VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama" Belagavi – 590010

REPORT ON INDUSTRIAL TRAINING AT

"AGRIMA ROOF AND FACADE SYSTEMS, BENGALORE"

Submitted By

SUHAS K

4AL21CV013

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING
In
CIVIL ENGINEERING

Under the guidance of

Dr. H G UMESHCHANDRA
Associate Professor
Department of Civil Engineering

ALVA'S
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DEPARTMENT OF CIVIL ENGINEERING
ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY
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2023-24

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CERTIFICATE

This is to certify that **SUHAS K** bearing **4AL21CV013** has submitted an **INTERNSHIP REPORT** on training done at "**AGRIMA ROOF AND FACADE SYSTEMS.**" for VI semester B.E. in Civil Engineering, in partial fulfilment for the award of BACHELOR OF ENGINEERING in **CIVIL ENGINEERING** of the **VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI** during the academic year **2023–24**. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The report has been approved as it satisfies the academic requirements in respect of **21INT68-INTERNSHIP** prescribed for the Bachelor of Engineering Degree.

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31/07/2024

EXTERNIAL VIVA

1) .....

2).....

CIE = 99/100

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ACKNOWLEDGEMENT

I express my sincere gratitude and indebtedness to "**AGRIMA ROOF AND FACADE SYSTEMS**." Bengaluru for their guidance, keen interest and advice rendered during the training period.

I express my sincere gratitude and indebtedness to **Dr. Peter Fernandes** , Principal of Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I express my sincere gratitude and indebtedness to **Prof. Durga Prasad Baliga** HOD, Department of Civil Engineering, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work

I express my sincere gratitude to my **guide** Mr Ashwin (senior engineer) from agrima roof and facade systems Bengaluru .for their constant guidance and support throughout this work

I am thankful to my guide, **Dr.H G Umeshchandra, Associate Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work

I am also thankful to the Internship Coordinator, **Prof. Anusha B Rao Assistant Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I am also thankful to all the technical and non-technical staff of Simon and Associates who have directly or indirectly helped in this endeavor

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CHAPTER 1

COMPANY PROFILE

1.1 About Agrima Roof and Façade System

In the year 1985, a small team of young Engineers fresh from Civil Engineering Graduation. Started executing Civil and Mechanical work at Nuclear Reactor Installation in Kaiga, India. The team climbed in work and scope over the years. The team added critical and complex works such as Reactivity Mechanism, End Shield Installations, Heavy water plant, nuclear piping, etc. expanding the learning curve continuously. Consistently winning safety awards for seven times is one proof of the excellent track record maintained by the team.

The company was named "AGRIMA ROOF AND FACADE SYSTEMS" in the year 2012 and took an initiation of sustainable building materials in construction and also executed export projects at Maldives and Bangladesh. Agrima got affiliated with Palram, Israel in the year 2016. Pure engineering and construction company with well-established divisions in mechanical, pre-engineered buildings, and fabrications. Promoted by engineers with two decades of experience. Having offices in Bangalore, Hyderabad and Hong Kong.

More than 250 works completed in remote and project areas in India.

1.2 Services

1) Pre-Engineered building
2) Kingspan–Ireland
   i) Standing Seam Roofing System – Aluminium
   ii) Façade System - Aluminium
3) Palram system –Israel
   i) poly house and flat
   ii) skylight
   iii) Multiwall Polycarbonate Standing seam roofing & Facade system
   iv) Solid Polycarbonate Standing-Seam Architectural System
   v) Multi-layered PVC sheet
4) Kalzip Roofing and Facade system
5) Nuclear works
6) Lysaght - Tata
   i) Galvalume Roof & FaçadeTrimdek
   ii) Klip-Lok System
   iii) Flex-Lok System
   iv) MR-24 System

CHAPTER 2

PRE-ENGINEERING BUILDING

2.1 Introduction

Technological improvement over the years has contributed immensely to the enhancement of the quality of life through various new products and services .Technology can be utilized which has the potential totransform civil construction practices across the country.

Pre-engineered buildings are metal enclosure buildings that contain factory mode structural frames, roof and wall support. The complete design of such buildings is created at a factory and the pre-engineered building components are brought to the site and installed. Pre-engineered buildings is designed by a pre-engineered building supplier or pre-engineered building manufacturer with single design to be fabricated using various material and methods to satisfy a wide range of structure and aesthetic design requirments.This is constructed with a buildings built to design that was created specifically for that building with in some geographic industry sectors pre-engineered buildings are also called pre-engineered metal buildings as is becoming increasingly common due to the reduced amount of pre-engineering involves in custom computer– aided designs simply engineered metal buildings the I-beams are then field assembled to form the entire from of the pre-engineered building some manufacturers taper the forming member according to the local loadings effects larger plate dimensions are used in areas of higher load effects.

Advantages of pre-engineered buildings

Time saving:-It takes less time to complete pre-engineered buildings and projects can deliver on time.

Cost effective solution:-As most of the ports of pre-engineered buildings are manufactured at a factory they save you lots of money.

Low maintenance and highly durable:-The steel does not crack; wrap the construction required zero maintenance.

Customized solution:-You can design the pre-engineered buildings structureas per your needs and requirements and the space available at the site.

Eco friendly:-Most importantly these structures are eco-friendly as the material used in the construction can be recycled and reused considering environment safety concerns.

Less expensive because of the design manufacturing and on site erection cost saving. Since all of these pre-fabricated and skilled labours are used to connect the various components quick assembly is possible

Dis-advantages of pre-engineered buildings

1. Eco system in India is yet to develop.
2. Non-standard buildings are difficult to implement.
3. Complex machines and technique required
4. Complex software required.
5. Modifications are not possible.

Application s of the pre-engineered buildings

1. Warehouse
2. Factories
3. Gas stations
4. Metro stations
5. Railway station
6. Outdoor stadium etc…….

2.2 Materials

Fabrication is defined as the process of manufacturing, assembly and joining different components to form complex structures. The structure generally uses readily available standard sections which are manufactured from steel used in fabrication is selected from a range of alloys of iron and corban with addition of small quantity of silica .these various alloys of steel are tensile strength.
Important to select the suitable material depending upon the condition of service as per the function requirement .The availability of the material at site is also an important conditions. Structure steel is produced in wide range of shapes and grades which permits maximum flexibility of design steel is relatively inexpensive most versatile and economic material available to fabrication.

Steel as a construction material

Steel as a basic raw material for construction has been receiving attention all over the world. The effects are being made to achieve maximum economy in its utilization. Structure steel is widely used in various types of industrial structure such as building, framework, railway and highway bridges, tower construction special structure such as storage tanks, gas holders, bunkers, technologies structure, like blast furniture's stoves.

Merits of steel

Steel is mainly used for the construction due to its high strength properties and ability to resist more loads and comparatively lighter weight. Steel as a construction material gives long services life, higher gas and water tightness case for fabrication; assembly erection alteration and modification up to a greater extent are possible on steel structure construction required at later date.

Classification of steel material

1. Shaped products
2. Flat products
3. Track material
4. Special items for steel structure construction in industry
   The steel sections generally used are angle, channels, beam plates, roils, galvanized sheets, tubes and pipes.

Sankey diagram for steel

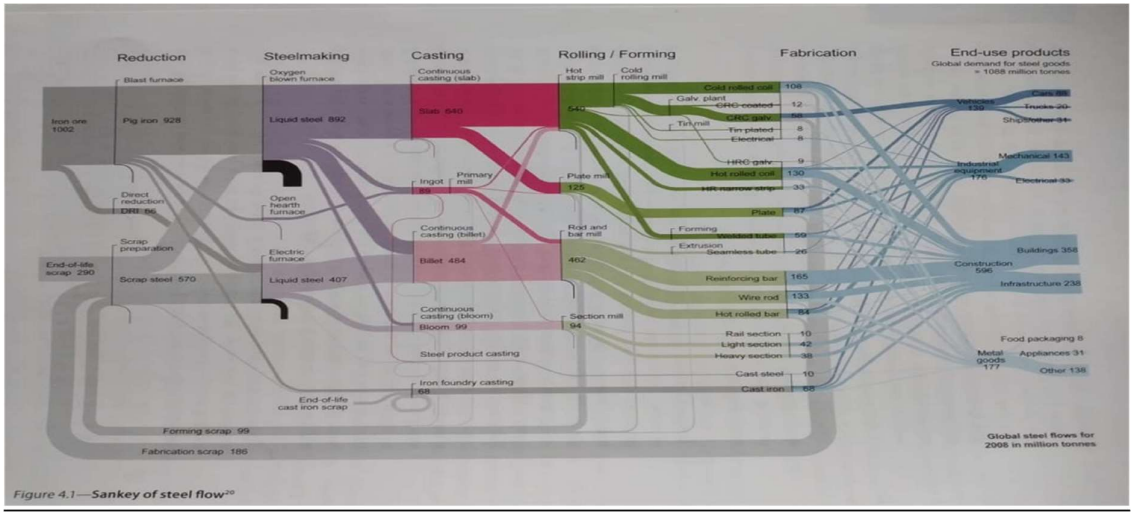


Figure 4.1—Sankey of steel flow[20]

Fig.1 Sankey diagram of steel

The steel map shown that two-third of the worlds steel is made from mined oreand one-third from recycled scrap one-fifth from manufacturing and fabrication and two fifth from end life productions and buildings the dominant production routes for steel made from ore is the basic oxygen furnace and from scrap is the electric arc furnace although these is one same interchange between the two more than 99% of the worlds steel rolled after casting and the resting stock products are approximately one tenth plate for tenth strip four tenth ,rod and bar and one tenth section ,half of the words steel is used in construction of which one third is reinforcing steel most steel used in vehicle manufacture is from cold rolled coil or from casting.

Sustainability of pre-engineered buildings (PEBs)

Pre-engineered buildings are considered sustainable because they have a lower environmental impact than traditional brick and stone construction. Pre- engineered buildings are built using sustainable materials like recycled steel and composite material made from recycled plastic. Pre-engineered buildings are designed to optimize material used which also limits any waste production, their production process results in low carbon footprint when compared to traditional building.

Components of pre-engineered buildings (PEBs)

Pre-engineered buildings (PEBs) are metal buildings that can be adopted to suit a wide range of structural application. They are supplied as a fully finished produced along with steel structure, building accessories and roof cladding. They required on site fabrication or welding.

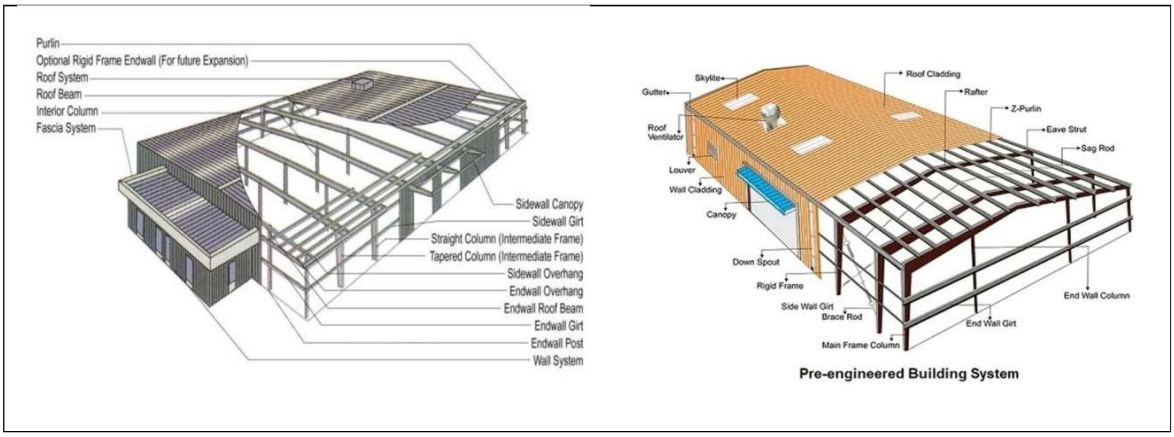


Fig.2 Components of pre-engineered buildings

Primary Frame:-Primary frames consist of trusses, column or castellated beams etc. These are built up of I-sections steel members all the load of structure members passes to the base and consist of endwall frames. These end wall frame are either designed with rigid frames or with economic bearing frame. These frames are reinforced with wind bracing and connecting bolts, sometimes with anchor bolts.

Secondary elements:-Are cold-framed structural members available in different shape like C, Z etc.. Commonly known as "purling" for overall structure stability these purines transfer force from one frameto another.

Roofs and wall panels:-Some of the pre-engineering building components like roofs and wall panels come in tin shades and curtainwalls mode of glass and roll framed steel sheets some special roofing sheets are used to minimize energy usage.

Sandwich panels:-These panels are made in this layer where one non-aluminum layer is placed in between two aluminum sheet. Some other components of sandwich panels are bolted insulation, mezzanine floors, skylight flashlight, cage ladder, cable trays ducts, cranes etc..

Foundation and floors system:-Made up of conventional concrete system usually called as open foundations system.

Main frame Or vertical columns:-The mainframe includes the steel rigid frames of the building.

End wall frames:-This is designed as a main rigid frame.

Purlins, grits and eave structure:-These are the secondary cold- frames members of the components of the pre-engineered buildings.

Design requirements

The structure design is an art and science of designing with the elegance and economy, safe serviceable and structure, internal all structures are designed to safety certain basic structure and functional requirements.

Structural design requirements

1. Strength
2. Stability
3. Safety
4. Durability
5. Serviceability
6. Economy

The designed structure should be strong enough to with stand all types of loads coming without excessive deformations or deflection and shouldbe stable under largest stipulated loads.

The entire process of the structure planning and design requires
Not only imagination and concepts thinking but also sound knowledge ofscience of structural engineering knowledge of practice aspects such as relevant design codes and lows backed up by ample experience intuition and judgment.
In order to accurate design a pre-engineered building ,engineers considers the clear span between bearing points, boys spacing roof slope, live loads dead collateral loads wind uplift, deflection criteria, internal crane system and maximum practical size and weight of fabricated members.

When design a pre-engineered building (PEBs), engineers should consider many factors. Such as

1. Building dimensions length, width and height.
2. Clear span:-Distance between bearing points.
3. Bay spacing:-Distance between bays.
4. Roof slope:-Angle of the roof.
5. Loads:-Live loads on the roof and frames, dead loads, wind load and earthquake zone.
6. Internal crane system:-Whether there is an internal crane system.
7. Foundation:-Composition of the footing plate, footing brace footing. Column with reinforced concrete and blots.
8. Fire exits and safety:-Whether the area is prone to wild fires.
9. End bay length:-Distance from the outside of the outer flange of endwall column to the center line of the first interior from column's.
10. Interior bay length:-Distance between the center line's two adjacent interior main frame columns.

Structural welding code:-Steel structure simple span beam shall be span /240 and steel structure for cantilever span beam shall be span/120.

Basis of design

1. **Design objective:-**The objective of design's the achievement of an acceptable probability that structure will perform satisfactorily for the intended purpose during the design life with an appropriate degree of safety they should sustain all the load's and deformation's.
2. **Methods of design:-**Structure and its elements shall normally, be design by the limit state methods .Account should be taken of accepted theories, experimented information and experience and theneed to design for durability.
3. **Design process:-**Structural design including design for durability construction and use should be considered as a whole. The realizationof design objectives required complaisance with clearly designed standard for material's, fabrication, erection and in service maintenance.
4. **Design requirement's:-**The structural should design is an art and science of designing with the elegance and economy, safe serviceable and adorable structure ,Ingeneral all structures are design to safety certain basic structural andfunctional requirement's.

Various steps in structure design

1. Structure planning
2. Estimation of loads
3. Analysis of structure
4. Member design
5. Drawing detailing and preparation of schedules.

Member design:-All the member are designed manually /using softwareaccording to IS code using analysis results from STAAD-PRO. Drawingand detailing is done in auto cad.

2.3 Introduction to stability

The stability of a pre-engineered building depends on various factors such as the design, construction materials foundation and environmental conditions pre-engineered buildings are typically designedand fabricated to meet specific structure requirements and their stability is often ensured through rigorous engineering and quality process.

The use of high quality steel and other construction materials along with precise engineering calculation, helps to ensure the stability and durability of pre-engineered buildings additionally the proper installationof the building components and adherence to building codes and regulation are crucial for maintaining stability

environmental factors such as wind, snow, seismic activity and soil conditions also play a significant role in the stability of pre-engineered buildings.

The design and construction of these building must take into account these factors to ensure that they can withstand the forces and loads imposed on them. Regular maintenance and inspection are also imposed for
Ensuring the an going stability of pre-engineered buildings this Includes checking for any signs of structure detritions addressing Any issues promptly and making any necessary repair or Reinforcement

Stability:-Vertical support for the whole building is provided by mainframe. It also provides lateral stability for the building in its
Direction while lateral stability in other direction is achieved by a bracingsystem.
The capability of a structure system to transmit various loadings safety to the ground.

Designer have kept structure in equilibrium
$\Sigma H=0$
$\Sigma V=0$
$\Sigma M=0$
Stability of the structure involves 2^{nd} order deflection.

Fundamentals of stabilities

1. Forces follows stiffness
2. Basis of every structure analysis
3. Compatibility
4. Displacement must be in argument
5. Forces to displacement
6. Serviceability and ultimate stress
7. Bare of steel structure

Two fundamental concepts

1. Stiffness in series – avoided
2. Stiffness in parallel – ok

Stability analysis is a method used to predict the behavior of dynamicsystem.

What are stability analysis (as per the AISE)

1. You must include deformation
2. 5mm deflection is ignored
3. Must be equilibrium
4. Loss of stiffness

Geometric effect

1. Screep
2. Camber

Material effects

1. Variation in cross sectional area
2. Crystalline structure
3. Strain harder

Preferment based design

1. It ignores code based design
2. Increase complexity of code
3. Increases compitation

CHAPTER 3

TOLERANCE AND BRACING

Tolerance:-Is defining as acceptable range of deviation from the desired measurement without causing the product to fail. Creating tolerance when designing and manufacturing products is incredible important safety equipment like seatbelt car brakes and airplane wings tends to have a remarkable low tolerance.

Tolerance in engineering is the allowable variation range frame the desired measurement without causing a product to be defective.
Tolerance for any part of the structure the structure should not be out of plumb more than 3.5mm on each 10mm section of height ant not more than 7.0mm per 30 meter section.
The tolerance specified in this standard do not apply to steel structure where the deviation from true position are intimately linked with and direct influenced on erected steel structure shall be as per recommendations of process technologists the tolerance on deviation in the erected steel structure from the true position shall not exceed the valued.

Bracing:-Bracing is structural element that provides lateral stability and resists forces that act perpendicular to the plane of a structure without proper bracing ,a steel structure is vulnerable to collapse without forces of wind ,earth quakes or other external factors. The pre-engineered buildings is analyzed for both lateral forces acting together on a same structure six different types of bracings are provided for lateral stiffness (including tie-runner) bracing used are inverted v-bracing, v-bracing, diagonal bracing, k-bracing, x-bracing and tie-runner.

1. Inverted v-bracing:-Is a type of bracing that provides diagonal supports in one direction it is also known as chevron bracing.
2. Inverted v-bracing:-The two members meet at a center point on the upper horizontal member.
3. X-bracing provides diagonal support in two directions.
4. K-bracing resembles the latter k and can be mounted vertically or horizontally it increases lateral and vertical force resistance.
5. Steel concentrically braced frame are frequently used as efficient lateral load resisting system to resist earth quack and wind loads
6. Horizontal bracing:-The bracing at each floor (in horizontal planes) provides load paths for the transference of horizontal forces to the planes of vertical bracing, horizontal bracing is needed at each floor leave.

Temporary Bracing

1. Structural steel frames require temporary bracing duringconstruction
2. Temporary bracing is placed before plumbing up the structuralframe
3. This gives the structure temporary lateral stability
4. Temporary bracing is removed by the erector.
5. In a braced frame, temporary bracing is removed after final bolt-up is complete and the permanent bracing system is in place
6. In a rigid frame, temporary bracing is removed after final bolt-up is complete.

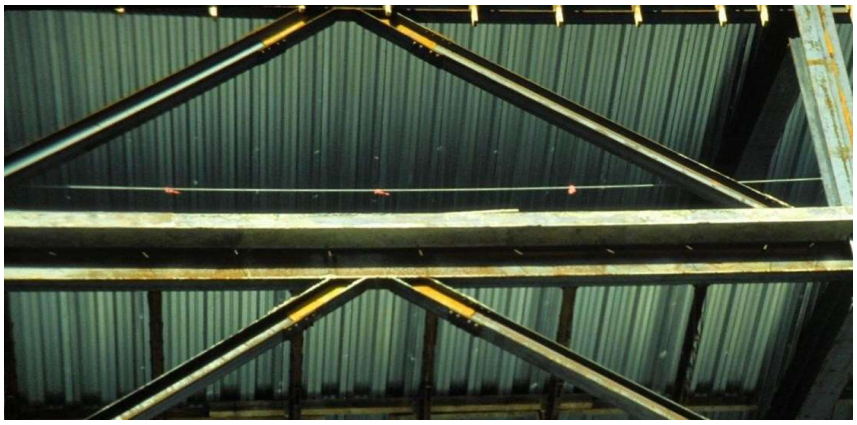


Fig.3 Chevron bracing

Chevron Bracing

1. The members used in Chevron bracing are designed for both tension and compression forces.
2. Chevron bracing allows for doorways or corridors through the bracing lines in a structure.
3. A multi-floor frame elevation using Chevron bracing is shown above.
4. Chevron bracing members use two types of connections.
5. The floor level connection may use a gusset plate much like the connection on X braced frames.

CHAPTER 4

INTRODUCTION TO CONNECTION

Connection in steel structure are crucial element in the structure steel building steel connections include parts such as nails, bolts and welding which serve to connect two or more steel components they can also be used to join steel building to other types of construction they can also a brick or concrete blocks the load bearing capacity and strength of steel connections depends on the installation method proper installation is crucial factor in ensuring that the connections functions effectively.

There are three most common types of connections in steel structure welding connections; bolted connections and riveted connection among them riveted connections are used less frequently due to different in disassembly.

There are three main type of connection

1. Welded connection
2. Bolted connection
3. Riveted connection

Welded connection:-Welding is most common used method in the production of steel structure this method utilized heat (through flame or electric arc)to locally heat the metal at the contact point until it melts and gradually bents after cooling this metal part will slowly solidified forming the weld.

Bolt connection:- Bolt connection in steel structure have been popular for a large time this type of connections is established by fastening two components together using bolts and heavy-duty nuts .Bolts connections can be easily assembled or disassembled ,which greatly facilitates regular inspection and maintenance they can be applied to components subjected to tension, shear or even both.

Riveted connection:-Riveted connection are similar to bolted connections in that both use a type of components to join various elements together this technique involves placing rivets the end of the rivet to ensure the components remain intact however riveted connections rather old method and less common used in practical applications this days.

Steel Connection Types

The Specification for Structural Steel Buildings (AISC 2005) defines twotypes of connections:

1. Simple Connections (above left)
2. Moment Connections (above right)
3. Fully-Restrained and Partially-Restrained

Simple Connections

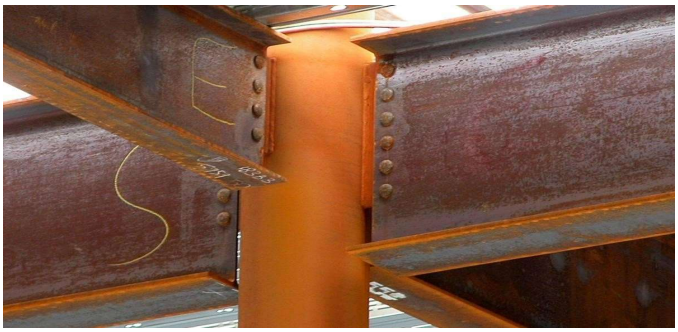


Fig.4 Simple connection

1. Designed as flexible connections
2. Connections are assumed to be free to rotate
3. Vertical shear forces are the primary forces transferred by the connection
4. Require a separate bracing system for lateral stability
5. The following few slides show some common simple framing connections.

Moment Connections

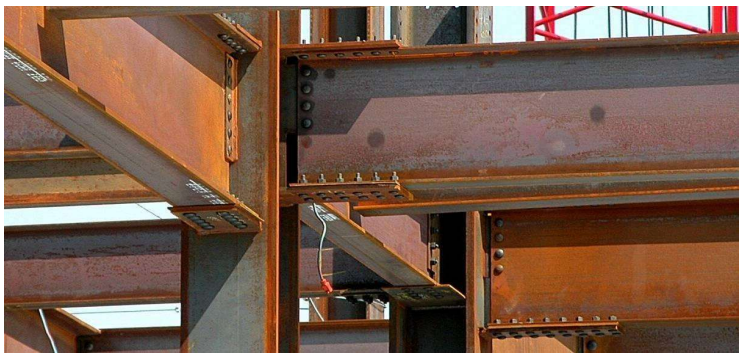


Fig.5 Moment connection

1. Designed as rigid connections which allow little or no rotation
    a. Used in rigid frames
2. Moment and vertical shear forces are transferred through the connection
3. Two types of moment connections are permitted:
    a. Fully-Res trained
    b. Partially-Restrained

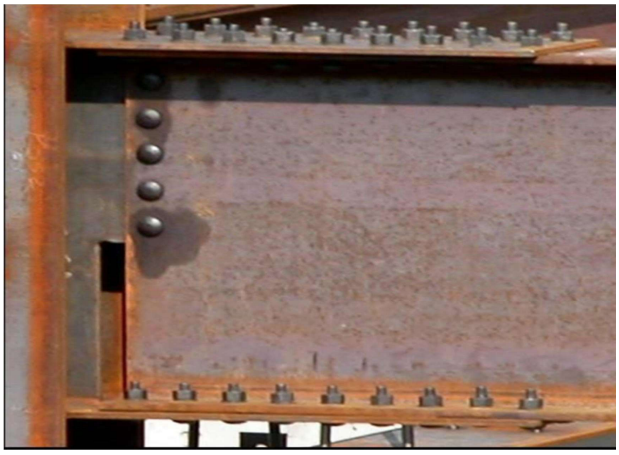


Fig.6 Fully restrained connection

Fig.7 Partially restrained connection

1. Have sufficient strength to transfer moment with negligible rotation between connected members.
2. The angle between connected members is maintained.
3. Have sufficient strength to transfer moments but the rotation between connected members is not negligible.
4. The angle between connected members may change.

Types of weld joints

The purpose of welding joints is to join parts together so that stresses are distributed the forces causing stress in welded joints are tensile, compression, bending, torsion and shear.

Butt joint or Butt weld:-Is a joint where two pieces of metal are placedtogether in a same plane and the side of each metal is joined by welding butt weld is the most common type of joint that is used in the fabrication of structures and piping systems Its fairly simple to prepare and there are many different variation that can be applied to achieve thedesire resect.

Lap joint:-Lap welding joints are essentially a modified version of the butt joint they are framed when two pieces of metal are placed in an overlapping pattern on top of each other they are most commonly used to joint two pieces with differing thicknesses together welds can made ononе or both side.

4.1 Fabrication and erection

Fabrication through welding

The fabrication process includes design and engineering, as well as detailing and manufacturing at the factory. All steel components are fabricated at the factory and linked by bolts at the site. So the erection process is fast, step by step, easy to install and requires simple equipment.

Twelve principles of welded connection design:-

1. A good welded connection is properly sized
    a. Big enough
    b. But not larger than necessary
    c. Otherwise
    d. Increase in distortion
       Increase in construction
       cost
    e. Increase in cracking and tearing tendencies.
2. A good weld connection uses proper weld type

   Fillets> PJP>CJP
    a. PJP: partial joint penetration
    b. CJP: complete joint penetration
3. A good welded connection is preferably evenly loaded.
4. A good welded connection accounts for uneven stress distributionwhen someone.
5. but not all of the elements are connected
6. Shear leg: Is a concept used to account for the uneven stress distributionin connected members when same but not all of their elements (flange, web, leg, etc...) are connected.
7. A good welded connection account for non-uniformity of load transferalong the line of weld due to differences in relative stiffness of has walls.

8. A good welded connection has protected roots.
9. A good welded connection has terminations that have been properlydetailed.
10. A good welded connection does not introduce stress raisers.
11. A good welded connection accounts for material properties.
12. A good welded connection accounts for commercial reality.
13. A good welded connection accounts for safe and economical joint.
14. A good welded connection allows the welder to see the puddle.

"Good workmanship and good design details incorporating joining geometry that avoids severe stress concentrations are generally the most effective means of provides fracture resistant construction".

Erection through bolts

1. Lifting and placing: Components are lifted and placed into position.
2. Connecting: Components are connected together. This is usuallydone by bolting, but sometimes site welding is used.
3. Aligning: Components are positioned and aligned on prepared foundations.
4. Securing: Components are secured to form a complete frame.

Bolting basics

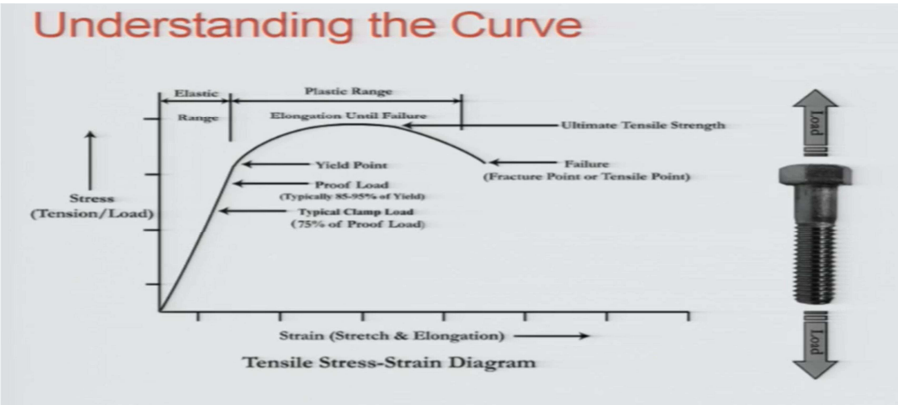


Fig.8 Stress-strain diagram of bolt

1. Nuts should be strength then bolts.
2. The most bolt threads in the grip the better worry more about shank-out than stick-out.
3. Lubrication is essential to performance (especially if performing as clamps).
4. Torque can be a good indicator of tension if controlled but we donot control or recognize torque directly.

Bolts and nuts threads

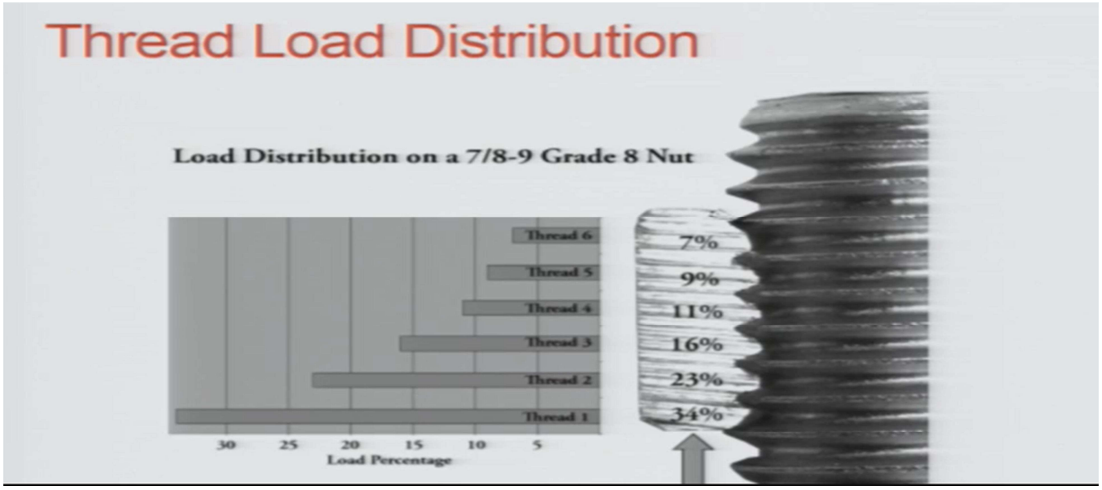


Fig.9 Distribution of load in bolt thread

1. There are over 120 elements to thread design.
2. Standard allow as ignoring most of those elements but a few are important to understand.
3. Inch series structural bolts are always "unified course", class -2Atolerance

Engineer's responsibility

1. grade/type/ finish selection
2. non-standard selection [if any]
3. installation method
4. inspection
5. Proposed assembly [nuts/washers/ hole size/etc.]
6. standards allow to ignore most of the 120 elements in thread design but few
   Important of engineers responsibility
   Load distribution [half the load is in first two threads
   Basic thread dia
   Thread
   class
   Geometry
   Pitch and pitch diameter [pd]
   To oversize the pd if coating is done [major dia and minor dia]
   Coating is a significant issue- ensure 4 point contact.

CHAPTER 5

QUALITY CONTROL

Quality control in pre-engineered buildings ensures that the buildings are manufacturing to the required strength and durability standards pre-engineered buildings are designed to with stand various loads and environmental conditions.

Quality control plays pivotal role in the manufacturing processes of pre-engineered buildings as it ensure the structure integrity and safety of these modern.
One of the fundamental aspects of quality control in pre-engineering buildings manufacturing is the thorough inspection and testing of materials used in the construction process. This ensures that the raw materials meet the required specifications and possess the necessary strength, durability, and other essential properties.

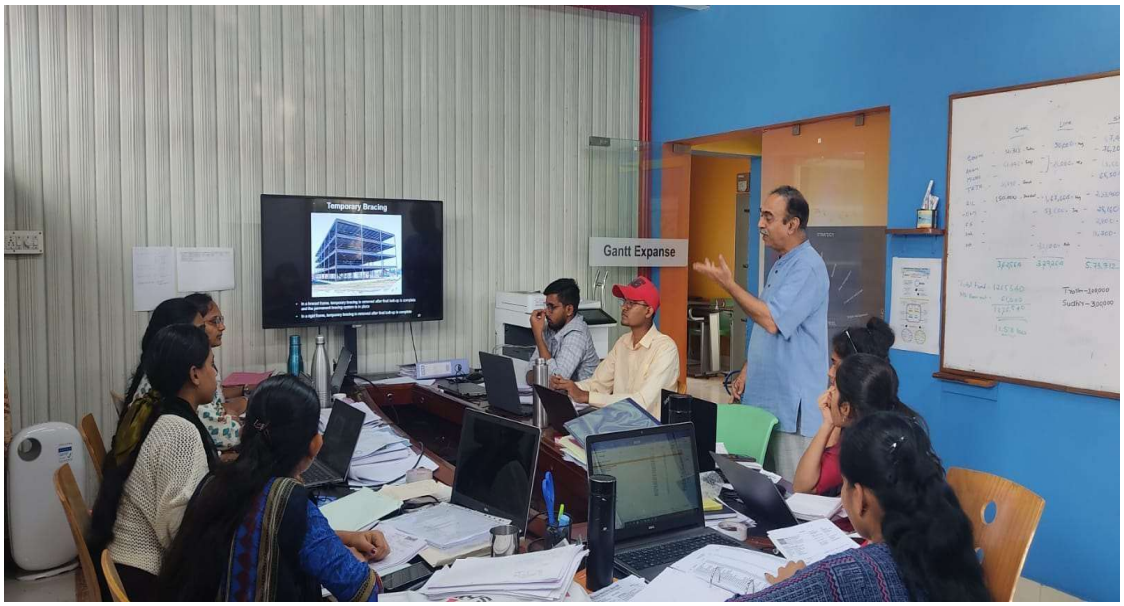
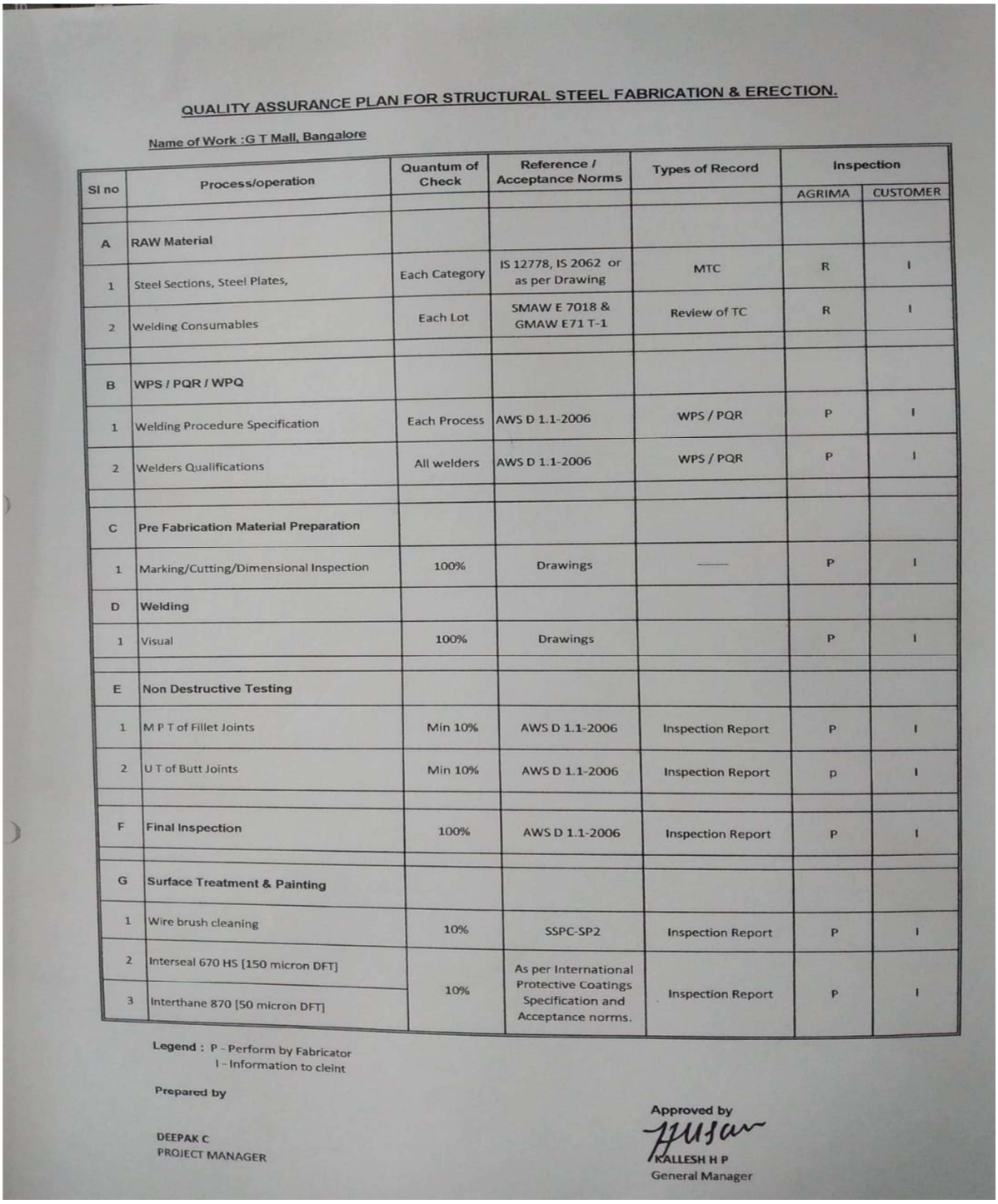


Fig.10 Explanation about temporary bracings

Sir explained the pre-engineered structure and along with that sir explained how bracing and connections are done in pre-engineeredbuildings.



QUALITY ASSURANCE PLAN FOR STRUCTURAL STEEL FABRICATION & ERECTION.

Name of Work :G T Mall, Bangalore

Sl no	Process/operation	Quantum of Check	Reference / Acceptance Norms	Types of Record	Inspection	
					AGRIMA	CUSTOMER
A	RAW Material					
1	Steel Sections, Steel Plates,	Each Category	IS 12778, IS 2062 or as per Drawing	MTC	R	I
2	Welding Consumables	Each Lot	SMAW E 7018 & GMAW E71 T-1	Review of TC	R	I
B	WPS / PQR / WPQ					
1	Welding Procedure Specification	Each Process	AWS D 1.1-2006	WPS / PQR	P	I
2	Welders Qualifications	All welders	AWS D 1.1-2006	WPS / PQR	P	I
C	Pre Fabrication Material Preparation					
1	Marking/Cutting/Dimensional Inspection	100%	Drawings	——	P	I
D	Welding					
1	Visual	100%	Drawings		P	I
E	Non Destructive Testing					
1	M P T of Fillet Joints	Min 10%	AWS D 1.1-2006	Inspection Report	P	I
2	U T of Butt Joints	Min 10%	AWS D 1.1-2006	Inspection Report	p	I
F	Final Inspection	100%	AWS D 1.1-2006	Inspection Report	P	I
G	Surface Treatment & Painting					
1	Wire brush cleaning	10%	SSPC-SP2	Inspection Report	P	I
2	Interseal 670 HS [150 micron DFT]	10%	As per International Protective Coatings Specification and Acceptance norms.	Inspection Report	P	I
3	Interthane 870 [50 micron DFT]					

Legend : P - Perform by Fabricator
I - Information to cleint

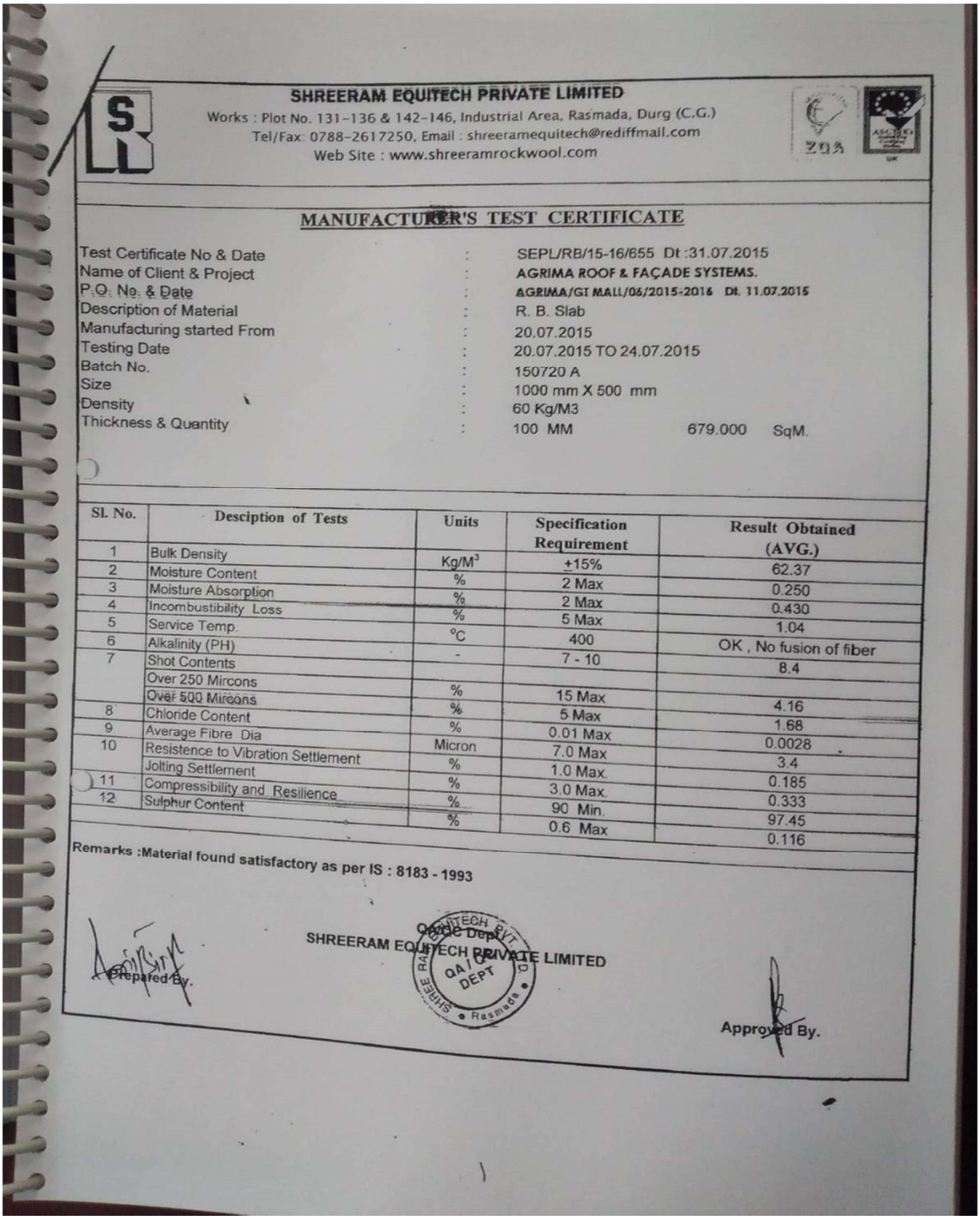
Prepared by

DEEPAK C
PROJECT MANAGER

Approved by

KALLESH H P
General Manager

Fig.11 Welding procedure



SHREERAM EQUITECH PRIVATE LIMITED

Works : Plot No. 131-136 & 142-146, Industrial Area, Rasmada, Durg (C.G.)
Tel/Fax: 0788-2617250, Email : shreeramequitech@rediffmail.com
Web Site : www.shreeramrockwool.com

MANUFACTURER'S TEST CERTIFICATE

Test Certificate No & Date	:	SEPL/RB/15-16/655 Dt :31.07.2015
Name of Client & Project	:	AGRIMA ROOF & FAÇADE SYSTEMS.
P.O. No. & Date	:	AGRIMA/GT MALL/06/2015-2016 Dt. 11.07.2015
Description of Material	:	R. B. Slab
Manufacturing started From	:	20.07.2015
Testing Date	:	20.07.2015 TO 24.07.2015
Batch No.	:	150720 A
Size	:	1000 mm X 500 mm
Density	:	60 Kg/M3
Thickness & Quantity	:	100 MM 679.000 SqM.

Sl. No.	Desciption of Tests	Units	Specification Requirement	Result Obtained (AVG.)
1	Bulk Density	Kg/M^3	+15%	62.37
2	Moisture Content	%	2 Max	0.250
3	Moisture Absorption	%	2 Max	0.430
4	Incombustibility Loss	%	5 Max	1.04
5	Service Temp.	°C	400	OK , No fusion of fiber
6	Alkalinity (PH)	-	7 - 10	8.4
7	Shot Contents			
	Over 250 Mircons	%	15 Max	4.16
	Over 500 Mircons	%	5 Max	1.68
8	Chloride Content	%	0.01 Max	0.0028
9	Average Fibre Dia	Micron	7.0 Max	3.4
10	Resistence to Vibration Settlement	%	1.0 Max.	0.185
	Jolting Settlement	%	3.0 Max.	0.333
11	Compressibility and Resilience	%	90 Min.	97.45
12	Sulphur Content	%	0.6 Max	0.116

Remarks :Material found satisfactory as per IS : 8183 - 1993

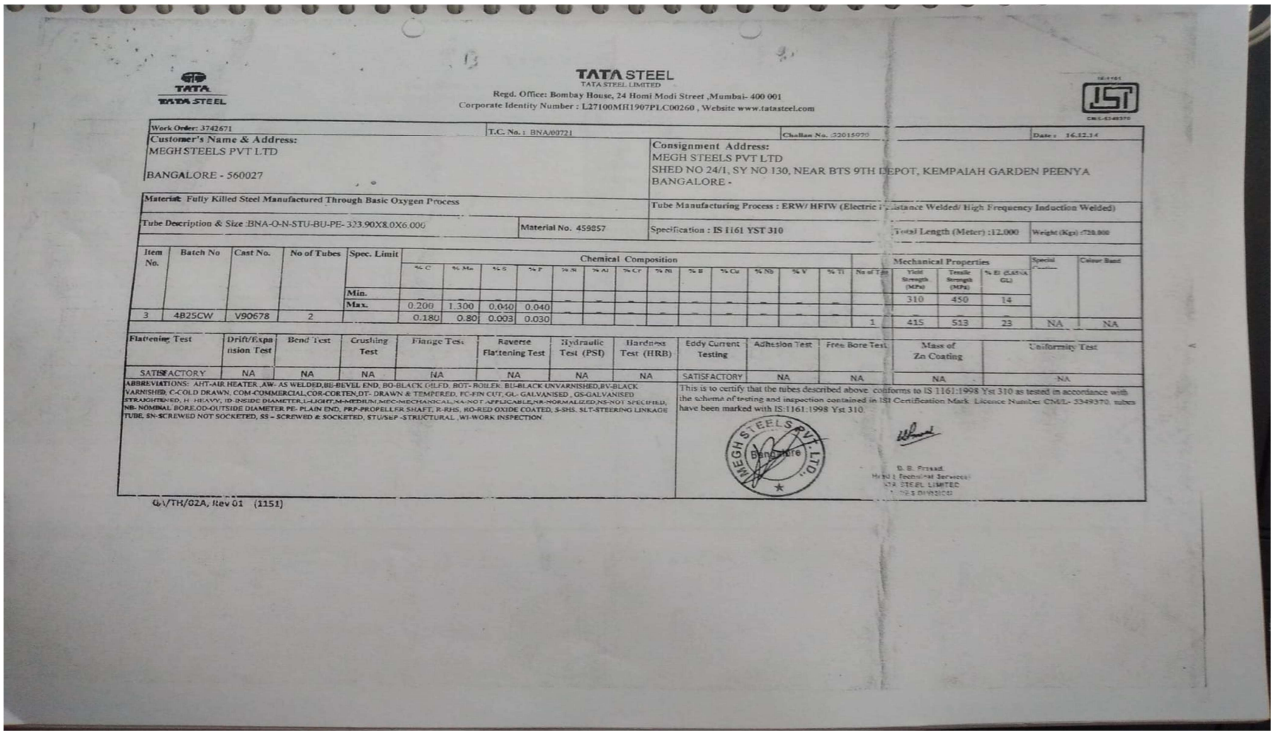
SHREERAM EQUITECH PRIVATE LIMITED

Prepared By.

QA/QC Dept.

Approved By.

Fig.12 Manufacturing certificate



TATA STEEL
TATA STEEL LIMITED
Regd. Office: Bombay House, 24 Homi Modi Street ,Mumbai- 400 001
Corporate Identity Number : L27100MH1907PLC00260 , Website www.tatasteel.com

Work Order: 3742671 | T.C. No. : BNA/09721 | Challan No. :32015099 | Date : 16.12.14

Customer's Name & Address:
MEGH STEELS PVT LTD
BANGALORE - 560027

Consignment Address:
MEGH STEELS PVT LTD
SHED NO 24/1, SY NO 130, NEAR BTS 9TH DEPOT, KEMPAIAH GARDEN PEENYA
BANGALORE -

Material: Fully Killed Steel Manufactured Through Basic Oxygen Process
Tube Manufacturing Process : ERW/ HFIW (Electric Resistance Welded/ High Frequency Induction Welded)
Tube Description & Size :BNA-O-N-STU-BU-PE- 323.90X8.0X6.000
Material No. 459857
Specification : IS 1161 YST 310
Total Length (Meter) :12.000
Weight (Kgs) :728.800

Item No.	Batch No	Cast No.	No of Tubes	Spec. Limit	Chemical Composition													Mechanical Properties			Special Feature	Colour Band
					% C	% Mn	% S	% P	% N	% Al	% Cr	% Ni	% B	% Cu	% Nb	% V	% Ti	No of Tests	Yield Strength (MPa)	Tensile Strength (MPa)	% El (GAUGE GL)		
				Min.															310	450	14		
				Max.	0.200	1.300	0.040	0.040															
3	4B25CW	V90678	2		0.180	0.80	0.003	0.030										1	415	513	23	NA	NA

Flattening Test	Drift/Expansion Test	Bend Test	Crushing Test	Flange Test	Reverse Flattening Test	Hydraulic Test (PSI)	Hardness Test (HRB)	Eddy Current Testing	Adhesion Test	Free Bore Test	Mass of Zn Coating	Uniformity Test
SATISFACTORY	NA	NA	NA	NA	NA	NA	NA	SATISFACTORY	NA	NA	NA	NA

ABBREVIATIONS: AHT-AIR HEATER, AW- AS WELDED,BE-BEVEL END, BO-BLACK OILED, BOT- BOILER, BU-BLACK UNVARNISHED,BV-BLACK VARNISHED, C-COLD DRAWN, COM-COMMERCIAL,COR-CORTEN,DT- DRAWN & TEMPERED, FC-FIN CUT, GL- GALVANISED , GS-GALVANISED STRAIGHTENED, H - HEAVY, ID-INSIDE DIAMETER,L-LIGHT,M-MEDIUM,MECH-MECHANICAL,NA-NOT APPLICABLE,NR-NORMALIZED,NS-NOT SPECIFIED, NB- NOMINAL BORE,OD-OUTSIDE DIAMETER PE- PLAIN END, PRP-PROPELLER SHAFT, R-RHS, RO-RED OXIDE COATED, S-SHS, SLT-STEERING LINKAGE TUBE, SN-SCREWED NOT SOCKETED, SS - SCREWED & SOCKETED, STUSLF -STRUCTURAL, WI-WORK INSPECTION

This is to certify that the tubes described above conforms to IS 1161:1998 Yst 310 as tested in accordance with the scheme of testing and inspection contained in ISI Certification Mark. Licence Number: CML- 3349370. tubes have been marked with IS:1161:1998 Yst 310.

MEGH STEELS PVT LTD Bangalore

B. B. Prasad
Head (Technical Services)
TATA STEEL LIMITED
A TATA ENTERPRISE

Q:\/TH/02A, Rev 01 (1151)

Fig.13 Tensile test certificate on steel

Site visit

We visited to PNR site on 23/11/2023 at 9:00AM and saw all the work and we discuss some of the things with Mr. Manju who was the site incharge and cleared some doubt, he explained how the erection has done in the site and machinery used for the erection

Fig.14 I-section beam structure

Fig.15 I-section column structure

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8. Quality Control, Project Documented By Agrima Roof And Façade Systems (Project Name, "G T Mall Banglore").This Project Was Done In 2013.

ANNEXURE

College Permission letter

ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY
(Unit of Alva's Education Foundation (R), Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi & Approved by AICTE, New Delhi. Recognized by Government of Karnataka.
A+, Accredited by NACC & NBA (ECE & CSE)
Shobhavana Campus, MIJAR-574225, Moodbidri, D.K., Karnataka
Ph: 08258-262725; Mob:7022262724,7026262725,mail:principalaiet08@gmail.com

INTERNSHIP DETAILS (2023 – 24)

PERSONAL DETAILS		
1	Name of the Student	Suhas K
2	USN	4AL21CV013
3	Semester	IV th sem
4	Mobile Number	8792765101
5	Email ID	ksuhas019@gmail.com

COMPANY DETAILS			
1	Name of the company	Agrima Roof and Facade systems	
2	Address of the Company	D.no: H0, 2nd main Road NR, near APS college, NR colony, Basavanagudi, Bengaluru, Karnataka 560019	
3	Name of the Contact Person	Name	Ashwin
		Designation	Senior Engineer
		Contact No.	9741079651
		E mail	constructionwarriors@agrima.in
4	Duration of Internship	Days. one month (30 days)	
5	Date of Internship: (dd/mm/yyyy)	From: 30/10/23 To: 30/11/2023	

Signature of Student	Suhas K
Signature of TPO (Dept. Placement Coordinator)	
Signature of Internship Coordinator	
Signature of HOD	25.10.23

AGRIMA
ROOF AND FACADE SYSTEMS

Internship completion certificate

This is to certify that

Mr. **Suhas K** bearing USN **4AL21CV013** from Alva's Institute of Engineering and Technology, Moodbidri has actively participated on topic "**Pre-Engineered Buildings**" in one month intern's program at our company in the month of November-2023.

B Govind Ramesh
Chief mentor
Agrima Roof And Facade Systems

Dr H Ajith Hebbar
HOD, Dept. Of Civil Engineering
Alva's Institute of Engineering and Technology

#40 2nd main,NR colony (near APS college),Bengaluru-19,E-mail aalambana@agrima.in

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama" Belagavi – 590010

REPORT ON INDUSTRIAL TRAINING AT

"AGRIMA ROOF AND FACADE SYSTEMS, BENGALORE"

Submitted By

PRASHANTH S

4AL21CV007

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF ENGINEERING
In
CIVIL ENGINEERING

Under the guidance of

Dr. H G UMESHCHANDRA
Associate Professor
Department of Civil Engineering

ALVA'S
Education Foundation®

DEPARTMENT OF CIVIL ENGINEERING
ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY
MOODBIDRI – 574 225

2023-24

ALVA'S INSTITUTE OF ENGINEERING AND TECHNOLOGY

(A Unit of Alva's Education Foundation®)

MOODBIDRI – 574 225

(Affiliated to VTU, Belagavi)

ALVA'S
Education Foundation®

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

This is to certify that **PRASHANTH S** bearing **4AL21CV007** has submitted an **INTERNSHIP REPORT** on training done at "**AGRIMA ROOF AND FACADE SYSTEMS.**" for VI semester B.E. in Civil Engineering, in partial fulfilment for the award of BACHELOR OF ENGINEERING in **CIVIL ENGINEERING** of the **VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI** during the academic year **2023–24**. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The report has been approved as it satisfies the academic requirements in respect of **21INT68-INTERNSHIP** prescribed for the Bachelor of Engineering Degree.

Dr. H G UMESHCHANDRA	**Prof. ANUSHA B RAO**	**Prof. DURGA PRASAD BALIGA**
Internal Guide	**Internship Coordinator**	**Head of the Department**

31/07/2024

Dept. of Civil Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodbidri - 574 225

EXTERNIAL VIVA

1) .....

2).....

CIE = 99/100

Department of Civil Engineering
Alva's Institute of Engg. & Technology
Shobhavana Campus, Mijar
MOODBIDRI - 574225, D.K.

ACKNOWLEDGEMENT

I express my sincere gratitude and indebtedness to "**AGRIMA ROOF AND FACADE SYSTEMS**." Bengaluru for their guidance, keen interest and advice rendered during the training period.

I express my sincere gratitude and indebtedness to **Dr. Peter Fernandes** , Principal of Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I express my sincere gratitude and indebtedness to **Prof. Durga Prasad Baliga** HOD, Department of Civil Engineering, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work

I express my sincere gratitude to my **guide** Mr Ashwin (senior engineer) from agrima roof and facade systems Bengaluru .for their constant guidance and support throughout this work

I am thankful to my guide, **Dr.H G Umeshchandra, Associate Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work

I am also thankful to the Internship Coordinator, **Prof. Anusha B Rao Assistant Professor, Department of Civil Engineering**, Alva's Institute of Engineering and Technology, Moodbidri, for their constant guidance and support throughout this work.

I am also thankful to all the technical and non-technical staff of Simon and Associates who have directly or indirectly helped in this endeavor

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CHAPTER 1

COMPANY PROFILE

1.1 About Agrima Roof and Façade System

In the year 1985, a small team of young Engineers fresh from Civil Engineering Graduation. Started executing Civil and Mechanical work at Nuclear Reactor Installation in Kaiga, India. The team climbed in work and scope over the years. The team added critical and complex works such as Reactivity Mechanism, End Shield Installations, Heavy water plant, nuclear piping, etc. expanding the learning curve continuously. Consistently winning safety awards for seven times is one proof of the excellent track record maintained by the team.

The company was named "AGRIMA ROOF AND FACADE SYSTEMS" in the year 2012 and took an initiation of sustainable building materials in construction andalso executed export projects at Maldives and Bangladesh. Agrima got affiliated with Palram, Israel in the year 2016. Pure engineering and construction company with well-established divisions in mechanical, pre-engineered buildings, and fabrications. Promoted by engineers with two decades of experience. Having offices in Bangalore, Hyderabad and Hong Kong.

More than 250 works completed in remote and project areas in India.

1.2 Services

1) Pre-Engineered building
2) Kingspan–Ireland
   i) Standing Seam Roofing System – Aluminium
   ii) Façade System - Aluminium
3) Palram system –Israel
   i) poly house and flat
   ii) skylight
   iii) Multiwall Polycarbonate Standing seam roofing & Facade system
   iv) Solid Polycarbonate Standing-Seam Architectural System
   v) Multi-layered PVC sheet
4) Kalzip Roofing and Facade system
5) Nuclear works
6) Lysaght - Tata
   i) Galvalume Roof & FaçadeTrimdek
   ii) Klip-Lok System
   iii) Flex-Lok System
   iv) MR-24 System

CHAPTER 2

PRE-ENGINEERING BUILDING

2.1 Introduction

Technological improvement over the years has contributed immensely to the enhancement of the quality of life through various new products and services .Technology can be utilized which has the potential totransform civil construction practices across the country.

Pre-engineered buildings are metal enclosure buildings that contain factory mode structural frames, roof and wall support. The complete design of such buildings is created at a factory and the pre-engineered building components are brought to the site and installed. Pre-engineered buildings is designed by a pre-engineered building supplier or pre-engineered building manufacturer with single design to be fabricated using various material and methods to satisfy a wide range of structure and aesthetic design requirments.This is constructed with a buildings built to design that was created specifically for that building with in some geographic industry sectors pre-engineered buildings are also called pre-engineered metal buildings as is becoming increasingly common due to the reduced amount of pre-engineering involves in custom computer– aided designs simply engineered metal buildings the I-beams are then field assembled to form the entire from of the pre-engineered building some manufacturers taper the forming member according to the local loadings effects larger plate dimensions are used in areas of higher load effects.

Advantages of pre-engineered buildings

Time saving:-It takes less time to complete pre-engineered buildings and projects can deliver on time.

Cost effective solution:-As most of the ports of pre-engineered buildings are manufactured at a factory they save you lots of money.

Low maintenance and highly durable:-The steel does not crack; wrap the construction required zero maintenance.

Customized solution:-You can design the pre-engineered buildings structureas per your needs and requirements and the space available at the site.

Eco friendly:-Most importantly these structures are eco-friendly as the material used in the construction can be recycled and reused consideringenvironment safety concerns.

Less expensive because of the design manufacturing and on site erection cost saving. Since all of these pre-fabricated and skilled labours are used to connect the various components quick assembly is possible

Dis-advantages of pre-engineered buildings

1. Eco system in India is yet to develop.
2. Non-standard buildings are difficult to implement.
3. Complex machines and technique required
4. Complex software required.
5. Modifications are not possible.

Application s of the pre-engineered buildings

1. Warehouse
2. Factories
3. Gas stations
4. Metro stations
5. Railway station
6. Outdoor stadium etc…….

2.2 Materials

Fabrication is defined as the process of manufacturing, assembly and joining different components to form complex structures. The structure generally uses readily available standard sections which are manufactured from steel used in fabrication is selected from a range of alloys of iron and corban with addition of small quantity of silica .these various alloys of steel are tensile strength.

Important to select the suitable material depending upon the condition of service as per the function requirement .The availability of the material at site is also an important conditions. Structure steel is produced in wide range of shapes and grades which permits maximum flexibility of design steel is relatively inexpensive most versatile and economic material available to fabrication.

Steel as a construction material

Steel as a basic raw material for construction has been receiving attention all over the world. The effects are being made to achieve maximum economy in its utilization. Structure steel is widely used in various types of industrial structure such as building, framework, railway and highway bridges, tower construction special structure such as storage tanks, gas holders, bunkers, technologies structure, like blast furniture's stoves.

Merits of steel

Steel is mainly used for the construction due to its high strength properties and ability to resist more loads and comparatively lighter weight. Steel as a construction material gives long services life, higher gas and water tightness case for fabrication; assembly erection alteration and modification up to a greater extent are possible on steel structure construction required at later date.

Classification of steel material

1. Shaped products
2. Flat products
3. Track material
4. Special items for steel structure construction in industry
   The steel sections generally used are angle, channels, beam plates, roils, galvanized sheets, tubes and pipes.

Sankey diagram for steel

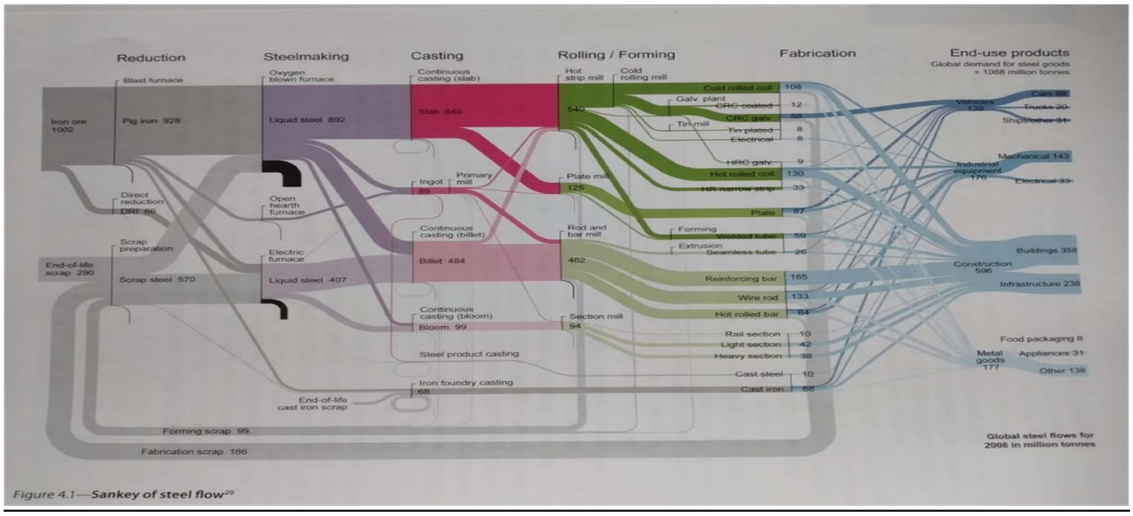


Fig.1 Sankey diagram of steel

The steel map shown that two-third of the worlds steel is made from mined oreand one-third from recycled scrap one-fifth from manufacturing and fabrication and two fifth from end life productions and buildings the dominant production routes for steel made from ore is the basic oxygen furnace and from scrap is the electric arc furnace although these is one same interchange between the two more than 99% of the worlds steel rolled after casting and the resting stock products are approximately one tenth plate for tenth strip four tenth ,rod and bar and one tenth section ,half of the words steel is used in construction of which one third is reinforcing steel most steel used in vehicle manufacture is from cold rolled coil or from casting.

Sustainability of pre-engineered buildings (PEBs)

Pre-engineered buildings are considered sustainable because they have a lower environmental impact than traditional brick and stone construction. Pre- engineered buildings are built using sustainable materials like recycled steel and composite material made from recycled plastic. Pre-engineered buildings are designed to optimize material used which also limits any waste production, their production process results in low carbon footprint when compared to traditional building.

Components of pre-engineered buildings (PEBs)

Pre-engineered buildings (PEBs) are metal buildings that can be adopted to suit a wide range of structural application. They are supplied as a fully finished produced along with steel structure, building accessories and roof cladding. They required on site fabrication or welding.

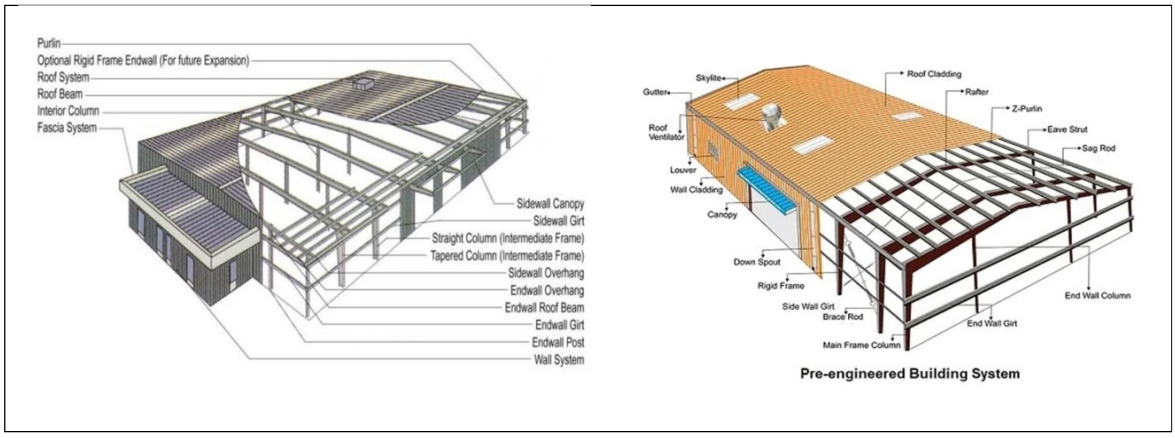


Fig.2 Components of pre-engineered buildings

Primary Frame:-Primary frames consist of trusses, column or castellated beams etc. These are built up of I-sections steel members all the load of structure members passes to the base and consist of end wall frames. These end wall frame are either designed with rigid frames or with economic bearing frame. These frames are reinforced with wind bracing and connecting bolts, sometimes with anchor bolts.

Secondary elements:-Are cold-framed structural members available in different shape like C, Z etc.. Commonly known as "purling" for overall structure stability these purines transfer force from one frameto another.

Roofs and wall panels:-Some of the pre-engineering building components like roofs and wall panels come in tin shades and curtain walls mode of glass and roll framed steel sheets some special roofing sheets are used to minimize energy usage.

Sandwich panels:-These panels are made in this layer where one non- aluminum layer is placed in between two aluminum sheet. Some other components of sandwich panels are bolted insulation, mezzanine floors, skylight flashlight, cage ladder, cable trays ducts, cranes etc..

Foundation and floors system:-Made up of conventional concrete system usually called as open foundations system.

Main frame Or vertical columns:-The mainframe includes the steel rigid frames of the building.

End wall frames:-This is designed as a main rigid frame.

Purlins, grits and eave structure:-These are the secondary cold- frames members of the components of the pre-engineered buildings.

Design requirements

The structure design is an art and science of designing with the elegance and economy, safe serviceable and structure, internal all structures are designed to safety certain basic structure and functional requirements.

Structural design requirements

1. Strength
2. Stability
3. Safety
4. Durability
5. Serviceability
6. Economy

The designed structure should be strong enough to with stand all types of loads coming without excessive deformations or deflection and should be stable under largest stipulated loads.

The entire process of the structure planning and design requires
Not only imagination and concepts thinking but also sound knowledge ofscience of structural engineering knowledge of practice aspects such as relevant design codes and lows backed up by ample experience intuition and judgment.
In order to accurate design a pre-engineered building ,engineers considers the clear span between bearing points, boys spacing roof slope, live loads dead collateral loads wind uplift, deflection criteria, internal crane system and maximum practical size and weight of fabricated members.

When design a pre-engineered building (PEBs), engineers should consider many factors. Such as

1. Building dimensions length, width and height.
2. Clear span:-Distance between bearing points.
3. Bay spacing:-Distance between bays.
4. Roof slope:-Angle of the roof.
5. Loads:-Live loads on the roof and frames, dead loads, wind load and earthquake zone.
6. Internal crane system:-Whether there is an internal crane system.
7. Foundation:-Composition of the footing plate, footing brace footing.
   Column with reinforced concrete and blots.
8. Fire exits and safety:-Whether the area is prone to wild fires.
9. End bay length:-Distance from the outside of the outer flange of end wall column to the center line of the first interior from column's.
10. Interior bay length:-Distance between the center line's two adjacent interior main frame columns.

Structural welding code:-Steel structure simple span beam shall be span /240 and steel structure for cantilever span beam shall be span/120.

Basis of design

1. **Design objective:-**The objective of design's the achievement of an acceptable probability that structure will perform satisfactorily for the intended purpose during the design life with an appropriate degree of safety they should sustain all the load's and deformation's.
2. **Methods of design:-**Structure and its elements shall normally, be design by the limit state methods .Account should be taken of accepted theories, experimented information and experience and theneed to design for durability.
3. **Design process:-**Structural design including design for durability construction and use should be considered as a whole. The realizationof design objectives required complaisance with clearly designed standard for material's, fabrication, erection and in service maintenance.
4. **Design requirement's:-**The structural should design is an art and science of designing with the elegance and economy, safe serviceable and adorable structure ,Ingeneral all structures are design to safety certain basic structural andfunctional requirement's.

Various steps in structure design

1. Structure planning
2. Estimation of loads
3. Analysis of structure
4. Member design
5. Drawing detailing and preparation of schedules.

Member design:-All the member are designed manually /using softwareaccording to IS code using analysis results from STAAD-PRO. Drawingand detailing is done in auto cad.

2.3 Introduction to stability

The stability of a pre-engineered building depends on various factors such as the design, construction materials foundation and environmental conditions pre-engineered buildings are typically designedand fabricated to meet specific structure requirements and their stability is often ensured through rigorous engineering and quality process.

The use of high quality steel and other construction materials along with precise engineering calculation, helps to ensure the stability and durability of pre-engineered buildings additionally the proper installationof the building components and adherence to building codes and regulation are crucial for maintaining stability environmental factors such as wind, snow, seismic activity and soil conditions also play a significant role in the stability of pre-engineered buildings.

The design and construction of these building must take into account these factors to ensure that they can withstand the forces and loads imposed on them. Regular maintenance and inspection are also imposed for
Ensuring the an going stability of pre-engineered buildings this Includes checking for any signs of structure detritions addressing Any issues promptly and making any necessary repair or Reinforcement

Stability:-Vertical support for the whole building is provided by mainframe. It also provides lateral stability for the building in its
Direction while lateral stability in other direction is achieved by a bracingsystem.
The capability of a structure system to transmit various loadings safety to the ground.

Designer have kept structure in equilibrium
$\Sigma H=0$
$\Sigma V=0$
$\Sigma M=0$
Stability of the structure involves 2^{nd} order deflection.

Fundamentals of stabilities

1. Forces follows stiffness
2. Basis of every structure analysis
3. Compatibility
4. Displacement must be in argument
5. Forces to displacement
6. Serviceability and ultimate stress
7. Bare of steel structure

Two fundamental concepts

1. Stiffness in series – avoided
2. Stiffness in parallel – ok

Stability analysis is a method used to predict the behavior of dynamicsystem.

What are stability analysis (as per the AISE)

1. You must include deformation
2. 5mm deflection is ignored
3. Must be equilibrium
4. Loss of stiffness

Geometric effect

1. Screep
2. Camber

Material effects

1. Variation in cross sectional area
2. Crystalline structure
3. Strain harder

Preferment based design

1. It ignores code based design
2. Increase complexity of code
3. Increases compitation

CHAPTER 3

TOLERANCE AND BRACING

Tolerance:-Is defining as acceptable range of deviation from the desired measurement without causing the product to fail. Creating tolerance when designing and manufacturing products is incredible important safety equipment like seatbelt car brakes and airplane wings tends to have a remarkable low tolerance.

Tolerance in engineering is the allowable variation range frame the desired measurement without causing a product to be defective.
Tolerance for any part of the structure the structure should not be out of plumb more than 3.5mm on each 10mm section of height ant not more than 7.0mm per 30 meter section.
The tolerance specified in this standard do not apply to steel structure where the deviation from true position are intimately linked with and direct influenced on erected steel structure shall be as per recommendations of process technologists the tolerance on deviation in the erected steel structure from the true position shall not exceed the valued.

Bracing:-Bracing is structural element that provides lateral stability and resists forces that act perpendicular to the plane of a structure without proper bracing ,a steel structure is vulnerable to collapse without forces of wind ,earth quakes or other external factors. The pre-engineered buildings is analyzed for both lateral forces acting together on a same structure six different types of bracings are provided for lateral stiffness (including tie-runner) bracing used are inverted v-bracing, v-bracing, diagonal bracing, k-bracing, x-bracing and tie-runner.

1. Inverted v-bracing:-Is a type of bracing that provides diagonal supports in one direction it is also known as chevron bracing.
2. Inverted v-bracing:-The two members meet at a center point on the upper horizontal member.
3. X-bracing provides diagonal support in two directions.
4. K-bracing resembles the latter k and can be mounted vertically or horizontally it increases lateral and vertical force resistance.
5. Steel concentrically braced frame are frequently used as efficient lateral load resisting system to resist earth quack and wind loads
6. Horizontal bracing:-The bracing at each floor (in horizontal planes) provides load paths for the transference of horizontal forces to the planes of vertical bracing, horizontal bracing is needed at each floor leave.

Temporary Bracing

1. Structural steel frames require temporary bracing duringconstruction
2. Temporary bracing is placed before plumbing up the structuralframe
3. This gives the structure temporary lateral stability
4. Temporary bracing is removed by the erector.
5. In a braced frame, temporary bracing is removed after final bolt-up is complete and the permanent bracing system is in place
6. In a rigid frame, temporary bracing is removed after final bolt-up is complete.

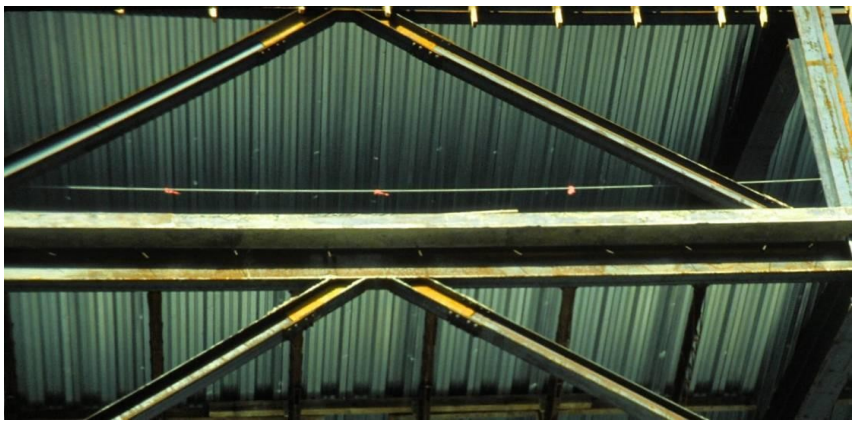


Fig.3 Chevron bracing

Chevron Bracing

1. The members used in Chevron bracing are designed for both tension and compression forces.
2. Chevron bracing allows for doorways or corridors through thebracing lines in a structure.
3. A multi-floor frame elevation using Chevron bracing is shownabove.
4. Chevron bracing members use two types of connections.
5. The floor level connection may use a gusset plate much like theconnection on X braced frames.

CHAPTER 4

INTRODUCTION TO CONNECTION

Connection in steel structure are crucial element in the structure steel building steel connections include parts such as nails, bolts and welding which serve to connect two or more steel components they can also be used to join steel building to other types of construction they can also a brick or concrete blocks the load bearing capacity and strength of steel connections depends on the installation method proper installation is crucial factor in ensuring that the connections functions effectively.

There are three most common types of connections in steel structure welding connections; bolted connections and riveted connection among them riveted connections are used less frequently due to different in disassembly.

There are three main type of connection

1. Welded connection
2. Bolted connection
3. Riveted connection

Welded connection:-Welding is most common used method in the production of steel structure this method utilized heat (through flame or electric arc)to locally heat the metal at the contact point until it melts and gradually bents after cooling this metal part will slowly solidified forming the weld.

Bolt connection:- Bolt connection in steel structure have been popular for a large time this type of connections is established by fastening two components together using bolts and heavy-duty nuts .Bolts connections can be easily assembled or disassembled ,which greatly facilitates regular inspection and maintenance they can be applied to components subjected to tension, shear or even both.

Riveted connection:-Riveted connection are similar to bolted connections in that both use a type of components to join various elements together this technique involves placing rivets the end of the rivet to ensure the components remain intact however riveted connections rather old method and less common used in practical applications this days.

Steel Connection Types

The Specification for Structural Steel Buildings (AISC 2005) defines twotypes of connections:

1. Simple Connections (above left)
2. Moment Connections (above right)
3. Fully-Restrained and Partially-Restrained

Simple Connections

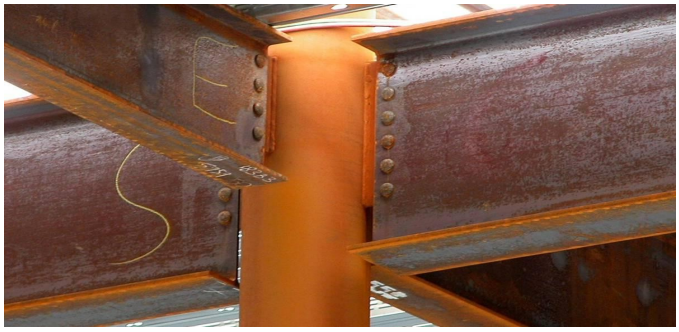


Fig.4 Simple connection

1. Designed as flexible connections
2. Connections are assumed to be free to rotate
3. Vertical shear forces are the primary forces transferred by theconnection
4. Require a separate bracing system for lateral stability
5. The following few slides show some common simple framingconnections.

Moment Connections

Fig.5 Moment connection

1. Designed as rigid connections which allow little or no rotation
    a. Used in rigid frames
2. Moment and vertical shear forces are transferred through theconnection
3. Two types of moment connections are permitted:
    a. Fully-Res trained
    b. Partially-Restrained

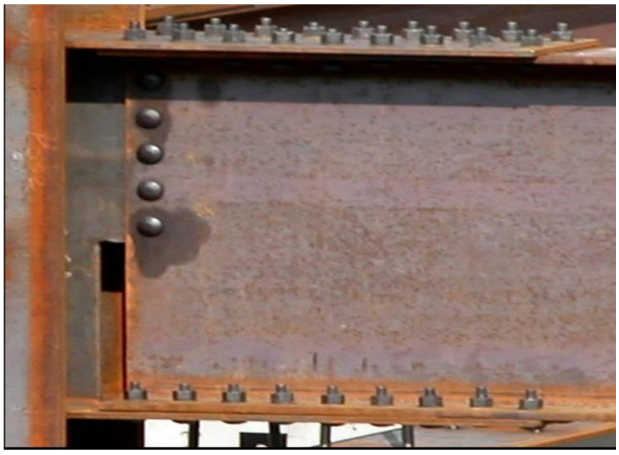


Fig.6 Fully restrained connection

Fig.7 Partially restrained connection

1. Have sufficient strength to transfer moment with negligible rotation between connected members.
2. The angle between connected members is maintained.
3. Have sufficient strength to transfer moments but the rotationbetween connected members is not negligible.
4. The angle between connected members may change.

Types of weld joints

The purpose of welding joints is to join parts together so that stresses are distributed the forces causing stress in welded joints are tensile, compression, bending, torsion and shear.

Butt joint or Butt weld:-Is a joint where two pieces of metal are placedtogether in a same plane and the side of each metal is joined by welding butt weld is the most common type of joint that is used in the fabrication of structures and piping systems Its fairly simple to prepare and there are many different variation that can be applied to achieve thedesire resect.

Lap joint:-Lap welding joints are essentially a modified version of the butt joint they are framed when two pieces of metal are placed in an overlapping pattern on top of each other they are most commonly used to joint two pieces with differing thicknesses together welds can made onone or both side.

4.1 Fabrication and erection

Fabrication through welding

The fabrication process includes design and engineering, as well as detailing and manufacturing at the factory. All steel components are fabricated at the factory and linked by bolts at the site. So the erection process is fast, step by step, easy to install and requires simple equipment.

Twelve principles of welded connection design:-

1. A good welded connection is properly sized

    a. Big enough
    b. But not larger than necessary

    c. Otherwise
    d. Increase in distortion
       Increase in construction
       cost
    e. Increase in cracking and tearing tendencies.

2. A good weld connection uses proper weld type

   Fillets> PJP>CJP

    a. PJP: partial joint penetration
    b. CJP: complete joint penetration

3. A good welded connection is preferably evenly loaded.

4. A good welded connection accounts for uneven stress distributionwhen someone.

5. but not all of the elements are connected

6. Shear leg: Is a concept used to account for the uneven stress distributionin connected members when same but not all of their elements (flange, web, leg, etc...) are connected.

7. A good welded connection account for non-uniformity of load transferalong the line of weld due to differences in relative stiffness of has walls.

8. A good welded connection has protected roots.
9. A good welded connection has terminations that have been properlydetailed.
10. A good welded connection does not introduce stress raisers.
11. A good welded connection accounts for material properties.
12. A good welded connection accounts for commercial reality.
13. A good welded connection accounts for safe and economical joint.
14. A good welded connection allows the welder to see the puddle.

"Good workmanship and good design details incorporating joining geometry that avoids severe stress concentrations are generally the most effective means of provides fracture resistant construction".

Erection through bolts

1. Lifting and placing: Components are lifted and placed into position.
2. Connecting: Components are connected together. This is usually done by bolting, but sometimes site welding is used.
3. Aligning: Components are positioned and aligned on prepared foundations.
4. Securing: Components are secured to form a complete frame.

Bolting basics

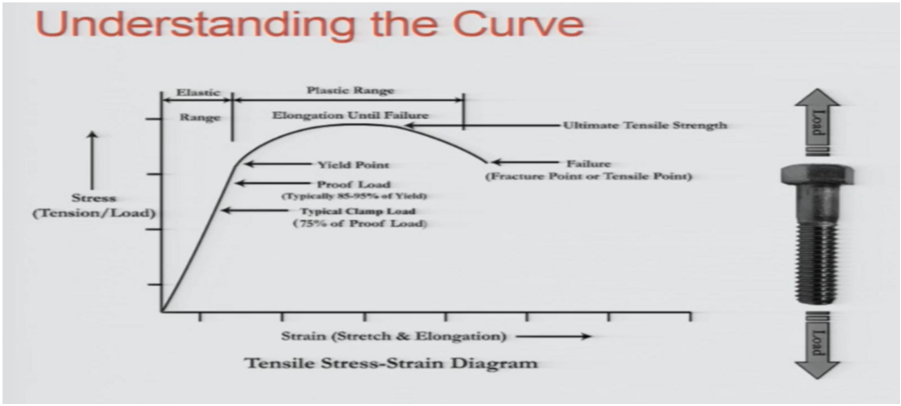


Fig.8 Stress-strain diagram of bolt

1. Nuts should be strength then bolts.
2. The most bolt threads in the grip the better worry more about shank-out than stick-out.
3. Lubrication is essential to performance (especially if performing asclamps).
4. Torque can be a good indicator of tension if controlled but we donot control or recognize torque directly.

Bolts and nuts threads

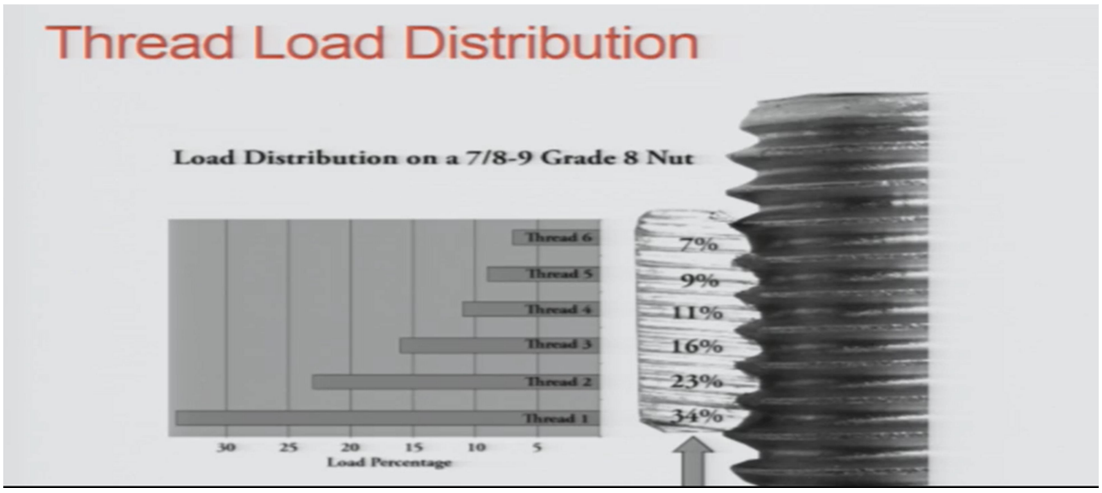


Fig.9 Distribution of load in bolt thread

1. There are over 120 elements to thread design.
2. Standard allow as ignoring most of those elements but a few areimportant to understand.
3. Inch series structural bolts are always “unified course”, class -2Atolerance

Engineer’s responsibility

1. grade/type/ finish selection
2. non-standard selection [if any]
3. installation method
4. inspection
5. Proposed assembly [nuts/washers/ hole size/etc.]
6. standards allow to ignore most of the 120 elements in thread design but few
   Important of engineers responsibility
   Load distribution [half the load is in first two threads
   Basic thread dia
   Thread
   class
   Geometry
   Pitch and pitch diameter [pd]
   To oversize the pd if coating is done [major dia and minor dia]
   Coating is a significant issue- ensure 4 point contact.

CHAPTER 5

QUALITY CONTROL

Quality control in pre-engineered buildings ensures that the buildings are manufacturing to the required strength and durability standards pre-engineered buildings are designed to with stand various loads and environmental conditions.

Quality control plays pivotal role in the manufacturing processes of pre-engineered buildings as it ensure the structure integrity and safety of these modern.
One of the fundamental aspects of quality control in pre-engineering buildings manufacturing is the thorough inspection and testing of materials used in the construction process. This ensures that the raw materials meet the required specifications and possess the necessary strength, durability, and other essential properties.

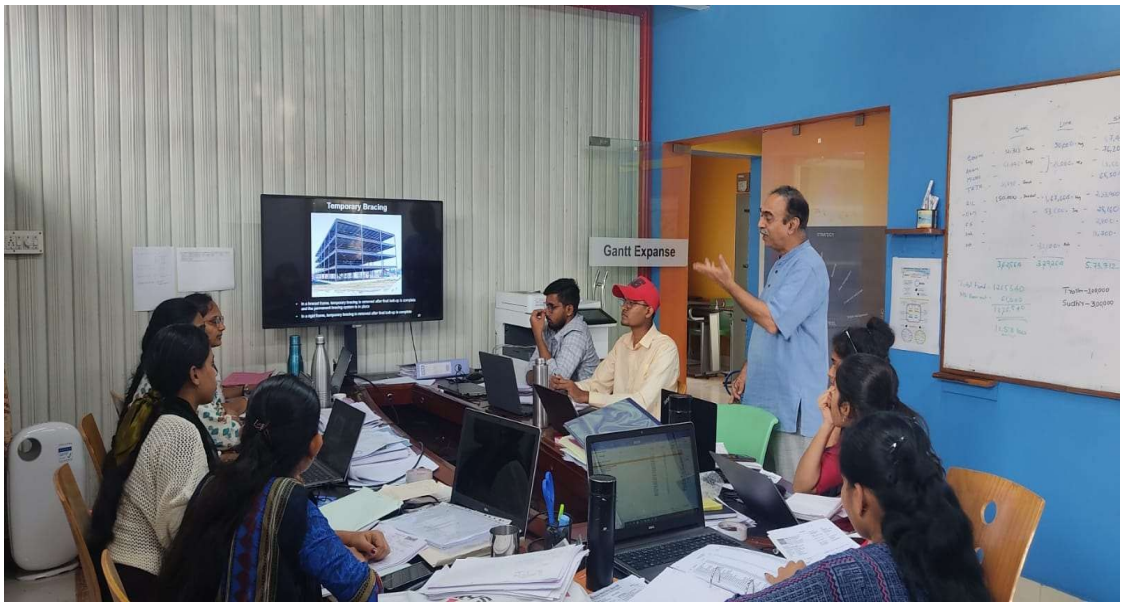
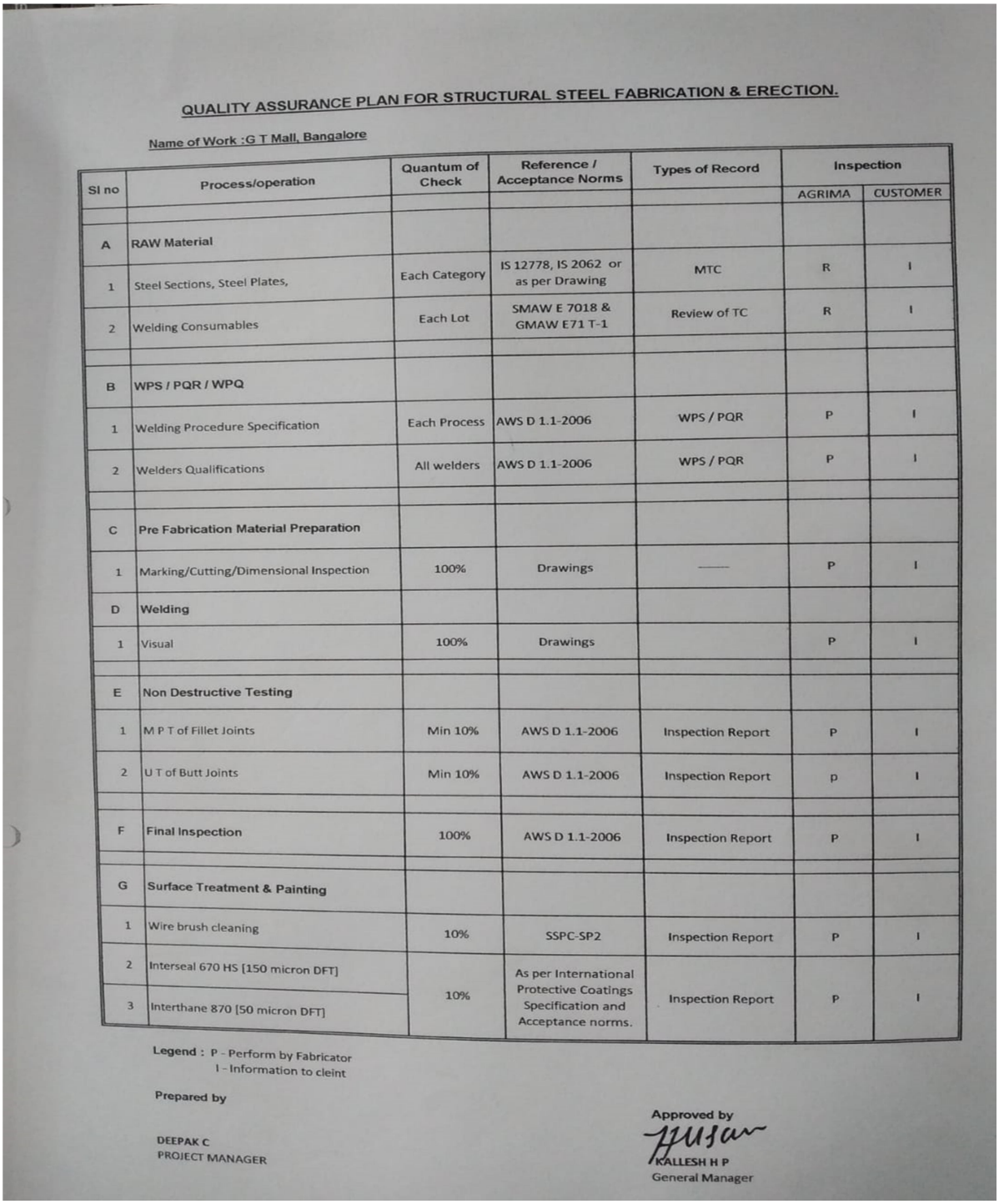


Fig.10 Explanation about temporary bracings

Sir explained the pre-engineered structure and along with that sir explained how bracing and connections are done in pre-engineeredbuildings.



QUALITY ASSURANCE PLAN FOR STRUCTURAL STEEL FABRICATION & ERECTION.

Name of Work :G T Mall, Bangalore

Sl no	Process/operation	Quantum of Check	Reference / Acceptance Norms	Types of Record	Inspection	
					AGRIMA	CUSTOMER
A	RAW Material					
1	Steel Sections, Steel Plates,	Each Category	IS 12778, IS 2062 or as per Drawing	MTC	R	I
2	Welding Consumables	Each Lot	SMAW E 7018 & GMAW E71 T-1	Review of TC	R	I
B	WPS / PQR / WPQ					
1	Welding Procedure Specification	Each Process	AWS D 1.1-2006	WPS / PQR	P	I
2	Welders Qualifications	All welders	AWS D 1.1-2006	WPS / PQR	P	I
C	Pre Fabrication Material Preparation					
1	Marking/Cutting/Dimensional Inspection	100%	Drawings	———	P	I
D	Welding					
1	Visual	100%	Drawings		P	I
E	Non Destructive Testing					
1	M P T of Fillet Joints	Min 10%	AWS D 1.1-2006	Inspection Report	P	I
2	U T of Butt Joints	Min 10%	AWS D 1.1-2006	Inspection Report	p	I
F	Final Inspection	100%	AWS D 1.1-2006	Inspection Report	P	I
G	Surface Treatment & Painting					
1	Wire brush cleaning	10%	SSPC-SP2	Inspection Report	P	I
2	Interseal 670 HS [150 micron DFT]	10%	As per International Protective Coatings Specification and Acceptance norms.	Inspection Report	P	I
3	Interthane 870 [50 micron DFT]					

Legend : P - Perform by Fabricator
I - Information to cleint

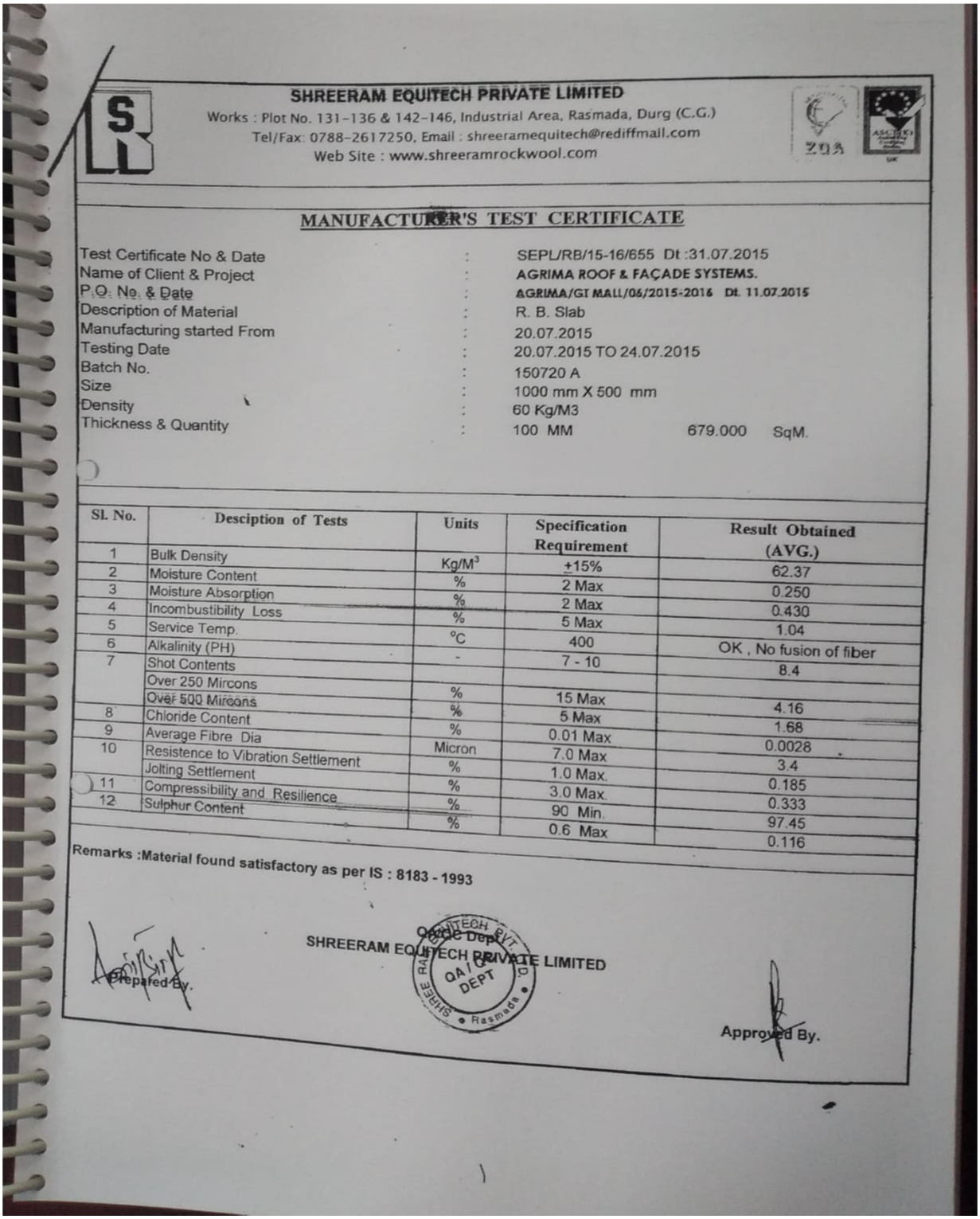
Prepared by

DEEPAK C
PROJECT MANAGER

Approved by

KALLESH H P
General Manager

Fig.11 Welding procedure



SHREERAM EQUITECH PRIVATE LIMITED

Works : Plot No. 131-136 & 142-146, Industrial Area, Rasmada, Durg (C.G.)
Tel/Fax: 0788-2617250, Email : shreeramequitech@rediffmail.com
Web Site : www.shreeramrockwool.com

ZQA

MANUFACTURER'S TEST CERTIFICATE

Test Certificate No & Date	:	SEPL/RB/15-16/655 Dt :31.07.2015
Name of Client & Project	:	AGRIMA ROOF & FAÇADE SYSTEMS.
P.O. No. & Date	:	AGRIMA/GT MALL/06/2015-2016 Dt. 11.07.2015
Description of Material	:	R. B. Slab
Manufacturing started From	:	20.07.2015
Testing Date	:	20.07.2015 TO 24.07.2015
Batch No.	:	150720 A
Size	:	1000 mm X 500 mm
Density	:	60 Kg/M3
Thickness & Quantity	:	100 MM 679.000 SqM.

Sl. No.	Desciption of Tests	Units	Specification Requirement	Result Obtained (AVG.)
1	Bulk Density	Kg/M^3	+15%	62.37
2	Moisture Content	%	2 Max	0.250
3	Moisture Absorption	%	2 Max	0.430
4	Incombustibility Loss	%	5 Max	1.04
5	Service Temp.	°C	400	OK , No fusion of fiber
6	Alkalinity (PH)	-	7 - 10	8.4
7	Shot Contents			
	Over 250 Mircons	%	15 Max	4.16
	Over 500 Mircons	%	5 Max	1.68
8	Chloride Content	%	0.01 Max	0.0028
9	Average Fibre Dia	Micron	7.0 Max	3.4
10	Resistence to Vibration Settlement	%	1.0 Max.	0.185
	Jolting Settlement	%	3.0 Max.	0.333
11	Compressibility and Resilience	%	90 Min.	97.45
12	Sulphur Content	%	0.6 Max	0.116

Remarks :Material found satisfactory as per IS : 8183 - 1993

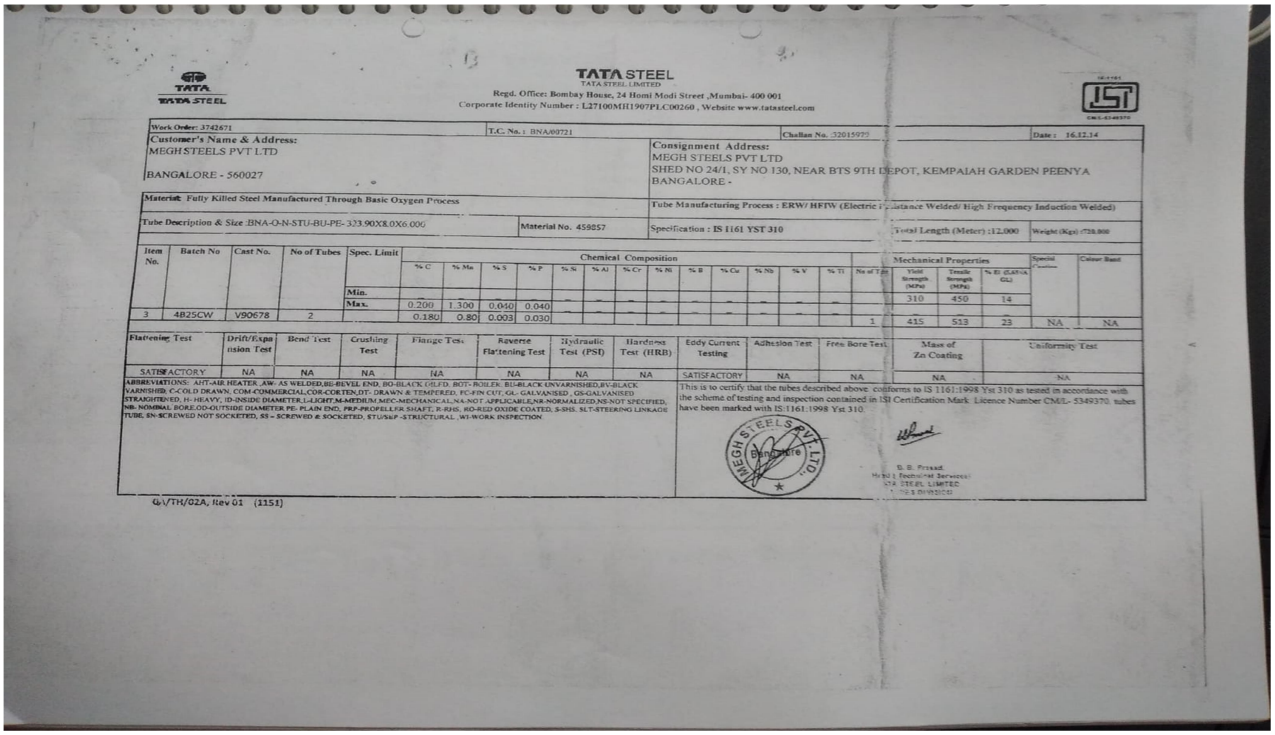
Prepared By.

SHREERAM EQUITECH PRIVATE LIMITED

QA / QC DEPT

Approved By.

Fig.12 Manufacturing certificate



TATA STEEL
TATA STEEL LIMITED
Regd. Office: Bombay House, 24 Homi Modi Street ,Mumbai- 400 001
Corporate Identity Number : L27100MH1907PLC00260 , Website www.tatasteel.com

Work Order: 3742671 | T.C. No. : BNA/09721 | Challan No. 32015979 | Date : 16.12.14

Customer's Name & Address:
MEGH STEELS PVT LTD
BANGALORE - 560027

Consignment Address:
MEGH STEELS PVT LTD
SHED NO 24/1, SY NO 130, NEAR BTS 9TH DEPOT, KEMPAIAH GARDEN PEENYA
BANGALORE -

Material: Fully Killed Steel Manufactured Through Basic Oxygen Process
Tube Manufacturing Process : ERW/ HFIW (Electric Resistance Welded/ High Frequency Induction Welded)
Tube Description & Size :BNA-O-N-STU-BU-PE- 323.90X8.0X6.000
Material No. 459857
Specification : IS 1161 YST 310
Total Length (Meter) :12.000 Weight (Kgs) :728.800

Item No.	Batch No	Cast No.	No of Tubes	Spec. Limit	Chemical Composition												Mechanical Properties			Special Condition	Colour Band
					% C	% Mn	% S	% P	% Si	% Al	% Cr	% Ni	% B	% Cu	% Nb	% V	% Ti	No of Tubes	Yield Strength (MPa)	Tensile Strength (MPa)	% El (GAUGE)		
				Min.															310	450	14		
				Max.	0.200	1.300	0.040	0.040															
3	4B25CW	V90678	2		0.180	0.80	0.003	0.030										1	415	513	23	NA	NA

Flattening Test	Drift/Expansion Test	Bend Test	Crushing Test	Flange Test	Reverse Flattening Test	Hydraulic Test (PSI)	Hardness Test (HRB)	Eddy Current Testing	Adhesion Test	Free Bore Test	Mass of Zn Coating	Uniformity Test
SATISFACTORY	NA	NA	NA	NA	NA	NA	NA	SATISFACTORY	NA	NA	NA	NA

ABBREVIATIONS: AHT-AIR HEATER, AW- AS WELDED,BE-BEVEL END, BO-BLACK OILED, BOT- BOILER, BU-BLACK UNVARNISHED,BV-BLACK VARNISHED, C-COLD DRAWN, COM-COMMERCIAL,COR-CORTEN,DT- DRAWN & TEMPERED, FC-FON CUT, GL- GALVANISED , GS-GALVANIZED STRAIGHTENED, H- HEAVY, ID-INSIDE DIAMETER,L-LIGHT,M-MEDIUM,MEC-MECHANICAL,NA-NOT APPLICABLE,NR-NORMALIZED,NS-NOT SPECIFIED, NB- NOMINAL BORE,OD-OUTSIDE DIAMETER,PE- PLAIN END, PRP-PROPELLER SHAFT, R-RHS, RO-RED OXIDE COATED, S-SHS, SLT-STEERING LINKAGE TUBE, SN-SCREWED NOT SOCKETED, SS - SCREWED & SOCKETED, STUS&P -STRUCTURAL, WI-WORK INSPECTION

This is to certify that the tubes described above conforms to IS 1161:1998 Yst 310 as tested in accordance with the scheme of testing and inspection contained in ISI Certification Mark Licence Number CM/L- 5349370. tubes have been marked with IS:1161:1998 Yst 310.

MEGH STEELS PVT LTD Bangalore

B. B. Prasad
Head (Technical Services)
TATA STEEL LIMITED

Q\/TH/02A, Rev 01 (1151)

Fig.13 Tensile test certificate on steel

Site visit

We visited to PNR site on 23/11/2023 at 9:00AM and saw all the work and we discuss some of the things with Mr. Manju who was the site incharge and cleared some doubt, he explained how the erection has done in the site and machinery used for the erection

Fig.14 I-section beam structure

Fig.15 I-section column structure

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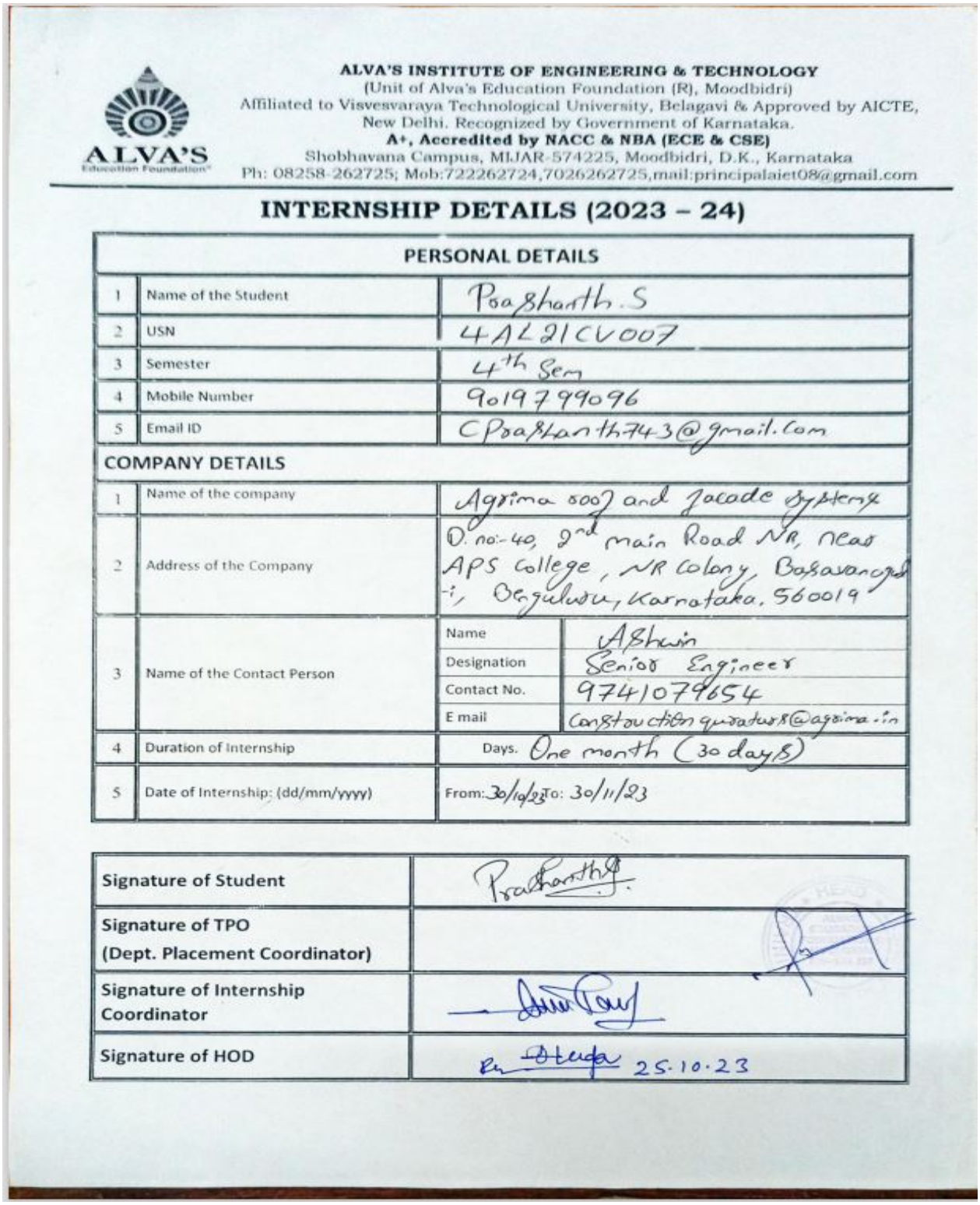
ANNEXURE

College Permission letter



ALVA'S INSTITUTE OF ENGINEERING & TECHNOLOGY
(Unit of Alva's Education Foundation (R), Moodbidri)
Affiliated to Visvesvaraya Technological University, Belagavi & Approved by AICTE, New Delhi. Recognized by Government of Karnataka.
A+, Accredited by NACC & NBA (ECE & CSE)
Shobhavana Campus, MIJAR-574225, Moodbidri, D.K., Karnataka
Ph: 08258-262725; Mob:7022262724,7026262725,mail:principalaiet08@gmail.com

INTERNSHIP DETAILS (2023 – 24)

PERSONAL DETAILS			
1	Name of the Student	Poashanth.S	
2	USN	4AL21CV007	
3	Semester	4th Sem	
4	Mobile Number	9019799096	
5	Email ID	CPoashanth743@gmail.com	
COMPANY DETAILS			
1	Name of the company	Agrima soof and facade systems	
2	Address of the Company	D. no:-40, 2nd main Road NR, near APS college, NR Colony, Basavangudi, Bagalur, Karnataka, 560019	
3	Name of the Contact Person	Name	Ashwin
		Designation	Senior Engineer
		Contact No.	9741079654
		E mail	construction quotations@agrima.in
4	Duration of Internship	Days.	One month (30 days)
5	Date of Internship: (dd/mm/yyyy)	From: 30/10/23 To: 30/11/23	

Signature of Student	Prashanth.S
Signature of TPO (Dept. Placement Coordinator)	
Signature of Internship Coordinator	
Signature of HOD	25.10.23

Internship Certificate

AGRIMA

ROOF AND FACADE SYSTEMS

Internship completion certificate

This is to certify that

Mr. **Prashanth S** bearing USN **4AL21CV007** from Alva's Institute of Engineering and Technology, Moodbidri has actively participated on topic **"Pre-Engineered Buildings"** in one month intern's program at our company in the month of November-2023.

B Govind Ramesh
Chief mentor
Agrima Roof And Facade Systems

Dr H Ajith Hebbar
HOD, Dept. Of Civil Engineering
Alva's Institute of Engineering and Technology

#40 2nd main,NR colony (near APS college),Bengaluru-19,E-mail aalambana@agrima.in