Permanent Modular Constructions Ltd.
Nova Scotia, Canada

DESIGN REPORT

for

Clients Name:…………………………………………….

Location:…………………………………………………

Governing Design Code……………………………

Date:……………………………..

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LGFS Framing System

1. Description of Structural System

The _________ Building is a One storey building, approximate 300m^2 of area and the drawings indicate that the Bar building is to fit seamlessly over the existing Roof of building, providing a uniform exterior profile. The LGS frame system will be drafted on outer to inner for exterior walls and on centre line for internal walls of architectural plans.

The Bar building will be designed to support loads independently of the existing building.

COMPONENTS	LGSF MATERIAL	GRADE OF MATERIAL	COATING ON MATERIAL
Load bearing walls	150S45-2.0	350 MPa	Z120
Non Load Bearing wall	100S45-1.2	350 MPa	Z120
Floor Joists	100S45-1.5	350 MPa	Z120
Roof Trusses	100S45-1.5	350 MPa	Z120

2. Layouts of the Building

The design parameters based on the supplied set of Architectural layouts.

3. Design Considerations

3.1 Design Loads (Summary):

Location	Dead Load	Live Load
Top Roof	1.5 kPa	0.75 kPa
Low Roof	1.5 kPa	0.75 kPa
Floor	1.4 kPa	3.0 kPa
Wall	1.0 kPa	-

Top Roof (In accessible)

ACP Sheet		0.1 kPa
300 mm LGS Floor		0.15 kPa
Services Load		1.0 kPa
12 mm Gyp. Board		0.1kPa
Total		1.35 kPa
Dead Load:	**say**	**1.5 kPa**
Live load:		**0.75 kPa (Inaccessible roof w/ Maintenance access)**

Lower Roof (In accessible) For Glass Enclosures

ACP Sheet		0.1 kPa
300 mm LGS Floor		0.15 kPa
Services Load		1.0 kPa
12 mm Gyp. Board		0.1kPa
Total		1.35 kPa
Dead Load:	**say**	**1.5 kPa**
Live load:		**0.75 kPa (Inacceible roof w/ Maintenance access)**

Floor:

Dead Load

15 mm Ceremic tiles	0.36 kPa
50 mm Aerocon panel	0.5 kPa
300 mm LGS Floor	0.15 kPa
12 mm Gyp. Board	0.1 kPa
Total	1.39 kPa

Dead Load: **say** **1.4 kPa**

Typical **Live load:** **3.0 kPa**

Wall weights:

Load bearing	1.0 KPa	(Incl. 150 mm LGFS Section + 75 mm Block Wall)
Non bearing	0.3 KPa	(Incl. 150 mm LGFS section + Gyp. Board on both side)

3.2 Design Loading (Lateral)

Seismic Details as per relevant Building Country code

Wind details as per relevant Building Country code

3.3 Load Combinations

Load Combinations as per relevant building country code

As per International Building Code
1.2D + 1.6L + 1.6Lr

4. Criteria and Approach for Design of Members

4.1. Design of Roof framing

The structural elements found in roof framing, like roof trusses and headers, are designed such that the members take the load coming onto them safely.

4.2. Steel Beams Supporting Floor Framing

The load from floor joists shall be transferred to the webbed beam supporting these joists.
Load on webbed beam = ½ x joist span x load intensity.
This load will act as a uniformly distributed load over the beam span. From the loading, design moment & shear are calculated. The beam is designed for moment, shear, and deflection.

For design of steel structural components, working stress method is used.

4.3. Headers

Headers are placed over the openings and it is subjected to only roof load. The roof load is transferred to headers through roof joists. Headers are checked in bending, shear and deflection. For headers in the bearing walls, steel sections are used which are designed for bending, shear & deflection.

4.4. Load Bearing Wall Studs

These studs are provided at the load-bearing walls and shall be designed as compression members by 'elastic theory of design'. These studs support the framing joist and are designed for the reaction of the joist. The point load from the bearing wall stud of any floor to the stud of floor beneath at the same location shall also be considered in the design. These studs are of light gage structural steel.

4.5. Non Load Bearing Wall Studs

These studs are provided at the non-load-bearing wall and shall be designed as a compression member by 'elastic theory of design'. These studs' shall be designed for the nominal loads from the joist by considering the joist parallel to the wall and designed for lateral load for interior walls and wind loads for the exterior walls. These studs are of light gage structural steel.

4.6. LGSF Structure Specifications

4.6.1 LGSF Top Roof:

Roof with a 5 degree slope.
400 mm deep Truss, made up of 150S45-2.0 mm G350 at 600mm centre to centre.

4.6.2 LGSF Floor:

300 mm deep C Joist, made up of SINGLE 150S45-2.0 mm G350 at 600mm centre to centre.

4.6.3 LGSF Walls:

External and internal wall supporting floor joists: 150S45-2.0 mm G350 back to back studs at 600mm centre to centre spacing.
Internal Non-load bearing walls: 150S45-2.0 mm G350 Single at 600mm centre to centre spacing.

4.6.4 MEP Units

MEP units are as per MEP drawings supplied.

4.6.5 Door and Window Openings:

Opening schedule will be taken from sections and elevations of supplied Arch drawings

1. The window openings have to be provided with (15+15) mm gap for the width on either sides and (15+15) mm gap for the height. For example if the width of opening is 1200mm it will be shown in the wall layout as 1230mm and if the height is 1500mm it will be shown as 1530mm.
2. The door openings have to be provided with (15+15) mm gap for the width on both sides and (15) mm gap for the height. For examples if the width of door opening is 900mm it will be shown in the wall layout as 930mm and if the height is 2100mm it will be shown as 2115 mm.

4.6.6. Structural Columns and Beams:

Structural beams and columns will be designed as required.

4.6.7 Bracing system:

Bracing system will be adopted on walls depending on the loadings and requirement.

1. K bracing of same material of wall.
2. Single/double strap bracing.

4.7 Material Design Standard

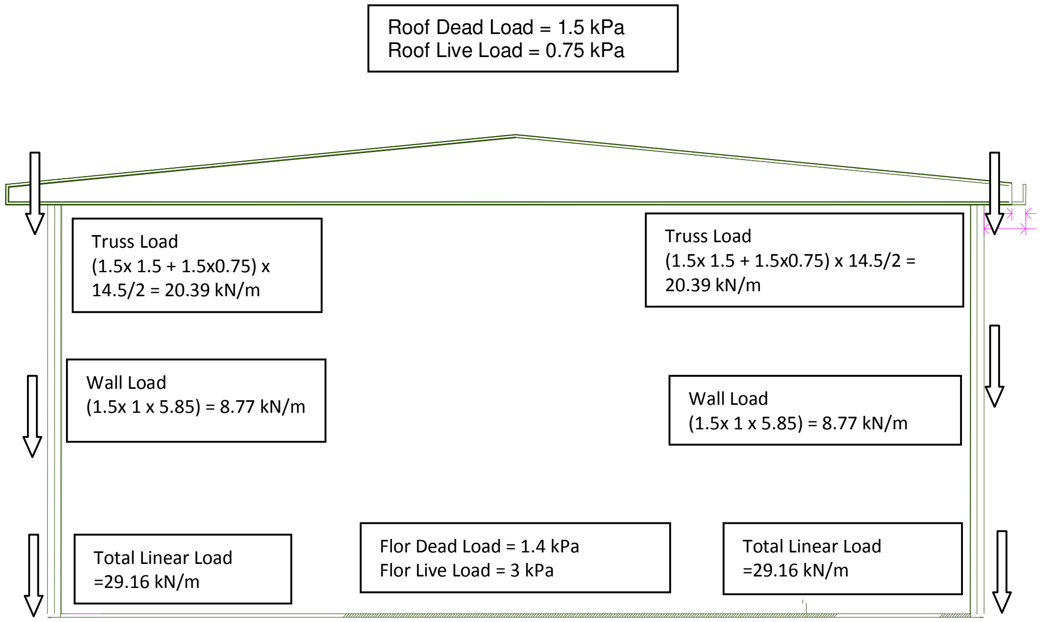
Relevant Building Design code

4.8 Walls Cladding:

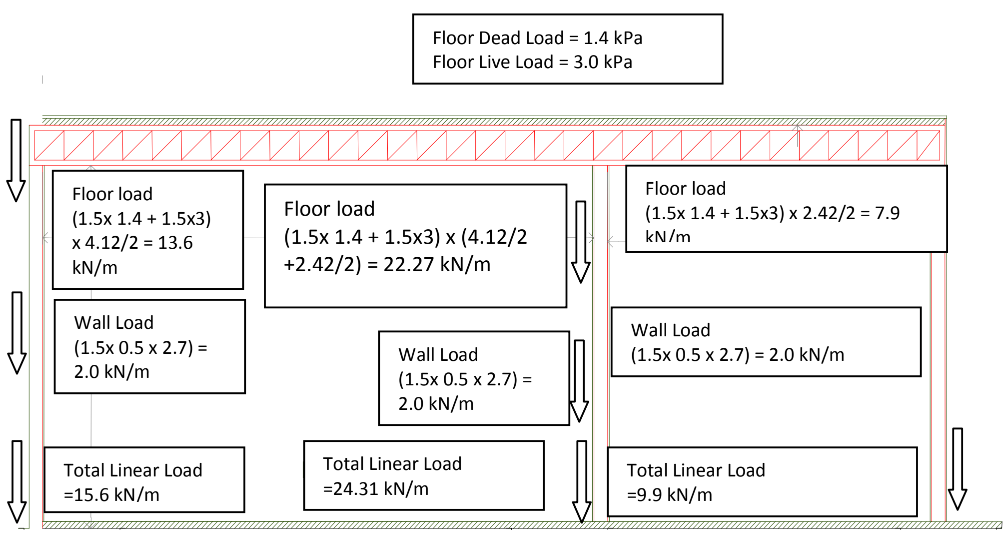
Following cladding material will considered for this project.

Exterior cladding: 12 mm (Fibre cement), 75 mm Aerocon Panel
Internal cladding: 18 mm Gypsum board Single Layer both side

Loading Diagram for Roof Truss & Wall



Loading Diagram – Mezzanine Floor & Wall



5. Truss/ Joist Design

Roof

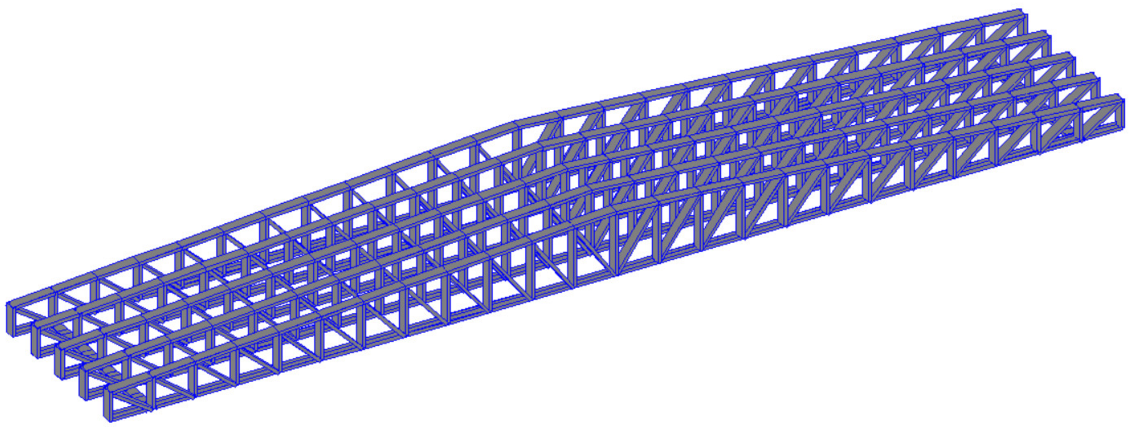
Design Actions:

Dead load: 1.5 kPa.

Live load: 0.75 kPa

Maximum Joists Span:

Clear span = 13500 mm + 600 mm cantilever on each side (refer to Structural Drawings)



Refer Staad Analysis for Design

Roof Truss, made up of Single 150S45-2.0 mm G350 at 600mm centre to centre.

First Floor

Design Actions:

Dead load: 1.4 kPa.

Live load: 3 kPa

Maximum Joists Span:

Clear span = 4125 mm (refer to Structural Drawings)

Refer Staad Analysis for Design

300 mm deep C Joist, made up of SINGLE 150S45 – 2.0 mm thk. at 600mm centre to centre.

6. Wall Design

Member Capacities

Roof wall

1.5D+1.5W+1.5L

Load on wall = 14.5 /2 x (1.5*1.5 + 1.5*0.75)
= 20.39 kN/m

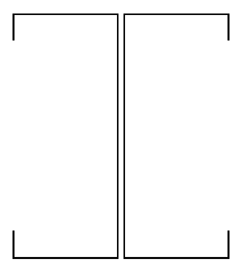
Load per stud = 20.39 x 0.6 = 12.24 KN/stud

150S45-2.0 Back to Back Studs at 600 ccs (Fy = 350 MPa) @ 1.2 m lateral Restrain

Maximum allowable axial load (combined with wind) = 50.8 kN

Max load = 12.24 KN < 50.8 kN therefore OK

SECTION DESIGNATION: 150S45-2.0 G350 (2) Back-to-Back



Section Dimensions:

Web Height =	150.00 mm
Top Flange =	45.00 mm
Bottom Flange =	45.00 mm
Stiffening Lip =	12.00 mm
Inside Corner Radius =	2.156 mm
Punchout Width =	38.10 mm
Punchout Length =	101.60 mm
Design Thickness =	2.000 mm

Steel Properties:

Fy =	345.00 Mpa
Fu =	448.18 Mpa
Fya =	389.00 Mpa

COMBINED AXIAL AND BENDING LOADS

INPUT PARAMETERS
Overall Wall Height = 5.85
Lateral Load = 1200.0 N/m^2
Load Factor for Lateral Load = 1.60
Lateral load not modified for deflection calculations
Studs Considered Fully Braced for Bending

K-phi (flexure) for Distortional Buckling = 0.00 N*mm/mm
K-phi (axial) for Distortional Buckling = 0.00 N*mm/mm

MAXIMUM FACTORED AXIAL LOADS (N)

BRACING	305 mm	SPACING 406 mm	600 mm	Maximum KL/r
1219 mm	70601	63285	50805	103
MID Pt	40238	36607	30043	152
THIRD Pt	70601	63285	50805	103
SHEATH 2 SIDES	N/A	N/A	N/A	103
DEFLECTION	L/694	L/522	L/353	

Note: Axial loads for sheathing braced design are based on the North American Standard for Cold-Formed Steel Framing - Wall Stud Design, 2007 Edition with 1/2 inch gypsum sheathing and No. 6 fasteners max 12 inches on center

7. Lateral Design

Wind

V = 39 m/s

q = 0.912 kPa

Q = 1.3 q = 1.2 kPa

Building overall dimensions: 27 m x 13 m x 5.85 m high

Wind on front:
Transverse
Area = 27 x 5.85 = 158 sqm
Cd = 1.5
Wu = 1.5 x 158 = 237 kN

Design for 237 kN transverse wind force

Bracing System

Bracing system: Provide X Braces

Bracing Capacities:

100 x 2.0 mm G350 strap braces at 45 degrees.

Strap Tension Capacity = 42 kN

Lateral Capacity per brace = 42 x .71 = 29.82 kN

Over strength factor = 1.4
Provide10 #12 screws per strap (capacity = 24 kN)

Evaluate bracing required

Strap Bracing

Transverse
Critical: 237 KN
Provide: 8 straps

Therefore provide 4 walls with Double Bracing

Hold Downs

X-bracing:

For typical panel, 45 degree strap (5.85 m high by 5.85 m long).

Uplift force from Strap = 21 kN x ⍰: ⍰ = material over strength factor = 1.4 for G350 steel
= 29.4 kN

Hold down required (critical case)

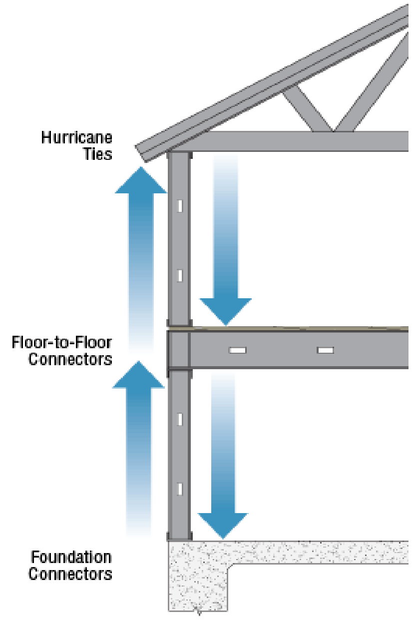
Perimeter walls: Gravity load (5.85 m length): No floor load
Wall: 20.39 x 5.85 = 119 kN

U = 29.4 x 5.85 – 119 = 53 kN (11900 lb) hold down

Provide HDU8S Hold-down w/ 17- #14 studs to connect to Stud and 7/8" (22 mm) dia. Bolt to foundation w/ Embedment depth of 300 mm

Model No.	Mil (Ga.)	H (in.)	W (in.)	℄ (in.)	Fasteners		Stud Member Thickness mil (ga.)	ASD (lbs.)		LRFD (lbs.)		Nominal Tension Load (lbs.)
					Anchor Bolt Dia.[1] (in.)	Stud Fasteners[7]		Tension Load	Deflection at ASD Load[4]	Tension Load	Deflection at LRFD Load[4]	
S/HD8S	118 (10)	11	2 5⁄16	1 ½	⅞	17 - #14[7]	2-33 (2-20ga)	7,335	0.12	11,715	0.204	13,720
							2-43 (2-18ga)	8,750	0.086	13,975	0.146	21,435
							2-54 (2-16ga)	8,855	0.106	14,145	0.162	21,700
							Steel Fixture	10,840	0.053	17,335	0.072	32,525

8. Connections



1. Roof Truss (Enclosed Area) to Wall Top Track Connection

Uplift force due to wind = 14.5/2 x 1.2 x 0.6
= 5.2 kN

Provide HTS16 Simpson Roof Truss connector to wall top track
w/ 6-#10 screws on Wall top track and 6-#10 screws to Roof truss.
Refer Connection details in Structural Drawing

2. Roof Truss (Glass Cube Area) to Steel Beam Connection

Uplift force due to wind = 5.1/2 x 1.2 x 0.6
= 1.836 kN

Provide SSC4.25 Simpson Roof Truss connector to Steel beam w/ 2-#12 Self drilling screws on Steel beam and 5-#10 screws to Roof truss.
Refer Connection details in Structural Drawing

3. Deck to Wall Connection
Uplift force due to wind = 14.5/2 x 1.2 x 0.3 = 2.61 kN
Provide 2 MM THICK CLIP ANGLE WITH 6 #10 SCREWS @ EACH CONNECTION
Capacity = 1.5 X 6 = 9 kN

Refer Connection details in Structural Drawing

4. Deck to Column Connection
Uplift force due to wind =14.5/2 x 1.2 x (8.4/2+8.4/2) = 73.08 kN @ Each RCC column junction

Shear Capacity of M10 bolts with Cracked Concrete = 13.4 kN

Required No. Of Bolts = 73.08 / 13.4 = 5.4 No.

Provide 6-M10 Bolts to connect Deck Beam to Existing RCC Column

Refer Connection details in Structural Drawing