LARSEN & TOUBRO

PATNA METRO RAIL CORPORATION

SUMMER INTERNSHIP PROJECT REPORT

Submitted by

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PATNA METRO

REPORT OF INTERNSHIP ACTIVITIES

At

PATNA METRO

Presented to

THE PROJECT DIRECTOR

LARSEN & TOUBRO

In partial fulfilment of the requirements
for the degree of

B.Tech CIVIL ENGINEERING

BY

SAURAV KUMAR

INDIAN INSTITUTE OF TECHNOLOGY

PATNA

APPROVAL

This is to certify that Mr. Saurav Kumar, Roll No. 2301CE25, has successfully completed the internship training at Patna Metro Rail Project under the supervision of the undersigned authorities, during the period 10th June 2025 to 10th July 2025.

This report is submitted in partial fulfillment of the requirements for the internship program and has been reviewed and approved by the following authorities:

DESIGNATION	SIGNATURE	STAMP
PROJECT MANAGER		
DEPUTY PROJECT MANAGER		L&T
STATION MANAGER	(SHIVOM)	Shiv Om Verma Station Manager PS No.-20373534 (L&T)

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ACKNOWLEDGEMENT

I would like to express my heartfelt gratitude to all those who contributed to the successful completion of this internship and the preparation of this report.

First and foremost, I sincerely thank the Patna Metro Rail Corporation for providing me with the invaluable opportunity to undergo summer training at the Moin-ul-Haq Stadium Metro Station.

I extend my sincere appreciation to the entire team at Larsen & Toubro, especially the site engineers, supervisors, and departmental staff, whose constant guidance, technical expertise, and encouragement played a crucial role in enhancing my learning during the internship.

I would also like to acknowledge the training coordinator and project mentors who ensured a well-structured and informative training program, offering insightful exposure to real-time construction activities.

Lastly, I am grateful to my institution and faculty members for their continuous support, and to my peers and colleagues who made this internship experience both enriching and memorable

Objective

The Summer Training Program has mainly two objectives viz. ‘Learning New Things’ and ‘Gaining Practical Experience’. It helps to get exposure to the environment of the industry wherein we are to be placed. This 1 month of training also enhances our soft skills and meeting so many engineers and learning from them makes us a confident professional.

It also teaches us the sense of responsibility, taking initiatives, projecting the innovative ideas and most important management.

It is also needed for the completion of the bachelor’s degree in the field of Civil Engineering.

Overview of Patna Metro Rail Project

The Patna Metro Rail Project is an ambitious rapid transit initiative currently under construction in Patna, Bihar, India. The project is being implemented in five phases and will be owned and operated by the Patna Metro Rail Corporation, a state-run entity. Patna Metro is being developed under a Public-Private Partnership (PPP) model and has an estimated cost of ₹13,365.77 crore (approximately US$1.6 billion). This figure excludes land acquisition costs, which are being borne separately by the Government of Bihar.

Phase-1: Scope and Timeline :

Phase-1 of the Patna Metro includes the construction of both elevated and underground corridors:

- Elevated Corridor: 15.36 km (9.54 miles)
- Underground Corridor: 16.30 km (10.13 miles)

The first phase features the East-West and North-South Corridors, with five stations targeted to become operational by August 2025. This phase will significantly enhance urban mobility across Patna.

Key Contractors and Construction Progress :

In January 2022, Larsen & Toubro (L&T) was awarded a significant contract by the Delhi Metro Rail Corporation (DMRC) for the design and construction of Corridor-2 of Phase-1. The contract is valued at ₹1,989 crore (approximately US$240 million).
The scope of work under this contract includes the construction of six underground stations on Corridor-2:

1. Rajendra Nagar
2. Moin-Ul-Haq Stadium
3. Patna Science College
4. Patna Medical College and Hospital (PMCH)
5. Gandhi Maidan
6. Akashvani

These stations are being developed using advanced construction techniques to ensure structural integrity, safety, and passenger comfort.

Need and Benefits of Patna Metro :

Patna is a growing city with increasing population, traffic congestion, and pollution. The existing road infrastructure is not sufficient to handle the rising number of vehicles. To solve these
issues, Patna Metro is being constructed to provide a fast, reliable, and eco-friendly mode of transportation. It will reduce travel time, ease road traffic, and lower air and noise pollution. The metro will also improve connectivity between key areas like hospitals, markets, railway stations, and educational institutions. It will create job opportunities and support the overall development of the city. For daily commuters, the metro will offer a safe, comfortable, and affordable travel option.Site execution
Following the completion of the architectural drawing review and planning process, we proceed with the commencement of the main site execution phase. This critical stage encompasses the collaborative efforts of three primary departments:

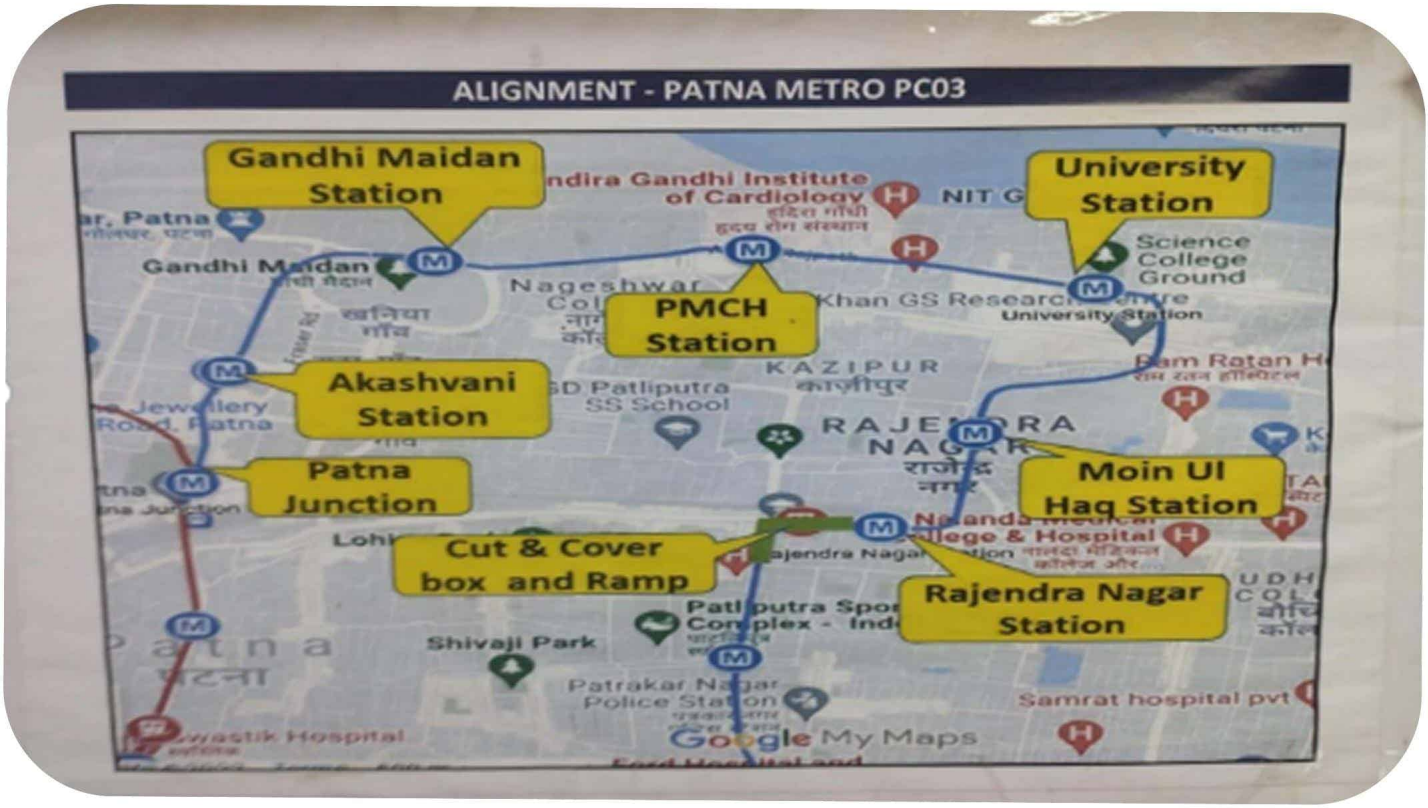
- Structures
- MEP (Mechanical, Electrical, and Plumbing)
- Finishing

Each department plays a vital role in ensuring the project's successful implementation in accordance with the approved plans and quality standards.

STATIONS FOR PHASE 1 PATNA METRO

THE Patna metro plan for phase I is divided into into various station and each station is allotted to set of engineers of PMRC who Supervise the L&T work . The various stations of the proposed phase I are as follows :

- Rajendra Nagar
- Moin-Ul-Haq Stadium
- Patna Science College
- Patna Medical College and Hospital (PMCH)
- Gandhi Maidan
- Akashvani

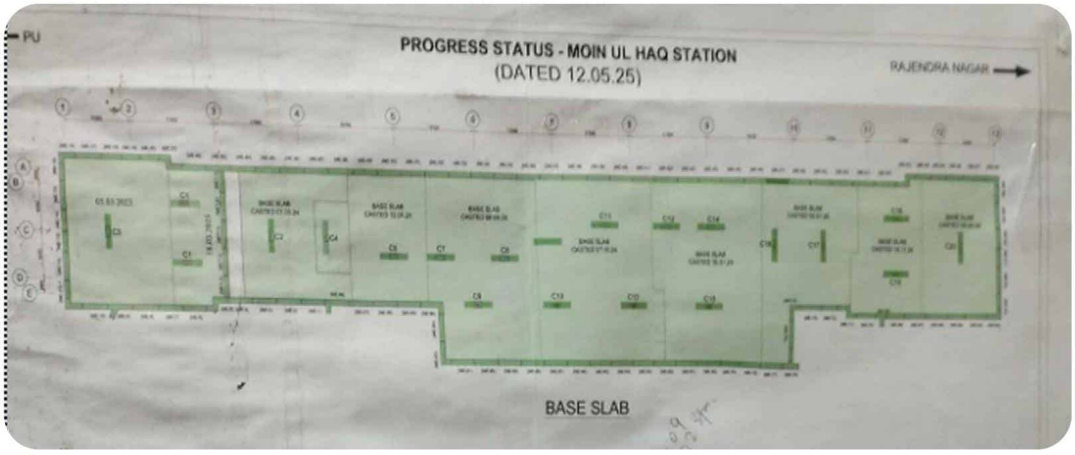


Moin-UL-Haq Stadium

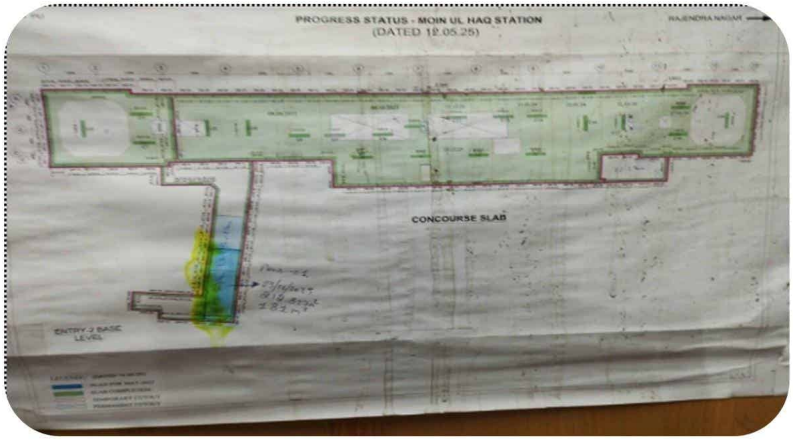
MUH Stadium Station is an important part of the Patna Metro because it is located near a big stadium and schools, where many people visit every day. This station will help people travel easily and quickly, especially during sports and public events. It will also reduce traffic on the roads and support clean and eco-friendly travel. The station is expected to help the nearby area grow with more shops, houses, and better transport for everyone.

The station has : -

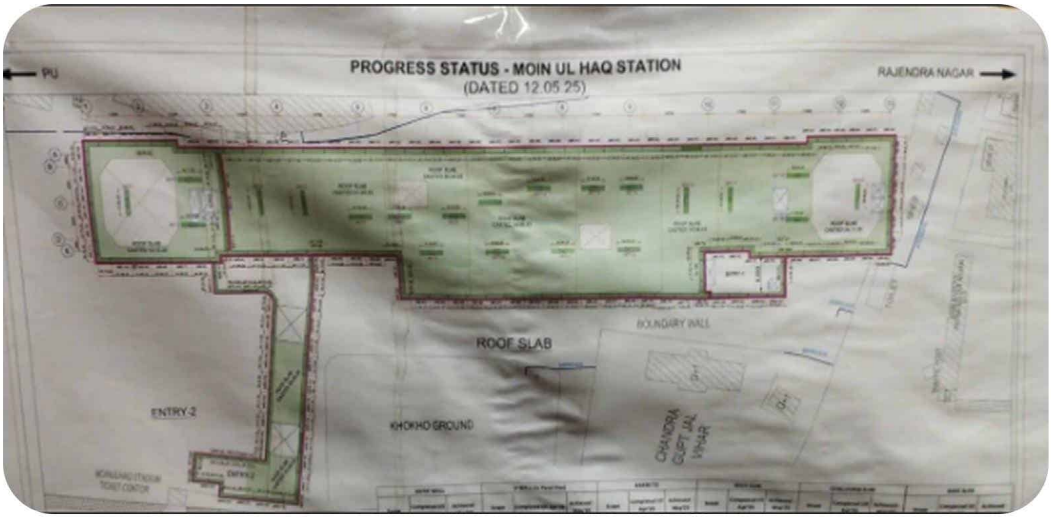
- Base Slab



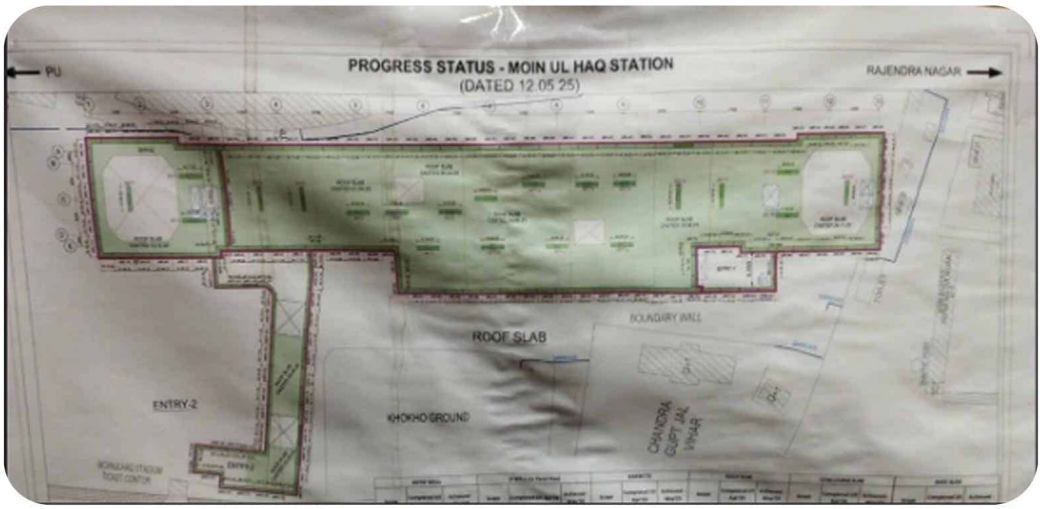
- Concourse Slab



- Platform Slab



- Roof Slab



Training Site Overview

As part of my internship, I am currently undergoing practical training at the Moin- ul-Haq Metro Station. This placement has provided me with valuable exposure to on-site construction processes and technical practices involved in modern metro infrastructure development.

Observation of Ongoing Construction Activities :

During my internship at the Moin-ul-Haq Metro Station under the Patna Metro muh project, I had the opportunity to observe several key construction activities in progress. These included block masonry work for internal and external walls, platform slab casting, and reinforcement, shuttering, and concreting of structural columns. Being present on-site during these operations provided me with practical insights into the execution of major civil engineering components and helped me understand the sequencing, materials, manpower, and safety measures involved in metro construction.

Quality Department

The Quality Control (QC) department plays a vital role in ensuring safety, durability, and compliance with design standards during the metro construction process. In large-scale infrastructure like metro stations: – It ensures that materials meet specifications (e.g., concrete grade, polymer, rebar, etc.). – It helps in minimizing structural defects by inspecting the work at every stage (e.g., slab casting, block work, platform, column). – It maintains documentation of tests (e.g., slump, cube test, polymer, DPT) for future audits. – It reduces risk of structural failure by identifying issues early. It ensures that all construction complies with IS codes (e.g., IS 456:2000, IS 10262, etc.). Thus, quality control is not optional, but essential for the success and safety of metro construction.

- ## Method Statement: Quality Department in Metro Construction

  - **Introduction**

    The Quality Department plays a critical role in ensuring that all construction activities in metro projects meet the required standards, codes, and specifications. Their primary objective is to implement a quality management system (QMS) that ensures safety, durability, and functionality of the metro infrastructure.

  - **Scope**

    This method statement covers the quality assurance (QA) and quality control (QC) practices to be followed in the construction of metro stations, viaducts, tunnels, and associated structures.

  - **Responsibilities**

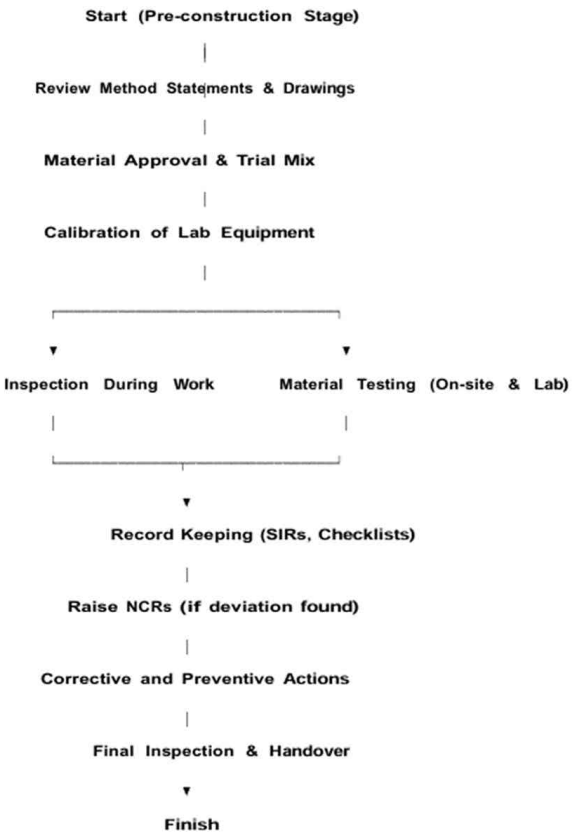
    • Quality Manager: Responsible for overall quality control and assurance activities.

    • QA/QC Engineers: Responsible for field inspections, document verification, and testing.

    • Lab Technicians: Carry out on-site and off-site testing of materials.

    • Site Supervisors: Ensure implementation of quality procedures at the work front.

- **QA/QC Process Flow Chart**



- **Quality Control Tests (Examples)**

Material/Activity	Test Name	Standard/Code
Concrete	Slump test, cube test	IS 1199, IS 516
Steel	Tensile, bend, rebend	IS 1786
Cement	Fineness, consistency	IS 4031
Aggregates	Sieve, impact, crushing	IS 2386
Bitumen	Penetration, ductility	IS 1201 to 1220

- **Tools & Equipment**
  - Cube moulds and slump cones
  - Compression testing machine (CTM)
  - Vernier calipers, tape, gauges
  - Concrete thermometer
  - Digital camera for documentation
- **Records Maintained**
  - Site Inspection Reports (SIR)
  - Material Approval Sheets
  - Daily Quality Reports
  - Lab Test Reports
  - Calibration Records NCRs and Corrective Action Reports
- **Safety & Coordination**
  - Quality team works in coordination with HSE (Health, Safety, Environment) and site execution teams.
  - All testing and inspection activities are done following safety protocols.

Some observation :-

- **Slump Test Values Observed (For Workability of Concrete)**

Concrete Work	Slump Range(in mm)
Roof Slab	100 – 150
Columns	125 – 175
Platform Slab	125 – 175
D – wall	150 – 200

  - Slump test helps check workability and indirectly indicates water-cement ratio.
  - A higher slump (150–200 mm) is typically used for pumpable concrete.

- **Temperature Check**

  As per standard, the ambient temperature during concreting should not exceed 32°C, to avoid rapid evaporation and improper hydration of cement. Above this, retarders or chilling methods may be used.

- **Cube Casting and Sampling as per IS 456:2000**

  One sample = 3 cubes (150x150x150 mm)

Concrete Volume(m^3)	No. of Cubes
0 – 5	3
6 – 15	6
16 – 30	9
31 – 50	12
>50	+3 cubes for every 50 m^3

  Note: Cubes are cured and tested at 7 and 28 days for compressive strength.

- **Polymer Testing (Observed during D-Wall Work)**

Test	Acceptable Range
Viscosity	34 – 143 sec
pH	8 – 11
Density	1 – 1.025 g/cc
Sand Content	Max 1%

Polymer is used in D-wall construction to stabilize trench and prevent collapse. These parameters ensure proper fluid properties during excavation.

- **DPT Test (Dye Penetrant Test) – Observed on Welds**

  The DPT test is used to identify surface cracks or defects on metal joints, particularly in welding areas.

  Steps:

  1. Cleaner Application: Surface is cleaned using solvent cleaner.
  2. Penetrant Application: Red dye penetrant is applied and left for 10 mins.
  3. Developer Application: A white developer is applied to bring out the cracks visually.
  4. Inspection: Cracks appear as red lines on the developer surface.

  This test is non-destructive and important for ensuring structural weld quality.

- **Cement Test: Initial & Final Setting Time**

  Conducted as per IS: 4031 (Part 5) – 1988

  Purpose: To determine the time cement takes to start and complete setting after water is added.

  ✔Initial Setting Time:

  - The time elapsed between water addition and when the paste starts losing plasticity.
  - Standard value: Minimum 30 minutes.

  ✔Final Setting Time:

  - Time taken for cement paste to completely lose plasticity and attain hardness.
  - Standard value: Maximum 600 minutes (10 hours).

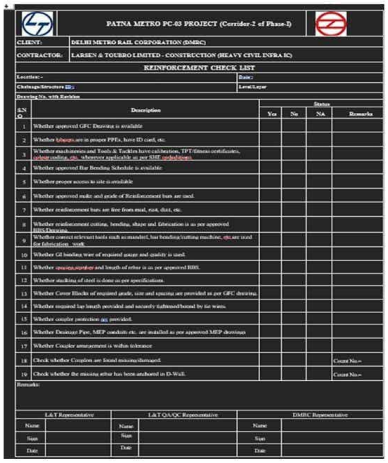
  Experiment Procedure (Brief):

  1. Take 400g of cement and mix with 0.85P of water.
  2. Fill Vicat mould and level the top.
  3. Insert Vicat needle every 10 mins.
  4. For initial setting time, record when needle fails to penetrate 5mm from bottom.
  5. For final setting time, use annular needle and record time when only slight impression is made.

- **Concrete Grades Used in MUH Station**

Concrete Member	Grade
Slab & Columns	M40
PCC (Plain Cement Concrete)	M15

M40 grade gives higher compressive strength and is used in critical structural elements. M15 is used in non-structural base concrete.



PATNA METRO PC-03 PROJECT (Corridor-2 of Phase-I)

CLIENT: DELHI METRO RAIL CORPORATION (DMRC)

CONTRACTOR: LARSEN & TOUBRO LIMITED - CONSTRUCTION (HEAVY CIVIL INFRA SC)

REINFORCEMENT CHECK LIST

SN	Description	Status			
		Yes	No	NA	Remarks
1	Whether approved GFC Drawing is available				
2	Whether Workers are in proper PPEs, have ID card, etc.				
3	Whether machineries and Tools & Tackles have calibration, TPT/fitness certificates, valid certificates, etc. wherever applicable as per SHE guidelines				
4	Whether approved Bar Bending Schedule is available				
5	Whether proper access to site is available				
6	Whether approved make and grade of Reinforcement bars are used.				
7	Whether reinforcement bars are free from mud, rust, dust, etc.				
8	Whether reinforcement cutting, bending, shape and fabrication is as per approved BBS/drawing				
9	Whether correct relevant bends such as standard, bar bending/cutting machine, etc are used for fabrication work				
10	Whether GI binding wire of required gauge and grade is used.				
11	Whether spacing, number and length of rebar is as per approved BBS.				
12	Whether stacking of steel is done as per specifications.				
13	Whether Cover Blocks of required grade, size and spacing are provided as per GFC drawing.				
14	Whether required lap length provided and securely tightened/bound by tor wires.				
15	Whether cotaller protection are provided.				
16	Whether Drainage Pipe, MEP conduits etc. are installed as per approved MEP drawings				
17	Whether Coupler arrangement is within tolerance				
18	Check whether Couplers are found missing/damaged.				Count Nos.=
19	Check whether the missing rebar has been anchored in D-Wall.				Count Nos.=

Remarks:

L&T Representative	L&T QA/QC Representative	DMRC Representative
Name	Name	Name
Sign	Sign	Sign
Date	Date	Date

Sketch list drawing

Conclusion

The quality control department ensures every component and material used in metro construction is tested and documented. The above field tests, material sampling, and cement/concrete checks help achieve durability, safety, and serviceability of the station structure.

Civil Department

- Responsible for construction of the station structure, platforms, and supporting facilities.
- The location near a stadium requires strong planning to handle large crowds during events.
- Special attention is given to passenger flow, structural safety, and emergency exits.

Some observation :-

1. Block Work

Block work is a method of building walls using concrete or cement blocks joined with mortar. It provides strength, stability, and is widely used in modern construction for internal .

Work location :- on concourse slab from grid no. 4 to grid no. 10

In our MUH station , solid concrete blocks of size 200 mm × 200 mm × 400 mm and Grade M7.5 are used with 1:5 cement-sand mortar mix.

- **Site Details**

Wall Length: 107.3 meters

Wall Height: 3.7 meters

Wall Thickness: 200 mm

Block Size: 200 mm × 200 mm × 400 mm

Total Wall Area = 107.3 × 3.7 = 396.01 m²

- **Numerical Estimation**

1 .Volume of One Block

Block Size = 0.2 × 0.2 × 0.4 = 0.016 m³

2 .Number of Blocks Required

Total Wall Volume = 107.3 × 3.7 × 0.2 = 79.68 m³

No. of Blocks = 79.68 / 0.016 = 4,980 Blocks (approx)

Total with 10% wastage = 4980 × 1.10 = 5,478 Blocks (rounded)

3 .Mortar Requirement (1:5 Cement:Sand Mix)

Step1- Estimate Mortar Volume (Assume 25% of wall volume) Mortar Volume = 79.68 × 0.25 = 19.92 m³

Step2 - Convert to Dry Volume (Add 33% for voids, shrinkage, etc) Dry Volume of Mortar = 19.92 × 1.33 = 26.49 m³

Step3- Mix Ratio = 1:5 (Cement : Sand) → Total = 1 + 5 = 6 parts

- Cement Volume

1/6 x 26.49 = 4.42 m³

- Sand Volume

5/6 x 26.49 = 22.07 m³

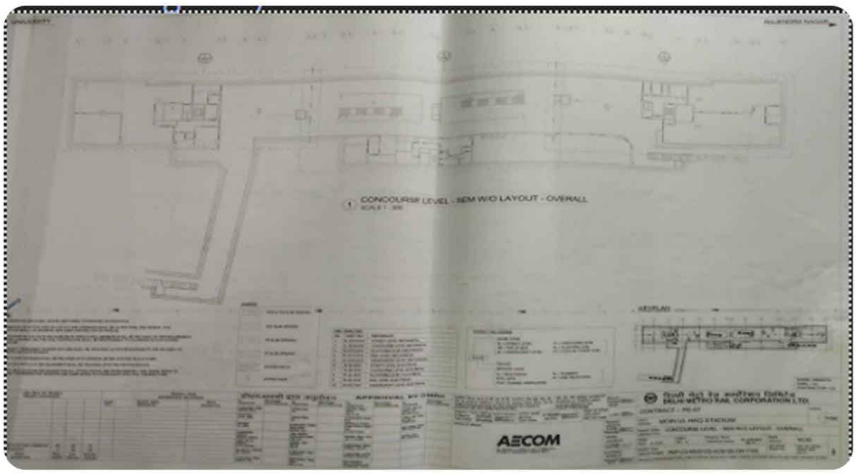
- **Tools and Tackles Used**
  - Mason’s trowel
  - Plumb bob
  - string line
  - Measuring tape
  - Block cutter
  - Water bucket
  - Mortar pan
  - Wheelbarrow
- **Machinery Used**
  - Block cutting machine – for size adjustment
  - Concrete mixer machine – for mortar preparation
  - Wheelbarrows – for transportation
  - Water pump – for curing and mixing
  - Scaffolding setup – for work at height
- **Material Required Summary**

Solid Concrete Blocks (200x200x400 mm): approx. 5,478 blocks Cement: approx. 126 bags
Sand: approx. 22.07 cubic meters

- **Manpower Requirement**

Masons: 2-3(depending on speed & area) Helpers: 4-5 (material handling, mixing, curing)
Supervisor: 1 (Manages labor and materials on-site to ensure smooth and timely execution of block work).
Site engg. – 1(Ensures block work is carried out accurately, safely, and as per drawings and specifications}.

- **Diagram and Sketch**



Conclusion

Block work at MUH station is done properly with good quality. Materials and workers are well managed, and the wall is strong and ready for next steps. This report shows a clear understanding of the work

2. Column Work

Column work is a crucial activity in metro station construction, as columns are primary load- bearing members. They transfer loads from slabs and beams to the foundation.

- **Typical Column Dimensions**
  - Size: Common sizes include 835 mm x 1970 mm as per drawing
  - Height: 5.1 m
  - Concrete Grade: M40
- **Materials Required**

The materials used for column work in metro construction include:

- Reinforcement Steel: Fe500/Fe550 Jindal bars (as per drawing)
- Shuttering Plyboard: Standard waterproof plywood, 12 mm thick
- Props and Channels: For supporting the shuttering formwork
- Binding Wire: 20 gauge wire for tying reinforcement bars
- Cover Blocks: 40 mm thick concrete blocks to maintain reinforcement cover

- **Methodology**

Step 1: Marking and Layout

- Check centerlines from drawings
- Mark exact location and size on slab

Step 2: Reinforcement Fixing (as per drawing)

- Main bar diameter: 25 mm
- Strips diameter: 16 mm
- Shear connector diameter: 12 mm
- Connections are fixed using a welding machine Step 3: Shuttering and Formwork
- Fix shuttering tightly using:

1. Standard plywood (1220 x 2440 mm)
2. City prop jack
3. Tie rod
4. Nails

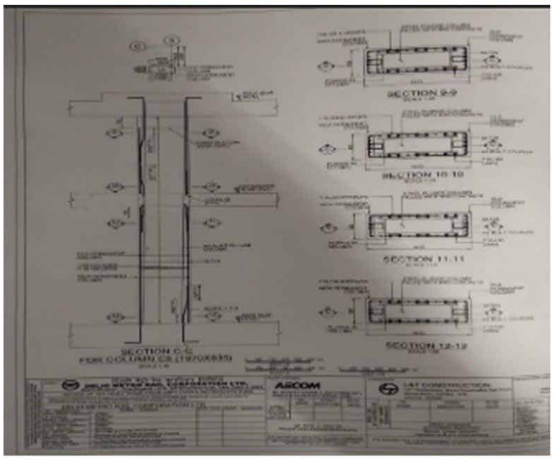
- Check verticality using a plumb bob

Step 4: Inspection Before Pouring

- Check formwork tightness
- Check steel placing and cover blocks
- Check alignment and supports using total station Step 5: Concrete Pouring
- Pour concrete using stationary concrete pump
- Use vibrator to remove air voids
- Fill concrete up to shuttering level and stop Step 6: Curing and De-shuttering
- After 24 hours, carefully remove props and shuttering Step 7: Coating
- Apply AS 20 High Strength Bonding Agent (done at our station)

- **Tools & Tackles**
  - Measuring tape
  - Plumb bob
  - Total station
  - Rebar cutter
  - Vibrator (needle type)
  - Hammer and nails
  - Scaffolding
- **Machinery Used**
  - Concrete Mixer: Brings concrete from casting yard
  - Vibrator (Needle): Compacts concrete inside shutter
  - Cutting Machine: Cuts reinforcement bars
  - Bending Machine: Bends reinforcement bars
- **Manpower Required**
  - Shuttering Carpenter: 2
  - Helpers: 2–3
  - Fitters: 2–3
  - Supervisor/Foreman: 1
- **Quality Checks**
  - Concrete slump check
  - Cube casting for compressive strength test
  - Reinforcement spacing and cover block check
  - Plumb and alignment check
- **Diagrams**

Column Shuttering System



Column Reinforcement Layout

Platform Slab

The platform slab is crucial as it supports passenger load, facilitates train boarding, houses utilities, and ensures safety, stability, and accessibility in metro stations for smooth daily operations.

- **Site Activity Observed**

I observed the execution of platform slab work at Grid Line 7 to 10. The approximate dimensions of the slab were:

- Length: 23 meters
- Breadth: 12 meters
- Thickness: 250 mm

The construction team was actively involved in staging, formwork installation, reinforcement placement, and concrete preparation for the platform slab.

- **Materials Used**

1. Scaffolding Components

- Base Plate
- Spindle Jack
- Screw Jack Pin
- Scaffolding Tower
- Diagonal Bracing

2.Formwork Components

- U-Shaped Precast Support
- Waler
- Splice Plate
- Screw Lock Pin
- H-Beam or Dock Beam
- Plywood Sheets (1220 mm × 2440 mm)
- Nails
- Joint Connector Pin
- Binding Wire

1. Reinforcement

- 10 mm dia steel bars (Grade 550D) for top and bottom mesh
- 16 mm dia steel bars for undercroft beams
- 10 mm dia steel rings (stirrups) at 135 mm c/c spacing

3.Machinery Used

- Hydra / Crane (for lifting materials)
- Bar Bending Machine
- Bar Cutting Machine
- Concrete Mixer / RMC Supply
- Needle Vibrator
- Concrete Pump
- Welding Machine
- Wheelbarrow / Trolley

- **Methodology of Platform Slab Construction**

1. Scaffolding Setup – The base structure was prepared using base plates, spindle jacks, screw jack pins, diagonal bracing, and towers to form a stable scaffolding system.
2. Formwork Installation –On top of the scaffolding, U-shaped precast supports were placed. Waler beams were fixed over them, and splice plates with connector pins were used to lock the alignment between walers.
3. Decking and Plywood Fixing – Plywood sheets were placed on the formwork system to cover the slab area uniformly and tightly.
4. Reinforcement Fixing – 10 mm dia steel bars with 135 mm c/c spacing were tied in both directions as per the structural drawing. For undercroft beams, 16 mm dia main bars and 10 mm dia stirrups were installed.
5. Concreting – Concrete was placed using RMC with the help of a concrete pump, and needle vibrators were used for proper compaction and to avoid honeycombing.
6. Curing – After setting, curing was carried out using water or curing compounds to achieve the required strength and durability.

- **Calculations**

1. Plywood Requirement

Standard Sheet Size: 1220 mm × 2440 mm ≈ 2.9 m² Slab Area: 23 m × 12 m = 276 m²

Number of Sheets Required: 276 / 2.9 ≈ 95 sheets

2.Concrete Quantity

Volume = 23 m × 12 m × 0.25 m = 69 m³

3.Reinforcement Details

Main Slab: 10 mm dia bars @ 135 mm c/c (both ways)

Undercroft Beams: 16 mm dia main bars and 10 mm dia stirrups @ 135 mm c/c

Dock and plywood fixing after someday reinforcement fixing

Conclusion

The platform slab construction is a critical and technical part of metro station construction. It demands precise staging, accurate formwork, correct placement of reinforcement, and controlled concreting. The work observed at Grid 7 to 10 was executed in a systematic and safe manner, meeting the required quality standards and structural specifications.

ENVIRONMENT HEALTH SAFETY (EHS) DEPARTMENT

The EHS department of Larsen & Toubro is based on the EHS Management System and Procedures, which follow the international standards ISO 14001 and OHSAS 18001.
OHSAS stands for Occupational Health Safety Assessment Series. Occupational safety refers to the safety norms to be followed on a construction site or any other workplace.

The EHS procedures are categorized into three major parts:

1. System Procedures (S.P): – These define all legislative requirements that are to be followed on-site. They also outline the roles and responsibilities of the staff and workmen working towards ensuring safety.
2. Control Procedures (C.P): – These include all the measures required to control the number of accidents on site, ensuring a safer working environment. It also defines the use of Personal Protective Equipment (PPE) such as:
    - Gloves
    - Safety Helmet
    - Safety Jacket
    - Safety Shoes and others used while on site.

3.General Procedures (G.P): – These procedures define all methods related to workmen welfare and the safety materials used on site.EHS department organises a training for the workmen so that each of them can safely work at site. These are the few of the many signaries you will see at a site.
A sign board indicating the use of PERSONAL PROTECTIVE EQUIPMENTS at site for safety. The construction site is filled with many such sign boards indicating the safety measures that are to be taken while working at the site.
EHS department also issues a safe to start card on daily basis after observing that safety measures are taken at the site where work has to be done.

Environmental Measures in Muh station

1. Dust Control: Water spraying and fog cannon used to suppress dust.
2. Noise Pollution: Use of noise barriers and low-noise machines.
3. Water Pollution: Sedimentation tanks and proper drainage to prevent dirty water flow.
4. Waste Management: Reuse of debris, proper disposal using crushers and tippers.
5. Tree Protection:Tree transplantation machines used to save existing trees.

Water Sprinkling

SAFETY DEPARTMENT

The Safety Department plays a vital role in ensuring a secure working environment throughout the station construction process. Its main responsibility is to monitor and enforce safety standards, minimize the risk of accidents, and ensure compliance with all applicable safety regulations.

They ensure that all personnel wear the required Personal Protective Equipment (PPE) such as helmets, gloves, safety jackets, and boots. The department also supervises the safe operation of machinery, handling of materials, and proper usage of scaffolding, ladders, and lifting equipment.

A crucial responsibility of the safety department is issuing the Permit to Work (PTW). This includes:

- Hot Work Permits (for welding, cutting, etc.),
- Confined Space Entry Permits, and
- Height Work Permits.

These permits ensure that high-risk activities are carried out only under controlled and supervised conditions with proper safety precautions in place.

Picture showing golden rule that is followed in L&T

HEALTH DEPARTMENT

Role in Metro Construction:

• Medical Checkups: Regular health check-ups of laborers and staff.
• First Aid Facility: First aid kits and trained staff always available on-site.
• Emergency Response: Quick response in case of injury or accident.
• Sanitation and Cleanliness: Proper toilets, handwashing stations, and cleaning schedules. • Clean Drinking Water: Availability of safe water at multiple locations.
• ORS Distribution: ORS (Oral Rehydration Solution) given during summer to prevent dehydration and heat stroke among workers.

Mechanical Department

The Mechanical Department plays a vital role in metro work by handling installation, maintenance, and operation of machines, ensuring smooth construction, safety, lifting tasks, and supporting various structural activities efficiently.

- **Mechanical Machinery Used in Our Station**

1. Excavator – Used for digging earth, trenches, and removing soil. At our station, it's mainly used for excavation during entry/exit and base slab works.
2. JCB Machine – Commonly used for excavation, loading, and shifting materials across the station area.
3. Bar Bending Machine – Used to bend reinforcement bars (rebar) into required shapes for beams, columns, and slabs.
4. Concrete Pump – Pumps concrete to higher elevations or difficult-to-reach areas. It's used for slab and column casting.
5. Transit Mixer – Transports ready-mix concrete from the batching plant (located at our casting yard) to the construction site.
6. Scissor Lift – Used to lift workers vertically for work on platforms or ceilings.
    - 5-ton: Used for roof work and coupler fixing in columns.
    - 10-ton: Used for installation of OTE duct.

- **Types of Cranes Used**

1. Crawler Crane (400T) – Large crane on tracks used for heavy lifting, especially for TBM part installation.
2. Mobile Crane (50T) – Wheel-mounted crane used for shifting steel bars, concrete buckets, and equipment across the site.
3. Overhead Gantry Crane (25T) – Installed at the casting yard to shift heavy machinery like JCBs, segments, or precast blocks.

Electrical Department

The electrical department is essential in metro work for powering systems, lighting, signaling, safety devices, and machinery, ensuring smooth operation, energy distribution, and reliable infrastructure throughout the station and tunnels.

- **Electrical Machinery Used in Our Station**

1. Welding Machine – Used to join steel structures and frames. At our station, used in column shuttering and chair formations.
2. Drilling Machine – Makes holes in concrete and walls. Often used in columns or D-wall areas for fixing couplers.
3. Power Distribution Boards (PDB) – Distributes power to various equipment on-site. Common types observed: PD63A and PD125A.
4. Lighting Tower – Provides illumination for night-time construction activities and safety.
5. Bar Cutting Machine – Cuts rebar using electrical power via male and female sockets for fast and safe operation.
6. Circular Saw – Electric saw used to cut plywood sheets for shuttering and staging.
7. Core Drilling Machine – Used to create circular holes in slabs and walls. At our station, it was used for fixing the OTE duct.

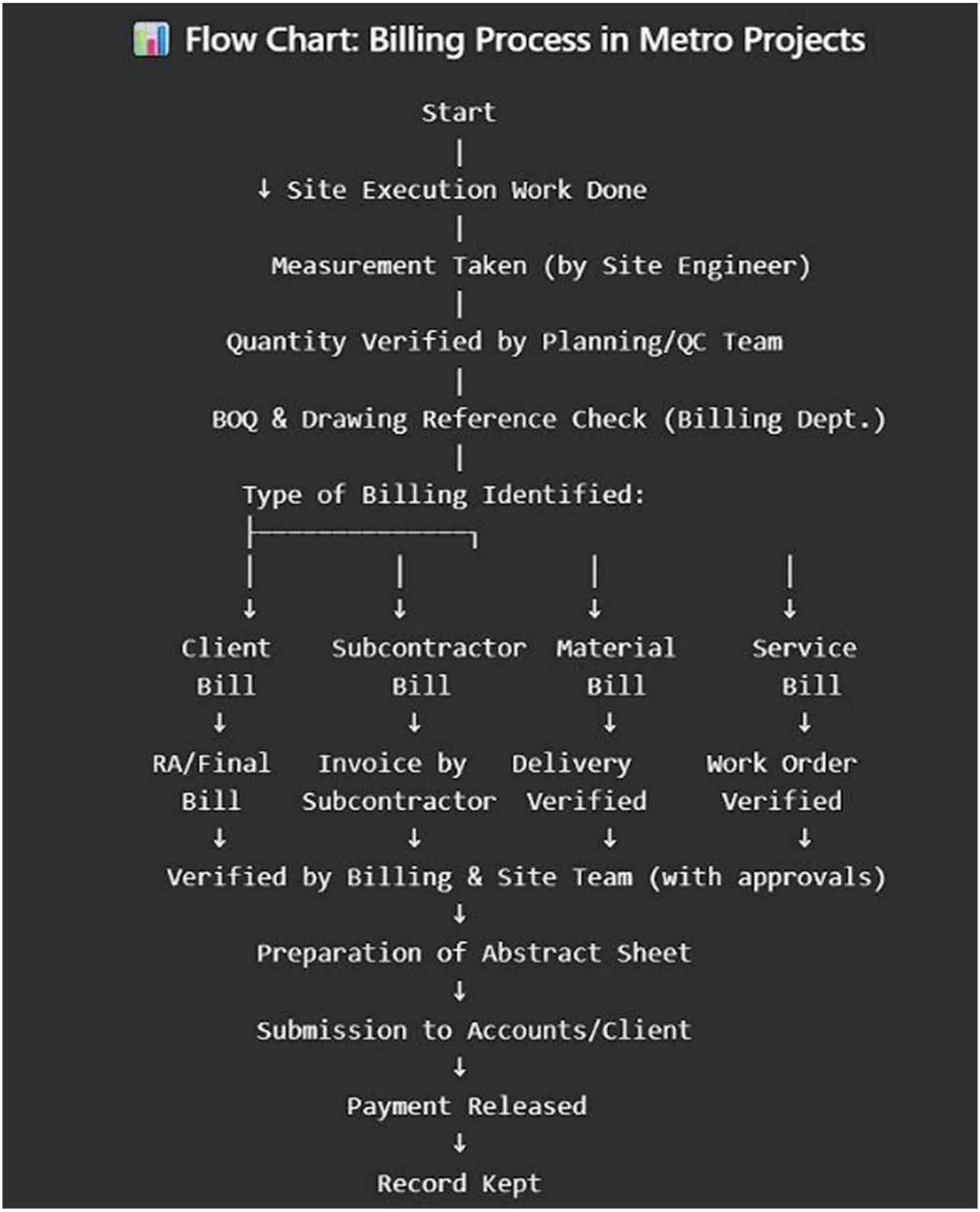
Surveyor Department

The Surveyor Department plays a fundamental role in metro construction by ensuring precision in alignment, leveling, and layout of structures. From the initial setting out of the alignment to the final track laying, surveyors provide accurate coordinates and elevation data required for foundations, piers, stations, tunnels, and tracks. They help in transferring benchmarks, controlling vertical and horizontal alignment, and detecting any structural deviations early.

The following key instruments and materials are being used by the surveyors on-site:

1. Total Station – This is the primary instrument used by the surveyors. It provides precise measurement of distances, angles, and coordinates. It is essential for setting out the centerline of structures, grid points, and other reference locations during construction.
2. Tripod Stand – The total station is mounted on a sturdy tripod stand to maintain stability and accuracy during measurements.
3. Whitener (Correction Fluid) – Whitener is used on concrete surfaces or block work to clearly mark reference points, grid numbers, and alignment data.
4. Spray Paint – Surveyors use marking spray to highlight important levels, alignment marks, and grid intersections on floors and walls for visibility during construction work.

BILLING DEPARTMENT



PLANNING DEPARTMENT

The Planning Department is one of the most critical departments in a metro construction project. It is responsible for the overall scheduling, coordination, and monitoring of construction activities to ensure timely project delivery.

They also prepare Daily Progress Reports (DPRs), Weekly and Monthly Reports, and monitor the actual progress versus planned progress. In case of delays, the planning team coordinates with site engineers and contractors to revise schedules and speed up activities through resource adjustments or parallel works.

The Planning Department works closely with civil, electrical, mechanical, and procurement teams to ensure that materials, manpower, machinery, and drawings are available as per site requirements. They also maintain important project documents and ensure that all construction aligns with milestones and deadlines given by higher authorities like DMRC, PMC, or consultants.

Overall, the Planning Department ensures smooth project execution, avoids time and cost overruns, and keeps the entire project team aligned with the master construction plan.

ADDITIONAL TECHNICAL CONCEPTS

1. A Tunnel Boring Machine (TBM) is a specialized machine used to excavate tunnels with a circular cross-section, commonly used in metro rail and underground projects.
2. 🚧 Main Parts of a TBM:
3. Cutter Head – Rotates and breaks the soil or rock.
4. Grippers/Shield – Supports the tunnel face and keeps the TBM in position.
5. Screw Conveyor – Removes excavated material (muck) from the front.
6. Segment Erector – Installs pre-cast concrete rings (segments) to form the tunnel lining.
7. Hydraulic Jacks – Push the machine forward by applying pressure against installed segments.
8. Control Cabin – Operator controls TBM speed, pressure, and alignment.
9. Backup Gantry – Carries equipment, ventilation, and conveyors for muck removal and material supply.
10. 🔄 How TBM Works:
11. The cutter head rotates and cuts through soil or rock at the tunnel face.
12. Excavated material is collected and removed via the screw conveyor.
13. As the TBM moves forward, it erects concrete segments to line the tunnel.
14. The machine keeps continuous alignment and records geotechnical data.
15. The process continues until the tunnel length is completed.

- **Role of Sodium Silicate in TBM (Tunnel Boring Machine)**

  Sodium silicate plays a vital role in TBM tunneling, especially when working in loose, soft, or water-bearing soils. It is used as a ground stabilizing agent to prevent soil collapse and reduce water inflow at the tunnel face. In TBM operations, sodium silicate is injected into the surrounding soil, where it reacts with other chemicals (like calcium chloride) to form a gel-like substance. This reaction strengthens the soil and reduces its permeability, making it stable enough for safe excavation. This method, known as chemical grouting, helps maintain tunnel
  face pressure, improves machine performance, and enhances safety during underground construction.

OTE stands for Over Track Exhaust duct. An OTE duct is a ventilation duct installed above the metro track (in the tunnel or station) to remove hot air and smoke.
It is a large rectangular or circular duct made of GI (galvanized iron) or fire-rated material, fixed to the tunnel or station roof.

TBM(turnel boring machine)

CONCLUSION

This internship at Moin-ul-Haq Metro Station has been a very valuable experience for me. I got to see how a big metro project is actually built on-site. I learned many things about construction work, planning, safety, and the roles of different departments. By observing the work of the Civil, Mechanical, Electrical, Planning, and Quality Control departments, I understood how important teamwork and coordination are. I saw different activities like block work, column casting, slab construction, and safety checks. I also got to know about the machines and tools used, and how quality tests are done on concrete and materials.
This training helped me improve my technical knowledge, confidence, and understanding of how real projects are managed. It made me more responsible and prepared for my future as a civil engineer. I am thankful for this great learning opportunity.