MAEER's
MIT COLLEGE OF RAILWAY ENGINEERING & RESEARCH (MITCORER), Barshi

Academic Year 2018-19

A Visit Report on

"Prefabricated Concrete Sleeper Factory, Mohol"

Date/Day: Saturday, 22/09/2018

Time: 10:30 am to 04:00 pm

Venue: Vishal Nirmiti Pvt. Ltd, Mohol

Managing Director

Mr. Narendra Sawalkar

(Vishal Nirmiti Pvt. Ltd., Mohol)

Event Coordinator

Prof. Vinod Choudhari

MITCORER, Barshi

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MAEER, Pune's

MIT College of Railway Engineering & Research,

Near Dudh Pandhari, Industrial Estate No. 03, Jamgaon (A), Barshi, Dist – Solapur 413 401.

Approved by AICTE, New Delhi, Govt. of Maharashtra, DTE & Affiliated to Solapur University

DTE Code: EN 6901

Ref.No.MITCORER/CIVIL/2018-19/ 01Date: 20/09/2018

To,
The Manager, (Mr. Sawalkar N.P.)
Nirmiti Pvt. Ltd.,
Mohol 413 213

Subject: Seeking permission for Production of Prefabricated Railway Concrete Sleepers, Mohol 413 213

Dear Sir,

This letter is intended to you to seek permission to visit Production of Prefabricated Railway Concrete Sleeper Unit, Mohol. As per the curriculum, the students of Second Year of B.E. Civil Engineering at MAEER's MIT College of Railway Engineering and Research, Barshi wish to visit and study production of Prefabricated Railway Concrete Sleepers which shall motivate students to learn practically casting of Prefabricated Railway Concrete Sleepers and boost their morale to pursue the career in Civil Engineering.

MAEER's MIT College of Railway Engineering and Research established in 2017 at Barshi by Hon. Prof Dr Vishwanath D Karad, Renowned Socialist and Educationalist for imparting quality education to students and budding professionals in the various fields initiated Maharashtra's 1st Private Engineering college at Pune in 1983. MAEER's MIT College of Railway Engineering (MITCORER), Barshi is committed to raising standards of performance and achievement of students in its institute. We are committed to transform students into Competent Technocrat and Responsible Citizen who will contribute in Development and Prosperity of India as well as Native place he/she belongs to. MITCORER provides excellent educational opportunities in a dynamic learning environment to bring out well cultured and promising professionals in the conventional & emerging technologies. With Vision of Creating and Nurturing an environment to provide value based quality education to produce competent and skilled professionals keeping pace with changing technology, MITCORER has a mission of transforming aspiring students from semi urban background into competent quality conscious professionals.

Total students of 38 shall be accompanied by Prof.V.A.Choudhari (Mobile no. 9921048610), Prof. Vikas Ganiger and Prof Mangesh Kevadkar wish to visit the Prefabricated Concrete Sleeper factory unit on 22nd Sept 2018. I look forward for your necessary permission and co-operation.

Thanking you in anticipation.

Yours faithfully,

Prof V.A.Choudhari	Prof. Vikas Ganiger	Dr. Atul Ayare
Industrial Visit Coordinator	HOD, Civil Dept.	Principal

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"Prefabricated Concrete Sleeper Factory, Mohol"

22nd September 2018

VISIT AGENDA

TIME	EVENT/ACTIVITY
10.00pm	Departure from MITCORER Barshi Campus
12.00pm	Arrival at Prefabricated Concrete Sleeper factory at Mohol
12.10pm	Tensioning of Tendons by means of hydraulic jack
12.20pm	Placing of concrete in sleeper mould and compaction
12.30pm	Steam curing of concrete sleeper for hardening
12.40pm	Demoulding of concrete sleepers & water curing
12.50pm	Testing, Quality Inspection and Stacking of Sleepers
01.10pm	Vote of Thanks by Prof V.A.Choudhari
02.25pm	Departure from Prefabricated Concrete Sleeper factory ,Mohol
4.15pm	Arrival at MITCORER Barshi Campus

Visit Coordinator (Prof. V.A.Choudhari)

Principal (Dr. Atul Ayare)

Report on Prefabricated Sleeper factory,Mohol

1.1 Introduction:

The Primary function of sleeper is to transmit the axle load of therolling stock to the formation through the ballast and to maintain gauge, leveland alignment parameters of the track. Another important requirement fromsleeper is to provide adequate longitudinal and lateral resistance of track forLWR.Due to increase in axle load of the moving vehicles accompanied withthe need for high-speed trains, necessity for heavier track structure was felt.Concrete sleeper are an essential ingredient of the track structure andhence this procurement is a vital exercise for Indian Railway. Every year,approximately 80 to 100 lacks concrete sleepers worth Rs. 500/- to 600crores are procured by Railways. The manufacture of concrete sleepersstarted three decades ago. These are manufacture from more than 80concrete sleepers plants spared all over the country, set up by privatemanufacturers, constructed mostly on Railway land.The procurement of concrete sleepers is centralized at Railway Boardlevel and was through a system of repeat orders till 1997. Due to variousproblems that resulted in Law Suits, arbitration cases, audit objection,vigilance and CBI cases all over the railways.

1.2 Need of PSC system:

It is a well-known fact that concrete by itself cannot take tensile stress.Tensile stress to be developed in a sleeper under movement of traffic hence theneed for increasing the tensile strength of concrete when used in sleeperswas felt. Further due to impact forces of moving vehicles, the need forincreasing concrete strength in compression was also very much felt.In pre-stressed concrete, permanent stress are created in the memberby tensioning and anchoring the reinforcement, before the actual loads areapplied on them. Pre-stressed member behaves as ductile material with incertain stress limits, further the size of the member can be considerablyreduced and they can be kept for from crack developments. Hence Pre-stressedconcrete design are adopted for design of concrete sleeper in Railways.

1.3 Design Criteria for PSC Sleepers (B.G.):

1) Axle Load : 22.5 t.

2) Truck Structure : 60 Kg. (UIC) rail,

Sleeperspacing 600mm C/C,

Ballast Cushion 250mm.

3) Ballast Pressure : 6.0 Kg./cm2

4) Load Distribution Factor : 0.55 – 0.60 underneaththe wheel.

5) Dynamic augment for speed & : 2.5rail wheel irregularities.

6) Center Binding Coefficient : 0.4

7) Factor of Safety : Ratio of resisting moment/impose bending moment = 2 & 1.5 at rail seat & center respectively.

8) Load factor at rail seat bottom : Ratio of ultimate bending moment/imposed bending moment = 3.

9) Section at sleeper center : Capable of resisting a hoggingmoment without cracking at centre top portion.

10) Design load and Ballast reaction diagram.

11) Minimum compressive strength ofconcrete prior to transfer of prestress : 40 N/mm2

12) Permissible bending stress in concrete :

1) Compressive - 0.4 Fc

2) Tensile – 0.04 Fc.

These are basically two types of concrete sleepers namely :-

(a) Mono block,

(b) Twin block.

Most suitable types of sleeper is mono block sleeper and now a daysmostly mono block sleeper is being used.

1.4 MIX DESIGN M55 FOR PRESTRESSED CONCRETE SLEEPER:

- W/C Ratio : 0.33
- Aggregate cement ratio : 4.00
- C.A.-I 20mm : 52%
- C.A.-II 10mm : 22%
- F.A : 26%
- Coefficient of variation : <10%
- Max.Rejection limit : 2.5%
- Grade of hydraulic cement used : 53 S IS 12269 .
- Water used : Confirming to IS 456.
- CF : 0.80
- Degree of workability: Stiff.
- Degree of Quality Control : Very good.
- Type of Exposure : Severe .

- TMS: 67.00N/mm2.
- Specific Gravity of Cement : 3.15.
- Specific Gravity of CA : 2.71 to 2.77.
- Specific Gravity of FA : 2.66.
- Cement content as per IRS T-39 : 350 to 480 Kg/Cum

Quantity required for one Batch of four sleepers

- **Cement = 215 Kg**
- **CA- I = 448 Kg**
- **CA - II = 189 Kg.**
- **FA = 223 Kg.**
- **Water = 70.95 Kg**

1.5 Manufacturing of Prestressed Concrete Sleepers:

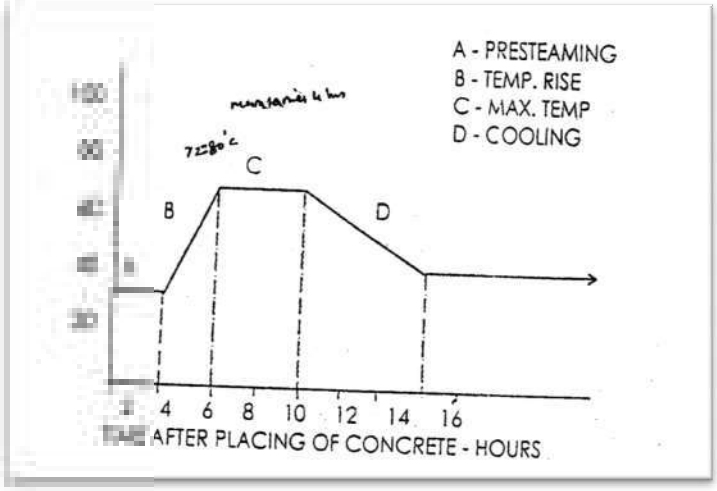
There are two method of manufacturing PSC sleeper.

1) Long line method.

2) Stress bench method.

1.5.1 LONG LINE METHOD:

In this method, 105 to 135 mtr. long bed containing 41 to 55 stationarysingle/twin/three moulds are used and all the various manufacturingoperations are mobile in nature. Trolley tracks are provided in between thecasting beds for movement of concrete trolley and other gantries mountedon wheel.In long line method individual HTS wire is stretched by Jack andanchor at stretching ends. Generally 3 x 3 ply – 18 nos. HTS wire is beingused and stretching of 18 nos. HTS wire separately.After tensioning of HTS wire, concrete is poured in moulds with heavy vibration of moulds by rotatory vibratos fixed on each moulds having 9000 RPM.Then steam is passed to moulds and covered with tarpoline for steam curing. The steam curing cycle is followed strictly to achieve early strength.A-14 ½ Hrs. steam curing cycle is given below:



After completion of steam curing, steam cubes checked forcompressive strength it should be minimum 40 N/mm2. Then transfer theprestress by end cutting of HTS wire.Then sleepers to put in water submerged tank for water curing for 14days.

1.5.2 STRESS BENCH METHOD:

1) Cleaning &oiling of moulds
2) Insertion of HTS wire
3) Pre-stressing of wires – Cement
4) Filling Concrete in moulds - Coarse Aggregate
5) Vibration of mouldsFine Aggregate
6) Steam curing Water
7) Transfer prestress byBoiler
8) Cutting the wires.
9) De-moulding
10) Water curing
11) Testing & Dimension
12) checking
13) Stacking
14) Dispatch

1.6 MOULDS:

Moulds shall be of steel and shall be of rigid construction so as toprevent any distortion during casting of sleepers. Moulds shall not allow anyappreciable leakage of cement mortar in casting. The holes in the end platesshall be accurately drilled for correct placement of prestressing wires.Mould is cleaned by wire brush and provide oil on the mould surface.

1.7 STRETCHING OF WIRES:

The pre-stressing wires shall stretch collectively by an approvedmethod. The tensioning force shall be as shown on the sleeper drawing.Generally 70% of breaking load. In no case stretching force exceed 75% ofthe specified UTS of wires. The pre-tensioning force in the wire shall beapplied by a tensioning device equipped with auto cut off unit along withmeasuring gauge. The final force shall be verified by measuring theextension of wire.

1.8 MIXING & CONSOLIDATION OF CONCRETE:

Batching of different ingredients shall be done by weight only. Amodern mechanized or automatic weigh batcher shall be used for weighingaggregates and cement. The weigh batcher shall have an accuracy of + 3%.

1.9 PROVISION OF SGCI INSERTS:

Inserts to be provided in proper position, every insert is to be checkedin Go/No – go gauge before fixing in moulds. Grease to be provided to everyinserts and fixed with PIN so that it should not beloosed/ shifted during vibration / compaction.

2.0 STEAM CURING:

The 4 moulds are fixed in a bench after compaction of concrete. Thebenches are put in stream curing chambers in stress bench method. The chambers then covered with tarpaulin or steel plates to avoid leakage of steam. The moulds/benches are kept in steam chamber as per specified steam curing cycle. The compressive strength of steam cubs be checked after completion of cycle i.e. 40 N/mm2 is must otherwise duration is increased by 1 or 2 Hrs. The benches/moulds removed from steam chamber after desire cube strength for demoulding of sleepers. Pre-stress to be transfer to sleepers by cutting ofwires. Sleepers to be demoulded from the moulds and put in water curing tank. It should be ensure that clean water is must in water curing tank and also ensured that sleeper must be completely submerge in water for 14days.Then sleeper to be tested as per specified procedure for moment ofcracking at rail seat and sleeper top and also checked the dimension ofsleeper as specified.Sleepers to be stacked and dispatch as per requirement of zonalrailway, sleeper to be loaded in wagons/truck by sleeper manufacturer asspecify.

2.1 INSPECTION AND QUALITY CONTROL:

Checks and inspections carried out at all stages starting from procurement of raw materials to supply of finished product is quality control. These checks provided necessary feedback for corrective measure to be adopted for production of sleeper to specified standards. Quality control should be an integral part of the production programme. The various quality control function should be performed by the production people themselves within the plant. The Supervisors should notonly be trained to Supervise the production but should also be trained to ensure that quality standards are maintained. Cost effectiveness apart this will create a culture where quality is inbuilt, not inspected.

2.2 RAW MATERIALS:

(I) Special Cement :-

1) It should be preferably obtained always from the same source.

2) Cement should be properly stacked in closed godown on damp prooffloors away from wall.

3) The height of stacks should be limited to 14 stacks.

4) Cement should always be confirmed on first in first out basis.

5) Cement should always be received with test certificate.

6) Cement should always be used after testing in the 's laboratory.

(II) Aggregates :-

1) Only tested aggregate should be used.

2) Aggregate should always be obtained from the same source.

3) Shape and size of course aggregate may vary for different deliveriesfrom same crusher.This should be controlled at crusher site or factory gate.

4) Flaky and elongated pieces of course aggregate increased water andcement requirement. Percentage of such pieces should be kept undercontrolled.

5) River sand generally contains round smooth surface gravel stonepebbles, it should always be used after sieving.

(III) Water:-

1) Only tested water confirming to clause 4.3 of IS-456 -1978 should beused for the making and curing of concrete.

(IV) Variation in Mix proportions:-

1) Aggregates should always be weigh batched.

2) Weigh batcher should be checked for accuracy periodically.

3) For accuracy it is better to install and automatic weigh batchingsystem to reduced operational error.

4) Combined aggregate granulometry should be checked periodically.

5) Moisture in aggregates should be checked daily and quantity ofwater to be added in a mix should be adjusted before starting thework.

6) Automatic batching of water quantity is necessary.

(V) Sampling and testing:-

1) For proper quantity of the concrete quality random and carefulsampling is necessary.

2) Beam and cube testing should be carried out according tospecification with due care to rate of loading.

3) Beam and cube should be cast from random concrete samples on astandard vibrating table.

4) Water curing of beam and cubes should be done as specified in IS -516.

5) Pressure gauges used in testing should be calibrated periodically toeliminate possibility of wrong reporting.

(VI) Strength of concrete at transfer of prestress :-

The specified strength of concrete at transfer of prestress is 40N/mm2 steam curing is necessary to attain the release strength in areasonable time for early release of moulds. The various stages of a steam curing cycle influence the gain in strength and long termbehavior of concrete. The following points need attention incontrolling a steam cycle:-

1. Pre-steaming period should not be less than initial setting timeof cement.
2. The rate of increase of temperature should not be more than 20Deg. centigrade per hour.
3. The Max. temperature attained should be restricted to 80 Deg.centigrade.

4. The rate of cooling should be gradual.

(VII) Strength of concrete at 15 days:-

The specified characteristics strength of a concrete at 15 days is 55N/mm2. This is achieved after 14 days submerged water curing ofconcrete sleepers .**Submerged water curing of concrete sleepersis essential from strength and durability considerations.**

(VIII) Analysis of Test Results:-

For proper appreciation of the quality of concrete sleepers produced in a plant in a given period of time, it is necessary to analyzethe available test results.It is now generally acceptable that the variation in concrete strength follows the normal distribution. The normal distributions curve is symmetrical about its mean. The standard deviation is measures of the variability calculate from the equation.

S.D. = __ (x – m)2 x = an individual result

n – 1 n = the number of results

m = the mean of n results

The analysis of cube test results can be carried out fortnightly or

monthly.

C.S. = m – 2 SD N / mm2

The degree of control is evaluated by the variation in test

results usually in terms of SD and coefficient of variation ‘CV’

CV = SD x 100 / m Preferably 5 – 7 % (maximum = 10%).

Overstressing of HTS Strands beyond the specified limit is a seriousmatter and it adversely affects the long term behavior of concrete sleepers.Overstressing may cause premature fatigue failures.

The following control checks are necessary during the tensioning operation:-

1) Correct configuration of wires in the end plats should be ensured.

2) Wedges and barrels should always be inspected before use.

3) Equal length of all the strands should be ensured between two endblocks.

4) Calibrated pressure gauge should be use.

5) Load on strands should be cross checked with measuredelongation.

6) Record of tensioning should be maintained for each lines / stressbench.

Sleeper dimension viz. length, height at various sections and rail seatslope depends on accuracy in moulds fabrication. Whereas the criticalgauge and Toe-Load controlling dimensions depend on accuracy of the moulds, insert dimension and fixing arrangement of the inserts.Mouldshould be periodically checked and rectified for inaccuracies if any.Surface finish largely depends on the surface of moulds, mould oil andcompaction of Concrete.

2.3 MEASURING INSTRUMENTS / EQUIPMENTS TO BE USED:

(i) Universal Testing machine (ii) Extensometer (iii) Micrometer (iv) Electronic Weighing Balance.

For Chemical Proprieties: Test Certificate of Firm to be attached.

2.4 TESTING OF WATER CURED CONCRETE CUBES:

Concrete Cubes shall be water cured for 14 days after demoulding.Three cubes per lot shall be tested for 15 days compressive strength of concrete. The minimum strength will represent the strength of concrete for lot.Cubes to be checked on compressive testing machine having capacity of 2000 K.N. the cubes shall be surface dry at the time to testing the rate of loading shall be about 400 KN/minutes. Depending on 15 days cube strength of the lot. The scale of testing for the lot shall be as follows:

i) 55 N/mm2 and above – One Sleeper for SBT per Lot.

ii) Less than 55 N/mm2 – Five sleeper for SBT per Lot.

After Stabilization of production technique sleeper to be tested for Rail seat bottom center top only. Moment of failure or Test for Ultimate load to be tested, one sleeper per 2500 sleeper.

2.5 RE-TEST:

For every sleeper failed in Acceptance Test, two more sleepers from same lot shall be retested. In case of failure of the sleeper in M. F. Test, 2 more sleepers from the same lot to be tested.

2.6 CRITICAL DIMENSION OF SLEEPER

To be checked 100% and recorded in register (60 Kg.)

1) Outer inserts gauge - 1921.5mm (+1.5 mm.,- 0)

2) Between inserts at Rail Seat - 162 mm (+1.5 mm.,- 0)

3) Slope at Rail Seat - 1 in 20 + 0.25

4) Toe Gap - 8mm + 1mm.

2.7 OTHER DIMENSIONS OF SLEEPERS

To be checked 1%

1) Length – 2750mm + 3mm

2) Top Width – 154mm(+3mm,- 1.5mm)

3) Bottom Width

At Center - 220mm (+ 4.5mm, - 3.0mm)

At Rail Seat - 250mm (+ 4.5mm, - 3.0mm)

At End - 270mm (+ 4.5mm, - 3.0mm)

4) Height /Depth of Sleeper -

At Center - 180mm (+ 4.5mm, - 3.0mm)

At Rail Seat - 210mm (+ 4.5mm, - 3.0mm)

At End - 235mm (+ 4.5mm, - 3.0mm)

5) Volume of Sleeper - 108900 Cm3

6) Weight - 282.5 Kg.

7) HTS Wire - 18 Nos. 3 x 3 Weight 8.217 Kg. Per Sleeper.

8) SGCI Insert - Weight 1.555Kg. + 3%.

2.8 VISUAL INSPECTION:

All sleepers shall be free from surface defect such as water retaining pockets, air holes or honey combed formation. Two coats of suitable ISI mark anticorrosive paint, shall be applied at the end of the sleeper after curing.

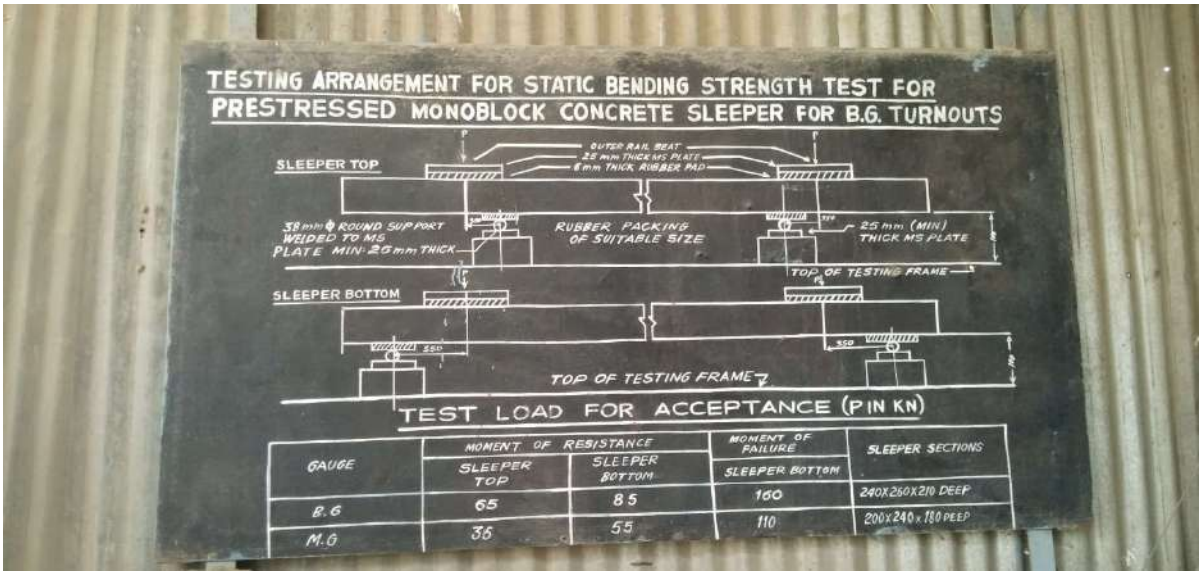
Prof. V.A.Choudhari
Co-ordinator

Dr. Atul Ayare
Principal

Photographs of Visit

Stretching of high Tensile Steel Wires by Hydraulic Jack

Compaction of Concrete in Sleeper Mould



Testing Arrangement of Prefabricated Sleeper for Broad Gauge

Curing of Sleepers in Rectangular Water tank

Felicitation and Vote of thanks by Students of MITCORER, Barshi

Group Photo of students of MITCORER, Barshi

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Attendance Sheet

UNDERTAKING LETTER - STUDENTS

We the students of **SE(Civil)** do here-by undertake that we are going on Industrial Visit **Pre fabricated concrete sleeper factory at Mohol** organized on date **22/09/2018** departure date 22/09/2018 time 10.00AM from MITCORER and arrival on date 22/09/2018 time 4.30 PM at MITCORER. Faculty and staff of MITCORER will not be held responsible for any mishap/eventualities during the Visit.

Sr.No	Name	Mobile No of Student	Mobile No of Parent	Signature
1.	Aniket Navnath Bhandare	9561835593	3867769575	
2.	Gaikwad Tushar Hanumant	9881732465	9657701581	
3.	Gujar Prajwal Bhaskar	9881550820	9822742206	
4.	Hadge Nikita Santosh			
5.	Jadhav Abhishek Shrimant	8766800470	9405917018	
6.	Jadhvar Sagar Rajaram	7057643852	9146493802	
7.	Jagtap Nilesh Chandrakant	9145590890	8888071038	
8.	Jeve Ashwini Bhausaheb	7620347216	9850750l5	
9.	Kadam Dnyanesh Dnyaneshwar	8655587279	9769257132	
10.	Khan Nadeemahmad Maqsood Ahmed	7020810083	9403576854	
11.	Kshirsagar Adarsh Anil	8975495914	9689907439	
12.	Londhe Samadhan Gorakh	9096462376	9970882554	
13.	Madane Preeti Yashvant	9881033778	9011379410	
14.	Mangire Vishwaraj Umakant			
15.	Masood Moin Moula Ali	8625052850	8857011531	
16.	Mulla Sajid Mahebub	9112113800	9975358500	
17.	Mundhe Suraj Nanasaheb	8888063851	9922559850	
18.	Pardeshi Sonal Ranjan	9921237779	9921699127	
19.	Pathan Aftab Samsher	7020233346	9881302885	
20.	Pooja Chandrakant Mane	9373027574	9421915361	
21.	Satnak Ganesh Sahebrao	7517933418	8865239 8	
22.	Shaikh Shoeb Abdul Jabbar	9146433700	9423340977	

23.	Shekh Soheil Rasul	9561950746	9604758839	
24.	Shete Yashwant Hanmant	7218450055	9623515121	
25.	Shetty Vikas Ramesh	7030598236	8087851781	
26.	Shinde Padmasinha Mukund	7083363016	8830218598	
27.	Sonwane Tushar Raghunath	8766707353	7776813287	
28.	Takmoge sarthak balaji	9834107303	9834107303	
29.	Thorat Keshav Vijay	8983300707	8605767574	
30.	Upalekar Rashmi Satish	8375507375	8375507375	
31.	Mahadik Abhijeet Laxman	9146518122	9881174744	
32.	Khapale Amol Bharat	9511920929	7507336706	
33.	Jalkute Shraddha Dhananjay	9881571129	9822241276	
34.	Mujawar Aref Chand			
35.	Kale Sourabh Nanasaheb	7050259612	8698019000	
36.	Shinde Balaji Babasaheb	9146702413	9767454567	
37.	Kewadkar Sandesh Daji			
38.	Shaikh Mubeen Shafik	7620474819	8180048694	

Coordinator HOD Principal

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Letter of Appreciation

To,
Mr. Narendra Sawalkar
Vishal Nirmiti Pvt.Ltd.,
Mohol

Subject: Letter of Appreciation

Respected Sir,

Thank you very much for providing us permission for Prefabricated Concrete Sleeper Factory at Mohol and guide our students during visit of Prefabricated Concrete Sleeper Factory on 22nd September 2018 at Prefabricated Concrete Sleeper Factory at Mohol, Maharashtra.

We are grateful for the time and appreciate the effort you have taken to share your knowledge and experiences with us. Your expertise on the field, depth of understanding, and ability to present your views in such an interesting way produced that this is one of our memorable visit.

Thank you for wonderful interaction and making the Visit successful, and we appreciate your continued support.

Sincerely,

Principal
MITCORER,Barshi