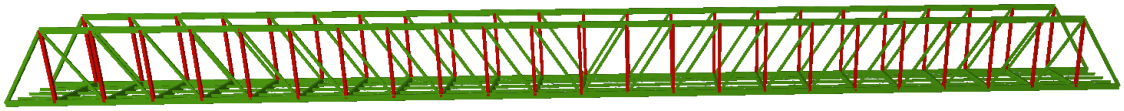
MEMORIAS DE CALCULO ESTRUCTURAL
PROYECTO: PUENTE PEATONAL SOBRE LA QUEBRADA SAN ANDRÉS
MUNICIPIO DE INZA - DEPARTAMENTO DEL CAUCA



MEMORIA DE CÁLCULO DISEÑO ESTRUCTURAL

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INTRODUCCIÓN

El presente documento contiene el diseño estructural del puente sobre la quebrada San Andres ubicada en el municipio de Inza, departamento del cauca.

Para el análisis estructural se tuvieron en cuenta las cargas debidas al peso propio de las estructuras (carga muerta), cargas debido a su funcionamiento que no se encuentran de forma permanente (cargas vivas), cargas producto de fuerzas naturales como el viento y el sismo, bajo las combinaciones estipuladas en el Código Colombiano de Puentes CCP-14.

1. ZONA DE AMENAZA SISMICA

Zona de amenaza sísmica Alta

1.1. CÓDIGOS Y NORMAS DEL DISEÑO ESTRUCTURAL

Concretos Código Colombiano de Puentes CCP-14.

Sismo

Concretos Código Colombiano de Puentes CCP-14.

2. METODO DE DISEÑO:

Para el chequeo de la estructura se hace un análisis teniendo en cuenta los parámetros de carga, estados limites y las combinaciónes de diseño estipulados por código colombiano de puentes CCP14.

3. PROGRAMA DE DISEÑO

3.1. Descripcion programa de calculo csi bridge

CSiBridge es un software totalmente independiente que integra las capacidades de modelado, análisis y dimensionamiento de estructuras de puentes en un único modelo, para satisfacer las necesidades de los profesionales de ingeniería. La facilidad con que todas estas tareas se pueden lograr, hace del CSiBridge el software más versátil y productivo actualmente disponible en el mercado.

Con CSiBridge, los ingenieros pueden definir fácilmente geometrías complejas de puentes y diversos tipos de cargas y análisis. El modelado es basado en la definición paramétrica de los varios elementos estructurales, utilizando términos que son familiares para los ingenieros de puentes, como las líneas de layout, tramos, sección del tablero, aparatos de apoyo, estribos, pilares, juntas y pos-tensado. El software permite crear modelos tipo spine, shell o solid, que se actualizan automáticamente cuando se cambian los parámetros de definición del puente.

Entre otros tipos de puentes, destacamos puentes de vigas de hormigón armado y pretensado de varias geometrías parametrizables, puentes mixtos, puentes atirantados, puentes colgantes, puentes en arco, entre otros.

CSiBridge permite el dimensionamiento rápido y eficaz y el refuerzo estructural de puentes existentes de hormigón y metálicos. El modelado paramétrico permite al usuario construir modelos de puentes simples o complejos y hacer cambios de manera eficiente, manteniendo un control total sobre el proceso de dimensionamiento. Permite definir rápidamente los carriles y vehículos e incluir también los efectos de ancho (consideración automática de la distribución transversal de cargas).

Con la ayuda de la herramienta Construction Scheduler el usuario puede definir las distintas fases de construcción de la obra y su duración, cargas, condiciones de apoyo, etc. Entre otros tipos de procesos constructivos que el CSiBridge permite modelar, destacamos los puentes prefabricados, con cambio de las condiciones de apoyo de las vigas antes y después de hormigonada la losa de hormigón in situ, puentes construidos con recurso al sistema de cimbra deslizante, puentes construidos por empuje, puentes de avanzos, entre otros.

CSiBridge incluye de forma completamente integrada el módulo de dimensionamiento y el motor de cálculo SAPFire® que incluyen, entre otras, las siguientes capacidades:

Análisis de secuencia constructiva, incluyendo efectos diferidos de fluencia, retracción y envejecimiento del hormigón y relajación del acero;

Cálculo automático de deformación axial en cables para obtención de esfuerzos objetivos, contra-flechas y buscador de forma;

No linealidades geométricas (P-delta y grandes desplazamientos);

No linealidades materiales (superestructura, aparatos de apoyo, subestructura y apoyos para simular el suelo);

Análisis de pandeo, análisis estáticos y dinámicos.

Dimensionamiento según las normativas europea (Eurocódigo), americana (AASHTO LRFD), canadiense (CAN/CSA S6), china (JTG-D62-2004) e indiana (IRC 2011), para las combinaciones de carga automáticas y dimensionamiento sísmico.

3.2. Descripcion programa de calculo Cype

Licencia de uso CYPE Ingenieros, S.A.: Información para el licenciatario

Félix Alberto Cajas Muñoz, con domicilio en Carrera 8 Nº 17n - 34 Teléfono: 3163843671 Fax: 3174788714

Correo electrónico: felixcajas@yahoo.es

Licenciatario nº: 67570 con Licencia nº: 134041 con 1 (un) puestos de trabajo y versión: 2017, incluye llave electrónica física, de los programas titulados:

•CYPECAD - : C3D - CYPECAD Base, PMT - Columnas metálicos, VMT - Vigas metálicas, UNI - Unidireccional (viguetas de hormigón genéricas), UVM - Forjados de viguetas madera, UNS - Forjados de viguetas "in situ", prefabricadas y metálicas, UNF - Forjados de viguetas prefabricadas, UNM - Forjados de viguetas metálicas, RET - Reticular, LMA - Módulo de losas macizas, PPA - Placas aligeradas, PAN - Pantallas, MUS - Muros de edificación, LFL - Losas y vigas de cimentación, MAP - Muros de bloques de hormigón, LMX - Módulo de losas mixtas, AUT - Introducción automática de obras: DXF, DWG y modelos CAD/BIM, ECL - Escaleras, SPC - Sistemas de protección colectiva, MTP - Muros de tensión plana, EEC - Interacción de la estructura con los elementos constructivos, PUN - Comprobación de punzonamiento, MEN - Ménsulas cortas, LPS - Losas postesadas para edificación, SBP - StruBIM Pro, SBE - StruBIM Expert, PHA - Columnas de hormigón, VHA -Vigas de hormigón, ZAP - Zapatas aisladas y continuas (incluye vigas centradoras y de atado), ENZ - Encepados (incluye vigas centradoras y de atado), ZCA -

Cálculo avanzado de cimentaciones superficiales, PLA - Placas de anclaje, SI6 - Comprobación de resistencia al fuego, USE - Uniones III. Soldadas. Pórticos de edificación con perfiles laminados y armados en doble T., UN4 - Uniones IV. Atornilladas. Pórticos de edificación con perfiles laminados y armados en doble T., PMX - Columnas mixtos de hormigón y acero. Para CYPECAD y Metal3D, TKL - Exportación a Tekla (de las Estructuras 3D integradas), CIS - Exportación a CIS/2, TCM - Exportación a TecnoMetal 4D, UN1 - Uniones I - Soldadas - Naves con perfiles laminados y armados en doble T, UN2 - Uniones II - Atornilladas - Naves con perfiles laminados y armados en doble T, UN5 – Uniones V. Celosías planas con perfiles tubulares, Q04 - Cálculo en paralelo hasta ocho procesadores

•CYPE 3D - : M3D - CYPE 3D, MAD - Perfiles de madera, GEP - Generador de pórticos, AL9 - Perfiles de aluminio y secciones genéricas, PHA - Columnas de hormigón, VHA - Vigas de hormigón, ZAP - Zapatas aisladas y continuas (incluye vigas centradoras y de atado), ENZ - Encepados (incluye vigas centradoras y de atado), ZCA - Cálculo avanzado de cimentaciones superficiales, PLA - Placas de anclaje, SI6 - Comprobación de resistencia al fuego, USE - Uniones III. Soldadas. Pórticos de edificación con perfiles laminados y armados en doble T., UN4 - Uniones IV. Atornilladas. Pórticos de edificación con perfiles laminados y armados en dobleT., PMX - Columnas mixtos de hormigón y acero. Para CYPECAD y Metal3D, TKL - Exportación a Tekla (de las Estructuras 3D integradas), CIS - Exportación a CIS/2, TCM - Exportación a TecnoMetal 4D, UN1 - Uniones I - Soldadas - Naves con perfiles laminados y armados en doble T, UN2 - Uniones II - Atornilladas - Naves con perfiles laminados y armados en doble T, UN5 - Uniones V. Celosías planas con perfiles tubulares, Q04 - Cálculo en paralelo hasta ocho procesadores

4. CARACTERISTICAS DE LOS MATERIALES.

- **Concreto**

Elemento	Material	Resistencia a la compresion	Modulo de eslasticidad	Peso especifico
		Mpa	Mpa	kN/m3
E. Ppal	Acero conformado	250	200000	76.97
Tablero	Acero Laminado	250	200000	76.97
Estribo		28 Mpa	24870.06	24

5. HIPOTESIS DE CARGA

$DC = Peso\ propio\ y\ carga\ muerta$
$PL = Carga\ viva\ peatonal$
$W = Viento\ horizontal\ y\ vertical$

FACTORES DE REDUCCIÓN

ϕ=0.9 Para secciones controladas por tracción

ϕ=0.9 Para secciones controladas por cortante y torsión

5.1. Peso propio y carga muerta (DC)

Carga muerta=22kg/m2

LAMINAS ALFAJOR O ANTIDESLIZANTE — Especificaciones técnicas

CALIDADES MAS COMUNES		COMPOSICION QUIMICA							PROPIEDADES MECANICAS					APLICACIONES MAS FRECUENTES
		L	C	MN	P	S	SI	CU	LIMITE ELASTICO		RESISTENCIA A LA TRACCION		% ALARGA	
ASTM	DIN		(X 100)	(X 100)	(X 100)	(X 100)	(X 100)	(X 100)						
ASTM 569		MIN												Fabricación de pisos antideslizantes
		MAX	15	60	3,5	1			25Kg/mm²	250MPa	35Kg/mm²	365MPa	22	

DIMENSIONES Y PESOS DE PLANCHAS COMERCIALES

	ESPESOR			M2	1.0X2.0 MTS	1.22X2.44 MTS(4'X8')	1.0X3.0 MTS	1.22X3.66 MTS (4'X12')	1.83 x 6.09 MTS (6'X20')
	CALIBRE	PULGADA	MILIMETRO	Kg.	Kg.	Kg.	Kg.	Kg.	Kg.
			2,50	20,68	41,35	61,44	62,03	92,32	230,00
L	12		2,66	22,00	44,00	65,38	65,99	98,23	245,00
A	11		3,00	24,81	49,62	73,73	74,43	110,78	277,00
M		1/8"	3,17	26,22	52,43	77.91	78,65	117,06	292,00
I			4,00	33,08	66,16	98,31	99,24	147,71	369,00
N			4,50	37,22	74,43	110,60	111,65	166,17	415,00
A		3/16"	4,76	39,37	78,73	116,99	118,10	175,77	439,00
S			5,00	41,35	82,70	122,89	124,05	184,64	461,00
			5,50	45,49	90,97	135,18	136,46	203,10	507,00
			6,00	49,62	99,24	147,47	148,66	221,56	553,00
		1/4"	6,35	52,51	105,03	156,06	157,54	234,49	585,00
A			7,50	62,03	124,05	184,33	186,08	276,95	691,00
L		5/16"	7,94	65,66	131,32	195,15	196,99	293,20	732,00

Nota: El peso propio es calculado internamente por el programa.

5.2. Carga viva peatonal (PL)

PL = 4.2kN/m2

5.3. Carga de viento.

Carga vertical de viento

3.8.2 — Presión de Viento Vertical — A menos que se especifique de otra manera en el Artículo 3.8.3, debe considerarse una fuerza de viento longitudinal lineal en dirección vertical, hacia arriba, obtenida de multiplicar 0.96 kPa por el ancho del tablero, incluyendo parapetos y aceras. Esta fuerza debe aplicarse solamente para los estados límite de Resistencia III y de Servicio IV que no involucran viento sobre carga viva, y solamente cuando la dirección del viento se supone perpendicular al eje longitudinal del puente. Esta fuerza lineal debe aplicarse a un cuarto del ancho del puente, hacia barlovento, en conjunto con las fuerzas de viento horizontales especificadas en el Artículo 3.8.1.

Wv	kN/m	2.400

Carga horizontal de viento

3.8 — CARGA DE VIENTO: *WL* Y *WS*

3.8.1 — Presión Horizontal de Viento

3.8.1.1 — General — Debe asumirse que las presiones especificadas aquí son causadas por una velocidad de viento básica de diseño, V_B, de160 km/h.

La carga de viento se debe suponer uniformemente distribuida sobre el área expuesta al viento. El área expuesta debe ser la suma de las áreas de todos los componentes, como se ven en una vista en alzada perpendicular a la dirección supuesta del viento, incluyendo el sistema de piso, las barandillas, y las barreras de sonido. Debe variarse esta dirección para determinar las fuerzas extremas en la estructura o en sus componentes. Pueden ser despreciadas en el análisis las áreas que no contribuyen al efecto extremo bajo consideración.

Para puentes o partes de puentes y barreras de sonido a más de 10000 mm por encima del nivel del terreno o del agua, la velocidad de diseño del viento, V_{DZ}, debería

Tabla 3.8.1.1-1 — Valores de V_o y Z_o para varias Condiciones de Superficie Aguas Arriba

Condición	Campo Abierto	Suburbano	Ciudad
V_o (km/h)	13.20	17.50	19.30
Z_o (m)	0.07	1.00	2.50

Excepto para barreras de sonido, V_{30} puede establecerse de:

- Curvas de kilómetro-con-viento-más-veloz disponibles en ASCE 7-88 para varios periodos de recurrencia,
- Mediciones de viento específicos del sitio, y
- A falta de mejores criterios, la suposición que $V_{10} = V_B = 160$ km/h.

Para barreras de sonido, V_{10} debe tomarse como se especifica en el Artículo 15.8.2.

$$V_{DZ} = 2.5 V_o \left(\frac{V_{10}}{V_B}\right) \ln\left(\frac{Z}{Z_0}\right) \qquad (3.8.1.1\text{-}1)$$

donde:

V_{DZ} = Velocidad del viento de diseño a la elevación, Z (km/h)
V_{30} = velocidad del viento a 10000 mm sobre el nivel del terreno o sobre el nivel de diseño del agua (km/h)
V_B = Velocidad básica del viento de 160 km/h a 10000 mm de altura, que generan las presiones de diseño especificadas en los Artículos 3.8.1.2.1 y 3.8.1.2.2
Z = Altura de la estructura a la cual se calculan las cargas de viento medida desde el nivel del terreno, o desde el nivel del agua, > 10000 mm
V_o = Velocidad de fricción, característica meteorológica del viento tomada como se especifica en la Tabla 3.8.1.1-1, para varias características de la superficie contra el viento (km/h)
Z_o = Longitud de fricción del fetch o campo de viento aguas arriba, una característica del viento tomada como se especifica en la Tabla 3.8.1.1-1 (mm)

Vo	Km/h	13.20	Velocidad de friccion
V_{10}	Km/h	160.00	Velocidad de viento a 10m sobre el NT
V_B	Km/h	160.00	Velocidad de viento de 160 kM/h
Z	m	5.70	Altura de la estructura
Z_0	m	0.07	Longitud de friccion del fetch
V_{Dz}	m	145.2	Velocidad del viento de diseño a Z

3.8.1.2 — Presión de viento sobre estructuras: *WS*

3.8.1.2.1 — General — Si las condiciones locales lo justifican, puede seleccionarse una velocidad de viento básica de diseño para las combinaciones de viento que no involucran viento sobre carga viva. La dirección del viento de diseño debe suponerse horizontal, a menos que se especifique otra cosa en el Artículo 3.8.3. A falta de datos más precisos, la presión de ciento de diseño puede determinarse como:

$$P_D = P_B \frac{V_{DZ}^2}{V_B^2} = P_B \frac{V_{DZ}^2}{25600} \qquad (3.8.1.2.1\text{-}1)$$

P_B = presión de viento básica especificada en la Tabla 3.8.1.2.1-1 (MPa)

Debe calcularse la fuerza de viento sobre la estructura multiplicando la presión de viento de diseño, P_D, calculada usando la Ec. 3.8.1.2.1-1, por el área expuesta, incluyendo el área de barreras de sonido, si existen, independientemente de la presión de viento de diseño usada en el diseño de las barreras de sonido propiamente dichas.

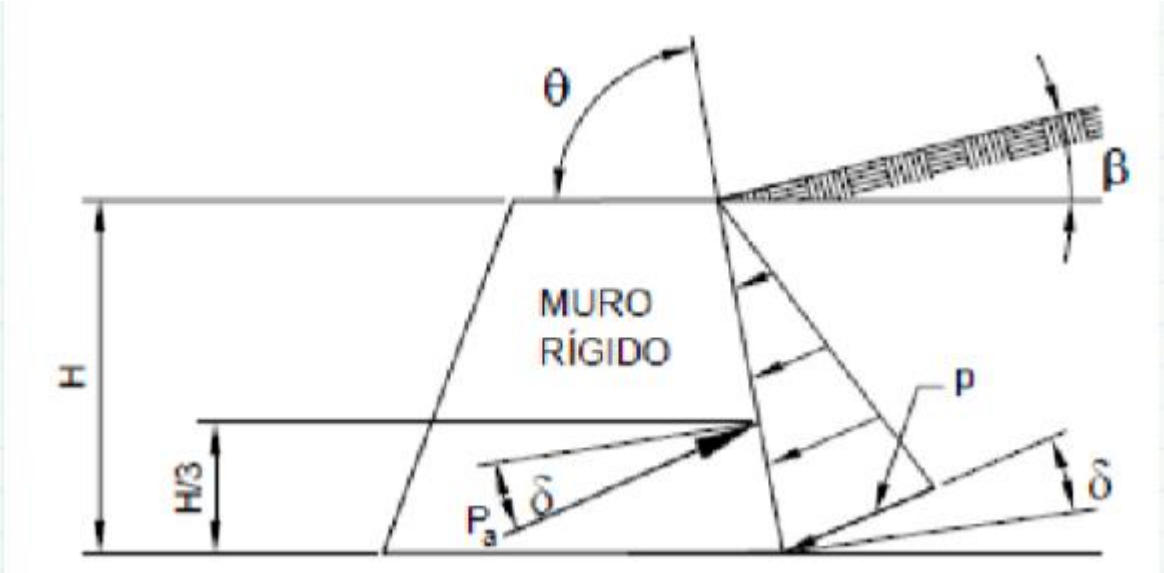
Tabla 3.8.1.2.1-1 — Presiones Básicas, P_B, Correspondientes a $V_B = 160$ km/h

Componente de la Subestructura	Carga de Barlovento MPa	Carga de Sotavento MPa
Cerchas, Columnas, y Arcos	0.0024	0.0012
Vigas	0.0024	NA
Superficies grandes Planas	0.0019	NA

La carga total de viento no debe ser menor que 4.5 kN/m en el plano de barlovento de una cuerda de cercha o arco y 2.2 kN/m en el plano de sotavento, y no menor que 4.5 kN/m sobre vigas.

PB_B	Mpa	0.0024	Presion de viento basica barlovento
PBs	Mpa	0.0012	Presion de viento basica sotavento
PD_B	kN/m2	1.98	Presion de viento barlovento
PD_B	kN/m3	0.99	Presion de viento sotavento
PD_B	kN/m	0.40	Carga a Barlovento Perfiles Laterales
PD_B	kN/m	0.20	Carga a Sotavento perfiles Laterales
PD_B	kN/m	0.20	Carga a Barlovento Perfiles Laterales
PD_B	kN/m	0.10	Carga a Sotavento perfiles Laterales

5.4. Empuje de terreno (EH)



5.1. Calculo del coeficiente activo (Ka) y pasivo (Kp)

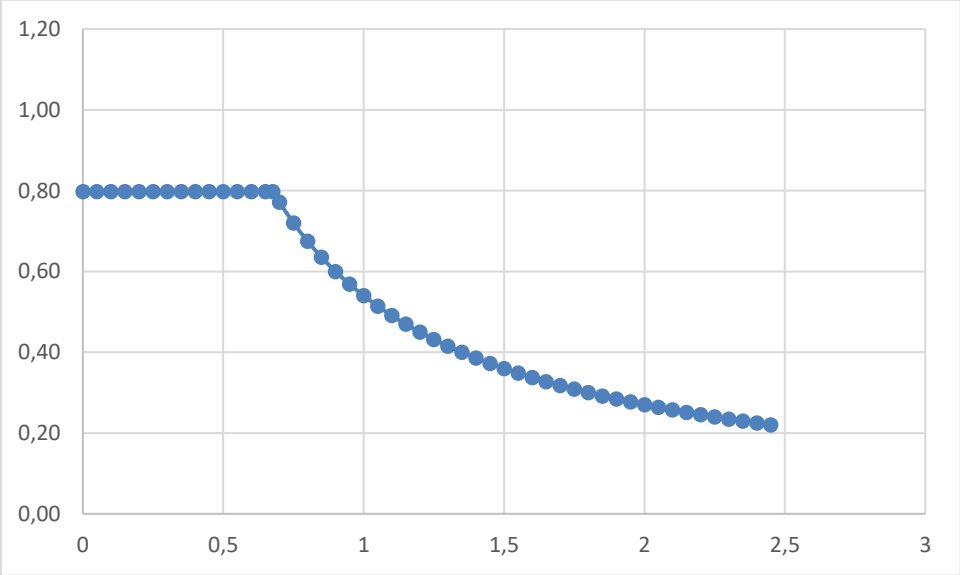
$$Ka = \frac{sen^2(\theta + \emptyset' f)}{\Gamma(sen^2\theta * sen(\theta - \delta))}$$

$$\Gamma = \left(1 + \left(\sqrt{\frac{sen(\emptyset' f + \delta)\, sen(\emptyset' f - \beta)}{sen(\theta - \delta)\, sen(\theta + \beta)}}\right)\right)^2$$

θ	[°]	90.00	Ang cara trasera-horizontal muro
ϕ'_f	[°]	30.00	Angulo efectivo de friccion interna
δ	[°]	0.00	Angulo de friccion relleno-muro
β	[°]	0.00	Angulo de inclinacion relleno-horiz
Γ	[.]	2.25	Factor Γ
Ka	[.]	0.33	Coeficiente de presion lateral activa
Kp	[.]	3.00	Coeficiente de presion lateral pasiva

5.5. Sismo (EQ)

Espectro de aceleraciones			
PGA	[.]	0.30	Aceleracion pico horizontal
Ss	[.]	0.60	Coeficiente de aceleracion espectral horizontal T0.2
S1	[.]	0.30	Coeficiente de aceleracion espectral horizontal T0.1
Fa	[.]	1.28	Valores factor de Sitio Fa
Fv	[.]	1.80	Valores factor de Sitio Fv
S_{Ds}	[.]	0.77	Coeficiente de aceleracion espectral horizontal T0.4
S_{D1}	[.]	0.54	Coeficiente de aceleracion espectral horizontal T0.4
Ts	[.]	0.70	Coeficiente de aceleracion espectral horizontal T0.5



6. ESTADOS LIMITE Y COMBINACIONES DE CARGA

Para el caso de estructuras enterradas se aplicarán los estados limites mencionados en la sección 12.

Para los estados limites de resistencia y servicio, los casos que se muestran son considerados. El caso e gatiga no necesita ser investigado en alcantarillas tiopo cajon de concreto reforzado (5.5.3)

Las combinaciones de carga para el estado limite de resistencia 1 que se han tomado en cuenta.

1. $U = 1.0[1.25DC+1.3EV+1.35EH+1.75(LL+IM)+1.75LS$ (cargas verticales y horizontales máximas)
2. $U = 1.0[0.9DC+0.9EV+1.35EH+1.75LS]$ (cargas verticales mínimas, horizontales máximas)
3a. $U = 1.0[1.25DC+1.3EV+0.9EH+1.75(LL+IM)+1.0WA]$ (cargas verticales máximas, horizontales mínimas, alcantarilla con agua)
3b. $U = 1.0[1.25DC+1.3EV+0.9EH+1.75(LL+IM)]$ (cargas verticales máximas, horizontales mínimas, alcantarilla sin agua)

Combinaciones de carga para el estado limite de servicio 1

4. $U = DC+EV+EH+(LL+IM)+LS$ (cargas verticales y horizontales máximas)
5. $U = DC+EV+EH+LS$ (cargas verticales mínimas, horizontales máximas)
6a. $U = DC+EV+EH+(LL+IM)+WA$ (cargas verticales máximas, horizontales mínimas, alcantarilla con agua)
6b. $U = DC+EV+EH+(LL+IM)$ (cargas verticales máximas, horizontales mínimas, alcantarilla sin agua)

7. DATOS DE SUELO DE RELLENO Y DE SOPORTE

Suelo trasportado atropico de relleno			
γ_{nat}	[kN/m3]	19	*Peso Unitario Humedo*
γ_{sec}	[kN/m3]	17	*Peso Unitario Humedo*
Vp	[m/s]	250-330	*Velocidad de onda longitudinal*
Vs	[m/s]	125-165	*Velocidad de onda longitudinal*
C	[kN/m2]	-	*Cohesion*
ϕ	[°]	-	*Angulo de friccion interna*
μ	[.]	0.33	*Velocidad de onda longitudinal*
G	[Mpa]	26-46	*Modulo de corte*
E	[Mpa]	69-122	*Modulo de elasticidad*
GE	[.]	Bajo	*Grado de expansión*
PC	[.]	No	*Potencial de colapso*

qu	[kN/m2]	174	*Capacidad de carga admisible*
Δc	[cm]	7.68	*Asentamientos por consolidacion*
Δi	[cm]	0.34	*Asentamientos instantaneos*
μ	[.]	0.44	*Modulo de Poisson*
Es	[Mpa]	202	*Modulo de elasticidad*
Kv	[Mpa]	41940	*Modulo de reaccion vertical*
Kh	[Mpa]	25160	*Modulo de reaccion horizontal*

Roca altamente meteorizada			
γ_{nat}	[kN/m3]	21.7	*Peso Unitario Humedo*
γ_{sec}	[kN/m3]	19.7	*Peso Unitario Humedo*
Vp	[m/s]	560-880	*Velocidad de onda longitudinal*
Vs	[m/s]	187-293	*Velocidad de onda longitudinal*
C	[kN/m2]	65-100	*Cohesion*
ϕ	[°]	15-25	*Angulo de friccion interna*
μ	[.]	0.44	*Modulo de poisson*
G	[Mpa]	69-169	*Modulo de corte*
E	[Mpa]	199-489	*Modulo de elasticidad*
GE	[.]	Medio	*Grado de expansión*
PC	[.]	No	*Potencial de colapso*

qu	[kN/m2]	157.2	*Capacidad de carga admisible*
Δc	[cm]	5.78	*Asentamientos por consolidacion*
Δi	[cm]	0.15	*Asentamientos instantaneos*

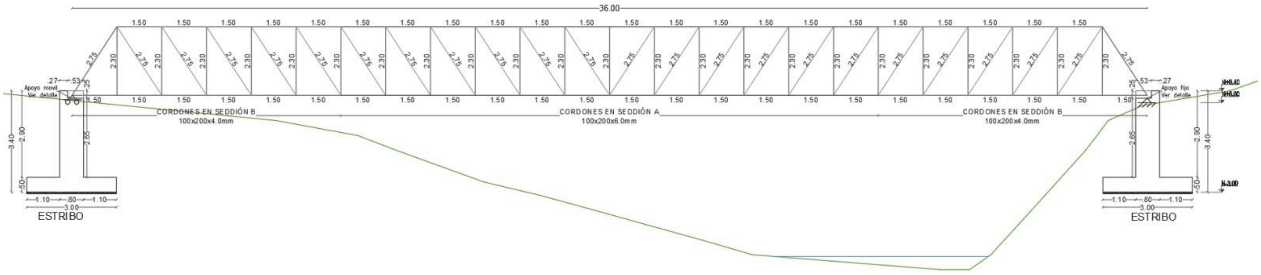
PARÁMETRO	NOMENCLATURA	VALOR	FUENTE
Aceleración pico del terreno	PGA (g)	0.30	Figura 3.10.2.1-1 del CCP-14
Coeficiente de aceleración de respuesta espectral horizontal para un periodo de 0.2s en roca	Ss (g)	0.60	Figura 3.10.2.1-2 del CCP-14
Coeficiente de aceleración de respuesta espectral horizontal para un periodo de 1.0s en roca	S1 (g)	0.30	Figura 3.10.2.1-3 del CCP-14
Tipo de perfil de suelo		D	Tabla 3.10.3.1-1 del CCP-14
Factor de sitio para periodo nulo en el espectro de respuesta de aceleraciones	Fpga	1.2	Tabla 3.10.3.2-1 del CCP-14
Factor de sitio para intervalos de periodo cortos en el espectro de respuesta de aceleraciones	Fa	1.28	Tabla 3.10.3.2-2 del CCP-14
Factor de ajuste de clase de sitio para la aceleración espectral de 1 seg	Fv	1.8	Tabla 3.10.3.2-3 del CCP-14
Coeficiente de aceleración pico del suelo modificado por factores de sitios para periodo corto	As (g)	0.36	As=Fpga*PGA
Coeficiente de aceleración de respuesta espectral horizontal para un periodo de 1.0s modificado por un factor de sitio de periodos largos	SD1	0.54	SD1=Fv*S1
Zona de desempeño sísmico		4	Tabla 3.10.6-1 del CCP-14
Coeficiente de aceleración sísmica horizontal para cero desplazamiento	Kho	0.19	Capítulo 11.6.5.2.2 del CCP-14

Tabla 38 Determinación de parámetros sísmicos
Fuente: El Autor

PARÁMETRO	NOMENCLATURA	VALOR
Coeficiente de aceleración sísmica horizontal para cero desplazamiento	Kho	0.19
Coeficiente de aceleración sísmica vertical para cero desplazamiento	Kv	0
Angulo de fricción del suelo	φ	28
Inclinación de la cara posterior de la estructura	α	0
Inclinación de la pendiente	β	90
Angulo de fricción de la estructura- suelo	δ	19
Coeficiente de presion activa	Ka	0.36
Angulo sísmico (Arctan (Kh/(1-Kv)))	θ	10.8
Coeficiente sísmico de presión activa	KAE	0.48
Coeficiente de presión pasiva	Kp	2.77
Angulo sísmico (Arctan (Kh/(1-Kv)))	θ	10.8
Coeficiente sísmico de presión pasiva	KPE	4.22

Tabla 39 Determinación de la presión lateral de tierras
Fuente: Propia

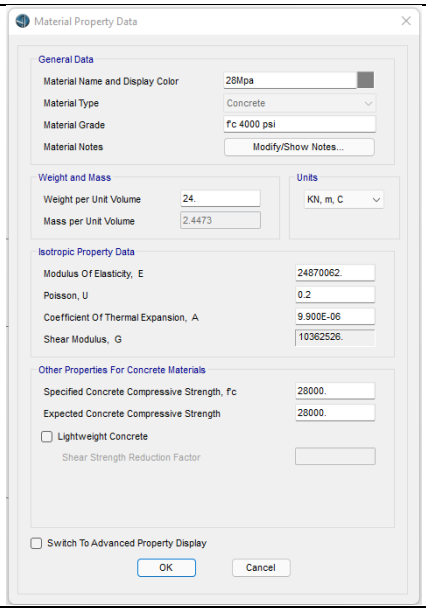
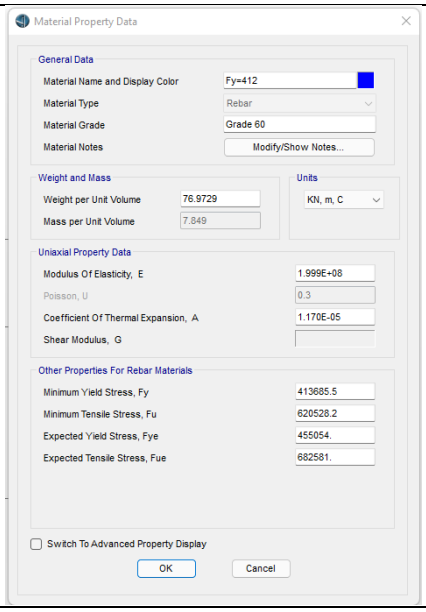
8. GEOMETRIA



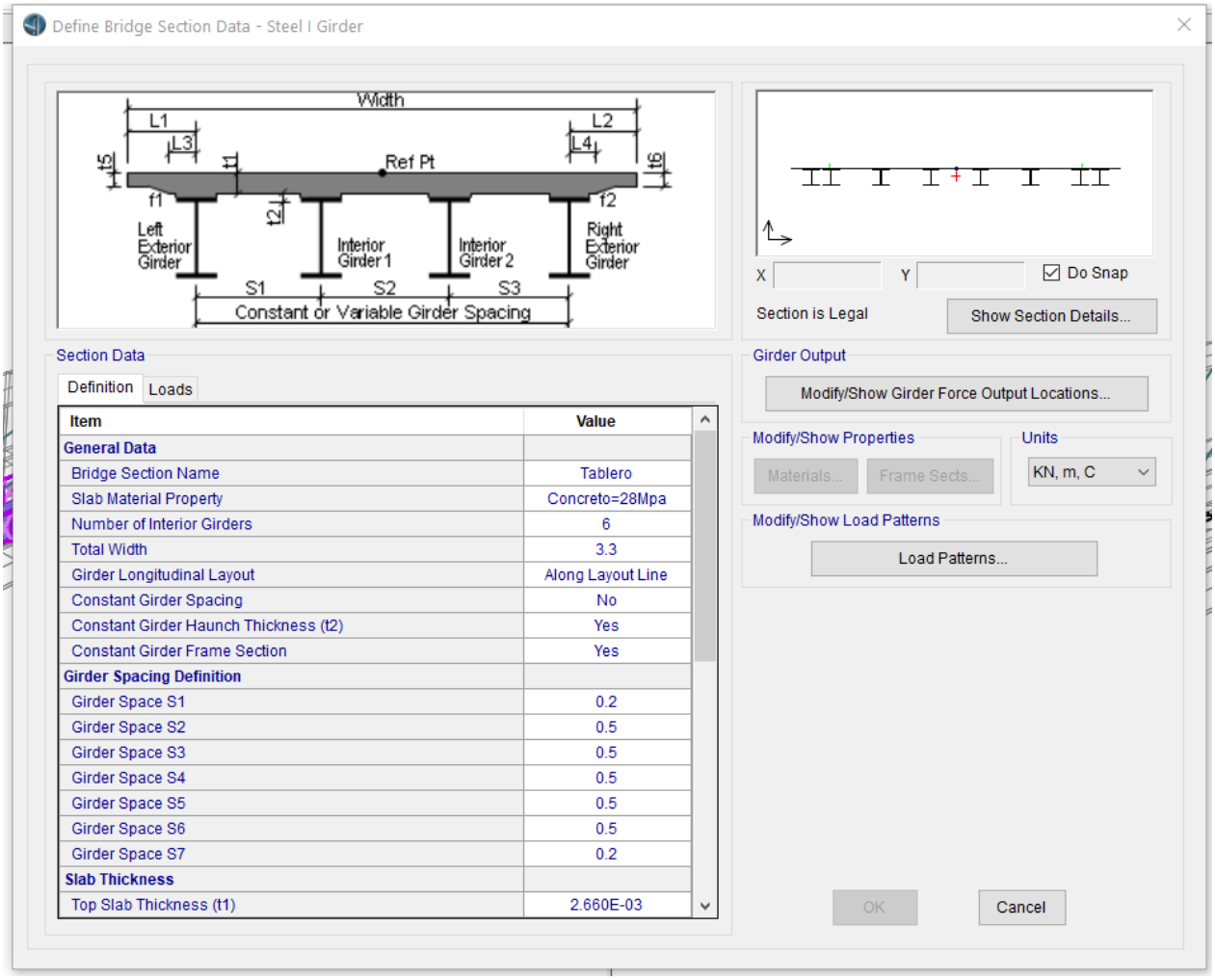


9. ENTRADA DE DATOS PROGRAMA DE DISEÑO

9.1. Definicion de materiales

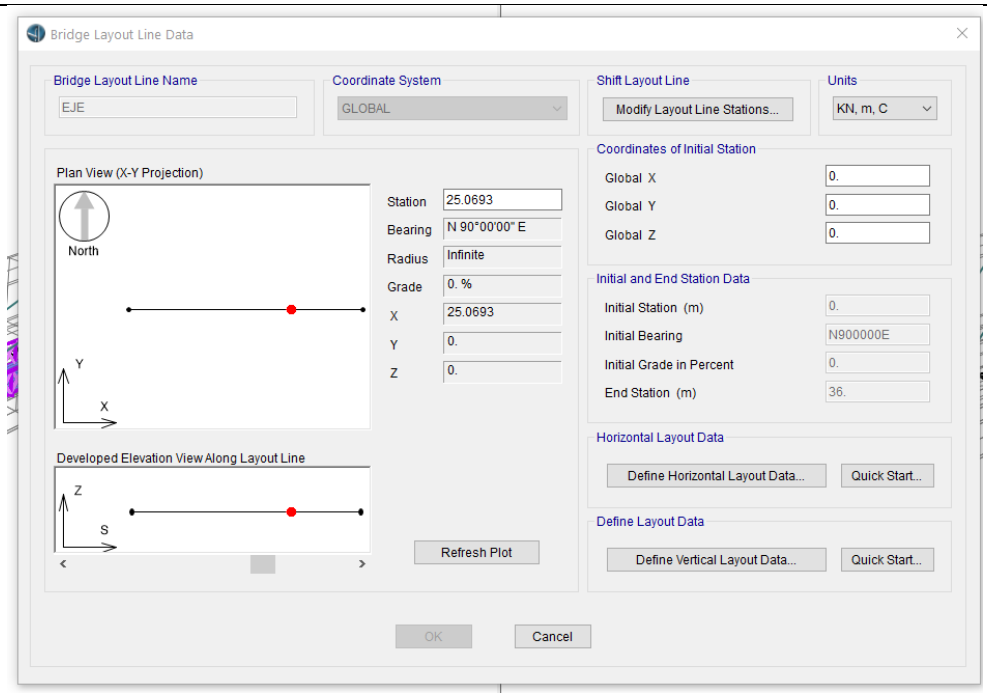
Concreto	Acero
	

9.2. Tablero o losa superior

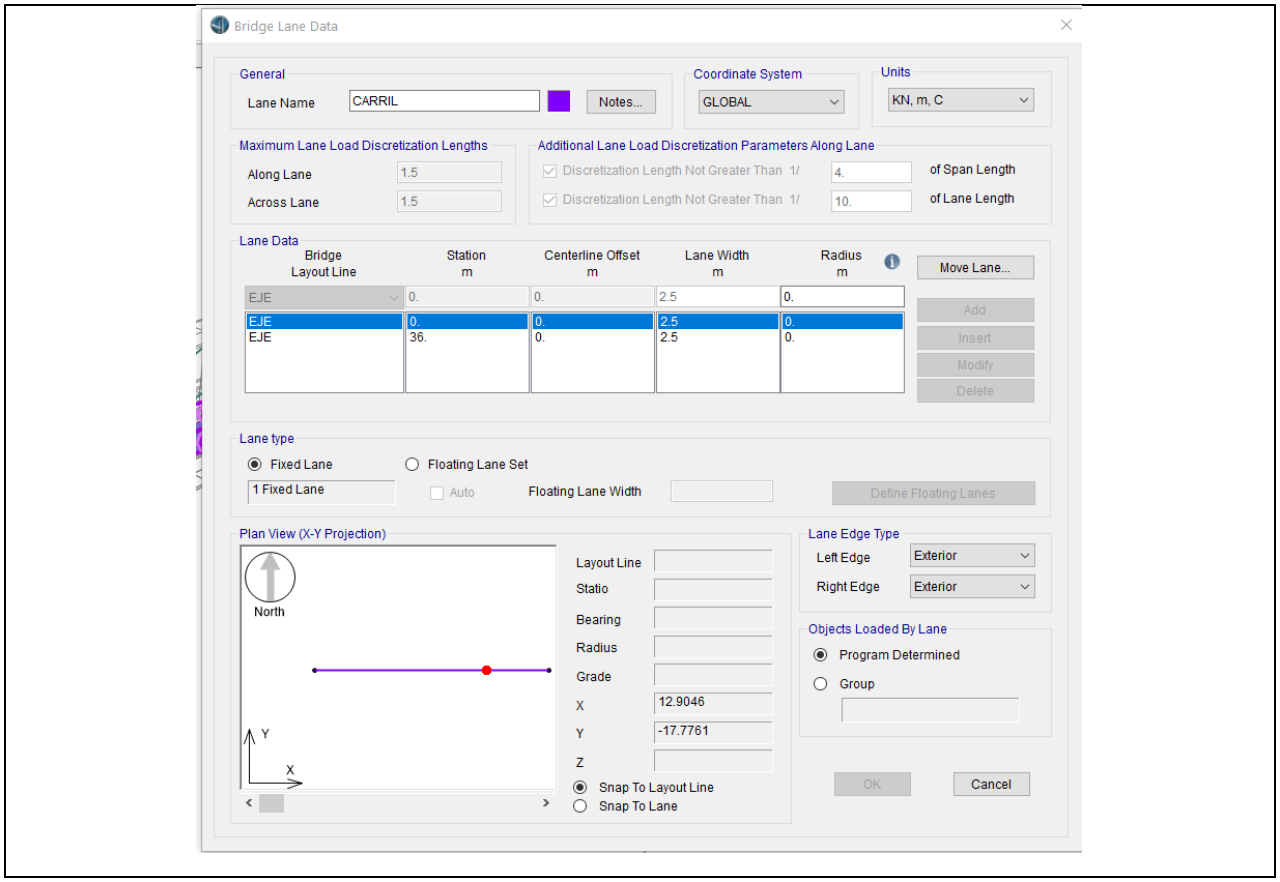


9.3. Definicion de eje y carril de diseño para la carga viva

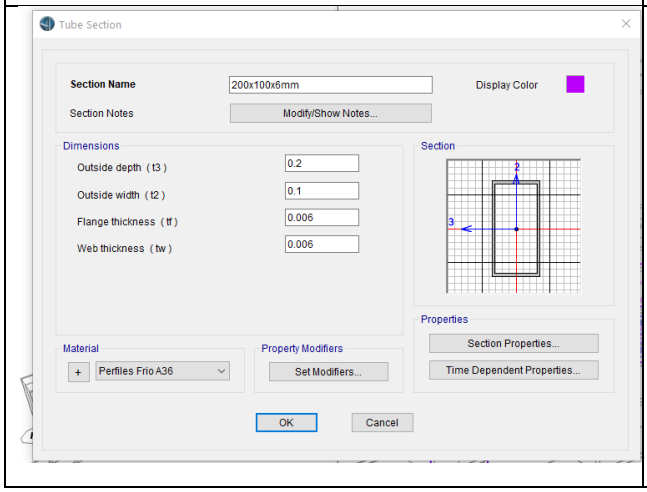
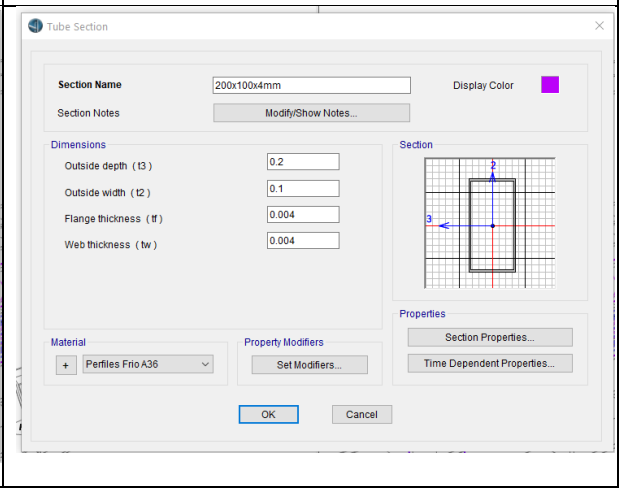
Eje de diseño

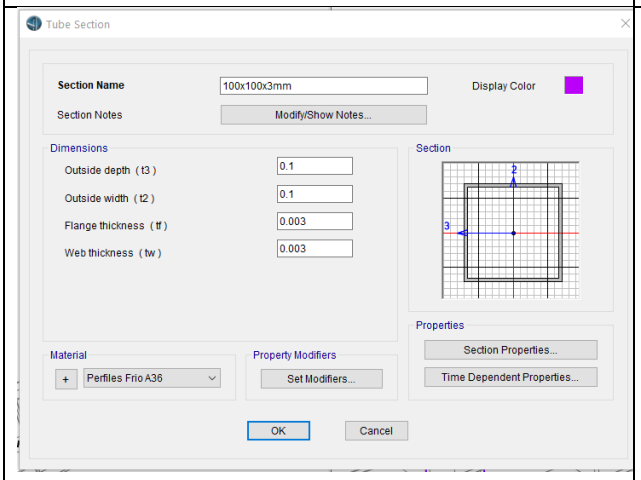
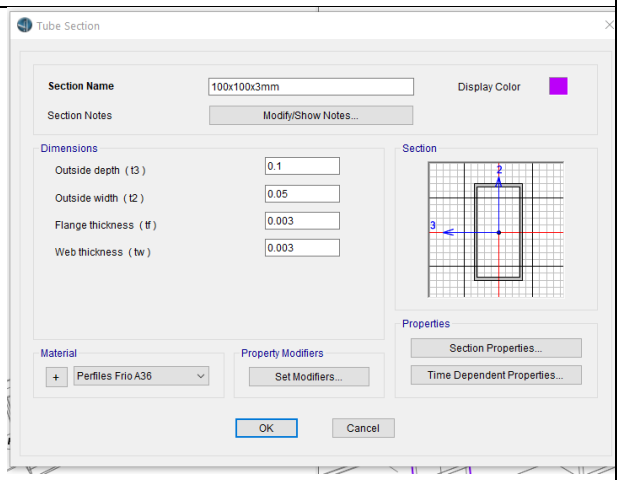


Carril de diseño



9.4. Definicion de secciones

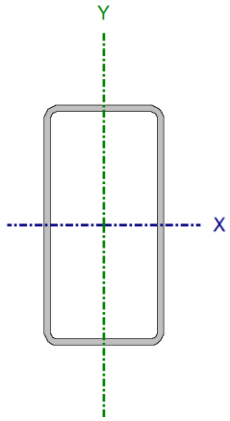
Cordon 200x100x6mm	Cordon 200x100x4mm
	

Celosia vertical	Celosia inclinada
	

10. Comprobaciones Superestructura

10.1. Calculo tipo

Perfil: 200x100x6
Material: Acero (ASTM A 572 50 ksi)



Nudos		Longitud (m)	Características mecánicas			
Inicial	Final		Área (cm²)	I_x(1) (cm4)	I_y(1) (cm4)	I_t(2) (cm4)
N23	N25	1.500	33.61	1699.23	574.94	1415.92

Notas:
(1) Inercia respecto al eje indicado
(2) Momento de inercia a torsión uniforme

	Pandeo		Pandeo lateral	
	Plano ZX	Plano ZY	Ala sup.	Ala inf.
β	1.00	1.00	0.00	0.00
L_K	1.500	1.500	0.000	0.000
C_m	1.000	1.000	-	-
C_b	-		1.000	

Notación:
β: Coeficiente de pandeo
L_K: Longitud de pandeo (m)
C_m: Coeficiente de momentos
C_b: Factor de modificación para el momento crítico

Barra	COMPROBACIONES (AISI S100-07 (2007))														Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N23/N25	w / t ≤ (w / t)Máx. Cumple	η = 16.0	η = 70.3	η = 0.3	x: 1.5 m η = 6.1	x: 0.563 m η = 4.0	x: 1.5 m η = 0.3	x: 0 m η = 0.2	x: 1.5 m η = 6.2	x: 0.563 m η = 4.0	x: 1.5 m η = 0.4	x: 0.563 m η = 0.2	x: 0.188 m η = 22.0	x: 1.5 m η = 76.9	x: 1.5 m η = 76.5	**CUMPLE η = 76.9**

Notación:
w / t: Limitaciones geométricas
T: Resistencia a tracción
P: Resistencia a compresión
Tr: Resistencia a torsión
M_x: Resistencia a flexión alrededor del eje X
M_y: Resistencia a flexión alrededor del eje Y
V_x: Resistencia a corte en la dirección del eje X
V_y: Resistencia a corte en la dirección del eje Y
M_xTr: Resistencia a flexión alrededor del eje X combinada con torsión
M_yTr: Resistencia a flexión alrededor del eje Y combinada con torsión
M_xV_y: Resistencia a flexión alrededor del eje X combinada con corte en la dirección del eje Y
M_yV_x: Resistencia a flexión alrededor del eje Y combinada con corte en la dirección del eje X
MT: Resistencia a flexión combinada con tracción
MP: Resistencia a flexión combinada con compresión
TPTrMV: Flexión combinada con cortante, axil y torsión - Comprobación de Von Mises
x: Distancia al origen de la barra
η: Coeficiente de aprovechamiento (%)

Limitaciones geométricas (B1)

Se debe satisfacer:

w_1 / t : ***12.67*** ✓

Donde:

w_1: Longitud del tramo recto del elemento horizontal (paralelo al eje X). w_1 : *76.00* mm

t: Espesor. t : *6.00* mm

w_2 / t : ***29.33*** ✓

Donde:

w_2: Longitud del tramo recto del elemento vertical (paralelo al eje Y). w_2 : *176.00* mm

t: Espesor. **t** : *6.00* mm

Resistencia a tracción (Apéndices A & B, C2)

Se debe satisfacer:

η_T : ***0.160*** ✓

El esfuerzo solicitante de cálculo pésimo se produce para la combinación de acciones 0.9·PP+0.9·CM+1.6·V+.

Donde:

T_f: Resistencia a tracción requerida para las combinaciones de carga LRFD. T_f : *166.65* kN

T_c: Resistencia de diseño a tracción.

T_c : *1043.63* kN

Donde:

φ_t: Factor de resistencia para tracción. φ_t : *0.90*

T_n: La resistencia nominal a tracción es igual al valor calculado según la Sección C2.1 del Apéndice B: T_n : *1159.59* kN

C2.1 Plastificación de la sección bruta.

T_n : *1159.59* kN

Donde:

A_g: Área de la sección bruta. A_g : *33.61* cm²

F_y: Límite elástico del acero. F_y : *345.00* MPa

Resistencia a compresión (C4)

Se debe satisfacer:

η_C : ***0.703*** ✓

El esfuerzo solicitante de cálculo pésimo se produce para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

Donde:

P_f: Resistencia a compresión requerida para las combinaciones de carga LRFD. **P_f** : *630.25* kN

P_c: Resistencia de diseño a compresión.

P_c : *896.50* kN

Donde:

φ_c: Factor de resistencia para compresión. **φ_c** : *0.85*

P_n: Resistencia nominal a compresión. **P_n** : *1054.70* kN

C4.1 Resistencia nominal a compresión, considerando el efecto del pandeo por flexión, flexotorsión o torsión.

P_n : *1054.70* kN

Donde:

A_e: Área de la sección eficaz. **A_e** : *33.61* cm²

Para

F_n : *313.80* MPa

Donde:

F_y: Límite elástico del acero. **F_y** : *345.00* MPa

λ_c : *0.48*

Donde:

F_y: Límite elástico del acero. **F_y** : *345.00* MPa

F_e: Tension elástica de pandeo a flexión calculada según las Secciones C4.1.1 a C4.1.4. **F_e** : *1523.18* MPa

C4.1.1 Secciones no sometidas a pandeo por torsión o por flexotorsión.

F_{crit}: Tensión crítica de pandeo, tomada como la menor de F_{ex} y F_{ey}. **F_{crit}** : *1523.18* MPa

Donde:

F_{ex} : *4501.75* MPa

Donde:

r_x : *71.10* mm

Donde:

I_x: Momento de inercia respecto al eje X. **I_x** : *1699.23* cm4

A: Área de la sección bruta. **A** : *33.61* cm²
E: Módulo de Young. **E** : *203000.00* MPa
K_x: Factor de longitud eficaz para el eje X. **K_x** : *1.00*
L: Longitud de la barra. **L** : *1.500* m

F_{ey} : *1523.18* MPa

Donde:

r_y : *41.36* mm

Donde:

I_y: Momento de inercia respecto al eje Y. **I_y** : *574.94* cm4
A: Área de la sección bruta. **A** : *33.61* cm²
E: Módulo de Young. **E** : *203000.00* MPa
K_y: Factor de longitud eficaz para el eje Y. **K_y** : *1.00*
L: Longitud de la barra. **L** : *1.500* m

C4.1.2 Secciones con uno o dos ejes de simetría sometidas a pandeo por torsión o por flexotorsión.

(ii) Para secciones con dos ejes de simetría.

Las comprobaciones de la Sección C4.1.2 no proceden, ya que las longitudes efectivas de pandeo lateral de este elemento son nulas.

Resistencia a torsión (Comprobación adicional)

Se debe satisfacer:

η_{Tr} : ***0.003*** ✓

El esfuerzo solicitante de cálculo pésimo se produce para la combinación de acciones 1.2·PP+1.2·CM-0.3·SX-SY.

Donde:

Tr_f: Resistencia requerida a torsión, utilizando las combinaciones de carga LRFD. **Tr_f** : *0.13* kN·m

Tr_c: Resistencia de diseño a torsión.

Tr_c : *40.61* kN·m

Donde:

φ_{Tr}: Factor de resistencia para torsión, tomado de AISC-05. **φ_{Tr}** : *0.90*

Tr_n: Resistencia nominal a torsión.

Tr_n : *45.13* kN·m

Donde:

C: Módulo resistente a torsión.

C : *218.00* cm³

Donde:

A_c: Área encerrada por la línea media de los elementos que componen la sección. — **A_c** : *181.66* cm²

t: Espesor. — **t** : *6.00* mm

F_n : *207.00* MPa

Donde:

F_y: Límite elástico del acero. — **F_y** : *345.00* MPa

Resistencia a flexión alrededor del eje X (C3.1)

Se debe satisfacer:

η_B : ***0.061*** ✓

M_f: Resistencia a flexión crítica requerida para las combinaciones de carga LRFD. — **M_f** : *3.41* kN·m

Para flexión positiva:

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

M_f^+: Resistencia requerida para flexión positiva. — **M_f^+** : *3.41* kN·m

Para flexión negativa:

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 0.9·PP+0.9·CM+1.6·V+.

M_f^-: Resistencia requerida para flexión negativa. — **M_f^-** : *0.84* kN·m

M_c: Resistencia de diseño a flexión.

M_c : *55.69* kN·m

Donde:

φ_b: Factor de resistencia para flexión. — **φ_b** : *0.95*

M_n: La resistencia a flexión nominal mínima se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1. — **M_n** : *58.62* kN·m

Donde:

M_n^+: La resistencia a flexión nominal se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1 para flexión positiva. M_n^+ : *58.62* kN·m

M_n^-: La resistencia a flexión nominal se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1 para flexión negativa. M_n^- : *58.62* kN·m

C3.1.1 Resistencia nominal de la sección.

La resistencia a flexión nominal se calcula según el Apartado C3.1.1, ya que se cumple la siguiente condición:

Donde:

L_{ub}: Separación entre arriostramientos laterales de la barra. L_{ub} : *0.000* m

L_u : *21.914* m

Donde:

C_b: Coeficiente de momentos, que depende de la ley de momentos flectores. C_b : *1.0*

F_y: Límite elástico del acero. F_y : *345.00* MPa

S_{fx} : *169.92* cm³

Donde:

I_x: Momento de inercia respecto al eje X. I_x : *1699.23* cm4

I_y: Momento de inercia respecto al eje Y. I_y : *574.94* cm4

I_{xy}: Producto de inercia. I_{xy} : *0.00* cm4

x_c: Distancia a la fibra extrema comprimida en flexión. x_c : *38.00* mm

y_c: Distancia a la fibra extrema comprimida en flexión. y_c : *100.00* mm

E: Módulo de Young. **E** : *203000.00* MPa

G: Módulo de elasticidad transversal. **G** : *78076.92* MPa

J: Momento de inercia a torsión uniforme. **J** : *1415.92* cm4

M_n : *58.62* kN·m

Donde:

S_{ex} : *169.92* cm³

Donde:

I_{ex}: Momento eficaz de inercia respecto al eje X. I_{ex} : *1699.23* cm4

I_{ey}: Momento eficaz de inercia respecto al eje Y. I_{ey} : *574.94* cm4

I_{exy}: Producto eficaz de inercia. I_{exy} : *0.00* cm4

x: Distancia a la fibra extrema en flexión. **x** : *38.00* mm

y: Distancia a la fibra extrema en flexión. **y** : *100.00* mm

F_y: Límite elástico del acero. F_y : *345.00* MPa

Resistencia a flexión alrededor del eje Y (C3.1)

Se debe satisfacer:

η_B : ***0.040*** ✓

M_f: Resistencia a flexión crítica requerida para las combinaciones de carga LRFD. **M_f** : *1.49* kN·m

Para flexión positiva:

El esfuerzo solicitante de cálculo pésimo se produce en un punto situado a una distancia de 0.563 m del nudo N23, para la combinación de acciones 1.2·PP+1.2·CM+1.6·V+.

M_f^+: Resistencia requerida para flexión positiva. **M_f^+** : *1.49* kN·m

Para flexión negativa:

El esfuerzo solicitante de cálculo pésimo se produce en un punto situado a una distancia de 0.563 m del nudo N23, para la combinación de acciones 1.2·PP+1.2·CM+0.3·SX+SY.

M_f^-: Resistencia requerida para flexión negativa. **M_f^-** : *0.71* kN·m

M_c: Resistencia de diseño a flexión.

M_c : *37.69* kN·m

Donde:

φ_b: Factor de resistencia para flexión. **φ_b** : *0.95*

M_n: La resistencia a flexión nominal mínima se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1. **M_n** : *39.67* kN·m

Donde:

M_n^+: La resistencia a flexión nominal se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1 para flexión positiva. **M_n^+** : *39.67* kN·m

M_n^-: La resistencia a flexión nominal se calcula como la menor de las calculadas en los apartados aplicables del Capítulo C3.1 para flexión negativa. **M_n^-** : *39.67* kN·m

C3.1.1 Resistencia nominal de la sección.

La resistencia a flexión nominal se calcula según el Apartado C3.1.1, ya que se cumple la siguiente condición:

Donde:

L_{ub}: Separación entre arriostramientos laterales de la barra. **L_{ub}** : *0.000* m

L_u : *55.672* m

Donde:

C_b: Coeficiente de momentos, que depende de la ley de momentos flectores. C_b : *1.0*

F_y: Límite elástico del acero. F_y : *345.00* MPa

S_{fy} : *114.99* cm³

Donde:

I_x: Momento de inercia respecto al eje X. I_x : *1699.23* cm4

I_y: Momento de inercia respecto al eje Y. I_y : *574.94* cm4

I_{xy}: Producto de inercia. I_{xy} : *0.00* cm4

x_c: Distancia a la fibra extrema comprimida en flexión. x_c : *50.00* mm

y_c: Distancia a la fibra extrema comprimida en flexión. y_c : *88.00* mm

E: Módulo de Young. **E** : *203000.00* MPa

G: Módulo de elasticidad transversal. **G** : *78076.92* MPa

J: Momento de inercia a torsión uniforme. **J** : *1415.92* cm4

M_n : *39.67* kN·m

Donde:

S_{ey} : *114.99* cm³

Donde:

I_{ex}: Momento eficaz de inercia respecto al eje X. I_{ex} : *1699.23* cm4

I_{ey}: Momento eficaz de inercia respecto al eje Y. I_{ey} : *574.94* cm4

I_{exy}: Producto eficaz de inercia. I_{exy} : *0.00* cm4

x: Distancia a la fibra extrema en flexión. **x** : *50.00* mm

y: Distancia a la fibra extrema en flexión. **y** : *88.00* mm

F_y: Límite elástico del acero. F_y : *345.00* MPa

Resistencia a corte en la dirección del eje X (C3.2)

Se debe satisfacer:

η_V : ***0.003*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 0.9·PP+0.9·CM+1.6·V+.

Donde:

V_f: Resistencia a cortante requerida para las combinaciones de carga LRFD. V_f : *0.29* kN

La resistencia a corte requerida se ha reducido de forma que la fuerza aplicada se distribuye entre todos los elementos, puesto que la sección tiene más de un elemento que resiste cortante.

V_c: Resistencia de diseño a cortante.

V_c : *89.67* kN

Donde:

φ_v: Factor de resistencia para cortante. **φ_v** : *0.95*

V_n: La resistencia nominal a cortante es el menor de los valores calculados según la Sección C3.2.1. **V_n** : *94.39* kN

C3.2.1 Resistencia a cortante del alma descontando los agujeros.

V_n : *94.39* kN

Donde:

A_w: Área de los elementos paralelos a la dirección del cortante.

A_w : *4.56* cm²

Donde:

h: Altura del tramo recto del alma. **h** : *76.00* mm

t: Espesor de los elementos paralelos a la dirección del cortante. **t** : *6.00* mm

(a) Para

F_v : *207.00* MPa

Donde:

h: Altura del tramo recto del alma. **h** : *76.00* mm

t: Espesor de los elementos paralelos a la dirección del cortante. **t** : *6.00* mm

E: Módulo de Young. **E** : *203000.00* MPa

F_y: Límite elástico del acero. **F_y** : *345.00* MPa

1.Para almas sin rigidizadores transversales:

K_v: Coeficiente de abolladura por cortante. **K_v** : *5.34*

Resistencia a corte en la dirección del eje Y (C3.2)

Se debe satisfacer:

η_V : ***0.002*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N23, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV+0.8·V+.

Donde:

V_f: Resistencia a cortante requerida para las combinaciones de carga LRFD. **V_f** : *0.42* kN

La resistencia a corte requerida se ha reducido de forma que la fuerza aplicada se distribuye entre todos los elementos, puesto que la sección tiene más de un elemento que resiste cortante.

V_c: Resistencia de diseño a cortante.

V_c : *207.66* kN

Donde:

φ_v: Factor de resistencia para cortante. **φ_v** : *0.95*

V_n: La resistencia nominal a cortante es el menor de los valores calculados según la Sección C3.2.1. **V_n** : *218.59* kN

C3.2.1 Resistencia a cortante del alma descontando los agujeros.

V_n : *218.59* kN

Donde:

A_w: Área de los elementos paralelos a la dirección del cortante.

A_w : *10.56* cm²

Donde:

h: Altura del tramo recto del alma. **h** : *176.00* mm

t: Espesor de los elementos paralelos a la dirección del cortante. **t** : *6.00* mm

(a) Para

F_v : *207.00* MPa

Donde:

h: Altura del tramo recto del alma. **h** : *176.00* mm

t: Espesor de los elementos paralelos a la dirección del cortante. **t** : *6.00* mm

E: Módulo de Young. **E** : *203000.00* MPa

F_y: Límite elástico del acero. **F_y** : *345.00* MPa

1.Para almas sin rigidizadores transversales:

K_v: Coeficiente de abolladura por cortante. **K_v** : *5.34*

Resistencia a flexión alrededor del eje X combinada con torsión (C3.6)

Se debe satisfacer:

η_B : ***0.062*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

Donde:

M_f: Resistencia requerida para flexión positiva. **M_f** : *3.41* kN·m

M_c: Resistencia de diseño a flexión, según C3.1. **M_c** : *55.69* kN·m

R: Factor de reducción de resistencia debido a la torsión.

R : *0.99*

Donde:

Las tensiones utilizadas en esta comprobación se han calculado en el siguiente punto, en el cual se produce la combinación pésima de tensiones normales y tangenciales.

x: Coordenada X del punto de cálculo respecto al centro de gravedad. **x** : *-38.00* mm

y: Coordenada Y del punto de cálculo respecto al centro de gravedad. **y** : *-100.00* mm

f_{bx}: Tensión normal debida a la flexión alrededor del eje X.

f_{bx} : *20.04* MPa

Donde:

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. **M_{fx}** : *3.41* kN·m

I_x: Momento de inercia respecto al eje X. **I_x** : *1699.23* cm4

f_{Tr}: Tensión tangencial debida a la torsión. **f_{Tr}** : *0.12* MPa

Resistencia a flexión alrededor del eje Y combinada con torsión (C3.6)

Se debe satisfacer:

η_B : ***0.040*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en un punto situado a una distancia de 0.563 m del nudo N23, para la combinación de acciones 1.2·PP+1.2·CM+0.5·CV+1.6·V+.

Donde:

M_f: Resistencia requerida para flexión positiva. **M_f** : *1.49* kN·m

M_c: Resistencia de diseño a flexión, según C3.1. **M_c** : *37.69* kN·m

R: Factor de reducción de resistencia debido a la torsión.

R : *0.99*

Donde:

Las tensiones utilizadas en esta comprobación se han calculado en el siguiente punto, en el cual se produce la combinación pésima de tensiones normales y tangenciales.

x: Coordenada X del punto de cálculo respecto al centro de gravedad. **x** : *-50.00* mm

y: Coordenada Y del punto de cálculo respecto al centro de gravedad. **y** : *88.00* mm

f_{by}: Tensión normal debida a la flexión alrededor del eje Y.

f_{by} : *12.98* MPa

Donde:

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. **M_{fy}** : *1.49* kN·m

I_y: Momento de inercia respecto al eje Y. **I_y** : *574.94* cm4

f_{Tr}: Tensión tangencial debida a la torsión. **f_{Tr}** : *0.15* MPa

Resistencia a flexión alrededor del eje X combinada con corte en la dirección del eje Y (C3.3)

Se debe satisfacer:

η : ***0.004*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

Donde:

(a) Para vigas sin rigidizadores transversales.

η : *0.004*

Donde:

R: Factor de reducción de resistencia debido a la torsión, calculado según C3.6. — **R** : *0.99*

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. — **M_{fx}** : *3.41* kN·m

M_{cx}: Resistencia de diseño a flexión alrededor del eje X. — **M_{cx}** : *55.69* kN·m

V_{fy}: Resistencia a cortante requerida en la dirección del eje Y para las combinaciones de carga LRFD. — **V_{fy}** : *0.14* kN

V_{cy}: Resistencia de diseño a cortante en la dirección del eje Y. — **V_{cy}** : *207.66* kN

Resistencia a flexión alrededor del eje Y combinada con corte en la dirección del eje X (C3.3)

Se debe satisfacer:

η : ***0.002*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en un punto situado a una distancia de 0.563 m del nudo N23, para la combinación de acciones 1.2·PP+1.2·CM+0.5·CV+1.6·V+.

Donde:

(a) Para vigas sin rigidizadores transversales.

η : *0.002*

Donde:

R: Factor de reducción de resistencia debido a la torsión, calculado según C3.6. — **R** : *0.99*

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. — **M_{fy}** : *1.49* kN·m

M_{cy}: Resistencia de diseño a flexión alrededor del eje Y. — **M_{cy}** : *37.69* kN·m

V_{fx}: Resistencia a cortante requerida en la dirección del eje X para las combinaciones de carga LRFD. — **V_{fx}** : *0.01* kN

V_{cx}: Resistencia de diseño a cortante en la dirección del eje X. — **V_{cx}** : *89.67* kN

Resistencia a flexión combinada con tracción (C5.1.2)

Se debe satisfacer:

η_f : ***0.220*** ✓

$\eta <$ ***0.001*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en un punto situado a una distancia de 0.188 m del nudo N23, para la combinación de acciones 0.9·PP+0.9·CM+1.6·V+.

Donde:

η_f : *0.220*

Donde:

R_x: Factor de reducción de la resistencia a flexión alrededor del eje X debido a la torsión, calculado según C3.6. — R_x : *0.98*

R_y: Factor de reducción de la resistencia a flexión alrededor del eje Y debido a la torsión, calculado según C3.6. — R_y : *0.99*

φ_{bx}: Factor de resistencia para flexión alrededor del eje X. — φ_{bx} : *0.95*

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. — M_{fx} : *1.17* kN·m

M_{nxt} : *58.62* kN·m

Donde:

S_{ftx} : *169.92* cm³

Donde:

I_x: Momento de inercia respecto al eje X. — I_x : *1699.23* cm4

I_y: Momento de inercia respecto al eje Y. — I_y : *574.94* cm4

I_{xy}: Producto de inercia. — I_{xy} : *0.00* cm4

x_t: Distancia a la fibra extrema traccionada en flexión alrededor del eje X. — x_t : *38.00* mm

y_t: Distancia a la fibra extrema traccionada en flexión alrededor del eje X. — y_t : *100.00* mm

F_y: Límite elástico del acero. — F_y : *345.00* MPa

φ_{by}: Factor de resistencia para flexión alrededor del eje Y. — φ_{by} : *0.95*

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. — M_{fy} : *1.44* kN·m

M_{nyt} : *39.67* kN·m

Donde:

S_{fty} : *114.99* cm³

Donde:

- **I_x**: Momento de inercia respecto al eje X. — I_x : *1699.23* cm4
- **I_y**: Momento de inercia respecto al eje Y. — I_y : *574.94* cm4
- **I_{xy}**: Producto de inercia. — I_{xy} : *0.00* cm4
- **x_t**: Distancia a la fibra extrema traccionada en flexión alrededor del eje Y. — x_t : *50.00* mm
- **y_t**: Distancia a la fibra extrema traccionada en flexión alrededor del eje Y. — y_t : *88.00* mm

F_y: Límite elástico del acero. — F_y : *345.00* MPa

φ_t: Factor de resistencia para tracción. — φ_t : *0.90*

T_f: Resistencia a tracción requerida para las combinaciones de carga LRFD. — T_f : *166.65* kN

T_n: Resistencia nominal a tracción, según la Sección C2. — T_n : *1159.59* kN

η : *-0.100*

Donde:

R_x: Factor de reducción de la resistencia a flexión alrededor del eje X debido a la torsión, calculado según C3.6. — R_x : *0.98*

R_y: Factor de reducción de la resistencia a flexión alrededor del eje Y debido a la torsión, calculado según C3.6. — R_y : *0.99*

φ_{bx}: Factor de resistencia para flexión alrededor del eje X. — φ_{bx} : *0.95*

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. — M_{fx} : *1.17* kN·m

M_{nx}: Resistencia nominal a flexión alrededor del eje X según la Sección C3.1. — M_{nx} : *58.62* kN·m

φ_{by}: Factor de resistencia para flexión alrededor del eje Y. — φ_{by} : *0.95*

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. — M_{fy} : *1.44* kN·m

M_{ny}: Resistencia nominal a flexión alrededor del eje Y según la Sección C3.1. — M_{ny} : *39.67* kN·m

φ_t: Factor de resistencia para tracción. — φ_t : *0.90*

T_f: Resistencia a tracción requerida para las combinaciones de carga LRFD. — T_f : *166.65* kN

T_n: Resistencia nominal a tracción, según la Sección C2. — T_n : *1159.59* kN

Resistencia a flexión combinada con compresión (C5.2.2)

(a) Se debe satisfacer el siguiente criterio si

η : ***0.769*** ✓

η_o : ***0.702*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

Donde:

η : *0.769*

Donde:

R_x: Factor de reducción de la resistencia a flexión alrededor del eje X debido a la torsión, calculado según C3.6. — **R_x** : *0.99*

R_y: Factor de reducción de la resistencia a flexión alrededor del eje Y debido a la torsión, calculado según C3.6. — **R_y** : *0.73*

φ_c: Factor de resistencia para compresión. — φ_c : *0.85*

P_f: Resistencia a compresión requerida para las combinaciones de carga LRFD. — **P_f** : *630.25* kN

P_n: Resistencia nominal a compresión según la Sección C4. — **P_n** : *1054.70* kN

φ_{bx}: Factor de resistencia para flexión alrededor del eje X. — φ_{bx} : *0.95*

C_{mx}: Coeficiente de momento en los extremos para flexión respecto al eje X. — **C_{mx}** : *1.0*

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. — **M_{fx}** : *3.41* kN·m

M_{nx}: Resistencia nominal a flexión alrededor del eje X según la Sección C3.1. — **M_{nx}** : *58.62* kN·m

α_x : *0.96*

Donde:

P_{Ex} : *15130.91* kN

Donde:

E: Módulo de Young. — **E** : *203000.00* MPa

I_x: Momento de inercia respecto al eje X. — **I_x** : *1699.23* cm4

K_x: Factor de longitud eficaz para el eje X. — **K_x** : *1.00*

L: Longitud de la barra. — **L** : *1.500* m

φ_{by}: Factor de resistencia para flexión alrededor del eje Y. — φ_{by} : *0.95*

C_{my}: Coeficiente de momento en los extremos para flexión respecto al eje Y. C_{my} : *1.0*

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. M_{fy} : *0.04* kN·m

M_{ny}: Resistencia nominal a flexión alrededor del eje Y según la Sección C3.1. M_{ny} : *39.67* kN·m

α_y : *0.88*

Donde:

P_{Ey} : *5119.59* kN

Donde:

- **E**: Módulo de Young. **E** : *203000.00* MPa
- I_y: Momento de inercia respecto al eje Y. I_y : *574.94* cm4
- K_y: Factor de longitud eficaz para el eje Y. K_y : *1.00*
- **L**: Longitud de la barra. **L** : *1.500* m

η_o : *0.702*

Donde:

R_x: Factor de reducción de la resistencia a flexión alrededor del eje X debido a la torsión, calculado según C3.6. R_x : *0.99*

R_y: Factor de reducción de la resistencia a flexión alrededor del eje Y debido a la torsión, calculado según C3.6. R_y : *0.73*

φ_c: Factor de resistencia para compresión. φ_c : *0.85*

P_f: Resistencia a compresión requerida para las combinaciones de carga LRFD. P_f : *630.25* kN

P_{no}: Resistencia nominal a compresión según la Sección C4 con P_{no} : *1159.59* kN

φ_{bx}: Factor de resistencia para flexión alrededor del eje X. φ_{bx} : *0.95*

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. M_{fx} : *3.41* kN·m

M_{nx}: Resistencia nominal a flexión alrededor del eje X según la Sección C3.1. M_{nx} : *58.62* kN·m

φ_{by}: Factor de resistencia para flexión alrededor del eje Y. φ_{by} : *0.95*

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. M_{fy} : *0.04* kN·m

M_{ny}: Resistencia nominal a flexión alrededor del eje Y según la Sección C3.1. M_{ny} : *39.67* kN·m

Flexión combinada con cortante, axil y torsión - Comprobación de Von Mises (Comprobación adicional)

Ya que la norma no proporciona una comprobación general para secciones sometidas a torsión combinada con otros esfuerzos, se considera que este elemento debe cumplir, además, el siguiente criterio de rotura de Von Mises:

η : ***0.765*** ✓

η : ***0.001*** ✓

η : ***0.585*** ✓

El esfuerzo solicitante de cálculo pésimo se produce en el nudo N25, para la combinación de acciones 1.2·PP+1.2·CM+1.6·CV.

Donde:

f_a: Tensión normal debida a compresión, calculada utilizando el área de la sección bruta.

f_a : *187.51* MPa

Donde:

P_f: Resistencia a compresión requerida para las combinaciones de carga LRFD. P_f : *630.25* kN

A: Área de la sección bruta. **A** : *33.61* cm²

Las tensiones utilizadas en esta comprobación se han calculado en el siguiente punto, en el cual se produce la combinación pésima de tensiones normales y tangenciales.

x: Coordenada X del punto de cálculo respecto al centro de gravedad. **x** : *-38.00* mm

y: Coordenada Y del punto de cálculo respecto al centro de gravedad. **y** : *-100.00* mm

f_{bx}: Tensión normal debida a la flexión alrededor del eje X.

f_{bx} : *20.04* MPa

Donde:

M_{fx}: Resistencia requerida a flexión respecto al eje X para las combinaciones de carga LRFD. M_{fx} : *3.41* kN·m

I_x: Momento de inercia respecto al eje X. I_x : *1699.23* cm4

f_{by}: Tensión normal debida a la flexión alrededor del eje Y.

f_{by} : *0.24* MPa

Donde:

M_{fy}: Resistencia requerida a flexión respecto al eje Y para las combinaciones de carga LRFD. M_{fy} : *0.04* kN·m

I_y: Momento de inercia respecto al eje Y. I_y : *574.94* cm4

f_{Vx}: Tensión tangencial debida al esfuerzo cortante en la dirección del eje X. f_{Vx} : *-0.02* MPa

f_{Vy}: Tensión tangencial debida al esfuerzo cortante en la dirección del eje Y. f_{Vy} : *0.03* MPa

f_{Tr}: Tensión tangencial debida a la torsión. f_{Tr} : *0.12* MPa

F_a: Resistencia a compresión de la sección.

F_a : *266.73* MPa

Donde:

φ_c: Factor de resistencia para compresión. φ_c : *0.85*

F_n: Tensión crítica nominal de pandeo, calculada según el Capítulo C4. F_n : *313.80* MPa

F_{bx}, F_{by}: Resistencia de la sección a flexión alrededor de los ejes X y Y, respectivamente.

F_{bx} : *327.75* MPa

F_{by} : *327.75* MPa

Donde:

φ_b: Factor de resistencia para flexión. φ_b : *0.95*

F_y: Límite elástico del acero. F_y : *345.00* MPa

F_{Vx}, F_{Vy}: Resistencia de la sección a cortante en las direcciones X y Y, respectivamente.

F_{Vx} : *189.23* MPa

F_{Vy} : *189.23* MPa

Donde:

φ_v: Factor de resistencia para cortante. φ_v : *0.95*

F_y: Límite elástico del acero. F_y : *345.00* MPa

F_{Tr}: Resistencia a torsión de la sección.

F_{Tr} : *179.27* MPa

Donde:

φ_{Tr}: Factor de resistencia para torsión. φ_{Tr} : *0.90*

F_y: Límite elástico del acero. F_y : *345.00* MPa

10.2. Resumen de comprobaciones

Comprobaciones E.L.U. (Resumido)

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N4/N3	w / t ≤ (w / t)Máx. Cumple	x: 2.3 m η = 3.0	x: 0 m η = 3.3	η = 5.2	x: 2.3 m η = 16.9	x: 0 m η = 43.1	x: 0 m η = 2.7	η = 1.6	x: 2.3 m η = 17.8	x: 0 m η = 46.0	x: 2.3 m η = 3.2	x: 0 m η = 21.3	x: 0 m η = 42.5	x: 0 m η = 54.4	x: 0 m η = 48.5	**CUMPLE η = 54.4**
N6/N5	w / t ≤ (w / t)Máx. Cumple	x: 2.3 m η = 8.6	x: 0 m η = 45.1	η = 6.2	x: 2.3 m η = 20.3	x: 0 m η = 41.6	x: 0 m η = 2.8	η = 1.9	x: 2.3 m η = 20.9	x: 0 m η = 45.0	x: 2.3 m η = 4.4	x: 0 m η = 20.3	x: 0 m η = 60.7	x: 0 m η = 83.1	x: 0 m η = 70.7	**CUMPLE η = 83.1**
N8/N7	w / t ≤ (w / t)Máx. Cumple	x: 2.3 m η = 8.0	x: 0 m η = 43.0	η = 6.2	x: 0 m η = 19.6	x: 0 m η = 36.9	x: 0 m η = 2.5	η = 1.9	x: 0 m η = 20.2	x: 0 m η = 40.4	x: 0 m η = 4.1	x: 0 m η = 16.4	x: 0 m η = 54.8	x: 0 m η = 82.5	x: 0 m η = 70.2	**CUMPLE η = 82.5**
N10/N9	w / t ≤ (w / t)Máx. Cumple	x: 2.3 m η = 6.8	x: 0 m η = 36.9	η = 5.8	x: 0 m η = 17.3	x: 0 m η = 35.8	x: 0 m η = 2.5	η = 1.7	x: 0 m η = 17.8	x: 0 m η = 39.0	x: 0 m η = 3.2	x: 0 m η = 15.3	x: 0 m η = 52.0	x: 0 m η = 70.4	x: 0 m η = 60.4	**CUMPLE η = 70.4**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N12/N11	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 6.0	x: 0 m η = 32.9	η = 5.2	x: 0 m η = 15.3	x: 0 m η = 33.9	x: 0 m η = 2.4	η = 1.5	x: 0 m η = 15.8	x: 0 m η = 36.9	x: 0 m η = 2.5	x: 0 m η = 13.7	x: 0 m η = 47.5	x: 0 m η = 65.9	x: 0 m η = 57.0	**CUMPLE η = 65.9**
N14/N13	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 4.8	x: 0 m η = 27.2	η = 4.1	x: 0 m η = 13.2	x: 0 m η = 33.6	x: 0 m η = 2.4	η = 1.3	x: 0 m η = 13.4	x: 0 m η = 35.8	x: 0 m η = 1.8	x: 0 m η = 12.9	x: 0 m η = 44.9	x: 0 m η = 54.6	x: 0 m η = 48.1	**CUMPLE η = 54.6**
N16/N15	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 3.9	x: 0 m η = 23.0	η = 3.2	x: 0 m η = 11.1	x: 0 m η = 33.1	x: 0 m η = 2.5	η = 1.1	x: 0 m η = 11.4	x: 0 m η = 34.9	x: 0 m η = 1.3	x: 0 m η = 12.3	x: 0 m η = 42.0	x: 0 m η = 50.5	x: 0 m η = 45.1	**CUMPLE η = 50.5**
N18/N17	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 3.0	x: 0 m η = 17.3	η = 2.4	x: 0 m η = 9.0	x: 0 m η = 33.4	x: 0 m η = 2.5	η = 0.9	x: 0 m η = 9.2	x: 0 m η = 34.7	x: 0 m η = 0.8	x: 0 m η = 12.1	x: 0 m η = 40.2	x: 0 m η = 39.0	x: 0 m η = 37.5	**CUMPLE η = 40.2**
N20/N19	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 2.2	x: 0 m η = 13.1	η = 1.6	x: 0 m η = 6.8	x: 0 m η = 32.1	x: 0 m η = 2.4	η = 0.7	x: 0 m η = 7.0	x: 0 m η = 33.0	x: 0 m η = 0.5	x: 0 m η = 10.9	x: 0 m η = 36.4	x: 0 m η = 36.0	x: 0 m η = 34.6	**CUMPLE η = 36.4**
N22/N21	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 1.3	x: 0 m η = 7.3	η = 0.8	x: 0 m η = 4.7	x: 0 m η = 32.4	x: 0 m η = 2.5	η = 0.4	x: 0 m η = 4.8	x: 0 m η = 32.8	x: 0 m η = 0.2	x: 0 m η = 10.8	x: 0 m η = 34.9	x: 0 m η = 34.4	x: 0 m η = 34.1	**CUMPLE η = 34.9**
N24/N23	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 0.6	x: 0 m η = 3.0	η = 0.3	x: 0 m η = 2.6	x: 0 m η = 31.2	x: 0 m η = 2.4	η = 0.2	x: 0 m η = 2.7	x: 0 m η = 31.2	x: 0 m η = 0.1	x: 0 m η = 9.8	x: 0 m η = 31.6	x: 0 m η = 32.3	x: 0 m η = 32.1	**CUMPLE η = 32.3**
N26/N25	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 0.2	x: 0 m η = 0.3	η = 0.8	x: 0 m η = 0.1	x: 0 m η = 31.5	x: 0 m η = 2.4	η < 0.1	x: 0 m η = 0.5	x: 0 m η = 31.9	x: 0 m η < 0.1	x: 0 m η = 10.2	x: 0 m η = 32.4	x: 0 m η = 32.4	x: 0 m η = 31.6	**CUMPLE η = 32.4**
N28/N27	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 0.4	x: 0 m η = 3.0	η = 1.4	x: 0 m η = 2.6	x: 0 m η = 31.5	x: 0 m η = 2.4	η = 0.2	x: 0 m η = 3.0	x: 0 m η = 32.3	x: 0 m η = 0.1	x: 0 m η = 10.5	x: 0 m η = 33.3	x: 0 m η = 34.6	x: 0 m η = 32.8	**CUMPLE η = 34.6**
N30/N29	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 1.0	x: 0 m η = 7.3	η = 2.2	x: 0 m η = 4.7	x: 0 m η = 32.9	x: 0 m η = 2.5	η = 0.4	x: 0 m η = 4.9	x: 0 m η = 34.2	x: 0 m η = 0.2	x: 0 m η = 11.7	x: 0 m η = 36.8	x: 0 m η = 37.0	x: 0 m η = 34.3	**CUMPLE η = 37.0**
N32/N31	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 2.0	x: 0 m η = 13.0	η = 3.0	x: 0 m η = 6.9	x: 0 m η = 32.7	x: 0 m η = 2.5	η = 0.7	x: 0 m η = 7.0	x: 0 m η = 34.4	x: 0 m η = 0.5	x: 0 m η = 11.9	x: 0 m η = 38.6	x: 0 m η = 38.5	x: 0 m η = 35.1	**CUMPLE η = 38.6**
N34/N33	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 2.8	x: 0 m η = 17.3	η = 3.7	x: 0 m η = 9.0	x: 0 m η = 34.0	x: 0 m η = 2.5	η = 0.9	x: 0 m η = 9.1	x: 0 m η = 36.1	x: 0 m η = 0.8	x: 0 m η = 13.1	x: 0 m η = 42.4	x: 0 m η = 40.7	x: 0 m η = 38.0	**CUMPLE η = 42.4**
N36/N35	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 3.8	x: 0 m η = 23.0	η = 4.5	x: 0 m η = 11.2	x: 0 m η = 33.5	x: 0 m η = 2.4	η = 1.1	x: 0 m η = 11.3	x: 0 m η = 36.1	x: 0 m η = 1.3	x: 0 m η = 13.1	x: 0 m η = 44.0	x: 0 m η = 51.4	x: 0 m η = 45.3	**CUMPLE η = 51.4**
N38/N37	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 4.6	x: 0 m η = 27.2	η = 5.2	x: 0 m η = 13.2	x: 0 m η = 33.5	x: 0 m η = 2.4	η = 1.3	x: 0 m η = 13.4	x: 0 m η = 36.5	x: 0 m η = 1.8	x: 0 m η = 13.4	x: 0 m η = 46.5	x: 0 m η = 55.0	x: 0 m η = 48.0	**CUMPLE η = 55.0**
N40/N39	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 5.9	x: 0 m η = 32.9	η = 6.0	x: 0 m η = 15.4	x: 0 m η = 33.9	x: 0 m η = 2.4	η = 1.5	x: 0 m η = 15.7	x: 0 m η = 37.3	x: 0 m η = 2.5	x: 0 m η = 14.0	x: 0 m η = 49.3	x: 0 m η = 65.8	x: 0 m η = 56.8	**CUMPLE η = 65.8**
N42/N41	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 6.8	x: 0 m η = 36.9	η = 6.2	x: 0 m η = 17.4	x: 0 m η = 36.7	x: 0 m η = 2.6	η = 1.7	x: 0 m η = 17.7	x: 0 m η = 40.1	x: 0 m η = 3.2	x: 0 m η = 16.2	x: 0 m η = 54.3	x: 0 m η = 70.3	x: 0 m η = 60.4	**CUMPLE η = 70.3**
N44/N43	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 8.1	x: 0 m η = 43.0	η = 6.4	x: 0 m η = 19.7	x: 0 m η = 38.9	x: 0 m η = 2.7	η = 1.9	x: 0 m η = 20.0	x: 0 m η = 42.5	x: 0 m η = 4.1	x: 0 m η = 18.1	x: 0 m η = 58.5	x: 0 m η = 82.4	x: 0 m η = 70.5	**CUMPLE η = 82.4**
N46/N45	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 8.9	x: 0 m η = 45.1	η = 6.7	x: 2.3 m η = 20.6	x: 0 m η = 43.3	x: 0 m η = 2.9	η = 1.9	x: 2.3 m η = 20.8	x: 0 m η = 47.1	x: 2.3 m η = 4.4	x: 0 m η = 22.2	x: 0 m η = 65.0	x: 0 m η = 82.5	x: 0 m η = 70.5	**CUMPLE η = 82.5**
N48/N47	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 3.2	x: 0 m η = 3.7	η = 6.4	x: 2.3 m η = 17.1	x: 0 m η = 39.3	x: 0 m η = 2.5	η = 1.6	x: 2.3 m η = 17.3	x: 0 m η = 42.9	x: 2.3 m η = 3.0	x: 0 m η = 18.5	x: 0 m η = 39.1	x: 0 m η = 53.9	x: 0 m η = 46.2	**CUMPLE η = 53.9**
N51/N50	$w / t \leq (w / t)_{Máx.}$ Cumple	η < 0.1	η = 0.9	η = 8.7	x: 0 m η = 16.7	x: 0 m η = 41.4	η = 18.1	x: 0 m η = 3.4	x: 0 m η = 21.7	x: 0 m η = 46.7	x: 0 m η = 4.7	x: 0 m η = 22.4	x: 0 m η = 26.1	x: 0 m η = 68.6	x: 0 m η = 54.2	**CUMPLE η = 68.6**
N50/N49	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.0	η = 9.0	x: 1.125 m η = 17.1	x: 0 m η = 32.1	η = 8.5	x: 0 m η = 2.4	x: 1.125 m η = 19.6	x: 0 m η = 37.6	x: 1.125 m η = 3.9	x: 0 m η = 14.9	N.P.[2]	x: 1.125 m η = 50.7	x: 1.125 m η = 37.3	**CUMPLE η = 50.7**
N49/N4	$w / t \leq (w / t)_{Máx.}$ Cumple	η < 0.1	η = 0.8	η = 9.0	x: 0.563 m η = 22.3	x: 0.563 m η = 52.1	η = 19.6	x: 0 m η = 2.8	x: 0.563 m η = 27.4	x: 0.563 m η = 55.1	x: 0.563 m η = 7.5	x: 0.563 m η = 34.2	x: 0.563 m η = 67.9	x: 0.563 m η = 79.9	x: 0.563 m η = 64.4	**CUMPLE η = 79.9**
N55/N54	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.4	η = 8.4	x: 0.563 m η = 15.5	x: 0 m η = 39.4	η = 15.8	x: 0 m η = 4.6	x: 0.563 m η = 15.8	x: 0 m η = 39.7	x: 0.563 m η = 2.7	x: 0 m η = 18.2	N.P.[2]	x: 0 m η = 53.6	x: 0 m η = 41.2	**CUMPLE η = 53.6**
N54/N53	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.4	η = 9.0	x: 0.563 m η = 25.1	x: 0.563 m η = 39.4	η = 10.4	x: 0 m η = 2.8	x: 0.563 m η = 27.4	x: 0.563 m η = 40.5	x: 0.563 m η = 7.6	x: 0.563 m η = 17.5	N.P.[2]	x: 0.563 m η = 68.1	x: 0.563 m η = 60.3	**CUMPLE η = 68.1**
N53/N52	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.3	η = 9.2	x: 0 m η = 25.1	x: 0 m η = 39.4	η = 14.1	x: 0.563 m η = 2.4	x: 0 m η = 26.1	x: 0 m η = 40.5	x: 0 m η = 6.9	x: 0 m η = 17.5	N.P.[2]	x: 0 m η = 67.1	x: 0 m η = 60.3	**CUMPLE η = 67.1**
N52/N6	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.3	η = 8.5	x: 0 m η = 18.0	x: 0.563 m η = 48.7	η = 15.8	x: 0.563 m η = 4.3	x: 0 m η = 20.1	x: 0.563 m η = 51.0	x: 0 m η = 4.1	x: 0.563 m η = 28.5	N.P.[2]	x: 0.563 m η = 65.1	x: 0.563 m η = 52.8	**CUMPLE η = 65.1**
N58/N57	$w / t \leq (w / t)_{Máx.}$ Cumple	η < 0.1	η = 0.1	η = 8.0	x: 0.563 m η = 11.5	x: 0 m η = 36.3	η = 17.7	x: 0 m η = 2.6	x: 0.563 m η = 11.8	x: 0 m η = 36.6	x: 0.563 m η = 1.4	x: 0 m η = 16.5	x: 0 m η = 39.0	x: 0 m η = 47.1	x: 0 m η = 35.8	**CUMPLE η = 47.1**
N57/N56	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 8.3	x: 1.125 m η = 14.1	x: 0 m η = 27.3	η = 7.2	x: 0 m η = 1.1	x: 1.125 m η = 16.5	x: 0 m η = 32.3	x: 1.125 m η = 2.7	x: 0 m η = 10.9	x: 0.563 m η = 27.5	x: 0 m η = 40.7	x: 0 m η = 33.2	**CUMPLE η = 40.7**
N56/N8	$w / t \leq (w / t)_{Máx.}$ Cumple	η < 0.1	η = 0.3	η = 8.1	x: 0 m η = 14.0	x: 0.563 m η = 47.0	η = 18.3	x: 0.563 m η = 2.3	x: 0.563 m η = 16.7	x: 0.563 m η = 49.7	x: 0.563 m η = 2.8	x: 0.563 m η = 28.0	x: 0.563 m η = 39.0	x: 0.563 m η = 60.1	x: 0.563 m η = 51.0	**CUMPLE η = 60.1**
N62/N61	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 4.2	η = 7.1	x: 0.563 m η = 14.4	x: 0 m η = 31.2	η = 12.5	x: 0 m η = 4.0	x: 0.563 m η = 14.8	x: 0 m η = 31.5	x: 0.563 m η = 2.3	x: 0 m η = 11.5	N.P.[2]	x: 0 m η = 43.7	x: 0 m η = 33.1	**CUMPLE η = 43.7**
N61/N60	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 4.2	η = 7.3	x: 0.563 m η = 22.9	x: 0.563 m η = 31.7	η = 8.4	x: 0 m η = 2.3	x: 0.563 m η = 23.8	x: 0.563 m η = 31.8	x: 0.563 m η = 5.7	x: 0.563 m η = 10.8	N.P.[2]	x: 0.563 m η = 55.4	x: 0.563 m η = 51.4	**CUMPLE η = 55.4**
N60/N59	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 4.2	η = 7.3	x: 0 m η = 22.9	x: 0 m η = 31.7	η = 11.2	x: 0.563 m η = 2.1	x: 0 m η = 24.2	x: 0 m η = 32.5	x: 0 m η = 5.9	x: 0 m η = 11.8	N.P.[2]	x: 0 m η = 58.6	x: 0 m η = 51.4	**CUMPLE η = 58.6**
N59/N10	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 4.2	η = 7.2	x: 0 m η = 16.5	x: 0.563 m η = 40.1	η = 13.1	x: 0.563 m η = 4.0	x: 0 m η = 18.8	x: 0.563 m η = 42.6	x: 0 m η = 3.6	x: 0.563 m η = 19.8	N.P.[2]	x: 0.563 m η = 54.6	x: 0.563 m η = 43.1	**CUMPLE η = 54.6**
N65/N64	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.1	η = 6.0	x: 0.563 m η = 11.6	x: 0 m η = 25.6	η = 12.5	x: 0 m η = 2.6	x: 0.563 m η = 11.8	x: 0 m η = 25.8	x: 0.563 m η = 1.4	x: 0 m η = 8.2	x: 0.563 m η = 31.6	x: 0 m η = 33.9	x: 0.563 m η = 26.6	**CUMPLE η = 33.9**
N64/N63	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.2	η = 6.2	x: 1.125 m η = 13.9	x: 0 m η = 18.0	η = 4.7	x: 0 m η = 1.0	x: 1.125 m η = 15.7	x: 0 m η = 21.8	x: 1.125 m η = 2.5	x: 0 m η = 4.9	x: 0 m η = 31.5	x: 1.125 m η = 28.9	x: 0 m η = 26.1	**CUMPLE η = 31.5**
N63/N12	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.3	η = 6.1	x: 0 m η = 13.8	x: 0.563 m η = 33.0	η = 13.1	x: 0.563 m η = 2.4	x: 0 m η = 15.7	x: 0.563 m η = 35.0	x: 0 m η = 2.5	x: 0.563 m η = 14.0	x: 0.563 m η = 43.9	x: 0.563 m η = 44.0	x: 0.563 m η = 37.2	**CUMPLE η = 44.0**
N69/N68	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.6	η = 5.0	x: 0.563 m η = 14.3	x: 0 m η = 19.4	η = 7.0	x: 0 m η = 4.1	x: 0.563 m η = 14.6	x: 0 m η = 20.5	x: 0.563 m η = 2.3	x: 0 m η = 4.3	N.P.[2]	x: 0 m η = 31.1	x: 0 m η = 23.7	**CUMPLE η = 31.1**
N68/N67	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.6	η = 5.1	x: 0.563 m η = 22.8	x: 0.563 m η = 23.2	η = 7.1	x: 0 m η = 2.4	x: 0.563 m η = 23.3	x: 0.563 m η = 23.2	x: 0.563 m η = 5.5	x: 0.563 m η = 5.9	N.P.[2]	x: 0.563 m η = 46.9	x: 0.563 m η = 43.8	**CUMPLE η = 46.9**
N67/N66	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.7	η = 5.1	x: 0 m η = 22.8	x: 0 m η = 23.2	η = 8.3	x: 0.563 m η = 2.1	x: 0 m η = 23.5	x: 0 m η = 23.5	x: 0 m η = 5.5	x: 0 m η = 6.2	N.P.[2]	x: 0 m η = 48.2	x: 0 m η = 43.8	**CUMPLE η = 48.2**
N66/N14	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.7	η = 5.0	x: 0 m η = 16.6	x: 0.563 m η = 25.5	η = 7.9	x: 0.563 m η = 4.0	x: 0 m η = 18.2	x: 0.563 m η = 27.2	x: 0 m η = 3.4	x: 0.563 m η = 8.0	N.P.[2]	x: 0.563 m η = 40.5	x: 0.563 m η = 32.3	**CUMPLE η = 40.5**
N72/N71	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 4.1	x: 0.563 m η = 11.9	x: 0 m η = 18.5	η = 8.7	x: 0 m η = 2.5	x: 0.563 m η = 12.0	x: 0 m η = 18.6	x: 0.563 m η = 1.5	x: 0 m η = 4.2	x: 0.563 m η = 22.4	x: 0.563 m η = 23.9	x: 0.563 m η = 20.9	**CUMPLE η = 23.9**
N71/N70	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.2	η = 4.2	x: 1.125 m η = 14.1	x: 0 m η = 10.3	η = 2.2	x: 0 m η = 0.9	x: 1.125 m η = 15.3	x: 0 m η = 11.7	x: 1.125 m η = 2.3	x: 0 m η = 1.4	x: 0.563 m η = 19.3	x: 0 m η = 23.3	x: 0 m η = 19.4	**CUMPLE η = 23.3**
N70/N16	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.3	η = 4.1	x: 0 m η = 14.0	x: 0.563 m η = 22.6	η = 9.1	x: 0.563 m η = 2.4	x: 0 m η = 15.3	x: 0.563 m η = 23.9	x: 0 m η = 2.4	x: 0.563 m η = 6.5	x: 0 m η = 22.4	x: 0.563 m η = 32.4	x: 0.563 m η = 27.7	**CUMPLE η = 32.4**
N76/N75	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.1	η = 3.2	x: 0.563 m η = 14.3	x: 0 m η = 15.3	η = 5.8	x: 0 m η = 4.0	x: 0.563 m η = 14.4	x: 0 m η = 15.4	x: 0.563 m η = 2.2	x: 0 m η = 2.7	N.P.[2]	x: 0.563 m η = 19.7	x: 0.563 m η = 18.2	**CUMPLE η = 19.7**
N75/N74	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.1	η = 3.2	x: 0.563 m η = 22.8	x: 0.563 m η = 15.7	η = 4.5	x: 0 m η = 2.3	x: 0.563 m η = 22.8	x: 0.563 m η = 15.7	x: 0.563 m η = 5.3	x: 0.563 m η = 2.7	N.P.[2]	x: 0.563 m η = 39.3	x: 0.563 m η = 37.0	**CUMPLE η = 39.3**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N74/N73	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.1	η = 3.2	x: 0 m η = 22.8	x: 0 m η = 15.7	η = 4.8	x: 0.563 m η = 2.1	x: 0 m η = 22.9	x: 0 m η = 15.7	x: 0 m η = 5.3	x: 0 m η = 2.7	N.P.[2]	x: 0 m η = 39.3	x: 0 m η = 37.0	**CUMPLE η = 39.3**
N73/N18	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.2	η = 3.2	x: 0 m η = 16.1	x: 0.563 m η = 17.0	η = 5.8	x: 0.563 m η = 4.0	x: 0 m η = 17.1	x: 0.563 m η = 18.1	x: 0 m η = 3.0	x: 0.563 m η = 3.6	N.P.[2]	x: 0.563 m η = 24.8	x: 0.563 m η = 19.7	**CUMPLE η = 24.8**
N79/N78	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 2.2	x: 0.563 m η = 11.9	x: 0 m η = 12.5	η = 5.9	x: 0 m η = 2.5	x: 0.563 m η = 11.9	x: 0 m η = 12.6	x: 0.563 m η = 1.5	x: 0 m η = 1.9	x: 0.563 m η = 19.0	x: 0.563 m η = 18.2	x: 0.563 m η = 17.8	**CUMPLE η = 19.0**
N78/N77	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 2.2	x: 1.125 m η = 14.0	x: 0 m η = 4.9	x: 0.75 m η = 0.5	x: 0 m η = 0.9	x: 1.125 m η = 14.6	x: 0 m η = 5.6	x: 1.125 m η = 2.1	x: 0 m η = 0.3	x: 0.563 m η = 16.9	x: 1.125 m η = 19.3	x: 1.125 m η = 17.3	**CUMPLE η = 19.3**
N77/N20	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.3	η = 2.2	x: 0 m η = 13.9	x: 0.563 m η = 12.5	η = 5.9	x: 0.563 m η = 2.3	x: 0 m η = 14.6	x: 0.563 m η = 12.6	x: 0 m η = 2.2	x: 0.563 m η = 1.9	x: 0 m η = 19.0	x: 0 m η = 21.5	x: 0 m η = 19.0	**CUMPLE η = 21.5**
N83/N82	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 0.9	η = 1.2	x: 0.563 m η = 14.3	x: 0 m η = 9.9	η = 3.4	x: 0 m η = 4.0	x: 0.563 m η = 14.3	x: 0 m η = 10.2	x: 0.563 m η = 2.2	x: 0 m η = 1.2	N.P.[2]	x: 0.563 m η = 17.5	x: 0.563 m η = 17.0	**CUMPLE η = 17.5**
N82/N81	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 0.9	η = 1.2	x: 0.563 m η = 22.8	x: 0.563 m η = 8.9	η = 2.8	x: 0 m η = 2.3	x: 0.563 m η = 22.8	x: 0.563 m η = 9.0	x: 0.563 m η = 5.3	x: 0.563 m η = 0.9	N.P.[2]	x: 0.563 m η = 32.6	x: 0.563 m η = 31.1	**CUMPLE η = 32.6**
N81/N80	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.0	η = 1.2	x: 0 m η = 22.8	x: 0 m η = 8.9	η = 2.5	x: 0.563 m η = 2.1	x: 0 m η = 22.8	x: 0 m η = 9.0	x: 0 m η = 5.3	x: 0 m η = 0.9	N.P.[2]	x: 0 m η = 32.6	x: 0 m η = 31.1	**CUMPLE η = 32.6**
N80/N22	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 1.0	η = 1.2	x: 0 m η = 16.1	x: 0.563 m η = 8.9	η = 3.4	x: 0.563 m η = 4.0	x: 0 m η = 16.5	x: 0.563 m η = 8.9	x: 0 m η = 2.8	x: 0.563 m η = 0.9	N.P.[2]	x: 0 m η = 20.6	x: 0 m η = 19.3	**CUMPLE η = 20.6**
N86/N85	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.2	η = 0.2	x: 0.563 m η = 11.9	x: 0 m η = 9.9	η = 3.1	x: 0 m η = 2.5	x: 0.563 m η = 11.9	x: 0 m η = 10.0	x: 0.563 m η = 1.5	x: 0 m η = 1.0	x: 0.563 m η = 14.9	x: 0 m η = 13.6	x: 0.563 m η = 14.4	**CUMPLE η = 14.9**
N85/N84	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.2	η = 0.2	x: 1.125 m η = 14.0	x: 1.125 m η = 6.9	η = 1.9	x: 0 m η = 0.9	x: 1.125 m η = 14.1	x: 1.125 m η = 7.0	x: 1.125 m η = 2.0	x: 1.125 m η = 0.5	x: 0.563 m η = 14.2	x: 1.125 m η = 19.3	x: 1.125 m η = 18.3	**CUMPLE η = 19.3**
N84/N24	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.3	η = 0.2	x: 0 m η = 13.9	x: 0.563 m η = 9.2	η = 2.6	x: 0.563 m η = 2.4	x: 0 m η = 14.0	x: 0.563 m η = 9.3	x: 0 m η = 2.0	x: 0.563 m η = 0.9	x: 0 m η = 14.9	x: 0.563 m η = 19.3	x: 0.563 m η = 17.8	**CUMPLE η = 19.3**
N90/N89	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.3	η = 0.6	x: 0.563 m η = 14.2	x: 0 m η = 14.0	η = 2.5	x: 0 m η = 4.1	x: 0.563 m η = 12.5	x: 0 m η = 14.4	x: 0.563 m η = 2.2	x: 0 m η = 2.1	N.P.[2]	x: 0 m η = 22.0	x: 0 m η = 19.8	**CUMPLE η = 22.0**
N89/N88	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.3	η = 0.7	x: 0.563 m η = 22.7	x: 0 m η = 10.6	η = 3.8	x: 0 m η = 2.4	x: 0.563 m η = 22.1	x: 0 m η = 11.0	x: 0.563 m η = 5.2	x: 0 m η = 1.4	N.P.[2]	x: 0.563 m η = 26.4	x: 0.563 m η = 25.5	**CUMPLE η = 26.4**
N88/N87	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.3	η = 0.7	x: 0 m η = 22.7	x: 0.563 m η = 10.5	η = 3.7	x: 0.563 m η = 2.1	x: 0 m η = 22.2	x: 0.563 m η = 10.9	x: 0 m η = 5.2	x: 0.563 m η = 1.3	N.P.[2]	x: 0 m η = 26.0	x: 0 m η = 25.5	**CUMPLE η = 26.0**
N87/N26	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 2.3	η = 0.6	x: 0 m η = 16.4	x: 0.563 m η = 13.7	η = 2.4	x: 0.563 m η = 4.0	x: 0 m η = 16.6	x: 0.563 m η = 14.1	x: 0 m η = 2.8	x: 0.563 m η = 2.1	N.P.[2]	x: 0.563 m η = 28.6	x: 0.563 m η = 26.1	**CUMPLE η = 28.6**
N93/N92	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.3	η = 1.4	x: 0.563 m η = 11.9	x: 0 m η = 18.8	η = 3.4	x: 0 m η = 2.5	x: 0.563 m η = 11.9	x: 0 m η = 19.7	x: 0.563 m η = 1.5	x: 0 m η = 4.0	x: 0.563 m η = 12.9	x: 0 m η = 24.8	x: 0 m η = 21.4	**CUMPLE η = 24.8**
N92/N91	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.2	η = 1.5	x: 1.125 m η = 14.0	x: 0 m η = 14.2	η = 4.2	x: 0 m η = 0.9	x: 1.125 m η = 14.4	x: 0 m η = 15.1	x: 1.125 m η = 2.1	x: 0 m η = 2.5	x: 0.563 m η = 12.8	x: 1.125 m η = 24.1	x: 1.125 m η = 20.8	**CUMPLE η = 24.1**
N91/N28	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.2	η = 0.3	η = 1.5	x: 0 m η = 13.9	x: 0.563 m η = 18.9	η = 3.5	x: 0.563 m η = 2.4	x: 0 m η = 14.4	x: 0.563 m η = 19.8	x: 0 m η = 2.1	x: 0.563 m η = 4.1	x: 0 m η = 12.9	x: 0.563 m η = 31.2	x: 0.563 m η = 27.4	**CUMPLE η = 31.2**
N97/N96	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 3.8	η = 2.4	x: 0.563 m η = 14.3	x: 0 m η = 23.6	η = 4.1	x: 0 m η = 4.0	x: 0.563 m η = 14.3	x: 0 m η = 25.1	x: 0.563 m η = 2.2	x: 0 m η = 6.5	N.P.[2]	x: 0 m η = 33.9	x: 0 m η = 29.1	**CUMPLE η = 33.9**
N96/N95	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 3.8	η = 2.5	x: 0.563 m η = 22.8	x: 0 m η = 18.6	η = 6.4	x: 0 m η = 2.3	x: 0.563 m η = 22.8	x: 0 m η = 20.1	x: 0.563 m η = 5.3	x: 0 m η = 4.4	N.P.[2]	x: 0 m η = 27.7	x: 0.563 m η = 26.6	**CUMPLE η = 27.7**
N95/N94	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 3.8	η = 2.5	x: 0 m η = 22.8	x: 0.563 m η = 18.4	η = 6.5	x: 0.563 m η = 2.1	x: 0 m η = 22.8	x: 0.563 m η = 19.9	x: 0 m η = 5.3	x: 0.563 m η = 4.3	N.P.[2]	x: 0.563 m η = 33.5	x: 0.563 m η = 28.7	**CUMPLE η = 33.5**
N94/N30	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 3.9	η = 2.4	x: 0 m η = 16.1	x: 0.563 m η = 24.3	η = 4.4	x: 0.563 m η = 4.0	x: 0 m η = 16.9	x: 0.563 m η = 25.8	x: 0 m η = 2.9	x: 0.563 m η = 6.9	N.P.[2]	x: 0.563 m η = 40.9	x: 0.563 m η = 35.6	**CUMPLE η = 40.9**
N100/N99	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.1	η = 3.3	x: 0.563 m η = 11.9	x: 0 m η = 29.1	η = 5.3	x: 0 m η = 2.5	x: 0.563 m η = 11.9	x: 0 m η = 31.1	x: 0.563 m η = 1.5	x: 0 m η = 10.0	x: 0 m η = 18.2	x: 0 m η = 37.6	x: 0 m η = 31.3	**CUMPLE η = 37.6**
N99/N98	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 3.4	x: 1.125 m η = 14.0	x: 0 m η = 22.1	η = 6.4	x: 0 m η = 0.9	x: 1.125 m η = 15.0	x: 0 m η = 24.1	x: 1.125 m η = 2.3	x: 0 m η = 6.2	x: 0.563 m η = 15.1	x: 1.125 m η = 33.2	x: 1.125 m η = 27.1	**CUMPLE η = 33.2**
N98/N32	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.3	η = 3.3	x: 0 m η = 14.0	x: 0.563 m η = 30.3	η = 5.9	x: 0.563 m η = 2.3	x: 0 m η = 14.9	x: 0.563 m η = 32.3	x: 0 m η = 2.3	x: 0.563 m η = 10.8	x: 0 m η = 16.3	x: 0.563 m η = 44.9	x: 0.563 m η = 38.1	**CUMPLE η = 44.9**
N104/N103	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 5.3	η = 4.2	x: 0.563 m η = 14.3	x: 0 m η = 34.2	η = 6.1	x: 0 m η = 4.0	x: 0.563 m η = 14.4	x: 0 m η = 36.7	x: 0.563 m η = 2.2	x: 0 m η = 13.9	N.P.[2]	x: 0 m η = 48.4	x: 0 m η = 40.8	**CUMPLE η = 48.4**
N103/N102	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 5.3	η = 4.3	x: 0.563 m η = 22.8	x: 0 m η = 25.9	η = 9.0	x: 0 m η = 2.3	x: 0.563 m η = 23.1	x: 0 m η = 28.5	x: 0.563 m η = 5.4	x: 0 m η = 8.8	N.P.[2]	x: 0 m η = 38.7	x: 0 m η = 31.7	**CUMPLE η = 38.7**
N102/N101	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 5.3	η = 4.3	x: 0 m η = 22.8	x: 0.563 m η = 25.6	η = 9.3	x: 0.563 m η = 2.1	x: 0 m η = 23.2	x: 0.563 m η = 28.2	x: 0 m η = 5.4	x: 0.563 m η = 8.7	N.P.[2]	x: 0.563 m η = 44.3	x: 0.563 m η = 36.8	**CUMPLE η = 44.3**
N101/N34	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 5.3	η = 4.2	x: 0 m η = 16.2	x: 0.563 m η = 35.7	η = 6.7	x: 0.563 m η = 4.0	x: 0 m η = 17.5	x: 0.563 m η = 38.3	x: 0 m η = 3.1	x: 0.563 m η = 15.1	N.P.[2]	x: 0.563 m η = 56.2	x: 0.563 m η = 47.9	**CUMPLE η = 56.2**
N107/N106	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.1	η = 4.9	x: 0.563 m η = 11.9	x: 0 m η = 39.8	η = 7.7	x: 0 m η = 2.6	x: 0.563 m η = 12.0	x: 0 m η = 42.8	x: 0.563 m η = 1.5	x: 0 m η = 18.9	x: 0 m η = 19.7	x: 0 m η = 50.8	x: 0 m η = 41.9	**CUMPLE η = 50.8**
N106/N105	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 5.0	x: 1.125 m η = 14.2	x: 0 m η = 28.8	η = 8.4	x: 0 m η = 1.0	x: 1.125 m η = 15.6	x: 0 m η = 31.8	x: 1.125 m η = 2.4	x: 0 m η = 10.8	x: 1.125 m η = 15.0	x: 1.125 m η = 41.4	x: 1.125 m η = 32.9	**CUMPLE η = 41.4**
N105/N36	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 5.0	x: 0 m η = 14.1	x: 0.563 m η = 41.6	η = 8.5	x: 0.563 m η = 2.4	x: 0 m η = 15.5	x: 0.563 m η = 44.6	x: 0 m η = 2.4	x: 0.563 m η = 20.6	x: 0.563 m η = 23.2	x: 0.563 m η = 58.6	x: 0.563 m η = 48.9	**CUMPLE η = 58.6**
N111/N110	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.7	η = 5.6	x: 0.563 m η = 14.4	x: 0 m η = 42.7	η = 7.8	x: 0 m η = 4.1	x: 0.563 m η = 14.6	x: 0 m η = 46.1	x: 0.563 m η = 2.3	x: 0 m η = 21.9	N.P.[2]	x: 0 m η = 61.9	x: 0 m η = 51.9	**CUMPLE η = 61.9**
N110/N109	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.8	η = 5.7	x: 0.563 m η = 22.9	x: 0 m η = 31.6	η = 11.2	x: 0 m η = 2.4	x: 0.563 m η = 23.4	x: 0 m η = 35.1	x: 0.563 m η = 5.5	x: 0 m η = 13.5	N.P.[2]	x: 0 m η = 49.0	x: 0 m η = 39.7	**CUMPLE η = 49.0**
N109/N108	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.8	η = 5.7	x: 0 m η = 22.9	x: 0.563 m η = 31.4	η = 11.7	x: 0.563 m η = 2.1	x: 0 m η = 23.5	x: 0.563 m η = 34.9	x: 0 m η = 5.5	x: 0.563 m η = 13.5	N.P.[2]	x: 0.563 m η = 54.2	x: 0.563 m η = 44.5	**CUMPLE η = 54.2**
N108/N38	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 6.8	η = 5.6	x: 0 m η = 16.5	x: 0.563 m η = 44.6	η = 8.6	x: 0.563 m η = 4.0	x: 0 m η = 18.3	x: 0.563 m η = 48.1	x: 0 m η = 3.4	x: 0.563 m η = 23.9	N.P.[2]	x: 0.563 m η = 69.6	x: 0.563 m η = 58.9	**CUMPLE η = 69.6**
N114/N113	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.1	η = 6.2	x: 0.563 m η = 11.6	x: 0 m η = 46.6	η = 9.0	x: 0 m η = 2.6	x: 0.563 m η = 11.8	x: 0 m η = 50.4	x: 0.563 m η = 1.4	x: 0 m η = 26.2	x: 0.563 m η = 30.0	x: 0 m η = 59.8	x: 0 m η = 48.7	**CUMPLE η = 59.8**
N113/N112	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 6.4	x: 1.125 m η = 14.0	x: 0 m η = 35.1	η = 10.2	x: 0 m η = 1.0	x: 1.125 m η = 15.8	x: 0 m η = 39.0	x: 1.125 m η = 2.5	x: 0 m η = 16.3	x: 0 m η = 36.4	x: 1.125 m η = 48.5	x: 1.125 m η = 37.9	**CUMPLE η = 48.5**
N112/N40	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 6.3	x: 0 m η = 13.9	x: 0.563 m η = 48.8	η = 10.8	x: 0.563 m η = 2.4	x: 0 m η = 15.8	x: 0.563 m η = 52.6	x: 0 m η = 2.5	x: 0.563 m η = 28.7	x: 0.563 m η = 21.3	x: 0.563 m η = 67.6	x: 0.563 m η = 55.9	**CUMPLE η = 67.6**
N118/N117	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 8.2	η = 6.8	x: 0.563 m η = 14.5	x: 0 m η = 52.5	η = 10.4	x: 0 m η = 4.1	x: 0.563 m η = 14.8	x: 0 m η = 56.6	x: 0.563 m η = 2.3	x: 0 m η = 33.2	N.P.[2]	x: 0 m η = 74.5	x: 0 m η = 62.3	**CUMPLE η = 74.5**
N117/N116	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 8.2	η = 7.1	x: 0.563 m η = 22.9	x: 0 m η = 37.6	η = 13.0	x: 0 m η = 2.4	x: 0.563 m η = 23.7	x: 0 m η = 41.8	x: 0.563 m η = 5.7	x: 0 m η = 19.0	N.P.[2]	x: 0 m η = 56.6	x: 0 m η = 45.4	**CUMPLE η = 56.6**
N116/N115	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 8.2	η = 7.1	x: 0 m η = 22.9	x: 0.563 m η = 36.8	η = 13.3	x: 0.563 m η = 2.1	x: 0 m η = 24.0	x: 0.563 m η = 41.1	x: 0 m η = 5.8	x: 0.563 m η = 18.4	N.P.[2]	x: 0.563 m η = 61.3	x: 0.563 m η = 49.7	**CUMPLE η = 61.3**
N115/N42	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.[1]	η = 8.3	η = 6.9	x: 0 m η = 16.6	x: 0.563 m η = 55.0	η = 11.8	x: 0.563 m η = 4.0	x: 0 m η = 18.8	x: 0.563 m η = 59.2	x: 0 m η = 3.6	x: 0.563 m η = 36.4	N.P.[2]	x: 0.563 m η = 82.9	x: 0.563 m η = 70.0	**CUMPLE η = 82.9**
N121/N120	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 0.1	η = 0.2	η = 7.2	x: 0.563 m η = 11.6	x: 0 m η = 59.7	η = 13.8	x: 0 m η = 2.6	x: 0.563 m η = 11.8	x: 0 m η = 64.0	x: 0.563 m η = 1.5	x: 0 m η = 42.9	x: 0 m η = 24.9	x: 0 m η = 75.7	x: 0 m η = 62.5	**CUMPLE η = 75.7**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N120/N119	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta < 0.1$	$\eta = 0.2$	$\eta = 7.4$	x: 1.125 m $\eta = 14.4$	x: 0 m $\eta = 35.5$	$\eta = 10.2$	x: 0 m $\eta = 1.2$	x: 1.125 m $\eta = 16.5$	x: 0 m $\eta = 40.1$	x: 1.125 m $\eta = 2.7$	x: 0 m $\eta = 17.1$	x: 0 m $\eta = 17.3$	x: 1.125 m $\eta = 50.7$	x: 1.125 m $\eta = 38.9$	**CUMPLE $\eta = 50.7$**
N119/N44	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta < 0.1$	$\eta = 0.2$	$\eta = 7.2$	x: 0 m $\eta = 14.2$	x: 0.563 m $\eta = 62.1$	$\eta = 15.0$	x: 0.563 m $\eta = 2.3$	x: 0.563 m $\eta = 17.2$	x: 0.563 m $\eta = 66.6$	x: 0.563 m $\eta = 3.0$	x: 0.563 m $\eta = 46.6$	x: 0.563 m $\eta = 29.8$	x: 0.563 m $\eta = 84.0$	x: 0.563 m $\eta = 70.1$	**CUMPLE $\eta = 84.0$**
N125/N124	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	$\eta = 10.7$	$\eta = 7.0$	x: 0.563 m $\eta = 15.4$	x: 0 m $\eta = 56.3$	$\eta = 13.4$	x: 0 m $\eta = 4.6$	x: 0.563 m $\eta = 15.7$	x: 0 m $\eta = 60.5$	x: 0.563 m $\eta = 2.7$	x: 0 m $\eta = 38.4$	N.P.(2)	x: 0 m $\eta = 84.0$	x: 0 m $\eta = 71.3$	**CUMPLE $\eta = 84.0$**
N124/N123	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	$\eta = 10.6$	$\eta = 7.6$	x: 0.563 m $\eta = 25.0$	x: 0 m $\eta = 31.9$	$\eta = 10.9$	x: 0 m $\eta = 2.9$	x: 0.563 m $\eta = 26.9$	x: 0 m $\eta = 36.5$	x: 0.563 m $\eta = 7.3$	x: 0 m $\eta = 14.5$	N.P.(2)	x: 0 m $\eta = 55.0$	x: 0 m $\eta = 44.1$	**CUMPLE $\eta = 55.0$**
N123/N122	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	$\eta = 10.5$	$\eta = 7.8$	x: 0 m $\eta = 25.0$	x: 0.563 m $\eta = 31.1$	$\eta = 11.1$	x: 0.563 m $\eta = 2.4$	x: 0 m $\eta = 26.1$	x: 0.563 m $\eta = 35.9$	x: 0 m $\eta = 6.9$	x: 0.563 m $\eta = 14.0$	N.P.(2)	x: 0.563 m $\eta = 59.7$	x: 0.563 m $\eta = 48.3$	**CUMPLE $\eta = 59.7$**
N122/N46	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	$\eta = 10.4$	$\eta = 7.2$	x: 0 m $\eta = 18.1$	x: 0.563 m $\eta = 58.3$	$\eta = 14.4$	x: 0.563 m $\eta = 4.3$	x: 0 m $\eta = 19.8$	x: 0.563 m $\eta = 62.6$	x: 0 m $\eta = 4.0$	x: 0.563 m $\eta = 41.2$	N.P.(2)	x: 0.563 m $\eta = 91.5$	x: 0.563 m $\eta = 78.0$	**CUMPLE $\eta = 91.5$**
N127/N126	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta < 0.1$	$\eta = 0.4$	$\eta = 6.3$	x: 1.125 m $\eta = 16.3$	x: 0 m $\eta = 16.6$	$\eta = 4.8$	x: 0 m $\eta = 2.1$	x: 1.125 m $\eta = 18.0$	x: 0 m $\eta = 20.5$	x: 1.125 m $\eta = 3.3$	x: 0 m $\eta = 4.4$	x: 1.125 m $\eta = 11.3$	x: 1.125 m $\eta = 36.0$	x: 1.125 m $\eta = 26.6$	**CUMPLE $\eta = 36.0$**
N129/N50	x: 0.188 m $w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	N.P.(3)	N.P.(4)	x: 1.5 m $\eta = 12.5$	x: 1.5 m $\eta = 28.4$	$\eta = 2.0$	x: 1.5 m $\eta = 3.4$	N.P.(5)	N.P.(6)	x: 1.5 m $\eta = 1.7$	x: 1.5 m $\eta = 8.1$	x: 1.5 m $\eta = 31.2$	N.P.(7)	N.P.(8)	**CUMPLE $\eta = 31.2$**
N50/N54	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 9.2$	N.P.(3)	$\eta = 4.6$	x: 0 m $\eta = 15.0$	x: 1.5 m $\eta = 26.4$	$\eta = 3.7$	x: 0 m $\eta = 3.3$	x: 0 m $\eta = 15.3$	x: 1.5 m $\eta = 29.0$	x: 0 m $\eta = 2.5$	x: 1.5 m $\eta = 8.6$	x: 0 m $\eta = 42.8$	N.P.(7)	x: 0 m $\eta = 40.6$	**CUMPLE $\eta = 42.8$**
N54/N57	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 12.9$	x: 0.938 m $\eta = 0.9$	$\eta = 4.4$	x: 0 m $\eta = 10.8$	x: 1.5 m $\eta = 29.2$	$\eta = 4.1$	x: 0 m $\eta = 2.9$	x: 0 m $\eta = 11.6$	x: 1.5 m $\eta = 31.6$	x: 0 m $\eta = 1.4$	x: 1.5 m $\eta = 10.2$	x: 0 m $\eta = 41.9$	x: 0 m $\eta = 15.1$	x: 0 m $\eta = 40.0$	**CUMPLE $\eta = 41.9$**
N57/N61	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 21.6$	x: 0.563 m $\eta < 0.1$	$\eta = 4.1$	x: 0 m $\eta = 12.4$	x: 1.5 m $\eta = 23.4$	$\eta = 3.2$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 12.7$	x: 1.5 m $\eta = 25.7$	x: 0 m $\eta = 1.7$	x: 1.5 m $\eta = 6.7$	x: 0 m $\eta = 49.0$	x: 0.563 m $\eta = 4.5$	x: 0 m $\eta = 47.2$	**CUMPLE $\eta = 49.0$**
N61/N64	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 24.4$	x: 0.375 m $\eta = 0.6$	$\eta = 3.5$	x: 1.5 m $\eta = 10.7$	x: 1.5 m $\eta = 22.0$	$\eta = 3.0$	x: 1.5 m $\eta = 3.1$	x: 1.5 m $\eta = 11.0$	x: 1.5 m $\eta = 23.9$	x: 1.5 m $\eta = 1.3$	x: 1.5 m $\eta = 5.8$	x: 1.5 m $\eta = 46.5$	x: 1.5 m $\eta = 12.5$	x: 1.5 m $\eta = 44.9$	**CUMPLE $\eta = 46.5$**
N64/N68	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 30.4$	N.P.(3)	$\eta = 3.0$	x: 0 m $\eta = 12.0$	x: 1.5 m $\eta = 14.8$	$\eta = 2.0$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 12.3$	x: 1.5 m $\eta = 16.5$	x: 0 m $\eta = 1.6$	x: 1.5 m $\eta = 2.7$	x: 0 m $\eta = 52.3$	N.P.(7)	x: 0 m $\eta = 50.6$	**CUMPLE $\eta = 52.3$**
N68/N71	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 30.5$	N.P.(3)	$\eta = 2.4$	x: 1.5 m $\eta = 11.2$	x: 1.5 m $\eta = 12.6$	$\eta = 1.7$	x: 1.5 m $\eta = 3.1$	x: 1.5 m $\eta = 11.5$	x: 1.5 m $\eta = 13.9$	x: 1.5 m $\eta = 1.4$	x: 1.5 m $\eta = 2.0$	x: 1.5 m $\eta = 48.8$	N.P.(7)	x: 1.5 m $\eta = 47.3$	**CUMPLE $\eta = 48.8$**
N71/N75	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 34.4$	N.P.(3)	$\eta = 2.0$	x: 0 m $\eta = 11.8$	x: 1.5 m $\eta = 7.3$	$\eta = 1.0$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 12.1$	x: 1.5 m $\eta = 8.1$	x: 0 m $\eta = 1.6$	x: 1.5 m $\eta = 0.7$	x: 0 m $\eta = 53.0$	N.P.(7)	x: 0 m $\eta = 51.5$	**CUMPLE $\eta = 53.0$**
N75/N78	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 35.1$	N.P.(3)	$\eta = 1.4$	x: 1.5 m $\eta = 11.0$	x: 0 m $\eta = 6.6$	$\eta = 0.8$	x: 1.5 m $\eta = 3.1$	x: 1.5 m $\eta = 11.2$	x: 0 m $\eta = 6.9$	x: 1.5 m $\eta = 1.4$	x: 0 m $\eta = 0.5$	x: 1.5 m $\eta = 51.3$	N.P.(7)	x: 1.5 m $\eta = 49.9$	**CUMPLE $\eta = 51.3$**
N78/N82	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 37.8$	N.P.(3)	$\eta = 1.0$	x: 0 m $\eta = 11.4$	x: 0 m $\eta = 5.4$	$\eta = 0.7$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 11.7$	x: 0 m $\eta = 5.4$	x: 0 m $\eta = 1.5$	x: 0 m $\eta = 0.3$	x: 0 m $\eta = 53.7$	N.P.(7)	x: 0 m $\eta = 52.4$	**CUMPLE $\eta = 53.7$**
N82/N85	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 38.1$	N.P.(3)	$\eta = 0.6$	x: 1.5 m $\eta = 11.0$	x: 0 m $\eta = 5.4$	$\eta = 0.7$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 11.3$	x: 0 m $\eta = 5.8$	x: 1.5 m $\eta = 1.4$	x: 0 m $\eta = 0.3$	x: 1.5 m $\eta = 52.5$	N.P.(7)	x: 1.5 m $\eta = 51.2$	**CUMPLE $\eta = 52.5$**
N85/N89	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 39.2$	N.P.(3)	$\eta = 0.5$	x: 0 m $\eta = 11.2$	x: 0 m $\eta = 10.9$	$\eta = 1.4$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 11.5$	x: 0 m $\eta = 11.0$	x: 0 m $\eta = 1.4$	x: 0 m $\eta = 1.2$	x: 0 m $\eta = 56.2$	N.P.(7)	x: 0 m $\eta = 54.8$	**CUMPLE $\eta = 56.2$**
N89/N92	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 38.8$	N.P.(3)	$\eta = 0.6$	x: 1.5 m $\eta = 11.2$	x: 0 m $\eta = 12.7$	$\eta = 1.7$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 11.5$	x: 0 m $\eta = 12.9$	x: 1.5 m $\eta = 1.4$	x: 0 m $\eta = 1.7$	x: 1.5 m $\eta = 54.3$	N.P.(7)	x: 1.5 m $\eta = 53.3$	**CUMPLE $\eta = 54.3$**
N92/N96	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 38.4$	N.P.(3)	$\eta = 1.0$	x: 0 m $\eta = 11.0$	x: 0 m $\eta = 18.7$	$\eta = 2.5$	x: 0 m $\eta = 3.2$	x: 0 m $\eta = 11.3$	x: 0 m $\eta = 19.2$	x: 0 m $\eta = 1.4$	x: 0 m $\eta = 3.7$	x: 0 m $\eta = 57.0$	N.P.(7)	x: 0 m $\eta = 55.1$	**CUMPLE $\eta = 57.0$**
N96/N99	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 37.7$	N.P.(3)	$\eta = 1.6$	x: 1.5 m $\eta = 11.4$	x: 0 m $\eta = 20.5$	$\eta = 2.8$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 11.7$	x: 0 m $\eta = 21.4$	x: 1.5 m $\eta = 1.5$	x: 0 m $\eta = 4.7$	x: 1.5 m $\eta = 54.6$	N.P.(7)	x: 1.5 m $\eta = 53.4$	**CUMPLE $\eta = 54.6$**
N99/N103	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 35.9$	N.P.(3)	$\eta = 2.0$	x: 0 m $\eta = 11.0$	x: 0 m $\eta = 26.6$	$\eta = 3.7$	x: 0 m $\eta = 3.1$	x: 0 m $\eta = 11.2$	x: 0 m $\eta = 27.7$	x: 0 m $\eta = 1.4$	x: 0 m $\eta = 7.8$	x: 0 m $\eta = 56.1$	N.P.(7)	x: 0 m $\eta = 53.6$	**CUMPLE $\eta = 56.1$**
N103/N106	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 34.9$	N.P.(3)	$\eta = 2.5$	x: 1.5 m $\eta = 11.8$	x: 0 m $\eta = 28.5$	$\eta = 3.9$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 12.1$	x: 0 m $\eta = 29.9$	x: 1.5 m $\eta = 1.6$	x: 0 m $\eta = 9.1$	x: 1.5 m $\eta = 54.4$	N.P.(7)	x: 1.5 m $\eta = 52.6$	**CUMPLE $\eta = 54.4$**
N106/N110	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 32.2$	N.P.(3)	$\eta = 2.7$	x: 0 m $\eta = 11.2$	x: 0 m $\eta = 33.9$	$\eta = 4.7$	x: 0 m $\eta = 3.1$	x: 0 m $\eta = 11.5$	x: 0 m $\eta = 35.4$	x: 0 m $\eta = 1.4$	x: 0 m $\eta = 12.7$	x: 0 m $\eta = 54.8$	N.P.(7)	x: 0 m $\eta = 51.8$	**CUMPLE $\eta = 54.8$**
N110/N113	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 31.7$	$\eta = 2.1$	$\eta = 3.2$	x: 1.5 m $\eta = 12.1$	x: 0 m $\eta = 36.2$	$\eta = 5.0$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 12.4$	x: 0 m $\eta = 38.1$	x: 1.5 m $\eta = 1.6$	x: 0 m $\eta = 14.7$	x: 1.5 m $\eta = 53.5$	x: 1.5 m $\eta = 43.8$	x: 1.5 m $\eta = 51.2$	**CUMPLE $\eta = 53.5$**
N113/N117	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 28.0$	$\eta = 3.0$	$\eta = 3.5$	x: 0 m $\eta = 10.8$	x: 0 m $\eta = 42.4$	$\eta = 5.9$	x: 0 m $\eta = 3.1$	x: 0 m $\eta = 11.1$	x: 0 m $\eta = 44.3$	x: 0 m $\eta = 1.3$	x: 0 m $\eta = 20.0$	x: 0 m $\eta = 52.1$	x: 0 m $\eta = 52.3$	x: 0 m $\eta = 48.6$	**CUMPLE $\eta = 52.3$**
N117/N120	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 25.3$	$\eta = 5.0$	$\eta = 3.8$	x: 1.5 m $\eta = 12.5$	x: 1.5 m $\eta = 44.1$	$\eta = 6.2$	x: 1.5 m $\eta = 3.2$	x: 1.5 m $\eta = 12.8$	x: 1.5 m $\eta = 46.3$	x: 1.5 m $\eta = 1.8$	x: 1.5 m $\eta = 21.8$	x: 1.5 m $\eta = 52.5$	x: 1.5 m $\eta = 55.3$	x: 1.5 m $\eta = 50.7$	**CUMPLE $\eta = 55.3$**
N120/N124	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 21.1$	$\eta = 2.2$	$\eta = 3.9$	x: 1.5 m $\eta = 10.9$	x: 1.5 m $\eta = 48.2$	$\eta = 6.7$	x: 1.5 m $\eta = 2.9$	x: 1.5 m $\eta = 11.6$	x: 1.5 m $\eta = 50.2$	x: 1.5 m $\eta = 1.4$	x: 1.5 m $\eta = 25.7$	x: 1.5 m $\eta = 58.1$	x: 0 m $\eta = 57.0$	x: 1.5 m $\eta = 53.4$	**CUMPLE $\eta = 58.1$**
N124/N127	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 18.5$	$\eta = 0.2$	$\eta = 3.7$	x: 1.5 m $\eta = 15.5$	x: 1.5 m $\eta = 41.9$	$\eta = 5.8$	x: 1.5 m $\eta = 3.3$	x: 1.5 m $\eta = 15.9$	x: 1.5 m $\eta = 44.0$	x: 1.5 m $\eta = 2.6$	x: 1.5 m $\eta = 19.7$	x: 1.5 m $\eta = 53.9$	x: 1.5 m $\eta = 47.4$	x: 1.5 m $\eta = 49.5$	**CUMPLE $\eta = 53.9$**
N127/N130	x: 0 m $w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 20.9$	$\eta = 2.8$	N.P.(4)	x: 0 m $\eta = 13.0$	x: 0 m $\eta = 43.3$	$\eta = 3.0$	x: 0 m $\eta = 3.5$	N.P.(5)	N.P.(6)	x: 0 m $\eta = 1.8$	x: 0 m $\eta = 18.8$	x: 0 m $\eta = 60.1$	x: 0 m $\eta = 16.8$	x: 0 m $\eta = 59.9$	**CUMPLE $\eta = 60.1$**
N131/N53	x: 0.214 m $w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	N.P.(3)	N.P.(4)	x: 3 m $\eta = 60.6$	x: 3 m $\eta = 13.2$	$\eta = 0.5$	x: 3 m $\eta = 7.1$	N.P.(5)	N.P.(6)	x: 3 m $\eta = 37.3$	x: 3 m $\eta = 1.7$	x: 3 m $\eta = 60.6$	N.P.(7)	N.P.(8)	**CUMPLE $\eta = 60.6$**
N53/N60	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 10.6$	$\eta = 3.5$	$\eta = 4.2$	x: 0 m $\eta = 45.8$	x: 3 m $\eta = 17.7$	$\eta = 1.2$	x: 0 m $\eta = 5.9$	x: 0 m $\eta = 42.0$	x: 3 m $\eta = 20.1$	x: 0 m $\eta = 21.3$	x: 3 m $\eta = 4.1$	x: 0 m $\eta = 61.5$	x: 0 m $\eta = 33.7$	x: 0 m $\eta = 57.4$	**CUMPLE $\eta = 61.5$**
N60/N67	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 19.1$	$\eta = 6.3$	$\eta = 3.1$	x: 0 m $\eta = 40.7$	x: 3 m $\eta = 12.0$	$\eta = 0.8$	x: 0 m $\eta = 5.8$	x: 0 m $\eta = 37.1$	x: 3 m $\eta = 13.8$	x: 0 m $\eta = 16.9$	x: 3 m $\eta = 1.9$	x: 0 m $\eta = 61.0$	x: 3 m $\eta = 29.2$	x: 0 m $\eta = 59.7$	**CUMPLE $\eta = 61.0$**
N67/N74	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 26.3$	$\eta = 8.7$	$\eta = 2.1$	x: 0 m $\eta = 40.7$	x: 3 m $\eta = 6.2$	$\eta = 0.4$	x: 0 m $\eta = 5.8$	x: 0 m $\eta = 36.9$	x: 3 m $\eta = 7.5$	x: 0 m $\eta = 16.9$	x: 3 m $\eta = 0.6$	x: 0 m $\eta = 67.0$	x: 3 m $\eta = 24.7$	x: 0 m $\eta = 67.0$	**CUMPLE $\eta = 67.0$**
N74/N81	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 30.8$	$\eta = 10.2$	$\eta = 1.1$	x: 0 m $\eta = 40.6$	x: 3 m $\eta = 1.5$	x: 0.429 m $\eta = 0.1$	x: 0 m $\eta = 5.8$	x: 0 m $\eta = 36.5$	x: 3 m $\eta = 1.8$	x: 0 m $\eta = 16.8$	x: 3 m $\eta < 0.1$	x: 0 m $\eta = 71.4$	x: 3 m $\eta = 19.8$	x: 0 m $\eta = 71.4$	**CUMPLE $\eta = 71.4$**
N81/N88	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 33.4$	$\eta = 11.0$	$\eta = 0.1$	x: 0 m $\eta = 40.4$	x: 0 m $\eta = 5.1$	$\eta = 0.3$	x: 0 m $\eta = 5.8$	x: 0 m $\eta = 36.1$	x: 0 m $\eta = 5.2$	x: 0 m $\eta = 16.7$	x: 0 m $\eta = 0.3$	x: 0 m $\eta = 73.8$	x: 0 m $\eta = 23.6$	x: 0 m $\eta = 73.8$	**CUMPLE $\eta = 73.8$**
N88/N95	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 34.2$	$\eta = 11.3$	$\eta = 0.7$	x: 3 m $\eta = 40.4$	x: 0 m $\eta = 10.8$	$\eta = 0.7$	x: 3 m $\eta = 5.8$	x: 3 m $\eta = 36.2$	x: 0 m $\eta = 11.2$	x: 3 m $\eta = 16.7$	x: 0 m $\eta = 1.3$	x: 3 m $\eta = 74.6$	x: 0 m $\eta = 30.3$	x: 3 m $\eta = 74.6$	**CUMPLE $\eta = 74.6$**
N95/N102	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 33.4$	$\eta = 11.0$	$\eta = 1.7$	x: 3 m $\eta = 40.6$	x: 0 m $\eta = 16.2$	$\eta = 1.1$	x: 3 m $\eta = 5.8$	x: 3 m $\eta = 36.6$	x: 0 m $\eta = 17.2$	x: 3 m $\eta = 16.8$	x: 0 m $\eta = 3.0$	x: 3 m $\eta = 75.3$	x: 0 m $\eta = 36.6$	x: 3 m $\eta = 74.0$	**CUMPLE $\eta = 75.3$**
N102/N109	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 31.4$	$\eta = 10.4$	$\eta = 2.6$	x: 3 m $\eta = 40.7$	x: 0 m $\eta = 21.4$	$\eta = 1.5$	x: 3 m $\eta = 5.8$	x: 3 m $\eta = 37.0$	x: 0 m $\eta = 22.8$	x: 3 m $\eta = 16.9$	x: 0 m $\eta = 5.2$	x: 3 m $\eta = 76.8$	x: 0 m $\eta = 42.1$	x: 3 m $\eta = 73.4$	**CUMPLE $\eta = 76.8$**
N109/N116	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 28.2$	$\eta = 9.3$	$\eta = 3.3$	x: 3 m $\eta = 40.7$	x: 0 m $\eta = 26.5$	$\eta = 1.9$	x: 3 m $\eta = 5.8$	x: 3 m $\eta = 37.2$	x: 0 m $\eta = 28.3$	x: 3 m $\eta = 16.9$	x: 0 m $\eta = 8.1$	x: 3 m $\eta = 76.9$	x: 3 m $\eta = 46.9$	x: 3 m $\eta = 72.8$	**CUMPLE $\eta = 76.9$**
N116/N123	$w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 26.0$	$\eta = 8.6$	$\eta = 3.8$	x: 3 m $\eta = 46.0$	x: 0 m $\eta = 29.8$	$\eta = 2.1$	x: 3 m $\eta = 5.9$	x: 3 m $\eta = 42.1$	x: 0 m $\eta = 31.9$	x: 3 m $\eta = 21.5$	x: 0 m $\eta = 10.2$	x: 3 m $\eta = 81.5$	x: 3 m $\eta = 50.7$	x: 3 m $\eta = 76.9$	**CUMPLE $\eta = 81.5$**
N123/N132	x: 0 m $w / t \leq (w / t)_{Máx.}$ Cumple	$\eta = 24.8$	$\eta = 8.2$	N.P.(4)	x: 0 m $\eta = 61.0$	x: 0 m $\eta = 18.2$	$\eta = 0.6$	x: 0 m $\eta = 7.1$	N.P.(5)	N.P.(6)	x: 0 m $\eta = 37.8$	x: 0 m $\eta = 3.3$	x: 0 m $\eta = 85.8$	x: 0 m $\eta = 37.4$	x: 0 m $\eta = 85.8$	**CUMPLE $\eta = 85.8$**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N133/N49	x: 0.188 m w / t ≤ (w / t)$_{Máx.}$ Cumple	N.P.(1)	N.P.(3)	N.P.(4)	x: 1.5 m η = 12.5	x: 1.5 m η = 29.7	η = 2.1	x: 1.5 m η = 3.4	N.P.(5)	N.P.(6)	x: 1.5 m η = 1.7	x: 1.5 m η = 8.9	x: 1.5 m η = 32.2	N.P.(7)	N.P.(8)	**CUMPLE η = 32.2**
N49/N52	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 9.2	η = 2.6	η = 4.6	x: 0 m η = 15.0	x: 1.5 m η = 29.8	η = 4.1	x: 0 m η = 3.3	x: 0 m η = 15.3	x: 1.5 m η = 31.9	x: 0 m η = 2.5	x: 1.5 m η = 10.3	x: 0 m η = 52.2	x: 0 m η = 34.9	x: 0 m η = 47.6	**CUMPLE η = 52.2**
N52/N56	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 11.9	η = 8.1	η = 4.5	x: 0 m η = 10.8	x: 1.5 m η = 31.8	η = 4.4	x: 0 m η = 2.9	x: 0 m η = 11.2	x: 1.5 m η = 34.2	x: 0 m η = 1.3	x: 1.5 m η = 11.9	x: 0 m η = 50.0	x: 0 m η = 41.4	x: 0 m η = 47.1	**CUMPLE η = 50.0**
N56/N59	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 20.8	η = 11.2	η = 4.0	x: 0 m η = 12.4	x: 1.5 m η = 25.9	η = 3.5	x: 0 m η = 3.2	x: 0 m η = 12.7	x: 1.5 m η = 28.1	x: 0 m η = 1.7	x: 1.5 m η = 8.0	x: 0 m η = 54.2	x: 0 m η = 38.2	x: 0 m η = 50.1	**CUMPLE η = 54.2**
N59/N63	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 22.9	η = 14.1	η = 3.6	x: 1.5 m η = 10.7	x: 1.5 m η = 23.9	η = 3.3	x: 1.5 m η = 3.1	x: 1.5 m η = 11.0	x: 1.5 m η = 25.9	x: 1.5 m η = 1.3	x: 1.5 m η = 6.8	x: 1.5 m η = 50.1	x: 1.5 m η = 39.7	x: 1.5 m η = 47.6	**CUMPLE η = 50.1**
N63/N66	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 29.3	η = 15.8	η = 2.9	x: 0 m η = 12.0	x: 1.5 m η = 16.4	η = 2.3	x: 0 m η = 3.2	x: 0 m η = 12.3	x: 1.5 m η = 18.1	x: 0 m η = 1.6	x: 1.5 m η = 3.3	x: 0 m η = 52.3	x: 0 m η = 34.2	x: 0 m η = 50.6	**CUMPLE η = 52.3**
N66/N70	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 29.2	η = 16.1	η = 2.5	x: 1.5 m η = 11.2	x: 1.5 m η = 13.9	η = 1.9	x: 1.5 m η = 3.1	x: 1.5 m η = 11.5	x: 1.5 m η = 15.2	x: 1.5 m η = 1.4	x: 1.5 m η = 2.4	x: 1.5 m η = 48.8	x: 1.5 m η = 33.2	x: 1.5 m η = 47.3	**CUMPLE η = 48.8**
N70/N73	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 33.6	η = 16.4	η = 1.9	x: 0 m η = 11.8	x: 1.5 m η = 9.9	η = 1.3	x: 0 m η = 3.2	x: 0 m η = 12.1	x: 1.5 m η = 10.6	x: 0 m η = 1.6	x: 1.5 m η = 1.1	x: 0 m η = 53.0	x: 0 m η = 26.0	x: 0 m η = 51.5	**CUMPLE η = 53.0**
N73/N77	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 34.3	η = 16.8	η = 1.5	x: 1.5 m η = 11.0	x: 0 m η = 7.7	η = 1.0	x: 1.5 m η = 3.1	x: 1.5 m η = 11.2	x: 0 m η = 7.8	x: 1.5 m η = 1.4	x: 0 m η = 0.6	x: 1.5 m η = 51.3	x: 1.5 m η = 24.9	x: 1.5 m η = 49.9	**CUMPLE η = 51.3**
N77/N80	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 37.2	η = 17.2	η = 0.9	x: 0 m η = 11.4	x: 0 m η = 4.5	η = 0.6	x: 0 m η = 3.2	x: 0 m η = 11.7	x: 0 m η = 4.8	x: 0 m η = 1.5	x: 0 m η = 0.2	x: 0 m η = 53.7	x: 0 m η = 23.3	x: 0 m η = 52.4	**CUMPLE η = 53.7**
N80/N84	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 37.7	η = 17.0	η = 0.5	x: 1.5 m η = 11.0	x: 0 m η = 4.7	η = 0.6	x: 1.5 m η = 3.2	x: 1.5 m η = 11.3	x: 0 m η = 5.0	x: 1.5 m η = 1.4	x: 0 m η = 0.3	x: 1.5 m η = 52.0	x: 0 m η = 23.5	x: 1.5 m η = 50.9	**CUMPLE η = 52.0**
N84/N87	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 39.0	η = 16.9	η = 0.5	x: 0 m η = 11.2	x: 0 m η = 10.6	η = 1.4	x: 0 m η = 3.2	x: 0 m η = 11.5	x: 0 m η = 10.8	x: 0 m η = 1.4	x: 0 m η = 1.2	x: 0 m η = 52.4	x: 0 m η = 30.5	x: 0 m η = 51.5	**CUMPLE η = 52.4**
N87/N91	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 38.8	η = 15.8	η = 0.7	x: 1.5 m η = 11.2	x: 0 m η = 12.6	η = 1.7	x: 1.5 m η = 3.2	x: 1.5 m η = 11.5	x: 0 m η = 12.9	x: 1.5 m η = 1.4	x: 0 m η = 1.7	x: 1.5 m η = 50.7	x: 0 m η = 31.2	x: 1.5 m η = 50.1	**CUMPLE η = 50.7**
N91/N94	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 38.4	η = 15.0	η = 1.1	x: 0 m η = 11.0	x: 0 m η = 18.9	η = 2.6	x: 0 m η = 3.2	x: 0 m η = 11.3	x: 0 m η = 19.4	x: 0 m η = 1.4	x: 0 m η = 3.8	x: 0 m η = 51.8	x: 0 m η = 38.2	x: 0 m η = 50.8	**CUMPLE η = 51.8**
N94/N98	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 37.7	η = 13.0	η = 1.5	x: 1.5 m η = 11.4	x: 0 m η = 20.9	η = 2.9	x: 1.5 m η = 3.2	x: 1.5 m η = 11.7	x: 0 m η = 21.8	x: 1.5 m η = 1.5	x: 0 m η = 4.8	x: 1.5 m η = 55.0	x: 1.5 m η = 35.8	x: 1.5 m η = 52.7	**CUMPLE η = 55.0**
N98/N101	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 35.9	η = 11.7	η = 2.0	x: 0 m η = 11.0	x: 0 m η = 27.2	η = 3.8	x: 0 m η = 3.1	x: 0 m η = 11.2	x: 0 m η = 28.3	x: 0 m η = 1.4	x: 0 m η = 8.1	x: 0 m η = 56.8	x: 0 m η = 41.9	x: 0 m η = 55.2	**CUMPLE η = 56.8**
N101/N105	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 34.9	η = 9.2	η = 2.4	x: 1.5 m η = 11.8	x: 0 m η = 29.3	η = 4.1	x: 1.5 m η = 3.2	x: 1.5 m η = 12.1	x: 0 m η = 30.6	x: 1.5 m η = 1.6	x: 0 m η = 9.5	x: 1.5 m η = 59.9	x: 1.5 m η = 41.2	x: 1.5 m η = 56.9	**CUMPLE η = 59.9**
N105/N108	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 32.2	η = 8.0	η = 2.8	x: 0 m η = 11.2	x: 0 m η = 34.7	η = 4.8	x: 0 m η = 3.1	x: 0 m η = 11.5	x: 0 m η = 36.2	x: 0 m η = 1.4	x: 0 m η = 13.3	x: 0 m η = 59.9	x: 0 m η = 46.3	x: 0 m η = 57.7	**CUMPLE η = 59.9**
N108/N112	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 31.7	η = 5.3	η = 3.1	x: 1.5 m η = 12.1	x: 0 m η = 37.2	η = 5.2	x: 1.5 m η = 3.2	x: 1.5 m η = 12.4	x: 0 m η = 39.0	x: 1.5 m η = 1.6	x: 0 m η = 15.4	x: 1.5 m η = 64.0	x: 1.5 m η = 46.0	x: 1.5 m η = 60.6	**CUMPLE η = 64.0**
N112/N115	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 28.0	η = 3.6	η = 3.6	x: 0 m η = 10.8	x: 0 m η = 43.5	η = 6.1	x: 0 m η = 3.1	x: 0 m η = 11.1	x: 0 m η = 45.4	x: 0 m η = 1.3	x: 0 m η = 21.0	x: 0 m η = 63.6	x: 0 m η = 50.6	x: 0 m η = 61.0	**CUMPLE η = 63.6**
N115/N119	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 25.3	η = 1.0	η = 3.8	x: 1.5 m η = 12.5	x: 1.5 m η = 45.2	η = 6.3	x: 1.5 m η = 3.2	x: 1.5 m η = 12.8	x: 1.5 m η = 47.3	x: 1.5 m η = 1.8	x: 1.5 m η = 22.8	x: 1.5 m η = 65.4	x: 1.5 m η = 50.9	x: 1.5 m η = 61.5	**CUMPLE η = 65.4**
N119/N122	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 21.1	η = 2.8	η = 4.0	x: 1.5 m η = 10.9	x: 1.5 m η = 49.1	η = 6.9	x: 1.5 m η = 2.9	x: 1.5 m η = 11.3	x: 1.5 m η = 51.3	x: 1.5 m η = 1.4	x: 1.5 m η = 26.8	x: 0 m η = 59.8	x: 1.5 m η = 57.0	x: 0 m η = 57.1	**CUMPLE η = 59.8**
N122/N126	w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 18.5	η = 4.1	η = 3.6	x: 1.5 m η = 15.5	x: 1.5 m η = 42.5	η = 5.9	x: 1.5 m η = 3.3	x: 1.5 m η = 15.9	x: 1.5 m η = 44.5	x: 1.5 m η = 2.6	x: 1.5 m η = 20.2	x: 1.5 m η = 55.9	x: 1.5 m η = 54.0	x: 1.5 m η = 51.8	**CUMPLE η = 55.9**
N126/N134	x: 0 m w / t ≤ (w / t)$_{Máx.}$ Cumple	η = 16.9	η = 19.3	N.P.(4)	x: 0 m η = 13.0	x: 0 m η = 43.5	η = 3.0	x: 0 m η = 3.5	N.P.(5)	N.P.(6)	x: 0 m η = 1.8	x: 0 m η = 19.0	x: 0 m η = 43.1	x: 0 m η = 71.7	x: 0 m η = 66.1	**CUMPLE η = 71.7**
N6/N3	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 62.7	x: 0 m η = 62.6	η = 5.5	x: 2.746 m η = 10.6	x: 0 m η = 12.7	x: 0 m η = 1.4	x: 0 m η = 0.6	x: 2.746 m η = 10.8	x: 0 m η = 15.8	x: 2.746 m η = 1.2	x: 0 m η = 2.5	x: 0 m η = 75.6	x: 0 m η = 97.7	x: 0 m η = 76.7	**CUMPLE η = 97.7**
N8/N5	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 55.4	x: 0 m η = 53.7	η = 5.4	x: 2.746 m η = 13.9	x: 0 m η = 10.7	x: 0 m η = 1.3	x: 0 m η = 0.7	x: 2.746 m η = 14.2	x: 0 m η = 13.6	x: 2.746 m η = 2.0	x: 0 m η = 1.9	x: 2.746 m η = 70.3	x: 0 m η = 82.5	x: 2.746 m η = 69.6	**CUMPLE η = 82.5**
N10/N7	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 51.0	x: 0 m η = 47.9	η = 5.2	x: 2.746 m η = 11.8	x: 0 m η = 10.9	x: 0 m η = 1.4	x: 0 m η = 0.6	x: 2.746 m η = 12.0	x: 0 m η = 13.8	x: 2.746 m η = 1.4	x: 0 m η = 1.9	x: 2.746 m η = 64.2	x: 0 m η = 74.5	x: 2.746 m η = 63.6	**CUMPLE η = 74.5**
N12/N9	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 44.3	x: 0 m η = 41.5	η = 5.0	x: 2.746 m η = 10.9	x: 0 m η = 10.6	x: 0 m η = 1.4	x: 0 m η = 0.5	x: 2.746 m η = 11.2	x: 0 m η = 13.4	x: 2.746 m η = 1.3	x: 0 m η = 1.8	x: 2.746 m η = 56.0	x: 0 m η = 65.4	x: 2.746 m η = 55.5	**CUMPLE η = 65.4**
N14/N11	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 39.2	x: 0 m η = 36.3	η = 4.7	x: 2.746 m η = 9.6	x: 0 m η = 11.8	x: 0 m η = 1.5	x: 0 m η = 0.5	x: 2.746 m η = 9.7	x: 0 m η = 14.4	x: 2.746 m η = 0.9	x: 0 m η = 2.1	x: 2.746 m η = 49.6	x: 0 m η = 60.0	x: 2.746 m η = 49.3	**CUMPLE η = 60.0**
N16/N13	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 32.5	x: 0 m η = 29.0	η = 4.3	x: 2.746 m η = 8.3	x: 0 m η = 11.9	x: 0 m η = 1.4	x: 0 m η = 0.4	x: 2.746 m η = 8.4	x: 0 m η = 14.3	x: 2.746 m η = 0.7	x: 0 m η = 2.1	x: 2.746 m η = 41.1	x: 0 m η = 50.8	x: 0 m η = 41.7	**CUMPLE η = 50.8**
N18/N15	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 27.3	x: 0 m η = 24.4	η = 3.9	x: 2.746 m η = 6.9	x: 0 m η = 13.0	x: 0 m η = 1.5	x: 0 m η = 0.4	x: 2.746 m η = 7.0	x: 0 m η = 15.2	x: 2.746 m η = 0.5	x: 0 m η = 2.3	x: 2.746 m η = 34.8	x: 0 m η = 45.9	x: 0 m η = 37.9	**CUMPLE η = 45.9**
N20/N17	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 20.6	x: 0 m η = 18.8	η = 3.6	x: 2.746 m η = 5.6	x: 0 m η = 13.0	x: 0 m η = 1.5	x: 0 m η = 0.3	x: 2.746 m η = 5.7	x: 0 m η = 15.1	x: 2.746 m η = 0.3	x: 0 m η = 2.3	x: 0 m η = 28.8	x: 0 m η = 38.6	x: 0 m η = 32.0	**CUMPLE η = 38.6**
N22/N19	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 15.3	x: 0 m η = 14.2	η = 3.3	x: 2.746 m η = 4.2	x: 0 m η = 14.0	x: 0 m η = 1.5	x: 0 m η = 0.2	x: 2.746 m η = 4.2	x: 0 m η = 15.9	x: 2.746 m η = 0.2	x: 0 m η = 2.6	x: 0 m η = 22.6	x: 0 m η = 32.0	x: 0 m η = 28.3	**CUMPLE η = 32.0**
N24/N21	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 8.7	x: 0 m η = 8.5	η = 3.0	x: 2.746 m η = 2.9	x: 0 m η = 14.2	x: 0 m η = 1.5	x: 0 m η = 0.1	x: 2.746 m η = 3.0	x: 0 m η = 15.9	x: 2.746 m η = 0.1	x: 0 m η = 2.6	x: 0 m η = 18.5	x: 0 m η = 26.4	x: 0 m η = 22.9	**CUMPLE η = 26.4**
N26/N23	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 3.1	x: 0 m η = 5.0	η = 2.7	x: 1.765 m η = 1.7	x: 0 m η = 15.0	x: 0 m η = 1.5	x: 2.746 m η = 0.1	x: 2.746 m η = 2.7	x: 0 m η = 16.6	x: 2.746 m η = 0.1	x: 0 m η = 2.8	x: 0 m η = 11.4	x: 0 m η = 23.6	x: 0 m η = 20.4	**CUMPLE η = 23.6**
N26/N27	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 3.1	x: 0 m η = 3.6	η = 3.3	x: 1.765 m η = 1.7	x: 0 m η = 13.5	x: 0 m η = 1.5	x: 0 m η = 0.1	x: 2.746 m η = 2.9	x: 0 m η = 15.4	x: 2.746 m η = 0.1	x: 0 m η = 2.4	x: 0 m η = 11.1	x: 0 m η = 21.4	x: 0 m η = 17.6	**CUMPLE η = 21.4**
N28/N29	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 8.7	x: 0 m η = 7.3	η = 3.5	x: 2.746 m η = 2.9	x: 0 m η = 12.8	x: 0 m η = 1.4	x: 0 m η = 0.1	x: 2.746 m η = 3.2	x: 0 m η = 14.8	x: 2.746 m η = 0.1	x: 0 m η = 2.2	x: 0 m η = 18.2	x: 0 m η = 24.4	x: 0 m η = 20.4	**CUMPLE η = 24.4**
N30/N31	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 15.3	x: 0 m η = 12.8	η = 3.8	x: 2.746 m η = 4.2	x: 0 m η = 12.8	x: 0 m η = 1.5	x: 0 m η = 0.2	x: 2.746 m η = 4.4	x: 0 m η = 14.9	x: 2.746 m η = 0.2	x: 0 m η = 2.2	x: 0 m η = 22.6	x: 0 m η = 30.1	x: 0 m η = 25.7	**CUMPLE η = 30.1**
N32/N33	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 20.6	x: 0 m η = 17.8	η = 4.1	x: 2.746 m η = 5.6	x: 0 m η = 11.9	x: 0 m η = 1.4	x: 0 m η = 0.3	x: 2.746 m η = 5.7	x: 0 m η = 14.2	x: 2.746 m η = 0.3	x: 0 m η = 2.0	x: 0 m η = 28.8	x: 0 m η = 36.6	x: 0 m η = 29.7	**CUMPLE η = 36.6**
N34/N35	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 27.3	x: 0 m η = 23.4	η = 4.3	x: 2.746 m η = 6.9	x: 0 m η = 11.8	x: 0 m η = 1.4	x: 0 m η = 0.4	x: 2.746 m η = 6.8	x: 0 m η = 14.3	x: 2.746 m η = 0.5	x: 0 m η = 2.1	x: 2.746 m η = 34.6	x: 0 m η = 43.7	x: 0 m η = 35.6	**CUMPLE η = 43.7**
N36/N37	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 32.5	x: 0 m η = 28.7	η = 4.7	x: 2.746 m η = 8.2	x: 0 m η = 10.7	x: 0 m η = 1.4	x: 0 m η = 0.4	x: 2.746 m η = 8.3	x: 0 m η = 13.4	x: 2.746 m η = 0.7	x: 0 m η = 1.8	x: 2.746 m η = 41.1	x: 0 m η = 49.3	x: 2.746 m η = 40.9	**CUMPLE η = 49.3**
N38/N39	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 39.2	x: 0 m η = 35.5	η = 4.9	x: 2.746 m η = 9.6	x: 0 m η = 6.2	η = 0.4	x: 0 m η = 0.5	x: 2.746 m η = 9.2	x: 0 m η = 8.9	x: 2.746 m η = 0.9	x: 0 m η = 0.8	x: 2.746 m η = 49.3	x: 0 m η = 51.7	x: 2.746 m η = 49.2	**CUMPLE η = 51.7**
N40/N41	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 44.3	x: 0 m η = 41.6	η = 5.1	x: 2.746 m η = 10.9	x: 0 m η = 9.7	x: 0 m η = 1.3	x: 0 m η = 0.5	x: 2.746 m η = 11.0	x: 0 m η = 12.6	x: 2.746 m η = 1.2	x: 0 m η = 1.6	x: 2.746 m η = 55.5	x: 0 m η = 64.7	x: 2.746 m η = 55.2	**CUMPLE η = 64.7**
N42/N43	w / t ≤ (w / t)$_{Máx.}$ Cumple	x: 2.746 m η = 51.0	x: 0 m η = 48.3	η = 5.2	x: 2.746 m η = 11.8	x: 0 m η = 10.6	x: 0 m η = 1.3	x: 0 m η = 0.6	x: 2.746 m η = 11.9	x: 0 m η = 13.5	x: 2.746 m η = 1.4	x: 0 m η = 1.9	x: 2.746 m η = 63.6	x: 0 m η = 74.8	x: 2.746 m η = 63.2	**CUMPLE η = 74.8**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N44/N45	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 55.3	x: 0 m η = 55.2	η = 5.3	x: 2.746 m η = 13.8	x: 0 m η = 11.0	x: 0 m η = 1.3	x: 0 m η = 0.7	x: 2.746 m η = 14.0	x: 0 m η = 14.0	x: 2.746 m η = 2.0	x: 0 m η = 2.0	x: 2.746 m η = 69.6	x: 0 m η = 85.4	x: 2.746 m η = 69.2	**CUMPLE η = 85.4**
N46/N47	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 62.6	x: 0 m η = 63.5	η = 5.7	x: 2.746 m η = 10.5	x: 0 m η = 12.6	x: 0 m η = 1.4	x: 0 m η = 0.6	x: 2.746 m η = 10.6	x: 0 m η = 15.8	x: 2.746 m η = 1.1	x: 0 m η = 2.5	x: 0 m η = 74.5	x: 0 m η = 100.0	x: 0 m η = 78.0	**CUMPLE η = 100.0**
N51/N137	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 3.7	x: 0 m η = 0.6	η = 4.5	x: 2.3 m η = 16.9	x: 0 m η = 28.5	x: 0 m η = 1.6	η = 1.6	x: 2.3 m η = 17.8	x: 0 m η = 31.1	x: 2.3 m η = 3.2	x: 0 m η = 9.7	x: 0 m η = 40.6	x: 0 m η = 14.4	x: 0 m η = 35.3	**CUMPLE η = 40.6**
N55/N138	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 45.1	η = 5.6	x: 2.3 m η = 20.3	x: 0 m η = 25.5	x: 0 m η = 1.6	η = 1.9	x: 2.3 m η = 20.9	x: 0 m η = 28.5	x: 2.3 m η = 4.4	x: 0 m η = 8.1	N.P.(2)	x: 0 m η = 86.5	x: 0 m η = 76.1	**CUMPLE η = 86.5**
N58/N139	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 43.0	η = 5.7	x: 0 m η = 19.6	x: 0 m η = 19.9	x: 0 m η = 1.3	η = 1.9	x: 0 m η = 20.2	x: 0 m η = 23.1	x: 0 m η = 4.1	x: 0 m η = 5.4	N.P.(2)	x: 0 m η = 77.7	x: 0 m η = 69.0	**CUMPLE η = 77.7**
N62/N140	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 36.9	η = 5.5	x: 0 m η = 17.3	x: 0 m η = 18.2	x: 0 m η = 1.3	η = 1.7	x: 0 m η = 17.8	x: 0 m η = 21.2	x: 0 m η = 3.2	x: 0 m η = 4.5	N.P.(2)	x: 0 m η = 70.4	x: 0 m η = 62.5	**CUMPLE η = 70.4**
N65/N141	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 32.9	η = 4.9	x: 0 m η = 15.3	x: 0 m η = 16.2	x: 0 m η = 1.2	η = 1.5	x: 0 m η = 15.8	x: 0 m η = 19.0	x: 0 m η = 2.5	x: 0 m η = 3.6	N.P.(2)	x: 0 m η = 59.2	x: 0 m η = 53.3	**CUMPLE η = 59.2**
N69/N142	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 27.2	η = 4.0	x: 0 m η = 13.2	x: 0 m η = 15.6	x: 0 m η = 1.2	η = 1.3	x: 0 m η = 13.4	x: 0 m η = 17.8	x: 0 m η = 1.8	x: 0 m η = 3.2	N.P.(2)	x: 0 m η = 53.0	x: 0 m η = 47.7	**CUMPLE η = 53.0**
N72/N143	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 23.0	η = 3.1	x: 0 m η = 11.1	x: 0 m η = 15.1	x: 0 m η = 1.2	η = 1.1	x: 0 m η = 11.4	x: 0 m η = 16.9	x: 0 m η = 1.3	x: 0 m η = 2.9	N.P.(2)	x: 0 m η = 42.9	x: 0 m η = 39.2	**CUMPLE η = 42.9**
N76/N144	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 17.3	η = 2.3	x: 0 m η = 9.0	x: 0 m η = 15.3	x: 0 m η = 1.2	η = 0.9	x: 0 m η = 9.2	x: 0 m η = 16.6	x: 0 m η = 0.8	x: 0 m η = 2.8	N.P.(2)	x: 0 m η = 36.7	x: 0 m η = 33.8	**CUMPLE η = 36.7**
N79/N145	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 13.1	η = 1.6	x: 0 m η = 6.8	x: 0 m η = 14.1	x: 0 m η = 1.2	η = 0.7	x: 0 m η = 7.0	x: 0 m η = 15.0	x: 0 m η = 0.5	x: 0 m η = 2.3	N.P.(2)	x: 0 m η = 25.8	x: 0 m η = 24.8	**CUMPLE η = 25.8**
N83/N146	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 7.4	η = 0.7	x: 0 m η = 4.7	x: 0 m η = 14.5	x: 0 m η = 1.2	η = 0.4	x: 0 m η = 4.8	x: 0 m η = 14.9	x: 0 m η = 0.2	x: 0 m η = 2.2	N.P.(2)	x: 0 m η = 20.2	x: 0 m η = 19.6	**CUMPLE η = 20.2**
N86/N147	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 3.1	η = 0.3	x: 0 m η = 2.6	x: 0 m η = 13.5	x: 0 m η = 1.1	η = 0.2	x: 0 m η = 2.7	x: 0 m η = 13.5	x: 0 m η = 0.1	x: 0 m η = 1.8	N.P.(2)	x: 0 m η = 15.3	x: 0 m η = 15.2	**CUMPLE η = 15.3**
N90/N148	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 0.2	x: 0 m η = 0.5	η = 0.7	x: 0 m η = 0.1	x: 0 m η = 14.2	x: 0 m η = 1.2	η < 0.1	x: 0 m η = 0.5	x: 0 m η = 14.6	x: 0 m η < 0.1	x: 0 m η = 2.1	x: 0.958 m η = 3.5	x: 0 m η = 15.5	x: 0 m η = 14.7	**CUMPLE η = 15.5**
N93/N149	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 3.0	η = 1.4	x: 0 m η = 2.6	x: 0 m η = 13.8	x: 0 m η = 1.2	η = 0.2	x: 0 m η = 2.7	x: 0 m η = 14.7	x: 0 m η = 0.1	x: 0 m η = 2.2	N.P.(2)	x: 0 m η = 16.7	x: 0 m η = 15.1	**CUMPLE η = 16.7**
N97/N150	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 7.3	η = 2.2	x: 0 m η = 4.7	x: 0 m η = 15.0	x: 0 m η = 1.2	η = 0.4	x: 0 m η = 4.8	x: 0 m η = 16.3	x: 0 m η = 0.2	x: 0 m η = 2.7	N.P.(2)	x: 0 m η = 21.7	x: 0 m η = 19.7	**CUMPLE η = 21.7**
N100/N151	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 13.0	η = 2.9	x: 0 m η = 6.9	x: 0 m η = 14.9	x: 0 m η = 1.2	η = 0.7	x: 0 m η = 7.2	x: 0 m η = 16.6	x: 0 m η = 0.5	x: 0 m η = 2.8	N.P.(2)	x: 0 m η = 27.0	x: 0 m η = 25.1	**CUMPLE η = 27.0**
N104/N152	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 17.3	η = 3.6	x: 0 m η = 9.0	x: 0 m η = 16.3	x: 0 m η = 1.3	η = 0.9	x: 0 m η = 9.5	x: 0 m η = 18.3	x: 0 m η = 0.9	x: 0 m η = 3.4	N.P.(2)	x: 0 m η = 38.0	x: 0 m η = 34.2	**CUMPLE η = 38.0**
N107/N153	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 23.0	η = 4.3	x: 0 m η = 11.2	x: 0 m η = 16.3	x: 0 m η = 1.2	η = 1.1	x: 0 m η = 11.9	x: 0 m η = 18.8	x: 0 m η = 1.4	x: 0 m η = 3.5	N.P.(2)	x: 0 m η = 44.5	x: 0 m η = 39.8	**CUMPLE η = 44.5**
N111/N154	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 27.2	η = 5.0	x: 0 m η = 13.2	x: 0 m η = 16.7	x: 0 m η = 1.2	η = 1.3	x: 0 m η = 14.1	x: 0 m η = 19.5	x: 0 m η = 2.0	x: 0 m η = 3.8	N.P.(2)	x: 0 m η = 54.6	x: 0 m η = 48.4	**CUMPLE η = 54.6**
N114/N155	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 32.9	η = 5.9	x: 0 m η = 15.4	x: 0 m η = 17.9	x: 0 m η = 1.2	η = 1.5	x: 0 m η = 16.4	x: 0 m η = 21.3	x: 0 m η = 2.7	x: 0 m η = 4.5	N.P.(2)	x: 0 m η = 61.7	x: 0 m η = 54.5	**CUMPLE η = 61.7**
N118/N156	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 36.9	η = 6.1	x: 0 m η = 17.4	x: 0 m η = 20.1	x: 0 m η = 1.4	η = 1.7	x: 0 m η = 18.6	x: 0 m η = 23.5	x: 0 m η = 3.5	x: 0 m η = 5.5	N.P.(2)	x: 0 m η = 73.0	x: 0 m η = 63.9	**CUMPLE η = 73.0**
N121/N157	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 43.0	η = 6.1	x: 0 m η = 19.7	x: 0 m η = 22.4	x: 0 m η = 1.4	η = 1.9	x: 0 m η = 21.1	x: 0 m η = 25.9	x: 0 m η = 4.5	x: 0 m η = 6.7	N.P.(2)	x: 0 m η = 81.3	x: 0 m η = 71.0	**CUMPLE η = 81.3**
N125/N158	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	x: 0 m η = 45.1	η = 6.3	x: 2.3 m η = 20.8	x: 0 m η = 27.5	x: 0 m η = 1.8	η = 1.9	x: 2.3 m η = 22.3	x: 0 m η = 31.0	x: 2.3 m η = 5.0	x: 0 m η = 9.6	N.P.(2)	x: 0 m η = 90.8	x: 0 m η = 78.5	**CUMPLE η = 90.8**
N128/N159	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.3 m η = 4.0	x: 0 m η = 0.7	η = 5.9	x: 2.3 m η = 17.5	x: 0 m η = 25.0	x: 0 m η = 1.4	η = 1.6	x: 2.3 m η = 19.1	x: 0 m η = 28.4	x: 2.3 m η = 3.7	x: 0 m η = 8.1	x: 0 m η = 40.6	x: 0 m η = 13.1	x: 0 m η = 33.2	**CUMPLE η = 40.6**
N55/N137	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 62.7	N.P.(3)	η = 4.1	x: 2.746 m η = 10.6	x: 0 m η = 5.8	x: 0 m η = 0.7	x: 0 m η = 0.6	x: 2.746 m η = 11.4	x: 0 m η = 8.1	x: 2.746 m η = 1.3	x: 0 m η = 0.7	x: 0 m η = 79.1	N.P.(7)	x: 0 m η = 76.6	**CUMPLE η = 79.1**
N58/N138	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 55.4	N.P.(3)	η = 3.9	x: 2.746 m η = 13.9	x: 0 m η = 3.3	x: 0 m η = 0.6	x: 0 m η = 0.7	x: 2.746 m η = 14.6	x: 0 m η = 5.4	x: 2.746 m η = 2.1	x: 0 m η = 0.3	x: 0 m η = 71.6	N.P.(7)	x: 2.746 m η = 69.6	**CUMPLE η = 71.6**
N62/N139	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 51.0	N.P.(3)	η = 3.6	x: 2.746 m η = 11.8	x: 0 m η = 3.3	x: 0 m η = 0.7	x: 0 m η = 0.6	x: 2.746 m η = 12.6	x: 0 m η = 5.3	x: 2.746 m η = 1.6	x: 0 m η = 0.3	x: 0 m η = 65.5	N.P.(7)	x: 2.746 m η = 63.6	**CUMPLE η = 65.5**
N65/N140	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 44.3	N.P.(3)	η = 3.5	x: 2.746 m η = 10.9	x: 0 m η = 2.8	x: 0 m η = 0.6	x: 0 m η = 0.5	x: 2.746 m η = 11.7	x: 0 m η = 4.7	x: 2.746 m η = 1.4	x: 0 m η = 0.2	x: 2.746 m η = 57.4	N.P.(7)	x: 2.746 m η = 55.7	**CUMPLE η = 57.4**
N69/N141	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 39.2	N.P.(3)	η = 3.2	x: 2.746 m η = 9.7	x: 0 m η = 3.8	x: 0 m η = 0.7	x: 0 m η = 0.5	x: 2.746 m η = 10.5	x: 0 m η = 5.6	x: 2.746 m η = 1.1	x: 0 m η = 0.3	x: 2.746 m η = 51.8	N.P.(7)	x: 2.746 m η = 49.9	**CUMPLE η = 51.8**
N72/N142	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 32.5	N.P.(3)	η = 2.8	x: 2.746 m η = 8.3	x: 0 m η = 4.0	x: 0 m η = 0.7	x: 0 m η = 0.4	x: 2.746 m η = 8.9	x: 0 m η = 5.5	x: 2.746 m η = 0.8	x: 0 m η = 0.3	x: 2.746 m η = 42.3	N.P.(7)	x: 2.746 m η = 40.9	**CUMPLE η = 42.3**
N76/N143	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 27.3	N.P.(3)	η = 2.4	x: 2.746 m η = 7.0	x: 0 m η = 5.0	x: 0 m η = 0.7	x: 0 m η = 0.4	x: 2.746 m η = 7.6	x: 0 m η = 6.3	x: 2.746 m η = 0.6	x: 0 m η = 0.4	x: 0 m η = 36.6	N.P.(7)	x: 2.746 m η = 34.9	**CUMPLE η = 36.6**
N79/N144	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 20.6	N.P.(3)	η = 2.1	x: 2.746 m η = 5.7	x: 0 m η = 5.1	x: 0 m η = 0.7	x: 0 m η = 0.3	x: 2.746 m η = 6.2	x: 0 m η = 6.3	x: 2.746 m η = 0.4	x: 0 m η = 0.4	x: 2.746 m η = 27.6	N.P.(7)	x: 2.746 m η = 26.5	**CUMPLE η = 27.6**
N83/N145	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 15.3	N.P.(3)	η = 1.8	x: 2.746 m η = 4.3	x: 0 m η = 6.0	x: 0 m η = 0.8	x: 0 m η = 0.2	x: 2.746 m η = 4.8	x: 0 m η = 7.0	x: 2.746 m η = 0.2	x: 0 m η = 0.5	x: 0 m η = 22.0	N.P.(7)	x: 0 m η = 20.7	**CUMPLE η = 22.0**
N86/N146	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 8.7	N.P.(3)	η = 1.6	x: 2.746 m η = 3.0	x: 0 m η = 6.2	x: 0 m η = 0.7	x: 0 m η = 0.1	x: 2.746 m η = 3.4	x: 0 m η = 7.1	x: 2.746 m η = 0.1	x: 0 m η = 0.5	x: 0 m η = 13.1	N.P.(7)	x: 0 m η = 12.2	**CUMPLE η = 13.1**
N90/N147	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 3.3	x: 0 m η = 0.7	η = 1.3	x: 1.961 m η = 1.8	x: 0 m η = 7.1	x: 0 m η = 0.8	x: 0 m η = 0.1	x: 1.961 m η = 2.2	x: 0 m η = 7.8	x: 1.765 m η < 0.1	x: 0 m η = 0.6	x: 0 m η = 10.4	x: 0 m η = 6.9	x: 0 m η = 8.9	**CUMPLE η = 10.4**
N90/N149	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 3.1	x: 2.157 m η = 0.6	η = 1.8	x: 1.765 m η = 1.8	x: 0 m η = 5.6	x: 0 m η = 0.7	x: 0 m η = 0.1	x: 1.765 m η = 2.4	x: 0 m η = 6.6	x: 1.765 m η = 0.1	x: 0 m η = 0.4	x: 0 m η = 9.0	x: 0 m η = 5.8	x: 0 m η = 7.0	**CUMPLE η = 9.0**
N93/N150	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 8.7	N.P.(3)	η = 2.1	x: 2.746 m η = 2.9	x: 0 m η = 4.9	x: 0 m η = 0.7	x: 0 m η = 0.1	x: 2.746 m η = 3.5	x: 0 m η = 6.1	x: 2.746 m η = 0.1	x: 0 m η = 0.4	x: 2.354 m η = 12.8	N.P.(7)	x: 2.746 m η = 11.7	**CUMPLE η = 12.8**
N97/N151	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 15.3	N.P.(3)	η = 2.3	x: 2.746 m η = 4.2	x: 0 m η = 4.7	x: 0 m η = 0.7	x: 0 m η = 0.2	x: 2.746 m η = 4.9	x: 0 m η = 6.0	x: 2.746 m η = 0.2	x: 0 m η = 0.4	x: 2.746 m η = 21.4	N.P.(7)	x: 2.746 m η = 19.9	**CUMPLE η = 21.4**
N100/N152	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 20.6	N.P.(3)	η = 2.6	x: 2.746 m η = 5.6	x: 0 m η = 3.9	x: 0 m η = 0.7	x: 0 m η = 0.3	x: 2.746 m η = 6.3	x: 0 m η = 5.4	x: 2.746 m η = 0.4	x: 0 m η = 0.3	x: 2.746 m η = 27.5	N.P.(7)	x: 2.746 m η = 26.3	**CUMPLE η = 27.5**
N104/N153	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 27.3	N.P.(3)	η = 2.8	x: 2.746 m η = 6.9	x: 0 m η = 4.0	x: 0 m η = 0.7	x: 0 m η = 0.4	x: 2.746 m η = 7.6	x: 0 m η = 5.6	x: 2.746 m η = 0.6	x: 0 m η = 0.3	x: 2.746 m η = 36.2	N.P.(7)	x: 2.746 m η = 34.5	**CUMPLE η = 36.2**
N107/N154	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 32.5	N.P.(3)	η = 3.2	x: 2.746 m η = 8.2	x: 0 m η = 3.2	x: 0 m η = 0.6	x: 0 m η = 0.4	x: 2.746 m η = 9.0	x: 0 m η = 5.0	x: 2.746 m η = 0.8	x: 0 m η = 0.3	x: 2.746 m η = 42.1	N.P.(7)	x: 2.746 m η = 40.9	**CUMPLE η = 42.1**
N111/N155	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 39.2	N.P.(3)	η = 3.5	x: 2.746 m η = 9.6	x: 0 m η = 3.1	x: 0 m η = 0.6	x: 0 m η = 0.5	x: 2.746 m η = 10.4	x: 0 m η = 5.0	x: 2.746 m η = 1.1	x: 0 m η = 0.3	x: 2.746 m η = 51.2	N.P.(7)	x: 2.746 m η = 49.2	**CUMPLE η = 51.2**
N114/N156	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 44.3	N.P.(3)	η = 3.8	x: 2.746 m η = 10.9	x: 0 m η = 2.3	x: 0 m η = 0.6	x: 0 m η = 0.5	x: 2.746 m η = 11.7	x: 0 m η = 4.4	x: 2.746 m η = 1.4	x: 0 m η = 0.2	x: 2.746 m η = 56.8	N.P.(7)	x: 2.746 m η = 55.2	**CUMPLE η = 56.8**
N118/N157	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 51.0	N.P.(3)	η = 3.8	x: 2.746 m η = 11.8	x: 0 m η = 3.1	x: 0 m η = 0.6	x: 0 m η = 0.6	x: 2.746 m η = 12.5	x: 0 m η = 5.2	x: 2.746 m η = 1.6	x: 0 m η = 0.3	x: 0 m η = 65.4	N.P.(7)	x: 2.746 m η = 63.2	**CUMPLE η = 65.4**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N121/N158	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 55.5	N.P.(3)	η = 3.9	x: 2.746 m η = 13.8	x: 0 m η = 3.7	x: 0 m η = 0.6	x: 0 m η = 0.7	x: 2.746 m η = 14.5	x: 0 m η = 5.9	x: 2.746 m η = 2.1	x: 0 m η = 0.4	x: 0 m η = 71.8	N.P.(7)	x: 0 m η = 69.6	**CUMPLE η = 71.8**
N125/N159	$w / t \leq (w / t)_{Máx.}$ Cumple	x: 2.746 m η = 62.8	N.P.(3)	η = 4.3	x: 2.746 m η = 10.5	x: 0 m η = 5.6	x: 0 m η = 0.7	x: 0 m η = 0.6	x: 2.746 m η = 11.5	x: 0 m η = 8.0	x: 2.746 m η = 1.3	x: 0 m η = 0.7	x: 0 m η = 79.3	N.P.(7)	x: 0 m η = 76.3	**CUMPLE η = 79.3**
N13/N15	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 13.3	η = 57.9	η = 3.6	x: 1.5 m η = 6.3	x: 1.5 m η = 4.4	x: 0 m η = 0.5	x: 0 m η = 0.4	x: 1.5 m η = 6.3	x: 1.5 m η = 6.4	x: 1.5 m η = 0.4	x: 1.5 m η = 0.4	x: 1.5 m η = 24.1	x: 1.5 m η = 64.5	x: 1.5 m η = 64.2	**CUMPLE η = 64.5**
N15/N17	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 14.2	η = 62.4	η = 3.1	x: 1.5 m η = 6.5	x: 1.313 m η = 4.3	x: 0 m η = 0.4	x: 0 m η = 0.4	x: 1.5 m η = 6.5	x: 1.313 m η = 6.1	x: 1.5 m η = 0.4	x: 1.313 m η = 0.4	x: 1.5 m η = 24.4	x: 1.5 m η = 69.4	x: 1.5 m η = 69.0	**CUMPLE η = 69.4**
N17/N19	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 14.9	η = 65.8	η = 2.2	x: 1.5 m η = 6.1	x: 1.125 m η = 4.4	x: 0 m η = 0.4	x: 0 m η = 0.2	x: 1.5 m η = 6.1	x: 1.125 m η = 5.6	x: 1.5 m η = 0.4	x: 1.125 m η = 0.3	x: 1.5 m η = 24.1	x: 1.5 m η = 72.3	x: 1.5 m η = 72.0	**CUMPLE η = 72.3**
N19/N21	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.5	η = 68.3	η = 1.5	x: 1.5 m η = 6.3	x: 0.938 m η = 4.3	x: 0 m η = 0.4	x: 0 m η = 0.2	x: 1.5 m η = 6.3	x: 0.938 m η = 5.1	x: 1.5 m η = 0.4	x: 0.938 m η = 0.3	x: 1.313 m η = 23.6	x: 1.5 m η = 75.1	x: 1.5 m η = 74.7	**CUMPLE η = 75.1**
N21/N23	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.8	η = 69.8	η = 0.7	x: 1.313 m η = 5.5	x: 0.938 m η = 4.2	x: 0 m η = 0.3	x: 0 m η = 0.1	x: 1.313 m η = 5.5	x: 0.938 m η = 4.5	x: 1.313 m η = 0.3	x: 0.938 m η = 0.2	x: 1.125 m η = 22.8	x: 1.5 m η = 75.6	x: 1.313 m η = 75.3	**CUMPLE η = 75.6**
N23/N25	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 16.0	η = 70.3	η = 0.3	x: 1.5 m η = 6.1	x: 0.563 m η = 4.0	x: 1.5 m η = 0.3	x: 0 m η = 0.2	x: 1.5 m η = 6.2	x: 0.563 m η = 4.0	x: 1.5 m η = 0.4	x: 0.563 m η = 0.2	x: 0.188 m η = 22.0	x: 1.5 m η = 76.9	x: 1.5 m η = 76.5	**CUMPLE η = 76.9**
N25/N27	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 16.0	η = 70.3	η = 1.1	x: 0 m η = 6.1	x: 0.75 m η = 3.9	x: 1.5 m η = 0.3	x: 1.5 m η = 0.2	x: 0 m η = 6.2	x: 0.75 m η = 4.5	x: 0 m η = 0.4	x: 0.75 m η = 0.2	x: 0.938 m η = 22.8	x: 0 m η = 76.9	x: 0 m η = 76.5	**CUMPLE η = 76.9**
N27/N29	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.8	η = 69.8	η = 1.7	x: 0.188 m η = 5.5	x: 0.375 m η = 4.1	x: 1.5 m η = 0.4	x: 1.5 m η = 0.1	x: 0.188 m η = 5.5	x: 0.375 m η = 5.1	x: 0.188 m η = 0.3	x: 0.375 m η = 0.3	x: 0.188 m η = 24.0	x: 0 m η = 75.6	x: 0 m η = 75.3	**CUMPLE η = 75.6**
N29/N31	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.6	η = 68.3	η = 2.6	x: 0 m η = 6.3	x: 0.375 m η = 4.1	x: 1.5 m η = 0.4	x: 1.5 m η = 0.2	x: 0 m η = 6.3	x: 0.375 m η = 5.6	x: 0 m η = 0.4	x: 0.188 m η = 0.3	x: 0 m η = 24.8	x: 0 m η = 75.1	x: 0 m η = 74.7	**CUMPLE η = 75.1**
N31/N33	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.1	η = 65.8	η = 3.2	x: 0 m η = 6.1	x: 0.188 m η = 4.1	x: 1.5 m η = 0.5	x: 1.5 m η = 0.3	x: 0 m η = 6.1	x: 0.188 m η = 6.0	x: 0 m η = 0.4	x: 0.188 m η = 0.4	x: 0 m η = 25.0	x: 0 m η = 72.3	x: 0 m η = 72.0	**CUMPLE η = 72.3**
N33/N35	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 14.4	η = 62.4	η = 4.0	x: 0 m η = 6.4	x: 0 m η = 4.0	x: 1.5 m η = 0.5	x: 1.5 m η = 0.4	x: 0 m η = 6.5	x: 0 m η = 6.2	x: 0 m η = 0.4	x: 0 m η = 0.4	x: 0 m η = 25.1	x: 0 m η = 69.3	x: 0 m η = 69.0	**CUMPLE η = 69.3**
N35/N37	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 13.5	η = 57.9	η = 4.3	x: 0 m η = 6.2	x: 0 m η = 3.9	x: 1.5 m η = 0.6	x: 1.5 m η = 0.4	x: 0 m η = 6.3	x: 0 m η = 6.3	x: 0 m η = 0.4	x: 0 m η = 0.4	x: 0 m η = 24.2	x: 0 m η = 64.5	x: 0 m η = 64.2	**CUMPLE η = 64.5**
N142/N143	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 57.9	η = 3.6	x: 1.5 m η = 6.6	x: 1.5 m η = 4.4	x: 0 m η = 0.4	x: 0 m η = 0.4	x: 1.5 m η = 7.5	x: 1.5 m η = 6.4	x: 1.5 m η = 0.6	x: 1.5 m η = 0.4	N.P.(2)	x: 1.5 m η = 69.3	x: 1.5 m η = 66.3	**CUMPLE η = 69.3**
N143/N144	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 62.4	η = 3.1	x: 1.5 m η = 6.8	x: 1.5 m η = 4.3	x: 0 m η = 0.3	x: 0 m η = 0.4	x: 1.5 m η = 7.7	x: 1.5 m η = 6.1	x: 1.5 m η = 0.6	x: 1.5 m η = 0.4	N.P.(2)	x: 1.5 m η = 73.6	x: 1.5 m η = 70.8	**CUMPLE η = 73.6**
N144/N145	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 65.8	η = 2.2	x: 1.5 m η = 6.4	x: 1.5 m η = 4.3	x: 0 m η = 0.3	x: 0 m η = 0.2	x: 1.5 m η = 7.0	x: 1.5 m η = 5.6	x: 1.5 m η = 0.5	x: 1.5 m η = 0.3	N.P.(2)	x: 1.5 m η = 76.2	x: 1.5 m η = 74.0	**CUMPLE η = 76.2**
N145/N146	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 68.3	η = 1.5	x: 1.5 m η = 6.6	x: 1.125 m η = 4.2	x: 0 m η = 0.2	x: 0 m η = 0.2	x: 1.5 m η = 7.0	x: 1.125 m η = 5.1	x: 1.5 m η = 0.5	x: 1.125 m η = 0.3	N.P.(2)	x: 1.5 m η = 78.3	x: 1.5 m η = 76.4	**CUMPLE η = 78.3**
N146/N147	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 69.8	η = 0.7	x: 1.313 m η = 5.9	x: 0.938 m η = 4.1	x: 0 m η = 0.2	x: 0 m η = 0.1	x: 1.313 m η = 6.0	x: 0.938 m η = 4.5	x: 1.313 m η = 0.4	x: 0.938 m η = 0.2	N.P.(2)	x: 1.313 m η = 78.5	x: 1.313 m η = 77.3	**CUMPLE η = 78.5**
N147/N148	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 70.3	η = 0.3	x: 1.5 m η = 6.1	x: 0.563 m η = 3.9	x: 1.5 m η = 0.2	x: 0 m η = 0.2	x: 1.5 m η = 6.2	x: 0.563 m η = 4.0	x: 1.5 m η = 0.4	x: 0.563 m η = 0.2	N.P.(2)	x: 1.125 m η = 78.5	x: 1.125 m η = 77.7	**CUMPLE η = 78.5**
N148/N149	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 70.3	η = 1.0	x: 0 m η = 6.1	x: 0.563 m η = 3.9	x: 1.5 m η = 0.2	x: 1.5 m η = 0.2	x: 0 m η = 6.3	x: 0.563 m η = 4.4	x: 0 m η = 0.4	x: 0.563 m η = 0.2	N.P.(2)	x: 0.188 m η = 79.2	x: 0.188 m η = 77.7	**CUMPLE η = 79.2**
N149/N150	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 69.8	η = 1.6	x: 0.188 m η = 5.8	x: 0 m η = 4.1	x: 1.5 m η = 0.3	x: 1.5 m η = 0.1	x: 0.188 m η = 6.2	x: 0 m η = 5.0	x: 0.188 m η = 0.4	x: 0 m η = 0.3	N.P.(2)	x: 0 m η = 79.1	x: 0 m η = 77.3	**CUMPLE η = 79.1**
N150/N151	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 68.3	η = 2.5	x: 0 m η = 6.5	x: 0 m η = 4.1	x: 1.5 m η = 0.3	x: 1.5 m η = 0.2	x: 0 m η = 7.2	x: 0 m η = 5.5	x: 0 m η = 0.5	x: 0 m η = 0.3	N.P.(2)	x: 0 m η = 78.9	x: 0 m η = 76.4	**CUMPLE η = 78.9**
N151/N152	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 65.8	η = 3.1	x: 0 m η = 6.3	x: 0 m η = 4.1	x: 1.5 m η = 0.4	x: 1.5 m η = 0.3	x: 0 m η = 7.1	x: 0 m η = 5.9	x: 0 m η = 0.5	x: 0 m η = 0.3	N.P.(2)	x: 0 m η = 76.6	x: 0 m η = 73.9	**CUMPLE η = 76.6**
N152/N153	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 62.5	η = 3.8	x: 0 m η = 6.6	x: 0 m η = 3.9	x: 1.5 m η = 0.4	x: 1.5 m η = 0.4	x: 0 m η = 7.7	x: 0 m η = 6.1	x: 0 m η = 0.6	x: 0 m η = 0.4	N.P.(2)	x: 0 m η = 73.8	x: 0 m η = 70.6	**CUMPLE η = 73.8**
N153/N154	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 58.1	η = 4.1	x: 0 m η = 6.3	x: 0 m η = 3.8	x: 1.5 m η = 0.4	x: 1.5 m η = 0.4	x: 0 m η = 7.5	x: 0 m η = 6.1	x: 0 m η = 0.6	x: 0 m η = 0.4	N.P.(2)	x: 0 m η = 69.2	x: 0 m η = 66.0	**CUMPLE η = 69.2**
N3/N5	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 7.8	η = 36.6	η = 5.6	x: 0 m η = 9.9	x: 0 m η = 3.4	x: 0 m η = 0.9	x: 0 m η = 1.8	x: 0 m η = 10.1	x: 0 m η = 6.8	x: 0 m η = 1.0	x: 0 m η = 0.5	x: 0 m η = 19.0	x: 0 m η = 47.3	x: 0 m η = 46.8	**CUMPLE η = 47.3**
N5/N7	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 10.8	η = 52.1	η = 5.8	x: 1.5 m η = 7.1	x: 1.5 m η = 3.7	x: 0 m η = 1.0	x: 0 m η = 0.6	x: 1.5 m η = 7.2	x: 1.5 m η = 7.3	x: 1.5 m η = 0.5	x: 1.5 m η = 0.5	x: 1.5 m η = 22.7	x: 1.5 m η = 59.5	x: 1.5 m η = 59.3	**CUMPLE η = 59.5**
N7/N9	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 13.5	η = 66.4	η = 6.2	x: 1.5 m η = 8.5	x: 1.5 m η = 5.3	x: 0 m η = 1.0	x: 0 m η = 0.9	x: 1.5 m η = 8.6	x: 1.5 m η = 9.0	x: 1.5 m η = 0.7	x: 1.5 m η = 0.8	x: 1.5 m η = 27.6	x: 1.5 m η = 75.7	x: 1.5 m η = 75.1	**CUMPLE η = 75.7**
N9/N11	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 15.8	η = 78.8	η = 5.8	x: 1.5 m η = 8.3	x: 1.5 m η = 6.5	x: 0 m η = 0.9	x: 0 m η = 0.7	x: 1.5 m η = 8.3	x: 1.5 m η = 10.1	x: 1.5 m η = 0.7	x: 1.5 m η = 1.0	x: 1.5 m η = 30.7	x: 1.5 m η = 87.6	x: 1.5 m η = 87.1	**CUMPLE η = 87.6**
N11/N13	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 17.8	η = 89.8	η = 5.6	x: 1.5 m η = 8.9	x: 1.5 m η = 7.1	x: 0 m η = 0.8	x: 0 m η = 0.7	x: 1.5 m η = 9.0	x: 1.5 m η = 10.5	x: 1.5 m η = 0.8	x: 1.5 m η = 1.1	x: 1.5 m η = 32.9	x: 1.5 m η = 99.6	x: 1.5 m η = 98.9	**CUMPLE η = 99.6**
N37/N39	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 18.2	η = 89.8	η = 5.8	x: 0 m η = 8.9	x: 0 m η = 5.6	x: 1.5 m η = 1.0	x: 1.5 m η = 0.7	x: 0 m η = 8.9	x: 0 m η = 9.2	x: 0 m η = 0.8	x: 0 m η = 0.8	x: 0 m η = 32.0	x: 0 m η = 99.5	x: 0 m η = 98.9	**CUMPLE η = 99.5**
N39/N41	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 16.2	η = 78.8	η = 5.9	x: 0 m η = 8.2	x: 0 m η = 3.9	x: 1.5 m η = 0.9	x: 1.5 m η = 0.7	x: 0 m η = 8.3	x: 0 m η = 7.5	x: 0 m η = 0.7	x: 0 m η = 0.6	x: 0 m η = 28.1	x: 0 m η = 87.6	x: 0 m η = 87.1	**CUMPLE η = 87.6**
N41/N43	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 13.9	η = 66.4	η = 5.7	x: 0 m η = 8.4	x: 0 m η = 2.9	x: 1.5 m η = 1.0	x: 1.5 m η = 0.9	x: 0 m η = 8.4	x: 0 m η = 6.4	x: 0 m η = 0.7	x: 0 m η = 0.4	x: 0 m η = 24.9	x: 0 m η = 75.5	x: 0 m η = 75.0	**CUMPLE η = 75.5**
N43/N45	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 11.1	η = 52.1	η = 5.5	x: 0 m η = 7.0	x: 1.5 m η = 3.7	x: 1.5 m η = 0.9	x: 1.5 m η = 0.6	x: 0 m η = 7.4	x: 1.5 m η = 7.0	x: 0 m η = 0.6	x: 1.5 m η = 0.5	x: 1.5 m η = 20.3	x: 0 m η = 59.5	x: 0 m η = 59.1	**CUMPLE η = 59.5**
N45/N47	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 8.0	η = 36.6	η = 5.8	x: 1.5 m η = 10.2	x: 1.5 m η = 2.8	x: 1.5 m η = 0.7	x: 1.5 m η = 1.8	x: 1.5 m η = 10.2	x: 1.5 m η = 6.3	x: 1.5 m η = 1.1	x: 1.5 m η = 0.4	x: 1.5 m η = 20.1	x: 1.5 m η = 47.1	x: 1.5 m η = 46.8	**CUMPLE η = 47.1**
N137/N138	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 36.9	η = 4.8	x: 0 m η = 9.9	x: 0 m η = 2.7	x: 0 m η = 0.6	x: 0 m η = 1.8	x: 0 m η = 11.3	x: 0 m η = 5.6	x: 0 m η = 1.3	x: 0 m η = 0.3	N.P.(2)	x: 0 m η = 51.2	x: 0 m η = 47.6	**CUMPLE η = 51.2**
N138/N139	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 52.4	η = 5.2	x: 1.5 m η = 7.4	x: 1.5 m η = 3.3	x: 0 m η = 0.8	x: 0 m η = 0.6	x: 1.5 m η = 8.8	x: 1.5 m η = 6.5	x: 1.5 m η = 0.8	x: 1.5 m η = 0.4	N.P.(2)	x: 1.5 m η = 64.9	x: 1.5 m η = 61.1	**CUMPLE η = 64.9**
N139/N140	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 66.6	η = 5.8	x: 1.5 m η = 8.8	x: 1.5 m η = 5.1	x: 0 m η = 0.8	x: 0 m η = 0.9	x: 1.5 m η = 10.5	x: 1.5 m η = 8.6	x: 1.5 m η = 1.1	x: 1.5 m η = 0.7	N.P.(2)	x: 1.5 m η = 82.0	x: 1.5 m η = 77.2	**CUMPLE η = 82.0**
N140/N141	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 79.0	η = 5.6	x: 1.5 m η = 8.6	x: 1.5 m η = 6.5	x: 0 m η = 0.7	x: 0 m η = 0.7	x: 1.5 m η = 10.2	x: 1.5 m η = 9.9	x: 1.5 m η = 1.0	x: 1.5 m η = 1.0	N.P.(2)	x: 1.5 m η = 95.2	x: 1.5 m η = 90.3	**CUMPLE η = 95.2**
N155/N156	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 79.2	η = 5.6	x: 0 m η = 8.2	x: 0 m η = 4.6	x: 1.5 m η = 0.8	x: 1.5 m η = 0.7	x: 0 m η = 9.7	x: 0 m η = 8.0	x: 0 m η = 0.9	x: 0 m η = 0.6	N.P.(2)	x: 0 m η = 93.9	x: 0 m η = 89.3	**CUMPLE η = 93.9**
N156/N157	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 66.9	η = 5.4	x: 0 m η = 8.4	x: 0 m η = 2.8	x: 1.5 m η = 0.8	x: 1.5 m η = 0.9	x: 0 m η = 10.0	x: 0 m η = 6.1	x: 0 m η = 1.0	x: 0 m η = 0.4	N.P.(2)	x: 0 m η = 80.3	x: 0 m η = 76.1	**CUMPLE η = 80.3**
N157/N158	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 52.6	η = 5.0	x: 0 m η = 7.0	x: 1.5 m η = 3.8	x: 1.5 m η = 0.7	x: 1.5 m η = 0.6	x: 0 m η = 8.1	x: 1.5 m η = 6.8	x: 0 m η = 0.7	x: 1.5 m η = 0.5	N.P.(2)	x: 0 m η = 63.0	x: 0 m η = 59.8	**CUMPLE η = 63.0**
N158/N159	$w / t \leq (w / t)_{Máx.}$ Cumple	N.P.(1)	η = 37.1	η = 5.0	x: 1.5 m η = 10.6	x: 1.5 m η = 2.3	x: 1.5 m η = 0.4	x: 1.5 m η = 1.8	x: 1.5 m η = 12.1	x: 1.5 m η = 5.3	x: 1.5 m η = 1.5	x: 1.5 m η = 0.3	N.P.(2)	x: 1.5 m η = 52.2	x: 1.5 m η = 48.5	**CUMPLE η = 52.2**
N1/N4	$w / t \leq (w / t)_{Máx.}$ Cumple	η = 14.0	η = 16.7	η = 5.1	x: 1.5 m η = 4.4	x: 1.5 m η = 36.6	x: 0 m η = 4.4	x: 0 m η = 0.9	x: 1.5 m η = 7.3	x: 1.5 m η = 39.7	x: 1.5 m η = 0.5	x: 1.5 m η = 15.9	x: 1.5 m η = 35.1	x: 1.5 m η = 60.7	x: 1.5 m η = 51.1	**CUMPLE η = 60.7**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N4/N6	w / t ≤ (w / t)Máx. Cumple	η = 10.8	η = 18.1	η = 8.3	x: 1.5 m η = 3.6	x: 0 m η = 22.4	x: 0 m η = 5.1	x: 0 m η = 0.9	x: 1.5 m η = 8.1	x: 1.5 m η = 24.8	x: 1.5 m η = 0.7	x: 0 m η = 6.4	x: 0 m η = 33.9	x: 1.5 m η = 38.0	x: 0 m η = 34.4	**CUMPLE η = 38.0**
N135/N51	w / t ≤ (w / t)Máx. Cumple	η = 14.4	η = 2.6	η = 3.3	x: 1.5 m η = 4.4	x: 1.5 m η = 35.3	x: 0 m η = 4.2	x: 0 m η = 1.0	x: 1.5 m η = 6.3	x: 1.5 m η = 37.4	x: 1.5 m η = 0.4	x: 1.5 m η = 14.1	x: 1.5 m η = 41.2	x: 1.5 m η = 16.9	x: 1.5 m η = 39.6	**CUMPLE η = 41.2**
N51/N55	w / t ≤ (w / t)Máx. Cumple	η = 12.2	x: 0.75 m η = 3.6	η = 8.3	x: 0 m η = 4.0	x: 0 m η = 22.4	η = 4.8	x: 0 m η = 1.1	x: 1.5 m η = 8.1	x: 0 m η = 23.2	x: 1.5 m η = 0.7	x: 0 m η = 5.6	x: 0 m η = 35.3	x: 1.5 m η = 13.6	x: 0 m η = 34.4	**CUMPLE η = 35.3**
N6/N8	w / t ≤ (w / t)Máx. Cumple	η = 20.7	η = 30.1	η = 8.8	x: 1.5 m η = 7.4	x: 1.5 m η = 25.9	x: 0 m η = 6.0	x: 0 m η = 1.9	x: 1.5 m η = 10.5	x: 1.5 m η = 28.0	x: 1.5 m η = 1.1	x: 1.5 m η = 8.1	x: 1.5 m η = 44.8	x: 1.5 m η = 64.5	x: 1.5 m η = 51.3	**CUMPLE η = 64.5**
N8/N10	w / t ≤ (w / t)Máx. Cumple	η = 28.8	η = 34.9	η = 8.1	x: 1.5 m η = 7.4	x: 1.5 m η = 19.9	x: 0 m η = 4.6	x: 0 m η = 1.3	x: 1.5 m η = 9.8	x: 1.5 m η = 22.9	x: 1.5 m η = 1.0	x: 1.5 m η = 5.4	x: 1.5 m η = 50.8	x: 1.5 m η = 59.8	x: 1.5 m η = 50.6	**CUMPLE η = 59.8**
N55/N58	w / t ≤ (w / t)Máx. Cumple	η = 26.7	x: 0.75 m η = 6.5	η = 8.7	x: 1.5 m η = 9.2	x: 1.5 m η = 20.2	x: 0 m η = 4.5	x: 0 m η = 2.1	x: 1.5 m η = 12.3	x: 1.5 m η = 25.3	x: 1.5 m η = 1.5	x: 1.5 m η = 6.6	x: 1.5 m η = 48.6	x: 1.5 m η = 18.8	x: 1.5 m η = 44.5	**CUMPLE η = 48.6**
N58/N62	w / t ≤ (w / t)Máx. Cumple	η = 35.5	x: 0.563 m η = 6.6	η = 8.1	x: 1.5 m η = 9.1	x: 0 m η = 17.3	η = 3.8	x: 0 m η = 1.4	x: 1.5 m η = 10.9	x: 0 m η = 17.9	x: 1.5 m η = 1.2	x: 0 m η = 3.4	x: 1.5 m η = 55.5	x: 1.5 m η = 18.1	x: 1.5 m η = 52.6	**CUMPLE η = 55.5**
N62/N65	w / t ≤ (w / t)Máx. Cumple	η = 46.7	x: 0.375 m η = 9.6	η = 7.0	x: 1.5 m η = 8.6	x: 1.5 m η = 16.5	x: 0 m η = 3.4	x: 0 m η = 1.3	x: 1.5 m η = 11.0	x: 1.5 m η = 20.6	x: 1.5 m η = 1.2	x: 1.5 m η = 4.3	x: 1.5 m η = 63.8	x: 1.5 m η = 20.2	x: 1.5 m η = 59.1	**CUMPLE η = 63.8**
N65/N69	w / t ≤ (w / t)Máx. Cumple	η = 54.0	x: 0.375 m η = 9.1	η = 6.1	x: 1.5 m η = 9.4	x: 0 m η = 11.4	η = 2.3	x: 0 m η = 1.3	x: 1.5 m η = 10.5	x: 0 m η = 12.0	x: 1.5 m η = 1.1	x: 0 m η = 1.5	x: 1.5 m η = 69.6	x: 1.5 m η = 16.5	x: 1.5 m η = 67.4	**CUMPLE η = 69.6**
N10/N12	w / t ≤ (w / t)Máx. Cumple	η = 36.8	η = 43.9	η = 7.1	x: 1.5 m η = 7.0	x: 1.5 m η = 20.1	x: 0 m η = 4.5	x: 0 m η = 1.1	x: 1.5 m η = 9.0	x: 1.5 m η = 22.7	x: 1.5 m η = 0.8	x: 1.5 m η = 5.3	x: 1.5 m η = 56.3	x: 1.5 m η = 73.2	x: 1.5 m η = 62.0	**CUMPLE η = 73.2**
N12/N14	w / t ≤ (w / t)Máx. Cumple	η = 43.6	η = 47.7	η = 6.1	x: 1.5 m η = 8.1	x: 1.5 m η = 11.8	x: 0 m η = 2.8	x: 0 m η = 1.2	x: 1.5 m η = 8.7	x: 1.5 m η = 14.2	x: 1.5 m η = 0.8	x: 1.5 m η = 2.1	x: 1.5 m η = 60.6	x: 1.5 m η = 66.4	x: 1.5 m η = 59.8	**CUMPLE η = 66.4**
N111/N114	w / t ≤ (w / t)Máx. Cumple	η = 41.1	N.P.(3)	η = 6.6	x: 0 m η = 9.2	x: 0 m η = 18.3	x: 1.5 m η = 4.1	x: 1.5 m η = 1.3	x: 0 m η = 10.5	x: 0 m η = 22.3	x: 0 m η = 1.1	x: 0 m η = 5.1	x: 0 m η = 55.5	N.P.(7)	x: 0 m η = 53.7	**CUMPLE η = 55.5**
N114/N118	w / t ≤ (w / t)Máx. Cumple	η = 33.3	η = 0.7	η = 7.0	x: 0 m η = 8.1	x: 0 m η = 27.2	x: 1.5 m η = 6.1	x: 1.5 m η = 1.3	x: 0 m η = 10.6	x: 0 m η = 31.3	x: 0 m η = 1.1	x: 0 m η = 10.1	x: 0 m η = 49.6	x: 0 m η = 39.1	x: 0 m η = 47.0	**CUMPLE η = 49.6**
N38/N40	w / t ≤ (w / t)Máx. Cumple	η = 41.1	η = 22.2	η = 6.5	x: 0 m η = 8.1	x: 0 m η = 19.0	x: 1.5 m η = 4.5	x: 1.5 m η = 1.2	x: 0 m η = 8.7	x: 0 m η = 22.9	x: 0 m η = 0.8	x: 0 m η = 5.4	x: 0 m η = 54.7	x: 0 m η = 52.2	x: 0 m η = 53.7	**CUMPLE η = 54.7**
N40/N42	w / t ≤ (w / t)Máx. Cumple	η = 33.3	η = 17.1	η = 7.0	x: 0 m η = 6.9	x: 0 m η = 28.4	x: 1.5 m η = 6.6	x: 1.5 m η = 1.1	x: 0 m η = 8.2	x: 0 m η = 32.5	x: 0 m η = 0.7	x: 0 m η = 10.9	x: 0 m η = 49.5	x: 0 m η = 56.5	x: 0 m η = 48.4	**CUMPLE η = 56.5**
N42/N44	w / t ≤ (w / t)Máx. Cumple	η = 24.4	x: 0.938 m η = 2.9	η = 7.5	x: 0 m η = 7.3	x: 1.5 m η = 25.9	x: 1.5 m η = 6.2	x: 1.5 m η = 1.3	x: 0 m η = 8.6	x: 1.5 m η = 30.5	x: 0 m η = 0.7	x: 1.5 m η = 9.7	x: 0 m η = 49.0	x: 0 m η = 36.5	x: 0 m η = 45.5	**CUMPLE η = 49.0**
N44/N46	w / t ≤ (w / t)Máx. Cumple	η = 16.5	x: 0.75 m η = 6.7	η = 7.7	x: 1.5 m η = 7.4	x: 1.5 m η = 37.7	x: 1.5 m η = 8.4	x: 1.5 m η = 1.9	x: 1.5 m η = 8.9	x: 1.5 m η = 42.2	x: 1.5 m η = 0.8	x: 1.5 m η = 18.5	x: 1.5 m η = 51.3	x: 1.5 m η = 22.9	x: 1.5 m η = 46.8	**CUMPLE η = 51.3**
N118/N121	w / t ≤ (w / t)Máx. Cumple	η = 24.4	η = 17.3	η = 7.5	x: 0 m η = 8.6	x: 0 m η = 24.4	x: 1.5 m η = 5.7	x: 1.5 m η = 1.4	x: 0 m η = 10.1	x: 0 m η = 29.0	x: 0 m η = 1.0	x: 0 m η = 8.7	x: 0 m η = 40.0	x: 0 m η = 54.8	x: 0 m η = 43.2	**CUMPLE η = 54.8**
N121/N125	w / t ≤ (w / t)Máx. Cumple	η = 14.5	η = 22.7	η = 7.6	x: 1.5 m η = 8.7	x: 1.5 m η = 36.2	x: 1.5 m η = 7.9	x: 1.5 m η = 2.1	x: 1.5 m η = 11.4	x: 1.5 m η = 40.6	x: 1.5 m η = 1.4	x: 1.5 m η = 17.1	x: 0 m η = 29.9	x: 1.5 m η = 72.2	x: 1.5 m η = 59.5	**CUMPLE η = 72.2**
N125/N128	w / t ≤ (w / t)Máx. Cumple	x: 0.75 m η = 8.7	η = 45.4	η = 6.9	x: 1.5 m η = 6.7	x: 1.5 m η = 17.4	x: 1.5 m η = 4.1	x: 1.5 m η = 1.3	x: 1.5 m η = 10.4	x: 1.5 m η = 21.6	x: 1.5 m η = 1.1	x: 1.5 m η = 4.8	x: 1.5 m η = 19.2	x: 1.5 m η = 78.2	x: 1.5 m η = 66.7	**CUMPLE η = 78.2**
N46/N48	w / t ≤ (w / t)Máx. Cumple	η = 21.1	x: 0.563 m η = 16.3	η = 6.8	x: 1.5 m η = 6.2	x: 1.5 m η = 18.5	x: 1.5 m η = 4.5	x: 1.5 m η = 1.0	x: 1.5 m η = 9.8	x: 1.5 m η = 22.7	x: 1.5 m η = 1.0	x: 1.5 m η = 5.3	x: 1.5 m η = 48.9	x: 1.5 m η = 28.3	x: 1.5 m η = 42.9	**CUMPLE η = 48.9**
N48/N2	w / t ≤ (w / t)Máx. Cumple	η = 25.8	x: 1.5 m η = 18.3	η = 4.6	x: 1.5 m η = 2.7	x: 0 m η = 59.0	x: 1.5 m η = 7.1	x: 1.5 m η = 0.8	x: 1.5 m η = 3.7	x: 0 m η = 61.8	x: 1.5 m η = 0.1	x: 0 m η = 38.6	x: 0 m η = 80.6	x: 0 m η = 38.4	x: 0 m η = 81.2	**CUMPLE η = 81.2**
N34/N36	w / t ≤ (w / t)Máx. Cumple	η = 36.9	η = 22.9	η = 4.8	x: 0.188 m η = 6.0	x: 0 m η = 10.6	x: 1.5 m η = 2.9	x: 1.5 m η = 0.8	x: 0.188 m η = 6.5	x: 0 m η = 13.4	x: 0.188 m η = 0.4	x: 0 m η = 1.8	x: 0 m η = 47.1	x: 0 m η = 41.6	x: 0 m η = 45.7	**CUMPLE η = 47.1**
N36/N38	w / t ≤ (w / t)Máx. Cumple	η = 33.0	η = 20.6	η = 5.5	x: 0.188 m η = 5.4	x: 0 m η = 15.7	x: 1.5 m η = 4.4	x: 1.5 m η = 0.7	x: 0 m η = 6.2	x: 0 m η = 18.7	x: 0 m η = 0.4	x: 0 m η = 3.6	x: 0 m η = 42.6	x: 0 m η = 45.3	x: 0 m η = 41.2	**CUMPLE η = 45.3**
N104/N107	w / t ≤ (w / t)Máx. Cumple	η = 40.0	x: 1.313 m η = 2.8	η = 4.8	x: 0 m η = 6.8	x: 0 m η = 10.1	x: 1.5 m η = 2.6	x: 1.5 m η = 0.8	x: 0 m η = 7.7	x: 0 m η = 12.9	x: 0 m η = 0.6	x: 0 m η = 1.7	x: 0 m η = 50.7	x: 0 m η = 9.8	x: 0 m η = 48.6	**CUMPLE η = 50.7**
N107/N111	w / t ≤ (w / t)Máx. Cumple	η = 35.6	x: 1.125 m η = 2.5	η = 5.3	x: 0 m η = 6.1	x: 0 m η = 15.2	x: 1.5 m η = 4.1	x: 1.5 m η = 0.8	x: 0 m η = 8.0	x: 0 m η = 18.1	x: 0 m η = 0.6	x: 0 m η = 3.4	x: 0 m η = 50.1	x: 0 m η = 11.4	x: 0 m η = 45.7	**CUMPLE η = 50.1**
N30/N32	w / t ≤ (w / t)Máx. Cumple	η = 42.7	η = 29.9	η = 3.1	x: 0.375 m η = 6.0	x: 0 m η = 7.7	x: 1.5 m η = 2.0	x: 1.5 m η = 0.6	x: 0.375 m η = 6.5	x: 0 m η = 9.4	x: 0.375 m η = 0.4	x: 0 m η = 0.9	x: 0 m η = 51.3	x: 0 m η = 43.6	x: 0 m η = 50.0	**CUMPLE η = 51.3**
N32/N34	w / t ≤ (w / t)Máx. Cumple	η = 40.2	η = 28.4	η = 4.0	x: 0.563 m η = 5.6	x: 0 m η = 13.1	x: 1.5 m η = 3.5	x: 1.5 m η = 0.5	x: 0.563 m η = 6.1	x: 0 m η = 15.2	x: 0.563 m η = 0.4	x: 0 m η = 2.4	x: 0 m η = 48.8	x: 0 m η = 49.0	x: 0 m η = 47.4	**CUMPLE η = 49.0**
N97/N100	w / t ≤ (w / t)Máx. Cumple	η = 48.5	x: 1.313 m η = 4.7	η = 3.1	x: 0.188 m η = 6.5	x: 0 m η = 7.4	x: 1.5 m η = 1.7	x: 1.5 m η = 0.7	x: 0.188 m η = 6.9	x: 0 m η = 9.2	x: 0.188 m η = 0.5	x: 0 m η = 0.9	x: 0 m η = 57.7	x: 0 m η = 9.7	x: 0 m η = 56.6	**CUMPLE η = 57.7**
N100/N104	w / t ≤ (w / t)Máx. Cumple	η = 45.8	x: 1.5 m η = 4.3	η = 3.9	x: 0.375 m η = 6.0	x: 0 m η = 12.7	x: 1.5 m η = 3.2	x: 1.5 m η = 0.6	x: 0.375 m η = 7.6	x: 0 m η = 14.8	x: 0.375 m η = 0.6	x: 0 m η = 2.3	x: 0 m η = 58.8	x: 0 m η = 11.9	x: 0 m η = 55.3	**CUMPLE η = 58.8**
N26/N28	w / t ≤ (w / t)Máx. Cumple	η = 45.6	η = 34.2	η = 1.4	x: 0.375 m η = 6.5	x: 0 m η = 4.7	x: 1.5 m η = 1.1	x: 1.5 m η = 0.6	x: 0.375 m η = 7.0	x: 0 m η = 5.5	x: 0.375 m η = 0.5	x: 0 m η = 0.3	x: 0.375 m η = 53.2	x: 0 m η = 42.2	x: 0.375 m η = 52.2	**CUMPLE η = 53.2**
N28/N30	w / t ≤ (w / t)Máx. Cumple	η = 44.5	η = 33.5	η = 2.1	x: 0.75 m η = 5.8	x: 0 m η = 10.2	x: 1.5 m η = 2.6	x: 1.5 m η = 0.4	x: 0.75 m η = 6.3	x: 0 m η = 11.3	x: 0.75 m η = 0.4	x: 0 m η = 1.3	x: 1.125 m η = 51.6	x: 0 m η = 49.1	x: 0.938 m η = 50.5	**CUMPLE η = 51.6**
N90/N93	w / t ≤ (w / t)Máx. Cumple	η = 53.5	x: 1.5 m η = 6.2	η = 1.3	x: 0.375 m η = 6.5	x: 0 m η = 4.8	x: 1.5 m η = 0.9	x: 1.5 m η = 0.6	x: 0.375 m η = 7.0	x: 0 m η = 5.5	x: 0.375 m η = 0.5	x: 0 m η = 0.3	x: 0 m η = 62.4	x: 0 m η = 8.3	x: 0 m η = 61.8	**CUMPLE η = 62.4**
N93/N97	w / t ≤ (w / t)Máx. Cumple	η = 52.2	x: 0.938 m η = 6.0	η = 2.1	x: 0.563 m η = 6.1	x: 0 m η = 10.1	x: 1.5 m η = 2.4	x: 1.5 m η = 0.4	x: 0.563 m η = 7.1	x: 0 m η = 11.1	x: 0.563 m η = 0.5	x: 0 m η = 1.3	x: 0 m η = 63.9	x: 0 m η = 11.6	x: 0 m η = 61.4	**CUMPLE η = 63.9**
N22/N24	w / t ≤ (w / t)Máx. Cumple	η = 44.8	η = 35.5	η = 0.9	x: 0.75 m η = 5.8	x: 1.5 m η = 2.8	x: 0 m η = 0.7	x: 0 m η = 0.4	x: 0.75 m η = 6.3	x: 1.5 m η = 3.0	x: 0.75 m η = 0.4	x: 1.5 m η = 0.1	x: 0.188 m η = 52.6	x: 0.938 m η = 41.4	x: 0.188 m η = 51.3	**CUMPLE η = 52.6**
N24/N26	w / t ≤ (w / t)Máx. Cumple	η = 45.7	η = 35.6	η = 0.9	x: 1.125 m η = 6.5	x: 0 m η = 7.0	x: 1.5 m η = 1.7	x: 0 m η = 0.6	x: 1.125 m η = 7.0	x: 0 m η = 7.1	x: 1.125 m η = 0.5	x: 0 m η = 0.5	x: 1.5 m η = 53.7	x: 0 m η = 45.6	x: 1.5 m η = 52.6	**CUMPLE η = 53.7**
N83/N86	w / t ≤ (w / t)Máx. Cumple	η = 53.8	x: 0.938 m η = 6.5	η = 1.1	x: 0.75 m η = 6.1	x: 0 m η = 2.9	η = 0.6	x: 0 m η = 0.4	x: 0.75 m η = 6.7	x: 0 m η = 3.5	x: 0.75 m η = 0.5	x: 0 m η = 0.1	x: 0.188 m η = 63.0	x: 1.5 m η = 9.1	x: 0.188 m η = 61.4	**CUMPLE η = 63.0**
N86/N90	w / t ≤ (w / t)Máx. Cumple	η = 54.7	x: 1.5 m η = 6.5	η = 0.9	x: 1.125 m η = 6.5	x: 0 m η = 7.5	x: 1.5 m η = 1.6	x: 0 m η = 0.6	x: 1.125 m η = 7.0	x: 0 m η = 7.6	x: 1.125 m η = 0.5	x: 0 m η = 0.6	x: 0 m η = 65.1	x: 0 m η = 10.2	x: 0 m η = 63.7	**CUMPLE η = 65.1**
N18/N20	w / t ≤ (w / t)Máx. Cumple	η = 40.9	η = 34.3	η = 2.9	x: 0.938 m η = 5.6	x: 1.5 m η = 6.0	x: 0 m η = 1.6	x: 0 m η = 0.5	x: 0.938 m η = 6.1	x: 1.5 m η = 7.3	x: 0.938 m η = 0.4	x: 1.5 m η = 0.5	x: 1.5 m η = 51.0	x: 1.5 m η = 45.5	x: 1.5 m η = 49.5	**CUMPLE η = 51.0**
N20/N22	w / t ≤ (w / t)Máx. Cumple	η = 43.1	η = 35.0	η = 1.9	x: 1.125 m η = 6.0	x: 0 m η = 4.4	x: 1.5 m η = 1.0	x: 0 m η = 0.6	x: 1.125 m η = 6.5	x: 0 m η = 5.4	x: 1.125 m η = 0.4	x: 0 m η = 0.3	x: 1.5 m η = 52.9	x: 0 m η = 43.2	x: 1.5 m η = 51.5	**CUMPLE η = 52.9**
N76/N79	w / t ≤ (w / t)Máx. Cumple	η = 50.1	x: 1.5 m η = 6.6	η = 2.8	x: 1.125 m η = 6.1	x: 1.5 m η = 5.2	η = 1.1	x: 0 m η = 0.6	x: 1.125 m η = 7.3	x: 1.5 m η = 6.7	x: 1.125 m η = 0.5	x: 1.5 m η = 0.5	x: 0.375 m η = 59.9	x: 1.5 m η = 11.2	x: 0.375 m η = 57.1	**CUMPLE η = 59.9**
N79/N83	w / t ≤ (w / t)Máx. Cumple	η = 52.4	x: 1.125 m η = 6.6	η = 1.9	x: 1.313 m η = 6.4	x: 0 m η = 5.4	x: 1.5 m η = 1.2	x: 0 m η = 0.6	x: 1.125 m η = 6.5	x: 0 m η = 6.2	x: 1.125 m η = 0.4	x: 0 m η = 0.4	x: 1.5 m η = 61.7	x: 0 m η = 8.9	x: 1.5 m η = 61.2	**CUMPLE η = 61.7**
N14/N16	w / t ≤ (w / t)Máx. Cumple	η = 34.4	η = 31.4	η = 4.7	x: 1.313 m η = 5.4	x: 1.5 m η = 8.9	x: 0 m η = 2.4	x: 0 m η = 0.7	x: 1.5 m η = 5.9	x: 1.5 m η = 11.4	x: 1.5 m η = 0.4	x: 1.5 m η = 1.3	x: 1.5 m η = 46.3	x: 1.5 m η = 47.8	x: 1.5 m η = 44.8	**CUMPLE η = 47.8**
N16/N18	w / t ≤ (w / t)Máx. Cumple	η = 37.9	η = 32.9	η = 3.9	x: 1.313 m η = 6.1	x: 1.5 m η = 5.6	x: 0 m η = 1.5	x: 0 m η = 0.8	x: 1.313 m η = 6.6	x: 1.5 m η = 7.1	x: 1.313 m η = 0.4	x: 1.5 m η = 0.5	x: 1.5 m η = 49.8	x: 1.5 m η = 42.6	x: 1.5 m η = 48.3	**CUMPLE η = 49.8**
N69/N72	w / t ≤ (w / t)Máx. Cumple	η = 42.9	x: 0.188 m η = 6.3	η = 4.7	x: 1.5 m η = 6.2	x: 1.5 m η = 8.0	x: 0 m η = 1.9	x: 0 m η = 0.7	x: 1.5 m η = 8.0	x: 1.5 m η = 10.5	x: 1.5 m η = 0.6	x: 1.5 m η = 1.1	x: 1.5 m η = 53.9	x: 1.5 m η = 13.0	x: 1.5 m η = 50.2	**CUMPLE η = 53.9**

Barras	COMPROBACIONES (AISI S100-07 (2007))															Estado
	w / t	T	P	Tr	M_x	M_y	V_x	V_y	M_xTr	M_yTr	M_xV_y	M_yV_x	MT	MP	TPTrMV	
N72/N76	w / t ≤ (w / t)Máx. Cumple	η = 46.6	x: 0 m η = 6.2	η = 3.9	x: 1.5 m η = 6.8	x: 0 m η = 5.5	η = 1.4	x: 0 m η = 0.8	x: 1.5 m η = 7.4	x: 0 m η = 6.1	x: 1.5 m η = 0.6	x: 0 m η = 0.4	x: 1.5 m η = 57.8	x: 1.5 m η = 10.4	x: 1.5 m η = 56.1	**CUMPLE η = 57.8**
N1/N3	w / t ≤ (w / t)Máx. Cumple	x: 2.746 m η = 15.9	x: 0 m η = 77.7	η = 6.1	x: 2.746 m η = 10.4	x: 0 m η = 11.2	η = 0.1	x: 2.746 m η = 0.9	x: 2.746 m η = 10.8	x: 0 m η = 14.6	x: 2.746 m η = 1.2	x: 0 m η = 2.1	x: 0 m η = 37.1	x: 2.746 m η = 96.2	x: 2.746 m η = 88.1	**CUMPLE η = 96.2**
N2/N47	w / t ≤ (w / t)Máx. Cumple	x: 2.746 m η = 16.4	x: 0 m η = 77.9	η = 7.7	x: 2.746 m η = 11.0	x: 0 m η = 8.6	η = 0.1	x: 2.746 m η = 0.9	x: 2.746 m η = 11.0	x: 0 m η = 13.0	x: 2.746 m η = 1.2	x: 0 m η = 1.7	x: 0 m η = 37.5	x: 2.746 m η = 96.1	x: 2.746 m η = 88.8	**CUMPLE η = 96.1**

Notación:
w / t: Limitaciones geométricas
T: Resistencia a tracción
P: Resistencia a compresión
Tr: Resistencia a torsión
M_x: Resistencia a flexión alrededor del eje X
M_y: Resistencia a flexión alrededor del eje Y
V_x: Resistencia a corte en la dirección del eje X
V_y: Resistencia a corte en la dirección del eje Y
M_xTr: Resistencia a flexión alrededor del eje X combinada con torsión
M_yTr: Resistencia a flexión alrededor del eje Y combinada con torsión
M_xV_y: Resistencia a flexión alrededor del eje X combinada con corte en la dirección del eje Y
M_yV_x: Resistencia a flexión alrededor del eje Y combinada con corte en la dirección del eje X
MT: Resistencia a flexión combinada con tracción
MP: Resistencia a flexión combinada con compresión
TPTrMV: Flexión combinada con cortante, axil y torsión - Comprobación de Von Mises
x: Distancia al origen de la barra
η: Coeficiente de aprovechamiento (%)
N.P.: No procede

Comprobaciones que no proceden (N.P.):
(1) La comprobación no procede, ya que no hay axil de tracción.
(2) No hay interacción entre axil de tracción y momento flector para ninguna combinación. Por lo tanto, la comprobación no procede.
(3) La comprobación no procede, ya que no hay axil de compresión.
(4) La comprobación no procede, ya que no hay torsión.
(5) No hay interacción entre torsión y flexión alrededor del eje X para ninguna combinación. Por lo tanto, la comprobación no procede.
(6) No hay interacción entre torsión y flexión alrededor del eje Y para ninguna combinación. Por lo tanto, la comprobación no procede.
(7) No hay interacción entre axil de compresión y momento flector para ninguna combinación. Por lo tanto, la comprobación no procede.
(8) La comprobación no procede, ya que no hay esfuerzos combinados.

Barras	COMPROBACIONES (ANSI/AISC 360-10 (LRFD))								Estado
	P_t	λ_c	P_c	M_x	M_y	V_x	V_y	$PM_xM_yV_xV_yT$	
N55/N10	η = 49.6	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 49.6**
N62/N6	η = 80.0	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 80.0**
N135/N6	η = 65.0	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 65.0**
N62/N14	η = 38.4	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 38.4**
N69/N10	η = 54.7	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 54.7**
N125/N42	η = 85.0	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 85.0**
N118/N38	η = 79.0	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 79.0**
N104/N38	η = 98.2	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 98.2**
N111/N34	η = 65.6	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 65.6**
N104/N30	η = 50.3	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 50.3**
N97/N34	η = 73.7	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 73.7**
N97/N26	η = 30.8	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 30.8**
N90/N30	η = 48.4	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 48.4**
N90/N22	η = 14.1	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 14.1**
N83/N26	η = 22.1	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 22.1**
N83/N18	η = 13.1	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 13.1**

Barras	COMPROBACIONES (ANSI/AISC 360-10 (LRFD))								Estado
	P_t	λ_c	P_c	M_x	M_y	V_x	V_y	$PM_xM_yV_xV_yT$	
N76/N22	η = 13.1	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 13.1**
N76/N14	η = 28.0	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 28.0**
N69/N18	η = 26.2	N.P.(1)	N.P.(1)	N.P.(2)	N.P.(2)	N.P.(3)	N.P.(3)	N.P.(4)	**CUMPLE η = 26.2**

Notación:
- *P_t: Resistencia a tracción*
- *λ_c: Limitación de esbeltez para compresión*
- *P_c: Resistencia a compresión*
- *M_x: Resistencia a flexión eje X*
- *M_y: Resistencia a flexión eje Y*
- *V_x: Resistencia a corte X*
- *V_y: Resistencia a corte Y*
- *$PM_xM_yV_xV_yT$: Esfuerzos combinados y torsión*
- *x: Distancia al origen de la barra*
- *η: Coeficiente de aprovechamiento (%)*
- *N.P.: No procede*

Comprobaciones que no proceden (N.P.):
- *(1) La comprobación no procede, ya que no hay axil de compresión.*
- *(2) La comprobación no procede, ya que no hay momento flector.*
- *(3) La comprobación no procede, ya que no hay esfuerzo cortante.*
- *(4) No hay torsión u otros esfuerzos combinados, por lo que la comprobación no procede.*

11. CHEQUEO ANCLAJE

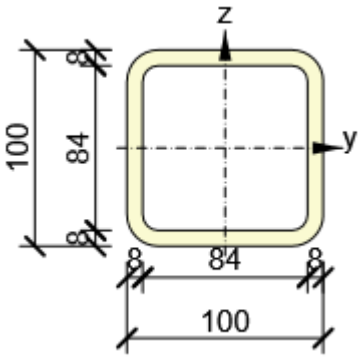
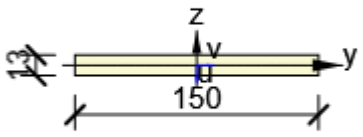
Beams and columns

Name	Cross-section	β – Direction [°]	γ - Pitch [°]	α - Rotation [°]	Offset ex [mm]	Offset ey [mm]	Offset ez [mm]	Forces in
COL	2 - 100X100X3(RHS100x100)	0.0	-90.0	0.0	0	0	0	Node

Cross-sections

Name	Material
2 - 100X100X3(RHS100x100)	A36
3 - Plate 12.7, 150	A36

Cross-sections

Name	Material	Drawing
2 - 100X100X3(RHS100x100)	A36	
3 - Plate 12.7, 150	A36	

Anchors

Name	Bolt assembly	Diameter [mm]	fu [MPa]	Gross area [mm²]
3/4 A325	3/4 A325	19	825.0	285

Load effects (equilibrium not required)

Name	Member	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
LE1	COL	-158.0	-4.0	215.0	0.0	0.0	0.0

Foundation block

Item	Value	Unit
CB 1		
Dimensions	900 x 900	mm
Depth	600	mm
Anchor	3/4 A325	
Anchoring length	300	mm
Shear force transfer	Shear lug	
Cross-section of shear lug	Plate 12.7, 150	
Length of shear lug	50	mm

Check

Summary

Name	Value	Check status
Analysis	100.0%	OK
Anchors	4.7 < 100%	OK
Welds	78.3 < 100%	OK
Concrete block	11.2 < 100%	OK
Shear	25.2 < 100%	OK
Buckling	Not calculated	

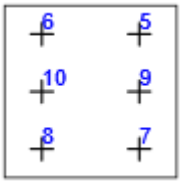
Plates

Name	F_y [MPa]	Thickness [mm]	Loads	σ_{Ed} [MPa]	ε_{Pl} [%]	Check status
BP1	248.2	19.1	LE1	138.9	0.0	OK

Design data

Material	fy [MPa]	ε_{lim} [%]
A36	248.2	5.0

Anchors

Shape	Item	Loads	N_f [kN]	ϕN_{cbg} [kN]	ϕV_{cp} [kN]	Ut_t [%]	Ut_s [%]	Ut_{ts} [%]	Status
	A5	LE1	0.0	-	336.5	0.0	0.0	0.0	OK
	A6	LE1	0.0	-	336.5	0.0	0.0	0.0	OK
	A7	LE1	3.5	143.5	336.5	4.7	0.0	0.6	OK
	A8	LE1	3.3	143.5	336.5	4.7	0.0	0.6	OK
	A9	LE1	0.0	-	336.5	0.0	0.0	0.0	OK
	A10	LE1	0.0	-	336.5	0.0	0.0	0.0	OK

Design data

Grade	ϕN_{sa} [kN]
3/4 A325 - 1	124.4

Detailed result for A5

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta} =$ 124.4 kN ≥ $N_f =$ 0.0 kN

Where:

$\phi =$ 0.70 – resistance factor

$A_{se,N} =$ 215 mm^2 – tensile stress area

$f_{uta} =$ 825.0 MPa – specified tensile strength of anchor steel: $f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$, where:

$f_{ya} =$ 634.3 MPa – specified yield strength of anchor steel

$f_u =$ 825.0 MPa – specified ultimate strength of anchor steel

Concrete pryout resistance (ACI 318-14 – 17.5.3)

The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp} =$ 336.5 kN ≥ $V_g =$ 0.0 kN

Where:

ϕ = 0.65 – resistance factor

k_{cp} = 2.00 – concrete pry-out factor

N_{cp} = 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

V_g = 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3}$ = 0.00 ≤ 1.0

Where:

U_{tt} = 0.00 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

U_{ts} = 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Detailed result for A6

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta}$ = 124.4 kN ≥ N_f = 0.0 kN

Where:

ϕ = 0.70 – resistance factor

$A_{se,N}$ = 215 mm^2 – tensile stress area

f_{uta} = 825.0 MPa – specified tensile strength of anchor steel:
$f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$
, where:
f_{ya} =
634.3 MPa – specified yield strength of anchor steel
f_u =
825.0 MPa – specified ultimate strength of anchor steel

Concrete pryout resistance (ACI 318-14 – 17.5.3)
The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp}$ = 336.5 kN ≥ V_g = 0.0 kN

Where:

ϕ = 0.65 – resistance factor

k_{cp} = 2.00 – concrete pry-out factor

N_{cp} = 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

V_g = 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3}$ = 0.00 ≤ 1.0

Where:

U_{tt} = 0.00 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

U_{ts} = 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Detailed result for A7

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta}$ = 124.4 kN ≥ N_f = 3.5 kN

Where:

ϕ = 0.70 – resistance factor

$A_{se,N}$ = 215 mm² – tensile stress area

f_{uta} = 825.0 MPa – specified tensile strength of anchor steel:
$f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$
, where:
f_{ya} =
634.3 MPa – specified yield strength of anchor steel
f_u =
825.0 MPa – specified ultimate strength of anchor steel

Concrete breakout resistance of anchor in tension (ACI 318-14 – 17.4.2)
The check is preformed for group of anchors that form common tension breakout cone: A7, A8

$\phi N_{cbg} = \phi \cdot \frac{A_{Nc}}{A_{Nc0}} \cdot \Psi_{ed,N} \cdot \Psi_{ec,N} \cdot \Psi_{c,N} \cdot N_b$ = 143.5 kN ≥ N_{fg} = 6.8 kN

Where:

N_{fg} = 6.8 kN – sum of tension forces of anchors with common concrete breakout cone area

ϕ = 0.70 – resistance factor

A_{Nc} = 642785 mm² – concrete breakout cone area for group of anchors

A_{Nc0} = 532900 mm² – concrete breakout cone area for single anchor not influenced by edges

$\Psi_{ed,N}$ = 0.99 – modification factor for edge distance:

$\Psi_{ed,N} = \min(0.7 + \frac{0.3 \cdot c_{a,min}}{1.5 \cdot h_{ef}}, 1)$

, where:

$c_{a,min}$ =

350 mm – minimum distance from the anchor to the edge

$h_{ef} = \min(h_{emb}, \max(\frac{c_{a,max}}{1.5}, \frac{s}{3})) =$

243 mm – depth of embedment, where:

h_{emb} =

300 mm – anchor length

$c_{a,max}$ =

365 mm – maximum distance from the anchor to one of the three closest edges

s =

170 mm – maximum spacing between anchors

$\Psi_{ec,N} = 1.00$ – modification factor for eccentrically loaded group of anchors

$\Psi_{ec,N} = \Psi_{ecx,N} \cdot \Psi_{ecy,N}$

, where:

$\Psi_{ecx,N} = \frac{1}{1+\frac{2e_{x,N}}{3h_{ef}}} =$

1.00 – modification factor that depends on eccentricity in x-direction

$e_{x,N}$ =

1 mm – tension load eccentricity in x-direction

$\Psi_{ecy,N} = \frac{1}{1+\frac{2e_{y,N}}{3h_{ef}}} =$

1.00 – modification factor that depends on eccentricity in y-direction

$e_{y,N}$ =

0 mm – tension load eccentricity in y-direction

h_{ef} =

243 mm – depth of embedment

$\Psi_{c,N} = 1.00$ – modification factor for concrete conditions

$N_b =$ 172.6 kN – basic concrete breakout strength of a single anchor in tension:

$N_b = k_c \cdot \lambda_a \cdot \sqrt{f_c} \cdot h_{ef}^{1.5}$

, where:

k_c =

10.0 – coefficient for cast-in anchors

λ_a =

1.00 – modification factor for lightweight concrete

f_c =

20.7 MPa – concrete compressive strength

h_{ef} =

243 mm – depth of embedment

Concrete pryout resistance (ACI 318-14 – 17.5.3)

The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp} =$ 336.5 kN ≥ $V_g =$ 0.0 kN

Where:

ϕ = 0.65 – resistance factor

k_{cp} = 2.00 – concrete pry-out factor

N_{cp} = 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

V_g = 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3}$ = 0.01 ≤ 1.0

Where:

U_{tt} = 0.05 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

U_{ts} = 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Detailed result for A8

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta}$ = 124.4 kN ≥ N_f = 3.3 kN

Where:

ϕ = 0.70 – resistance factor

$A_{se,N}$ = 215 mm^2 – tensile stress area

f_{uta} = 825.0 MPa – specified tensile strength of anchor steel:
$f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$
, where:
f_{ya} =
634.3 MPa – specified yield strength of anchor steel
f_u =
825.0 MPa – specified ultimate strength of anchor steel

Concrete breakout resistance of anchor in tension (ACI 318-14 – 17.4.2)
The check is preformed for group of anchors that form common tension breakout cone: A7, A8

$\phi N_{cbg} = \phi \cdot \frac{A_{Nc}}{A_{Nco}} \cdot \Psi_{ed,N} \cdot \Psi_{ec,N} \cdot \Psi_{c,N} \cdot N_b$ = 143.5 kN ≥ N_{fg} = 6.8 kN

Where:

N_{fg} = 6.8 kN – sum of tension forces of anchors with common concrete breakout cone area

ϕ = 0.70 – resistance factor

A_{Nc} = 642785 mm² – concrete breakout cone area for group of anchors

A_{Nc0} = 532900 mm² – concrete breakout cone area for single anchor not influenced by edges

$\Psi_{ed,N}$ = 0.99 – modification factor for edge distance:

$\Psi_{ed,N} = \min(0.7 + \frac{0.3 \cdot c_{a,min}}{1.5 \cdot h_{ef}}, 1)$

, where:

$c_{a,min}$ =

350 mm – minimum distance from the anchor to the edge

$h_{ef} = \min(h_{emb}, \max(\frac{c_{a,max}}{1.5}, \frac{s}{3})) =$

243 mm – depth of embedment, where:

h_{emb} =

300 mm – anchor length

$c_{a,max}$ =

365 mm – maximum distance from the anchor to one of the three closest edges

s =

170 mm – maximum spacing between anchors

$\Psi_{ec,N}$ = 1.00 – modification factor for eccentrically loaded group of anchors

$\Psi_{ec,N} = \Psi_{ecx,N} \cdot \Psi_{ecy,N}$

, where:

$\Psi_{ecx,N} = \frac{1}{1+\frac{2 e_{x,N}}{3 h_{ef}}} =$

1.00 – modification factor that depends on eccentricity in x-direction

$e_{x,N}$ =

1 mm – tension load eccentricity in x-direction

$\Psi_{ecy,N} = \frac{1}{1+\frac{2 e_{y,N}}{3 h_{ef}}} =$

1.00 – modification factor that depends on eccentricity in y-direction

$e_{y,N}$ =

0 mm – tension load eccentricity in y-direction

h_{ef} =

243 mm – depth of embedment

$\Psi_{c,N}$ = 1.00 – modification factor for concrete conditions

N_b = 172.6 kN – basic concrete breakout strength of a single anchor in tension:

$N_b = k_c \cdot \lambda_a \cdot \sqrt{f_c} \cdot h_{ef}^{1.5}$

, where:

k_c =

10.0 – coefficient for cast-in anchors

λ_a =

1.00 – modification factor for lightweight concrete

f_c =

20.7 MPa – concrete compressive strength

h_{ef} =

243 mm – depth of embedment

Concrete pryout resistance (ACI 318-14 – 17.5.3)
The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp} =$ 336.5 kN ≥ $V_g =$ 0.0 kN

Where:

$\phi =$ 0.65 – resistance factor

$k_{cp} =$ 2.00 – concrete pry-out factor

$N_{cp} =$ 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

$V_g =$ 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3} =$ 0.01 ≤ 1.0

Where:

$U_{tt} =$ 0.05 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

$U_{ts} =$ 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Detailed result for A9

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta} =$ 124.4 kN ≥ $N_f =$ 0.0 kN

Where:

$\phi =$ 0.70 – resistance factor

$A_{se,N} =$ 215 mm^2 – tensile stress area

$f_{uta} =$ 825.0 MPa – specified tensile strength of anchor steel:
$f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$
, where:
$f_{ya} =$
634.3 MPa – specified yield strength of anchor steel
$f_u =$
825.0 MPa – specified ultimate strength of anchor steel

Concrete pryout resistance (ACI 318-14 – 17.5.3)
The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp} =$ 336.5 kN ≥ $V_g =$ 0.0 kN

Where:

ϕ = 0.65 – resistance factor

k_{cp} = 2.00 – concrete pry-out factor

N_{cp} = 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

V_g = 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3}$ = 0.00 ≤ 1.0

Where:

U_{tt} = 0.00 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

U_{ts} = 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Detailed result for A10

Anchor tensile resistance (ACI 318-14 – 17.4.1)

$\phi N_{sa} = \phi \cdot A_{se,N} \cdot f_{uta}$ = 124.4 kN ≥ N_f = 0.0 kN

Where:

ϕ = 0.70 – resistance factor

$A_{se,N}$ = 215 mm^2 – tensile stress area

f_{uta} = 825.0 MPa – specified tensile strength of anchor steel:
$f_{uta} = \min(860\ \text{MPa}, 1.9 \cdot f_{ya}, f_u)$
, where:
f_{ya} =
634.3 MPa – specified yield strength of anchor steel
f_u =
825.0 MPa – specified ultimate strength of anchor steel

Concrete pryout resistance (ACI 318-14 – 17.5.3)
The check is preformed for group of anchors on common base plate

$\phi V_{cp} = \phi \cdot k_{cp} \cdot N_{cp}$ = 336.5 kN ≥ V_g = 0.0 kN

Where:

ϕ = 0.65 – resistance factor

k_{cp} = 2.00 – concrete pry-out factor

N_{cp} = 258.9 kN – concrete cone tension break-out resistance in case all anchors are in tension

V_g = 0.0 kN – sum of shear forces of anchors on common base plate

Interaction of tensile and shear forces (ACI 318-14 – R17.6)

$U_{tt}^{5/3} + U_{ts}^{5/3}$ = 0.00 ≤ 1.0

Where:

U_{tt} = 0.00 – maximum ratio of factored tensile force and tensile resistance determined from all appropriate failure modes

U_{ts} = 0.00 – maximum ratio of factored shear force and shear resistance determined from all appropriate failure modes

Welds

Item	Edge	Xu	Th [mm]	Ls [mm]	L [mm]	Lc [mm]	Fn [kN]	ϕRn [kN]	Ut [%]	Status
BP1	Member 2-bfl 1	E70xx	◢6.4◣	◢9.0◣	150	19	29.1	38.4	75.8	OK
		E70xx	◢6.4◣	◢9.0◣	150	19	29.3	38.0	77.2	OK
BP1	COL	E70xx	◢3.5◣	◢5.0◣	344	6	5.0	6.4	78.3	OK
		E70xx	◢3.5◣	◢5.0◣	345	6	4.6	5.9	77.8	OK

Detailed result for BP1 / Member 2-bfl 1 - 1

Weld resistance check (AISC 360-16: J2-4)

$\phi R_n = \phi \cdot F_{nw} \cdot A_{we}$ = 38.4 kN ≥ F_n = 29.1 kN

Where:

F_{nw} = 431.5 MPa – nominal stress of weld material:

$F_{nw} = 0.6 \cdot F_{EXX} \cdot (1 + 0.5 \cdot sin^{1.5}\theta)$

, where:

F_{EXX} = 482.6 MPa – electrode classification number, i.e. minimum specified tensile strength

θ = 80.7° – angle of loading measured from the weld longitudinal axis

A_{we} = 119 mm² – effective area of weld critical element

ϕ = 0.75 – resistance factor for welded connections

Detailed result for BP1 / Member 2-bfl 1 - 2

Weld resistance check (AISC 360-16: J2-4)

$\phi R_n = \phi \cdot F_{nw} \cdot A_{we}$ = 38.0 kN ≥ F_n = 29.3 kN

Where:

F_{nw} = 426.6 MPa – nominal stress of weld material:

$F_{nw} = 0.6 \cdot F_{EXX} \cdot (1 + 0.5 \cdot sin^{1.5}\theta)$

, where:

F_{EXX} =

482.6 MPa – electrode classification number, i.e. minimum specified tensile strength

θ =

74.5° – angle of loading measured from the weld longitudinal axis

A_{we} = 119 mm² – effective area of weld critical element

ϕ = 0.75 – resistance factor for welded connections

Detailed result for BP1 / COL - 1

Weld resistance check (AISC 360-16: J2-4)

$\phi R_n = \phi \cdot F_{nw} \cdot A_{we}$ = 6.4 kN ≥ F_n = 5.0 kN

Where:

F_{nw} = 391.5 MPa – nominal stress of weld material:

$F_{nw} = 0.6 \cdot F_{EXX} \cdot (1 + 0.5 \cdot sin^{1.5}\theta)$

, where:

F_{EXX} =

482.6 MPa – electrode classification number, i.e. minimum specified tensile strength

θ =

52.3° – angle of loading measured from the weld longitudinal axis

A_{we} = 22 mm² – effective area of weld critical element

ϕ = 0.75 – resistance factor for welded connections

Detailed result for BP1 / COL - 2

Weld resistance check (AISC 360-16: J2-4)

$\phi R_n = \phi \cdot F_{nw} \cdot A_{we}$ = 5.9 kN ≥ F_n = 4.6 kN

Where:

F_{nw} = 359.2 MPa – nominal stress of weld material:

$F_{nw} = 0.6 \cdot F_{EXX} \cdot (1 + 0.5 \cdot sin^{1.5}\theta)$

, where:

F_{EXX} =

482.6 MPa – electrode classification number, i.e. minimum specified tensile strength

θ =

37.9° – angle of loading measured from the weld longitudinal axis

A_{we} = 22 mm² – effective area of weld critical element

$\phi = 0.75$ – resistance factor for welded connections

Concrete block

Item	Loads	A_1 [mm2]	A_2 [mm2]	σ [MPa]	Ut [%]	Status
CB 1	LE1	65047	643400	2.6	11.2	OK

Detailed result for CB 1

Concrete block compressive resistance check (AISC 360-16 Section J8)

$\phi_c f_{p,max} =$ 22.9 MPa ≥ $\sigma =$ 2.6 MPa

Where:

$f_{p,max} = 35.2$ MPa – concrete block design bearing strength:

$f_{p,max} = 0.85 \cdot f'_c \cdot \sqrt{\frac{A_2}{A_1}} \leq 1.7 \cdot f'_c$

, where:

$f'_c =$

20.7 MPa – concrete compressive strength

$A_1 =$

65047 mm^2 – base plate area in contact with concrete surface

$A_2 =$

643400 mm^2 – concrete supporting surface

$\phi_c = 0.65$ – resistance factor for concrete

Shear in contact plane

Item	Loads	V [kN]	P_{br} [kN]	V_{cb} [kN]	Ut [%]	Status
BP1	LE1	141.3	1238.3	560.7	25.2	OK

Detailed result for BP1

Bearing capacity check (ACI 349-01–B.4.5, ACI 349-01 RB11)

$\phi_c P_{br} = \phi \cdot 1.3 \cdot f'_c \cdot A_1 + \phi \cdot K_c \cdot (N_y - P_a) =$ 1238.3 kN ≥ $V =$ 141.3 kN

Where:

$\phi = 0.7$ – resistance factor for bearing of bolts on steel

$f'_c = 20.7$ MPa – concrete compressive strength

$A_1 = 7515\ mm^2$ – projected area of the embedded area of the shear lug in the direction of the force excluding the portion of the lug in contact with the grout above concrete member

$K_c = 1.60$ – confinement coefficient

$N_y = 820.1\ kN$ – yield strength of tensioned anchors

$N_y = n \cdot A_{se} \cdot F_y$

, where:

$n =$

6.0 – number of tensioned anchors

$A_{se} =$

215 mm^2 – tensile stress area of an anchor

$F_y =$

634.3 MPa – anchor yield strength

$P_a = -159.2\ kN$ – external axial load

Concrete breakout strength check (ACI 349 – B11)

$\phi V_{cb} = \phi \cdot \Psi_{a,v} \cdot A_{vc} \cdot 10.5 \cdot \sqrt{f'_c} =$ 560.7 kN ≥ $V =$ 141.3 kN

Where:

$\phi = 0.85$ – steel embedment material resistance factor for reinforcement

$\Psi_{a,V} = 1.0$ – modification factor for shear lug loaded at an angle with the concrete edge

$\Psi_{a,V} = \sqrt{\frac{1}{(\cos \alpha_V)^2 + (0.5 \cdot \sin \alpha_V)^2}}$

, where:

$\alpha_V =$

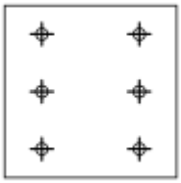
0.0 ° – angle between direction of shear force and direction perpendicular to concrete edge

$A_{vc} = 436785\ mm^2$ – effective stress area defined by projecting a 45º plane from the bearing edges of the shear lug to the free surface in the direction of the shear load. The bearing area of the shear lug is excluded from the projected area.

$f'_c = 20.7\ MPa$ – concrete compressive strength

Manufacturing operations

Name	Plates [mm]	Shape	Nr.	Welds [mm]	Length [mm]	Bolts	Nr.

BP1	P19.1x300.0-300.0 (A36)		1	Double fillet: a = 3.5 Double fillet: a = 6.4	346.5 150.0	3/4 A325	6

Welds

Type	Material	Throat thickness [mm]	Leg size [mm]	Length [mm]
Double fillet	E70xx	3.5	5.0	346.5
Double fillet	E70xx	6.4	9.0	150.0

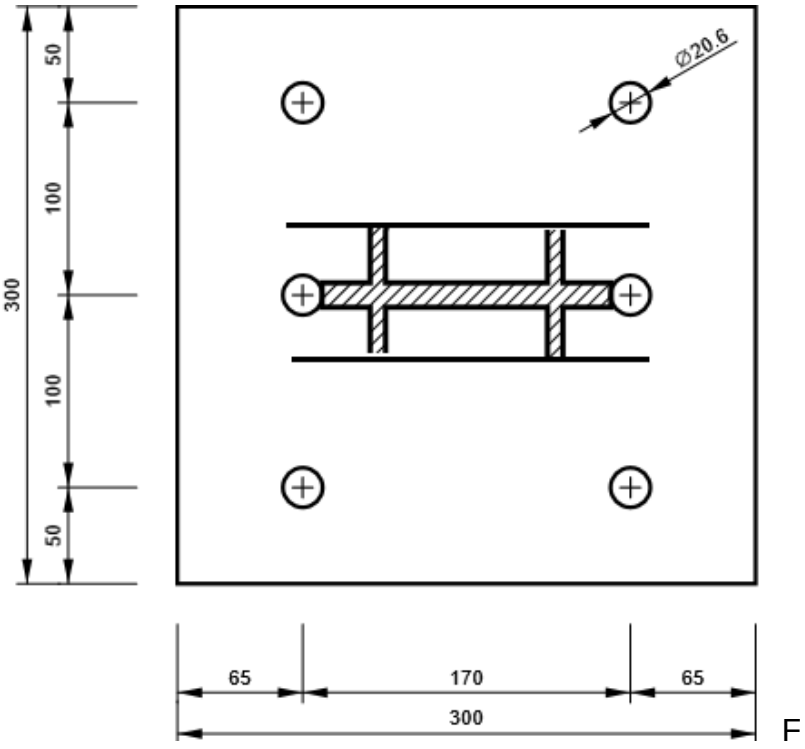
Anchors

Name	Length [mm]	Drill length [mm]	Count
3/4 A325	319	300	6

Drawing

BP1

P19.1x300-300 (A36)



F

Symbol explanation

Symbol	Symbol explanation
ε_{Pl}	Strain
f_y	Yield strength
ε_{lim}	Limit of plastic strain
N_f	Tension force
ϕN_{cbg}	Concrete breakout strength in tension – ACI 318-14 – 17.4.2
ϕV_{cp}	Concrete pryout strength in shear – ACI 318-14 – 17.5.3
Ut	Utilization
Ut_s	Utilization in shear
Ut_{ts}	Utilization in tension and shear EN 1993-1-8 table 3.4
ϕN_{sa}	Steel strength in tension – ACI 318-14 – 17.4.1
T_h	Throat thickness of weld
L_s	Leg size of weld
L	Length of weld
L_c	Length of critical weld element
F_n	Force in weld critical element
ϕRn_w	Weld resistance AISC 360-16 J2.4
A_1	Loaded area
A_2	Supporting area
σ	Average stress in concrete
V	Resultant of shear forces Vy, Vz in bolt
P_{br}	Concrete block bearing capacity
V_{cb}	Concrete cone breakout resistance

Code settings

Item	Value	Unit	Reference
Friction coefficient - concrete	0.40	-	ACI 349 – B.6.1.4
Friction coefficient in slip-resistance	0.30	-	AISC 360-16 – J3.8
Limit plastic strain	0.05	-	
Weld stress evaluation	Plastic redistribution		
Detailing	No		
Distance between bolts [d]	2.66	-	AISC 360-16 – J3.3
Distance between bolts and edge [d]	1.25	-	AISC 360-16 – J.3.4
Concrete breakout resistance	Yes		
Base metal capacity check at weld fusion face	No		AISC 360-16 – J2-2
Cracked concrete	Yes		ACI 318-14 – Chapter 17

Local deformation check	No		
Local deformation limit	0.03	-	CIDECT DG 1, 3 - 1.1
Geometrical nonlinearity (GMNA)	Yes		Allow large deformations of hollow sections
Braced system	No		

12. DISEÑO ESTRIBO

12.1. Estado limite resistencia

Cantilever wall analysis

Input data

Project

Date : 14/09/2022

Settings

(input for current task)

Materials and standards

Concrete structures : ACI 318-11

Wall analysis

Active earth pressure calculation :	Mazindrani (Rankine)
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Consider always vertical
Base key :	The base key is considered as inclined footing bottom
Allowable eccentricity :	0.333
Verification methodology :	according to LRFD

Material of structure

Unit weight γ = 24.00 kN/m^3
Analysis of concrete structures carried out according to the standard ACI 318-11.
Concrete : Concrete ACI
Compressive strength f_c' = 28.00 MPa

Longitudinal steel : A615/60
Tensile strength f_y = 413.69 MPa

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	3.00
3	1.10	3.00
4	1.10	3.60
5	-1.90	3.60
6	-1.90	3.00
7	-0.80	3.00
8	-0.80	0.00

The origin [0,0] is located at the most upper right point of the wall.
Wall section area = 4.20 m^2.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	SC		28.00	0.00	19.00	10.00	0.00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	SC		cohesive	-	0.33	-	-

Soil parameters

SC

Unit weight : γ = 19.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 0.00 °
Soil : cohesive
Poisson's ratio : ν = 0.33
Saturated unit weight : γ_{sat} = 20.00 kN/m^3

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	SC	

Foundation

Type of foundation : input parameters of contact base-soil

Parameters

Angle of friction base-soil ψ = 14.67 °
Cohesion base-soil a = 32.25 kPa

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - SC
Soil thickness in front of structure h = 1.50 m

Terrain in front of structure is flat.

Applied forces acting on the structure

No.	Force		Name	Action	F_x	F_z	M	x	z
	new	edit			[kN/m]	[kN/m]	[kNm/m]	[m]	[m]
1	Yes		DC	permanent	0.00	40.74	0.00	-0.54	0.25
2	Yes		PL	variable	0.00	173.00	0.00	-0.54	0.25
3	Yes		W	accidental	0.00	-38.80	0.00	-0.54	0.25

Earthquake

Factor of horizontal acceleration K_h = 0.1625
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : Strength I
The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1

Passive pressure on front face of the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m^3]	δ_d [°]	K_p	Comment
1	0.90	0.00	28.00	0.00	19.00	0.00	2.770	
2	0.00	89.93(0.00)	28.00	0.00	19.00	0.00	2.770	MODIFIED
3	0.10	0.00	28.00	0.00	19.00	0.00	2.770	
4	0.50	0.00	28.00	0.00	19.00	0.00	2.770	

Passive pressure distribution on front face of the structure

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	0.90	17.10	0.00	47.36	47.36	0.00
2	0.90	17.10	0.00	47.36	47.36	0.00
	0.90	17.13	0.00	47.44	47.44	0.00

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
3	0.90	17.13	0.00	47.44	47.44	0.00
	1.00	19.00	0.00	52.63	52.63	0.00
4	1.00	19.00	0.00	52.63	52.63	0.00
	1.50	28.50	0.00	78.94	78.94	0.00

Earthquake effects (passive earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_p	K_{pe}	K_{pe}-K_p	Comment
1	0.90	28.00	0.00	9.23	2.770	2.483	-0.287	
2	0.00	28.00	0.00	9.23	2.141	2.058	-0.083	
3	0.10	28.00	0.00	9.23	2.770	2.483	-0.287	
4	0.50	28.00	0.00	9.23	2.770	2.483	-0.287	

Earthquake effects (passive earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	28.50	-8.18	-8.18	0.00
	0.90	17.10	11.40	-3.27	-3.27	0.00
2	0.90	17.10	11.40	-0.94	0.00	-0.94
	0.90	17.13	11.37	-0.94	0.00	-0.94
3	0.90	17.13	11.37	-3.27	-3.27	0.00
	1.00	19.00	9.50	-2.73	-2.73	0.00
4	1.00	19.00	9.50	-2.73	-2.73	0.00
	1.50	28.50	0.00	0.00	0.00	0.00

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m^3]	δ_d [°]	K_a	Comment
1	3.00	0.00	28.00	0.00	19.00	28.00	0.361	
2	0.60	0.00	28.00	0.00	19.00	0.00	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	3.00	57.00	0.00	20.58	20.58	0.00
2	3.00	57.00	0.00	20.58	20.58	0.00
	3.60	68.40	0.00	24.69	24.69	0.00

Earthquake effects (active earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_a	K_{ae}	K_{ae}-K_a	Comment
1	3.00	28.00	0.00	9.23	0.319	0.458	0.139	
2	0.60	28.00	0.00	9.23	0.361	0.475	0.114	

Earthquake effects (active earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	68.40	9.49	8.38	4.45
	3.00	57.00	11.40	1.58	1.40	0.74
2	3.00	57.00	11.40	1.30	1.30	0.00
	3.60	68.40	0.00	0.00	0.00	0.00

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	100.80	1.50	0.900	0.900	1.250
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000	1.000	1.000
FF resistance	-44.40	-0.50	0.00	1.10	0.900	0.900	1.500
Earthq.- face	6.13	-1.00	0.00	0.55	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.000	1.000	1.350
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000	1.000	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.500	1.500	1.500
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000	1.000	1.000
DC	0.00	-3.35	40.74	1.36	0.650	0.650	1.500
PL	0.00	-3.35	173.00	1.36	1.750	1.750	1.750
W	0.00	-3.35	-38.80	1.36	1.000	0.000	0.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 684.75 kNm/m

Overturning moment M_{ovr} = 198.27 kNm/m

CDR CDR = 3.45

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 209.32 kN/m

Active horizontal force H_{act} = 74.46 kN/m

CDR CDR = 2.81

Wall for slip is SATISFACTORY
Overall check - WALL is SATISFACTORY
Maximum stress in footing bottom : 216.68 kPa

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	91.01	582.30	47.82	0.052	216.68
2	114.90	451.64	74.46	0.085	181.30

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	75.27	385.03	47.80
2	69.84	346.23	47.80

Verification of foundation soil

Stress in the footing bottom : rectangle
Eccentricity verification
Max. eccentricity of normal force $e = 0.085$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY
Verification of bearing capacity
Bearing capacity of foundation soil $R = 430.00$ kPa
Partial factor on bearing capacity $\gamma_{Rv} = 0.65$
Max. stress at footing bottom $\sigma = 216.68$ kPa
Bearing capacity of foundation soil $R_d = 279.50$ kPa
CDR $CDR = 1.29$

Bearing capacity of foundation soil is SATISFACTORY
Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Wall stem check - front reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	0.900	1.250	0.900
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-15.94	-0.30	0.00	0.00	0.900	0.900	0.900
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.500	0.900	1.500

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.500	1.500	0.650
PL	0.00	-2.75	173.00	0.26	1.750	1.750	1.750
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - front reinf.

Front reinforcement is not required.

Wall stem check - back reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	0.900	1.250	0.900
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-15.94	-0.30	0.00	0.00	0.900	0.900	0.900
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.500	0.900	1.500
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.500	1.500	0.650
PL	0.00	-2.75	173.00	0.26	1.750	1.750	1.750
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - back reinf.

Wall check at the construction joint 3.00 m from the wall crest
Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 640.3 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.80 m

Reinforcement ratio	ρ	=	0.14	%	>	0.08	%	=	ρ_{min}
Position of neutral axis	c	=	0.04	m	<	0.31	m	=	c_{max}
Ultimate shear force	ϕV_n	=	472.59	kN	>	53.25	kN	=	V_u
Ultimate moment	ϕM_n	=	282.10	kNm	>	127.77	kNm	=	M_u

Cross-section is SATISFACTORY.

Wall jump check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-1.33	100.80	1.50	1.250
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000
FF resistance	-44.40	-0.50	0.00	1.10	1.500
Earthq.- face	6.13	-1.00	0.00	0.55	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.350
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.500
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000
DC	0.00	-3.35	40.74	1.36	1.500
PL	0.00	-3.35	173.00	1.36	1.750
W	0.00	-3.35	-38.80	1.36	0.000

Wall jump check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 954.2 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.60 m

Reinforcement ratio	ρ	=	0.19 %	>	0.19 %	=	ρ_{min}
Position of neutral axis	c	=	0.02 m	<	0.22 m	=	c_{max}
Ultimate shear force	ϕV_n	=	340.78 kN	>	239.94 kN	=	V_u
Ultimate moment	ϕM_n	=	187.35 kNm	>	136.45 kNm	=	M_u

Cross-section is SATISFACTORY.

Wall heel check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-0.30	15.84	2.45	1.250
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.350
Active pressure	44.45	-1.20	0.00	3.00	1.500
Contact stress	0.00	0.00	-171.24	2.42	0.900

Wall heel check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 0.0 mm^2
Cross-section width = 1.00 m

Cross-section height = 0.60 m

12.2. Estado limite evento extremo

Wall analysis

Active earth pressure calculation :	Mazindrani (Rankine)
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Consider always vertical
Base key :	The base key is considered as inclined footing bottom
Allowable eccentricity :	0.333
Verification methodology :	according to LRFD

Material of structure

Unit weight γ = 24.00 kN/m^3
Analysis of concrete structures carried out according to the standard ACI 318-11.
Concrete : Concrete ACI
Compressive strength f_c' = 28.00 MPa

Longitudinal steel : A615/60
Tensile strength f_y = 413.69 MPa

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	3.00
3	1.10	3.00
4	1.10	3.60
5	-1.90	3.60
6	-1.90	3.00
7	-0.80	3.00
8	-0.80	0.00

The origin [0,0] is located at the most upper right point of the wall.
Wall section area = 4.20 m^2.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	SC		28.00	0.00	19.00	10.00	0.00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	SC		cohesive	-	0.33	-	-

Soil parameters

SC

Unit weight : γ = 19.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 0.00 °
Soil : cohesive
Poisson's ratio : ν = 0.33
Saturated unit weight : γ_{sat} = 20.00 kN/m3

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	SC	

Foundation

Type of foundation : input parameters of contact base-soil
Parameters
Angle of friction base-soil ψ = 14.67 °
Cohesion base-soil a = 32.25 kPa

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - SC
Soil thickness in front of structure h = 1.50 m

Terrain in front of structure is flat.

Applied forces acting on the structure

No.	Force new	Force edit	Name	Action	F_x [kN/m]	F_z [kN/m]	M [kNm/m]	x [m]	z [m]
1	Yes		DC	permanent	0.00	40.74	0.00	-0.54	0.25
2	Yes		PL	variable	0.00	173.00	0.00	-0.54	0.25
3	Yes		W	accidental	0.00	-38.80	0.00	-0.54	0.25

Earthquake

Factor of horizontal acceleration $K_h = 0.1625$
Factor of vertical acceleration $K_v = 0.0000$

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : Extreme I
The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1

Passive pressure on front face of the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m³]	δ_d [°]	K_p	Comment
1	0.90	0.00	28.00	0.00	19.00	0.00	2.770	
2	0.00	89.93(0.00)	28.00	0.00	19.00	0.00	2.770	MODIFIED
3	0.10	0.00	28.00	0.00	19.00	0.00	2.770	
4	0.50	0.00	28.00	0.00	19.00	0.00	2.770	

Passive pressure distribution on front face of the structure

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	0.90	17.10	0.00	47.36	47.36	0.00
2	0.90	17.10	0.00	47.36	47.36	0.00
	0.90	17.13	0.00	47.44	47.44	0.00
3	0.90	17.13	0.00	47.44	47.44	0.00
	1.00	19.00	0.00	52.63	52.63	0.00
4	1.00	19.00	0.00	52.63	52.63	0.00
	1.50	28.50	0.00	78.94	78.94	0.00

Earthquake effects (passive earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_p	K_{pe}	K_{pe}-K_p	Comment
1	0.90	28.00	0.00	9.23	2.770	2.483	-0.287	

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_p	K_{pe}	K_{pe}-K_p	Comment
2	0.00	28.00	0.00	9.23	2.141	2.058	-0.083	
3	0.10	28.00	0.00	9.23	2.770	2.483	-0.287	
4	0.50	28.00	0.00	9.23	2.770	2.483	-0.287	

Earthquake effects (passive earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	28.50	-8.18	-8.18	0.00
	0.90	17.10	11.40	-3.27	-3.27	0.00
2	0.90	17.10	11.40	-0.94	0.00	-0.94
	0.90	17.13	11.37	-0.94	0.00	-0.94
3	0.90	17.13	11.37	-3.27	-3.27	0.00
	1.00	19.00	9.50	-2.73	-2.73	0.00
4	1.00	19.00	9.50	-2.73	-2.73	0.00
	1.50	28.50	0.00	0.00	0.00	0.00

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m^3]	δ_d [°]	K_a	Comment
1	3.00	0.00	28.00	0.00	19.00	28.00	0.361	
2	0.60	0.00	28.00	0.00	19.00	0.00	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	3.00	57.00	0.00	20.58	20.58	0.00
2	3.00	57.00	0.00	20.58	20.58	0.00
	3.60	68.40	0.00	24.69	24.69	0.00

Earthquake effects (active earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_a	K_{ae}	K_{ae}-K_a	Comment
1	3.00	28.00	0.00	9.23	0.319	0.458	0.139	
2	0.60	28.00	0.00	9.23	0.361	0.475	0.114	

Earthquake effects (active earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	68.40	9.49	8.38	4.45
	3.00	57.00	11.40	1.58	1.40	0.74
2	3.00	57.00	11.40	1.30	1.30	0.00
	3.60	68.40	0.00	0.00	0.00	0.00

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	100.80	1.50	0.900	0.900	1.250
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000	1.000	1.000
FF resistance	-59.21	-0.50	0.00	1.10	0.900	0.900	1.500
Earthq.- face	6.13	-1.00	0.00	0.55	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.000	1.000	1.350
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000	1.000	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.500	1.500	1.500
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000	1.000	1.000
DC	0.00	-3.35	40.74	1.36	0.650	0.650	1.500
PL	0.00	-3.35	173.00	1.36	0.000	0.000	0.500
W	0.00	-3.35	-38.80	1.36	1.000	0.000	0.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 349.09 kNm/m

Overturning moment M_{ovr} = 191.61 kNm/m

CDR CDR = 1.82

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 121.39 kN/m

Active horizontal force H_{act} = 61.14 kN/m

CDR CDR = 1.99

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Maximum stress in footing bottom : 134.14 kPa

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	49.64	366.05	25.62	0.045	134.14

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
2	65.86	148.89	61.14	0.147	70.39

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	67.87	385.03	33.00
2	38.22	173.23	33.00

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.147

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Bearing capacity of foundation soil	R	=	430.00	kPa
Partial factor on bearing capacity	γ_{Rv}	=	0.80	
Max. stress at footing bottom	σ	=	134.14	kPa
Bearing capacity of foundation soil	R_d	=	344.00	kPa
CDR	CDR	=	2.56	

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Wall stem check - front reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	0.900	1.250	0.900
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-21.26	-0.30	0.00	0.00	0.900	0.900	0.900
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.500	0.900	1.500
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.500	1.500	0.650
PL	0.00	-2.75	173.00	0.26	0.500	0.500	0.000
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - front reinf.

Front reinforcement is not required.

Wall stem check - back reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	0.900	1.250	0.900
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-21.26	-0.30	0.00	0.00	0.900	0.900	0.900
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.500	0.900	1.500
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.500	1.500	0.650
PL	0.00	-2.75	173.00	0.26	0.500	0.500	0.000
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - back reinf.

Wall check at the construction joint 3.00 m from the wall crest
Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm

Inputted reinforcement area	=	989.7	mm^2
Required reinforcement area	=	480.7	mm^2
Cross-section width	=	1.00	m
Cross-section height	=	0.80	m

Reinforcement ratio	ρ	=	0.14	%	>	0.06	%	=	ρ_{min}
Position of neutral axis	c	=	0.04	m	<	0.31	m	=	c_{max}
Ultimate shear force	ϕV_n	=	472.59	kN	>	48.47	kN	=	V_u
Ultimate moment	ϕM_n	=	282.10	kNm	>	96.06	kNm	=	M_u

Cross-section is SATISFACTORY.

Wall jump check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-1.33	100.80	1.50	1.250
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000
FF resistance	-59.21	-0.50	0.00	1.10	1.500
Earthq.- face	6.13	-1.00	0.00	0.55	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.350
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.500
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
DC	0.00	-3.35	40.74	1.36	1.500
PL	0.00	-3.35	173.00	1.36	0.500
W	0.00	-3.35	-38.80	1.36	0.000

Wall jump check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 632.6 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.60 m

Reinforcement ratio	ρ	=	0.19	%	>	0.12	%	= ρ_{min}
Position of neutral axis	c	=	0.02	m	<	0.22	m	= c_{max}
Ultimate shear force	ϕV_n	=	340.78	kN	>	141.43	kN	= V_u
Ultimate moment	ϕM_n	=	187.35	kNm	>	90.83	kNm	= M_u

Cross-section is SATISFACTORY.

Wall heel check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-0.30	15.84	2.45	1.250
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.350
Active pressure	44.45	-1.20	0.00	3.00	1.500
Contact stress	0.00	0.00	-111.16	2.43	0.900

Wall heel check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 36.2 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.60 m

Reinforcement ratio	ρ	=	0.19	%	>	0.01	%	= ρ_{min}
Position of neutral axis	c	=	0.02	m	<	0.22	m	= c_{max}
Ultimate shear force	ϕV_n	=	340.78	kN	>	4.40	kN	= V_u
Ultimate moment	ϕM_n	=	187.35	kNm	>	5.23	kNm	= M_u

Cross-section is SATISFACTORY.

12.3. Estado limite servicio

Settings

(input for current task)

Materials and standards

Concrete structures : ACI 318-11

Wall analysis

Active earth pressure calculation :	Mazindrani (Rankine)
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Consider always vertical
Base key :	The base key is considered as inclined footing bottom
Allowable eccentricity :	0.333
Verification methodology :	according to LRFD

Material of structure

Unit weight γ = 24.00 kN/m^3
Analysis of concrete structures carried out according to the standard ACI 318-11.
Concrete : Concrete ACI
Compressive strength f_c' = 28.00 MPa

Longitudinal steel : A615/60
Tensile strength f_y = 413.69 MPa

Geometry of structure

No.	Coordinate X [m]	Depth Z [m]
1	0.00	0.00
2	0.00	3.00
3	1.10	3.00
4	1.10	3.60
5	-1.90	3.60
6	-1.90	3.00
7	-0.80	3.00
8	-0.80	0.00

The origin [0,0] is located at the most upper right point of the wall.
Wall section area = 4.20 m^2.

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m³]	γ_{su} [kN/m³]	δ [°]
1	SC		28.00	0.00	19.00	10.00	0.00

Soil parameters to compute pressure at rest

No.	Name	Pattern	Type calculation	φ_{ef} [°]	ν [–]	OCR [–]	K_r [–]
1	SC		cohesive	-	0.33	-	-

Soil parameters

SC

Unit weight : γ = 19.00 kN/m³
Stress-state : effective
Angle of internal friction : φ_{ef} = 28.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 0.00 °
Soil : cohesive
Poisson's ratio : ν = 0.33
Saturated unit weight : γ_{sat} = 20.00 kN/m³

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	SC	

Foundation

Type of foundation : input parameters of contact base-soil

Parameters

Angle of friction base-soil ψ = 14.67 °
Cohesion base-soil a = 32.25 kPa

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: passive
Soil on front face of the structure - SC

Soil thickness in front of structure h = 1.50 m

Terrain in front of structure is flat.

Applied forces acting on the structure

No.	Force new	Force edit	Name	Action	F_x [kN/m]	F_z [kN/m]	M [kNm/m]	x [m]	z [m]
1	Yes		DC	permanent	0.00	40.74	0.00	-0.54	0.25
2	Yes		PL	variable	0.00	173.00	0.00	-0.54	0.25
3	Yes		W	accidental	0.00	-38.80	0.00	-0.54	0.25

Earthquake

Factor of horizontal acceleration K_h = 0.1625
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : Service I
The wall is free to move. Active earth pressure is therefore assumed.

Verification No. 1

Passive pressure on front face of the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m³]	δ_d [°]	K_p	Comment
1	0.90	0.00	28.00	0.00	19.00	0.00	2.770	
2	0.00	89.93(0.00)	28.00	0.00	19.00	0.00	2.770	MODIFIED
3	0.10	0.00	28.00	0.00	19.00	0.00	2.770	
4	0.50	0.00	28.00	0.00	19.00	0.00	2.770	

Passive pressure distribution on front face of the structure

Layer No.	Start [m] End [m]	σ_z [kPa]	σ_w [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	0.90	17.10	0.00	47.36	47.36	0.00
2	0.90	17.10	0.00	47.36	47.36	0.00
	0.90	17.13	0.00	47.44	47.44	0.00
3	0.90	17.13	0.00	47.44	47.44	0.00
	1.00	19.00	0.00	52.63	52.63	0.00
4	1.00	19.00	0.00	52.63	52.63	0.00
	1.50	28.50	0.00	78.94	78.94	0.00

Earthquake effects (passive earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_p	K_{pe}	K_{pe}-K_p	Comment
1	0.90	28.00	0.00	9.23	2.770	2.483	-0.287	
2	0.00	28.00	0.00	9.23	2.141	2.058	-0.083	
3	0.10	28.00	0.00	9.23	2.770	2.483	-0.287	
4	0.50	28.00	0.00	9.23	2.770	2.483	-0.287	

Earthquake effects (passive earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	28.50	-8.18	-8.18	0.00
	0.90	17.10	11.40	-3.27	-3.27	0.00
2	0.90	17.10	11.40	-0.94	0.00	-0.94
	0.90	17.13	11.37	-0.94	0.00	-0.94
3	0.90	17.13	11.37	-3.27	-3.27	0.00
	1.00	19.00	9.50	-2.73	-2.73	0.00
4	1.00	19.00	9.50	-2.73	-2.73	0.00
	1.50	28.50	0.00	0.00	0.00	0.00

Active pressure behind the structure - partial results

Layer No.	Thickness [m]	α [°]	φ_d [°]	c_d [kPa]	γ [kN/m^3]	δ_d [°]	K_a	Comment
1	3.00	0.00	28.00	0.00	19.00	28.00	0.361	
2	0.60	0.00	28.00	0.00	19.00	0.00	0.361	

Active pressure distribution behind the structure (without surcharge)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_W [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vert. comp. [kPa]
1	0.00	0.00	0.00	0.00	0.00	0.00
	3.00	57.00	0.00	20.58	20.58	0.00
2	3.00	57.00	0.00	20.58	20.58	0.00
	3.60	68.40	0.00	24.69	24.69	0.00

Earthquake effects (active earth pressure) - partial results

Layer No.	Thickness [m]	φ_d [°]	β [°]	ψ [°]	K_a	K_{ae}	K_{ae}-K_a	Comment
1	3.00	28.00	0.00	9.23	0.319	0.458	0.139	
2	0.60	28.00	0.00	9.23	0.361	0.475	0.114	

Earthquake effects (active earth pressure)

Layer No.	Start [m] End [m]	σ_Z [kPa]	σ_D [kPa]	Pressure [kPa]	Hor. comp. [kPa]	Vertical comp. [kPa]
1	0.00	0.00	68.40	9.49	8.38	4.45
	3.00	57.00	11.40	1.58	1.40	0.74
2	3.00	57.00	11.40	1.30	1.30	0.00
	3.60	68.40	0.00	0.00	0.00	0.00

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.33	100.80	1.50	1.000	1.000	1.000
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000	1.000	1.000
FF resistance	-59.21	-0.50	0.00	1.10	1.000	1.000	1.000
Earthq.- face	6.13	-1.00	0.00	0.55	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.000	1.000	1.000
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000	1.000	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.000	1.000	1.000
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000	1.000	1.000
DC	0.00	-3.35	40.74	1.36	1.000	1.000	1.000
PL	0.00	-3.35	173.00	1.36	1.000	1.000	1.000
W	0.00	-3.35	-38.80	1.36	1.000	0.000	0.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 618.88 kNm/m
Overturning moment M_{ovr} = 161.97 kNm/m

CDR CDR = 3.82
Wall for overturning is SATISFACTORY
Check for slip
Resisting horizontal force H_{res} = 186.18 kN/m
Active horizontal force H_{act} = 33.00 kN/m

CDR CDR = 5.64
Wall for slip is SATISFACTORY
Overall check - WALL is SATISFACTORY
Maximum stress in footing bottom : 145.44 kPa

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	67.87	385.03	33.00	0.059	145.44
2	62.44	346.23	33.00	0.060	131.18

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	67.87	385.03	33.00
2	62.44	346.23	33.00

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.060

Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 145.44 kPa

Bearing capacity of foundation soil R_d = 430.00 kPa

CDR CDR = 2.96

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Dimensioning No. 1

Wall stem check - front reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	1.000	1.000	1.000
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-21.26	-0.30	0.00	0.00	1.000	1.000	1.000
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.000	1.000	1.000
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.000	1.000	1.000
PL	0.00	-2.75	173.00	0.26	1.000	1.000	1.000
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - front reinf.

Front reinforcement is not required.

Wall stem check - back reinf.

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. moment	Coeff. norm.force	Coeff. shear for.
Weight - wall	0.00	-1.50	57.58	0.40	1.000	1.000	1.000
Earthq.- constr.	9.36	-1.50	0.00	0.40	1.000	1.000	1.000
FF resistance	-21.26	-0.30	0.00	0.00	1.000	1.000	1.000
Earthq.- face	2.20	-0.60	0.00	0.00	1.000	1.000	1.000
Active pressure	30.84	-1.00	0.00	0.80	1.000	1.000	1.000
Earthq.- act.pressure	9.77	-2.00	0.00	0.80	1.000	1.000	1.000
DC	0.00	-2.75	40.74	0.26	1.000	1.000	1.000
PL	0.00	-2.75	173.00	0.26	1.000	1.000	1.000
W	0.00	-2.75	-38.80	0.26	0.000	0.000	0.000

Wall stem check - back reinf.

Wall check at the construction joint 3.00 m from the wall crest
Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 446.5 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.80 m

Reinforcement ratio	ρ	=	0.14	%	>	0.06	%	=	ρ_{min}
Position of neutral axis	c	=	0.04	m	<	0.31	m	=	c_{max}
Ultimate shear force	ϕV_n	=	472.59	kN	>	30.92	kN	=	V_u
Ultimate moment	ϕM_n	=	282.10	kNm	>	89.27	kNm	=	M_u

Cross-section is SATISFACTORY.

Wall stem check - back reinf. - V_u

Wall check at the construction joint 2.71 m from the wall crest
Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 446.5 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.80 m

Ultimate shear force ϕV_n = 472.59 kN > 32.85 kN = V_u
Cross-section is SATISFACTORY.

Wall jump check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-1.33	100.80	1.50	1.000
Earthq.- constr.	16.38	-1.33	0.00	1.50	1.000
FF resistance	-59.21	-0.50	0.00	1.10	1.000
Earthq.- face	6.13	-1.00	0.00	0.55	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.000
Earthquake - soil wedge	10.19	-2.10	0.00	2.45	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.000
Earthq.- act.pressure	15.05	-2.40	7.79	3.00	1.000
DC	0.00	-3.35	40.74	1.36	1.000
PL	0.00	-3.35	173.00	1.36	1.000
W	0.00	-3.35	-38.80	1.36	0.000

Wall jump check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 624.1 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.60 m

Reinforcement ratio	ρ	=	0.19 %	>	0.12 %	=	ρ_{min}
Position of neutral axis	c	=	0.02 m	<	0.22 m	=	c_{max}
Ultimate shear force	ϕV_n	=	340.78 kN	>	156.86 kN	=	V_u
Ultimate moment	ϕM_n	=	187.35 kNm	>	89.62 kNm	=	M_u

Cross-section is SATISFACTORY.

Wall heel check

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Design coefficient
Weight - wall	0.00	-0.30	15.84	2.45	1.000
Weight - earth wedge	0.00	-2.10	62.70	2.45	1.000
Active pressure	44.45	-1.20	0.00	3.00	1.000
Contact stress	0.00	0.00	-109.66	2.42	1.000

Wall heel check

Reinforcement and dimensions of the cross-section
5 prof. No. 5, cover 75.0 mm
Inputted reinforcement area = 989.7 mm^2
Required reinforcement area = 0.0 mm^2
Cross-section width = 1.00 m
Cross-section height = 0.60 m

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA: AÑO 2018**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
1,1	LOCALIZACIÓN Y REPLANTEO	M2	4.409,00	

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
EQUIPO DE TOPOGRAFÍA			$ 60.000,00	68,9	$ 870,95
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 347,08
				SUBTOTAL	$ 1.218,03

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
ESTACAS EN MADERA	UND	0,5	$ 800,00	$ 400,00
PINTURA	GALÓN	0,001	$ 82.000,00	$ 82,00
PUNTILLAS	LIBRA	0,02	$ 8.000,00	$ 160,00
			SUBTOTAL	$ 642,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
CAMIONETA	1	1	68,9	$ 55.000,00	$ 798,37
				SUBTOTAL	$ 798,37

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
COMISIÓN DE TOPOGRAFÍA (UN TOPÓGRAFO + 2 CADENEROS)	250000,0	190%	475000,0	68,4	$ 6.941,64
				SUBTOTAL	$ 6.941,64
				TOTAL COSTO DIRECTO	$ 9.600,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
1,2	Acarreo interno de material	UND		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
HERRAMIENTA MENOR 5% DE MANO DE OBRA					$ 952,39
				SUBTOTAL	$ 952,39

2. Materiales

Descripción			Unidad	Cantidad	Precio Unit.	Vr Unitario
						$ -
					SUBTOTAL	$ -

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
AYUDANTES - 2	100000,0	190%	190000,0	9,97	$ 19.047,88
				SUBTOTAL	$ 19.047,88
				TOTAL COSTO DIRECTO	$ 20.000,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA: AÑO 2018**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
2,1	EXCAVACIONES CORTE A MÁQUINA.	M3	14.314,00	

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
RETROEXCAVADORA			180000	9,30	$ 19.348,71
RIPER			80000	9,30	$ 8.599,43
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 332,50
				SUBTOTAL	$ 28.280,64

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
			SUBTOTAL	$ -

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
CAMA BAJA	1	1	1	$ 69,86	$ 69,86
				SUBTOTAL	$ 69,86

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
COMISIÓN DE TOPOGRAFÍA (UN TOPÓGRAFO + 2 CADENEROS)	250000,0	190%	475000,0	100,0	$ 4.750,00
AYUDANTES - 2	100000,0	190%	190000,0	100,0	$ 1.900,00
				SUBTOTAL	$ 6.650,00
				TOTAL COSTO DIRECTO	$ 35.000,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
2,2	**Relleno con material del sitio**	**M3**	**7.833,00**	

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
COMPACTADOR TIPO SALTARIN			160000	42,31	$ 3.781,50
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 372,30
				SUBTOTAL	$ 4.153,80

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
			SUBTOTAL	$ -

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
OFICIAL -1	70000,0	190%	133000,0	45,0	$ 2.955,56
AYUDANTES - 2	100000,0	190%	190000,0	42,3112614	$ 4.490,53
				SUBTOTAL	$ 7.446,09
				TOTAL COSTO DIRECTO	$ 11.600,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
3.1	Concreto simple para solados	M3		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 640,97
				SUBTOTAL	$ 640,97

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
CONCRETO 2500 psi	M3	0,0515	$ 360.000,00	$ 18.540,00
			SUBTOTAL	$ 18.540,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
CUADRILLA (1 OFICIAL + 2 AYUDANTES)	170000,0	190%	323000,0	25,2	$ 12.819,34

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
3.2	Concreto de 280 kg/cm2 para cimentacion	M3		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
FORMALETA			18750	1	$ 150.000,00
ELEMENTOS DE SEGURIDAD		GLB	34375	6	$ 45.833,33
VIBRADOR DE CONCRETO			9000	6	$ 12.000,00
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 13.193,66
				SUBTOTAL	$ 221.026,99

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
CONCRETO 280 kg/cm2	M3	1,05	$ 450.000,00	$ 472.500,00
ANTISOL	KG	0,4	$ 6.500,00	$ 2.600,00
			SUBTOTAL	$ 475.100,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
CUADRILLA (1 OFICIAL + 4 AYUDANTES)	170000,0	190%	323000,0	1,2	$ 263.873,22

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
4,1	ACERO DE REFUERZO PDR-60	KG		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 88,12
				SUBTOTAL	$ 88,12

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
ACERO DE REFUERZO 60.000 PSI	KG	1,03	$ 5.400,00	$ 5.562,00
ALAMBRE NEGRO #18	KG	0,04	$ 9.700,00	$ 388,00
SEGUETA SIN MARCO	UND	0,04	$ 10.000,00	$ 400,00
			SUBTOTAL	$ 6.350,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
OFICIAL - 1	70000,0	190%	133000,0	183,3	$ 725,66
AYUDANTES - 2	100000,0	190%	190000,0	183,3	$ 1.036,66
				SUBTOTAL	$ 1.762,31
				TOTAL COSTO DIRECTO	$ 8.200,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
4,2	ACERO DE REFUERZO PDR-60	KG		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
TALADRO DE ARBOL			70000	10	$ 7.000,00
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 300,32
				SUBTOTAL	$ 7.300,32

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
PLATINA A36	KG	1,05	$ 6.500,00	$ 6.825,00
BROCA	UND	0,04	$ 12.000,00	$ 480,00
ALAMBRE NEGRO #18	KG	0,04	$ 9.700,00	$ 388,00
SEGUETA SIN MARCO	UND	0,04	$ 10.000,00	$ 400,00
			SUBTOTAL	$ 8.093,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
OFICIAL - 1	70000,0	190%	133000,0	53,8	$ 2.473,19
AYUDANTES - 2	100000,0	190%	190000,0	53,8	$ 3.533,13
				SUBTOTAL	$ 6.006,32
				TOTAL COSTO DIRECTO	$ 21.400,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
4,3	**Suministro e instalacion de malla galvanizada de proteccion calibre No 12. inlcuye varilla de fijacion de 1/2".**	**KG**		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
EQUIPO DE SOLDADURA			50000	25	$ 2.000,00
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 600,01
				SUBTOTAL	$ 2.600,01

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
MALLA ESLABONADA ROMBO 2"	M2	1	$ 21.000,00	$ 21.000,00
VARILLA 1/2	KG	1	$ 5.400,00	$ 5.400,00
PLATINA FIJACIÓN	ML	1	$ 6.000,00	$ 6.000,00
ALAMBRE LISO	ML	2	$ 500,00	$ 1.000,00
			SUBTOTAL	$ 33.400,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
OFICIAL - 1	70000,0	190%	133000,0	26,9	$ 4.941,24
AYUDANTES - 2	100000,0	190%	190000,0	26,9	$ 7.058,92
				SUBTOTAL	$ 12.000,16
				TOTAL COSTO DIRECTO	$ 48.000,00

ANÁLISIS DE PRECIOS UNITARIOS

A. DATOS GENERALES

CONTRATO No:		**FECHA:**
OBJETO DEL CONTRATO:		
CONTRATISTA:		
INTERVENTOR:		
SUPERVISOR:		

B. DATOS ESPECIFÍCOS

Ítem	Descripción	Unidad	Cantidad	Elemento
5,1	ESTRUCTURA METÁLICA	KG		

1. Equipo

Descripción	Marca	Tipo	Tarifa/Hora	Rendimiento	Vr. Unitario
EQUIPO DE SOLDADURA			50000	25	$ 2.000,00
HERRAMIENTA MENOR 5% DE LA MANO DE OBRA					$ 543,72
				SUBTOTAL	$ 2.543,72

2. Materiales

Descripción	Unidad	Cantidad	Precio Unit.	Vr Unitario
ACERO PARA ESTRUCTURA METÁLICA	KG	1,03	$ 5.400,00	$ 5.562,00
SOLDADURA	KG	0,02	$ 20.000,00	$ 400,00
ANTICORROSIVO	GL	0,02	$ 50.000,00	$ 1.000,00
PINTURA DE ESMALTE	GL	0,017	$ 60.000,00	$ 1.020,00
			SUBTOTAL	$ 7.982,00

3. Transportes

Material	Vol. o Peso	Distancia	m2 o Ton/Km	Tarifa	Vr. Unitario
				SUBTOTAL	$ -

4. Mano de Obra

Trabajador	Jornal	Prestac.	Jornal Total	Rendimiento	Vr. Unitario
OFICIAL - 1	70000,0	190%	133000,0	29,7	$ 4.477,72
AYUDANTES - 2	100000,0	190%	190000,0	29,7	$ 6.396,74
				SUBTOTAL	$ 10.874,46
				TOTAL COSTO DIRECTO	$ 21.400,00

ADMINISTRACIÓN	**IMPUESTOS MUNICIPALES**			
	RETEICA	1%	Todos los contratos	10%
	ESTAMPILLA PRO ELECTRIFICACIÓN	0,5%		
	ESTAMPILLA ADULTO MAYOR	4%		
	ESTAMPILLA PRO DEPORTE	2,5%		
	ESTAMPILLA PRO CULTURA	2%		
	SERVICIOS PERSONALES PERSONALES PERSONA JURIDICA	4%	Mantenimiento, mano de obra, logistica, etc.	6%
	SERVICIOS PERSONALES PERSONAL NATURAL	6%		
	POLIZAS Y OTROS GASTOS DE PERFECCIONAMIENTO DEL CONTRATO	6%		6%
			TOTAL	**22%**
IMPREVISTOS	Corresponden a un rubro dispuesto para cubrir sobrecostos eventuales en los que pueda incurrir el contratista durante la ejecución de sus obligaciones, los cuales forman parte del riesgo normal del contrato.			3%
UTILIDAD	es el beneficio que el contratista espera recibir tras la ejecución de sus obligaciones contractuales.			5%