ENGINEERING GREATER AMBITIONS

STEELS PRIVATE LIMITED

Pre Engineered Building System

Compliance with the latest design and building codes that is applicable to the PEB industry.

The codes that are used in the design and manufacture of a PEB Steel Structure greatly impact its cost. Codes specify minimum design loads,load combination,allowable deflection,manufacturing tolerance,fit up tolerance,etc. Use of less recognized codes or out of date codes often results in cheaper, but potentially unsafe, building structures. The PEB industry was originated in USA, where over one million PEBs are produced each year. American code authorities continuously update their codes as a result of empirical data on the performance of PEBs.

Design Software

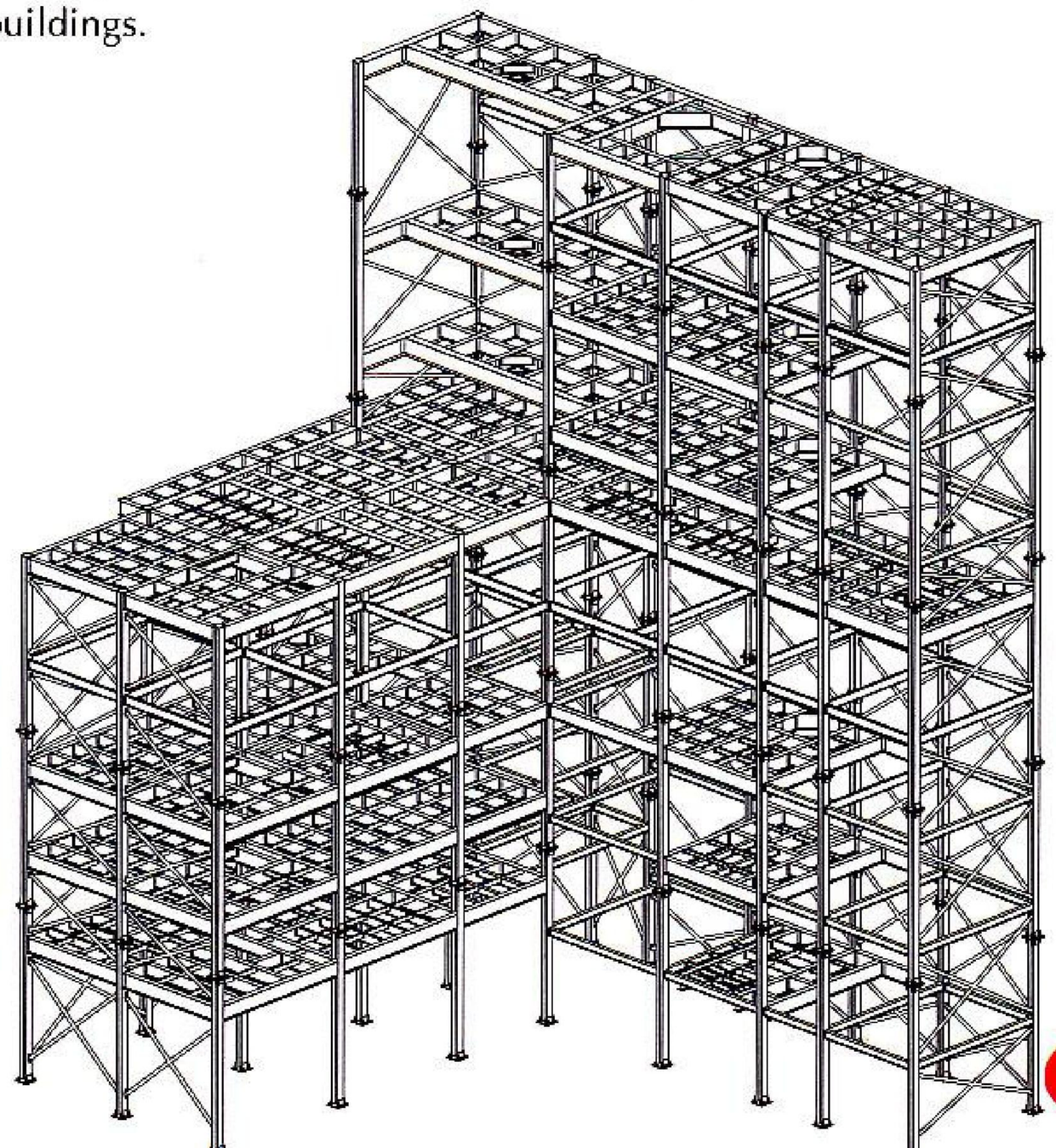
Ralco Steel is proud to be using the latest edition of the engineering software developed and sold by Metal Building Software, U.S. based company that specializes in one product only: Software for the design and drafting of PEBs. More than 100 PEB manufacturers in USA, South America, Europe and Asia use this software every day. MBS software incorporates the latest US Code applicable to the design of PEBs. This is important to both the PEB manufacturer and the buyers, both appreciate that their buildings are safely designed with this software.

MBS software is a comprehensive design & detailing software. It produces the design, shop drawing, erection drawing and BOM (Bill of Materials) of a PEB (i.e. the PEB steel structure and (The Panel and Panel Accessories). Its efficiency far exceeds stand alone software that produces either design output or detailing output but not both.

Applicable Design and Building Codes

RALCO Engineers are proficient in providing you with the highest quality building using the following codes:

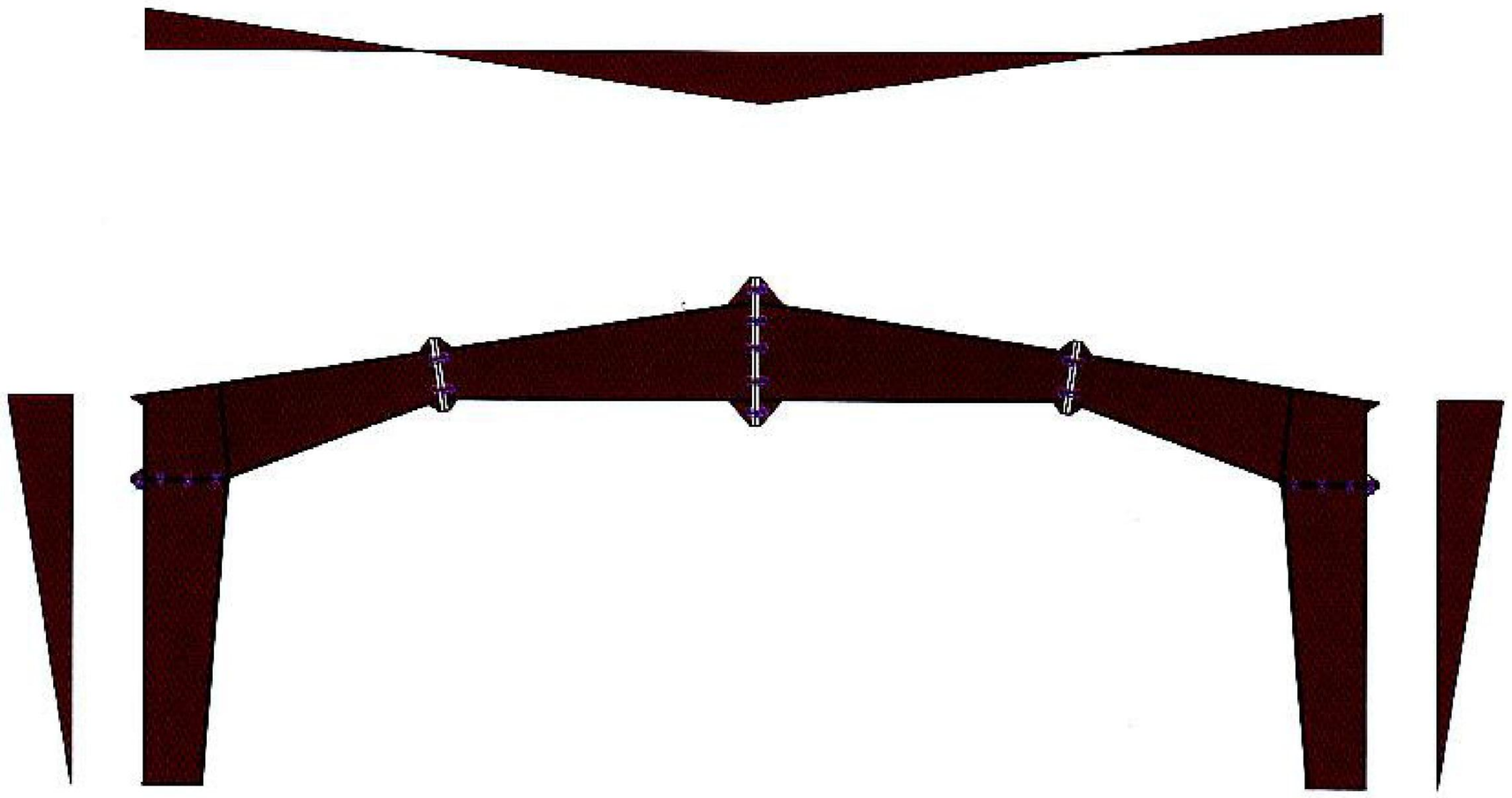
- American Institute of Steel Construction (AISC)
  This manual is used for the design of the built up sections, hot rolled sections and welded plates
- American Iron and Steel Institutes (AISI)
  This manual is used for the design of cold formed sections
- American Welding Society (AWS)
  This manual is used for all welding specification and procedures
- Metal Building Manufactures Association (MBMA)
  This manual is used for all loading conditions, fabrication tolerances and considered as a guideline for pre-engineered buildings.



PEB Vs. Conventional Steel

Generally, pre-engineered steel buildings are the preferred choice for most of low rise buildings due to plenty of reasons some of which are:

- Low initial cost (Nearly 20 % lower than conventional buildings)
- Fast delivery due to the ease in manufacturing.
- Architectural versatility.
- Possibility for large future expansion of the building.
- Fast and easy erection of the building elements.
- Single source responsibility.
- Low maintenance requirement.

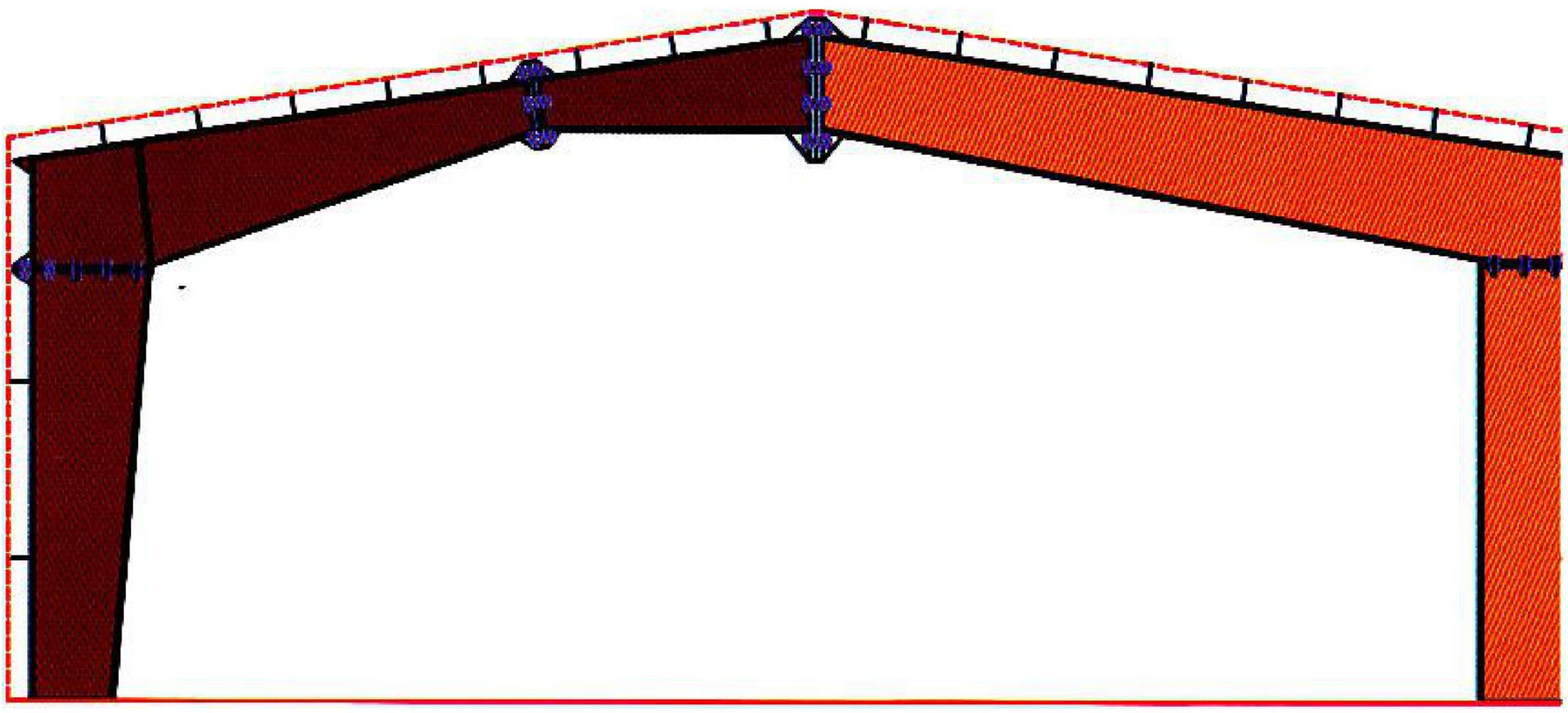


In conventional steel building, hot rolled sections (including beams and columns) are used. The size of each member is selected on the basis of the maximum internal stress in the member.

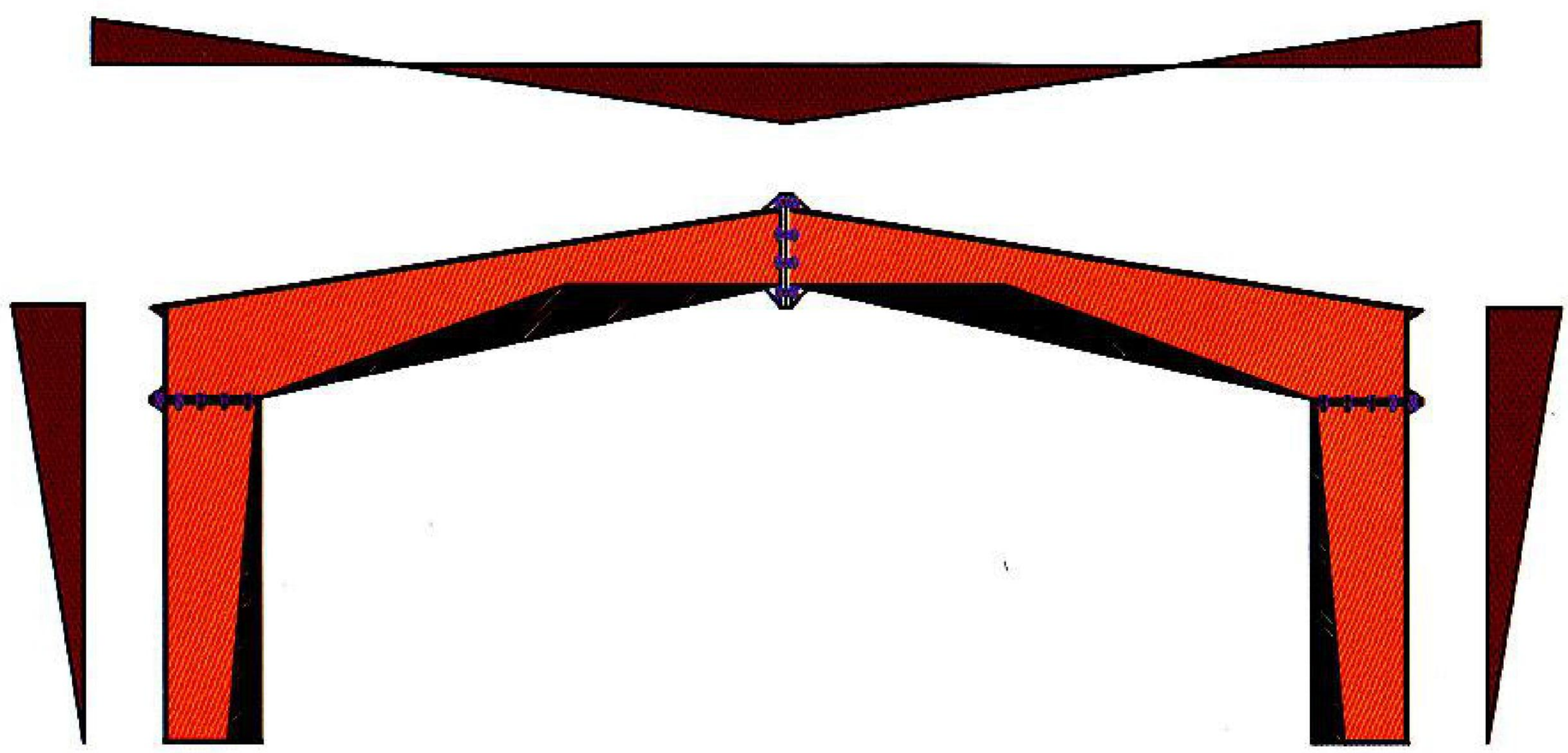
Since the hot rolled sections have constant depth, many parts within these sections (as indicated in the hatched area) lie within the area of low internal stresses which forms excess in the design requirements. (i.e. excess in building weight which is equivalent to higher building cost)

Conventional Steel Frame

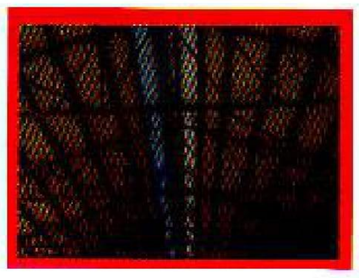
On the other hand,the frames of pre-engineered steel buildings are formed of standard plates stocked by Ralco Steel Co. manufacturer. PEB frames are normally tapered and often have webs and flanges of variable thicknesses along the individual members. The frame geometry is matching the shape of the internal stress (bending moment) diagram thus optimizing material usage and reducing the total structure weight (i.e. less weight of the building which is equivalent to lower building cost)



Pre-Engineered Vs. Conventional Steel



Conventional Steel Frame



Basic Building Parameters

The PEB steel structure of a building consists of primary rigid frame, end wall bearing frames, secondary structural members (Purlins & Girts) wall & roof sheeting and bracing components. It also consists of additional structural framing such as mezzanines, roof monitors, roof extensions, canopies, fascias, parapets, partitions and roof & wall framed openings, in addition to anchor bolts, connection bolts and fasteners.

Building width : The distance between outside of girt/block wall one side to outside of girt/block wall of the opposite side wall.

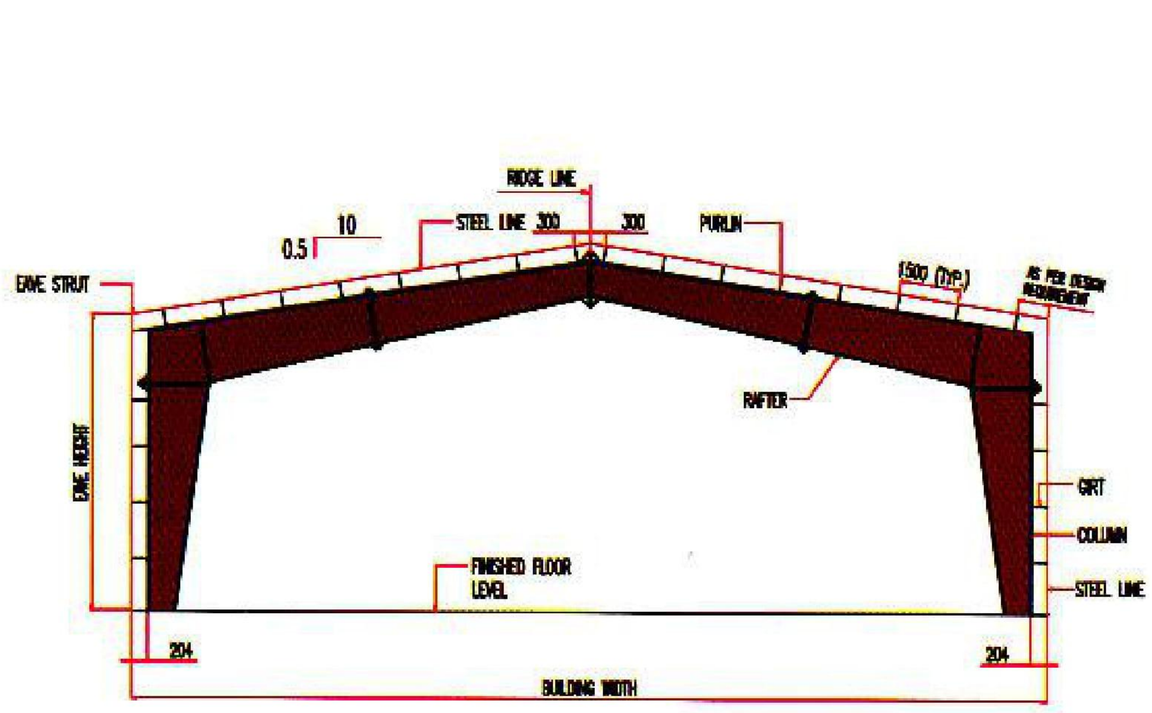
Building length : For by-pass endwalls the distance between the outside of wall girts in opposite end walls, for flush endwalls, the distance between the outside flanges of endwall columns in opposite endwalls. Building length is a combination of several bay length.

End bay length : The distance from outside of the girt/block wall to the center line of the first interior frame columns.

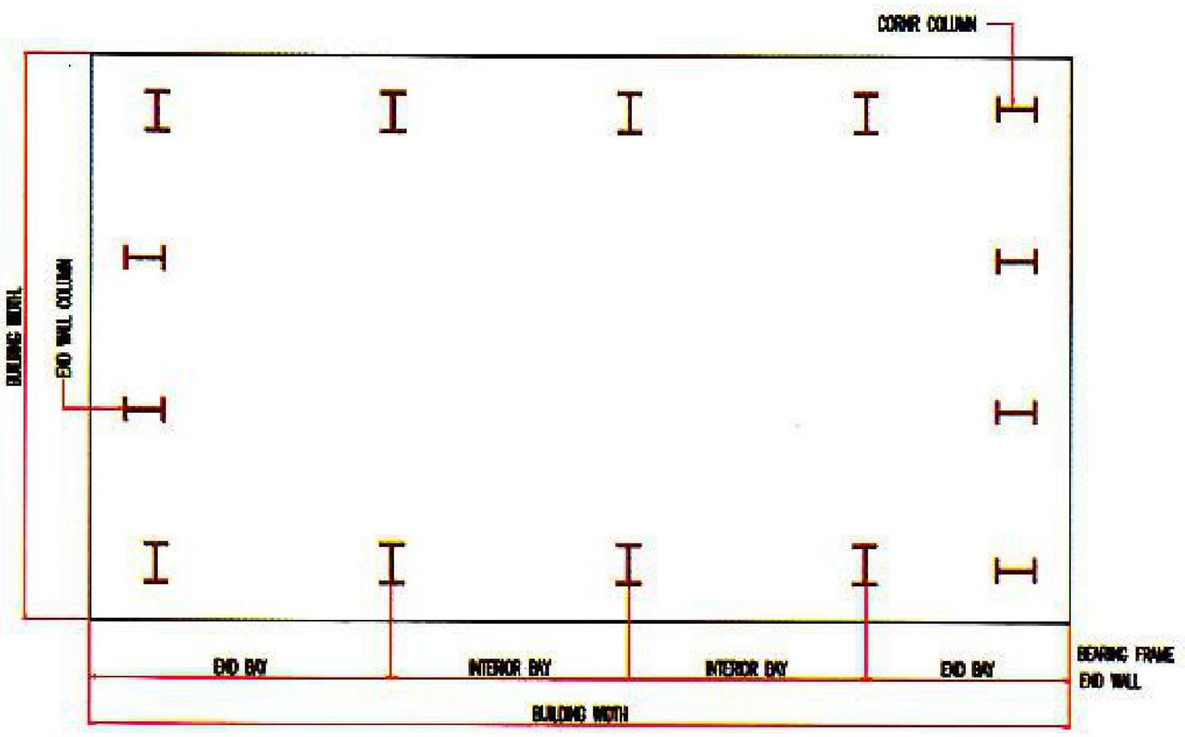
Interior bay length : The distance between the center lines of columns of the two adjacent main frames. The most common bay length used in the PEB industry one 5,6,7,8,9 and 10m.

Building height : (Eave height) The distance from Finish Floor Level (FFL) (normally the bottom of the main rigid frames column base plate) to the top outer point of the eave strut. Eave heights up to 30m are possible.

Roof slope (x/10) : Angle of the roof with respect to the horizontal. The most common roof slopes are 0.5/10 and 1/10. Any practical roof slope is possible.



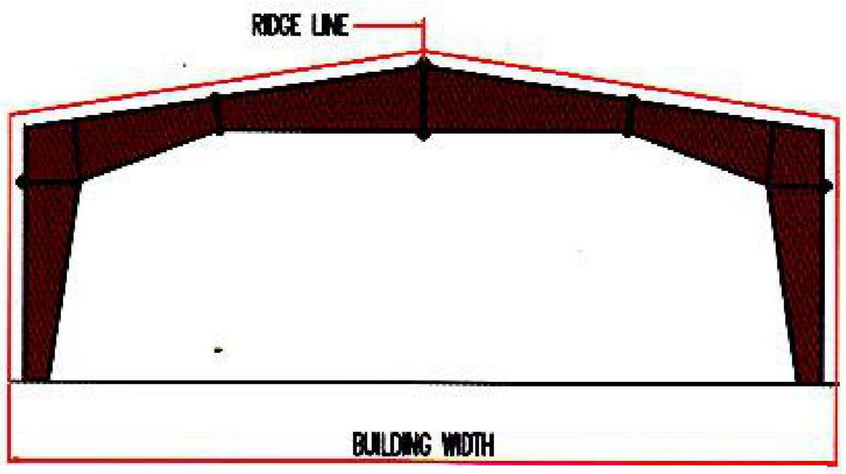
SECTION



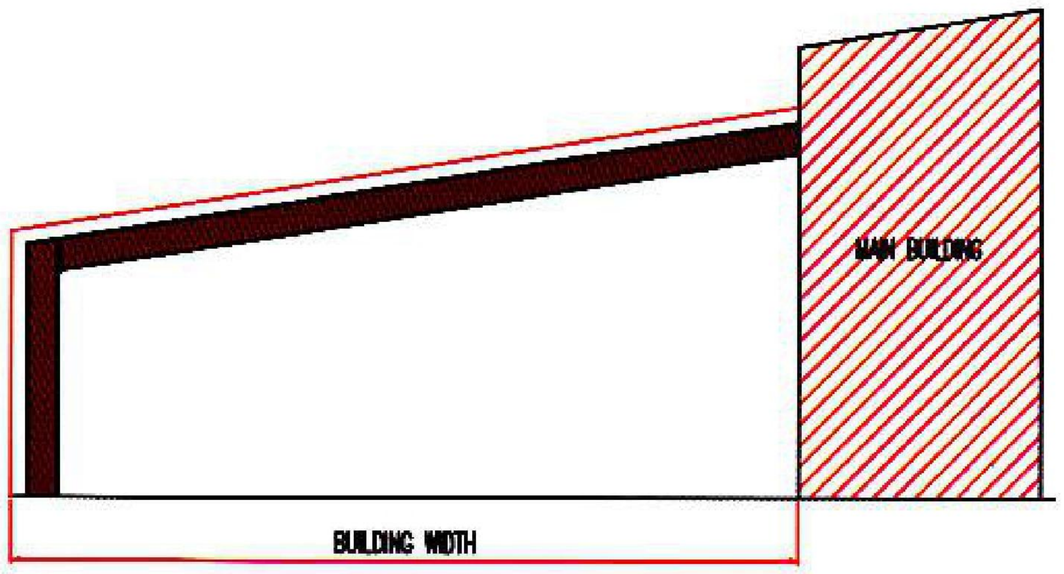
PLAN

Primary Framing Systems

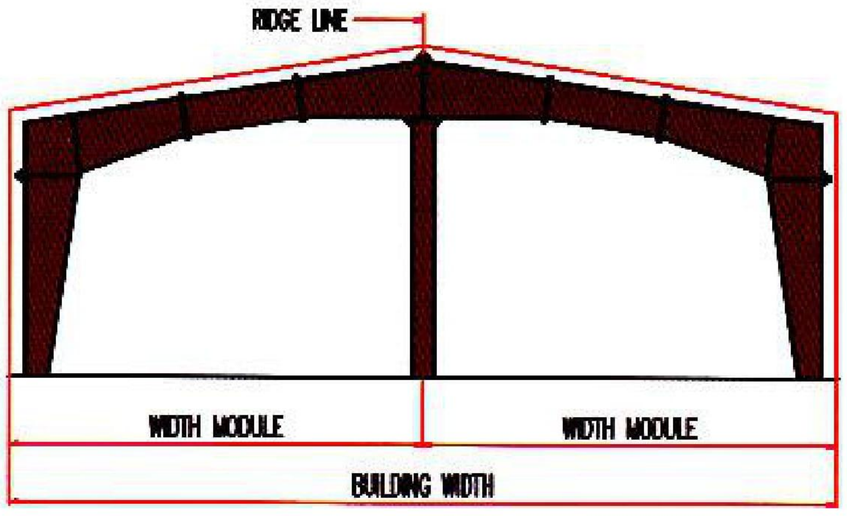
The most commonly used primary framing systems are shown below. All are shown symmetrical about ridge line. Framing systems which are unsymmetrical about the ridge line and multi span multi-gable framing with unequal modules are possible but may require more engineering time.



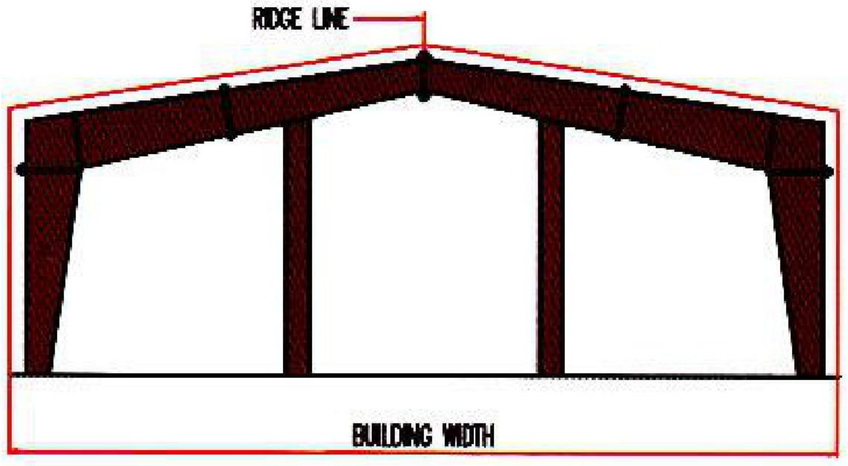
CLEAR SPAN(CS)



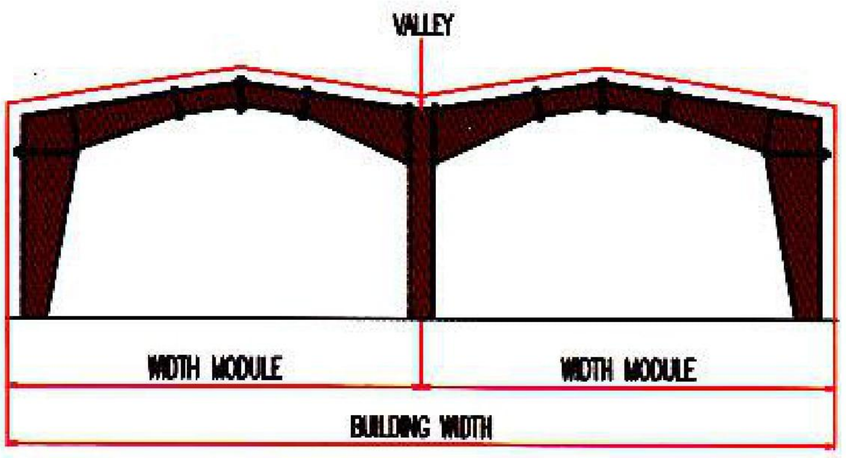
LEAN TO



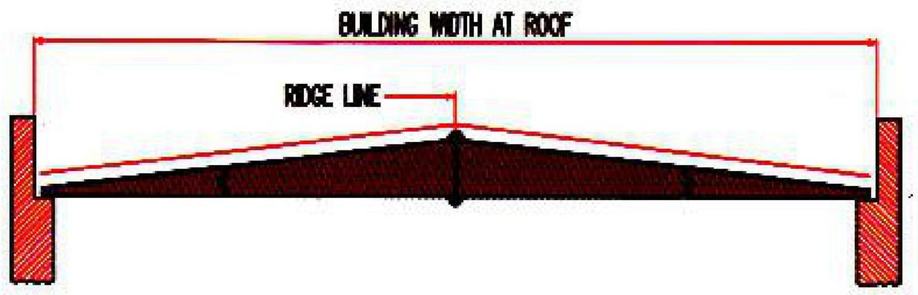
MULTI SPAN - 1(MS-1)



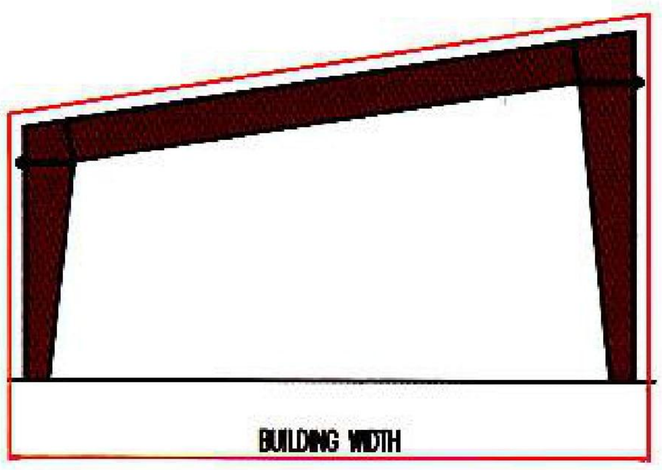
MULTI SPAN - 2(MS-2)



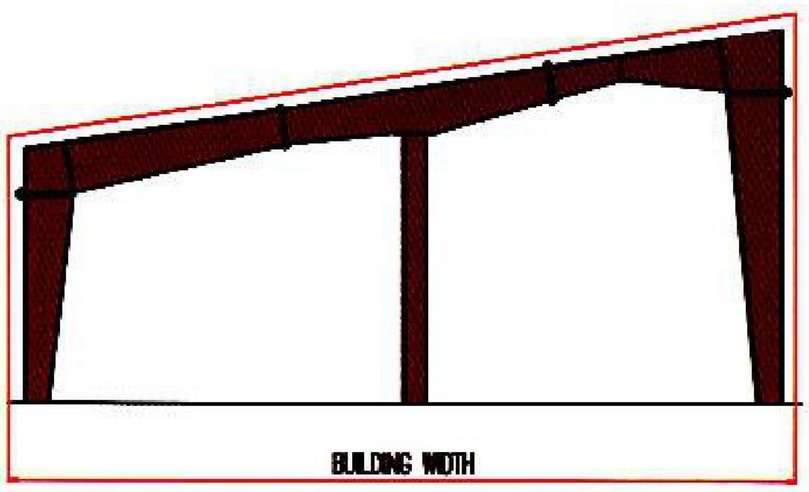
MULTI GABLE - 1(CS+CS)



ROOF SYSTEM



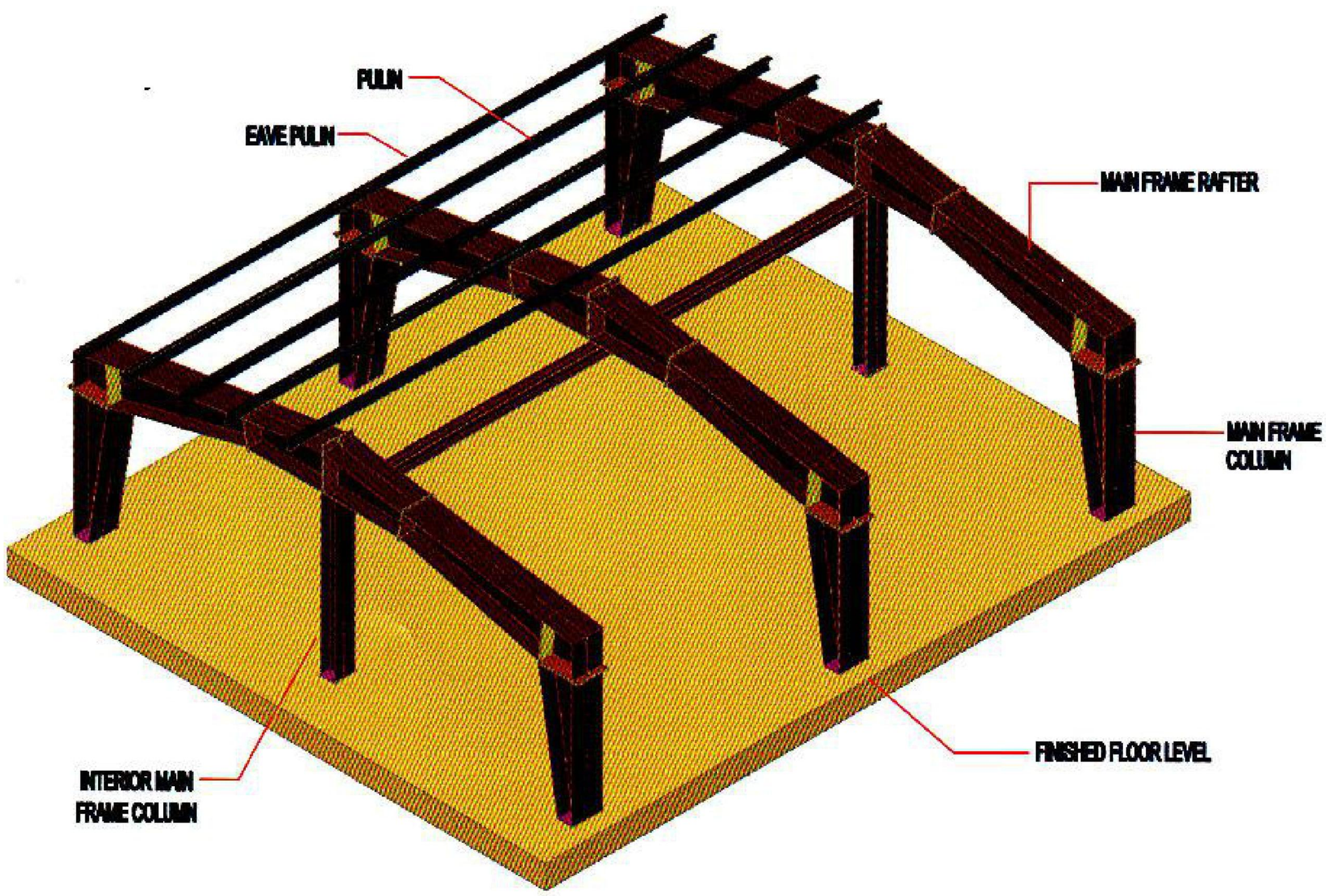
SINGLE SLOPE(CS)

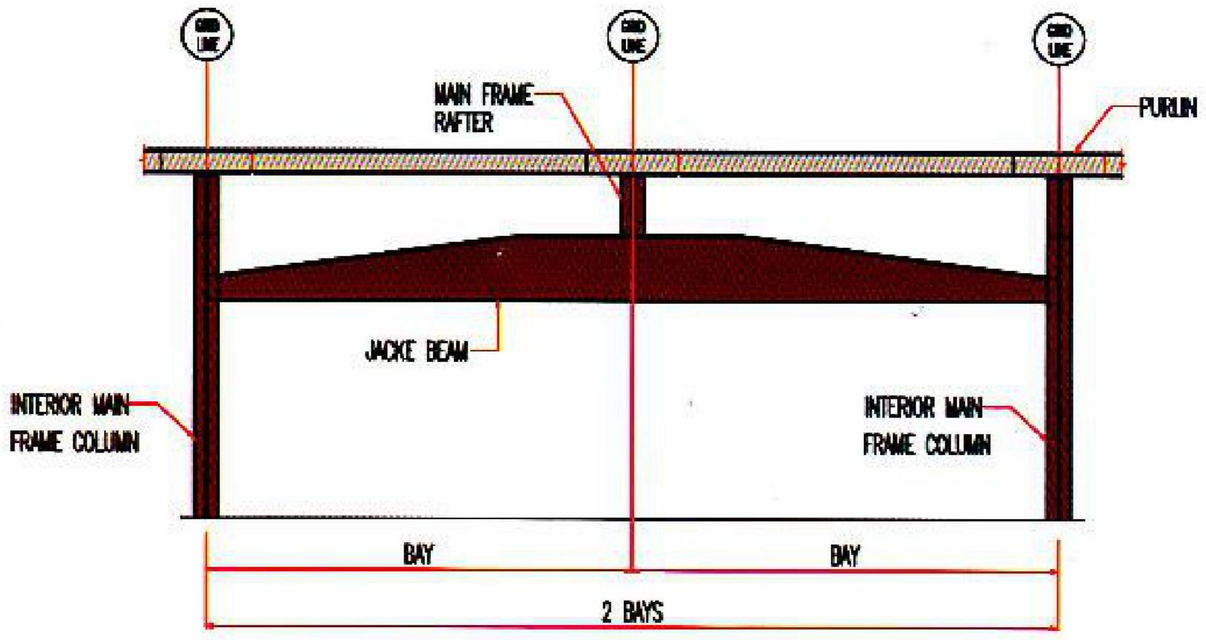


SINGLE SLOPE(MS-1)

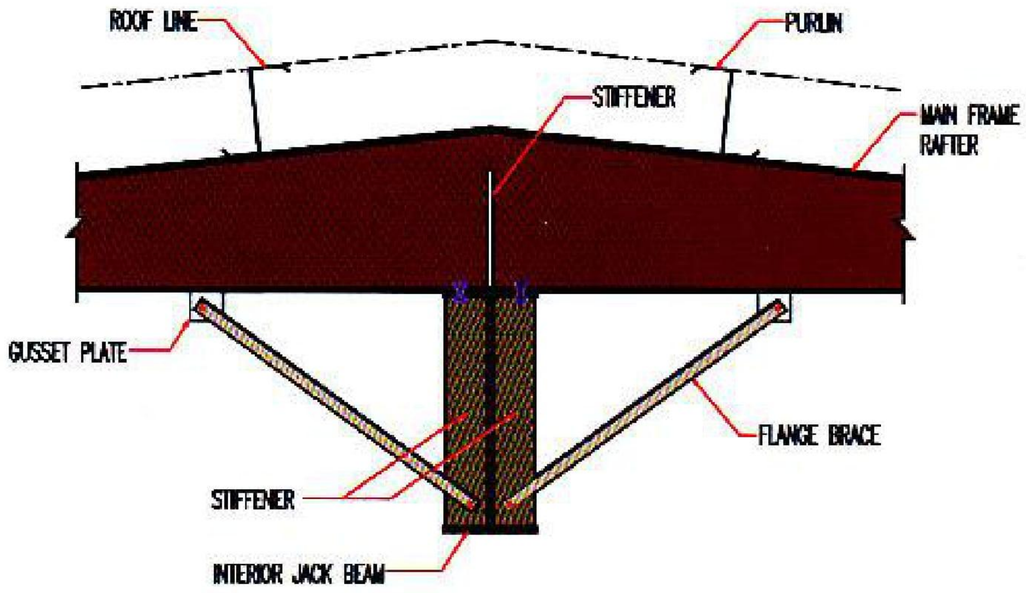
Basic Building Components
Jack Beams

Jack Beams are used to make economical as well as safe approach for creating longer bay length when large unobstructed space is required. Common bay lengths (5,6,7,8,9,& 10m) can be doubled with the use of jack beams making it possible to have 12,15,16,18 and 20m clear bay length in areas where unobstructed space is required. For example, if the customer specified to have 10m bay lengths instead of the more economical 8m bay length, Jack beams will be used in the interior of the building to make that possible. Jack beams may also be used on the exterior side walls in the same way.





INTERIOR JACK BEAM



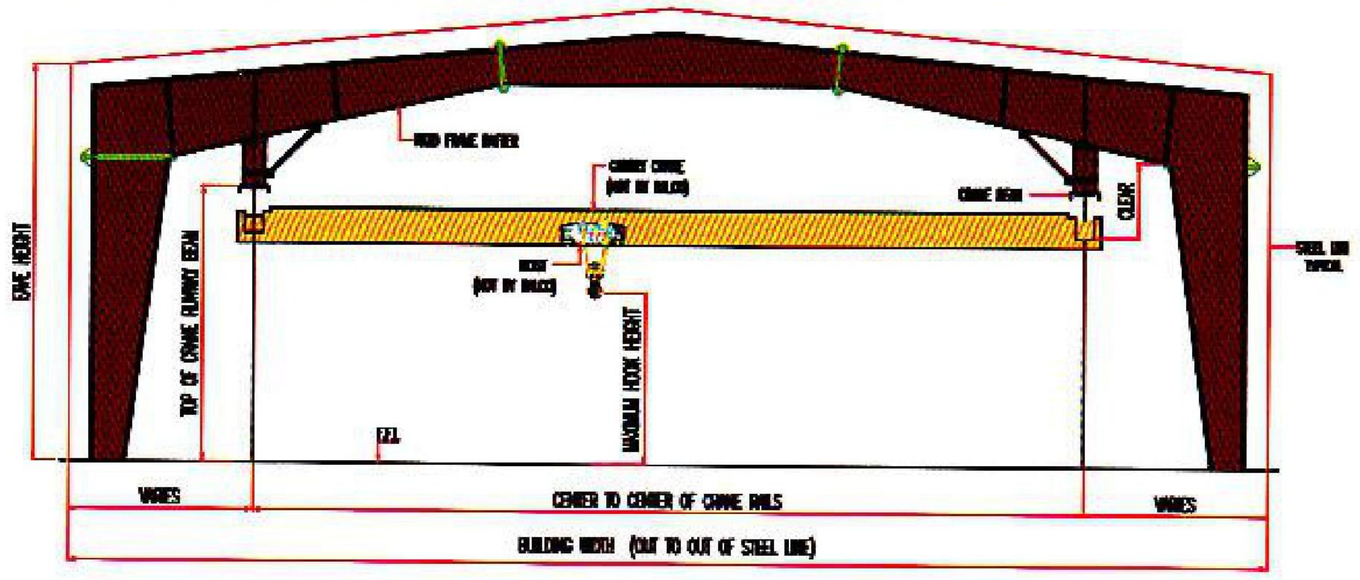
JACK BEAM AT MIDDLE OF RAFTER

Crane Systems

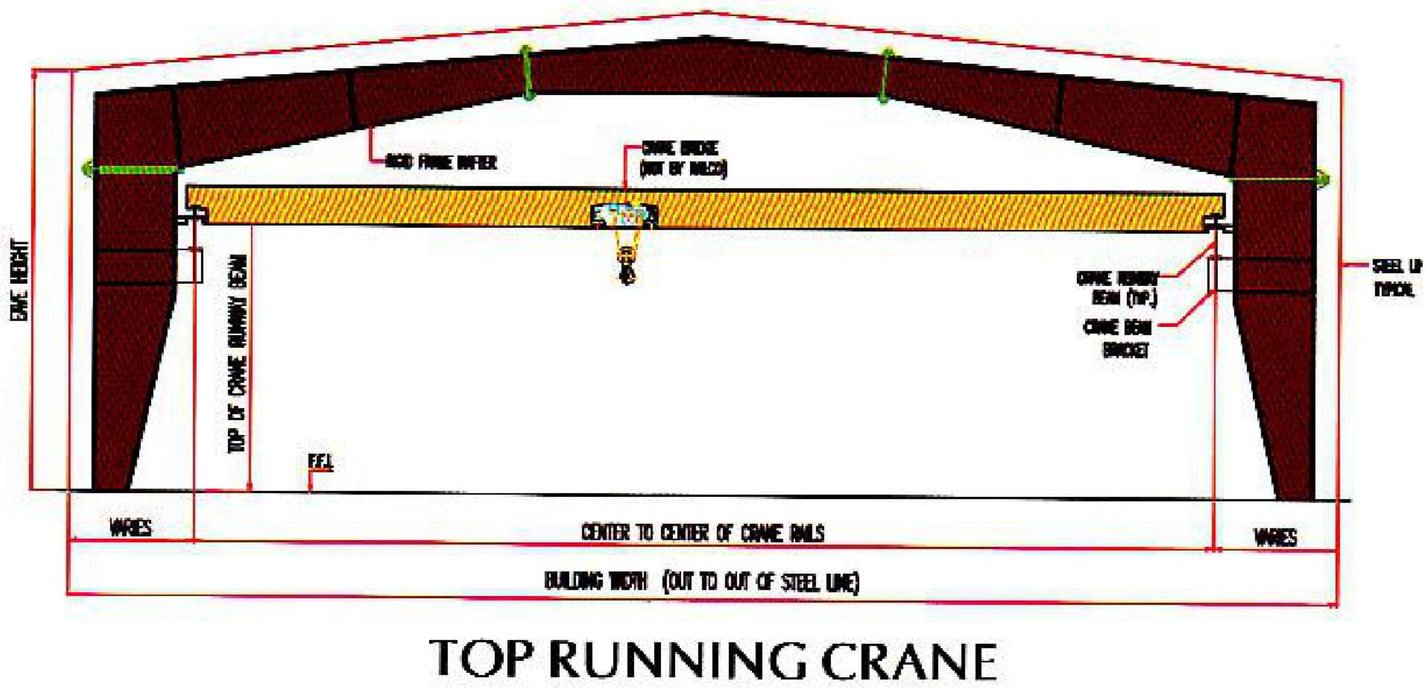
When crane system is required, RALCO supply includes column/ rafter brackets, crane runway beams & lateral tie that support crane system. RALCO request the customer to provide complete crane information from the crane manufacturer in order to design and estimate crane buildings.

The most common types of the crane systems in pre-engineered steel buildings are :-

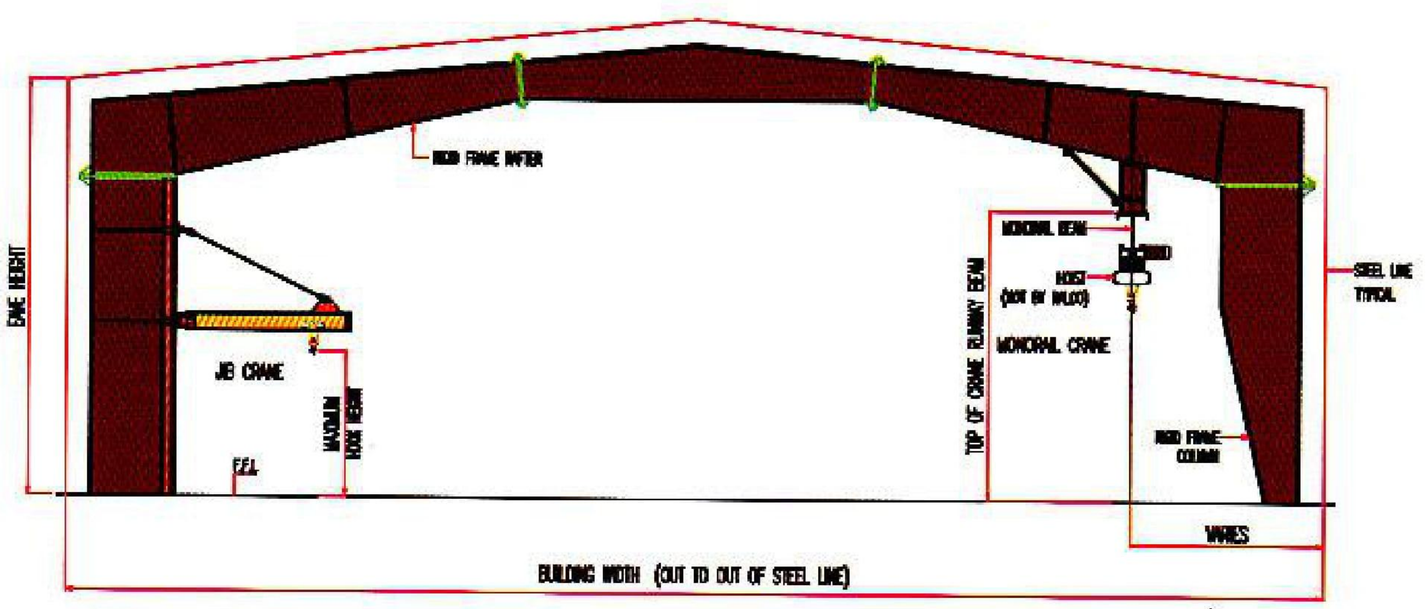
- Top running crane
- Underhung crane
- Monorail crane
- Jib crane
- Gantry crane
- Semi-gantry crane



UNDERHUNG CRANE



TOP RUNNING CRANE



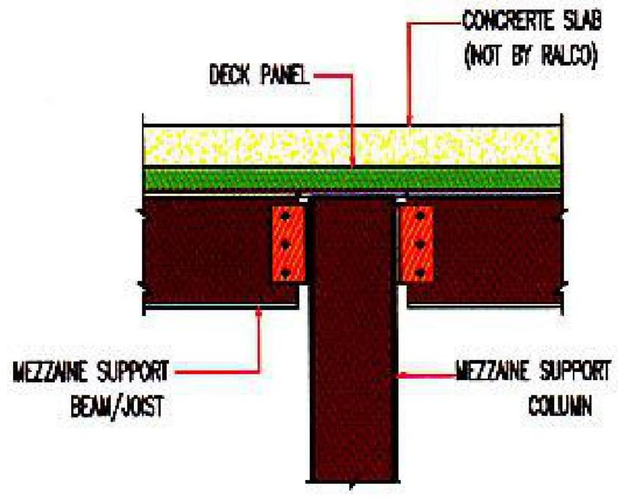
JIB AND MONORAIL CRANE

SEMI GANTRY CRANE

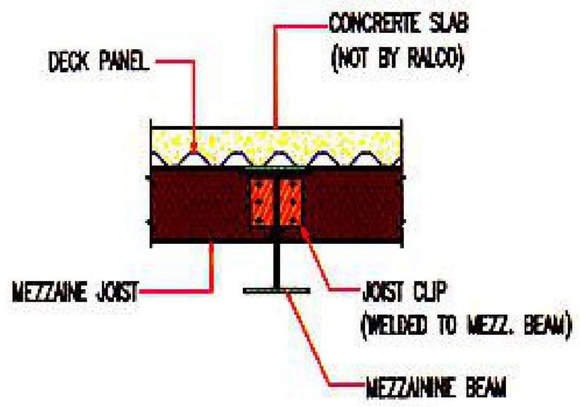
Mezzanine Systems

A mezzanine system is used to provide a separate floor in the building. A mezzanine consists of independent support columns, main beams, joists and deck panels.

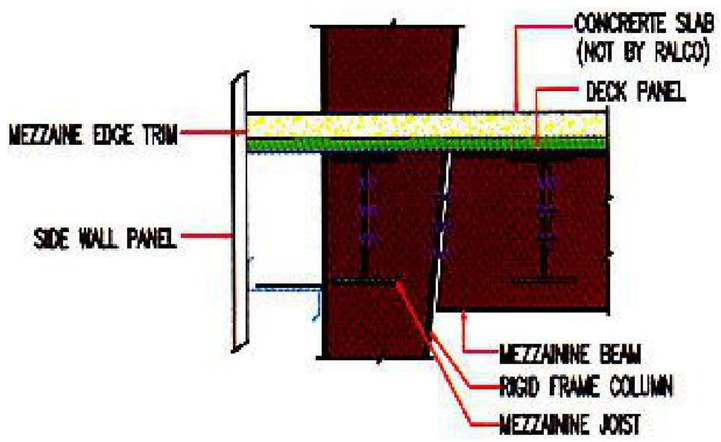
- Independent mezzanine columns may be square tube or built-up sections as required by the design. Mezzanine beams or joists can be connected directly to main frame columns.
- Mezzanine beams are built-up I sections that are normally spanning in the direction of rigid frame rafters.
- Mezzanine joists are built-up or hot rolled I sections that are normally spaced at 1.5m, for a 10mm thick concrete slab. Joist connects into mezzanine beams with flush type connection. The clear height below the mezzanine is normally 3m above the finished floor level.
- Mezzanine concrete slab should be designed by a qualified structural engineer to support the specified dead, live and collateral loads.
- Mezzanine deck fasteners are 5.5mm diameters, self drilling screws with hexagonal thread nuts but without a scaling, and are spaced at 333mm on centers.



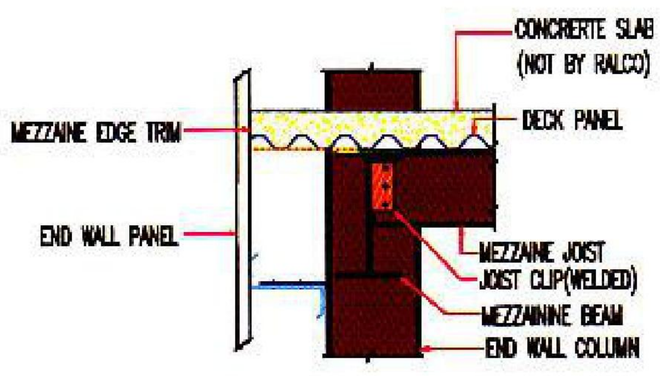
BEAM/JOIST CONN. TO MEZZ.COLUMN



FLUSH MEZZ JOIST CONN TO MEZZ.BEAM

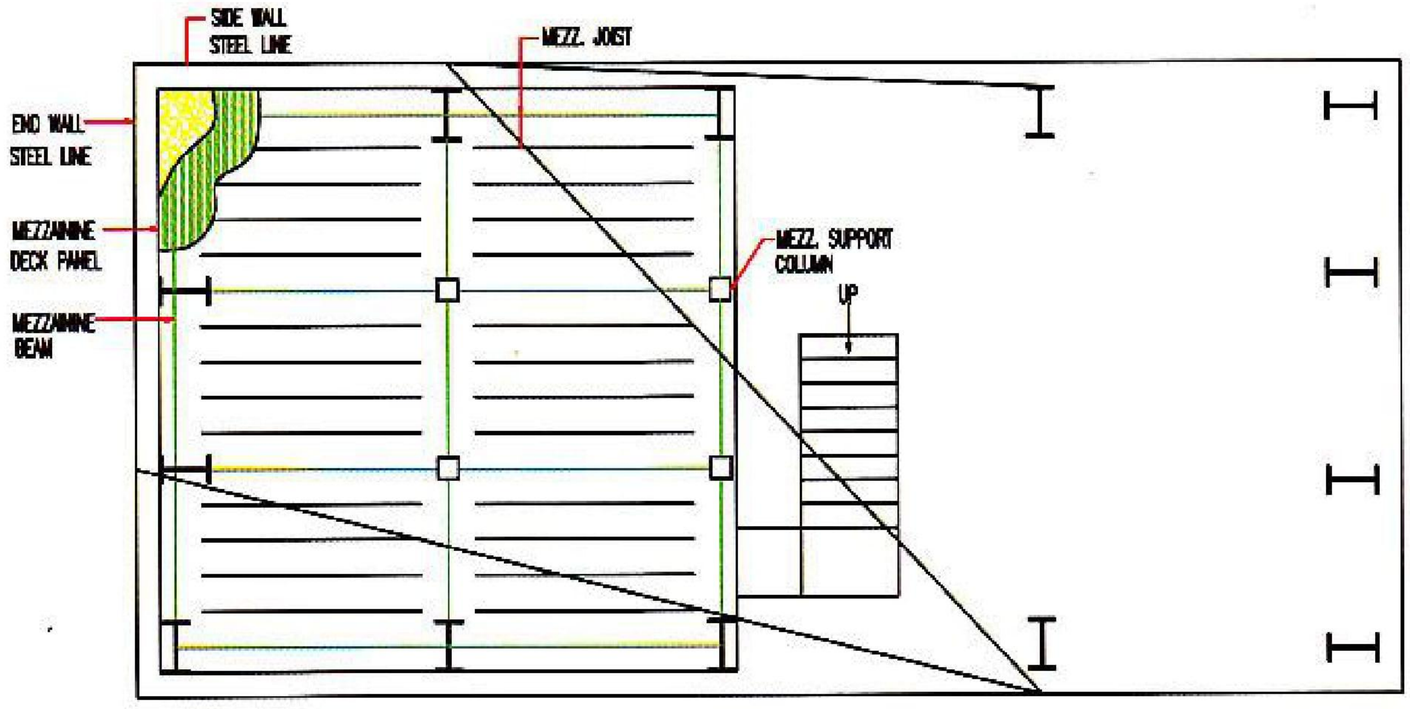


MEZZ CONN. TO MAIN FRAME



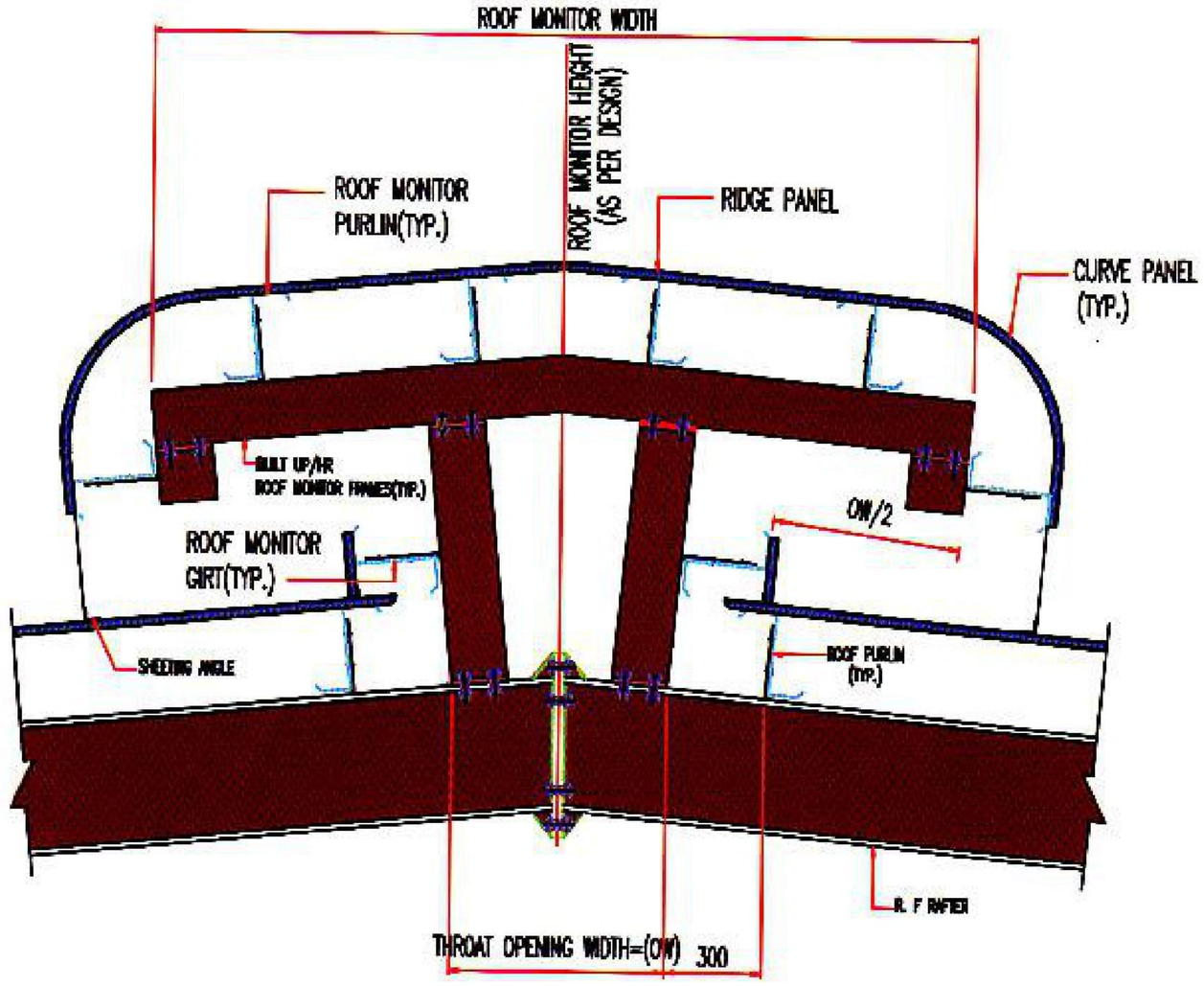
JOIST CONN. TO MEZZ.BEAM AT END WALL

MEZZANINE PLAN

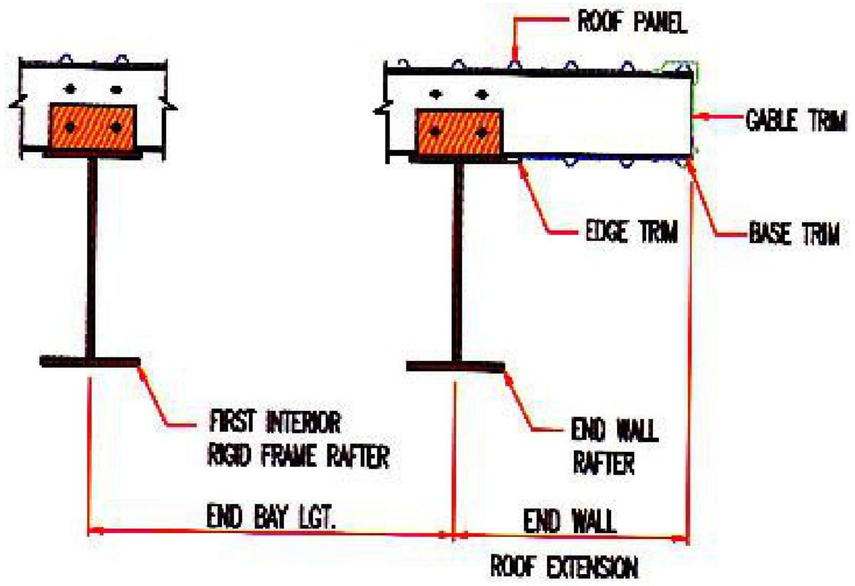


Roof Monitors, Roof Extensions and Canopies

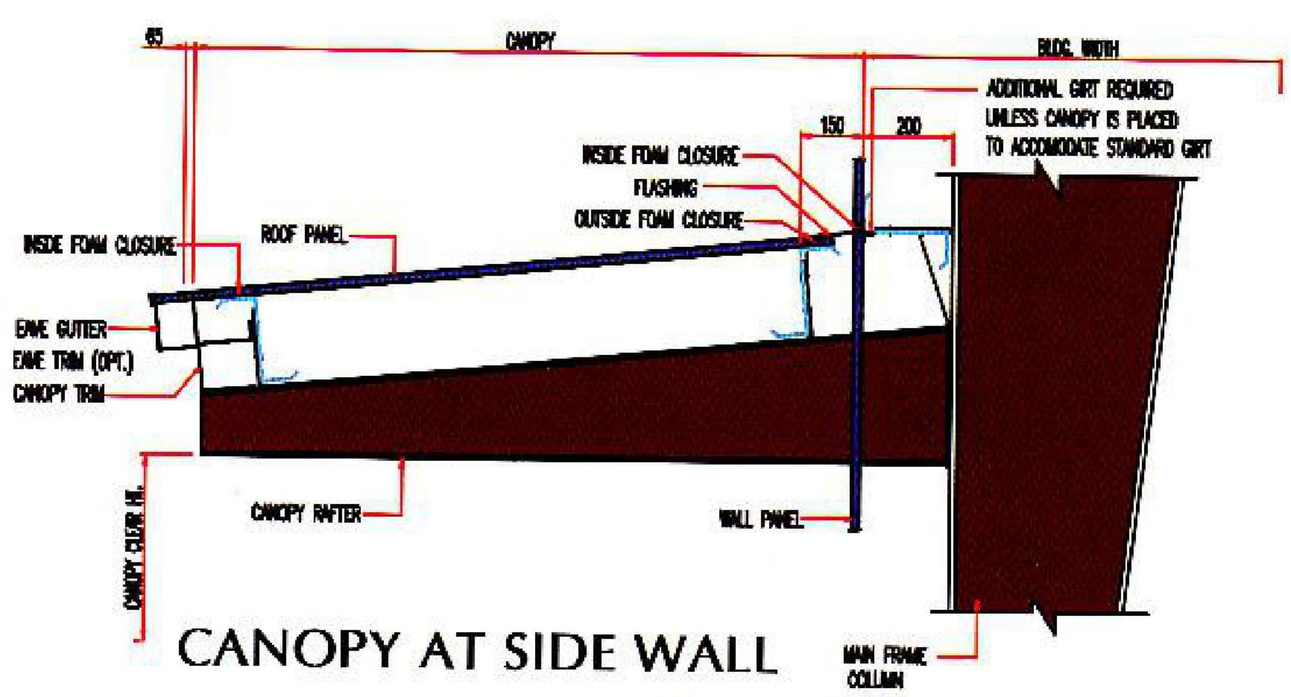
- Standard roof monitors have a throat opening width 1m and are made of hot rolled (or) built-up sections; wider throat opening widths are also possible. Panels for the roof monitors are made of the same materials as the roof panels, unless otherwise specified. Eaves are constructed with curved panels. A bird screen mesh is provided along both side walls of the roof monitor.



ROOF MONITOR CROSS SECTION



END WALL ROOF EXTENSION



CANOPY AT SIDE WALL

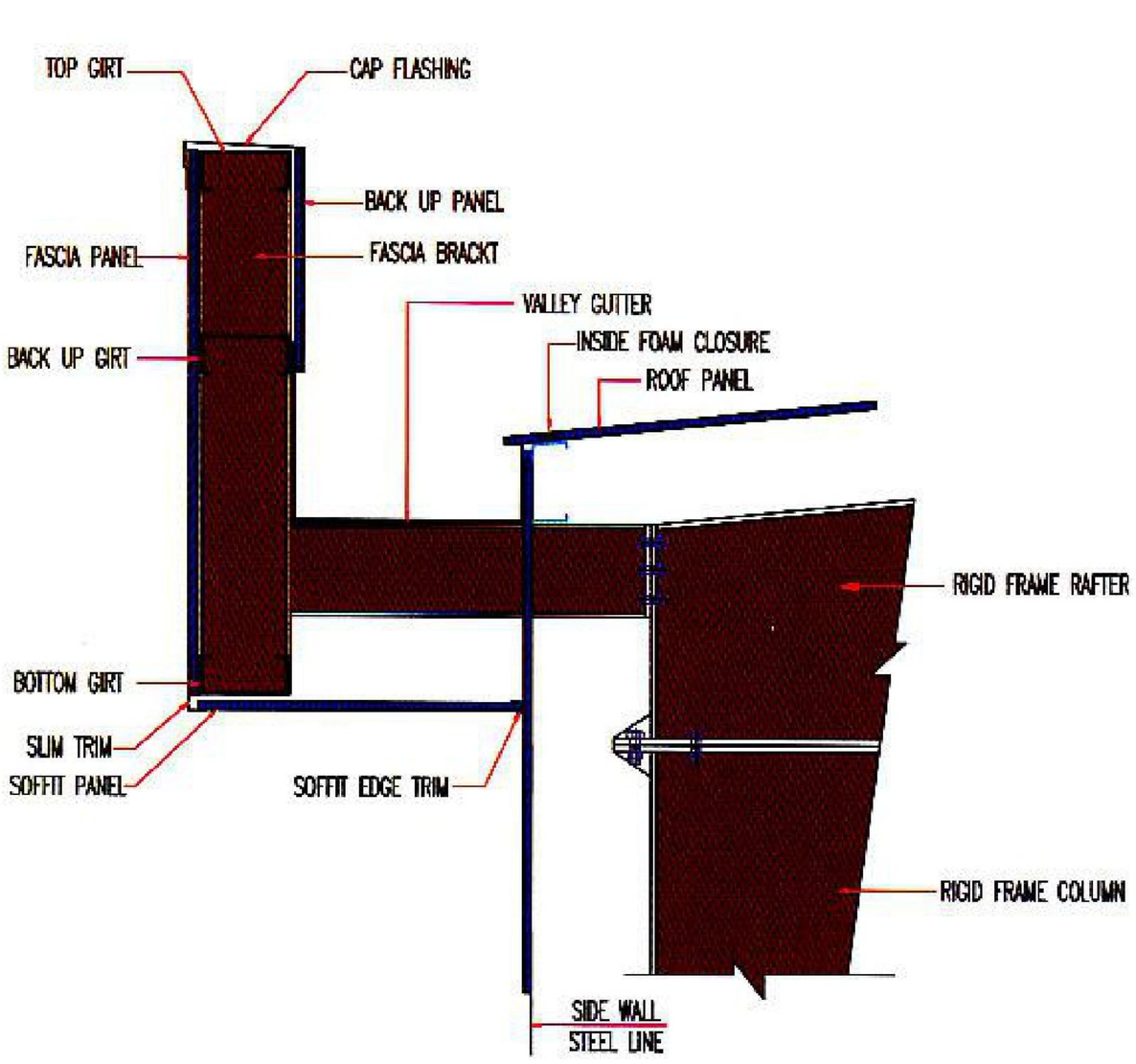
- Standard sidewall roof extensions are 1.5m wide. They are made of 200mm deep hot rolled or built-up section rafter and 200mm flush eave struts and purlins making it possible to add an optional soffit panels without the need of additional framing. Wider extensions and extensions that support fascias are achieved using tapered built-up rafters and by-pass purlins.
- Standard endwall roof extensions are 1.5m wide. They are achieved by extending the end bay purlins beyond the endwall steel line. They can accommodate an optional soffit panel without the need for additional framing; longer extensions may require heavier endwall purlins that are deeper than 200mm.
- Standard canopies are 1.5m wide. They are cantilevers beyond the steel lines of a building at a height that is below the eave. Their rafters are made of hot rolled or built-up sections. The cano pies can be supplied with or without soffit panel.

Facias

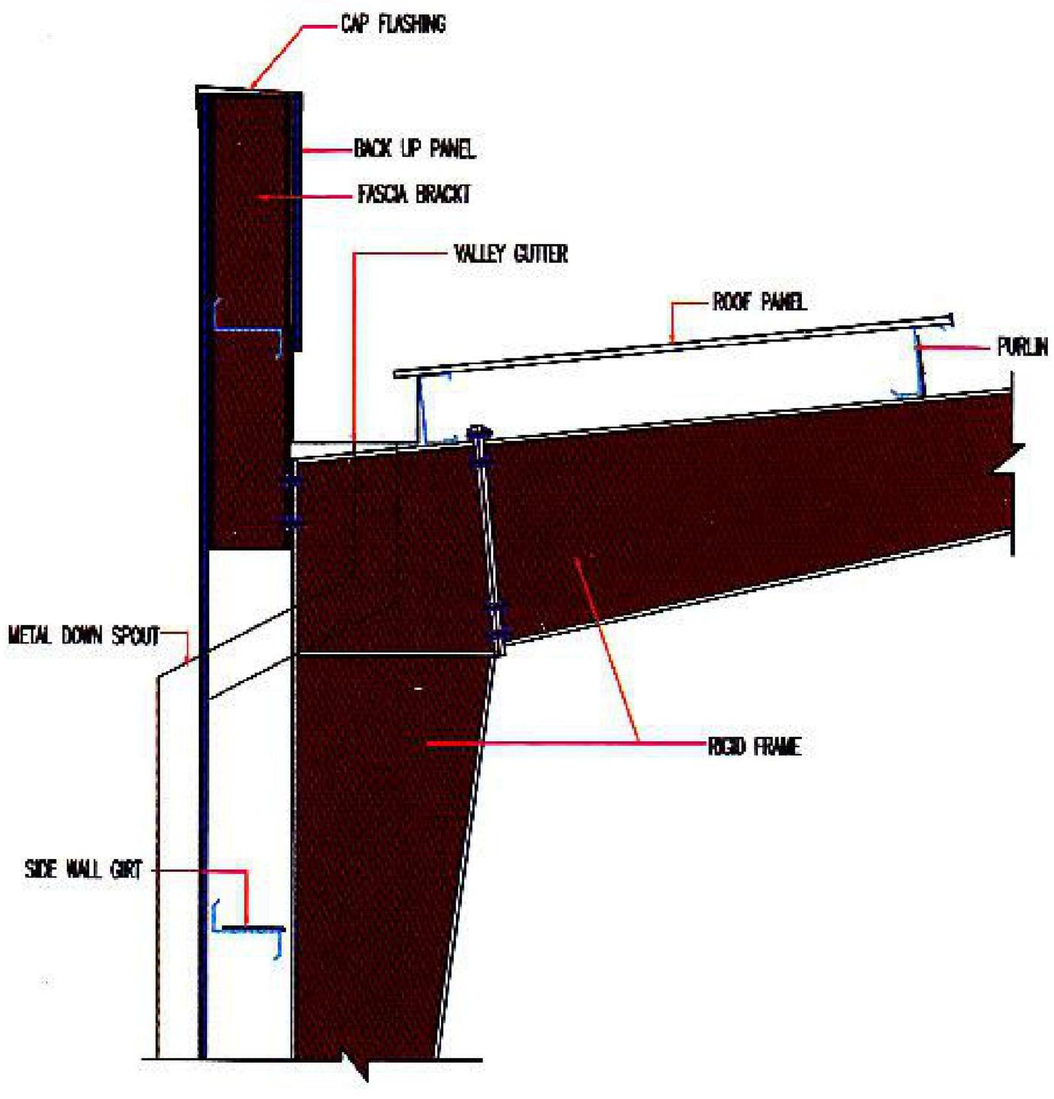
There are five common types of fascias. When panels and panels accessories are not in RALCO scope, only the fascia framing will be supplied.

- Vertical Fascia.
- Center Curved Fascia.
- Bottom Curved Fascia.
- Top and Bottom Curved Fascia
- Parapet Fascia

If the main purpose of a fascia is to conceal the gable/roof slope of a building, RALCO recommends the use of vertical fascias and center fascias because they can be used without the added expense and maintenance requirement of valley gutters.



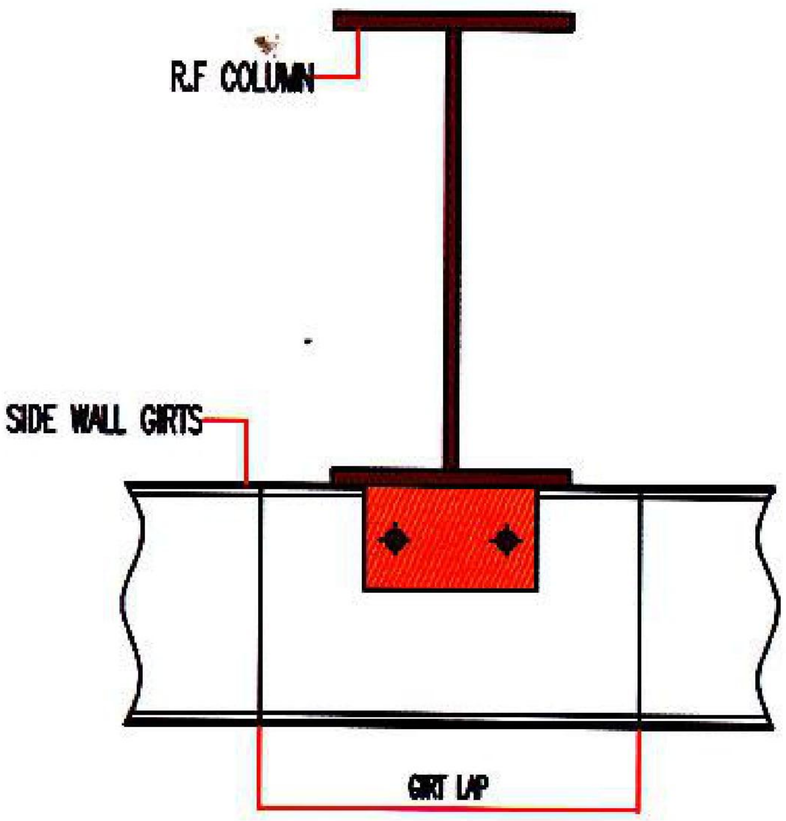
VERTICAL FACIA



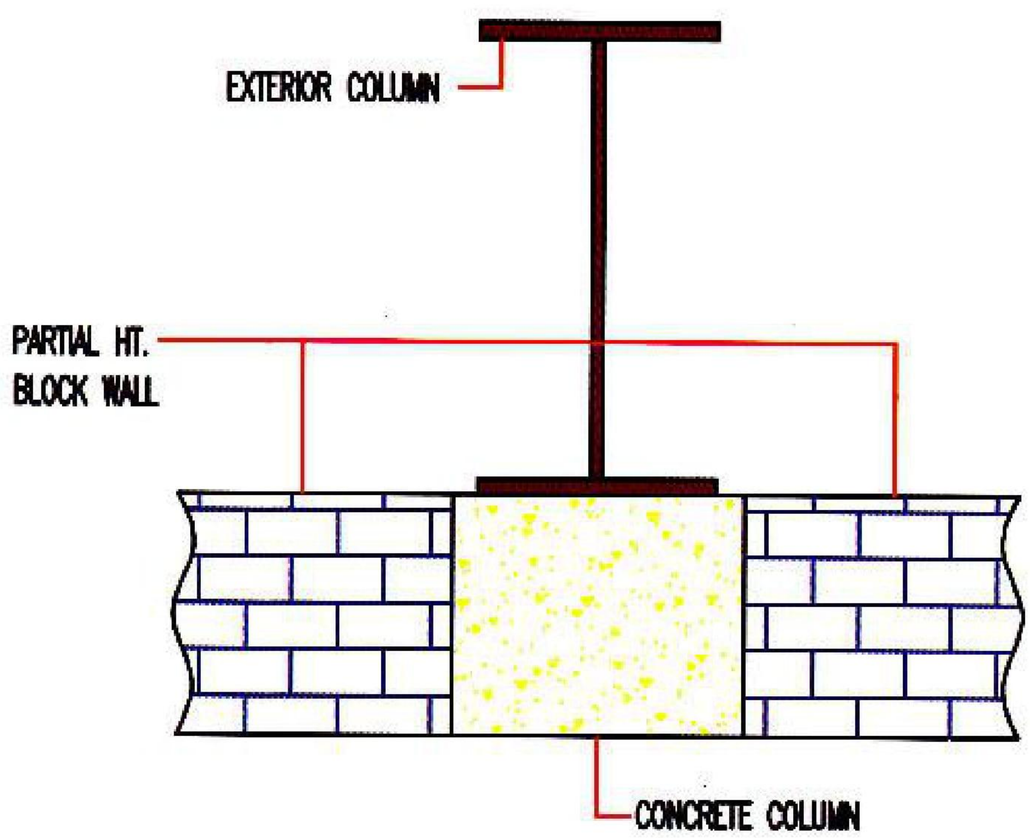
PARAPET FACIA

Secondary Structural Members

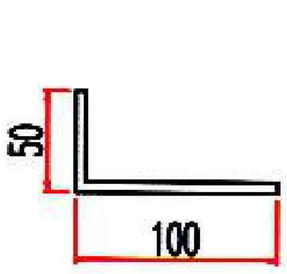
Secondary structural members are made from material that conform to ASTM A653M grade SS: 340 G90 class 1 and are designed in accordance with the 2002 edition of the American Iron and Steel Institute (AISI), Cold formed Steel Design Manual. It include roof purlins, wall girts, eave struts, C-Section, flange brace, gable angles and base angles. Purlins, Girts, Eave Struts and C-Section are rolled formed from 345mm wide galvanized coils in thickness of 1.5, 1.75, 2.0, 2.25 and 2.5mm.



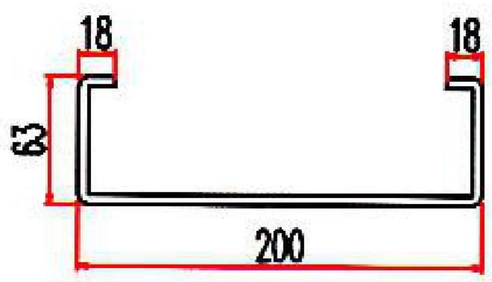
BY-PASS GIRT



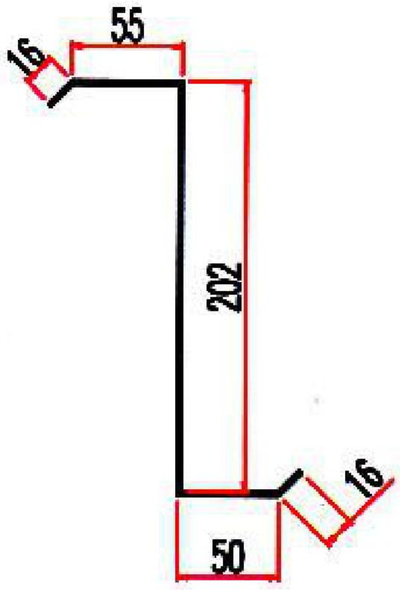
BY-PASS BLOCK DETAILS



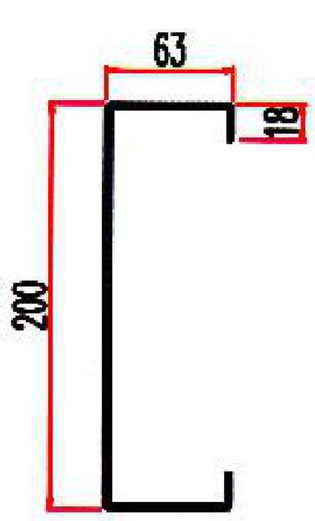
BASE ANGLE



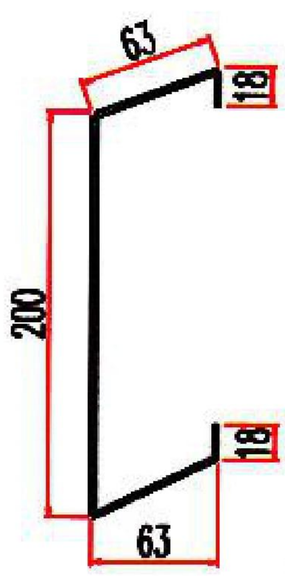
BASE CHANNEL



Z-SECTION



C-SECTION

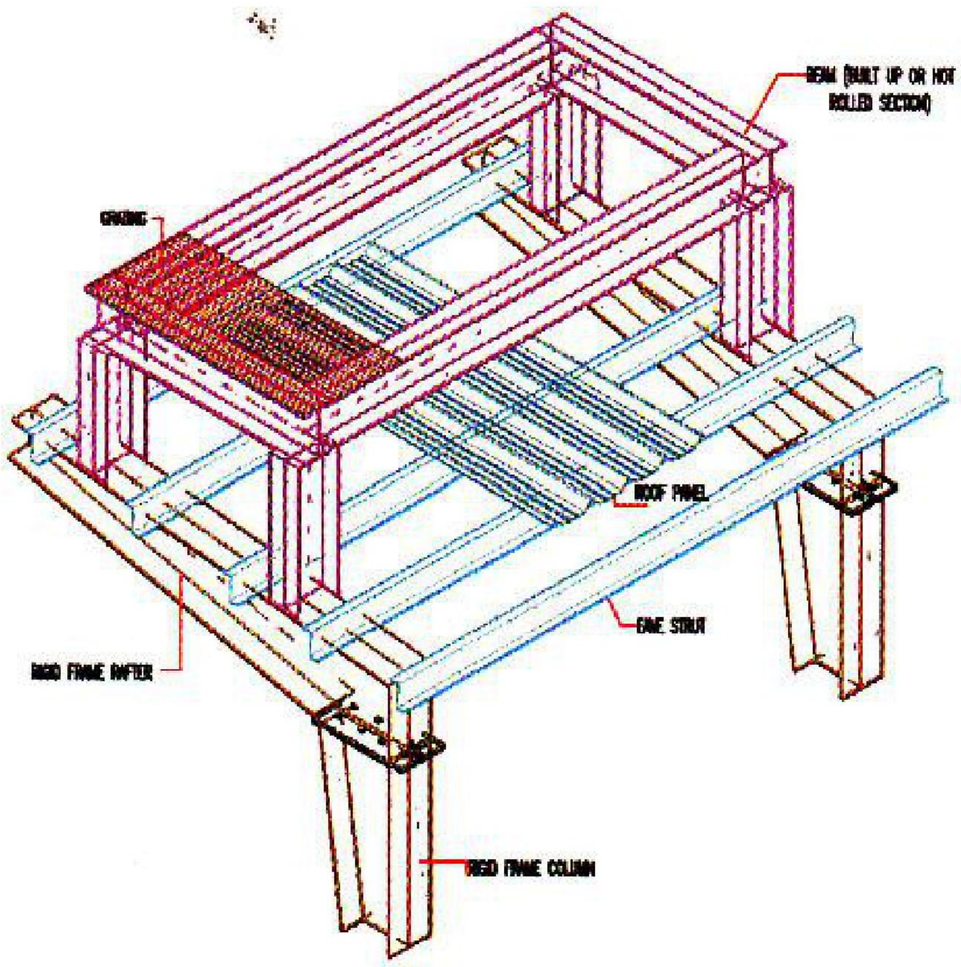


EAVE SECTION

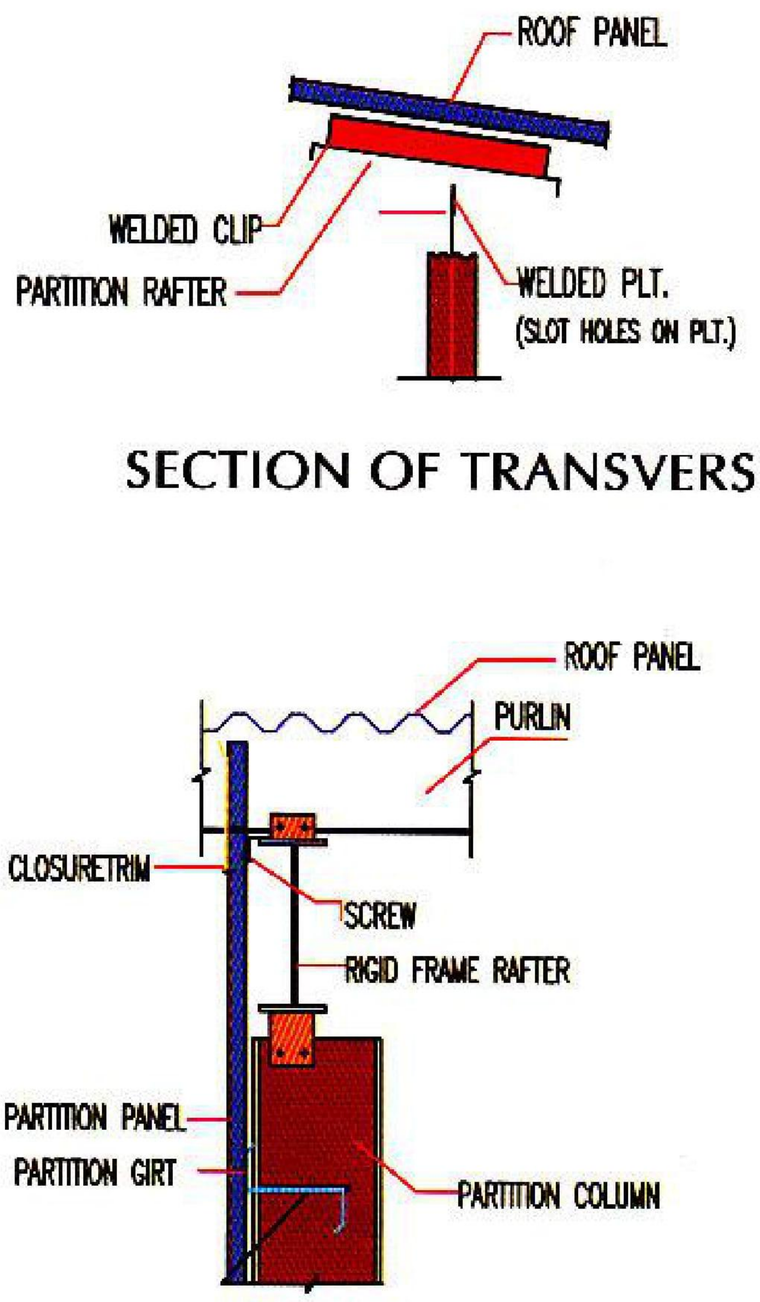
Interior Partitions and Roof Platforms

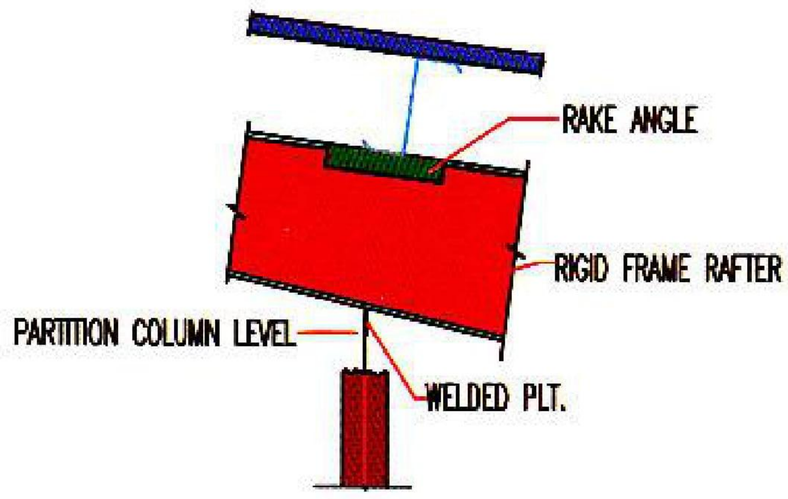
Interior partitions are used to divide the space in a building. It will not carry any loads from the roof. Following are the types of partitions.

- Transverse partitions may be located along a rigid frame line or in between rigid frames.
- Longitudinal partitions may be located anywhere between sidewalls. Partition framing is normally designed for a lateral wind load of 0.25 KN/m2

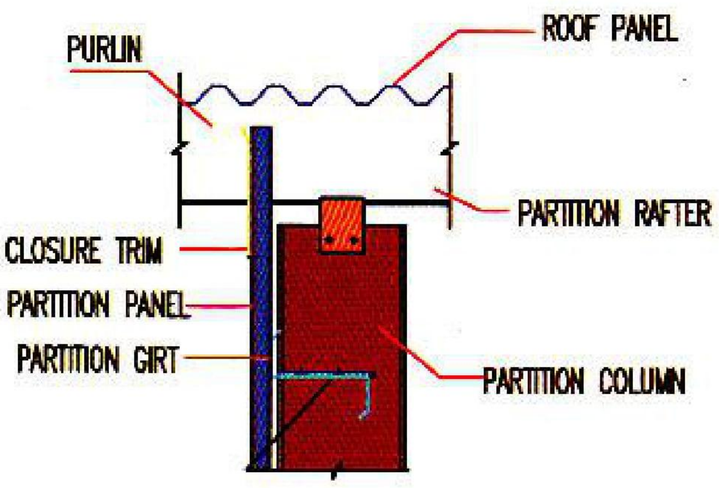


Roof Platforms : are made up of hot rolled pipe stub columns and structural framing that is located above the roof panels, often for the purpose of supporting A/C units, equipments, water tanks, etc. The structural framing is made of built-up or hot rolled sections. Stub columns and the structural framing are epoxy painted to prevent rust. As they are continuously exposed to the atmosphere, pipe flashing is used around pipe columns to prevent potential water leaks.





SECTION OF TRANSVERSE PARTITION AT RIGID FRAME



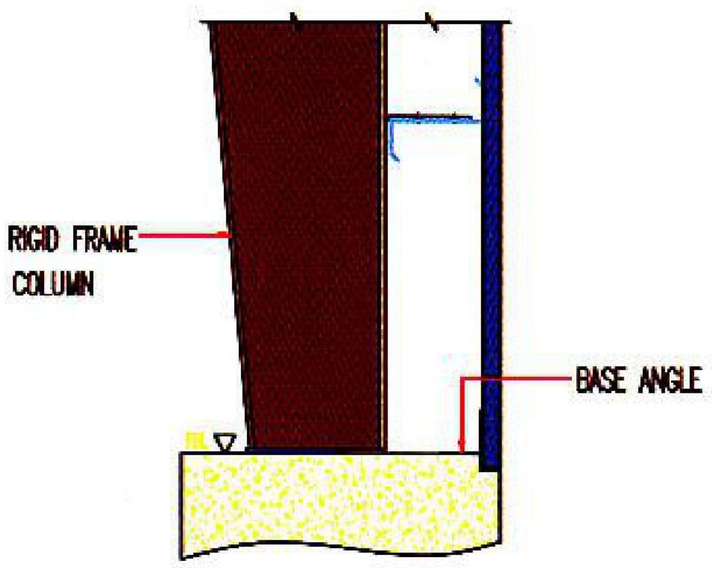
SECTION OF LONGITUDINAL PARTITION RIGID FRAME

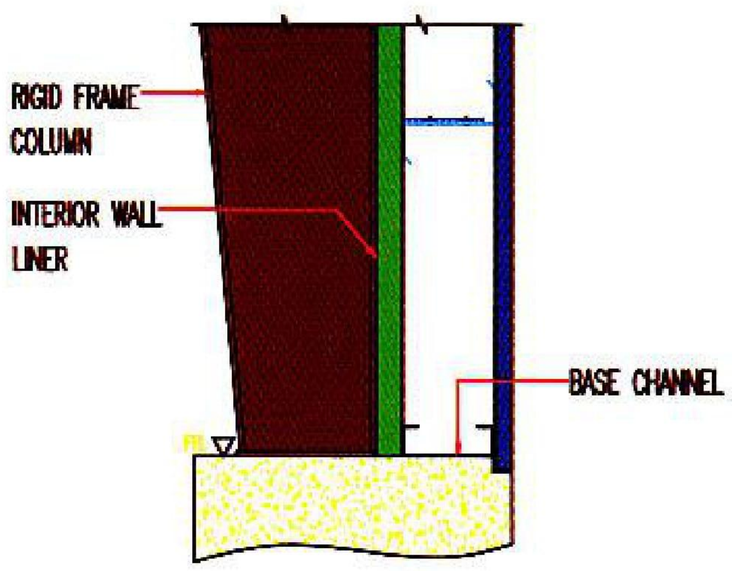
A common practice in the PEB industry is to connect the sidewall girts to rigid frame column and to connect the end wall girts to wind columns in a by-pass condition.

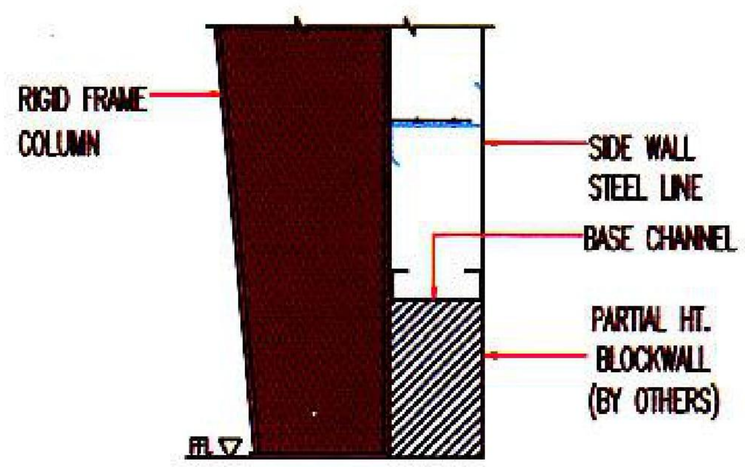
The by-pass condition is more practical in endwalls because it allows cables,pipes,etc. to be laid within the 200mm girt line all around the building. It also allows a better construction of partial height block wall (normally 2.25 to 3.00 m high) which are very common in this region.

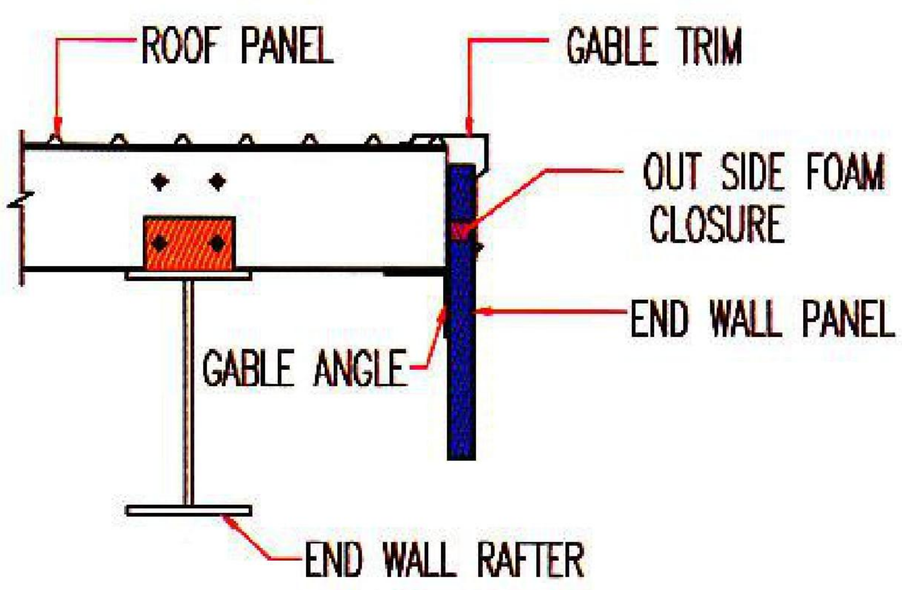
Gable Angles are connected to bottom flanges of roof purlins at building ends using self drilling fasteners. They transfer the wind load from the endwall panels which are fastened to this gable angle to the roof purlins, at the gable of the building.

Base Angles are fastened to the concrete floor with masonary nails at 500mm on centers. They transfer the wind load from wall panels directly to slab. When interior wall liner is required, a base channel is used instead of a base angle.





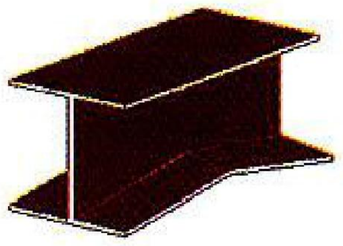




Primary Built-Up Members

High grade steel plate conforming to ASTM A572 grade 50

TYPICAL COLUMN



TYPICAL RAFTER

Common applications of PEB

Industrial

- Factories
- Workshops
- Warehouses
- Rolling mills
- Cold Stores
- Oil & Gas Industry
- Cement & Steel Plants

Commercial

- Shopping Malls
- Showrooms
- Distribution Centers
- Supermarkets
- Hyper markets
- Labor Camps
- Fast Food Restaurants
- Low Rise Office Building

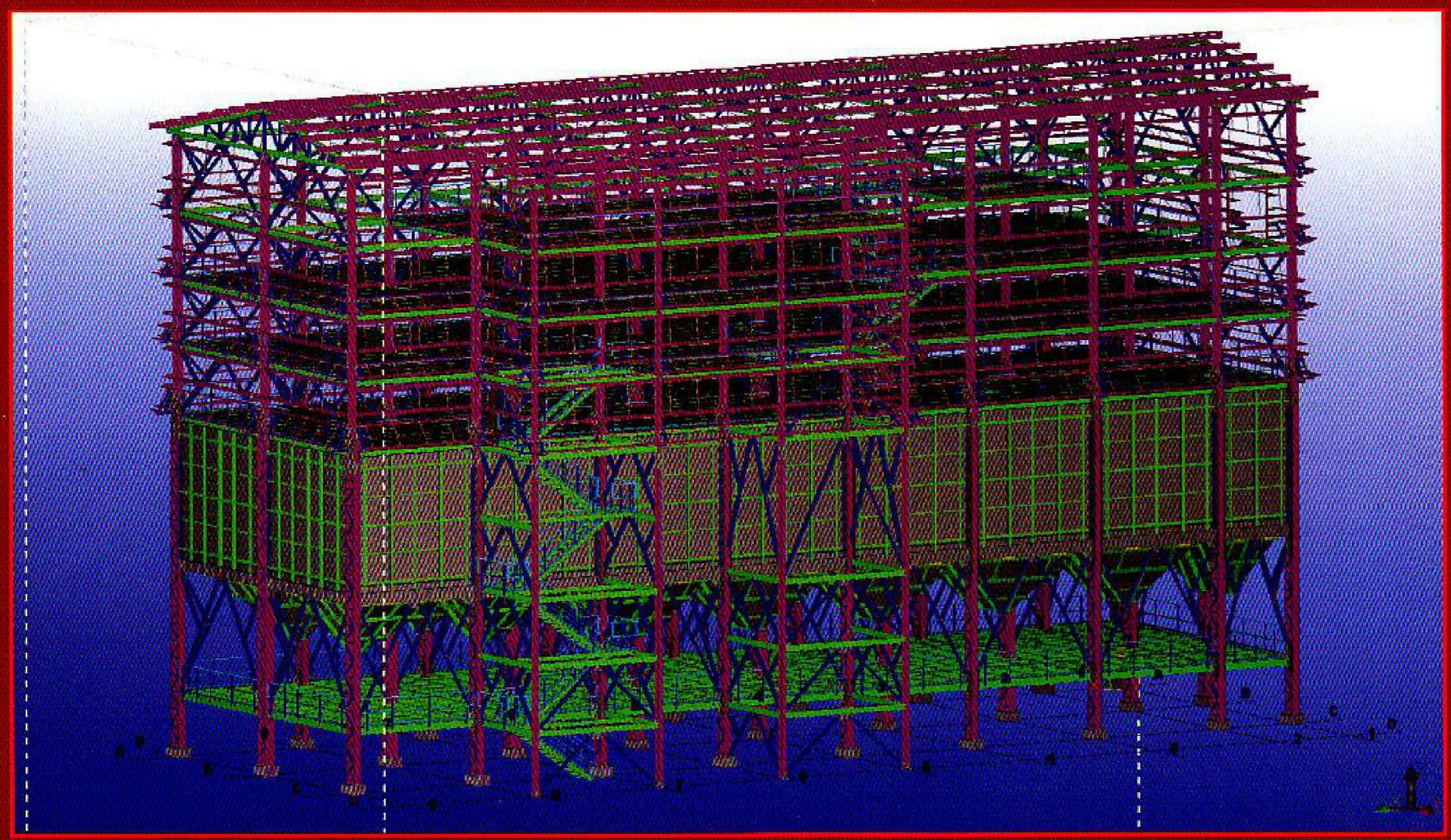
Institutional

- School
- Exhibition Halls
- Hospitals
- Theaters / Auditoriums
- Sports Halls
- Libraries

Specialty Buildings

Specialty buildings require additional considerations, more engineering time and longer delivery time. In short, any kind of structure can be done in PEB. Specialty building include :

- Aircraft Hangers
- Vehicle parking Shelters
- Bulk Storage building
- Fuel Stations
- Poultry Farms



RALCO STEELS PRIVATE LIMITED

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FACTORY

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