

INTERNSHIP REPORT
ON

"INDORE METRO"

Submitted to-

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE GWALIOR
(A govt. Aided Autonomous Institute under RGPV, Bhopal (M.P) Established in 1957)

IN PARTIAL FULFILLMENT FOR REQUIREMENT FOR THE AWARD OF THE DEGREE OF

BACHELOR of TECHNOLOGY
In
CIVIL ENGINEERING



2018-2022

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**MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE
GWALIOR**

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URC Construction (P) Ltd



May 18.2022

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. Umesh Dangi, a final year (B. Tech - Civil Engineering) student from Madhav Institute of Technology and Science, Gwalior has completed internship training at our construction site (Metro construction Package IN03 & IN02). Indore) from 03.01.2022 to 16.05.2022

He has completed his training in various departments including Quality Assurance & Quality Control and Survey department. We found him to be punctual, hardworking and inquisitive.

His attitude and performance during the training was found excellent. He has the capabilities to supervise primary works and concrete.

We wish all success in his future endeavor.

For URC Construction (P) Ltd



Authorized Signatory



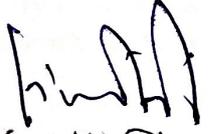
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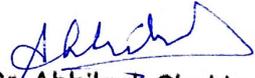
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RECOMMENDATION

It is hereby recommended that the internship report entitled
– INDORE METRO CONSTRUCTION which is being
submitted by UMESH DANGI completed under the guidance
of Dr. ABHILASH SHUKLA may be accepted in the partial
fulfillment of the award of the degree of Bachelor of
Engineering in Civil Engineering.

Guided by

for 
Prof. and Head
Civil Engineering Department
Department
MITS, Gwalior


Dr. Abhilash Shukla
Civil Engineering
MITS, Gwalior



ACKNOWLEDGEMENT

When it comes to properly acknowledging someone's support and assistance, it may be a challenging undertaking, chiefly when the support offered is so wholehearted and unwavering.

I am eternally grateful to my renowned guide, **Dr. Abhilash Shukla**, Assistant Professor of Civil Engineering Department, MITS Gwalior.

Also, I would like to thank **Dr. M.K. Trivedi**, Head of Civil Engineering Department, MITS Gwalior, and all other academics and staff members of MITS Gwalior's Civil Engineering Department for their unwavering support throughout the project.

I am really grateful to **Dr. R. K. Pandit**, Director of MITS Gwalior, for establishing an outstanding institutional environment and for giving all facilities and assistance in the preparation of my dissertation. I also acknowledge with gratitude to our supporting **Mr. VIKRAM** for providing the facilities needed for the accomplishment of this project.

I take great pleasure for my institute **URC CONSTRUCTION PVT.LTD, INDORE (M.P.)** for providing the opportunities.

The environment of company has been valuable experience for me. It has provided an opportunity to learn at our own pace in discipline of interest. I would like to thank all those who helped me during different stages of completion of this project.

UMESH DANGI

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DEPARTMENT OF CIVIL ENGINEERING

MITS GWALIOR (M.P.)

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INTRODUCTION

INDORE METRO RAIL PROJECT

The **Indore Metro** is a system which is under construction for the city of Indore, India. The total system consists of 11 corridors (lines) covering a distance of 124 kilometres (77 mi). This project will cost approximately ₹12,000 crore . The cost per km will be 182 crores and total cost is 15,000 crores. There will be three types of run – on road, on bridges, and underground in some locations. The Indore Metro project has been subject to serious contestation due to the inappropriate shifting of Seismic zone-II to Seismic zone-IV category which has led to increase in budgetary cost for the entire project.

Plan

Six corridors have been proposed by DMRC. The main corridors are:

- Annapurna to Sukhliya
- Super Corridor MR 10 to Ring Road
- Niranjapur to Bhawarkuwa

The planned Metro in Indore is Metro system which is designed by Rohit Associates Cities & Rails Private Limited, headed by architect Rohit Gupta. This system consists of a Network of 100–107 km and with lines overlapping and branching. Rohit Associates was appointed to prepare a detailed project report for the MRTS including the selection of the system for the city. Based on the multi-criteria analysis and recommendations of consultant Rohit Associates, The Government of Madhya Pradesh approved the inception report prepared by the consultant on 30 June 2014. As of 9 December 2014, Geotechnical surveys and formation of the company is being carried on for the implementation of the project. The project is projected to be completed by 2024

On 1 May 2019, the Asian Development Bank gave in-principle approval to fund the Indore Metro project. The Union Government will stand as guarantor for the loan.

ROUTE NETWORK

In Phase 1, consists of 30 stations.⁽⁰⁾

(Bhawarsala Square - Super Corridor 1)

Length: 33.53 km

Alignment: Elevated & Underground

No. of Stations: 30

Stations are

- Bhawarsala Square
- MR 10 Road
- ISBT / MR 10 Flyover
- Chandragupta Square
- Hira Nagar
- Bapat Square
- Meghdoot Garden
- Vijay Nagar Square
- Radisson Square
- Mumtaj Bag Colony 1
- Mumtaj Bag Colony 2
- Bengali Square
- Patrakar Coloy
- Palasia Square

- High Court / Hotel Residency
- Indore Railway Station
- Rajwada Palace
- nMaulana Azad Marg
- Bada Ganpati
- Ramchandra Nagar Square
- Kalani Nagar
- BSF
- Airport
- Gandhi Nagar Nanod
- Super corridor 6
- Super corridor 5
- Super corridor 4
- Super corridor 3
- Super corridor 2
- Super corridor 1

INDORE METRO MAP

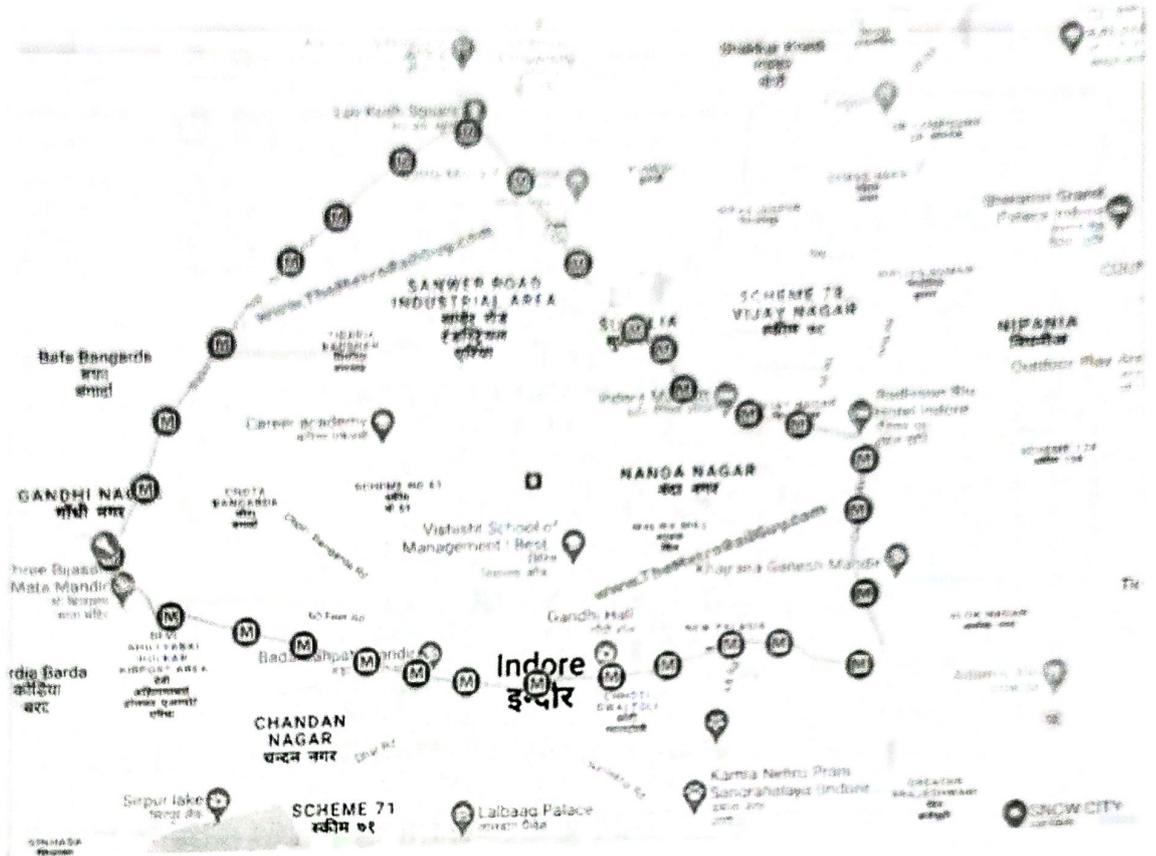


FIG.1 INDORE METRO MAP

SAFETY HEALTH AND ENVIRONMENT

It is important to know about the safety inductive points as to prevent the accidents taken in the site. Labours at the site should be taken extra care. Therefore it is important to know some points as follows:

- Establishing and maintaining ecofriendly and occupational health and safety management system in compliance with the international standard.
- Dissemination of this HSE policy through communication and training to personal working for on behalf of Simplex infrastructures and be made available to other interesting parties, as required.
- It is very essential to be taken care in particulars like manual material handling, electrical safety, fire protection, lifting, welding and gas cutting etc.

FIRE PROTECTION:

- Do not smoke at flammable storage area.
- In fire emergency do not use elevators and lift use only exit stairs.
- In case of emergency assemble at a assembly point.
- In case of emergency follow escape route.
- Fire extinguishers must be clearly visible and easily accessible.
- Extinguisher shall be hung at 1m height from ground with the back ground having red and white strip.

ELEVATED STRUCTURE

FIELD INVESTIGATION [IS: 2131-1981]:

Soil investigation is the study of the type of, properties and behavior of sub surface soil. The extensive subsurface soil investigation was carried out, at each pile location to check the availability, depth and quality of the hard rock, to get an idea of number of soil layers present with the depth and bearing capacity of soil layers. Based on the above data collected and the laboratory test was conducted on the soil sample collected from the investigation trenches, the type of foundations (shallow or deep), the number of piles required and depth of foundation can be decided.

SUB-STRUCTURE CONSISTS OF:

- Pile
- Pile Cap
- Pier and Pier Cap
- Crash Barrier
- Bearing with Bearing pedestal

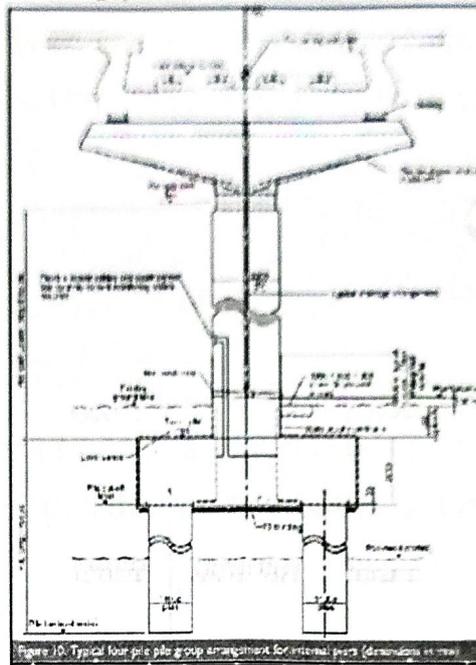


FIG.2 SUB STRUCTURE

- PILE

When the load coming over the structure is large and when the soil is not in condition to take the load the deep foundations are preferred. Deep foundation is done

by piling operation in two ways i.e. End bearing pile which rests on hard or weathered rock, other one is friction pile in which the load is registered by the friction action. In site both end bearing and friction bearing piles are used to take the load coming over the structure.

- Soil Exploration:

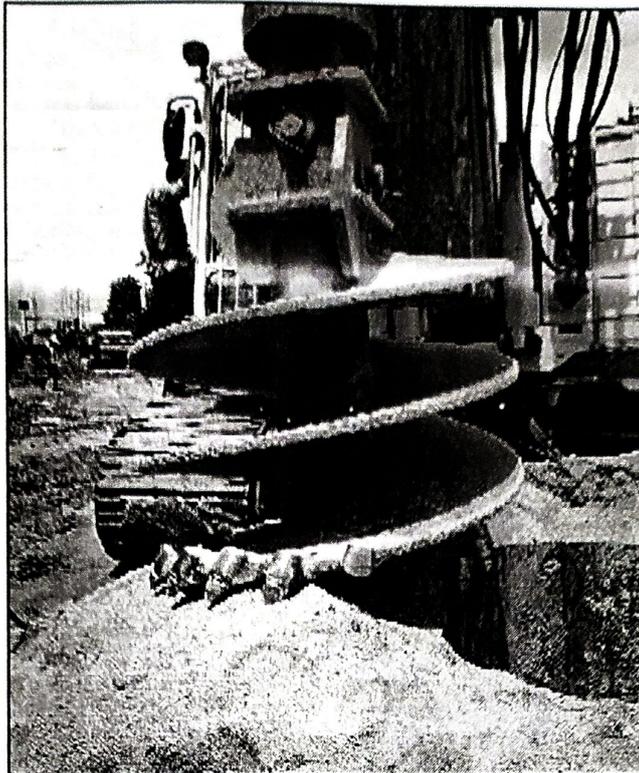
Properties of the soil at site is determined and based on this number of pile in a group is designed. Depth of pile is decided on the bases of type of pile and soil strata.

- Boring:

Marking are done on the site where the piles have to be provided so it has to ensure the exact location for boring. Boring is done up to 2 to 3 m depth before driving the casing.

Casing is to be insert up to the depth where the sand soil is found in order to prevent the collapse of soil into the bore.

Casing can be temporary and permanent liner. As precaution a small length of liner is always kept above the ground surface. Polymer is used to prevent the collapse of bore in case of sandy soils, as in case of clay soil we don't use liner. Boring is done using rotary boring machine when the soil strata ids hard. Boring is done by bailer, chisel mechanism when the soil strata is soft.



Pile Driving Equipment (Full Article)

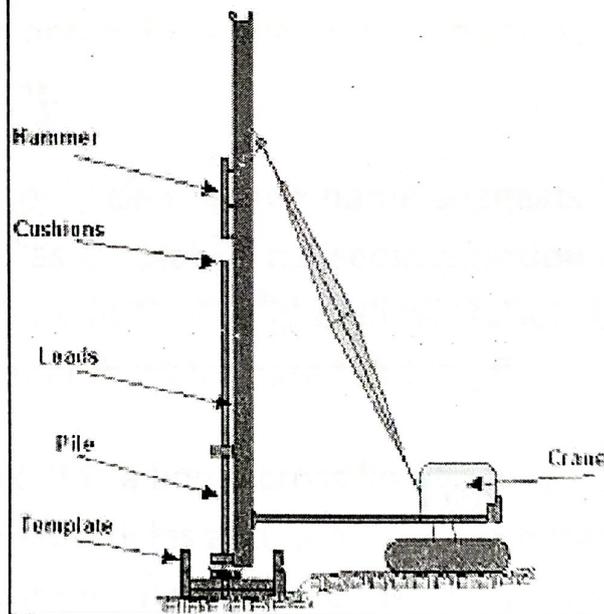


FIG.4 AUGER BORING

Stabilization of Borehole:

Due to the geological condition or pit conditions on soil present in the site. During drilling borehole, the loose soil may collapse due to vibration of machine and other natural conditions. To prevent this collapse, the polymer is used.

The polymer products are as follows:

- Poly fluid: poly fluid is a synthetic drilling granular polymer characterized by high molecular weight. It is used for preparation of stabilizing and lubricating mud in drilling for deep foundations like piling. Poly fluid is easy to prepare and is fully degradable, nontoxic and safe for environment.
- Poly clear: poly clear as the name suggests is dispersant, which acts as a catalyst for sedimentation and cleaning process of excavation and sedimentation tanks. It also acts as thinner in water based drilling fluids.
- Poly Matrix: It is a liquid cross linking polymer. It helps to bind the soil particles and reinforce the overall stability of the excavation. Poly matrix helps in increasing the suspension properties of the slurry for challenging ground condition.

Periodically the viscosity (55-70sec), density (1.01-1.07), pH (8-12) of the polymer is to be checked.



Fig.5 Polymer mix tank



Fig: 6 POLYMER FLUID IN PILE EXCAVATION

Standard Penetration Test (SPT):

This test is to determine the presence of hard rock strata and soft rock strata.

The procedure is as follows:

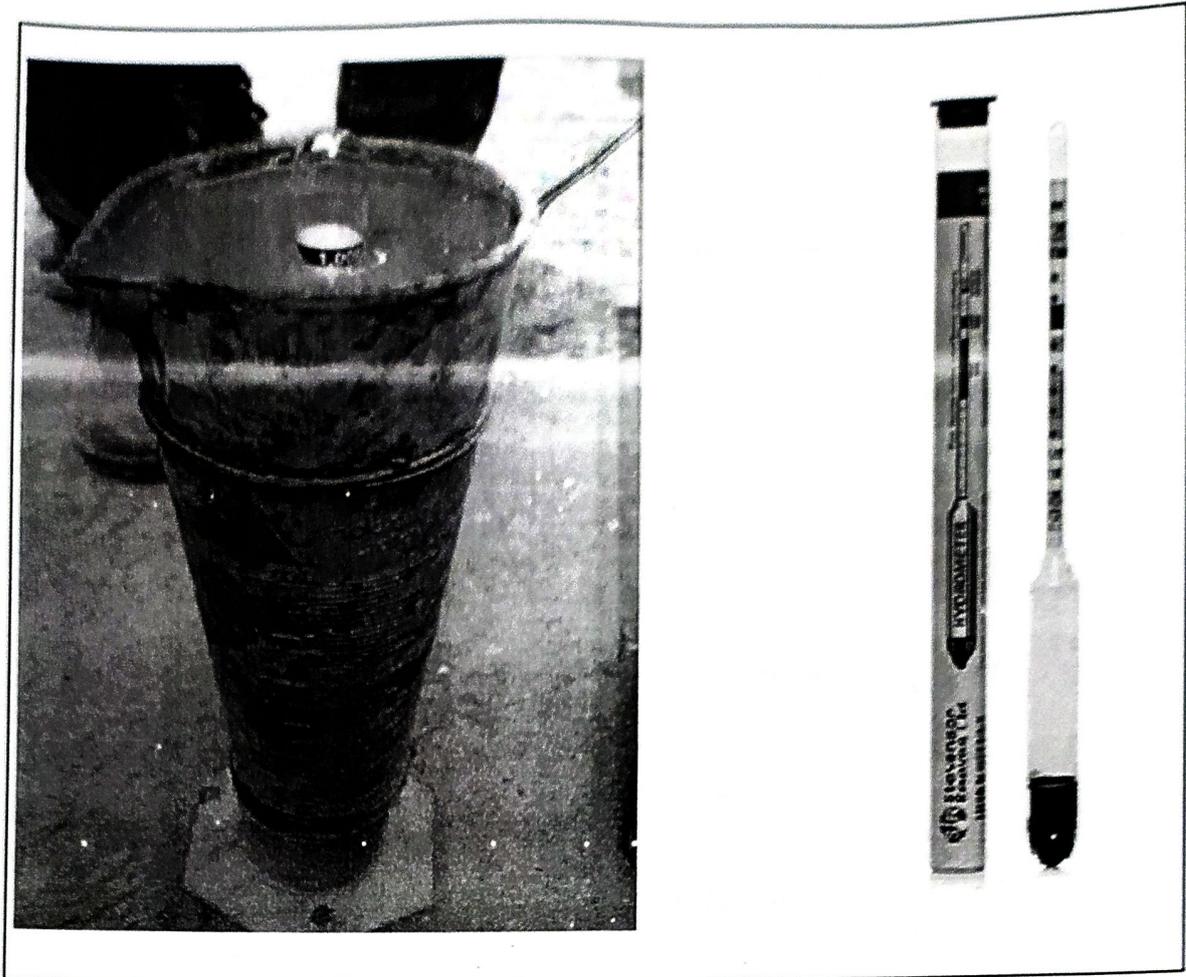


FIG.7 HYDROMETER

- The tripod is set up over the center of the bore hole.
- The chisel is fitted to motor driven pulley.
- Blows are imparted to the strata underneath.

| No of blows | Depth in mm |
|-------------|-------------|
| 450 | 600 |
| 900 | 1200 |

- This gives the settlement of the strata.

- If the settlement is <200 mm, then it is a hard rock/strata.
If the settlement >200 mm then it is weathered rock.

- Weight of chisel:

| Dia. of pile | Weight in tones |
|--------------|-----------------|
| 600 | 1.8 |
| 1200 | 3.6 |

Based on the results of SPT, for hard strata socketing of pile is done.

| Settlement in mm | Depth of pile in m |
|------------------|--------------------|
| <200 mm | 1.5D |
| >200 mm | 2.5D |

Where, D = Diameter of pile

Therefore; Depth of pile is determined and pile is completed.

Usually the depth of pile is kept 0.6m above the foundation level. After obtaining complete yield strength of the concrete the extra 0.6m is chipped out for further construction.

FIG.8 CHISLER

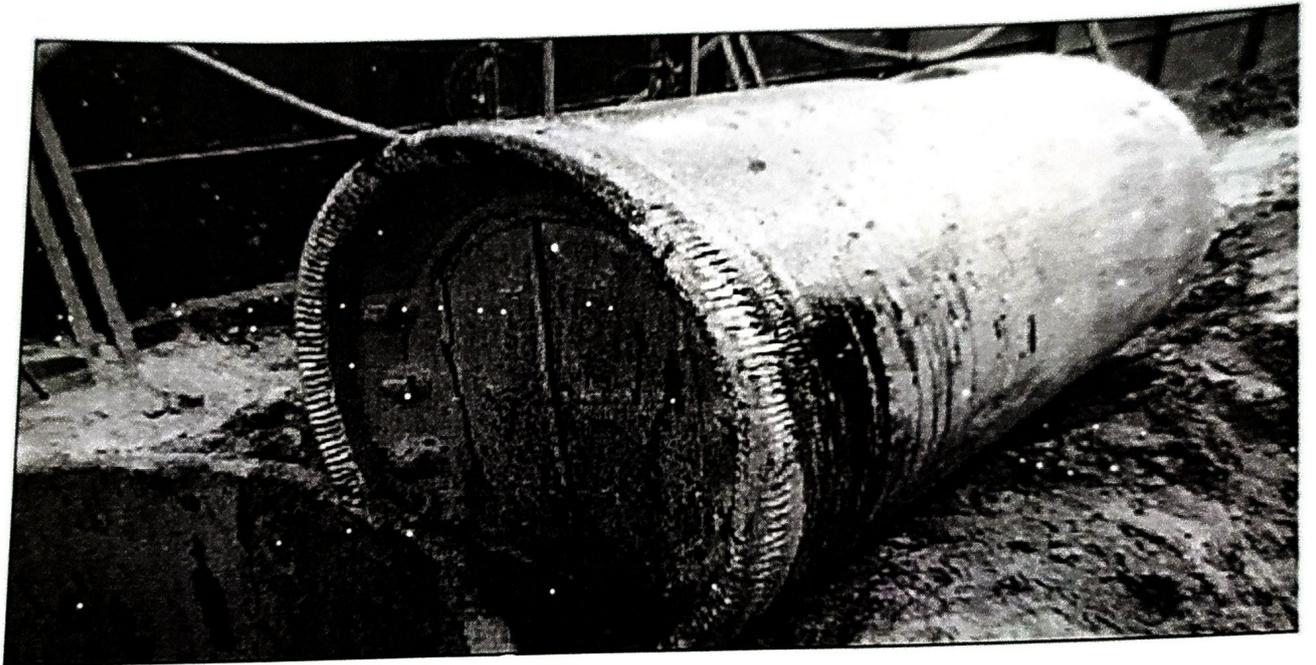
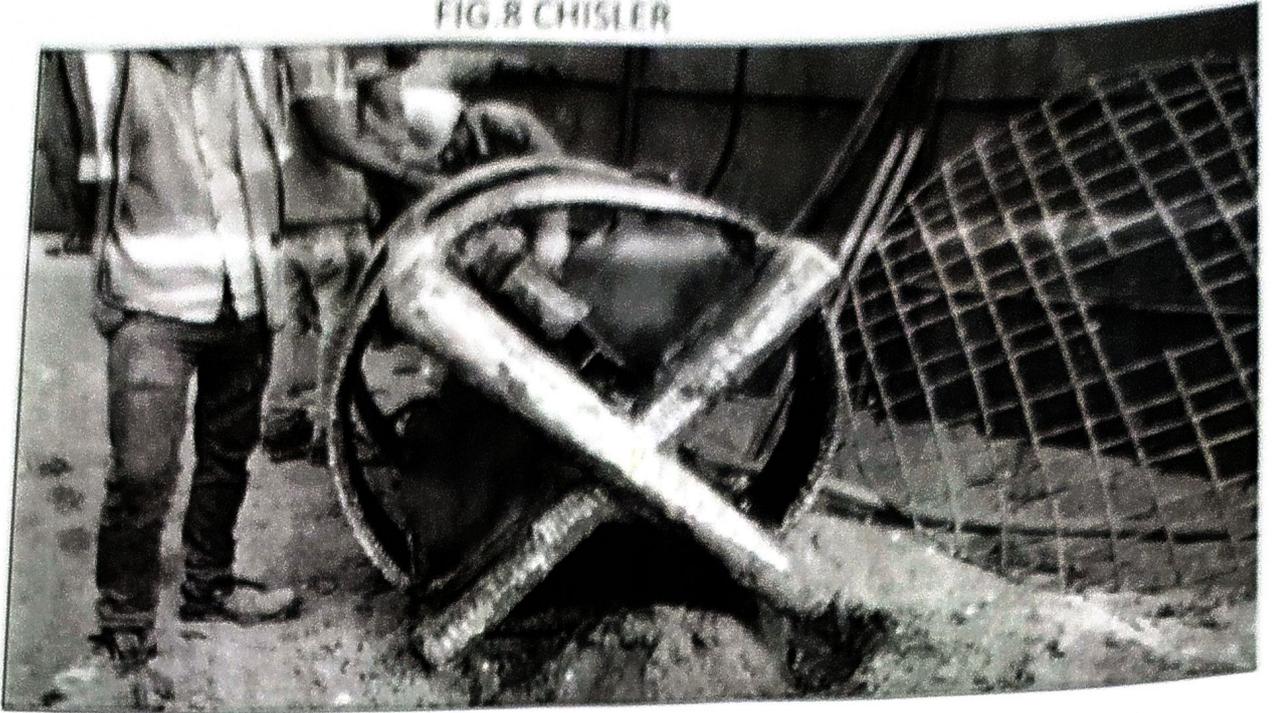


FIG.9 BAILER

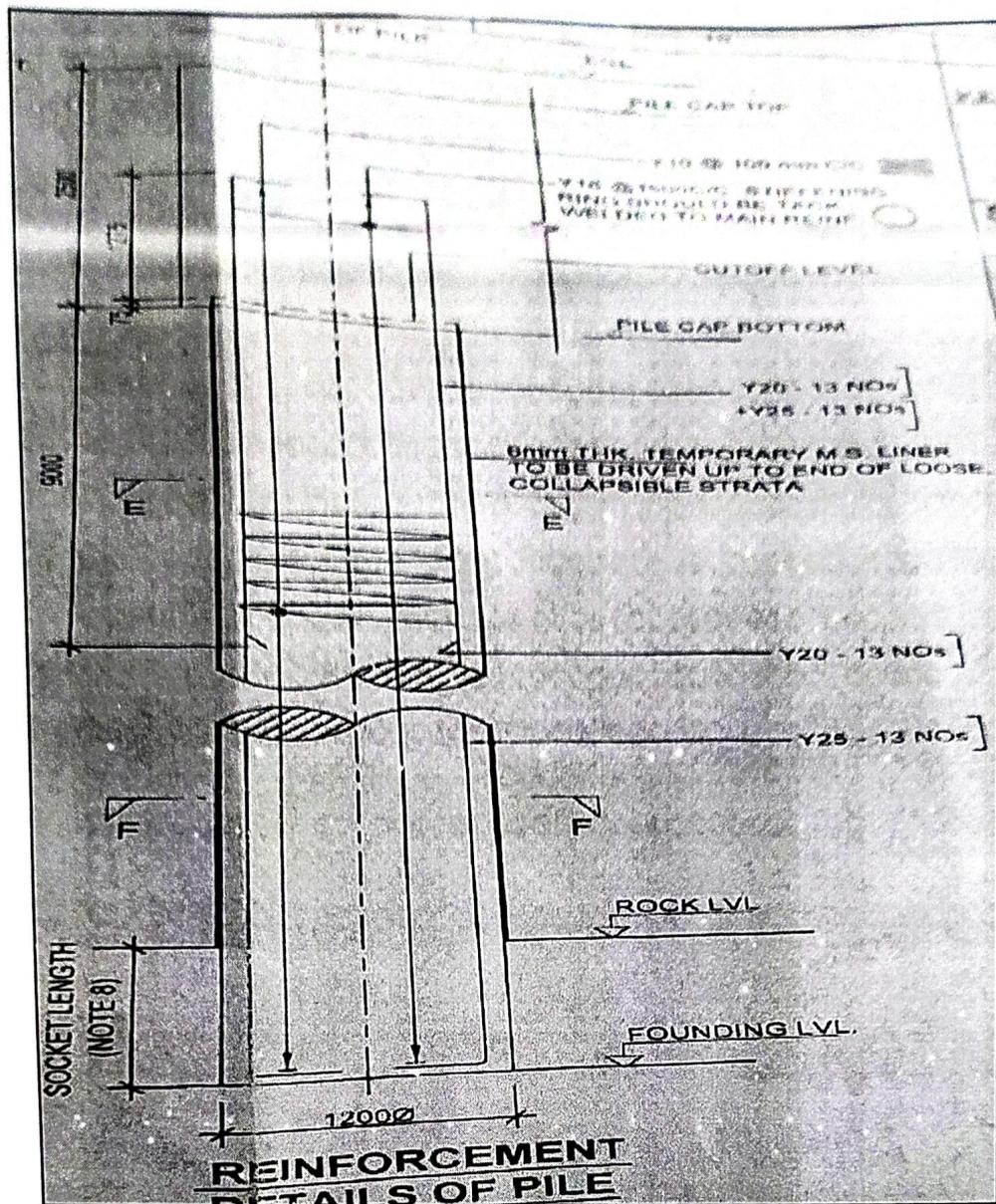


Fig:10 REINFORCEMENT DETAILS OF PILE

- Flushing:

Polymer slurry is used in the sides of the pile bore holes, with temporary and permanent casing wherever sub soil or the ground water conditions are likely to cause mud flows or instability of pile bore and sand boiling.

It helps to bind the soil particle and increases the overall stability of the soil excavated.

- Concreting:

Concrete of grade M35 is prepared at batching plant and is brought to site by Transit mixer. It must have slump value of about 150 ± 25 mm at batching plant and 100 ± 25 mm at the time pouring. Concreting is done using tremie pipes. Tremie pipes are lowered in to the boring and funnel is fitted to the top end of the pipe. Concrete is poured into the tremie pipe it is seen that the pipe bottom end remains in concrete till the concrete in bore reaches 2-3m. The dia of tremie pipe is 250mm.

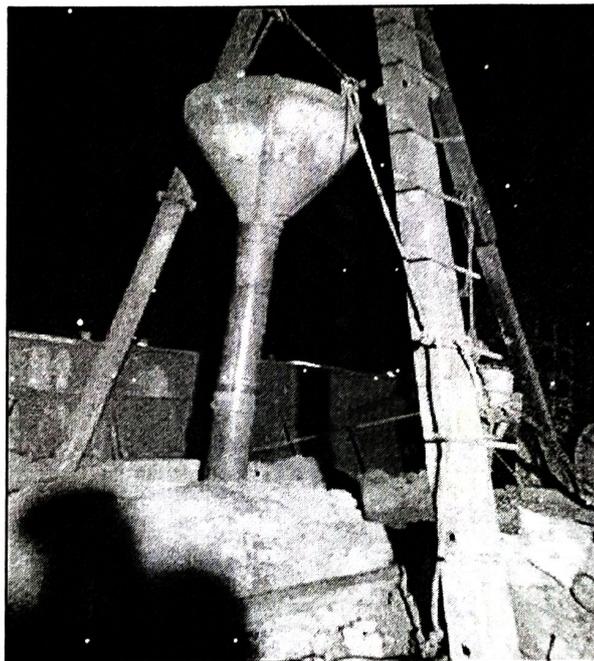


fig: 11 Tremie pipe with funnel fitted

Pile load test.

A test pile tested to determine the load carrying capacity of the pile by load either to its ultimate load and to twice the estimate safe load.

If the pile support the load primary by resistance developed at the pile tip and base is called 'end bearing pile' and if primarily friction along its surface then 'friction pile'.

Initial test pile- one and more piles, which was not working piles, may be installed if required to assess the loads carrying capacity of a pile. These piles are tested either to their ultimate load capacity or twice the estimated safe loads.

- Test is conducted on the non-working & working piles.
- The actual designed ultimate load of each pile is 750 tones. Therefore, the total load added during initial load test is 2.5 times the ultimate load pile.
- The weights are added on the hydraulic jacks provided.
- The settlement is noted from the gauges placed below the jacks.
- If the final settlement is within 12mm then, the two third of the load is taken.

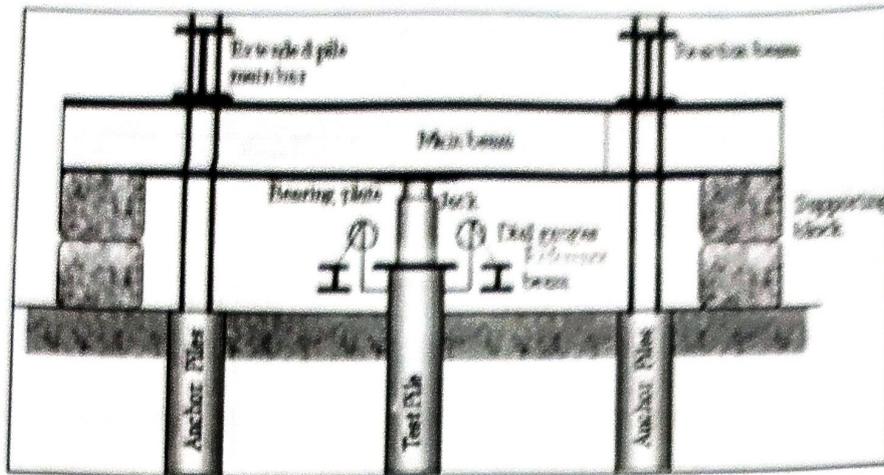


Fig.12 pile load test

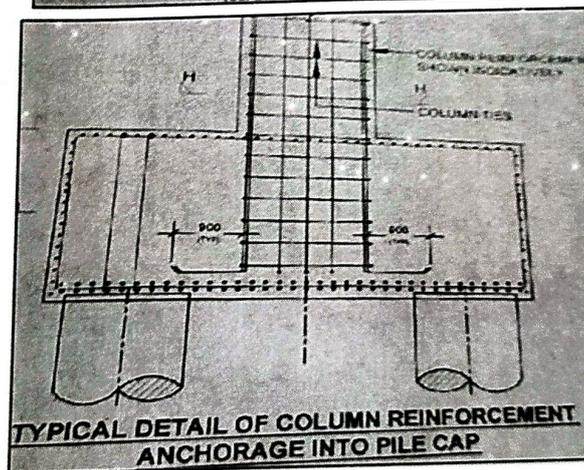
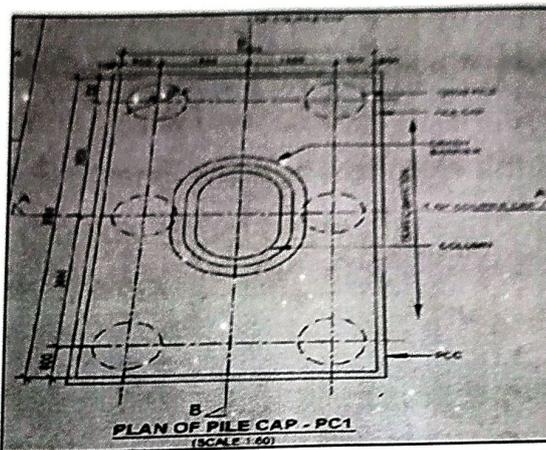


FIG.13 PLANE OF PILE CAP

PILE CAP:

Piles are grouped and pile cap is constructed over them to direct the load coming over Pier to Pile. In site at some places 4 piles and 6 piles are grouped based on the soil condition and pile cap is constructed.

- Concrete should not come in contact with soil. So leveling course (PCC) of 75-100mm is laid on the ground before pile cap is constructed to have a levelled surface. Pile cap is of depth 1.8-2.0 m.
 - Reinforcement Fe500 are provided as per design specifications of different diameter at given Spacing on the site with a clear cover of 75 mm.
 - Formwork is placed and concreting is done. Top level of pile cap is provided 0.5m below the existing ground level
-
- In viaduct the dimension of pile cap is (square)
5.2*5.2*1.8 m.
 - At stations the dimensions of pile cap is (rectangular)
8.3*5.3*2.5 m.

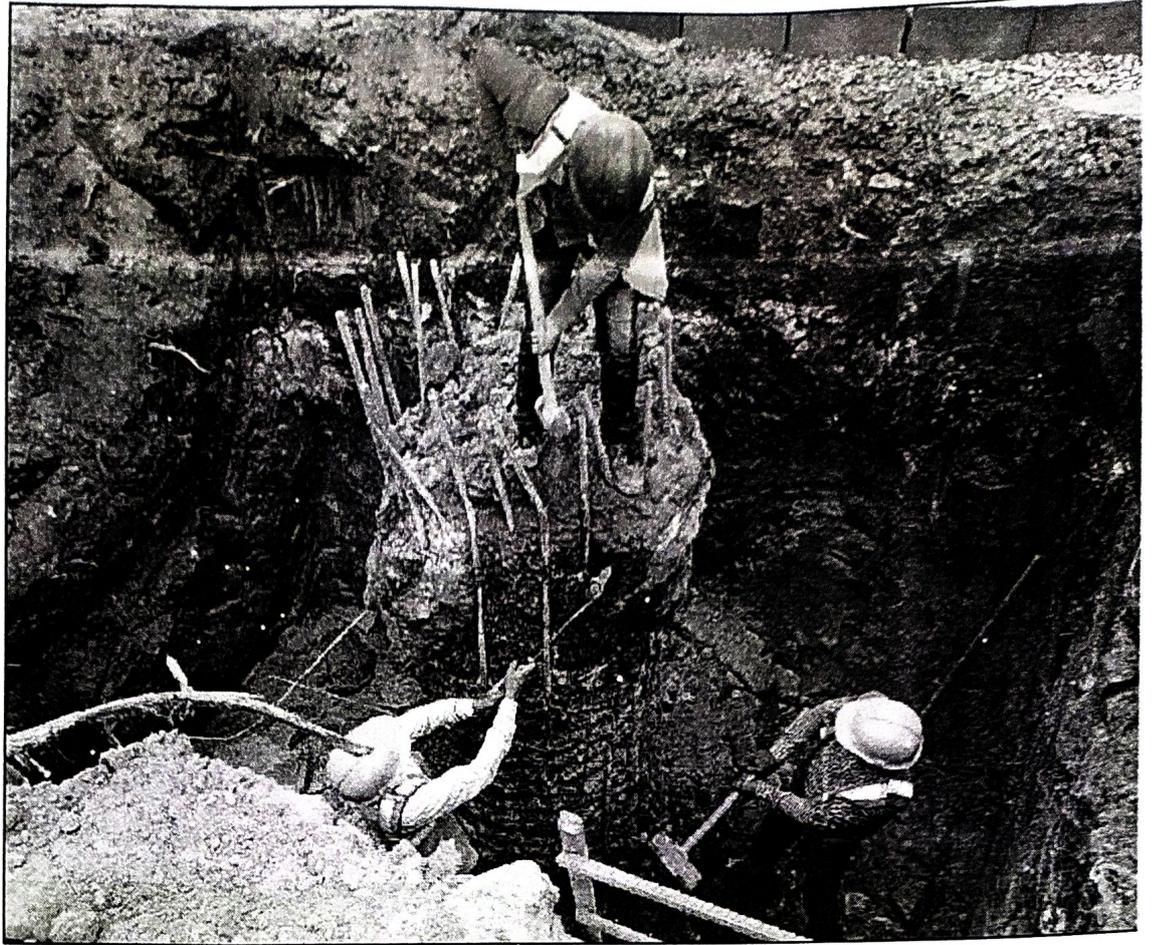


Fig.14 pile Chipping in Progress

FIG.15 PILE CAP

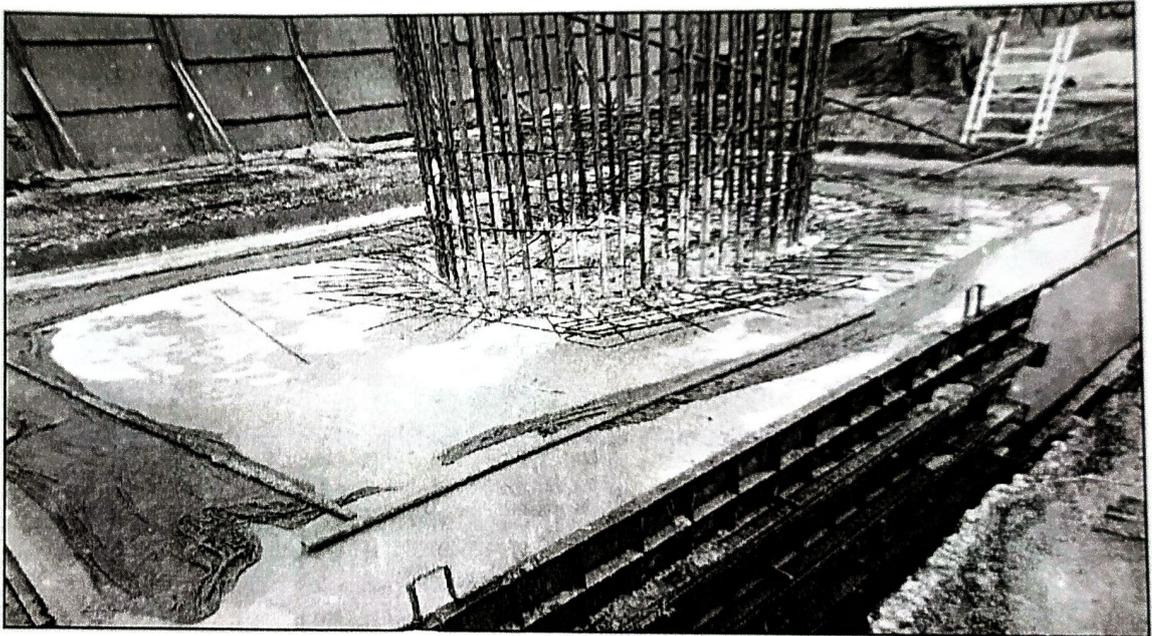
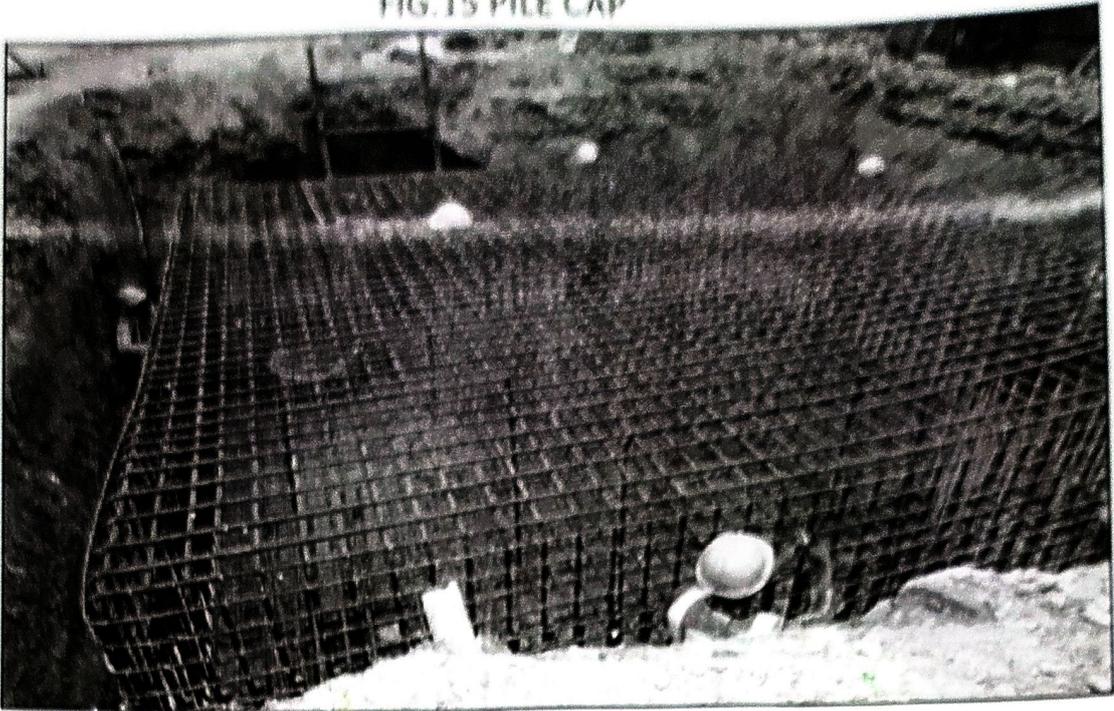


FIG.16 CURING IN PROGRESS FOR PILE CAP AT STATION

PIER AND PIER CAP:

Pier are raised structure typically supported by well-spaced. They are open structure help the movement of traffic below the elevated structure to move without obstruction. Its construction activities are as follows:

- Pier Starter

Before construction of pier, pier starter is constructed to have to check level. It is in the shape of pier. It serves as the base for placing formwork.

- Reinforcement:

Reinforcement for Pier is tied to the pile cap and are projected throughout the length of pier as per design specification. The length of the reinforcement falls short, they are extended by connecting them to reinforcement by coupler joint (threading process) since diameter of these reinforcement are greater if it is more 16mm. Suitable cover is provided by tying cover blocks to the outer reinforcement.

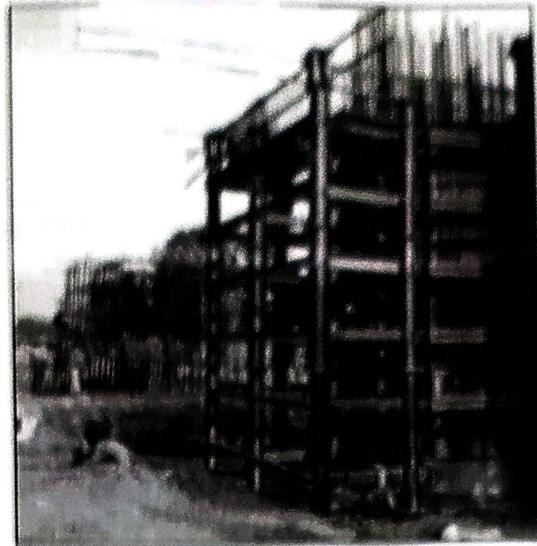


Fig: 17 PIER REINFORCEMENT AND SHUTTERING

- Form work:

Formwork is erected as per the shape of the pier and is connected using nuts and bolts. The inner surface of the formwork is thoroughly before concreting. Drain pipe is installed at the centre of the pier to drain out the water from the structure.

- Concreting:

According to design concrete of grade M50 is to be used for casting pier. Concreting is done by Pump or Boom placer. Required slump must be $125\text{mm} \pm 25\text{mm}$ at the time of casting. To pour the concrete to fill duct of pier tremie pipe is used to prevent segregation of concrete. The depth of pour above the structure must not exceed 1.5m according to IS standards. Compaction is done using needle vibrator to achieve design strength. The dia of needle vibrator is 40mm-60mm Care should be taken to avoid more compaction which might lead to segregation.

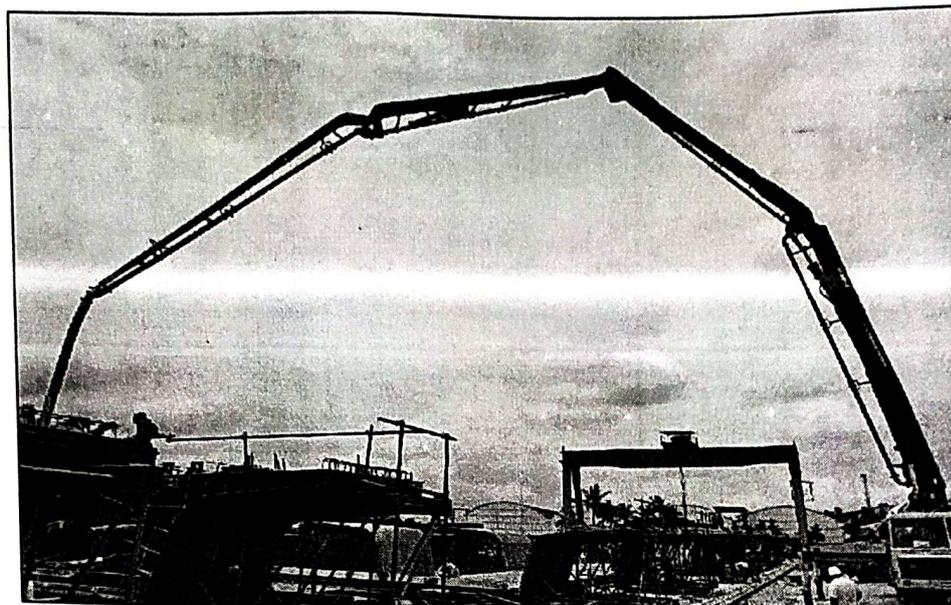


FIG.18 BOOM PLACER

- Curing:

De-shuttering is done for vertical structure after 24 hours of casting and is cured for 14 days to achieve desired strength

PIER CAP:

Pier and Pier cap are monolithic structures. But transition zones, Portal and Cantilever Pier cap are casted separately. The upper or bearing part of pier made of concrete is designed to distribute concentrated loads evenly over entire area of the pier. Construction steps of pier cap are same as that of pier.

FIG.19 PIER CAP INFORCEMENT



CRASH BARRIER:

Crash barrier is strong fence at the base of the pier to protect pier from damages caused from the traffic. Certain gap must be left between pier and crash barrier. Thermocol is provided to maintain the gap and it acts as shutter.

Reinforcement is tied according to design, formwork is placed and concreting is done using M35 grade concrete.



FIG.20 CRASH BARRIER

BEARING:

A bearing is component which provide a resting surface between pier cap and segment.

Bearing pedestal is constructed before placing the bearing. For this project for straight and curved alignment ELASTOMERIC bearings are used and when vertical load is greater, POT

bearings are used.



FIG.21 ELASTOMERIC BEARING

PEDESTALS:

Pedestals acts as height boosters that transfer load from bridge deck to the pier and substructure.

The process to install the pedestals is the cost effective and uses well-understood technologies to jack the bridges and to install the bearings.

Although pedestals increases the vertical clearance height of bridges thereby reducing the likelihood of impact

damage, they make the bridges more susceptible to instability and damage from lateral loads such as those produced by small and moderate earthquakes. The Typical pedestal dimensions are $0.8 \times 1 \times 0.15$ m.



FIG.22 TYPICAL BEARING PEDESTAL

SEGMENTS:

Span consists of number of segments. Segments are pre-casted elements which are casted in casting yard and are brought to site. Segments are lifted by launching girder and segments trolley which are made to rest on alternate piers. The lifting of segments by using of macalloy bars. Segments are match casted at casting yard and are dry matched at site. Epoxy glue is applied on both the face of

segments and they are fixed together. The extra glue oozes out and is trimmed off before it hardens.

Segments are held together by epoxy glue and are post tensioned by drawing tendons through the ducts provided while match casting as per the cable profile. Different spans have different cable profile as mentioned in the drawing. Parapets are casted in casting yard and are to be erected above the segments.

COMPONENTS OF SEGMENTS:

The component parts of a segment include the following:

- Soffit slab
- Webs
- Decks with cantilevers on both sides
- Shear keys
- Pre-stressing ducts

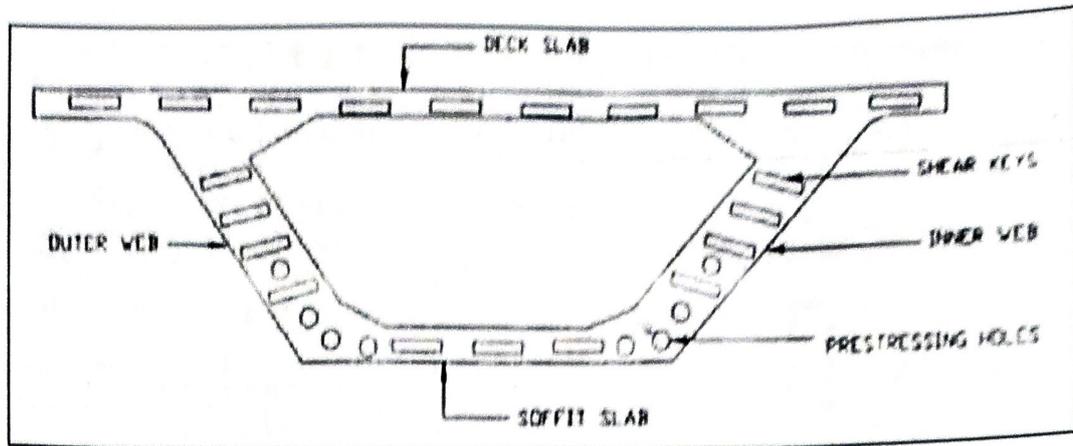
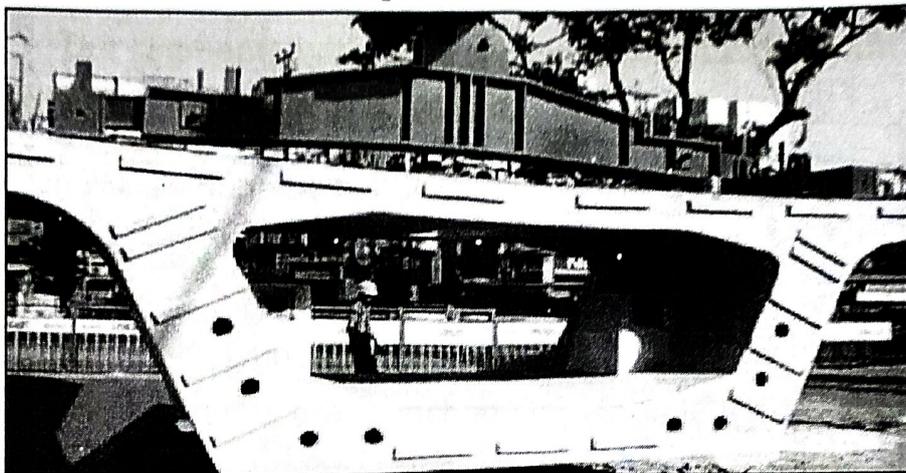


Fig:23 SEGMENT



TYPE OF SPANS:

Depending upon the geometry the spans that include in the construction are of two types.

They are as follows:

- Straight span
- Curved span

Based on the ground profile the length of the span varies. In this particular construction the length of the spans are restricted between 22m to 31m.

- 25m – 2 pier segments + 7 normal segments

LAUNCHING OF THE SEGMENTS:

The segments which are casted at the casting yard is brought to the site and launched.

It is basically done by two methods:

- Suspended type launching gantry
- Under slung launching gantry.

The segments are launched sequentially by the above methods. The under slung method is preferable for launching at curves.



Fig:24 LAUNCHING GIRDER

ALIGNMENT AND GLUING:

- The segments are glued together using a special glue called Epoxy. It is highly viscous.
- This is applied manually, 1.5mm on each face of the segment.

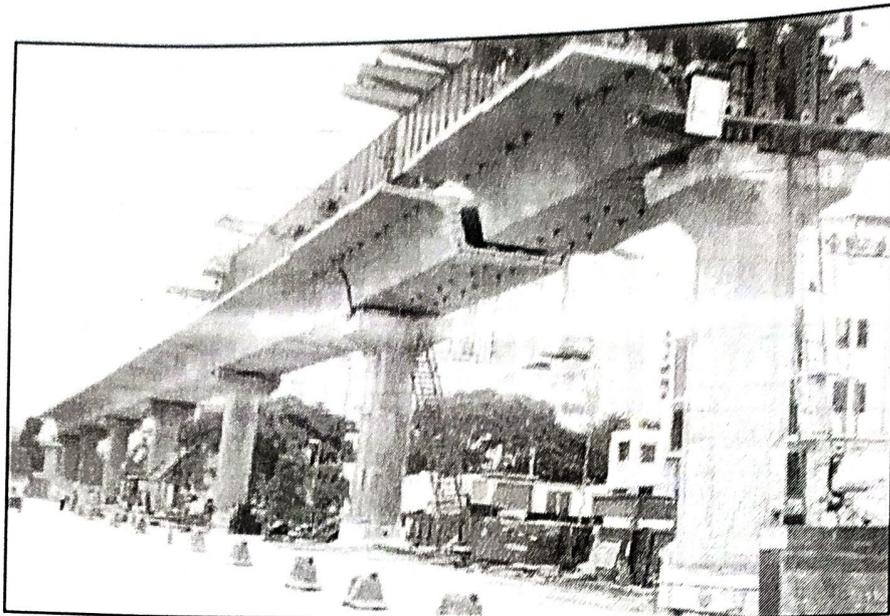


Fig:24 LAUNCHING GIRDER

ALIGNMENT AND GLUING:

- The segments are glued together using a special glue called Epoxy. It is highly viscous.
- This is applied manually, 1.5mm on each face of the segment.

- Spot life of this glue is 20 min, i.e., after this time a little amount of setting will start.
- Open time is 60mins i.e. this time period the glue can let open to air. The glue will not take up any load.
- It only acts as a waterproofing material, which protects the pre-stress cables from corrosion.

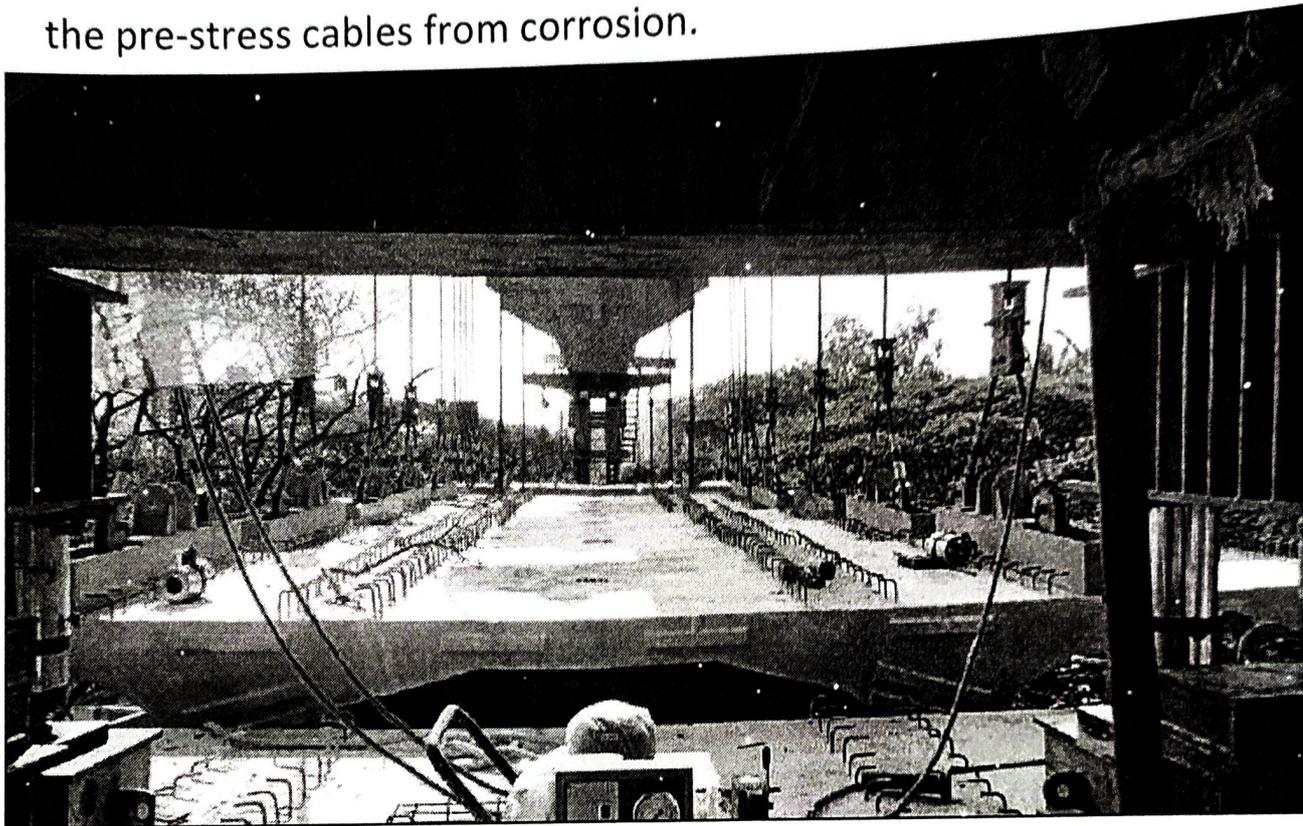


FIG.25 ALIGNMENT

STATION:

Each station structure can be divided into different levels

- Road level • Concourse level
- Platform level.

Hence any station plan consists of three plans at each level.

ROAD LEVEL:

The station in the road level consist entry area , footpaths, and pump house, electrical substation at some station etc

CONCOURSE LEVEL:

The station in the concourse level consist of ticket counter, automatic fare collecting system, office room, control room etc.

PLATFORM LEVEL:

The station in the platform level consists of platforms, tracks, signals, etc.

FIG.26 METRO STATION

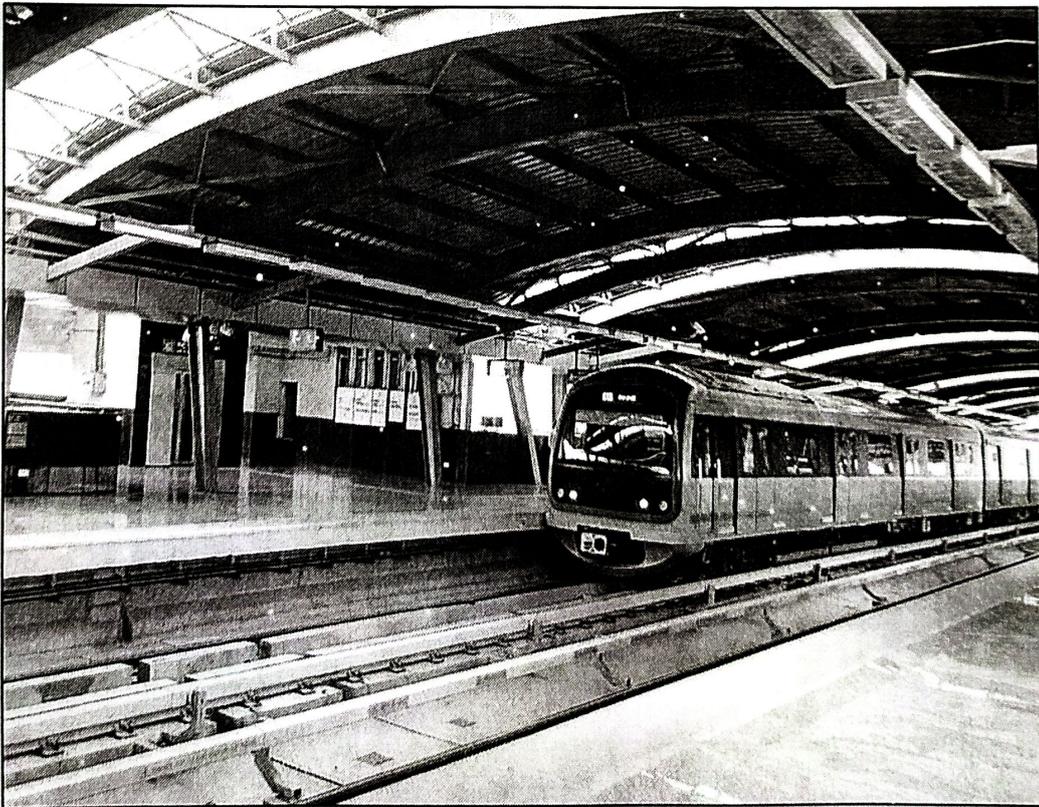




FIG.27 VIEW OF TRACK IN VIADUCT PORTION

The metro runs on the rails which is parallel to each other at a distance of distance of 1.435m which is called as meter gauge.

- Metro runs on the unique system called as Third rail system.
- This is located next to the track which runs parallel to the two rails.
- The power of 750DC volts will be passed through the third rail.
- Where it is connected to the locomotive of the train by which the power passes and locomotive moves by converting the electric energy into mechanical energy.

- The rails are supported by the track beam which is permanent until concrete fails.
- The rails are placed on the track beam where rails are fitted using bolts, nuts and chairs.
- The load of the train is directly applied on the rails and then the load from the rail is transferred to the sleepers. The flat bottom rails are used in the metro
- Metro locomotive runs on the electric power where it is converted to mechanical energy.
- The dimension of metro train is

| | |
|------------|-------|
| Length 'm' | 20.8m |
| Width 'm' | 2.88m |
| Height 'm' | 3.8m |

- Power – Third rail system, 750V, DC Supply
- Coach – 1000 passenger's capacity. More floor area for standing, Wi-Fi enabled. Stainless steel coaches

- Anti- collision system to avoid accidents.
- Speed: maximum of 80kmph and average of 34kmph.

CASTING YARD

OPERATIONS TAKING PLACE IN CASTING YARD:

Casting yard is the essential requirement for the pre-cast construction. Both viaduct segment and I girders are casted in the casting yard, cured, transported to the respective site by trailers according to the site requirement. Hence to cater for these needs and area of about 2.5 to 3 hectares is required.

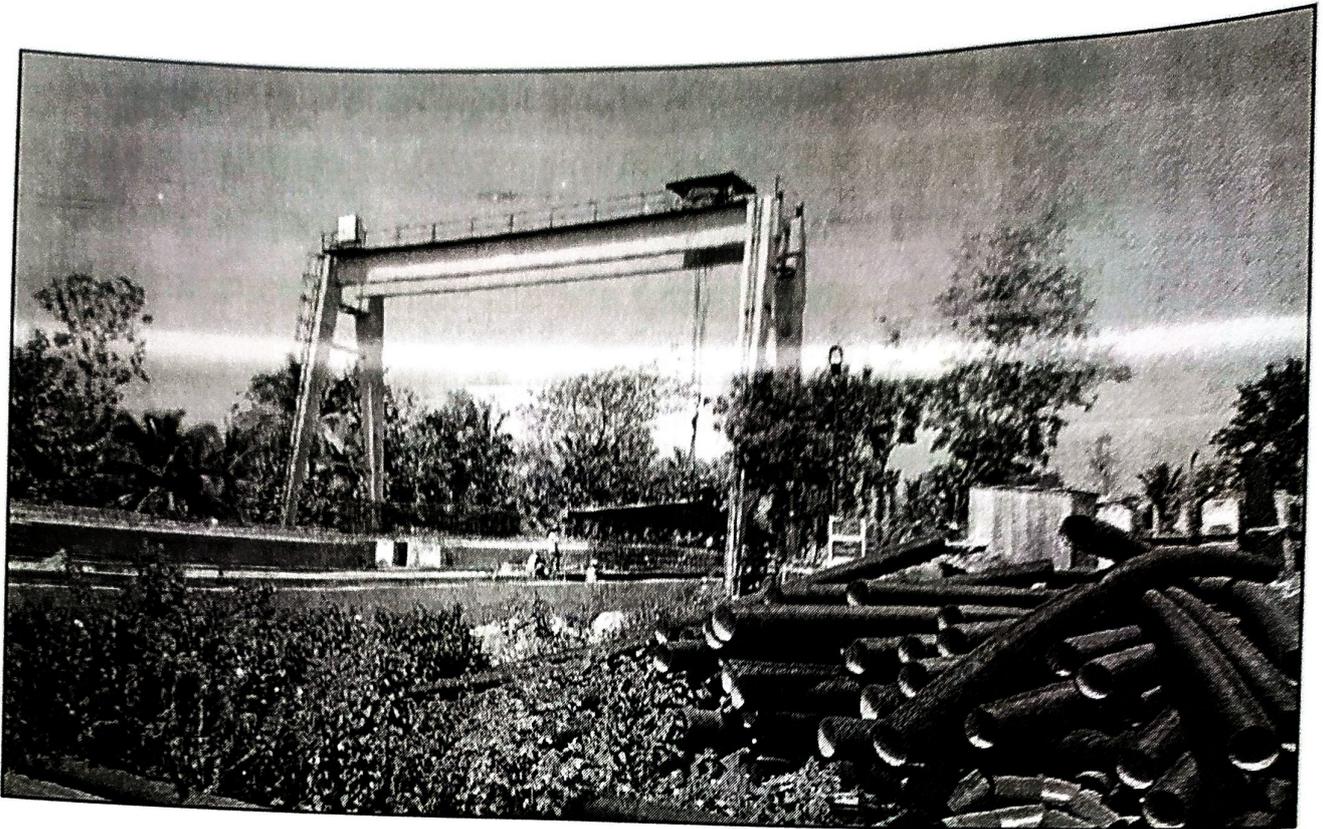


Fig28: Casting yard

The casting yard consist of-

- Batching plant
- Quality control laboratory
- Casting Yard
- Segments
- PCS I- Girder
- U-Drain

BATCHING PLANT :

At the constructions site where considerable quantity of concrete are required , central batching plants and batching is generally deployed. These plant are erected at the sites to deliver either the mixed concrete.

They are two plants which is having a capacity of 30cum/hour and 60cum/hour.

The plants are semi-automatically controlled. Capacity of plants depends on the maximum cycle time of the mixer. Designing of plants can be done by knowing the maxing capacity depending upon the site requirement.

The batching plant consists of 3 Silos for storing cement and GGBS. It also consists of open tray having 3 bifurcations in which coarse aggregates (20mm and 12mm) and fine aggregates (M-sand) are stored. Water is stored in tank and chemical admixture is stored in barrels.

By using the semi-automatically controlled process, batching up the concrete in gradients and mixing is done according to the mix design.

The produced concrete is poured into the Transit Mixer which carries it to the site of placing.

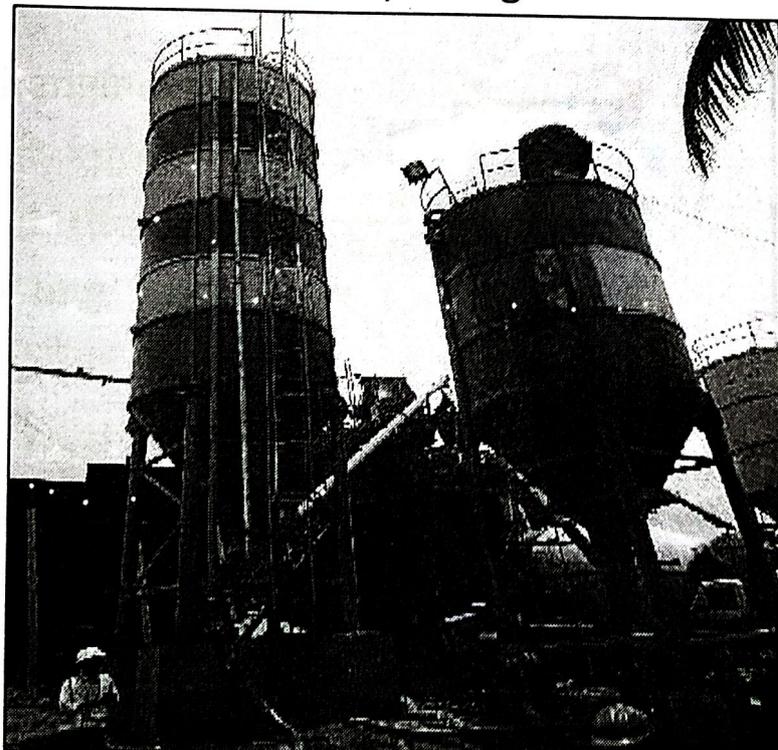


FIG.29 SILOS AT BATCHING PLANT

QUALITY CONTROL:

Quality control is one of the important parameter to be taken into consideration for the construction. It gives us the detailed knowledge about the various parameters like the tests conducted, materials of different grades being used and so on.

The role of quality control begins at the inception of the project and goes on till the completion of the project. Every material must meet the requirements so that the final construction is avoiding of defects. Different types of concrete are checked for quality for different works such as pile foundation, pile caps, precast drains, etc. And the design mix specimen is evaluated for the suitability of its purpose.

A civil engineer ensures the quality of each batch. The mix design is approved by a third party consultant who have worked out the various constraints and determined the various testing parameters for the mixed specimen. The people working here recreate the specimen by using the materials suggested by the consultant and test the specimen. Various admixtures are employed in making of concrete.

The various tests conducted here are: 1). For cement:

- Specific gravity.
- Consistency.
- Soundness.

- Initial and final setting time.
- Specific surface, etc.

2). For fine aggregates (M-sand):

- Specific gravity.
- Moisture content.
- Sieve analysis, etc.

3) For Coarse Aggregates (12mm and 20mm):

- Specific gravity.
- Moisture content.
- Impact test, etc.

4) For concrete:

- Compressive strength.
- Slump test, etc.

SEGMENT:

TYPES OF SEGMENTS:

The entire span i.e., the length between two piers consists of three types of segments each being uniquely designed based on the loads distributed. A brief description is as follows:

Pier Segment:

Each pier carries two segments, one of the preceding span and other of the succeeding span. The length of the pier segments are 1.95m. it consists of manhole to check for any inspection that has occurred during the life time of the

structure. An expansion joint of about 100mm is left between the two pier segments which vary in its cross sections with variation in temperature.

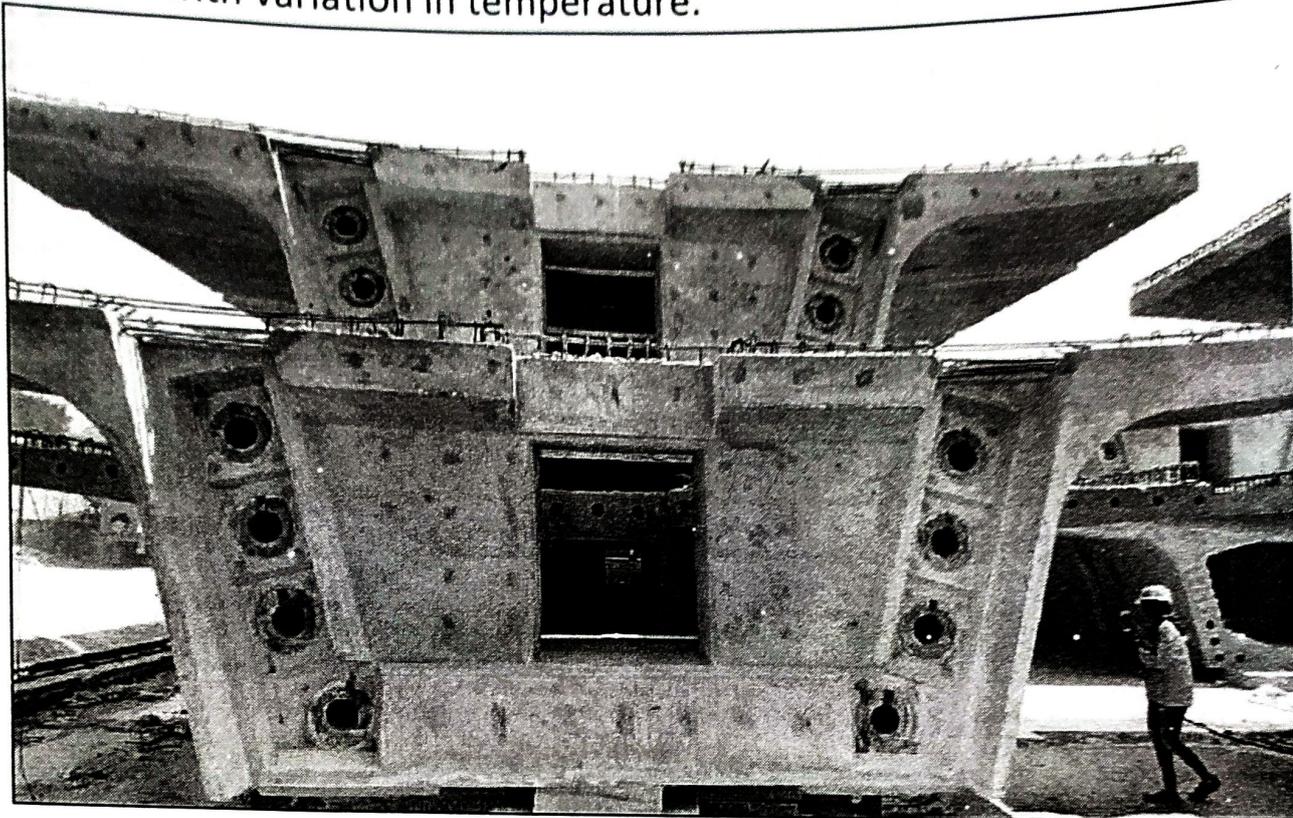


FIG.30 PIER SEGMENT

1. Segment with future pre-stressing holes:

The segment is designed in a unique way, so as to protect the entire span from aging of structure. In case there occurs any loss of pre-stress during the life time of the structure pre-stressing cables could be pass through these holes and stressed and hence safe guard the structure. The width of the segment is 3m, just like other intermediate segments. Two segments of the span are provided with future prestressing holes.

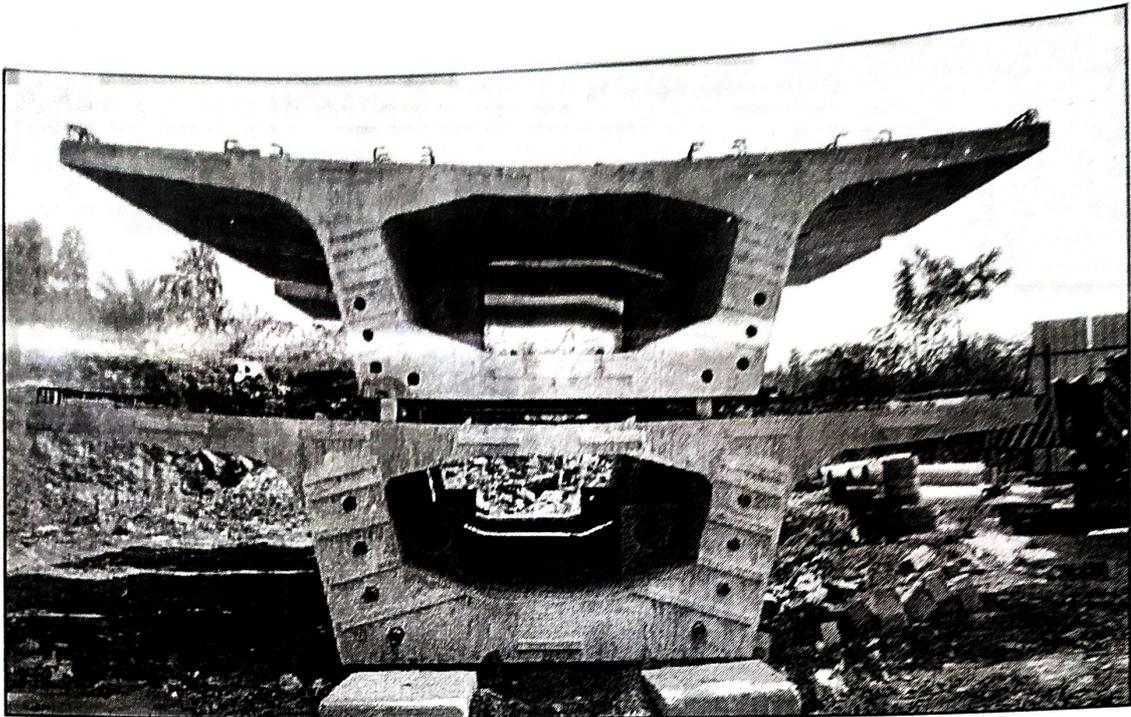


FIG.31 PRE STRESSED PIER SEGMENT

1. Intermediate segment:

The segments other than the pier segments are considered as intermediate segments. The width of the intermediate segments is 3m. Each segment in the intermediate span varies in design only in the position of pre-stressing holes and shear keys to provide a parabolic cable profile.

MATERIAL SPECIFICATIONS:

CEMENT:

The cements used should be of the following types:

- 53 grades ordinary Portland cement conforming to IS:12269

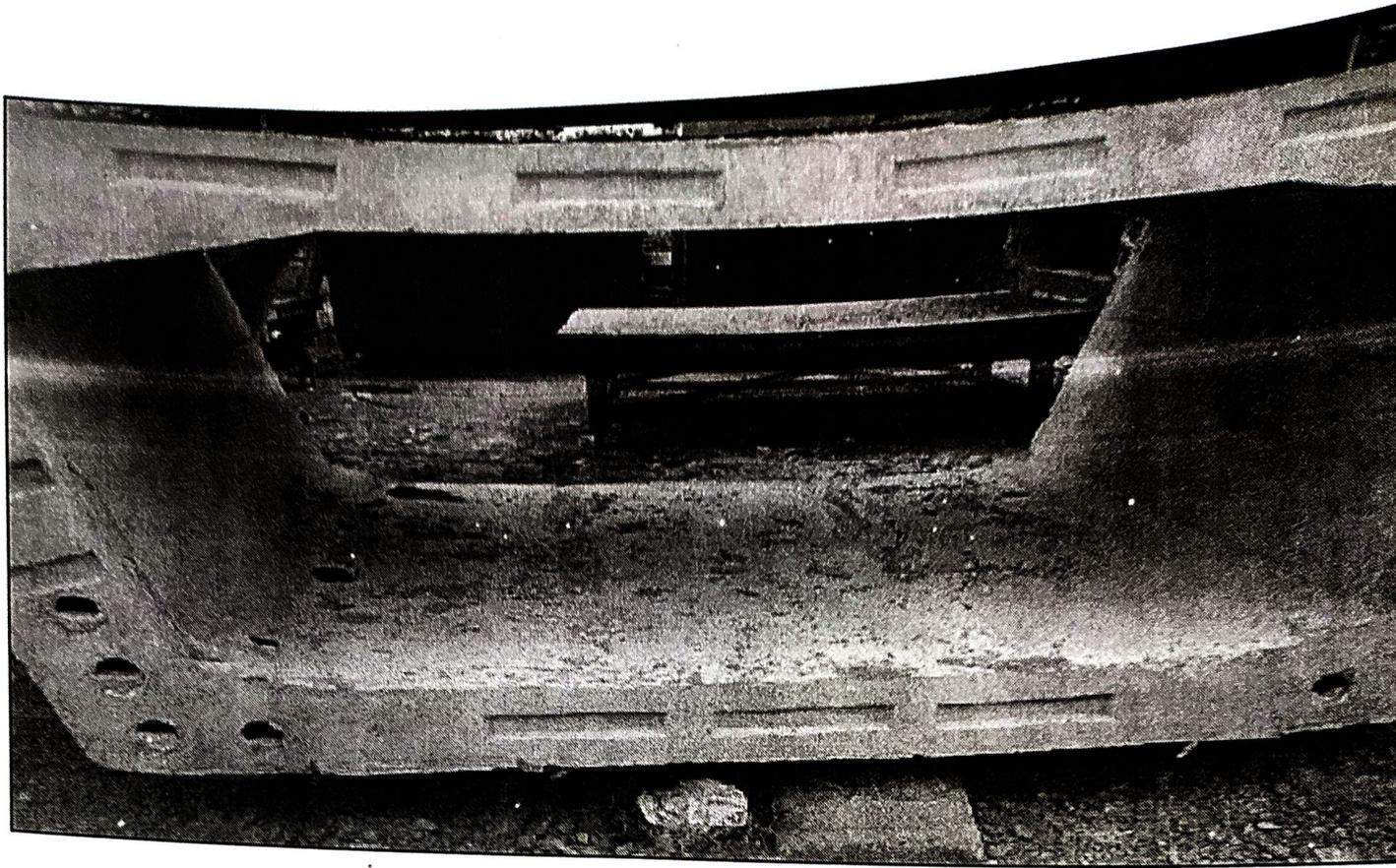


Fig.32 INTERMEDIATE SEGMENT

All cement from each type shall be obtained from a constant source. Cement of different types should not be mixed together

- It can be obtained in bulk stored in suitable silos of adequate capacities. And the same older than three months from the date of manufacture should not be used.

- Provision should be made for carrying out the following tests on cement:
- Setting time by Vicat's apparatus .
- Compressive strength of cement

FIS-30 SLUMP TEST

SEGMENT CASTING OPERATIONS

SEQUENCE OF CONSTRUCTION

The sequence of construction is as follows:

1. Preparation of formwork

The formwork should be made of non-absorbent material and apply codes of

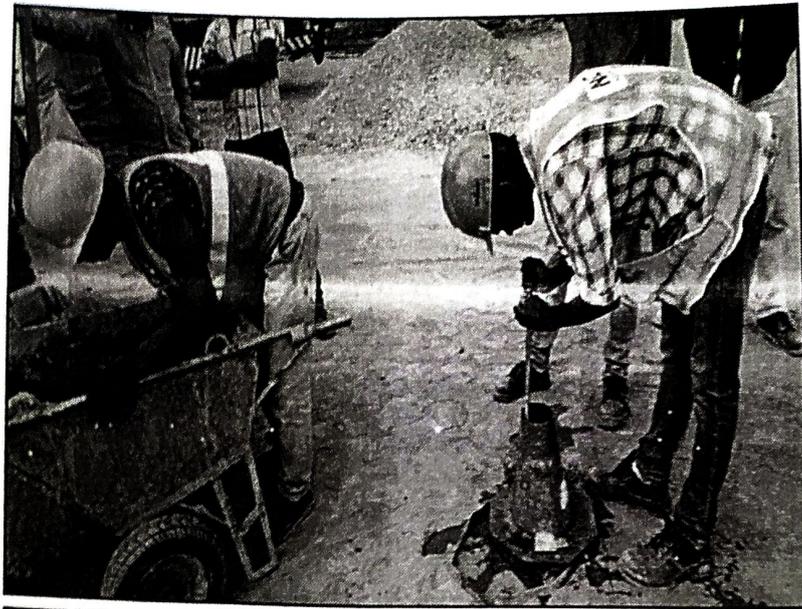


FIG.33 SLUMP TEST

SEGMENT CASTING OPERATIONS:

SEQUENCE OF CONSTRUCTION:

The general sequence of construction is outlined below:

- Clean the bed.
- Check for any local undulations and apply correction.

- Apply de-molding agent.
- Place sheathing and check with drawing for cable Profile
- Shift the reinforcement to the Segment casting bed
- Place and fix the formwork.
- Check the safety control measures implemented as per the requirement of HSE plan.
- For the proper compaction of cement mortar, vibrators are used namely,
 - Bottom vibrator • Side vibrator
 - Needle Vibrator
- De-shutter the form work after lapse of 12 hours or concrete attains a strength of 20MPA whichever is later.
- Strips the end from work of sides followed with the inner formwork.
- Wrap hessian cloth and kept moist always.-14 days



FIG.34 SEGMENT CASTING

CONCRETING AND CURING OF SEGMENT: CONCRETING

The concrete shall be poured in layers each not exceeding 450mm. Same shall be continued from one end of the segment. Proper compaction of the concrete shall be ensured with the compaction vibrators.

Final Curing:

The segment shall be shifted to stacking yard and cured for 14 days. As an alternate method to hessian cloth or sprinkling water, the segment may be cured applying one coat white resin based curing compound. And also pond curing is done here. Any damage occurred shall be repaired. It shall be ensured that curing compound shall be applied to the ends of the segment where the joining of segments shall be done by bonding agent application

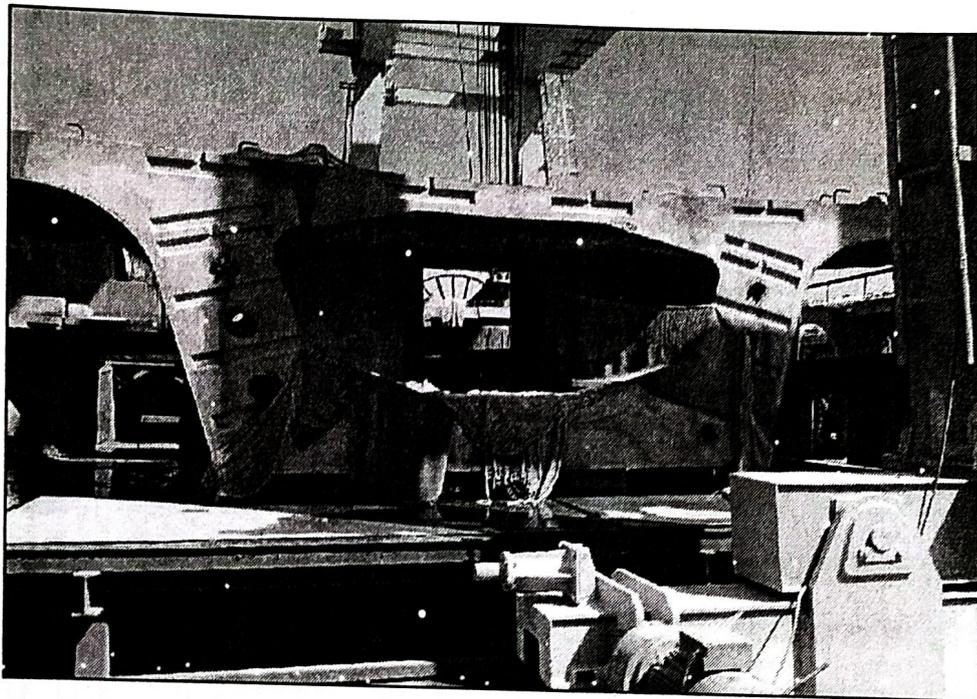


FIG.35 CURING

CHECK CONDUCTED FOR SEGMENTS MAINLY FOR HONEY COMB.

INTEGRITY TEST:

ULTRASONIC PULSE VELOCITY TEST:

RESULT OF TEST:

From the result of ultrasonic pulse velocity test, it is inferred that the quality of concrete falls under the category of "Good Concrete" as per quality grading chart. Based on experience, for a given grade of concrete ultrasonic velocity values of 4km/s and above are considered "Acceptable" quality. The values that are obtained less than 4km/s are called for appropriate treatment. This happens when in anchorage regions due to inference from the steel plate, steel cone, and non-availability of adequate space to keep the probes for testing etc. Hence pressure grouting with low viscosity epoxy is recommended at these regions in order to fill up the entrapped voids if any during the process of concreting. Such grouting, if executed as per standard practice will ensure the soundness of the concrete at these regions.

Any minor distress features observed, such as minor edge damage and surface honey combs shall be called for appropriate treatment. Further, in regions where the pulse velocity reading obtained is less than 4km/s, such regions shall be pressure grouted with low viscosity epoxy as per standard practice.

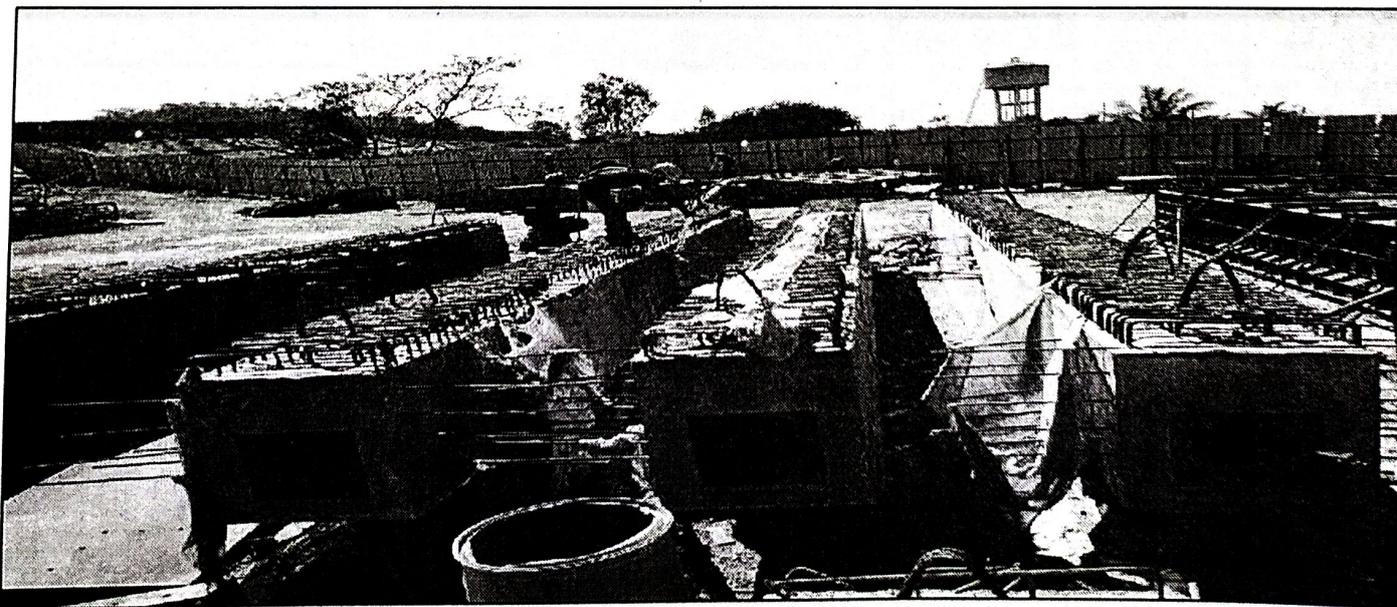
RECOMMENDATIONS:

It is recommended to take utmost care in casting these segments so as not to have any damages/surface blow holes in concrete and achieve a smooth and uniform surface which is an essential feature in match casting of segments.

PRESTRESSED I-GIRDER:

I-girder is a structural member which is used at the station. But to bear the more load post-tensioned concrete girders are used. Like, below the track level at station and at transition span. In BMRCL, precast pre-tensioned I-girders

Now-a-days curing is also made by STEAM curing process.



CONSTRUCTION OF I-GIRDER:

- The reinforcement cage is prepared as per the design.
- These cages are then introduced with HTS wires at required position.
- A parabolic profile of wires is used.
- The HTS wires are jacked together at one end and jacked one by one at other using mono jack.
- After jacking .
- After attaining the required strength, the jack is released to transfer Pre-Stress.
- Curing
- I-girder can be done by steam curing.

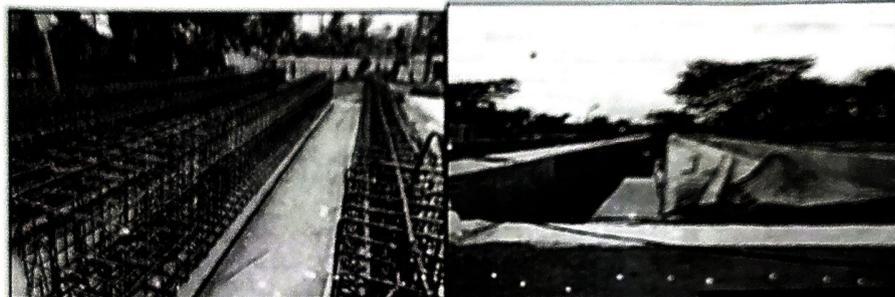


FIG.37 REINFORCEMENT & I-GRIDERS

PRE-TENSIONED CONCRETE:

For the construction of I-girders by pre-tensioning method, the reinforcement cage is prepared first as per the design. This cage is lowered into the casting bed with formwork in

place. The cage is then introduced with HTS wires at required position.

The wires are jacked together at one end and jacked individually at the other end. Concreting (M50) is done after jacking the wires. After attaining the required strength of 40N/mm^2 , the jack is released, transferring the stress from the wires to the concrete. Curing is done for the required period before the girder is dispatched to the site. Pre-stressing cables of 15.2mm diameter and 140mm^2 areas are used with ultimate tensile strength of 1861N/mm^2 and HDPE sheathing is opted for. Sheathing is provided so that all the stress is not released at the end which might lead to the cracking of concrete at ends.

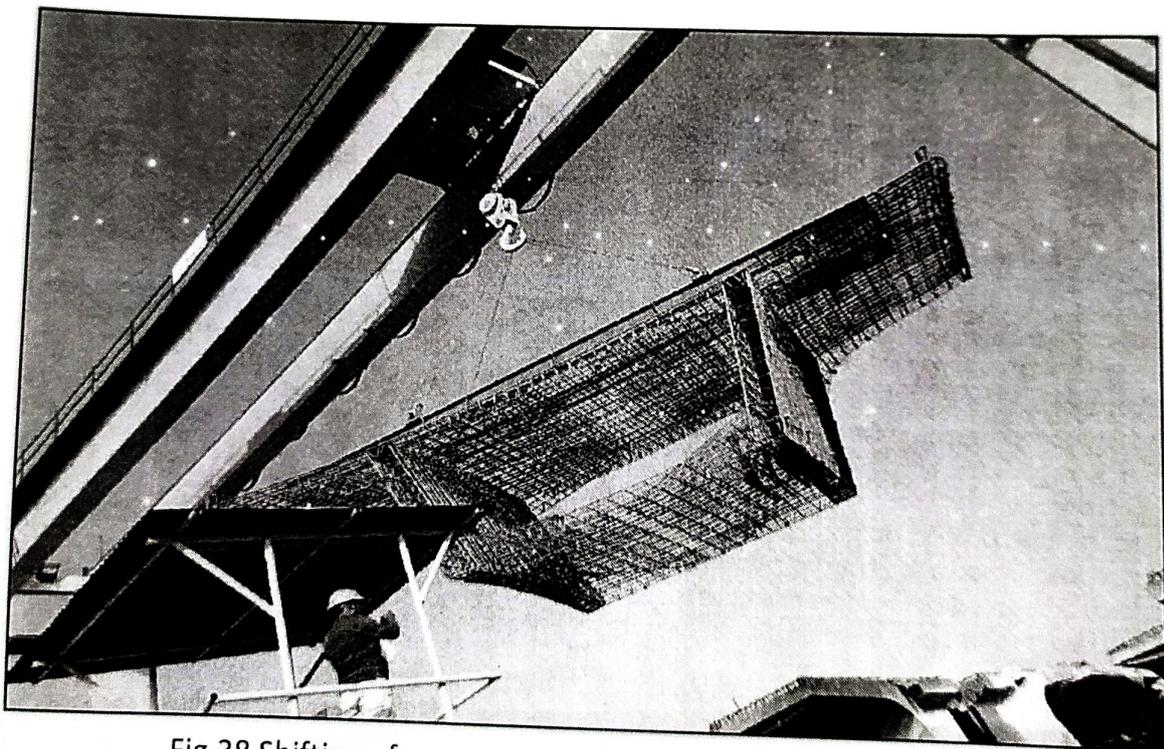


Fig.38 Shifting of segment reinforcement into Casting Bed



Fig.39 Inner shutter and outer wing shutter for Segments



FIG.40 CONCRETE BOOM PLACER



Fig.41 Curing of segments in Progress



Fig.42 Bar bending in Progress

CONCLUSION

It was a wonderful learning experience at URC CONSTRUCTION PVT LTD for four month in Indore. We gain a lot of insight regarding almost every aspect of site. We were given exposure in almost all the departments at the site. The friendly welcome from all the employes is appreciating, sharing their experiences & giving their peace of wisdom which they have gained in long journey of work. We hope this experience will surely help us in future and also in shaping our career.

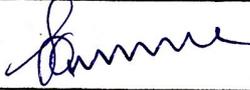
For the past four month of the internship has proven to be very useful and interesting as we could learn and experience the concepts of civil engineering practically. We tried to make the best use of given opportunity in learning the professional ethics and practices followed in the work space.

We would like to thank our mentors from URC CONSTRUCTION PVT LTD for teaching and helping us understand the operations taking place during the construction of Metro Rail Project.

THANK YOU !!!

FORMAT

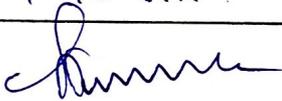
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | |
|--|--|---------|---------------|--------------------------|-----------|
| Name of student | Umesh Dangji | | Department | Civil Engineering | |
| Industry/Organization | URC Construction (P) Ltd | | Date/Duration | 03-01-2022 to 15-01-2022 | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | ✓ | | |
| Performance/Quality of work | | | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | ✓ | | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively involved in all activity assigned 2. showed self responsibility during the training period 3. learned the things in QC/QA lab. | | | | |
| OVERALL GRADE (Any one) | <u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u> | | | | |
| Name of Industry Mentor | S. JAYAKUMAR (A.G.M.) | | | | |
| Signature of Industry Mentor |  | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
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FORMAT

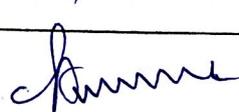
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | |
|--|--|---------|---------------|--------------------------|-----------|
| Name of student | Umesh Dangi | | Department | Civil Engineering | |
| Industry/Organization | URC Construction (P) Ltd | | Date/Duration | 16-01-2022 to 31-01-2022 | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | ✓ | | |
| Performance/Quality of work | | | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | ✓ | | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively involved in all activity assigned 2. showed self responsibility during the training period 3. learned the things in Qc/QA lab. | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | |
| Name of Industry Mentor | S. JAYAKUMAR (AGM) | | | | |
| Signature of Industry Mentor |  | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
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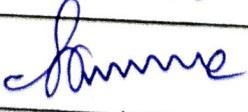
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | | |
|--|--|---------|---------------|--------------------------|-----------|--|
| Name of student | Umesh Dangji | | Department | Civil Engineering | | |
| Industry/Organization | URC Construction (P) Ltd | | Date/Duration | 01-02-2022 to 15-02-2022 | | |
| Criterion | Poor | Average | Good | Very Good | Excellent | |
| Punctuality/ Timely completion of assigned work | | | ✓ | ✓ | | |
| Learning capacity /Knowledge up gradation | | | ✓ | | ✓ | |
| Performance/Quality of work | | | | | ✓ | |
| Behaviour/Discipline/ Team work | | | | | ✓ | |
| Sincerity/Hard work | | | ✓ | | | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively involved in all activity assigned 2. showed self responsibility during the training period 3. Learned the things in QC/QA lab. | | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | | |
| Name of Industry Mentor | S. JAYAKUMAR (AGM) | | | | | |
| Signature of Industry Mentor |  | | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
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| | | | | | |
|--|---|---------|---------------|----------------------|-----------|
| Name of student | Umesh Dangi | | Department | Civil Engg. | |
| Industry/Organization | URC Construction P. Ltd. | | Date/Duration | 18-02-22 to 28-02-22 | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | ✓ | | |
| Performance/Quality of work | | | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | ✓ | | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively involved in all activity assigned 2. showed self responsibility during the training period. 3. learned the things in AC/OA lab. | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT ✓ | | | | |
| Name of Industry Mentor | S. JAYAKUMAR (A. G. M.) | | | | |
| Signature of Industry Mentor |  | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhikash Shukla | Sign |  |
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FORMAT

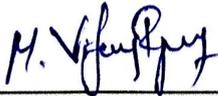
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | | |
|--|--|---------|---------------|--------------------------|-----------|--|
| Name of student | Omash Dangi | | Department | Civil Engineering | | |
| Industry/Organization | VRL Construction (P) Ltd | | Date/Duration | 01-03-2022 to 15-03-2022 | | |
| Criterion | Poor | Average | Good | Very Good | Excellent | |
| Punctuality/ Timely completion of assigned work | | | | ✓ | | |
| Learning capacity /Knowledge up gradation | | | | ✓ | | |
| Performance/Quality of work | | | | | ✓ | |
| Behaviour/Discipline/ Team work | | | | | ✓ | |
| Sincerity/Hard work | | | | ✓ | | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively involved in all activity assigned 2. showed self responsibility during the training period 3. Learned the things in surveying department | | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | | |
| Name of Industry Mentor | M. VIJAYARAGAVAN (Sr. Engineer) | | | | | |
| Signature of Industry Mentor | M. Vijayarajan | | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
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FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | |
|--|---|---------|---------------|-----------------------------|-----------|
| Name of student | Umesh Dangi | | Department | C.E. | |
| Industry/Organization | URC Construction Pvt Ltd | | Date/Duration | 16-03-2022 to 31-03-2022 | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | | ✓ | |
| Performance/Quality of work | | - | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | | ✓ | |
| Comment on nature of work done/Area/Topic | <ol style="list-style-type: none"> 1. Actively assign involved in all activity assigned 2. Showed self responsibility during the training period 3. Learned the things in survey department | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | |
| Name of Industry Mentor | M. VISAYA RAGAVAN (Sr. Engineer) | | | | |
| Signature of Industry Mentor |  | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
|----------------|--|------------------------|---------------------|------|---|

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | |
|--|---|----------------|-----------------------------|------------------|------------------|
| Name of student | Umesh Dangji | Department | C.E. | | |
| Industry/Organization | URC Construction LD Lhd | Date/Duration | 01-04-2022 to 15-04-2022 | | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | | ✓ | |
| Performance/Quality of work | | | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | | ✓ | |
| Comment on nature of work done/Area/Topic | <p>1. Actively involved in all activity assigned</p> <p>2. showed self responsibility during the training period.</p> <p>3. Learned the things in survey department</p> | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | |
| Name of Industry Mentor | M. VIJAYA RAGAVAN (Sr. Engineer) | | | | |
| Signature of Industry Mentor |  | | | | |

| | | | | | |
|----------------|--|------------------------|---------------------|------|---|
| Receiving Date | | Name of Faculty Mentor | Dr. Abhilash Shukla | Sign |  |
|----------------|--|------------------------|---------------------|------|---|

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

| | | | | | |
|--|--|---------|---------------|--------------------------|-----------|
| Name of student | Umesh Dangi | | Department | C.E. | |
| Industry/Organization | URC Construction (P) Ltd | | Date/Duration | 16-04-2022 to 30-04-2022 | |
| Criterion | Poor | Average | Good | Very Good | Excellent |
| Punctuality/ Timely completion of assigned work | | | | ✓ | |
| Learning capacity /Knowledge up gradation | | | | ✓ | |
| Performance/Quality of work | | | | | ✓ |
| Behaviour/Discipline/ Team work | | | | | ✓ |
| Sincerity/Hard work | | | | ✓ | |
| Comment on nature of work done/Area/Topic | <p>1. Actively involved in all activity assigned</p> <p>2. showed self responsibility during the training period</p> <p>3. learned the things in survey department</p> | | | | |
| OVERALL GRADE (Any one) | POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT | | | | |
| Name of Industry Mentor | M. VIJAYA RAGAVAN (Sr. Engineer.) | | | | |
| Signature of Industry Mentor |  | | | | |

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