}$	140.00 mm	*Inside dimension of left brace tube*		
$t_{br-left}$	10.00 mm	*Left brace tube wall thickness*		
$E_{br-left}$	199948.01 MPa	*Elastic modulus of the left brace material*		
R_{y-left}	1.25	*Ration of expected yield stress to minimum yield stress of the left brace material*		
$F_{ybr-left}$	344.74 MPa	*Minimum yield stress of the left brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br-left}/t_{br-left}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br-left}$/(R_{y-left} * $F_{ybr-left}$))$^{0.5}$*		
Seismic Right Brace Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Right Brace	**Pass**	*Condition: Ratio <= Limit*		
$b_{br-right}$	140.00 mm	*Inside dimension of right brace tube*		
$t_{br-right}$	10.00 mm	*Right brace tube wall thickness*		
$E_{br-right}$	199948.01 MPa	*Elastic modulus of the right brace material*		
$R_{y-right}$	1.25	*Ration of expected yield stress to minimum yield stress of the right brace material*		
$F_{ybr-right}$	344.74 MPa	*Minimum yield stress of the right brace material*		
Ratio	14.00	*Width to thickness ratio, $b_{br-right}/t_{br-right}$*		
Limit	14.00	*Limiting ratio, 0.65*($E_{br-right}$/($R_{y-right}$ * $F_{ybr-right}$))$^{0.5}$*		
Check Seismic Left Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	389.60 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =(A_g+A_r)-2*(t_p+2*gap)*t_{des}*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =A_g-2*(t_p+2*gap)*t_{des}*		
A_e	4683.86 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		

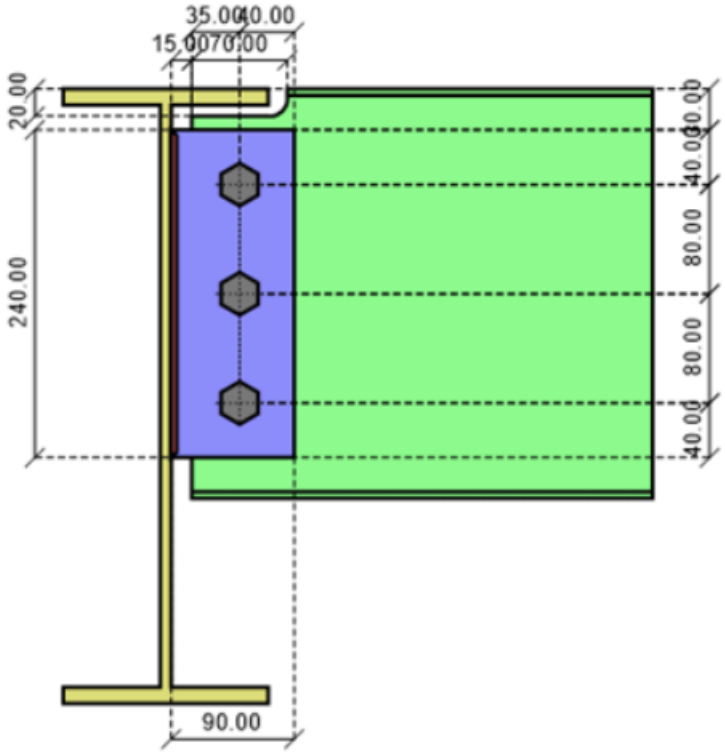
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A14. Salud Chev-EJE 3-AR4-VS2/VM2: Seismic Report (continued):*

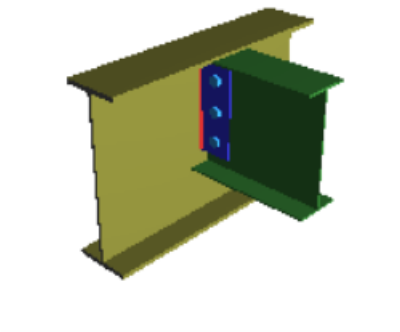
Limit State	Required	Available	Unity Check	Result
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.83	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6634.68 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Check Seismic Right Brace Area				**REINF REQ'D**
Additional brace reinforcement required, see A_{rn} below				
Check Area of Brace	**Fail**	*Condition: A_e >= A_g , AISC 341-16 section F2.5b(c)*		
t_p	20.00 mm	*Thickness of gusset plate*		
gap	1.59 mm	*Assumed gap on each side of the brace slot*		
t_{des}	10.00 mm	*Brace wall thickness*		
L	389.60 mm	*Length of brace to gusset connection*		
B	160.00 mm	*Depth of brace member*		
H	160.00 mm	*Width of brace member*		
d_r	0.00 mm	*Depth of brace reinforcing bar*		
A_r	0.00 mm^2	*Area of brace reinforcing bars*		
x_bar	60.00 mm	*Eccentricity of connection*		
U	0.85	*Shear lag factor per AISC 360-16 table D3.1 case 6*		
A_g	6000.00 mm^2	*Gross area of brace*		
A_n	5536.50 mm^2	*Net area with reinf bars =$(A_g+A_r)-2*(t_p+2*gap)*t_{des}$*		
A_{no}	5536.50 mm^2	*Net area without reinf bars =$A_g-2*(t_p+2*gap)*t_{des}$*		
A_e	4683.86 mm^2	*Effective net area of the brace = A_n * U*		
Req'd Reinf. Area of Brace		*Per AISC Seismic Design Manual page 5-275*		
U_a	0.75	*Assumed shear lag factor of reinforced brace*		
A_{rna}	2421.06 mm^2	*Assumed calculation of required area = A_g/U_a-A_{no}*		
d_r	34.92 mm	*Required reinf. bar depth (assuming two square bars) = $(A_{rna}/2)^{0.5}$ rounded to nearest 1/8 inches*		
x_bar'	65.52 mm	*Eccentricity of the composite section*		
U'	0.83	*Adjusted shear lag factor for composite section*		
A_n'	7976.01 mm^2	*Adjusted net area of the composite section*		
A_e'	6634.68 mm^2	*Adjusted effective net area of brace and reinforcement bars*		
A_{rn}	2439.51 mm^2	*Required area of reinforcement bars*		
Seismic Weld Limitations				**PASS**
All welds must be E70, E80 or E90 per AISC 341-16, A3.4a				

B.15 Salud VPrin-VPiso-1: 2D Views Report

Side view



B.15 Salud VPrin-VPiso-1: LRFD Results Report



Material Properties:				
Girder	HI450-8-150-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI300-4-120-5	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P6.00x90.00x24 0.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	80.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	80.00 mm	*Min bolt spacing*		
d_{bolt}	15.88 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	80.00 mm	*Max bolt spacing*		
t	4.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	4.00 mm	*Weld size*		
D_{min}	3.17 mm	*Min size allowed per Table J2.4*		
t_{min}	6.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	4.00 mm	*Weld size*		
L_{min}	240.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	6.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	10.14 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	9.52 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	9.15 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	80.00 kN	170.18 kN	**0.47**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 0.90**	(G2-1)	

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B.15 Salud VPrin-VPiso-1: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	1120.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.82	*Web shear coefficient (G2-4)*		
ϕR_n	170.18 kN	*Shear yield strength*		
Plate Shear Yield	80.00 kN	297.85 kN	**0.27**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	1440.00 mm^2	*Gross area subject to shear*		
ϕR_n	297.85 kN	*Shear yield strength*		
Beam Shear Rupture	80.00 kN	179.77 kN	**0.45**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	891.40 mm^2	*Net area subject to shear*		
ϕR_n	179.77 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	80.00 kN	221.25 kN	**0.36**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	1097.10 mm^2	*Net area subject to shear*		
ϕR_n	221.25 kN	*Shear rupture strength*		
Beam Block Shear	80.00 kN	164.56 kN	**0.49**	**PASS**
$R_n = [\ min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	840.00 mm^2	*Gross area subject to shear*		
A_{nv}	649.50 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	101.90 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	164.56 kN	*Block shear strength*		
Plate Block Shear	80.00 kN	245.84 kN	**0.33**	**PASS**
$R_n = [\ min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	1200.00 mm^2	*Gross area subject to shear*		
A_{nv}	914.25 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	182.85 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	245.84 kN	*Block shear strength*		
Plate Flexural Yield			**0.09**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	80.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	1440.00 mm^2	*Gross area of the plate*		

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B.15 Salud VPrin-VPiso-1: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	86400.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	297.85 kN	*Available shear strength (see check 'Shear Yield')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	4.00 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	26.81 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.09	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.16**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	80.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	1097.10 mm^2	*Net area of the plate*		
Z_{net}	67567.65 mm^3	*Plastic modulus of net section*		
V_c	221.25 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	4.00 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	22.71 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.16	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	80.00 kN	536.14 kN	**0.15**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	50.00 mm	*Unbraced length*		
d	240.00 mm	*Plate depth*		
d_{ct}	70.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	6.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln(L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	19.86 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	86400.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	29.79 kN-m	*Plastic moment, M_p=F_y*Z*		
a	50.00 mm	*Design eccentricity*		
ϕR_n	536.14 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	80.00 kN	82.68 kN	**0.97**	**PASS**
R_n = (M_p- (M_p - M_y) * (λ / λ_p)- 1)/e		**ϕ = 0.9**	(AISC 15th Eq. 9-7)	
h_o	280.00 mm	*Reduced beam depth*		
d	300.00 mm	*Beam depth*		
t_w	4.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	70.00 mm	*Cope length*		

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B.15 Salud VPrin-VPiso-1: LRFD Results Report (continued):

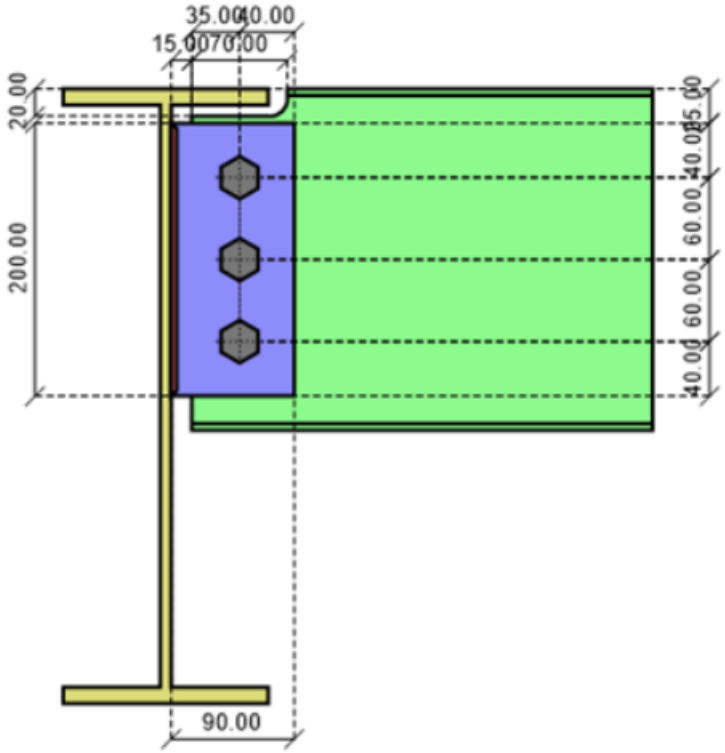
Limit State	Required	Available	Unity Check	Result
k	21.67	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.47	*Buckling adjustment factor, f = 2*(c/d) (AISC 15th Eqn 9-14a)*		
k_1	10.11	*Modified plate buckling coefficient, k_1 = max(f*k, 1.61) (AISC 15th Eqn 9-10)*		
λ	70.00	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	36.38	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
I_n	14542953.43 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	186.91 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	77806.52 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
Y_{max_pl}	212.50 mm	*Maximum distance from the plastic neutral plane*		
Z_{net}	137125.00 mm^3	*Plastic section modulus of the cross section*		
M_y	26.82 kN-m	*Flexural yield moment, $M_y=F_y*S_{net}$*		
M_p	47.27 kN-m	*Plastic bending moment, $M_p=F_y*Z_{net}$*		
e	85.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	82.68 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	80.00 kN	153.67 kN	**0.52**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	4.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	41.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	62.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	68.30 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	68.30 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	68.30 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	88.78 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	134.53 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	153.67 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	80.00 kN	165.81 kN	**0.48**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	6.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	31.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	62.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	73.69 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	73.69 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	102.45 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	100.90 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		

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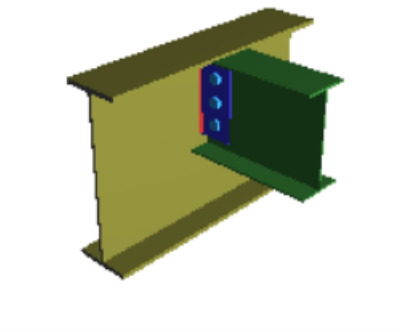
B.15 Salud VPrin-VPiso-1: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
$R_{n\text{-}spacing\text{-}tearout}$	201.79 kN	*Tear out at spaces = 1.2*$L_{c\text{-}spacing}$*t*F_u*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}$=F_{nv}*A_{bolt}*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	165.81 kN	*Bolt bearing strength*		
Bolt Shear at Beam	80.00 kN	126.51 kN	**0.63**	**PASS**
$R_n = F_{nv}*A_b*N_{bolt}*C$		**ϕ = 0.75**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	197.93 mm^2	*Area of bolt*		
N_{bolt}	3	*Number of bolts*		
C	0.76	*Eccentricity coefficient*		
ϕR_n	126.51 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.76***		
IC method			(AISC 15th p.7-6)	
C	0.76	*Coefficient (2.2890 / 3)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	3	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	80.00 mm	*Vertical bolt spacing*		
E_x	50.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-75.14 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	0.53 kN/mm	1.23 kN/mm	**0.43**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
1.392 = ϕ * 0.6 * F_{E70} * $2^{0.5}$/2 * 1/16, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	4.00 mm	*Weld fillet size*		
r_u	0.53 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.23 kN/mm	*Weld strength*		

Side view



B.16 Salud VPrin-VPiso-2: LRFD Results Report



Material Properties:				
Girder	HI450-8-150-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI250-4-120-5	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P6.00x90.00x20 0.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	70.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	60.00 mm	*Min bolt spacing*		
d_{bolt}	15.88 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	60.00 mm	*Max bolt spacing*		
t	4.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	4.00 mm	*Weld size*		
D_{min}	3.17 mm	*Min size allowed per Table J2.4*		
t_{min}	6.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	4.00 mm	*Weld size*		
L_{min}	200.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	6.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	10.14 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	9.52 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	8.92 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	70.00 kN	167.75 kN	**0.42**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 0.90**	(G2-1)	

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B.16 Salud VPrin-VPiso-2: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	920.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.98	*Web shear coefficient (G2-4)*		
ϕR_n	167.75 kN	*Shear yield strength*		
Plate Shear Yield	70.00 kN	248.21 kN	**0.28**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	1200.00 mm^2	*Gross area subject to shear*		
ϕR_n	248.21 kN	*Shear yield strength*		
Beam Shear Rupture	70.00 kN	139.44 kN	**0.50**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	691.40 mm^2	*Net area subject to shear*		
ϕR_n	139.44 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	70.00 kN	172.85 kN	**0.40**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	857.10 mm^2	*Net area subject to shear*		
ϕR_n	172.85 kN	*Shear rupture strength*		
Beam Block Shear	70.00 kN	128.94 kN	**0.54**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	660.00 mm^2	*Gross area subject to shear*		
A_{nv}	469.50 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	101.90 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	128.94 kN	*Block shear strength*		
Plate Block Shear	70.00 kN	197.44 kN	**0.35**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	960.00 mm^2	*Gross area subject to shear*		
A_{nv}	674.25 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	182.85 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	197.44 kN	*Block shear strength*		
Plate Flexural Yield			**0.11**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	70.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	1200.00 mm^2	*Gross area of the plate*		

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B.16 Salud VPrin-VPiso-2: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	60000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	248.21 kN	*Available shear strength (see check 'Shear Yield')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	3.50 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	18.62 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.11	*Unity check per interaction equation, $(V_r/V_c)^2$ + (|P_r|/P_c + |M_r|/M_c)^2 <= 1*		
Plate Flexural Rupture			**0.22**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	70.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	857.10 mm^2	*Net area of the plate*		
Z_{net}	45739.65 mm^3	*Plastic modulus of net section*		
V_c	172.85 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	3.50 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	15.37 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.22	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	70.00 kN	372.32 kN	**0.19**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	50.00 mm	*Unbraced length*		
d	200.00 mm	*Plate depth*		
d_{ct}	65.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	6.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln (L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	13.79 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	60000.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	20.68 kN-m	*Plastic moment, M_p=F_y*Z*		
a	50.00 mm	*Design eccentricity*		
ϕR_n	372.32 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	70.00 kN	86.17 kN	**0.81**	**PASS**
$R_n = (M_p - (M_p - M_y) * (\lambda / \lambda_p) - 1)/e$		**ϕ = 0.9**	(AISC 15th Eq. 9-7)	
h_o	230.00 mm	*Reduced beam depth*		
d	250.00 mm	*Beam depth*		
t_w	4.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	70.00 mm	*Cope length*		

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B.16 Salud VPrin-VPiso-2: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
k	15.66	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.56	*Buckling adjustment factor, f = 2*(c/d) (AISC 15th Eqn 9-14a)*		
k_1	8.77	*Modified plate buckling coefficient, k_1 = max(f*k, 1.61) (AISC 15th Eqn 9-10)*		
λ	57.50	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	33.88	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
I_n	8559125.00 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	158.50 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	54000.79 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
Y_{max_pl}	187.50 mm	*Maximum distance from the plastic neutral plane*		
Z_{net}	97125.00 mm^3	*Plastic section modulus of the cross section*		
M_y	18.62 kN-m	*Flexural yield moment, $M_y=F_y*S_{net}$*		
M_p	33.48 kN-m	*Plastic bending moment, $M_p=F_y*Z_{net}$*		
e	85.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	86.17 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	70.00 kN	153.67 kN	**0.46**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	4.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	36.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	42.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	68.30 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	68.30 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	68.30 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	78.02 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	91.51 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	153.67 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	70.00 kN	165.81 kN	**0.42**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	6.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	31.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	42.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	73.69 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	73.69 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	102.45 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	100.90 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		

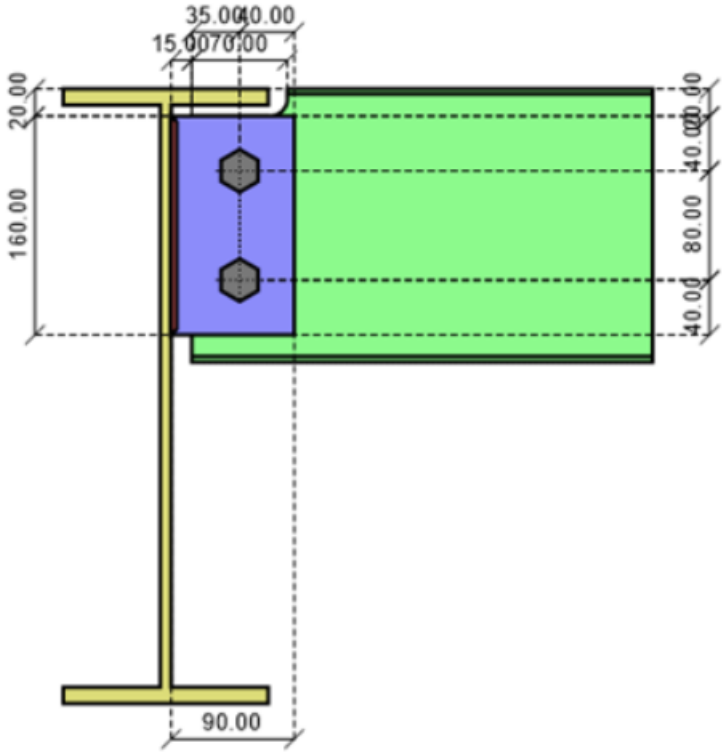
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B.16 Salud VPrin-VPiso-2: LRFD Results Report (continued):

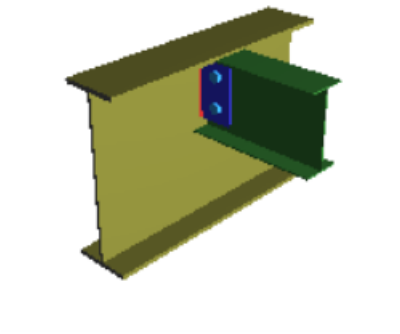
Limit State	Required	Available	Unity Check	Result
$R_{n\text{-}spacing\text{-}tearout}$	137.26 kN	*Tear out at spaces = 1.2*$L_{c\text{-}spacing}$*t*F_u*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	165.81 kN	*Bolt bearing strength*		
Bolt Shear at Beam	70.00 kN	109.30 kN	**0.64**	**PASS**
$R_n = F_{nv}*A_b*N_{bolt}*C$		**ϕ = 0.75**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	197.93 mm^2	*Area of bolt*		
N_{bolt}	3	*Number of bolts*		
C	0.66	*Eccentricity coefficient*		
ϕR_n	109.30 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.66***		
IC method			(AISC 15th p.7-6)	
C	0.66	*Coefficient (1.9775 / 3)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	3	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	60.00 mm	*Vertical bolt spacing*		
E_x	50.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-38.88 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	0.63 kN/mm	1.23 kN/mm	**0.51**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	4.00 mm	*Weld fillet size*		
r_u	0.63 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.23 kN/mm	*Weld strength*		

B.17 Salud VPrin-VPiso-3: 2D Views Report

Side view



B.17 Salud VPrin-VPiso-3: LRFD Results Report



Material Properties:				
Girder	HI450-8-150-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI200-4-100-4	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P6.00x90.00x16 0.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	50.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	80.00 mm	*Min bolt spacing*		
d_{bolt}	15.88 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	80.00 mm	*Max bolt spacing*		
t	4.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	4.00 mm	*Weld size*		
D_{min}	3.17 mm	*Min size allowed per Table J2.4*		
t_{min}	6.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	4.00 mm	*Weld size*		
L_{min}	160.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	6.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	10.14 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	9.52 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	8.91 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	50.00 kN	148.93 kN	**0.34**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 1.00**	(G2-1)	

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B.17 Salud VPrin-VPiso-3: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	720.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-2)*		
ϕR_n	148.93 kN	*Shear yield strength*		
Plate Shear Yield	50.00 kN	198.57 kN	**0.25**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	960.00 mm^2	*Gross area subject to shear*		
ϕR_n	198.57 kN	*Shear yield strength*		
Beam Shear Rupture	50.00 kN	114.47 kN	**0.44**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	567.60 mm^2	*Net area subject to shear*		
ϕR_n	114.47 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	50.00 kN	147.50 kN	**0.34**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	731.40 mm^2	*Net area subject to shear*		
ϕR_n	147.50 kN	*Shear rupture strength*		
Beam Block Shear	50.00 kN	108.00 kN	**0.46**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	480.00 mm^2	*Gross area subject to shear*		
A_{nv}	365.70 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	101.90 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	108.00 kN	*Block shear strength*		
Plate Block Shear	50.00 kN	172.09 kN	**0.29**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	720.00 mm^2	*Gross area subject to shear*		
A_{nv}	548.55 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	182.85 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	172.09 kN	*Block shear strength*		
Plate Flexural Yield			**0.11**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	50.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	960.00 mm^2	*Gross area of the plate*		

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B.17 Salud VPrin-VPiso-3: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	38400.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	198.57 kN	*Available shear strength (see check 'Shear Yield')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	2.50 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	11.91 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.11	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.18**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	50.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	731.40 mm^2	*Net area of the plate*		
Z_{net}	29256.00 mm^3	*Plastic modulus of net section*		
V_c	147.50 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	50.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	2.50 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	9.83 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.18	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	50.00 kN	238.28 kN	**0.21**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	50.00 mm	*Unbraced length*		
d	160.00 mm	*Plate depth*		
d_{ct}	60.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	6.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln(L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	8.83 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	38400.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	13.24 kN-m	*Plastic moment, M_p=F_y*Z*		
a	50.00 mm	*Design eccentricity*		
ϕR_n	238.28 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	50.00 kN	75.27 kN	**0.66**	**PASS**
R_n = (M_p- (M_p - M_y) * (λ / λ_p)- 1)/e		**ϕ = 0.9**	(AISC 15th Eq. 9-7)	
h_o	180.00 mm	*Reduced beam depth*		
d	200.00 mm	*Beam depth*		
t_w	4.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	70.00 mm	*Cope length*		

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B.17 Salud VPrin-VPiso-3: LRFD Results Report (continued):

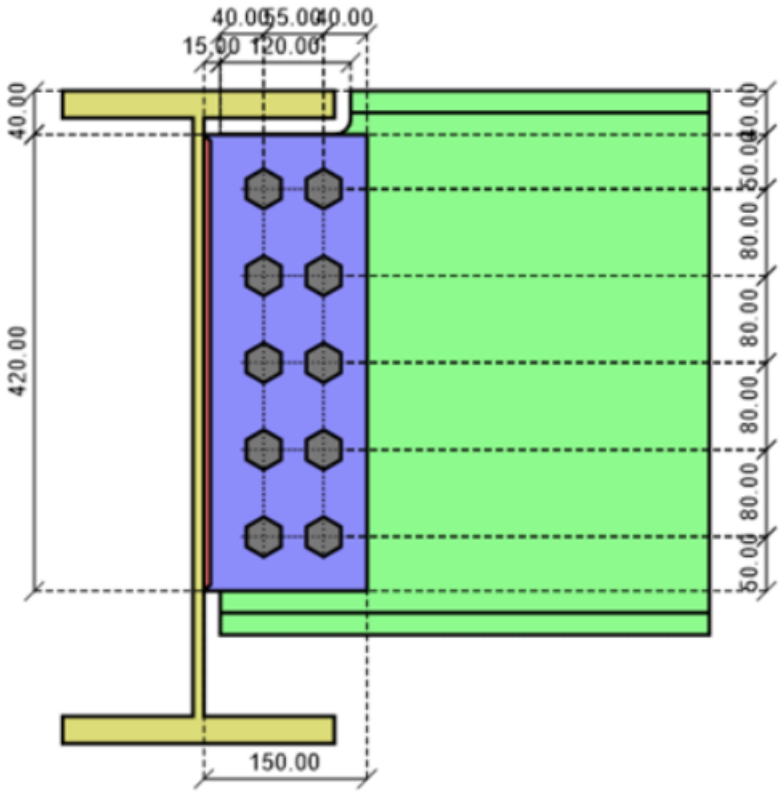
Limit State	Required	Available	Unity Check	Result
k	10.45	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.70	*Buckling adjustment factor, f = 2*(c/d) (AISC 15th Eqn 9-14a)*		
k_1	7.32	*Modified plate buckling coefficient, k_1 = max(f*k, 1.61) (AISC 15th Eqn 9-10)*		
λ	45.00	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	30.94	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
I_n	3883878.96 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	120.61 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	32202.31 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
Y_{max_pl}	138.00 mm	*Maximum distance from the plastic neutral plane*		
Z_{net}	56976.00 mm^3	*Plastic section modulus of the cross section*		
M_y	11.10 kN-m	*Flexural yield moment, $M_y=F_y*S_{net}$*		
M_p	19.64 kN-m	*Plastic bending moment, $M_p=F_y*Z_{net}$*		
e	85.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	75.27 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	50.00 kN	101.67 kN	**0.49**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 1*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	4.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	31.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	62.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	67.26 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	68.30 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	68.30 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	67.26 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	134.53 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	101.67 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	50.00 kN	110.54 kN	**0.45**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 1*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	6.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	31.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	62.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	73.69 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	73.69 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	102.45 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	100.90 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		

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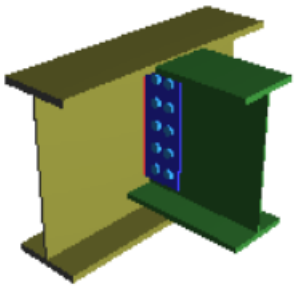
B.17 Salud VPrin-VPiso-3: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
$R_{n\text{-}spacing\text{-}tearout}$	201.79 kN	*Tear out at spaces = 1.2*$L_{c\text{-}spacing}$*t*F_u*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}$=F_{nv}*A_{bolt}*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	110.54 kN	*Bolt bearing strength*		
Bolt Shear at Beam	50.00 kN	67.78 kN	**0.74**	**PASS**
$R_n = F_{nv}*A_b*N_{bolt}*C$		**ϕ = 0.75**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	197.93 mm^2	*Area of bolt*		
N_{bolt}	2	*Number of bolts*		
C	0.61	*Eccentricity coefficient*		
ϕR_n	67.78 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.61***		
IC method			(AISC 15^{th} p.7-6)	
C	0.61	*Coefficient (1.2264 / 2)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	2	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	80.00 mm	*Vertical bolt spacing*		
E_x	50.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-32.01 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	0.66 kN/mm	1.23 kN/mm	**0.54**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	4.00 mm	*Weld fillet size*		
r_u	0.66 kN/mm	*Required weld stress per AISC 15^{th} Eqn 8-11*		
ϕRn	1.23 kN/mm	*Weld strength*		

Side view


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B.18 Salud VPrin-VPS-1 MOMENTO: LRFD Results Report



Material Properties:				
Girder	HI600-10-250-25	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI500-6-220-20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P10.00x150.00x420.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	376.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	55.00 mm	*Min bolt spacing*		
d_{bolt}	19.05 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	80.00 mm	*Max bolt spacing*		
t	6.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	6.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	6.00 mm	*Weld size*		
L_{min}	420.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	10.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	15.21 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	11.11 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	14.73 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	376.00 kN	377.44 kN	**1.00**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**ϕ = 0.90**	(G2-1)	

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B.18 Salud VPrin-VPS-1 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	2760.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.73	*Web shear coefficient (G2-4)*		
ϕR_n	377.44 kN	*Shear yield strength*		
Plate Shear Yield	376.00 kN	868.74 kN	**0.43**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	4200.00 mm^2	*Gross area subject to shear*		
ϕR_n	868.74 kN	*Shear yield strength*		
Beam Shear Rupture	376.00 kN	422.15 kN	**0.89**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	2093.25 mm^2	*Net area subject to shear*		
ϕR_n	422.15 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	376.00 kN	622.91 kN	**0.60**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	3088.75 mm^2	*Net area subject to shear*		
ϕR_n	622.91 kN	*Shear rupture strength*		
Beam Block Shear	376.00 kN	388.87 kN	**0.97**	**PASS**
$R_n = [\min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}]$		**ϕ = 0.75**	(J4-5)	
A_{gv}	2220.00 mm^2	*Gross area subject to shear*		
A_{nv}	1619.92 mm^2	*Net area subject to shear*		
U_{bs}	0.50	*Non uniform tension stress factor*		
A_{nt}	369.98 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	388.87 kN	*Block shear strength*		
Plate Block Shear	376.00 kN	648.12 kN	**0.58**	**PASS**
$R_n = [\min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}]$		**ϕ = 0.75**	(J4-5)	
A_{gv}	3700.00 mm^2	*Gross area subject to shear*		
A_{nv}	2699.87 mm^2	*Net area subject to shear*		
U_{bs}	0.50	*Non uniform tension stress factor*		
A_{nt}	616.62 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	648.12 kN	*Block shear strength*		
Plate Flexural Yield			**0.21**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	376.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	4200.00 mm^2	*Gross area of the plate*		

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B.18 Salud VPrin-VPS-1 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	441000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	868.74 kN	*Available shear strength (see check 'Shear Yield')*		
ex	55.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	20.68 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	136.83 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.21	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.40**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	376.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	3088.75 mm^2	*Net area of the plate*		
Z_{net}	333085.12 mm^3	*Plastic modulus of net section*		
V_c	622.91 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	55.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	20.68 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	111.96 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.40	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	376.00 kN	2487.75 kN	**0.15**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	55.00 mm	*Unbraced length*		
d	420.00 mm	*Plate depth*		
d_{ct}	90.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	10.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln(L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	101.35 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	441000.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	152.03 kN-m	*Plastic moment, M_p=F_y*Z*		
a	55.00 mm	*Design eccentricity*		
ϕR_n	2487.75 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	376.00 kN	709.72 kN	**0.53**	**PASS**
$R_n = F_{cr} * S_{net} / e$		**ϕ = 0.9**	(AISC 15th Eq. 9-6)	
h_o	460.00 mm	*Reduced beam depth*		
d	500.00 mm	*Beam depth*		
t_w	6.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	120.00 mm	*Cope length*		

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B.18 Salud VPrin-VPS-1 MOMENTO: LRFD Results Report (continued):

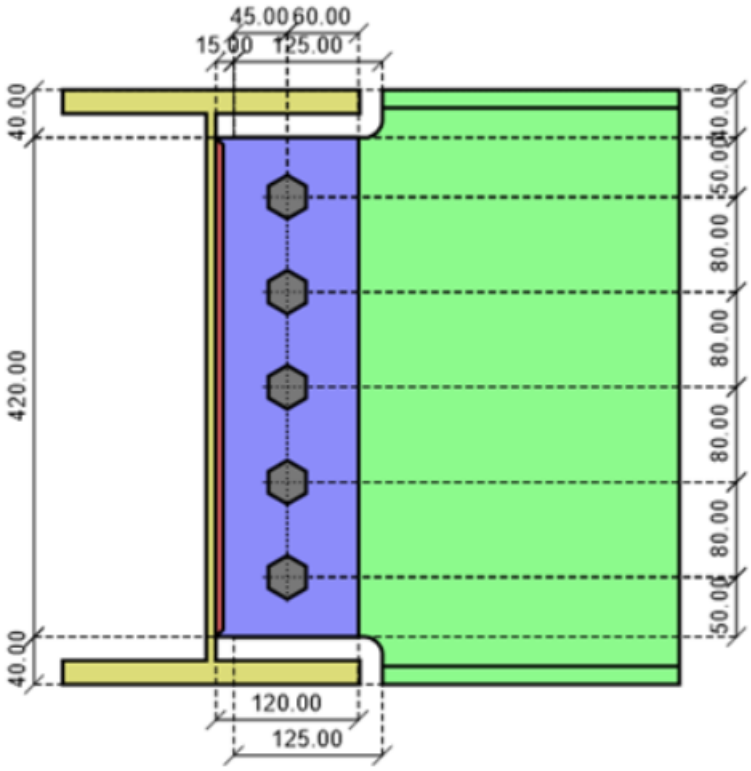
Limit State	Required	Available	Unity Check	Result
k	20.20	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.48	*Buckling adjustment factor, f = 2*(c/d) (AISC 15th Eqn 9-14a)*		
k_1	9.70	*Modified plate buckling coefficient, k_1 = max(f*k, 1.61) (AISC 15th Eqn 9-10)*		
λ	76.67	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	35.62	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
F_{cr}	297.82 MPa	*Critical stress, $F_{cr} = 0.903*E*k_1/(\lambda^2)$ (AISC 15th Eqn 9-9)*		
I_n	130023666.67 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	363.75 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	357453.38 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
e	135.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	709.72 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	376.00 kN	795.89 kN	**0.47**	**PASS**
$R_n = 2*R_{n\text{-}edge} + 8*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	6.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	39.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	59.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	106.12 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	106.12 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	122.94 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	128.04 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	191.55 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	795.89 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	376.00 kN	795.89 kN	**0.47**	**PASS**
$R_n = 2*R_{n\text{-}edge} + 8*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	10.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	39.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	59.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	106.12 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	106.12 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	204.90 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	213.40 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	319.25 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		

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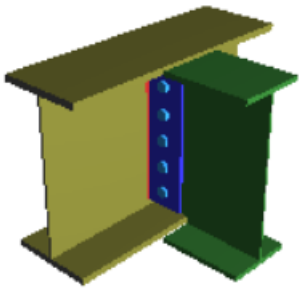
B.18 Salud VPrin-VPS-1 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	795.89 kN	*Bolt bearing strength*		
Bolt Shear at Beam	376.00 kN	610.63 kN	**0.62**	**PASS**
$R_n = F_{nv} * A_b * N_{bolt} * C$		**$\phi = 0.75$**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	285.02 mm^2	*Area of bolt*		
N_{bolt}	10	*Number of bolts*		
C	0.77	*Eccentricity coefficient*		
ϕR_n	610.63 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.77***		
IC method			(AISC 15th p.7-6)	
C	0.77	*Coefficient (7.6723 / 10)*		
N_{rows}	2	*Number of rows of bolts*		
N_{cols}	5	*Number of bolts per row*		
D_x	55.00 mm	*Horizontal bolt spacing*		
D_y	80.00 mm	*Vertical bolt spacing*		
E_x	82.50 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-142.63 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	1.38 kN/mm	1.84 kN/mm	**0.75**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$ **Double Fillet** **$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)**				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	10.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	6.00 mm	*Weld fillet size*		
r_u	1.38 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.84 kN/mm	*Weld strength*		

Side view


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120.00
125.00

B.19 Salud VPrin-VPS-2 MOMENTO: LRFD Results Report



Material Properties:				
Girder	HI500-8-250-20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI500-6-200-15	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P10.00x120.00x 420.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	320.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	80.00 mm	*Min bolt spacing*		
d_{bolt}	19.05 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	80.00 mm	*Max bolt spacing*		
t	6.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	6.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	6.00 mm	*Weld size*		
L_{min}	420.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	10.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	15.21 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	11.11 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	14.73 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	320.00 kN	344.62 kN	**0.93**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 0.90**	(G2-1)	

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B.19 Salud VPrin-VPS-2 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	2520.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.73	*Web shear coefficient (G2-4)*		
ϕR_n	344.62 kN	*Shear yield strength*		
Plate Shear Yield	320.00 kN	868.74 kN	**0.37**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	4200.00 mm^2	*Gross area subject to shear*		
ϕR_n	868.74 kN	*Shear yield strength*		
Beam Shear Rupture	320.00 kN	373.75 kN	**0.86**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	1853.25 mm^2	*Net area subject to shear*		
ϕR_n	373.75 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	320.00 kN	622.91 kN	**0.51**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	3088.75 mm^2	*Net area subject to shear*		
ϕR_n	622.91 kN	*Shear rupture strength*		
Beam Block Shear	320.00 kN	395.03 kN	**0.81**	**PASS**
$R_n = [\ min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	2220.00 mm^2	*Gross area subject to shear*		
A_{nv}	1619.93 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	203.32 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	395.03 kN	*Block shear strength*		
Plate Block Shear	320.00 kN	708.81 kN	**0.45**	**PASS**
$R_n = [\ min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	3700.00 mm^2	*Gross area subject to shear*		
A_{nv}	2699.87 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	488.87 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	708.81 kN	*Block shear strength*		
Plate Flexural Yield			**0.16**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	320.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	4200.00 mm^2	*Gross area of the plate*		

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Limit State	Required	Available	Unity Check	Result
Z_{pl}	441000.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	868.74 kN	*Available shear strength (see check 'Shear Yield')*		
ex	60.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	19.20 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	136.83 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.16	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.29**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	320.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	3088.75 mm^2	*Net area of the plate*		
Z_{net}	333085.12 mm^3	*Plastic modulus of net section*		
V_c	622.91 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	60.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	19.20 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	111.96 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.29	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	320.00 kN	2280.44 kN	**0.14**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	60.00 mm	*Unbraced length*		
d	420.00 mm	*Plate depth*		
d_{ct}	90.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	10.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln(L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	101.35 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	441000.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	152.03 kN-m	*Plastic moment, M_p=F_y*Z*		
a	60.00 mm	*Design eccentricity*		
ϕR_n	2280.44 kN	*Plate flexural buckling*		
Coped Beam Lateral Torsional Buckling	320.00 kN	543.56 kN	**0.59**	**PASS**
R_n = min(F_{cr} * S, M_p) / e		**ϕ = 0.9**	(F11-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
c_t	125.00 mm	*Length of top cope*		
L_b	125.00 mm	*Unbraced length, L_b = c_t*		
d	500.00 mm	*Beam depth*		
d_{ct}	40.00 mm	*Depth of cope at top of the beam*		
h	420.00 mm	*Reduced beam depth*		

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B.19 Salud VPrin-VPS-2 MOMENTO: LRFD Results Report (continued):

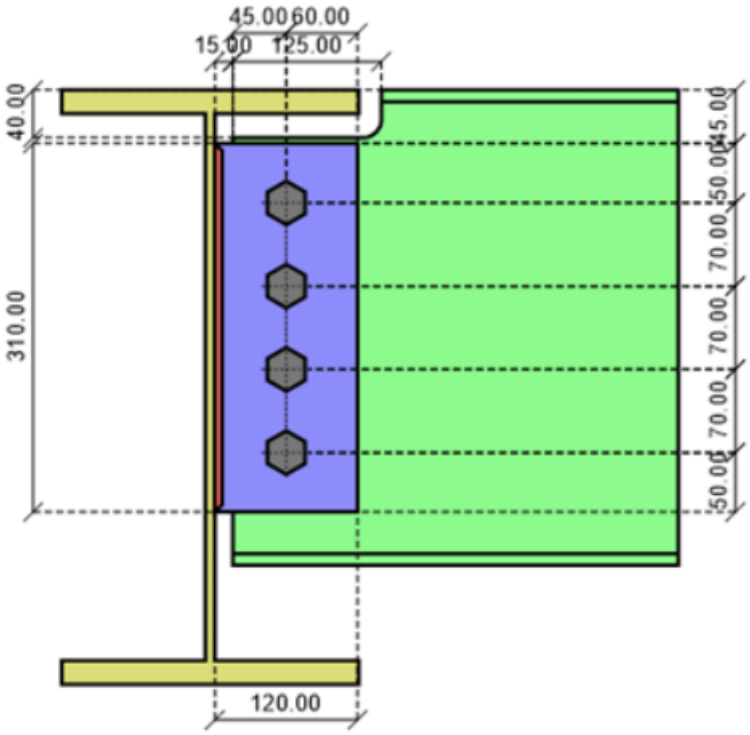
Limit State	Required	Available	Unity Check	Result
t_w	6.00 mm	*Beam web thickness*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b = max{(3 + ln (L_b/d)) * (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
E	199948.01 MPa	*Modulus of elasticity of material*		
F_{cr}	479.33 MPa	*Critical stress, F_{cr} = 1.9*E*C_b/(L_b*h/(t_w^2)) (F11-4)*		
S	176400.00 mm^3	*Section modulus, S = t_w*(h^2)/6*		
Z	264600.00 mm^3	*Plastic modulus, Z = t_w*(h^2)/4*		
M_p	91.22 kN-m	*Plastic moment, M_p = F_y*Z*		
e	140.00 mm	*Distance from the face of the cope to the point of inflection*		
ϕR_n	543.56 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	320.00 kN	397.95 kN	**0.80**	**PASS**
R_n = 1*$R_{n\text{-}edge}$ + 4*$R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	6.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	39.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	59.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	106.12 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	106.12 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	122.94 kN	*Bearing = 2.4*d*t*F_u*		
$R_{n\text{-}edge\text{-}tearout}$	128.04 kN	*Tear out at edge = 1.2*$L_{c\text{-}edge}$*t*F_u*		
$R_{n\text{-}spacing\text{-}tearout}$	191.55 kN	*Tear out at spaces = 1.2*$L_{c\text{-}spacing}$*t*F_u*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}$=F_{nv}*A_{bolt}*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	397.95 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	320.00 kN	397.95 kN	**0.80**	**PASS**
R_n = 1*$R_{n\text{-}edge}$ + 4*$R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	10.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	39.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	59.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	106.12 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	106.12 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	204.90 kN	*Bearing = 2.4*d*t*F_u*		
$R_{n\text{-}edge\text{-}tearout}$	213.40 kN	*Tear out at edge = 1.2*$L_{c\text{-}edge}$*t*F_u*		
$R_{n\text{-}spacing\text{-}tearout}$	319.25 kN	*Tear out at spaces = 1.2*$L_{c\text{-}spacing}$*t*F_u*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}$=F_{nv}*A_{bolt}*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	397.95 kN	*Bolt bearing strength*		
Bolt Shear at Beam	320.00 kN	340.31 kN	**0.94**	**PASS**
R_n = F_{nv}*A_b*N_{bolt}*C		**ϕ = 0.75**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	285.02 mm^2	*Area of bolt*		

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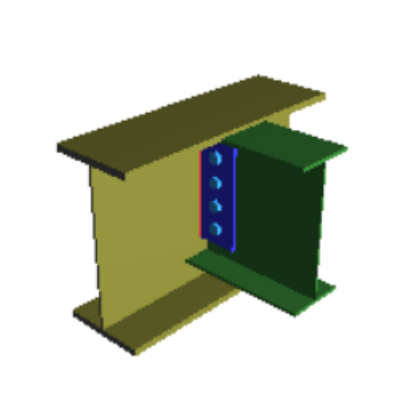
B.19 Salud VPrin-VPS-2 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
N_{bolt}	5	*Number of bolts*		
C	0.86	*Eccentricity coefficient*		
ϕR_n	340.31 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.86***		
IC method			(AISC 15th p.7-6)	
C	0.86	*Coefficient (4.2758 / 5)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	5	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	80.00 mm	*Vertical bolt spacing*		
E_x	60.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-196.74 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	1.00 kN/mm	1.84 kN/mm	**0.54**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	6.00 mm	*Weld fillet size*		
r_u	1.00 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.84 kN/mm	*Weld strength*		

Side view


45.00
60.00
15.00
125.00
40.00
310.00
45.00
50.00
70.00
70.00
70.00
50.00
120.00

B.20 Salud VPrin-VPS-3 MOMENTO: LRFD Results Report



Material Properties:				
Girder	HI500-8-250-20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI400-5-170-10	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P10.00x120.00x 310.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	200.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	70.00 mm	*Min bolt spacing*		
d_{bolt}	19.05 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	70.00 mm	*Max bolt spacing*		
t	5.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	6.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	6.00 mm	*Weld size*		
L_{min}	310.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	10.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	15.21 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	11.11 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	14.45 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	200.00 kN	256.41 kN	**0.78**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 0.90**	(G2-1)	

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B.20 Salud VPrin-VPS-3 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	1800.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.77	*Web shear coefficient (G2-4)*		
ϕR_n	256.41 kN	*Shear yield strength*		
Plate Shear Yield	200.00 kN	641.21 kN	**0.31**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	3100.00 mm^2	*Gross area subject to shear*		
ϕR_n	641.21 kN	*Shear yield strength*		
Beam Shear Rupture	200.00 kN	273.37 kN	**0.73**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	1355.50 mm^2	*Net area subject to shear*		
ϕR_n	273.37 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	200.00 kN	445.90 kN	**0.45**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	2211.00 mm^2	*Net area subject to shear*		
ϕR_n	445.90 kN	*Shear rupture strength*		
Beam Block Shear	200.00 kN	245.73 kN	**0.81**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	1325.00 mm^2	*Gross area subject to shear*		
A_{nv}	936.06 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	169.44 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	245.73 kN	*Block shear strength*		
Plate Block Shear	200.00 kN	531.79 kN	**0.38**	**PASS**
$R_n = [\ \min(0.6 * F_u * A_{nv}, 0.6 * F_y * A_{gv}) + U_{bs} * F_u * A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	2600.00 mm^2	*Gross area subject to shear*		
A_{nv}	1822.13 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	488.88 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	531.79 kN	*Block shear strength*		
Plate Flexural Yield			**0.12**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	200.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	3100.00 mm^2	*Gross area of the plate*		

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B.20 Salud VPrin-VPS-3 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	240250.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	641.21 kN	*Available shear strength (see check 'Shear Yield')*		
ex	60.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	12.00 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	74.54 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Plate Flexural Rupture			**0.24**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	200.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	2211.00 mm^2	*Net area of the plate*		
Z_{net}	178020.00 mm^3	*Plastic modulus of net section*		
V_c	445.90 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	60.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	12.00 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	59.84 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.24	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$*		
Plate Flexural Buckling	200.00 kN	1242.35 kN	**0.16**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	60.00 mm	*Unbraced length*		
d	310.00 mm	*Plate depth*		
d_{ct}	95.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	10.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln(L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	55.22 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	240250.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	82.82 kN-m	*Plastic moment, M_p=F_y*Z*		
a	60.00 mm	*Design eccentricity*		
ϕR_n	1242.35 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	200.00 kN	306.40 kN	**0.65**	**PASS**
$R_n = F_{cr} * S_{net} / e$		**ϕ = 0.9**	(AISC 15th Eq. 9-6)	
h_o	360.00 mm	*Reduced beam depth*		
d	400.00 mm	*Beam depth*		
t_w	5.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	125.00 mm	*Cope length*		

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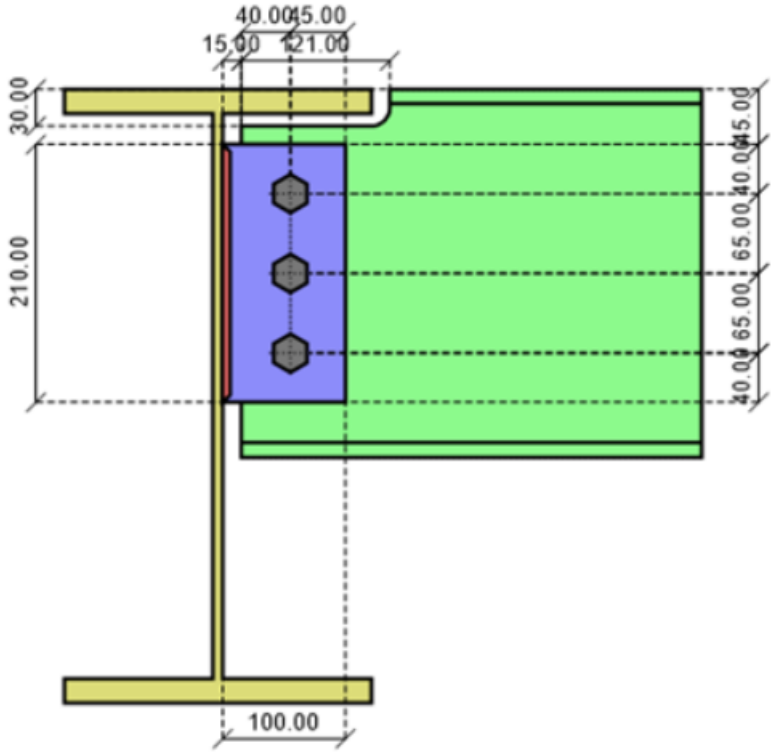
Limit State	Required	Available	Unity Check	Result
k	12.60	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.63	*Buckling adjustment factor, $f = 2*(c/d)$ (AISC 15th Eqn 9-14a)*		
k_1	7.88	*Modified plate buckling coefficient, $k_1 = max(f*k, 1.61)$ (AISC 15th Eqn 9-10)*		
λ	72.00	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	32.10	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
F_{cr}	274.31 MPa	*Critical stress, $F_{cr} = 0.903*E*k_1/(\lambda^2)$ (AISC 15th Eqn 9-9)*		
I_n	45817880.41 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	263.70 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	173752.89 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
e	140.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	306.40 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	200.00 kN	307.35 kN	**0.65**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 3*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	5.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	44.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	49.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	102.45 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	102.45 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	102.45 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	120.15 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	132.73 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	307.35 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	200.00 kN	318.36 kN	**0.63**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 3*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	19.05 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	10.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	39.68 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	49.36 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	106.12 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	106.12 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	204.90 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	213.40 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	265.47 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	106.12 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		

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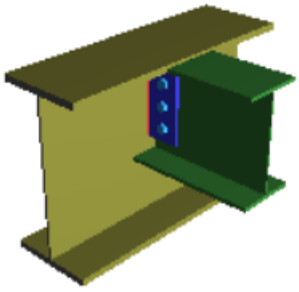
B.20 Salud VPrin-VPS-3 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	318.36 kN	*Bolt bearing strength*		
Bolt Shear at Beam	200.00 kN	241.08 kN	**0.83**	**PASS**
$R_n = F_{nv} * A_b * N_{bolt} * C$		**$\phi = 0.75$**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	285.02 mm^2	*Area of bolt*		
N_{bolt}	4	*Number of bolts*		
C	0.76	*Eccentricity coefficient*		
ϕR_n	241.08 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.76***		
IC method			(AISC 15th p.7-6)	
C	0.76	*Coefficient (3.0290 / 4)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	4	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	70.00 mm	*Vertical bolt spacing*		
E_x	60.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-88.76 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	0.99 kN/mm	1.84 kN/mm	**0.54**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$ **Double Fillet** **$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)**				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	6.00 mm	*Weld fillet size*		
r_u	0.99 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.84 kN/mm	*Weld strength*		

Side view


40.00
45.00
15.00
121.00
30.00
210.00
45.00
40.00
65.00
65.00
40.00
100.00

B.21 Salud VPrin-VPS-4 MOMENTO: LRFD Results Report



Material Properties:				
Girder	HI500-8-250-20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI300-4-170-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P10.00x100.00x 210.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	90.00 kN	*User Input Shear Load*
Axial Load	0.00 kN	*User Input Axial Force*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions at Beam				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3) * d_{bolt}*	*(J3.3)*	
S_{min}	65.00 mm	*Min bolt spacing*		
d_{bolt}	15.88 mm	*Bolt diameter*		
Check Max Bolt Spacing	**Pass**	*Condition: S_{max}<= min(304.80 mm, 24*t)*	*(J3.5a)*	
S_{max}	65.00 mm	*Max bolt spacing*		
t	4.00 mm	*Thickness of governing element (Beam)*		
Check Min Edge Distance	**Pass**	*Condition: ED_{min} >= ED_{allow}*	*(J3.4)*	
Check Max Edge Distance	**Pass**	*Condition: ED_{max} <= min (152.40 mm, 12*t)*	*(J3.5)*	
Girder Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	6.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	6.00 mm	*Weld size*		
L_{min}	210.00 mm	*Min weld segment length*		
Rotational Ductility				**PASS**
Check Rotational Ductility	**Pass**			
Configuration	Extended	*Per page 10-87 through 10-90 of Steel Design Manual*		
t	10.00 mm	*Plate thickness*		
$t_{max\text{-}weld}$	15.21 mm	*Max. plate thickness to avoid weld failure*		
$t_{max\text{-}bolts}$	9.52 mm	*Max. plate thickness to avoid bolt failure (AISC 15th p. 10-90, exceptions)*		
$t_{max\text{-}plate}$	14.96 mm	*Max. plate thickness to avoid plate rupture (AISC 15th p. 9-17)*		
Per AISC exceptions, the $t_{max\text{-}bolts}$ requirement is ignored				
Beam Shear Yield	90.00 kN	164.11 kN	**0.55**	**PASS**
R_n = 0.6 *F_y*A_{gv}*C_{v1}		**ϕ = 0.90**	(G2-1)	

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B.21 Salud VPrin-VPS-4 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	1080.00 mm^2	*Gross area subject to shear*		
C_{v1}	0.82	*Web shear coefficient (G2-4)*		
ϕR_n	164.11 kN	*Shear yield strength*		
Plate Shear Yield	90.00 kN	434.37 kN	**0.21**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	2100.00 mm^2	*Gross area subject to shear*		
ϕR_n	434.37 kN	*Shear yield strength*		
Beam Shear Rupture	90.00 kN	171.70 kN	**0.52**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	851.40 mm^2	*Net area subject to shear*		
ϕR_n	171.70 kN	*Shear rupture strength*		
Plate Shear Rupture at Beam	90.00 kN	308.26 kN	**0.29**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	1528.50 mm^2	*Net area subject to shear*		
ϕR_n	308.26 kN	*Shear rupture strength*		
Beam Block Shear	90.00 kN	151.79 kN	**0.59**	**PASS**
$R_n = [\ \min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	740.00 mm^2	*Gross area subject to shear*		
A_{nv}	549.50 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	121.90 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	151.79 kN	*Block shear strength*		
Plate Block Shear	90.00 kN	366.03 kN	**0.25**	**PASS**
$R_n = [\ \min(0.6*F_u*A_{nv}, 0.6*F_y*A_{gv}) + U_{bs}*F_u*A_{nt}\ ]$		**$\phi = 0.75$**	(J4-5)	
A_{gv}	1700.00 mm^2	*Gross area subject to shear*		
A_{nv}	1223.75 mm^2	*Net area subject to shear*		
U_{bs}	1.00	*Uniform tension stress factor*		
A_{nt}	354.75 mm^2	*Net area subject to tension*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
F_y	344.74 MPa	*Minimum yield stress of material*		
ϕR_n	366.03 kN	*Block shear strength*		
Plate Flexural Yield			**0.06**	**PASS**
$(V_r/V_c)^2 + (\lvert P_r\rvert/P_c + \lvert M_r\rvert/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	0.00 kN	*User input axial load*		
V_r	90.00 kN	*User input shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	2100.00 mm^2	*Gross area of the plate*		

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B.21 Salud VPrin-VPS-4 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Z_{pl}	110250.00 mm^3	*Plastic modulus of the shear plate*		
P_c	0.00 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	434.37 kN	*Available shear strength (see check 'Shear Yield')*		
ex	55.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	4.95 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	34.21 kN-m	*Available moment M_c=φ*(F_y* Z), φ=0.90*		
UC	0.06	*Unity check per interaction equation, $(V_r/V_c)^2$ + ($\|P_r\|/P_c$ + $\|M_r\|/M_c)^2$ <= 1*		
Plate Flexural Rupture			**0.12**	**PASS**
$(V_r/V_c)^2 + (M_r/M_c)^2 <= 1$			(Eq.10-5)	
V_r	90.00 kN	*User input shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	1528.50 mm^2	*Net area of the plate*		
Z_{net}	84577.74 mm^3	*Plastic modulus of net section*		
V_c	308.26 kN	*Available shear strength (see check 'Shear Rupture')*		
ex	55.00 mm	*Horizontal distance from face of support to first row of bolts*		
ey	0.00 mm	*Vertical distance from center of weld to center of beam*		
M_r	4.95 kN-m	*Moment due to eccentricity = V_r*ex + P_r*ey*		
M_c	28.43 kN-m	*Available moment M_c= φ*(F_u* Znet), φ=0.75*		
UC	0.12	*Unity check per interaction equation, $(V_r/V_c)^2 + (M_r/M_c)^2$ <= 1*		
Plate Flexural Buckling	90.00 kN	621.94 kN	**0.14**	**PASS**
R_n = min(C_b*[1.52 - 0.274*(L_b*d/t_p^2)*F_y/E]*M_y, M_p)/a		**ϕ = 0.90**	(F11-2)	
F_y	344.74 MPa	*Minimum yield stress of plate material*		
L_b	55.00 mm	*Unbraced length*		
d	210.00 mm	*Plate depth*		
d_{ct}	85.00 mm	*Distance from the top of the beam to the top bolt*		
t_p	10.00 mm	*Plate thickness*		
E	199948.01 MPa	*Modulus of elasticity of material*		
C_b	1.84	*Lateral-torsional buckling modification factor, C_b= max{(3 + ln (L_b/d))* (1-d_{ct}/d), 1.84} (AISC 15th Eqn 9-15)*		
M_y	25.34 kN-m	*Yield moment about the axis of bending, M_y= F_y*(t_p*(d^2)/6)*		
Z	110250.00 mm^3	*Plastic modulus, Z=t_p*(d^2)/4*		
M_p	38.01 kN-m	*Plastic moment, M_p=F_y*Z*		
a	55.00 mm	*Design eccentricity*		
ϕR_n	621.94 kN	*Plate flexural buckling*		
Coped Beam Local Web Buckling	90.00 kN	145.96 kN	**0.62**	**PASS**
$R_n = F_{cr} * S_{net} / e$		**ϕ = 0.9**	(AISC 15th Eq. 9-6)	
h_o	270.00 mm	*Reduced beam depth*		
d	300.00 mm	*Beam depth*		
t_w	4.00 mm	*Beam web thickness*		
F_y	344.74 MPa	*Minimum yield stress of material*		
E	199948.01 MPa	*Modulus of elasticity of material*		
c	121.00 mm	*Cope length*		

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B.21 Salud VPrin-VPS-4 MOMENTO: LRFD Results Report (continued):

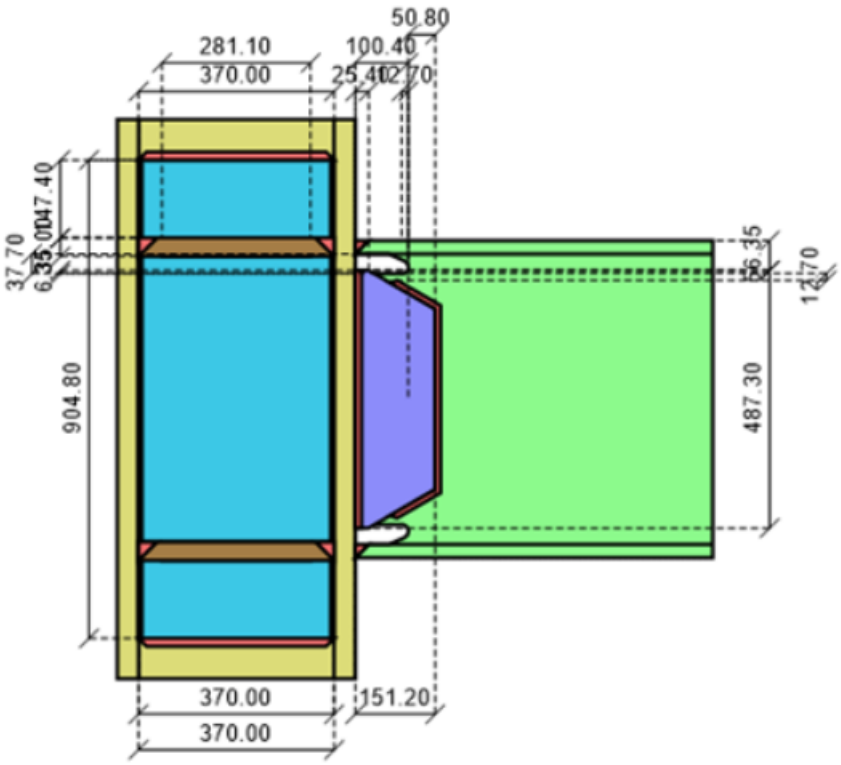
Limit State	Required	Available	Unity Check	Result
k	8.27	*Plate buckling coefficient, $k = 2.2*(h_o/c)^{1.65}$ (AISC 15th Eqn 9-13a)*		
f	0.81	*Buckling adjustment factor, $f = 2*(c/d)$ (AISC 15th Eqn 9-14a)*		
k_1	6.67	*Modified plate buckling coefficient, $k_1 = max(f*k, 1.61)$ (AISC 15th Eqn 9-10)*		
λ	67.50	*Web slenderness, $\lambda = h_o/t_w$ (AISC 15th Eqn 9-11)*		
λ_p	29.55	*Limiting slenderness, $\lambda_p = 0.475*(k_1*E/F_y)^{0.5}$ (AISC 15th Eqn 9-12)*		
F_{cr}	264.40 MPa	*Critical stress, $F_{cr} = 0.903*E*k_1/(\lambda^2)$ (AISC 15th Eqn 9-9)*		
I_n	18238804.31 mm^4	*Moment of inertia with respect to the elastic neutral axis*		
Y_{max_el}	218.65 mm	*Maximum distance from the elastic neutral plane*		
S_{net}	83416.12 mm^3	*Elastic section modulus of the cross section, $S_{net} = I_n/Y_{max_el}$*		
e	136.00 mm	*Distance from the face of the supporting member to the face of the cope*		
ϕR_n	145.96 kN	*Coped beam local web buckling*		
Bolt Bearing on Beam	90.00 kN	153.67 kN	**0.59**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	4.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	46.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	47.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	68.30 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	68.30 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	68.30 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	99.53 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	102.26 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		
ϕR_n	153.67 kN	*Bolt bearing strength*		
Bolt Bearing on Plate at Beam	90.00 kN	165.81 kN	**0.54**	**PASS**
$R_n = 1*R_{n\text{-}edge} + 2*R_{n\text{-}spacing}$		**ϕ = 0.75**	(section J3.10)	
d	15.88 mm	*Bolt diameter*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
t	10.00 mm	*Thickness of material*		
$L_{c\text{-}edge}$	31.27 mm	*Vertical distance from edge of hole to edge of material*		
$L_{c\text{-}spacing}$	47.54 mm	*Vertical distance from edges of adjacent holes*		
$R_{n\text{-}edge}$	73.69 kN	*Strength at edge = min($R_{n\text{-}edge\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}spacing}$	73.69 kN	*Strength at spaces = min($R_{n\text{-}spacing\text{-}tearout}$, $R_{n\text{-}bearing}$, $R_{n\text{-}bolt}$)*		
$R_{n\text{-}bearing}$	170.75 kN	*Bearing = $2.4*d*t*F_u$*		
$R_{n\text{-}edge\text{-}tearout}$	168.16 kN	*Tear out at edge = $1.2*L_{c\text{-}edge}*t*F_u$*		
$R_{n\text{-}spacing\text{-}tearout}$	255.65 kN	*Tear out at spaces = $1.2*L_{c\text{-}spacing}*t*F_u$*		
$R_{n\text{-}bolt}$	73.69 kN	*Bolt shear strength $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	372.32 MPa	*Nominal shear stress of bolt*		

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B.21 Salud VPrin-VPS-4 MOMENTO: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕR_n	165.81 kN	*Bolt bearing strength*		
Bolt Shear at Beam	90.00 kN	108.27 kN	**0.83**	**PASS**
$R_n = F_{nv} * A_b * N_{bolt} * C$		**$\phi = 0.75$**	(J3-1)	
F_{nv}	372.32 MPa	*Shear stress N type*		
A_b	197.93 mm^2	*Area of bolt*		
N_{bolt}	3	*Number of bolts*		
C	0.65	*Eccentricity coefficient*		
ϕR_n	108.27 kN	*Bolt shear rupture strength*		
Bolt Group Eccentricity		***0.65***		
IC method			(AISC 15th p.7-6)	
C	0.65	*Coefficient (1.9590 / 3)*		
N_{rows}	1	*Number of rows of bolts*		
N_{cols}	3	*Number of bolts per row*		
D_x	0.00 mm	*Horizontal bolt spacing*		
D_y	65.00 mm	*Vertical bolt spacing*		
E_x	55.00 mm	*Horizontal distance from face of support to center of bolt group*		
E_y	0.00 mm	*Vertical distance from center of weld to center of beam*		
Ang	90.00	*Angle of force in degrees, relative X axis*		
IC_x	-41.23 mm	*Center of rotation, X*		
IC_y	0.00 mm	*Center of rotation, Y*		
Girder Weld Strength	0.80 kN/mm	1.84 kN/mm	**0.43**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16}$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	8.00 mm	*Base material thickness (girder)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	6.00 mm	*Weld fillet size*		
r_u	0.80 kN/mm	*Required weld stress per AISC 15th Eqn 8-11*		
ϕRn	1.84 kN/mm	*Weld strength*		

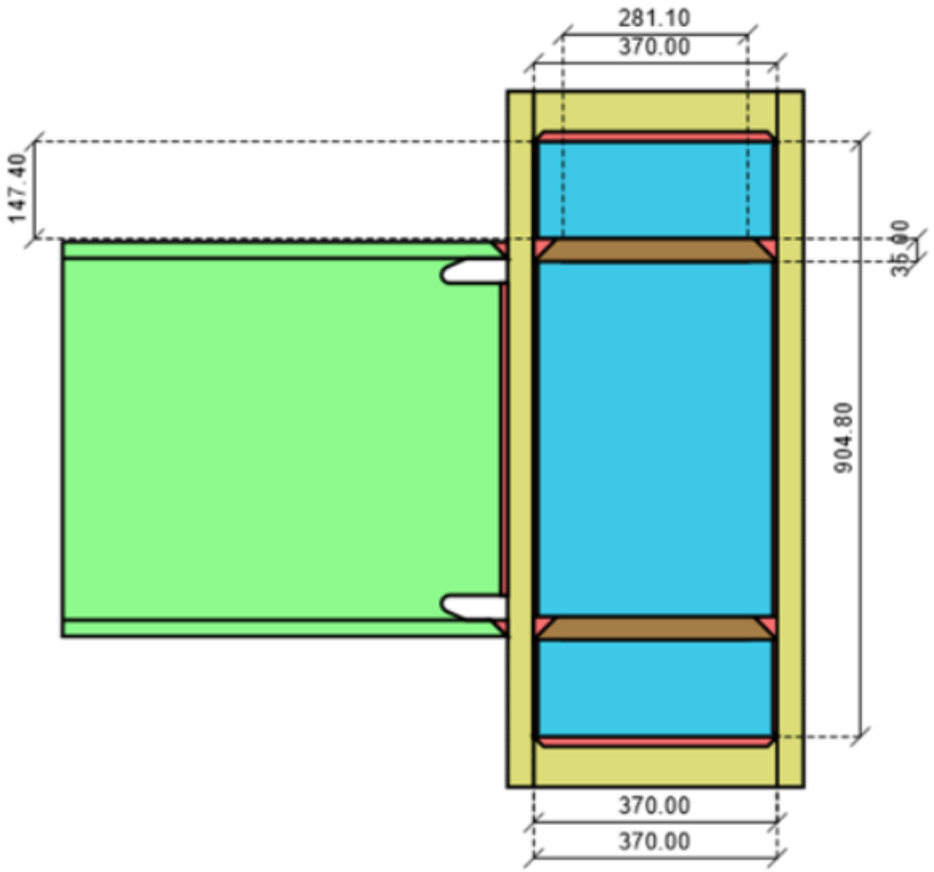
Side view



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*C.22 WUF HI600-10-250*25/20: 2D Views Report (continued):*

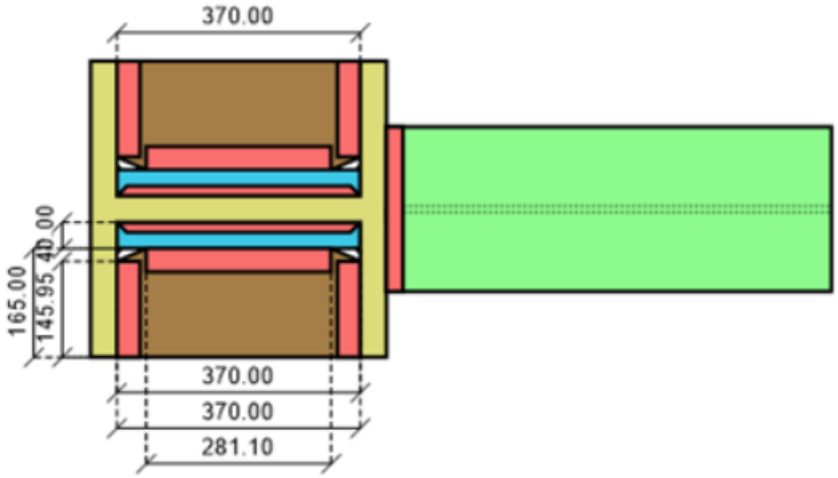
Right view



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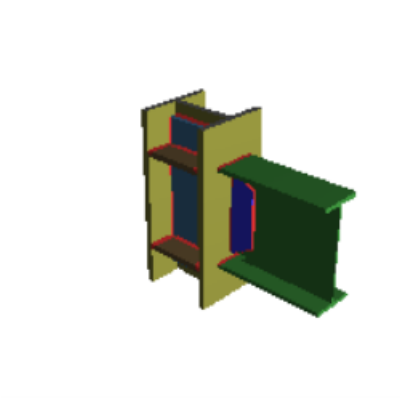
*C.22 WUF HI600-10-250*25/20: 2D Views Report (continued):*

Top view



*C.22 WUF HI600-10-250*25/20: LRFD Results Report*

Column/Beam Direct Weld Moment Connection



Material Properties:				
Column	K450*20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI600-10-250-25	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P12.00x151.20x487.30	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Doubler	P40.00x370.00x904.80	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Transverse Stiffener	P35.00x165.00x370.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	120.00 kN	*User Input Shear Load*
Moment	120.00 kN-m	*User Input Moment*
Axial Load	0.00 kN	*User Input Axial Force*
Puf_c	208.70 kN	*Required Flange Force (compression)*
Puf_t	208.70 kN	*Required Flange Force (tension)*
Top Column Dist	0.00 mm	*User Input Top Column Dist*
Column Force	0.00 kN	*User Input Column Force*
Story Shear	100.00 kN	*User Input Story Shear*

Input Data:		
Seismic System	SMF (WUF-W)	*User Input Seismic System*
Gravity Shear, Vg	225.00 kN	*User Input Shear due to Gravity*
Clear Span, L	1200.00 cm	*User Input Clear Span of Beam*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{max}	10.41 mm	*Max Size Allowed*		
t	12.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	10.41 mm	*Weld size*		
L_{min}	99.54 mm	*Min weld segment length*		
Beam Web Shear Yield	120.00 kN	883.51 kN	**0.14**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 0.90$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	4746.00 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-3)*		
ϕR_n	883.51 kN	*Shear yield strength*		

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*C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Plate Shear Yield	120.00 kN	1209.53 kN		**n/a**
$R_n = 0.6 * F_y * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	5847.60 mm^2	*Gross area subject to shear*		
ϕR_n	1209.53 kN	*Shear yield strength*		
Beam Web Shear Rupture	120.00 kN	957.13 kN	**0.13**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	4746.00 mm^2	*Net area subject to shear*		
ϕR_n	957.13 kN	*Shear rupture strength*		
Plate Shear Rupture	120.00 kN	1179.30 kN		**n/a**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	5847.60 mm^2	*Net area subject to shear*		
ϕR_n	1179.30 kN	*Shear rupture strength*		
Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Column Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Beam Flange Tensile Yield	208.70 kN	1939.15 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6250.00 mm^2	*Gross area subject to compression*		
ϕR_n	1939.15 kN	*Tensile yield strength*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (tension)*		
Beam Flange Tensile Rupture	208.70 kN	2100.75 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	6250.00 mm^2	*Net area subject to tension*		
ϕR_n	2100.75 kN	*Tensile rupture strength*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (tension)*		

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*C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Beam Flange Compression	208.70 kN	1939.15 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.9**	(J4-6)	
K	0.65	*Effective length factor*		
L	10.04 cm	*Unbraced length*		
r	0.72 cm	*Radius of gyration*		
L_c	65.26 mm	*Effective length, L_c=K*L*		
L_c/r	9.04	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Capacity = Minimum Yield stress for L_c/r <= 25*		
A_g	6250.00 mm^2	*Gross area subject to compression*		
ϕR_n	1939.15 kN	*Compressive strength*		
Column Flange Bending	208.70 kN	1551.32 kN	**0.13**	**PASS**
$R_n = 0.5 * 6.25 * F_{yf} * t_f^2$		**ϕ = 0.90**	(J10-1)	
d_{end}	12.50 mm	*Distance from concentrated force to top of column*		
F_{yf}	344.74 MPa	*Minimum yield stress of column*		
t_f	40.00 mm	*Column flange thickness*		
ϕR_n	1551.32 kN	*Column flange local bending*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (tension)*		
Column Web Yielding	208.70 kN	1034.21 kN	**0.20**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_{w\text{-}eq}$		**ϕ = 1.00**	(J10-3)	
d_{end}	12.50 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
F_y	344.74 MPa	*Minimum yield stress of column*		
$t_{w\text{-}eq}$	120.00 mm	*Equivalent web thickness for yielding. $t_{w\text{-}eq}=t_w+2*t_{dp}*F_{ydp}/F_y$*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	25.00 mm	*Length of bearing*		
ϕR_n	1034.21 kN	*Column web local yielding*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (worst) in bolts due to moment*		
Column Web Buckling	208.70 kN	38257.41 kN	**0.01**	**PASS**
$R_n = 12 * t_w^3 * (E * F_y)^{0.5} / h * Q_f + 2*12 * t_{dp}^3 * (E * F_{ydp})^{0.5} / h * Q_f$		**ϕ = 0.90**	(J10-8)	
d_{end}	12.50 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
h	450.00 mm	*Clear distance between flanges h=d-2*k_{des}*		

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C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	38257.41 kN	*Column web compression buckling*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (compression)*		
Column Web Crippling	208.70 kN	13948.01 kN	**0.01**	**PASS**
$R_n = 0.4*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f + 2*0.4*t_{dp}^2*(1+3*(l_b/d_{col})*(t_{dp}/t_f)^{1.5})*(E*F_{ydp}*t_f/t_{dp})^{0.5}*Q_f$		**ϕ = 0.75**	(J10-5a)	
d_{end}	12.50 mm	*Distance from concentrated force to top of column*		
l_b/d_{col}	0.06	*Bearing length to column depth ratio*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
t_f	40.00 mm	*Column flange thickness*		
l_b	25.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	13948.01 kN	*Column web crippling capacity*		
d_m	575.00 mm	*Moment arm between the flange forces*		
R_{req}	208.70 kN	*Required Flange Force (compression)*		
Column Panel Zone Shear	308.70 kN	4021.02 kN	**0.08**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}))$ $(\alpha*P_r <= 0.75*P_c)$, $\alpha = 1.0$		**ϕ = 0.90**	(J10-11)	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	$P_c=P_y=F_{yc}*A$		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		
b_{fc}	450.00 mm	*Column flange width*		
d_b	600.00 mm	*Beam depth*		
ϕR_n	4021.02 kN	*Web panel zone capacity*		
R_f	208.70 kN	*Beam flange force.* $R_f = M / d_m$		
M	120.00 kN-m	*Moment demand*		
d_m	575.00 mm	*Moment arm from centerline forces*		
V_{above}	100.00 kN	*Story shear in column above connection*		
R_p	308.70 kN	*Panel zone shear demand.* $R_p = R_f + V_{above}$		

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*C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Trans. Stiffener Yield at Column Flange	0.00 kN	3169.81 kN	**0.00**	**PASS**
$R_n = 2 * F_{yst} * A_{st}$		**$\phi = 0.9$**	(J4-1)	
t_s	35.00 mm	*Stiffener thickness*		
b_s	165.00 mm	*Stiffener width*		
clip	19.05 mm	*Stiffener corner clip dimension*		
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{st}	5108.25 mm^2	*Cross-sectional area = $(b_s$ - clip) * t_s*		
ϕR_n	3169.81 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Shear at Column Web	0.00 kN	4070.04 kN	**0.00**	**PASS**
$R_n = 2 * 0.6 * F_{yst} * A_{gv}$		**$\phi = 1.0$**	(J4-3)	
t_s	35.00 mm	*Stiffener thickness*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{gv}	9838.50 mm^2	*Cross-sectional area = $(d_p$ - 2*clip) * t_s*		
ϕR_n	4070.04 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Compression	0.00 kN	2999.71 kN	**0.00**	**PASS**
$R_n = 2 * F_{cr} * A_{st}$		**$\phi = 0.9$**	(E3-1)	
t_s	35.00 mm	*Stiffener thickness*		
K	0.75	*Effective length factor*		
L	370.00 mm	*Unbraced length*		
r	10.10 mm	*Radius of gyration = t_s / $(12)^{0.5}$*		
L_c	277.50 mm	*Effective length, L_c=K*L*		
L_c/r	27.47	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{st}	5108.25 mm^2	*Gross area subject to compression*		
E	199948.01 MPa	*Modulus of elasticity*		
F_e	2616.05 MPa	*Elastic buckling stress (E3-4)*		
F_{cr}	326.24 MPa	*Critical stress (E3-2)*		
ϕR_n	2999.71 kN	*Compressive strength*		
Trans. Stiffener Weld Strength at Column Flange				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Trans. Stiffener Weld Strength at Panel Zone				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Doubler)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Seismic Material and Geometry Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 MPa) (AISC 341-16, A3.1)*		

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*C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of beam*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of column*		
Check Max Beam Depth	**Pass**	*Condition: beam shape <= W36 (AISC 358-16, 8.3.1(2))*		
Beam Shape		*Selected beam shape depth*		
Check Max Beam Weight	**Pass**	*Condition: beam weight <= 0.00 kN/mm (AISC 358-16, 8.3.1 (3))*		
Beam Weight	0.00 kN/mm	*Selected beam weight*		
Check Beam Flange Thickness	**Pass**	*Condition: t_{bf} <= 25.40 mm (AISC 358-16, 8.3.1(4))*		
t_{bf}	25.00 mm	*Beam flange thickness*		
Check Span to Depth Ratio	**Pass**	*Condition: Span/d_b >= 7.00 (AISC 358-16, 8.3.1(5))*		
Span	12000.00 mm	*Beam span*		
d_b	600.00 mm	*Beam depth*		
Check Max Column Depth	**Pass**	*Condition: column shape <= W36 (AISC 358-16, 8.3.2(3))*		
Column Shape		*Selected column shape depth*		
Check Shear Plate Thickness	**Pass**	*Condition: t_p >= t_{bw} (AISC 358-16, 8.6(1))*		
t_p	12.00 mm	*Shear plate thickness*		
t_{bw}	10.00 mm	*Thickness of beam web*		
Seismic Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	125.00 mm	*Half of beam flange width*		
t_{bf}	25.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Modulus of elasticity of beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of beam material*		
Ratio	5.00	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
P_{ub}	0.00 kN	*Axial compression in beam*		
Φ_C	0.90	*Resistance factor for compression*		
A_b	18000.00 mm^2	*Gross area of the beam*		
P_{yb}	6825.81 kN	*Nominal axial yield strength, $P_{yb}=R_{yb}*F_{yb}*A_b$*		
Ca_b	0.00	*Ratio of required strength to available strength, $Ca_b=P_{ub}/(\varphi_C*P_{yb})$*		
h_b	550.00 mm	*Clear distance between beam flanges*		
t_{bw}	10.00 mm	*Thickness of beam web*		
Ratio	55.00	*Width to thickness ratio, h_b/t_{bw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Column Flange	**Pass**	*Condition: Ratio <= Limit*		
b_c	225.00 mm	*Half of column flange width*		
t_{cf}	40.00 mm	*Column flange thickness*		
E_c	199948.01 MPa	*Modulus of elasticity of column material*		
R_{yc}	1.10	*Ration of expected yield stress to minimum yield stress of the column material*		

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C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
Ratio	5.62	*Width to thickness ratio, b_c/t_{cf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		
Check Column Web	**Pass**	*Condition: Ratio <= Limit*		
P_{uc}	0.00 kN	*Axial compression in column*		
ϕ_C	0.90	*Resistance factor for compression*		
A_c	50800.00 mm^2	*Gross area of the column*		
P_{yc}	19263.95 kN	*Nominal axial yield strength, $P_{yc}=R_{yc}*F_{yc}*A_c$*		
Ca_c	0.00	*Ratio of required strength to available strength, $Ca_c=P_{uc}/(\varphi_C*P_{yc})$*		
h_c	370.00 mm	*Clear distance between column flanges*		
t_{cw}	40.00 mm	*Thickness of column web*		
Ratio	9.25	*Width to thickness ratio, h_c/t_{cw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_c/(R_{yc}*F_{yc}))^{0.5}*(1-1.04*Ca_c)$*		
Seismic Moment at Face of Column		***2309.39 kN-m***		
$M_f = M_{pr} + V_h * S_h$			(AISC 358-16, Section 8.7)	
F_y	344.74 MPa	*Minimum yield stress of material*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress*		
C_{pr}	1.40	*Factor to account for peak connection strength (per AISC 358-16 section 8.7 Step 1)*		
Z_x	4350000.00 mm^3	*Plastic section modulus of beam section*		
M_{pr}	2309.39 kN-m	*Probable maximum moment at plastic hinge, $M_{pr}=C_{pr}*R_y*F_y*Z_x$ (AISC 358-16, Eqn 2.4-1)*		
S_h	0.00 mm	*Distance from face of column to the plastic hinge per AISC 358-16 section 8.7 Step 2*		
L	1200.00 cm	*Clear span of beam between column flanges*		
L_h	1200.00 cm	*Beam length between plastic hinges, $L_h=L-2*S_h$*		
V_g	225.00 kN	*Shear due to gravity*		
V_h	609.90 kN	*Probable maximum shear, $V_h=((2*M_{pr})/L_h)+Vg$*		
M_f	2309.39 kN-m	*Probable maximum moment at face of column*		
d_m	575.00 mm	*Moment arm between the flange forces, $d_m=d_b-t_{bf}$*		
d_b	600.00 mm	*Beam depth*		
t_{bf}	25.00 mm	*Beam flange thickness*		
F_{pr}	4016.35 kN	*Design flange force, $F_{pr}=M_f / d_m$*		
Seismic Weld Limitations				**PASS**
Check Web Weld Material	**Pass**	*Condition: Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Web Weld	E70	*Web weld*		
Check Web Weld Type	**Pass**	*Condition: Web weld must be a CJP (AISC 358-16, 8.6(5))*		
Weld Type	CJP	*Web weld type*		
Check Column Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Column Weld	E70	*Column weld*		

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C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Beam Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Beam Weld	E70	*Beam weld*		
Check Beam Weld Type	**Pass**	*Condition: Beam weld must be a fillet weld (AISC 358-16, 8.6 (3))*		
Weld Type	Single Fillet	*Beam weld type*		
Check Beam Weld Size	**Pass**	*Condition: D = t_p - 1.59 mm (AISC 358-16, 8.6 (3))*		
t_p	12.00 mm	*Shear plate thickness*		
D_{16}	6.56	*Fillet weld size in sixteenths of an inch*		
Check Moment Weld Material	**Pass**	*Condition: Moment weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Moment Weld	E70	*Moment weld*		
Check Moment Weld Type	**Pass**	*Condition: Moment weld must be a CJP (AISC 358-16, 8.5(1))*		
Weld Type	CJP	*Moment weld type*		
Check Transverse Stiffener Weld Material	**Pass**	*Condition: Transverse Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Transverse Stiffener Weld	""E70""	*Transverse Stiffener weld*		
Check Transverse Stiffener Weld Type	**Pass**	*Condition: Transverse stiffener weld must be a CJP (AISC 341-16, E3.6f.2(c))*		
Weld Type	CJP	*Transverse stiffener weld type*		
Check Stiffener Weld Material	**Pass**	*Condition: Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Stiffener Weld	""""	*Stiffener weld*		
Check Doubler Web Weld Material	**Pass**	*Condition: Doubler Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Web Weld	""E70""	*Doubler Web weld*		
Check Doubler Flange Weld Material	**Pass**	*Condition: Doubler Flange weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Flange Weld	""E70""	*Doubler Flange weld*		
Check Doubler Flange Weld Type	**Pass**	*Condition: Doubler flange weld must be a PJP or Fillet (AISC 341-16, E3.6e.3)*		
Weld Type	Single Fillet	*Doubler Flange Weld Type*		
Seismic WUF-W Connection Detail Limitations				**PASS**
Check a	**Pass**	*Condition: 6.35 mm <= a <= 12.70 mm (AISC 358-16, Fig. 8.3)*		
a	6.35 mm	*Vertical distance from access hole to edge of shear plate*		
Check b	**Pass**	*Condition: 25.40 mm <= b (AISC 358-16, Fig. 8.3)*		
b	25.40 mm	*Horizontal distance from face of column to start of shear plate taper*		
Check c	**Pass**	*Condition: 20.00 degrees <= c <= 40.00 degrees (AISC 358-16, Fig. 8.3)*		
c	30.00 degrees	*Shear plate taper angle*		
Check d	**Pass**	*Condition: 50.80 mm <= d (AISC 358-16, Fig. 8.3)*		
d	50.80 mm	*Horizontal distance from inner-most access hole edge to end of shear plate taper*		
Check e	**Pass**	*Condition: 12.70 mm <= e <= 25.40 mm (AISC 358-16, Fig. 8.3)*		
e	12.70 mm	*Distance from end of fillet weld to edge of access hole*		
Seismic Column-Beam Moment Ratio				**PASS**
$M^*_{pc} / M^*_{pb} > 1.0$			(AISC 341-16, Eqn E3-1)	
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
P_{uc}	0.00 kN	*Axial force in column*		

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C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
A_c	50800.00 mm^2	*Gross area of the column*		
Z_c	8749000.00 mm^3	*Plastic section modulus of the column*		
α_s	1.00	*Force level adjustment factor*		
M^*_{pc}	3016.09 kN-m	*Nominal flexural strength of the column, $M^*_{pc}=Z_c*(F_{yc}-\alpha_s*P_{uc}/A_c)$ per AISC 341-16 Eqn (E3-2)*		
M_{pr}	2309.39 kN-m	*Probable maximum moment, see 'Seismic Moment at Face of Column' check*		
S_h	0.00 mm	*Distance from face of column to plastic hinge, see 'Seismic Moment at Face of Column' check*		
d_c	450.00 mm	*Depth of the column*		
V_h	609.90 kN	*Probable maximum shear at plastic hinge, see 'Seismic Moment at Face of Column' check*		
M_{uv}	137.23 kN-m	*Additional moment due to shear amplification, $M_{uv}=V_h*(S_h+0.5*d_c)$*		
M^*_{pb}	2446.61 kN-m	*Expected flexural strength of the beam, $M^*_{pb}=M_{pr}+\alpha_s*M_{uv}$, per AISC 358-16 8.4(2)(a)*		
M^*_{pc} / M^*_{pb}	1.23	*Column-beam moment ratio*		
Seismic Beam Web Checks			**0.69**	**PASS**
V_h	609.90 kN	*Probable maximum shear, see 'Seismic Moment at Face of Column' check*		
Check Beam Web Shear Yield	**Pass**	*Condition: $V_h <= \varphi*R_{ny}$ (G2-1 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{ny}$	883.51 kN	*Shear yield strength, see 'Beam Web Shear Yield' check*		
Check Beam Web Shear Rupture	**Pass**	*Condition: $V_h <= \varphi*R_{nr}$ (J4-4 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{nr}$	957.13 kN	*Shear rupture strength, see 'Beam Web Shear Rupture' check*		
Seismic Trans. Stiffener Plate Requirements				**PASS**
Check Stiffener Requirement (Strength)	**Stiffeners Req'd**	*(AISC 341-16, E3.6f.1(a))*		
F_{pr}	4016.35 kN	*Required flange force, see 'Seismic Moment at Face of Column' check (AISC 341-16, E3.6f.1(a))*		
Column Flange Bending		*Condition: $F_{pr} <= \varphi R_{nb}$ (J10-1)*		
ϕR_{nb}	1551.32 kN	*Column flange bending strength, see 'Column Flange Bending' check*		
Column Web Yielding		*Condition: $F_{pr} <= \varphi R_{ny}$ (J10-3)*		
ϕR_{ny}	1034.21 kN	*Column web yielding strength, see 'Column Web Yielding' check*		
Column Web Crippling		*Condition: $F_{pr} <= \varphi R_{nc}$ (J10-5a)*		
ϕR_{nc}	13948.01 kN	*Column web crippling strength, see 'Column Web Crippling' check*		
Unbalanced tension force	2982.13 kN	*Transverse stiffeners are provided*		
Unbalanced compression force	2982.13 kN	*Transverse stiffeners are provided*		
Check Stiffener Requirement (Geometry)	**Stiffeners Req'd**	*Condition: $t_{cf} >= t_{lim}$ (AISC 341-16, Eqn E3-8)*		
t_{cf}	40.00 mm	*Column flange thickness*		
b_{bf}	250.00 mm	*Beam flange width*		
t_{lim}	41.67 mm	*Thickness requirement, $t_{lim} = b_{bf}/6$*		
Seismic Geometry Restrictions for Trans. Stiffener				**PASS**
Check Min Width	**Pass**	*Condition: $b_s >= (b_{bf}-t_w) / 2 - t_{dp}$ (AISC 341-16, E3.6f.2(a))*		

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C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):

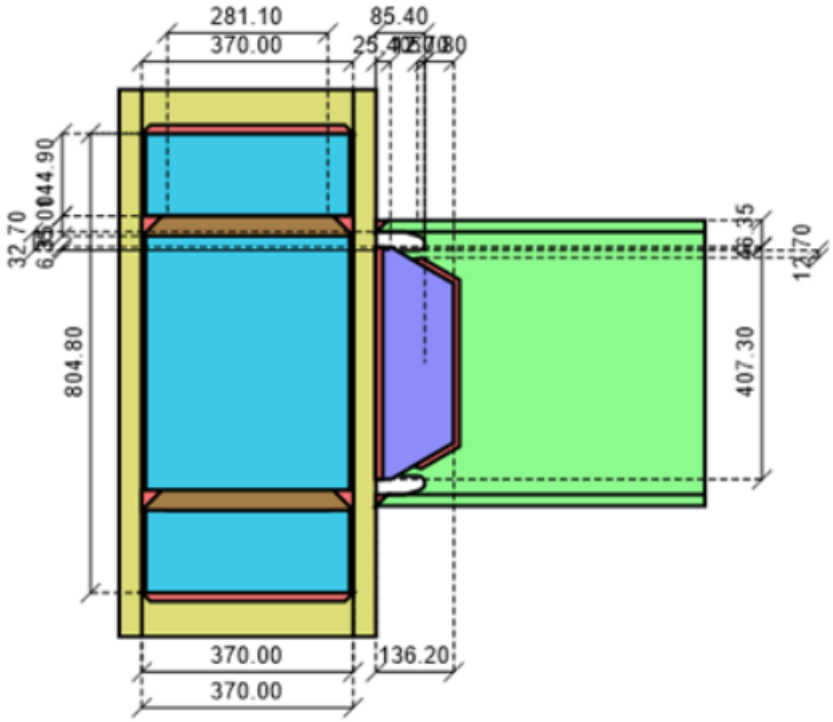
Limit State	Required	Available	Unity Check	Result
b_s	165.00 mm	*Stiffener plate width*		
b_{bf}	250.00 mm	*Beam flange width*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	40.00 mm	*Double plate thickness*		
Check Min Thickness	**Pass**	*Condition: $t_p >= 0.5 * t_{bf}$ (AISC 341-16, E3.6f.2(b))*		
t_p	35.00 mm	*Stiffener plate thickness*		
t_{bf}	25.00 mm	*Beam flange thickness*		
Seismic Trans. Stiffener Strength				**PASS**
Transverse stiffeners shall satisfy the requirements of AISC 360-16 Section J10.8			(AISC 341-16, Section E3.6f.1(a))	
Stiffener Yield at Column Flange	**Pass**	*Condition: $R_{req_cf} <= \varphi R_{ncf}$ (J4-1)*		
ϕR_{ncf}	3169.81 kN	*Stiffener strength at column flange, see 'Trans. Stiffener Yield at Column Flange' check*		
R_{req_cf}	2982.13 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Shear at Column Web	**Pass**	*Condition: $R_{req_cw} <= \varphi R_{ncw}$ (J4-3)*		
ϕR_{ncw}	4070.04 kN	*Stiffener strength at column Web, see 'Trans. Stiffener Shear at Column Web' check*		
R_{req_cw}	2982.13 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Compression	**Pass**	*Condition: $R_{req_c} <= \varphi R_{nc}$*		
ϕR_{nc}	2999.71 kN	*Stiffener compression strength, see 'Trans. Stiffener Compression' check*		
R_{req_c}	2982.13 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Weld Strength at Column Flange	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Column Flange' check*		
Stiffener Weld Strength at Panel Zone	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Panel Zone' check*		
Seismic Panel Zone Limitations				**PASS**
No welds are required at the top and bottom edges of the doubler plate			(AISC 341-16, Section E3.6e.3(b)(1))	
Check Column Web Thickness	**Pass**	*Condition: $t_{wc} >= (d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_{wc}	40.00 mm	*Column web thickness*		
d_b	600.00 mm	*Depth of connecting beam*		
t_{fb}	25.00 mm	*Beam flange thickness*		
d_z	550.00 mm	*Clear distance between beam flanges, $d_z=d_b-2*t_{fb}$*		
w_z	370.00 mm	*Width of panel zone between column flanges*		
Check Doubler Thickness	**Pass**	*Condition: $t_{dp} >= max(t_1, t_2)$*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
t_1	10.22 mm	*Thickness requirement, $t_1=(d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_2	6.35 mm	*Thickness requirement, $t_2=0.25$ in (AISC 341-16, E3.6e.3)*		
Seismic Column Panel Zone Shear	4016.35 kN	4467.80 kN	**0.90**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}))$ $(\alpha*P_r<=0.75*P_c)$, $\alpha = 1.0$		**$\phi = 1.00$**	(AISC 358-16, 8.4 (1))	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	*$P_c=P_y=F_{yc}*A$*		

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*C.22 WUF HI600-10-250*25/20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		
b_{fc}	450.00 mm	*Column flange width*		
d_b	600.00 mm	*Beam depth*		
ϕR_n	4467.80 kN	*Web panel zone capacity*		
R_p	4016.35 kN	*Panel zone shear demand.* $R_p = M_f / d_m$		
M_f	2309.39 kN-m	*Probable maximum moment at face of column, see 'Seismic Moment at Face of Column' check*		
d_m	575.00 mm	*Moment arm*		
Seismic Column Panel Zone at Trans. Stiffener Weld	2982.13 kN	4651.48 kN	**0.64**	**PASS**
$R_n = 2 * 0.6 * F_{yd} * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_{yd}	344.74 MPa	*Minimum yield stress of doubler plate*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
L	281.10 mm	*Contact length,* $L=d_p-2*clip$		
t_d	40.00 mm	*Doubler plate thickness*		
A_{gv}	11244.00 mm^2	*Gross area subject to shear,* $A_{gv}=L*t_d$		
ϕR_n	4651.48 kN	*Available shear strength of the doubler plate*		
R_{req}	2982.13 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check (AISC 341-16 Section E3.6f.2(c))*		

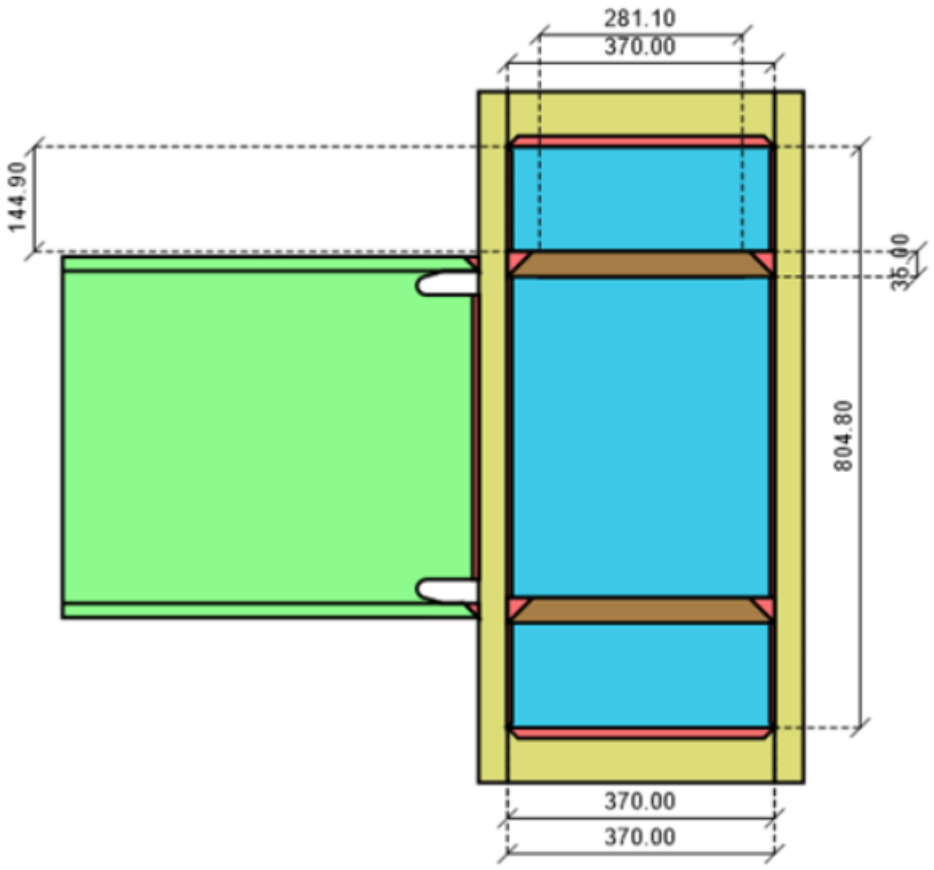
Side view



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*C.23 WUF HI500-10-250*20: 2D Views Report (continued):*

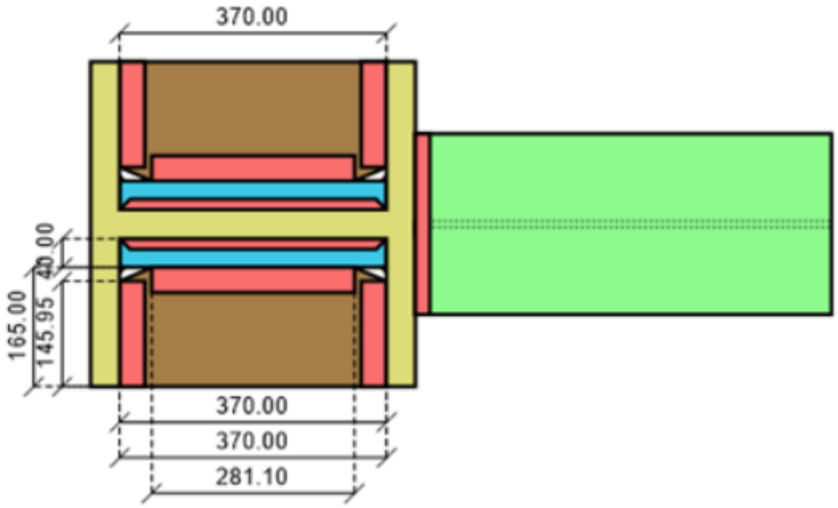
Right view



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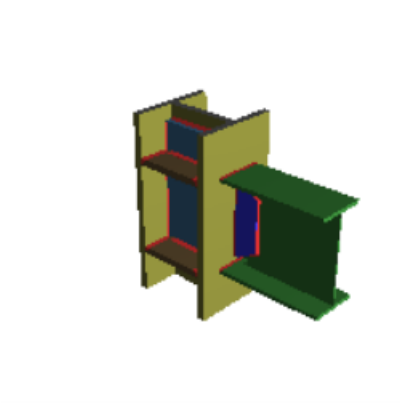
*C.23 WUF HI500-10-250*20: 2D Views Report (continued):*

Top view



*C.23 WUF HI500-10-250*20: LRFD Results Report*

Column/Beam Direct Weld Moment Connection



Material Properties:				
Column	K450*20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI500-8-250-20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P12.00x136.20x407.30	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Doubler	P40.00x370.00x804.80	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Transverse Stiffener	P35.00x165.00x370.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	120.00 kN	*User Input Shear Load*
Moment	120.00 kN-m	*User Input Moment*
Axial Load	0.00 kN	*User Input Axial Force*
Puf_c	250.00 kN	*Required Flange Force (compression)*
Puf_t	250.00 kN	*Required Flange Force (tension)*
Top Column Dist	0.00 mm	*User Input Top Column Dist*
Column Force	0.00 kN	*User Input Column Force*
Story Shear	100.00 kN	*User Input Story Shear*

Input Data:		
Seismic System	SMF (WUF-W)	*User Input Seismic System*
Gravity Shear, Vg	225.00 kN	*User Input Shear due to Gravity*
Clear Span, L	1000.00 cm	*User Input Clear Span of Beam*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{max}	10.41 mm	*Max Size Allowed*		
t	12.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	10.41 mm	*Weld size*		
L_{min}	82.22 mm	*Min weld segment length*		
Beam Web Shear Yield	120.00 kN	575.61 kN	**0.21**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 0.90$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	3156.80 mm^2	*Gross area subject to shear*		
C_{v1}	0.98	*Web shear coefficient (G2-4)*		
ϕR_n	575.61 kN	*Shear yield strength*		
Plate Shear Yield	120.00 kN	1010.96 kN		**n/a**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	4887.60 mm^2	*Gross area subject to shear*		
ϕR_n	1010.96 kN	*Shear yield strength*		
Beam Web Shear Rupture	120.00 kN	636.64 kN	**0.19**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	3156.80 mm^2	*Net area subject to shear*		
ϕR_n	636.64 kN	*Shear rupture strength*		
Plate Shear Rupture	120.00 kN	985.69 kN		**n/a**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	4887.60 mm^2	*Net area subject to shear*		
ϕR_n	985.69 kN	*Shear rupture strength*		
Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Column Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Beam Flange Tensile Yield	250.00 kN	1551.32 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	5000.00 mm^2	*Gross area subject to compression*		
ϕR_n	1551.32 kN	*Tensile yield strength*		
d_m	480.00 mm	*Moment arm between the flange forces*		
R_{req}	250.00 kN	*Required Flange Force (tension)*		
Beam Flange Tensile Rupture	250.00 kN	1680.60 kN	**0.15**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	5000.00 mm^2	*Net area subject to tension*		
ϕR_n	1680.60 kN	*Tensile rupture strength*		
d_m	480.00 mm	*Moment arm between the flange forces*		
R_{req}	250.00 kN	*Required Flange Force (tension)*		
Beam Flange Compression	250.00 kN	1551.32 kN	**0.16**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.9**	(J4-6)	
K	0.65	*Effective length factor*		

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
L	8.54 cm	*Unbraced length*		
r	0.58 cm	*Radius of gyration*		
L_c	55.51 mm	*Effective length, L_c=K*L*		
L_c/r	9.61	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Capacity = Minimum Yield stress for L_c/r <= 25*		
A_g	5000.00 mm^2	*Gross area subject to compression*		
ϕR_n	1551.32 kN	*Compressive strength*		
Column Flange Bending	250.00 kN	1551.32 kN	**0.16**	**PASS**
$R_n = 0.5 * 6.25 * F_{yf} * t_f^2$		**ϕ = 0.90**	(J10-1)	
d_{end}	10.00 mm	*Distance from concentrated force to top of column*		
F_{yf}	344.74 MPa	*Minimum yield stress of column*		
t_f	40.00 mm	*Column flange thickness*		
ϕR_n	1551.32 kN	*Column flange local bending*		
d_m	480.00 mm	*Moment arm between the flange forces*		
R_{req}	250.00 kN	*Required Flange Force (tension)*		
Column Web Yielding	250.00 kN	827.37 kN	**0.30**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_{w\text{-}eq}$		**ϕ = 1.00**	(J10-3)	
d_{end}	10.00 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
F_y	344.74 MPa	*Minimum yield stress of column*		
$t_{w\text{-}eq}$	120.00 mm	*Equivalent web thickness for yielding. $t_{w\text{-}eq}=t_w+2*t_{dp}*F_{ydp}/F_y$*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	20.00 mm	*Length of bearing*		
ϕR_n	827.37 kN	*Column web local yielding*		
d_m	480.00 mm	*Moment arm between the flange forces*		
R_{req}	250.00 kN	*Required Flange Force (worst) in bolts due to moment*		
Column Web Buckling	250.00 kN	38257.41 kN	**0.01**	**PASS**
$R_n = 12 * t_w^3 * (E * F_y)^{0.5} / h * Q_f + 2*12 * t_{dp}^3 * (E * F_{ydp})^{0.5} / h * Q_f$		**ϕ = 0.90**	(J10-8)	
d_{end}	10.00 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
h	450.00 mm	*Clear distance between flanges h=d-2*k_{des}*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	38257.41 kN	*Column web compression buckling*		
d_m	480.00 mm	*Moment arm between the flange forces*		

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
R_{req}	250.00 kN	*Required Flange Force (compression)*		
Column Web Crippling	250.00 kN	13549.50 kN	**0.02**	**PASS**
$R_n = 0.4*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f + 2*0.4*t_{dp}^2*(1+3*(l_b/d_{col})*(t_{dp}/t_f)^{1.5})*(E*F_{ydp}*t_f/t_{dp})^{0.5}*Q_f$		**ϕ = 0.75**	(J10-5a)	
d_{end}	10.00 mm	*Distance from concentrated force to top of column*		
l_b/d_{col}	0.04	*Bearing length to column depth ratio*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
t_f	40.00 mm	*Column flange thickness*		
l_b	20.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	13549.50 kN	*Column web crippling capacity*		
d_m	480.00 mm	*Moment arm between the flange forces*		
R_{req}	250.00 kN	*Required Flange Force (compression)*		
Column Panel Zone Shear	350.00 kN	4155.06 kN	**0.08**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}))$ $(\alpha*P_r <= 0.75*P_c)$, $\alpha = 1.0$		**ϕ = 0.90**	(J10-11)	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	$P_c=P_y=F_{yc}*A$		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		
b_{fc}	450.00 mm	*Column flange width*		
d_b	500.00 mm	*Beam depth*		
ϕR_n	4155.06 kN	*Web panel zone capacity*		
R_f	250.00 kN	*Beam flange force.* $R_f = M / d_m$		
M	120.00 kN-m	*Moment demand*		
d_m	480.00 mm	*Moment arm from centerline forces*		
V_{above}	100.00 kN	*Story shear in column above connection*		
R_p	350.00 kN	*Panel zone shear demand.* $R_p = R_f + V_{above}$		
Trans. Stiffener Yield at Column Flange	0.00 kN	3169.81 kN	**0.00**	**PASS**
$R_n = 2 * F_{yst} * A_{st}$		**ϕ = 0.9**	(J4-1)	
t_s	35.00 mm	*Stiffener thickness*		
b_s	165.00 mm	*Stiffener width*		
clip	19.05 mm	*Stiffener corner clip dimension*		

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C.23 WUF HI500-10-250*20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{st}	5108.25 mm^2	*Cross-sectional area = (b_s - clip) * t_s*		
ϕR_n	3169.81 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Shear at Column Web	0.00 kN	4070.04 kN	**0.00**	**PASS**
$R_n = 2 * 0.6 * F_{yst} * A_{gv}$		**$\phi = 1.0$**	(J4-3)	
t_s	35.00 mm	*Stiffener thickness*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{gv}	9838.50 mm^2	*Cross-sectional area = (d_p - 2*clip) * t_s*		
ϕR_n	4070.04 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Compression	0.00 kN	2999.71 kN	**0.00**	**PASS**
$R_n = 2 * F_{cr} * A_{st}$		**$\phi = 0.9$**	(E3-1)	
t_s	35.00 mm	*Stiffener thickness*		
K	0.75	*Effective length factor*		
L	370.00 mm	*Unbraced length*		
r	10.10 mm	*Radius of gyration = t_s / $(12)^{0.5}$*		
L_c	277.50 mm	*Effective length, L_c=K*L*		
L_c/r	27.47	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{st}	5108.25 mm^2	*Gross area subject to compression*		
E	199948.01 MPa	*Modulus of elasticity*		
F_e	2616.05 MPa	*Elastic buckling stress (E3-4)*		
F_{cr}	326.24 MPa	*Critical stress (E3-2)*		
ϕR_n	2999.71 kN	*Compressive strength*		
Trans. Stiffener Weld Strength at Column Flange				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Trans. Stiffener Weld Strength at Panel Zone				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Doubler)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Seismic Material and Geometry Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of column*		
Check Max Beam Depth	**Pass**	*Condition: beam shape <= W36 (AISC 358-16, 8.3.1(2))*		
Beam Shape		*Selected beam shape depth*		

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Check Max Beam Weight	**Pass**	*Condition: beam weight <= 0.00 kN/mm (AISC 358-16, 8.3.1 (3))*		
Beam Weight	0.00 kN/mm	*Selected beam weight*		
Check Beam Flange Thickness	**Pass**	*Condition: t_{bf} <= 25.40 mm (AISC 358-16, 8.3.1(4))*		
t_{bf}	20.00 mm	*Beam flange thickness*		
Check Span to Depth Ratio	**Pass**	*Condition: Span/d_b >= 7.00 (AISC 358-16, 8.3.1(5))*		
Span	10000.00 mm	*Beam span*		
d_b	500.00 mm	*Beam depth*		
Check Max Column Depth	**Pass**	*Condition: column shape <= W36 (AISC 358-16, 8.3.2(3))*		
Column Shape		*Selected column shape depth*		
Check Shear Plate Thickness	**Pass**	*Condition: t_p >= t_{bw} (AISC 358-16, 8.6(1))*		
t_p	12.00 mm	*Shear plate thickness*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Seismic Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	125.00 mm	*Half of beam flange width*		
t_{bf}	20.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Modulus of elasticity of beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of beam material*		
Ratio	6.25	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
P_{ub}	0.00 kN	*Axial compression in beam*		
ϕ_C	0.90	*Resistance factor for compression*		
A_b	13680.00 mm^2	*Gross area of the beam*		
P_{yb}	5187.62 kN	*Nominal axial yield strength, $P_{yb}=R_{yb}*F_{yb}*A_b$*		
Ca_b	0.00	*Ratio of required strength to available strength, $Ca_b=P_{ub}/(\varphi_C*P_{yb})$*		
h_b	460.00 mm	*Clear distance between beam flanges*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Ratio	57.50	*Width to thickness ratio, h_b/t_{bw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Column Flange	**Pass**	*Condition: Ratio <= Limit*		
b_c	225.00 mm	*Half of column flange width*		
t_{cf}	40.00 mm	*Column flange thickness*		
E_c	199948.01 MPa	*Modulus of elasticity of column material*		
R_{yc}	1.10	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
Ratio	5.62	*Width to thickness ratio, b_c/t_{cf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		
Check Column Web	**Pass**	*Condition: Ratio <= Limit*		
P_{uc}	0.00 kN	*Axial compression in column*		

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C.23 WUF HI500-10-250*20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕ_C	0.90	*Resistance factor for compression*		
A_c	50800.00 mm^2	*Gross area of the column*		
P_{yc}	19263.95 kN	*Nominal axial yield strength, $P_{yc}=R_{yc}*F_{yc}*A_c$*		
Ca_c	0.00	*Ratio of required strength to available strength, $Ca_c=P_{uc}/(\varphi_C*P_{yc})$*		
h_c	370.00 mm	*Clear distance between column flanges*		
t_{cw}	40.00 mm	*Thickness of column web*		
Ratio	9.25	*Width to thickness ratio, h_c/t_{cw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_c/(R_{yc}*F_{yc}))^{0.5}*(1-1.04*Ca_c)$*		
Seismic Moment at Face of Column		***1498.82 kN-m***		
$M_f = M_{pr} + V_h * S_h$			(AISC 358-16, Section 8.7)	
F_y	344.74 MPa	*Minimum yield stress of material*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress*		
C_{pr}	1.40	*Factor to account for peak connection strength (per AISC 358-16 section 8.7 Step 1)*		
Z_x	2823200.00 mm^3	*Plastic section modulus of beam section*		
M_{pr}	1498.82 kN-m	*Probable maximum moment at plastic hinge, $M_{pr}=C_{pr}*R_y*F_y*Z_x$ (AISC 358-16, Eqn 2.4-1)*		
S_h	0.00 mm	*Distance from face of column to the plastic hinge per AISC 358-16 section 8.7 Step 2*		
L	1000.00 cm	*Clear span of beam between column flanges*		
L_h	1000.00 cm	*Beam length between plastic hinges, $L_h=L-2*S_h$*		
V_g	225.00 kN	*Shear due to gravity*		
V_h	524.77 kN	*Probable maximum shear, $V_h=((2*M_{pr})/L_h)+Vg$*		
M_f	1498.82 kN-m	*Probable maximum moment at face of column*		
d_m	480.00 mm	*Moment arm between the flange forces, $d_m=d_b-t_{bf}$*		
d_b	500.00 mm	*Beam depth*		
t_{bf}	20.00 mm	*Beam flange thickness*		
F_{pr}	3122.56 kN	*Design flange force, $F_{pr}=M_f / d_m$*		
Seismic Weld Limitations				**PASS**
Check Web Weld Material	**Pass**	*Condition: Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Web Weld	E70	*Web weld*		
Check Web Weld Type	**Pass**	*Condition: Web weld must be a CJP (AISC 358-16, 8.6(5))*		
Weld Type	CJP	*Web weld type*		
Check Column Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Column Weld	E70	*Column weld*		
Check Beam Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Beam Weld	E70	*Beam weld*		
Check Beam Weld Type	**Pass**	*Condition: Beam weld must be a fillet weld (AISC 358-16, 8.6 (3))*		
Weld Type	Single Fillet	*Beam weld type*		
Check Beam Weld Size	**Pass**	*Condition: D = t_p - 1.59 mm (AISC 358-16, 8.6 (3))*		

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
t_p	12.00 mm	*Shear plate thickness*		
D_{16}	6.56	*Fillet weld size in sixteenths of an inch*		
Check Moment Weld Material	**Pass**	*Condition: Moment weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Moment Weld	E70	*Moment weld*		
Check Moment Weld Type	**Pass**	*Condition: Moment weld must be a CJP (AISC 358-16, 8.5(1))*		
Weld Type	CJP	*Moment weld type*		
Check Transverse Stiffener Weld Material	**Pass**	*Condition: Transverse Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Transverse Stiffener Weld	""E70""	*Transverse Stiffener weld*		
Check Transverse Stiffener Weld Type	**Pass**	*Condition: Transverse stiffener weld must be a CJP (AISC 341-16, E3.6f.2(c))*		
Weld Type	CJP	*Transverse stiffener weld type*		
Check Stiffener Weld Material	**Pass**	*Condition: Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Stiffener Weld	""""	*Stiffener weld*		
Check Doubler Web Weld Material	**Pass**	*Condition: Doubler Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Web Weld	""E70""	*Doubler Web weld*		
Check Doubler Flange Weld Material	**Pass**	*Condition: Doubler Flange weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Flange Weld	""E70""	*Doubler Flange weld*		
Check Doubler Flange Weld Type	**Pass**	*Condition: Doubler flange weld must be a PJP or Fillet (AISC 341-16, E3.6e.3)*		
Weld Type	Single Fillet	*Doubler Flange Weld Type*		
Seismic WUF-W Connection Detail Limitations				**PASS**
Check a	**Pass**	*Condition: 6.35 mm <= a <= 12.70 mm (AISC 358-16, Fig. 8.3)*		
a	6.35 mm	*Vertical distance from access hole to edge of shear plate*		
Check b	**Pass**	*Condition: 25.40 mm <= b (AISC 358-16, Fig. 8.3)*		
b	25.40 mm	*Horizontal distance from face of column to start of shear plate taper*		
Check c	**Pass**	*Condition: 20.00 degrees <= c <= 40.00 degrees (AISC 358-16, Fig. 8.3)*		
c	30.00 degrees	*Shear plate taper angle*		
Check d	**Pass**	*Condition: 50.80 mm <= d (AISC 358-16, Fig. 8.3)*		
d	50.80 mm	*Horizontal distance from inner-most access hole edge to end of shear plate taper*		
Check e	**Pass**	*Condition: 12.70 mm <= e <= 25.40 mm (AISC 358-16, Fig. 8.3)*		
e	12.70 mm	*Distance from end of fillet weld to edge of access hole*		
Seismic Column-Beam Moment Ratio				**PASS**
$M^*_{pc} / M^*_{pb} > 1.0$			(AISC 341-16, Eqn E3-1)	
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
P_{uc}	0.00 kN	*Axial force in column*		
A_c	50800.00 mm^2	*Gross area of the column*		
Z_c	8749000.00 mm^3	*Plastic section modulus of the column*		
α_s	1.00	*Force level adjustment factor*		
M^*_{pc}	3016.09 kN-m	*Nominal flexural strength of the column, $M^*_{pc}=Z_c*(F_{yc}-\alpha_s*P_{uc}/A_c)$ per AISC 341-16 Eqn (E3-2)*		

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C.23 WUF HI500-10-250*20: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
M_{pr}	1498.82 kN-m	*Probable maximum moment, see 'Seismic Moment at Face of Column' check*		
S_h	0.00 mm	*Distance from face of column to plastic hinge, see 'Seismic Moment at Face of Column' check*		
d_c	450.00 mm	*Depth of the column*		
V_h	524.77 kN	*Probable maximum shear at plastic hinge, see 'Seismic Moment at Face of Column' check*		
M_{uv}	118.07 kN-m	*Additional moment due to shear amplification, $M_{uv}=V_h*(S_h+0.5*d_c)$*		
M^*_{pb}	1616.89 kN-m	*Expected flexural strength of the beam, $M^*_{pb}=M_{pr}+\alpha_s*M_{uv}$, per AISC 358-16 8.4(2)(a)*		
M^*_{pc} / M^*_{pb}	1.87	*Column-beam moment ratio*		
Seismic Beam Web Checks			**0.91**	**PASS**
V_h	524.77 kN	*Probable maximum shear, see 'Seismic Moment at Face of Column' check*		
Check Beam Web Shear Yield	**Pass**	*Condition: $V_h <= \varphi*R_{ny}$ (G2-1 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{ny}$	575.61 kN	*Shear yield strength, see 'Beam Web Shear Yield' check*		
Check Beam Web Shear Rupture	**Pass**	*Condition: $V_h <= \varphi*R_{nr}$ (J4-4 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{nr}$	636.64 kN	*Shear rupture strength, see 'Beam Web Shear Rupture' check*		
Seismic Trans. Stiffener Plate Requirements				**PASS**
Check Stiffener Requirement (Strength)	**Stiffeners Req'd**	*(AISC 341-16, E3.6f.1(a))*		
F_{pr}	3122.56 kN	*Required flange force, see 'Seismic Moment at Face of Column' check (AISC 341-16, E3.6f.1(a))*		
Column Flange Bending		*Condition: $F_{pr} <= \varphi R_{nb}$ (J10-1)*		
ϕR_{nb}	1551.32 kN	*Column flange bending strength, see 'Column Flange Bending' check*		
Column Web Yielding		*Condition: $F_{pr} <= \varphi R_{ny}$ (J10-3)*		
ϕR_{ny}	827.37 kN	*Column web yielding strength, see 'Column Web Yielding' check*		
Column Web Crippling		*Condition: $F_{pr} <= \varphi R_{nc}$ (J10-5a)*		
ϕR_{nc}	13549.50 kN	*Column web crippling strength, see 'Column Web Crippling' check*		
Unbalanced tension force	2295.18 kN	*Transverse stiffeners are provided*		
Unbalanced compression force	2295.18 kN	*Transverse stiffeners are provided*		
Check Stiffener Requirement (Geometry)	**Stiffeners Req'd**	*Condition: $t_{cf} >= t_{lim}$ (AISC 341-16, Eqn E3-8)*		
t_{cf}	40.00 mm	*Column flange thickness*		
b_{bf}	250.00 mm	*Beam flange width*		
t_{lim}	41.67 mm	*Thickness requirement, $t_{lim} = b_{bf}/6$*		
Seismic Geometry Restrictions for Trans. Stiffener				**PASS**
Check Min Width	**Pass**	*Condition: $b_s >= (b_{bf}-t_w) / 2 - t_{dp}$ (AISC 341-16, E3.6f.2(a))*		
b_s	165.00 mm	*Stiffener plate width*		
b_{bf}	250.00 mm	*Beam flange width*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	40.00 mm	*Double plate thickness*		
Check Min Thickness	**Pass**	*Condition: $t_p >= 0.5 * t_{bf}$ (AISC 341-16, E3.6f.2(b))*		

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C.23 WUF HI500-10-250*20: LRFD Results Report (continued):

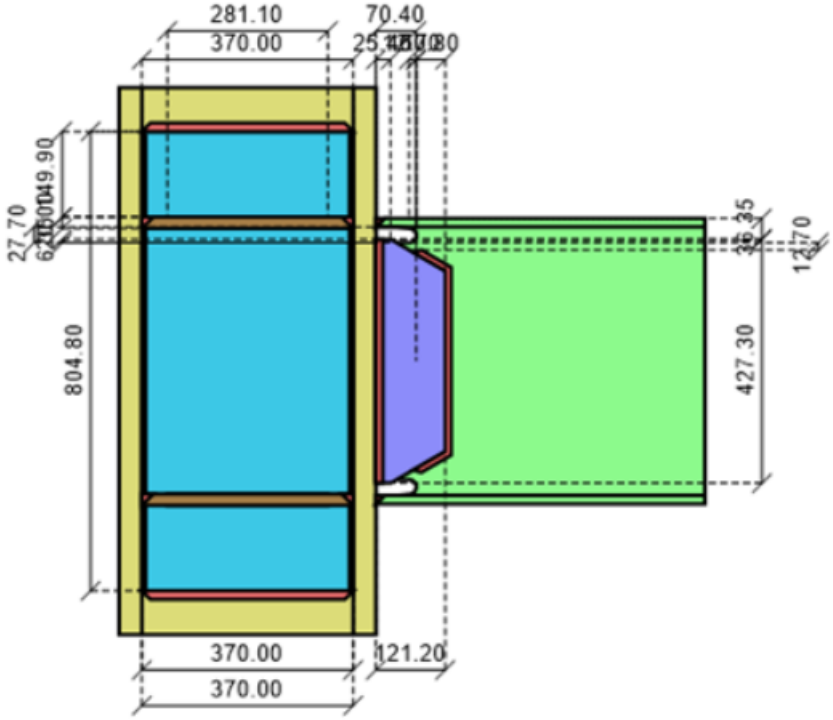
Limit State	Required	Available	Unity Check	Result
t_p	35.00 mm	*Stiffener plate thickness*		
t_{bf}	20.00 mm	*Beam flange thickness*		
Seismic Trans. Stiffener Strength				**PASS**
Transverse stiffeners shall satisfy the requirements of AISC 360-16 Section J10.8		(AISC 341-16, Section E3.6f.1(a))		
Stiffener Yield at Column Flange	**Pass**	*Condition: $R_{req_cf} <= \varphi R_{ncf}$ (J4-1)*		
ϕR_{ncf}	3169.81 kN	*Stiffener strength at column flange, see 'Trans. Stiffener Yield at Column Flange' check*		
R_{req_cf}	2295.18 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Shear at Column Web	**Pass**	*Condition: $R_{req_cw} <= \varphi R_{ncw}$ (J4-3)*		
ϕR_{ncw}	4070.04 kN	*Stiffener strength at column Web, see 'Trans. Stiffener Shear at Column Web' check*		
R_{req_cw}	2295.18 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Compression	**Pass**	*Condition: $R_{req_c} <= \varphi R_{nc}$*		
ϕR_{nc}	2999.71 kN	*Stiffener compression strength, see 'Trans. Stiffener Compression' check*		
R_{req_c}	2295.18 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Weld Strength at Column Flange	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Column Flange' check*		
Stiffener Weld Strength at Panel Zone	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Panel Zone' check*		
Seismic Panel Zone Limitations				**PASS**
No welds are required at the top and bottom edges of the doubler plate		(AISC 341-16, Section E3.6e.3(b)(1))		
Check Column Web Thickness	**Pass**	*Condition: $t_{wc} >= (d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_{wc}	40.00 mm	*Column web thickness*		
d_b	500.00 mm	*Depth of connecting beam*		
t_{fb}	20.00 mm	*Beam flange thickness*		
d_z	460.00 mm	*Clear distance between beam flanges, $d_z=d_b-2*t_{fb}$*		
w_z	370.00 mm	*Width of panel zone between column flanges*		
Check Doubler Thickness	**Pass**	*Condition: $t_{dp} >= max(t_1, t_2)$*		
t_{dp}	40.00 mm	*Doubler plate thickness*		
t_1	9.22 mm	*Thickness requirement, $t_1=(d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_2	6.35 mm	*Thickness requirement, $t_2=0.25$ in (AISC 341-16, E3.6e.3)*		
Seismic Column Panel Zone Shear	3122.56 kN	4616.73 kN	**0.68**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}$)) ($\alpha*P_r<=0.75*P_c$), $\alpha = 1.0$		**$\phi = 1.00$**	(AISC 358-16, 8.4 (1))	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	*$P_c=P_y=F_{yc}*A$*		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		

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*C.23 WUF HI500-10-250*20: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
b_{fc}	450.00 mm	*Column flange width*		
d_b	500.00 mm	*Beam depth*		
ϕR_n	4616.73 kN	*Web panel zone capacity*		
R_p	3122.56 kN	*Panel zone shear demand.* $R_p = M_f / d_m$		
M_f	1498.82 kN-m	*Probable maximum moment at face of column, see 'Seismic Moment at Face of Column' check*		
d_m	480.00 mm	*Moment arm*		
Seismic Column Panel Zone at Trans. Stiffener Weld	2295.18 kN	4651.48 kN	**0.49**	**PASS**
$R_n = 2 * 0.6 * F_{yd} * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_{yd}	344.74 MPa	*Minimum yield stress of doubler plate*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
L	281.10 mm	*Contact length,* $L=d_p-2*clip$		
t_d	40.00 mm	*Doubler plate thickness*		
A_{gv}	11244.00 mm^2	*Gross area subject to shear,* $A_{gv}=L*t_d$		
ϕR_n	4651.48 kN	*Available shear strength of the doubler plate*		
R_{req}	2295.18 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check (AISC 341-16 Section E3.6f.2(c))*		

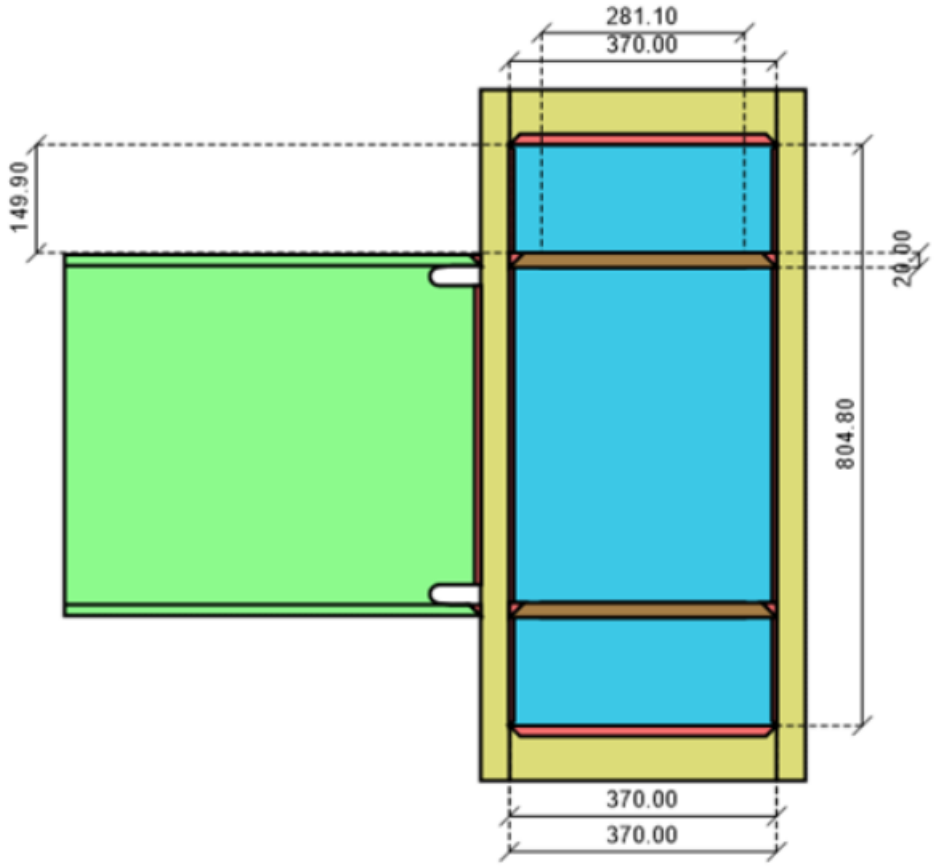
Side view



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*C.24 WUF HI500-8-200*15: 2D Views Report (continued):*

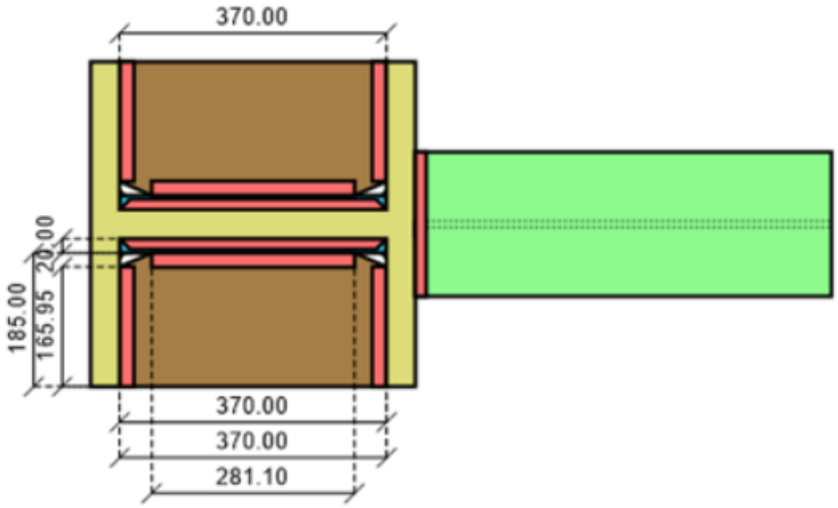
Right view



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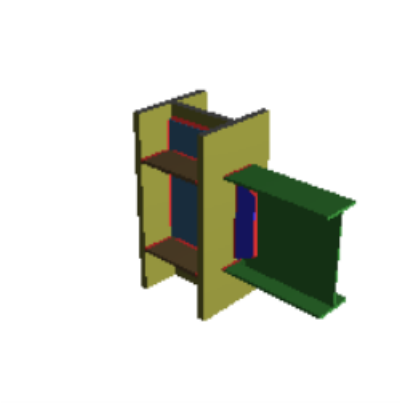
*C.24 WUF HI500-8-200*15: 2D Views Report (continued):*

Top view



*C.24 WUF HI500-8-200*15: LRFD Results Report*

Column/Beam Direct Weld Moment Connection



Material Properties:				
Column	K450*20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI500-8-15*200	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P12.00x121.20x427.30	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Doubler	P20.00x370.00x804.80	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Transverse Stiffener	P20.00x185.00x370.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	120.00 kN	*User Input Shear Load*
Moment	120.00 kN-m	*User Input Moment*
Axial Load	0.00 kN	*User Input Axial Force*
Puf_c	247.42 kN	*Required Flange Force (compression)*
Puf_t	247.42 kN	*Required Flange Force (tension)*
Top Column Dist	0.00 mm	*User Input Top Column Dist*
Column Force	0.00 kN	*User Input Column Force*
Story Shear	100.00 kN	*User Input Story Shear*

Input Data:		
Seismic System	SMF (WUF-W)	*User Input Seismic System*
Gravity Shear, Vg	225.00 kN	*User Input Shear due to Gravity*
Clear Span, L	720.00 cm	*User Input Clear Span of Beam*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{max}	10.41 mm	*Max Size Allowed*		
t	12.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	10.41 mm	*Weld size*		
L_{min}	64.90 mm	*Min weld segment length*		
Beam Web Shear Yield	120.00 kN	604.78 kN	**0.20**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 0.90$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	3316.80 mm^2	*Gross area subject to shear*		
C_{v1}	0.98	*Web shear coefficient (G2-4)*		
ϕR_n	604.78 kN	*Shear yield strength*		
Plate Shear Yield	120.00 kN	1060.61 kN		**n/a**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	5127.60 mm^2	*Gross area subject to shear*		
ϕR_n	1060.61 kN	*Shear yield strength*		
Beam Web Shear Rupture	120.00 kN	668.90 kN	**0.18**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	3316.80 mm^2	*Net area subject to shear*		
ϕR_n	668.90 kN	*Shear rupture strength*		
Plate Shear Rupture	120.00 kN	1034.09 kN		**n/a**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	5127.60 mm^2	*Net area subject to shear*		
ϕR_n	1034.09 kN	*Shear rupture strength*		
Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Column Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Beam Flange Tensile Yield	247.42 kN	930.79 kN	**0.27**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	3000.00 mm^2	*Gross area subject to compression*		
ϕR_n	930.79 kN	*Tensile yield strength*		
d_m	485.00 mm	*Moment arm between the flange forces*		
R_{req}	247.42 kN	*Required Flange Force (tension)*		
Beam Flange Tensile Rupture	247.42 kN	1008.36 kN	**0.25**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	3000.00 mm^2	*Net area subject to tension*		
ϕR_n	1008.36 kN	*Tensile rupture strength*		
d_m	485.00 mm	*Moment arm between the flange forces*		
R_{req}	247.42 kN	*Required Flange Force (tension)*		
Beam Flange Compression	247.42 kN	930.79 kN	**0.27**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.9**	(J4-6)	
K	0.65	*Effective length factor*		

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
L	7.04 cm	*Unbraced length*		
r	0.43 cm	*Radius of gyration*		
L_c	45.76 mm	*Effective length, L_c=K*L*		
L_c/r	10.57	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Capacity = Minimum Yield stress for L_c/r <= 25*		
A_g	3000.00 mm^2	*Gross area subject to compression*		
ϕR_n	930.79 kN	*Compressive strength*		
Column Flange Bending	247.42 kN	1551.32 kN	**0.16**	**PASS**
$R_n = 0.5 * 6.25 * F_{yf} * t_f^2$		**ϕ = 0.90**	(J10-1)	
d_{end}	7.50 mm	*Distance from concentrated force to top of column*		
F_{yf}	344.74 MPa	*Minimum yield stress of column*		
t_f	40.00 mm	*Column flange thickness*		
ϕR_n	1551.32 kN	*Column flange local bending*		
d_m	485.00 mm	*Moment arm between the flange forces*		
R_{req}	247.42 kN	*Required Flange Force (tension)*		
Column Web Yielding	247.42 kN	413.69 kN	**0.60**	**PASS**
$R_n = (2.5 * k + l_b) * F_y * t_{w\text{-}eq}$		**ϕ = 1.00**	(J10-3)	
d_{end}	7.50 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
F_y	344.74 MPa	*Minimum yield stress of column*		
$t_{w\text{-}eq}$	80.00 mm	*Equivalent web thickness for yielding. $t_{w\text{-}eq}=t_w+2*t_{dp}*F_{ydp}/F_y$*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	15.00 mm	*Length of bearing*		
ϕR_n	413.69 kN	*Column web local yielding*		
d_m	485.00 mm	*Moment arm between the flange forces*		
R_{req}	247.42 kN	*Required Flange Force (worst) in bolts due to moment*		
Column Web Buckling	247.42 kN	15940.59 kN	**0.02**	**PASS**
$R_n = 12 * t_w^3 * (E * F_y)^{0.5} / h * Q_f + 2*12 * t_{dp}^3 * (E * F_{ydp})^{0.5} / h * Q_f$		**ϕ = 0.90**	(J10-8)	
d_{end}	7.50 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
h	450.00 mm	*Clear distance between flanges h=d-2*k_{des}*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	15940.59 kN	*Column web compression buckling*		
d_m	485.00 mm	*Moment arm between the flange forces*		

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
R_{req}	247.42 kN	*Required Flange Force (compression)*		
Column Web Crippling	247.42 kN	7301.21 kN	**0.03**	**PASS**
$R_n = 0.4*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f + 2*0.4*t_{dp}^2*(1+3*(l_b/d_{col})*(t_{dp}/t_f)^{1.5})*(E*F_{ydp}*t_f/t_{dp})^{0.5}*Q_f$		**ϕ = 0.75**	(J10-5a)	
d_{end}	7.50 mm	*Distance from concentrated force to top of column*		
l_b/d_{col}	0.03	*Bearing length to column depth ratio*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
t_f	40.00 mm	*Column flange thickness*		
l_b	15.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	7301.21 kN	*Column web crippling capacity*		
d_m	485.00 mm	*Moment arm between the flange forces*		
R_{req}	247.42 kN	*Required Flange Force (compression)*		
Column Panel Zone Shear	347.42 kN	4155.06 kN	**0.08**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}))$ $(\alpha*P_r <= 0.75*P_c)$, $\alpha = 1.0$		**ϕ = 0.90**	(J10-11)	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	$P_c=P_y=F_{yc}*A$		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		
b_{fc}	450.00 mm	*Column flange width*		
d_b	500.00 mm	*Beam depth*		
ϕR_n	4155.06 kN	*Web panel zone capacity*		
R_f	247.42 kN	*Beam flange force.* $R_f = M / d_m$		
M	120.00 kN-m	*Moment demand*		
d_m	485.00 mm	*Moment arm from centerline forces*		
V_{above}	100.00 kN	*Story shear in column above connection*		
R_p	347.42 kN	*Panel zone shear demand.* $R_p = R_f + V_{above}$		
Trans. Stiffener Yield at Column Flange	0.00 kN	2059.53 kN	**0.00**	**PASS**
$R_n = 2 * F_{yst} * A_{st}$		**ϕ = 0.9**	(J4-1)	
t_s	20.00 mm	*Stiffener thickness*		
b_s	185.00 mm	*Stiffener width*		
clip	19.05 mm	*Stiffener corner clip dimension*		

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{st}	3319.00 mm^2	*Cross-sectional area = (b_s - clip) * t_s*		
ϕR_n	2059.53 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Shear at Column Web	0.00 kN	2325.74 kN	**0.00**	**PASS**
R_n = 2 * 0.6 * F_{yst} * A_{gv}		**ϕ = 1.0**	(J4-3)	
t_s	20.00 mm	*Stiffener thickness*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{gv}	5622.00 mm^2	*Cross-sectional area = (d_p - 2*clip) * t_s*		
ϕR_n	2325.74 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Compression	0.00 kN	1739.44 kN	**0.00**	**PASS**
R_n = 2 * F_{cr} * A_{st}		**ϕ = 0.9**	(E3-1)	
t_s	20.00 mm	*Stiffener thickness*		
K	0.75	*Effective length factor*		
L	370.00 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration = t_s / $(12)^{0.5}$*		
L_c	277.50 mm	*Effective length, L_c=K*L*		
L_c/r	48.06	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{st}	3319.00 mm^2	*Gross area subject to compression*		
E	199948.01 MPa	*Modulus of elasticity*		
F_e	854.22 MPa	*Elastic buckling stress (E3-4)*		
F_{cr}	291.16 MPa	*Critical stress (E3-2)*		
ϕR_n	1739.44 kN	*Compressive strength*		
Trans. Stiffener Weld Strength at Column Flange				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Trans. Stiffener Weld Strength at Panel Zone				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Doubler)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Seismic Material and Geometry Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of column*		
Check Max Beam Depth	**Pass**	*Condition: beam shape <= W36 (AISC 358-16, 8.3.1(2))*		
Beam Shape		*Selected beam shape depth*		

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Check Max Beam Weight	**Pass**	*Condition: beam weight <= 0.00 kN/mm (AISC 358-16, 8.3.1 (3))*		
Beam Weight	0.00 kN/mm	*Selected beam weight*		
Check Beam Flange Thickness	**Pass**	*Condition: t_{bf} <= 25.40 mm (AISC 358-16, 8.3.1(4))*		
t_{bf}	15.00 mm	*Beam flange thickness*		
Check Span to Depth Ratio	**Pass**	*Condition: Span/d_b >= 7.00 (AISC 358-16, 8.3.1(5))*		
Span	7200.00 mm	*Beam span*		
d_b	500.00 mm	*Beam depth*		
Check Max Column Depth	**Pass**	*Condition: column shape <= W36 (AISC 358-16, 8.3.2(3))*		
Column Shape		*Selected column shape depth*		
Check Shear Plate Thickness	**Pass**	*Condition: t_p >= t_{bw} (AISC 358-16, 8.6(1))*		
t_p	12.00 mm	*Shear plate thickness*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Seismic Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	100.00 mm	*Half of beam flange width*		
t_{bf}	15.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Modulus of elasticity of beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of beam material*		
Ratio	6.67	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
P_{ub}	0.00 kN	*Axial compression in beam*		
ϕ_C	0.90	*Resistance factor for compression*		
A_b	9760.00 mm^2	*Gross area of the beam*		
P_{yb}	3701.11 kN	*Nominal axial yield strength, $P_{yb}=R_{yb}*F_{yb}*A_b$*		
Ca_b	0.00	*Ratio of required strength to available strength, $Ca_b=P_{ub}/(\varphi_C*P_{yb})$*		
h_b	470.00 mm	*Clear distance between beam flanges*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Ratio	58.75	*Width to thickness ratio, h_b/t_{bw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Column Flange	**Pass**	*Condition: Ratio <= Limit*		
b_c	225.00 mm	*Half of column flange width*		
t_{cf}	40.00 mm	*Column flange thickness*		
E_c	199948.01 MPa	*Modulus of elasticity of column material*		
R_{yc}	1.10	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
Ratio	5.62	*Width to thickness ratio, b_c/t_{cf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		
Check Column Web	**Pass**	*Condition: Ratio <= Limit*		
P_{uc}	0.00 kN	*Axial compression in column*		

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C.24 WUF HI500-8-200*15: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
ϕ_C	0.90	*Resistance factor for compression*		
A_c	50800.00 mm^2	*Gross area of the column*		
P_{yc}	19263.95 kN	*Nominal axial yield strength, $P_{yc}=R_{yc}*F_{yc}*A_c$*		
Ca_c	0.00	*Ratio of required strength to available strength, $Ca_c=P_{uc}/(\varphi_C*P_{yc})$*		
h_c	370.00 mm	*Clear distance between column flanges*		
t_{cw}	40.00 mm	*Thickness of column web*		
Ratio	9.25	*Width to thickness ratio, h_c/t_{cw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_c/(R_{yc}*F_{yc}))^{0.5}*(1-1.04*Ca_c)$*		
Seismic Moment at Face of Column		***1007.00 kN-m***		
$M_f = M_{pr} + V_h * S_h$			(AISC 358-16, Section 8.7)	
F_y	344.74 MPa	*Minimum yield stress of material*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress*		
C_{pr}	1.40	*Factor to account for peak connection strength (per AISC 358-16 section 8.7 Step 1)*		
Z_x	1896800.00 mm^3	*Plastic section modulus of beam section*		
M_{pr}	1007.00 kN-m	*Probable maximum moment at plastic hinge, $M_{pr}=C_{pr}*R_y*F_y*Z_x$ (AISC 358-16, Eqn 2.4-1)*		
S_h	0.00 mm	*Distance from face of column to the plastic hinge per AISC 358-16 section 8.7 Step 2*		
L	720.00 cm	*Clear span of beam between column flanges*		
L_h	720.00 cm	*Beam length between plastic hinges, $L_h=L-2*S_h$*		
V_g	225.00 kN	*Shear due to gravity*		
V_h	504.72 kN	*Probable maximum shear, $V_h=((2*M_{pr})/L_h)+Vg$*		
M_f	1007.00 kN-m	*Probable maximum moment at face of column*		
d_m	485.00 mm	*Moment arm between the flange forces, $d_m=d_b-t_{bf}$*		
d_b	500.00 mm	*Beam depth*		
t_{bf}	15.00 mm	*Beam flange thickness*		
F_{pr}	2076.30 kN	*Design flange force, $F_{pr}=M_f / d_m$*		
Seismic Weld Limitations				**PASS**
Check Web Weld Material	**Pass**	*Condition: Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Web Weld	E70	*Web weld*		
Check Web Weld Type	**Pass**	*Condition: Web weld must be a CJP (AISC 358-16, 8.6(5))*		
Weld Type	CJP	*Web weld type*		
Check Column Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Column Weld	E70	*Column weld*		
Check Beam Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Beam Weld	E70	*Beam weld*		
Check Beam Weld Type	**Pass**	*Condition: Beam weld must be a fillet weld (AISC 358-16, 8.6 (3))*		
Weld Type	Single Fillet	*Beam weld type*		
Check Beam Weld Size	**Pass**	*Condition: D = t_p - 1.59 mm (AISC 358-16, 8.6 (3))*		

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C.24 WUF HI500-8-200*15: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
t_p	12.00 mm	*Shear plate thickness*		
D_{16}	6.56	*Fillet weld size in sixteenths of an inch*		
Check Moment Weld Material	**Pass**	*Condition: Moment weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Moment Weld	E70	*Moment weld*		
Check Moment Weld Type	**Pass**	*Condition: Moment weld must be a CJP (AISC 358-16, 8.5(1))*		
Weld Type	CJP	*Moment weld type*		
Check Transverse Stiffener Weld Material	**Pass**	*Condition: Transverse Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Transverse Stiffener Weld	""E70""	*Transverse Stiffener weld*		
Check Transverse Stiffener Weld Type	**Pass**	*Condition: Transverse stiffener weld must be a CJP (AISC 341-16, E3.6f.2(c))*		
Weld Type	CJP	*Transverse stiffener weld type*		
Check Stiffener Weld Material	**Pass**	*Condition: Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Stiffener Weld	""""	*Stiffener weld*		
Check Doubler Web Weld Material	**Pass**	*Condition: Doubler Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Web Weld	""E70""	*Doubler Web weld*		
Check Doubler Flange Weld Material	**Pass**	*Condition: Doubler Flange weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Flange Weld	""E70""	*Doubler Flange weld*		
Check Doubler Flange Weld Type	**Pass**	*Condition: Doubler flange weld must be a PJP or Fillet (AISC 341-16, E3.6e.3)*		
Weld Type	Single Fillet	*Doubler Flange Weld Type*		
Seismic WUF-W Connection Detail Limitations				**PASS**
Check a	**Pass**	*Condition: 6.35 mm <= a <= 12.70 mm (AISC 358-16, Fig. 8.3)*		
a	6.35 mm	*Vertical distance from access hole to edge of shear plate*		
Check b	**Pass**	*Condition: 25.40 mm <= b (AISC 358-16, Fig. 8.3)*		
b	25.40 mm	*Horizontal distance from face of column to start of shear plate taper*		
Check c	**Pass**	*Condition: 20.00 degrees <= c <= 40.00 degrees (AISC 358-16, Fig. 8.3)*		
c	30.00 degrees	*Shear plate taper angle*		
Check d	**Pass**	*Condition: 50.80 mm <= d (AISC 358-16, Fig. 8.3)*		
d	50.80 mm	*Horizontal distance from inner-most access hole edge to end of shear plate taper*		
Check e	**Pass**	*Condition: 12.70 mm <= e <= 25.40 mm (AISC 358-16, Fig. 8.3)*		
e	12.70 mm	*Distance from end of fillet weld to edge of access hole*		
Seismic Column-Beam Moment Ratio				**PASS**
$M^*_{pc} / M^*_{pb} > 1.0$			(AISC 341-16, Eqn E3-1)	
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
P_{uc}	0.00 kN	*Axial force in column*		
A_c	50800.00 mm^2	*Gross area of the column*		
Z_c	8749000.00 mm^3	*Plastic section modulus of the column*		
α_s	1.00	*Force level adjustment factor*		
M^*_{pc}	3016.09 kN-m	*Nominal flexural strength of the column, $M^*_{pc}=Z_c*(F_{yc}-\alpha_s*P_{uc}/A_c)$ per AISC 341-16 Eqn (E3-2)*		

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C.24 WUF HI500-8-200*15: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
M_{pr}	1007.00 kN-m	*Probable maximum moment, see 'Seismic Moment at Face of Column' check*		
S_h	0.00 mm	*Distance from face of column to plastic hinge, see 'Seismic Moment at Face of Column' check*		
d_c	450.00 mm	*Depth of the column*		
V_h	504.72 kN	*Probable maximum shear at plastic hinge, see 'Seismic Moment at Face of Column' check*		
M_{uv}	113.56 kN-m	*Additional moment due to shear amplification, $M_{uv}=V_h*(S_h+0.5*d_c)$*		
M^*_{pb}	1120.56 kN-m	*Expected flexural strength of the beam, $M^*_{pb}=M_{pr}+\alpha_s*M_{uv}$, per AISC 358-16 8.4(2)(a)*		
M^*_{pc} / M^*_{pb}	2.69	*Column-beam moment ratio*		
Seismic Beam Web Checks			**0.83**	**PASS**
V_h	504.72 kN	*Probable maximum shear, see 'Seismic Moment at Face of Column' check*		
Check Beam Web Shear Yield	**Pass**	*Condition: $V_h <= \varphi*R_{ny}$ (G2-1 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{ny}$	604.78 kN	*Shear yield strength, see 'Beam Web Shear Yield' check*		
Check Beam Web Shear Rupture	**Pass**	*Condition: $V_h <= \varphi*R_{nr}$ (J4-4 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{nr}$	668.90 kN	*Shear rupture strength, see 'Beam Web Shear Rupture' check*		
Seismic Trans. Stiffener Plate Requirements				**PASS**
Check Stiffener Requirement (Strength)	**Stiffeners Req'd**	*(AISC 341-16, E3.6f.1(a))*		
F_{pr}	2076.30 kN	*Required flange force, see 'Seismic Moment at Face of Column' check (AISC 341-16, E3.6f.1(a))*		
Column Flange Bending		*Condition: $F_{pr} <= \varphi R_{nb}$ (J10-1)*		
ϕR_{nb}	1551.32 kN	*Column flange bending strength, see 'Column Flange Bending' check*		
Column Web Yielding		*Condition: $F_{pr} <= \varphi R_{ny}$ (J10-3)*		
ϕR_{ny}	413.69 kN	*Column web yielding strength, see 'Column Web Yielding' check*		
Column Web Crippling		*Condition: $F_{pr} <= \varphi R_{nc}$ (J10-5a)*		
ϕR_{nc}	7301.21 kN	*Column web crippling strength, see 'Column Web Crippling' check*		
Unbalanced tension force	1662.61 kN	*Transverse stiffeners are provided*		
Unbalanced compression force	1662.61 kN	*Transverse stiffeners are provided*		
Check Stiffener Requirement (Geometry)	**Stiffeners Not Req'd**	*Condition: $t_{cf} >= t_{lim}$ (AISC 341-16, Eqn E3-8)*		
t_{cf}	40.00 mm	*Column flange thickness*		
b_{bf}	200.00 mm	*Beam flange width*		
t_{lim}	33.33 mm	*Thickness requirement, $t_{lim} = b_{bf}/6$*		
Seismic Geometry Restrictions for Trans. Stiffener				**PASS**
Check Min Width	**Pass**	*Condition: $b_s >= (b_{bf}-t_w) / 2 - t_{dp}$ (AISC 341-16, E3.6f.2(a))*		
b_s	185.00 mm	*Stiffener plate width*		
b_{bf}	200.00 mm	*Beam flange width*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	20.00 mm	*Double plate thickness*		
Check Min Thickness	**Pass**	*Condition: $t_p >= 0.5 * t_{bf}$ (AISC 341-16, E3.6f.2(b))*		

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C.24 WUF HI500-8-200*15: LRFD Results Report (continued):

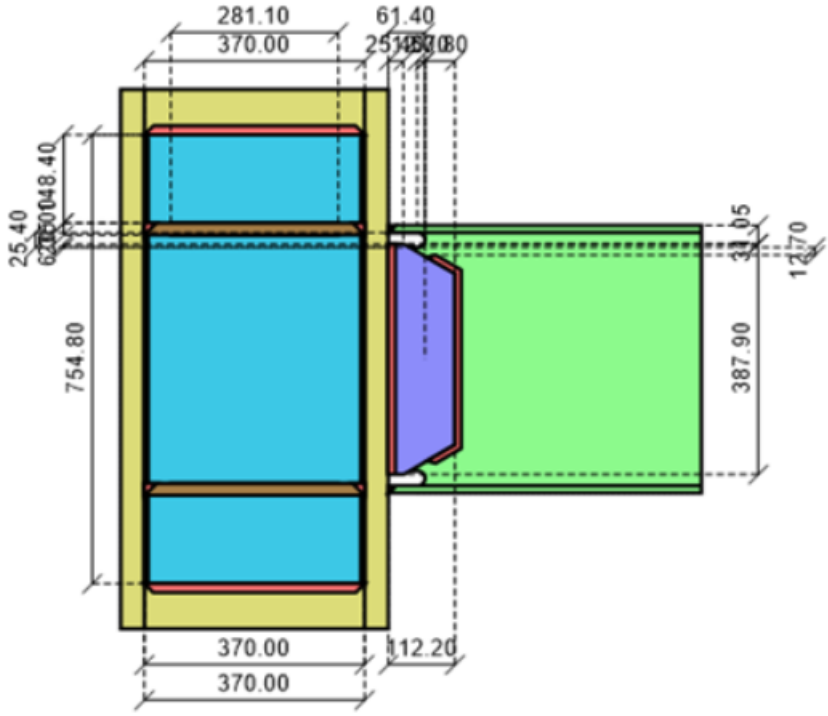
Limit State	Required	Available	Unity Check	Result
t_p	20.00 mm	*Stiffener plate thickness*		
t_{bf}	15.00 mm	*Beam flange thickness*		
Seismic Trans. Stiffener Strength				**PASS**
Transverse stiffeners shall satisfy the requirements of AISC 360-16 Section J10.8		(AISC 341-16, Section E3.6f.1(a))		
Stiffener Yield at Column Flange	**Pass**	*Condition: $R_{req_cf} <= \varphi R_{ncf}$ (J4-1)*		
ϕR_{ncf}	2059.53 kN	*Stiffener strength at column flange, see 'Trans. Stiffener Yield at Column Flange' check*		
R_{req_cf}	1662.61 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Shear at Column Web	**Pass**	*Condition: $R_{req_cw} <= \varphi R_{ncw}$ (J4-3)*		
ϕR_{ncw}	2325.74 kN	*Stiffener strength at column Web, see 'Trans. Stiffener Shear at Column Web' check*		
R_{req_cw}	1662.61 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Compression	**Pass**	*Condition: $R_{req_c} <= \varphi R_{nc}$*		
ϕR_{nc}	1739.44 kN	*Stiffener compression strength, see 'Trans. Stiffener Compression' check*		
R_{req_c}	1662.61 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Weld Strength at Column Flange	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Column Flange' check*		
Stiffener Weld Strength at Panel Zone	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Panel Zone' check*		
Seismic Panel Zone Limitations				**PASS**
No welds are required at the top and bottom edges of the doubler plate		(AISC 341-16, Section E3.6e.3(b)(1))		
Check Column Web Thickness	**Pass**	*Condition: $t_{wc} >= (d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_{wc}	40.00 mm	*Column web thickness*		
d_b	500.00 mm	*Depth of connecting beam*		
t_{fb}	15.00 mm	*Beam flange thickness*		
d_z	470.00 mm	*Clear distance between beam flanges, $d_z=d_b-2*t_{fb}$*		
w_z	370.00 mm	*Width of panel zone between column flanges*		
Check Doubler Thickness	**Pass**	*Condition: $t_{dp} >= max(t_1, t_2)$*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
t_1	9.33 mm	*Thickness requirement, $t_1=(d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_2	6.35 mm	*Thickness requirement, $t_2=0.25$ in (AISC 341-16, E3.6e.3)*		
Seismic Column Panel Zone Shear	2076.30 kN	4616.73 kN	**0.45**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}$)) ($\alpha*P_r<=0.75*P_c$), $\alpha = 1.0$		**$\phi = 1.00$**	(AISC 358-16, 8.4 (1))	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	*$P_c=P_y=F_{yc}*A$*		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		

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*C.24 WUF HI500-8-200*15: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
b_{fc}	450.00 mm	*Column flange width*		
d_b	500.00 mm	*Beam depth*		
ϕR_n	4616.73 kN	*Web panel zone capacity*		
R_p	2076.30 kN	*Panel zone shear demand. $R_p = M_f / d_m$*		
M_f	1007.00 kN-m	*Probable maximum moment at face of column, see 'Seismic Moment at Face of Column' check*		
d_m	485.00 mm	*Moment arm*		
Seismic Column Panel Zone at Trans. Stiffener Weld	1662.61 kN	2325.74 kN	**0.71**	**PASS**
$R_n = 2 * 0.6 * F_{yd} * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_{yd}	344.74 MPa	*Minimum yield stress of doubler plate*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
L	281.10 mm	*Contact length, $L=d_p-2*clip$*		
t_d	20.00 mm	*Doubler plate thickness*		
A_{gv}	5622.00 mm^2	*Gross area subject to shear, $A_{gv}=L*t_d$*		
ϕR_n	2325.74 kN	*Available shear strength of the doubler plate*		
R_{req}	1662.61 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check (AISC 341-16 Section E3.6f.2(c))*		

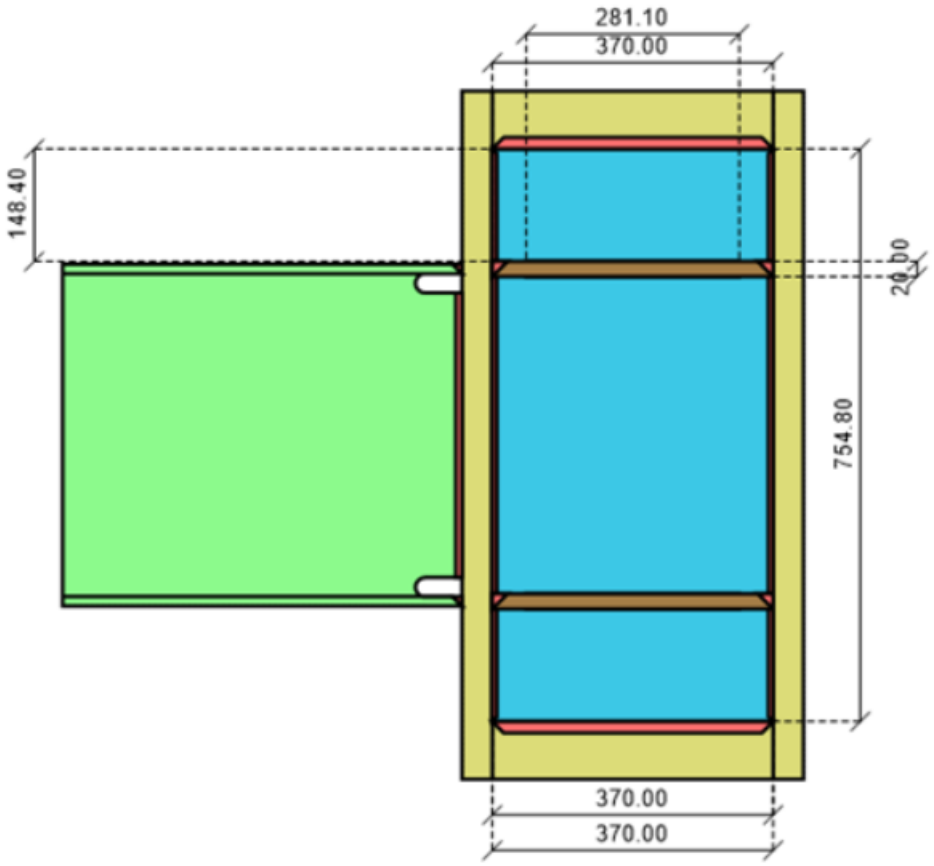
Side view



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*C.25 WUF HI450-8-150*12: 2D Views Report (continued):*

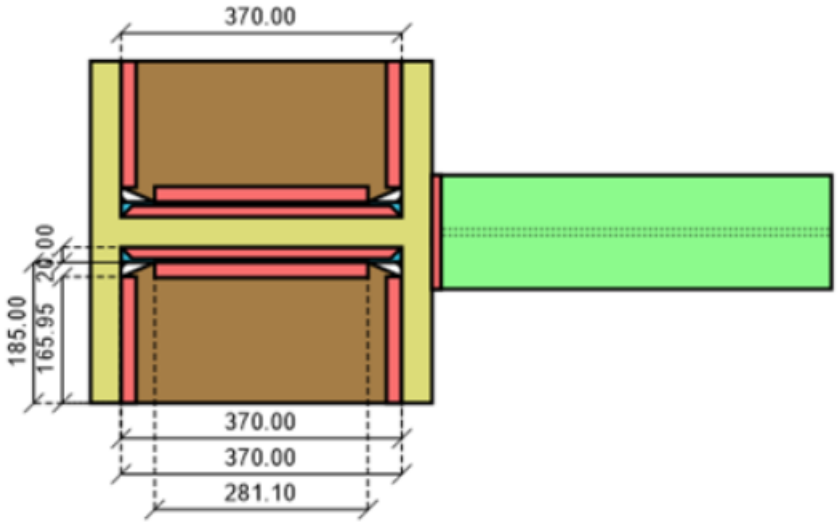
Right view



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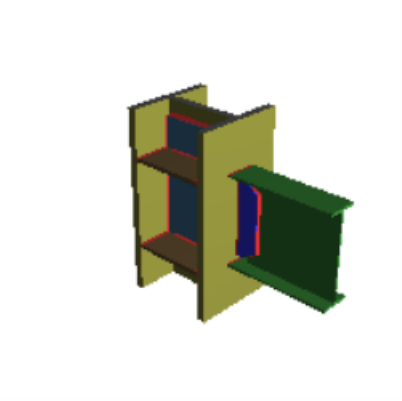
*C.25 WUF HI450-8-150*12: 2D Views Report (continued):*

Top view



*C.25 WUF HI450-8-150*12: LRFD Results Report*

Column/Beam Direct Weld Moment Connection



Material Properties:				
Column	K450*20	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Beam	HI450-8-150-12	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate	P12.00x112.20x387.90	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Doubler	P20.00x370.00x754.80	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Transverse Stiffener	P20.00x185.00x370.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	120.00 kN	*User Input Shear Load*
Moment	120.00 kN-m	*User Input Moment*
Axial Load	0.00 kN	*User Input Axial Force*
Puf_c	273.97 kN	*Required Flange Force (compression)*
Puf_t	273.97 kN	*Required Flange Force (tension)*
Top Column Dist	0.00 mm	*User Input Top Column Dist*
Column Force	0.00 kN	*User Input Column Force*
Story Shear	100.00 kN	*User Input Story Shear*

Input Data:		
Seismic System	SMF (WUF-W)	*User Input Seismic System*
Gravity Shear, Vg	225.00 kN	*User Input Shear due to Gravity*
Clear Span, L	720.00 cm	*User Input Clear Span of Beam*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Beam Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{max}	10.41 mm	*Max Size Allowed*		
t	12.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	10.41 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	8.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	10.41 mm	*Weld size*		
L_{min}	54.51 mm	*Min weld segment length*		
Beam Web Shear Yield	120.00 kN	558.77 kN	**0.21**	**PASS**
$R_n = 0.6 * F_y * A_{gv} * C_{v1}$		**$\phi = 0.90$**	(G2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	3001.60 mm^2	*Gross area subject to shear*		
C_{v1}	1.00	*Web shear coefficient (G2-3)*		
ϕR_n	558.77 kN	*Shear yield strength*		
Plate Shear Yield	120.00 kN	962.81 kN		**n/a**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	4654.80 mm^2	*Gross area subject to shear*		
ϕR_n	962.81 kN	*Shear yield strength*		
Beam Web Shear Rupture	120.00 kN	605.34 kN	**0.20**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	3001.60 mm^2	*Net area subject to shear*		
ϕR_n	605.34 kN	*Shear rupture strength*		
Plate Shear Rupture	120.00 kN	938.74 kN		**n/a**
$R_n = 0.6 * F_u * A_{nv}$		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	4654.80 mm^2	*Net area subject to shear*		
ϕR_n	938.74 kN	*Shear rupture strength*		
Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Column Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Plate)	E70			
Weld Electrode (Filler)	E70			
Beam Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Beam)	E70			
Weld Electrode (Filler)	E70			
Beam Flange Tensile Yield	273.97 kN	558.48 kN	**0.49**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.90**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	1800.00 mm^2	*Gross area subject to compression*		
ϕR_n	558.48 kN	*Tensile yield strength*		
d_m	438.00 mm	*Moment arm between the flange forces*		
R_{req}	273.97 kN	*Required Flange Force (tension)*		
Beam Flange Tensile Rupture	273.97 kN	605.02 kN	**0.45**	**PASS**
$R_n = F_u * A_n$		**ϕ = 0.75**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	1800.00 mm^2	*Net area subject to tension*		
ϕR_n	605.02 kN	*Tensile rupture strength*		
d_m	438.00 mm	*Moment arm between the flange forces*		
R_{req}	273.97 kN	*Required Flange Force (tension)*		
Beam Flange Compression	273.97 kN	558.48 kN	**0.49**	**PASS**
$R_n = F_y * A_g$		**ϕ = 0.9**	(J4-6)	
K	0.65	*Effective length factor*		

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
L	6.14 cm	*Unbraced length*		
r	0.35 cm	*Radius of gyration*		
L_c	39.91 mm	*Effective length, L_c=K*L*		
L_c/r	11.52	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Capacity = Minimum Yield stress for L_c/r <= 25*		
A_g	1800.00 mm^2	*Gross area subject to compression*		
ϕR_n	558.48 kN	*Compressive strength*		
Column Flange Bending	273.97 kN	1551.32 kN	**0.18**	**PASS**
R_n = 0.5 * 6.25 * F_{yf} * t_f^2		**ϕ = 0.90**	(J10-1)	
d_{end}	6.00 mm	*Distance from concentrated force to top of column*		
F_{yf}	344.74 MPa	*Minimum yield stress of column*		
t_f	40.00 mm	*Column flange thickness*		
ϕR_n	1551.32 kN	*Column flange local bending*		
d_m	438.00 mm	*Moment arm between the flange forces*		
R_{req}	273.97 kN	*Required Flange Force (tension)*		
Column Web Yielding	273.97 kN	330.95 kN	**0.83**	**PASS**
R_n = (2.5 * k + l_b) * F_y * $t_{w\text{-}eq}$		**ϕ = 1.00**	(J10-3)	
d_{end}	6.00 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
F_y	344.74 MPa	*Minimum yield stress of column*		
$t_{w\text{-}eq}$	80.00 mm	*Equivalent web thickness for yielding. $t_{w\text{-}eq}=t_w+2*t_{dp}*F_{ydp}/F_y$*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
k	0.00 mm	*Distance from outer face of the flange to the web toe of the fillet*		
l_b	12.00 mm	*Length of bearing*		
ϕR_n	330.95 kN	*Column web local yielding*		
d_m	438.00 mm	*Moment arm between the flange forces*		
R_{req}	273.97 kN	*Required Flange Force (worst) in bolts due to moment*		
Column Web Buckling	273.97 kN	15940.59 kN	**0.02**	**PASS**
R_n = 12 * t_w^3 * (E * F_y)$^{0.5}$ / h *Q_f + 2*12 * t_{dp}^3 * (E * F_{ydp})$^{0.5}$ / h *Q_f		**ϕ = 0.90**	(J10-8)	
d_{end}	6.00 mm	*Distance from concentrated force to top of column*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
h	450.00 mm	*Clear distance between flanges h=d-2*k_{des}*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	15940.59 kN	*Column web compression buckling*		
d_m	438.00 mm	*Moment arm between the flange forces*		

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
R_{req}	273.97 kN	*Required Flange Force (compression)*		
Column Web Crippling	273.97 kN	7201.59 kN	**0.04**	**PASS**
$R_n = 0.4*t_w^2*(1+3*(l_b/d_{col})*(t_w/t_f)^{1.5})*(E*F_y*t_f/t_w)^{0.5}*Q_f + 2*0.4*t_{dp}^2*(1+3*(l_b/d_{col})*(t_{dp}/t_f)^{1.5})*(E*F_{ydp}*t_f/t_{dp})^{0.5}*Q_f$		**ϕ = 0.75**	(J10-5a)	
d_{end}	6.00 mm	*Distance from concentrated force to top of column*		
l_b/d_{col}	0.03	*Bearing length to column depth ratio*		
d_{col}	450.00 mm	*Column depth*		
t_w	40.00 mm	*Column web thickness*		
t_f	40.00 mm	*Column flange thickness*		
l_b	12.00 mm	*Length of bearing*		
F_y	344.74 MPa	*Minimum yield stress of column*		
E	199948.01 MPa	*Modulus of elasticity*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
F_{ydp}	344.74 MPa	*Minimum yield stress of doubler plate*		
Q_f	1.00	*Chord stress interaction parameter*		
ϕR_n	7201.59 kN	*Column web crippling capacity*		
d_m	438.00 mm	*Moment arm between the flange forces*		
R_{req}	273.97 kN	*Required Flange Force (compression)*		
Column Panel Zone Shear	373.97 kN	4244.41 kN	**0.09**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}))$ $(\alpha*P_r <= 0.75*P_c)$, $\alpha = 1.0$		**ϕ = 0.90**	(J10-11)	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	$P_c=P_y=F_{yc}*A$		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		
b_{fc}	450.00 mm	*Column flange width*		
d_b	450.00 mm	*Beam depth*		
ϕR_n	4244.41 kN	*Web panel zone capacity*		
R_f	273.97 kN	*Beam flange force.* $R_f = M / d_m$		
M	120.00 kN-m	*Moment demand*		
d_m	438.00 mm	*Moment arm from centerline forces*		
V_{above}	100.00 kN	*Story shear in column above connection*		
R_p	373.97 kN	*Panel zone shear demand.* $R_p = R_f + V_{above}$		
Trans. Stiffener Yield at Column Flange	0.00 kN	2059.53 kN	**0.00**	**PASS**
$R_n = 2 * F_{yst} * A_{st}$		**ϕ = 0.9**	(J4-1)	
t_s	20.00 mm	*Stiffener thickness*		
b_s	185.00 mm	*Stiffener width*		
clip	19.05 mm	*Stiffener corner clip dimension*		

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{st}	3319.00 mm^2	*Cross-sectional area = (b_s - clip) * t_s*		
ϕR_n	2059.53 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Shear at Column Web	0.00 kN	2325.74 kN	**0.00**	**PASS**
$R_n = 2 * 0.6 * F_{yst} * A_{gv}$		**$\phi = 1.0$**	(J4-3)	
t_s	20.00 mm	*Stiffener thickness*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
F_{yst}	344.74 MPa	*Minimum yield stress of Stiffener*		
A_{gv}	5622.00 mm^2	*Cross-sectional area = (d_p - 2*clip) * t_s*		
ϕR_n	2325.74 kN	*Available transverse stiffener strength*		
R_{req}	0.00 kN	*Required transverse stiffener strength*		
Trans. Stiffener Compression	0.00 kN	1739.44 kN	**0.00**	**PASS**
$R_n = 2 * F_{cr} * A_{st}$		**$\phi = 0.9$**	(E3-1)	
t_s	20.00 mm	*Stiffener thickness*		
K	0.75	*Effective length factor*		
L	370.00 mm	*Unbraced length*		
r	5.77 mm	*Radius of gyration = t_s / $(12)^{0.5}$*		
L_c	277.50 mm	*Effective length, L_c=K*L*		
L_c/r	48.06	*Plate slenderness check from J4-6*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{st}	3319.00 mm^2	*Gross area subject to compression*		
E	199948.01 MPa	*Modulus of elasticity*		
F_e	854.22 MPa	*Elastic buckling stress (E3-4)*		
F_{cr}	291.16 MPa	*Critical stress (E3-2)*		
ϕR_n	1739.44 kN	*Compressive strength*		
Trans. Stiffener Weld Strength at Column Flange				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Trans. Stiffener Weld Strength at Panel Zone				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Doubler)	E70			
Req'd Filler (Transverse Stiffener)	E70			
Weld Electrode (Filler)	E70			
Seismic Material and Geometry Limitations				**PASS**
Check Max Yield Stress of the Beam	**Pass**	*Condition: F_y <= 50 ksi (345 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of beam*		
Check Max Yield Stress of the Column	**Pass**	*Condition: F_y <= 70 ksi (485 MPa) (AISC 341-16, A3.1)*		
F_y	344.74 MPa	*Minimum yield stress of column*		
Check Max Beam Depth	**Pass**	*Condition: beam shape <= W36 (AISC 358-16, 8.3.1(2))*		
Beam Shape		*Selected beam shape depth*		

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
Check Max Beam Weight	**Pass**	*Condition: beam weight <= 0.00 kN/mm (AISC 358-16, 8.3.1 (3))*		
Beam Weight	0.00 kN/mm	*Selected beam weight*		
Check Beam Flange Thickness	**Pass**	*Condition: t_{bf} <= 25.40 mm (AISC 358-16, 8.3.1(4))*		
t_{bf}	12.00 mm	*Beam flange thickness*		
Check Span to Depth Ratio	**Pass**	*Condition: Span/d_b >= 7.00 (AISC 358-16, 8.3.1(5))*		
Span	7200.00 mm	*Beam span*		
d_b	450.00 mm	*Beam depth*		
Check Max Column Depth	**Pass**	*Condition: column shape <= W36 (AISC 358-16, 8.3.2(3))*		
Column Shape		*Selected column shape depth*		
Check Shear Plate Thickness	**Pass**	*Condition: t_p >= t_{bw} (AISC 358-16, 8.6(1))*		
t_p	12.00 mm	*Shear plate thickness*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Seismic Width to Thickness Ratios				**PASS**
Limiting Width to Thickness Ratios (AISC 341-16, Table D1.1)				
Check Beam Flange	**Pass**	*Condition: Ratio <= Limit*		
b_b	75.00 mm	*Half of beam flange width*		
t_{bf}	12.00 mm	*Beam flange thickness*		
E_b	199948.01 MPa	*Modulus of elasticity of beam material*		
R_{yb}	1.10	*Ration of expected yield stress to minimum yield stress of the beam material*		
F_{yb}	344.74 MPa	*Minimum yield stress of beam material*		
Ratio	6.25	*Width to thickness ratio, b_b/t_{bf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Beam Web	**Pass**	*Condition: Ratio <= Limit*		
P_{ub}	0.00 kN	*Axial compression in beam*		
ϕ_C	0.90	*Resistance factor for compression*		
A_b	7008.00 mm^2	*Gross area of the beam*		
P_{yb}	2657.52 kN	*Nominal axial yield strength, $P_{yb}=R_{yb}*F_{yb}*A_b$*		
Ca_b	0.00	*Ratio of required strength to available strength, $Ca_b=P_{ub}/(\varphi_C*P_{yb})$*		
h_b	426.00 mm	*Clear distance between beam flanges*		
t_{bw}	8.00 mm	*Thickness of beam web*		
Ratio	53.25	*Width to thickness ratio, h_b/t_{bw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_b/(R_{yb}*F_{yb}))^{0.5}$*		
Check Column Flange	**Pass**	*Condition: Ratio <= Limit*		
b_c	225.00 mm	*Half of column flange width*		
t_{cf}	40.00 mm	*Column flange thickness*		
E_c	199948.01 MPa	*Modulus of elasticity of column material*		
R_{yc}	1.10	*Ration of expected yield stress to minimum yield stress of the column material*		
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
Ratio	5.62	*Width to thickness ratio, b_c/t_{cf}*		
Limit	7.35	*Limiting ratio, $0.32*(E_c/(R_{yc}*F_{yc}))^{0.5}$*		
Check Column Web	**Pass**	*Condition: Ratio <= Limit*		
P_{uc}	0.00 kN	*Axial compression in column*		

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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
ϕ_C	0.90	*Resistance factor for compression*		
A_c	50800.00 mm^2	*Gross area of the column*		
P_{yc}	19263.95 kN	*Nominal axial yield strength, $P_{yc}=R_{yc}*F_{yc}*A_c$*		
Ca_c	0.00	*Ratio of required strength to available strength, $Ca_c=P_{uc}/(\varphi_C*P_{yc})$*		
h_c	370.00 mm	*Clear distance between column flanges*		
t_{cw}	40.00 mm	*Thickness of column web*		
Ratio	9.25	*Width to thickness ratio, h_c/t_{cw}*		
Limit	59.01	*Limiting ratio, $2.57*(E_c/(R_{yc}*F_{yc}))^{0.5}*(1-1.04*Ca_c)$*		
Seismic Moment at Face of Column		***611.24 kN-m***		
$M_f = M_{pr} + V_h * S_h$			(AISC 358-16, Section 8.7)	
F_y	344.74 MPa	*Minimum yield stress of material*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
R_y	1.10	*Ratio of expected yield stress to the specified minimum yield stress*		
C_{pr}	1.40	*Factor to account for peak connection strength (per AISC 358-16 section 8.7 Step 1)*		
Z_x	1151352.00 mm^3	*Plastic section modulus of beam section*		
M_{pr}	611.24 kN-m	*Probable maximum moment at plastic hinge, $M_{pr}=C_{pr}*R_y*F_y*Z_x$ (AISC 358-16, Eqn 2.4-1)*		
S_h	0.00 mm	*Distance from face of column to the plastic hinge per AISC 358-16 section 8.7 Step 2*		
L	720.00 cm	*Clear span of beam between column flanges*		
L_h	720.00 cm	*Beam length between plastic hinges, $L_h=L-2*S_h$*		
V_g	225.00 kN	*Shear due to gravity*		
V_h	394.79 kN	*Probable maximum shear, $V_h=((2*M_{pr})/L_h)+Vg$*		
M_f	611.24 kN-m	*Probable maximum moment at face of column*		
d_m	438.00 mm	*Moment arm between the flange forces, $d_m=d_b-t_{bf}$*		
d_b	450.00 mm	*Beam depth*		
t_{bf}	12.00 mm	*Beam flange thickness*		
F_{pr}	1395.54 kN	*Design flange force, $F_{pr}=M_f / d_m$*		
Seismic Weld Limitations				**PASS**
Check Web Weld Material	**Pass**	*Condition: Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Web Weld	E70	*Web weld*		
Check Web Weld Type	**Pass**	*Condition: Web weld must be a CJP (AISC 358-16, 8.6(5))*		
Weld Type	CJP	*Web weld type*		
Check Column Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Column Weld	E70	*Column weld*		
Check Beam Weld Material	**Pass**	*Condition: Column weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Beam Weld	E70	*Beam weld*		
Check Beam Weld Type	**Pass**	*Condition: Beam weld must be a fillet weld (AISC 358-16, 8.6 (3))*		
Weld Type	Single Fillet	*Beam weld type*		
Check Beam Weld Size	**Pass**	*Condition: D = t_p - 1.59 mm (AISC 358-16, 8.6 (3))*		

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C.25 WUF HI450-8-150*12: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
t_p	12.00 mm	*Shear plate thickness*		
D_{16}	6.56	*Fillet weld size in sixteenths of an inch*		
Check Moment Weld Material	**Pass**	*Condition: Moment weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Moment Weld	E70	*Moment weld*		
Check Moment Weld Type	**Pass**	*Condition: Moment weld must be a CJP (AISC 358-16, 8.5(1))*		
Weld Type	CJP	*Moment weld type*		
Check Transverse Stiffener Weld Material	**Pass**	*Condition: Transverse Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Transverse Stiffener Weld	""E70""	*Transverse Stiffener weld*		
Check Transverse Stiffener Weld Type	**Pass**	*Condition: Transverse stiffener weld must be a CJP (AISC 341-16, E3.6f.2(c))*		
Weld Type	CJP	*Transverse stiffener weld type*		
Check Stiffener Weld Material	**Pass**	*Condition: Stiffener weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Stiffener Weld	""""	*Stiffener weld*		
Check Doubler Web Weld Material	**Pass**	*Condition: Doubler Web weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Web Weld	""E70""	*Doubler Web weld*		
Check Doubler Flange Weld Material	**Pass**	*Condition: Doubler Flange weld must be E70, E80 or E90 (AISC 341-16, A3.4b)*		
Doubler Flange Weld	""E70""	*Doubler Flange weld*		
Check Doubler Flange Weld Type	**Pass**	*Condition: Doubler flange weld must be a PJP or Fillet (AISC 341-16, E3.6e.3)*		
Weld Type	Single Fillet	*Doubler Flange Weld Type*		
Seismic WUF-W Connection Detail Limitations				**PASS**
Check a	**Pass**	*Condition: 6.35 mm <= a <= 12.70 mm (AISC 358-16, Fig. 8.3)*		
a	6.35 mm	*Vertical distance from access hole to edge of shear plate*		
Check b	**Pass**	*Condition: 25.40 mm <= b (AISC 358-16, Fig. 8.3)*		
b	25.40 mm	*Horizontal distance from face of column to start of shear plate taper*		
Check c	**Pass**	*Condition: 20.00 degrees <= c <= 40.00 degrees (AISC 358-16, Fig. 8.3)*		
c	30.00 degrees	*Shear plate taper angle*		
Check d	**Pass**	*Condition: 50.80 mm <= d (AISC 358-16, Fig. 8.3)*		
d	50.80 mm	*Horizontal distance from inner-most access hole edge to end of shear plate taper*		
Check e	**Pass**	*Condition: 12.70 mm <= e <= 25.40 mm (AISC 358-16, Fig. 8.3)*		
e	12.70 mm	*Distance from end of fillet weld to edge of access hole*		
Seismic Column-Beam Moment Ratio				**PASS**
$M^*_{pc} / M^*_{pb} > 1.0$			(AISC 341-16, Eqn E3-1)	
F_{yc}	344.74 MPa	*Minimum yield stress of column material*		
P_{uc}	0.00 kN	*Axial force in column*		
A_c	50800.00 mm^2	*Gross area of the column*		
Z_c	8749000.00 mm^3	*Plastic section modulus of the column*		
α_s	1.00	*Force level adjustment factor*		
M^*_{pc}	3016.09 kN-m	*Nominal flexural strength of the column, $M^*_{pc}=Z_c*(F_{yc}-\alpha_s*P_{uc}/A_c)$ per AISC 341-16 Eqn (E3-2)*		

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C.25 WUF HI450-8-150*12: LRFD Results Report (continued):

Limit State	Required	Available	Unity Check	Result
M_{pr}	611.24 kN-m	*Probable maximum moment, see 'Seismic Moment at Face of Column' check*		
S_h	0.00 mm	*Distance from face of column to plastic hinge, see 'Seismic Moment at Face of Column' check*		
d_c	450.00 mm	*Depth of the column*		
V_h	394.79 kN	*Probable maximum shear at plastic hinge, see 'Seismic Moment at Face of Column' check*		
M_{uv}	88.83 kN-m	*Additional moment due to shear amplification, $M_{uv}=V_h*(S_h+0.5*d_c)$*		
M^*_{pb}	700.07 kN-m	*Expected flexural strength of the beam, $M^*_{pb}=M_{pr}+\alpha_s*M_{uv}$, per AISC 358-16 8.4(2)(a)*		
M^*_{pc} / M^*_{pb}	4.31	*Column-beam moment ratio*		
Seismic Beam Web Checks			**0.71**	**PASS**
V_h	394.79 kN	*Probable maximum shear, see 'Seismic Moment at Face of Column' check*		
Check Beam Web Shear Yield	**Pass**	*Condition: $V_h <= \varphi*R_{ny}$ (G2-1 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{ny}$	558.77 kN	*Shear yield strength, see 'Beam Web Shear Yield' check*		
Check Beam Web Shear Rupture	**Pass**	*Condition: $V_h <= \varphi*R_{nr}$ (J4-4 & AISC 358-16, 8.7 Step 5)*		
$\phi*R_{nr}$	605.34 kN	*Shear rupture strength, see 'Beam Web Shear Rupture' check*		
Seismic Trans. Stiffener Plate Requirements				**PASS**
Check Stiffener Requirement (Strength)	**Stiffeners Req'd**	*(AISC 341-16, E3.6f.1(a))*		
F_{pr}	1395.54 kN	*Required flange force, see 'Seismic Moment at Face of Column' check (AISC 341-16, E3.6f.1(a))*		
Column Flange Bending		*Condition: $F_{pr} <= \varphi R_{nb}$ (J10-1)*		
ϕR_{nb}	1551.32 kN	*Column flange bending strength, see 'Column Flange Bending' check*		
Column Web Yielding		*Condition: $F_{pr} <= \varphi R_{ny}$ (J10-3)*		
ϕR_{ny}	330.95 kN	*Column web yielding strength, see 'Column Web Yielding' check*		
Column Web Crippling		*Condition: $F_{pr} <= \varphi R_{nc}$ (J10-5a)*		
ϕR_{nc}	7201.59 kN	*Column web crippling strength, see 'Column Web Crippling' check*		
Unbalanced tension force	1064.60 kN	*Transverse stiffeners are provided*		
Unbalanced compression force	1064.60 kN	*Transverse stiffeners are provided*		
Check Stiffener Requirement (Geometry)	**Stiffeners Not Req'd**	*Condition: $t_{cf} >= t_{lim}$ (AISC 341-16, Eqn E3-8)*		
t_{cf}	40.00 mm	*Column flange thickness*		
b_{bf}	150.00 mm	*Beam flange width*		
t_{lim}	25.00 mm	*Thickness requirement, $t_{lim} = b_{bf}/6$*		
Seismic Geometry Restrictions for Trans. Stiffener				**PASS**
Check Min Width	**Pass**	*Condition: $b_s >= (b_{bf}-t_w) / 2 - t_{dp}$ (AISC 341-16, E3.6f.2(a))*		
b_s	185.00 mm	*Stiffener plate width*		
b_{bf}	150.00 mm	*Beam flange width*		
t_w	40.00 mm	*Column web thickness*		
t_{dp}	20.00 mm	*Double plate thickness*		
Check Min Thickness	**Pass**	*Condition: $t_p >= 0.5 * t_{bf}$ (AISC 341-16, E3.6f.2(b))*		

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Limit State	Required	Available	Unity Check	Result
t_p	20.00 mm	*Stiffener plate thickness*		
t_{bf}	12.00 mm	*Beam flange thickness*		
Seismic Trans. Stiffener Strength				**PASS**
Transverse stiffeners shall satisfy the requirements of AISC 360-16 Section J10.8		(AISC 341-16, Section E3.6f.1(a))		
Stiffener Yield at Column Flange	**Pass**	*Condition: $R_{req_cf} <= \varphi R_{ncf}$ (J4-1)*		
ϕR_{ncf}	2059.53 kN	*Stiffener strength at column flange, see 'Trans. Stiffener Yield at Column Flange' check*		
R_{req_cf}	1064.60 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Shear at Column Web	**Pass**	*Condition: $R_{req_cw} <= \varphi R_{ncw}$ (J4-3)*		
ϕR_{ncw}	2325.74 kN	*Stiffener strength at column Web, see 'Trans. Stiffener Shear at Column Web' check*		
R_{req_cw}	1064.60 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Compression	**Pass**	*Condition: $R_{req_c} <= \varphi R_{nc}$*		
ϕR_{nc}	1739.44 kN	*Stiffener compression strength, see 'Trans. Stiffener Compression' check*		
R_{req_c}	1064.60 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check*		
Stiffener Weld Strength at Column Flange	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Column Flange' check*		
Stiffener Weld Strength at Panel Zone	**Pass**	*CJP-weld, see 'Trans. Stiffener Weld Strength at Panel Zone' check*		
Seismic Panel Zone Limitations				**PASS**
No welds are required at the top and bottom edges of the doubler plate		(AISC 341-16, Section E3.6e.3(b)(1))		
Check Column Web Thickness	**Pass**	*Condition: $t_{wc} >= (d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_{wc}	40.00 mm	*Column web thickness*		
d_b	450.00 mm	*Depth of connecting beam*		
t_{fb}	12.00 mm	*Beam flange thickness*		
d_z	426.00 mm	*Clear distance between beam flanges, $d_z=d_b-2*t_{fb}$*		
w_z	370.00 mm	*Width of panel zone between column flanges*		
Check Doubler Thickness	**Pass**	*Condition: $t_{dp} >= max(t_1, t_2)$*		
t_{dp}	20.00 mm	*Doubler plate thickness*		
t_1	8.84 mm	*Thickness requirement, $t_1=(d_z + w_z)/90$ (AISC 341-16, eqn E3-7)*		
t_2	6.35 mm	*Thickness requirement, $t_2=0.25$ in (AISC 341-16, E3.6e.3)*		
Seismic Column Panel Zone Shear	1395.54 kN	4716.01 kN	**0.30**	**PASS**
$R_n = 0.60 * F_{yc} * d_c * t_{wc}*(1 + (3*b_{fc}*t_{fc}^2) / (d_b*d_c*t_{wc}$)) ($\alpha*P_r<=0.75*P_c$), $\alpha = 1.0$		**$\phi = 1.00$**	(AISC 358-16, 8.4 (1))	
P_r	0.00 kN	*Axial force in the column at the connection*		
P_c	17512.69 kN	*$P_c=P_y=F_{yc}*A$*		
F_{yc}	344.74 MPa	*Minimum yield stress of column*		
A	50800.00 mm^2	*Column cross-sectional area*		
d_c	450.00 mm	*Column depth*		
t_{wc}	40.00 mm	*Column web thickness*		
t_{fc}	40.00 mm	*Column flange thickness*		

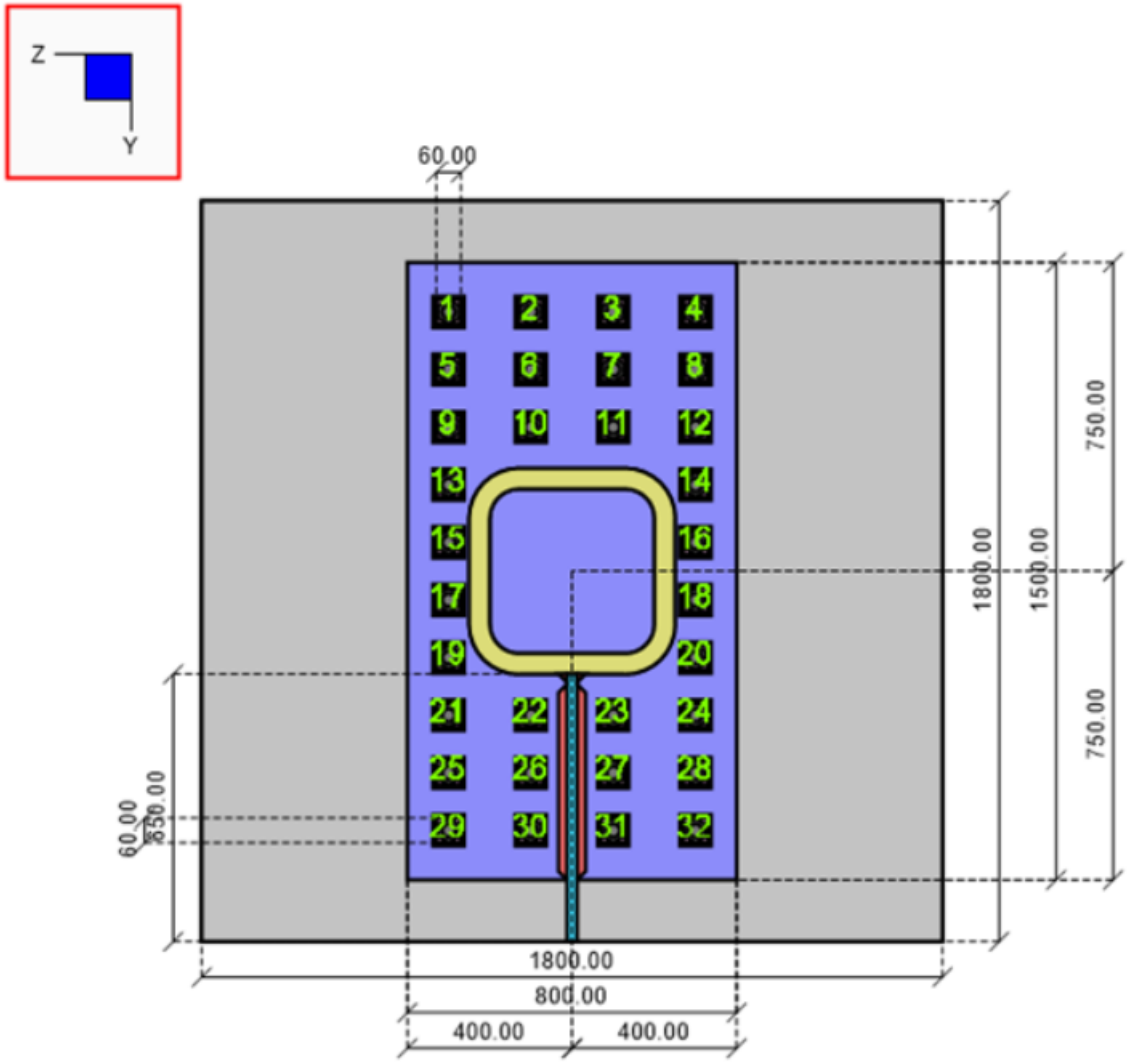
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*C.25 WUF HI450-8-150*12: LRFD Results Report (continued):*

Limit State	Required	Available	Unity Check	Result
b_{fc}	450.00 mm	*Column flange width*		
d_b	450.00 mm	*Beam depth*		
ϕR_n	4716.01 kN	*Web panel zone capacity*		
R_p	1395.54 kN	*Panel zone shear demand.* $R_p = M_f / d_m$		
M_f	611.24 kN-m	*Probable maximum moment at face of column, see 'Seismic Moment at Face of Column' check*		
d_m	438.00 mm	*Moment arm*		
Seismic Column Panel Zone at Trans. Stiffener Weld	1064.60 kN	2325.74 kN	**0.46**	**PASS**
$R_n = 2 * 0.6 * F_{yd} * A_{gv}$		**ϕ = 1.00**	(J4-3)	
F_{yd}	344.74 MPa	*Minimum yield stress of doubler plate*		
d_p	370.00 mm	*Stiffener depth*		
clip	44.45 mm	*Stiffener corner clip dimension*		
L	281.10 mm	*Contact length,* $L=d_p-2*clip$		
t_d	20.00 mm	*Doubler plate thickness*		
A_{gv}	5622.00 mm^2	*Gross area subject to shear,* $A_{gv}=L*t_d$		
ϕR_n	2325.74 kN	*Available shear strength of the doubler plate*		
R_{req}	1064.60 kN	*Required transverse stiffener strength, see 'Seismic Trans. Stiffener Plate Requirements' check (AISC 341-16 Section E3.6f.2(c))*		

D.26 Base Plate BRACE 1 EJE A: 2D Views Report

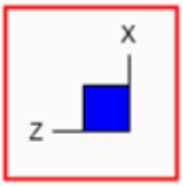
Top view

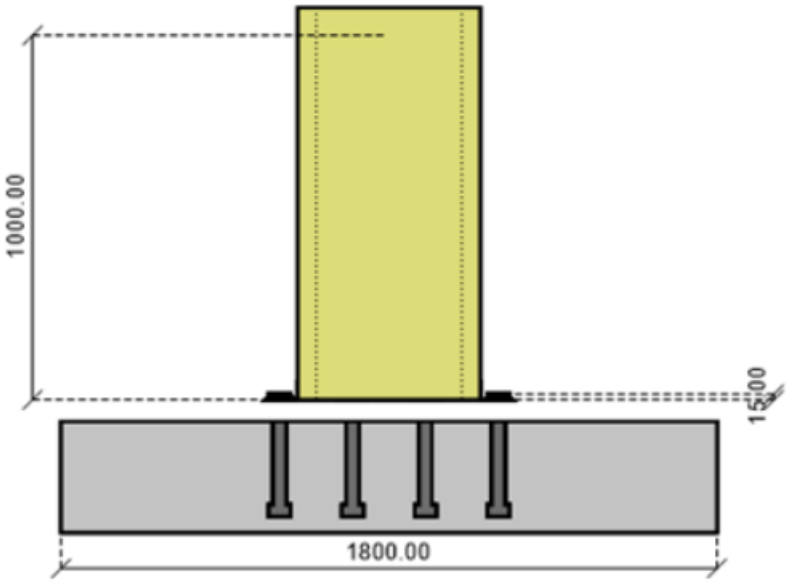


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D.26 Base Plate BRACE 1 EJE A: 2D Views Report (continued):

Front view

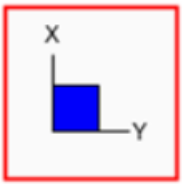


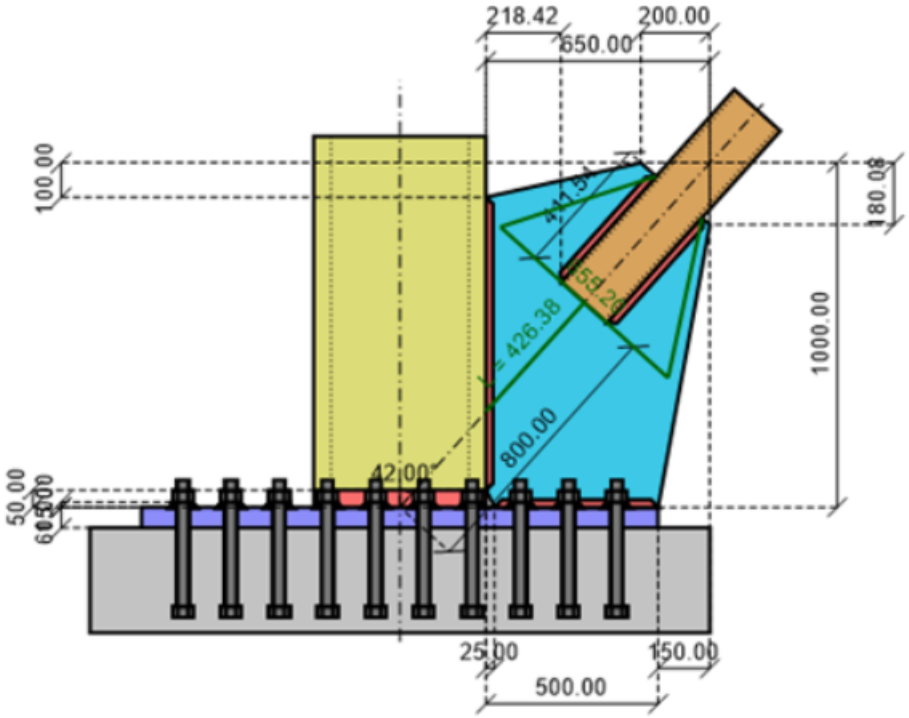


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D.26 Base Plate BRACE 1 EJE A: 2D Views Report (continued):

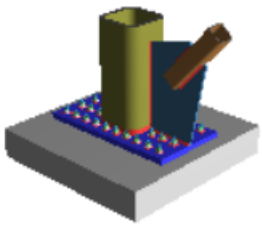
Left view





D.26 Base Plate BRACE 1 EJE A: Summary Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

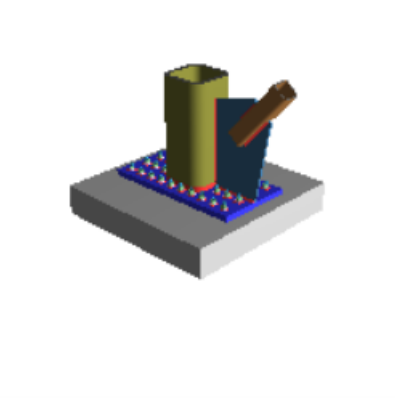
Input Data:

Brace Axial	-1200.00 kN	*Brace Axial (tension)*
Column Axial	3000.00 kN	*Axial load on the column*
Column Strong Axis Shear	70.00 kN	*Shear load on the column that causes strong axis bending*
Column Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Column Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Column Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**0.88**	**PASS**
Gusset/Column connection	Column Weld Strength	**0.24**	**PASS**
Gusset/Brace connection	Brace Tensile Rupture	**0.61**	**PASS**

D.26 Base Plate BRACE 1 EJE A: Base Plate Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:

Design Axial	2108.23 kN	*Axial load on the column*
Design Strong Axis Shear	872.96 kN	*Shear load on the column that causes strong axis bending*
Design Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Design Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Design Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	120.00 mm	*Min edge distance y*		
e_z	100.00 mm	*Min edge distance z*		
ED_{allow}	41.27 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	120.00 mm	*Max edge distance y*		
d_z	100.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	60.00 mm	*Thickness of base plate*		
Check Plate Washer Encroachment on Column	**Pass**			
Check Plate Washers Encroachment on Each Other	**Pass**			
Check Plate Washer Width	**Pass**	*Condition: L_{pw} > d_h + (2*AB_{tol})*		
L_{pw}	60.00 mm	*Plate washer length*		
d_h	34.92 mm	*Anchor bolt hole diameter*		
AB_{tol}	9.52 mm	*Anchor bolt placement tolerance (per AISC 303-10, Section 7.5.1)*		

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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Plate Washer Weld Edge Distance	**Pass**	*Condition: min(e_z , e_y) - ((L_{pw} / 2) + D_{pw}) >= 1/16 in*		
D_{pw}	8.00 mm	*Plate washer weld size*		
Loading at Base Plate				**n/a**
P_c	3000.00 kN	*User input axial load in column*		
V_{zc}	70.00 kN	*User input strong axis shear in column*		
V_{yc}	0.00 kN	*User input weak axis shear in column*		
M_{zc}	100.00 kN-m	*User input strong axis moment in column*		
M_{yc}	0.00 kN-m	*User input weak axis moment in column*		
P	-1200.00 kN	*User input axial load in brace*		
θ	42.00 degrees	*Brace angle from vertical*		
V	-891.77 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-802.96 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
H_b	-333.60 kN	*Calculated shear at the gusset to base plate connection, H_b=(H*(β-e) - V*e_c)/β per AISC DG 29, section 4.3*		
H_c	-469.35 kN	*Calculated axial at the gusset to column connection, H_c=(H*e + V*e_c)/β per AISC DG 29, section 4.3*		
P_{bp}	2108.23 kN	*Design axial load, P_{bp} = P_c + V*		
V_{z_bp}	872.96 kN	*Design strong axis shear load, V_{z_bp} = V_{zc} - H*		
V_{y_bp}	0.00 kN	*Design weak axis shear load, V_{y_bp} = V_{yc}*		
M_{z_bp}	100.00 kN-m	*Design strong axis moment load, M_{z_bp} = M_{zc} + H_c*e*		
M_{y_bp}	0.00 kN-m	*Design weak axis moment load, M_{y_bp} = M_{yc}*		
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	100.00 kN-m	*User input strong axis moment*		
P_u	2108.23 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	12.73 kN/mm	*Bearing force = φR_n*B*		
e	47.43 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		
e_{crit}	667.19 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	1405.13 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	2108.23 kN	*User input axial load*		

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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.87 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = $\lvert(M_{uy}/P_u)\rvert$*		
e_{crit}	355.84 mm	*Critical eccentricity = (B/2) - $P_u/(2*q_{max})$*		
Y_z	800.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Gusset Shear Yield	333.60 kN	2456.26 kN	**0.14**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11875.00 mm^2	*Gross area subject to shear*		
ϕR_n	2456.26 kN	*Shear yield strength*		
Gusset Shear Rupture	333.60 kN	2394.85 kN	**0.14**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11875.00 mm^2	*Net area subject to shear*		
ϕR_n	2394.85 kN	*Shear rupture strength*		
Concrete Bearing			**0.12**	**PASS**
$R_n = 0.85 * f'_c * \alpha$		**$\phi = 0.65$**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'_c	24.00 MPa	*Concrete compressive strength*		
P_u	2108.23 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
A_1	1200000.00 mm^2	*Plate area = B*N*		
L	1800.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1800.00 mm	*Effective concrete support length*		
W'	960.00 mm	*Effective concrete support width*		
A_2	1728000.00 mm^2	*Effective concrete support area = L' * W'*		
α	1.20	*Bearing stress increase factor = $\min(2, (A_2/A_1)^{0.5})$*		
ϕR_n	15.91 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: $f_{py} <= \varphi R_n$*		
Design with small moment				
Y_y	1405.13 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	1.88 MPa	*Required bearing stress = $P_u / (B * Y_y)$*		
UC_y	0.12	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: $f_{pz} <= \varphi R_n$*		
Design with small moment				
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	1.76 MPa	*Required bearing stress = $P_u / (N * Y_z)$*		
UC_z	0.11	*Unity check for Weak Axis*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.25 kN-m/mm	0.28 kN-m/mm	**0.88**	**PASS**
$M_n = F_y * t_p^2 / 4$		**$\phi = 0.9$**	(AISC DG1 (3.3.13))	

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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	1.88 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	1405.13 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.25 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.02 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.25 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.20 kN-m/mm	0.28 kN-m/mm	**0.72**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	1.76 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	800.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.02 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	0.88	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.20 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * \beta$*		
M_{pl}	0.20 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Anchor Bolt Shear	872.96 kN	4421.62 kN	**0.20**	**PASS**
$R_n = F_{nv} * A_b * N_{bolt}$		**ϕ = 0.75**	(J3-1)	
V_{uy}	872.96 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	872.96 kN	*Resultant shear force*		
F_{nv}	232.70 MPa	*Shear stress N type*		
A_b	791.73 mm^2	*Area of bolt*		

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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N_{bolt}	32	*Number of bolts*		
ϕR_n	4421.62 kN	*Bolt shear rupture strength*		
Anchor Bolt Bending	172.60 MPa	290.87 MPa	**0.59**	**PASS**
$F'_{nt} = \min(1.3*F_{nt} - (F_{nt} / (\phi*F_{nv})*f_{rv}), F_{nt})$		**ϕ = 0.75**	(J3-3)	
F_{nt}	387.83 MPa	*Nominal tensile stress, per Table J3.2*		
F_{nv}	232.70 MPa	*Nominal shear stress, per Table J3.2*		
V_u	872.96 kN	*Resultant shear force, see 'Anchor bolt shear' check*		
N_{bolt}	32	*Number of bolts*		
A_b	791.73 mm^2	*Bolt cross sectional area*		
f_{rv}	34.46 MPa	*Required shear stress: $f_{rv} = (V_u / N_{bolt}) / A_b$*		
$\phi F'_{nt}$	290.87 MPa	*Available tensile stress*		
t_p	60.00 mm	*Thickness of base plate*		
t_{pw}	15.00 mm	*Plate washer thickness*		
M_u	0.92 kN-m	*Bending moment = $(V_u / N_{bolt})*(t_p + (t_{pw} / 2)) / 2$*		
d	31.75 mm	*Bolt diameter*		
S	5334.33 mm^3	*Bolt section modulus = $d^3 / 6$*		
f_{tb}	172.60 MPa	*Bending stress = M_u / S*		
f_{rt}	0.00 MPa	*Required axial tensile stress*		
f_t	172.60 MPa	*Total required tensile stress = $f_{tb} + f_{rt}$*		
Anchor Bolt Bearing on Plate Washer	872.96 kN	4421.62 kN	**0.20**	**PASS**
$R_n = N_{bolt} * \min(2.4*d_b*t_{pw}*F_u, R_{n\text{-}bolt})$		**ϕ = 0.75**	(section J3.10)	
V_u	872.96 kN	*Resultant shear force, see 'Anchor Bolt Shear' check*		
N_{bolt}	32	*Number of bolts*		
d_b	31.75 mm	*Bolt diameter*		
t_{pw}	15.00 mm	*Thickness of washer plate*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
$R_{n\text{-}bolt}$	184.23 kN	*Bolt shear strength, $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	232.70 MPa	*Nominal shear stress of bolt*		
A_{bolt}	791.73 mm^2	*Area of bolt*		
ϕRn	4421.62 kN	*Total bolt bearing strength*		
Plate Washer Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{max}	13.41 mm	*Max Size Allowed*		
t	15.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	8.00 mm	*Weld size*		
L_{min}	60.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	8.00 mm	*Weld size*		

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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
L_{max}	60.00 mm	*Max weld segment length*		
Weld Limitations at Gusset				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{max}	23.41 mm	*Max Size Allowed*		
t	25.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	475.00 mm	*Min weld segment length*		
Plate Washer Weld Strength	872.96 kN	9434.73 kN	**0.09**	**PASS**
$\phi Rn = N_{bolt} * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
V_{uy}	872.96 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	872.96 kN	*Resultant shear force*		
N_{bolt}	32	*Number of bolts*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	8.00 mm	*Weld fillet size*		
d	60.00 mm	*Plate washer size*		
L	240.00 mm	*Weld length L=4*d*		
ϕRn	9434.73 kN	*Weld strength*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Gusset Weld Strength	333.60 kN	2917.64 kN	**0.11**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		

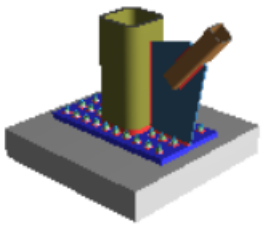
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D.26 Base Plate BRACE 1 EJE A: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	475.00 mm	*Weld length*		
ϕRn	2917.64 kN	*Weld strength*		

D.26 Base Plate BRACE 1 EJE A: Gusset/Column Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	-891.77 kN	*Calculated Shear Load*
Axial Load	-469.35 kN	*Calculated Axial Load (tension)*
Moment Load	-0.00 kN-m	*Calculated Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	317.16 MPa	*Column yield strength*		
t	50.00 mm	*Column wall thickness*		
B	500.00 mm	*Column face width*		
b	350.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	35.15	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	850.00 mm	*Min weld segment length*		
Loading at Gusset to Column				**n/a**
P	-1200.00 kN	*User input axial load in brace*		
θ	42.00 degrees	*Brace angle from vertical*		
V	-891.77 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-802.96 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		

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D.26 Base Plate BRACE 1 EJE A: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
H_c	-469.35 kN	*Calculated axial at the gusset to column connection, $H_c=(H*e + V*e_c)/6$ per AISC DG 29, section 4.3*		
Gusset Shear Yield	891.77 kN	4395.41 kN	**0.20**	**PASS**
$R_n = 0.6 *F_y*A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	21250.00 mm^2	*Gross area subject to shear*		
ϕR_n	4395.41 kN	*Shear yield strength*		
Gusset Shear Rupture	891.77 kN	4285.52 kN	**0.21**	**PASS**
$R_n = 0.6 *F_u*A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	21250.00 mm^2	*Net area subject to shear*		
ϕR_n	4285.52 kN	*Shear rupture strength*		
Gusset Axial Yield	469.35 kN	6593.11 kN	**0.07**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	21250.00 mm^2	*Gross area subject to tension*		
ϕR_n	6593.11 kN	*Tensile yield strength*		
Gusset Tensile Rupture	469.35 kN	7142.54 kN	**0.07**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	21250.00 mm^2	*Net area subject to tension*		
ϕR_n	7142.54 kN	*Tensile rupture strength*		
Gusset Flexural Yield			**0.05**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-469.35 kN	*Calculated axial load*		
V_r	891.77 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	21250.00 mm^2	*Gross area of the plate*		
Z_{pl}	4515625.00 mm^3	*Plastic modulus of the shear plate*		
P_c	6593.11 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4395.41 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	1401.03 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.05	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Gusset Flexural Rupture			**0.05**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-469.35 kN	*Calculated axial load*		
V_r	891.77 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	21250.00 mm^2	*Net area of the plate*		
Z_{net}	4515625.00 mm^3	*Plastic modulus of net section*		

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D.26 Base Plate BRACE 1 EJE A: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
P_c	7142.54 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4285.52 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	1517.78 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.05	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r \rvert/P_c + \lvert M_r \rvert/M_c)^2 <= 1$*		
Column Weld Strength	1007.75 kN	4176.83 kN	**0.24**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	50.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	20.00 mm	*Weld fillet size*		
L	850.00 mm	*Weld length*		
ϕRn	4176.83 kN	*Weld strength*		
Column Web Bending	222.94 kN-m	4245.94 kN-m	**0.05**	**PASS**
$M_n = k * m_p * L$		**ϕ = 0.9**	(AISC DG#29 Eqn 4-17)	
H_c	-469.35 kN	*Calculated axial at the gusset to column connection*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
M_{req}	222.94 kN-m	*Required moment in column web, $M_{req} = \lvert H_c \rvert * \beta$*		
B	500.00 mm	*Column width*		
t_{des}	50.00 mm	*Column wall thickness*		
h	400.00 mm	*Distance between column flanges, $h = B - 2 * t_{des}$*		
L	900.00 mm	*Gusset to column length*		
k	26.44	*Average 'k' value, k=h/L+ 8*L/h+ 8*		
F_{yc}	317.16 MPa	*Minimum yield stress of column material*		
m_p	198.22 kN	*Column force, $m_p = 0.25 * F_{yc} * t_{des}^2$*		
ϕMn	4245.94 kN-m	*Available moment per (AISC DG29, Eqn 4-17)*		
HSS Punching Shear	222.94 kN-m	2429.35 kN-m	**0.09**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	399.90 MPa	*Column tensile strength*		
t	50.00 mm	*Column wall thickness*		
l_p	900.00 mm	*Plate length*		
M_e	222.94 kN-m	*Required moment per Column Web Bending*		
ϕM_n	2429.35 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	469.35 kN	7682.74 kN	**0.06**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	317.16 MPa	*Minimum yield stress of column material*		
B	500.00 mm	*Column width*		
t	50.00 mm	*Column wall thickness*		

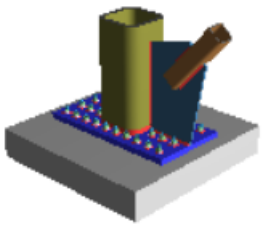
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D.26 Base Plate BRACE 1 EJE A: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L	900.00 mm	*Length of gusset plate*		
T	350.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	162.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	162.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7682.74 kN	*Transverse plastification strength*		

D.26 Base Plate BRACE 1 EJE A: Gusset/Brace Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Brace Axial	-1200.00 kN	*Brace Axial (tension)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	411.54 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	411.54 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	1200.00 kN	5082.14 kN	**0.24**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	16380.03 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	655.20 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	5082.14 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	1200.00 kN	5505.65 kN	**0.22**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	655.20 mm	*Whitmore tensile width*		
A_n	16380.03 mm^2	*Net area of plate*		
ϕR_n	5505.65 kN	*Plate tensile rupture strength*		

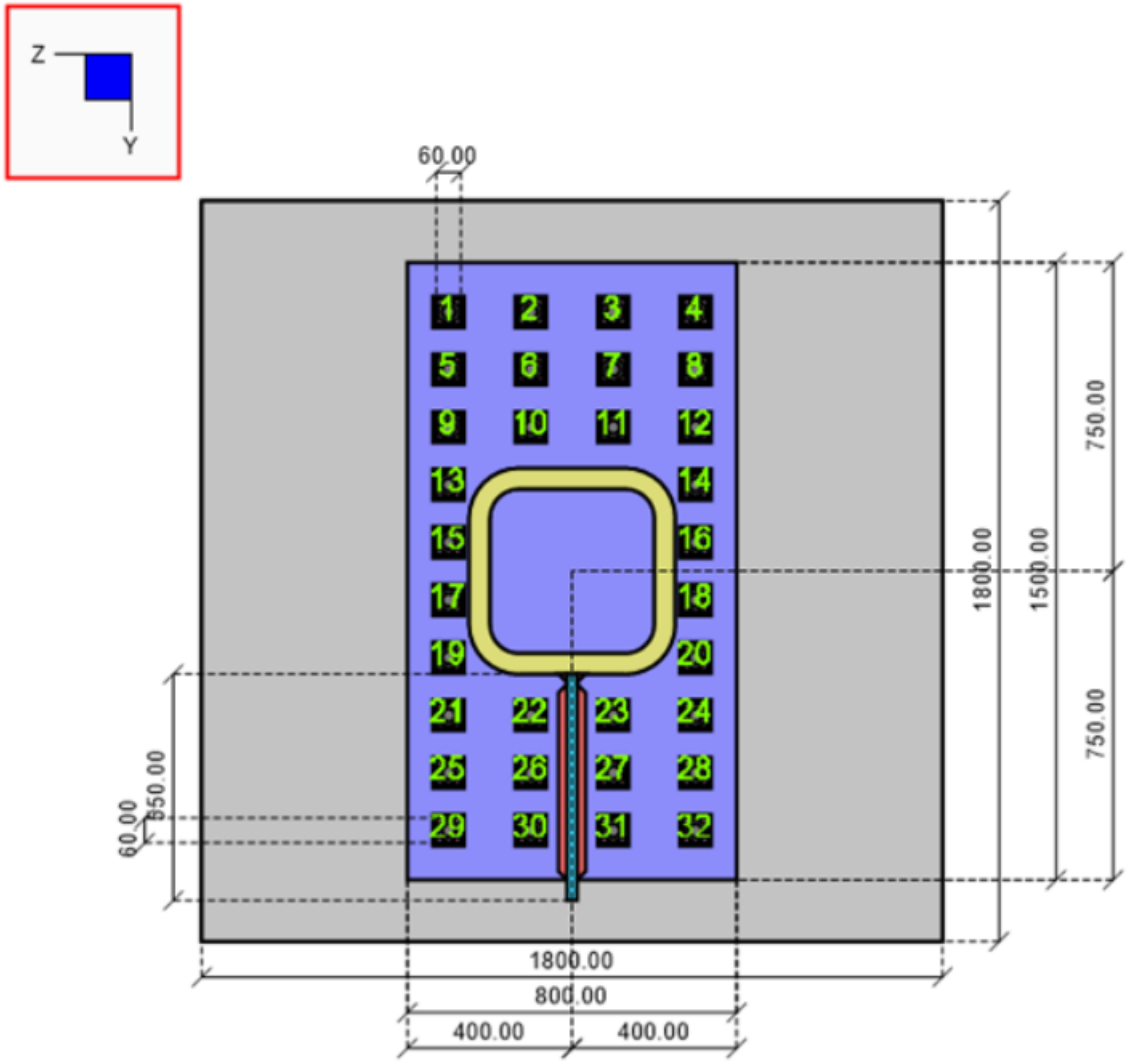
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D.26 Base Plate BRACE 1 EJE A: Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Tensile Yield	1200.00 kN	2501.97 kN	**0.48**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1200.00 kN	1980.08 kN	**0.61**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	6176.06 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7387.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.84	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.84	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1980.08 kN	*Tensile rupture strength*		
Brace Weld Strength	1200.00 kN	3799.59 kN	**0.32**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (brace)*		
α	0.75	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	411.54 mm	*Weld length*		
ϕRn	3799.59 kN	*Weld strength*		

D.27 Base Plate BRACE 2 EJE C: 2D Views Report

Top view

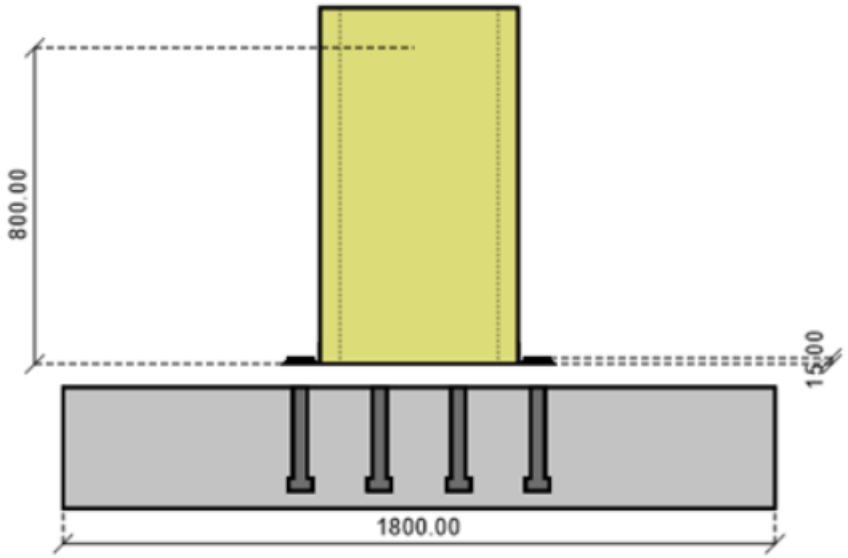


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D.27 Base Plate BRACE 2 EJE C: 2D Views Report (continued):

Front view

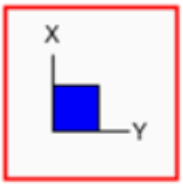


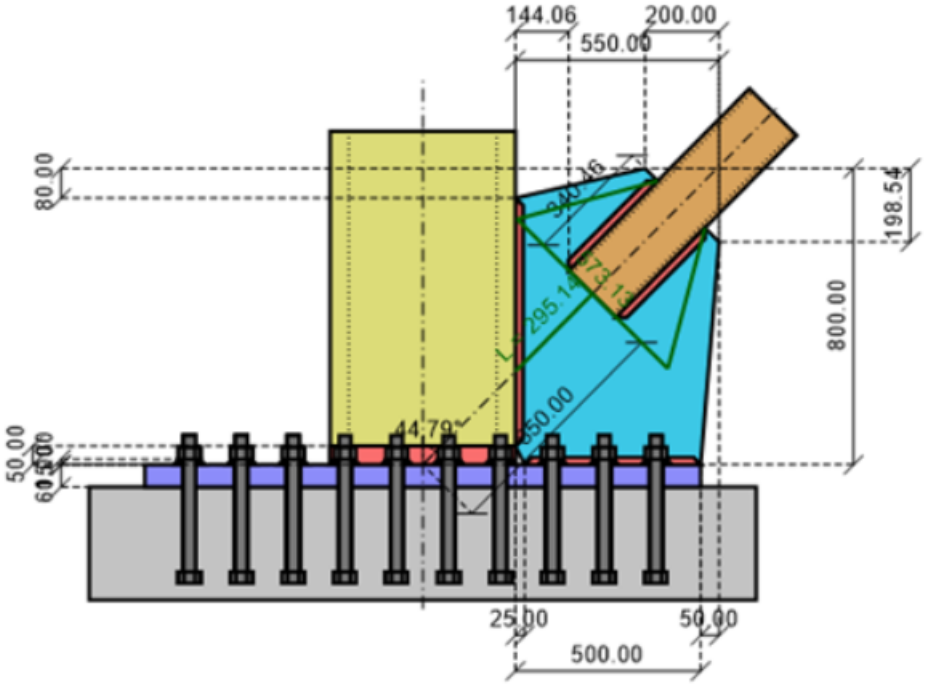


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D.27 Base Plate BRACE 2 EJE C: 2D Views Report (continued):

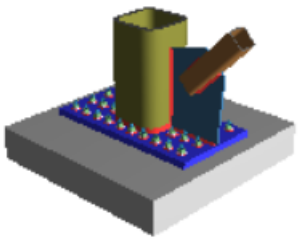
Left view





D.27 Base Plate BRACE 2 EJE C: Summary Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x550.00x800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

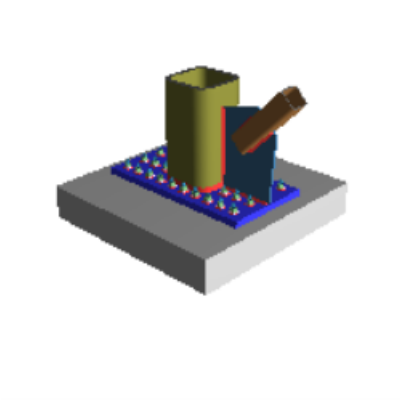
Input Data:

Brace Axial	-1200.00 kN	*Brace Axial (tension)*
Column Axial	3000.00 kN	*Axial load on the column*
Column Strong Axis Shear	70.00 kN	*Shear load on the column that causes strong axis bending*
Column Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Column Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Column Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**0.90**	**PASS**
Gusset/Column connection	Column Weld Strength	**0.31**	**PASS**
Gusset/Brace connection	Brace Tensile Rupture	**0.63**	**PASS**

D.27 Base Plate BRACE 2 EJE C: Base Plate Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x550.00x800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Design Axial	2148.37 kN	*Axial load on the column*
Design Strong Axis Shear	915.41 kN	*Shear load on the column that causes strong axis bending*
Design Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Design Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Design Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	120.00 mm	*Min edge distance y*		
e_z	100.00 mm	*Min edge distance z*		
ED_{allow}	41.27 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	120.00 mm	*Max edge distance y*		
d_z	100.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	60.00 mm	*Thickness of base plate*		
Check Plate Washer Encroachment on Column	**Pass**			
Check Plate Washers Encroachment on Each Other	**Pass**			
Check Plate Washer Width	**Pass**	*Condition: L_{pw} > d_h + (2*AB_{tol})*		
L_{pw}	60.00 mm	*Plate washer length*		
d_h	34.92 mm	*Anchor bolt hole diameter*		
AB_{tol}	9.52 mm	*Anchor bolt placement tolerance (per AISC 303-10, Section 7.5.1)*		

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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Plate Washer Weld Edge Distance	**Pass**	*Condition: min(e_z , e_y) - ((L_{pw} / 2) + D_{pw}) >= 1/16 in*		
D_{pw}	8.00 mm	*Plate washer weld size*		
Loading at Base Plate				**n/a**
P_c	3000.00 kN	*User input axial load in column*		
V_{zc}	70.00 kN	*User input strong axis shear in column*		
V_{yc}	0.00 kN	*User input weak axis shear in column*		
M_{zc}	100.00 kN-m	*User input strong axis moment in column*		
M_{yc}	0.00 kN-m	*User input weak axis moment in column*		
P	-1200.00 kN	*User input axial load in brace*		
θ	44.79 degrees	*Brace angle from vertical*		
V	-851.63 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-845.41 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	385.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
H_b	-292.40 kN	*Calculated shear at the gusset to base plate connection, H_b=(H*(β-e) - V*e_c)/β per AISC DG 29, section 4.3*		
H_c	-553.01 kN	*Calculated axial at the gusset to column connection, H_c=(H*e + V*e_c)/β per AISC DG 29, section 4.3*		
P_{bp}	2148.37 kN	*Design axial load, P_{bp} = P_c + V*		
V_{z_bp}	915.41 kN	*Design strong axis shear load, V_{z_bp} = V_{zc} - H*		
V_{y_bp}	0.00 kN	*Design weak axis shear load, V_{y_bp} = V_{yc}*		
M_{z_bp}	100.00 kN-m	*Design strong axis moment load, M_{z_bp} = M_{zc} + H_c*e*		
M_{y_bp}	0.00 kN-m	*Design weak axis moment load, M_{y_bp} = M_{yc}*		
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	100.00 kN-m	*User input strong axis moment*		
P_u	2148.37 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	12.73 kN/mm	*Bearing force = φR_n*B*		
e	46.55 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		
e_{crit}	665.62 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	1406.91 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	2148.37 kN	*User input axial load*		

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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.87 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = $\|(M_{uy} / P_u)\|$*		
e_{crit}	354.99 mm	*Critical eccentricity = (B/2) - P_u /(2*q_{max})*		
Y_z	800.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Gusset Shear Yield	292.40 kN	2456.26 kN	**0.12**	**PASS**
R_n = 0.6 *F_y*A_{gv}		**ϕ = 1.00**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11875.00 mm^2	*Gross area subject to shear*		
ϕR_n	2456.26 kN	*Shear yield strength*		
Gusset Shear Rupture	292.40 kN	2394.85 kN	**0.12**	**PASS**
R_n = 0.6 *F_u*A_{nv}		**ϕ = 0.75**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11875.00 mm^2	*Net area subject to shear*		
ϕR_n	2394.85 kN	*Shear rupture strength*		
Concrete Bearing			**0.12**	**PASS**
R_n = 0.85 * f'$_c$ * α		**ϕ = 0.65**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'$_c$	24.00 MPa	*Concrete compressive strength*		
P_u	2148.37 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
A_1	1200000.00 mm^2	*Plate area = B*N*		
L	1800.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1800.00 mm	*Effective concrete support length*		
W'	960.00 mm	*Effective concrete support width*		
A_2	1728000.00 mm^2	*Effective concrete support area = L' * W'*		
α	1.20	*Bearing stress increase factor = min(2, $(A_2 / A_1)^{0.5}$)*		
ϕR_n	15.91 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: f_{py} <= φR_n*		
Design with small moment				
Y_y	1406.91 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	1.91 MPa	*Required bearing stress = P_u / (B * Y_y)*		
UC_y	0.12	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: f_{pz} <= φR_n*		
Design with small moment				
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	1.79 MPa	*Required bearing stress = P_u / (N * Y_z)*		
UC_z	0.11	*Unity check for Weak Axis*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.25 kN-m/mm	0.28 kN-m/mm	**0.90**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	

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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	1.91 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	1406.91 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.25 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.03 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.25 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.21 kN-m/mm	0.28 kN-m/mm	**0.74**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	1.79 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	800.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.02 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	0.88	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.21 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * \beta$*		
M_{pl}	0.21 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Anchor Bolt Shear	915.41 kN	4421.62 kN	**0.21**	**PASS**
$R_n = F_{nv} * A_b * N_{bolt}$		**ϕ = 0.75**	(J3-1)	
V_{uy}	915.41 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	915.41 kN	*Resultant shear force*		
F_{nv}	232.70 MPa	*Shear stress N type*		
A_b	791.73 mm^2	*Area of bolt*		

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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N_{bolt}	32	*Number of bolts*		
ϕR_n	4421.62 kN	*Bolt shear rupture strength*		
Anchor Bolt Bending	180.99 MPa	290.87 MPa	**0.62**	**PASS**
$F'_{nt} = \min(1.3*F_{nt} - (F_{nt} / (\phi*F_{nv})*f_{rv}), F_{nt})$		**ϕ = 0.75**	(J3-3)	
F_{nt}	387.83 MPa	*Nominal tensile stress, per Table J3.2*		
F_{nv}	232.70 MPa	*Nominal shear stress, per Table J3.2*		
V_u	915.41 kN	*Resultant shear force, see 'Anchor bolt shear' check*		
N_{bolt}	32	*Number of bolts*		
A_b	791.73 mm^2	*Bolt cross sectional area*		
f_{rv}	36.13 MPa	*Required shear stress: $f_{rv} = (V_u / N_{bolt}) / A_b$*		
$\phi F'_{nt}$	290.87 MPa	*Available tensile stress*		
t_p	60.00 mm	*Thickness of base plate*		
t_{pw}	15.00 mm	*Plate washer thickness*		
M_u	0.97 kN-m	*Bending moment = $(V_u / N_{bolt})*(t_p + (t_{pw} / 2)) / 2$*		
d	31.75 mm	*Bolt diameter*		
S	5334.33 mm^3	*Bolt section modulus = $d^3 / 6$*		
f_{tb}	180.99 MPa	*Bending stress = M_u / S*		
f_{rt}	0.00 MPa	*Required axial tensile stress*		
f_t	180.99 MPa	*Total required tensile stress = $f_{tb} + f_{rt}$*		
Anchor Bolt Bearing on Plate Washer	915.41 kN	4421.62 kN	**0.21**	**PASS**
$R_n = N_{bolt} * \min(2.4*d_b*t_{pw}*F_u, R_{n\text{-}bolt})$		**ϕ = 0.75**	(section J3.10)	
V_u	915.41 kN	*Resultant shear force, see 'Anchor Bolt Shear' check*		
N_{bolt}	32	*Number of bolts*		
d_b	31.75 mm	*Bolt diameter*		
t_{pw}	15.00 mm	*Thickness of washer plate*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
$R_{n\text{-}bolt}$	184.23 kN	*Bolt shear strength, $R_{n\text{-}bolt}=F_{nv}*A_{bolt}$*		
F_{nv}	232.70 MPa	*Nominal shear stress of bolt*		
A_{bolt}	791.73 mm^2	*Area of bolt*		
ϕRn	4421.62 kN	*Total bolt bearing strength*		
Plate Washer Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{max}	13.41 mm	*Max Size Allowed*		
t	15.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	8.00 mm	*Weld size*		
L_{min}	60.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	8.00 mm	*Weld size*		

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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
L_{max}	60.00 mm	*Max weld segment length*		
Weld Limitations at Gusset				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{max}	23.41 mm	*Max Size Allowed*		
t	25.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	475.00 mm	*Min weld segment length*		
Plate Washer Weld Strength	915.41 kN	9434.73 kN	**0.10**	**PASS**
$\phi Rn = N_{bolt} * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
V_{uy}	915.41 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	915.41 kN	*Resultant shear force*		
N_{bolt}	32	*Number of bolts*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	8.00 mm	*Weld fillet size*		
d	60.00 mm	*Plate washer size*		
L	240.00 mm	*Weld length L=4*d*		
ϕRn	9434.73 kN	*Weld strength*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Gusset Weld Strength	292.40 kN	2917.64 kN	**0.10**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		

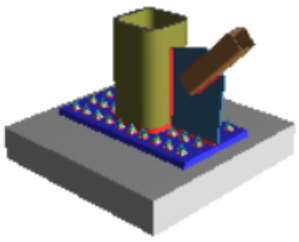
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D.27 Base Plate BRACE 2 EJE C: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	475.00 mm	*Weld length*		
ϕRn	2917.64 kN	*Weld strength*		

D.27 Base Plate BRACE 2 EJE C: Gusset/Column Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x550.00x800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	-851.63 kN	*Calculated Shear Load*
Axial Load	-553.01 kN	*Calculated Axial Load (tension)*
Moment Load	-0.00 kN-m	*Calculated Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	317.16 MPa	*Column yield strength*		
t	50.00 mm	*Column wall thickness*		
B	500.00 mm	*Column face width*		
b	350.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	35.15	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	670.00 mm	*Min weld segment length*		
Loading at Gusset to Column				**n/a**
P	-1200.00 kN	*User input axial load in brace*		
θ	44.79 degrees	*Brace angle from vertical*		
V	-851.63 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-845.41 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	385.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		

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D.27 Base Plate BRACE 2 EJE C: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
H_c	-553.01 kN	*Calculated axial at the gusset to column connection, $H_c=(H*e + V*e_c)/6$ per AISC DG 29, section 4.3*		
Gusset Shear Yield	851.63 kN	3464.62 kN	**0.25**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	16750.00 mm^2	*Gross area subject to shear*		
ϕR_n	3464.62 kN	*Shear yield strength*		
Gusset Shear Rupture	851.63 kN	3378.00 kN	**0.25**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	16750.00 mm^2	*Net area subject to shear*		
ϕR_n	3378.00 kN	*Shear rupture strength*		
Gusset Axial Yield	553.01 kN	5196.92 kN	**0.11**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	16750.00 mm^2	*Gross area subject to tension*		
ϕR_n	5196.92 kN	*Tensile yield strength*		
Gusset Tensile Rupture	553.01 kN	5630.00 kN	**0.10**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	16750.00 mm^2	*Net area subject to tension*		
ϕR_n	5630.00 kN	*Tensile rupture strength*		
Gusset Flexural Yield			**0.07**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-553.01 kN	*Calculated axial load*		
V_r	851.63 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	16750.00 mm^2	*Gross area of the plate*		
Z_{pl}	2805625.00 mm^3	*Plastic modulus of the shear plate*		
P_c	5196.92 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3464.62 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	870.48 kN-m	*Available moment $M_c=\varphi*(F_y * Z)$, $\varphi=0.90$*		
UC	0.07	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Gusset Flexural Rupture			**0.07**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-553.01 kN	*Calculated axial load*		
V_r	851.63 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	16750.00 mm^2	*Net area of the plate*		
Z_{net}	2805625.00 mm^3	*Plastic modulus of net section*		

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D.27 Base Plate BRACE 2 EJE C: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
P_c	5630.00 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3378.00 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	943.02 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.07	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r \rvert/P_c + \lvert M_r \rvert/M_c)^2 <= 1$*		
Column Weld Strength	1015.43 kN	3292.33 kN	**0.31**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	50.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	20.00 mm	*Weld fillet size*		
L	670.00 mm	*Weld length*		
ϕRn	3292.33 kN	*Weld strength*		
Column Web Bending	212.91 kN-m	2948.61 kN-m	**0.07**	**PASS**
$M_n = k * m_p * L$		**ϕ = 0.9**	(AISC DG#29 Eqn 4-17)	
H_c	-553.01 kN	*Calculated axial at the gusset to column connection*		
β	385.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
M_{req}	212.91 kN-m	*Required moment in column web, $M_{req} = \lvert H_c \rvert * \beta$*		
B	500.00 mm	*Column width*		
t_{des}	50.00 mm	*Column wall thickness*		
h	400.00 mm	*Distance between column flanges, $h = B - 2 * t_{des}$*		
L	720.00 mm	*Gusset to column length*		
k	22.96	*Average 'k' value, k=h/L+ 8*L/h+ 8*		
F_{yc}	317.16 MPa	*Minimum yield stress of column material*		
m_p	198.22 kN	*Column force, $m_p = 0.25 * F_{yc} * t_{des}^2$*		
ϕMn	2948.61 kN-m	*Available moment per (AISC DG29, Eqn 4-17)*		
HSS Punching Shear	212.91 kN-m	1554.79 kN-m	**0.14**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	399.90 MPa	*Column tensile strength*		
t	50.00 mm	*Column wall thickness*		
l_p	720.00 mm	*Plate length*		
M_e	212.91 kN-m	*Required moment per Column Web Bending*		
ϕM_n	1554.79 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	553.01 kN	6804.46 kN	**0.08**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	317.16 MPa	*Minimum yield stress of column material*		
B	500.00 mm	*Column width*		
t	50.00 mm	*Column wall thickness*		

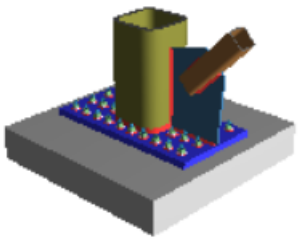
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D.27 Base Plate BRACE 2 EJE C: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L	720.00 mm	*Length of gusset plate*		
T	350.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	162.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	162.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	6804.46 kN	*Transverse plastification strength*		

D.27 Base Plate BRACE 2 EJE C: Gusset/Brace Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K180*12	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x550.00x800.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Brace Axial	-1200.00 kN	*Brace Axial (tension)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	12.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	340.46 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	340.46 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	1200.00 kN	4445.55 kN	**0.27**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	14328.27 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	573.13 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	4445.55 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	1200.00 kN	4816.01 kN	**0.25**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	573.13 mm	*Whitmore tensile width*		
A_n	14328.27 mm^2	*Net area of plate*		
ϕR_n	4816.01 kN	*Plate tensile rupture strength*		

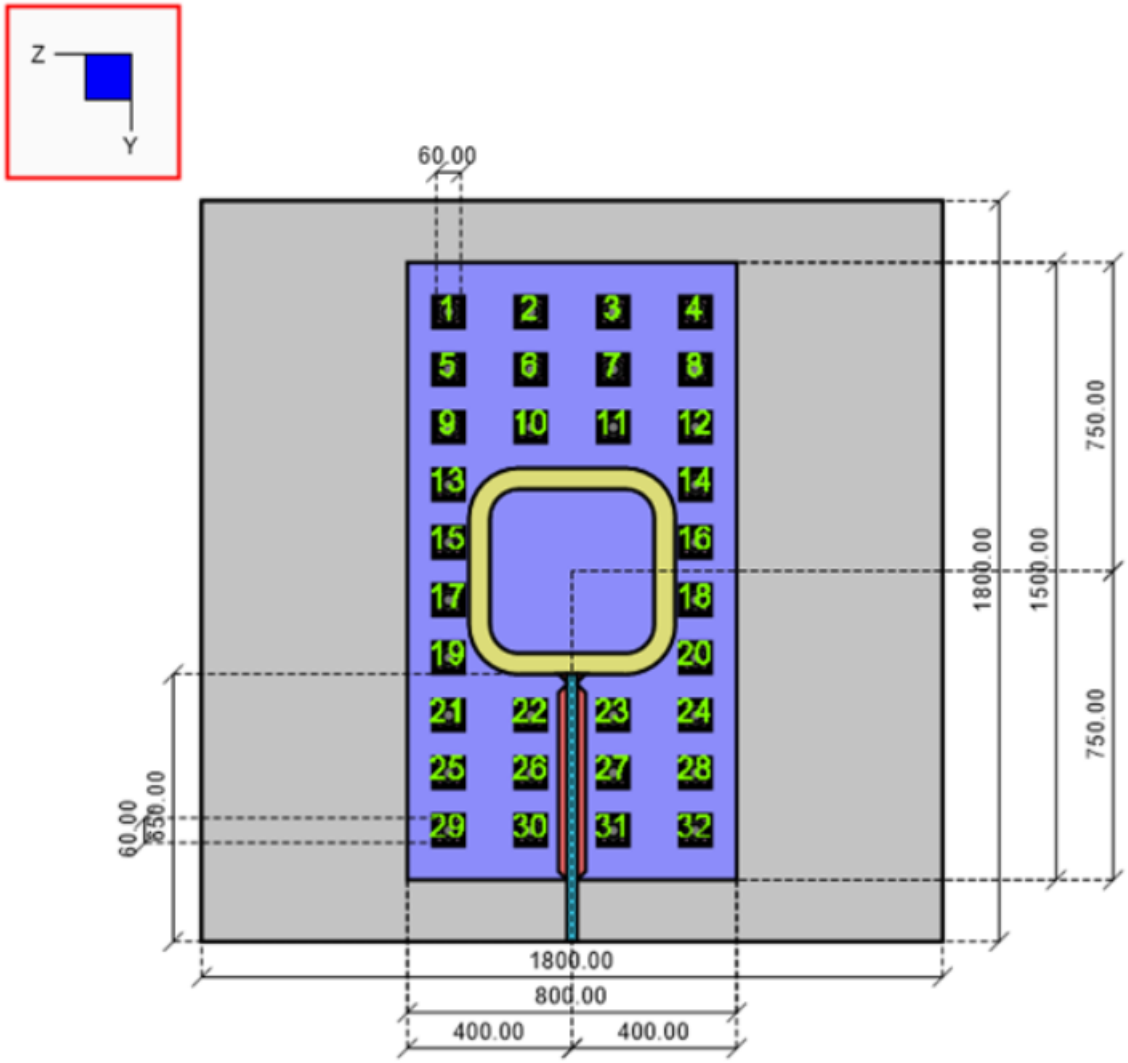
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D.27 Base Plate BRACE 2 EJE C: Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Tensile Yield	1200.00 kN	2501.97 kN	**0.48**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	8064.00 mm^2	*Gross area subject to tension*		
ϕR_n	2501.97 kN	*Tensile yield strength*		
Brace Tensile Rupture	1200.00 kN	1898.98 kN	**0.63**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	5923.09 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	7387.80 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.80	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.80	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1898.98 kN	*Tensile rupture strength*		
Brace Weld Strength	1200.00 kN	3143.37 kN	**0.38**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	12.00 mm	*Base material thickness (brace)*		
α	0.75	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	340.46 mm	*Weld length*		
ϕRn	3143.37 kN	*Weld strength*		

D.28 Base Plate BRACE 1 EJE E: 2D Views Report

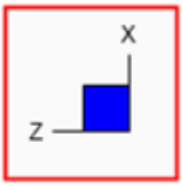
Top view

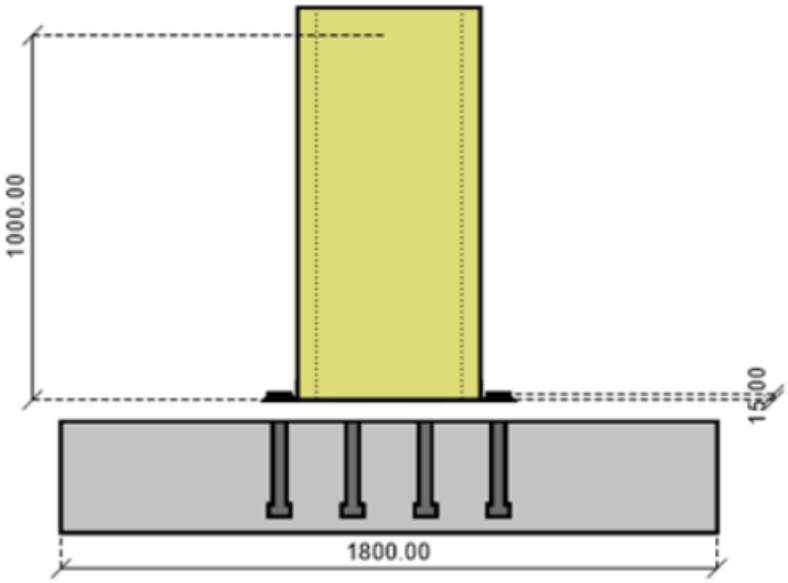


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D.28 Base Plate BRACE 1 EJE E: 2D Views Report (continued):

Front view

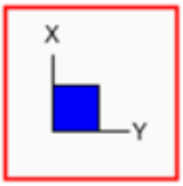


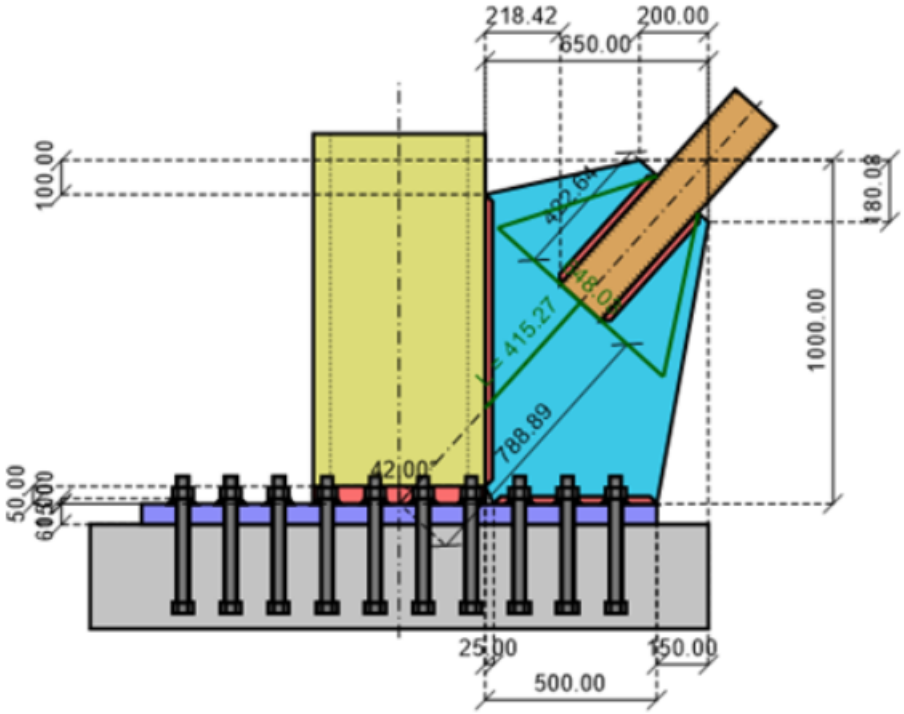


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D.28 Base Plate BRACE 1 EJE E: 2D Views Report (continued):

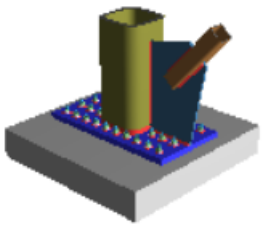
Left view





D.28 Base Plate BRACE 1 EJE E: Summary Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

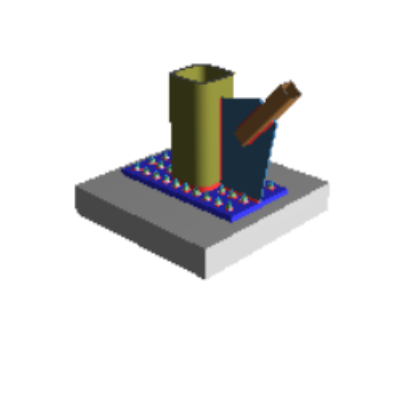
Input Data:

Brace Axial	-800.00 kN	*Brace Axial (tension)*
Column Axial	3000.00 kN	*Axial load on the column*
Column Strong Axis Shear	70.00 kN	*Shear load on the column that causes strong axis bending*
Column Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Column Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Column Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**1.00**	**PASS**
Gusset/Column connection	Column Weld Strength	**0.16**	**PASS**
Gusset/Brace connection	Brace Tensile Rupture	**0.53**	**PASS**

D.28 Base Plate BRACE 1 EJE E: Base Plate Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Design Axial	2405.48 kN	*Axial load on the column*
Design Strong Axis Shear	605.30 kN	*Shear load on the column that causes strong axis bending*
Design Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Design Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Design Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	120.00 mm	*Min edge distance y*		
e_z	100.00 mm	*Min edge distance z*		
ED_{allow}	41.27 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	120.00 mm	*Max edge distance y*		
d_z	100.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	60.00 mm	*Thickness of base plate*		
Check Plate Washer Encroachment on Column	**Pass**			
Check Plate Washers Encroachment on Each Other	**Pass**			
Check Plate Washer Width	**Pass**	*Condition: L_{pw} > d_h + (2*AB_{tol})*		
L_{pw}	60.00 mm	*Plate washer length*		
d_h	34.92 mm	*Anchor bolt hole diameter*		
AB_{tol}	9.52 mm	*Anchor bolt placement tolerance (per AISC 303-10, Section 7.5.1)*		

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D.28 Base Plate BRACE 1 EJE E: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Plate Washer Weld Edge Distance	**Pass**	*Condition: min(e_z , e_y) - ((L_{pw} / 2) + D_{pw}) >= 1/16 in*		
D_{pw}	8.00 mm	*Plate washer weld size*		
Loading at Base Plate				**n/a**
P_c	3000.00 kN	*User input axial load in column*		
V_{zc}	70.00 kN	*User input strong axis shear in column*		
V_{yc}	0.00 kN	*User input weak axis shear in column*		
M_{zc}	100.00 kN-m	*User input strong axis moment in column*		
M_{yc}	0.00 kN-m	*User input weak axis moment in column*		
P	-800.00 kN	*User input axial load in brace*		
θ	42.00 degrees	*Brace angle from vertical*		
V	-594.52 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-535.30 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
H_b	-222.40 kN	*Calculated shear at the gusset to base plate connection, H_b=(H*(β-e) - V*e_c)/β per AISC DG 29, section 4.3*		
H_c	-312.90 kN	*Calculated axial at the gusset to column connection, H_c=(H*e + V*e_c)/β per AISC DG 29, section 4.3*		
P_{bp}	2405.48 kN	*Design axial load, P_{bp} = P_c + V*		
V_{z_bp}	605.30 kN	*Design strong axis shear load, V_{z_bp} = V_{zc} - H*		
V_{y_bp}	0.00 kN	*Design weak axis shear load, V_{y_bp} = V_{yc}*		
M_{z_bp}	100.00 kN-m	*Design strong axis moment load, M_{z_bp} = M_{zc} + H_c*e*		
M_{y_bp}	0.00 kN-m	*Design weak axis moment load, M_{y_bp} = M_{yc}*		
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	100.00 kN-m	*User input strong axis moment*		
P_u	2405.48 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	12.73 kN/mm	*Bearing force = φR_n*B*		
e	41.57 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		
e_{crit}	655.52 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	1416.86 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	2405.48 kN	*User input axial load*		

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D.28 Base Plate BRACE 1 EJE E: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.87 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = $\lvert(M_{uy}/P_u)\rvert$*		
e_{crit}	349.61 mm	*Critical eccentricity = (B/2) - $P_u/(2*q_{max})$*		
Y_z	800.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Gusset Shear Yield	222.40 kN	2456.26 kN	**0.09**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11875.00 mm^2	*Gross area subject to shear*		
ϕR_n	2456.26 kN	*Shear yield strength*		
Gusset Shear Rupture	222.40 kN	2394.85 kN	**0.09**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11875.00 mm^2	*Net area subject to shear*		
ϕR_n	2394.85 kN	*Shear rupture strength*		
Concrete Bearing			**0.13**	**PASS**
$R_n = 0.85 * f'_c * \alpha$		**$\phi = 0.65$**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'_c	24.00 MPa	*Concrete compressive strength*		
P_u	2405.48 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
A_1	1200000.00 mm^2	*Plate area = B*N*		
L	1800.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1800.00 mm	*Effective concrete support length*		
W'	960.00 mm	*Effective concrete support width*		
A_2	1728000.00 mm^2	*Effective concrete support area = L' * W'*		
α	1.20	*Bearing stress increase factor = $\min(2, (A_2/A_1)^{0.5})$*		
ϕR_n	15.91 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: $f_{py} <= \varphi R_n$*		
Design with small moment				
Y_y	1416.86 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	2.12 MPa	*Required bearing stress = $P_u / (B * Y_y)$*		
UC_y	0.13	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: $f_{pz} <= \varphi R_n$*		
Design with small moment				
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	2.00 MPa	*Required bearing stress = $P_u / (N * Y_z)$*		
UC_z	0.13	*Unity check for Weak Axis*		
Lateral Slip			**0.61**	**PASS**
$V_n = \mu * P_u <= \min[0.2 * f'_c * A_c, (0.8\ ksi) * A_c]$		**$\phi = 0.75$**	(ACI 318-14 Table 22.9.4.4)	
V_{uy}	605.30 kN	*Strong axis shear*		

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D.28 Base Plate BRACE 1 EJE E: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	605.30 kN	*Resultant shear force*		
Check Strong Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{py}	2.12 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_y	1416.86 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
B	800.00 mm	*Plate width*		
A_c	1133484.92 mm^2	*Area of concrete section resisting shear transfer = $Y_y * B$*		
P_u	2405.48 kN	*Axial compressive force = $f_{py} * Y_y * B$*		
μ	0.55	*Static friction coefficient*		
f'_c	24.00 MPa	*Concrete compressive strength*		
ϕV_n	992.26 kN	*Allowable static friction*		
Check Weak Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{pz}	2.00 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
N	1500.00 mm	*Plate length*		
A_c	1200000.00 mm^2	*Area of concrete section resisting shear transfer = $Y_z * N$*		
P_u	2405.48 kN	*Axial compressive force = $f_{pz} * Y_z * N$*		
ϕV_n	992.26 kN	*Allowable static friction*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.28 kN-m/mm	0.28 kN-m/mm	**1.00**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	2.12 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	1416.86 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.28 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.03 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.28 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.23 kN-m/mm	0.28 kN-m/mm	**0.83**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		

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D.28 Base Plate BRACE 1 EJE E: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
B	800.00 mm	*Base plate width*		
f_p	2.00 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	800.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.03 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	0.88	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.23 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * β$*		
M_{pl}	0.23 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Washer Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{max}	13.41 mm	*Max Size Allowed*		
t	15.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	8.00 mm	*Weld size*		
L_{min}	60.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	8.00 mm	*Weld size*		
L_{max}	60.00 mm	*Max weld segment length*		
Weld Limitations at Gusset				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{max}	23.41 mm	*Max Size Allowed*		
t	25.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	475.00 mm	*Min weld segment length*		
Plate Washer Weld Strength	605.30 kN	9434.73 kN	**0.06**	**PASS**
$\phi Rn = N_{bolt} * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15th Eqn 8-2a)				

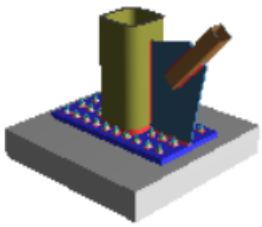
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D.28 Base Plate BRACE 1 EJE E: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uy}	605.30 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	605.30 kN	*Resultant shear force*		
N_{bolt}	32	*Number of bolts*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	8.00 mm	*Weld fillet size*		
d	60.00 mm	*Plate washer size*		
L	240.00 mm	*Weld length L=4*d*		
ϕRn	9434.73 kN	*Weld strength*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Gusset Weld Strength	222.40 kN	2917.64 kN	**0.08**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	475.00 mm	*Weld length*		
ϕRn	2917.64 kN	*Weld strength*		

D.28 Base Plate BRACE 1 EJE E: Gusset/Column Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	-594.52 kN	*Calculated Shear Load*
Axial Load	-312.90 kN	*Calculated Axial Load (tension)*
Moment Load	-0.00 kN-m	*Calculated Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	317.16 MPa	*Column yield strength*		
t	50.00 mm	*Column wall thickness*		
B	500.00 mm	*Column face width*		
b	350.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	35.15	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	850.00 mm	*Min weld segment length*		
Loading at Gusset to Column				**n/a**
P	-800.00 kN	*User input axial load in brace*		
θ	42.00 degrees	*Brace angle from vertical*		
V	-594.52 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-535.30 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		

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D.28 Base Plate BRACE 1 EJE E: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
H_c	-312.90 kN	*Calculated axial at the gusset to column connection, $H_c=(H*e + V*e_c)/6$ per AISC DG 29, section 4.3*		
Gusset Shear Yield	594.52 kN	4395.41 kN	**0.14**	**PASS**
$R_n = 0.6 *F_y*A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	21250.00 mm^2	*Gross area subject to shear*		
ϕR_n	4395.41 kN	*Shear yield strength*		
Gusset Shear Rupture	594.52 kN	4285.52 kN	**0.14**	**PASS**
$R_n = 0.6 *F_u*A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	21250.00 mm^2	*Net area subject to shear*		
ϕR_n	4285.52 kN	*Shear rupture strength*		
Gusset Axial Yield	312.90 kN	6593.11 kN	**0.05**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	21250.00 mm^2	*Gross area subject to tension*		
ϕR_n	6593.11 kN	*Tensile yield strength*		
Gusset Tensile Rupture	312.90 kN	7142.54 kN	**0.04**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	21250.00 mm^2	*Net area subject to tension*		
ϕR_n	7142.54 kN	*Tensile rupture strength*		
Gusset Flexural Yield			**0.02**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-312.90 kN	*Calculated axial load*		
V_r	594.52 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	21250.00 mm^2	*Gross area of the plate*		
Z_{pl}	4515625.00 mm^3	*Plastic modulus of the shear plate*		
P_c	6593.11 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4395.41 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	1401.03 kN-m	*Available moment $M_c=\varphi*(F_y* Z)$, $\varphi=0.90$*		
UC	0.02	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Gusset Flexural Rupture			**0.02**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-312.90 kN	*Calculated axial load*		
V_r	594.52 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	21250.00 mm^2	*Net area of the plate*		
Z_{net}	4515625.00 mm^3	*Plastic modulus of net section*		

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D.28 Base Plate BRACE 1 EJE E: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
P_c	7142.54 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4285.52 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	1517.78 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.02	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r \rvert/P_c + \lvert M_r \rvert/M_c)^2 <= 1$*		
Column Weld Strength	671.83 kN	4176.83 kN	**0.16**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	50.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	20.00 mm	*Weld fillet size*		
L	850.00 mm	*Weld length*		
ϕRn	4176.83 kN	*Weld strength*		
Column Web Bending	148.63 kN-m	4245.94 kN-m	**0.04**	**PASS**
$M_n = k * m_p * L$		**ϕ = 0.9**	(AISC DG#29 Eqn 4-17)	
H_c	-312.90 kN	*Calculated axial at the gusset to column connection*		
β	475.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
M_{req}	148.63 kN-m	*Required moment in column web, $M_{req} = \lvert H_c \rvert * β$*		
B	500.00 mm	*Column width*		
t_{des}	50.00 mm	*Column wall thickness*		
h	400.00 mm	*Distance between column flanges, $h = B - 2 * t_{des}$*		
L	900.00 mm	*Gusset to column length*		
k	26.44	*Average 'k' value, k=h/L+ 8*L/h+ 8*		
F_{yc}	317.16 MPa	*Minimum yield stress of column material*		
m_p	198.22 kN	*Column force, $m_p = 0.25 * F_{yc} * t_{des}^2$*		
ϕMn	4245.94 kN-m	*Available moment per (AISC DG29, Eqn 4-17)*		
HSS Punching Shear	148.63 kN-m	2429.35 kN-m	**0.06**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	399.90 MPa	*Column tensile strength*		
t	50.00 mm	*Column wall thickness*		
l_p	900.00 mm	*Plate length*		
M_e	148.63 kN-m	*Required moment per Column Web Bending*		
ϕM_n	2429.35 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	312.90 kN	7682.74 kN	**0.04**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	317.16 MPa	*Minimum yield stress of column material*		
B	500.00 mm	*Column width*		
t	50.00 mm	*Column wall thickness*		

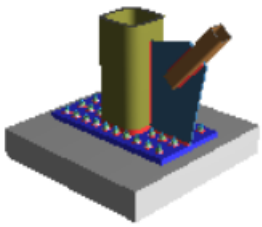
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D.28 Base Plate BRACE 1 EJE E: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L	900.00 mm	*Length of gusset plate*		
T	350.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	162.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	162.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	7682.74 kN	*Transverse plastification strength*		

D.28 Base Plate BRACE 1 EJE E: Gusset/Brace Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x650.00x1000.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Brace Axial	-800.00 kN	*Brace Axial (tension)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	422.64 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	422.64 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	800.00 kN	5026.48 kN	**0.16**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	16200.63 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	648.03 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	5026.48 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	800.00 kN	5445.35 kN	**0.15**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	648.03 mm	*Whitmore tensile width*		
A_n	16200.63 mm^2	*Net area of plate*		
ϕR_n	5445.35 kN	*Plate tensile rupture strength*		

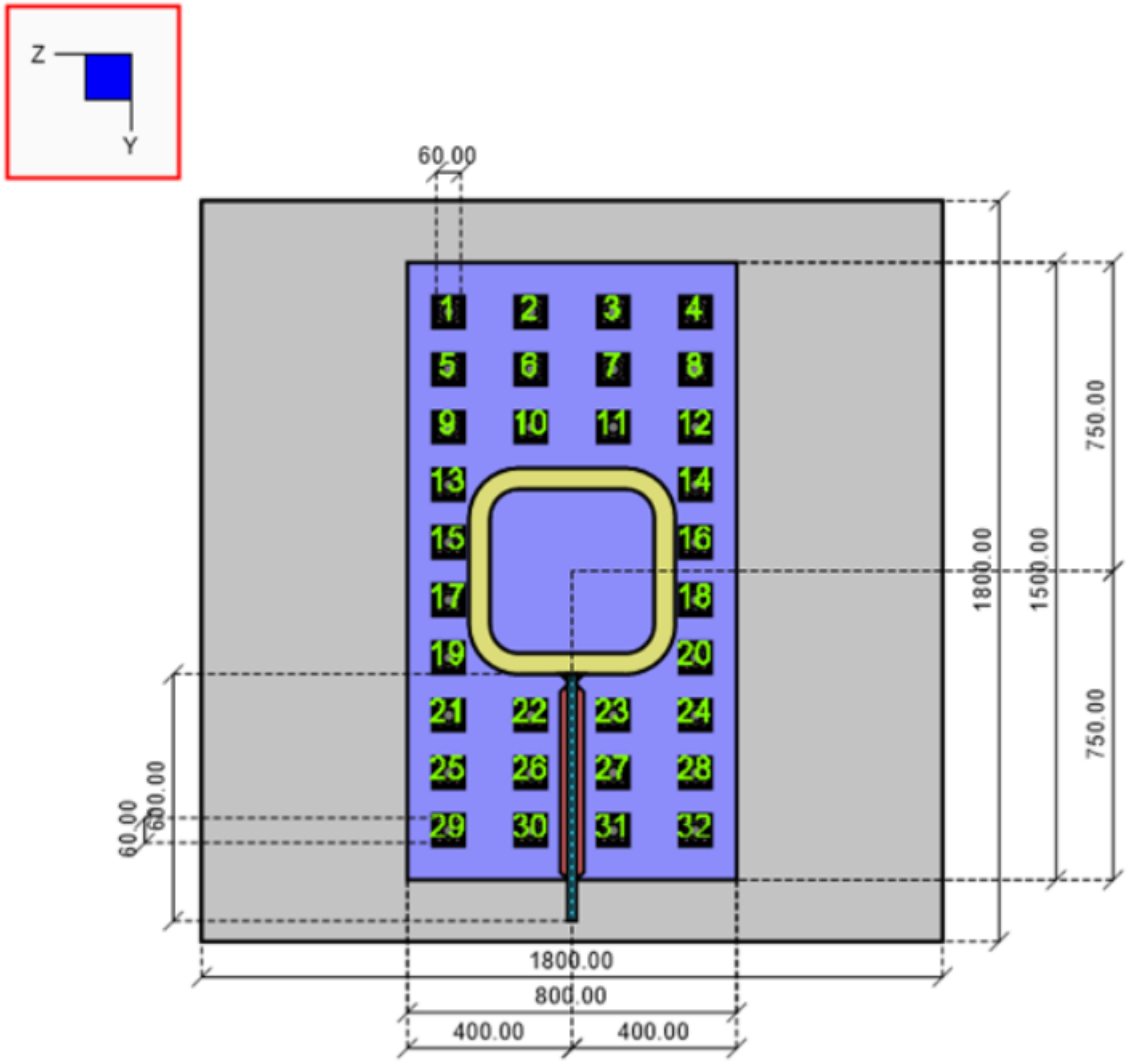
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D.28 Base Plate BRACE 1 EJE E: Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Tensile Yield	800.00 kN	1861.58 kN	**0.43**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	800.00 kN	1495.54 kN	**0.53**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	4664.71 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5436.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.86	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.86	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1495.54 kN	*Tensile rupture strength*		
Brace Weld Strength	800.00 kN	3251.77 kN	**0.25**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (brace)*		
α	0.63	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	422.64 mm	*Weld length*		
ϕRn	3251.77 kN	*Weld strength*		

D.29 Base Plate BRACE 1 EJE E EJE 1-2: 2D Views Report

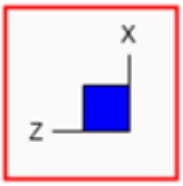
Top view

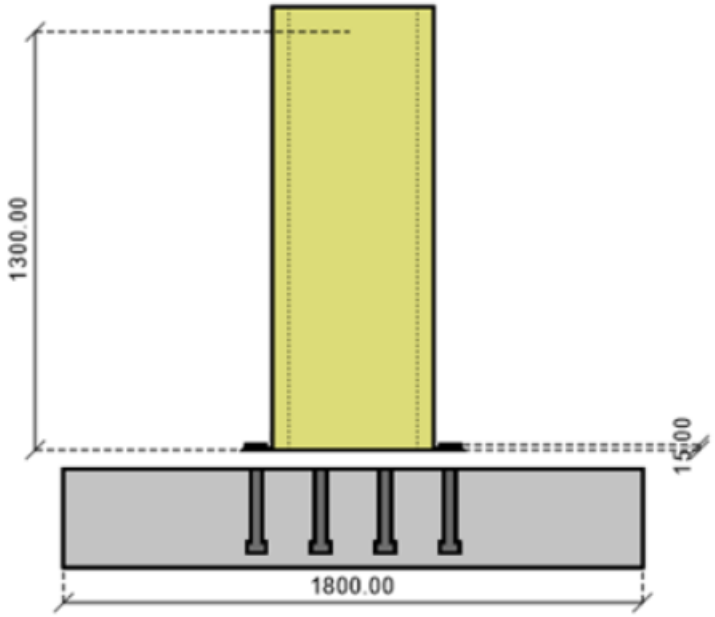


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D.29 Base Plate BRACE 1 EJE E EJE 1-2: 2D Views Report (continued):

Front view

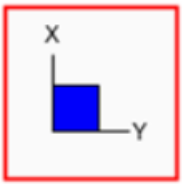


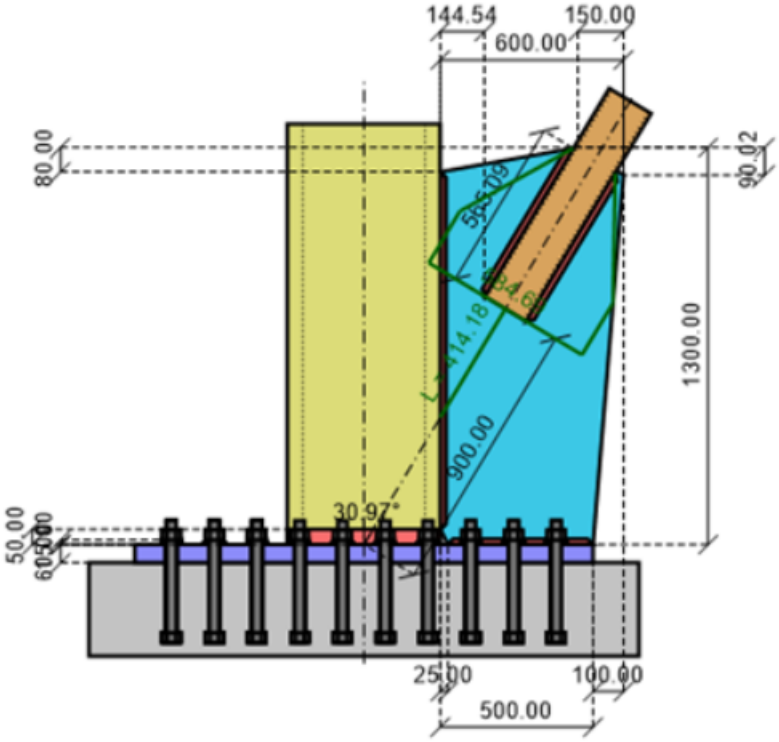


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D.29 Base Plate BRACE 1 EJE E EJE 1-2: 2D Views Report (continued):

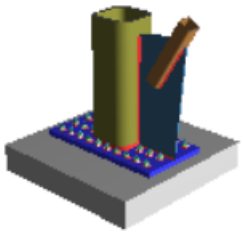
Left view





D.29 Base Plate BRACE 1 EJE E EJE 1-2: Summary Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x600.00x1300.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

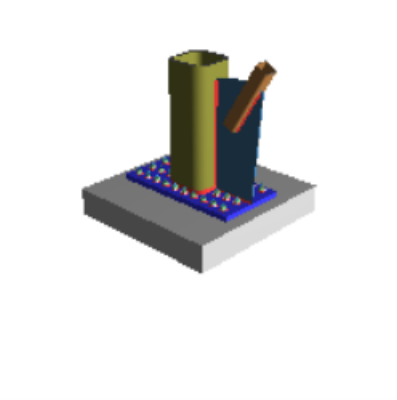
Input Data:

Brace Axial	-800.00 kN	*Brace Axial (tension)*
Column Axial	3000.00 kN	*Axial load on the column*
Column Strong Axis Shear	70.00 kN	*Shear load on the column that causes strong axis bending*
Column Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Column Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Column Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**0.96**	**PASS**
Gusset/Column connection	Gusset Shear Rupture	**0.15**	**PASS**
Gusset/Brace connection	Brace Tensile Rupture	**0.50**	**PASS**

D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x600.00x1300.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Design Axial	2314.05 kN	*Axial load on the column*
Design Strong Axis Shear	481.67 kN	*Shear load on the column that causes strong axis bending*
Design Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Design Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Design Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	120.00 mm	*Min edge distance y*		
e_z	100.00 mm	*Min edge distance z*		
ED_{allow}	41.27 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	120.00 mm	*Max edge distance y*		
d_z	100.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	60.00 mm	*Thickness of base plate*		
Check Plate Washer Encroachment on Column	**Pass**			
Check Plate Washers Encroachment on Each Other	**Pass**			
Check Plate Washer Width	**Pass**	*Condition: L_{pw} > d_h + (2*AB_{tol})*		
L_{pw}	60.00 mm	*Plate washer length*		
d_h	34.92 mm	*Anchor bolt hole diameter*		
AB_{tol}	9.52 mm	*Anchor bolt placement tolerance (per AISC 303-10, Section 7.5.1)*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Plate Washer Weld Edge Distance	**Pass**	*Condition: min(e_z , e_y) - ((L_{pw} / 2) + D_{pw}) >= 1/16 in*		
D_{pw}	8.00 mm	*Plate washer weld size*		
Loading at Base Plate				**n/a**
P_c	3000.00 kN	*User input axial load in column*		
V_{zc}	70.00 kN	*User input strong axis shear in column*		
V_{yc}	0.00 kN	*User input weak axis shear in column*		
M_{zc}	100.00 kN-m	*User input strong axis moment in column*		
M_{yc}	0.00 kN-m	*User input weak axis moment in column*		
P	-800.00 kN	*User input axial load in brace*		
θ	30.97 degrees	*Brace angle from vertical*		
V	-685.95 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-411.67 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	635.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
H_b	-141.61 kN	*Calculated shear at the gusset to base plate connection, H_b=(H*(β-e) - V*e_c)/β per AISC DG 29, section 4.3*		
H_c	-270.06 kN	*Calculated axial at the gusset to column connection, H_c=(H*e + V*e_c)/β per AISC DG 29, section 4.3*		
P_{bp}	2314.05 kN	*Design axial load, P_{bp} = P_c + V*		
V_{z_bp}	481.67 kN	*Design strong axis shear load, V_{z_bp} = V_{zc} - H*		
V_{y_bp}	0.00 kN	*Design weak axis shear load, V_{y_bp} = V_{yc}*		
M_{z_bp}	100.00 kN-m	*Design strong axis moment load, M_{z_bp} = M_{zc} + H_c*e*		
M_{y_bp}	0.00 kN-m	*Design weak axis moment load, M_{y_bp} = M_{yc}*		
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	100.00 kN-m	*User input strong axis moment*		
P_u	2314.05 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	12.73 kN/mm	*Bearing force = φR_n*B*		
e	43.21 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		
e_{crit}	659.11 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	1413.57 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	2314.05 kN	*User input axial load*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.87 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = $\lvert(M_{uy}/P_u)\rvert$*		
e_{crit}	351.52 mm	*Critical eccentricity = (B/2) - $P_u/(2*q_{max})$*		
Y_z	800.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Gusset Shear Yield	141.61 kN	1965.01 kN	**0.07**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	9500.00 mm^2	*Gross area subject to shear*		
ϕR_n	1965.01 kN	*Shear yield strength*		
Gusset Shear Rupture	141.61 kN	1915.88 kN	**0.07**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	9500.00 mm^2	*Net area subject to shear*		
ϕR_n	1915.88 kN	*Shear rupture strength*		
Concrete Bearing			**0.13**	**PASS**
$R_n = 0.85 * f'_c * \alpha$		**$\phi = 0.65$**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'_c	24.00 MPa	*Concrete compressive strength*		
P_u	2314.05 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
A_1	1200000.00 mm^2	*Plate area = B*N*		
L	1800.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1800.00 mm	*Effective concrete support length*		
W'	960.00 mm	*Effective concrete support width*		
A_2	1728000.00 mm^2	*Effective concrete support area = L' * W'*		
α	1.20	*Bearing stress increase factor = $\min(2, (A_2/A_1)^{0.5})$*		
ϕR_n	15.91 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: $f_{py} <= \varphi R_n$*		
Design with small moment				
Y_y	1413.57 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	2.05 MPa	*Required bearing stress = $P_u / (B * Y_y)$*		
UC_y	0.13	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: $f_{pz} <= \varphi R_n$*		
Design with small moment				
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	1.93 MPa	*Required bearing stress = $P_u / (N * Y_z)$*		
UC_z	0.12	*Unity check for Weak Axis*		
Lateral Slip			**0.50**	**PASS**
$V_n = \mu * P_u <= \min[0.2 * f'_c * A_c, (0.8\ ksi) * A_c]$		**$\phi = 0.75$**	(ACI 318-14 Table 22.9.4.4)	
V_{uy}	481.67 kN	*Strong axis shear*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	481.67 kN	*Resultant shear force*		
Check Strong Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{py}	2.05 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_y	1413.57 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
B	800.00 mm	*Plate width*		
A_c	1130856.76 mm^2	*Area of concrete section resisting shear transfer = $Y_y * B$*		
P_u	2314.05 kN	*Axial compressive force = $f_{py} * Y_y * B$*		
μ	0.55	*Static friction coefficient*		
f'_c	24.00 MPa	*Concrete compressive strength*		
ϕV_n	954.55 kN	*Allowable static friction*		
Check Weak Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{pz}	1.93 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
N	1500.00 mm	*Plate length*		
A_c	1200000.00 mm^2	*Area of concrete section resisting shear transfer = $Y_z * N$*		
P_u	2314.05 kN	*Axial compressive force = $f_{pz} * Y_z * N$*		
ϕV_n	954.55 kN	*Allowable static friction*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.27 kN-m/mm	0.28 kN-m/mm	**0.96**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	2.05 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	1413.57 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.27 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.03 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.27 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.22 kN-m/mm	0.28 kN-m/mm	**0.80**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
B	800.00 mm	*Base plate width*		
f_p	1.93 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	800.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.03 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	0.88	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.22 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * β$*		
M_{pl}	0.22 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Washer Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{max}	13.41 mm	*Max Size Allowed*		
t	15.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	8.00 mm	*Weld size*		
L_{min}	60.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	8.00 mm	*Weld size*		
L_{max}	60.00 mm	*Max weld segment length*		
Weld Limitations at Gusset				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{max}	18.41 mm	*Max Size Allowed*		
t	20.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	18.00 mm	*Weld size*		
L_{min}	475.00 mm	*Min weld segment length*		
Plate Washer Weld Strength	481.67 kN	9434.73 kN	**0.05**	**PASS**
$ϕRn = N_{bolt} * C_1 * α * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = ϕ * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $ϕ=0.75$ (AISC 15th Eqn 8-2a)				

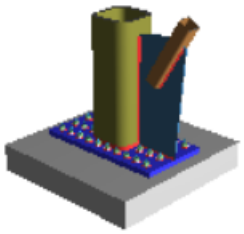
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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uy}	481.67 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	481.67 kN	*Resultant shear force*		
N_{bolt}	32	*Number of bolts*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	8.00 mm	*Weld fillet size*		
d	60.00 mm	*Plate washer size*		
L	240.00 mm	*Weld length L=4*d*		
ϕRn	9434.73 kN	*Weld strength*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Gusset Weld Strength	141.61 kN	2625.88 kN	**0.05**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	18.00 mm	*Weld fillet size*		
L	475.00 mm	*Weld length*		
ϕRn	2625.88 kN	*Weld strength*		

D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Column Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x600.00x1300.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	-685.95 kN	*Calculated Shear Load*
Axial Load	-270.06 kN	*Calculated Axial Load (tension)*
Moment Load	-0.00 kN-m	*Calculated Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	317.16 MPa	*Column yield strength*		
t	50.00 mm	*Column wall thickness*		
B	500.00 mm	*Column face width*		
b	350.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	35.15	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	20.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	18.00 mm	*Weld size*		
L_{min}	1170.00 mm	*Min weld segment length*		
Loading at Gusset to Column				**n/a**
P	-800.00 kN	*User input axial load in brace*		
θ	30.97 degrees	*Brace angle from vertical*		
V	-685.95 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-411.67 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	635.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
H_c	-270.06 kN	*Calculated axial at the gusset to column connection, $H_c=(H*e + V*e_c)/6$ per AISC DG 29, section 4.3*		
Gusset Shear Yield	685.95 kN	4840.12 kN	**0.14**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	23400.00 mm^2	*Gross area subject to shear*		
ϕR_n	4840.12 kN	*Shear yield strength*		
Gusset Shear Rupture	685.95 kN	4719.12 kN	**0.15**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	23400.00 mm^2	*Net area subject to shear*		
ϕR_n	4719.12 kN	*Shear rupture strength*		
Gusset Axial Yield	270.06 kN	7260.18 kN	**0.04**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	23400.00 mm^2	*Gross area subject to tension*		
ϕR_n	7260.18 kN	*Tensile yield strength*		
Gusset Tensile Rupture	270.06 kN	7865.20 kN	**0.03**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	23400.00 mm^2	*Net area subject to tension*		
ϕR_n	7865.20 kN	*Tensile rupture strength*		
Gusset Flexural Yield			**0.02**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-270.06 kN	*Calculated axial load*		
V_r	685.95 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	23400.00 mm^2	*Gross area of the plate*		
Z_{pl}	6844500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	7260.18 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	4840.12 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	2123.59 kN-m	*Available moment $M_c=\varphi*(F_y * Z)$, $\varphi=0.90$*		
UC	0.02	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Gusset Flexural Rupture			**0.02**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-270.06 kN	*Calculated axial load*		
V_r	685.95 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	23400.00 mm^2	*Net area of the plate*		
Z_{net}	6844500.00 mm^3	*Plastic modulus of net section*		

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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
P_c	7865.20 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	4719.12 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	2300.56 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.02	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$*		
Column Weld Strength	737.20 kN	5174.36 kN	**0.14**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	50.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	18.00 mm	*Weld fillet size*		
L	1170.00 mm	*Weld length*		
ϕRn	5174.36 kN	*Weld strength*		
Column Web Bending	171.49 kN-m	7123.19 kN-m	**0.02**	**PASS**
$M_n = k * m_p * L$		**ϕ = 0.9**	(AISC DG#29 Eqn 4-17)	
H_c	-270.06 kN	*Calculated axial at the gusset to column connection*		
β	635.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
M_{req}	171.49 kN-m	*Required moment in column web, $M_{req} = \lvert H_c \rvert * \beta$*		
B	500.00 mm	*Column width*		
t_{des}	50.00 mm	*Column wall thickness*		
h	400.00 mm	*Distance between column flanges, $h = B - 2 * t_{des}$*		
L	1220.00 mm	*Gusset to column length*		
k	32.73	*Average 'k' value, k=h/L+ 8*L/h+ 8*		
F_{yc}	317.16 MPa	*Minimum yield stress of column material*		
m_p	198.22 kN	*Column force, $m_p = 0.25 * F_{yc} * t_{des}^2$*		
ϕMn	7123.19 kN-m	*Available moment per (AISC DG29, Eqn 4-17)*		
HSS Punching Shear	171.49 kN-m	4464.01 kN-m	**0.04**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	399.90 MPa	*Column tensile strength*		
t	50.00 mm	*Column wall thickness*		
l_p	1220.00 mm	*Plate length*		
M_e	171.49 kN-m	*Required moment per Column Web Bending*		
ϕM_n	4464.01 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	270.06 kN	9128.92 kN	**0.03**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	317.16 MPa	*Minimum yield stress of column material*		
B	500.00 mm	*Column width*		
t	50.00 mm	*Column wall thickness*		

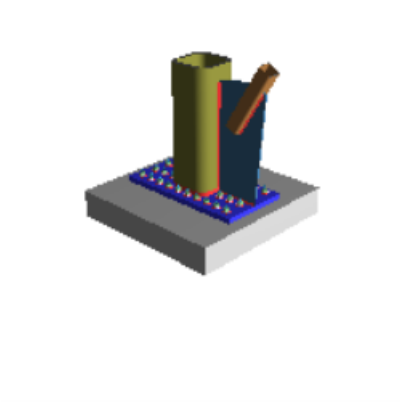
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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L	1220.00 mm	*Length of gusset plate*		
T	350.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	165.00 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	165.00 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	20.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	9128.92 kN	*Transverse plastification strength*		

D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Brace Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K160*10	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P20.00x600.00x1300.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Brace Axial	-800.00 kN	*Brace Axial (tension)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{min}	4.76 mm	*Min size allowed per Table J2.4*		
t_{min}	10.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	18.00 mm	*Weld size*		
L_{min}	565.09 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	18.00 mm	*Weld size*		
L_{max}	565.09 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	800.00 kN	3628.14 kN	**0.22**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	11693.72 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	584.69 mm	*Whitmore tensile width*		
t	20.00 mm	*Thickness of plate*		
ϕR_n	3628.14 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	800.00 kN	3930.49 kN	**0.20**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	20.00 mm	*Thickness of plate*		
L_w	584.69 mm	*Whitmore tensile width*		
A_n	11693.72 mm^2	*Net area of plate*		
ϕR_n	3930.49 kN	*Plate tensile rupture strength*		

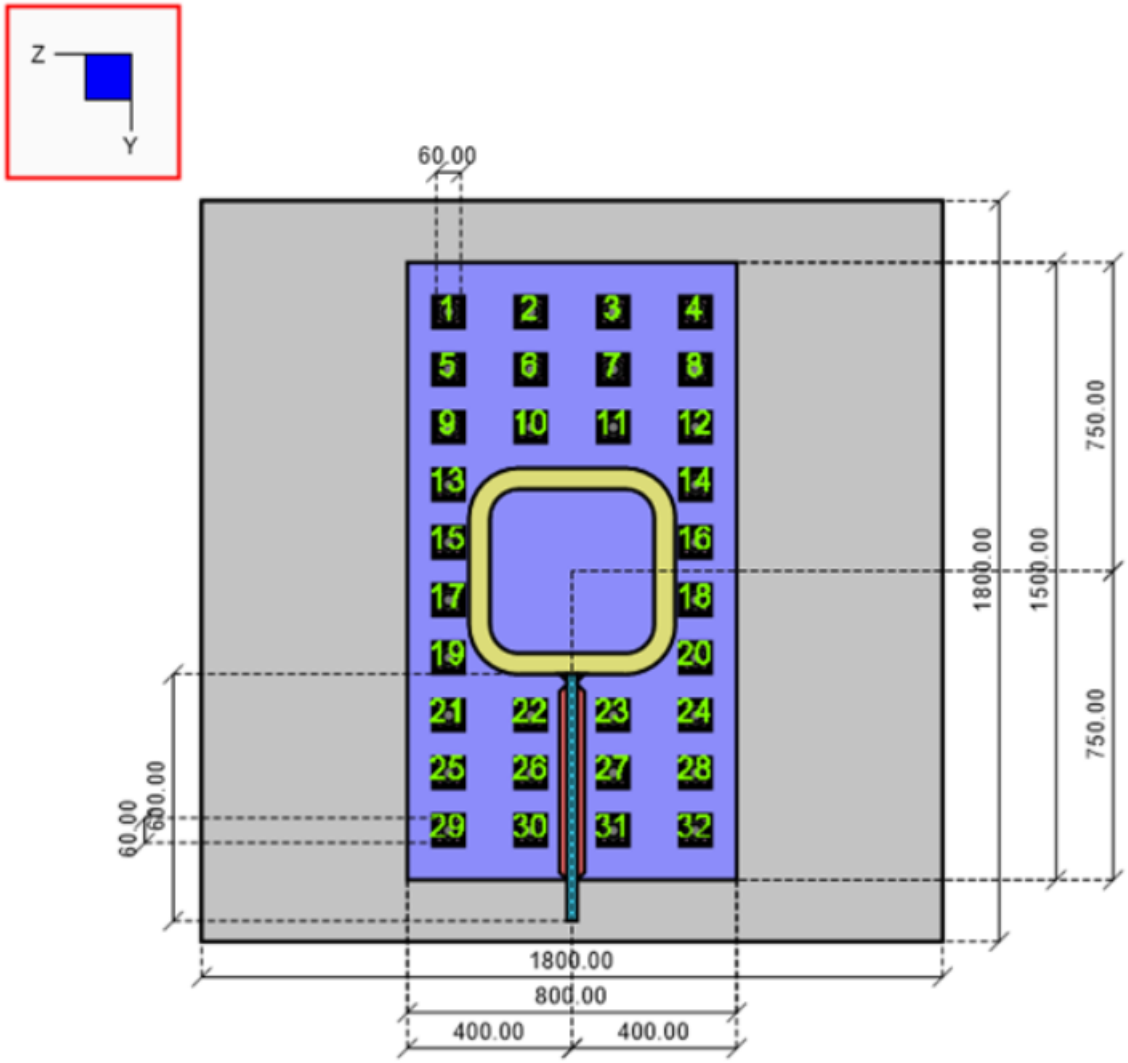
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D.29 Base Plate BRACE 1 EJE E EJE 1-2: Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Tensile Yield	800.00 kN	1861.58 kN	**0.43**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	6000.00 mm^2	*Gross area subject to tension*		
ϕR_n	1861.58 kN	*Tensile yield strength*		
Brace Tensile Rupture	800.00 kN	1586.57 kN	**0.50**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	4948.65 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	5536.50 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.89	*Shear lag factor (table D3.1)*		
U_{Bound}	0.47	*Shear lag factor (lower bound)*		
U	0.89	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	1586.57 kN	*Tensile rupture strength*		
Brace Weld Strength	800.00 kN	4347.77 kN	**0.18**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	10.00 mm	*Base material thickness (brace)*		
α	0.70	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	18.00 mm	*Weld fillet size*		
L	565.09 mm	*Weld length*		
ϕRn	4347.77 kN	*Weld strength*		

D.30 Base Plate BRACE 1 EJE 6/1 : 2D Views Report

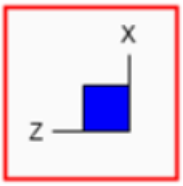
Top view

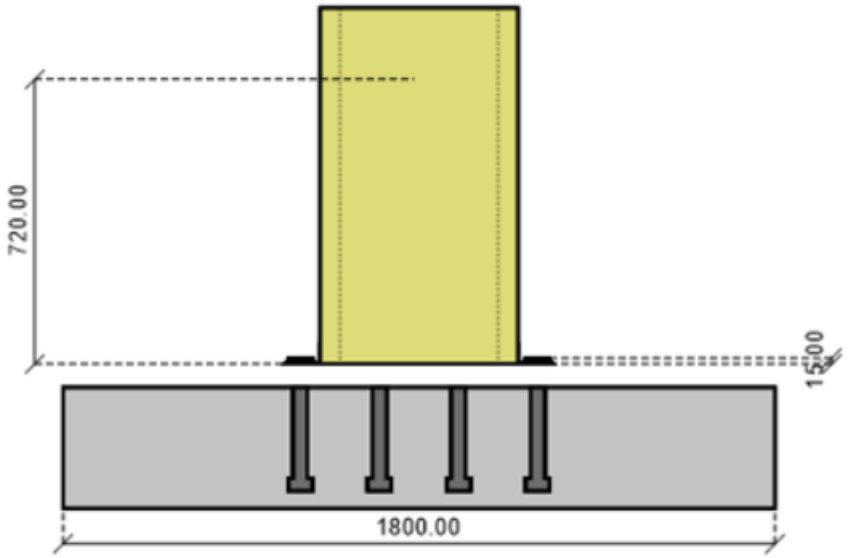


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D.30 Base Plate BRACE 1 EJE 6/1 : 2D Views Report (continued):

Front view

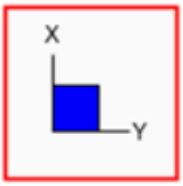


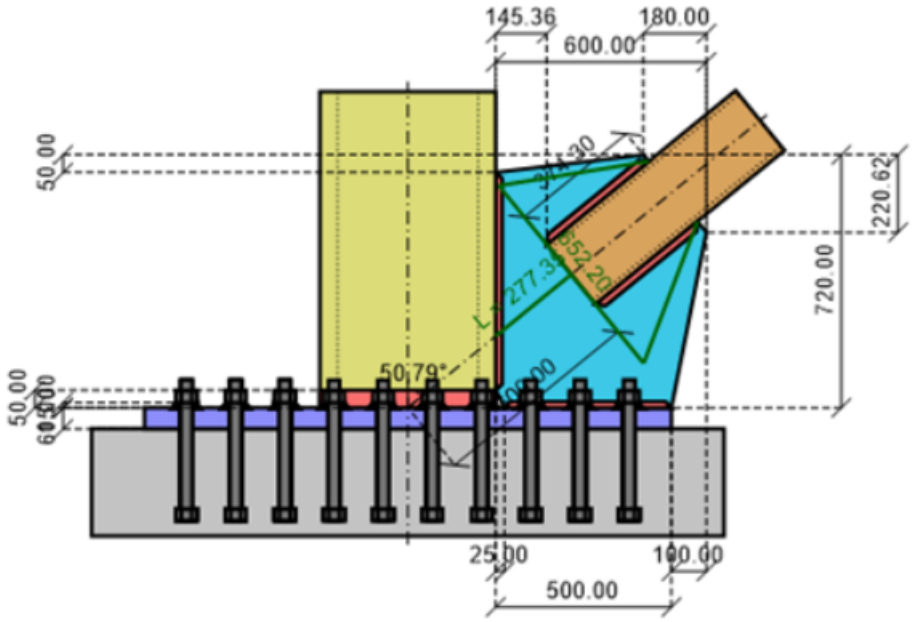


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D.30 Base Plate BRACE 1 EJE 6/1 : 2D Views Report (continued):

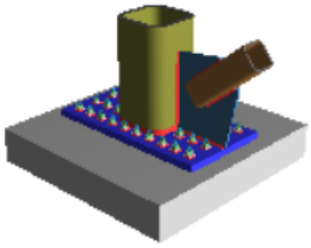
Left view





D.30 Base Plate BRACE 1 EJE 6/1 : Summary Report

Brace to Column Base Plate Connection



Material Properties:

Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K220*15	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x600.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

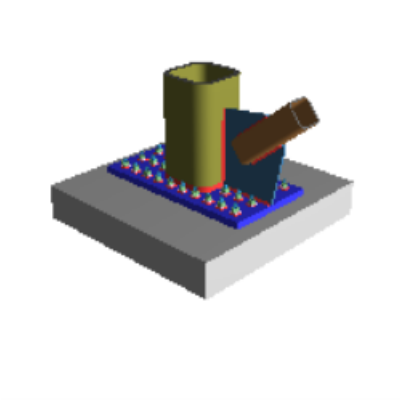
Input Data:

Brace Axial	-800.00 kN	*Brace Axial (tension)*
Column Axial	3000.00 kN	*Axial load on the column*
Column Strong Axis Shear	70.00 kN	*Shear load on the column that causes strong axis bending*
Column Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Column Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Column Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Connection	Required	Max Unity Check	Result
Column/Base Plate connection	Plate Flexural Yielding(Compression) (Strong Axis)	**1.03**	**FAIL**
Gusset/Column connection	Column Weld Strength	**0.22**	**PASS**
Gusset/Brace connection	Brace Tensile Rupture	**0.28**	**PASS**

D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K220*15	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x600.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Design Axial	2494.27 kN	*Axial load on the column*
Design Strong Axis Shear	689.87 kN	*Shear load on the column that causes strong axis bending*
Design Weak Axis Shear	0.00 kN	*Shear load on the column that causes weak axis bending*
Design Strong Axis Moment	100.00 kN-m	*Column moment about the strong axis*
Design Weak Axis Moment	0.00 kN-m	*Column moment about the weak axis*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Geometry Restrictions				**PASS**
Check Min Bolt Spacing	**Pass**	*Condition: S_{min} >= (2+2/3)d_{bolt} (J3.3)*		
S_{min}	140.00 mm	*Min bolt spacing*		
d_{bolt}	31.75 mm	*Anchor bolt diameter*		
Check Min Edge Distance	**Pass**	*Condition: min(e_z , e_y) >= ED_{allow} (J3.4)*		
e_y	120.00 mm	*Min edge distance y*		
e_z	100.00 mm	*Min edge distance z*		
ED_{allow}	41.27 mm	*Minimum allowed edge distance*		
Check Max Edge Distance	**Pass**	*Condition: Condition: max(d_z , d_y) <= min(6.00 in, 12*t) (J3.5)*		
d_y	120.00 mm	*Max edge distance y*		
d_z	100.00 mm	*Max edge distance z*		
ED_{allow}	152.40 mm	*Maximum allowed edge distance*		
t	60.00 mm	*Thickness of base plate*		
Check Plate Washer Encroachment on Column	**Pass**			
Check Plate Washers Encroachment on Each Other	**Pass**			
Check Plate Washer Width	**Pass**	*Condition: L_{pw} > d_h + (2*AB_{tol})*		
L_{pw}	60.00 mm	*Plate washer length*		
d_h	34.92 mm	*Anchor bolt hole diameter*		
AB_{tol}	9.52 mm	*Anchor bolt placement tolerance (per AISC 303-10, Section 7.5.1)*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
Check Plate Washer Weld Edge Distance	**Pass**	*Condition: min(e_z , e_y) - ((L_{pw} / 2) + D_{pw}) >= 1/16 in*		
D_{pw}	8.00 mm	*Plate washer weld size*		
Loading at Base Plate				**n/a**
P_c	3000.00 kN	*User input axial load in column*		
V_{zc}	70.00 kN	*User input strong axis shear in column*		
V_{yc}	0.00 kN	*User input weak axis shear in column*		
M_{zc}	100.00 kN-m	*User input strong axis moment in column*		
M_{yc}	0.00 kN-m	*User input weak axis moment in column*		
P	-800.00 kN	*User input axial load in brace*		
θ	50.79 degrees	*Brace angle from vertical*		
V	-505.73 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-619.87 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	360.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
H_b	-268.66 kN	*Calculated shear at the gusset to base plate connection, H_b=(H*(β-e) - V*e_c)/β per AISC DG 29, section 4.3*		
H_c	-351.20 kN	*Calculated axial at the gusset to column connection, H_c=(H*e + V*e_c)/β per AISC DG 29, section 4.3*		
P_{bp}	2494.27 kN	*Design axial load, P_{bp} = P_c + V*		
V_{z_bp}	689.87 kN	*Design strong axis shear load, V_{z_bp} = V_{zc} - H*		
V_{y_bp}	0.00 kN	*Design weak axis shear load, V_{y_bp} = V_{yc}*		
M_{z_bp}	100.00 kN-m	*Design strong axis moment load, M_{z_bp} = M_{zc} + H_c*e*		
M_{y_bp}	0.00 kN-m	*Design weak axis moment load, M_{y_bp} = M_{yc}*		
Load Distribution (Strong Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uz}	100.00 kN-m	*User input strong axis moment*		
P_u	2494.27 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	12.73 kN/mm	*Bearing force = φR_n*B*		
e	40.09 mm	*Equivalent eccentricity = |(M_{uz} /P_u)|*		
e_{crit}	652.03 mm	*Critical eccentricity = (N/2) - P_u /(2*q_{max})*		
Y_y	1419.82 mm	*Bearing length = N-2*e (per AISC DG1, Eqn 3.3.8)*		
Load Distribution (Weak Axis)				**n/a**
Strong and Weak Axis checked separately. No interaction check performed.				
Design with small moment (e <= e_{crit}).				
M_{uy}	0.00 kN-m	*User input weak axis moment*		
P_u	2494.27 kN	*User input axial load*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
ϕR_n	15.91 MPa	*Allowable bearing stress (see 'Concrete Bearing' check)*		
q_{max}	23.87 kN/mm	*Bearing force = φR_n*N*		
e	0.00 mm	*Equivalent eccentricity = $\lvert(M_{uy}/P_u)\rvert$*		
e_{crit}	347.75 mm	*Critical eccentricity = (B/2) - $P_u/(2*q_{max})$*		
Y_z	800.00 mm	*Bearing length = B-2*e (per AISC DG1, Eqn 3.3.8)*		
Gusset Shear Yield	268.66 kN	2456.26 kN	**0.11**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	11875.00 mm^2	*Gross area subject to shear*		
ϕR_n	2456.26 kN	*Shear yield strength*		
Gusset Shear Rupture	268.66 kN	2394.85 kN	**0.11**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	11875.00 mm^2	*Net area subject to shear*		
ϕR_n	2394.85 kN	*Shear rupture strength*		
Concrete Bearing			**0.14**	**PASS**
$R_n = 0.85 * f'_c * \alpha$		**$\phi = 0.65$**	(ACI 318-14 Table 22.8.3.2)	
Calculate Bearing Stress				
f'_c	24.00 MPa	*Concrete compressive strength*		
P_u	2494.27 kN	*Axial load on the column*		
N	1500.00 mm	*Plate length*		
B	800.00 mm	*Plate width*		
A_1	1200000.00 mm^2	*Plate area = B*N*		
L	1800.00 mm	*Concrete support length*		
W	1800.00 mm	*Concrete support width*		
L'	1800.00 mm	*Effective concrete support length*		
W'	960.00 mm	*Effective concrete support width*		
A_2	1728000.00 mm^2	*Effective concrete support area = L' * W'*		
α	1.20	*Bearing stress increase factor = $\min(2, (A_2/A_1)^{0.5})$*		
ϕR_n	15.91 MPa	*Allowable bearing stress*		
Check Strong Axis	**Pass**	*Condition: $f_{py} <= \varphi R_n$*		
Design with small moment				
Y_y	1419.82 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
f_{py}	2.20 MPa	*Required bearing stress = $P_u / (B * Y_y)$*		
UC_y	0.14	*Unity check for Strong Axis*		
Check Weak Axis	**Pass**	*Condition: $f_{pz} <= \varphi R_n$*		
Design with small moment				
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
f_{pz}	2.08 MPa	*Required bearing stress = $P_u / (N * Y_z)$*		
UC_z	0.13	*Unity check for Weak Axis*		
Lateral Slip			**0.67**	**PASS**
$V_n = \mu * P_u <= \min[0.2 * f'_c * A_c, (0.8\ ksi) * A_c]$		**$\phi = 0.75$**	(ACI 318-14 Table 22.9.4.4)	
V_{uy}	689.87 kN	*Strong axis shear*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	689.87 kN	*Resultant shear force*		
Check Strong Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{py}	2.20 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_y	1419.82 mm	*Bearing length (see 'Load Distribution Strong Axis' check)*		
B	800.00 mm	*Plate width*		
A_c	1135852.55 mm^2	*Area of concrete section resisting shear transfer = $Y_y * B$*		
P_u	2494.27 kN	*Axial compressive force = $f_{py} * Y_y * B$*		
μ	0.55	*Static friction coefficient*		
f'_c	24.00 MPa	*Concrete compressive strength*		
ϕV_n	1028.89 kN	*Allowable static friction*		
Check Weak Axis	**Pass**	*Condition $V_u <= \varphi V_n$*		
f_{pz}	2.08 MPa	*Bearing stress (see 'Concreate Bearing' check)*		
Y_z	800.00 mm	*Bearing length (see 'Load Distribution Weak Axis' check)*		
N	1500.00 mm	*Plate length*		
A_c	1200000.00 mm^2	*Area of concrete section resisting shear transfer = $Y_z * N$*		
P_u	2494.27 kN	*Axial compressive force = $f_{pz} * Y_z * N$*		
ϕV_n	1028.89 kN	*Allowable static friction*		
Plate Flexural Yielding(Compression)(Strong Axis)	0.29 kN-m/mm	0.28 kN-m/mm	**1.03**	**FAIL**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		
B	800.00 mm	*Base plate width*		
f_p	2.20 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	1419.82 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.29 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * m^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	1.00	*Side bending adjustment factor. β=Y/((Y/2)+n), if (Y<2*n), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.03 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * n^2 / 2 * \beta$*		
M_{pl}	0.29 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Flexural Yielding(Compression)(Weak Axis)	0.24 kN-m/mm	0.28 kN-m/mm	**0.86**	**PASS**
$M_n = F_y * t_p^2 / 4$		**ϕ = 0.9**	(AISC DG1 (3.3.13))	
F_y	344.74 MPa	*Minimum yield strength of base plate*		
t_p	60.00 mm	*Thickness of base plate*		
ϕM_n	0.28 kN-m/mm	*Base plate bending capacity per unit width*		
N	1500.00 mm	*Base plate length*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
B	800.00 mm	*Base plate width*		
f_p	2.08 MPa	*Required bearing stress (see 'Concrete Bearing' check)*		
Y	800.00 mm	*Bearing length (see 'Load Distribution' check)*		
d	500.00 mm	*Column depth*		
b	500.00 mm	*Column width*		
m	512.50 mm	*m = (N - 0.95*d)/2 (per AISC DG1, sect. 3.1.3)*		
n	162.50 mm	*n = (B - 0.95*b)/2 (per AISC DG1, sect. 3.1.3)*		
M_{pl1}	0.03 kN-m/mm	*Bending moment (straight) per unit width, $M_{pl1} = f_p * n^2 / 2$ (per AISC DG1, sect 3.3.2)*		
β	0.88	*Side bending adjustment factor. β=Y/((Y/2)+m), if (Y<2*m), otherwise β=1 (see Help for reference)*		
M_{pl2}	0.24 kN-m/mm	*Bending moment (side) per unit width, $M_{pl2} = f_p * m^2 / 2 * β$*		
M_{pl}	0.24 kN-m/mm	*Required bending moment per unit width , $M_{pl} = max(M_{pl1}, M_{pl2})$ (per AISC DG1, sect 3.1.2)*		
Plate Washer Weld Limitations				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{max}	13.41 mm	*Max Size Allowed*		
t	15.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	8.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	8.00 mm	*Weld size*		
L_{min}	60.00 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	8.00 mm	*Weld size*		
L_{max}	60.00 mm	*Max weld segment length*		
Weld Limitations at Gusset				**PASS**
Weld Max/Min Size, Length			(J2.2b)	
Check Weld Max Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{max}	23.41 mm	*Max Size Allowed*		
t	25.00 mm	*Min shelf dimension*		
Check Weld Min Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	18.00 mm	*Weld size*		
L_{min}	475.00 mm	*Min weld segment length*		
Plate Washer Weld Strength	689.87 kN	9434.73 kN	**0.07**	**PASS**
$ϕRn = N_{bolt} * C_1 * α * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = ϕ * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $ϕ=0.75$ (AISC 15th Eqn 8-2a)				

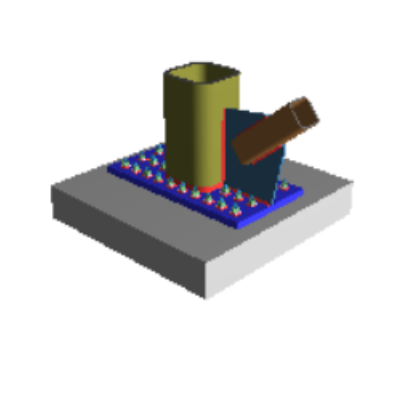
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D.30 Base Plate BRACE 1 EJE 6/1 : Base Plate Report (continued):

Limit State	Required	Available	Unity Check	Result
V_{uy}	689.87 kN	*Strong axis shear*		
V_{uz}	0.00 kN	*Weak axis shear*		
$V_u = (V_{uy}^2 + V_{uz}^2)^{0.5}$	689.87 kN	*Resultant shear force*		
N_{bolt}	32	*Number of bolts*		
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	8.00 mm	*Weld fillet size*		
d	60.00 mm	*Plate washer size*		
L	240.00 mm	*Weld length L=4*d*		
ϕRn	9434.73 kN	*Weld strength*		
Column Flange Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Column Web Weld Strength				**PASS**
Complete Joint Penetration			(J2.6)	
Req'd Filler (Column)	E60 or E70			
Req'd Filler (Base Plate)	E70			
Weld Electrode (Filler)	E70			
Gusset Weld Strength	268.66 kN	2625.88 kN	**0.10**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, ϕ=0.75 (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	60.00 mm	*Base material thickness (base plate)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
D	18.00 mm	*Weld fillet size*		
L	475.00 mm	*Weld length*		
ϕRn	2625.88 kN	*Weld strength*		

D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Column Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K220*15	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x600.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Shear Load	-505.73 kN	*Calculated Shear Load*
Axial Load	-351.20 kN	*Calculated Axial Load (tension)*
Moment Load	-0.00 kN-m	*Calculated Moment*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
HSS Limitations				**PASS**
Check Column Slenderness	**Pass**	*Condition: b/t ≤ Limit per AISC 15th p.10-153*		
E	199948.01 MPa	*Modulus of elasticity*		
F_y	317.16 MPa	*Column yield strength*		
t	50.00 mm	*Column wall thickness*		
B	500.00 mm	*Column face width*		
b	350.00 mm	*Inside width of column per Table B4.1a, b = B - 3*t*		
b / t	7.00	*Column slenderness ratio per AISC 15th p.10-153*		
Limit	35.15	*Slender wall limit per p.10-153, 1.40 * (E / Fy)$^{0.5}$*		
Column Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	18.00 mm	*Weld size*		
D_{min}	7.94 mm	*Min size allowed per Table J2.4*		
t_{min}	25.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: L_{min} ≥ 4*D per J2.2b*		
D	18.00 mm	*Weld size*		
L_{min}	620.00 mm	*Min weld segment length*		
Loading at Gusset to Column				**n/a**
P	-800.00 kN	*User input axial load in brace*		
θ	50.79 degrees	*Brace angle from vertical*		
V	-505.73 kN	*Vertical component of brace load, V=P*cos(ϑ)*		
H	-619.87 kN	*Horizontal component of brace load, H=P*sin(ϑ)*		
e	0.00 mm	*Workpoint vertical offset*		
e_c	250.00 mm	*Half the column depth*		
β	360.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
H_c	-351.20 kN	*Calculated axial at the gusset to column connection, $H_c=(H*e + V*e_c)/6$ per AISC DG 29, section 4.3*		
Gusset Shear Yield	505.73 kN	3206.06 kN	**0.16**	**PASS**
$R_n = 0.6 * F_y * A_{gv}$		**$\phi = 1.00$**	(J4-3)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_{gv}	15500.00 mm^2	*Gross area subject to shear*		
ϕR_n	3206.06 kN	*Shear yield strength*		
Gusset Shear Rupture	505.73 kN	3125.91 kN	**0.16**	**PASS**
$R_n = 0.6 * F_u * A_{nv}$		**$\phi = 0.75$**	(J4-4)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_{nv}	15500.00 mm^2	*Net area subject to shear*		
ϕR_n	3125.91 kN	*Shear rupture strength*		
Gusset Axial Yield	351.20 kN	4809.09 kN	**0.07**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(J4-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15500.00 mm^2	*Gross area subject to tension*		
ϕR_n	4809.09 kN	*Tensile yield strength*		
Gusset Tensile Rupture	351.20 kN	5209.85 kN	**0.07**	**PASS**
$R_n = F_u * A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15500.00 mm^2	*Net area subject to tension*		
ϕR_n	5209.85 kN	*Tensile rupture strength*		
Gusset Flexural Yield			**0.03**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(AISC 15th Eq.10-5)	
P_r	-351.20 kN	*Calculated axial load*		
V_r	505.73 kN	*Calculated shear load*		
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	15500.00 mm^2	*Gross area of the plate*		
Z_{pl}	2402500.00 mm^3	*Plastic modulus of the shear plate*		
P_c	4809.09 kN	*Available tensile strength (see check 'Axial Yield')*		
V_c	3206.06 kN	*Available shear strength (see check 'Shear Yield')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	745.41 kN-m	*Available moment $M_c=\varphi*(F_y * Z)$, $\varphi=0.90$*		
UC	0.03	*Unity check per interaction equation, $(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$*		
Gusset Flexural Rupture			**0.03**	**PASS**
$(V_r/V_c)^2 + (\|P_r\|/P_c + \|M_r\|/M_c)^2 <= 1$			(Eq.10-5)	
P_r	-351.20 kN	*Calculated axial load*		
V_r	505.73 kN	*Calculated shear load*		
F_u	448.16 MPa	*Minimum tensile stress of material*		
A_n	15500.00 mm^2	*Net area of the plate*		
Z_{net}	2402500.00 mm^3	*Plastic modulus of net section*		

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D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
P_c	5209.85 kN	*Available tensile strength (see check 'Tension Rupture')*		
V_c	3125.91 kN	*Available shear strength (see check 'Shear Rupture')*		
M_r	0.00 kN-m	*Calculated moment*		
M_c	807.52 kN-m	*Available moment $M_c = \varphi * (F_u * Znet)$, $\varphi = 0.75$*		
UC	0.03	*Unity check per interaction equation, $(V_r/V_c)^2 + (\lvert P_r \rvert / P_c + \lvert M_r \rvert / M_c)^2 <= 1$*		
Column Weld Strength	615.72 kN	2741.97 kN	**0.22**	**PASS**
$\phi Rn = 2 * C_1 * \alpha * \beta * 1.392 * D_{16} * L$				
Double Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi = 0.75$ (AISC 15th Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15th table 8-3)*		
t	50.00 mm	*Base material thickness (column)*		
α	1.00	*Base material proration factor (re-arrangement of AISC 15th Eqn 9-2)*		
β	0.80	*Force redistribution adjustment factor*		
D	18.00 mm	*Weld fillet size*		
L	620.00 mm	*Weld length*		
ϕRn	2741.97 kN	*Weld strength*		
Column Web Bending	126.43 kN-m	2629.27 kN-m	**0.05**	**PASS**
$M_n = k * m_p * L$		**ϕ = 0.9**	(AISC DG#29 Eqn 4-17)	
H_c	-351.20 kN	*Calculated axial at the gusset to column connection*		
β	360.00 mm	*Distance from the top face of the base plate to the centroid of the gusset to column connection*		
M_{req}	126.43 kN-m	*Required moment in column web, $M_{req} = \lvert H_c \rvert * \beta$*		
B	500.00 mm	*Column width*		
t_{des}	50.00 mm	*Column wall thickness*		
h	400.00 mm	*Distance between column flanges, $h = B - 2 * t_{des}$*		
L	670.00 mm	*Gusset to column length*		
k	22.00	*Average 'k' value, k=h/L+ 8*L/h+ 8*		
F_{yc}	317.16 MPa	*Minimum yield stress of column material*		
m_p	198.22 kN	*Column force, $m_p = 0.25 * F_{yc} * t_{des}^2$*		
ϕMn	2629.27 kN-m	*Available moment per (AISC DG29, Eqn 4-17)*		
HSS Punching Shear	126.43 kN-m	1346.34 kN-m	**0.09**	**PASS**
$M_n = 0.2 * F_u * t * l_p^2$		**ϕ = 0.75**	(AISC 15th Eq.10-7)	
F_u	399.90 MPa	*Column tensile strength*		
t	50.00 mm	*Column wall thickness*		
l_p	670.00 mm	*Plate length*		
M_e	126.43 kN-m	*Required moment per Column Web Bending*		
ϕM_n	1346.34 kN-m	*Allowable shear rupture (punching shear)*		
HSS Column Transverse Plastification	351.20 kN	6560.49 kN	**0.05**	**PASS**
$R_n = (0.5 * t^2 * F_y) * ((a+b) * (4 * ((T * a * b)/(a+b))^{0.5} + L)/(a * b)) * Q_f$		**ϕ = 1.00**	(AISC 15th Eq.9-30)	
F_y	317.16 MPa	*Minimum yield stress of column material*		
B	500.00 mm	*Column width*		
t	50.00 mm	*Column wall thickness*		

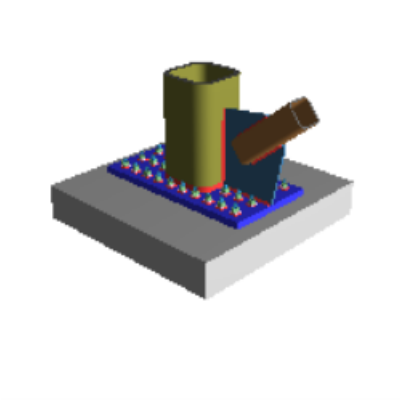
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D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Column Report (continued):

Limit State	Required	Available	Unity Check	Result
L	670.00 mm	*Length of gusset plate*		
T	350.00 mm	*Unbraced length of HSS column face (AISC 15th Fig.9-5), T = B - 3*t*		
a	162.50 mm	*Distance from left side to edge of gusset plate (AISC 15th Fig.9-5)*		
b	162.50 mm	*Distance from right side to edge of gusset plate (AISC 15th Fig.9-5)*		
c	25.00 mm	*Width of gusset plate connection*		
Q_f	1.00	*Column stress interaction parameter (user input)*		
ϕR_n	6560.49 kN	*Transverse plastification strength*		

D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Brace Report

Brace to Column Base Plate Connection



Material Properties:				
Column	K500*20-eq	A500 Gr.B Rect	F_y = 317.16 MPa	F_u = 399.90 MPa
Base Plate	P60.00x800.00x1500.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Plate Washers	P15.00x60.00x60.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa
Brace	K220*15	A500 Gr.C Rect	F_y = 344.74 MPa	F_u = 427.48 MPa
Gusset	P25.00x600.00x720.00	A572 Gr.50	F_y = 344.74 MPa	F_u = 448.16 MPa

Input Data:		
Brace Axial	-800.00 kN	*Brace Axial (tension)*

Note: Unless specified, all code references are from AISC 360-16

Limit State	Required	Available	Unity Check	Result
Brace Weld Limitations				**PASS**
Weld Min Size, Length			(J2.2b)	
Check Weld Min Size	**Pass**			
D	20.00 mm	*Weld size*		
D_{min}	6.35 mm	*Min size allowed per Table J2.4*		
t_{min}	15.00 mm	*Controlling member thickness*		
Check Weld Min Length	**Pass**	*Condition: $L_{min} \geq 4*D$ per J2.2b*		
D	20.00 mm	*Weld size*		
L_{min}	374.30 mm	*Min weld segment length*		
Check Weld Max Length	**Pass**	*Condition: $L_{max} \leq 100*D$*		
D	20.00 mm	*Weld size*		
L_{max}	374.30 mm	*Max weld segment length*		
Gusset Plate Tensile Yield (Whitmore)	800.00 kN	5058.87 kN	**0.16**	**PASS**
$R_n = F_y*A_g$		**$\phi = 0.9$**	(J4-1)	
F_y	344.74 MPa	*Gusset plate yield stress*		
A_g	16305.03 mm^2	*Gross area of plate (Whitmore), $A_g=L_w*t$*		
L_w	652.20 mm	*Whitmore tensile width*		
t	25.00 mm	*Thickness of plate*		
ϕR_n	5058.87 kN	*Plate tensile yield strength*		
Gusset Plate Tensile Rupture (Whitmore)	800.00 kN	5480.44 kN	**0.15**	**PASS**
$R_n = F_u*A_n$		**$\phi = 0.75$**	(J4-2)	
F_u	448.16 MPa	*Gusset plate tensile stress*		
t	25.00 mm	*Thickness of plate*		
L_w	652.20 mm	*Whitmore tensile width*		
A_n	16305.03 mm^2	*Net area of plate*		
ϕR_n	5480.44 kN	*Plate tensile rupture strength*		

continued on next page...

D.30 Base Plate BRACE 1 EJE 6/1 : Gusset/Brace Report (continued):

Limit State	Required	Available	Unity Check	Result
Brace Tensile Yield	800.00 kN	3816.25 kN	**0.21**	**PASS**
$R_n = F_y * A_g$		**$\phi = 0.90$**	(D2-1)	
F_y	344.74 MPa	*Minimum yield stress of material*		
A_g	12300.00 mm^2	*Gross area subject to tension*		
ϕR_n	3816.25 kN	*Tensile yield strength*		
Brace Tensile Rupture	800.00 kN	2863.01 kN	**0.28**	**PASS**
$R_n = F_u * A_e$		**$\phi = 0.75$**	(D2-2)	
F_u	427.48 MPa	*Minimum tensile stress of material*		
A_e	8929.97 mm^2	*Effective net area, $A_e = A_n * U$*		
A_n	11454.75 mm^2	*Net area subject to tension*		
$U_{D3.1}$	0.78	*Shear lag factor (table D3.1)*		
U_{Bound}	0.46	*Shear lag factor (lower bound)*		
U	0.78	*Governing shear lag factor, max($U_{D3.1}$, U_{Bound})*		
ϕR_n	2863.01 kN	*Tensile rupture strength*		
Brace Weld Strength	800.00 kN	4319.71 kN	**0.19**	**PASS**
$\phi Rn = 4 * C_1 * \alpha * 1.392 * D_{16} * L$				
Single Fillet				
$1.392 = \phi * 0.6 * F_{E70} * 2^{0.5}/2 * 1/16$, $\phi=0.75$ (AISC 15^{th} Eqn 8-2a)				
C_1	1.00	*Electrode strength coefficient (AISC 15^{th} table 8-3)*		
t	15.00 mm	*Base material thickness (brace)*		
α	0.94	*Base material proration factor (re-arrangement of AISC 15^{th} Eqn 9-2)*		
D	20.00 mm	*Weld fillet size*		
L	374.30 mm	*Weld length*		
ϕRn	4319.71 kN	*Weld strength*		

Atentamente,



Firmado electrónicamente por:
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