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Why PEB Structures are Needed and Its Benefits

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ABSTRACT:

Through a variety of new products and services, technological advancements in each industry have contributed to the improvement of quality of life. One of the construction industry's revolutions is the pre-engineering building structure (PEB structure). Traditional steel building structures have long had a problem with excessive steel consumption and greater structure costs (CSB structure). However, the PEB structure concept includes appealing elements that optimise the design, such as members that are developed according to the steel frame's bending moment diagram, resulting in a structure that is efficient in terms of steel consumption and cost. In any sort of industrial structure, column-free structures with extensive spans are needed, and PEB structures meet this criterion while taking less time and money than CSB structures. That is why, in addition to maintaining the quality of predesign and prefabrication, this process is adaptable due to its lightweight and cost-effective design.

Introduction:

In practically every corner of the world, the steel sector is expanding rapidly. Steel is the preferred design material because it is naturally ductile and flexible. Steel constructions are not only cost-effective, but also environmentally benign at a time when global warming is a concern. In this case, the word "economical" is defined in terms of both time and money. Steel structures (pre-fabricated) are built in a very short amount of time, and PEB structures are a good illustration of this. PEB structures are steel constructions in which surplus steel is avoided by tapering the sections to the required bending moment. If we use normal steel constructions, the time frame would be longer, and the cost will be higher, making it uneconomical. As a result, with PEB constructions, the entire design is completed in the factory, and members are prefabricated and brought to the site where they are erected in less than 6 to 8 weeks.

Steel buildings also have far superior strength-to-weight ratios than RCC and can be removed much more readily. Because PEB constructions have bolted connections, they can be dismantled and reused. As a result, PEB structures can be relocated and/or expanded to meet future needs. The market for the PEB structure was worth $2.06 billion in 2015, and it is expected to grow to $3.56 billion by 2020. The manufacturing capacity of the PEB structure is 6.0 lac tonnes per year. The industry is increasing at a compound annual growth rate of 25-30 percent (CAGR)**.**

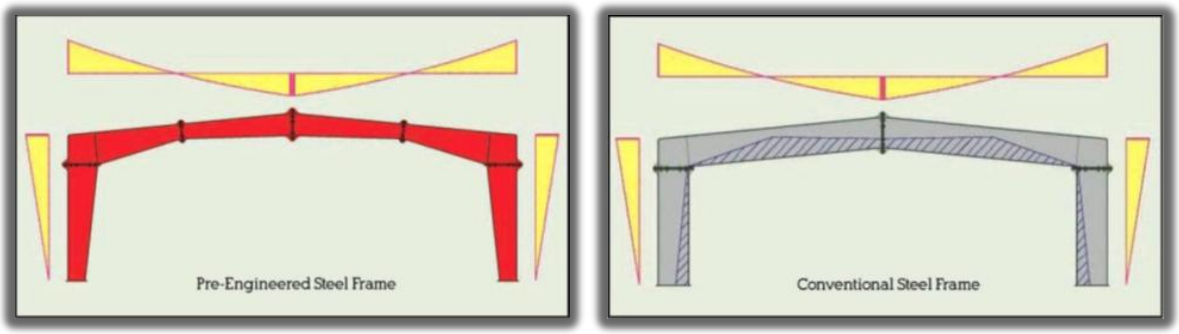


Fig. Conventional steel frame and pre-engineered steel frame

Because of their basic design, simplicity, and ease of installation, unbraced frames, such as portal frames, are the most prevalent type of frames used in industrial building construction. This sort of frame allows for a large utility area with the least amount of column space possible. Inner columns are eliminated in such structures, requiring significantly less foundation and area, as well as valley gutters and internal drainage. The portal frame is a rigid jointed plane that supports roofing and side cladding and is comprised of hot rolled or cold rolled sections. Its usual span is 30-40 metres, and bay spacing is 4.5-10 metres.

Components of PEB structure:

1. Main Frame/Primary Members:

A PEB structure's primary members are the load-bearing and support members. Columns, rafters, and other supporting parts make comprise the mainframe. These members come in a variety of shapes and sizes, depending on the application and requirements. The frame is put together by bolting the connecting section endplates together.

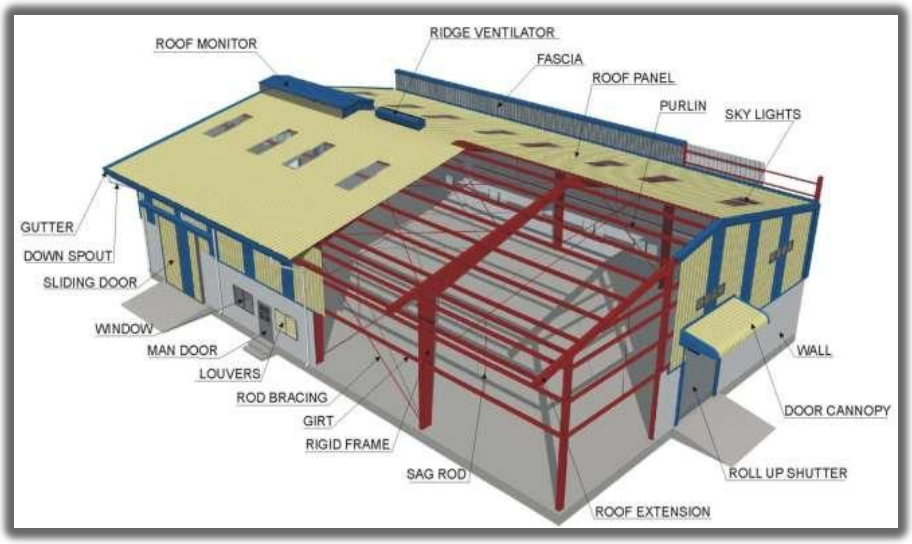
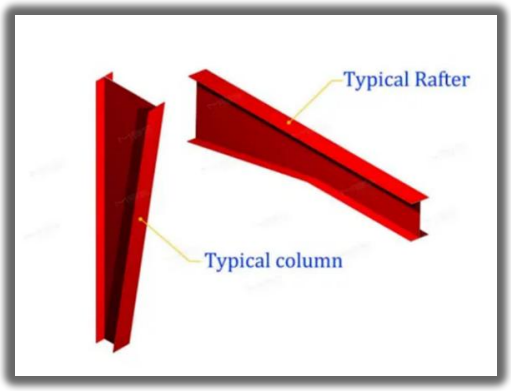


Fig. Components of PEB structure



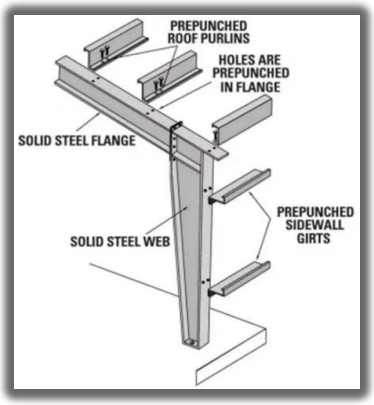
Moment resistant frames provide lateral stability and use anchor bolts to transfer roof and wall loads to the base. Tapered or constant depth columns and rafters are used to construct mainframes. The tapered profile is based on the structure's moment diagram, resulting in more economy than any other construction. This is the primary distinction from other structural steel frame buildings, which use straight columns and beams. To ensure excellent quality and speed of fabrication, the tapered parts are welded using an automatic welding equipment. A continuous single-side fillet weld joins the flanges to the web. Splices with a flange plate are frequently installed in the frame's low-moment zones.

2. Secondary Frame/Cold-Formed Members:

Purlins, girts, eave struts, wind bracing, flange bracing, base angles, clips, and other miscellaneous structural pieces are all examples of secondary structural framing.

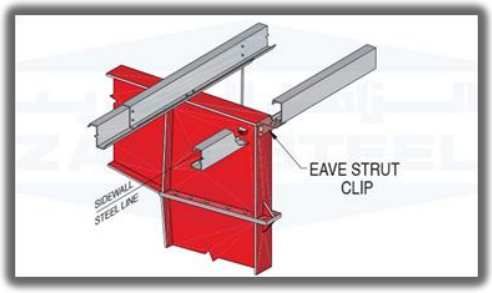
(i.) Purlins and Girts:

Purlins and girts are employed on the roof, grits on the walls, and eave struts at the juncture of the sidewall and the roof. Cold-formed "Z" sections with stiffened flanges shall be used for purlins and girts.



2. Eave struts:

Eave struts must be cold-formed "C" sections with uneven flanges. Eave struts are 200 mm deep, with a 104 mm top flange and a 118 mm bottom flange that run parallel to the roof slope. Each flange has a stiffener lip of 24 mm.

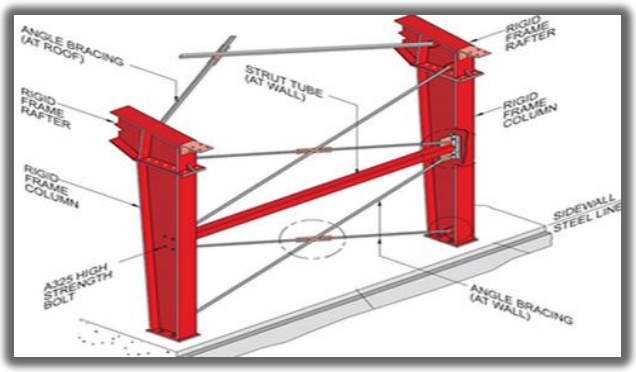


3. Exterior cladding:

Exterior cladding creates a water-tight seal around the building. The structural loads, such as wind and live load, are transferred to the secondary framing. The Purlin and girt are braced on both sides by it.

4. Wind bracing:

A main part that ensures the building's stability against longitudinal pressures such as wind, cranes, and earthquakes is cable bracing. The roof and side walls must have diagonal bracing. It allows wind loads operating on the building's end walls to be effectively transferred to the foundation.



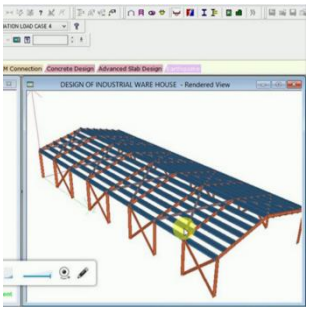
5. Other accessories:

Bolts, turbo ventilators, skylights, lovers, doors and windows, roof curbs, and fasteners are examples of non-structural components of the buildings.

Process of construction of PEB structure:

The PEB structure construction process is roughly divided into the following parts:

1. Designing: In a PEB construction, design is a critical factor. Experienced personnel are on hand to ensure a safe and efficient design.



2. Detailing: We use a variety of applications for detailing, all of which produce excellent results and make our erection work easier.

3. Planning: In-house ERP system that integrates all departments and allows for accurate project planning.

4. Production: The most up-to-date state-of-the-art manufacturing facilities allows us to give the highest quality products to our customers.

5. Painting: Painting is done on primary and hot-rolled members to extend the material's life and give it a nice aesthetic appearance.

6. Shipment: A well-trained dispatch crew and approved logistics vendors send materials to the job site and track shipments in real time.

7. Erection & Installation: Using an experienced and sufficient project team, as well as a certified erector, erect the building according to the timeline.

7. Building maintenance and after-sales services: After the building is handed over, the sales and project teams are always available if any service or alteration is required.

Conclusion:

To summarise, "PEB structures provide end-users with a considerably more cost-effective and better solution for long-span structures requiring significant column-free spaces." As a result, in terms of cost-effectiveness, time-saving, future scope, subtlety, and economy, the PEB structure outperforms the CSB structure. The findings reveal that steel structures are significantly more cost-effective, energy-efficient, and design-flexible than other types of industrial structures.

There was also a 37 percent overall material and cost savings in the PEB structure as compared to the CSB structure. It's conceivable because the framework incorporates all of the traits that are compatible with modern needs, such as speed, quality, and cost-effectiveness. For huge industrial enclosures with thermal and acoustical properties, it would be the only option. The main benefit of metal construction is the rapidity with which it can be designed and constructed for a variety of structures.

PEB constructions are more cost-effective and save materials. PEB structure implementation is increasing, although utilisation of PEB structure is lower than projected. PEB structures are simple to create. As a result, more study is needed to produce more outputs for design methodologies and material reduction in PEB structures.

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