

รายการคำนวณ

ประกอบการต่อเติมโครงสร้างหลังคา

โครงการปรับปรุงพื้นที่แผนกผู้ป่วยนอก (OPD)

สารบัญ

บทที่	หัวข้อ	หน้า
	หน้าปก	i
	สารบัญ	ii
	สารบัญตาราง	iii
	สัญลักษณ์	iv
1.	ข้อกำหนดการออกแบบโครงสร้าง	1
2.	ข้อกำหนดในการออกแบบ	1
	2.1 มาตรฐานการออกแบบ	1
	2.2 น้ำหนักบรรทุก	1
	2.3 วัสดุ	2
	2.4 ข้อกำหนดการก่อตัว	3
	เอกสารอ้างอิง	4
	ภาคผนวก ก. แบบจำลองโครงสร้าง	5
	ภาคผนวก ข. รายการคำนวณ	12

Supakit P.

สารบัญตาราง

		หน้า
ตารางที่	ชื่อ	หน้า
2.1	Required Strength for Different Load Combinations	2

Supakit T.

สัญลักษณ์

TIS	= Thai Industrial Standard
kN	= Kilonewton
kg	= Kilogram
m ²	= Square meter
mm	= Millimeter
m	= Meter
กก.	= กิโลกรัม
ตร.ม.	= ตารางเมตร
มม.	= มิลลิเมตร
ซม.	= เซนติเมตร
ม.	= เมตร

Supakit T.

1.ข้อกำหนดการออกแบบโครงสร้าง

เอกสารรายงานการออกแบบโครงสร้างเล่มนี้ ใช้สำหรับประกอบแบบการออกแบบต่อเติมโครงสร้างหลังคาแผนกผู้ป่วยนอก สถาบันโรคทรวงอก อ.เมือง จ.นนทบุรี เท่านั้น

2.ข้อกำหนดในการออกแบบ

2.1 มาตรฐานการออกแบบ

- AISC 89: American Institute of Steel Construction (Allowable Stress Design)
- ACI 318-19: Building Code Requirement for Structural Concrete and Commentary
- ASCE 7-22: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

2.2 น้ำหนักบรรทุก

น้ำหนักบรรทุกคงที่

- น้ำหนักคอนกรีตเสริมเหล็ก	2,400 kg/m ³
- น้ำหนักเหล็กเสริม	7,850 kg/m ³
- โครงสร้างหลังคา	25 kg/m ²
- หลังคากระเบื้องลอนคู่, ลอนเล็ก รวมแป	12 – 15 kg/m ²

น้ำหนักบรรทุกจร

- หลังคา	50 kg/m ²
- อาคารสำนักงาน ธนาคาร	250 kg/m ²
- บ้านได้, ห้องโถง และทางเดิน	350 kg/m ²
- ห้องแถว ตึกแถว อาคารชุด หอพัก โรงแรม	200 kg/m ²
- อาคารพาณิชย์ มหาวิทยาลัย วิทยาลัย โรงเรียน	300 kg/m ²
- ตลาด ห้างสรรพสินค้า หอประชุม โรงมหรสพ ที่จอดรถ/เก็บรถยนต์นั่ง	400 kg/m ²
- ที่จอดรถหรือเก็บรถยนต์บรรทุกเปล่าและรถอื่นๆ	800 kg/m ²

Supakit T.

การรวมน้ำหนักบรรทุก

ตารางที่ 2.1: Required Strength for Different Load Combinations

AISC Code Section	Load	Required Strength
	Dead (D)	$U = D$
	Dead (D) & Live (L)	$U = D + L$
	Dead (D) & Live (L)	$U = D + L_r$
	Dead (D) & Live (L)	$U = D + 0.75(L + L_r)$
	Dead, Wind (W) or Earthquake (E)	$U = D + (W \text{ or } 0.7E)$
	Dead, Wind (W) or Earthquake & Live (L)	$U = D + 0.75(W \text{ or } 0.7E) + 0.75(L + L_r)$
	Dead, Wind (W) or Earthquake	$U = 0.6D + (W \text{ or } 0.7E)$

2.3 วัสดุ

คอนกรีต

สำหรับกำลังคอนกรีตที่ใช้ออกแบบ คือกำลังรับแรงอัดของตัวอย่างทดสอบลูกทรงกระบอก โดยสามารถแบ่งได้ตามประเภทของโครงสร้างได้ดังนี้

Slab	240	ksc
Beam	240	ksc
Column and Shear Wall	300	ksc
RC. footing	300	ksc
Pre-stressed concrete	400	ksc
Other Structures	240	ksc

เหล็กเสริม

สำหรับเหล็กเสริมคอนกรีตอ้างอิงตามมาตรฐาน TIS 20-2543 สำหรับเหล็กกลม และ TIS 24-2548 ข้อ้อย โดยมีรายละเอียดดังนี้:

Plain round bars Grade SR24	$f_y = 2,400 \text{ kg/cm}^2$
Deformed bars Grade SD40	$f_y = 4,000 \text{ kg/cm}^2$

เหล็กรูปพรรณ

Mild carbon steel - ASTM A36 or JIS G3101 Grade SS400 or TIS 1227 Grade SS400

Tensile strength of structural steel	$f_u = 4,000 \text{ kg./cm}^2$
Yield strength of structural steel	$f_y = 2,400 \text{ kg./cm}^2$
Modulus of elasticity of structural steel	$E_s = 2,040,000 \text{ kg./cm}^2$

Suphakit T.

สลักยึด (Bolts)

-ISO 898 Grade 8.8

Tensile strength of bolts	$f_u = 8,460 \text{ kg./cm.}^2$
Yield strength of bolts	$f_y = 6,100 \text{ kg./cm.}^2$
Modulus of elasticity of bolts	$E_s = 2,040,000 \text{ kg./cm.}^2$
Allowable Tensile Stress	$F_t = 3,000 \text{ kg./cm.}^2$
Allowable Shear Stress	$F_v = 1,300 \text{ kg./cm.}^2$

ลวดเชื่อม

-AWS Classification E60

Tensile strength of electrodes grade E60	$f_u = 4,200 \text{ kg./cm.}^2$
Yield strength of electrodes grade E60	$f_y = 3,375 \text{ kg./cm.}^2$

-AWS Classification E70

Tensile strength of electrodes grade E70	$f_u = 4,900 \text{ kg./cm.}^2$
Yield strength of electrodes grade E70	$f_y = 4,000 \text{ kg./cm.}^2$

2.4 ข้อกำหนดการโก่งตัว

The serviceability design is the limitation the deflection of structural members and structural elements, which is criteria as follows.

-Aluminium framework less	L/180 or 20mm whichever is less
-Aluminium framework (reinforce with steelwork)	L/240
-Structural steelworks (Out of Plane)	L/240
-Structural steelworks (In Plane)	L/500
-Structural steelworks (cantilevered)	L/150
-Aluminium transom: max. dead load	L/1000 or 3mm
-Aluminium cladding center and aluminium backpan center less	L/90 or 20mm whichever is less

Saphakit T.

เอกสารอ้างอิง

AISC 89: American Institute of Steel Construction (Allowable Stress Design)

ASCE 7-22: Minimum Design Loads and Associated Criteria for Buildings and Other Structures

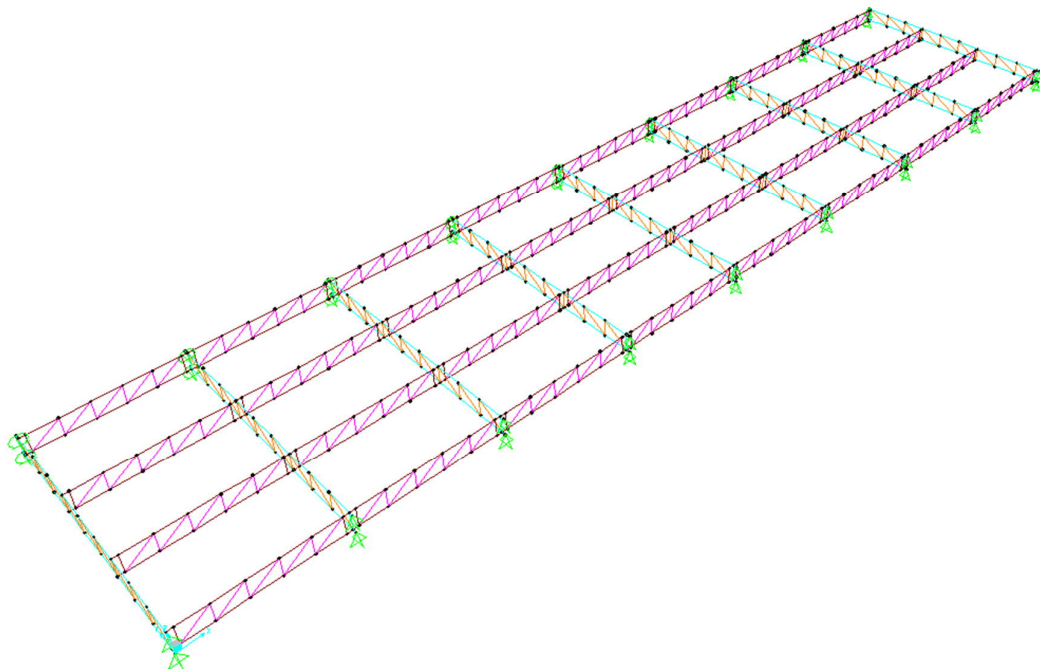
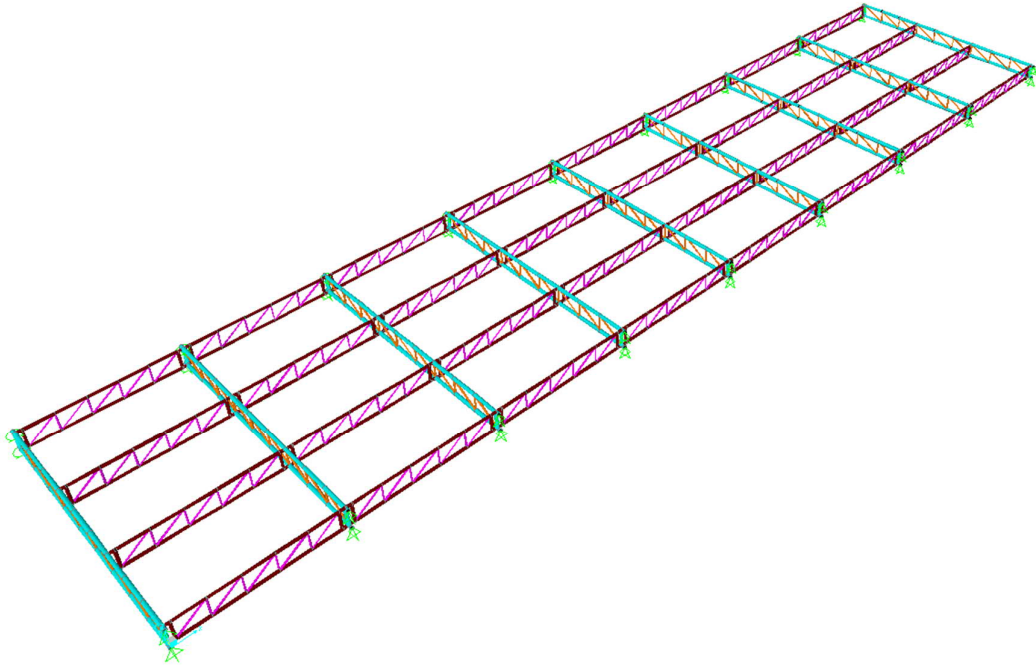
ACI 318-19 Building Code Requirements for Structural Concrete

Supakit T

ภาคผนวก ก. แบบจำลองโครงสร้าง

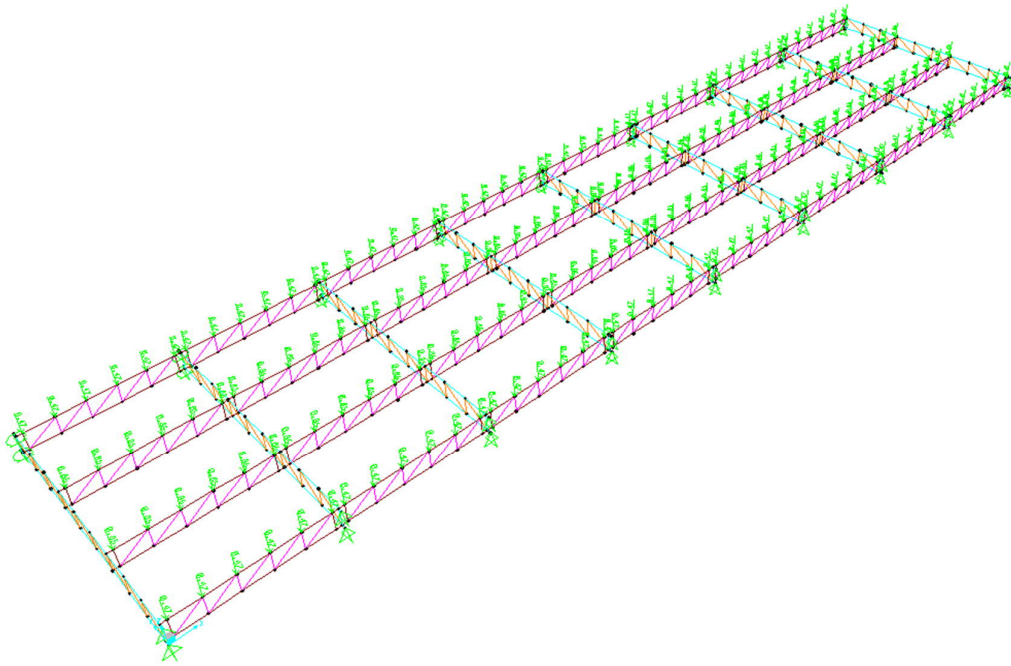
Supakit T.

ภาคผนวก ก.1 แบบจำลองโครงสร้างหลังคา 1

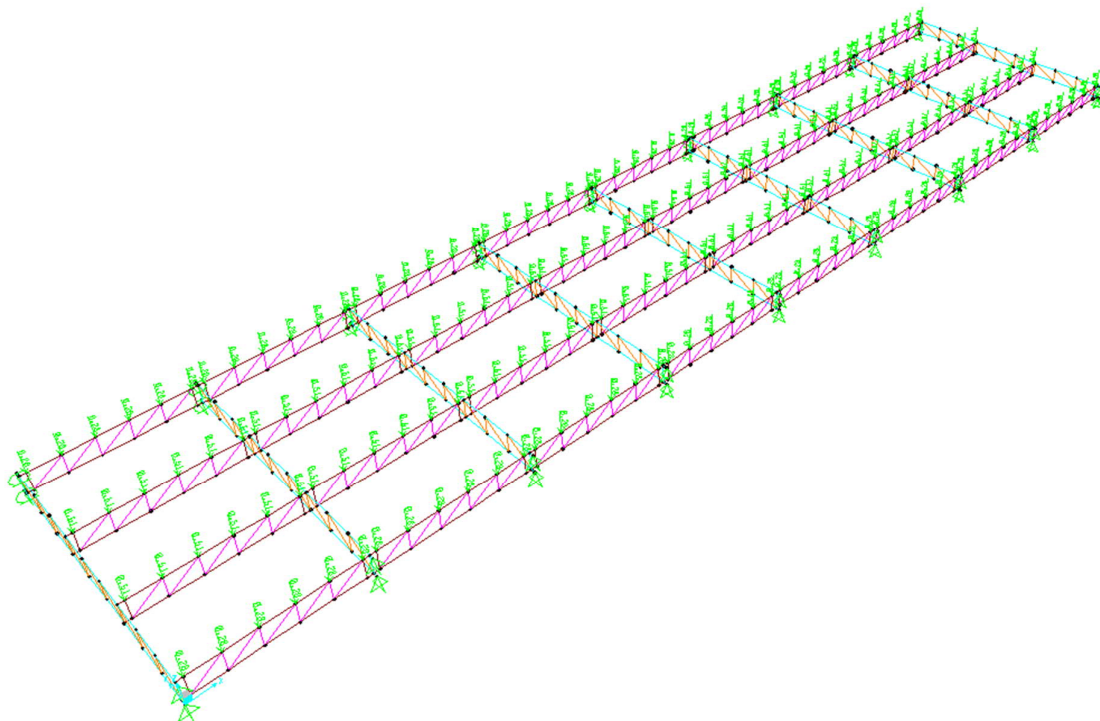


ก.1 รูปแสดง 3 มิติ

Suphakit T.

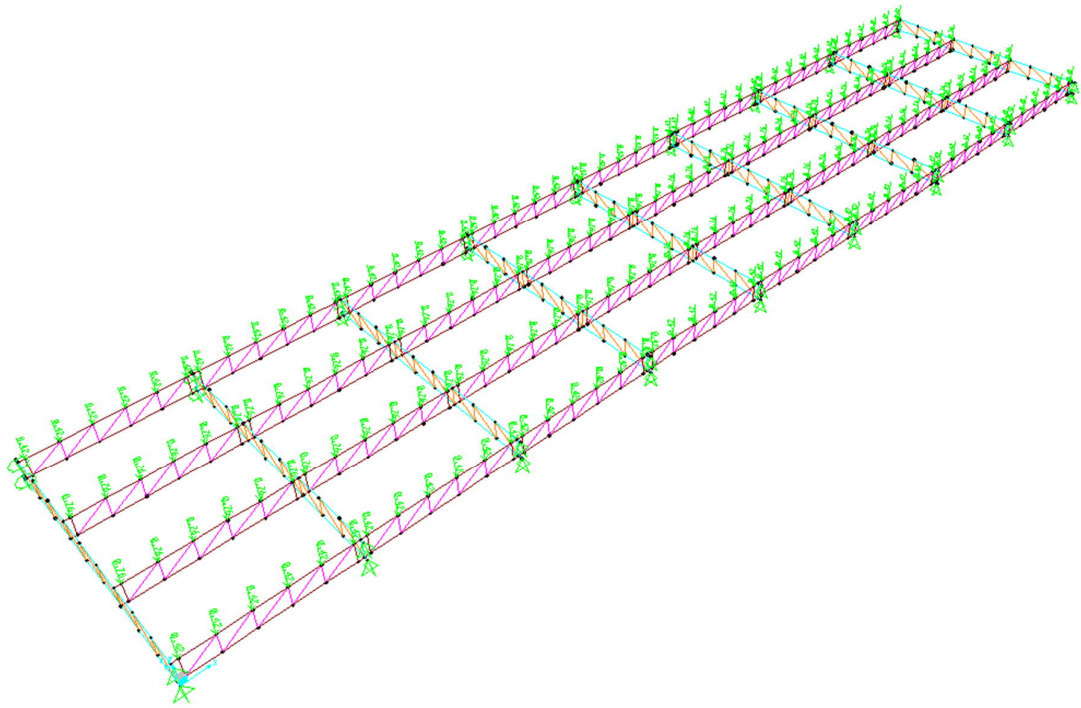


ก.2 รูปแสดงการใส่น้ำหนักบรรทุกทุกจร



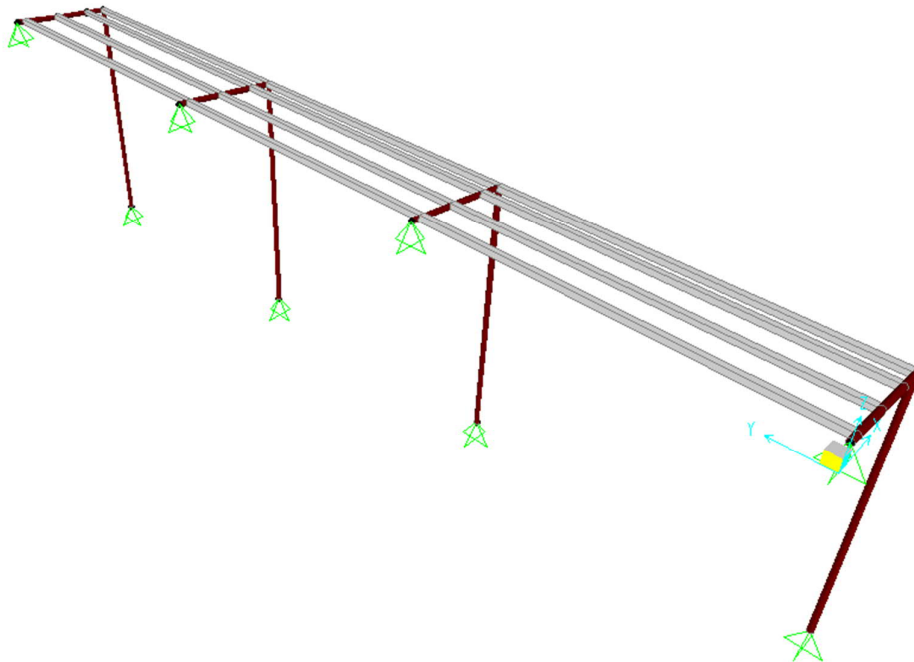
ก.3 รูปแสดงการใส่น้ำหนักบรรทุกทุกคงที่

Supakit T.

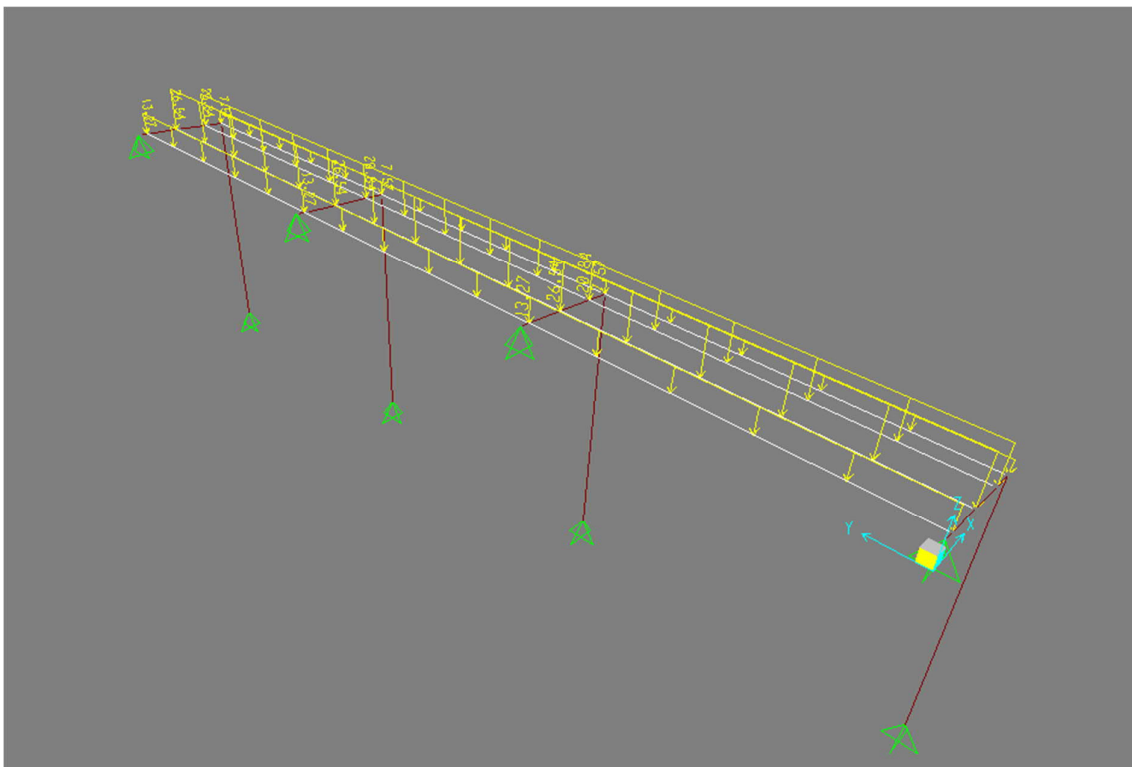


ก.4 รูปแสดงการใส่น้ำหนักบรรทุกแรงลม

ภาคผนวก ก.2 แบบจำลองโครงสร้างหลังคา 2



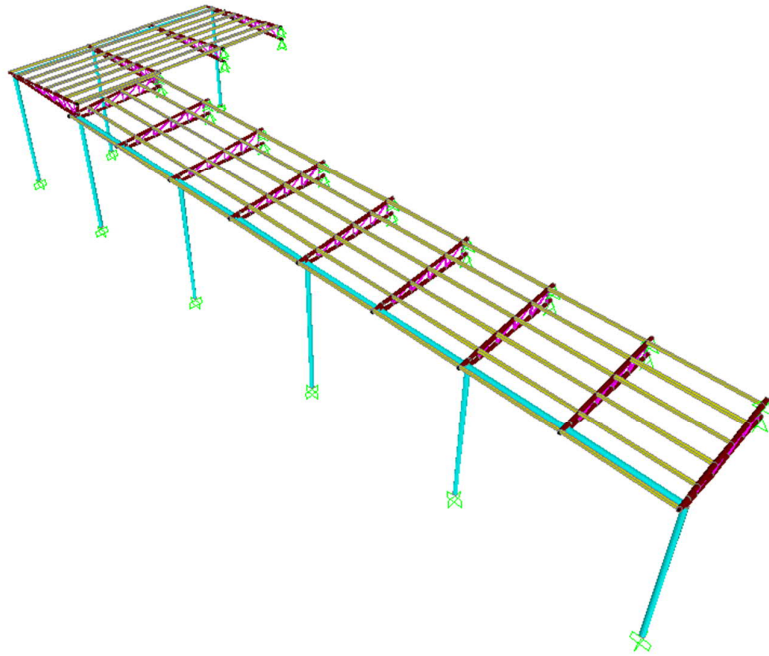
ก.4 รูปแสดง 3 มิติ



ก.5 รูปแสดงการใส่น้ำหนักบรรทุก

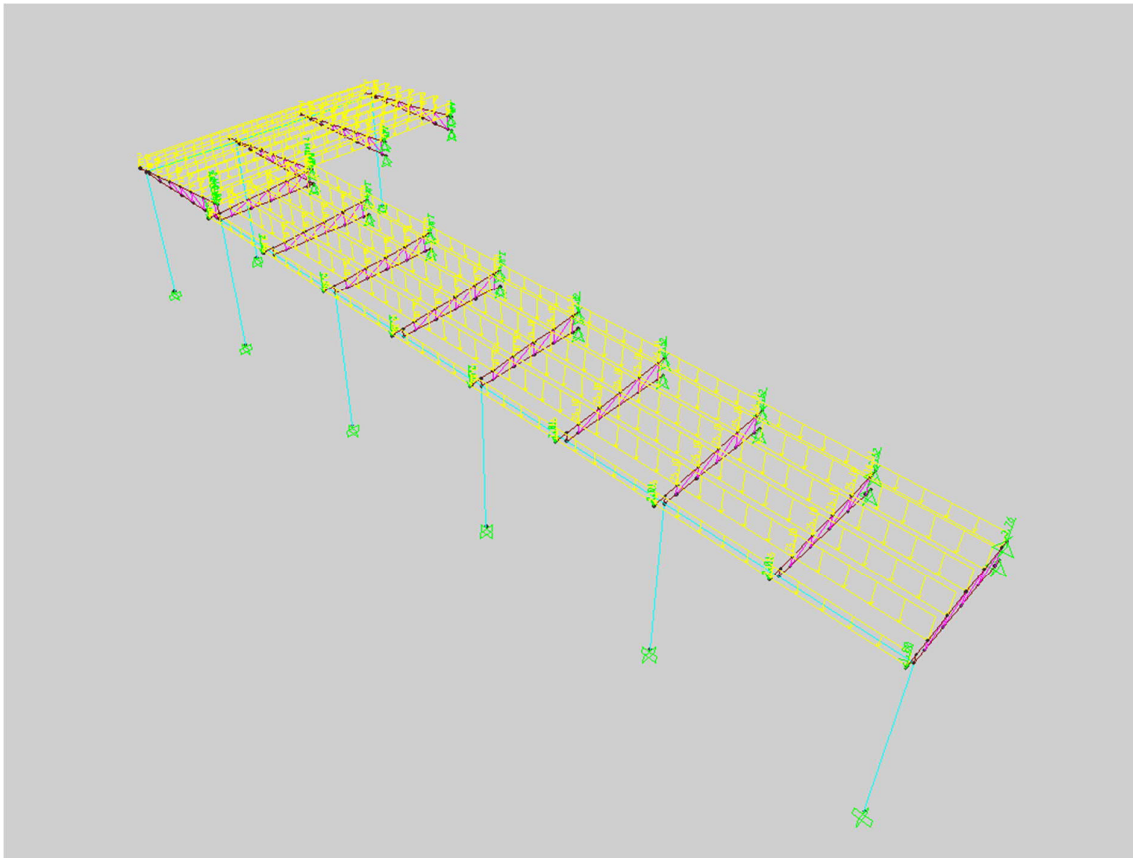
Suphakit T.

ภาคผนวก ก.3 แบบจำลองโครงสร้างหลังคา 3



ก.6 รูปแสดง 3 มิติ

Supakit T.



ก.7 รูปแสดงการใส่น้ำหนักบรรทุก

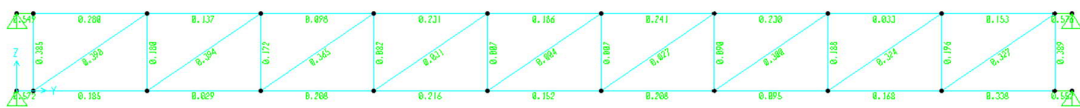
ภาคผนวก ข. รายการคำนวณ

Suphakit T.

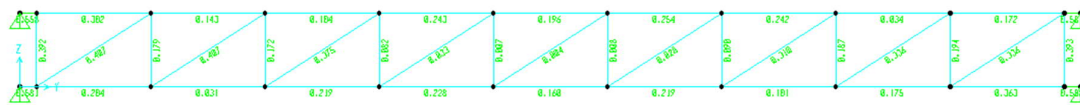
ภาคผนวก ข.1 รายการคำนวณโครงสร้างหลังคา 1



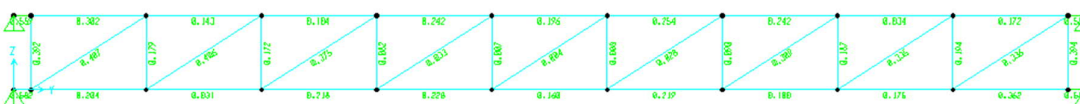
Truss TA1



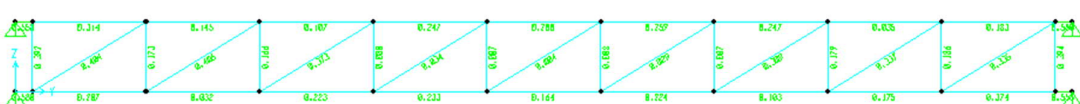
Truss TA2



Truss TA3

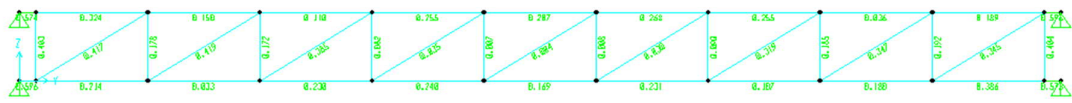


Truss TA4



Truss TA5

Supakit T.



Truss TA6



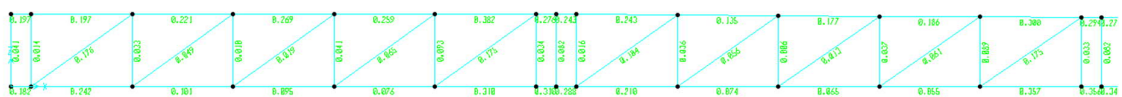
Truss TA7



Truss TA8



Truss TA9

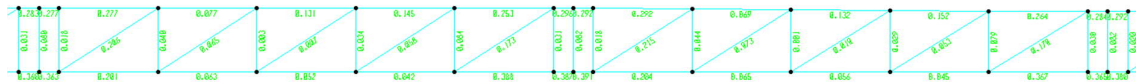


Truss TB1&TB2

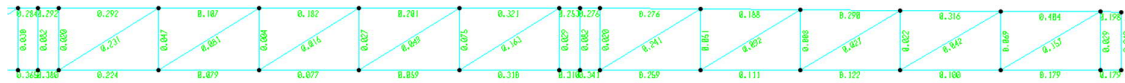


Truss TB3&TB4

Supakit T.



Truss TB5&TB6



Truss TB7&TB8

Sugha kit ?

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 769
X Mid : 28.520
Y Mid : 2.448
Z Mid : 0.222
Length : 0.863
Loc : 0.432

Design Sect: CHS-32x3.2 mm
Design Type: Brace
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 3.971E-04
IMajor : 0.000
IMinor : 0.000
Ixy : 0.000

SMajor : 3.651E-06
SMinor : 3.651E-06
ZMajor : 5.004E-06
ZMinor : 5.004E-06
Fy : 235000.000

rMajor : 0.014
rMinor : 0.014
E : 199947978.80
Fy : 235000.000

AVMajor: 1.994E-04
AVMinor: 1.994E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.432	-10.657	0.002	0.000	0.000	0.000	0.000

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.241	=	0.236 +	0.005 +	0.000	0.950	OK

AXIAL FORCE DESIGN

Axial	P Force	fa Stress	Fa Allowable	Ft Allowable
	-10.657	26837.251	113810.633	141000.000

MOMENT DESIGN

Major Moment	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Minor Moment	0.002	668.416	155100.000	271260.406	1.000	1.000	1.000	1.000
	0.000	0.000	155100.000	271260.406	1.000	1.000	1.000	1.000

Shear Design

Major Shear	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Minor Shear	0.000	0.000	94000.000	0.000	OK	0.000
	0.000	0.000	94000.000	0.000	OK	0.000

Supakrit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 1208
X Mid : 28.000
Y Mid : 0.504
Z Mid : 0.225
Length : 0.899
Loc : 0.449

Design Sect: CHS-40x3.2mm
Design Type: Brace
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 4.564E-04
IMajor : 0.000
IMinor : 0.000
IXy : 0.000

SMajor : 4.863E-06
SMinor : 4.863E-06
ZMajor : 6.607E-06
ZMinor : 6.607E-06

rMajor : 0.016
rMinor : 0.016
E : 199947978.80
Fy : 235000.000

AVMajor: 2.290E-04
AVMinor: 2.290E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.449	-22.633	0.003	0.000	0.000	0.000	0.000

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.428	=	0.423	+	0.005	+	0.000
						OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Ft Allowable
-22.633	49589.508	117245.960	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
0.003	631.091	155100.000	330166.472	1.000	1.000	1.000	1.000
Minor Moment	0.000	155100.000	330166.472	1.000	1.000	1.000	1.000

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
0.000	0.000	94000.000	0.000	OK	0.000
Major Shear	0.000	94000.000	0.000	OK	0.000
Minor Shear	0.000	94000.000	0.000	OK	0.000

Sophakitt T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 444
X Mid : 20.075
Y Mid : 4.782
Z Mid : 0.000
Length : 0.150
Loc : 0.150

Design Sect: CHS-65x3.2 mm
Design Type: Beam
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 7.349E-04
IMajor : 0.000
IMinor : 0.000
IXy : 0.000

SMajor : 1.289E-05
SMinor : 1.289E-05
ZMajor : 1.711E-05
ZMinor : 1.711E-05

rMajor : 0.026
rMinor : 0.026
E : 199947978.80
Fy : 235000.000

AVMajor: 3.679E-04
AVMinor: 3.679E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.150	-7.114	0.451	0.000	-3.002	0.000	0.000

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P Ratio	M Major Ratio	M Minor Ratio	Ratio Limit	Status Check
0.417	=	0.225	+	0.192	+	0.000
					0.950	OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Fa Allowable	Ft Allowable
-7.114	9681.041	43065.194	43065.194	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
0.451	34981.788	155100.000	30624137.64	0.850	1.000	1.000	1.000
Minor Moment	0.000	155100.000	43065.194	1.000	1.000	26.667	

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
3.002	8160.091	94000.000	0.087	OK	0.000
Minor Shear	0.000	94000.000	0.000	OK	0.000

Suphakit T

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 33
X Mid : 28.000
Y Mid : 7.173
Z Mid : 0.450
Length : 0.115
Loc : 0.000

Design Sect: CHS-90x3.2 mm
Design Type: Beam
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 9.892E-04
IMajor : 1.199E-06
IMinor : 1.199E-06
Ixy : 0.000

SMajor : 2.359E-05
SMinor : 2.359E-05
ZMajor : 3.100E-05
ZMinor : 3.100E-05
Fy : 235000.000

rMajor : 0.035
rMinor : 0.035
E : 199947978.80
Fy : 235000.000

AVMajor: 4.950E-04
AVMinor: 4.950E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.000	43.693	1.122	0.000	9.752	0.000	0.000

PMM DEMAND/CAPACITY RATIO

Governing Equation (H2-1)	Total Ratio	P Ratio	M Major Ratio	M Minor Ratio	Ratio Limit	Status Check
0.620	=	0.313	+	0.307	+	0.000
						OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Ft Allowable
43.693	44168.599	140150.448	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
1.122	47556.392	155100.000	94326508.2	1.000	1.000	1.000	1.000
Minor Moment	0.000	2.097E-05	155100.000	94326508.2	1.000	1.000	1.000

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
9.752	19703.151	94000.000	0.210	OK	0.000
Minor Shear	0.000	5.645E-06	94000.000	0.000	OK

Suphakit T.

Project :

Date :

Location :

Page :

Member : PURLIN-SHS-50X50X2.3 MM

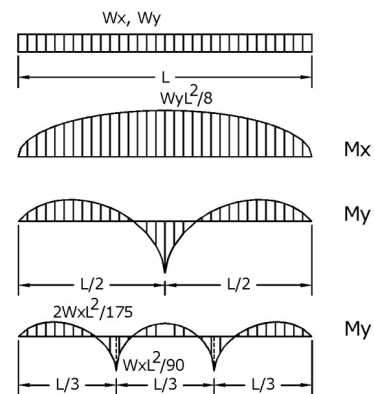
By :

SQUARE TUBE STEEL DESIGN OF PURLIN MEMBER (ASD)

MATERIAL PROPERTY

(1) Steel Grade	=	SM400
(2) Yield Strength of Steel (Fy)	=	2,400 ksc.
(3) Modulus of Elasticity (Es)	=	2.04E+06 ksc.

COMPUTATION



DATA

(1) Length (L)	=	2.31 m.
(2) Spacing (@)	=	0.740 m.
(3) Sag Rod	=	0 ea./spac.
(4) Slope of Roof (q)	=	1.00 degree

SECTION PROPERTY

(1) Section Size	=	SHS 50X50X2.3 MM
(2) Steel Area (Ag)	=	4.250 cm. ²
(3) Section Modulus (Sx)	=	6.34 cm. ³
(4) Section Modulus (Sy)	=	6.34 cm. ³
(5) Moment of Inertia (Ix)	=	15.90 cm. ⁴
(6) Moment of Inertia (Iy)	=	15.90 cm. ⁴

W_x	=	$W^* \sin \theta$	=	1.10	kg./m.
W_y	=	$W^* \cos \theta$	=	63.25	kg./m.
or	=	$0.75(W^* \cos q + W_{WL})$	=	72.41	kg./m.
M_x	=	$(1/8) W_y^* L^2$	=	48.30	kg.-m.
M_y	=	$(1/8) W_x^* L^2$	=	0.74	kg.-m.

LOADING

(1) Live Load (LL)	=	50.0 kg./m. ²
(2) Dead Load (DL)	=	
(2.1) Roof Material	=	25.0 kg./m. ²
(2.2) Other	=	5.0 kg./m. ²
(2.3) Purlin	=	4.06 kg./m.
(3) Total Load (LL + DL)	=	63.3 kg./m.
(4) Wind Load (WL)	=	45.0 kg./m. ²

CHECK

fb	=	$M_x/S_x + 2M_y/S_y$	=	785.1	ksc.
Fb	=	$0.6 * F_y$	=	1440.0	ksc.
		fb <= Fb		Status OK	
\triangle	=	$5W_{y(LL)}L^4/(384EI)$	=	0.42	cm.
$\triangle_{allow.}$	=	$L/360$	=	0.64	cm.
		Deflection		Status OK	

Supratit T

Current Date: 7/28/2023 6:38 PM

Units system: SI

File name: C:\Users\supha\OneDrive\Desktop\2023-07\RAMJOINT BASE PLATE.cnx\

Steel connections

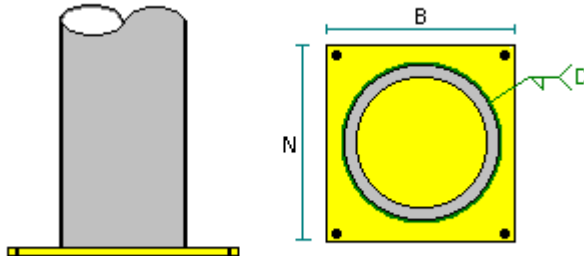
Data

Connection name	: Pinned BP - HSS Member
Connection ID	: 1

Family: Column - Base (CB)
Type: Base plate

GENERAL INFORMATION

Connector



MEMBERS

Column

Column type	:	Prismatic member
Section	:	PIPE101.6X3.2
Material	:	S275
Longitudinal offset	:	0 mm

CONNECTOR

Base plate

Position on the support	:	Center
N: Longitudinal dimension	:	215 mm
B: Transversal dimension	:	215 mm
Thickness	:	12 mm
Material	:	S275
Column weld	:	E60XX
D: Column weld size (1/16 in)	:	6
Override A2/A1 ratio	:	No
Include shear lug	:	No

Support

With pedestal	:	No
Longitudinal dimension	:	2.44 m
Transversal dimension	:	2.44 m
Thickness	:	609.6 mm
Material	:	C25-30
Include grouting	:	No

Anchor

Anchor position	:	Longitudinal position
Rows number per side	:	1
Anchors per row	:	2
Longitudinal edge distance on the plate	:	40 mm
Transverse edge distance on the plate	:	40 mm
Anchor type	:	Headed

Head type	:	Hexagonal
Include lock nut	:	No
Anchor	:	M-16
Effective embedment depth	:	150 mm
Total length	:	183.12 mm
Material	:	Class 8.8
Fy	:	0.64 kN/mm ²
Fu	:	0.8 kN/mm ²
Cracked concrete	:	No
Brittle steel	:	No
Anchors welded to base plate	:	No
<u>Anchor reinforcement</u>		
Type of reinforcement	:	Primary
Tension reinforcement	:	No
Shear reinforcement	:	No

Steel connections

Results

Connection name : Pinned BP - HSS Member
Connection ID : 1

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [KN]	Mu22 [KN*m]	Mu33 [KN*m]	Vu2 [KN]	Vu3 [KN]	Load type
DL	-64.78	0.00	0.00	14.50	0.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.05	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	3.13	DL	0.35	DG1 Sec 3.1.2
Flexural yielding (tension interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld shear capacity	[KN/m]	1253.81	90.86	DL	0.07	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.35	

Major axis Anchors

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

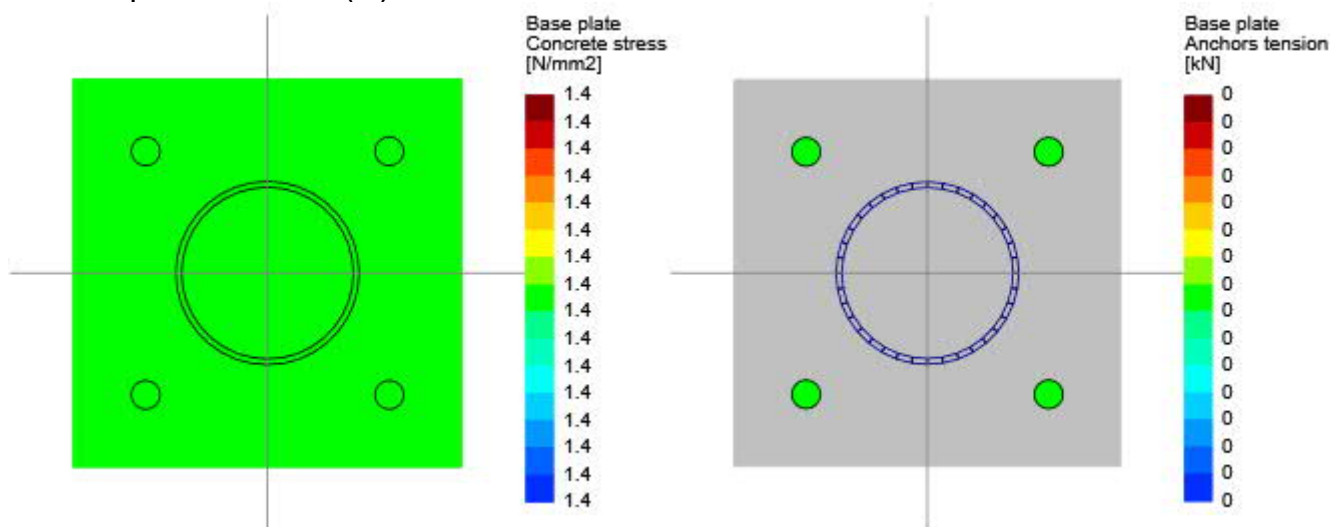
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	0.00	DL	0.00	Eq. D-3
Breakout of anchor in tension	[KN]	80.72	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	58.37	0.00	DL	0.00	Sec. D.4.1.1
Anchor shear	[KN]	44.83	3.63	DL	0.08	Eq. D-20
Breakout of anchor in shear	[KN]	274.03	3.63	DL	0.01	Sec. D.4.1.1
Breakout of group of anchors in shear	[KN]	282.94	14.50	DL	0.05	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	161.45	3.63	DL	0.02	Eq. D-4, Sec. D.4.1.1

Ratio 0.08

Global critical strength ratio 0.35

Major axis

Maximum compression and tension (DL)



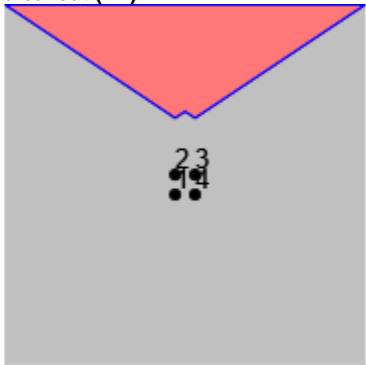
Maximum bearing pressure	1.40	[N/mm2]
Minimum bearing pressure	1.40	[N/mm2]
Maximum anchor tension	0.00	[KN]
Minimum anchor tension	0.00	[KN]
Neutral axis angle	0.00	
Bearing length	1E33	[mm]

Anchors tensions

Anchor	Transverse [mm]	Longitudinal [mm]	Shear [KN]	Tension [KN]
1	-67.50	-67.50	3.63	0.00
2	-67.50	67.50	3.63	0.00
3	67.50	67.50	3.63	0.00
4	67.50	-67.50	3.63	0.00

Major axis

Results for shear breakout (DL)



Group	Area [mm ²]	Shear [kN]	Anchors
1	1486449.00	14.50	1, 2, 3, 4
2	1486449.00	7.25	2, 3

Current Date: 7/28/2023 6:42 PM

Units system: SI

File name: C:\Users\supha\OneDrive\Desktop\2023-07\RAMJOINT BASE PLATE.cnx\

Steel connections

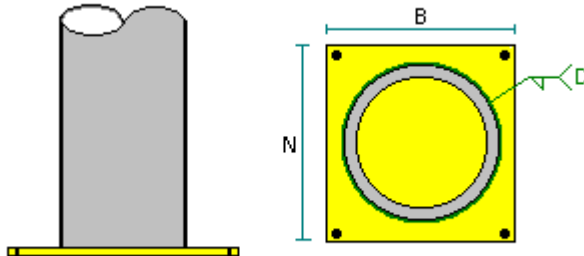
Data

Connection name : Fixed biaxial BP
Connection ID : 2

Family: Column - Base (CB)
Type: Base plate

GENERAL INFORMATION

Connector



MEMBERS

Column

Column type	:	Prismatic member
Section	:	PIPE101.6X3.2
Material	:	S275
Longitudinal offset	:	0 mm
Transversal offset	:	0 mm

CONNECTOR

Base plate

Position on the support	:	Center
N: Longitudinal dimension	:	215 mm
B: Transversal dimension	:	215 mm
Thickness	:	12 mm
Material	:	S275
Column weld	:	E60XX
D: Column weld size (1/16 in)	:	6
Override A2/A1 ratio	:	No
Include shear lug	:	No

Support

With pedestal	:	No
Longitudinal dimension	:	2.44 m
Transversal dimension	:	2.44 m
Thickness	:	609.6 mm
Material	:	C25-30
Include grouting	:	No

Anchor

Anchor position	:	Longitudinal position
Rows number per side	:	1
Anchors per row	:	2
Longitudinal edge distance on the plate	:	40 mm
Transverse edge distance on the plate	:	40 mm

Anchor type	:	Headed
Head type	:	Hexagonal
Include lock nut	:	No
Anchor	:	M-16
Effective embedment depth	:	150 mm
Total length	:	183.12 mm
Material	:	Class 8.8
Fy	:	0.64 kN/mm ²
Fu	:	0.8 kN/mm ²
Cracked concrete	:	No
Brittle steel	:	No
Anchors welded to base plate	:	No
<u>Anchor reinforcement</u>		
Type of reinforcement	:	Primary
Tension reinforcement	:	No
Shear reinforcement	:	No

Steel connections

Results

Connection name : Fixed biaxial BP
Connection ID : 2

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [KN]	Mu22 [KN*m]	Mu33 [KN*m]	Vu2 [KN]	Vu3 [KN]	Load type
DL	64.75	0.00	0.00	14.50	0.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	8.09	DL	0.91	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	150.22	DL	0.08	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1253.81	90.86	DL	0.07	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	202.86	DL	0.11	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.91	

**Design for minor axis
Base plate (AISC 360-16 LRFD)**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	8.09	DL	0.91	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	150.22	DL	0.08	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1253.81	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	202.86	DL	0.11	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio	0.91					

**Major axis
Anchors**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	16.19	DL	0.19	Eq. D-3
Breakout of anchor in tension	[KN]	80.72	16.19	DL	0.20	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	136.42	64.75	DL	0.47	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	58.37	16.19	DL	0.28	Sec. D.4.1.1
Anchor shear	[KN]	44.83	3.63	DL	0.08	Eq. D-20
Breakout of anchor in shear	[KN]	274.03	3.63	DL	0.01	Sec. D.4.1.1
Breakout of group of anchors in shear	[KN]	282.94	14.50	DL	0.05	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	161.45	3.63	DL	0.02	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	272.85	14.50	DL	0.05	Eq. D-5, Sec. D.4.1.1
Interaction of tensile and shear forces	[KN]	1.20	0.00	DL	0.00	Eq. D-3, Eq. D-4, Sec. D.4.1.1, Eq. D-5, Eq. D-20, Sec. D.7

Ratio 0.47

Minor axis Anchors

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

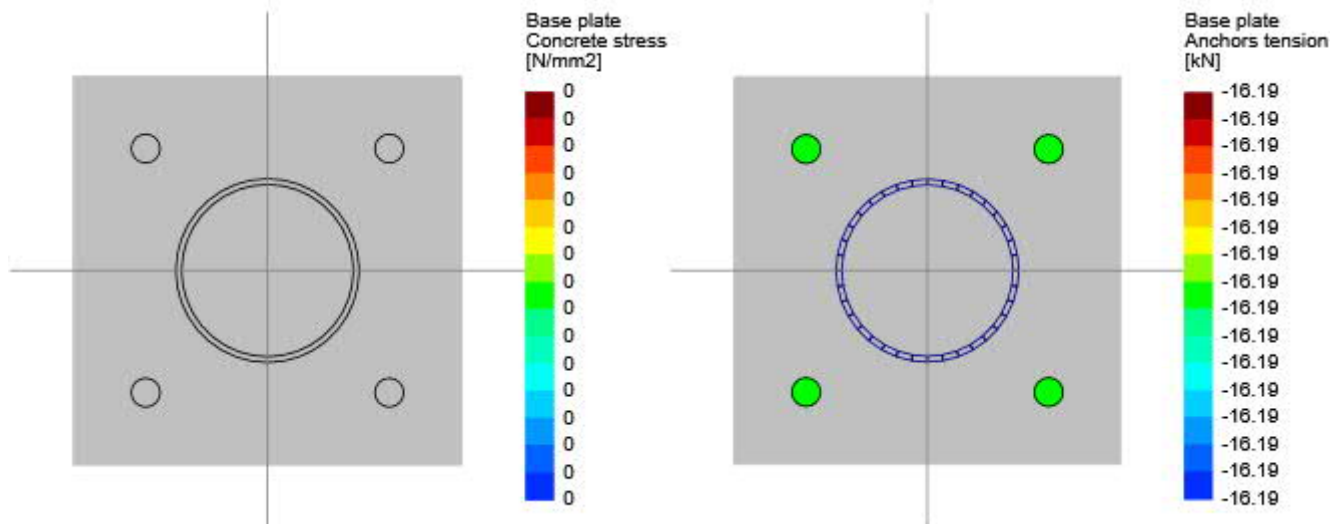
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	16.19	DL	0.19	Eq. D-3
Breakout of anchor in tension	[KN]	80.72	16.19	DL	0.20	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	136.42	64.75	DL	0.47	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	58.37	16.19	DL	0.28	Sec. D.4.1.1
Anchor shear	[KN]	44.83	0.00	DL	0.00	Eq. D-20
Breakout of anchor in shear	[KN]	274.03	0.00	DL	0.00	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	161.45	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	272.85	0.00	DL	0.00	Eq. D-5, Sec. D.4.1.1

Ratio 0.47

Global critical strength ratio 0.91

Biaxial

Maximum compression and tension (DL)



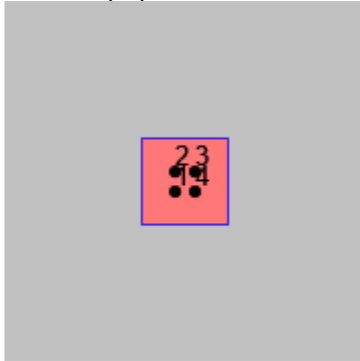
Maximum bearing pressure	0.00	[N/mm2]
Minimum bearing pressure	0.00	[N/mm2]
Maximum anchor tension	16.19	[KN]
Minimum anchor tension	16.19	[KN]
Neutral axis angle	0.00	
Bearing length	-1E33	[mm]

----- **Anchors tensions**

Anchor	Transverse [mm]	Longitudinal [mm]	Shear [KN]	Tension [KN]
1	-67.50	-67.50	3.63	16.19
2	-67.50	67.50	3.63	16.19
3	67.50	67.50	3.63	16.19
4	67.50	-67.50	3.63	16.19

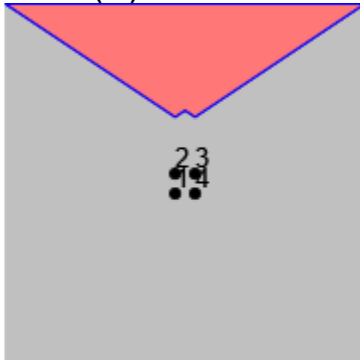
Major axis

Results for tensile breakout (DL)



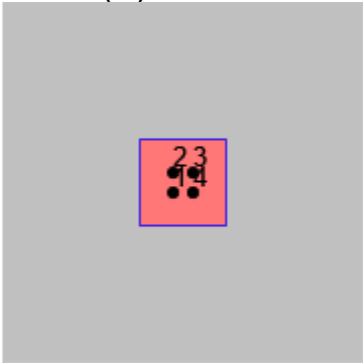
Group	Area [mm2]	Tension [KN]	Anchors
1	342225.00	64.75	1, 2, 3, 4

Results for shear breakout (DL)



Group	Area [mm2]	Shear [KN]	Anchors
1	1486449.00	14.50	1, 2, 3, 4
2	1486449.00	7.25	2, 3

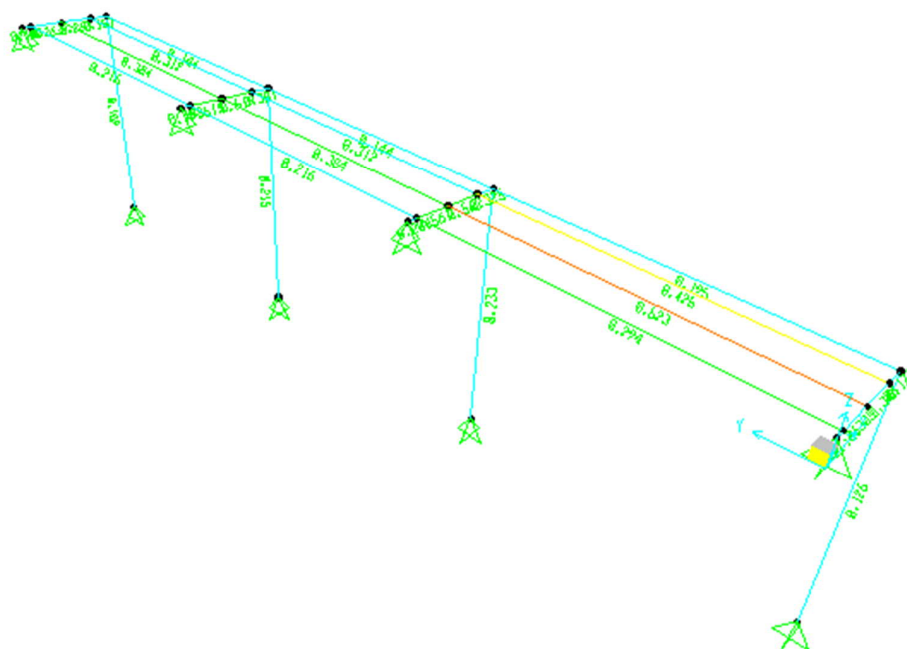
Results for tensile breakout (DL)



Minor axis

Group	Area [mm2]	Tension [KN]	Anchors
1	342225.00	64.75	1, 2, 3, 4

ภาคผนวก ข.2 รายการคำนวณโครงสร้างหลังคา 2



Suphakit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 10
X Mid : 0.939
Y Mid : 4.665
Z Mid : 0.225
Length : 0.531
Loc : 0.000

Design Sect: CHS-65x3.2 mm
Design Type: Brace
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 7.349E-04
IMajor : 0.000
IMinor : 0.000
IXy : 0.000

SMajor : 1.289E-05
SMinor : 1.289E-05
ZMajor : 1.711E-05
ZMinor : 1.711E-05

rMajor : 0.026
rMinor : 0.026
E : 199947978.80
Fy : 235000.000

AVMajor: 3.679E-04
AVMinor: 3.679E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.000	-0.048	1.123	2.926E-05	1.328	2.677E-05	2.370E-06

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-3)	Total Ratio	P Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.562	=	0.000	+	0.561	+	0.000
						OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Ft Allowable
-0.048	65.296	115628.140	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
1.123	87078.455	155100.000	299909.128	1.000	1.000	2.854	1.000
Minor Moment	2.926E-05	155100.000	2442920.908	0.850	1.000	1.000	

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
1.328	3608.610	94000.000	0.038	OK	0.000
Minor Shear	2.677E-05	94000.000	0.000	OK	0.000

Sughalit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 11
X Mid : 1.503
Y Mid : 4.665
Z Mid : -1.675
Length : 3.650
Loc : 3.650

Design Sect: CHS-90x3.2 mm
Design Type: Column
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 9.892E-04
IMajor : 1.199E-06
IMinor : 1.199E-06
IXy : 0.000

SMajor : 2.359E-05
SMinor : 2.359E-05
ZMajor : 3.100E-05
ZMinor : 3.100E-05
Fy : 235000.000

rMajor : 0.035
rMinor : 0.035
E : 199947978.80
Fy : 235000.000

AVMajor: 4.950E-04
AVMinor: 4.950E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
3.650	-4.537	-0.649	3.525E-06	0.178	0.000	0.000

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-3)	Total Ratio	P Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.233	=	0.055	+	0.177	+	0.000
						OK

AXIAL FORCE DESIGN

Axial	P Force	fa Stress	Fa Allowable	Ft Allowable
	-4.537	4586.768	83026.348	141000.000

MOMENT DESIGN

Major Moment	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Minor Moment	3.525E-06	-0.649	27506.979	155100.000	0.149	155100.000	0.850	1.000
				93636.185	0.850	1.000	1.000	1.000

SHEAR DESIGN

Major Shear	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	Torsion
Minor Shear	0.178	359.228	94000.000	0.004	OK	0.000
				0.000	OK	0.000

Suphakit T

Project :

Date :

Location :

Page :

Member : PURLIN-SHS 75X75X3.2 MM

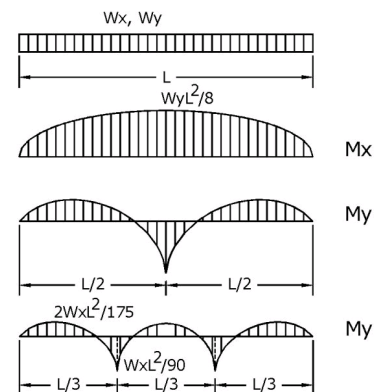
By :

SQUARE TUBE STEEL DESIGN OF PURLIN MEMBER (ASD)

MATERIAL PROPERTY

(1) Steel Grade	=	SM400
(2) Yield Strength of Steel (Fy)	=	2,400 ksc.
(3) Modulus of Elasticity (Es)	=	2.04E+06 ksc.

COMPUTATION



DATA

(1) Length (L)	=	4.67 m.
(2) Spacing (@)	=	0.500 m.
(3) Sag Rod	=	0 ea./spac.
(4) Slope of Roof (q)	=	5.00 degree

SECTION PROPERTY

(1) Section Size	=	SHS 75X75X3.2 MM
(2) Steel Area (Ag)	=	8.930 cm. ²
(3) Section Modulus (Sx)	=	20.10 cm. ³
(4) Section Modulus (Sy)	=	20.10 cm. ³
(5) Moment of Inertia (Ix)	=	75.50 cm. ⁴
(6) Moment of Inertia (Iy)	=	75.50 cm. ⁴

W_x	=	$W^* \sin \theta$	=	3.84	kg./m.
W_y	=	$W^* \cos \theta$	=	43.89	kg./m.
or	=	$0.75(W^* \cos q + W_{WL})$	=	49.79	kg./m.
M_x	=	$(1/8) W_y^* L^2$	=	135.45	kg.-m.
M_y	=	$(1/8) W_x^* L^2$	=	10.45	kg.-m.

LOADING

(1) Live Load (LL)	=	50.0 kg./m. ²
(2) Dead Load (DL)	=	
(2.1) Roof Material	=	25.0 kg./m. ²
(2.2) Other	=	5.0 kg./m. ²
(2.3) Purlin	=	4.06 kg./m.
(3) Total Load (LL + DL)	=	44.1 kg./m.
(4) Wind Load (WL)	=	45.0 kg./m. ²

CHECK

fb	=	$M_x/S_x + 2M_y/S_y$	=	777.8	ksc.
Fb	=	$0.6 * F_y$	=	1440.0	ksc.
		fb <= Fb		Status OK	
\triangle	=	$5W_{y(LL)}L^4/(384EI)$	=	1.00	cm.
$\triangle_{allow.}$	=	$L/360$	=	1.30	cm.
		Deflection		Status OK	

Supahat T

Steel connections

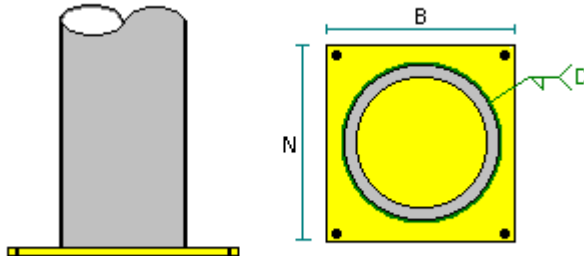
Data

Connection name : Fixed biaxial BP
Connection ID : 3

Family: Column - Base (CB)
Type: Base plate

GENERAL INFORMATION

Connector



MEMBERS

Column

Column type : Prismatic member
Section : PIPE76.3X3.2
Material : S275
Longitudinal offset : 0 mm
Transversal offset : 0 mm

CONNECTOR

Base plate

Position on the support : Center
N: Longitudinal dimension : 160 mm
B: Transversal dimension : 230 mm
Thickness : 12 mm
Material : S275
Column weld : E60XX
D: Column weld size (1/16 in) : 6
Override A2/A1 ratio : No
Include shear lug : No

Support

With pedestal : No
Longitudinal dimension : 2.44 m
Transversal dimension : 2.44 m
Thickness : 609.6 mm
Material : C 4-60
Include grouting : No

Anchor

Anchor position : Longitudinal position
Rows number per side : 1
Anchors per row : 1
Longitudinal edge distance on the plate : 40 mm
Transverse edge distance on the plate : 40 mm

Anchor type	:	Headed
Head type	:	Hexagonal
Include lock nut	:	No
Anchor	:	M-16
Effective embedment depth	:	150 mm
Total length	:	183.12 mm
Material	:	Class 8.8
Fy	:	0.64 kN/mm ²
Fu	:	0.8 kN/mm ²
Cracked concrete	:	No
Brittle steel	:	No
Anchors welded to base plate	:	No
<u>Anchor reinforcement</u>		
Type of reinforcement	:	Primary
Tension reinforcement	:	No
Shear reinforcement	:	No

Steel connections

Results

Connection name : Fixed biaxial BP
Connection ID : 3

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [KN]	Mu22 [KN*m]	Mu33 [KN*m]	Vu2 [KN]	Vu3 [KN]	Load type
DL	10.00	0.00	0.00	4.35	0.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	2.50	DL	0.28	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	67.84	DL	0.04	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1253.81	36.29	DL	0.03	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	41.72	DL	0.02	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.28	

**Design for minor axis
Base plate (AISC 360-16 LRFD)**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	2.50	DL	0.28	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	67.84	DL	0.04	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1253.81	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	41.72	DL	0.02	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.28	

**Major axis
Anchors**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	150.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1136.20	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	5.00	DL	0.06	Eq. D-3
Breakout of anchor in tension	[KN]	84.79	5.00	DL	0.06	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	113.05	10.00	DL	0.09	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	64.40	5.00	DL	0.08	Sec. D.4.1.1
Anchor shear	[KN]	44.83	2.17	DL	0.05	Eq. D-20
Breakout of anchor in shear	[KN]	286.84	2.17	DL	0.01	Sec. D.4.1.1
Breakout of group of anchors in shear	[KN]	297.17	4.35	DL	0.01	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	169.57	2.17	DL	0.01	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	226.09	4.35	DL	0.02	Eq. D-5, Sec. D.4.1.1
Interaction of tensile and shear forces	[KN]	1.20	0.00	DL	0.00	Eq. D-3, Eq. D-4, Sec. D.4.1.1, Eq. D-5, Eq. D-20, Sec. D.7

Ratio 0.09

Minor axis Anchors

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	150.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1136.20	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

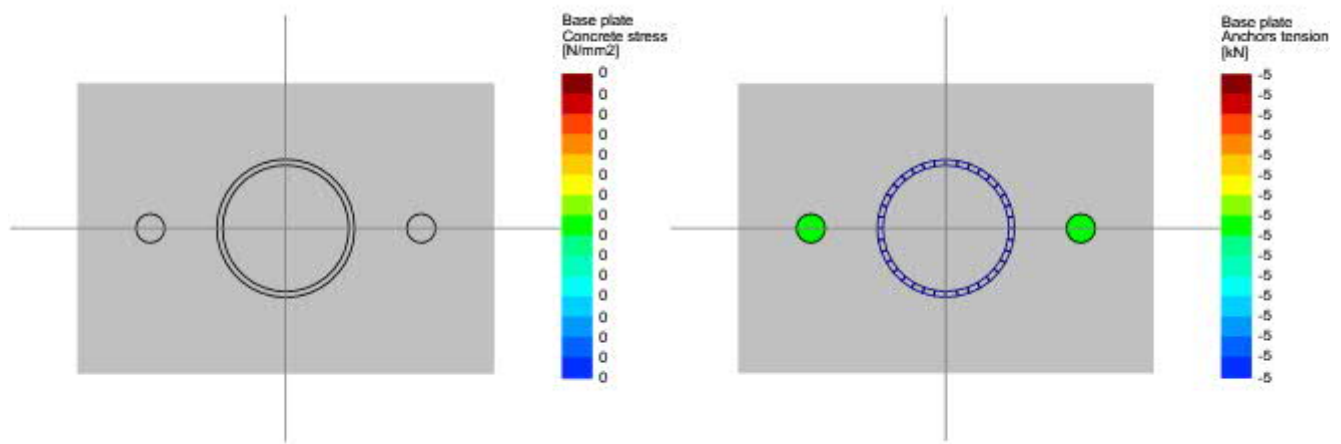
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	5.00	DL	0.06	Eq. D-3
Breakout of anchor in tension	[KN]	84.79	5.00	DL	0.06	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	113.05	10.00	DL	0.09	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	64.40	5.00	DL	0.08	Sec. D.4.1.1
Anchor shear	[KN]	44.83	0.00	DL	0.00	Eq. D-20
Breakout of anchor in shear	[KN]	297.17	0.00	DL	0.00	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	169.57	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	226.09	0.00	DL	0.00	Eq. D-5, Sec. D.4.1.1

Ratio 0.09

Global critical strength ratio 0.28

Biaxial

Maximum compression and tension (DL)



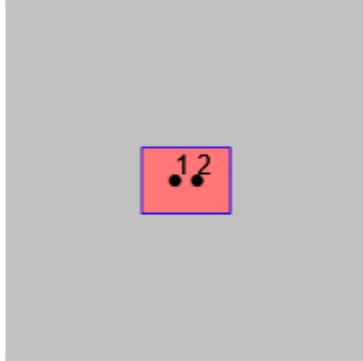
Maximum bearing pressure	0.00	[N/mm2]
Minimum bearing pressure	0.00	[N/mm2]
Maximum anchor tension	5.00	[KN]
Minimum anchor tension	5.00	[KN]
Neutral axis angle	0.00	
Bearing length	-1E33	[mm]

Anchors tensions

Anchor	Transverse [mm]	Longitudinal [mm]	Shear [KN]	Tension [KN]
1	-75.00	0.00	2.17	5.00
2	75.00	0.00	2.17	5.00

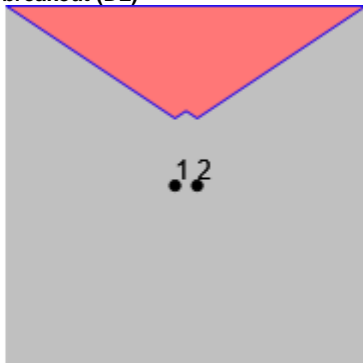
Major axis

Results for tensile breakout (DL)



Group	Area [mm2]	Tension [KN]	Anchors
1	270000.00	10.00	1, 2

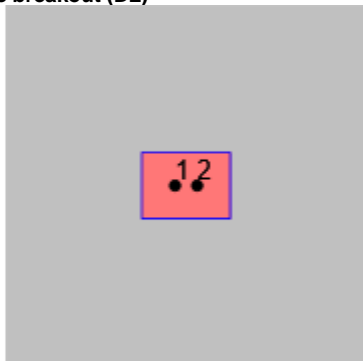
Results for shear breakout (DL)



Group	Area [mm2]	Shear [KN]	Anchors
1	1486449.00	4.35	1, 2

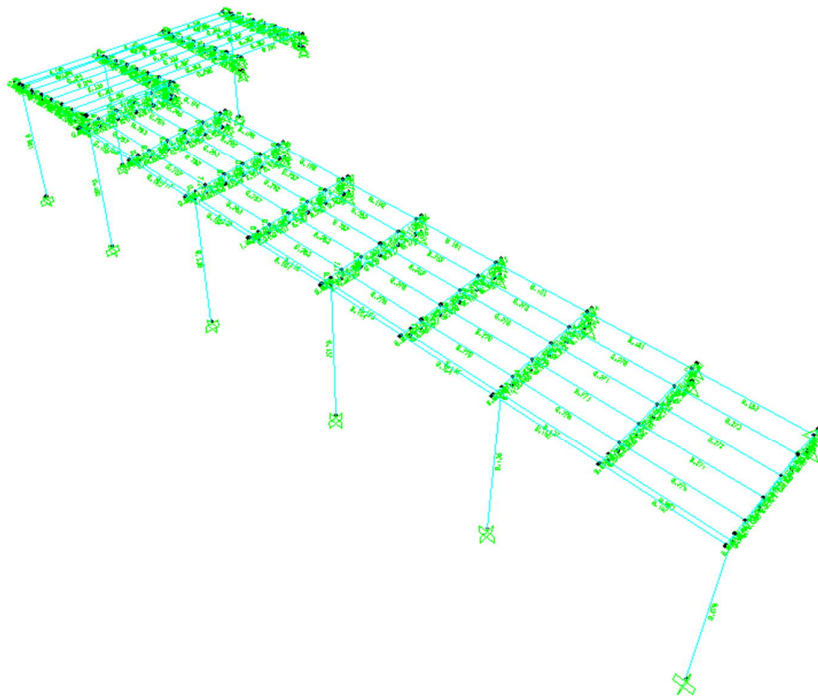
Minor axis

Results for tensile breakout (DL)

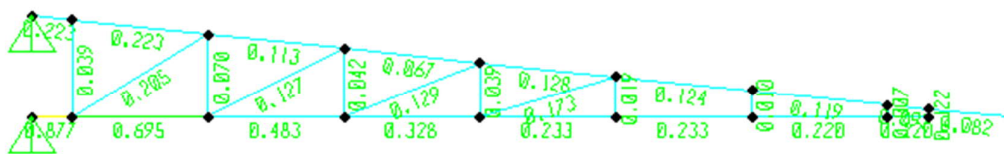


Group	Area [mm2]	Tension [KN]	Anchors
1	270000.00	10.00	1, 2

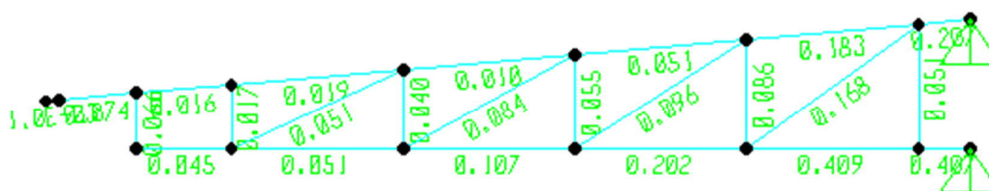
ภาคผนวก ข.3 รายการคำนวณโครงสร้างหลังคา 3



Suphakit T.



TRUSS T3A



TRUSS T3B

Supakit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 723
X Mid : 4.814
Y Mid : 17.133
Z Mid : 0.154
Length : 0.587
Loc : 0.293

Design Sect: CHS-32x3.2 mm
Design Type: Brace
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 3.971E-04
IMajor : 0.000
IMinor : 0.000
IXy : 0.000

SMajor : 3.651E-06
SMinor : 3.651E-06
ZMajor : 5.004E-06
ZMinor : 5.004E-06

rMajor : 0.014
rMinor : 0.014
E : 199947978.80
Fy : 235000.000

AVMajor: 1.994E-04
AVMinor: 1.994E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.293	-10.038	0.001	0.000	0.000	0.000	-1.601E-04

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.205	=	0.202	+	0.002	+	0.000
						OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Ft Allowable
-10.038	25277.717	124870.456	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
0.001	307.057	155100.000	586835.935	1.000	1.000	1.000	1.000
Minor Moment	0.000	155100.000	586835.935	1.000	1.000	1.000	1.000

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
0.000	0.000	94000.000	0.000	OK	0.000
Minor Shear	0.000	94000.000	0.000	OK	0.000

Suphakit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 692

X Mid : 4.814

Y Mid : 17.133

Z Mid : 0.000

Length : 0.500

Loc : 0.500

Design Sect: CHS-65x3.2 mm

Design Type: Beam

Frame Type : Ordinary Moment Frame

Sect Class : Compact

Major Axis : 0.000 degrees counterclockwise from local 3

RLLF : 1.000

Area : 7.349E-04

IMajor : 0.000

IMinor : 0.000

Ixy : 0.000

SMajor : 1.289E-05

SMinor : 1.289E-05

ZMajor : 1.711E-05

ZMinor : 1.711E-05

Fy : 235000.000

rMajor : 0.026

rMinor : 0.026

E : 199947978.80

Fy : 235000.000

AVMajor: 3.679E-04

AVMinor: 3.679E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.500	-25.608	0.333	5.056E-04	-0.892	-0.002	1.364E-04

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P Ratio	M Major Ratio	M Minor Ratio	Ratio Limit	Status Check
0.695	=	0.551	+	0.143	+	0.000
						0.950
						OK

AXIAL FORCE DESIGN

P Force	fa Stress	Fa Allowable	Ft Allowable
-25.608	34846.063	63214.784	141000.000

MOMENT DESIGN

M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
0.333	25853.263	155100.000	2756172.387	0.850	1.000	1.000	1.000
Minor Moment	39.217	155100.000	63273.012	1.000	1.000	6.600	

SHEAR DESIGN

V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
0.892	2424.292	94000.000	0.026	OK	0.000
Minor Shear	0.002	94000.000	7.143E-05	OK	0.000

Supadit T.

SAP2000 Steel Design

Project

Job Number

Engineer

AISC-ASD01 STEEL SECTION CHECK

Combo : US5 = D + 0.75WL +0.75L
Units : KN, m, C

Frame : 13
X Mid : 0.262
Y Mid : 16.733
Z Mid : -1.675
Length : 3.350
Loc : 0.000

Design Sect: CHS-90x3.2 mm
Design Type: Column
Frame Type : Ordinary Moment Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 9.892E-04
IMajor : 1.199E-06
IMinor : 1.199E-06
IXy : 0.000

SMajor : 2.359E-05
SMinor : 2.359E-05
ZMajor : 3.100E-05
ZMinor : 3.100E-05
Fy : 235000.000

rMajor : 0.035
rMinor : 0.035
E : 199947978.80
Fy : 235000.000

AVMajor: 4.950E-04
AVMinor: 4.950E-04

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
0.000	-4.832	2.343E-04	-0.003	6.995E-05	-9.533E-04	0.001

PMM DEMAND/CAPACITY RATIO

Governing Equation (H1-1)	Total Ratio	P	Ratio	MMajor Ratio	MMinor Ratio	Ratio Limit	Status Check
0.160	=	0.159	+	0.000	+	0.000	OK

AXIAL FORCE DESIGN

Axial	P Force	fa Stress	Fa Allowable	Ft Allowable
	-4.832	4885.046	30696.572	141000.000

MOMENT DESIGN

Major Moment	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Minor Moment	-0.003	135.353	155100.000	30696.572	0.850	1.903	1.000	1.000

SHEAR DESIGN

Major Shear	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	Torsion Check
Minor Shear	6.995E-05	0.141	94000.000	1.504E-06	OK	0.000

Saphakit T.

Project :

Date :

Location :

Page :

Member : PURLIN-SHS-50X50X2.3 MM

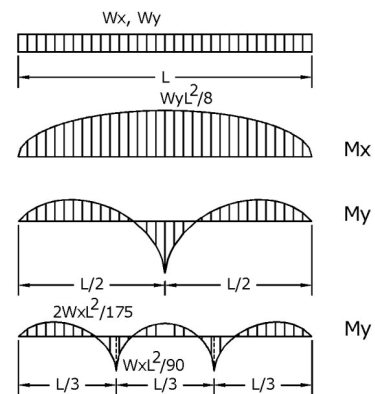
By :

SQUARE TUBE STEEL DESIGN OF PURLIN MEMBER (ASD)

MATERIAL PROPERTY

(1) Steel Grade	=	SM400
(2) Yield Strength of Steel (F _y)	=	2,400 ksc.
(3) Modulus of Elasticity (E _s)	=	2.04E+06 ksc.

COMPUTATION



DATA

(1) Length (L)	=	2.70 m.
(2) Spacing (@)	=	0.500 m.
(3) Sag Rod	=	0 ea./spac.
(4) Slope of Roof (q)	=	5.00 degree

SECTION PROPERTY

(1) Section Size	=	SHS 50X50X2.3 MM				
(2) Steel Area (Ag)	=	4.250 cm. ²	W _x	= W* sin θ	=	3.84 kg./m.
(3) Section Modulus (S _x)	=	6.34 cm. ³	W _y	= W*cos θ	=	43.89 kg./m.
(4) Section Modulus (S _y)	=	6.34 cm. ³		or = 0.75(W*cos q + W _{WL})	=	49.79 kg./m.
(5) Moment of Inertia (I _x)	=	15.90 cm. ⁴	M _x	= (1/8) W _y *L ²	=	45.38 kg.-m.
(6) Moment of Inertia (I _y)	=	15.90 cm. ⁴	M _y	= (1/8) W _x *L ²	=	3.50 kg.-m.

LOADING

(1) Live Load (LL)	=	50.0 kg./m. ²
(2) Dead Load (DL)	=	
(2.1) Roof Material	=	25.0 kg./m. ²
(2.2) Other	=	5.0 kg./m. ²
(2.3) Purlin	=	4.06 kg./m.
(3) Total Load (LL + DL)	=	44.1 kg./m.
(4) Wind Load (WL)	=	45.0 kg./m. ²

CHECK

fb	=	M _x /S _x + 2M _y /S _y	=	826.1 ksc.
Fb	=	0.6 * F _y	=	1440.0 ksc.
		fb <= Fb		Status OK
△	=	5W _{y(LL)} L ⁴ / (384EI)	=	0.53 cm.
△ _{allow.}	=	L/360	=	0.75 cm.
		Deflection		Status OK

Suphakit T.

Current Date: 7/28/2023 6:45 PM

Units system: SI

File name: C:\Users\supha\OneDrive\Desktop\2023-07\RAMJOINT BASE PLATE.cnx\

Steel connections

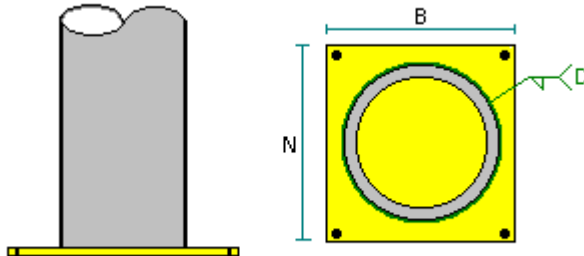
Data

Connection name : Fixed biaxial BP
Connection ID : 4

Family: Column - Base (CB)
Type: Base plate

GENERAL INFORMATION

Connector



MEMBERS

Column

Column type : Prismatic member
Section : PIPE76.3X3.2
Material : S275
Longitudinal offset : 0 mm
Transversal offset : 0 mm

CONNECTOR

Base plate

Position on the support : Center
N: Longitudinal dimension : 215 mm
B: Transversal dimension : 215 mm
Thickness : 12 mm
Material : S275
Column weld : E60XX
D: Column weld size (1/16 in) : 6
Override A2/A1 ratio : No
Include shear lug : No

Support

With pedestal : No
Longitudinal dimension : 2.44 m
Transversal dimension : 2.44 m
Thickness : 609.6 mm
Material : C25-30
Include grouting : No

Anchor

Anchor position : Longitudinal position
Rows number per side : 1
Anchors per row : 2
Longitudinal edge distance on the plate : 40 mm
Transverse edge distance on the plate : 40 mm

Anchor type	:	Headed
Head type	:	Hexagonal
Include lock nut	:	No
Anchor	:	M-16
Effective embedment depth	:	150 mm
Total length	:	183.12 mm
Material	:	Class 8.8
Fy	:	0.64 kN/mm ²
Fu	:	0.8 kN/mm ²
Cracked concrete	:	No
Brittle steel	:	No
Anchors welded to base plate	:	No
<u>Anchor reinforcement</u>		
Type of reinforcement	:	Primary
Tension reinforcement	:	No
Shear reinforcement	:	No

Steel connections

Results

Connection name : Fixed biaxial BP
Connection ID : 4

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [KN]	Mu22 [KN*m]	Mu33 [KN*m]	Vu2 [KN]	Vu3 [KN]	Load type
DL	-37.00	0.00	0.00	7.18	0.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.03	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	2.37	DL	0.27	DG1 Sec 3.1.2
Flexural yielding (tension interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld shear capacity	[KN/m]	1253.81	59.91	DL	0.05	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.27	

**Design for minor axis
Base plate (AISC 360-16 LRFD)**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	6	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.03	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	2.37	DL	0.27	DG1 Sec 3.1.2
Flexural yielding (tension interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld shear capacity	[KN/m]	1253.81	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1880.71	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio	0.27					

**Major axis
Anchors**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	0.00	DL	0.00	Eq. D-3
Breakout of anchor in tension	[KN]	80.72	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	58.37	0.00	DL	0.00	Sec. D.4.1.1
Anchor shear	[KN]	44.83	1.80	DL	0.04	Eq. D-20
Breakout of anchor in shear	[KN]	274.03	1.80	DL	0.01	Sec. D.4.1.1
Breakout of group of anchors in shear	[KN]	282.94	7.18	DL	0.03	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	161.45	1.80	DL	0.01	Eq. D-4, Sec. D.4.1.1
Ratio	0.04					

**Minor axis
Anchors**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1

Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

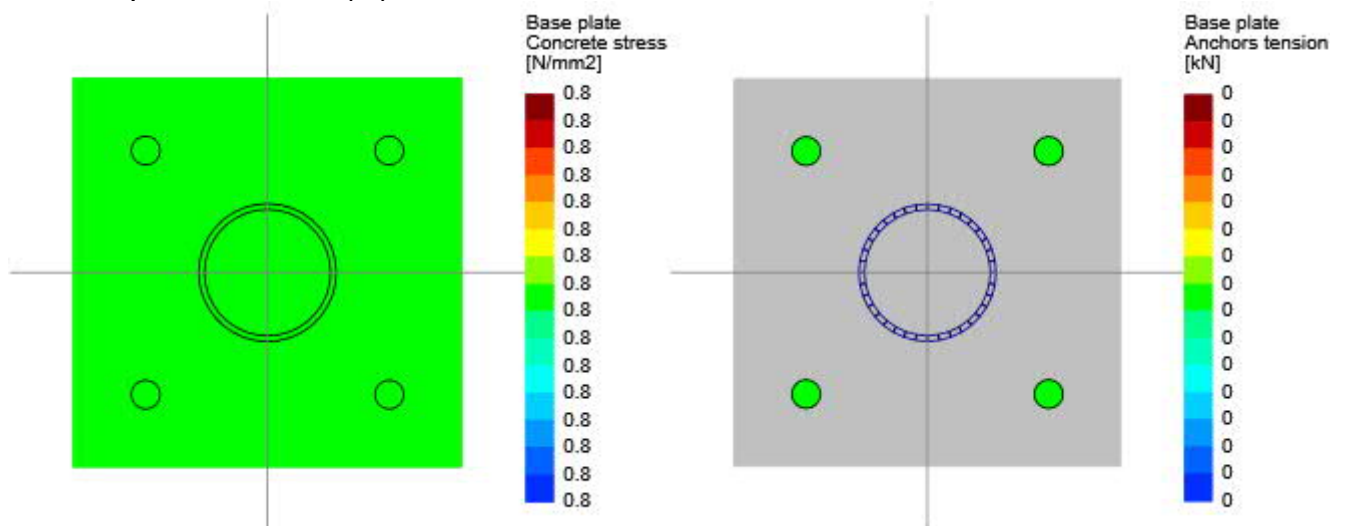
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	0.00	DL	0.00	Eq. D-3
Breakout of anchor in tension	[KN]	80.72	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	58.37	0.00	DL	0.00	Sec. D.4.1.1
Anchor shear	[KN]	44.83	0.00	DL	0.00	Eq. D-20
Breakout of anchor in shear	[KN]	274.03	0.00	DL	0.00	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	161.45	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1

Ratio 0.00

Global critical strength ratio 0.27

Biaxial

Maximum compression and tension (DL)

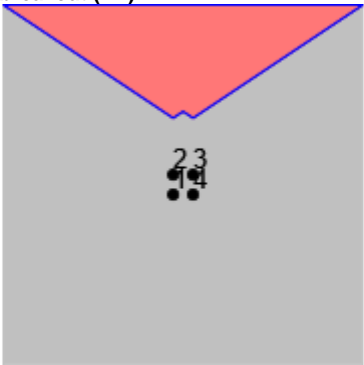


Maximum bearing pressure	0.80	[N/mm2]
Minimum bearing pressure	0.80	[N/mm2]
Maximum anchor tension	0.00	[KN]
Minimum anchor tension	0.00	[KN]
Neutral axis angle	0.00	
Bearing length	1E33	[mm]

Anchors tensions

Anchor	Transverse [mm]	Longitudinal [mm]	Shear [KN]	Tension [KN]
1	-67.50	-67.50	1.80	0.00
2	-67.50	67.50	1.80	0.00
3	67.50	67.50	1.80	0.00
4	67.50	-67.50	1.80	0.00

Results for shear breakout (DL)



Major axis

Group	Area [mm2]	Shear [KN]	Anchors
1	1486449.00	7.18	1, 2, 3, 4
2	1486449.00	3.59	2, 3

Steel connections

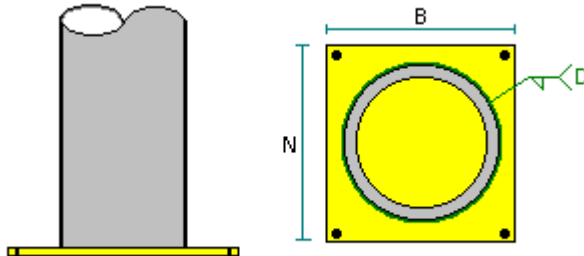
Data

Connection name : Fixed biaxial BP
Connection ID : 5

Family: Column - Base (CB)
Type: Base plate

GENERAL INFORMATION

Connector



MEMBERS

Column

Column type : Prismatic member
Section : PIPE76.3X3.2
Material : S275
Longitudinal offset : 0 mm
Transversal offset : 0 mm

CONNECTOR

Base plate

Position on the support : Center
N: Longitudinal dimension : 215 mm
B: Transversal dimension : 215 mm
Thickness : 12 mm
Material : S275
Column weld : E70XX
D: Column weld size (1/16 in) : 5
Override A2/A1 ratio : No
Include shear lug : No

Support

With pedestal : No
Longitudinal dimension : 2.44 m
Transversal dimension : 2.44 m
Thickness : 609.6 mm
Material : C 4-60
Include grouting : No

Anchor

Anchor position : Longitudinal position
Rows number per side : 1
Anchors per row : 2
Longitudinal edge distance on the plate : 40 mm
Transverse edge distance on the plate : 40 mm

Anchor type	:	Headed
Head type	:	Hexagonal
Include lock nut	:	No
Anchor	:	M-16
Effective embedment depth	:	150 mm
Total length	:	183.12 mm
Material	:	Class 8.8
Fy	:	0.64 kN/mm ²
Fu	:	0.8 kN/mm ²
Cracked concrete	:	No
Brittle steel	:	No
Anchors welded to base plate	:	No
<u>Anchor reinforcement</u>		
Type of reinforcement	:	Primary
Tension reinforcement	:	No
Shear reinforcement	:	No

Steel connections

Results

Connection name : Fixed biaxial BP
Connection ID : 5

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [KN]	Mu22 [KN*m]	Mu33 [KN*m]	Vu2 [KN]	Vu3 [KN]	Load type
DL	49.85	0.00	0.00	3.27	0.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	5	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	6.23	DL	0.70	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1828.47	98.94	DL	0.05	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1218.98	27.28	DL	0.02	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1828.47	207.97	DL	0.11	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.70	

**Design for minor axis
Base plate (AISC 360-16 LRFD)**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Base plate</u>						
Distance from anchor to edge	[mm]	32.00	6.35	--	✓	
Weld size	[1/16in]	5	2	--	✓	table J2.4

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
<u>Concrete base</u>						
Axial bearing	[KN/mm2]	0.03	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[KN*m/m]	8.91	0.00	DL	0.00	DG1 Eq. 3.3.13
Flexural yielding (tension interface)	[KN*m/m]	8.91	6.23	DL	0.70	DG1 Eq. 3.3.13
<u>Column</u>						
Weld capacity	[KN/m]	1828.47	98.94	DL	0.05	p. 8-9, Sec. J2.5, Sec. J2.4, HSS Manual p. 7-10
Elastic method weld shear capacity	[KN/m]	1218.98	0.00	DL	0.00	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[KN/m]	1828.47	207.97	DL	0.11	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.70	

**Major axis
Anchors**

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	12.46	DL	0.14	Eq. D-3
Breakout of anchor in tension	[KN]	84.79	12.46	DL	0.15	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	143.29	49.85	DL	0.35	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	64.40	12.46	DL	0.19	Sec. D.4.1.1
Anchor shear	[KN]	44.83	0.82	DL	0.02	Eq. D-20
Breakout of anchor in shear	[KN]	287.82	0.82	DL	0.00	Sec. D.4.1.1
Breakout of group of anchors in shear	[KN]	297.17	3.27	DL	0.01	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	169.57	0.82	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	286.57	3.27	DL	0.01	Eq. D-5, Sec. D.4.1.1
Interaction of tensile and shear forces	[KN]	1.20	0.00	DL	0.00	Eq. D-3, Eq. D-4, Sec. D.4.1.1, Eq. D-5, Eq. D-20, Sec. D.7

Ratio 0.35

Minor axis Anchors

GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[mm]	135.00	64.00	--	✓	Sec. D.8.1
Concrete cover	[mm]	1143.70	76.20	--	✓	Sec. 7.7.1
Effective length	[mm]	160.40	--	599.20	✓	

DESIGN CHECK

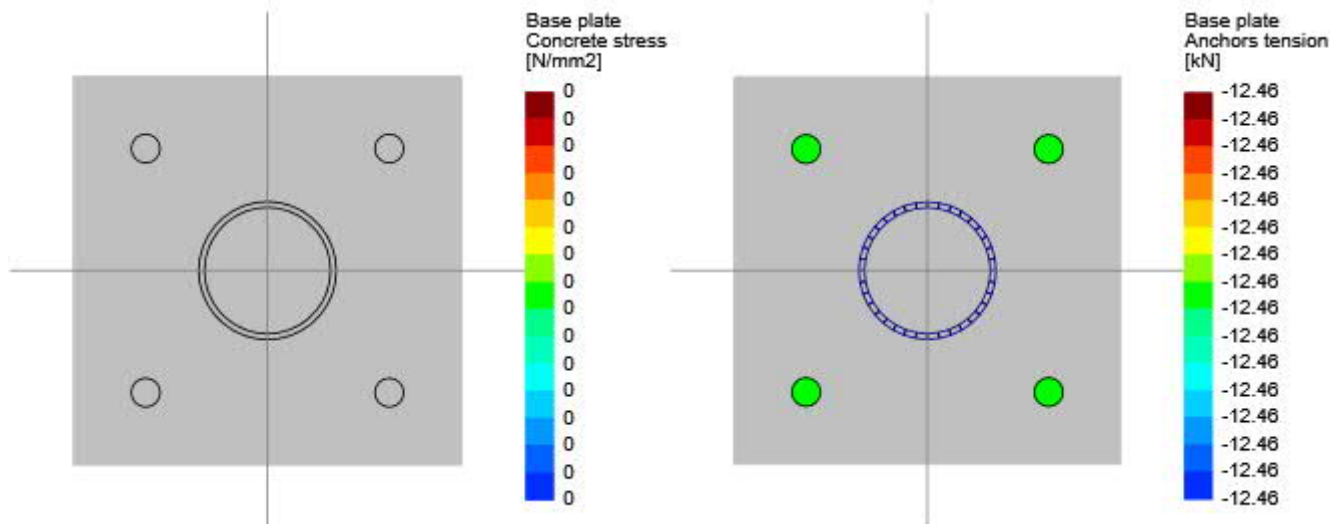
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[KN]	86.21	12.46	DL	0.14	Eq. D-3
Breakout of anchor in tension	[KN]	84.79	12.46	DL	0.15	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[KN]	143.29	49.85	DL	0.35	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[KN]	64.40	12.46	DL	0.19	Sec. D.4.1.1
Anchor shear	[KN]	44.83	0.00	DL	0.00	Eq. D-20
Breakout of anchor in shear	[KN]	287.82	0.00	DL	0.00	Sec. D.4.1.1
Pryout of anchor in shear	[KN]	169.57	0.00	DL	0.00	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[KN]	286.57	0.00	DL	0.00	Eq. D-5, Sec. D.4.1.1

Ratio 0.35

Global critical strength ratio 0.70

Biaxial

Maximum compression and tension (DL)



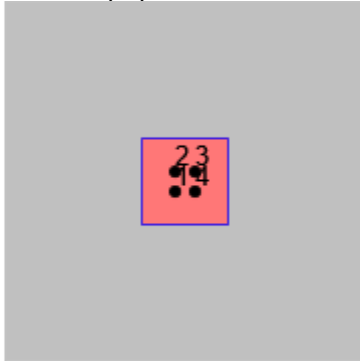
Maximum bearing pressure	0.00	[N/mm2]
Minimum bearing pressure	0.00	[N/mm2]
Maximum anchor tension	12.46	[KN]
Minimum anchor tension	12.46	[KN]
Neutral axis angle	0.00	
Bearing length	-1E33	[mm]

----- **Anchors tensions**

Anchor	Transverse [mm]	Longitudinal [mm]	Shear [KN]	Tension [KN]
1	-67.50	-67.50	0.82	12.46
2	-67.50	67.50	0.82	12.46
3	67.50	67.50	0.82	12.46
4	67.50	-67.50	0.82	12.46

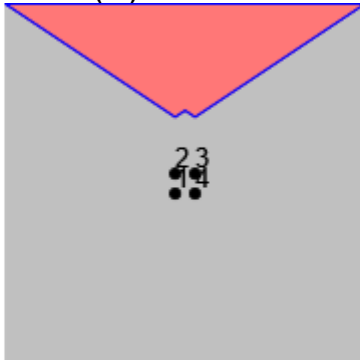
Major axis

Results for tensile breakout (DL)



Group	Area [mm2]	Tension [KN]	Anchors
1	342225.00	49.85	1, 2, 3, 4

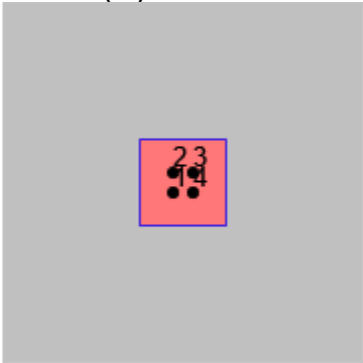
Results for shear breakout (DL)



Group	Area [mm2]	Shear [KN]	Anchors
1	1486449.00	3.27	1, 2, 3, 4
2	1486449.00	1.64	2, 3

Minor axis

Results for tensile breakout (DL)



Group	Area [mm2]	Tension [KN]	Anchors
1	342225.00	49.85	1, 2, 3, 4



ใช้สำหรับประกอบ

การออกแบบและรายการคำนวณโครงการปรับปรุงแผนผู้ป่วยนอก

สถาบันโรคทรวงอก เท่านั้น

Suphakit T.

(สุภกิจ ทัศวงศ์ 14736)

