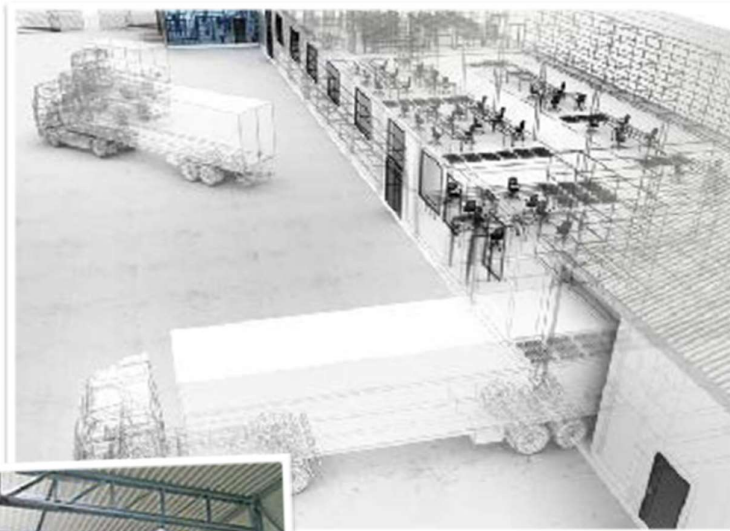


SECTION- V
SCOPE OF WORK, TECHNICAL
SPECIFICATION & DESIGN BASIS REPORT

BSES WAREHOUSE GHAZIPUR

BSES



PROJECT

PROPOSED WAREHOUSE PROJECT AT GHAZIPUR FOR M/S BSES YAMUNA POWER LTD

Client: BSES Yamuna Power Limited

Consultant:



**PC DESIGNS PRIVATE LIMITED
340 SULTANPUR, M.G. ROAD NEW DELHI -
110030**

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1. Preface

The Design Basis outlined below should be used in conjunction with the Scope of Works-Design Criteria Document provided by the Client, as well as the Submitted Template Drawings. These documents will guide the Vendor in preparing their Techno-commercial responses, drawings, and Basis of designs tailored to the specific requirements of the project's location.

The Entire Package consists of two complementary components. The first is the Design Criteria document, which describes the scope of works,

In case of any doubt or ambiguity regarding the intention of any part of the documents or drawings, the Vendor shall promptly seek clarification from the Client before proceeding with the works. The Client's interpretation of the documents will be final and binding to the Vendor.

The design may be subject to modifications and changes to comply with National, Regional, and Local Codes/Regulations/Standards, as well as any covenants and restrictions. The Vendor must consider the specific local statutory requirements pertaining to the project location. Any references to data from Codes and Regulations in this document are accurate at the time of issue, and any code versions should be updated with the latest codes.

During the preparation of the Vendor's Design basis, specific to the project location, factors such as Local soil conditions, seismic conditions, rainfall intensity, and wind loads must be taken into consideration.

The Vendor/Contractor shall be responsible for the design services systems comprehensively. In their design process, the Vendor must adhere to first design principles, ensuring fully functional and coordinated design solutions that comply with:

- Client facility-specific requirements
- Statutory requirements
- Local codes
- Industry best practices

The building profiles, sizes, finishes, device/equipment sizes, quantities, and locations indicated in the Basis of Design are indicative. Final design, placement, and installation details shall be discussed and finalized during project briefings and the design development stage.

1.1 General Requirement

Within this section of the document, the design criteria and requirements comprehensively outline the spatial and performance prerequisites for the various aspects of Pre-Engineered building (PEB) works.

The Template Design, meticulously prepared by the Client and accompanied by Template design drawings within this set of documents, serves the purpose of exemplifying the envisioned design solutions aimed at meeting the specific requirements of the Client.

The primary intent behind these drawings is to present the conceptual framework for each structure and system. They offer a preliminary representation of principal structural members, equipment, pipework, and cabling, serving solely as guiding references.

The Vendor is entrusted with the responsibility of transforming the Template Design into meticulously detailed design and construction drawings, with the exception of cases where such drawings are already provided by the Client for their scope of works. This transformation must be conducted in strict adherence to the relevant design standards and national norms, as mandated by the Client's Requirements.

Nonetheless, the Vendor retains the flexibility to deviate from the Template Design, albeit limited to the extent explicitly permitted in the pertinent sections of the Client's Requirements. Any deviations must be substantiated by the Vendor and secured with explicit approval from the Client.

1.2 The Structural System

- a) **Superstructure** - The superstructure above the plinth level will be constructed using a steel continuous portal system, meticulously designed to ensure structural integrity. This vital aspect of the project will be entrusted to a reputable Pre-Engineered Building (PEB) vendor with a proven track record in delivering exceptional results. The esteemed vendors shortlisted for the PEB work warehouse should be renowned for their expertise in the field and shall submit the credential in this regards.

- b) **Structural Arrangement**

The structural arrangement for these buildings has been thoughtfully planned, employing the PEB steel structure approach. The roof slope will be limited to a minimum of 1:20, ensuring optimal functionality and aesthetics. In adherence to meticulous design standards, all purlins located at pre-selected positions will be engineered to bear the combined loads of DEAD

LOAD, LIVE LOAD, and COLLATERAL LOAD uniformly. The precision in their positioning will harmonize seamlessly with the arch detailing. Additionally, concrete pedestals have been proposed up to this level, ensuring robust foundational support.

c) Steel Members:

The proposed buildings will be constructed using high-quality structural steel members boasting a grade of 345 MPa. This material selection has been carefully determined to withstand the effects of all vertical and horizontal loads, either acting individually or in complex combinations, in full compliance with the applicable codes and standards.

d) Structural Stability:

To underscore the commitment to enduring structural stability, the PEB supplier is expected to provide a comprehensive structural stability certificate, guaranteeing the structural soundness of the buildings for an impressive 50-year period.

In conclusion, the meticulous attention to design, material selection, and the involvement of reputable vendors ensures that the proposed buildings will stand tall, embodying both resilience and excellence in their construction.

2. Design Assumptions

Design assumptions are as following:

- i. **Rigid Connections:** The mainframe rafters and exterior columns are assumed to be rigidly connected to each other using moment connections. This ensures structural stability and robustness in the building's framework.
- ii. **Lateral Stability:** The lateral stability of the building is achieved through the frame action of the mainframes providing resistance against lateral loads.
- iii. **Longitudinal Stability:** The longitudinal stability of the building is ensured through the truss action in the cross-braced bays of the building, enhancing overall structural integrity.
- iv. **Roof Purlins:** The roof purlins are considered as continuous beams, supported at rigid frame locations, with their span equal to the bay spacing of the building.

- v. Sidewall Girts: Similar to roof purlins, the sidewall girts are treated as continuous beams, supported at rigid frame locations, with their span matching the bay spacing of the building.
- vi. End Wall Girts: The end wall girts are regarded as continuous beams, supported at wind column locations, providing necessary support for the building's end walls.
- vii. Sheeting for Lateral Support: Both roof and wall sheeting are responsible for providing lateral support for the purlins and girts, contributing to the overall stability of the building structure.
- viii. Structural Analysis and Design: The analysis and design of all main frames will be meticulously conducted using STAAD-Pro Software Connect Edition version, a reliable and advanced tool for accurate engineering assessments.
- ix. Secondary Members Design: The design of secondary members, namely Purlins & Girts, will be meticulously carried out using editable excel sheets, ensuring conformity with IS code 801:1975, the relevant Indian standard.
- x. Foundation and Pedestal: For the base plate design, the RCC foundation and pedestal will be carefully considered, using M25 grade concrete to ensure the stability and durability of the building's foundation.

These design assumptions form the bedrock of the structural considerations for the building, ensuring the adherence to high standards of safety, stability, and engineering excellence.

3. Design Methodology/ Design Parameter

- i. Wind Load: The wind load for the structure will be considered as 50m/s, following the guidelines of IS 875: 2020 (Part 3).
- ii. Terrain Category: The terrain category for the site is categorized as 2.
- iii. Wind Directional Factor: The wind directional factor, K_d , is assumed to be 0.9, as per the latest edition requirements.
- iv. Wind Exposure Factor: The C_{pi} value for the building, denoting a "Partially Enclosed" condition, is considered as 0.5.
- v. Roof Monitor Consideration: The roof monitor will be modelled in the STAAD software, and wind loads will be applied accordingly.

- vi. Transfer of Wind Load: A portion of the wind load acting on the brick/block wall will be transferred to the main portal column, and the PEB vendor will be responsible for designing the portal to withstand this additional load.
- vii. Wind Load Calculation: The wind load calculations will adhere to the guidelines of the IS code, taking into account the applicable terrain category based on the geographical location of the site. The entire PEB frame will be considered for wind loads, following IS 875: 2020 (Part 3).

3.1. Horizontal Deflection Criteria:

- a. Height/150 for un factored Load Combinations having wind load case.
- b. Height/150 for un factored Load Combinations having earthquake load case

3.2. Vertical Deflection Criteria:

- a. Primary Members: Span/180 for Dead + Live combination.
- b. Mezzanine Beams / Joist: Span/360 for Dead + Live combination or 25mm whichever is less.
- c. Secondary members: Span/150 for Dead + Live Load Case.
- d. Secondary members: Span/150 For Live load case & Dead + Live combination
- e. Cantilever Canopy- Span/120
- f. All the deflection should be purely member deflection not relative deflection.
- g. Girt- Span/150.
- h. Crane beam - Span/750.

3.3. Steel Structure Design:

- a. Primary Member Design – IS 800 latest revisions to be follow.
- b. Cold form Steel member Design- IS 801:1975 Pre-punched Purlins 10 X 25 mm Slots on purlin @1.50m c/c.
- c. All primary structural steel members (Rafter, Column, Jack beam. etc) should be provided with pre punch holes of 25mm dia @ 1.5m c/c length wise and 0.3m c/c width wise.
- d. Load combination- IS 800 latest revisions to be follow.
- e. Column Bounding Condition at Base – I/H Section columns only, All the external main frame columns are considered as fixed at the base whereas intermediate & wind columns are considered as pinned at the base. Intermediate columns at gable end is also fixed.
- f. Entire structure including cold roll formed members must be checked for various loads arising in erection condition.
- g. Maximum 1 welded joint shall be provided in web / flange of each built up member having total length of 6m or less. Maximum 2 welded joints shall be provided in web / flange of each built up member having total length of more than 6m.
- h. All main frame column will be Straight no tapered column is allowed. Wind column can be tapered.
- i. All foundation bolts need to be straight. 'J' Type foundation bolt will not be acceptable.
- j. Each foundation bolt must be supplied with Nut, Check nut and washer - all confirming PC 8.8 grade.
- k. All the built-up should be continuously weld in each direction (Double side welding).

- l. Grade of concrete – M-25.

3.4. Bracing Design:

- a- Two diagonal bracing should not be joined at centre & slenderness ratio shall be as per code Indian code.
- b- Rod/Angle/ Pipe on Roof / On Wall. For Dock side completely Portal Bracing up to 5mtr clear and above rod bracing & opposite to dock side portal up to 3.5M clear and above rod bracing at toilet location only and rest full ht. rod bracing need to be provided.
- c- Internal Bracing: No Cross bracing allowed inside the warehouse at any location.
- d- No cross bracing along Intermediate Column Rows if required consider full ht portal bracing.
- e- No bracing will be allowed for end wall columns. Both end wall frames need to be designed as rigid frame with Half bay loading, considering no future expansion.
- f- Flange bracing to be avoided at junction of staircase.
- g- Flange braces shall be provided on both sides of rafter / column / jack beam to stabilize the inner flanges or as per design consideration.
- h- Flange braces must be designed to safely restrain compression flange. Flange braces should satisfy slenderness ratio limit of 300.
- i- Material specifications shall be same as that given below for Hot rolled sections.
- j- Material specifications shall be same as that given below for cold roll formed sections. Cold roll formed flange braces must be min. 2.0mm thk. and GI having minimum coating of 275 GSM

3.5. Sag Rods:

- a- Inclined sag rods must be provided for purlins and side runners at eaves & ridge.
- b- Inclined sag rods for purlin must be provided between two purlins at eaves and at ridge for entire length of building.
- c- Inclined sag rods for side runner must be provided between two side runners at eaves and at louver location for entire length of building. Sag angles shall not be used at louver location.
- d- Straight and inclined sag rods must be provided between two side runners supporting louver. Side runners which support louver, must be straight for entire length.
- e- In case of AISC design standards, slenderness ratio of sag rod / sag angle in tension should be less than 300 & in compression should be less than 200

3.6. Seismic Design:

- a. As per IS: 1893- 2016 (Part 1).
- b. Importance Factor – $I = 1.2$
- c. Response Reduction Factor. $R = 3$
- d. Zone - IV IS 1893:2016 (Part 1),
- e. SS- (Soil Type – Soft)
- f. 25 Kg / M2 of Live load on roof shall be considered for calculation of seismic forces. (PEB vendor need to consider 25 Kg/sqm of load out of 75 Kg/sqm of live load for solar panel which they need to consider in earthquake calculations on entire roof area).
- g. 100% of collateral load on roof shall be considered for calculation of seismic forces.
- h. 50% of (Live load + collateral load) on mezzanine floor shall be considered for calculation of seismic forces.
- i. 100% of Dead load shall be considered for calculation of seismic forces.
- j. For seismic in longitudinal direction, diaphragm action due to purlin and sheeting can be considered. Diaphragm actions should not be used while designing bracing system for wind load.

4. Design Loads :-

- i. Live load on Purlins – 0.75 KN/sq.m.
- ii. Live load on rafters - 0.75 KN/sq.m.
- iii. Dead Load of Purlin - Self weight of structure. (Including all applicable accessories load)
- iv. Dead load of frame - Self weight of structure. (Including all applicable accessories load)
- v. Collateral load - 0.4KN/m², 100% Collateral load shall be considered in all Load Combination (including seismic) for Design & Deflection Criteria. All the purlins to be checked for a point load of 75kg at the centre in addition to collateral load.
- vi. All along periphery & Intermediate columns, brackets shall be provided at 2 levels as shown in architectural drawings. Both these brackets shall be 750 mm wide.
- vii. Cable tray and pipe rack load - Collateral load taken above shall be for Cable tray, lighting fixture, pipe rack etc.
- viii. Temperature loading - Temperature loading on External 18 Degrees & internal 10 & shrinkage 7.5 backup to be applied over the rafter and Columns & mezzanine members (TL-1 for external, TL-2 Internal and TL-7.5 shrinkage separate primary case load need to be provided in STAAD
- ix. Temperature Load combination - Thermal load shall not be combined with EQ/WL. The load factor shall be 1.0 in combination with DL, LL, and CL only.
- x. Purlin design to accommodate cable tray suspension using gripple wire (concentrated load).
- xi. Dead load on Mezzanine - As per design. 150mm RCC mezzanine slab and 50mm thick RCC finishing load.
- xii. Live load on Mezzanine – 750 Kg/sqmt
- xiii. Live load on staircase – 500 Kg/sqmt

5. Warehouse specification:-

SPECIFICATION FOR WAREHOUSE		
WAREHOUSE BUILDING		
1	Building Type	Pre-Engineered Building (fabricated, supplied and Erected by PEB vendors)
2	Building Clear Height	9.50 meters from FFL below the rafters at eaves & bottom of jack beam.
3	Roof Slope	1:20
4	Column Spacing along Side Wall (Bay Spacing)	As per Architectural drawing
5	Column Spacing along End Wall	As per Architectural drawing
6	Internal bay spacing	As per Architectural drawing
7	Column Base Plate Stiffeners: Base Plate and Anchor Bolts should not be visible above FFL.	250mm below FFL (Base plate Top)
8	Mezzanine	<p>As per drawing -</p> <p>Total mezzanine area – As per Drawings.</p> <p>1- Max 150mm thick Concrete Slab over Deck Sheet with member to be design as non-composite member in staad and Supported by Steel Beams and Columns.</p> <p>2- 2 Nos for each mezzanine; Chequered plate 1.5m wide Staircases to access mezzanine with landing & handrail of 1.2m height from top of slab with 100 mm toe guard. All external staircase will start from FGL and internal staircase will start from FFL.</p> <p>3- 0.8 mm thick G.I. profiled Sheet; Non-Composite Joist Design shall be followed.</p> <p>4- PEB vendor to provide MS handrailing on entire periphery of mezzanine floor. Specifications shall be – 1.1 metre height - Top rail of 50 NB (L) MS pipe - Maid rails Two no's 25 NB (L) MS pipe - Rail post shall be 50 NB (L) MS pipe placed at max 1.2 metre. c/c - Toe guard - 100 X 5 thk. (MS) shall be provided at all horizontal platforms.</p> <p>5- Mezzanine grid will be as per bay spacing and wind column spacing.</p>

		<p>6- All intermediate column of mezzanine will be terminated below mezzanine floor.</p> <p>7- External column of mezzanine shall extend up to rafter. However, these columns should not be treated as support for rafter.</p> <p>8- Height from finish floor of RCC slab of mezzanine floor to FFL shall be. 4.20 M.</p> <p>9- Clear height from Bottom of steel of mezzanine beam to top of RCC grade slab shall be 3.5M</p> <p>10- Mezzanine floor shall extend up to inside of sheeting on periphery and on remaining sides Mezzanine floor shall be provided up to outside flange of columns.</p>
9	<p>Additional loading on columns (Brackets for header pipes), in addition to the collateral and live load mentioned</p>	<p>1- Top of first bracket shall be 400mm below clear eaves level and top of second bracket shall be 900mm below eaves level.</p> <p>2- All along periphery brackets shall be provided at 2 levels as shown in architectural drawings. Both these brackets shall be 750 mm wide.</p> <p>3- All along internal column lines, brackets shall be provided at 1 level on either side as shown in architectural drawings. Both these brackets shall be 750mm wide. These brackets / platforms shall be supported on bottom flange of jack beam.</p> <p>4- On first and second level along periphery and on internal column lines, only loading and supply of bracket shall be considered.</p> <p>5- All these brackets shall be designed for load of 200 Kg / RM.</p> <p>6- Jack beam should be checked for one side platform condition (i.e., UDL of 200 Kg/RM & Torsional moment of 75 KG-m / RM) and both side platform condition (i.e., UDL of 400 Kg / RM & no torsional moment).</p>
10	Roof Slope	Roof Slope considered as 1:20

11	Crane Loading & requirement	10 Ton Capacity EOT required in between grid -1 to 5 in entire length.
12	False ceiling support arrangement in Mezzanine area	Structural members in mezzanine area should be designed for additional load of 15 Kg / M2 apart from loads specified above
13	Roof sheeting	<p>1- All roofing sheet shall be manufacture out of 0.55mm T.C.T. (SDP coated) Colour galvalume sheets with min. yield stress of 300 Mpa. Roofing sheet shall be of standing seam type with double lock system and concealed clips.</p> <p>2- Standing seam Roofing sheet, 360-degree double locking seaming arrangement shall be provided.</p> <p>3- Steel substrate shall have coating of Aluminium zinc alloy by hot dip process. The Aluminium zinc alloy composition by weight shall be nominally 55% Aluminium, 43.4% Zinc & 1.6 % silicon. The coating mass of minimum 150 gm / sq m confirming to AZ 150 shall be complied.</p> <p>4- Roof sheet shall be roll formed at site and installed in single length to avoid leakages.</p> <p>5- Roof sheet shall be guaranteed for at least 15 years against manufacturing defects and rusting and 10 years against leak proofness.</p> <p>6- PEB vendor to provide necessary design calculations for structural stability of roofing system.</p>
14	Roof & Wall Insulation	<p>1-Roof Insulation is to be provided on entire roof except at roof monitor location. Wall insulation is to be provided on complete wall area except louvers location.</p> <p>2- 50 MM thick rockwool insulation with 50kg/cum density with alu glass facing.</p> <p>3- Insulation is to be provided at top of purlin/girts and below roofing sheet/ wall cladding. 75X75X1.6mm mesh to be provided be roof insulation.</p> <p>3- Insulation is to be provided at top of purlin/girts and below roofing sheet/ wall cladding.</p>
15	Parapet Fascia at both Gable ends	As per drawing.

16	Provision of Solar Panel in Roof	Only loading for solar panel installation is considered in design, part of collateral load.
17	Facade	As per Elevation
18	Translucent Lighting Panels in Roof	One panel in each grid.
19	Translucent Lighting Panels in Wall	2mm thick Polycarbonate; as per building elevations.
20	Roof Access System	<p>2 Nos of cage ladder for each WH start from FRL/FGL. with Vertical Fall Arrestor giving access to roof from Road Level with lockable arrangement with mid landing.</p> <p>Ladder shall be made of hot rolled channels - min. ISMC 100 or as required by design. Ladder shall have steps made of min 24 Dia rod and placed at 250mm.</p> <p>The cage shall be made with min. 75X6 thk. flats placed such that, it protects person climbing up.</p> <p>Necessary platform may be provided at intermediate level.</p>
21	Roof lifeline	<p>The system shall be non-roof piercing suitable for standing seam roof system. Providing and installing Life line in SS 316 grade (Karam or equivalent approved). Strength of Life line shall be 22.2 KN. The roof shall be fitted with cleats to support minimum two safety harness lines running on the either side of the ridge ventilator as specified by the National Building code. Life line shall be supported at every 8m and single wire rope line shall not be used beyond 24m. After every 24m, separate load bearing support and separate life line rope shall be installed. Roof life line should cover entire roof area. Both side of ridge & periphery of building.</p>
22	Roof Ventilation- Roof monitor	<p>The ventilation system shall be designed and provided in a manner to achieve 6 air-changes in 1 hour with all dock and access doors in closed condition as per the National Building Code. The system should consist of louvers with filters & bird-mesh with a roof monitor. Louvers shall be designed as air inlet for building. Louvers shall be sufficient to provide 6 air changes per hour inside building. While sizing louvers, only half area of louver should be considered effective. Roof monitor shall be treated as air outlet for the building. Roof monitor must be sized to achieve 6 air changes per hour considering entire volume of building</p>

		<p>effective. Uses of Self-propelled Turbo Ventilators are prohibited. The system is to be designed keeping in mind that the dock doors will be opened only during loading and unloading and shall remain closed all the times. Roof monitor to achieve 6 ACPH; 25mm x 25mm x 1.2mm Bird Mesh (Vendor to confirm size & submit calculation for same with 6 ACPH for full stack height of building)</p>
23	Rainwater Gutter	<p>Eave Gutters made of Galvalume Sheet 26 G. Supporting details shall be provided and follow necessary precautions during erection to avoid water leakages. Valley Gutter & downspouts to be provided at both the ends. Gutter to be designed for maximum rainfall drainage from the roof. Gutter capacity shall be compatible with the design parameters used for a gravity rainwater system.</p> <p>Rainwater downpipes shall be external to the building and connected to the drainage system. Under no circumstances the rainwater gutters can be inside the building. (Length of down take pipes up to collection chamber at GL.).</p> <p>Down-pipe positions shall not conflict with the locations of external doors and dock doors.</p> <p>Flashings and sealants to be incorporated at all required locations such as, ridges, parapets and gutters. Eave Gutter - Galvalume, same as Wall Sheet Material.</p> <p>Canopy Gutter - Minimum 1.2mm GI Gutter</p> <p>Rainfall intensity considered as 150mm per hr (Calculation will be submitted by the vendor for gutter and down take size and numbers as per NBC requirement)</p>
24	Rainwater Pipes	<p>Down Spouts at made of sheeting material will be designed as per storm water management. Rainwater downpipes shall be external to the building and connected to the drainage system below up to road level to the nearest chamber including bends. Calculation to be done by PEB supplier. Support for down takes to be considered as same colour. Same as Wall Sheet Material for Bldg. Downspout & down take shall be avoided at Façade location. Size of Gutter & Downspout shall be uniform throughout length of</p>

		building at both sides. Minimum 2 nos of Down Sport need to be provided from building eave gutter at each column location (except facade location at centre of mezzanine). Rainwater down-takes shall go below finished ground level (1800MM min.) in such a way that the bottom of the rainwater down-take pipe shall be connected to the storm water chambers provided near the plinth of the building
25	Plinth height of building	Considered as 1200mm from internal road level.
26	Exterior Block Wall//brick wall Height around the shed	3.5m from FFL all around the building.
27	Wall Thickness	Wall thickness considered as 200mm thick solid block work / 230mm brick work/ACC blocks.
28	Sheeting above Wall	<p>1- As per Architectural drawings, / Block wall is provided up to 3.5m Height from FFL, on entire periphery (Not in PEB Vendor's Scope). Side cladding sheets are to be provided with at least 150mm overlap with Brick/block wall.</p> <p>2- Side cladding sheet shall be of trapezoidal profile, roll formed from 0.5mm TCT colour coated (SDP coated) galvalume sheets with min. yield strength of 550 Mpa. Steel substrate shall have coating of Aluminium zinc alloy by hot dip process. The Aluminium zinc alloy composition by weight shall be nominally 55% Aluminium, 43.4% Zinc & 1.6 % silicon. The coating mass of minimum 150 gm / sq m confirming to AZ 150 shall be complied. The paint finish thickness shall have a total coating thickness of nominal 35 µm, comprising of nominal 20 µm on exterior face and nominal 5 µm reverse coat on interior face over nominal 5 µm epoxy primer coat on both surfaces of approved colour shade by Client's Project Manager / Architect. Galvalume side cladding sheet shall confirm to AS 1397 / ASTM A 792. Galvalume sheet shall be cold roll formed to trapezoidal profile as per IS 513.</p> <p>3- Colour pattern of side cladding sheet shall be as suggested by Architect and shall have two different colours. Exact colour pattern shall be provided after finalization of</p>

		<p>order and during GA drawing approval.</p> <p>4- Side cladding sheet shall be guaranteed for at least 15 years against manufacturing defects and rusting and 10 years against leak proofness. Side cladding sheet of approved make shall be sized such that, they are installed in single length without any length wise overlap.</p> <p>5- Sheets shall have min. one corrugation side laps and min. 300 mm length overlap.</p> <p>6-Profile dimensions outer panel: Trapezoidal type profile sheet shall have 1015 mm effective cover width, nominal 28 mm deep ribs with subtle square fluting in the five pans at nominal 203 mm c/c. The end rib shall be designed for anti-capillary action, to avoid any seepage of water through the lateral overlap.</p>
29	Louvers on Wall Cladding	<p>0.5mm Colour Galvalume, 1m high Louvers (to be in PEB scope) band shall be provided with bottom at all around the periphery (as shown in drawing) with mesh from inside for safety and to avoid Pilferages.</p> <p>Louvers shall be manufactured from same material as that for side cladding. Colour of louvers shall be as approved by client.</p> <p>A Type louvers need to be provided.</p>
30	Canopy Type	<p>As per drawings,</p> <p>1- With soffits.</p> <p>2- Canopy shall not be supported by back kicker.</p>
31	Wall Framed Opening	<p>Framed opening need to be provided as per drawing.</p> <p>Framed opening need to be considered in built up section/ Hot rolled section.</p> <p>Framed opening in cold form is not allowed.</p>
32	Expansion joint	<p>Expansion joint provision in purlins and girts can be considered as per latest code. Expansion joints need to be achieved with slotted holes in purlins and girts.</p>

6. Design Submission: -

- 6.1. STAAD Input File: The report will feature the STAAD input file, showcasing the 3D design of the complete structure, encompassing all portals, gable end portal, bracing, mezzanine floors, canopy, lean-to shed, and other relevant elements.
- 6.2. Purlin and Side Girts Design: The design and connections of purlins and side girts will be included, ensuring structural integrity and stability.
- 6.3. Civil Assignment Drawings: The report will present civil assignment drawings, exhibiting the foundation bolt layout and details, along with foundation loads for various load combinations.
- 6.4. Design of Inert Plates: The location and details of various inert plates, along with their design loads, will be illustrated through civil assignment drawings.
- 6.5. Structural General Arrangement (GA) Drawings: A comprehensive set of structural GA drawings will be provided, presenting all necessary details of the structure.
- 6.6. Calculations for Additional Elements: The report will include detailed calculations for overhead gutter, down take pipes, extent of louvers, and roof monitors, ensuring accuracy and compliance.
- 6.7. Erection Condition Check: The STAAD file will be checked for the entire structure in the erection condition, ensuring safety during the construction phase.
- 6.8. Structural Stability Certificate: A structural stability certificate will be issued by an authorized design engineer, verifying the stability and safety of the structure. Note that the certificate should not be issued by the company itself.
- 6.9. Editable Excel Format: All design-related documents will be submitted in editable excel format, facilitating ease of review and future modifications.
- 6.10. Quality Assurance Plan (QAP): The PEB supplier is required to submit a Quality Assurance Plan for approval from the Consultant, PMC, or Client before material procurement, ensuring adherence to quality standards.

6.11. True Scale Drawings: All drawings will be presented in true scale, providing accurate representations of the structure.

6.12. Tonnage variation – Tonnage variation up to - 2% is acceptable. Additional quantity if required shall be supplied and installed free of cost. In case if the quantity reduces more than 2% proportional amount will be deducted from contractor's bill based upon the quoted rate of steel (fabrication and erection).

Additional Note: The centreline of the main frame column and gable end columns will be aligned in the same line, ensuring precision and uniformity in the structural layout.

7. Standard Material specifications:-

- a) Primary members – Steel for Built up sections shall be generally requirements of ASTM 572 as applicable, with Minimum yield of 50,000psi/345 Mpa Min thickness -5MM
- b) Secondary members - Steel used to form purlins, girts, eave struts and "C" sections shall conform to the requirements of ASTM A653 Grade 50. Minimum yield shall be 50,000 psi / 345 MPa. As per Design (Minimum member thickness shall be 2 MM).
- c) Anchor Bolts - IS: 2062 Gr A (Fy = 250 MPa) or higher grade coated as per design.
- d) Primary connection bolts - High Strength conforming to relevant IS Code of 4.6 Grade.
- e) Sheeting accessories (Trims, eaves, crimped, ridge, flashing, buffer blocks, profile foam closures, sheet end cover etc.) - Material & thickness to match the sheeting material used in roof.
- f) Sheet joint sealant - Butyle tape / mastic tape / both side self-adhesive tape (15 x 3 mm).
- g) Flashing & trims - All flashings will be of thickness and Specifications same as sheeting material of roof / cladding.
- h) Connection bolt - Primary - 8.8 Grade

List of Approved Make: -

Primary members – TATA/SAIL/JSW/ESSAR/JSPL

Secondary Members (Cold form) Pre-Galvanized – JSW/Essar

Polycarbonate Sheet – Sabic/GE/Palram, Danpalon

Roof sheeting Colour PPGL (SRI \geq 85) – Tata BlueScope/ JSW

Wall Sheeting (SRI \geq 85) PPGL - Tata BlueScope/ JSW.

PEB wall & roof Insulation – Rockwool Rocks wool, Rockwool India .

Decking Sheet – ESSAR / JSW/POSCO.

Paint – Asian paints, Berger, Nerolac

Self – tapping screw – Buildex class III, Hilti, Ejot

Roof life line – Mt and T, Karam, Sure safety

Anchor bolt & High strength bolt of 8.8 – Pooja forge, Panchsheel fasteners, SPL fasteners

8. Painting specifications: -

- a) The surface preparation will involve shot blasting to achieve Sa 2.5 standard, followed by the application of a 100 DFT epoxy paint system (low voc). Any damaged member after erection will undergo touch-up at the site using the same batch of epoxy paint for a seamless finish.
- b) All secondary members will be pre-galvanized with a minimum of 275 GSM coating, ensuring excellent corrosion resistance and durability for the structure.
- c) Roof and Wall sheeting colour scheme – As per client approval

9. Other requirement :-

- a) PEB vendor should supply necessary foundation templates - Made of MS plate / angle along with foundation bolts in sufficient quantity as per requirement of Project Management Consultant/ Architect/ Site In-charge.
- b) Canopy Lighting Support: Pre-punched purlin with 12mm Diameter holes @ 1.5 meters C/C.
- c) All Column (Incl. Mezzanine Columns) Base Plate Stiffeners; Base Plate and Anchor Bolts will not be visible above FFL.
- d) To be submitted in STAAD pro (V8i select series 6) connect edition latest version only (3D model). The frames to be designed taking the RCC Pedestals, loaded Plinth beams and fixed at foundation level. The foundation shall rest at 2 metres below the natural ground level.
- e) Deck Sheet thickness to be considered of 0.8mm.
- f) Water Test to be carried out and checked before handover. All required equipment and water arrangement will be in vendor's scope.
- g) Roof test certificate for no Leakage and Roof Load Carrying certificate.
- h) Structure Stability Certificate & Mezzanine Certificate to be provided signed off from Authorised Structural Engineer.
- i) Leak proof Guarantee/Warrantee to be considered for minimum 10 years.
- j) Framed Openings To be considered for all RUDs, Louvers & Glazing in PEB scope as per drawing.

10. Guaranty Warranty: -

- a) Structural Member Guarantee: The structural members of the building must be guaranteed for a minimum of 50 years of service life, ensuring long-lasting durability and reliability.

- b) **Roofing System Guarantee:** The roofing system, including roofing sheets, transparent sheets with safety mesh, roof monitors with bird mesh, etc., must be guaranteed for 15 years against manufacturing defects and rusting. Additionally, a 10-year guarantee against leak-proofness is required to ensure proper protection from water infiltration.
- c) **Side Cladding System Guarantee:** The side cladding system, encompassing side cladding sheets, louvers with mosquito mesh, all flashings, canopy roof, roof monitor cladding, and all sheeting fasteners, must be guaranteed for 15 years against manufacturing defects and rusting. Moreover, a 10-year guarantee against leak-proofness is expected to maintain the integrity of the cladding.
- d) **Painting Guarantee:** The painting of various structural components must be guaranteed against peeling off, fading, and flakes for a period of 10 years, ensuring the aesthetics and protection of the building.
- e) **GI Cold Roll Formed Sections Guarantee:** All GI cold roll-formed sections must be guaranteed against rusting for a duration of 10 years, safeguarding the integrity and longevity of the sections.

These guarantees demonstrate the commitment to quality and performance, providing confidence in the structural integrity and appearance of the building over an extended period.

11. Erection and Installation: -

- a) **Installation Practice:** The installation shall strictly adhere to the standard practices specified by the manufacturer and approved by the Client's Project Manager/Architect. All sheets and accessories must be stored and erected without any damage.
- b) **Submission of Erection Manual:** The Vendor must submit an erection manual, detailing the sequence and procedure of erection, before commencing the actual erection process. These documents must be approved by Architects, the Project Management Agency, and the Structural Consultant.
- c) **Design Calculations and Methodology:** The Vendor is required to submit design calculations supporting the proposed profile of the sheet and standard loading to the satisfaction of the design consultant and the Architect. Additionally, the Vendor shall submit the methodology for fixing the sheets and a maintenance manual for routine upkeep.

- d) Special Fixings and Trims: Special flashing, ridge capping, and trims must be fixed as per the manufacturer's recommendations. The shape and dimensions shall comply with the design requirements and receive approval from the Client's Project Manager/Architect.
- e) Panel Clips and Alignment: Panel clips shall be positioned by aligning the holes in the clip with the factory-punched holes in the secondary structural members. Panels shall be properly aligned by matching the factory-punched holes in the panel end with those in the eave structural member and by aligning the panel with the panel clip.
- f) Field-Seaming and Lap Joints: Panel side lap shall be field-seamed using a self-propelled and portable electrical lock-seaming machine. Panel end laps, when required, shall be at least 150 mm sealed with neutral-cure sealant and fastened together by clamping plates. Sealant shall contain hard nylon beads to prevent flow during clamping actions. The panel lap shall be joined by a two-piece clamped connection, avoiding a four-panel lap splice condition.
- g) Erector Familiarization and Compliance: The Vendor must ensure that the panel erector is familiarized with the erection procedure, and the supporting members are straight, level, and true (according to AISC) before starting panel erection. Panels shall be erected in accordance with the approved shop drawings provided by the Architects.
- h) Structural Stability Responsibility: The PEB Vendor shall be wholly responsible for the structural stability of the structure throughout the entire process, including site handling, erection, and post-erection completion.
- i) Ownership of Material and Safety Compliance: All material supplied to the site and under erection shall be treated as the PEB Vendor's property until the entire structural erection is completed and a structural stability certificate is issued. Therefore, the PEB Vendor shall ensure the safety of all PEB materials on-site and comply with all safety requirements of the customer. The PEB supplier shall provide check nuts to ensure the levelling of columns as well.
- j) Electricity and Water will be in PEB vendor's scope.
- k) PEB Vendor's need to provide 6 set of A0 drawing for all the drawings at each stage like GA Drawing, Erection drawing, As built drawings etc.

- l) PEB vendor shall comply with all safety requirements of customer/ PMC/ Architect.
- m) Erection/ Sheeting/ Cladding with Boom lift is mandatory.

12. Proposed Layout / Drawings (Attached As Annexure-VI)