	CALCULATION	REF

4.0 FRAME ANALYSIS

4.1 Modeling Geometry

4.1.1 Frame Analysis Modeling Description

(1) Program : STAAD Pro V8i

(2) Building Name : Workshop & Warehouse

(3) Structure : Reinforced Concrete & Steel Structure

(4) Lateral Load Resisting System

Transverse : Ordinary reinforced concrete moment frame

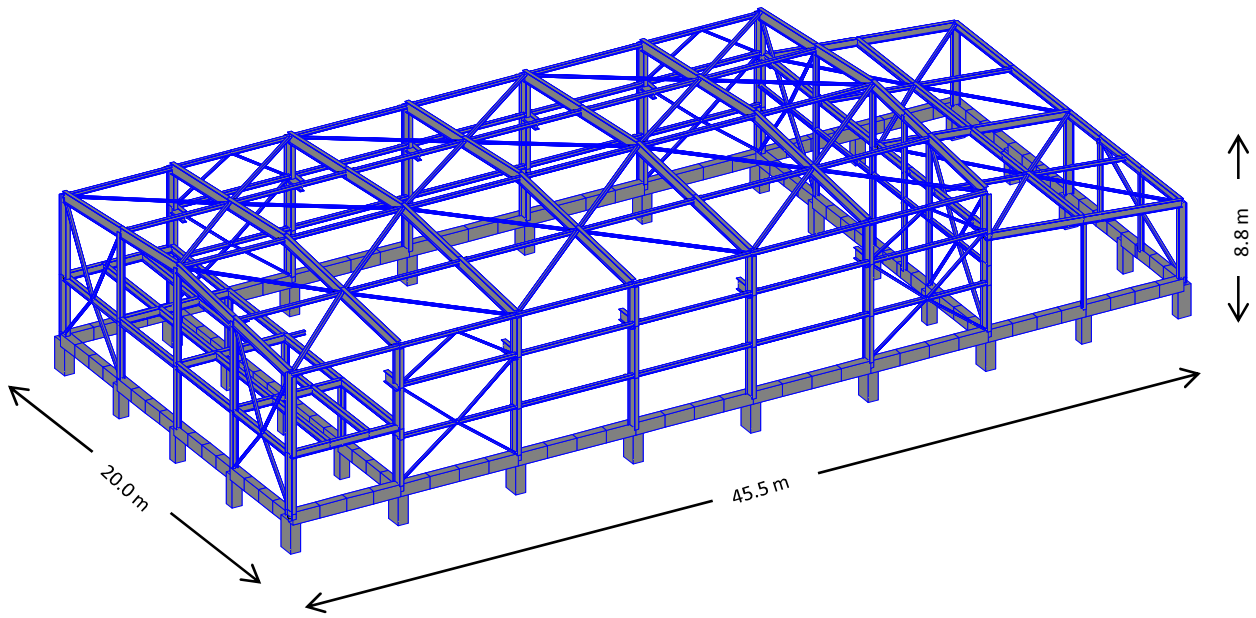
Longitudinal : Ordinary reinforced concrete moment frame

(5) Building Size

Building Width : 20.0 m

Building Length : 45.5 m

Building Height : 8.80 m



NO.	CALCULATION	REF

1.0 DESIGN INFORMATION

1.1 BUILDING DESCRIPTION

1) Location : **The plant site is located on Asam Asam Village, Jorong District, Tanah Laut Regency, South Kalimantan Province in Indonesia.**

2) Structure

Super Structure : **Steel Structure**

Sub Structure : **Reinforced Concrete Structure**

3) Intended Use : **Workshop & Warehouse**

4) Building Width : 45.5 m

5) Building Length : 20.0 m

6) Mean Roof Height : 8.80 m

7) Seismic Resisting system : :

Transverse : H. Steel system not specifically detailed for seismic resistance : 3

Longitudinal : H. Steel system not specifically detailed for seismic resistance : 3

1.2 DESIGN CODES AND STANDARDS

1) Project Specification

2) Steel : AISC 14th editions, ASD method

① Allowable stress design (ASD) method in accordance with AISC

3) Reinforced Concrete : Ultimate Strength Design, USD

① Ultimate strength design (USD) method in accordance with ACI 318M-14

4) Design Loads

① Design criteria for civil & building work (Doc. No. IKCP0-YYZ-04-0001)

② ANSI/ASCE 7-10 "Minimum design loads for buildings and other structures"

1.3 MATERIAL SPECIFICATIONS

1) Steel Structure

① Structural Steel : JIS & KS SECTION

- JIS G3101 SS400 : F_y = 245 MPa (t ≤ 16)
  F_y = 235 MPa (t > 16)
  Fu = 400 MPa

- JIS G3106 SM490 : F_y = 325 MPa (t ≤ 16)
  F_y = 315 MPa (t > 16)
  Fu = 450 MPa

② Unit Weight : w_s = 78.5 kN/m^3

③ Modulus of Elasticity : E_S = 200,000 MPa

④ Structural Bolt : JIS B1186 F8T or equivalent.

⑤ Anchor Bolt : ASTM F1554 Grade 36 or equivalent.

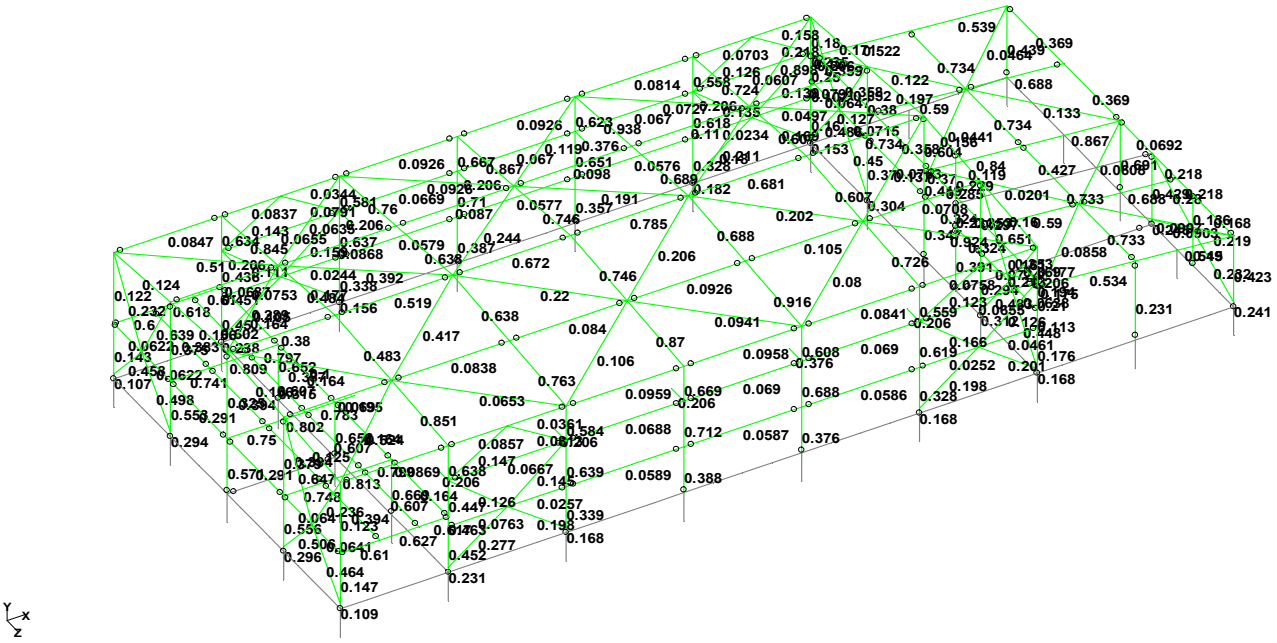
	CALCULATION	REF

Floor	Member Name	Section	Member Number	Load Combination	Stress Ratio	Remark
Roof Floor	RB4	H - 194 x 150 x 6 x 9	402	103	0.79	O.K.
	RG4	H - 194 x 150 x 6 x 9	333	103	0.16	O.K.
	RB8	H - 400 x 200 x 8 x 13	233	103	0.73	O.K.
	RG8	H - 400 x 200 x 8 x 13	225	103	0.87	O.K.
	RG11	H - 600 x 200 x 11 x 17	342	103	0.94	O.K.
Mezzanine Floor	MB8	H - 400 x 200 x 8 x 13	167	102	0.61	O.K.
	MG8	H - 400 x 200 x 8 x 13	178	102	0.81	O.K.
Crane Runway	BG1	H - 194 x 150 x 6 x 9	281	119	0.07	O.K.
	BR1	H - 600 x 200 x 11 x 17	277	102	0.38	O.K.
	WG1	H - 194 x 150 x 6 x 9	191	103	0.32	O.K.
	CG4	H - 194 x 150 x 6 x 9	107	102	0.39	O.K.
Column	C1	H - 600 x 200 x 11 x 17	206	103	0.71	O.K.
	C2	H - 250 x 250 x 9 x 14	110	102	0.67	O.K.
	C3	H - 400 x 200 x 8 x 13	128	103	0.69	O.K.
	C4	H - 200 x 200 x 8 x 12	317	103	0.60	O.K.
	C5	H - 194 x 150 x 6 x 9	129	108	0.43	O.K.
Brace	HBR1	2Ls - 100 x 100 x 10	358	103	0.92	O.K.
	HBR2	2Ls - 100 x 100 x 10	223	118	0.13	O.K.
	VBR1	CT - 175 x 175 x 7 x 11	291	103	0.65	O.K.

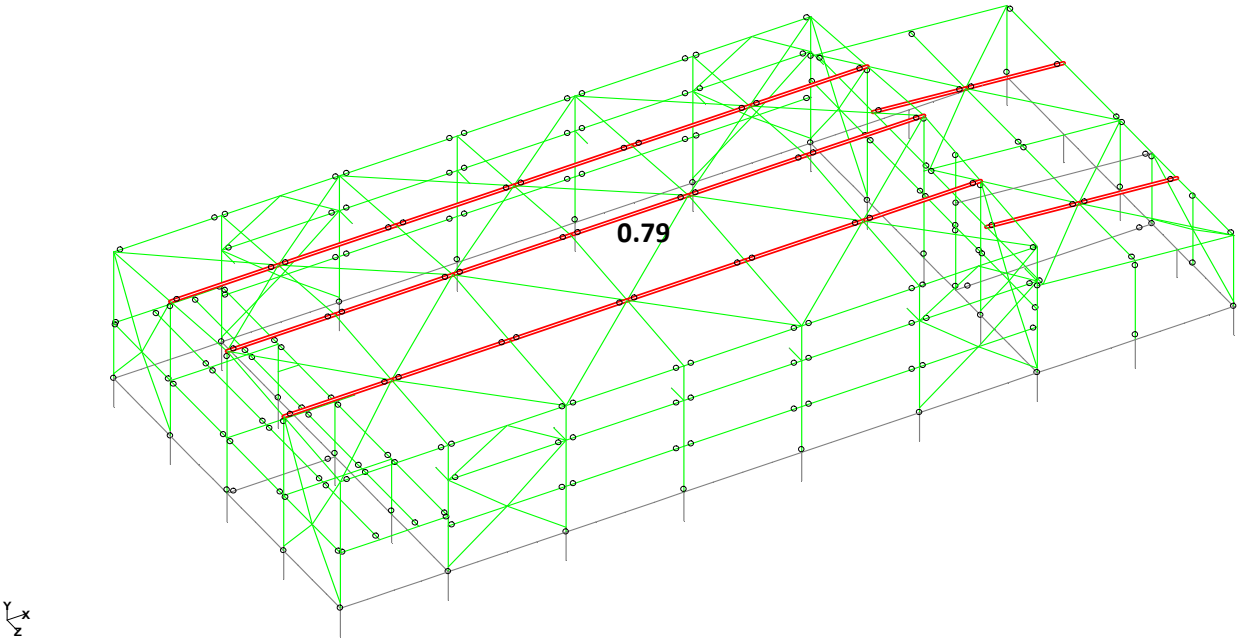
	CALCULATION	REF

5.0 STEEL MEMBER DESIGN

5.1 Member Stress Review

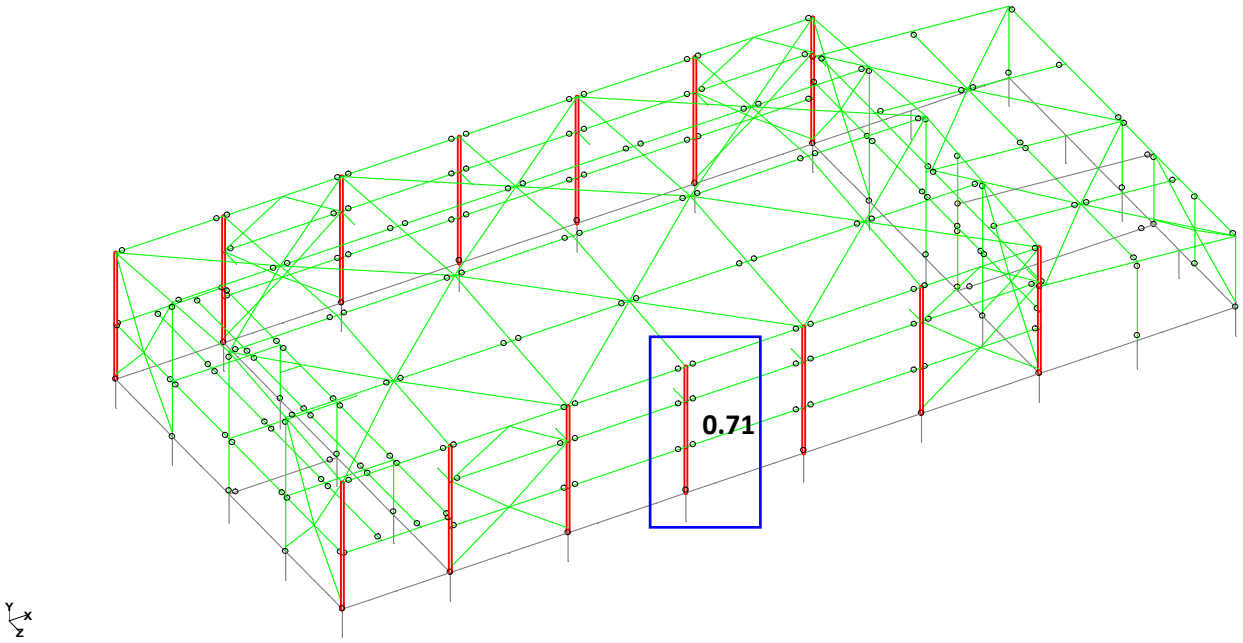


RB4 H - 194 x 150 x 6 x 9

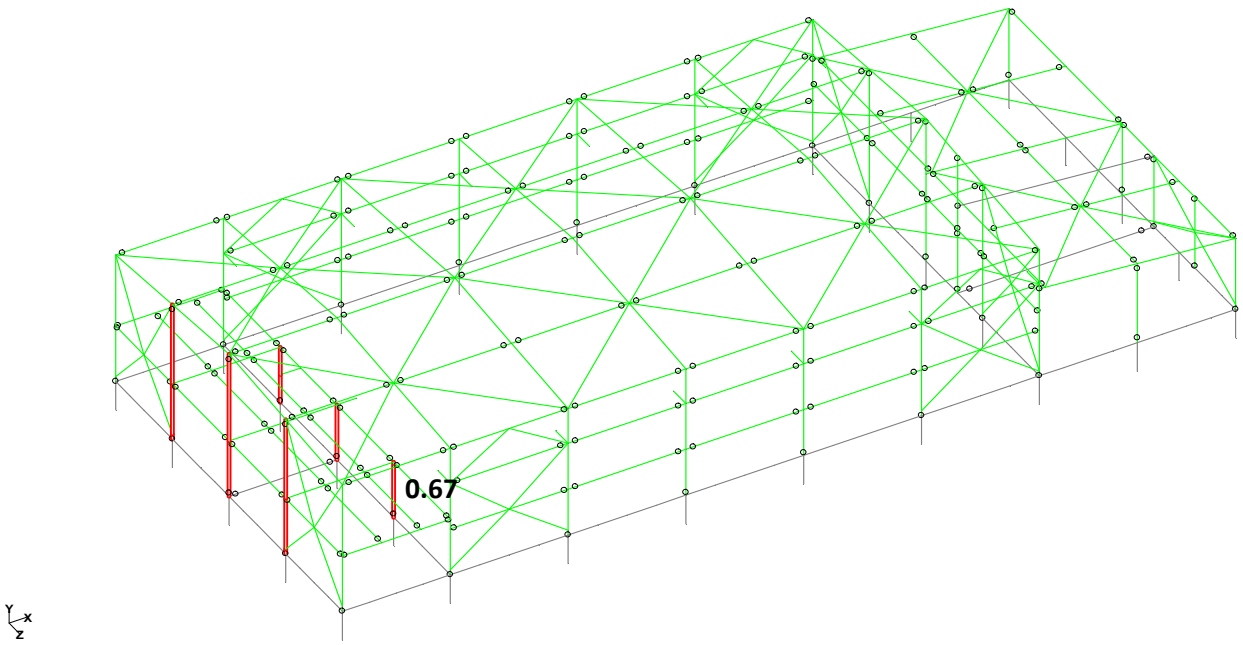


	CALCULATION	REF

C1 **H - 600 x 200 x 11 x 17**



C2 **H - 250 x 250 x 9 x 14**



	CALCULATION	REF

5.0 STEEL MEMBER DESIGN

5.2 Design of Member

5.2.1 C1

---------- START OF DESIGN OUTPUT OF MEMBER 206 ----------

MEMBER NO: 206 CRITICAL RATIO: 0.712(PASS) LOAD: 103
LOCATION (ft): 0.00 CONDITION: Eq. H1-1b
SECTION: ST H600X200X11 (JAPANESE SECTIONS)

UNIT: KIP FEET

STRENGTH CHECKS:
CRITICAL RATIO: 0.712(PASS) LOAD CASE: 103 LOCATION (ft): 0.00 CONDITION: Eq. H1-1b
DESIGN FORCES: Fx: 42.27(C) Fy: 9.64 Fz: -0.03
Mx: 2.15E-04 My: 1.23E-01 Mz: 1.83E+02

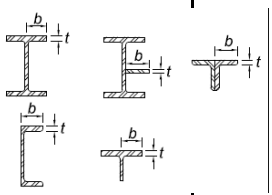
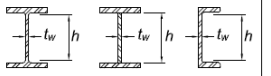
SECTION PROPERTIES: AZZ: 7.027 AYY: 10.230 CW: 7182.915
SZZ: 153.780 SYY: 13.852
IZZ: 1816.297 IYY: 54.537

MATERIAL PROPERTIES: FYLD: 34.084 FU: 58.000

ACTUAL MEMBER LENGTH(ft): 9.514
PARAMETERS: KZ: 1.500 KY: 1.500 NSF: 1.000 SLF: 1.000 CSP: 1.000

SLENDERNESS: ACTUAL SLENDERNESS RATIO: 104.778 LOAD: 128 LOC.(ft): 0.000
ALLOWABLE SLENDERNESS RATIO: 200.000

SECTION CLASS: FLANGE:/ ┤I├: ┤I├p: ┤I├r:
WEB:
COMPRESSION: Non-Slender 5.882 N/A 16.540
Slender 51.455 N/A 44.008
FLEXURE: Compact 5.882 11.223 29.535
Compact 51.455 111.053 168.352

Flanges of rolled I-shaped sections, plates projecting from rolled I-shaped sections, outstanding legs of pairs of angles connected with continuous contact, flanges of channels, and flanges of tees	b/t	$0.56\sqrt{\frac{E}{F_y}}$	
Webs of doubly symmetric rolled and built-up I-shaped sections and channels	h/t_w	$1.49\sqrt{\frac{E}{F_y}}$	

TENSION: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
YIELDING: 0.000 416.630 0.000 Eq. D2-1 101 0.000
RUPTURE: 0.000 591.993 0.000 Eq. D2-2 101 0.000

COMPRESSION: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
MAJOR: 43.922 357.789 0.123 Eq. E7-1 103 9.514
MINOR: 43.922 244.324 0.180 Eq. E7-1 103 9.514
INTERMEDIATE: Ag: KL/r: Fcr: Fe: Pn:
MAJOR: 19.723 50.086 29.270 116.979 597.507
MINOR: 20.414 104.778 19.988 26.730 408.021

E7.Members with Slender Elements

FLEX TOR BUCK: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
43.922 351.644 0.125 Eq. E7-1 103 9.514
INTERMEDIATE: Ag: Fcr: Pn:

	CALCULATION	REF

19.792 28.767 587.245

SHEAR: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
MAJOR(VZ): 0.047 86.044 0.001 Eq. G2-1 106 0.000
MINOR(VY): 9.643 139.471 0.069 Eq. G2-1 103 0.000
INTERMEDIATE: Aw: Cv: Kv: h/tw: Vn:
MAJOR(VZ): 7.027 1.000 1.200 5.882 143.694
MINOR(VY): 10.230 1.000 0.000 51.455 209.207

UNIT: KIP FEET

YIELDING: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
MAJOR: -1.83E+02 3.01E+02 0.610 Eq. F2-1 103 0.000
MINOR: -3.51E-01 3.72E+01 0.009 Eq. F6-1 106 9.514
INTERMEDIATE: Mnr: My: Cb:
MAJOR: 5.03E+02 0.00E+00 1.000
MINOR: 6.20E+01 0.00E+00 1.000

UNIT: KIP FEET

LAT TOR BUCK: FORCE: CAPACITY: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
MAJOR: -1.83E+02 2.81E+02 0.653 Eq. F2-2 103 0.000
INTERMEDIATE: Mn: Me: Cb: Lp: Lr: Lb:
MAJOR: 4.70E+02 0.00E+00 1.000 7.080 21.587 9.514

UNIT: KIP FEET

INTERACTION: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
FLEXURE COMP: 0.160 Eq. H1-1b 108 6.343
FLEXURE TENS: 0.656 Eq. H1-1b 103 0.000
INTERMEDIATE: Mcx: Mcy: Mrx: Mry: Pc: Pr:
FLEXURE COMP: 2.81E+02 3.72E+01 -3.02E+01 -1.23E-02 244.324 25.370
FLEXURE TENS: 2.81E+02 3.72E+01 -1.83E+02 1.23E-01 416.630 0.000

UNIT: KIP FEET

Chapter H. Design of Members for Combined Forces and Torsion

INTERACTION: RATIO: CRITERIA: LOAD CASE: LOCATION(ft):
IN PLANE FLEX: 0.712 Eq. H1-1b 103 0.000
OUT PLANE FLEX: 0.670 Eq. H1-2 103 0.000
INTERMEDIATE: Pc: Pr: Mc: Mr:
IN PLANE FLEX: 3.58E+02 4.23E+01 281.195 -183.481
OUT PLANE FLEX: 2.44E+02 4.23E+01 281.195 -183.481

H1. Doubly and Signly Symmetric Members Subject to Flexure and Compression

---------- END OF DESIGN OUTPUT OF MEMBER 206 ----------

NO.	CALCULATION	REF

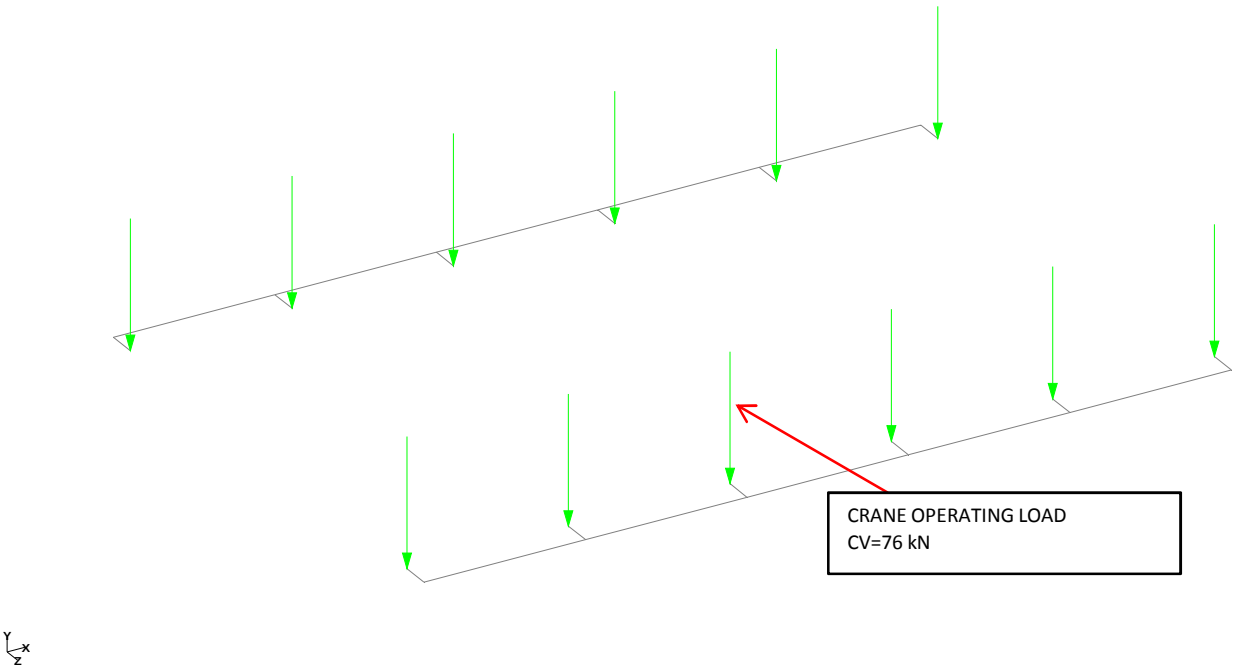
3.7.2 LOAD COMBINATIONS

1) Load Combinations For Steel Member Design, Deflection, Soil bearing and Stability Check

Load Combination	Dead		Live		Crane				Wind				Seismic				Remark
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	D	E	Lr	L	Cd	Cv	Ct	Cl	Wx+	Wx-	Wz+	Wz-	Ex+	Ex-	Ez+	Ez-	
LC #101	1.00	1.00															
LC #102	1.00	1.00		1.00		1.00	1.00	1.00									
LC #103	1.00	1.00	1.00			1.00	1.00	1.00									
LC #104	1.00	1.00	0.75	0.75		1.00	1.00	1.00									
LC #105	1.00	1.00				1.00			0.60								
LC #106	1.00	1.00				1.00				0.60							
LC #107	1.00	1.00				1.00					0.60						
LC #108	1.00	1.00				1.00						0.60					
LC #109	1.00	1.00				1.00	1.00		0.30								
LC #110	1.00	1.00				1.00	1.00			0.30							
LC #111	1.00	1.00				1.00	1.00				0.30						
LC #112	1.00	1.00				1.00	-1.00					0.30					
LC #113	1.00	1.00			1.00								0.70		0.21		
LC #114	1.00	1.00			1.00									0.70		0.21	
LC #115	1.00	1.00			1.00								0.21		0.70		
LC #116	1.00	1.00			1.00									0.21		0.70	
LC #117	1.00	1.00	0.75	0.75		0.75			0.45								
LC #118	1.00	1.00	0.75	0.75		0.75				0.45							
LC #119	1.00	1.00	0.75	0.75		0.75					0.45						
LC #120	1.00	1.00	0.75	0.75		0.75						0.45					
LC #121	1.00	1.00	0.75	0.75		0.75	0.75		0.23								
LC #122	1.00	1.00	0.75	0.75		0.75	0.75			0.23							
LC #123	1.00	1.00	0.75	0.75		0.75	0.75				0.23						
LC #124	1.00	1.00	0.75	0.75		0.75	-0.75					0.23					
LC #125	1.00	1.00		0.75	0.75								0.53		0.16		
LC #126	1.00	1.00		0.75	0.75									0.53		0.16	
LC #127	1.00	1.00		0.75	0.75								0.16		0.53		
LC #128	1.00	1.00		0.75	0.75									0.16		0.53	
LC #129	0.60	0.60							0.60								
LC #130	0.60	0.60								0.60							
LC #131	0.60	0.60									0.60						
LC #132	0.60	0.60										0.60					
LC #133	0.60	0.60											0.70		0.21		
LC #134	0.60	0.60												0.70		0.21	
LC #135	0.60	0.60											0.21		0.70		
LC #136	0.60	0.60												0.21		0.70	

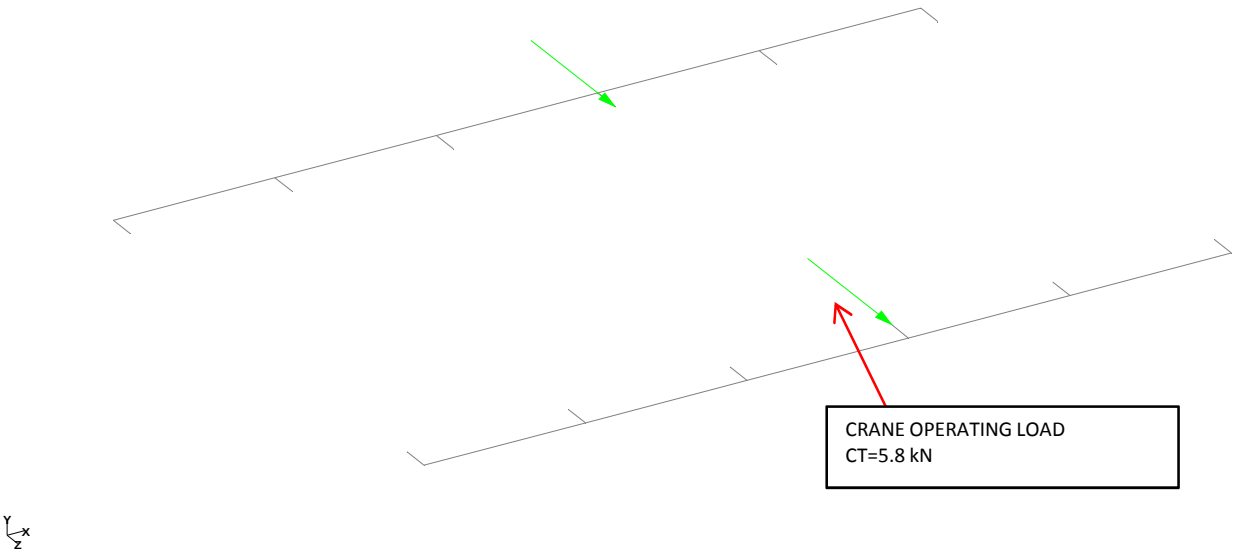
	CALCULATION	REF

4.4.6 Crane Operating Vertical Load



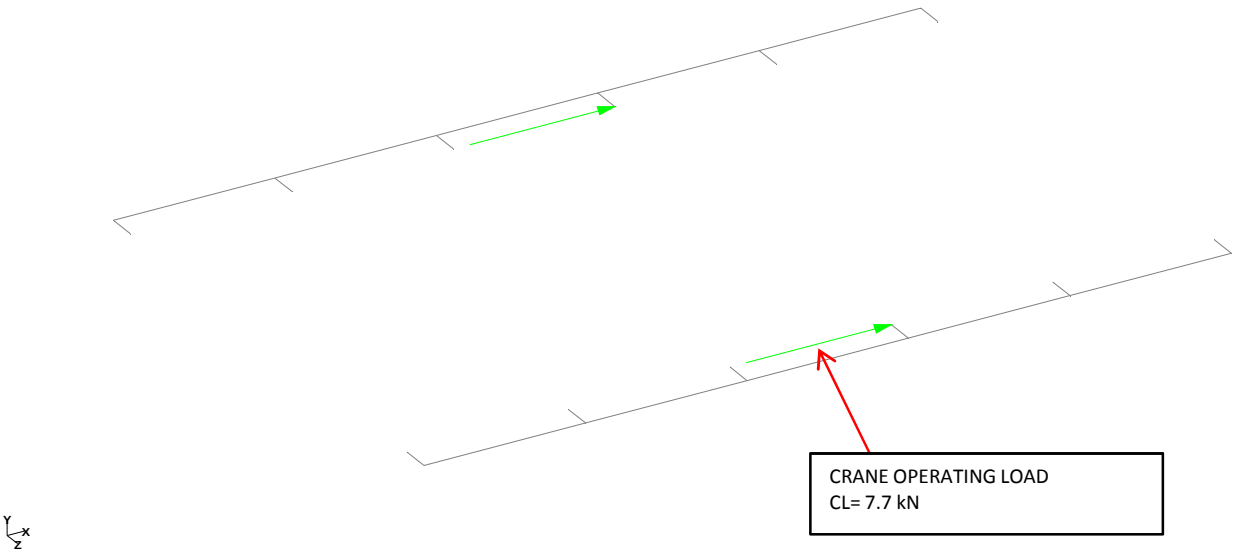
	CALCULATION	REF

4.4.7 Crane Operating Lateral Load



	CALCULATION	REF

4.4.8 Crane Operating Longitudinal Load

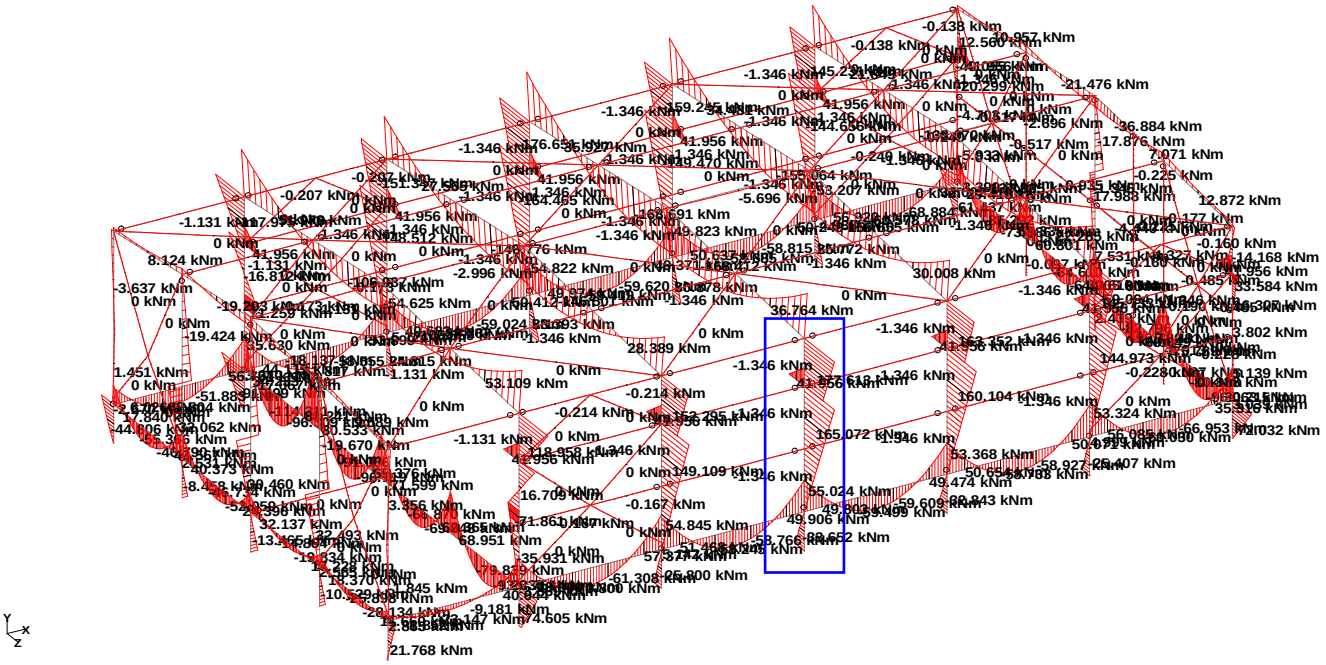


	CALCULATION	REF

4.6 Member Force

4.6.1 Bending Moment Diagram (LC104 : 1.0D+1.0E+0.75Lr+0.75L+0.75H)

- Roof Floor

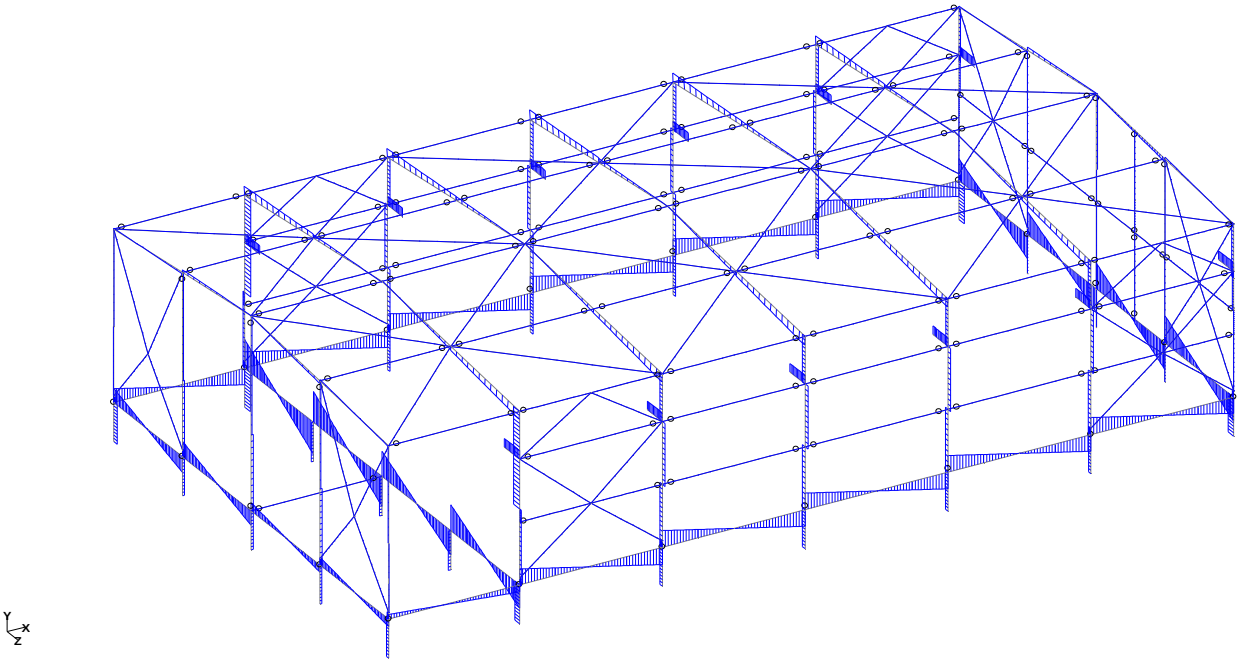


- Mezzanine Floor & Low Roof

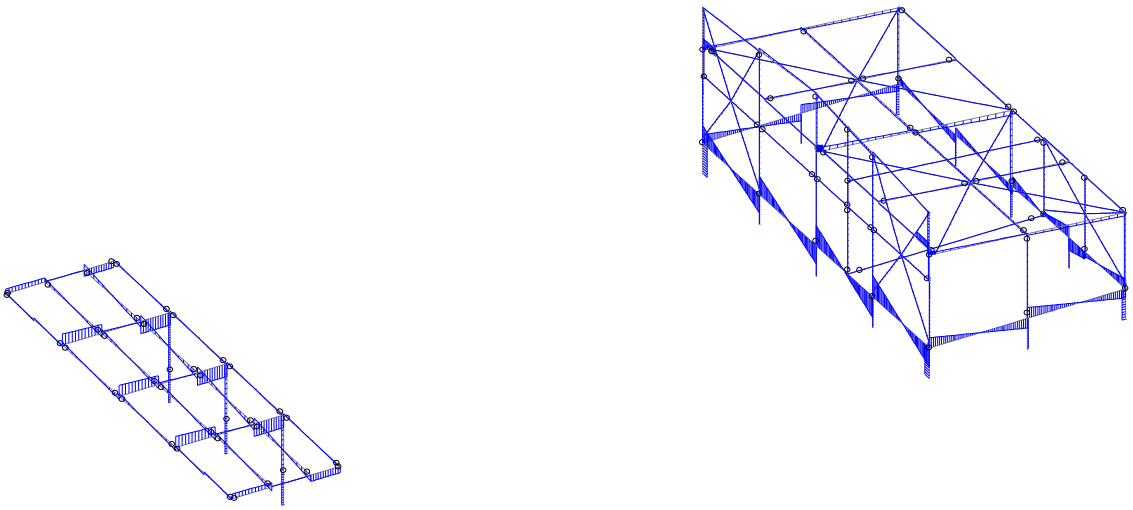
	CALCULATION	REF

4.6.2 Shear Force Diagram (LC104 : 1.0D+1.0E+0.75Lr+0.75L+0.75H)

- Roof Floor



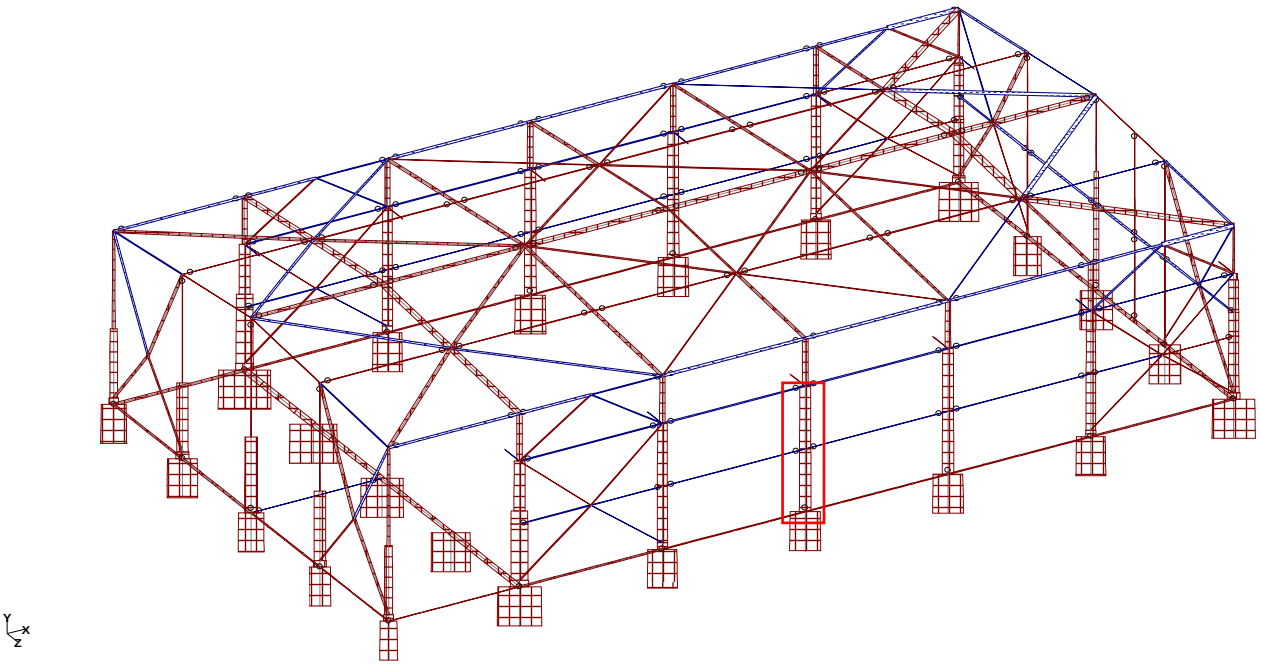
- Mezzanine Floor & Low Roof



	CALCULATION	REF

4.6.3 Axial Force Diagram (LC104 : 1.0D+1.0E+0.75Lr+0.75L+0.75H)

- Roof Floor



- Mezzanine Floor & Low Roof