

**COMMITTED TO  
EXCELLENCE**

# HANDBOOK

**A FLEXIBLE SOLUTIONS - TAILOR MADE FOR YOUR NEEDS**

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**ENDEE INFRASTRUCTURES AND DEVELOPMENTS PVT. LTD**

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Ground Floor, 2nd Main Road, Gandhi Nagar,  
Adyar, Chennai - 600 020

# HIGH QUALITY PRE-ENGINEERED STRUCTURES



Rather than a PEB complexity, Endee Infrastructures aims to provide pre-engineered building solutions that bring a sigh of relief. We do not profess we have the best pre-engineered building solution for your project.

Let's Get Your Facility Pre-engineered with Specialist in design and Built

Rather than a PEB complexity, Endee Infrastructures aims to provide pre-engineered building solutions that bring a sigh of relief. We do not profess we have the best pre-engineered building solution for your project. We're transforming industries and improving everyday life. As a world-class Pre Engineered Building operations management consulting firm, we are in the business to become the most respected provider of a solid backbone and other support systems to build a modern society and improving operational performance for our clients. Through our experience, insights and innovative solutions, we help our clients prepare for the challenges of tomorrow, today.

## Why Endee Infrastructures?

- Latest International Codes
- Consistency & Commitment to Quality
- Cost effective Solutions
- One-Stop Solution
- Reliable after aale service
- Detailed engineering output
- Performance-driven philosophy
- Faster cycle times
- On-time delivery
- Value-engineered solutions

ENDEE

# VISION, MISSION & CORE VALUES



Mission, Vision, and

THE ENDEE PROMISE  
WE BUILD FOR LIFE



## VISION

For PEB to be recognized as the benchmark in the steel buildings industry. This will be accomplished through Product, perfection, Engineering excellence and the Best customer services in the industry.



## MISSION

- To bring the PEB technology to where it is most needed in the world and help others "Build a Better Life" through industrialization;
- To build high capacity, efficient & cost effective steel factories for the speedy delivery and for benefiting from "Large Economies of Scale";
- To design and fabricate safety and technologically advanced buildings;
- To offer customers versatility in design & fabrication to meet their exact building requirements
- ;To offer customer services that are second to none in the industry.



## VALUE

- Be a Leader and not a Follower;
- Share knowledge and success with others;
- Forge local alliances wherever you go;
- Apply only the latest design and buildings codes
- Continually improve your products;
- Customer Service makes all the difference. Customers are lifetime partners. Always seek a win-win solution;
- The longest journey begins with the smallest step, to begin with, the end in mind and focus on the long-term instead of short-term.

ABOUT THE

# COMPANY



**engage,  
improve,  
empower**

Endee Infrastructures is a regional Pre-Engineered Building structural steel solutions provider (design, engineering and supply). It is residing in Chennai. The facility has successfully progressing projects for multinationals and large domestic clients, including Tsugmai, Hyundai, etc...

Endee is able to develop strong local connections and enhance the collective experience of a seasoned management. We collaborate with diverse suppliers and services providers in the building and construction ecosystem, to bring to our customers specialized and cost-effective solutions and services.

Our vision is to deliver the difference by understanding our customers' needs comprehensively, and creating a positive and personal experience that impacts their work lives.

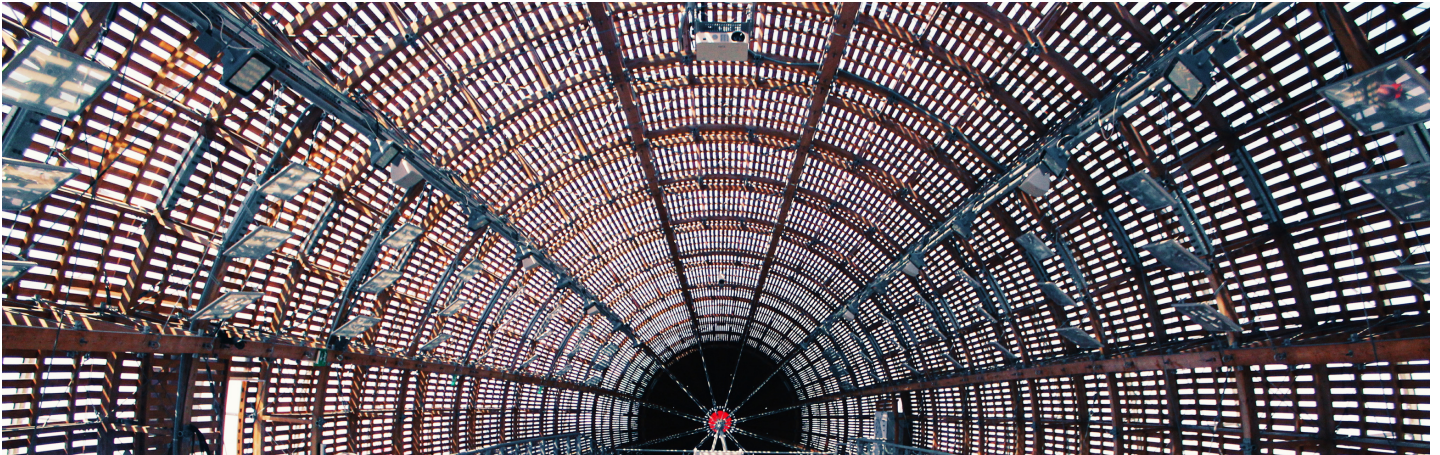
We work towards our vision by adopting an Endee Mindset - the way we approach a problem innovatively with the aim to bring a positive transformation to our customer experience.

# EXPERTISE

## PRE-ENGINEERED BUILDING | CIVIL ENGINEERING

### PRE-ENGINEERED BUILDING

PROUDLY CREATING PLACES TO WORK, LIVE, CONNECT AND ENJOY



The Pre-engineered building system is one of the fastest growing building systems in the world. The advantages that it offers appeal to all parties involved in the project. After all, who can resist a building system that offers speed, quality and value.

The Pre-engineered buildings are defined by the following geometrical parameters: Building width, Length, Eave height, Roof slope, Sidewall bay spacing, end wall bay spacing and main frame module space. Also design loads are the basic parameter. Building Length and width are defined by the distance between steel lines. Extreme surface edges of girts and purlins are treated as steel line. Sum of side wall bay spaces will be equal to the building length.

Roof Slope is defined as the ratio between vertical distance and horizontal distance of the roof surface. Standard roof slopes are 0.5:10 and 1.0:10. To describe the side wall bay spacing, main frame column spacing to be referred start from back end wall steel line to right end wall steel line. Same way back end wall and front end wall bay spacing to be given from left side wall steel line to right side wall steel line. The Pre-Engineered Steel Building system in itself offers great advantages to the customer as a more feasible, practical and efficient alternative to conventional buildings. The system has earned acceptance across the world and is gaining rapid ground in India as well. Some of the distinct advantages include:

- Durability - weather resistant, earthquake resistant
- Value - Low initial investment, low maintenance costs
- Environment friendly - All the materials can be recycled
- Flexible - Easy to expand, easy to setup and change
- Faster - Reduced construction time
- Aesthetics - Gives the engineer enough flexibility to create unique structures



# WHAT WE DO



## PEB / STRUCTURAL STEEL PROJECTS

WEIGHT ESTIMATION

COST ESTIMATION

PROPOSAL DRAWINGS

DESIGN CALCULATIONS

APPROVAL DRAWINGS

FABRICATION / SHOP DRAWINGS

BILL OF MATERIALS

ERECTION DRAWINGS

AS – BUILT DRAWINGS

FABRICATIONERECTION



## CIVIL & FOUNDATION PEB / STRUCTURAL STEEL PROJECTS

MATERIAL QUANTITY ESTIMATION

COST ESTIMATION

DESIGN CALCULATIONS

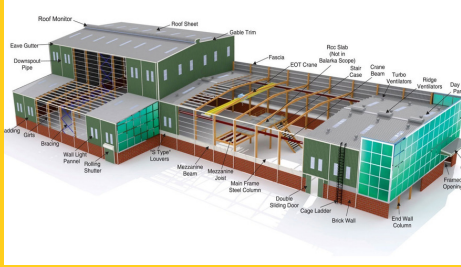
FOUNDATION DRAWINGS

COLUMN LAYOUT PLAN

BAR BENDING SCHEDULE, ETC.,

# ENDEE PEB APPLICATIONS

Engage. Improve. Empower.



**FACTORY SHEDS**



**WAREHOUSES**



**WORKSHOPS**



**MARRIAGE HALLS**



**COLLAGE AUDITORIUMS**



**FUEL & GAS STATIONS**



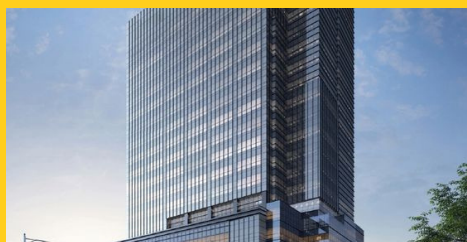
**COMMERCIAL SHOWROOMS**



**SUPERMARKETS**



**BULK STORAGE BUILDINGS**



**MULTI - STORIED BUILDINGS**



# ENDEE PEB DESIGNS & CODES

Design Calculation Packages has been prepared using the international codes that stated in the next clause (Applicable Design Codes) and the latest developments in engineering practices. A competent design engineer prepared the calculations which were checked by another engineer.

Design package divided into two sections as follows:

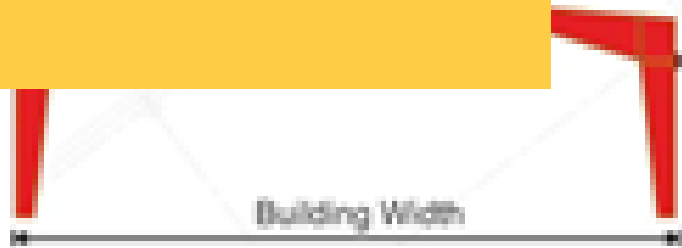
1. Design Information : This section contains the description of the building designed, design codes and material specifications used, assumptions, loads & design sketches showing building components layouts and members sizes
2. Computer Software analysis & Design : This section includes the output of computer program STAAD Pro used in the design along with explanations for the output where possible

## APPLICABLE CODES

1. Wind Load for PEB is applied as per : as per MBMA & or IS 875
2. AISC - American Institute of Steel Construction
3. Cold formed components have been designed in accordance with: **AISI 1986** "American Iron and Steel Institute" Cold Formed Steel Design Manual.
4. Welding has to applied in accordance with: **AWS D1.1:2008** "American Welding Society".
5. Seismic load calculations in accordance with:  
IS 1893 (Part I) : 2004 "CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES"
6. Dead load, live load, Collateral load are to add applicable code (IS 875)



# ENDEE PEB FRAME TYPES



Max. Practical Width = 80m

Clear Span (CS)



Max. Practical Width = 50m

Single slope



Max. Practical Width = 30m

Roof system (RS)



Max. Practical Width = 12m

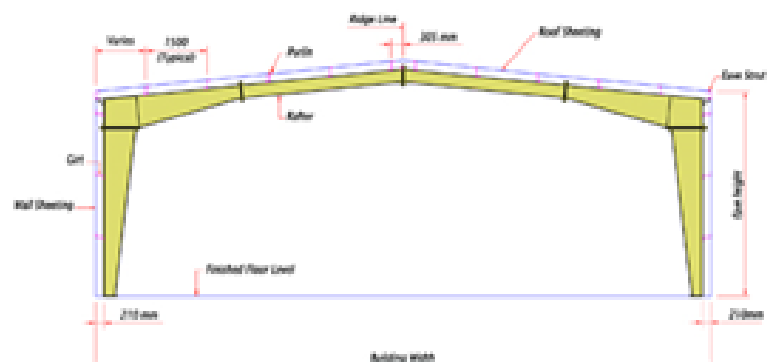
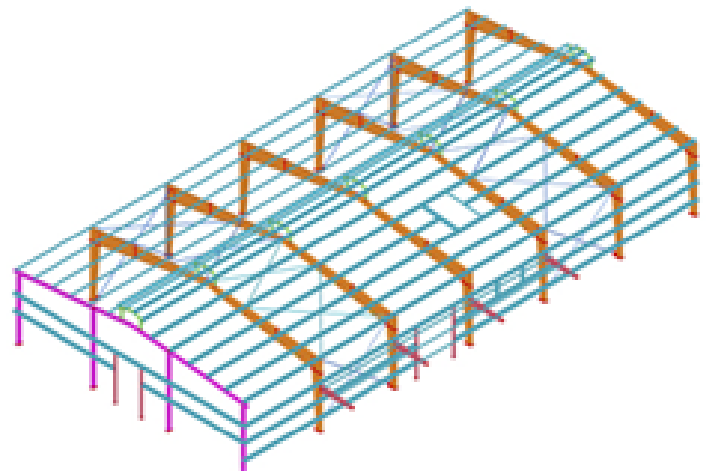
Lean-To (LT)

## MAIN FRAME

Rigid steel frames of the building are mainly considered as the Main Frames of PEB. PEB rigid frame comprises of tapered columns and tapered rafters (the fabricated tapered sections are referred to as built-up members). The tapered sections are fabricated using the state of art technology wherein the flanges are welded to the web. Splice plates are welded to the ends of the tapered sections. The frame is erected by bolting the splice plates of connecting sections together.

Endee pre-engineered buildings are custom-designed to meet your exact requirements. The most common Primary Framing systems are shown below. Practically any frame geometry is possible. Consult a Endee Infrastructure representative for your specific requirements.

The Pre-engineered buildings offer complete freedom of design to accommodate customers need. Endee has particularly developed several types to offer optimized economical configuration for customers to choose from according to space, span, crane and architectural requirements.



# ENDEE FRAME TYPES

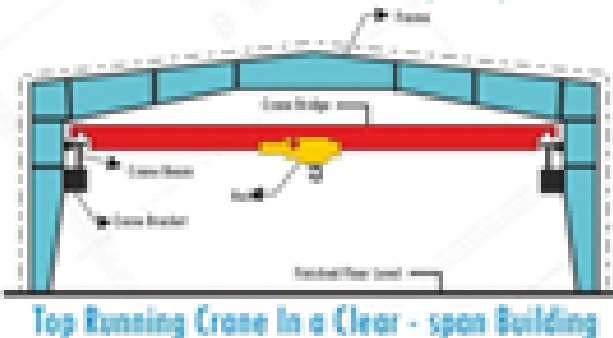
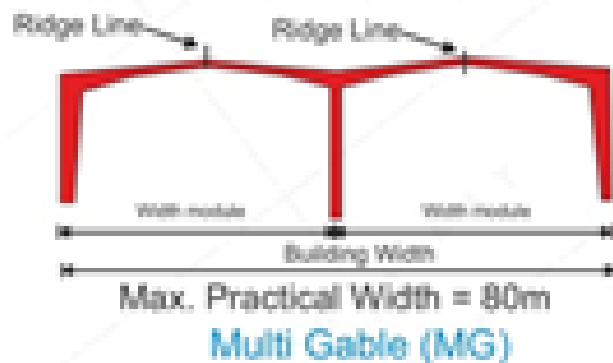
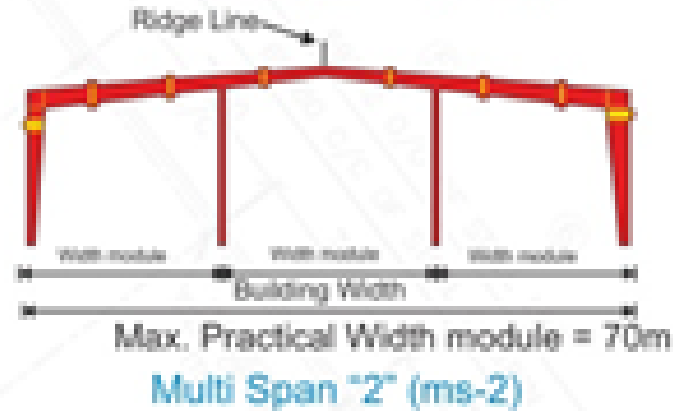
## PURLINS, GRITS & EAVE STRUTS

Purlins, Girts and Eave Struts are secondary structural members used to support the wall and roof panels. Purlins are used on the roof; Girts are used on the walls and Eave Struts are used at the intersection of the sidewall and the roof. Secondary members have two functions: they act as struts that help in resisting part of the longitudinal loads that are applied on the building such as wind and earthquake loads, and they provide lateral bracing to the compression flanges of the main frame members thereby increasing frame capacity.

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- Act as struts that help in resisting part of the longitudinal loads that are applied on the building such as wind and earthquake loads.
- Provide lateral bracing to the compression flanges of the main frame members thereby increasing frame capacity.



# SECONDARY FRAMES

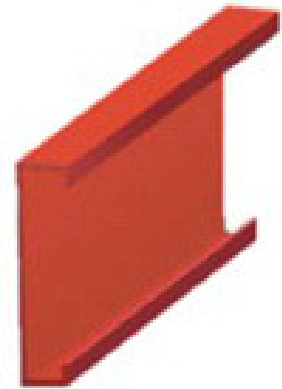


## PURLINS, GIRTS & EAVE STRUTS

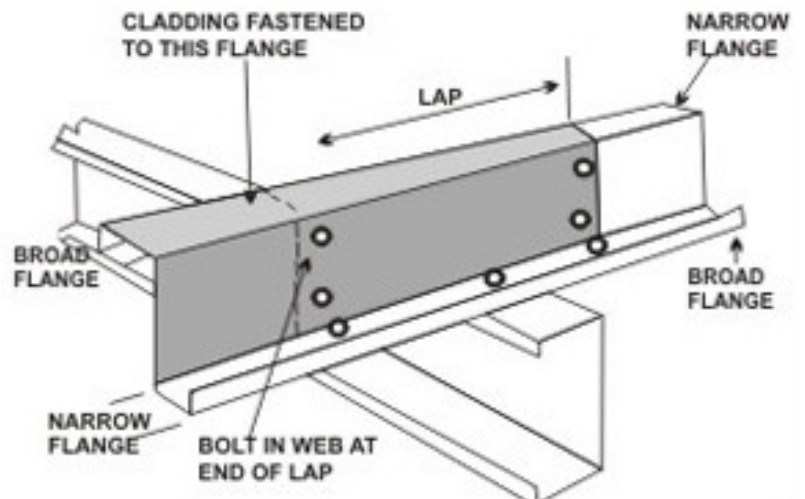
Purlins, girts and eave struts are available in high grade steel conforming to ASTM A 607 Grade 50 or equivalent, available in 1.5 mm, 1.75 mm, 2.0 mm, 2.25 mm, 2.5 mm and 3.0 mm thickness. They come with a pre-galvanized finish, or factory painted with a minimum of 35 microns (DFT) of corrosion protection primer. Minimum yield strength is 34.5 kN/ cm<sup>2</sup>



'Z' PURLIN



'C' PURLIN



# ROOF & WALL PANELS

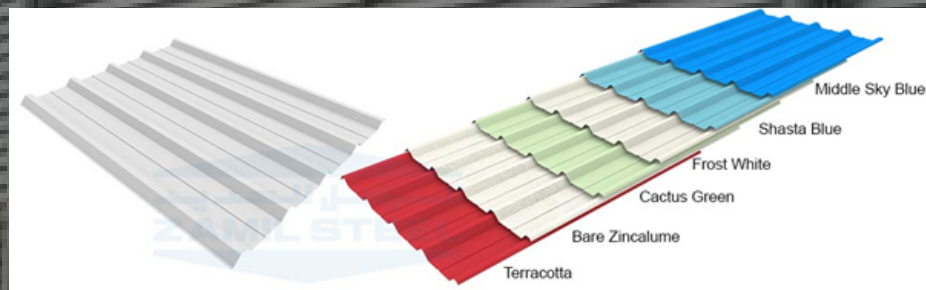









## PANELS and INSULATIONS

Panels used for sheeting purpose are generally of ribbed steel sheets used as roof and wall sheeting, roof and wall liners, partition and soft sheeting. The steel sheets are generally produced from steel coils having thickness 0.5 mm to 0.7 mm high tensile stress.

We offer engineering services and turnkey solutions for the supply and installation of the roof covering and wall cladding including the secondary members and all related accessories for new buildings as well as retrofitted buildings. Endee Infrastructure offers a complete line of Wall/Roof panels, panel related accessories, trims, purlins, girt, eave gutters, downspouts, curved eaves, wall flashings and louvers for a wide range of building applications. The metal skins are used as roof and wall panels, interior roof and wall liners, partition panels, soffit panels, etc.

Our roof and wall panel are an important part of our products line. Endee Infrastructure is your single source for a complete building system. Plain Galvalume Steel and Plain Aluminum panels are available in nominal thickness of 0.5mm and 0.7 mm, and in all standard colors. Panels can be specially ordered to meet any base metal specification, coating, finish, color and thickness. The most current availability of standard panel colors listed below. Your Endee representative can provide complete information on price and delivery.



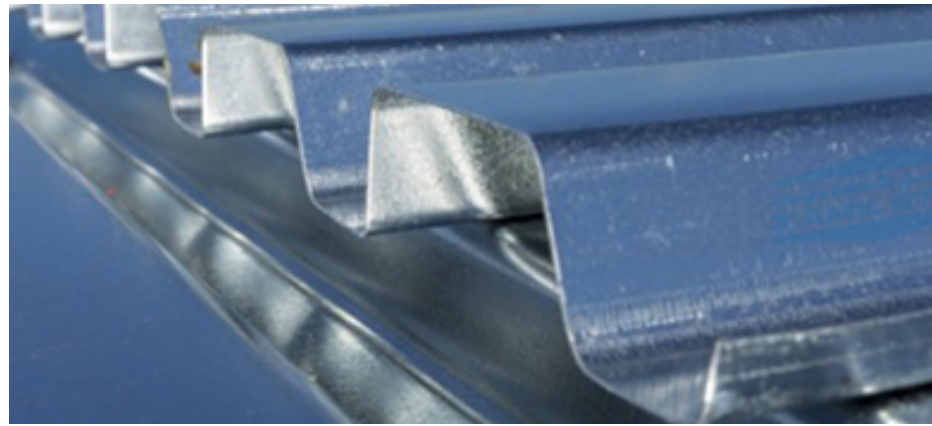
Frost White	
Flame Red	
Arabian Beige	
Leaf Green	
Cactus Green	
Daisy Yellow	
Royal Blue	

# ROOF & WALL PANELS

## STEEL DECKS

Steel deck is a cold formed corrugated steel sheet supported by steel joists or beams. It is used to support concrete or insulating membrane of a roof. Endee Infrastructure decks are based on load tables of the 1996 edition of the American Iron and Steel Institute specifications for the design of cold-formed steel structural members.

Endee Infrastructure deck is available with G90 (Z275), G60 (Z180), or A25 (ZF75) zinc protection as described by the ASTM A653 standard. A gray polyester paint finish without underlying zinc protection is also readily available. Upon request, we can also provide white finish paint with an underlying zinc protection of G90, or other types of material, given sufficient notice.

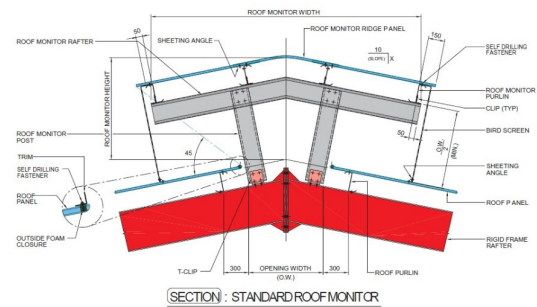


# ENDEE BUILDING ADDITIONS

PEB Structures

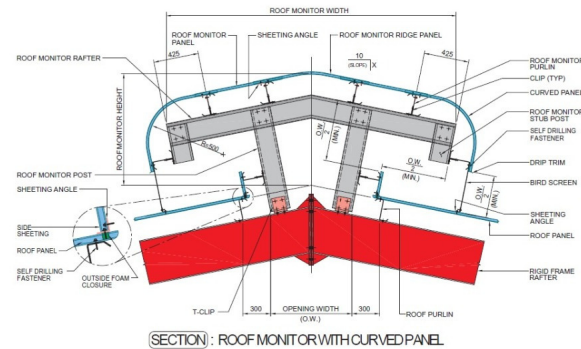
## ROOF MONITOR

Roof monitor combines economy, good appearance and easy erection. The size of the monitor can be adjusted to suit exact ventilation and lighting requirements. The overhang part is detailed to give a 45° protection from the rain. A light wire mesh is installed at 45° to prevent intrusion of birds. A curved eave panel may be incorporated at the eave of the monitor. It is very conducive to tropical areas where rainfall is normally heavy. Generally, roof monitors are made of lightweight, yet strong, cold-formed sections. Built-up sections and hot rolled sections are used for the framing members when the roof monitor is large and design warrants their use.

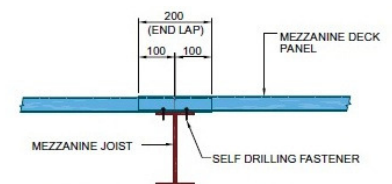


## MEZZANINE FLOOR

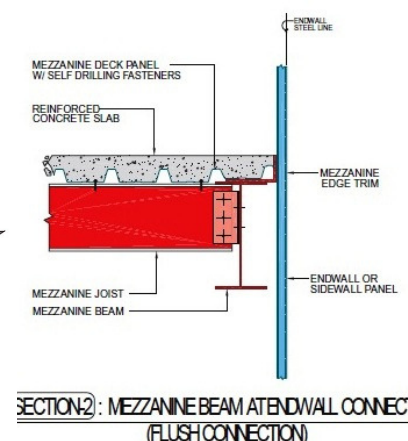
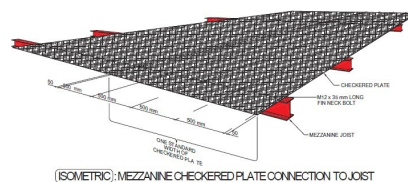
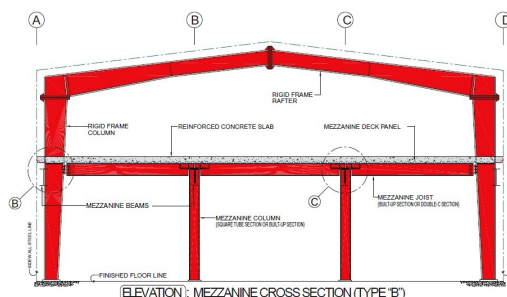
A mezzanine is an elevated flooring system located inside the outer shell of a pre-engineered steel building. The most common uses of a mezzanine are to accommodate offices or to serve as a storage area. Generally, the mezzanine framing is connected to the main rigid frame columns for lateral stability. Primary and secondary mezzanine members are analyzed as pinned at both ends. Though this design approach may result in a slightly heavier design, it has proven to be safer in the long term due to the possibility that the mezzanine may be partially removed as building layouts change during the lifetime of a structure.



The mezzanine structures consists of built-up or hot rolled main mezzanine beams that support built-up, hot rolled or cold-formed mezzanine joists which, in turn, support a metal deck. A reinforced concrete slab is cast on the metal deck as the finished surface. The metal deck is not designed to carry the floor live loads; it is intended only to carry the reinforced concrete slab during pouring. The reinforced concrete slab must be designed to carry the floor loads.



**(SECTION-1) : MEZZANINE DECK PANEL END LAP DETAIL**



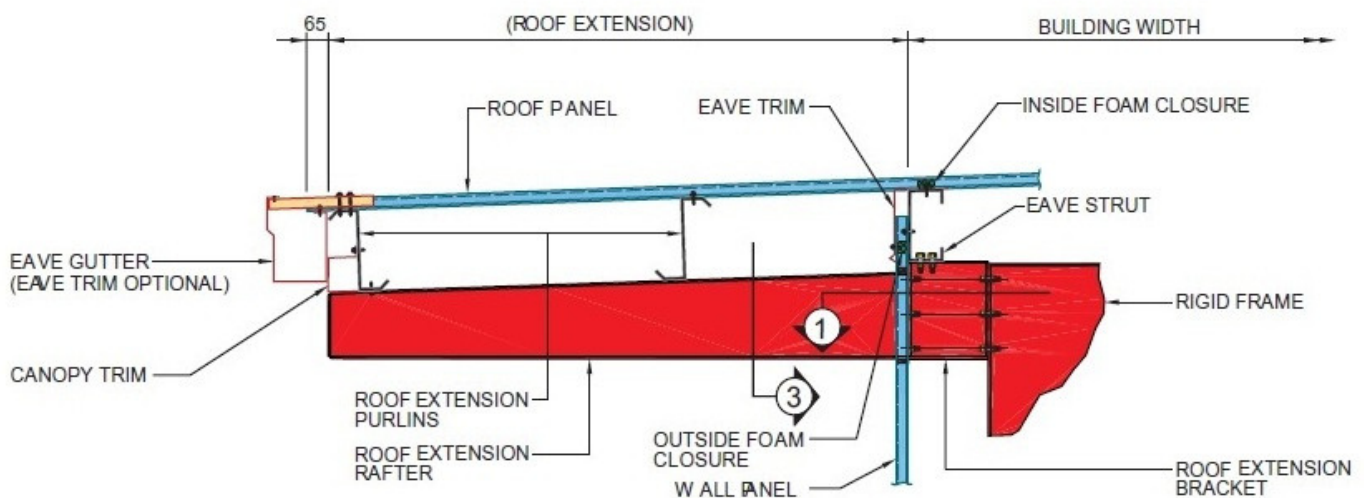
# ENDEE BUILDING ADDITIONS

PEB Structures

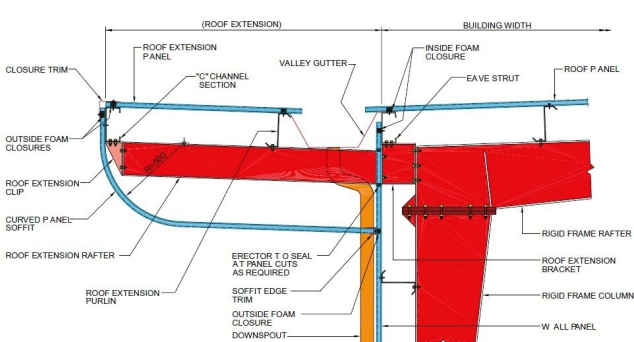
## ROOF EXTENSIONS

Roof extensions are continuations of the roof beyond the planes of the sidewall or end wall of a building. The primary purpose of roof extensions, whether at the sidewall or end wall, is to provide additional weather protection to the walls. They can also add aesthetic beauty to the overall physical appearance of a building.

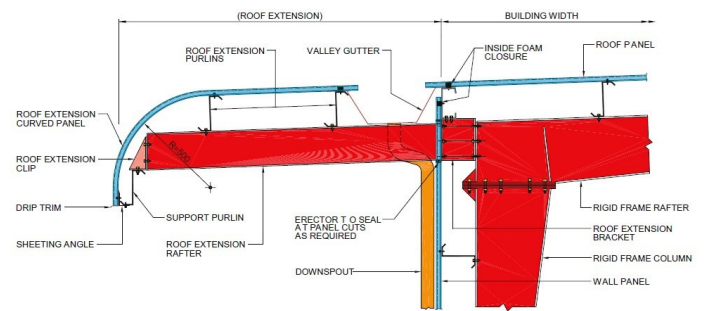
The framing of sidewall roof extensions may consist of built-up members, hot rolled members or cold formed sections that are cantilevered from the building at the sidewalls. Whereas the framing of end wall roof extensions consists mainly of cold formed "Z" sections which are continuous extensions of the end bay purlins and eave struts of the main building.



SECTION AA : ROOF EXTENSION AT EAVE (WITHOUT SOFFIT)



CROSS SECTION : ROOF EXTENSION AT EAVE (WITH CURVED PANEL SOFFIT AND VALLEY GUTTER)



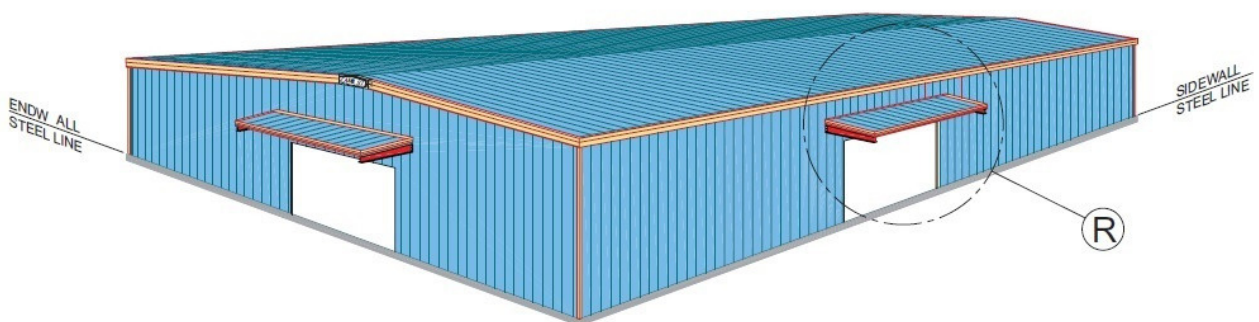
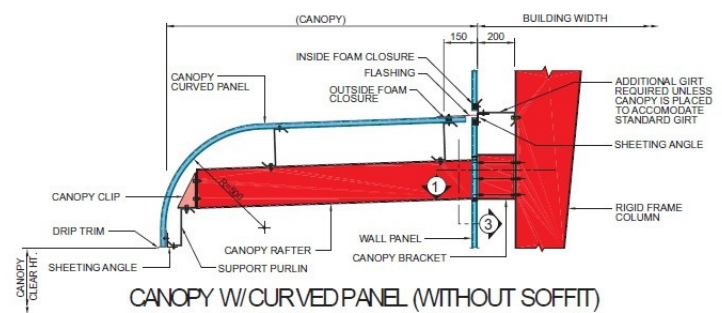
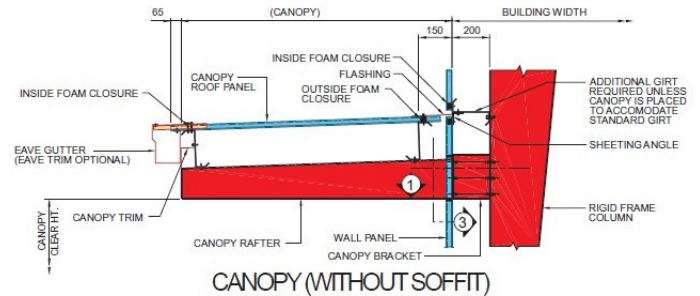
CROSS SECTION : ROOF EXTENSION AT EAVE (WITH CANOPY CURVED PANEL AND VALLEY GUTTER)

It is important to differentiate between sidewall roof extensions and endwall roof extensions. Whereas economical endwall roof extensions are limited in width due to the limited load capacities of "Z" sections, economical sidewall roof extensions can be designed for greater widths. Roof extensions can be supplied with or without a soffit. The term soffit refers to the provision of liner panels at the underside of the roof extension framing. Soffits are used when a neat flush appearance is required under roof extensions. Roof extensions are designed to accommodate gutters and return downspouts. The roof panels on roof extensions are a continuation of the roof panels of the main building.

## CANOPIES

Canopies are narrow roof systems that cantilever (below the eave of a building) from the sidewalls and end walls, providing various functions such as:

- A shade to block direct sunlight falling on the building walls.
- An extended covering to protect against rain in loading and unloading areas of warehouses,
- Factories, supermarkets, shopping malls, etc.
- A cover at entrances of buildings or for car parking adjacent to building walls.
- The width of a standard canopy is 1500 mm, but greater widths can easily be accommodated.



**ISOMETRIC** : CANOPIES BELOW EAVE AT ENDWALL AND SIDEWALL

The canopy consists of built up tapered, hot rolled or cold-formed canopy rafters, cantilevered from the main frame columns or from the end wall columns. Rafters support 200 mm deep purlins which in turn support roof panels. The roof panels of canopies normally match the roof panels of the building to which they are attached.

Canopies may extend along the full or partial length of the sidewalls or endwalls of a building. Ideally they should start at a wall column and end at a wall column. Canopies can be supplied with or without a soffit. The term soffit refers to the provision of liner panels at the underside of the canopy purlins.

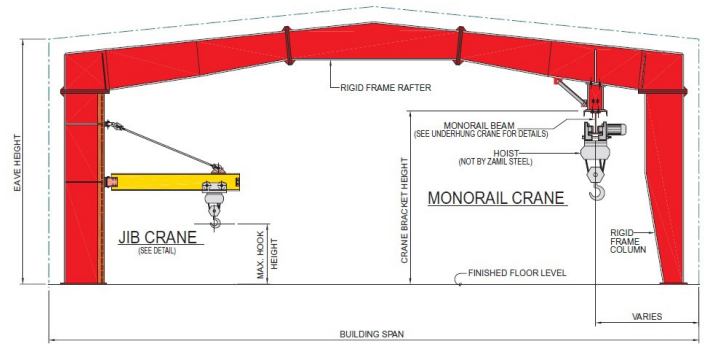
Soffits are used when a neat and elegant flush appearance is required under the canopy. Canopies are designed to accommodate flashing and gutters of the same material as used on the main building.



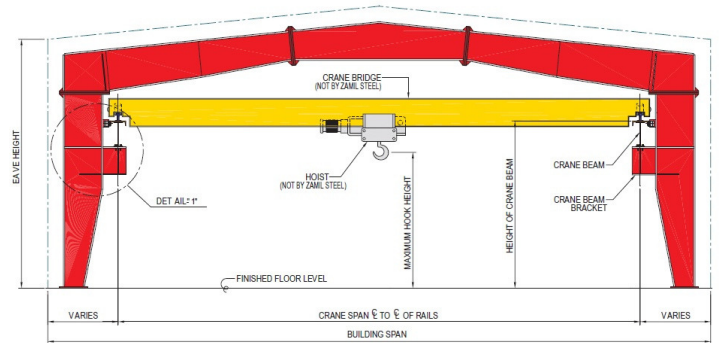
## CRANE SYSTEMS

A crane system greatly improves material handling productivity within a building, promotes safety and allows more efficient utilization of space by reducing or eliminating traffic due to forklifts and side loaders. The most common types of crane systems in Pre-engineered steel buildings are:

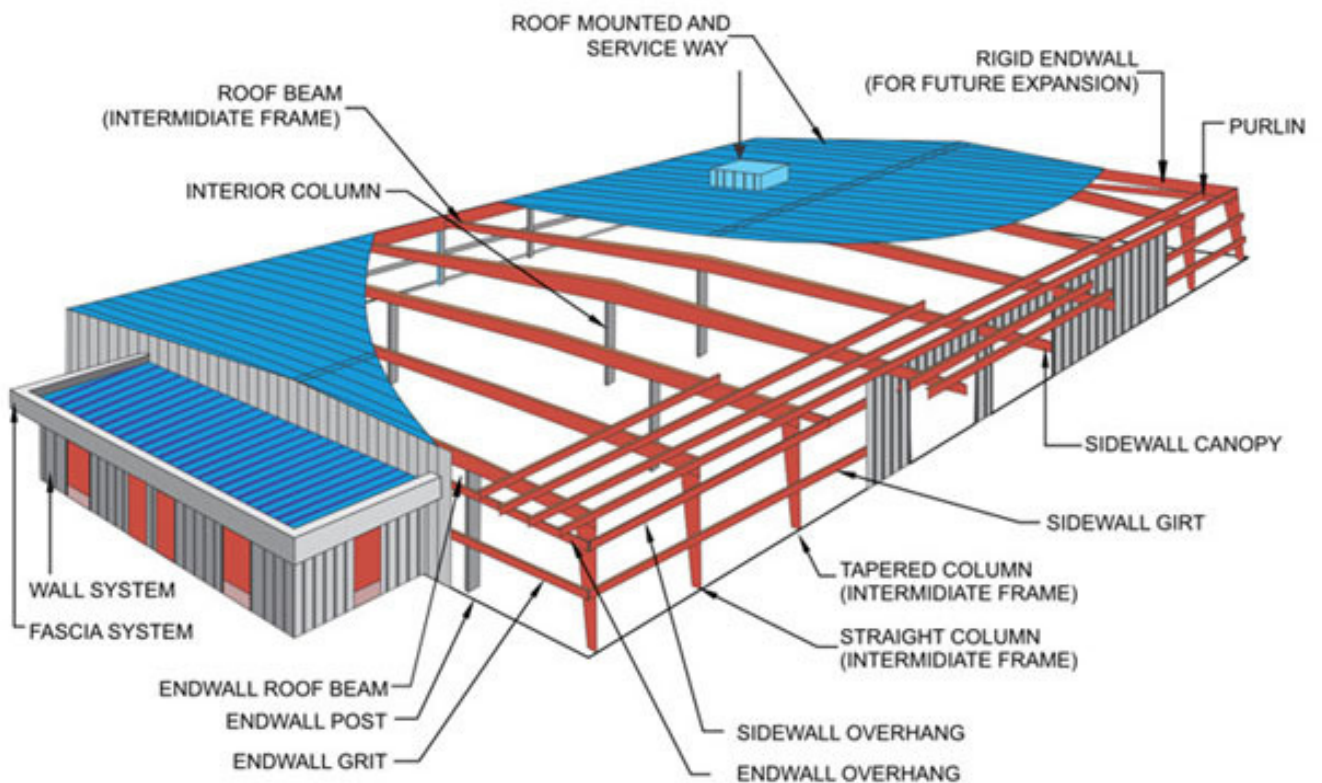
- Top Running Cranes
- Under hung Cranes
- Monorail Cranes
- JIB Cranes



(ELEVATION) : JIB CRANE AND MONORAIL CRANE



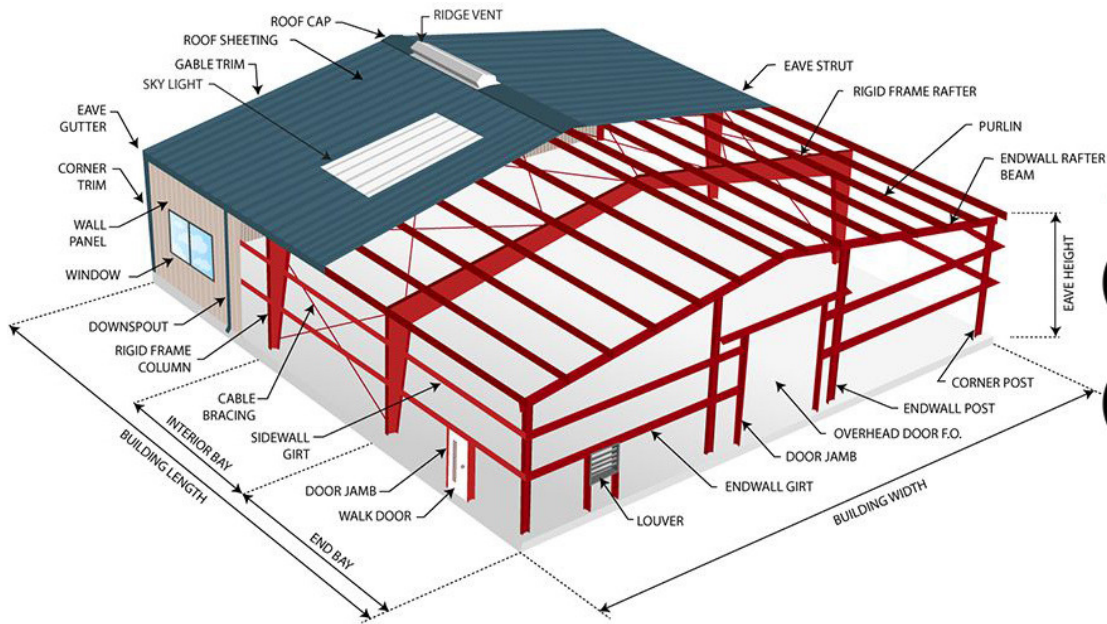
(ELEVATION) : TOP RUNNING CRANE IN A CLEAR SPAN BUILDING



# ENDEE BUILDING ADDITIONS

PEB Structures

- SLIDING DOORS - SINGLE LEAF OR DOUBLE LEAF
- LOUVERS
- WINDOWS
- PERSONAL DOORS
- SKY LIGHTS AND WALL LIGHTS
- RIDGE VENTILATORS
- ROOF CURBS., ETC.,



## COLORS



# ENDEE CIVIL SOLUTIONS

FOUNDATIONS & ANCHORAGE FOR PRE-ENGINEERED BUILDING

- MATERIAL QUANTITY ESTIMATION
- COST ESTIMATION
- DESIGN CALCULATIONS
- FOUNDATION DRAWINGS
- COLUMN LAYOUT PLAN
- BAR BENDING SCHEDULE, ETC.,

Foundation design and construction for Pre-Engineered Buildings are important to the assembly process. To ensure optimum integrity of new building, the foundation must meet certain design criteria and load conditions. It is required that all building foundations be designed by an experienced foundation engineer, and coordinated with all local city, county and state codes.

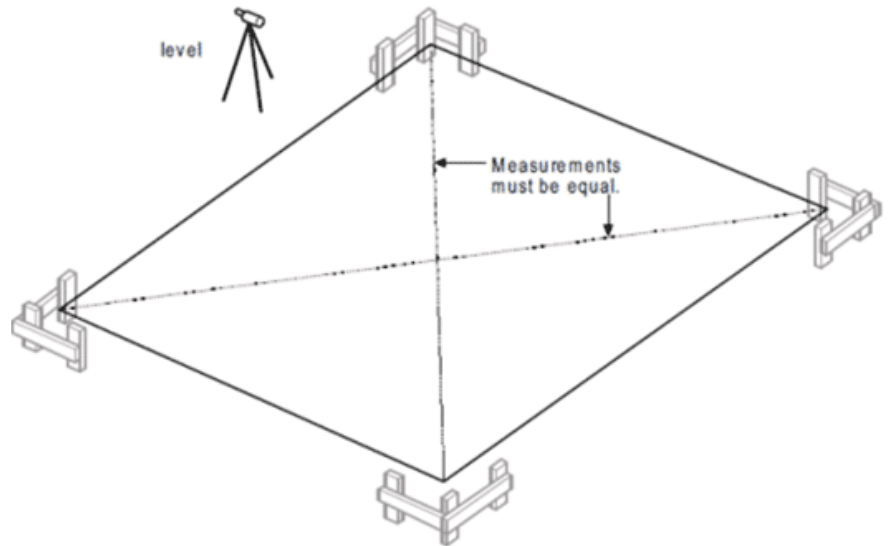
Improper foundation construction will limit the building's performance. The foundation should be sharply formed with true corners, straight sides, and a level top. This will allow for proper seating and alignment of all building components.

We will furnish anchor bolt drawings to outline basic guidelines and considerations for foundation design. The accuracy of foundation construction and anchor bolt settings is the most important factor in achieving trouble-free component alignment and fit-up.



# FOUNDATION LAYOUT SETTING ANCHOR BOLTS

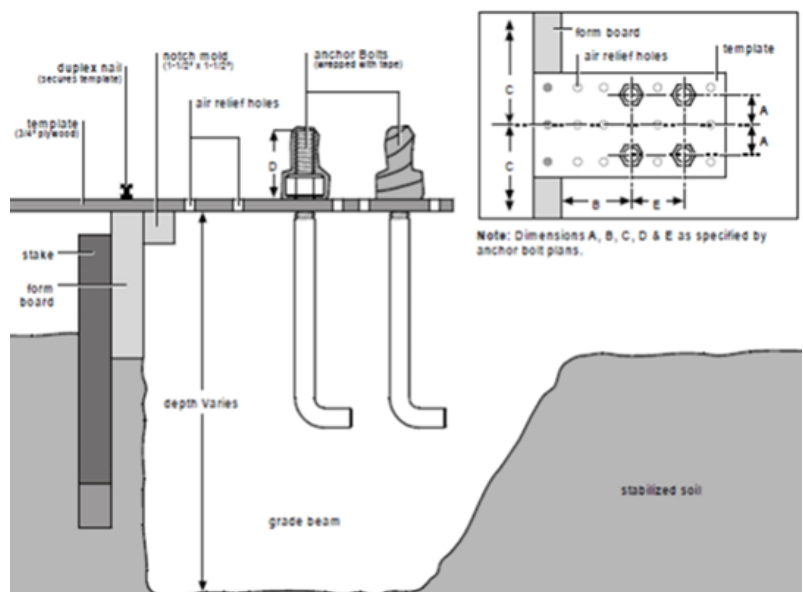
Regardless of the type of foundation that is used and its specific configuration, the foundation outline should be carefully and accurately laid out before any excavation is made. Whenever possible, a transit or similar means should be used to layout the foundation perimeter. This will ensure accurate placement of corner measures and in turn, ensure a square foundation.



The foundation is square and level, Measure diagonally to the farthest points of the foundation frame / string-line. Adjust the frame / string-line as necessary until the two diagonal dimensions are equal. If the diagonal lengths are equal, the framing is square. Ensure the foundation is level.

## Setting Anchor Bolts:-

To reduce the risk of anchor bolts pulling loose, do not erect any building components on "green" concrete. Concrete that has not cured properly may be damaged by erection equipment or building component affects. Normal Portland cement concrete should cure at least seven days, and high-early-strength concrete at least three days before the structural columns are erected. Due to tight tolerances in which your building was manufactured, it is extremely important that all anchor bolts are accurately placed (+/- 1/16") in accordance with the provided anchor bolt plan.



# THEORY OF PEB FOUNDATIONS

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A well-designed foundation is particularly important for any metal building. It ensures durability and prevents most forms of building deterioration in the future, such as leaking or flooding, shifting or tilting walls, and structural damage. For a steel building, the design of the foundation determines the rest of the planning and construction process and is therefore put into motion long before the actual building is available. There are several factors surrounding the design of the foundation that are important to consider before moving forward with the planning process.



## THE LAND

Before the building process begins, the land must be professionally surveyed and marked for leveling. The builders need to know the boundaries of the plot. The measurement of the land will greatly affect how the foundation should be designed, as will the soil quality. Grading shapes the soil to the height and conformation of the land as marked by the surveyor's stakes. Poor soil can result in shifting and sinking of steel buildings, no matter the design of the foundation. While foundations can be designed around poor soil, it is much less expensive to excavate the existing dirt and replace with higher quality soil.

## THE LOAD

Steel buildings tend to have a higher horizontal load, meaning that they are impacted more by lateral forces such as high winds and earthquakes. Forces such as these can cause buildings to overturn or slide off their foundations. The foundation can help to distribute or resist the high horizontal column reaction of steel buildings with the use of steel tie bars connected to anchor bolts or with an increased footing size, though the latter may result in higher costs.

# THEORY OF PEB FOUNDATIONS

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## WIND UPLIFT

Column/Foundation uplift occurs when high winds create a suctioning effect that lifts a building from its foundation. A steel building is at high risk for column/foundation uplift, the prevention of which starts with the foundation. Heavier foundations, a foundation with topsoil on it or deeper footings in the foundation are all options for reducing uplift in a steel building.

Additional considerations include:

- Local frost lines
- Weight of the equipment or machines to be housed in the building

As you can see, the type of foundation is determined by the land, the load, and the wind uplift estimated for the building. Ultimately, the goal of the foundation is to anchor the columns of the building, giving stability and strength. The foundation type should be decided accordingly, keeping these factors in mind.

# THEORY OF PEB FOUNDATIONS

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## Floating foundation

A floating foundation (also known as floating slab or just slab) is the popular option for most commercial and industrial buildings. It is a concrete slab with a continuous grade beam. It is poured and spread under a column or reinforces along the bottom and carries the vertical weight of the columns. The slab becomes the floor upon the completion of the structure. A floating foundation is easier, quicker, and more affordable to build, as it does not require much digging, nor does it require piers or footings. This type of foundation is also better in wet and coastal areas with softer soils, as it prevents sinking and unevenness over time. One thing to remember about the floating foundation, however, is that the sewer pipes and often much of the electrical conduit must be embedded in the slab ahead of time.

## Pier, footing, and grade beam

This type of foundation is often used for agricultural steel buildings, riding arenas, and open pavilions. The foundation sits on piers which rest on square or rectangular footings with a grade beam wall. In some cases, drilled piers can be used instead of the footing. Each pier carries the weight of a column, and the floor may be left as dirt or gravel. The piers and footing carry most of the vertical load of the steel building. The deep drilled piers work better with dry soil, while the depth also helps prevent wind uplift to the building. Meanwhile, the grade beam works against passive pressures to the soil and therefore resists horizontal column reactions. Piers can be tied together below ground to eliminate shifting. While the piers, footing, and grade beam option is more expensive, it is also more reliable and versatile as a foundation.

## Perimeter wall

Also known as perimeter footing, this foundation is poured around the exterior of the structure, supporting the exterior steel framing walls. Sometimes perimeter walls are used in conjunction with piers or concrete slabs.

# Working with Endee in Easy



## I. Inquiry & Exploration

Let us know your plans and needs so we can propose ways to help you.

## II. Request for Quotation

Request for quotation or tender

## III. Clarification Stage

Review document and drawings; Conduct clarification meetings

## IV. Value Engineering

Design options, cost estimates and sales quotation

## V. Tender Review

Commercial & technical review

## VI. Contract Award

Contract signed based on agreed commercial terms and design





# INCEPTING STRENGTH TOWARDS FUTURE

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