ศูนย์ออกแบบและให้คำปรึกษางานสถาปัตยกรรม
คณะสถาปัตยกรรมศาสตร์
มหาวิทยาลัยเชียงใหม่

รายการคำนวณ

“แบบระบบวิศวกรรมโครงสร้าง”

โครงการออกแบบปรับปรุงอาคารฟิสิกส์ 1
(อาคารหลังที่ 2 ของคณะวิทยาศาสตร์)
คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่

จัดทำโดย
ศูนย์ออกแบบและให้คำปรึกษางานสถาปัตยกรรม
คณะสถาปัตยกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่

รายการคำนวณงานวิศวกรรมโครงสร้าง
ปรับปรุงอาคารฟิสิกส์ 1 (อาคารหลังที่ 2 ของคณะวิทยาศาสตร์)
คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่

รายการคำนวณงานวิศวกรรมโครงสร้าง
ปรับปรุงอาคารฟิสิกส์ 1 (อาคารหลังที่ 2 ของคณะวิทยาศาสตร์)
คณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่

วิศวกรโครงสร้าง : ปราโมทย์ ฤทธิปรีดานันท์ วย.720
ทิวัตถ์ จันทร์แสนตอ ภย.65754

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1. ข้อกำหนดในการออกแบบ
   - 1.1 พระราชบัญญัติควบคุมอาคาร พ.ศ 2522
   - 1.2 มาตรฐานสำหรับอาคารคอนกรีตเสริมเหล็กโดยวิธีกำลังของ ว.ส.ท
   - 1.3 มาตรฐานสำหรับเหล็กรูปพรรณ ของ ว.ส.ท.
   - 1.4 มาตรฐานการคำนวณแรงลมและการตอบสนองของอาคาร (มยผ.1311-50) กรมโยธาธิการและผังเมือง กระทรวงมหาดไทย

2. น้ำหนักบรรทุกจร
   - 2.1 ทางเดิน = 400 กก/ตร.ม.
   - 2.2 หลังคา = 30 กก/ตร.ม.

3. กำลังวัสดุที่ใช้ในการออกแบบ
   - 3.1 คอนกรีต
     - คอนกรีตทั่วไป fc' = 280 กก/ตร.ซม. (CYLINDER)
   - 3.2 เหล็กเสริม
     - เหล็กเสริมกลม fy = 2400 กก/ตร.ซม. (SR-24)
     - เหล็กเสริมข้ออ้อย fy = 4000 กก/ตร.ซม. (SD-40)
   - 3.3 เหล็กรูปพรรณ fy = 2400 กก/ตร.ซม.
   - 3.4 ลวดเชื่อม มาตรฐาน E60

4. ในการคำนวณส่วนต่าง ๆ ของทางเชื่อมเหล็กรูปพรรณ ตามทฤษฎีกำลังประลัยให้ใช้น้ำหนักบรรทุกประลัยดังต่อไปนี้
   - 4.1 DCON1 = 1.4 DL
   - 4.2 DCON2 = 1.4 DL + 1.7 LL
   - 4.3 WIND1 = 1.2 DL + 0.8 WL
   - 4.4 WIND2 = 1.2 DL + 0.5 LL + 1.3 WL
   - 4.5 WIND3 = 0.9 DL + 1.3 WL

   DL = น้ำหนักบรรทุกคงที่
   LL = น้ำหนักบรรทุกจร
   WL = แรงลม

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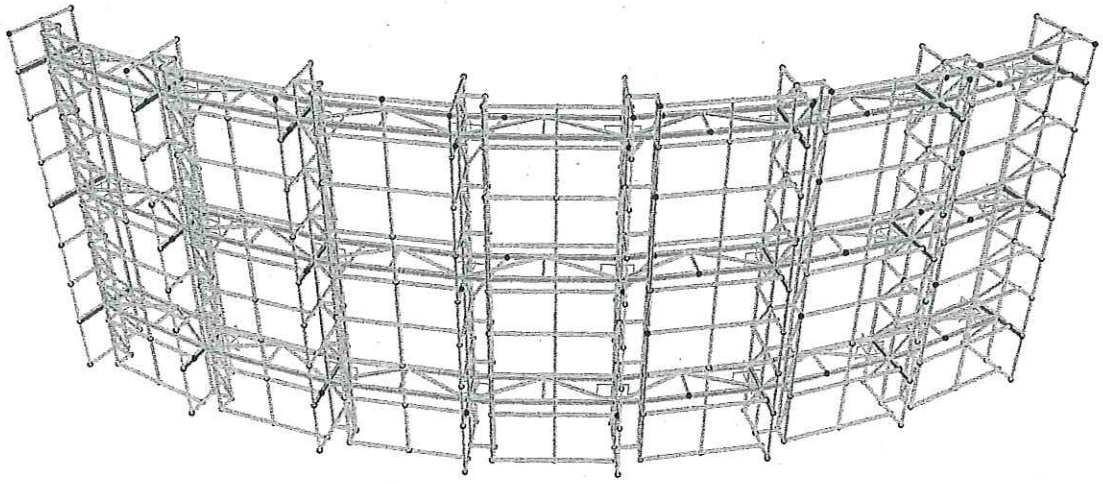
Facade

DL = 7.5 kg/m^2

Wind :
V = 56 mph
I_w = 1.0
C_p = 0.82
C_g = 2.0
C_e = 0.525



45. 90. 135. 180. 225. 270. 315. 360. 405. 450. 495. 540. 585. 630. E-3

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

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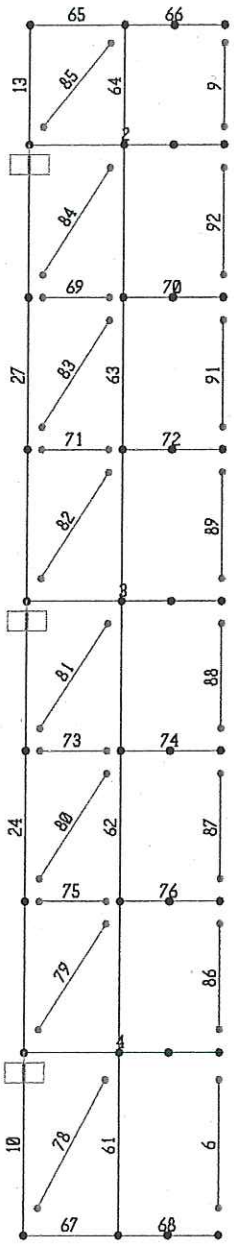

T1

3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 E+9

SAP2000 v14.2.4 - File:20-M Aluminium Facade-REV1 - Radial Plane @ T=274 - Kgf, cm, C Units

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

T1

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
2	TUBE150X50X2.7MM	Beam	0.094841	PMM	DL+WL	77
3	TUBE150X50X2.7MM	Beam	0.103542	PMM	DL+WL	77
4	TUBE150X50X2.7MM	Beam	0.066376	PMM	DL+WL	77
6	TUBE50X20X1.6MM	Column	0.030979	PMM	DL+WL	145
9	TUBE50X20X1.6MM	Column	0.019575	PMM	DL+LL	0
10	TUBE50X50X2.3MM.-B	Column	0.06054	PMM	DL+WL	145
13	TUBE50X50X2.3MM.-B	Column	0.05489	PMM	DL+WL	0
24	TUBE50X50X2.3MM.-B	Column	0.124338	PMM	DL+WL	120
27	TUBE50X50X2.3MM.-B	Column	0.112211	PMM	DL+WL	121.667
61	TUBE50X50X2.3MM.-B	Column	0.080515	PMM	DL+WL	145
62	TUBE50X50X2.3MM.-B	Column	0.090172	PMM	DL+WL	0
63	TUBE50X50X2.3MM.-B	Column	0.105769	PMM	DL+WL	243.333
64	TUBE50X50X2.3MM.-B	Column	0.538311	PMM	DL+WL	0
65	TUBE50X50X2.3MM.	Beam	0.050831	PMM	DL+WL	77
66	TUBE50X50X2.3MM.	Beam	0.053295	PMM	DL+WL	0
67	TUBE50X50X2.3MM.	Beam	0.03972	PMM	DL+WL	77
68	TUBE50X50X2.3MM.	Beam	0.057921	PMM	DL+WL	0
69	TUBE50X50X2.3MM.	Beam	0.045959	PMM	DL+WL	0
70	TUBE50X50X2.3MM.	Beam	0.074364	PMM	DL+WL	0
71	TUBE50X50X2.3MM.	Beam	0.037102	PMM	DL+WL	77
72	TUBE50X50X2.3MM.	Beam	0.068761	PMM	DL+LL	0
73	TUBE50X50X2.3MM.	Beam	0.0436	PMM	DL+WL	0
74	TUBE50X50X2.3MM.	Beam	0.077457	PMM	DL+WL	0
75	TUBE50X50X2.3MM.	Beam	0.039301	PMM	DL+WL	77
76	TUBE50X50X2.3MM.	Beam	0.065518	PMM	DL+LL	0
78	TUBE50X50X2.3MM.	Brace	0.04789	PMM	DL+WL	164.177
79	TUBE50X50X2.3MM.	Brace	0.05779	PMM	DL+LL	0
80	TUBE50X50X2.3MM.	Brace	0.052561	PMM	DL+WL	0
81	TUBE50X50X2.3MM.	Brace	0.073775	PMM	DL+WL	0
82	TUBE50X50X2.3MM.	Brace	0.04791	PMM	DL+LL	0
83	TUBE50X50X2.3MM.	Brace	0.053172	PMM	DL+WL	143.985
84	TUBE50X50X2.3MM.	Brace	0.072189	PMM	DL+WL	0
85	TUBE50X50X2.3MM.	Brace	0.047115	PMM	DL+WL	0
86	TUBE50X20X1.6MM	Column	0.021562	PMM	DL+WL	0
87	TUBE50X20X1.6MM	Column	0.02429	PMM	DL+WL	120
88	TUBE50X20X1.6MM	Column	0.028013	PMM	DL+WL	0
89	TUBE50X20X1.6MM	Column	0.026375	PMM	DL+WL	0
91	TUBE50X20X1.6MM	Column	0.027233	PMM	DL+WL	121.667
92	TUBE50X20X1.6MM	Column	0.036459	PMM	DL+WL	0

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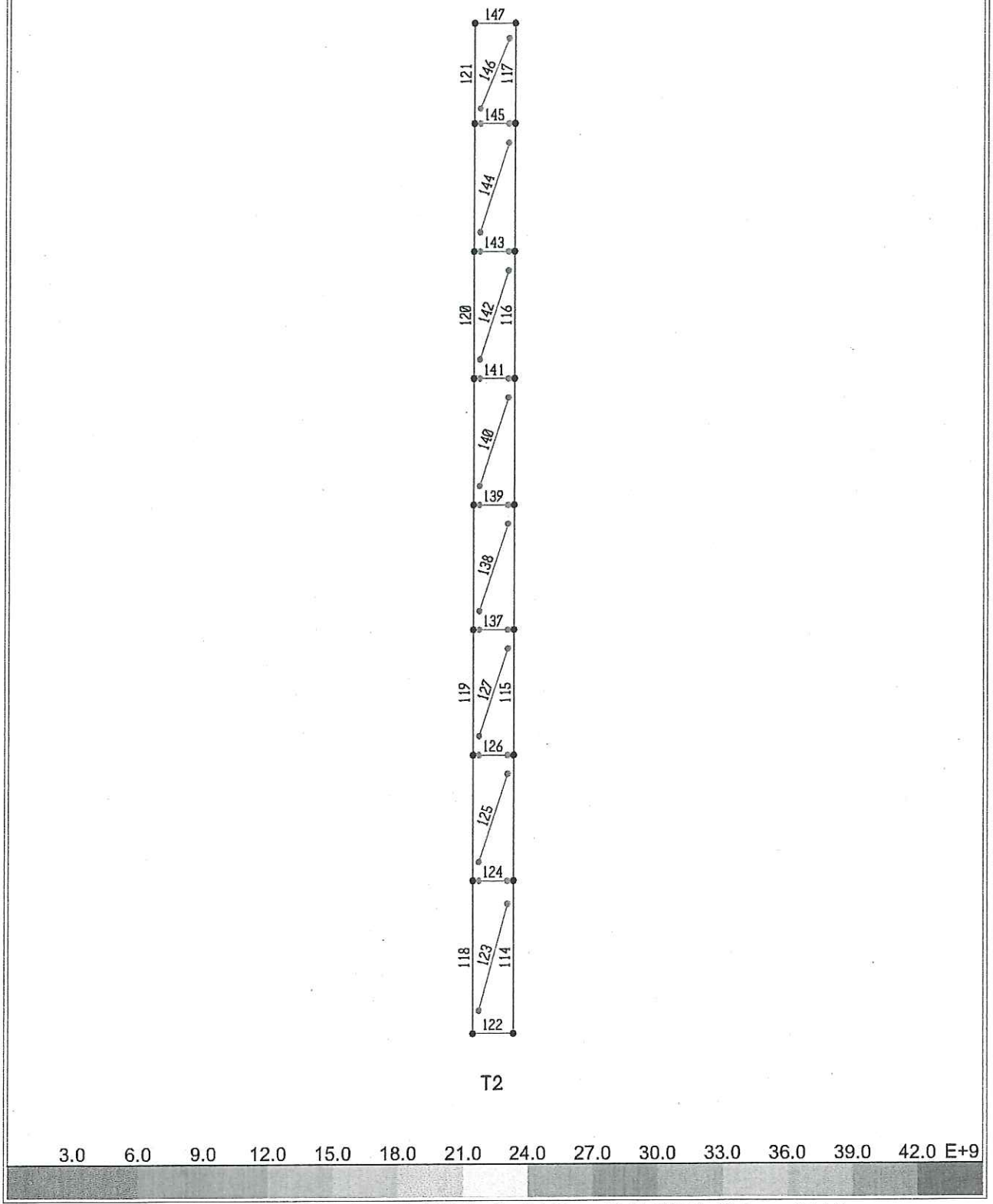

SAP2000 v14.2.4 - File:20-M Aluminium Facade-REV1 - Radial Plane @ T=275.5 - Kgf, cm, C Units

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

T2

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
114	TUBE50X50X2.3MM.-B	Column	0.035805	PMM	DL+WL	145
115	TUBE50X50X2.3MM.-B	Column	0.085753	PMM	DL+WL	0
116	TUBE50X50X2.3MM.-B	Column	0.074881	PMM	DL+WL	0
117	TUBE50X50X2.3MM.-B	Column	0.16997	PMM	DL+WL	0
118	TUBE50X50X2.3MM.-B	Column	0.067493	PMM	DL+LL	145
119	TUBE50X50X2.3MM.-B	Column	0.164223	PMM	DL+WL	0
120	TUBE50X50X2.3MM.-B	Column	0.188035	PMM	DL+WL	0
121	TUBE50X50X2.3MM.-B	Column	0.096884	PMM	DL+WL	0
122	TUBE50X50X2.3MM.	Beam	0.036285	PMM	DL+WL	0
123	TUBE50X50X2.3MM.	Brace	0.035334	PMM	DL+WL	150.416
124	TUBE50X50X2.3MM.	Beam	0.029907	PMM	DL+WL	0
125	TUBE50X50X2.3MM.	Brace	0.116909	PMM	DL+WL	0
126	TUBE50X50X2.3MM.	Beam	0.028603	PMM	DL+WL	40
127	TUBE50X50X2.3MM.	Brace	0.025903	PMM	DL+WL	63.246
137	TUBE50X50X2.3MM.	Beam	0.035397	PMM	DL+WL	0
138	TUBE50X50X2.3MM.	Brace	0.053764	PMM	DL+WL	0
139	TUBE50X50X2.3MM.	Beam	0.036621	PMM	DL+WL	0
140	TUBE50X50X2.3MM.	Brace	0.134637	PMM	DL+WL	0
141	TUBE50X50X2.3MM.	Beam	0.030837	PMM	DL+WL	40
142	TUBE50X50X2.3MM.	Brace	0.030333	PMM	DL+WL	64.037
143	TUBE50X50X2.3MM.	Beam	0.039154	PMM	DL+WL	0
144	TUBE50X50X2.3MM.	Brace	0.058016	PMM	DL+WL	0
145	TUBE50X50X2.3MM.	Beam	0.032519	PMM	DL+WL	0
146	TUBE50X50X2.3MM.	Brace	0.077839	PMM	DL+WL	0
147	TUBE50X50X2.3MM.	Beam	0.029188	PMM	DL+WL	40

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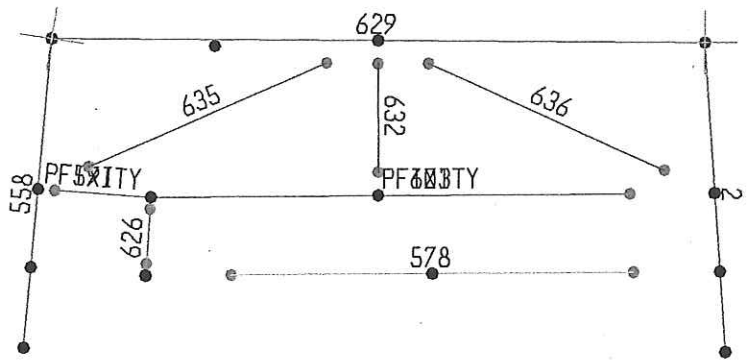

T3

3.0 6.0 9.0 12.0 15.0 18.0 21.0 24.0 27.0 30.0 33.0 36.0 39.0 42.0 E+9

SAP2000 v14.2.4 - File:20-M Aluminium Facade-REV1 - X-Y Plane @ Z=870 - Kgf, cm, C Units

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T3

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
2	TUBE150X50X2.7MM	Beam	0.094841	PMM	DL+WL	77
558	TUBE150X50X2.7MM	Beam	0.090737	PMM	DL+WL	77
578	TUBE50X50X2.3MM.-A	Beam	0.155675	PMM	DL+LL	147.615
591	TUBE100X50X3.2MM.-A	Beam	0.213659	PMM	DL+WL	58.039
603	TUBE100X50X3.2MM.-A	Beam	0.163884	PMM	DL+WL	0
626	TUBE50X50X2.3MM.	Beam	0.033893	PMM	DL+WL	0
629	TUBE100X50X3.2MM.-A	Beam	0.035065	PMM	DL+WL	0
632	TUBE50X50X2.3MM.-B	Beam	0.0507	PMM	DL+WL	79.033
635	TUBE50X50X2.3MM.-B	Beam	0.028404	PMM	DL+WL	47.532
636	TUBE50X50X2.3MM.-B	Beam	0.043234	PMM	DL+WL	47.532

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project
Job Number BK1
Engineer

AISC-ASD89 STEEL SECTION CHECK
Combo : DL+WL
Units : Kgf, cm, C

Frame	: 569	Design Sect	: TUBE50X50X2.3MM.-A		
X Mid	: 9.827	Design Type	: Beam		
Y Mid	: -2252.146	Frame Type	: Moment Resisting Frame		
Z Mid	: 505.000	Sect Class	: Compact		
Length	: 295.230	Major Axis	: 0.000 degrees counterclockwise from local 3		
Loc	: 147.615	RLLF	: 1.000		
Area	: 4.388	SMajor	: 6.672	rMajor : 1.950	AVMajor: 2.300
IMajor	: 16.680	SMinor	: 6.672	rMinor : 1.950	AVMinor: 2.300
IMinor	: 16.680	ZMajor	: 7.856	E : 2038901.916	
Ixy	: 0.000	ZMinor	: 7.856	Fy : 2500.000	

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
147.615	6.975	1536.893	-26.044	7.869	-2.977	50.219

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H2-1)	0.157	=	0.001	+	0.154	+	0.003	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	6.975	1.589	457.850	1500.000

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	1536.893	230.347	1500.000	1831.401	1.000	1.000	0.500	1.000
Minor Moment	-26.044	3.903	1500.000	457.850	1.000	1.000	1.000	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	7.869	3.421	1000.000	0.003	OK	0.000
Minor Shear	2.977	1.294	1000.000	0.001	OK	0.000

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Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE100X50X3.2MM.-A	A36	Box/Tube	10.0000	5.0000	0.3200	0.3200
TUBE150X50X2.7MM	A36	Box/Tube	15.0000	5.0000	0.2700	0.2700
TUBE50X20X1.6MM	A36	Box/Tube	5.0000	2.0000	0.1600	0.1600
TUBE50X50X2.3MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300
TUBE50X50X2.3MM.-A	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300
TUBE50X50X2.3MM.-B	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE100X50X3.2MM.-A	9.19	91.47	118.72	39.52	6.40	3.20	23.74
TUBE150X50X2.7MM	10.51	134.70	282.53	49.35	8.10	2.70	37.67
TUBE50X20X1.6MM	2.14	3.80	6.48	1.48	1.60	0.64	2.59
TUBE50X50X2.3MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67
TUBE50X50X2.3MM.-A	4.39	24.96	16.68	16.68	2.30	2.30	6.67
TUBE50X50X2.3MM.-B	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE100X50X3.2MM.-A	15.81	29.51	18.02	3.5942	2.0736	No	No
TUBE150X50X2.7MM	19.74	48.11	21.84	5.1852	2.1670	No	No
TUBE50X20X1.6MM	1.48	3.30	1.70	1.7415	0.8332	No	No
TUBE50X50X2.3MM	6.67	7.86	7.86	1.9496	1.9496	No	No
TUBE50X50X2.3MM.-A	6.67	7.86	7.86	1.9496	1.9496	No	No
TUBE50X50X2.3MM.-B	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE100X50X3.2MM.-A	Orange	1035.92	1.06	No	1.000000	1.000000	1.000000
TUBE150X50X2.7MM	16711808	312.77	0.32	No	1.000000	1.000000	1.000000

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Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt Kgf	TotalMass Kgf-s2/cm	FromFile	AMod	A2Mod	A3Mod
TUBE50X20X1.6MM	DarkYellow	129.53	0.13	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM	4259584	1222.91	1.25	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM .-A	16744703	724.62	0.74	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM .-B	Blue	1329.40	1.36	No	1.000000	1.000000	1.000000

Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE100X50X3.2MM.-A	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE150X50X2.7MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X20X1.6MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM .-A	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM .-B	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE100X50X3.2MM.-A	Added 11/9/2563 10:02:13
TUBE150X50X2.7MM	Added 21/2/2562 9:17:06
TUBE50X20X1.6MM	Added 12/9/2563 14:42:09
TUBE50X50X2.3MM	Added 30/6/2018 10:18:33
TUBE50X50X2.3MM .-A	Added 10/9/2563 15:56:59
TUBE50X50X2.3MM .-B	Added 20/2/2562 15:52:29

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Green	

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A992 Fy=50 ksi added 3/7/2017 14:04:36

ปราโมทย์ ฤทธิ์ปรีดานันท์ วย.720

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SMax
	Kgf/cm2	Kgf/cm2	Kgf/cm2	Kgf/cm2				
A36	2500.00	4000.00	2500.00	4000.00	Simple	Kinematic	0.015000	0.110000

Table: Material Properties 03a - Steel Data, Part 2 of 2

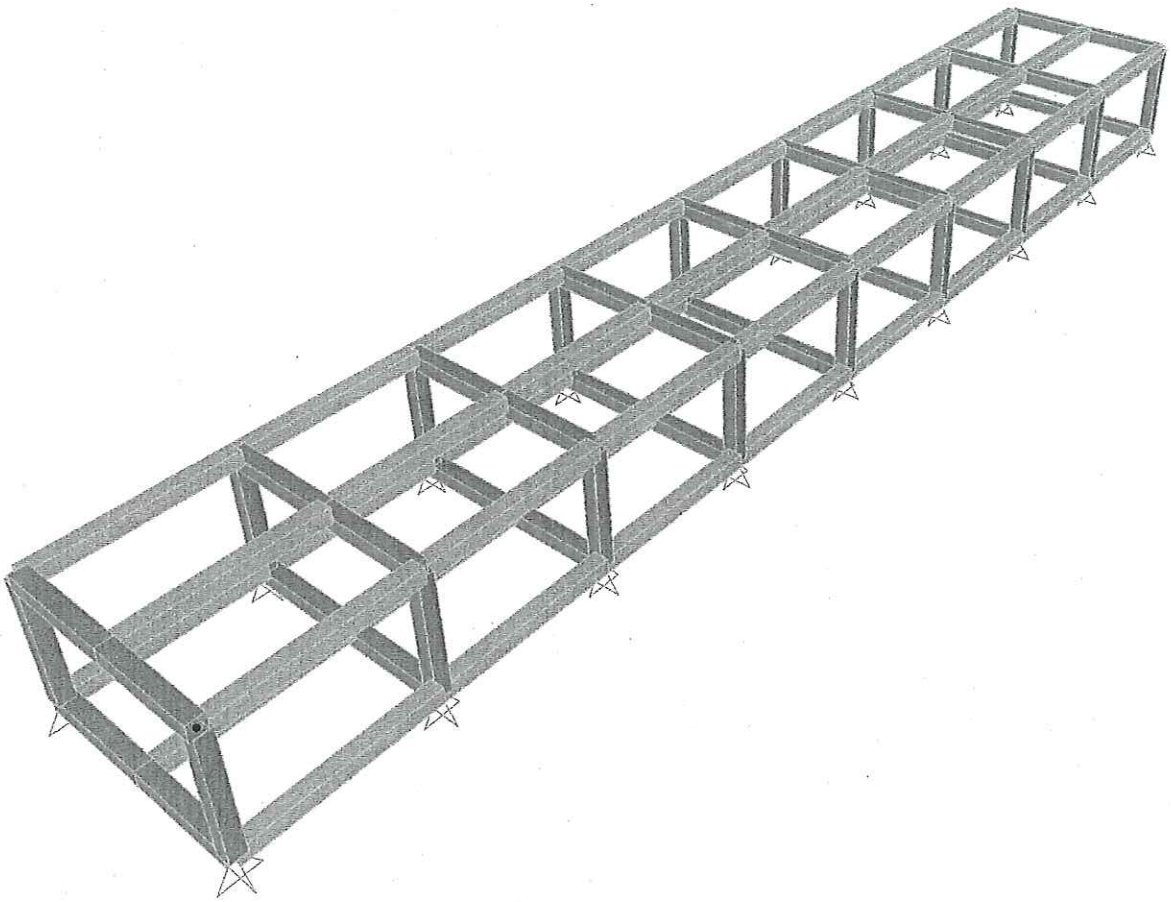
Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope
A36	0.170000	-0.100000

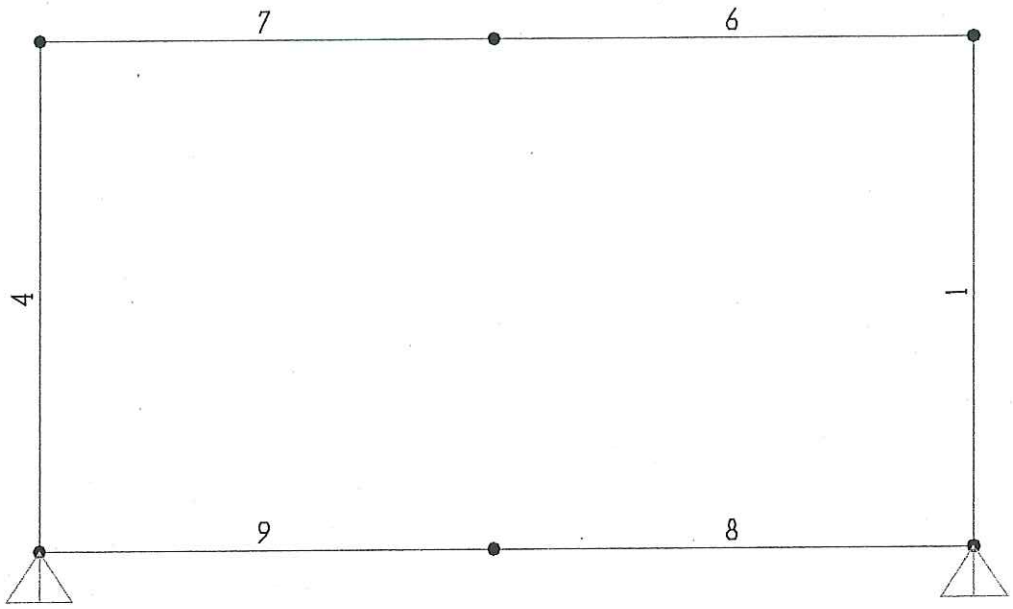
ปราโมทย์ ฤทธิปรีดานันท์ วย.720

โครงเหล็กรับพื้น ห้องบรรยาย

DL = 26 kg/m^2
SDL = 10 kg/m^2
LL = 300 kg/m^2



ปโมทย์ ฤทธิปรีดานันท์ วย.720



TM1

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

TM1

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
1	TUBE50X50X2.3MM.	Column	0.036641	PMM	DL+LL	40
4	TUBE50X50X2.3MM.	Column	0.033527	PMM	DL+LL	40
6	TUBE50X50X2.3MM.	Beam	0.043843	PMM	DL+LL	38
7	TUBE50X50X2.3MM.	Beam	0.043645	PMM	DL+LL	0
8	TUBE50X50X2.3MM.	Beam	0.005399	PMM	DL+LL	0
9	TUBE50X50X2.3MM.	Beam	0.00474	PMM	DL+LL	36

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project _____
Job Number K2
Engineer _____

AISC-ASD89 STEEL SECTION CHECK
Combo : DL+LL
Units : Kgf, cm, C

Frame : 232
X Mid : 90.000
Y Mid : 74.000
Z Mid : 40.000
Length : 60.000
Loc : 30.000

Design Sect: TUBE50X50X2.3MM.-A
Design Type: Beam
Frame Type : Moment Resisting Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 4.388
IMajor : 16.680
IMinor : 16.680
Ixy : 0.000

SMajor : 6.672
SMinor : 6.672
ZMajor : 7.856
ZMinor : 7.856

rMajor : 1.950
rMinor : 1.950
E : 2038901.916
Fy : 2500.000

AVMajor: 2.300
AVMinor: 2.300

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
30.000	0.063	605.180	0.010	0.000	-0.015	2.197

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H2-1)	0.055	=	0.000	+	0.055	+	0.000	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	0.063	0.014	1381.935	1500.000

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	605.180	90.704	1650.000	11085.137	1.000	1.000	1.000	1.000
Minor Moment	0.010	0.001	1650.000	11085.137	1.000	1.000	1.000	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	0.000	0.000	1000.000	0.000	OK	0.000
Minor Shear	0.015	0.007	1000.000	6.581E-06	OK	0.000

ปราโมทย์ ทิธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE50X50X2.3MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300
TUBE50X50X2.3MM .-A	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE50X50X2.3MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67
TUBE50X50X2.3MM .-A	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE50X50X2.3MM	6.67	7.86	7.86	1.9496	1.9496	No	No
TUBE50X50X2.3MM .-A	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE50X50X2.3MM	4259584	70.68	7.207E-02	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM .-A	16744703	99.20	0.10	No	1.000000	1.000000	1.000000

Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE50X50X2.3MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM .-A	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE50X50X2.3MM	Added 30/6/2018 10:18:33

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE50X50X2.3MM .-A	Added 10/9/2563 15:56:59

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Green	

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A992 Fy=50 ksi added 3/7/2017 14:04:36

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy Kgf/cm2	Fu Kgf/cm2	EffFy Kgf/cm2	EffFu Kgf/cm2	SSCurveOpt	SSHysType	SHard	SMax
A36	2500.00	4000.00	2500.00	4000.00	Simple	Kinematic	0.015000	0.110000

Table: Material Properties 03a - Steel Data, Part 2 of 2

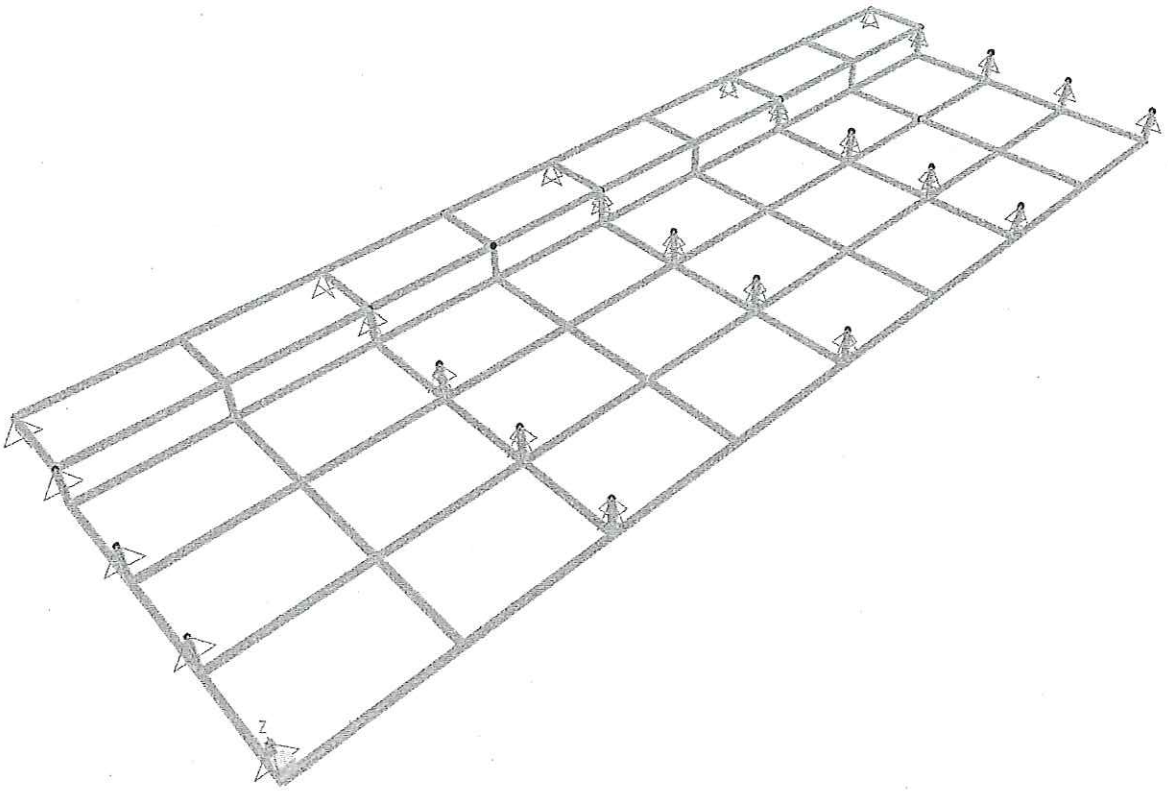
Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope
A36	0.170000	-0.100000

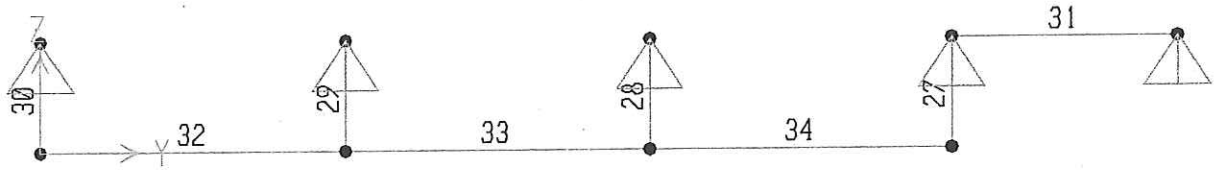
ปราโมทย์ ฤทธิปรีดานันท์ วย.720

ฝ้าเพดาน ชั้น2

DL = 25 kg/m^2
LL = 30 kg/m^2



ปราโมทย์ ฤทธิปรีดานันท์ วย.720



TC1

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

TC1

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
27	TUBE-50X50X2.30MM	Column	0.051727	PMM	1.2DL+1.6LL	42
28	TUBE-50X50X2.30MM	Column	0.089817	PMM	1.2DL+1.6LL	0
29	TUBE-50X50X2.30MM	Column	0.091237	PMM	1.2DL+1.6LL	0
30	TUBE-50X50X2.30MM	Column	0.053088	PMM	1.2DL+1.6LL	0
31	TUBE-50X50X2.30MM	Beam	0.002548	PMM	1.2DL+1.6LL	43.5
32	TUBE-50X50X2.30MM	Beam	0.005792	PMM	1.2DL+1.6LL	117
33	TUBE-50X50X2.30MM	Beam	0.004851	PMM	1.2DL+1.6LL	0
34	TUBE-50X50X2.30MM	Beam	0.005615	PMM	1.2DL+1.6LL	0

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project _____
Job Number K4
Engineer _____

AISC-ASD89 STEEL SECTION CHECK
Combo : 1.2DL+1.6LL
Units : Kgf, cm, C

Frame	: 20	Design Sect:	TUBE-50X50X2.30MM		
X Mid	: 150.000	Design Type:	Beam		
Y Mid	: 117.000	Frame Type :	Moment Resisting Frame		
Z Mid	: 0.000	Sect Class :	Compact		
Length	: 300.000	Major Axis :	0.000 degrees counterclockwise from local 3		
Loc	: 300.000	RLLF :	1.000		
Area	: 4.388	SMajor : 6.672	rMajor : 1.950	AVMajor: 2.300	
IMajor	: 16.680	SMinor : 6.672	rMinor : 1.950	AVMinor: 2.300	
IMinor	: 16.680	ZMajor : 7.856	E : 2038901.916		
Ixy	: 0.000	ZMinor : 7.856	Fy : 2531.051		

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
300.000	139.473	-7907.976	-9.318	151.604	0.134	0.142

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H2-1)	0.731	=	0.021	+	0.710	+	0.000	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	139.473	31.782	443.405	1518.630

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	-7907.976	1185.237	1670.493	443.405	1.000	1.000	1.000	1.000
Minor Moment	-9.318	1.397	1670.493	1773.622	1.000	1.000	0.500	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	151.604	65.915	1012.420	0.065	OK	0.000
Minor Shear	0.134	0.058	1012.420	5.738E-05	OK	0.000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE-50X50X2.30MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE-50X50X2.30MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE-50X50X2.30MM	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE-50X50X2.30MM	Cyan	418.19	0.43	No	1.000000	1.000000	1.000000

Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE-50X50X2.30MM	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE-50X50X2.30MM	Added 22/6/2563 14:35:44

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Blue	

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A36 added 24/7/2017 11:08:33

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy Kgf/cm2	Fu Kgf/cm2	EffFy Kgf/cm2	EffFu Kgf/cm2	SSCurveOpt	SSHysType	SHard	SMax
A36	2531.05	4077.80	3796.58	4485.58	Simple	Kinematic	0.020000	0.140000

Table: Material Properties 03a - Steel Data, Part 2 of 2

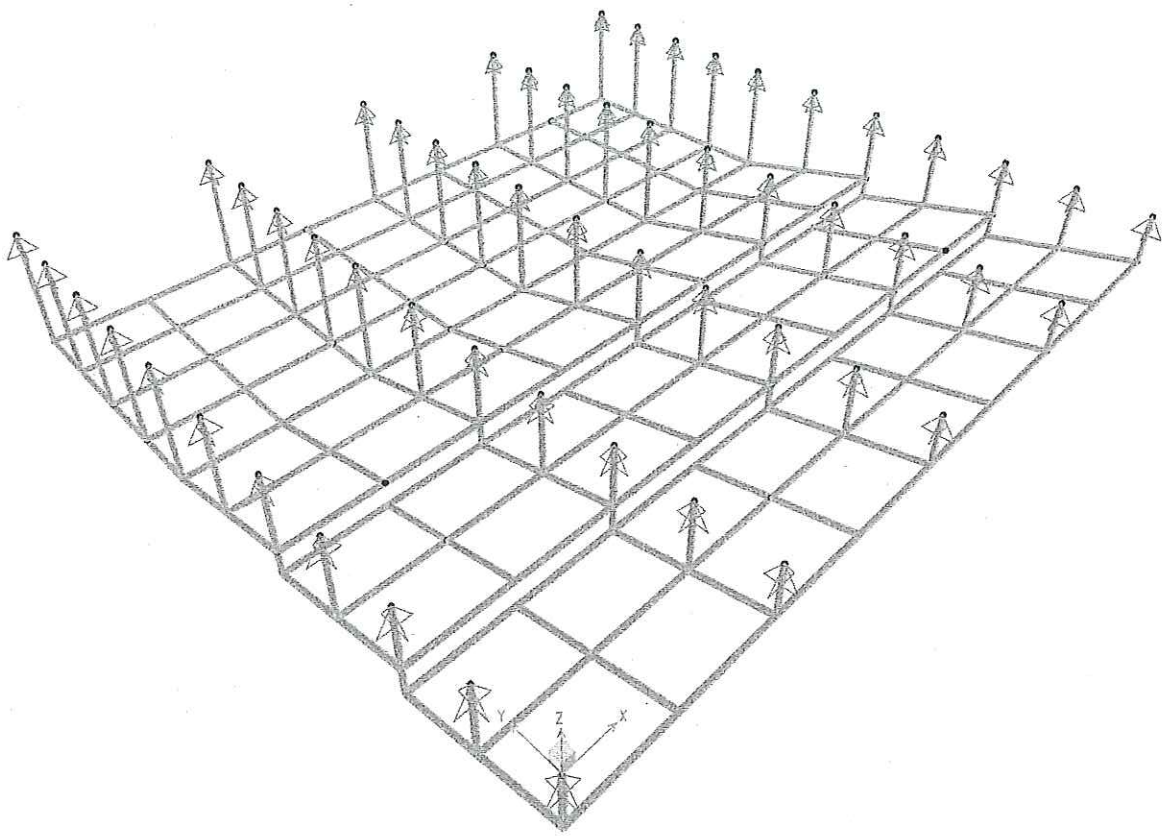
Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope
A36	0.200000	-0.100000

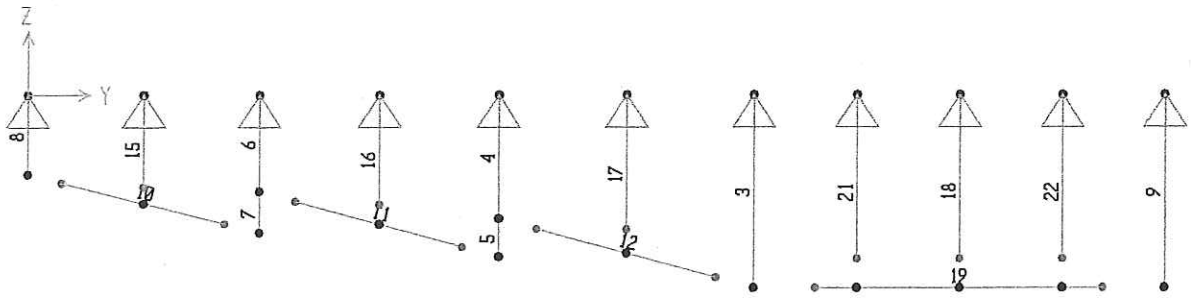
ปราโมทย์ ฤทธิปรีดานันท์ วย.720

ฝ้าเพดาน ชั้น3

DL = 25 kg/m^2
LL = 30 kg/m^2



ปราโมทย์ ฤทธิปรีดานันท์ วย.720



TC2

น.นิมิทย์ ฤทธิ์ปรีดานันท์ วย.720

TC2

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
3	TUBE-50X50X2.30MM	Column	0.201805	PMM	1.2DL+1.6LL	192
4	TUBE-50X50X2.30MM	Column	0.078511	PMM	1.2DL+1.6LL	123
5	TUBE-50X50X2.30MM	Column	0.19628	PMM	1.2DL+1.6LL	38
6	TUBE-50X50X2.30MM	Column	0.081015	PMM	1.2DL+1.6LL	96
7	TUBE-50X50X2.30MM	Column	0.195116	PMM	1.2DL+1.6LL	41
8	TUBE-50X50X2.30MM	Column	0.166773	PMM	1.2DL+1.6LL	79
9	TUBE-50X50X2.30MM	Column	0.122245	PMM	1.2DL+1.6LL	192
10	TUBE-50X50X2.30MM	Brace	0.02633	PMM	1.2DL+1.6LL	119.57
11	TUBE-50X50X2.30MM	Brace	0.025676	PMM	1.2DL+1.6LL	124.323
12	TUBE-50X50X2.30MM	Brace	0.060566	PMM	1.2DL+1.6LL	265.136
15	TUBE-50X50X2.30MM	Column	0.022447	PMM	1.2DL+1.6LL	108
16	TUBE-50X50X2.30MM	Column	0.023441	PMM	1.2DL+1.6LL	128.5
17	TUBE-50X50X2.30MM	Column	0.024914	PMM	1.2DL+1.6LL	157.5
18	TUBE-50X50X2.30MM	Column	0.01944	PMM	1.2DL+1.6LL	192
19	TUBE-50X50X2.30MM	Beam	0.048417	PMM	1.2DL+1.6LL	0
21	TUBE-50X50X2.30MM	Column	0.019642	PMM	1.2DL+1.6LL	192
22	TUBE-50X50X2.30MM	Column	0.019694	PMM	1.2DL+1.6LL	192

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project _____

Job Number K2

Engineer _____

AISC-ASD89 STEEL SECTION CHECK
Combo : 1.2DL+1.6LL
Units : Kgf, cm, C

Frame : 45 Design Sect: TUBE-50X50X2.30MM
X Mid : 150.000 Design Type: Beam
Y Mid : 600.000 Frame Type : Moment Resisting Frame
Z Mid : -157.500 Sect Class : Compact
Length : 300.000 Major Axis : 0.000 degrees counterclockwise from local 3
Loc : 300.000 RLLF : 1.000

Area : 4.388 SMajor : 6.672 rMajor : 1.950 AVMajor: 2.300
IMajor : 16.680 SMinor : 6.672 rMinor : 1.950 AVMinor: 2.300
IMinor : 16.680 ZMajor : 7.856 E : 2038901.916
Ixy : 0.000 ZMinor : 7.856 Fy : 2531.051

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
300.000	-5.085	-4297.475	69.020	79.701	-0.914	-0.258

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H1-3)	0.393	=	0.001	+	0.386	+	0.006	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	-5.085	1.159	1103.290	1518.630

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	-4297.475	644.100	1670.493	1773.622	0.850	1.000	0.500	1.000
Minor Moment	69.020	10.345	1670.493	1773.622	0.850	1.000	0.500	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	79.701	34.653	1012.420	0.034	OK	0.000
Minor Shear	0.914	0.398	1012.420	0.000	OK	0.000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE-50X50X2.30MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE-50X50X2.30MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE-50X50X2.30MM	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE-50X50X2.30MM	Cyan	1196.59	1.22	No	1.000000	1.000000	1.000000

Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE-50X50X2.30MM	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE-50X50X2.30MM	Added 22/6/2563 14:35:44

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Blue	

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A36 added 24/7/2017 11:08:33

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SMax
	Kgf/cm2	Kgf/cm2	Kgf/cm2	Kgf/cm2				
A36	2531.05	4077.80	3796.58	4485.58	Simple	Kinematic	0.020000	0.140000

Table: Material Properties 03a - Steel Data, Part 2 of 2

Table: Material Properties 03a - Steel Data, Part 2 of 2

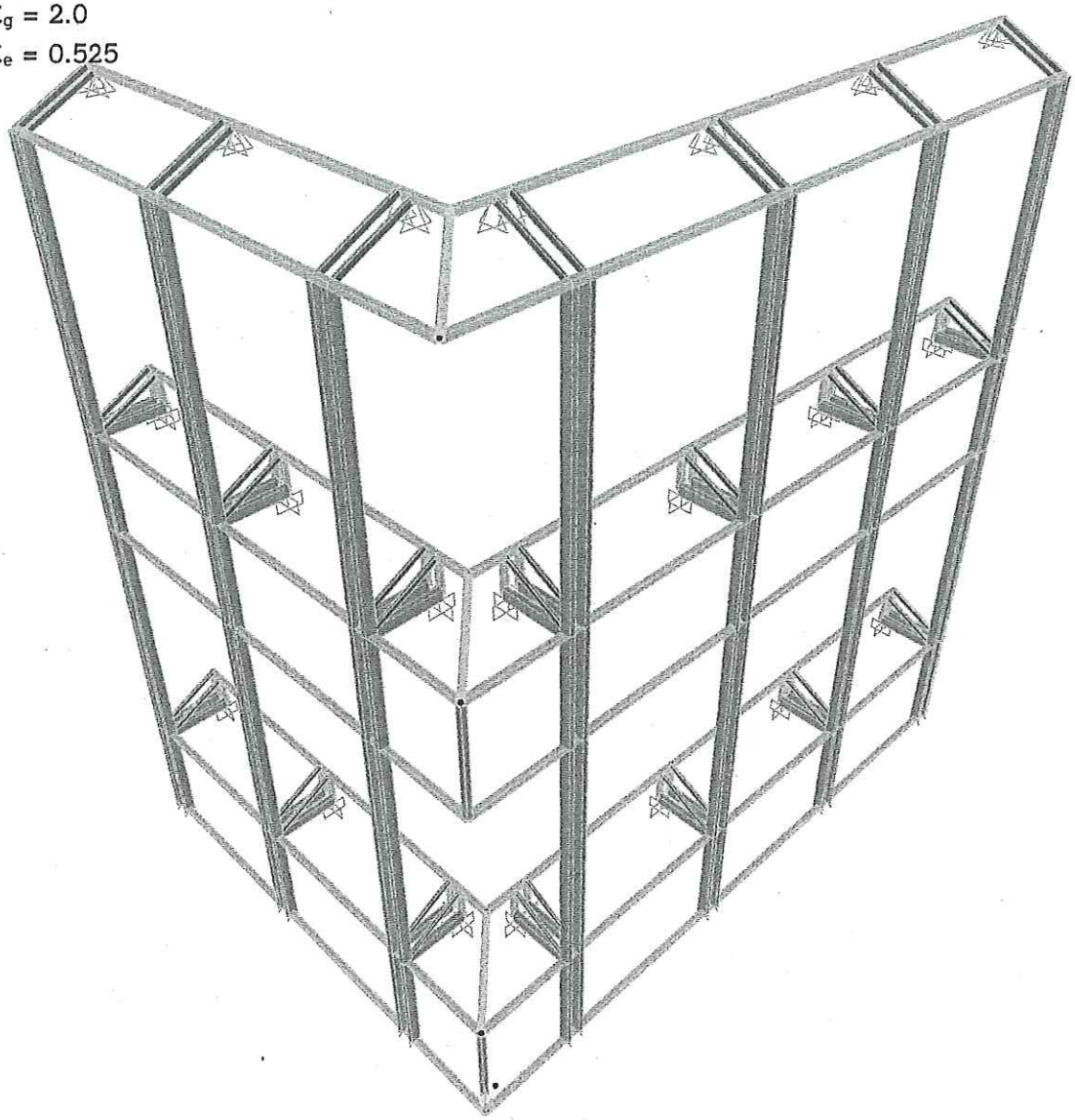
Material	SRup	FinalSlope
A36	0.200000	-0.100000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 11/23/63 10:29:09

Facade

DL = 7.5 kg/m^2
Wind :
V = 56 mph
I_w = 1.0
C_p = 0.82
C_g = 2.0
C_e = 0.525

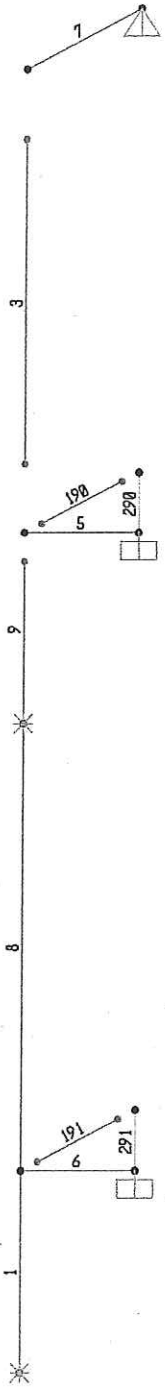


SAP2000 v14.2.4 - File:20-M Aluminium Facade 2 - 3-D View - Kgf, cm, C Units

วิราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000

11/23/63 10:30:21



T4

SAP2000 v14.2.4 - File:20-M Aluminium Facade 2 - Y-Z Plane @ X=98 - Kgf, cm, C Units

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T4

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
1	TUBE100X50X3.2MM.-A	Column	0.03924	PMM	DL+LL	113
3	TUBE100X50X3.2MM.-A	Column	0.014246	PMM	DL+LL	0
5	TUBE100X50X3.2MM.-A	Beam	0.068899	PMM	DL+LL	0
6	TUBE100X50X3.2MM.-A	Beam	0.084645	PMM	DL+LL	0
7	TUBE50X25X1.6MM	Brace	0.014753	PMM	DL+LL	0
8	TUBE100X50X3.2MM.-A	Column	0.030066	PMM	DL+LL	0
9	TUBE100X50X3.2MM.-A	Column	0.016409	PMM	DL+LL	0
190	TUBE50X25X1.6MM	Brace	0.019912	PMM	DL+LL	73.355
191	TUBE50X25X1.6MM	Brace	0.018518	PMM	DL+LL	73.355
290	TUBE50X50X2.3MM.-A	Column	0.082425	PMM	DL+LL	0
291	TUBE50X50X2.3MM.-A	Column	0.08044	PMM	DL+LL	0

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project
Job Number BK1
Engineer

AISC-ASD89 STEEL SECTION CHECK
Combo : DL+LL
Units : Kgf, cm, C

Frame	: 74	Design Sect:	TUBE50X50X2.3MM.-A		
X Mid	: 203.000	Design Type:	Beam		
Y Mid	: 0.000	Frame Type :	Moment Resisting Frame		
Z Mid	: 473.000	Sect Class :	Compact		
Length	: 180.000	Major Axis :	0.000 degrees counterclockwise from local 3		
Loc	: 90.000	RLLF :	1.000		
Area	: 4.388	SMajor :	6.672	rMajor :	1.950 AVMajor: 2.300
IMajor	: 16.680	SMinor :	6.672	rMinor :	1.950 AVMinor: 2.300
IMinor	: 16.680	ZMajor :	7.856	E :	2038901.916
Ixy	: 0.000	ZMinor :	7.856	Fy :	2500.000

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
90.000	-14.110	915.243	-0.149	0.000	0.149	4.012

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H1-3)	0.095	=	0.003	+	0.091	+	0.000	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	-14.110	3.215	971.845	1500.000

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	915.243	137.175	1500.000	1231.682	1.000	1.000	1.000	1.000
Minor Moment	-0.149	0.022	1500.000	1231.682	0.850	1.000	1.000	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	0.000	0.000	1000.000	0.000	OK	0.000
Minor Shear	0.149	0.065	1000.000	6.482E-05	OK	0.000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE100X50X3.2M M.-A	A36	Box/Tube	10.0000	5.0000	0.3200	0.3200
TUBE50X25X1.6MM	A36	Box/Tube	5.0000	2.5000	0.1600	0.1600
TUBE50X50X2.3MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300
.						
TUBE50X50X2.3MM .-A	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE100X50X3.2M M.-A	9.19	91.47	118.72	39.52	6.40	3.20	23.74
TUBE50X25X1.6MM	2.30	5.72	7.42	2.47	1.60	0.80	2.97
TUBE50X50X2.3MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67
.							
TUBE50X50X2.3MM .-A	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE100X50X3.2M M.-A	15.81	29.51	18.02	3.5942	2.0736	No	No
TUBE50X25X1.6MM	1.98	3.69	2.25	1.7971	1.0368	No	No
TUBE50X50X2.3MM	6.67	7.86	7.86	1.9496	1.9496	No	No
.							
TUBE50X50X2.3MM .-A	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE100X50X3.2M M.-A	Orange	871.55	0.89	No	1.000000	1.000000	1.000000
TUBE50X25X1.6MM	16711808	55.56	5.666E-02	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM	4259584	7.61	7.762E-03	No	1.000000	1.000000	1.000000
.							
TUBE50X50X2.3MM .-A	16744703	360.43	0.37	No	1.000000	1.000000	1.000000

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Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE100X50X3.2MM.-A	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X25X1.6MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM	1.000000	1.000000	1.000000	1.000000	1.000000	
.						
TUBE50X50X2.3MM.-A	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE100X50X3.2MM.-A	Added 11/9/2563 10:02:13
TUBE50X25X1.6MM	Added 12/9/2563 14:42:09
TUBE50X50X2.3MM	Added 30/6/2018 10:18:33
.	
TUBE50X50X2.3MM.-A	Added 10/9/2563 15:56:59

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Green	

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A992 Fy=50 ksi added 3/7/2017 14:04:36

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SMax
	Kgf/cm2	Kgf/cm2	Kgf/cm2	Kgf/cm2				
A36	2500.00	4000.00	2500.00	4000.00	Simple	Kinematic	0.015000	0.110000

Table: Material Properties 03a - Steel Data, Part 2 of 2

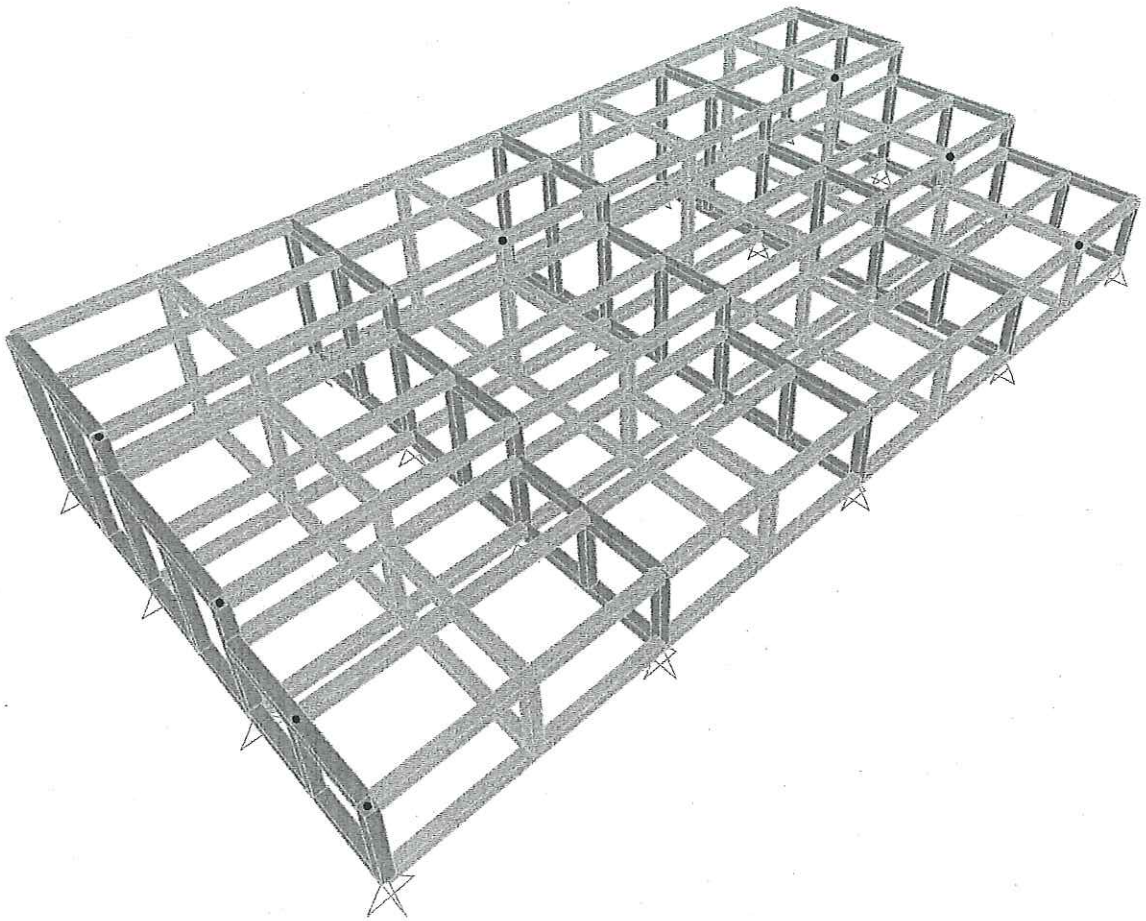
Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope
A36	0.170000	-0.100000

ปราโมทย์ ฤทธิรัตนานันท์ วย.720

โครงเหล็กรับที่นั่ง co working space

DL = 26 kg/m^2
SDL = 10 kg/m^2
LL = 300 kg/m^2



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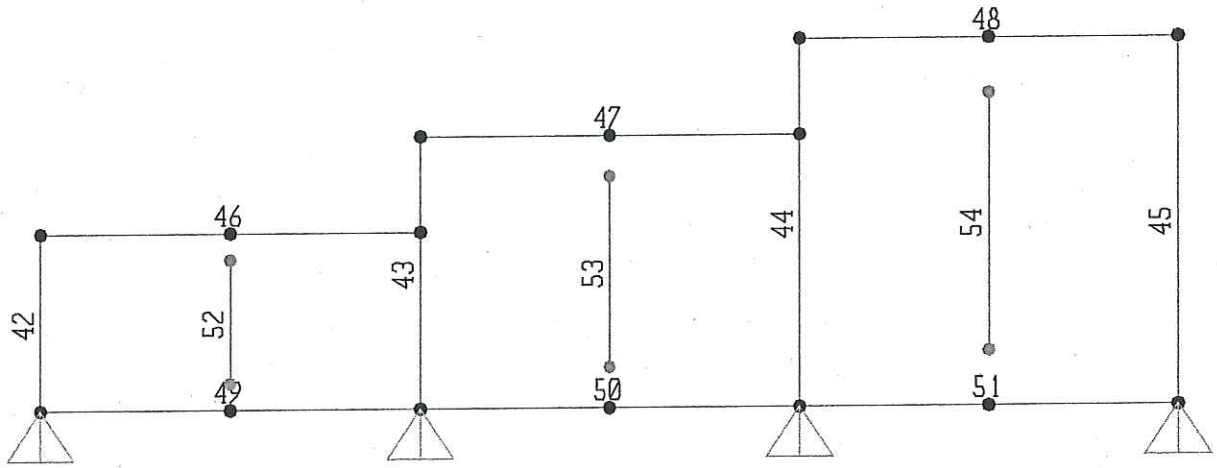


TM2

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

TM2

TABLE: Steel Design 1 - Summary Data - AISC-ASD89

Frame	DesignSect	DesignType	Ratio	RatioType	Combo	Location
Text	Text	Text	Unitless	Text	Text	cm
42	TUBE50X50X2.3MM.	Column	0.08377	PMM	DL+LL	0
43	TUBE50X50X2.3MM.	Column	0.07819	PMM	DL+LL	37
44	TUBE50X50X2.3MM.	Column	0.074517	PMM	DL+LL	77
45	TUBE50X50X2.3MM.	Column	0.064827	PMM	DL+LL	0
46	TUBE50X50X2.3MM.	Beam	0.104332	PMM	DL+LL	40
47	TUBE50X50X2.3MM.	Beam	0.090796	PMM	DL+LL	40
48	TUBE50X50X2.3MM.	Beam	0.10294	PMM	DL+LL	40
49	TUBE50X50X2.3MM.	Beam	0.126188	PMM	DL+LL	40
50	TUBE50X50X2.3MM.	Beam	0.133786	PMM	DL+LL	40
51	TUBE50X50X2.3MM.	Beam	0.126446	PMM	DL+LL	40
52	TUBE50X50X2.3MM.	Column	0.022686	PMM	DL+LL	0
53	TUBE50X50X2.3MM.	Column	0.018232	PMM	DL+LL	57
54	TUBE50X50X2.3MM.	Column	0.021448	PMM	DL+LL	0

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project _____
Job Number K2
Engineer _____

AISC-ASD89 STEEL SECTION CHECK
Combo : DL+LL
Units : Kgf, cm, C

Frame	: 65	Design Sect	: TUBE50X50X2.3MM.-A		
X Mid	: 180.000	Design Type	: Beam		
Y Mid	: 40.000	Frame Type	: Moment Resisting Frame		
Z Mid	: 37.000	Sect Class	: Compact		
Length	: 120.000	Major Axis	: 0.000 degrees counterclockwise from local 3		
Loc	: 60.000	RLLF	: 1.000		
Area	: 4.388	SMajor	: 6.672	rMajor : 1.950	AVMajor: 2.300
IMajor	: 16.680	SMinor	: 6.672	rMinor : 1.950	AVMinor: 2.300
IMinor	: 16.680	ZMajor	: 7.856	E : 2038901.916	
Ixy	: 0.000	ZMinor	: 7.856	Fy : 2500.000	

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
60.000	-0.010	2522.581	-7.410	-0.690	0.249	-0.018

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H1-3)	0.230	=	0.000	+	0.229	+	0.000	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	-0.010	0.002	1202.540	1500.000

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	2522.581	378.081	1650.000	2771.284	1.000	1.000	1.000	1.000
Minor Moment	-7.410	1.111	1650.000	11085.137	0.850	1.000	0.500	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	0.690	0.300	1000.000	0.000	OK	0.000
Minor Shear	0.249	0.108	1000.000	0.000	OK	0.000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 1 of 6

Table: Frame Section Properties 01 - General, Part 1 of 6

SectionName	Material	Shape	t3	t2	tf	tw
			cm	cm	cm	cm
TUBE50X50X2.3MM	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300
TUBE50X50X2.3MM .-A	A36	Box/Tube	5.0000	5.0000	0.2300	0.2300

Table: Frame Section Properties 01 - General, Part 2 of 6

Table: Frame Section Properties 01 - General, Part 2 of 6

SectionName	Area	TorsConst	I33	I22	AS2	AS3	S33
	cm2	cm4	cm4	cm4	cm2	cm2	cm3
TUBE50X50X2.3MM	4.39	24.96	16.68	16.68	2.30	2.30	6.67
TUBE50X50X2.3MM .-A	4.39	24.96	16.68	16.68	2.30	2.30	6.67

Table: Frame Section Properties 01 - General, Part 3 of 6

Table: Frame Section Properties 01 - General, Part 3 of 6

SectionName	S22	Z33	Z22	R33	R22	ConcCol	ConcBeam
	cm3	cm3	cm3	cm	cm		
TUBE50X50X2.3MM	6.67	7.86	7.86	1.9496	1.9496	No	No
TUBE50X50X2.3MM .-A	6.67	7.86	7.86	1.9496	1.9496	No	No

Table: Frame Section Properties 01 - General, Part 4 of 6

Table: Frame Section Properties 01 - General, Part 4 of 6

SectionName	Color	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod
		Kgf	Kgf-s2/cm				
TUBE50X50X2.3MM	4259584	154.83	0.16	No	1.000000	1.000000	1.000000
TUBE50X50X2.3MM .-A	16744703	315.24	0.32	No	1.000000	1.000000	1.000000

Table: Frame Section Properties 01 - General, Part 5 of 6

Table: Frame Section Properties 01 - General, Part 5 of 6

SectionName	JMod	I2Mod	I3Mod	MMod	WMod	GUID
TUBE50X50X2.3MM	1.000000	1.000000	1.000000	1.000000	1.000000	
TUBE50X50X2.3MM .-A	1.000000	1.000000	1.000000	1.000000	1.000000	

Table: Frame Section Properties 01 - General, Part 6 of 6

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE50X50X2.3MM	Added 30/6/2018 10:18:33

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

Table: Frame Section Properties 01 - General, Part 6 of 6

SectionName	Notes
TUBE50X50X2.3MM .-A	Added 10/9/2563 15:56:59

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	SymType	TempDepend	Color	GUID
A36	Steel	Isotropic	No	Green	

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
A36	ASTM A992 Fy=50 ksi added 3/7/2017 14:04:36

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy Kgf/cm2	Fu Kgf/cm2	EffFy Kgf/cm2	EffFu Kgf/cm2	SSCurveOpt	SSHysType	SHard	SMax
A36	2500.00	4000.00	2500.00	4000.00	Simple	Kinematic	0.015000	0.110000

Table: Material Properties 03a - Steel Data, Part 2 of 2

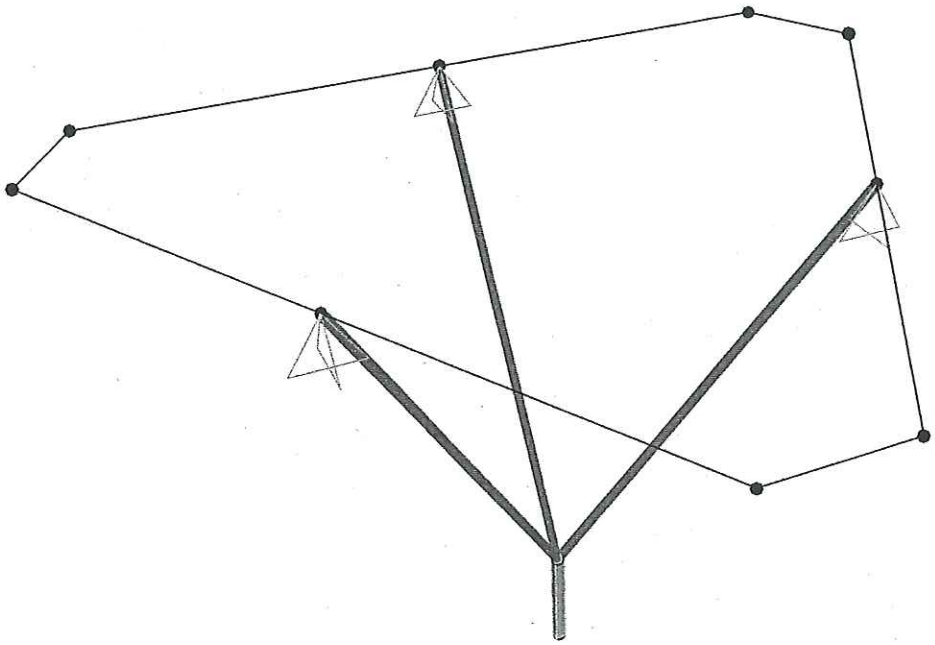
Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope
A36	0.170000	-0.100000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

โครงเหล็กรับ Pendulum

DL = 50 kg
LL = 30 kg



ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SAP2000 Steel Design

Project
Job Number PB1
Engineer

AISC-ASD89 STEEL SECTION CHECK
Combo : DL+WL
Units : Kgf, cm, C

Frame : 7
X Mid : 248.250
Y Mid : 174.871
Z Mid : 100.000
Length : 237.220
Loc : 94.888

Design Sect: PIPE-42.7X2.30MM
Design Type: Brace
Frame Type : Moment Resisting Frame
Sect Class : Compact
Major Axis : 0.000 degrees counterclockwise from local 3
RLLF : 1.000

Area : 2.919
IMajor : 5.975
IMinor : 5.975
Ixy : 0.000

SMajor : 2.799
SMinor : 2.799
ZMajor : 3.758
ZMinor : 3.758

rMajor : 1.431
rMinor : 1.431
E : 2038901.916
Fy : 2500.000

AVMajor: 1.463
AVMinor: 1.463

STRESS CHECK FORCES & MOMENTS

Location	P	M33	M22	V2	V3	T
94.888	-46.833	82.709	0.372	-0.287	-0.004	-1.563

PMM DEMAND/CAPACITY RATIO

Governing Equation	Total Ratio		P Ratio		MMajor Ratio		MMinor Ratio	Ratio Limit	Status Check
(H1-3)	0.060	=	0.042	+	0.018	+	0.000	0.950	OK

AXIAL FORCE DESIGN

	P Force	fa Stress	Fa Allowable	Ft Allowable
Axial	-46.833	16.043	381.878	1500.000

MOMENT DESIGN

	M Moment	fb Stress	Fb Allowable	Fe Allowable	Cm Factor	K Factor	L Factor	Cb Factor
Major Moment	82.709	29.554	1650.000	381.878	0.850	1.000	1.000	1.000
Minor Moment	0.372	0.133	1650.000	381.878	0.850	1.000	1.000	

SHEAR DESIGN

	V Force	fv Stress	Fv Allowable	Stress Ratio	Status Check	T Torsion
Major Shear	0.287	0.196	1000.000	0.000	OK	0.000
Minor Shear	0.004	0.003	1000.000	2.683E-06	OK	0.000

ปราโมทย์ ฤทธิปรีดานันท์ วย.720

SL

t =0.20 m. DL = 480 kg/m^2 SDL = 100 kg/m^2 LL= 2000 kg/m^2
Wu = 4212 kg/m^2 La = 1.90 m. Lb = 2.70 m. m=La/Lb = 0.70 Case 1

Short Span

c = 0.068
Mu$^+$ = 1034 kg.m/m.
Mn$^+$ = 1149 kg.m/m.
As = 2.05 cm^2/m.
As min = 3.60 cm^2/m.

Long Span

c = 0.016
Mu$^+$ = 491 kg.m/m.
Mn$^+$ = 545 kg.m/m.
As = 0.97 cm^2/m.
As min = 3.60 cm^2/m.

;Use = DB12mm.@0.20m.

ปราโมทัย ฤทธิปรีดานันท์ วย.720

ETABS 2016 Shear Wall Design

ACI 318-08 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (cm)	Centroid Y (cm)	Length (cm)	Thickness (cm)	LLRF
STORY1	LH1	0	145	190	20	1

Material Properties

E_c (kgf/cm²)	f'_c (kgf/cm²)	Lt.Wt Factor (Unitless)	f_y (kgf/cm²)	f_{ys} (kgf/cm²)
253105.07	280	1	4218.42	4218.42

Design Code Parameters

Φ_T	Φ_C	Φ_V	Φ_V (Seismic)	IP_{MAX}	IP_{MIN}	P_{MAX}
0.9	0.65	0.75	0.6	0.02	0.0025	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 cm	Left Y_1 cm	Right X_2 cm	Right Y_2 cm	Length cm	Thickness cm
Top	Leg 1	0	50	0	240	190	20
Bottom	Leg 1	0	50	0	240	190	20

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (cm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kgf	M_{u2} kgf-cm	M_{u3} kgf-cm	Pier A_g cm²
Top	9.5	0.0025	0.0034	DCON2	12287.44	-876.91	9514.71	3800
Bottom	9.5	0.0025	0.0034	DCON2	13565.84	282.12	10762.32	3800

Shear Design

Station Location	ID	Rebar cm²/cm	Shear Combo	P_u kgf	M_u kgf-cm	V_u kgf	ΦV_c kgf	ΦV_n kgf
Top	Leg 1	0.05	U5	8466.87	65052.52	1065.45	34653.15	58698.14
Bottom	Leg 1	0.05	U5	9562.64	171597.2	1065.45	34817.52	58862.5

Boundary Element Check (ACI 21.9.6.3, 21.9.6.4)

Station Location	ID	Edge Length (cm)	Governing Combo	P_u kgf	M_u kgf-cm	Stress Comp kgf/cm²	Stress Limit kgf/cm²	C Depth cm	C Limit cm
Top–Left	Leg 1	Not Stressed	U1	0	0	0	0	0	0
Top–Right	Leg 1	Not Required	U1	8466.87	65052.52	2.77	56	10.8	45.238
Bottom–Left	Leg 1	Not Stressed	U1	0	0	0	0	0	0
Botttom–Right	Leg 1	Not Required	U1	9562.64	171597.2	3.94	56	11.065	45.238

WL (Footing–Floor1)

t=0.20m.

As= 6.80 cm²/m. ; Use DB12mm.@0.20m. (เหล็กยืน)

Av/s = 2.50 cm²/m. ; Use DB12mm.@0.20m. (เหล็กนอน)

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ETABS 2016 Shear Wall Design

ACI 318-08 Pier Design

Pier Details

Story ID	Pier ID	Centroid X (cm)	Centroid Y (cm)	Length (cm)	Thickness (cm)	LLRF
STORY2	LH1	0	145	80	20	1

Material Properties

E_c (kgf/cm²)	f'_c (kgf/cm²)	Lt.Wt Factor (Unitless)	f_y (kgf/cm²)	f_{ys} (kgf/cm²)
253105.07	280	1	4218.42	4218.42

Design Code Parameters

Φ_T	Φ_C	Φ_V	Φ_V (Seismic)	IP_{MAX}	IP_{MIN}	P_{MAX}
0.9	0.65	0.75	0.6	0.02	0.0025	0.8

Pier Leg Location, Length and Thickness

Station Location	ID	Left X_1 cm	Left Y_1 cm	Right X_2 cm	Right Y_2 cm	Length cm	Thickness cm
Top	Leg 1	0	50	0	90	40	20
Top	Leg 2	0	200	0	240	40	20
Bottom	Leg 1	0	50	0	90	40	20
Bottom	Leg 2	0	200	0	240	40	20

Flexural Design for P_u, M_{u2} and M_{u3}

Station Location	Required Rebar Area (cm²)	Required Reinf Ratio	Current Reinf Ratio	Flexural Combo	P_u kgf	M_{u2} kgf-cm	M_{u3} kgf-cm	Pier A_g cm²
Top	4	0.0025	0.0021	DCON2	4920.21	291.91	7466	1600
Bottom	4	0.0025	0.0021	DCON2	11661.39	-506.39	10352.88	1600

Shear Design

Station Location	ID	Rebar cm²/cm	Shear Combo	P_u kgf	M_u kgf-cm	V_u kgf	ΦV_c kgf	ΦV_n kgf
Top	Leg 1	0.05	U5	1146.09	13641.89	228.97	4107.16	9169.26
Top	Leg 2	0.05	DCON1	1737.17	-5154.3	146.17	7288.6	12350.7
Bottom	Leg 1	0.05	U8	1548.7	55334.99	469.52	2442	7504.1
Bottom	Leg 2	0.05	U5	4996.01	51568.52	514.73	2904.89	7966.99

Boundary Element Check (ACI 21.9.6.3, 21.9.6.4)

Station Location	ID	Edge Length (cm)	Governing Combo	P_u kgf	M_u kgf-cm	Stress Comp kgf/cm²	Stress Limit kgf/cm²	C Depth cm	C Limit cm
Top–Left	Leg 1	Not Stressed	U1	0	0	0	0	0	0
Top–Right	Leg 1	Not Required	U1	1146.09	13641.89	3.99	56	0.323	9.524
Top–Left	Leg 2	Not Required	U6	1517.39	-699.5	2.03	56	0.252	9.524
Top–Right	Leg 2	Not Required	U6	2261.73	6879.33	4.12	56	0.435	9.524
Bottom–Left	Leg 1	Not Stressed	U1	0	0	0	0	0	0
Botttom–Right	Leg 1	Not Required	U1	3255.06	57264.14	14.81	56	1.104	9.524
Bottom–Left	Leg 2	Not Stressed	U1	0	0	0	0	0	0
Botttom–Right	Leg 2	Not Required	U1	4996.01	51568.52	15.91	56	1.328	9.524

WL (Floor1–Roof)

t=0.20m.

As= 5.00 cm²/m. ; Use DB12mm.@0.20m. (เหล็กยืน)

Av/s = 2.50 cm²/m. ; Use DB12mm.@0.20m. (เหล็กนอน)

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ETABS 2016 Shear Wall Design

ACI 318-08 Spandrel Design

Spandrel Details

Story ID	Spandrel ID	Centroid X (cm)	Centroid Y (cm)	Depth (cm)	Width (cm)	LLRF
STORY3	S1	0	90	140	20	1

Material Properties

E_c (kgf/cm²)	f'_c (kgf/cm²)	Lt.Wt Factor (Unitless)	f_y (kgf/cm²)	f_{ys} (kgf/cm²)
253105.07	280	1	4218.42	4218.42

Design Code Parameters

Φ_T	Φ_C	Φ_V	Φ_V (Seismic)
0.9	0.65	0.75	0.6

Spandrel Flexural Design—Top Reinforcement

Station Location	Reinf Area cm²	Reinf Percentage	Reinf Combo	Moment, M_u kgf-cm
Left	0	0	DCON2	0
Right	0.16	0.01	U8	-57354.82

Spandrel Flexural Design—Bottom Reinforcement

Station Location	Reinf Area cm²	Reinf Percentage	Reinf Combo	Moment, M_u kgf-cm
Left	0.32	0.01	U5	116281.35
Right	0.14	4.963E-03	DCON2	49839.99

Spandrel Shear Design

Station Location	A_{vert} cm²/cm	A_{horiz} cm²/cm	ShearCombo	V_u kgf	ϕV_c kgf	ϕV_s kgf	ϕV_n kgf
Left	0.05	0.03	U3	1077.29	13417.22	15945.62	29362.84
Right	0.05	0.03	U1	1883.92	13418.42	15945.62	29364.04

Spandrel Shear Design—Diagonal Reinforcement

Station Location	A_{diag} cm²	Shear Combo	V_u kgf	V_{uLimit} kgf	L/H Ratio	Seismic Design	Diag Reinf Mandatory
Left	0.21	U3	1077.29	44723.8	0.786	Yes	No
Right	0.37	U1	1883.92	44723.8	0.786	Yes	No

BL1

t=0.20m.

Ast = 0.16 cm² ; Use 2-DB16mm.
Asb = 0.32 cm² ; Use 2-DB16mm.
At/s = 2.50 cm²/m ; Use 1-DB12mm@0.20m.

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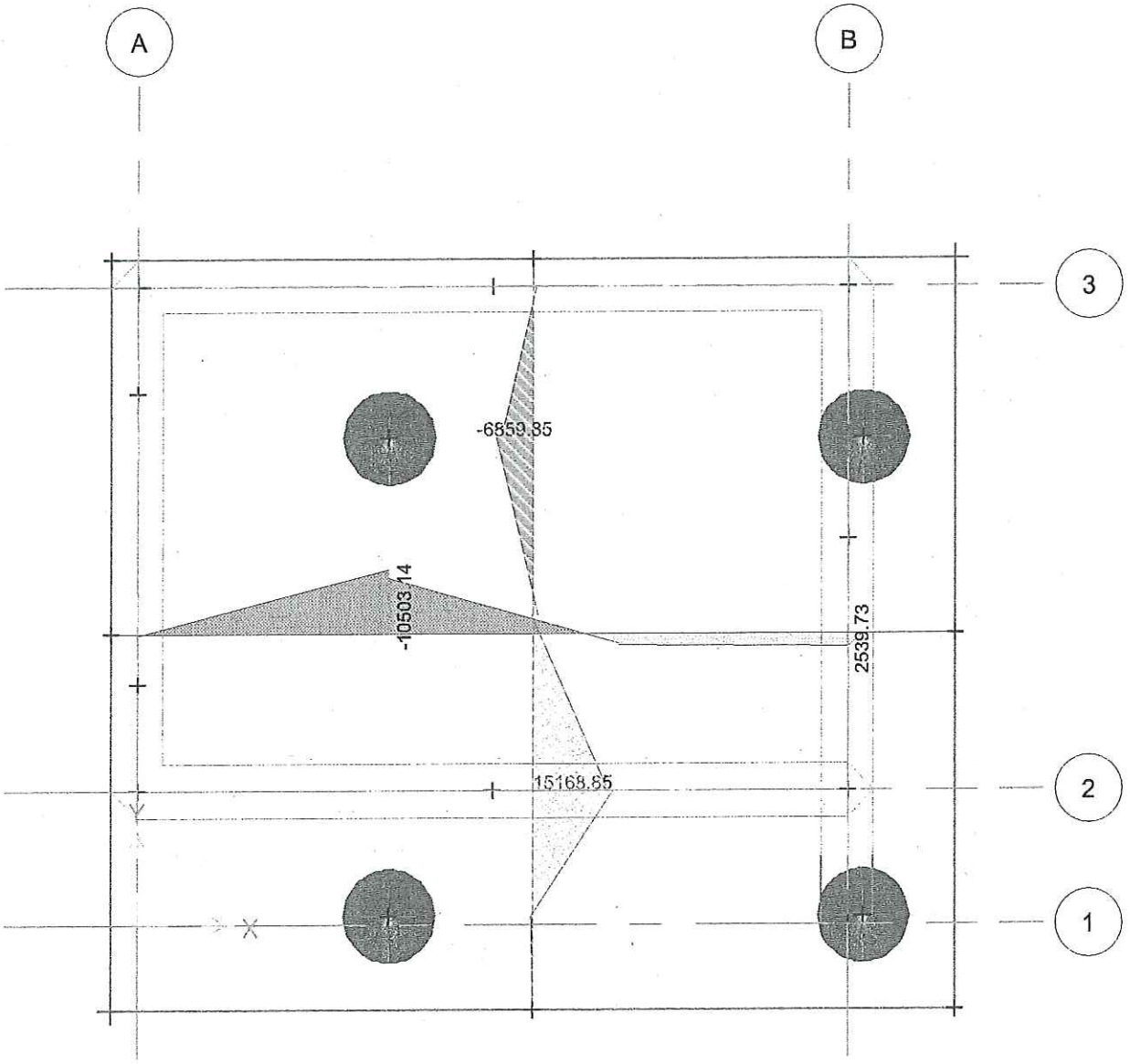

FL1 , t = 0.45 m.

$Mx_{,max}$

Mx = 3847 tkg-m./m.

As_{yy} = 11.66 cm^2 ใช้ DB16mm.@0.15m.

$My_{,max}$

My = 4740 kg-m./m.

As_{xx} = 9.57 cm^2 ใช้ DB16mm.@0.15m

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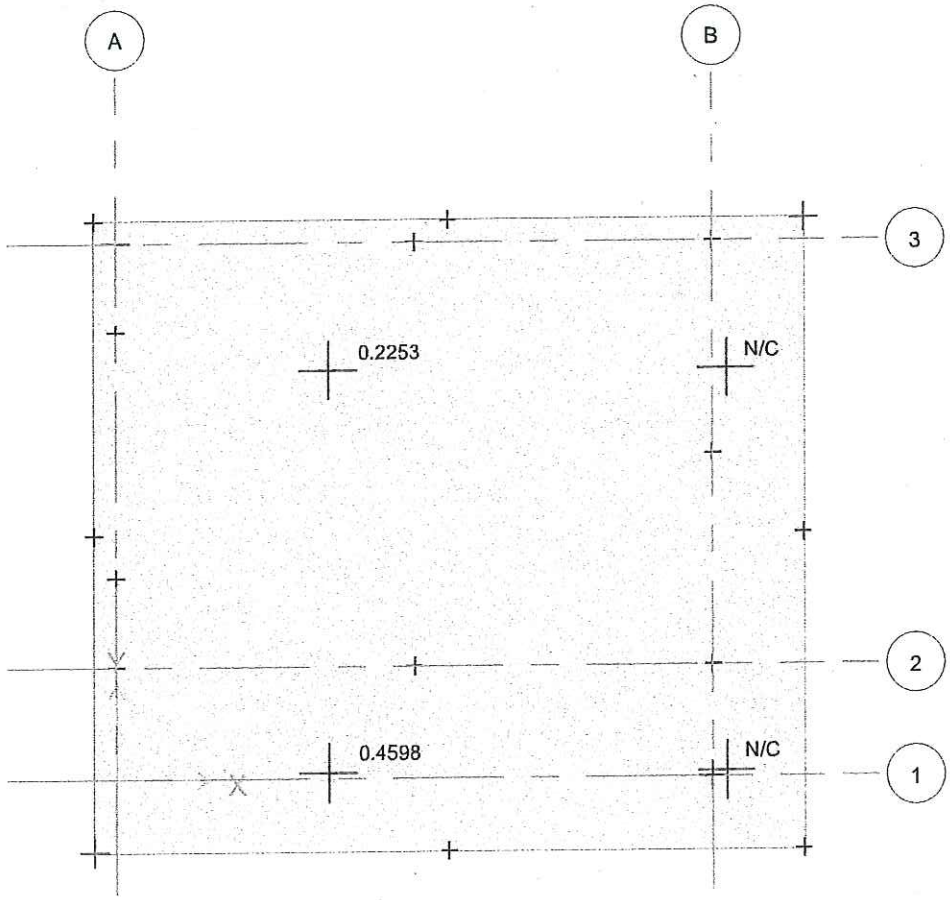
FL1 : แสดง Punching Shear



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SAP2000 Concrete Design

Project
Job Number BR1
Engineer

ACI 318-99 BEAM SECTION DESIGN Type: Sway Special Units: Kgf, cm, C (Summary)

L=400.000

Element : 7	D=50.000	B=25.000	bf=25.000
Station Loc : 400.000	ds=0.000	dct=4.000	dcb=4.000
Section ID : B25X50	E=253456.356	fc=280.000	Lt.Wt. Fac.=1.000
Combo ID : DL+WL	fy=4000.000	fys=2400.000	

Phi(Bending): 0.900
Phi(Shear): 0.850
Phi(Torsion): 0.850

Design Moments, M3

Positive Moment	Negative Moment	Special +Moment	Special -Moment
72523.609	-145047.219	72523.609	-145047.219

Flexural Reinforcement for Moment, M3

	Required Rebar	+Moment Rebar	-Moment Rebar	Minimum Rebar
Top (+2 Axis)	1.175	0.000	0.882	1.175
Bottom (-2 Axis)	0.586	0.439	0.000	0.586

Shear Reinforcement for Shear, V2

Design Rebar	Shear Vu	Shear phi*Vc	Shear phi*Vs	Shear Vp
0.000	1230.380	8674.110	0.000	0.000

Reinforcement for Torsion, T

Rebar At	Rebar Al	Torsion Tu	Critical Phi*Tcr	Area Ao	Perimeter Ph
0.000	0.000	0.059	39284.920	562.940	114.440

B 0.25X0.50m

A_c = 1.17 cm^2 use 2-DB12mm

A_s = 0.58 cm^2 use 2-DB12mm

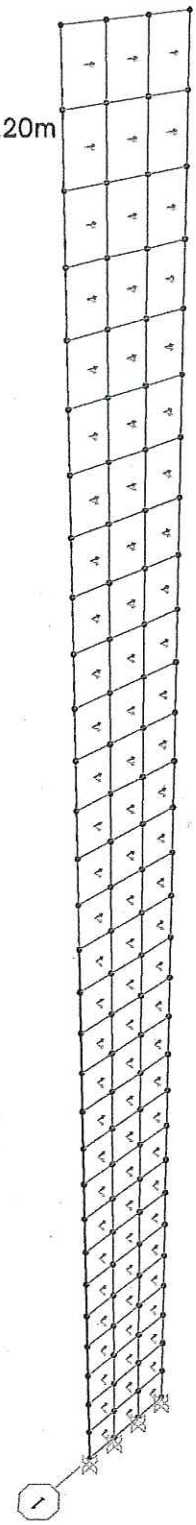
A_v = 0 cm^2 use RB6mm@0.10,0.20m

ประเทศไทย ฤทธิปรีดานันท์ วย.720

SAP2000 11/23/63 15:24:46

CR1

C 0.25X0.50m
A_s = 0.002 cm^2/m use 8-DB16mm
A_v = 0.063 cm^2/m use RB9mm@0.10,0.20m



SAP2000 v14.2.4 - File:20-M Column Physics Front - 3-D View - Kgf, m, C Units

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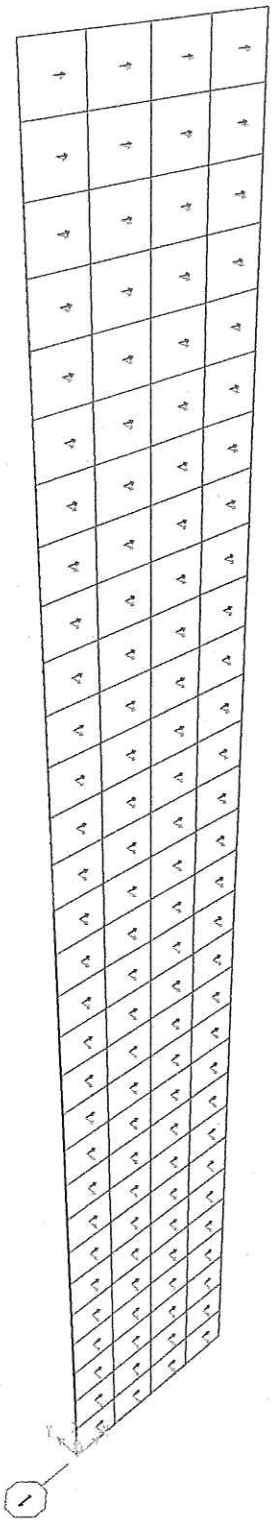
CR2

C 0.30X1.00m
A_s = 0.001 cm^2/m use 10-DB20mm
A_v = 0.003 cm^2/m
use RB9mm@0.125,0.25m



SAP2000 v14.2.4 - File:20-M Column Physics SIGN - 3-D View - Kgf, m, C Units

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SAP2000 Concrete Design

Project
Job Number CR3
Engineer

ACI 318-99 COLUMN SECTION DESIGN Type: Sway Special Units: Kgf, cm, C (Summary)

L=600.000
Element : 1
Station Loc : 600.000
Section ID : C25X50
Combo ID : 1.4DL+1.7LL

B=25.000 D=50.000 dc=5.703
E=253456.356 fc=280.000 Lt.Wt. Fac.=1.000
fy=4000.000 fys=2400.000 As=12.500 (Determined)
RLLF=1.000 As=1.000% (Determined)

Phi(Compression-Spiral): 0.750
Phi(Compression-Tied): 0.700
Phi(Tension): 0.900
Phi(Bending): 0.900
Phi(Shear/Torsion): 0.850

Overstrength Factor: 1.25

AXIAL FORCE & BIAXIAL MOMENT DESIGN FOR PU, M2, M3

Rebar Area	Design Pu	Design M2	Design M3	Minimum M2	Minimum M3
12.500	1366.575	2864.445	27925.736	3107.592	4132.524

AXIAL FORCE & BIAXIAL MOMENT FACTORS

	Cm Factor	Delta_ns Factor	Delta_s Factor	K Factor	L Length
Major Bending(M3)	0.600	1.000	1.000	1.000	600.000
Minor Bending(M2)	0.600	1.000	1.000	1.000	600.000

SHEAR DESIGN FOR V2,V3

	Design Rebar	Shear Vu	Shear phi*Vc	Shear phi*Vs	Shear Vp
Major Shear(V2)	0.000	46.543	8418.007	0.000	0.000
Minor Shear(V3)	0.000	4.774	7334.328	0.000	0.000

JOINT SHEAR DESIGN

	Joint Shear Ratio	Shear VuTop	Shear VuTot	Shear phi*Vc	Joint Area
Major Shear(V2)	N/C	N/C	N/C	N/C	N/C
Minor Shear(V3)	N/C	N/C	N/C	N/C	N/C

(6/5) BEAM/COLUMN CAPACITY RATIOS

Major Ratio	Minor Ratio
N/C	N/C

Notes:
N/A: Not Applicable
N/C: Not Calculated
N/N: Not Needed

C 0.25X0.50m

A_s = 12.50 cm^2 use 8-DB16mm

A_v = 0 cm^2 use RB9mm@0.10,0.20m

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	Job Title FR1		
	Client		
	Calcs by	Checked by	Date

Column Base Design :

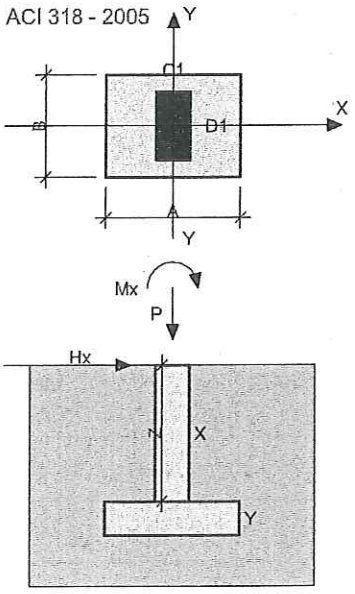
C15

Input Data

Base length A	(m)	1
Base width B	(m)	0.75
Column(s)	Col 1	Col 2
C (m)	0.25	
D (m)	0.5	
E (m)		
F (m)		
Stub column height X	(m)	1
Base depth Y	(m)	0.25
Soil cover Z	(m)	1
Concrete density	(kN/m^3)	24
Soil density	(kN/m^3)	18
Soil friction angle (?)		28
Base friction constant		0.5
Rebar depth top X	(mm)	50
Rebar depth top Y	(mm)	75
Rebar depth bottom X	(mm)	50
Rebar depth bottom Y	(mm)	75
ULS ovt. LF: Self weight		1.0
ULS LF: Self weight		1.4
Max. SLS bearing pr.	(kN/m^2)	80
S.F. Overturning (ULS)		1
S.F. Slip (ULS)		1
fc' base	(MPa)	28
fc' columns	(MPa)	28
fy	(MPa)	400

		Unfactored Loads						
Load Case	Col no.	LF ULS ovt	LF ULS	P (kN)	Hx (kN)	Hy (kN)	Mx (kNm)	My (kNm)
1	1	1	1.6	18	0.5	0	1.51	0

Sketch of Base



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PROKON	Job Number		Sheet
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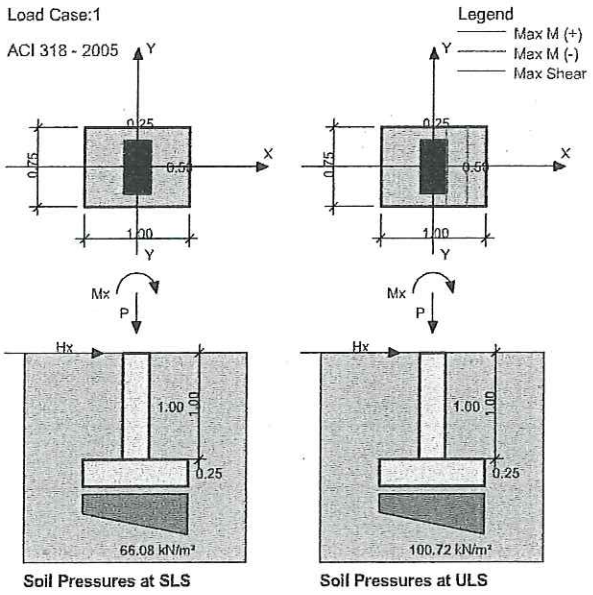
	Client		
	Calcs by	Checked by	Date

Output for Load Case 1

Output for Load Case 1	
Soil pressure (ULS) (kN/m²)	100.72
Soil pressure (SLS) (kN/m²)	66.08
SF overturning (SLS)	8.61
SF overturning (ULS)	8.61
Safety Factor slip (ULS)	47.55
Safety Factor uplift (ULS)	>100
Bottom	
Design moment X (kNm/m)	4.24
Reinforcement X (mm²/m)	59
Design moment Y (kNm/m)	0.31
Reinforcement Y (mm²/m)	5
Top	
Design moment X (kNm/m)	0.00
Reinforcement X (mm²/m)	0
Design moment Y (kNm/m)	0.00
Reinforcement Y (mm²/m)	0
Linear Shear X (MPa)	0.056
vc (MPa)	0.630
Linear Shear Y (MPa)	0.000
vc (MPa)	0.626
Linear Shear Other (MPa)	0.000
Punching Shear (MPa)	0.089
vc (MPa)	1.318
Cost	0.00



Soil Pressures at SLS

Soil Pressures at ULS

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	Job Title FR2		
	Client		
	Calcs by	Checked by	Date

Column Base Design :

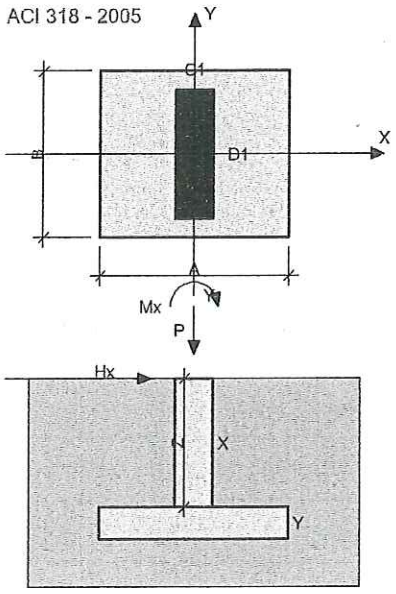
C15

Input Data

Base length A	(m)	1.5
Base width B	(m)	1.3
Column(s)	Col 1	Col 2
C	(m) 0.3	
D	(m) 1	
E	(m)	
F	(m)	
Stub column height X	(m)	1
Base depth Y	(m)	0.25
Soil cover Z	(m)	1
Concrete density	(kN/m^3)	24
Soil density	(kN/m^3)	18
Soil friction angle (?)		28
Base friction constant		0.5
Rebar depth top X	(mm)	50
Rebar depth top Y	(mm)	75
Rebar depth bottom X	(mm)	50
Rebar depth bottom Y	(mm)	75
ULS ovt. LF: Self weight		1
ULS LF: Self weight		1.4
Max. SLS bearing pr.	(kN/m²)	80
S.F. Overturning (ULS)		1
S.F. Slip (ULS)		1
fc' base	(MPa)	28
fc' columns	(MPa)	28
fy	(MPa)	400

		Unfactored Loads						
Load Case	Col no.	LF ULS ovt	LF ULS	P (kN)	Hx (kN)	Hy (kN)	Mx (kNm)	My (kNm)
1	1	1	1.6	43.2	1	0	3	0

Sketch of Base



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PROKON	Job Number		Sheet
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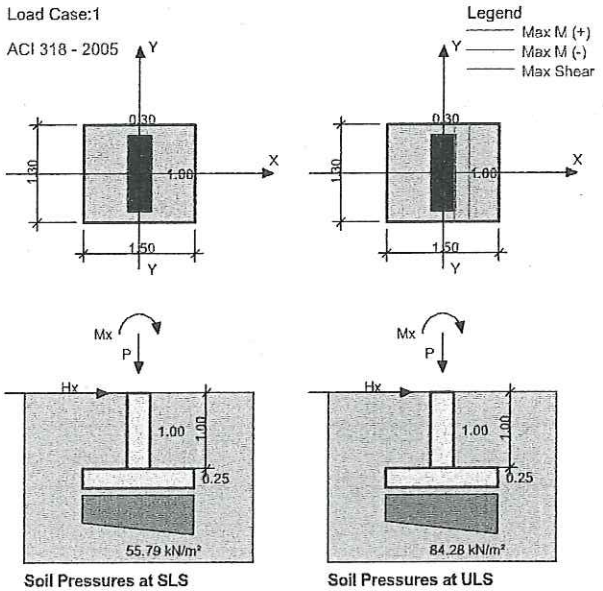
	Client		
	Calcs by	Checked by	Date

Output for Load Case 1

Output for Load Case 1	
Soil pressure (ULS) (kN/m²)	84.28
Soil pressure (SLS) (kN/m²)	55.79
SF overturning (SLS)	16.20
SF overturning (ULS)	16.20
Safety Factor slip (ULS)	54.26
Safety Factor uplift (ULS)	>100
Bottom	
Design moment X (kNm/m)	8.45
Reinforcement X (mm²/m)	118
Design moment Y (kNm/m)	0.41
Reinforcement Y (mm²/m)	7
Top	
Design moment X (kNm/m)	0.00
Reinforcement X (mm²/m)	0
Design moment Y (kNm/m)	0.00
Reinforcement Y (mm²/m)	0
Linear Shear X (MPa)	0.092
vc (MPa)	0.634
Linear Shear Y (MPa)	0.000
vc (MPa)	0.627
Linear Shear Other (MPa)	0.000
Punching Shear (MPa)	0.125
vc (MPa)	1.318
Cost	0.00



Soil Pressures at SLS

Soil Pressures at ULS

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	Job Title	FR3	
	Client		
	Calcs by	Checked by	Date

Column Base Design :

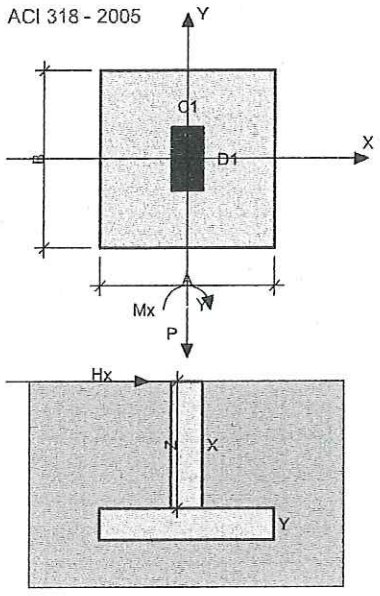
C15

Input Data

Base length A	(m)	1.4
Base width B	(m)	1.4
Column(s)	Col 1	Col 2
C	(m) 0.25	
D	(m) 0.5	
E	(m)	
F	(m)	
Stub column height X	(m)	1
Base depth Y	(m)	0.25
Soil cover Z	(m)	1
Concrete density	(kN/m^3)	24
Soil density	(kN/m^3)	18
Soil friction angle (?)		28
Base friction constant		0.5
Rebar depth top X	(mm)	50
Rebar depth top Y	(mm)	75
Rebar depth bottom X	(mm)	50
Rebar depth bottom Y	(mm)	75
ULS ovt. LF: Self weight		1
ULS LF: Self weight		1.4
Max. SLS bearing pr.	(kN/m^2)	80
S.F. Overturning (ULS)		1
S.F. Slip (ULS)		1
fc' base	(MPa)	28
fc' columns	(MPa)	28
fy	(MPa)	400

		Unfactored Loads						
Load Case	Col no.	LF ULS ovt	LF ULS	P (kN)	Hx (kN)	Hy (kN)	Mx (kNm)	My (kNm)
1	1	1	1.6	45.9	3.95	4.03		

Sketch of Base



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PROKON
Software Consultants (Pty) Ltd
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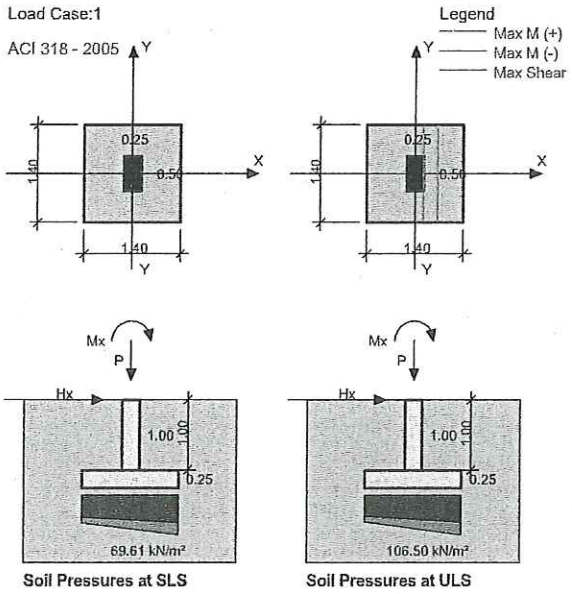
E-Mail : mail@prokon.com

Job Number		Sheet
Job Title		
Client		
Calcs by	Checked by	Date

Output for Load Case 1

Output for Load Case 1	
Soil pressure (ULS) (kN/m²)	106.50
Soil pressure (SLS) (kN/m²)	69.61
SF overturning (SLS)	9.30
SF overturning (ULS)	9.30
Safety Factor slip (ULS)	10.85
Safety Factor uplift (ULS)	>100
Bottom	
Design moment X (kNm/m)	8.35
Reinforcement X (mm²/m)	117
Design moment Y (kNm/m)	5.25
Reinforcement Y (mm²/m)	84
Top	
Design moment X (kNm/m)	0.00
Reinforcement X (mm²/m)	0
Design moment Y (kNm/m)	0.00
Reinforcement Y (mm²/m)	0
Linear Shear X (MPa)	0.092
vc (MPa)	0.634
Linear Shear Y (MPa)	0.083
vc (MPa)	0.632
Linear Shear Other (MPa)	0.000
Punching Shear (MPa)	0.147
vc (MPa)	1.318
Cost	0.00



Soil Pressures at SLS

Soil Pressures at ULS

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