ज्ञान ज्योति से मार्गदर्शन

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Indian Railways Institute of Civil Engineering, Pune

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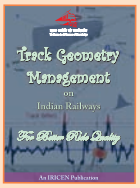

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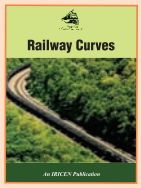

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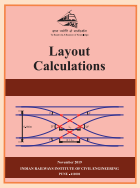

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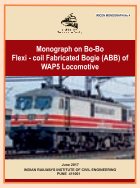

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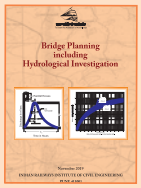

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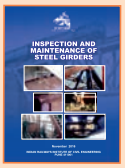

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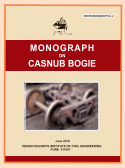

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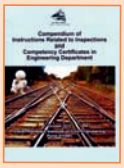

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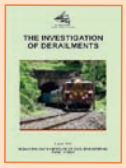

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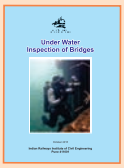

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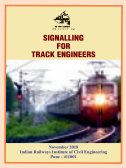

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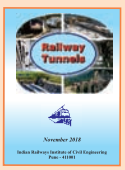

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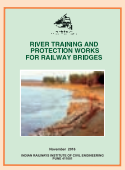

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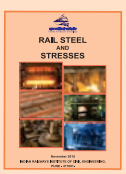

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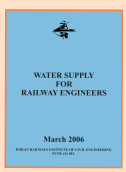

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From Director General's Desk

Dear Readers,

It is indeed a matter of pride and privilege to bring out the first issue of IRICEN journal for year 2020. It is heartening that railway fraternity shows great enthusiasm to bring out this journal containing seven papers for the first time.

This issue contains paper which are of practical importance such as a first paper deals with detailed discussion of safety guidelines and its adoption for construction of railway tunnel. The next paper deals with an innovative methods of deep screening of points & crossings by using alternative means such as road cranes and excavators.

The third paper deals with the contact stress in between wheel & rail using finite element method and it recommends for further study on rail defect generation and crack growth using this method. The next papers deals with replacement of top flange plate of steel plate girder.

The next paper deals with the status of implementation of guidelines issued by environmental and housekeeping management directed by the Railway Board and status of adoption of these guidelines in Trivandrum division of Southern Railway. The next paper deals with the effect of screen size while doing deep screening of railway track by BCM machine. The last paper cover in detail about removal of encroachment in the Bhusawal division and retrieval of large chunk of railway land.

I hope the readers will find the papers and other articles contained in this issue relevant and useful; however, they shall be cautious to utilize the information contained in these papers with due consideration of the relevant local issues.

The suggestions for making this journal more useful and relevant to the field user and contribution to forthcoming issues in the form of technical papers are most welcome to share their knowledge and experience with the Railway Engineers.

Pune (Santosh Kumar Agrawal)

March 2020 Director General

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2. The journal is likely to be printed in a paper of size 215 mm X 280 mm. While sending the articles the author should write in 2 columns. Sketches, tables and figures should be accommodated in a 2 column set up only.
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5. Only selected articles will be included in the IRICEN Journal of Civil Engineering.

Railway News

First Two TBMs Gear up for Pune Metro


Two Terrattee EPBMs have been completed and shipped to the underground works on line 1 of the 16.56km Pune Metro. The TBMs have already been despatched from the factory in China and are currently being shipped to the port of Mumbai. Both machines are expected to arrive in November and will be transported to Pune where they will be assembled and then tested on site in mid-December.

Earlier this year, Maharashtra metro Rail corporation announded that the Gulemark-Tata joint venture had won both the twin-tube tunnel packagers on the new north-south metro corridor. The 5km underground section, which runs from the college of Agriculture in Shivajinagar to Swargate and has five stations, is considered the most challenging portion of the line, as it passes under the densely populated areas of Kasbapeth, BudhwarPeth and Mandai market.

A spokesperson for the manufacturer said, "the EPBMs have mixed face dome style cutterheads designed to work in the compact basalt that is expected on these contracts at pressures of upto 4 bars. As the TBMs progress, they will install 1,400mm wide by 275mm thick pre-cast concrete lining rings, which consist of five segments plus a key".

The main challenges on the project will include tunnelling beneath century old surface structure, crossing under the river Mutha and TBM lowering and dismantling in built up areas of Budhwarpeth and Mandai stations.

When complete in 2022, Pune Metro network will comprise three rail corridors with a total length of 54.5km.

Ref: Tunnels and Tunnelling, International Edition, Dec. 2019, Page 11

Railways to Float Global Tender for Train-18 – Siemens, BHEL, Alstom, Bombardier & CAF Part of Bidding

The ambitious Train 18 project is likely to get a fresh impetus soon with the government planning to float a fresh global tender for 30 to 40 trains.

This comes amid controversies looming over the decision by the railways to stop production of Train 18 rakes at the Integral Coach Factory (ICF) in Chennai and initiating probe against top nine officials of India's first semi-high speed train, also known as Vande Bharat Express.

A major reason why the railways had called for production to be stopped at the ICF was because of the heavy rakes, which resulted in higher energy consumption.

"We are going for fresh global tenders of Train 18 now. This is after the Research Designs and Standards Organisation (RDSO), the research arm of the railways, changed the criteria for the trainset," said a senior railways official.

According to industry experts, major global players that are likely to be a part of the bidding include Alstom, Siemens, Bombardier and Spanish major CAF. Indian companies like Bharat Heavy Electricals (BHEL), too, may join the fray.

Prime Minister Narendra Modi had touted it as an iconic Make-in-India initiative on February 15, launching the first Vande Bharat train from New Delhi to Varanasi.

"If a new company is coming to make the train through a fresh tendering process, it will take an additional two-and-a-half years for the next Train 18 to see light of the day," said a former railways official.

Railways Minister Piyush Goyal had informed the Lok Sabha on November 27 that the plan is to produce 160 coaches in 2019-20, 240 coaches in 2020-21 and 240 coaches in 2021-22 at the ICF.

This was after the cancellation of two bulk tenders for propulsion systems of Train 18 earlier this year. A first one for the 43 propulsion systems and a second tender for 37 systems got cancelled due to lack of interest.

Around 35 per cent of the cost of the train is because of its propulsion system. Before the initial launch, the train was certified by RDSO after safety oscillation trials and the Commissioner of Railway Safety (CRS) had also cleared the train for commercial operations.

"When the train had gone through the entire clearance process, a change in criteria will only delay the launch of new trains," said a person close to the development.

Based on comparative data available with industry sources, the energy consumption of Rajdhani trains was seen at 10,340 kwh for 447 km. For the Shatabdi, it is 8,396 kwh and Train 18 it is 8,983 kwh for the same distance.

However, in terms of energy regeneration, Train 18 has an edge with the coaches regenerating 12.9 per cent of the total energy consumed, compared to 12.3 per cent by the Rajdhanis and 11 per cent by the Shatabdis. Regeneration is the power to send energy back to the grid, when the train is in braking mode.

Ref: www.railnews.in

India Among Top-7 Nations that Produce Own Train Sets

Proud achievement for Indian Railways! India is placed among the top countries in world that manufacture their own train sets. Asserting Indian Railways' 'Make-in-India' approach, Railway Minister Piyush Goyal has recently said that India is "one amongst only 7 countries in the world which make their own train sets". Addressing a gathering, Goyal said India is becoming a global power. India has been able to make its own train sets, Goyal said adding that this became possible since the central government is working in "proactive mode as well as in a transparent fashion".

Goyal stated that India is producing 'modern trains' like Vande Bharat Express. "Indian Railways has already started Vande Bharat Express from Delhi to Varanasi. During the Navratras, Indian Railways was hoping to start it from Delhi to Vaishno Devi, Katra too," Goyal said.

Vande Bharat Express is a semi-high speed engineless train set that has already generated export interest from various countries. Indian Railways is currently working on a plan to manufacture more energy-efficient versions of the Vande Bharat Express in both chair car and sleeper versions. According to the plans, by 2022, 40 such train sets will be ready for the Indian Railways network.

Recently, Piyush Goyal-led Railway Ministry has also taken the decision to replace all conventional ICF-design railway coaches with modern Linke Hofmann Busch (LHB) coaches. The Railway Ministry also informed Parliament it has started the process of acquiring technology to produce aluminium body coaches in its Indian Railways factories. A total of 411 pairs of trains are operating with LHB coaches on Indian Railways' network. From the financial year 2018-19 onwards, the Indian Railways production units are only manufacturing LHB coaches, the Ministry said.

Indian Railways' Integral Coach Factory (ICF) in Chennai is among the largest coach manufacturers in the world. It has the capability of producing passenger coaches, semi high-speed train sets like Vande Bharat Express. Recently, The Modern Coach Factory (MCF), located in Uttar Pradesh's Raebareli, created a record by manufacturing a total of 554 LHB coaches in the first four months of the current financial year.

Indian Railways is hoping to streamline the coach production process further by corporatising the manufacturing units and merging them under a single entity, the Indian Railway Rolling Stock Company.

Ref: www.railnews.in

Nagpur Division to Use New Concrete Technology to Firm up Hillocks in Ghat Section

Central Railway is contemplating usage of a new concrete technology to firm up the hillocks that are prone to landslides in the ghat section of Nagpur Division. The work is planned along side laying third-line in Teegaon-Chinchoda section of 17 kms that cuts through Sahyadri Ghats of Nagpur-Itarsi section. The area is treacherous as falling boulders from mountains abutting the tracks pose danger, particularly more during the monsoon season, for passenger trains.

After much deliberation, Construction Organisation of Central Railway zeroed on geotextiles, the in thing in construction business these days for use in preventing boulders from falling off the mountains. Concrete canvas is basically known as Geosynthetic Cementitious Composite Mats (GCCMs) in technical term. Right now Railways is using the technology for extending life of track formations that could in long run cut down its maintenance costs. Railways are now deciding to hold trials in Nagpur Division by using concrete impregnated fabric, the technical terminology, and if successful in preventing slippage of loose boulders here then same could be used in other ghat sections, said the railway officials.

Railways were on lookout for reliable technique to minimise threats of disruption in ghat section and is preparing to start slope protection work. As per details, the Construction Organisation has decided to even the hillock surface before the fabric is affixed on it with help of screws. The thin film would be put up at certain height that would be decided at time of execution of work given the challenging conditions that exist in the ghat. Officials further added that at present it is difficult to estimate how much height they could go but given the high cost of this new fast setting concrete, Railways are determined to go all out for testing the utility of the fabric.

Once the concrete fabric is fitted it is then allowed to hydrate to form a thin transparent wall. Compared to conventional concrete, geotextiles offers use of ease and can be carried on site easily. They came in rolls similar to cable bundles and two persons can lift it without much effort and it is then rolled out and applied on the surface. The wall is then sprayed with certain quantity of water and then allowed to solidify, which is maximum 24 hours. Once settled a thin transparent wall is formed and it is fire proof and beyond that water proof that is basically requirement in this section. Another advantage of geotextiles is that they are quite durable and have low carbon footprint.

The ghat receives very high intensity rainfall that leads to seepage of water in the mountains leading to loosening of soil that holds big boulders. CR officials said they are going to use this technology for very first time and thereafter monitor its performance. One worry among Railways engineers is to determine whether the concrete wall managed to withstand shocks from passing trains. Listing the advantage CR's engineers said that in comparison with traditional concrete use, the concrete canvas can be rolled out at a rate of 4002/hour, nearly 10 times faster, thereby reducing time on site time. Given it chemical component, even under harsh

ultra violet rays the concrete fabric does not lose shape and hence has long life. The maintenance is almost negligible that is added advantage and importantly it arrests growth of weeds inside the concrete wall.

Ref: www.railnews.in

New Jiribam-Imphal Rail Line Project Set for Completion Soon in Northeast India

Railways network in North-East region set for a massive boost with Jiribam-Imphal Rail Line project! Recently, VK Yadav, Chairman Railway Board inspected the progress of the upcoming 110-km long Jiribam-Imphal railway line project. The crucial infrastructure project will provide railway connectivity to Imphal, the capital of Manipur and boost the state's economy. According to details shared by the Railway Ministry, the rail line project is being developed at a cost of Rs 12,524 crore and it is targeted for completion in March 2022. The rail line includes 62 km of tunnels and as many as 139 bridges!

A few days ago, it was reported that the last Open Web Girder of Bridge Number 44 was launched successfully on 14 February 2020, which is the first-ever over 100 metres tall Pier Bridge of Jiribam-Imphal new line on Indian Railways network. The rail line will connect the state of Manipur to the rest of the country through the Indian Railways network. The rail line, which has been declared as a national project was taken up in 2008.

A part of the Jiribam-Imphal railway line, bridge number 164 of the project will be the tallest girder railway bridge of the Indian Railways network. The girder bridge twill have a pier height almost twice as high as Qutub Minar-141 metres. Also, three IITs of the country – Roorkee, Guwahati, and Kanpur are associated with the Jiribam-Imphal rail line project in terms of technical support and proof-checking of designs to make the bridge sustainable as well as cost-efficient.

Meanwhile, Railway Board Chairman also inspected the 51.38 km long Bairabi-Sairang new rail line project. The project is being executed at a cost of around Rs 5,021.45 crore. Once completed, the rail line will provide Indian Railways connectivity as well as boost the economy of Mizoram. Yadav also inspected Tunnel Number 20.

Ref: www.railnews.in

Guntakal-Kalluru Rail Line Opens to Traffic after Electrification, Doubling

The doubling of the rail line between Guntakal and Kalluru (41 km) has been completed in all aspects, along with electrification. and the speed at which the passenger trains can run on this section has been enhanced from 70 kmph to 100 kmph.

According to a release from the Indian Railways on Friday, Commissioner, Railway Safety inspected the electrified portion and certified it as fit to run passenger train services with immediate effect. About 20 curves have been straightened to enhance the strength of the track. This will enable all types of passenger services with electric traction on this line, which acts as a bypass line for south-bound trains and vice-versa.

Trains from Delhi, Mumbai and Hyderabad travel towards Bengaluru along this section, which was earlier a single line with trains running on diesel traction. Work on electrifing the route was sanctioned in 2015-16 at a cost of Rs. 357 crore. The project was completed in different phases beginning with doubling of the section between Khadarpet-Gullapalyamu, electrification of the entire single line, doubling between Guntakal-Gullapalyamu, doubling between Khadarpet-Kalluru and finally electrification of the second line.

With this, one more significant step has been taken towards fulfilling the dreams of Rayalaseema people to have better rail connectivity and more number of trains, the release said.

Iron ore and other bulk commodities such as cement and steel are transported along this route.

SCR General Manager Gajanan Mallya congratulated the officials of Guntakal division and the construction department for playing a key role in the successful completion of the project.

Ref: www.railnews.in

MRVC to Deploy Communication Based Train Control on Mumbai Suburban Rail Network

Mumbai Railway Vikas Corporation Ltd (MRVC) to finalise the Consulting Services firm for preparation of technical specification & Bid Management for " Implementation of CBTC (Communication Based Train Control) system to enhance safety and to achieve improved headway on Mumbai Suburban Railway network of Western & Central Railways" under the Mumbai Urban Transport Project (MUTP)-3A.

The Mumbai Rail Vikas Corporation (MRVC) has started preliminary work towards the implementation of the CBTC system on the Mumbai suburban network. The CBTC is a state-of-the-art signalling system, which will improve the efficiency and safety of operations. The project is part of the Rs. 33,690 crore Mumbai Urban Transport Project 3A (MUTP 3A).

The MRVC has proposed to implement the project on the slow and fast corridors on the Western Railway between Churchgate and Virar, on the slow and fast corridors between Chhatrapati Shivaji Maharaj Terminus and Kalyan, and on the Harbour and Trans-Harbour Lines.

The project aims to improve the frequency, thereby reducing overcrowding on trains. At present, trains on an average run at a peak frequency of around 3.5 minutes,

which MRVC officials said, will be brought down to around 2.5 minutes after the project is implemented.

The CBTC consulting services focus on the following requirements:-

1. Study of the existing technical system and thereafter modifications required to existing technical system covering every technical aspect such as signalling, communication, power supply, rolling stock etc for implementation & operation of CBTC.

2. Operational Requirement for implementation & operation of CBTC. This covers Inter-operability requirements, Migration strategy, mixed train operation, Fall Back System, Interface requirements with EMU Rolling Stock Systems, ETCS, PF screen door etc.

3. Technical Specifications. This covers designing of System specification, Grade of operation, Performance & functional requirements, Interlocking System, Communication System, rolling stocks, traction current etc.

4. Study of the existing system of train operation and thereafter suggest measures/modifications required to existing operating procedures such as operating manuals, Station working rules etc to migrate over CBTC.

5. Bid Management. This includes bid preparation, bid processing and bid evaluation.

6. Training, Workshop & Seminars.

CBTC Greenfield project shall be considered as "the CBTC work for new lines/Metros where tracks and other systems are new and on which there is no train / revenue services in operation.

Consultants may associate with other firms in the form of a joint venture or a sub consultancy to enhance their qualifications. A Consultant will be selected in accordance with the QCBS method.

"By increasing the frequency between trains we should be able to run more services every hour, which will ease the strain on the existing infrastructure," an MRVC official said.

At present, there are 15-17 services during peak hours, which officials said, will increase to 20-22 after the CBTC comes into effect. The system can also potentially allow driverless operations of local trains. The signalling technology is currently being implemented across all Metro corridors in the country. The key difference in implementing the project as opposed to the Metro is it would be a brownfield project, which means the system would need to be implemented on the existing infrastructure.

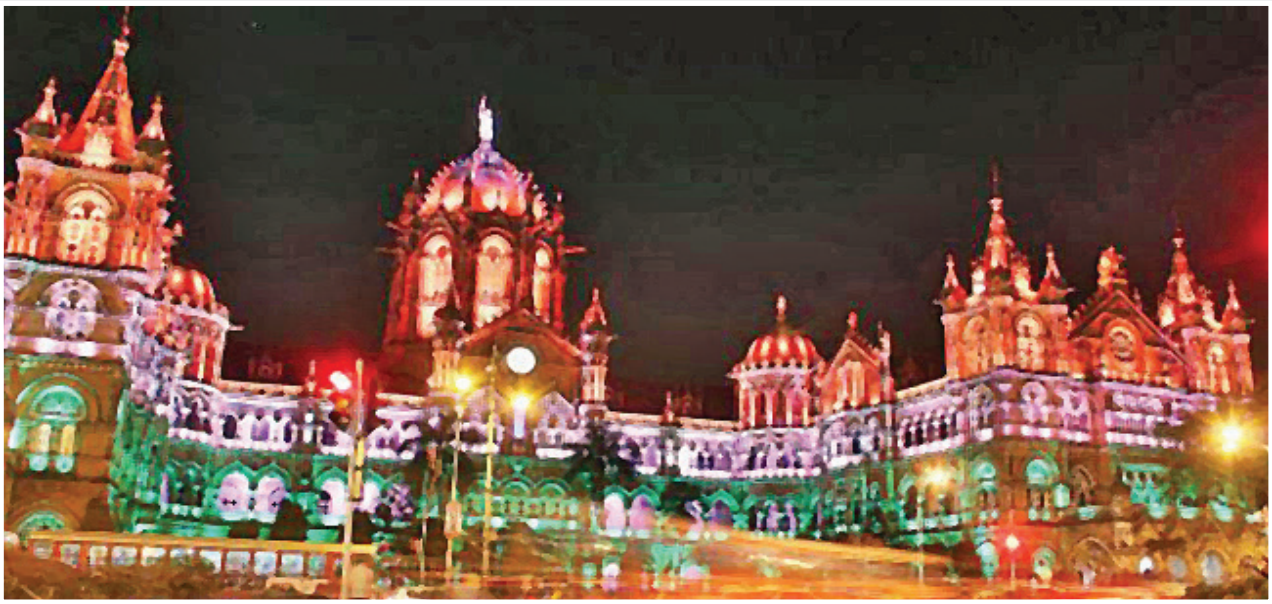
"On Metro corridors, the CBTC system is implemented at the time of construction. This project will be a challenge to implement on the suburban railway network as it will need to be executed while operations are under way. Moreover, new solutions should be found as long-distance trains and goods trains run on the same tracks along with suburban trains," an MRVC official said, adding in all likelihood, the Harbour and Trans-Harbour Lines will be undertaken first for implementation as there are no long-distance passenger trains or goods trains sharing space with local trains on those corridors.

The MRVC last week floated tenders to appoint general consultants for the Rs. 5,900 crore project, who will assist the MRVC in selecting the contractor.

What is CBTC?

In a CBTC system, all trains within a railway network are connected and communicate with each other using radio frequencies. The system moves away from traditional fixed signalling, where trains stop or slow down depending on the colour on the signal, and adjusts the speed of trains dynamically. The location of each train is communicated to the train behind it to maintain a safe braking distance at all times.

Ref: www.railnews.in



Glorious View of CSTM Building on the eve of Republic Day

Tunnelling Method and Safety Guidelines Adopted for Construction of Tunnel no.12 (10.28km) of Jiribam-Tupul-Imphal New Railway Line Project

By
*Anil Kumar**

Abstract:

Number of bridges on Indian Railways are to the tune of about 1.31 lakhs belonging to various types in lengths and different categories. Most of major bridges are of steel girders (Plate girder or Open Web Girder) and these girders are functioning well despite of having age of more than 100 years. Railways experiences with these girders are very well and time tested. These girders require periodical maintenance like painting & greasing. In corrosive environment, the conventional painting is not proving safeguard to corrosion. Details of problems encountered & methodology in replacement of corroded components of girders are discussed in this paper.

1.0 Introduction

One of the most prestigious Railway projects in Northeast is Jiribam-Tupul-Imphal BG new Rail Line. The total length of the corridor is 110.63 km is under construction in Manipur. The commissioning of the project from Jiribam is planned in two phases to Tupul and Imphal has been fixed by 2020 and 2022.

This project is challenging for varieties of reasons like inaccessibility to the sites of tunnelling, remoteness of the locations, difficult topography, design and technical challenges besides the frequent blockade, bandhs and security threats by some organisations active in the region.

Total number of tunnels on in this line is 46 and total length of tunnels in this project is 61.2 Kms. Among the tunnels, Tunnel no.12 in Tupul-Imphal section of the project is 10.28 Km long and lies in the Kangpokpi and Imphal west District of Manipur. The overburden height ranges varies from few hundred metres up to a maximum of about 800m. This tunnel is expected to pass the CMF (Churachandpur Mao Fault) a strike slip fault as well as Alluvium of poor soil condition with some gas pockets.

The elevations of Portal-1 & Portal- 2 are at 648.00 & 786.00 m above MSL respectively. Maximum height of over burden is about 807.00 m where elevation is 1498 m above MSL.

For faster construction, 2 (two) Nos. construction Adits are planned at Ch-108/000 &111/500 of length 1427m and 1252m respectively.

For the safe evacuation of the passengers during the emergency a parallel safety tunnel of 9.35km is being constructed as per International UIC'S Technical Specification of Inter- operability (TSI). The main tunnel and parallel safety tunnel will be connected through Cross passages at every 500m. The finish Crosssection area of the main tunnel is 38.2 SQM and safety tunnel is 18.0 SQM.

New Austrian Tunneling Method (NATM) is being adopted for making the tunnels on this line. Major Resources deployed are: Rocket Boomers, Shotcrete Machines, Concrete Pumps, Excavators, Crushing Plants, and Batching Plants etc. besides around 6000 Skilled Manpower.

1.1 SURVEY

Survey is most important for fixing alignment, Tunnel portals and profile marking. Underground surveying is quite different from surveying on the surface as the situation in tunnel may be hot, wet, dark, cramped, dusty and dangerous. The basic geodetic reference network (Bench Marks/Control Points) is the base of any tunnel survey and reliability or degree of accuracy depends upon the three dimensional network adjustments. In tunnel survey, it is very important to establish, preserve and check of those reference points on a regular basis and relocate and readjust those controls in high preference as unpredictable geological behaviour of rock or soil strata can move those points in horizontal, longitudinal or vertical way, which can create more problems in tunnels for both alignment and/or profile setting out.

- **Method of Survey**

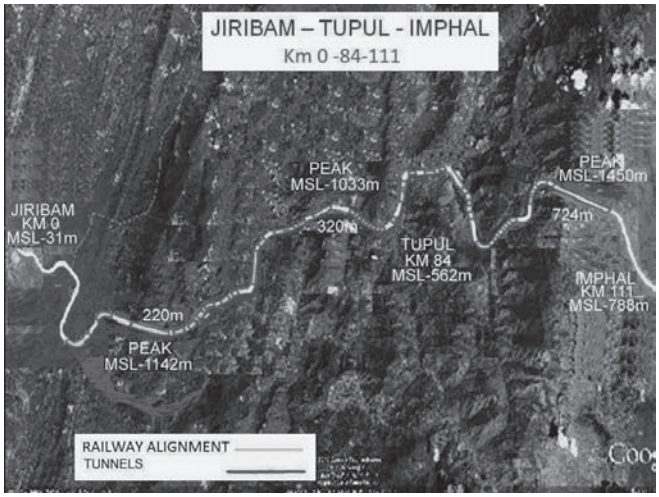
1. Reconnaissance Survey of said contractual boundary and surrounding area to finalize the spots for control pillars required for

**Chief Engineer/NFR(construction) Maligaon*

tunnel construction and most suitable network formation to obtain required degree of accuracy

2. Construction & fixing of Control Pillars
3. DGPS observation to transfer Base point (GPS 436, near T12-Portal1) co-ordinate in to the system by transferring it to point R2
4. Long Hours DGPS observation to measure Base Line Between R2 (Near CRPF camp of Portal 1) and M14(Near ABCI camp near Portal 2)
5. DGPS observation between Primary control points
6. DGPS observation between Primary and Secondary control points
7. Digital Level Traverse from Base point to all working portals Primary/Secondary control points
8. Total Station Traverse between Primary/ Secondary control points in between tunnel portals and Adit Portal Locations, as well
9. Calculation and fixing of co-ordinate(East/ North/Elevation) of each pillars
10. Topographical survey for a corridor of 200m (100m on either side of proposed alignment of Main Tunnel and Adits alignment)

New Austrian Tunneling Method (NATM) is being adopted for making the tunnels on this line. Major Resources deployed are: Rocket Boomers, Shotcrete Machines, Concrete Pumps, Excavators, Crushing Plants, and Batching Plants etc. besides around 6000 Skilled Manpower.



2.0 Important Safety Guidelines Considered In Planning Of Tunnel No 12

International Guidelines on Safety in Railway tunnels

Technical specification of interoperability relating to 'safety in railway tunnels' in the trans-European conventional and high-speed rail system (TSI-SRT)-2008

THE UIC-LEAFLET 779-9 R "SAFETY IN RAILWAY TUNNELS" (2003)

Guidelines issued by Railway Board on Safety in Railway tunnels

A. Recommendations of Committee on tunnel ventilation (Safety, relief & rescue) as accepted Rly. Bds'svide L/No - 2008/Elect.(Dev)/150/3. Dt. 18.12.2008,

Till such time a code of practice for ventilation and safety in rail tunnels is evolved, UIC'S Technical Specification of Inter- operability (TSI) relating to Safety in Railway Tunnels (SRT) as followed in trans-European conventional and high speed rail system, effective from Ist July' 08 may be adopted.

B. Remark of CRS Northern Circle accepted & circulated by Railway Bd.vide their L/No - 2014/ CEDO/ORI/06 Dt. 17.06.2014.

1. Vide S N - XV - It shall be certified by the General Manager that, the requirements in terms of International Codes (UIC-779-R and NFPA - 130 which cover issues related to safety in railway tunnels, have been followed.

C. Railway Bds's L/No - 2006/W-I/NF/36 (Sikkim) Dt. 20.02.2012. for Cross section over Sivok-Rungpo Project,

"Certainly the cost involved along with the above mentioned point should decide the provisions of the cross passage. We may consider as approx cost of the cross passage as 15-20% of tunnel cost, with in there parameters, the decision may be taken at Railway Level."

D. Railway Bds's Guidelinesvide their L/No - 2014/ W-i/NF/LMG-SLC/T-10 Dt. 01.4.2015

1. For tunnels up to a length of 3 km, Railway to follow its present practice i.e to provide normal single track cross section.

2. For tunnels more than 3 km in length , a wider cross section be preferred for self rescue, safe exit /escape

3. Adits being provided, should be used for escape.

4. Failing 2 & 3 above in view of geological consideration, then only safety parallel tunnel inter connected at suitable intervals with main tunnel, be considered, keeping cost, operation and maintenance involved in mind.

Para B/3- Cross section of the main and

adit tunnel needs to be properly designed. while designing the cross section of main tunnel it must be ensured to have a passage for movement and use of machinery and equipment to re rail the derailed rolling stock within the tunnel on rails, and also the cross section of adit should be so designed that it ensure faster construction

Case Study for Access to the safe area considering the International and National Guidelines

Four cases considered for study-

Case-I One bigger cross section tunnel with provision for road along the track for movement of rescue vehicles and materials.

Case-II -Rescue tunnel with same dimensions as main tunnel, with option for accommodating a BG track (doubling)

Case –III-Main tunnel with parallel safety and service tunnel

Case – IV -Main tunnel with adits (lateral egress) at every 1000m

Case-I One bigger cross section tunnel with provision for road along the track for movement of rescue vehicles and materials.

	Main Tunnel with Road	Construction Adit / Rescue Adit
Total Length (km)	11.55	2.974
Excavation Area (Sqm)	76.00	59.60
Finished Area (Sqm)	52.00	36.21
Projected Completion Time in Month	66 (Excavation is to be done in different phase due to larger cross sectional area)	
Benefits	east cost for civil works, enough area to work for maintenance due to road reduced access points for control	
Limitations	(1). safe area only at portal, (2) escape route is not safe area. (3). ventilation system requires sophisticated controls to manage any smoke flow (escape!) - may increase E&M cost (4). motor able walkway will be full of persons in case of emergency hampering the movement of vehicle movement. (5) the rescue teams are also at risk	
UIC 779-9R	not compliant, escape distance is above 1000m	
TSI-SRT	not compliant, escape distance is above 1000m how to integrate fire fighting points	
Railway Board	TSI-SRT is applicable, as per letter, and tunnel is longer than 3km then non-compliant	
REMARK	Not recommended	

Case-II -Rescue tunnel with same dimensions as main tunnel, with option for accommodating a BG track (doubling)

	Main Tunnel	Rescue Tunnel same as Main Tunnel	Construction Adit/ Rescue Adit
Total Length (km)	11.55	11.55	2.974
Excavation Area (Sqm)	71.22	71.22	59.60
Finished Area (Sqm)	42.10	42.10	36.21
Projected Completion Time in Month	54		
Benefits	in future it can be used in case of doubling modern system, safety is considered and it can be operated "redundantly" and it reduced the access points for control		
Limitations	double E&M systems required when fully equipped utilities will be in the "main tunnels" (then also full redundancy)ventilation system for the cross passages needs proper control - smoke		
UIC 779-9R	fully compliant		
TSI-SRT	fully compliant, fire fighting points to be integrated		
Railway Board	compliant		
REMARK	Recommended when the long term perspective for a doubling is there		

Case –III-Main tunnel with parallel safety and service tunnel

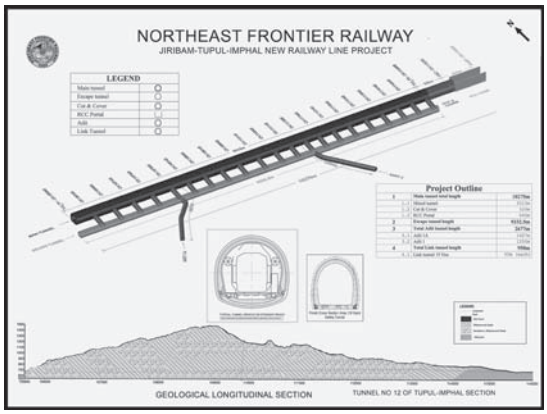
Case -III			
	Main Tunnel	**Rescue Tunnel**	**Construction Adit/ Rescue Adit**
Total Length (km)	11.55	9.26	2.974
Excavation Area (Sqm)	71.22	29.40	59.60
Finished Area (Sqm)	42.10	18.00	36.21
Projected Completion Time in Month	48		
Benefits	safety is fully considered all utilities are in the safe area, protected against any impact utilities in the main tunnel can be reduced to minimum due to parallel tube Ventilation in case of emergencies relatively easy to manage reduced access points for control		
Limitations	two parallel openings, but only one track		
UIC 779-9R	fully compliant		
TSI-SRT	fully compliant		
Railway Board	compliant		
REMARK	Recommended		

Case – IV -Main tunnel with 9 adits (lateral egress) at every 1000m,

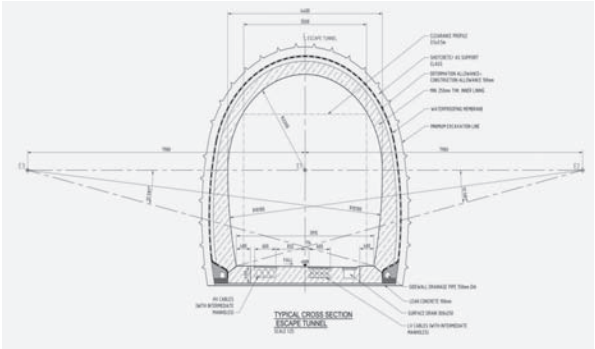
Case -IV			
	Main Tunnel	**Rescue Adit**	**Construction/Rescue Adit**
Total Length (km)	11.55	8.70	2.974
Excavation Area (Sqm)	71.22	59.60	59.60
Finished Area (Sqm)	42.10	36.21	36.21
Projected Completion Time in Month	48		
Benefits	safety is considered, however the benefit is not the same due to the 1000m escape distance.		
Limitations	Every adit needs a separate portal, length is as high or higher as with parallel tunnel, adit is much larger than e.g. Safety tunnel. The utilities have to be in the main tunnel. Length of adits depends on terrain, and here it is adverse for this solution. Every adit portal is one access point to be controlled.		
UIC 779-9R	compliant		
TSI-SRT	compliant, but fire fighting points must be there		
Railway Board	compliant		
REMARK	Not recommended		

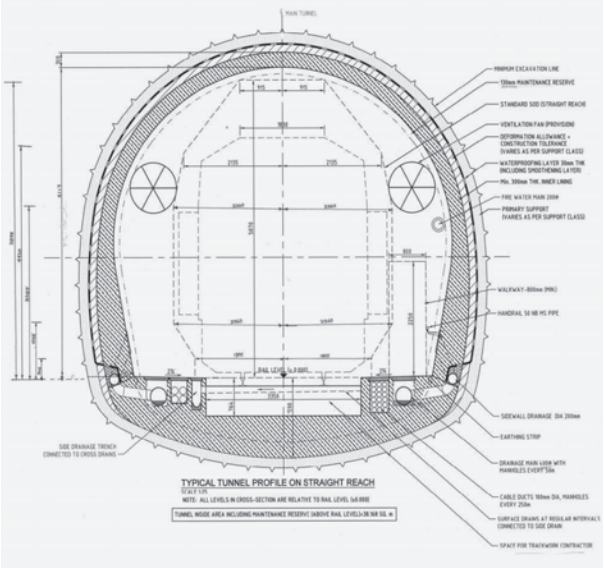
Final Decision on safety scheme of Tunnel-12 of Tupul-Imphal:

Considering Techno-economic consideration option III (Main tunnel of 10.28 Km with parallel safety /service tunnel= 9.35km) adopted.

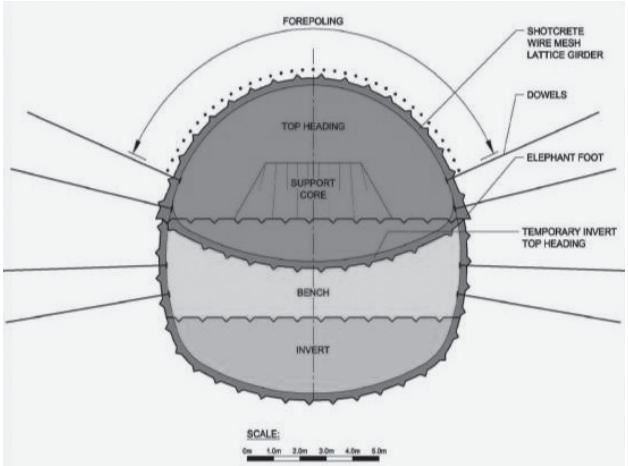


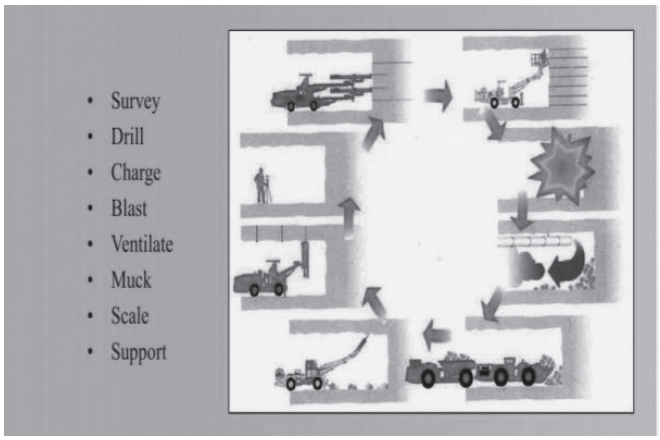
Tunnel cross section of Tunnel 12



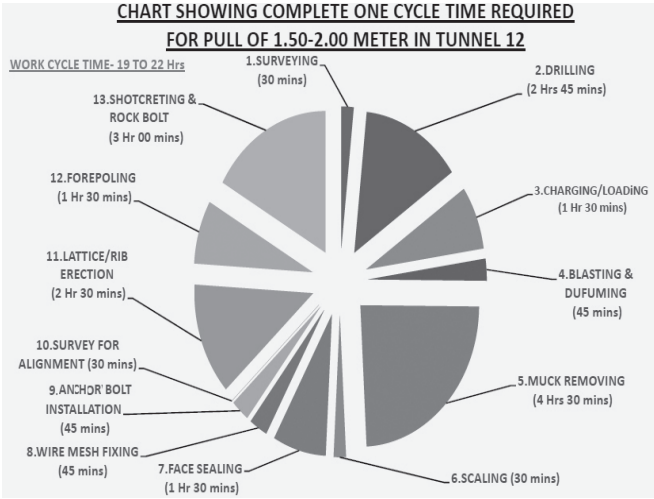


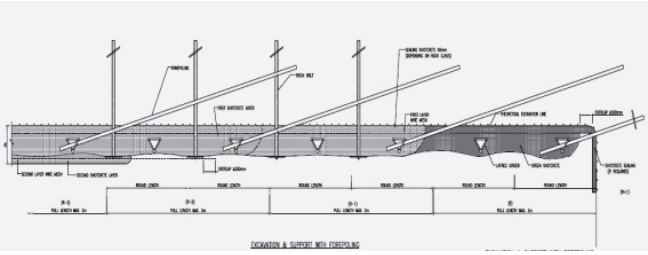
3. Tunnelling system adopted for construction of tunnel 12





NATM – New Austrian Tunnelling Method One of the most well known methods using some elements of an observational approach is the New Austrian Tunnelling Method, or NATM. The method has often been mentioned as a 'value engineered value engineered' due to version of tunnelling due to its use of light, informal support. It has long been understood that the ground, if allowed to deform slightly, is capable of contributing to its own support. NATM, with its use of modern means of monitoring and surface stabilisation, such as shotcrete and rock bolts, etc.



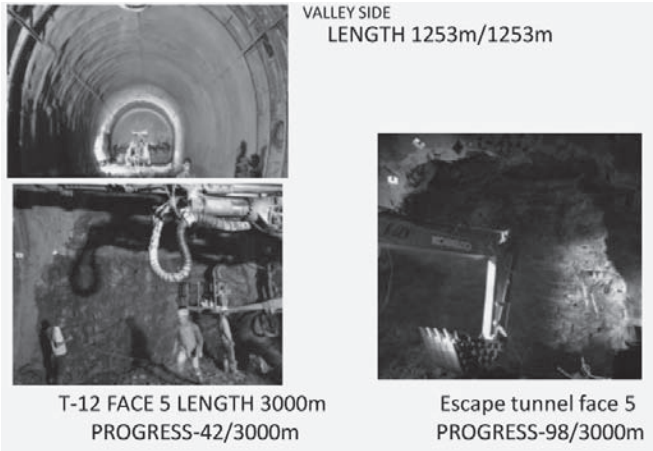


Portal Construction of Tunnel 12 Portal-1

Main Tunnel 12 & Safety Tunnel

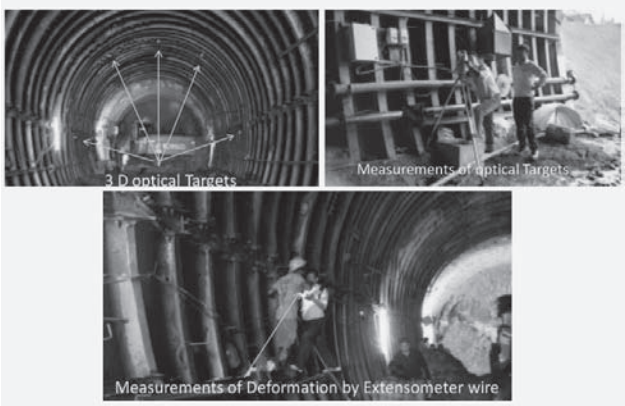
Tunnel 12 ADIT-1A (IJAI River Side)

Tunnel 12 ADIT-1A (Valley Side)

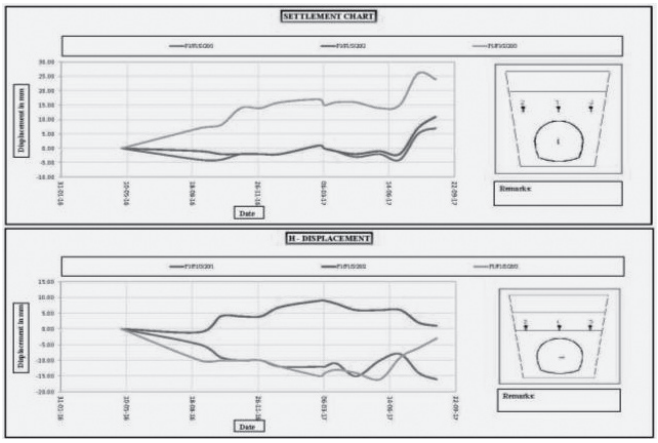


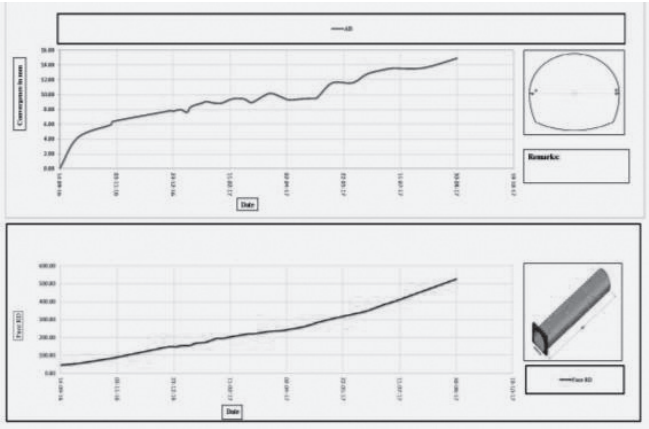
4. Monitoring /Observation of NATM

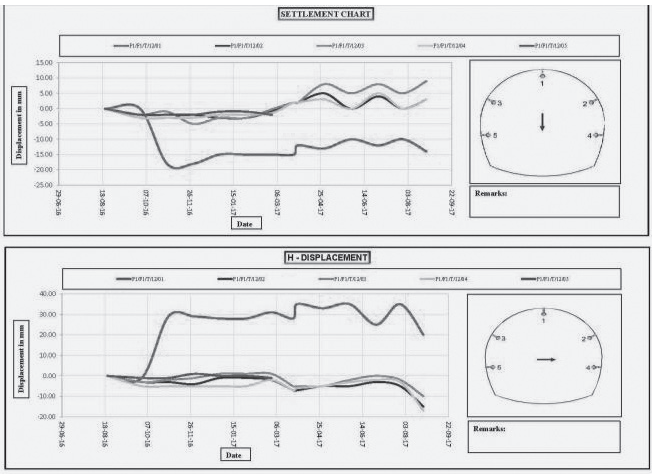
For successful application of observational methods like NATM is the observation of tunnel behaviour during construction. Monitoring and interpretation of deformations. In-situ observation is therefore essential, in order to keep the possible failures under control. 1.Deformation of the excavated tunnel surface/ excavated tunnel surface/ Convergence tape Surveying marks 2.Deformation of the ground surrounding the tunnel/ Extensometer 3.Monitoring of ground support element 'anchor'/ Total anchor force 4.Monitoring of ground support element 'shotcreteCell'/ Pressure cells.



3D Monitoring of Tunnel 12





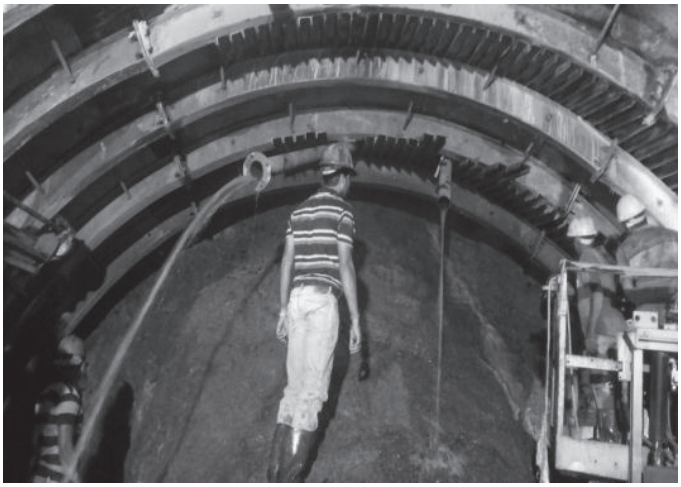


5. Experience and Challenges Faced During Execution of Tunneling Works.

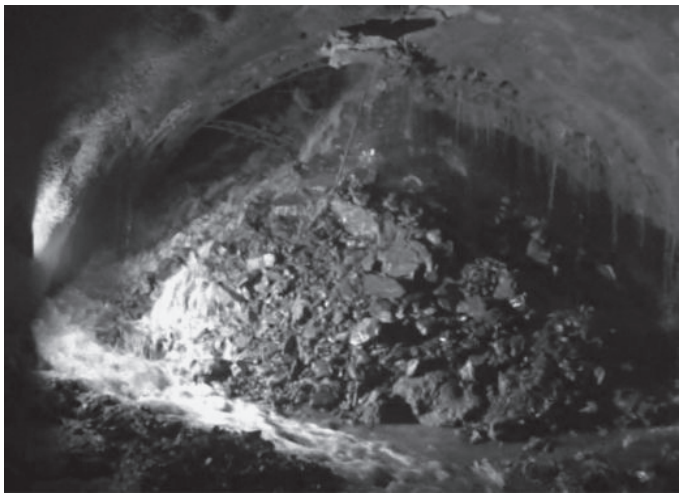
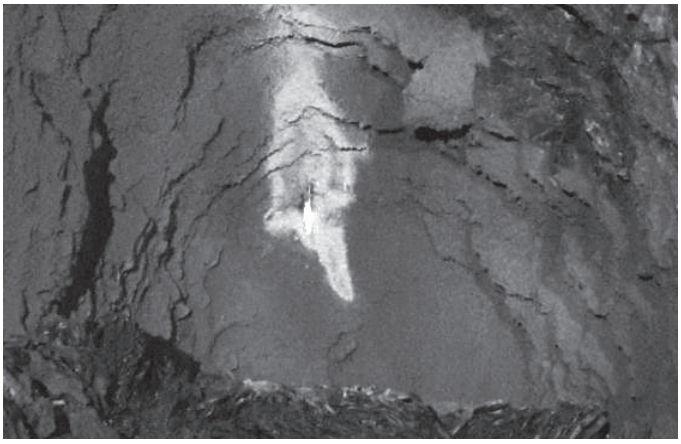
In due course of tunneling, a lot of geological challenges have been faced and overcome with suitable solutions.

Some of the experiences are as under:-

1. Tackling cavities with pressure grouting.
2. Working with noxious/hazards gases like-Methane by providing high capacity ventilation pumps and exitlines.
3. Tackling Ingress of Water with the help of P grout (Chemical).






Deep Screening of Points and Crossings in Elecrtrified Territory by an Innovative Approach Using Road Cranes & Excavators

By
Akshay Kumar Jha[1], D. S. Rama Rao[2], P. Devender[3]

Abstract:

Maintenance of the yards is very important to ensure safe movement of trains. The maintenance of points & crossings is vital for reducing the derailments in yards. Track parameters can be maintained within permissible limits provided there is clean ballast cushion below the Points & crossings. There are huge arrears of Deep screening of Points & Crossings on SCR. Total 1367 Points & crossings on main line and 2946 points & crossings on other than main line are overdue for Deep screening. These arrears are resulting due to various factors like availability of ballast cleaning machines, limited blocks, man power, etc., but the most important factor among them is the non-availability of sufficient number of Ballast cleaning machines. Traditionally deep screening is carried out by using BCMs or Manual Deep screening. As most of the track is PSC, deep screening by manual labour is very difficult and quality is unsatisfactory apart from posing safety hazards. Nowadays, we are also using T-28 track machines for deep screening in addition to BCMs. However the available Track machines including (BCMs & T-28s) are inadequate to cater the requirements of deep screening, posing a challenge to the P-way engineers. The paper presents a novel approach of using Road cranes & Excavators for providing full ballast cushion of 300 mm under the Points & crossings in the electrified/non-electrified yards.

1.0 Introduction:

1.1 Deep screening of ballast:

Due to presence of bad formation, ballast attrition, excessive rain fall and dropping of iron etc, ballast gets contaminated and track drainage is impaired. In such situations, it becomes necessary to screen the entire ballast right up to the formation level /sub-ballast level. Further through screening of ballast restores the resiliency and elasticity of the ballast bed, resulting in improved running quality of track. Such screening is called “Deep screening”, as distinguished from the shallow screening, which is done, during overhauling.

1.2 Deep screening should be carried out in the following situations by providing full ballast cushion as stipulated in para no.238 of IRPWM.

i. Prior to complete track renewal.

ii. Prior to through sleeper renewal.

iii. Where the caking of ballast has resulted in unsatisfactory riding

iv. Before converting existing track, fish plated or SWR into LWR or CWR; or before introduction of machine maintenance, unless the ballast has been screened in recent past.

v. Deep screening of the track shall be done after 500 GMT or 10 years, whichever is earlier. However, deep screening shall also be carried out if the existing clean ballast cushion is less than 150mm to ensure proper machine tamping.

a) The need for intermediate screening between track renewals may be decided by the Chief Engineer depending on the local conditions.

b) At the time of deep screening, standard ballast section should be provided invariably.

2.0 Necessity for an alternative method to BCMs:

As per the para 238 of IRPWM, the requirement of Deepscreening is very high on Indian Railways and due to non-availability of sufficient BCMs, the arrears in deepscreening is accumulating every after year. This aspect was addressed by Member Engineer in different forums and a need has arisen for carrying out Deep screening by an alternative method. The progress of the BCM machines for plain track is around

(1) Chief Track Engineer/S.C.Rly (2) Sr.Divisional Engineer/North/SC Division (3) SSE/PWay/SW/SC

300m per each Block of 3 hours whereas the progress in terms of Turnouts is only 1 Turnout per each Block of 3 hours. So, if the BCM machine is deployed for plain track, more length of the track can be deepscreened rather than 1 turnout which is around 45m in 3hrs. So an alternative method for Deepscreening of turnouts will be more beneficial than that for plain track, hence this method of deepscreening of points and crossings using Road cranes & Excavators has been evolved in South Central Railways in Secunderabad division and deployed in Karimnagar Yard of Peddapalli– Nizamabad section.

This method will be an alternative for carrying out deep screening in yards wherever it is feasible to use road cranes. Further this method is one of the initiatives taken to wipe out deep screening arrears in yards and lead to improvement in maintenance standards of the yards. As yards especially Points and crossings are the week spots for derailments /unusual whose cushion is generally lower than the specified and generally buried in coal and muck.

3.0 Methodology

The detailed procedure for deep screening of Points and crossings by using Road cranes and excavaters is summerised below.

3.1 Pre block activities are summerised in flow chart in fig. 1 below :

Mark the crane slings locations on sleepers. Insert the ropes in the position and keep ready for lifting as soon as the block permitted.

↓

Planning of Traffic blocks in consultation with S&T,OHE and agency for arranging the cranes to be done.

↓

A caution order of 20 kmph to beimposed a day in advance of block for preliminary works such as creating rail gap by rail cutting at SRJ and end of layout, removing the crib ballast upto bottom of the sleeper for full length of the layout.

↓

PWI shall ensure full fittings and replace greased ERCs with new one so that the ERCs shall not drop causing the falling of sleepers while handling the panel

↓

Feasibility study for placement of road cranes near the Point & crossing

↓

A joint survey to be done along with OHE and S &T dept.

↓

Ballast to be collected near the site

↓

Arrangement of Cranes and JCBs in the required position to be ensured.

↓

Existing rail and formation levels to be marked to cross check the post block rail level.

Figure 1.1 Schematic diagram of Pre Block Activities

3.2. Various pre block activities for deep screening of turnout by road cranes are depicted through photos below.

Photo 1.Collection of Ballast near site

Photo 2. Rail cutting & Fish Plating

Photo 3. Opening of Crib and Shoulder Ballast

Photo 4. Stabling Cranes ready near site

3.3 During Block Activities:

Block of 3.00 hrs- Engg/S&T and OHE combined is taken. During Block following activities are performed.

i) OHE adjustments.

ii) Fish plates removed,OHE track bonds removed and simultaneously attach slings to cranes. The slings positionedat sleepers no.**6-7, 15-16** for first crane and sleeper nos.**40-41, 48-49** for second crane for **1** in **8.5** layout. For **1 in 12** layout the slings positioned for first crane at sleeper nos.**7-8, 16-17** for second crane at sleeper nos.**37-38, 46-47** and for third crane at sleeper nos.**68-69,76-77** as shown in figures in annexure I & II.

iii) The entire panel lifted with cranes and kept aside.

Photo 5. Lifting & Keeping the Panel aside

iv) Removal of Caked Ballast with JCBs.

Photo 6. Removing existing Ballast with JCB

Photo 7. Levelled Ballast Bed

v) Proper slope of formation surface to be ensured.

vi) Dumping of ballast collected at the site along with the screened ballast removed from the points to a thickness of 300 mm. Then, the ballast levelled and rolled using JCBs.

Photo 8. Dumping New Ballast with JCB

vii) Compaction of Ballast Bed

viii) Placement of turnout in position

Photo 9. Keeping back FSL Panel in Position

Photo 10. Fish Plating Turnout ends after placing

ix) Release of the slings from the panel and replacing of sleepers which havegone out of square while handling.

x) Correcting of alignment and kutcha packing of the points and ramping out slope as needed.

xi) Removal of cranes away from the points.

xii) Clearing block after ensuring S&T and OHE attentions.

3.4 Post Block Activities : -

1. Provided full ballast profile.
2. All rail joints welded.
3. Ensured full ballast profile and attend to the cess.
4. Relaxed the caution order in stages in ten day to normal speed as envisaged in para 238(g)(ii)of IRPWM.

Photo 11.Post block works such as welding

Photo 12. After Packing and Boxing

4.0 Progress of Deep screening of Turnouts using Roadcranes taken up on SC Railway.

Deep screening of points in Karimnagar, Gangadhara yards was carried out by using Road cranes. The work was successfully completed duly deep screening the full length of points and crossing of 1 in 8.5 & 1 in 12 in a block of 2.5 hours & 3.00 hours respectively thereby improving the cushion from 100mm to 300mm.

In SSE/P.WAY/KRMR section deep screening of 8 nos.

Points and crossings completed successfully by using road cranes and Excavators. The details are in Table 1.

Table 1 : Progress of Deep screening of turnouts by Road cranes

S. no.	Date	Station	Point no.	Angle of crossing	Clean ballast cushion before deep screening	Clean ballast cushion after deep screening
1	18.12.2018	Karimnagar	13	1 in 8.5	100 mm	305 mm
2	11.03.2019	Karimnagar	12A	1 in 8.5	95 mm	295 mm
3	18.03.2019	Karimnagar	18	1 in 8.5	110 mm	295 mm
4	01.04.2019	Karimnagar	11A	1 in 8.5	105 mm	310 mm
5	20.06.2019	Gangadhara	14A	1 in 8.5	90 mm	300 mm
6	22.06.2019	Gangadhara	13A	1 in 8.5	115 mm	305 mm
7	25.06.2019	Gangadhara	11KL	1 in 8.5	105 mm	300 mm
8	27.06.2019	Gangadhara	13B	1 in 12	120 mm	310 mm

5.0 Advantages of Road Cranes Method Over Conventional Methods Of Deepscreening

Deep screening of points & crossing is conventionally done either manually or by BCMs. The difficulties faced by Pway Engineers while deepscreening with conventional methods are discussed below.

5.1 Manual Deepscreening of Track: Is specified in the Para 238 of IRPWM. As per this, the work to be done with a Caution order (CO) of 20 kmph by track labour. During the work, trains are allowed to pass duly providing the wooden blocks underneath the sleepers. As almost the entire track is of PSC sleeper with atleast M+7 sleeper density and 300mm cushion, the manual deep screening is very inconvenient to the labour due to less space between sleepers (especially for turnouts spacing is 550mm) and quantum of work is more compared to non PSC track. Due to heavy traffic density, almost all lines are saturated with trains, plying one after another giving very less working time. Keeping the wooden blocks under the sleepers is mandatory for passing trains in view of safety, thereby lot of time will be wasted in putting back of wooden sleepers leading to less effective working time. As the working hours are only limited to day light hours, very less output is obtained. On an average, 1 turnout of 1in 12 for full length takes approximately 4 days for deep screening provided labour works daily. Quite often, there will be absenteeism of labour due to injuries and strenuous nature of work which leads to extended speed restriction and detention of trains. Being a labour oriented method, its quality totally depends upon the skill of labour. Even though, the cost of deep screening manually for 1 in 8 ½ is Rs 45000/- and 1 in 12 in is Rs.59,000/- (approx.) but the detention costs as detailed in(annexure7) due to 20 kmph speed restriction for more no. of days makes this method uneconomical.

5.2 Deep screening of Turnout using BCM This is the most convenient method for deep screening of turnouts however the availability of Machines are not adequate to cater the needs of the deepscreening of both the plain track and Turnouts. The cost for deepscreening of turnout say for 1 in 12 using the BCM is approximately Rs. 6.0/- lakhs.(Annexure 3). During the BCM blocks of Turnouts, certain obstacles such as S&T & electrical cables, rail pegs, signal foundations buried under ballast are encountered to the cutter bar for which work gets stopped hampering the progress of the work. Further, entire turnout length cannot be deepscreened due to limited length of cutter bar across the track and also infringing dimensions which is totally dependent upon the track centres. Generally sleeper Nos 66 to 84 in 1 in 12 layout and sleepers Nos 48 to 54 in 1 in 8½ are left out during BCM and to be screened manually. Dedicated machine sidings and manpower are essentially required for stabling and maintenance of the machines. The above drawback has necessitated a novel method of Deepscreening.

5.3 Deep screening using Road cranes and excavators can overcome the difficulties mentioned in the above paras 5.1 &5.2.

Safety is ensured in this method as proper block is taken and its duration is same as that BCM block. Quality of work is very goodas the entire ballast bed underneath sleepers is replaced with fresh ballast collected near the site. Separate Sidings are not required for stabling of road cranes and excavators unlike BCMs. Further, movement of BCM machines (path &shunting) also cause detention of trains. The cost of deepscreening of turnouts by this method for 1 in 8 ½ is Rs 3.0 Lakhs and that for 1 in 12 is Rs 4.0 Lakhs (Annexure 5&6). Sometimes expenditure to the tune Rs 50,000/- in addition to the cost mentioned

above is incurred for creating level ground and approach paths for facilitating the placement of the Road cranes near the turnouts. The Cost of deepscreening with this method for 1 in 12 Turnout amounts to Rs 4.5laks which is less than that of BCM (Rs 6.0 Lakhs/ Turnout).In addition to the Operation and maintenance cost of the BCMs, the capital costs of establishing machine sidings along with the charges for Detentions of trains taken into consideration for the cost of deepscreening of Turnouts, then Deepscreening with Road cranes is very Reasonable. As this method involves removal & keeping aside of the entire layout for Deepscreening of ballast, any obstructions like concrete pedestals, rail pegs ,St sleepers etc existing underneath the sleepers can be easily removed by JCBs. Further, there will not be any sleeper left out without deepscreening as in the case of BCMs. Proper slope of formation can be ensured. Hence the above advantages of this method make it a best alternative for deepscreening of Turnouts. Once this method proliferates into the system, then it augments the capacity of Deepscreening activity and helps in reducing the maintenance arrears adding to the safety of track and running trains.

6.0. Limitations of presented method of Deep screening by Road cranes

a. OHE block is essntially required.

b. Block on adjoining Line is essentially required.

c. The Road cranes with Trailor mounted is preferable.

Rainy season working is difficult.

7.0 Conclusions:

Deep screening of points &crossings can be done effectively by this method using Road cranes and excavators. It is one of the best alternative to BCMs and T-28 for deep screening of Points & crossings in terms of effectiveness and economy also. Total deep screening activity except Unimat packing is outsourced. Many obstructions like concrete pedestals, rail pegs, ST sleepers, signal rods etc. are encountered in yards during BCM work and Block time gets affected in removing them whereas in this method these can be easily removed using excavators and no extra block required. The Points locations especially long sleepers no. 66 to 84 in 1 in 12 layout & sleepers no. 48 to 54 in 1 in 8.5 layout are left out during BCM, such locations will not be left over in this method. Proper slope of formation can be ensured before spreading the ballast. Clean ballast can be inserted under the sleepers including rolling there by highest quality can be achieved. This method is best suited for single line sections. However this method adds to capacity of system for carrying out Through Ballast Renewal of Turnouts with quality and safety.

Golden Moment of Matheran Train

A Study of Rail Wheel Contact Stress in Rails

By
N.S. Joshi[1], S.K. Agarwal[2], S.S. Sarawade[1]

Abstract:

The damages taking place on rail section are mostly associated with the contact stresses. These contact stresses mostly depend upon the rail and wheel contact profile. So in order to study the failure mechanism of rails, it is first necessary to determine stresses in the contact region. Hertz's theory is used to calculate the pressure generated at the contact region. This theory also helps to evaluate the size of the contact region. The results obtained by Hertz's theory are validated using ANSYS software. Further this study will be used to study crack propagation on rail surface.
Keywords: Rail-wheel contact, Contact pressure, Hertz's theory, ANSYS.

INTRODUCTION

Interaction of rail wheel is one of the fundamental issues in railway system. This interaction results in phenomena such as wear and noise. Rolling and sliding contact causes wear of rail and wheel profile. Rolling contact fatigue and wear are the important issues associated with rail-wheel contact. The maximum stress value was found to lie along the running direction of wheel because of the effect of rolling contact at rail-wheel interface using FEM [1]. The damage because of the contact stresses is seen to increase with increase in hardness of rail-wheel material [2]. Less contact stresses are developed in IRS-T12 than UIC-60 rail section for same loading and constraint [3]. The effective coefficient of friction at rail-wheel contact increases with increase in axle load for constant speed value [4].

STRESSES IN RAIL

This paper mainly describes about the contact pressure and bending stresses in rail wheel contact. Hertz's theory is used in used in evaluation of contact stresses at rail-wheel interface. The assumptions of this theory are as follows:

- Material of contacting bodies is homogeneous, isotropic and elastic.
- The contact area is much smaller than the dimensions of the contacting bodies (infinite half spaces). This applies for non – conformal contacts (point or line contact).
- The bodies are assumed to be perfectly smooth implying friction less contact.

The principal wheel and radii of curvature are shown in Fig 1:

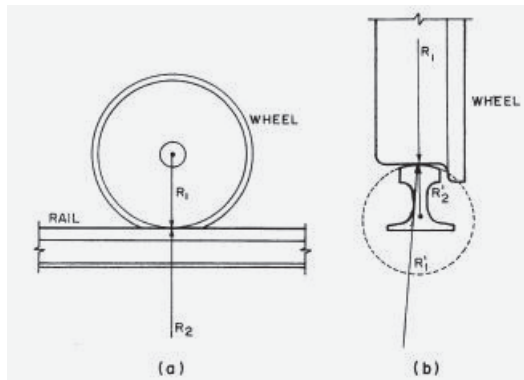


Fig 1: (a) Principal Wheel and (b) Radii of Curvature [5]

Based on these assumptions, Hertz's developed a solution for determination of contact area, pressure distributions and stresses developed in the contact region. According to this theory the shape of the contact region is elliptical. Let R_1 and R_2 be the principal rolling radius of wheel and rail at the point of contact (R2 = infinite for straight track), while R1'and R2' be the principal transverse radius of curvature of the wheel and the rail profile at point of contact. N denotes the axle load acting on each wheel. The following are the formulas of half widths a, b of the elliptical contact in longitudinal and lateral direction [6]:

$$a = m \times [3\pi N (K_1+K_2)/(4K_3)]^{(1/3)} \quad (1)$$

$$b = n \times [3\pi N (K_1+K_2)/(4K_3)]^{(1/3)} \quad (2)$$

Here K_1 and K_2 are constants that depend on the material properties of the two bodies. Whereas K_3 and K_4 are constant that depends on geometric properties of the two bodies (i.e. principle radii of curvature of the surfaces of two bodies at the origin). The coefficients m and n also depend upon the geometric properties of the bodies. Maximum contact pressure is given as:

$$P_o = 3N/2\pi ab \quad (3)$$

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The above theory is applied to rail section of material steel grade 880, to determine pressure at contact region. The following are the input parameters for contact theory mentioned in Table 1:

Table 1: Input Parameters of Rail-Wheel Contact

R1 (mm)	R'2 (mm)	$R_2 = R'_1$ (mm)	ϑ_w = ϑ_R	$E_W = E_R$ (N/mm2)	N(KN)
546	330	∞	0.265	2 x 105	122.625

By using above formulae the stresses are determined in the contact region. The summary of obtained results is given in Table 2:

Table 2: Summary of Results Obtained Using Hertz's Theory

$K_1=K_2$ (m^2/N)	K_3 (/m)	K_4 (/m)	m	n
$1.479x10^{-12}$	2.4309	0.2859	1.1913	0.8527

a (mm)	b (mm)	P_O (N/mm^2)		
8.413	6.02	1158.11		

In order to evaluate stresses in top and bottom fibers of rail arising due to bending moment, consider rail as a simply supported beam of length 1.3m with supports separated at a distance 'l' of 0.6m as shown in Fig 2. The maximum bending moment in rail due to load of 122.625KN is

$$M_{max} = \frac{Nl}{4} = \frac{(122.625*1000*600)}{4} = 9196875\text{Nmm}..(8)$$

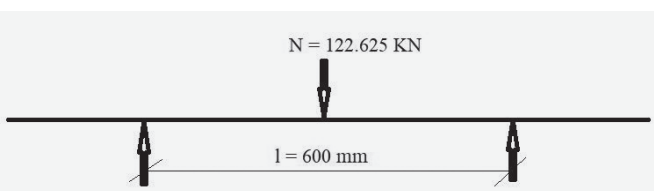

Fig 2: Rail as a Simply Supported Beam

The moment of inertia of rail section about neutral axis is 3038.3x104 mm4 [8]. The stress in top and bottom surface of rail is calculated as

$$\sigma = \frac{M_{max}}{I_{NA}} * y \quad \ldots\ldots(9)$$

where y is distance of surface from neutral axis.

Accordingly the stresses corresponding to y_{top}=77.5mm and y_{bottom}=62.5mm are 23.45 N/mm^2 and 18.91 N/mm^2.

FINITE ELEMENT ANALYSIS

In order to simulate above contact condition, ANSYS software is used to verify the results. The rail section and wheel are modeled using standard profiles [6.7] in SOLIDWORKS software. Firstly the stresses generated in contact region are determined in two dimensional analysis by considering only rail and wheel cross section for fixed rail support. Similarly the stresses in contact region are determined by three dimensional analysis. Stresses generated in top and bottom surface of rail because of the bending moment are calculated in ANSYS by considering rail as a simply supported beam subjected to vertical loading only. Wheel is subjected to a load of 122.625 KN. In two dimensional analysis the pressure at the contact region is determined in ANSYS as shown in Fig 3.

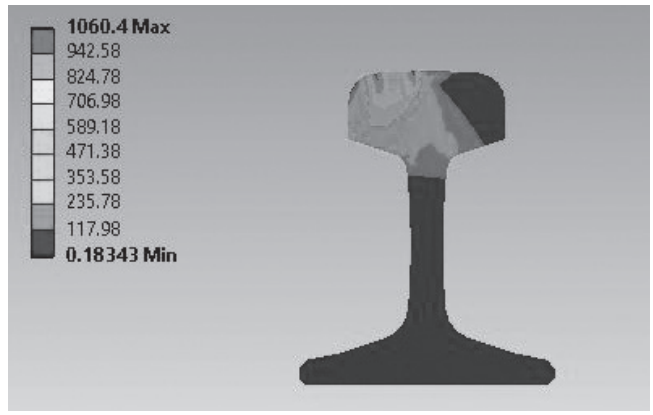

Fig 3: Contact Pressure in Two Dimensional Analysis

In order to determine dimensions of contact region it is necessary to carry out three dimensional analysis. Here a rail section of length 1.3m is considered. The pressure distribution on the rail top is shown in Fig 4.

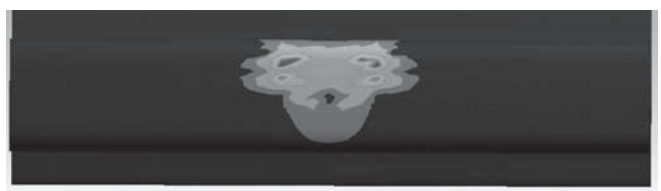

Fig 4: Pressure Distribution on Rail Surface

The pressure variation along the rail cross section is shown in Fig 5.

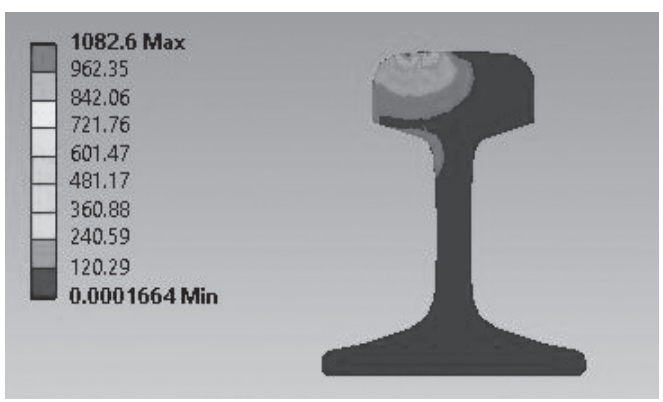

Fig 5: Pressure Distribution along Rail Cross Section

The stresses in top and bottom of rail surfaces are also determined in ANSYS by considering rail as a simply

supported beam with springs having very high stiffness of the order 120x106 N/mm subjected to vertical loading. The stresses in the top and bottom fibers of rail section due to the bending moment determined in ANSYS are 34.51 N/mm^2 and 23.91 N/mm^2. It is seen that the values of stresses in bottom fibers of rail section are almost same in case of theoretical calculations and ANSYS.

The results of the above cases are summarized in Table 3 as follows:

Table 3: Contact Pressure Obtained Using ANSYS and Hertz's theory

	a (m)	b (mm)	Contact Pressure (N/mm^2) (2D)	Contact Pressure (N/mm^2) (3D)
Hertz's Theory	8.413	6.02	1158.11	--
ANSYS	12.3	7.5	1060.4	1082.6

CONCLUSION

In this paper the contact pressure in case of Indian Railway is determined using Hertz's theory and validated using FEA. From the analysis of stresses in rail-wheel contact it can be seen that,

- The values of contact pressure obtained by Hertz's theory and FEA are approximately same. Hence the values obtained using Hertz's theory can be used in further study. Hertz's theory can be used to find stress for vertical load.
- Similarly dimensions of contact region obtained by Hertz's theory and FEA are approximately same.
- The stresses generated in top and bottom fibers of rail are also validated using FEA.
- The study of contact pressure encourage us to further utilized the FEM to study the crack initiation and propagation of rail defects.

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First EMU 3rd February 1925

Replacement of Top Flange of Plate Girder Bridge in Routine Traffic Blocks

By
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Abstract:
Number of bridges on Indian Railways are to the tune of about 1.31 lakhs belonging to various types in lengths and different categories. Most of major bridges are of steel girders (Plate girder or Open Web Girder) and these girders are functioning well despite of having age of more than 100 years. Railways experiences with these girders are very well and time tested. These girders require periodical maintenance like painting & greasing. In corrosive environment, the conventional painting is not proving safeguard to corrosion. Details of problems encountered & methodology in replacement of corroded components of girders are discussed in this paper.

1.0 Introduction

Steel girder bridges forms a vital but vulnerable link in railway system. Damage to a bridge may take a long time for repairs and in that case, financial repercussion will be quite severe on account of high cost of repairs and also interruption to traffic. With the increase in axle loads, the stresses transferred to various components of girder increases considerably. These stresses are also increases when the elastomeric pad of 5/10mm thickness under channel sleepers gets worn out. It is also observed that such elastomeric pads are not sufficient in shock absorption. Although, thickness of such pads have been increased to 25/30mm thickness which is functioning well.

This paper details the performance, experiences and indicates what could be provided/modified in plate girder bridges.

2.0 Study of steel of performance girders

Although plate girders are very sturdy and requires only periodical maintenance like through painting and greasing only. But plate girders located in nearby the major city/town having signal ahead of bridge gets corroded due to toilet dropping where trains stops on the bridge due to red signal.

In addition to this, stiffeners of X-bracing gets cracked due to increased loading and worn-out elastomeric pad under the channel sleepers.

3.0 Defects observed in girders of Br.No: 478 DN(3x12.20m Riveted Plate Girder) near Bilaspur on Howrah- Mumbai Main line:-

These girders were manufactured in 1910 and performance of these girders are very well. But due to stoppage of trains over this bridges and worn out elastomeric pads under channel sleepers, following defects were noticed respectively:

i) Top flange consists of 12mm plate in full length (13.41m) and top flange cover plate consists of 10mm thick in middle 9.80m length were found severely.

ii) Stiffeners connecting X-bracing at intermediate locations found cracked in bottom portion to the tune of 100mm lengths.

4.0 Planning for removal of defects observed:-

The above defects were reported to CBE/SECR and subsequently work for repairs work was sanctioned under revenue at the earliest. Following repairs activities were planned & taken in estimate:-

i) Replacement of top flanges and top flanges cover plates in both flanges in all three girders.

1. AEN/Bhilai/SECR, 2. AEN/Nainpur/SECR,
3. AEN/TM/Mughalsarai/ECR,
4. AEN/HQ/ERly, 5. AEN/Gomo/ECR

ii) Replacement of all cracked stiffeners.

iii) Replacement of corroded top lateral bracing along with gusset plates.

Out of above three activities, replacement of stiffeners and top laterals bracings were comparatively easy. Main hurdle was to replace the top flange and top flange cover plates under the running traffic. For this purpose, Bridge Design Cell was also consulted. Comments of Bridge Design cell was as under:-

i) Before starting of the work, 30 KMPH TSR should be imposed.

ii) Before taking out top flange plates, girders should be supported firmly at mid by suitable means so that any settlement of girder could not take place.

For compliance of this observations, a firm concrete base of 4.00mx4.00mx0.30m height were constructed below the middle portion of the girder. After 28 days, C.C.Cribs staging were erected over the concrete base.The space between bottom flange of girder and top of C.C.Crib staging were jammed tightly by wooden blocks at middle point.

5.0 Arrangement of materials, machinery and Man Power

i) Material required:

a) 12 mm thick mild steel plates of 13.41m x0.405mx6 Nos (conforming to IS-2062 Grade E250 B0 quality). As per market survey, plates of 13.41m length was not available. Maximum 12.50m length was available in the market. Alternatively contractor brought 12mm thick, 13.41m length steel plates from the workshop having the facility of straightening of plates from 12mm thick steel plate coil.

b) 10mm thick M.S plates of 9.80m length x0.405mx6 Nos- these plates were easily available.

c) Rivets of 20mm diameter conforming to IS-1148.

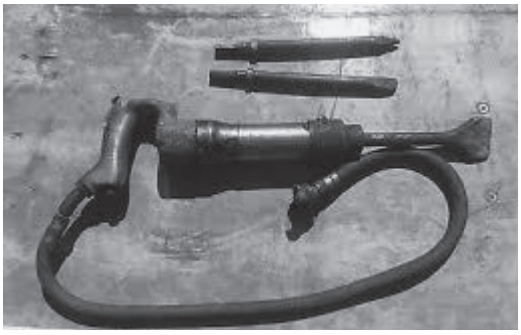
ii) Machinery , T & P required:

a) Compressor for riveting work

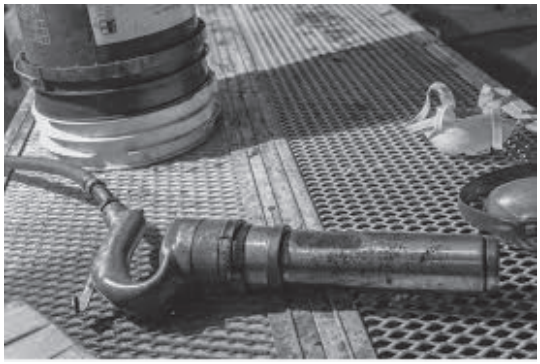
b) Pneumatic Rivet Bursters gun

c) Pneumatic Riveting hammer

d) Other accessories required for rivet work.



Burster

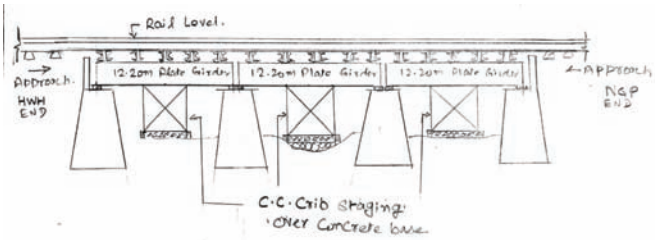


Riverting Hammer

iii) Man power: Team of 20 Nos skilled labours having skill of Riveting works. Now a days, labours having skill of riveting work is rarely available. The team deployed for riveting work were brought from Allahabad. Team of riveter are available in nearby villages of Allahabad.

6.0 Execution of Work:

i) Supporting of girders at centre: as discussed above, girders were supported on C.C.crib staging. In span 1&3, 6 layers & in span 2, 9 layers of C.C.Cribs were erected.



ii) T.S.R of 30 KMPH was imposed before staring the work.

iii) Cutting of rivets burster

a) Cutting of rivets were done by Rivet Burster gun which requires 7.00 Kg/ Sq.Cm of air pressure which is supplied by air compressor. Approx 360 nos. rivets in each top flange were available.

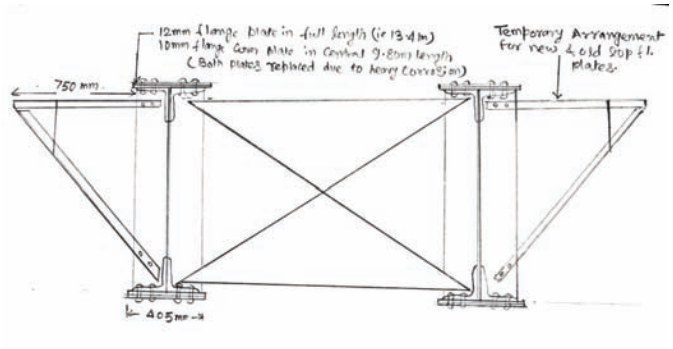
b) Firstly the rivets existing between sleeper gaps were cut & punched out.

c) For cutting of rivets under sleeper seats, sleepers were shifted toward gap. This was done after opening of guard rails temporarily, lifting of tracks with track lifting jacks and loosening of hook bolts and T-head bolts in Clips.

d) Excessive gaps between the sleepers were supported by wooden blocks.

e) After cutting of rivets, service bolts of 20 mm dia were fixed one by one in gap portions only.

f) Special temporary arrangement were erected temporarily for keeping the new plates in undrilled condition and old released plates as shown in the sketch.



g) By keeping additional 2 nos. C.C. Cribs over the C.C.Cribs staging, it becomes base for track lifting jacks keeping free the top flange. Since jacks were deployed centrally, ends portions are not fully free. It was ensured by using track lifting jacks at flanges of adjacent spans/ in approaches. In intermediate location i.e between center to end, wooden blocks were used over lateral bracing to keep free the top flange from track.

h) During traffic block of 1:30 Hrs: only one side (LHS or RHS) flange in one span were tackled during one block. All service bolts were opened quickly. Track were lifted after opening of hook bolts on both side and up to 6 sleepers on adjacent span. In this activity, some problems were faced like non-identification of CSK rivets (Countersunk rivets) during preparatory work. But nos. of such rivets were very less (approx. 6 nos). Hence with the use of Rivet Burster, all such rivets were cut & punched out during the block. After clearing of such hindrances, both plates (12mm & 10mm) were taken out and kept over the supporting arrangement as discussed vide (f)

i) New undrilled plates (painted with one coat of Zinc Chromate red oxide primer) kept over supporting arrangement were inserted over top flange angles. Before this, a primer coat of Zinc Chromate Red oxide conforming to IS-2074 was applied over the top flange angles.

j) After insertion of both plates in desired location, tracks were lowered.

k) During the block, some holes are done from underside in end & central portions with use of pneumatic drilling machine and service bolts provided.

l) After ensuring track parameters, traffic block cancelled.

m) Drilling of holes & providing service bolts continued after block one by one.

n) After completing drilling in gaps between sleepers, riveting done with pneumatic hammer.

o) Same process repeated in other side flange also. After completion of riveting in gap portion, sleepers were again shifted. Holes were drilled and riveting done.

p) After applying of one coat primer, sleepers were shifted to original position.

q) Same process repeated in all three spans.

r) After completion of all three spans, old worn-out elastomeric pads were repaced with new pads.

s) Guard rails were re-fixed and caution order of 30 KMPH were cancelled. All such activities takes 45 days i.e 15 days in each girder as an average.

7.0 Conclusion:

i) All existing plate girders (including all components) should be metallized and painted to enhance the life of girders. As per ACS.No:8 of IRS:B1-2001(Fabrication Specifications), all new plate girders are being metallized.

ii) 25mm thick elastomeric pads should be ensured under steel channel sleepers. Previous rubber pad of 5/10mm thick with M.S Grooved pad is not proved efficient in shock absorption.

Environmental Works Implementation With New Fund Provisions and Waste Management Rules

By
*M.Rama Lekshmi**

Abstract:

Environment and Housekeeping Management (EnHM) Directorate has been set up in Railway Board in 2015 to deal with the issues related to Environment as well as Housekeeping management in Indian Railways. Provision for environment related works in sanctioned works was introduced in 2016 to protect environment and contain the impact on environment due to our transport activities. The main objective of this paper is to study the implementation of environmental works with available funds and fund utilization with a case study of Southern Railway. This paper also discusses few concerns about environmental waste management and some suggestions for implementing practices in the Railways as per existing environmental waste management rules of the country.

1.0 Introduction:

The National Environmental Policy 2006 argues that environmental degradation often leads to poor health outcomes. Various guidelines issued by Railway Board on execution of railway works that includes environment sustainability works through CSR of corporates and PSUs (2016). Railway Board have issued various guidelines on conservation of water-rain water harvesting, artificial recharge of ground, water recycling plants (2017), creating as many water bodies as possible (2017) and recently on avoiding single use plastic (2019). All these guidelines provide great details for proper identification of possible environmental works that can be carried out with these fund provisions in all sanctioned estimates of all plan heads except that for computerization. Permissible work areas for environmental impact mitigation have been briefed for guidance. A lump sum provision of 1 % of total cost of work has been created for carrying out environment related works. Guidelines have been issued by Railway Board for the management of environmental wastes.

2.0 Scheme features:

Works identified by Zonal Railways/PUs/Other Units within jurisdiction with cost every year are approved by DRM. EnHM wing co-ordinates the works in Zonal Railways. In PUs/Other Units GM may nominate a nodal department. EnHM wing prioritizes the works. Such approved works within Zonal Railway shall figure in separate Annexure under the heading "Environmental Related Works under lumpsum provision of identified estimate". These works shall be in the list of approved works (LAW) till completion. Such works shall be processed/ sanctioned with clear mentioning of the provisioning from identified estimate. List of these works in LAW have references of such provisioning along with the expenditure incurred. Such works shall be generally completed in 2 years. Works chargeable to EBR (IF) may be excluded as per the existing guidelines. Railway Board guidelines enlist a list of possible works that can be possibly undertaken with the fund provision.

3.0 Overall Scenario- Southern Railway:

As per railway board guidelines Water efficient fixtures are being installed at stations and other buildings. Water Audit/ Energy Audit are being done regularly. Water Recycling plants and Sewage Treatment Plants are planned for construction.

No major Rain water harvesting works or afforestation have been done so far. No action plan has been submitted for creation of water bodies in railway land in compliance to Railway Board guidelines of 2015. No environment related monitoring devices have been installed. Green building features are yet to be used in building constructions and renovations. Fund utilizations are much below the available provisions and there are not much significant contributions made towards environment.

4.0 Scenario- Trivandrum Division:

EnHM wing in Trivandrum Division is headed by Sr.DME/TVC. A nodal officer is yet to be nominated in Construction Unit/Ernakulam. Therefore, no works have been proposed/executed by Construction Unit/ Ernakulam.

Identification of works appears to be non-satisfactory with regards to the contribution to environment.

Hard paving on unbuilt area in railway colonies and other areas are on the increase. This may in future

* *Dy.CE/CN/G/ERS*

become a cause for increased surface runoff and flooding in some railway colonies during monsoons if not monitored. Also covering buildings at top with steel roofs as a permanent solution to roof leakage has become a trend now. These are some of the practices being done that lack concern towards environmental protection.

5.0 Scale and Scope in Trivandrum Division:

Storm water collection network can be developed in railway colonies. Sewage treatment plants can be set up at stations where municipal sewer cross railway tracks depending on availability of land. Defunct boreholes could be possibly recharged and put into use. Flood mitigation measures can be studied for stations like ERS.

There is a good scope for rain water harvesting in large scale by creating or renovating water bodies in the arid railway land between Nagercoil and Tirunelveli stations. This shall be done for improving the ground water table level. Also there is plenty of railway land available for afforestation between NCJ and TEN stations. There is good scope for solar energy harvesting. Solar panels can be installed in new platform shelters as per Railway Board guidelines.

6.0 Discussion:

6.1 Environmental Contribution by TVC division:

Environmental works of TVC division (Engineering Department) in LAW 2019-20 includes the following works. Installation of Solid waste management plant in TVC for Rs.35,00,000, linking of treated water from Water re-cycling plant to high pressure jet cleaning for Rs.1,02,90,000, installation of Quick Watering System at KTYM for Rs.2,43,39,000, ISO certification for TVC station for Rs.80,000 and Procurement of materials for Bio Lab in TVC for Rs.26,68,000. No other environmental works were proposed in LAWs before 2019. It can be seen that these proposed works don't contribute much to the needed purpose.

6.2 Possible works in TVC-CAPE Doubling:

Doubling of tracks between Thiruvananthapuram and Kanyakumari (86.56 km) is in progress. Works are going on in various stages. Tenders had been awarded and earthwork is in progress at some stretches. Land acquisitions are yet to be completed at some stretches and tender schedules are not prepared for works in these locations.

Creation of new water bodies had not been planned with the new track formation for doubling. This is not a challenging task if planned in advance by first identifying locations for creation of water bodies from where railway earth could be taken for earthwork in formation in filling. The tender schedule for earthwork in formation shall be prepared with items for digging railway earth in addition to the normal practice of widening railway cuttings and other required men, materials, machinery and transportation items.

A new station building has been constructed at NJT station. Green building features were not adopted in this construction. A new station building is proposed at ERL station which can be built using green building concept or design for thermal comfort.

6.3 Fund Utilizations and contribution by TVC division:

Some of the RB estimates sanctioned (since 2016) with this fund provision (Engineering department) are KRPP-CGV section (Doubling)- (Capital)– Rs.1,90,14,00,000, TVC-CAPE section (Doubling)- (Capital)- Rs. 30,00,00,000, AMPA-HAD section (Doubling) – (Capital)- Rs.1,05,91,61,000, TEN-NCJ section- ROB in lieu of LC 82 – (Railway Funds) - Rs.2,34,53,770, SRR-ERS section- LUS in lieu of LC 68 A- Rs.12,34,665, TCR-GUV section - ROB in lieu of LC 82 – (Railway Funds) - Rs.2,14,27,602, ERM (Additional pit line) – Rs.24,15,68,000 and ERM (Modified L Catwalk Arrangements)-Rs.6,91,00,000.

Total fund utilization for works proposed as environmental works since 2016 is Rs. 4,08,77,000. Fund used for reasonable work is Rs.35,00,000. Total fund available from above ongoing projects is 1 % of Rs.3,61,73,45,037 i.e. Rs.3,61,73,450. Funds utilized for permitted works is only 0.09% which is much below the provisions.

There is no remarkable contribution achieved using the available means. Efforts towards large scale afforestation, ground water augmentation and solar energy harvesting are possible if there is proper planning and co-ordination between open line organization and construction unit.

7.0 Recommendations:

The following works contribute towards the living environment and these shall be recommended for listing by Railway Board in the permitted works.

1) Providing noise barrier at locations where residential buildings are located close to tracks to ensure less hazardous environment to the residents.

2) Sound insulation of buildings using features that reduce noise levels significantly that improves quality of life of the residents.

3) Noise pollution mapping shall be done at selected locations (stations) to understand the hazard level to take further measures.

National Building Code guidelines for site planning, green cover, net perviousness factor shall be enforced immediately. Buildings shall be designed for tropical climate for thermal comfort and Sun path analysis shall be performed in order to reduce the requirement of artificial air conditioning and mechanical ventilation. Use of locally available building materials for construction not only reduces the costs of transportation but also suits the local climate.

Bamboo shall be used in the place of steel for common

roofs in buildings. The possibility of using engineered bamboo for platform shelter construction at stations also needs to be studied. Use of bamboo in construction reduces heat emission and greenhouse gas emission.

Environmental related works item shall be included in MCDO annexure. These works shall also be included in SIG inspections. IRPSM module needs to be upgraded. E waste collection shall be targeted. The nature of proposed works shall be verified and it shall be ensured that works not from the permitted list are being done with these funds. There shall be proper planning of these works and proper monitoring of progress. Potential large scale environmental works shall be planned with these funds. These funds shall be fully and properly utilized. The evaluation shall not be made based on cost savings or cost incurred but on work prioritizations and contributions made to protect environment. There must be commitments from field units and these works shall be monitored at higher administrative levels.

8.0 Some suggestions for Environment waste management:

The first part of this paper discussed about implementing environmental protection works that require adequate funds and some possible waste management solutions are discussed below for managing construction and demolition wastes and electronic wastes.

The waste generated from increased construction activities and demolition of railway buildings are normally disposed away from railway land. Normally this is done by the contractors who are engaged in the construction and demolition activities and the Railways are generally not concerned about the disposal of these wastes. As per the Construction and Demolition (C&D) waste management rules, waste generators are responsible for collection and storage of C & D waste within their premises and for depositing C & D waste to collection centers or processing facilities designated and authorized by local body. Collection and reuse of construction debris shall be strictly monitored and proper disposal of C and D wastes shall be monitored through some mechanism as being done for transporting usable materials.

E waste from discarded electronic devices is growing at a high compound annual growth rate of in the country. With computerization and increased computer usage for various functions of the Railways and increased use of communication devices such as mobile phones electronic waste generation by the Railways increases year by year. Every year laptops and computers are being supplied to railway units and officers and as per the existing policy the devices are owned by the Railways till such time the officer deposits its residual value and takes the ownership of the same. The condition shall be changed such that the Railways shall be made responsible for collecting the e waste so generated without transferring the ownership of the waste to the employee. The policy shall be revised accordingly because officers can procure new laptops or computers after the codal life of the old devices purchased and the Railways can also play role in managing generated as per the E waste management rules. E waste generation shall be estimated for every year and e waste collection shall have exclusive target like other scrap collection. E waste collection units shall be created at division offices of Zonal Railways for collecting e waste from Railway supply and from personal purchase by employees. Also extended Producer responsibility obligations of the suppliers of electronic devices shall be made use of effectively managing electronic wastes.

We need to find ways to adopt Construction & Demolition waste management rules and E waste management rules.

9.0 Conclusions:

The case study of implementation of environmental works in Southern Railway with available funds in sanctioned estimates reveals that more emphasize is required for a meaningful outcome. The scenario is similar in many other Zonal Railways also. Lump sum provision of 1 % of total cost of work must be used for significant contribution toward environment. Works can be identified by open line and other units independently or jointly and also in collaboration with state PWDs. If there is a vacant land appropriate for afforestation there must be someone to grow trees. Mechanisms shall be devised for adopting practices of environmental waste management as per existing rules and guidelines. The necessity for doing these works shall be well understood because improving the health of nature is nothing but improving our health and livelihood. Improving ground water level, reducing heat emission, controlling air pollution or noise pollution or water pollution and managing environmental waste may not be our primary function but these are not less than our mandatory jobs. Environmental related works shall be treated as request of Nature and shall be done without waiting for reminders or warnings from nature as severe environment damages will become irreversible changes.

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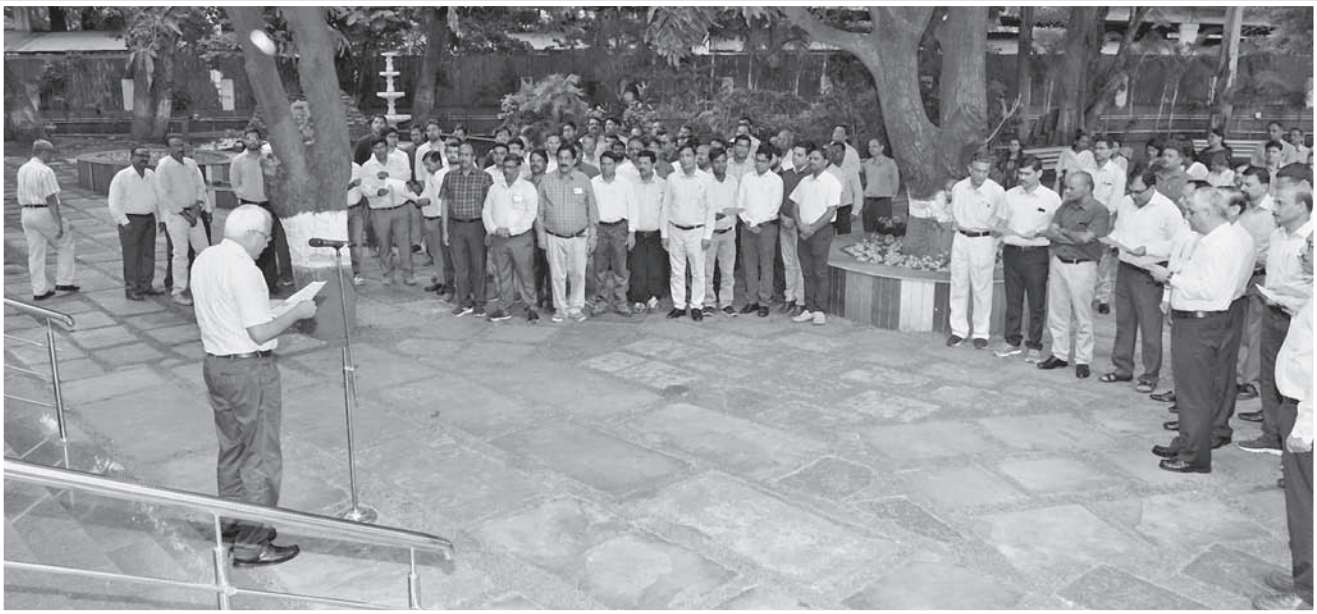


Pledge at IRICEN by Director, IRICEN to all Railway staff, their families and all Safai Karmchari

Modification in Size of Screens and Analysis of Standard Ballast being Screened Out During Deep Screening by BCM Machine

By
Pankaj Soin*, M.K.Gupta#

Abstract:

During Deep screening of the Track by BCM, the useful or the standard ballast is also screened along with the muck and leads to the sheer wastage of the valuable ballast. To find out the actual field condition and the quantum of standard ballast lost during deep screening, a detailed analysis of the Deep screening of the Ballast was done during block working of BCM-372 machine in Rajgarh-Baswa section. The detailed report of the screening is given below:

Preface:

During the deep screening of the track, it is found that the Ballast having size more than 20mm is also getting thrown out of the track along with the muck after deep screening by the waste conveyor of the BCM Machine. To understand the cause of the same first the physical structure of the Screening unit and the Size/Gradation of the Ballast to be used in the Track is to be understand.

The standard specifications of the Ballast are:

a	Retained on 65mm square mesh sieve	5% Max
b	Retained on 40 mm square mesh sieve	40%-60% (For machine crushed)
c	Retained on 20 mm square mesh sieve	Not less than 98% (for machine crushed)

Hence it is clear from the above specification that Ballast having size more than 20mm constitute 98% of the Ballast in the Track and the Ballast with size between 40mm to 65mm constitute 40% to 60% of the Total Ballast in the Track.

Screening Unit

The screening unit of BCM machine consists of three nos. of the vibrating sieves of the following square mesh sizes:

Type of Screen	Deck No.	As per IRTMM	As per Plasser Specifications
Upper screen	Deck No.1	80mm	80mm
Middle Screen	Deck No.2	50mm	50mm
Lower Screen	Deck No.3	36mm	32mm

It is clear from the above that as per the OEM the ballast passing 32mm sieve and retained on 80mm sieve will be screened and disposed out of the track.

Methodology used for Deep screening:

For excavating the ballast, there is endless scrapper chain located between the bogies and running under the track while working. The chain is basically composed of scrapper blade with fingers (chisels), intermediate links and bolts. Chain speed is variable between 2.4 to 4 metre per second.

The excavation chain is guided in two slanted channels and one horizontal channel. The top of the lateral guides are pivoted to the machine frame and hydraulically adjusted.

At the Beginning of work at site, the cutter bar is inserted underneath the sleepers and connected to the lateral guides by quick action locks. Hydraulic hoists are provided for easy handling of the cutter bar. At the end of the work at a particular site, the cutter bar is removed.

The screening unit consists of three vibrating sieves of 80mm, 50mm and 32mm size. The vibrations are provided by hydraulic motor which is operated at 950 rpm.

From underneath the screening unit, the waste drops to the conveyor belt which carries it to hydraulically adjustable belt. The waste can be discharged outside the track by means of the tilting waste conveyor.

Seriousness of the problem:

As per the prescribed Size and gradation of the

**Sr. DEN/W/AII Division*
#Chief Engineer/Track Machines

Ballast; 98% of the Ballast is having size more than or equals to 20mm and out of which, the ballast with size between 20mm to 40mm varies from 33% to 53%. Now since the smallest size of the sieves being used is square mesh of size 32 mm, hence there is a possibility that all the ballast between size 20mm to 32 mm would also screened and disposed out by the screening unit. Hence the New Ballast which is procured as per the prescribed Size and Gradation of the ballast would be disposed out from the Track by the BCM machine if the ballast is put into the track before deep screening.

During various inspections of the Block working of the BCM machine it has been noted and also pointed out by the senior officers that standard size ballast is also coming out along the muck. Hence need of detailed analysis of the problem and the remedial measure to be taken arises.

Factors affecting the Screening of Ballast:

The various factors which are affecting the screening of the ballast are:

i) The rate of vibration of the screens.

ii) The working mode speed of the machine.

iii) Inclination of the Screens.

iv) Quantum of the Ballast available in the Track.

v) Size of the Sieve in the screening unit.

i) The rate of vibration of screens: The Screen unit consists of 03 nos. of the vibrating screens of 80, 50 and 32mm size. The vibrations in the screens is provided by a hydraulic screen motor with part no. 62.05.4000.253 which provided vibrations @ 950rpm. Higher the vibrations more will be the screening of ballast. The vibration frequency of the motor is kept constant and keeping the vibrations constant, the screening will be govern by the other factors.

ii) The working mode speed of the machine: BCM machine shall be capable of cleaning, grading and profiling a maximum 550 cubic meters i.e. more than 2.13cum/m of ballast on plain track in an hour of working with the vibrating frequency of 950rpm of Screen motor. If we increase the speed of machine, the ballast increases on the sieve resulting in the heaping of non-retained ballast over the sieve and disposing it in the form of muck.

iii) Inclination of the Screens: The inclination angle of the screens should be such that maximum standard size ballast should be retained. The inclination of screens is designed by the OEM during machine manufacturing process. However, the inclination of the screens are kept constant, the screening will be governed by the other factors. Keeping the inclination fixed, the screening will be affected by the other factors.

iv) Quantum of the Ballast available in the Track: As it is already stated, that BCM machine shall be capable of cleaning, grading and profiling a 550 cubic meters of ballast on plain track in an hour of working. As the quantum of ballast available on the track increases, the ballast increases on the sieve resulting increase of non-retained ballast and disposing it in the form of muck.

v) Size of the Sieve in the screening unit: The Screen unit consists of 03 sizes of the screen floors of 80, 50 and 32mm size. At Deck 1, 80 mm size of screen floors are installed, its main purpose is to eliminate oversized ballast/boulders. At Deck 2; 50 mm screen floors are installed, its main use is to retain standard size ballast and to reduce unwanted load on smaller size screens. At Deck 3; 32 mm screen floors are installed to retain only standard size ballast and dispose crushed, broken smaller size ballast, sand and other unwanted wastes as muck.

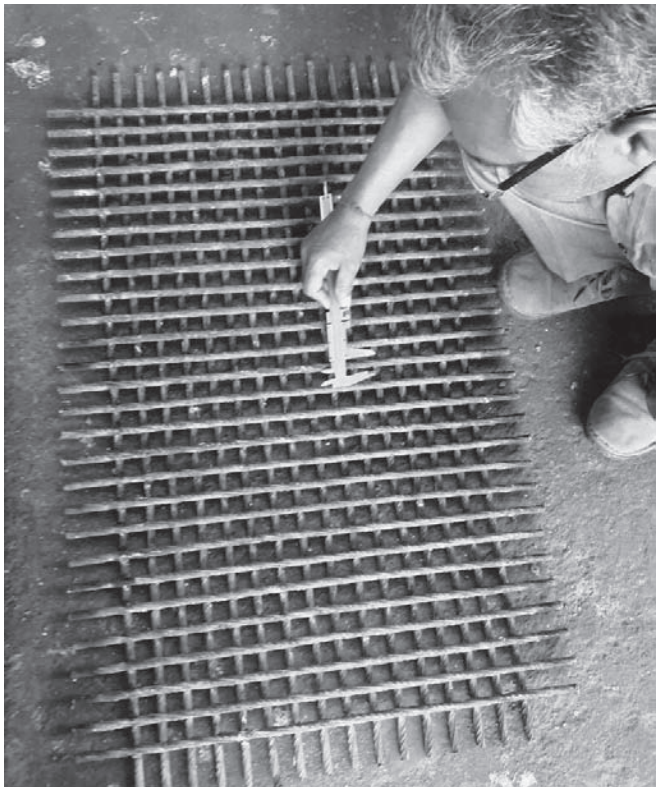
Hence out of all the above factors; Practical analysis of screening of Ballast were carried out by varying the Size of the screen at deck 3 of BCM machine.

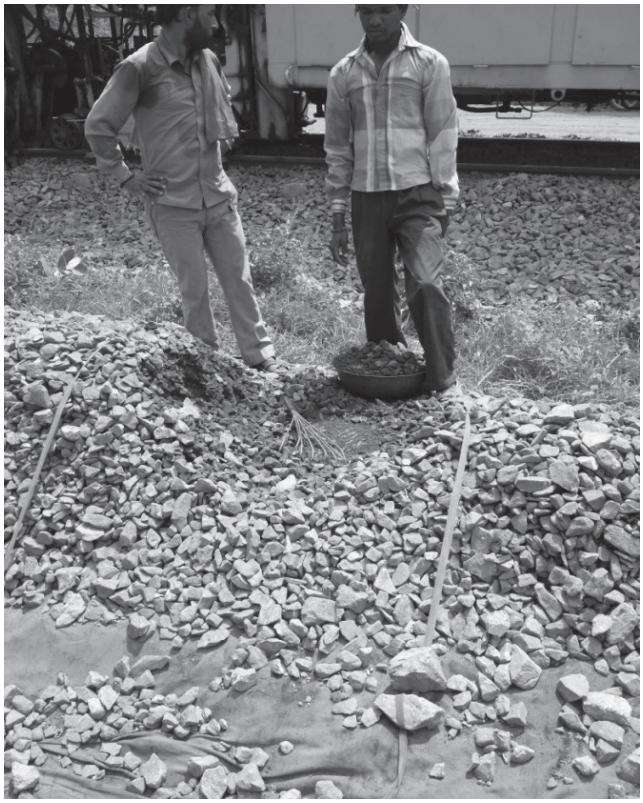
Field Analysis:

Practical Field analysis was carried out by varing the size of the sieves at Deck No. 3 of the BCM machine. Three different trials were carried out by using 32mm, 25mm and 20mm size sieve at Deck No.3. The various activities involved in caring out the field trials are:

a) Fabrications of 25mm and 20mm sieves:

Fabrication of the sieves to be used at Deck no.3 was done at zonal maintenance centre. The sieves are fabricated as per Plasser Part no. 64.09.5556, 64.09.5557, 64.09.5558, 64.09.5567 & 64.09.5566 for 3rd deck using 8mm reinforcement bars. The picture is showing the fabrication of the screens of 20mm at ZMC, Daurai.





b) Collection and screening of the waste muck through 20mm and 40mm sieve:

A big size tripoline was used for collection of the waste muck thrown out of the machine from the waste conveyor system. The waste muck was allowed to fall over the tripoline surface laid over almost leveled ground surface.

A strip of length 1m of muck was selected as a sample and was screened through 20mm sieve and 40mm sieve and percentage retention over the 20mm sieve and 40 mm sieve has been calculated. The sieves used for screening are exactly same as that of the screens prescribed for checking the gradation of ballast for ballast procurement.

The following results have been obtained by using 3 different sieves of sizes 32, 25 and 20mm sieves at deck no.3 of the BC machine:

Case no.01: Deep screening by BCM Machine using 32 mm Sieve at Deck 3:

Date of screening: 28.07.17

Block Section: Rajgarh-Digawara

Division: Jaipur

Location: 112/380- 112/220

Block duration: 12:50 to 14:50 Hours

Length of Sample: 1m

Sample Weight: 481.63 Kg

Retention on 20mm sieve: 446.28 kg = 92.66%

Retention on 40 mm sieve: 80.235 kg = 16.66%

Case no.02: Deep screening by BCM Machine using 25 mm Sieve at Deck 3:

Date of screening: 21.07.17

Block Section: Rajgarh-Digawara

Division: Jaipur

Location: 112/6-7

Block duration: 12:55 to 14:55 Hours

Length of Sample: 1m

Sample Weight: 380.30 Kg

Retention on 20mm sieve: 270.34 kg = 71.09%

Retention on 40 mm sieve: 33.60 kg = 8.83%

Case no.03: Deep screening by BCM Machine using 20 mm Sieve at Deck 3:

Date of screening: 05.09.17

Block Section: Rajgarh-Digawara

Division: Jaipur

Location: 109/01- 108/9

Block duration: 12:50 to 14:50 Hours

Length of Sample: 1m

Sample Weight: 343.05 Kg

Retention on 20mm sieve: 159.05 kg = 46.36%

Retention on 40 mm sieve: 25.35 kg = 7.39%

The above results can be seen in the comparison table for different sieve size vis-à-vis retention over 20 mm sieve and 40 mm sieve.

Deep screening using 32 mm sieve at Deck no.3		**Deep screening using 25 mm sieve at Deck no.3**		**Deep screening using 20 mm sieve at Deck no.3**	
%age Retention over 20mm Sieve	%age Retention over 40mm sieve	%age Retention over 20mm Sieve	%age Retention over 40mm sieve	%age Retention over 20mm Sieve	%age Retention over 40mm sieve
92.66	16.66	**71.09**	8.83	**46.36**	7.39

This can be seen from the table above that with reducing the size of the sieve from 32mm to 20mm at Deck 3 of BCM machine, the retention over the 20mm sieve while screening the screened ballast that thrown out of the track has been reduced from 92.66% to 46.36% which clearly indicates ballast with size more than 20mm is also screened out from the track by BCM machine.

As per the Ballast specifications approved by RDSO; Ballast with size equal to more than 20mm constitutes 98% of the total proportion of the Track ballast and the Track ballast with size between 20mm to 40 mm constitutes 33% to 53% of the total Track Ballast.

From the above trials with different sieves at Deck 3 it is found that the BCM machine is screening out the ballast with size between 20mm to 40mm out of the track which is very essential as per the prescribed specification of the Track ballast.

Economy Evaluation:

- Track ballast per unit metre of the P-way Track is 2.13 cum/m.
- The density of the ballast is calculated at the site = M/V = ((57 +55.5+ 55.23)/3)/0.04 = 1397.75 Kg/cum
- Hence the weight of the ballast in 1m length of the track is 2977.2075 kg.
- The ballast screened out of the track by BCM machine in 1m length of track is (481.3+380.3+343.05)/3 = 401.55 kg
- **Hence the Ballast on an average screened out of the track is 13.48 % of the total ballast available in the track.**

Now from the field trials of the deep screening of ballast by BCM using different size of sieves , the percentage retention over 20mm sieve are given below:

i) **In case of 32 mm sieve at deck no.3 :** The percentage retention over 20 mm sieve is 92.66% of the total screened ballast thrown out of the track i.e. 0.9266 x 0.1348 = 12.50% of the total ballast available in the track.

ii) **In case of 25 mm sieve at deck no.3 :** The percentage retention over 20 mm sieve is 71.09 %

of the total screened ballast thrown out of the track i.e. 0.7109 x 0.1348 = 9.58% of the total ballast available in the track.

iii) **In case of 20 mm sieve at deck no.3 :** The percentage retention over 20 mm sieve is 46.36% of the total screened ballast thrown out of the track i.e. 0.4636 x 0.1348 = 6.25% of the total ballast available in the track.

Hence this can be concluded from the exercise carried above that percentage retention over 20mm sieve is 12.50% when 32mm sieve is used at Deck 3 of BCM machine and 6.25 % when 20mm sieve is used at deck 3. Hence there is clear cut saving of 12.50-6.25 = 6.25% of the total ballast available in the Track.

If 2.13 cum/m ballast is available in the track as per standard profile than 6.25% i.e. 0.133125 Cum is saved in 1m length and 133.125 cum will be saved in 1km length.

Taking the latest accepted rates of the ballast as Rs 625/cum, the saving per km of Deep screening of the track by using 20mm sieve in place of 32 mm at deck 3 of BCM machine will be 625 X 133.125 = Rs. 83203.125 per KM.

NWR has total target of around 240 kms of Deep screening every year, hence total savings annually will be 83203.125 X 240 = 19968750.00 = 2.0 Crores.

CONCLUSION:

From the detailed field trials by using different size of the sieves at deck no. 3 of BCM machine during deep screen of the track it can be concluded that there is huge wastage of the standard size ballast i.e. Ballast with size more than 20mm when 32 mm sieve as prescribed by the OEM of the machine Plasser Austria is used. Ballast with size 20mm to 40 mm is essentially required for the track as per the standard ballast specifications laid down by RDSO. Hence in order to save the standard ballast with size 20mm and above during deep screening, it is concluded that 20mm sieve to be used in place of 32 mm sieve at Deck No. 3 which will lead to the saving of around 6.25% of the total ballast available in the track.

RECOMMENDATIONS:

From the field trials by using different sieves at Deck. No.3 of BCM machines for deep screening, it is recommended that 80, 50 and 20mm sieves should be used in place of 80, 50 and 32mm.

Colaba Station 1920

A Case Study on Removal of Encroachments on Bhusawal Division During 2017-19

By
*R. K. Yadav**

Abstract:

Bhusawal Station building with a single platform was constructed in 1860. Within next one year, Igatpuri-Bhusawal section was opened. By 1866, Bhusawal-Khandwa and in 1867, Bhusawal-Badnera sections were opened with single line working. In 1920, the Bhusawal Division was formed under the ***Great India Peninsula Railway (GIPR)****. Due to its strategic location,* ***once Bhusawal was a major Steam Loco Shed****. Over the years, due to expansion of towns around the Railway stations, encroachments had come up at various stations in and around Railway Colonies as well as in station premises. Situation had become alarming at Bhusawal, Manmad and Burhanpur stations.*

In one of the biggest drive of removal of encroachments on Indian Railways carried out from 15th to 17th Nov. 2018, after facing large number of Dharnas, Rail Rokos and 13 months long legal battle, more than ***3000 houses (hutment/Pucca houses) and approximately 350 shops*** *have been removed from Railway's land at Bhusawal and more than* ***120 acres of precious land have been reclaimed.***

Process for removal of encroachments from Rlys' land was started in June-2017 in a mission mode and a large number of encroachments from Rlys land at various stations have been removed, **as detailed below –**

1) BHUSAWAL –

Sanctioned staff strength of Bhusawal division is 18,000. Out of which, approximately 8,000 employees are headquartered at Bhusawal. There are more than 4,000 staff-quarters available at Bhusawal, which are spread over approximately in 5 square kms. Many of the quarters are single-storied. At Bhusawal, apart from officer's colony, staff colonies were named after number of Bungalows (D-type quarter) e.g. Eight Bungalow colony (having Eight D-type quarters), Fifteen Bungalow colony (having 15 D-type quarters) and Forty Bungalow colony (having 40 D-type quarters). Forty Bungalow colony is the largest one and spread over a large area. There were large number of K-type quarters for Group "D" staff adjacent to Steam Loco Shed and near Forty Block Colony, mostly divided in **three major parts**:-

i)	Aagwali Chawl	Colony for Firemen (Steam Engine).
ii)	Haddiwali Chawl	near boundary of Steam Loco Shed.
iii)	Chandmari Chawl	near Fire range of Army and trenching ground.

Encroachments in Railway Colonies started since very long time. Railway staff, after retirement had made hutments adjacent to their quarters.

There were approximately 415 'K' type and 246 Mitra type quarters which were non-standard. All these quarters were unauthorizedly occupied by the retired railway staff and outsiders. Later-on some anti-social elements had started capturing the land and making hutments in these areas. They had made a large number of hutments and provided them on rent. They were using free electricity and water of the Railways. These anti-social elements due to their muscle-power started selling of railway land and hutments. These areas had become safe zone for criminals. After committing crime in train and outside, they use to take shelter in these areas. Slowly - slowly it became unsafe for railway staff. Several cases of thefts and manhandling have taken place. Railway staff were not feeling safe to traverse through these areas while going for duty and coming back home after carrying out duties in night time.

Few of the encroachments were existing since last 60 – 70 years. The situation had deteriorated to such a level that encroachers were ruling the area and railway staff in colonies had become second-grade citizens.

There are Depots of Electrical, S&T, Engg & Stores department near Haddiwali Chawl. Terror of anti-social elements was such that no materials could be loaded or unloaded by Contractors Labour, without paying levy to the Goons. Railway Supervisors were working in an atmosphere of terror.

These hutments were constructed mainly in the area of 'K' type quarters. Even some internal roads, toilets and drains were constructed through the fund of

** CAO(C), NE Railway*

Municipality by the Corporators in these areas.

Besides, there are 'D' & 'B' type Bungalows at Bhusawal and each of them is having 5 to 6 Outhouses. The persons staying in the Outhouses were not doing any work for occupants of the quarters. However, over the years, they had made hutments around the Outhouses and thus the encroachments had become more than double the number of outhouses. They were using railway electricity and water and involved in all types of illegal activities.

Taking into consideration of the above facts, at Bhusawal, encroachments were removed in different phases as detailed below:-

1.1 South side of Bhusawal Railway station premises: In the circulating area, a large number of encroachments had taken place. In this area, antisocial elements were residing and preparing food etc for unauthorized vending in trains.

For removal of these encroachments from railway land, the process was started from June-2017 by giving individual notices & announcements through PA systems for vacating the railway premises.

In the month of September-2017, **154** number of **encroachments** were removed from South side of Bhusawal Railway Station and approximately **18,000 sqr mtrs Railway Land got vacated with the help of City Police, RPF and GRP.**

(Announcement was done through PA system)

The vacated area has been utilized for expansion of circulating area. South side is the main entrance of Bhusawal Railway Station from city side. However, only 1000 sqr mtrs space was available as circulating area.

(New Circulating Area at East Side)

Now, after removal of the encroachments, the circulating area has become 12,000 sqr mtrs with proper space for parking of two-wheelers, 4-wheelers, auto-rickshaws etc and green patch. An Army Tank has been placed at circulating area. Also 100 ft monumental flag has been provided apart from developing a beautiful garden with water fountains in circulating area.

After successful operation, process was started for removal of encroachments from other parts of Bhusawal and from other stations of the Division.

1.2 North Side Colony of Bhusawal :

Large number of encroachments were there in Aagwali Chawl, Haddiwali Chawl and Chamdmari Chawl in and around K-type quarters. Also large number of unauthorized Shops had come up on RPD Road passing though the Railway colonies.

i) First time, date for removal of encroachments from these areas, was fixed from 24/10/17 to 26/10/2017 and Notices were published in Newspapers on 06/10/17 & 18/10/2017.

(Unauthorised connection of Electricity was removed)

After publishing the above notices, a large number of

Dharnas, Pradarshans and Rail-roko were started by the encroachers and Local Public Representatives. Even delegation of leaders (Hon'ble MPs and Hon'ble MLAs) have given several representations in this regard and thus the drive was postponed by the Railways.

ii) Meanwhile, a special drive was launched from 31/10/2017 to 03/11/2017 for disconnection of Electricity in unauthorized structures in these areas with the help of local Police, RPF and Electrical staff called from other Depots.

After removal of unauthorized electric connection, saving of 7,500 Units of Electricity consumption per day was recorded, thus saving Rs. 16.87 lakh per month and Rs. 2.05 Crore P.A. it has further improved voltage in Rly Colonies.

iii) Before removal of hutments from Chandmari Chawl, Haddiwali Chawl and Aagwali Chawl, a drive was launched for dismantling of all 'K' type and 'J' type encroached quarters from the Railway Staff Colonies at Bhusawal and Manmad.

iv) Again, the drive was fixed for removal of encroachments from Chandmari Chawl, Haddiwali Chawl and Aagwali Chawl from 22/11/17 to 24/11/2017, Notices in the Newspapers on 08/11/2017, but it was postponed on the request of Public Representatives to give some more time.

v) Thereafter, the encroachment removal drives in the above Chawls were fixed from 12/12/17 to 14/12/2017, however, the encroachers filed Writ Petition in the Hon'ble High Court, Aurangabad Bench on 11/12/2017. Hon'ble High Court while admitting the Petition orally advised the Railway Advocate for not taking action till next hearing of the case. Hon'ble High Court on 19/12/2017, dismissed the case in favour of Rlys, advising the Petitioners to approach the appropriate Court. Therefore, this drive was postponed and Caveat was filed by the Railways against the Petitioners on 22/12/2017 with District Court, Bhusawal and drive was postponed to 26/12/2017 to 28/12/2017. But, Police force was not made available by the District Administration.

vi) Thereafter, the drive was fixed from 16/01/2018 to 18/01/2018 and notices were published in the Newspapers on 04/01/2018, 08/01/2018, 10/01/2018 & 12/01/2018 and Civil Administration was asked to provide adequate number of Police Personnel. However, the encroachers approached the Collector, Jalgaon to postpone the encroachment removal drive on the pretext of Xth & XIIth examinations of their wards.

On the advice of District Collector, Survey was made to assess number of students of these areas appearing Board Examinations of Xth and XIIth. During the survey, only 32 hall-tickets were received in such cases. Therefore, the District administration was requested to provide security force for removal of encroachments, other than 32 hutments.

vii) Accordingly, the date for the drive was fixed from 20/02/2018 to 22/02/2018. Meanwhile, in view of the letter from Shri Ramdas Athawale, Hon'ble Minister of State for Social Justice & Empowerment, District administration intervened and the drive was postponed till examination of Xth and XIIth students i.e. till March end.

viii) After the Xth & XIIth examinations, the drive was again planned to be conducted from 18/04/2018 to 20/04/2018. However, Police force was not made available due to the anticipated Law & Order situation.

ix) Meanwhile, the encroachers had filed Civil Suit before the Civil Judge Junior Bench, Bhusawal on 15/01/2018 which was dismissed by the Hon'ble Court on 25/04/2018.

x) The encroachers made Regular Civil Appeal before the District & Sessions Judge Bhusawal on 02/05/2018.

xi) After pursuing the case at Principal CSC(RPF)'s level and IG Nasik, the drive for removal of encroachments was fixed from 15/05/2018 to 17/05/2018. 300 number of Police Personnel, 150 RPF personnel and adequate number of JCBs and Trucks were mobilized and Route March was conducted on 13/05/2018 in the affected area. However, Hon'ble District & Sessions Court ordered on 14/05/2018 to maintain the status-quo till 06/06/2018, which further was extended upto 12/06/2018 and finally the case was dismissed by the Hon'ble Court on 12/06/2018 in favour of the Railways.

xii) Now, the Monsoon had set-in and as per the orders of Govt. of Maharashtra encroachments cannot be removed during Monsoon. Therefore, the Encroachment Removal Drive was postponed till the Monsoon is over.

xiii) Pending dismantling of unauthorized hutments, drive for dismantling of K-type and other sub-standard quarters and out-houses continued. During the period from Sept-2017 to Sept-2018, 385 'K' type quarters, 36 'J' type quarters, 150 MAP quarters, 14 RB-I abandoned quarters and 388 Outhouses were dismantled from different Colonies with the help of RPF and City Police.

xiv) After disconnecting Electric supply & Water supply in this area in Oct & Nov 2017, such drive was repeated on regular intervals. Due to these actions and repeated attempts made for removal of encroachments, approximately 20-30% number of occupants have removed their belongings and vacated the hutments. Also due to the constant pressure for removal of encroachments, most of the encroachers had made up their mind that they had to vacate the premises one day. But due to assurance given by the local leaders, they were having some hopes for retention of the same.

xv) During this period, whole Police set up starting from Police Inspector and Senior Divisional Police Officer at Bhusawal to Superintendent of Police, Jalgaon and IG, Nasik had been changed. Fresh co-ordination with the new set up was initiated and persuaded them

to provide adequate Police force after Dusshera for removal of encroachments. We have changed the strategy. Strategy was changed regarding publication of date of operation in Newspapers. It was now decided to disclose only 2 days in advance.

xvi) Just after the Dusshera festival, removal of encroachments in 15 Bungalow area (where less resistance was anticipated) was planned on 30th October 2018 with the help of State Police and RPF. After successfully removing all 190 balance encroachments from this area, encroachment removal in Chandmari Chawl, Haddiwali Chawl and Aagwali Chawl of 40 Bungalow Colony was planned after Diwali festival.

xvii) PLANNING –

After Dusshera festival, DEN (SW) and ASC (RPF)/ BSL were in touch with Senior Divisional Police Officer/ Bhusawal continuously. Intelligence inputs from RPF & Local Police were being shared. Law & Order situation was assessed and SP/Jalgaon was being informed from time to time. Date of removal of encroachment was fixed on 15th & 16th Nov 2018, but it was not disclosed. Sr.DSC (RPF) BSL & Sr.DEN (Co) BSL & Senior Divisional Police Officer/Bhusawal along with their team met SP/ Jalgaon and worked out a strategy. A meeting in this regard was held in meeting room of Collector/Jalgaon on 13th Nov 2018 which was attended by-

- **DRM, Sr.DSC, ASC, Sr.DE**N (Co), DEN (SW) from Rly.
- SP/Jalgaon, Addl.SP/Jalgaon, Senior Divisional Police Officer, Bhusawal, Police Inspectors of concerned Thanas of Bhusawal.

Following was discussed & decided:-

a) There were large numbers of hutments in the area. Many antisocial elements and history-sheeters were residing in this area. Therefore, stiff resistance was anticipated. As per Intelligence inputs, it was expected that they would use women as shield.

b) Deployment of Forces was done in large numbers so that it would act as deterrent. Therefore, more than 700 Police / RPF Personnel were proposed to be deployed with at least 100 Lady Constables.

c) It was decided that by 13th evening Notice in Newspapers would be given for encroachment removal on 15th & 16th Nov 2018. Also notices under Section -149 of IPC signed by Police Inspector of concerned Thana would be issued by 13th evening.

d) RPD Road going through colony towards ZRTI would be blocked for two days and traffic would be diverted through Varangaon Highway. Notice in this regard would be published in Newspapers of 14th Nov.18.

e) Preventive detention of few antisocial elements would be done by Police.

f) Whole area would be cordoned off since 5:00 am of 15th Nov. till completion of encroachment drive.

g) There are few religious structure (Boudh Vihar, Mosques and Temples) in this area. In earlier, encroachment removal drive, religious structures were also removed. But it was decided that any religious structures would not be touched, so that sentiments of public could not be exploited by antisocial elements.

h) Atleast 10-12 JCBs should be deployed. Each machine will be manned by One Rly Supervisor, one Sub-Inspector (RPF) and one Sub-Inspector (Police).

i) Adequate number of Tractors should be arranged for shifting of household of needy ones.

j) Atleast two Ambulance and two Fire Brigades should be arranged. Railway Hospital staff should be ready to take care of any injured person in case of any eventualities.

k) All the Personnel involved in drive would be instructed to keep their cool and restrain themselves from any provocation.

l) It was decided that no Lathi-charge etc., would be done.

m) Videography by Drone has to be done for complete operation.

xviii) EXECUTION -

On 13th evening, a Route march was conducted in the area by Police & RPF. A notification was issued in Newspapers regarding encroachment removal drive planned on 15th & 16th Nov.2018 and about closure of roads and diversion of traffic during this period.

Notices under section 149 of IPC were issued to the encroachers that they will be responsible for any Law & Order situation during encroachment removal drive, if they do not vacate the premises immediately.

(Addressed by SP, Jalgaon & Sr. DSC [RPF])

On 14th evening all Police Personnel, RPF Personnel, workmen assembled in RPF Parade Ground. All machineries were also brought there along with the operators. Briefing was done by SP, Jalgaon and Sr. DSC (RPF) about Do's and Don'ts as decided on 13th in the meeting with Collector.

(The area was cordoned off by Baracades)

Also in the evening of 14th November-2018, Route-march was conducted in the area by Superintendent of Police, Jalgaon himself along with other Police Officers, full Police Force, RPF Personnel and Railway Officials. Encroachment drive was planned from 06:00 hrs in the morning of 15th Nov-2018. After the Route-march on 14th Nov, most of the encroachers had started vacating the premises whole night and by the morning of 15th Nov-2018, more than 50% of the structures had been vacated. At 05:00 hrs in the morning of 15th Nov-2018 whole area was cordoned off. Nobody was allowed to enter the area. Only exist from the area was permitted.

For this operation, total 460 State Police Personnel (including 50 Lady Constables) and 300 RPF Personnel (including 48 Lady Constables) were deployed. SP/ Jalgaon was personally monitoring the operation and Addl, SP was available throughout the operation at Site. From Rly side, ADRM, Sr.DEN (Co), DEN (SW), Sr.DSC (RPF) and ASC (RPF) were available at spot.

14 JCBs, 2 Poclain and 20 tractors worked at the site. Fire Brigade and an Ambulance with Doctor were also available to handle the emergent situation. The drive started from 06:00 hrs in the morning till 18:00 hrs in the evening.

Encroachment drive was continued from 15/11/2018 to 16/11/2018. This drive was further extended till 17/11/2018 since the encroachments were more than the expected.

Before removal of Encroachment at Aagwali Chawl, Bhusawal (The space visible between the encroachments is of K-type quarters, which were dismantled few months back)

(After removal of Encroachment at Aagwali Chawl, Bhusawal)

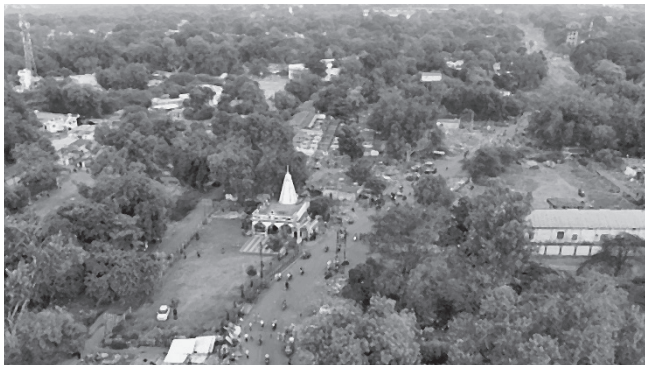

(Before removal of Encroachments at Haddiwali Chawl, Bhusawal)


(After removal of Encroachments at Haddiwali Chawl, Bhusawal)


(Before removal of Encroachments at Chandmari Chawl, Bhusawal)


(After removal of Encroachments at Chandmari Chawl, Bhusawal)

(Before removal of unauthorised Shops at Chandmari Chawl & RPD/POH Workshop Road, BSL)



(After removal of unauthorised Shops at Chandmari Chawl & RPD/POH Workshop Road, BSL)

A great deal of success has been achieved during this drive, in which more than 3000 hutments/ pucca structures and 350 shops have been removed, thus vacating 120 acres railway land from the clutches of encroachers. There was an illegal R.O. Water Plant being operated in this area which has also been dismantled.

During execution of complete drive, all the belongings of the encroachers have been removed by themselves and, if required by them, Railway Gangmen and other staff were available to help them. Not a single belongings were removed by force. For transportation, 20 numbers of Tractors were available. A dedicated group was formed for serving of food at fixed intervals to all Railway Officials, Police Officials and even encroachers, who needed them.

This has been the biggest ever encroachment Removal Drive in Maharashtra, as stated by SP/Jalgaon. Due to this, not only the precise Railway land has been vacated but also the Railway employees residing in the colonies and the people in the town heaved a sigh of relief since the anti-social activities running from the encroached areas have been eradicated. Apart from huge saving in Electricity, Water and maintenance activities, confidence amongst the staff has been strengthened and their moral has been boosted.

1.3 Officer's Colony, Tapti Club Road:

There are 95 officers' quarters at Bhusawal. Out of which, 70 quarters are at one place on Tapti Club Road. Colony was porous and boundary wall was broken at several places. There were many entry & exit to the colony. Out houses were there at three locations. With passage of time, large number of hutments came up near out houses as extension to them. Most of the persons residing in outhouses were not doing any household work for Officers Bungalow. They were involved in petty crimes and doing their own business. They were having free Electricity and Water and also threatening officers, if they are asked for any work.

People from City used to do morning and evening walk in Officers colony. They used to do exercise in front of the Gates of Bungalows. Only chain-link fencing was provided around the quarters. There was no privacy to residents. Colony roads were being used for learning of driving for two wheelers & four wheelers whole day. During Sept'17, when an Officer was away on leave, his house was burgled and valuables were taken away. Also while walking on colony road in evening, chain snatching incident took place with wife of one of the officers. Due to this situation, Officers living in colony were not feeling safe.

Following action was taken:-

i) Broken boundary wall was repaired. Height of boundary wall adjacent to D.S. High School (Nagar Palika) ground was raised. All entry points except near Tapti Club were closed by constructing RCC wall.

ii) All the outhouses and encroachments around them were removed with the help of RPF.

(Fencing with AC Sheets with Green colour provided to the quarters)

(Gate along with Security provided at Officers' Colony)

iii) Around the quarters, along with chain link fencing, released AC sheets after cutting to a particular height, have been provided and painted with green colour to have privacy and ensure good aesthetic.

iv) Entry / Exit allowed through only one gate near Tapti Club. Proper gate has been constructed.

v) Round the clock security and proper gate has been provided at the entrance.

vi) Entry of morning / evening walkers restricted. Timing was fixed (morning 5:00 hours to 8:00 hours & evening 18:00 hours to 20:00 hours). Identity Card has been issued to walkers after verifying their Aadhar Card. Initially, there was reluctance from Public but now it has been streamlined. Do's and Don'ts have been issued to morning walkers.

Now the residents of Officer's colony are feeling safe in the colony.

1.4 Central Zone Staff Colony at Filter House Road :

There are 17 numbers of Officers' quarters and 86 numbers of Senior Supervisors' Quarters. Through this Colony, one road named Tapi Road was passing through and going to Tapi River along the Filter House. Municipal Corporation has included this road in Development Plan without consent of Railway. Towards Tapi River many private buildings have come up. Also there are many slums. Slum dwellers through this road used to come in colony to roam around the quarters. There are 6-7 entry/ exit points to this colony. 91 numbers of outhouses were also there in which all type of illegal activities were taking places. Thefts were taking places in quarters even if it was unmanned for 1 to 2 Hrs. Therefore it was proposed to close the entry of Tapi Road towards River side.

Lot of resistance came from slum dwellers and occupants of private colony. Even delegation led by Hon'ble MPs came to DRM office and requested for not closing the entry. It was apprised to them that it was indeed required for safety of colony. Then they filed petition in Session Court. Matter went on in court for 3-4 months. Finally Court was convinced for closure of entry towards river side.

On suggestion of Hon'ble court, a passage was given at the boundary of colony and entry was closed. Other entry and exit were also closed. All the outhouses were dismantled. Only one entry / exit has been left for the colony, where round the clock security has been provided.

Now the occupants of this colony are feeling themselves safe.

1.5 Eight Bunglow Staff Colony:

In this colony there are 43 numbers of quarters for senior supervisors. 45 numbers of out- houses were also there. One road passing through this colony towards city side through which, anti-social elements used to come during night and take shelter in an around out houses. It became difficult for ladies to walk in colony road alone even during day time. In spite of stiff resistance of few persons from city, entry of road from city side was closed. All out-houses have been dismantled. Additional entry points were closed. Only one entry /exit point has been left after completing fencing work. A security guard has been provided during night time through contribution made by the occupants of colony.

Now occupants of this colony are feeling themselves safe.

1.6 Fifteen Bungalow Staff Colony:

In this colony, there are 748 numbers of quarters for Group C & D staff. There were 75 number of out-houses and 154 numbers of unserviceable quarters which were mostly occupied by encroachers. In addition, more than 150 hutments were existing in this colony. Unserviceable quarters and out houses were dismantled during last 4-5 months with the help of RPF and Local Police.

For removal of hutments encroachments, Removal Drive was conducted on 30.10.2018 with the help of State Police & RPF. Total 138 Police Personnel (including 26 Lady Constables) and 90 RPF Personnel (including 24 Lady Constables) were deployed. In addition, adequate manpower, 4 JCB, Fire Brigade, Ambulance were deployed. Route -march was done by Senior Divisional

Police Officer/Bhusawal along with full force on 29th evening of Oct.2018. By 30th morning, more than 50 numbers of encroachers had vacated their hutments. Drive started from 06:00 hrs morning and continued till 17:00 hrs. Total 190 encroachments removed.

(Before removal of Encroachment at 15-Bunglow, BSL)

Work of repair and construction of boundary wall and closure of entry/exit point in the area of 15 Bungalow Colony and having 430 staff quarter, is in progress. Only one entry/exit gate has been proposed for this colony. Also round the clock security proposed at entrance gate.

(After removal of Encroachment boundary wall constructed at 15-Bunglow, BSL)

Advantages to Railways after removal of Encroachment removal :-

(1) Saving in Railway Resources :

(i) More than 150 Acres of valuable land has been re-claimed. This land can be utilized for setting up of POH Workshop for LHB Coaches.

(ii) Saving of 12000 Units of Electricity per day resulting in saving of Rs.72,000/- per day i.e. saving of Rs.2.63 Cores Per Annum.

(iii) Saving of 30 to 40% towards water consumption.

(2) Curtailment in anti-social activities :

(i) Cases of theft and assault on Railway employees and their families shall definitely be stopped. This will certainly boost the morale and confidence of the staff residing in railway colonies.

(ii) Nuisance caused by drunkards especially in the close proximity of railway school has been reduced to large extent.

(3) Health and Sanitation :

(i) It has improved the cleanliness and hygiene

of railway premises due to drastic reduction in waste products.

(ii) Smooth movement of traffic due to removal of unauthorized shops on either side of the RPD road.

(iii) Massive reduction in sewerage maintenance.

(4) Other Advantages :

(i) System reliability improved due to curtailment in tripping/fluctuation of power supply.

(ii) Substantial reduction towards efforts on expenditure incurred in garbage collection/ disposal.

(iii) 60 numbers of Railway quarters have been allotted to the employees immediately after the removal of encroachments, which resulted in saving to Railways in terms of House Rent Allowance and safeguarding of Railway quarters.

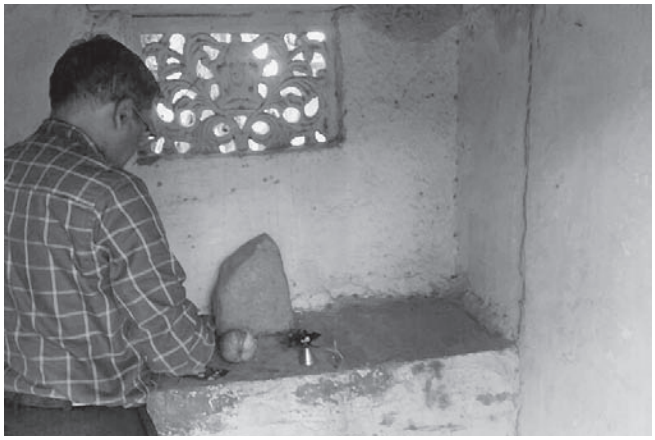
2. MANMAD-

2.1 Manmad is also one of the important stations of Bhusawal Division. There are 1970 quarters at Manmad. Out of which, there were 184 'K' type unserviceable quarters and 133 Outhouses and the situation of encroachment in and around these areas was similar to Bhusawal Station. These quarters and Outhouses were occupied by outsiders and antisocial elements and a large number of hutments i.e. 487 Nos. (76 hutments & 32 shops on open land + 184 between unserviceable quarters + 133 in & around Outhouses) had come up in and around the area. They were utilizing free Railway Water and Electricity. There is already scarcity of water at Manmad, i.e. in Railway Colonies the water-supply was available for once in a week and once in 15-20 days in city.

In the month of November-2017, a Special Drive was conducted with the help of local Police and RPF for disconnection of Electric connections in the unauthorized structures and removal of encroachments. All encroachments including out-houses and unserviceable quarters were removed in a month long drive. After removal of unauthorized Electric connection & encroachment, saving of 1,100 Units of Electricity consumption per day has been recorded, thus saving Rs. 21.86 lakh P.A. and has improved voltage in colonies.

(After removal of Encroachment from Portal Chawl, boundary wall constructed at Manmad)

2.2 At Manmad Station premises also there were large number of pucca encroachments adjacent to P/F No. 1. The area was being used for various illegal activities including unauthorized vending at station and in trains by the anti-social elements. With the help of RPF City Police, 83 encroachments were removed during the two-day Drive conducted from 08/03/2018 to 09/03/2018 and 12 encroachments were removed on the drive conducted on 23/06/2018.



(Before removal of Encroachment at station premises, Manmad)

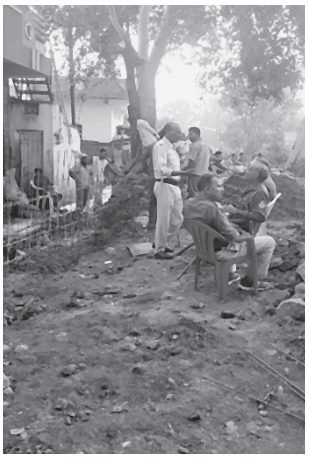
RCC boundary walls have been constructed along the Platform and, now Manmad station has become an encroachment-free Railway Station of the Division from 23/06/2018.

(After removal of Encroachment boundary wall constructed at Manmad)

3. BURHANPUR-

3.1 Burhanpur station is another important station of the Division, which has also been planned to be developed as Model Station. However, there were encroachments in station premises as well as on Municipal Corporation land in front of the station building.

3.2 Along Up platform, an infamous anti-social element had encroached the Rly. Land since last more than 30 yrs and using as Horse-Stable and made 07 hutments. While passing of Up trains, bad smell was being felt in train and it had become identity of Burhanpur Station while passage of trains. During the drive conducted on 14/12/2017, all the 7 hutments and 01 horse-stable which were existing in station premises have been removed and 2000 sqm Railway Land has been vacated with the help of RPF and City Police.



(Before removal of Encroachment at Burhanpur)

3.3 Joint survey was conducted with District Collector and SP Burhanpur and District administration and all the unauthorized stalls/ encroachments/ hotels/ gumtis etc., existing on the land of Municipal Corporation in front of station building got removed on 14.12.2017 for developing circulating area in front of the station.

After removal of the encroachments, RCC boundary wall have been constructed and proper circulating area, parking & green patch being developed in this area.

(After removal of Encroachment boundary wall constructed at Burhanpur)

4 DHULE -

Two drives were conducted at Dhule for removal of encroachments. On 26/10/2017, 50 encroachments have been removed from the railway premises.

Another drive was conducted on 03/10/2018 at Dhule, for which 13 City Police (including 2 Lady Constables), 12 Personnel of Rapid Action Force and 22 RPF Personnel were deployed. The drive was started from 08:00 hrs in the morning till 17:30 hrs of the day and 57 encroachments (50 Houses and 7 temples) have been removed.

By removal of encroachments at Dhule during both the drives, 20,750 sqm Railway Land has been vacated.

(Before removal of Encroachment at Dhule)

(After removal of Encroachment at Dhule)

5 CHALISGAON –

On 20/10/2018, a drive was conducted at Chalisgaon, for which 14 City Police (including 2 Lady Constables), 4 GRP Personnel and 28 RPF Personnel were deployed. The drive was started from 08:00 hrs in the morning till 17:00 hrs of the day and 30 Houses have been removed from the Railway Land, vacating 900 sqm land. RCC Boundary wall is being constructed along Rly boundary in Station area.

(Before removal of Encroachment at Chalisgaon)

RCC boundary wall have been constructed after removal of encroachment.

(After removal of Encroachment boundary wall constructed at Chalisgaon)

6 Other Stations -

Besides above, drives for encroachment removal at other stations on the Division have been conducted with the help of RPF and City POLICE during the year 2018 and a lot of encroachments have been removed from

the Railway land, as summarized below –

SN	Station	Drives conducted	No. of encroachments removed	Details
i)	Khandwa	Feb/Mar-2018	20	Outhouses surrounded with hutments.
ii)	Shegaon	20 & 21 June-2018	25	Unauthorized structures.
iv)	Chandani	June-2018	17	Temporary as well as Permanent hutments.
v)	Raver	Sept-2018	04	Hutments.
vi)	New Amravati-Walgaon section (Km 670)	Sept-2018	08	Hutments
TOTAL:			**74**	

Removal of Encroachments from Railway Colonies and Station premises was an arduous task because of intervention of local representatives and legal complications. However, with the full support and guidance of General Manager/ Central Railway, proper planning and coordination with State Administration and deployment of adequate security force all the encroachments were removed peacefully without any untoward incidence.

Summary of the No. of encroachments removed and railway land got vacated at all the above mentioned station, is as under.

Sr. No.	Name of Station		Nos. of Unauthorized Structures removed	Nos. of Rly Quarters removed	Nos. of Outhouses removed	Total
1.	Bhusawal	No.	3698	652	386	**4736**
		Area (m2)	564325	110358		**674683***
2.	Dhule	No.	107	-	-	**107**
		Area (m2)	20750	-		**20750**
3.	Manmad	No.	203	184	133	**520**
		Area (m2)	3200	8100		**11300**
4.	Burhanpur	No.	08	-	-	**08**
		Area (m2)	2000	-		**2000**
5.	Chandani	No.	17	-	-	**17**
		Area (m2)	500			**500**
6.	Raver	No.	04	-	-	**04**
		Area (m2)	80	-		**80**
7.	Khandwa	No.	-	-	20	**20**
		Area (m2)	-	350		**350**
8.	Shegaon	No.	25	-	-	**25**
		Area (m2)	450	-		**450**
9.	New-Amravati – Walgaon section	No.	08	-	-	**08**
		Area (m2)	1750	-		**1750**
10.	Chalisgaon	No.	30	-	-	**30**
		Area (m2)	900	-		**900**
	Total	No.	4100	836	539	**5475**
		Area (m2)	593955	118808		**712763**
		Area (Acre)	146.77	29.35		**176.12**

*(Includes 35 Acre land of 15 Blocks + 120 Acre land of Chandmari, Haddiwali & Aagwali Chawl + area of other land vacated at Bhusawal).

Literature Digest

Tuning the Design of Standard Pandrol Fastclip Baseplates to Provide Solutions to Application Requirements

Pandrol has been working on the design of indirect resilient baseplates for non-ballasted track since the 1980s. In this article, it is shown that while economies of scale can be achieved by adopting standardised baseplate designs, the capability also exists of modifying these designs where needed using low cost bespoke adaptions. Examples are provided of how key parameters can be modified by simple baseplate configuration changes.

Ref: Rail Engineering International, Edition 2019 No.4, Vol.48, Page1

Mechanised Maintenance of Ballasted Track in Tunnels: Experience Gained and Latest Methods and Technologies

Track maintenance in tunnels poses various challenges, such as restricted space, emissions of dust, noise, exhaust gas and heat, insufficient ventilation, which affect machine use and pose a health and safety risk for staff. In this article, a number of methods and technologies are presented that enhance machine use and protect the health and safety of staff working in tunnel.

Ref: Rail Engineering International, Edition 2019 No.4, Vol.48, Page1

Influence of Damage in Steel Rebars with Different Yield Strengths and Compressive Strength of Concrete on Longevity and Ductility of RC Beams under Fatigue Loading

Influence of depth of induced damage in steel reinforcement bars with different yield strenths and compressive strength of concrete on longevity and ductility of RC beams under fatigue loading is reported. RC beams fabricated with four concretes of compressive strengths of 25, 35, 45 and 55 Mpa combined with three types of steel reinforcement with yield strengths of 250, 415 and 500 were studied. The reinforcement bars were damaged with varying crack depths of 5.0, 5.5, 6.0 and 8.0 mm. The modes of failure and life of RC beams under fatigue loading established in terms of number of cycles (N) vs. mid-span deflection; load vs. mid-span deflection; normal strain vs. number of cycles; stiffness vs. number of cycles and crack lengths vs. number of cycles have been discussed. The magnitude of induced damage in rebars significantly influences the load carrying capacity and life of RC beams under fatigue loading, leading to conservative prediction of fatigue life. The fatigue life of RC beams with induced damage in RC beams with low yield strength steel reinforcement is greated than that of the High Yield Strength Deformed bars (HYSD). Further, the fatigue performance of RC beams decreases with increase in the strength of concrete. Hence, the longevity and ductility of RC beams with low strength concrete and low yield strength reinforcement has been observed to be significantly improved.

By: G. Appa Rao & R. Amaravel

Ref: Journal of Structural Engg, Apr-May 2019, Vol 46 Page 39-59

High-Rise Concrete Shear Walls Subject to Service Loads

The article provides a method for determining effective moment of inertia Ie for calculation of in-plane wall deflections using unfactored load. The method results in a map of the cracked concrete zones, and it allows calculation of Ie values that vary with the extent of cracking. The method provides a smooth transition between cracked and uncracked section properties, and it is suitable for manual calculations as well as computer models.

By: Neil Wexler and Hoonhee Jeoung

Ref: Concrete International, Volume: 41, Issue: 12 Page 37

Seismic Fragility of Railway Bridge Classes: Methods, Models, and Comparison with the State of the Art

This study proposes an approach for developing seismic fragility models based on elastic net regularized logistic regression and applies it to two railway bridge classes typical to the central and southeastern United States (CSUS). Railway bridge class fragilities are not available in the literature despite recorded evidence of earthquake damage to railway bridges. The introduction of elastic net regularization helps in selecting the best set of predictor variables for fragility modeling even if they are mutually correlated.

The proposed fragility models are compared to their corresponding highway bridge counterparts, given that current practice in regional risk assessment recommends adopting these as proxies for railway bridge fragility. The analysis reveals that multispan simply supported steel girder railway bridges, the most common bridge class, show lower fragility than their corresponding highway bridge counterparts. However, multispan simply supported steel through plate girder railway bridges, the other common bridge class, show comparatively higher seismic fragility. The proposed fragility models serve as key inputs in a broader framework of quantifying seismic resilience of railway networks, as well as providing a practical baseline for seismic loss assessment and retrofit prioritization.

By: Sushreyo Misra and Jamie Ellen Padgett

Ref: ASCE : Bridge Engineering, Dec 2019

Effect of Axial Clearance on Rolling Element Load of Double Row Tapered Roller Bearings

An external load applied to a roller bearing is distributed among the rolling elements. This distribution of the rolling element load changes according to the axial clearance of the bearing, and will affect the rolling contact fatigue life of the bearing. In this study, the rolling element load was measured using an optical fiber sensor that was inserted into one of the rollers in the double row tapered roller bearing to be measured, and the effect of the axial clearance on the rolling element load was investigated. As a result, it was clarified that the load distribution factor decreases as axial clearance increases.

By: Ken Takahashi, Daisuke Suzuki amd Takafumi Nagatomo

Ref: RTRI, Aug 2019

Shear Strength of Top Slab of Reinforced Concrete Box Culverts

An increase in the fill height of buried box culverts leads to an increase in the thickness of the slab and wall, as well as in the number or size of longitudinal slab reinforcements required to resist flexure. This geometrical configuration imposes a shear behavioral mode. This study focuses on determining the shear strength of reinforced concrete (RC) box culverts with uniformly distributed load at the top slab. A framework, consisting of several subframes, was designed to convert the single displacement applied at the top of the framework to the equivalent uniformly distributed forces at the top slab of the culvert, allowing a displacement control analysis algorithm to be performed. To validate the loading mechanism, using the proposed framework, the load was applied on the top of an RC beam in the laboratory, and numerical studies were conducted. After validation, two sizes of RC box culverts were experimentally and numerically investigated. The results from the experimental program and verified numerical models differed from ACI 318-14 formulation for the shear strength of top slabs of RC box culverts.

By: Masoud Ghahremannejad, AliAbolmaali and Maziar Mahdavi

Ref: ACI Structural Journal, Nov 2019

Retrofitting of Bridge Columns using UHPC

The National Bridge Inventory reports indicate that a noticeable portion of the United States bridge infrastructure is drastically approaching the end of its intended design life, mainly due to environmental effects such as corrosion. This necessitates developing new techniques and materials for the rehabilitation of these deficient structures in a timely manner. To address this issue, a repair method has been developed at Florida International University (FIU) using ultrahigh-performance concrete (UHPC). This paper investigates the performance of the proposed retrofit method through experimental studies. A total of 11 1/4-scale columns with equal height-to-diameter ratios (H/D=5) were cast and intentionally damaged to simulate a deficient column. Three columns with different transverse reinforcement ratios were considered as the baseline, seven of the columns were repaired using UHPC, and one was repaired with normal strength concrete (NSC) to compare. The retrofitted columns were subjected to combined constant vertical axial and cyclic lateral loads. The obtained experimental results revealed that the UHPC shell increased the strength of the damaged elements without increasing their size.

By: Mahsa Farzad, Mohamadreza Shafieifar and Atorod Azizinamini

Ref: ASCE : Bridge Engineering, Dec 2019

Self-Compacting Concrete – How Just One Admixture Can Get A Project on the Right Track

Self compacting concrete (SCC) is an innovative concrete that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement. The hardened concrete is dense,

uniform and has the same engineering properties and durability as traditional vibrated concrete.

SCC has higher fines content than conventional concrete due to higher binder content and a different combined aggregate grading curve. These adjustments, combined with specially adapted superplasticisers, produce unique fluidity and inherent compactability.

A viable alternative

A combination of Sika visco Flow and Watertight concrete Powder was added to the 101m^3 of concrete required for the tunnel's roof. The goal was to ensure that the tunnel roof was watertight to prevent rainwater ingress.

These two admixtures are completely compatible and do not affect each other's performance. On the contrary, water resistant SCC reduces the risk of lack of compaction, which can cause long term issues if not addressed correctly.

Although self-compacting concrete continues to be primarily a means of meeting noise limits and reducing the manpower required for a project this subway provides a fascinating case in point for the ways in which the technology can be adapted to confront a host of the challenges that the industry faces on a daily basis.

By: Peter Cowan

Ref: Concrete, Volume 53, November, 2019, Issue 09. Page 34 & 35

Testing Times : Marine Concrete

Marine infrastructure isolated in seas and oceans is often partially composed of structural concrete. When such structures exhibit significant deterioration, reach the end of operational life or are being decommissioned, the question of removal or maintenance comes to light. In both outcomes, it is important to understand the condition of the concrete elements to determine the environmental impact and cost implications of the proposed options.

Challenging waters

Sub-marine and intertidal environments can represent harsh conditions for concrete structures. Physical forces such as repeated impact, flexing and confining pressures may have to be accounted for, in addition to pronounced hazards such as climatically affected thermally cyclical weathering, sulphate attack or the potential ingress of chloride ions, which can lead to the corrosion of embedded reinforcement.

It is important to note that marine concrete structures are classified chiefly according to zones of chloride environment. In the UK, these are defined by BS EN 206-1(1) and further expanded in BS 6349-1-4(2) (figure1) and BS 8500(3). Accordingly, freeze-thaw classifications may be applicable in cold climates. For most structures, the driest parts of the splash zone with unbalanced wetting and drying cycles are the most at risk (XS3) from chloride ingress (figures 1 and 2) owing to the need for oxygen to establish a cathodic reaction.

In contrast, permanently submerged samples often develop a protective carbonate coating and may only lose reinforcement passivity because of the slow diffusion of chloridge ions. Additionally, other forms of attacks such as alkali – silica reaction (ASR), sulphate attack, abrasion or biological degradation may be more prevalent when submerged in cool or temperature conditions.

Testing methods

Concrete condition testing of marine structures should focus on the structures specific requirements, but can be targeted to the major areas of concern. An example of structural specific requirements may be the abundance, cause and resultant condition of observed cracking within a zone of potential weakness. In such cases, pulse impact echo and specialised adapted petrographic analysis, combined with chemical analysis and strength testing, could be used. Pulse impact echo surveys can locate cracks and provide an understanding of defect depth, while the petrographic analysis should confirm defect depth, determine any deterioration mechanisms, crack frequency and even the cause of cracking.

It is vital that testing is correlated with Fig.6: left overview of the concrete column and deck soffit of the structure showing significant corrosion of the external metal elements; right-view of the lower part of the structure during moderate rough sea conditions. The actual condition of elements suspected to be at risk and the corresponding exposure class.

Any marine concrete investigation will benefit from using a selective but wide range of correlated testing, specifically related to marine concrete structures.

By: Alex Smith

Ref: Concrete, Volume 53, November, 2019, Issue 09. Page 26 & 27

New Design Method for Geogrid Stabilised TrackBed

A new design method that accurately predicts subgrade deformation under train loading helps demonstrate the benefits of incorporating stabilisation geogrids in trackbed design, saving time and money over the lifetime of a railway.

Trackbed maintenance work and line speed restrictions significantly affect schedules and are expensive and disruptive to the public. Industry, train operators and asset owners. A lot of maintenance is aimed at rectifying poor track geometry and a loss of vertical and horizontal alignment of the rails, caused

by subgrade and ballast deformation, which often leads to speed restrictions.

Geogrids have been used to stabilise track ballast sub ballast and the subgrade beneath railways since the early 1980s.

When granular fill material, such as ballast or sub ballast is compacted over a geogrid, it partially penetrates and projects through the geogrid's apertures to create a strong and positive interlock. This interlock enables the geogrid to confine and restrain the granular materials from lateral spread, which helps maintain horizontal and vertical rail alignment.

By providing a stiffer foundation to the track settlement has been reduced by almost 40% for the same amount of rail traffic, compared with non stabilised sub ballast layers. These layers can also be upto two thirds thinner, while maintaining bearing capacity, reducing excavation and replacement of weak subgrades, cutting construction time and costs.

By: Andrew Lees

Ref.: The Journal(PWI-UK), October 2019, Vol.137 Page 24 & 25

An Innovative Development of a Modified PC Based Chemical Admixture to Significantly Improve the Pumpability of Concrete for High Rise Building Projects

This papers hews the significant cost savings that can be achieved in the high rise building projects by selecting a fit for purpose admixture. The innovative admixture, a modified polycarboxylate, enables single step vertical pumping of concrete upto 680 meters by reducing the viscosity and stickiness of high strength concrete Numerous rheological and actual field data, using Rheometer and Tribometer, on concrete viscosity, pumping pressure and theoretical calculations based on globally accepted pumping rate prediction equations have shown the effect of this unique admixture on increasing the concrete pumping rate and thereby reducing the concrete placing time resulting in reduced overall project construction period lading to significant cost savings.

As the construction industry is continually evolving the structure built today is far different from the ones built over a decade ago because growing urbanization trends and changing lifestyle has been accelerating to built the skyscrapers as well as centralize the buildings. This leads to a significant increasing the number of super tall buildings across the world. Since certain high rise building indicate various symbolic meaning such as history, culture, racial characterstics and technology representing their countries, so that those high rise buildings become cultural heritage. Therefore, many global construction engineering firms are eager to build the mega tall high-rise buildings accordingly.

Auramix UPS is a modified polycar boxy late either admixture specifically developed for high rise buildings. It is a blend of unique modified polycar boxy late eithers and rheology modifiers to exhibit lower stickiness, longer retention without excessive retardation and faster dispersion.

Ref: ICI Journal 2019, Conference of ICI New Delhi Centre, Oct-Dec. 2019

By: Justin (Byung Gi) Kim, Madhav Inamdar, Lawrence (Jong Jin) Yun and Paul (Kwang-Ryeon) Kim

Designs Applications and Performances of Asphalt Track Beds in the United States

Railway trackbed design and construction techniques have steadily evolved thourhgout the world from the initial 1830's designs; consisting of two parallel rails, consisting of wood or wood with metal straps, positioned only widely spaced wood crossties laid on the natural ground. It soon became obvious that the quality of the support under the ties should be improved.

Natural stone aggregate (later known as ballast) was deemed necessary and desired for placement around and under the ties to restrain excessive horizontal and vertical movements and displacements; thereby providing an improved track structure. Thus, the classic All-Granular support trackbed was defined; also termed the 'ballasted' trackbed.

By: Jerry G.Rose

Ref: The Journal(PWI-UK), October 2019, Vol.137 Pg.16 & 29

A Study on Compressive Strength of Steel Fiber Reinforced Concrete Columns Exposed upto 700°C

The main objective of the present study is to understand the compressive behaviour of reinforced concrete columns and steel fiber reinforced concrete columns (volume fraction of 1%) exposed to different temperatures (room temperature, 100, 200, 300, 400, 500, 600 and 700°C) and sustained for different heating periods of 1,2 and 3 h.

Fibre reinforced concrete (FRC) is a building material whose usage in the concrete industry is

increasing gradually. This growth is due to its physical and mechanical properties which provide conventional concrete elements various benefits such as better resistance to loads and environments loads such as wind and earthquake, in addition to resistance against accidental loads such as fire. Although concrete elements are well known for high degree of fire resistance, high temperatures affect the mechanical properties and deformation characteristics considerably and also cause spalling of concrete. As FRC columns consist of cement, fine aggregate, coarse aggregate, reinforcement and also fibres with different reactions to high temperature, the determination of their behaviour and mechanical properties in fire are a challenging task.

By: M.K.S.S.Krishna Chaitanya and K.Srinivasa Rao

Ref: ICI Journal October-December 2019, Page 17

Case Study on Precast Piling Works

Modern construction industry demands speed, quality and aesthetics. Appropriate foundation system plays a key role to fulfil some of these aspects. Selection of most techno-feasible solution depends upon the subsoil profile, functional/loading requirements, constructability aspects etc.

This paper is a case study on the foundation system adopted and executed for an onshore gas terminal at southern part of India. Andhra Pradesh. Subsoil at the present location consists of soft to firm clay upto 26m depth which is further underlain by stiff to very stiff silty clay upto 43m depth. In order to construct various process units and other structures in such type of soil, it is necessary to provide suitable foundation system to satisfy the performance requirement.

Segmental driven precast concrete pile foundation is generally proves techno feasible foundation system in such type of soil conditions. The various aspects of sub soil conditions, design, construction methodology and pile load test results are discussed in this paper.

By: Geethanjali Koppolu and VK Panwar

Ref: ICI Journal, Oct-Dec. 2019, Conference of ICI New Delhi Centre, Page 22

Development of Risk-Based Railway Track Maintenance Method Using Image Analysis Technology

A hazard sensing technology has been developed for track maintenance that can extract hazard factors related to the expansion of the damage caused by a derailment accident. In addition, a risk-based maintenance method was developed for track irregularity management using the hazard sensing results and a statistical risk model. As a result, it is now possible to extract the factor of magnification of derailment damage (collision with structures and the public, falls from elevated locations) through image analysis using images recorded from the front of commercially operated trains. In addition, a maintenance and management model was created to calculate the appropriate values of the management value of track irregularity and the inspection cycle time, considering the track maintenance cost and the damage scale of the derailment accident.

By: Atsushi SHIMIZU, Masashi MIWA

Ref: RTRI, Nov 2019, Vol, 60 Issue – 4

Review of Methods for Estimation of Passenger Car Unit Values of Vehicles

Estimation of passenger car unit (PCU) values is very important for traffic capacity analysis and other relevant applications such as level of service (LOS) measures, determination of saturation flow rate, signal design and coordination, and development of traffic flow models. Because of such wide applications, the accuracy of PCU values is highly significant in traffic flow analysis. Many research works have been carried out on estimation of PCUs in the past few decades. In developed countries, various methods were developed for estimating PCU values for different types of facilities which carry trucks and buses of lesser composition. But these methods are not completely analogous for mixed traffic due to the presence of wide variety of vehicle types, nonlane discipline, intraclass variability of vehicles and their maneuverability. With this consideration, various methods used for estimating PCUs for different facility types under homogeneous and mixed traffic conditions are reviewed and the drawbacks of the existing methods are identified in this paper. The challenges in estimating PCU values and future directions for improving the PCU estimation methods are also presented.

By: Pooja Raj, Kalaanidhi Sivagnanasundaram, Gowri Asaithambi and Ayyalasomayajula Udaya Ravi Shankar

Ref: ASCE : Transportation Engg, June 2019, Vol, 145

Construction of Method for Analytical Evaluation of Turnout Structures

In Japan, turnout structures are usually designed on the basis of verified experience or JIS specifications. Consequently, there is no established method yet for evaluating original turnout structures. This study

examines an evaluation method for turnout structures based on dynamic analyses. When considering new turnout structures, it is necessary to carry out evaluations of running safety and track material strength. In order to implement them efficiently, it was decided to evaluate them separately.

By: Saki SHIMIZU, Yuya OIKAWA, Katsutoshi SHIOTA

Ref: RTRI, Nov 2019, Vol, 60 Issue – 4

Effect of Rail Pad Stiffness on the Wheel/Rail Force Intensity in A Railway Slab Track with Short-Wave Irregularity

In this paper, a two-dimensional numerical model is developed to investigate the effect of rail pad stiffness on the wheel/rail force in a slab track with harmonic irregularity. The model consists of a vehicle, nonlinear Hertz spring, rail, rail pad, concrete slab, resilient layer, concrete base, and subgrade. The rail is simulated using the Timoshenko beam element for considering the effects of high-frequency excitation produced by short-wave irregularity. The results obtained from the model are compared with those available in the literature and from the field to prove the validity of the model. Through a parametric study, the effect of variations in rail pad stiffness, vehicle speed, and harmonic irregularity on the wheel/rail force is investigated. For the slab track without any irregularity, the wheel/rail force is at maximum when the vehicle speed reaches the critical speed. As the rail pad stiffness increases, the critical speed increases. When the amplitude of irregularity is high, wheel jumping phenomenon may occur. In this situation, as the vehicle speed and rail pad stiffness are increased, the dynamic wheel/rail force is increased. In the low-frequency range, the wheel/rail force increases as the rail pad stiffness increases. In the high-frequency range, the wheel/rail force increases as the rail pad stiffness is decreased.

By: Amin Khajehdezfuly

Ref: Rail & Rapid Transit, Nov 2019, Vol – 233 Issue – 10

Coupled Finite Element and Multibody Systems Dynamics Modelling for the Investigation of the Bridge Approach Problem

Railways are the most common mode of transportation for both people and cargo due to its advantages in economy, safety, and comfort. The finite element method has been broadly used for more than three decades to model the different components of the railroad system such as rails, sleepers (cross ties), and substructure and has been used to investigate a variety of problems associated with rail mechanics. Different multibody systems dynamics software programs have also been developed to investigate the dynamic performance and contact behaviour between the rails and the wheels and to determine the contact forces. In this work, a full three-dimensional model that couples both the finite element method and the multibody systems dynamics has been used to study the railroad system. The main focus of this study is to model the bridge approach problem under dynamic load. The bridge approach problem arises from the sudden change in the foundation's stiffness under the rails at the bridge entry and exit, leading to high levels of stress and settlement that can also cause further problems over time. The effect of using a concrete slab at the bridge entry is also investigated in this study, using two slab designs: rectangular and inclined. The results show the effectiveness of the three-dimensional model and slab implementation on the forces and the vertical deformation, especially the inclined slab that applies a gradual change in the stiffness rather than a sudden change.

By: Al El-Ghandour, Craig Foster

Ref: Rail & Rapid Transit, Nov 2019, Vol – 233 Issue – 10

The Transient Response of High-Speed Wheel/Rail Rolling Contact on “Roaring Rails” Corrugation

A high-speed wheel/rail finite element model is developed to focus on the non-steady-state rolling contact. The wheel/rail contact is solved based on the surface-to-surface contact algorithm, and the explicit finite element method is used to simulate the dynamic high-speed wheel/rail rolling contact. Considering the track–vehicle coupling system dynamics and the wheel/rail geometric nonlinearities, the wheel/rail contact on the short wave rail corrugation under the high-frequency vibration and the influence of train passing frequency on the track–vehicle system dynamics are studied. The explicit finite element method can be used to simulate the non-steady-state rolling contact process of the high-speed wheel/rail. After the initial load condition, the wheel/rail contact state tends to be stable in a short period of time. The short wave corrugation causes the high-frequency vibration of the track–vehicle system; the slightly advanced phase of the wheel/rail contact force promotes the development of rail corrugation in the rolling direction. When the train passing frequency is

close to the rail pinned–pinned frequency, the pinned–pinned resonance occurs. The overall vibration near the fastening is relatively large and accelerates the damage of components. The longitudinal force is clearly affected by the traction torque with a periodic wheel/rail stick-slip vibration. The pinned–pinned resonance will promote the sliding wear at the wave trough near the fastening and it will become severe with the increase of the traction.

By: Miao Yu, Wei-dong Wang, Jin-zhao Liu

Ref: Rail & Rapid Transit, Nov 2019, Vol – 233 Issue – 10

Foundation Reuse in Accelerated Bridge Construction

When an existing bridge is being considered for replacement due to a deteriorated or obsolete superstructure, the foundation may still have significant functional value. Reuse of these foundations during bridge replacement or widening can present significant cost and time savings over constructing new elements. The potential time savings associated with foundation reuse can reduce mobility impacts, a key goal of accelerated bridge construction (ABC), and the cost savings can increase the economic viability and sustainability of an ABC bridge replacement project. However, existing foundations may have uncertain material properties, geometry, or details that impact the risks associated with reuse. Unlike a new foundation, an existing foundation may have been damaged, may not have sufficient capacity, and may have limited remaining service life due to deterioration. Assessment of these issues, possible foundation-strengthening measures, and innovative approaches to optimize loading are discussed in this paper. An analysis of an ABC database is performed to examine the current role of foundation reuse in ABC projects. This paper presents some key findings identified through various research projects related to foundation reuse. Six case examples are presented in which foundations were reused or considered for reuse during a bridge replacement project.

By: Nathan T. Davis, Ehssan Hoomaan, Anil K. Agrawal, Masoud Sanayei

Ref: ASCE, Bridge Engineering, Oct 2019, Vol – 24 Issue – 10

Fiber Bragg Grating–Differential Settlement Measurement System for Bridge Displacement Monitoring: Case Study

Vertical displacements are one of the crucial parameters defining, for example, the load-carrying capacity of a bridge deck in short- and long-term monitoring. Bridge managers are always looking for an easy way to measure vertical displacements of bridges. However, such measurements are difficult to perform. With the advancement of fiber-optic technologies, fiber Bragg grating (FBG) sensors are more commonly used in structural health monitoring due to their outstanding advantages, including multiplexing capability over long distances as well as high resolution and accuracy. In this study, a set of FBG-differential settlement measurement (DSM) sensors, connected by a hydrostatic leveling system of communicating vessels, and previously adopted for displacement monitoring along a steel member, were used for displacement measurements along a large-scale prestressed concrete I (PCI) beam. Specifically, the PCI beam was subjected to a set of three-point bending tests in the laboratory. The measured displacements matched well with the corresponding experimental values recorded by LVDTs. In addition, in situ experiments on Bridge No. 24 of Highway No. 86 in Taiwan indicated that the FBG-DSM system can be effectively employed to measure vertical displacements along span bridges. In conclusion, the proposed FBG-DSM system can be used for field bridge applications referring to an absolute reference and without any external physical reference or a requirement for accessibility or particular environmental conditions.

By: Marco Bonopera; Kuo-Chun Chang; Chun-Chung Chen; Zheng-Kuan Lee

Ref: ASCE, Bridge Engineering, Oct 2019, Vol – 24 Issue – 10

Long-Term Monitoring of Temperature Effect on Horizontal Rotation Angle at Beam Ends of a Railway Steel Truss Bridge

In steel truss bridges, some truss members are exposed to solar radiation, while others are shaded by steel decks, which may result in large temperature gradients between truss members and further induce significant horizontal rotation angles (HRAs) at beam ends of steel truss bridges. Therefore, using the long-term monitoring data from a railway steel truss bridge with a 2-layer deck, the effect of temperature gradients on HRA was studied. Several analytic methods related to this topic are proposed, including a method for identifying large temperature gradients in steel truss bridges, a method for identifying whether the thermal load is the dominant load affecting HRA, and a method for identifying what kinds of temperature gradients have significant impacts on HRA. The results show that there are significant vertical temperature gradients between

the top and bottom truss members in the side trusses and significant transverse temperature gradients between the bottom truss members, the thermal load is the dominant load affecting HRA compared with the other dynamic loads, and the temperature gradient between the bottom truss members in the side trusses has the greatest effect on HRA.

By: Gao-Xin Wang, You-Liang Ding

Ref: ASCE, Bridge Engineering, Oct 2019, Vol – 24 Issue – 10

Seismic Performance of a New Connection Detail in an SDCL Steel Bridge System

The simple for dead load and continuous for live load (SDCL) steel bridge system has proven to be economical for nonseismic application. Although the system has been used in different methods of construction, this paper concentrates on accelerated bridge construction (ABC) application. The application of the SDCL steel bridge system in high seismic areas has been nonexistent, mainly due to lack of appropriate details. The extension of the SDCL system to high seismic areas was initiated by conducting a detailed numerical analysis to comprehend the types of forces that the connection must resist. The results of the numerical study led to the development of connection details over the middle pier. In this research, a component testing of the proposed SDCL connection was conducted to find the ultimate limit states, verification of numerical results, and merits of the proposed detail in light of established seismic design provisions. The developed connection behaved as designed and prevented damage to capacity-protected elements. The column showed sufficient ductility during cyclic tests, which indicated the connection should perform well under high levels of displacement.

By: Amir Sadeghnejad, Ramin Taghinezhadbilondy, Atorod Aizinamini

Ref: ASCE, Bridge Engineering, Oct 2019, Vol – 24 Issue – 10

Dynamic Response of Bridge Pier under Combined Earthquake and Wave– Current Action

A study of the dynamic response of a circular bridge pier forced simultaneously by earthquake and wave–current actions is presented. On the basis of diffraction wave theory, the analytic solution for the diffraction of incident waves with uniform current on a circular pier is given. On the basis of the radiation wave theory, the analytic solution for the hydrodynamic pressures on a circular pier induced by combined earthquake and wave–current action is obtained. Further, the solution for the dynamic responses of the pier under combined earthquake and wave–current action is obtained by treating the pier as a cantilever beam governed by beam theory. Last, the effects of hydrodynamic force, wave force, wave–current interaction, and surface wave condition on the dynamic responses of the pier are investigated. The results may be used for engineering practice and further research.

By: Piguang Wang; Mi Zhao; Xiuli Du; and Jingbo Liu

Ref: ASCE, Bridge Engineering, Oct 2019, Vol – 24 Issue – 10

5P Systems of Tunnel Excavation for Extremely Weak Rock Mass with Ingress of Water

Tunneling through Himalayan ranges is always a challenging job, especially in the weak rock formation with high ingress of water creating flowing ground condition. The occurrence of extremely poor strata in the form of shear zones, thrust ones, or highly jointed rock mass while tunneling in Himalayas makes the job construction engineers most difficult during execution and has a greater degree of uncertainty, regarding time and cost. Thus different methodologies are required to be adopted while excavating very poor rock mass (class V) and exceptionally poor (beyond class V) rock mass.

A system was evolved while working in one of the difficult projects where extra ordinary geological conditions were encountered. The system was termed as ‘5P Systems Of Tunneling’,which is performed through extremely weak rock formations.

This paper discuss 5P System in detail and the methodology to carry out the same for tunneling through extremely weak rock mass with high ingress of water creating flowing ground.

5P Systems Of Tunnel Excavation For Extremely Weak Rock Formations

a. 1st P-Plus- (Plugging and Stabilization of Face)
b. 2nd P-Pressure Relief (Pressure Relief and Drainage Holes)
c. 3rd P-Probing (Probe Drilling)
d. 4th P-Protection of Roof
e. 5th P-Pre-grouting (Pre-Grouting and Improving the Strength of Face)

Conclusion:

Although the tunnels are constructed in extremely weal strata, it takes much longer time to support the crown and proceed further. Sometimes it takes months of stabilization process without an inch of movement. The 5P System explained above in paper has been tried successfully at many projects in various forms, but the sequence explained in the paper has been found to be most successful and regular progress can be achieved if planned in advance; all the materials and equipment's should be made available in advance. Moreover, meticulous planning, quick decisions at the site and devotion of the engineers shall bring good results to expedite the excavation of tunnels with 5P System incident free.

Ref: CE & CR, January 2020

By: M M Madan

Advances in Waterproofing Technologies

Waterproofing plays a vital role in ensuring that a structure is sound, and the habitable area is healthy and safe over its designed service life. Water enters a structure through the weakest route, giving rise to unpredictable effects of enormous impacts; the water/dampness entering the living space can impact health, safety, fireworthiness, structural durability and aesthetics. These issues need to be addressed by a carefully selected waterproofing system.

Some of the latest waterproofing technologies are described below:

1. Coating Systems
   a. Polymer-Modified Cementitious Coatings
   b. LATEX-Modified Cementous Coatings
   c. Acrylic Coating
   d. Polyurethane Coating
2. Polyurea Coating
3. Membrane Systems
   a. Preformed Membranes
   b. PVC Membranes
   c. High Density Polyethylene (HDPE) Membrane
   d. Thermoplastic Polyolefin (TPO) Waterproofing Membranes
   e. Liquid Applied Membrane Systems
   f. Polyurethane Liquid Membrane
   g. Polymer Modified Bitumen Emulsions and Solutions
4. Integral Waterproofing Systems
   a. Water Repellents
   b. Air-Entraining Agents
   c. Crystalline Waterproofing Compounds
5. Impregnation Systems
   a. Crystalline Impregnation Technology
   b. Organosilane Impregnation Technology
6. Grouting Systems
   a. Cementitious Grouting
   b. Polymer Grouts
   c. Epoxy Grouts
   d. Polyurethane Grouts

Conclusion: The entry of water/dampness into the living space impact health, safety, fire-worthiness, structural durability and aesthetics. The aim of waterproofing is to restrict unwanted water from entering the built environment. Advances in polymer technology have changed waterproofing radically. Major technological advances have taken place in coating systems, membrane systems, integral waterproofing systems, impregnation systems and grouting systems. Modem systems based on the state-of-the-art polymer cement. Polymer resin or polymer membrane technologies combined with new methods of applications provide better performance. The availability of these technologies is slowly replacing the conventional waterproofing methods.

The most important aspect for any waterproofing treatment is its performance. The contemporary construction engineers have the option to select from a variety of advanced waterproofing technologies. The selection of inappropriate waterproofing systems, incorrect installation practices, disregard for sound principles of waterproofing and inadequate detailing are some of the main reasons for performance failure of waterproofing applications. Thus, appropriate waterproofing system with correct installation procedure IS the essential requirement for successful waterproofing Also, analyzing the causes of leakage/ dampness along with thorough understanding of various waterproofing systems is essential for selection of an appropriate waterproofing system for an application.

By: K P Abraham

Ref: Civil Engineering & Construction Review, Jan 2020

Steel Bridge Fitness for Service Estimate Using Probabilistic Method

Transportation Technology Center, Inc. (TTCI) is testing five riveted steel girder bridge spans for fatigue and safe service life performance to investigate improved fitness for service estimates for common steel railway bridge spans.

These bridges carry approximately 150 MGT per year of heavy axle load (HAL) traffic.

Service life estimation using a probabilistic method can be used not only to trend the risk of fatigue crack development, but also to inform decision-making regarding appropriate programs of inspection. The probilistic method provides risk-based information about the fitness of a bridge and its safe-use longevity.

Conclusion: The service life estimate of a steel bridge depends on the fatigue category and applied load for various levels of risk (probabilities of fatigue crack initiation). During the service life of a bridge, accumulated fatigue damage increases in time at different rates, depending on tonnage per year and train type. All these factors must be specified in order LO obtain accurate results from any reliability)' analysis.

- Use of fatigue life data specifically from full-scale girders, in conjunction with probability of failure, can provide the most versatile estimate of the remaining, service life of a span;
- Using a probabilistic method, the number of cycles or accumulated traffic is estimated in terms of probability of crack initiation. As a bridge management practice, inspections could be scheduled more often as a bridge member approaches a higher probability of crack initiation;
- The reliability analysis also can be used for estimating years of service life (or MGT) of a bridge with different levels of safety.

By: Anna M. Rakoczy

Ref: RT&S, June 2019

Designs on Greatness

With a main span of 2023 m, completion of the suspension bridge will open a new category for the world's longest span bridges, being the first in the world to have a main span of more than 2 km. it is being built at the western end of the Sea of Marmara, some 200km from Istanbul, and like the country's three bridges crossing the Bosphorus Straits, will straddle to continents, connecting the Asian and European parts of Turkey.

As well as a main span of 2023 the bridge has spans of 2023m, the bridge has spans of 770m on each side, and approach bridges of 680m and 365m on the Asian and European sides respectively, making a total length of 4608m. The two towers, which are being built in the water, will be 318m high, and the approach bridges include 15 additional piers, which are all based on land. The anchor blocks for the main cables are also land based and under construction.

By: Helena Russell

Ref: Bridge Design & Engineering, Fourth Quarter, 2019

'Bajaj Fibre Tuff'- Macro Synthetic Fibre For Shotcrete

'Bajaj Fibre Tuff'- Macro Synthetic Fibre is easily available in India as it is produce in India itself. It can be used effectively in concrete mix for high building foundation, shotcretes, beams, column, slabs along with steel rebars to obtain enhanced seismic performance in comparison to the ordinary RCC.

The tests were conducted at IIT Hyderabad and at RVNL Rishikesh-Karnaprayag Rail Project, Uttarakhand, amongst testing done at other institutes.

Conclusion

The energy absorption by polypropylene macro fibre manufactured by M\s Bajaj Reinforcement (LLP), Nagpur for various doses as found from the above testing's are

Energy Absorption by Polypropylene Macro Fibre for Various Doses

Dosage of fibre (kg/m³)	Energy absorption (Joule) for deflection up to 25 mm
5	595
6.5	781
7	800

As per EFNARC, the toughness classification based on energy absorption in Joule for deflection up to 25 mm is classified into the three classes and accordingly, the fibre tested not only fulfils, but exceeds the requirements of class 'b', i.e., energy absorption of 700 J for 6.5 kg/m³ and 7 kg/m³ dosages.

Hence, the 'Bajaj fibre' can be very well used in sprayed concrete having inherent properties of non-corrosiveness and at the same time, fulfill the requirements of strength, toughness and durability.

By: Sunil Bajaj

Ref: Civil Engineering & Construction Review, Jan 2020

Beneficial influence of Latex-Modified Concrete Overlays to Prevent Concrete Deck Deterioration in Bridges

Concrete is one of the most common construction material used thought the world due to its resilience, durability and performance. However, due to its micro structure, it absorbs moisture and aggressive chemicals (i.e. chloride and sulfate ions). How much water is absorbed by the concrete and how fast the moisture can penetrate into the core of the concrete depend on several parameters, such as the quality of the cementitious material, water:cement (w/c) ratio, how the concrete, has been cured and the quality of the aggregates.

Various protection systems have been used to prevent infiltration of aggressive materials into the concrete decks in bridges such as sealers, hot rubberized asphalts membrane, low-slump concrete overlays, epoxy coated overlays and latex-modified concrete (LMC) overlays.

Comparison of overlays systems: VELMC can be installed in less than 24 hours and if properly installed it can last between ten and 50 years.

By: Kaveh Afshinnia

Ref: Concrete, Sept 2019

Widening Horizons

A Technique using satellite radar to monitor the position of a structure offers civil engineers a new level of safety in bridge maintenance and management.

Many countries are facing the challenge of having to deal with a vulnerable and deteriorating infrastructure system.

There is no simple answer to this problem, but ii new tool tosupport civil infrastructure management, and specifically to the identification of structures in the most precarious conditions, is now being developed by researcher's harnessing the latest advances in radar satellite.

Interferometric Synthetic Aperture Radar (Insar) techniques use the relative motion between satellites and the Earth to measure displacements of the ground surface or structures over times.

The latest X-band satellites guarantee a very high sensitivity to movements with their sensors accurate to changes as small as one millimeter. The technology can also monitor a high density of monitoringpoints and take weekly measurements, unaffected by daylight and weather.

A recent example has been offered by the analysis of the pre-collapse satellite-based observations of the Polcevera Viaduct in Italy.

On 14 August 2018, the ninth pier, including a 240m-long section of the adjacent deck, suddenly collapsecausing the deaths of 43 people. After the collapse, the Italian Space Agency asked a number of agencies, including the Nasa Jet Propulsion Laboratory (JPL), to look at satellite data with the aim of characterising the displacement of the bridge before collapse.

In a joint study recently published in Remote Sensing, the team analysed.

By detecting anomalies that result in progressive relative, movements between different parts of a structure or between the structure and the ground, Insar monitoring can complement existing in-situ and remote sensing techniques and provide an additional level of safety to the infrastructure system management. While this technique cannot provide a substitute to local inspections determining, for example, degradation in the construction materials, ii offers an unmatched low-cost tool for the long-term monitoring of vast regions currently covered by SAR satellite constellations.

By: Giorgia Giardina

Ref: Bridge Design & Engineering, Fourth Quarter, 2019

Breaking the Mold

The Composite Tub (CT) Girder has been designed for use on highway, rail and pedestrian bridges, and was developed by AIT Bridges, a division of Advanced Infrastructure Technologies (AIT) in partnership with the University of Maine Advanced Structures and Composites Centre. According to AIT Bridges, the product is lighter thansteel and concrete girders by 50% and 75%, respectively, and is made from fibre-reinforced polymer, a material the company has used as part of its Composite Arch Bridge System since 2010.

The girder dimensions can be customised for each structure and for the Grist Mill Bridge they are being formed in a 24.4m long mold to produce girders that are 23.2m long, 1.2m tall and 1.2m wide.

It consists of lightweight corrosion-resistant FRP composite arch tubes which act as reinforcement and formwork for cast-in-place concrete, could reliably provide a 100- year low maintenance service life.

By: Khalifa Bokhammas

Ref: Bridge Design & Engineering, Fourth Quarter, 2019

Proposed IRICEN Hostel Building

Events

Glimpses of IRICEN DAY 2019


7 एवं 8 नवम्बर 2019


भारतीय रेल सिविल इंजीनियरिंग संस्थान, पुणे
7 एवं 8 नवम्बर 2019


7 एवं 8 नवम्बर 2019


62 वां इरिसेन दिवस

Updates Of Codes & Manuals

S.NO.	ACS NO.	DT OF ISSUE	REMARKS
TRACK			
1. Indian Railways P-Way Manual			
01.	150	26.08.2019	Para Nos 224(2)(e)(v), 224(2)(f)(xii), 224(2)(f) (xiii), 604(2), 604(5), 605(a), 607(1)(2)(3)(4)(5), 610, 614 replaced
02.	151	19.11.2019	Existing provision of item 7 of annexure 9/1 para 904 replaced
03.	152	10.12.2019	Item No. D (10) of para 228(3)(c), 1408 (1)(c) replaced
04.	153	20.12.2019	Existing annexure 2/6A of para 237/5(a) replaced
05.	154	01.01.2020	Existing para 291 replaced
06.	155	09.01.2020	Existing annexure 2/11 (Sketch & table) & annexure 2/13 (Sketch) of para 263 replaced
2. LWR Manual			
01.	02	1999	Para No 6.2, 6.2.1(i), 1.18 replaced
02.	03	1999	Heading of Para No 4.5.7 & sentence at para 4.5.7.1(1)(b)(i) replaced
03.	04	1999	Para No 6.3 modified, Para 6.3.1 added, Para 6.3.1 & 6.3.2 renumbered
04.	05	1999	New para 4.4.1(i) added
05.	06	1999	Text substituted to para No 2.2.1, Para No 5.2.1 reworded
06.	07	2000	Changes made to Figs 4.2.1(a) to (d)
07.	08	2002	Para No 1.1 & 1.2 reworded, Text added to para 4.5.3
08.	09	2005	Para No 6.2.1(i), 4.4.1 replaced
09.	10	2006	Fig. 5.6 & Para No 6.4.1(i)(c) replaced
10.	11	2006	Text substituted to Para 3.2.1
11.	12	2009	Para No 1.16, introductory para of Annexure XA [Para-9.1.2(i)] replaced
12.	13	2010	Para No 1.11 replaced
13.	14	2011	Para No 3.4, 8.2.5, 9.1.8(i), 9.1.8(iv), Annexure-VI item 1(c)(i), Annexure-V, Table-I replaced
14.	15	2012	Para No 8.1.5(i) & Figs 4.2.1(a) to (d) replaced
15.	16	2014	Para No 4.3.3(i), Fig. 4.2.1(a) to (d) replaced
16.	17	2018	Para No 5.6.1, Fig. 5.6, Annexure XIII-A replaced. New Fig 8.2.1 added
17.	18	11.03.2019	Footnote to para 4.5.7.1 (iv) at page 12 shall be replaced
18.	19	15.04.2019	Item No. 1 of Annexure III replaced, Fig 4.4.3(a) and 4.4.3(b) replaced, Fig 4.4.3(c) modified, Item No. 2 of Annexure III deleted
3. Track Machine Manual			
01.	01	Mar. 2000	Addition of text to the end of Preface.
02.	02	Mar. 2000	Annexure 8.1 para (A) & para (B) replaced
03.	03	May 2003	Para 4.6.8 added
04.	04		Para 4.6.8(iv) added
05.	05	Sept. 2003	Text added to para 5.6
06.	06	13.01.2004	Para No 4.3.3 & 8.3.2 replaced
07.	07	07.04.2004	Para No 4.3.1 modified
08.	08	25.10.2004	Para No 5.1.3 added & existing para 5.1.3 renumbered
09.	09	20.10.2006	Annexure 8.1 replaced
10.	10	12.12.2006	Para No 2 of Annexure 5.9 replaced
11.	12	22.08.2013	Annexure 8.2 replaced, New annexure 8.3 added, Table 6.2 in Para 6.3.5 modified, Text replaced in Para 8.4.5

12.	13	25.09.2012	Para 6.2.1 added
13.	14	14.06.2012	Para No 5.3.3 replaced
14.	15	14.06.2012	Para No 4.4.3 replaced
15.	16	12.11.2013	Para 9.6(ii) modified
16.	17		Para 6.2 modified
4. Manual For Ultrasonic Testing of Rails & Welds			
01.	01	Nov. 2014	Para No 8.15.1 replaced
02.	02	Dec. 2014	Para No 8.14, 8.15.1, Annexure IIA and IIB replaced
03.	03	Mar. 2016	Para No 4.1.1(c), 5.1.2, 8.6.4, 8.7.2, 8.10, 8.14, 8.15.1, Figs. 3 & 22 replaced. New clause b)(iii) below para 8.16 added, New para 6.3.1 & 6.3.2, 10.6 added
04.	04	Sept. 2018	Para 6.6, 8.14, 8.15, 8.15.1 & 8.15.2 modified
5. Indian Railways Code For The Engineering Department			
01.	50	21.09.2017	Introduction of measurement & recording of 'executed works' by the contractor' in Rly Construction Works.
02.	51	27.09.2017	Para Nos 701, 1102, 1209 should be amended
03.	52	23.10.2017	Existing para 1238 replaced
04.	53	06.11.2017	Para No 701 should be amended
05.	54	22.01.2018	Para No 1264 (e) & 1264 (f) should be amended
06.	56	05.03.2019	Para No 1264 should be amended
07.	57	08.01.2020	Para No 1829 should be amended
BRIDGE			
1. Indian Railways Bridge Manual			
01.	01	01.09.1999	Para No 1007 replaced, New para 1007(A) added.
02.	02	21.07.2000	New para 16 added
03.	03	21.07.2000	Deleted para 513(b)
04.	04	21.07.2000	Deleted para 515
05.	05	21.07.2000	Deleted para 603
06.	06	21.07.2000	Deleted para 222(1b), 222(2f)
07.	07	21.07.2000	Deleted para 618
08.	08	21.07.2000	Para No 504(4) replaced, Add new para 521, sub para 5 under para 616 and sub para 5 under para 210
09.	09	27.07.2000	Add new sub para 317 of Chapter III
10.	10	31.08.2000	Para No 604 replaced
11.	11	14.01.2003	Add para before chapter 1
12.	12	18.12.2007	Para No 217.2(a)(i) and para 217.2.(b)(i) replaced
13.	13	22.01.2008	Para No 317 replaced
14.	14	20.03.2008	Delete para 310, 312(4), 313(2) and 313(3) of chapter III,
15.	15	05.08.2008	Para No 410(2)(b), 418(5), 430 replaced, Para 3(ii) of 606 is proposed for deletion and Para 3(i) renumbered as 3
16.	16	13.08.2008	Para No 317(iii) replaced
17.	17	15.09.2008	Para 318 added
18.	18	17.12.2008	Para 224 added
19.	19	11.01.2010	Para 318 modified
20.	20	07.06.2010	Para No 1104(5) replaced
21.	21	02.07.2010	Para No 1107 (d) modified. Add para 1107(15)(i)
22.	22	28.03.2011	Para No 1107(15)(i) replaced & renumber as 1107(15)(b)(i), para 1107(15)(b) is renumbered as 1107(15)(b)(ii)

23.	23	23.08.2011	Replace existing Chapter-VIII by revised Chapter-VIII
24.	24	14.09.2011	Para 714(2), 1005(1), 1005(3), 1104, 1104(2), 1104(5), 1106(2), Page No xi (Index) 1104 modified
25.	25	17.12.2012	New sub para 3 may be added to existing para 311
26.	26	23.08.2013	Para No 217.2(a)(ii), 217.2(c), 217.4(c), 217.4(d), 217.4(e), 217.4(l), 615 to be replaced
27.	27	03.01.2014	New para 1107 5 i), 215 A added
28.	28	20.03.2014	Chapter-X, Part B – Title of Deep Cuttings replaced and para 1010 to 1015 & Annexure 10/2 replaced by Para 1010 to 1017 and Annexure 10/2 attached.
29.	29	15.04.2014	Para No 312(2), 312(4) replaced. Add new para 313(4)
30.	30	25.11.2014	Para 102(b), 504, 505, 506, 507, 508, 509 & Annexure 5/1 deleted
31.	31	09.02.2015	Para No 617 replaced.
32.	32	12.03.2015	Para No 222 2(f) replaced.
33.	33	21.03.2016	Para No 107(1) (a) is amended and 107 (1)(f) added. Para 222 (3) is amended by adding sub para (c), (d) and (e)
34.	34	04.10.2016	Added para 224
35.	35	31.07.2017	Para No 313(2) & 313(3) replaced.
36.	36	27.03.2018	Para No 317 & 318 replaced.
37.	37	09.10.2019	Para 1102.2(iv) replaced, Insert 11/2a proforma, Para 1107(15)(b)(i) & 1107(15)(b)(ii) modified
38.	38	14.01.2020	Para 317 replaced
2. Indian Railways Bridge Rule			
01.	47	22.06.2017	Add new para 2.8.1.2
02.	48	22.06.2017	Add new clauses
03.	49	26.12.2017	Para 2.12 deleted. New para 2.12 inserted
3. Indian Railways Bridge Substructure & Foundation Code			
01.	01	17.04.2014	Para 4.8.1, 4.9.3 replaced
02.	02	20.10.2016	Modify description & heading of contents at S.No. 7.5, Delete para 7.5.3
03.	03	22.06.2017	Modified para 4.5.9
04.	04	11.08.2017	Modified para 4.9.2 & 4.9.3
06.	06	04.11.2019	Modified paras 1.2, 1.5 I (f), 5.12.1, 5.12.2 (a), (b), (c), 5.12.3, 5.12.5, 5.12.6, 5.12.7, 5.12.8, 5.16.2.7 (b).
07.	07	11.11.2019	Para 5.10
08.	08	11.11.2019	Para 3.1 of Appendix V (Clause 6.9.3) modified
4. Indian Railways Concrete Bridge Code			
01.	01	16.12.2014	Replace table 10 of para 10.2.1
02.	02	14.01.2015	Insert para 5.4.7 & 5.4.7.2
03.	03	20.01.2015	Insert note under para 4.5.1, delete para 14.9 & replace, delete para 15.9.4.1 & replace, delete para 15.9.4.2 & replace, delete para 15.9.9 & replace
04.	04	15.11.2016	Para 14.9, 14.9.1 & 15.9.9 deleted
05.	05	13.06.2017	Para 16.4.4.4.5 modified
06.	06	27.07.2017	Para 7.1.5 modified
07.	07	26.06.2018	New para 4.5.1 added, existing para 7.1.5 modified
08.	08	23.05.2019	Replace the clause 7.2.6.4.2.4.1, Replace clause 7.2.6.4.2.4.2 and 12.3.2, Replace clause 15.4.2.2.1, Appendix B (Table B1), Appendix B (Table B2), Appendix B (Clause B-7.1), Appendix B1 (Fig B1-2),
5. Indian Railways Arch Bridge Code			
01.	07	25.09.2000	Replace para 1.1

02.	08	28.01.2015	Replace para 5.3.3
03.	09	19.11.2019	Replace paras 2.1.2, 5.3.2, 5.3.4, 5.3.5, 5.3.5.1, 12.1.1, 12.1.2, 12.2, 12.3
6. Indian Railways Welded Bridge Code			
01.	01	16.02.2015	Para 27.1 replaced
02.	02	11.07.2018	Para 27.1 replaced

IRICEN Calendar of Courses -2020 (Rev.3)

COURSE NO	COURSE NAME	FROM	TO	DURATION	ELIGIBILITY
MARCH					
20405	STAADPRO	02/03/2020	07/03/2020	1 Week	AEN/Design, Design Assistants
20302	Seminar Slot	02/03/2020	03/03/2020	2 days	
20303	S J V	05/03/2020	06/03/2020	2 Days	Officers of Rly & other Govt. Dept.
20003	First Review Meeting	09/03/2020	13/03/2020	1 Week	IRSE Probationers
20203	Sr. Prof. P.Way Part-1	16/03/2020	27/03/2020	2 Weeks	JAG, Selection Grade, SAG
20304	Seminar Slot	16/03/2020	17/03/2020	2 Days	
20305	EPC & PPP	19/03/2020	20/03/2020	2 Days	JAG/SG Officers
20406	Bridge Planning, Cont. & Maint.	23/03/2020	03/04/2020	2 Weeks	JS, SS, JAG
20407	Contract & Arbitration	23/03/2020	03/04/2020	2 Weeks	All Officers
20409	Basic Track Maintenance	30/03/2020	09/04/2020	2 Weeks	JS, SS
20204	Sr. Prof. P.WayPart-2	30/03/2020	09/04/2020	2 Weeks	JAG, Selection Grade, SAG
APRIL					
20413	MIDAS	06/04/2020	11/04/2020	1 Week	AEN/Design, Design Assistants
20306	DY. CE BRIDGE/ LINE	06/04/2020	07/04/2020	2 Days	DY CEs Bridge line All Railway
20307	PCE Seminar	08/04/2020	09/04/2020	2 Days	PCEs All Railway
20006	2018 IRSE Prob. (P) Phase-2	13/04/2020	05/06/2020	8 Weeks	IRSE Probationers
20004	Joining IRSE (P) 2019	13/04/2020	17/04/2020	1 Week	IRSE Probationers
20410	Advance Track Maintenance	13/04/2020	24/04/2020	2 Weeks	JS, SS, JAG
20424	Bridge Girder Inspection	20/04/2020	24/04/2020	1	JE/SSE/Bridge, ABEs
20102	Integrated	20/04/2020	10/07/2020	12 Weeks	Gr. B Officers
20205	Sr. Prof. Bridge Part-1	20/04/2020	30/04/2020	2 Weeks	JAG, Selection Grade, SAG
20411	R W I	27/04/2020	30/04/2020	1 Week	All Officers
MAY					
20008	2018 IRSE Prob. (Q) Phase-2	04/05/2020	26/06/2020	8 Weeks	IRSE Probationers
20206	Sr. Prof. Bridge Part-2	04/05/2020	15/05/2020	2 Weeks	JAG, Selection Grade, SAG
20207	Sr. Prof. P.Way Part-1	26/05/2020	05/06/2020	2 Weeks	JAG, Selection Grade, SAG
JUNE					
20208	Sr. Prof. P.Way Part-2	08/06/2020	19/06/2020	2 Weeks	JAG, Selection Grade, SAG
20414	Bridge Planning, Cont. & Maint.	08/06/2020	19/06/2020	2 Weeks	JS, SS, JAG
20312	CTE Seminar	22/06/2020	23/06/2020	2 Days	CTEs All Railway
20313	CAO Seminar	25/06/2020	26/06/2020	2 Days	CAOs All Railway
20007	IRSE Prob. 2019 (P Batch) Phase-1	29/06/2020	21/08/2020	8 weeks	IRSE Probationers
20701	Awareness Course G-1	29/06/2020	03/07/2020	1 Week	Probationers other Dept.
JULY					
20702	Awareness Course G-2	06/07/2020	10/07/2020	1 Week	Probationers other Dept.
20012	IRSE Prob. 2019 (Q Batch) Phase-1	13/07/2020	04/09/2020	8 weeks	IRSE Probationers
20703	Awareness Course G-3	13/07/2020	17/07/2020	1 Week	Probationers other Dept.

20704	Awareness Course G-4	20/07/2020	24/07/2020	1 Week	Probationers other Dept.
20705	Awareness Course G-5	27/07/2020	31/07/2020	1 Week	Probationers other Dept.
AUGUST					
20706	Awareness Course G-6	03/08/2020	07/08/2020	1 Week	Probationers other Dept.
20707	Awareness Course G-7	10/08/2020	14/08/2020	1 Week	Probationers other Dept.
20503	Spl. Course For MES Engrs.	17/08/2020	21/08/2020	1 Week	Millitary Engineers
20708	Awareness Course G-8	17/08/2020	21/08/2020	1 Week	Probationers other Dept.
20308	Seminar Slot	24/08/2020	25/08/2020	2 Days	
20408	Bridge Design Assistant	24/08/2020	11/09/2020	3 Weeks	AEN/Design, Design Assistants
20309	CE/TP Seminar	27/08/2020	28/08/2020	2 Days	CE/TP All Railway
20310	Seminar Slot	31/08/2020	01/09/2020	2 Days	
SEPTEMBER					
20311	CEW/CPDE Seminar	03/09/2020	04/09/2020	2 Days	CEW/CPDE All Railway
20417	Contract & Arbitration	07/09/2020	18/09/2020	2 Weeks	All Officers
20504	Spl. Course For DMRC Engineers	07/09/2020	11/09/2020	1 Week	DMRC Engineers
20209	Sr. Prof. Bridge Part-1	14/09/2020	25/09/2020	2 Weeks	JAG, Selection Grade, SAG
20420	STAADPRO	14/09/2020	18/09/2020	1 Week	AEN/Design, Design Assistants
20009	SECOND Review Meeting IRSE -18	21/09/2020	25/09/2020	1 WEEK	IRSE Probationers
20415	Basic Track Maintenance	21/09/2010	01/10/2020	2 Weeks	JS, SS
20412	Tunnelling	21/09/2020	01/10/2020	2 Weeks	All Officers
20210	Sr. Prof. Bridge Part-2	28/09/2020	09/10/2020	2 Weeks	JAG, Selection Grade, SAG
OCTOBER					
20103	Integrated	05/10/2020	24/12/2020	12 Weeks	Gr. B Officers
20416	Advance Track Maintenance	05/10/2020	16/10/2020	2 Weeks	JS, SS, JAG
20419	Course on Geotech Engineering	05/10/2020	16/10/2020	2 Weeks	All officers
20211	Sr. Prof. P Way Part-1	12/10/2020	23/10/2020	2 Weeks	JAG,Selection Grade, SAG
20418	R W I	19/10/2020	23/10/2020	1 Week	All officers
20421	Bridge Planning, Cont. & Maint.	19/10/2020	29/10/2020	2 Weeks	JS, SS, JAG
20212	Sr. Prof. P.Way Part-2	26/10/2020	06/11/2020	2 Weeks	JAG, Selection Grade, SAG
NOVEMBER					
20314	IRICEN Day	02/11/2020	04/11/2020	3 DAYS	IRSE Officers Batch 1994
20315	CE/TMC	09/11/2020	10/11/2020	2 Days	CE/TMC All Railway
20316	DY. CE Bridge Design	23/11/2020	24/11/2020	2 Days	DY. CE BR Design ALL RLY.
20317	S J V	26/11/2020	27/11/2020	2 Days	Officers of Rly & other Govt. Dept.
DECEMBER					
20422	Spl. Course For Const. Engineers	01/12/2020	11/12/2020	2 Weeks	SS/JAG/SG Officers
20505	Spl. Course For DMRC (TNLG.)	01/12/2020	05/12/2020	1 Week	DMRC Engineers
20423	MIDAS	07/12/2020	11/12/2020	1 Week	AEN/Design, Design Assistants
20010	Posting Exam. IRSE	14/12/2020	18/12/2020	1 Week	IRSE Probationers
20011	Orientation IRSE Prob.	21/12/2020	24/12/2020	1 Week	IRSE Probationers

SSTW Calendar of Courses -2020 (Rev.3)

COURSE NO	COURSE NAME	FROM	TO	DURATION	ELIGIBILITY
MARCH					
20605	Refresher Course (P. Way)	02/03/2020	20/03/2020	3	JE/SSE/P. Way
20804	Survey	02/03/2020	06/03/2020	1	JE/SSE/ Works
20606	Refresher Course (Works)	09/03/2020	20/03/2020	2	JE/SSE/ Works
20805	RWI (P. Way)	23/03/2020	27/03/2020	1	JE/SSE/ P.Way
20806	Contract Management	23/03/2020	27/03/2020	1	JE/SSE/P. Way-Works-BR
20607	Refresher Course (P. Way)	30/03/2020	17/04/2020	3	JE/SSE/P. Way
APRIL					
20608	Refresher Course (Bridge)	13/04/2020	30/04/2020	3	JE/SSE/Bridge
20807	Land Management	20/04/2020	24/04/2020	1	JE/SSE/ Works
20904	"Inspection Of Girder Bridges" for RITES Engineers	06/04/2020	11/04/2020	1	RITES Engineers, JE/ SSE/BR
20609	Refresher Course (P. Way)	27/04/2020	15/05/2020	3	JE/SSE/P. Way
MAY					
20902	TCB-2 For RVNL Engineers	04/05/2020	29/05/2020	4	RVNL Engineers
20610	Refresher (USFD)	18/05/2020	22/05/2020	1	JE/SSE (USFD)
20611	Refresher Course (P. Way)	26/05/2020	12/06/2020	3	JE/SSE/P. Way
JUNE					
20809	Building Construction	01/06/2020	05/06/2020	1	JE/SSE/ Works
20612	Refresher Course (Works)	08/06/2020	19/06/2020	2	JE/SSE/ Works
20613	Refresher Course (Bridge)	15/06/2020	03/07/2020	3	JE/SSE/Bridge
20614	Refresher Course (P. Way)	22/06/2020	10/07/2020	3	JE/SSE/P. Way
JULY					
20810	RWI (P. Way)	13/07/2020	17/07/2020	1	JE/SSE/P. Way
20903	TCB-3 For RVNL Engineers	13/07/2020	07/08/2020	4	RVNL Engineers
20615	Refresher Course (P. Way)	20/07/2020	07/08/2020	3	JE/SSE/P. Way
AUGUST					
20811	Course on Geotech Engineering	08.08.20	12/08/2020	1	JE/SSE/ Works
20812	Concrete Technology	17.08.20	21/08/2020	1	JE/SSE/ Works
20616	Refresher Course (P. Way)	17.08.20	04/09/2020	3	JE/SSE/P. Way
20617	Refresher Course (Works)	24.08.20	04/09/2020	2	JE/SSE/ Works
SEPTEMBER					
20813	R W I (TFC)	07/09/2020	11/09/2020	1	Traffic Inspectors
20814	Survey	07/09/2020	11/09/2020	1	JE/SSE/ Works
20618	Refresher Course (P. Way)	14-09-2020	01/10/2020	3	JE/SSE/P. Way
20815	Contract Management	14-09-2020	18-09-2020	1	JE/SSE/P. Way-Works-BR
20816	Land Management	21-09-2020	25-09-2020	1	JE/SSE/Works
20817	Building Construction	28-09-2020	01/10/2020	1	JE/SSE/Works
OCTOBER					
20619	Refresher Course (Bridge)	10/05/2020	23-10-2020	3	JE/SSE/Bridge
20818	TMS	10/05/2020	10/09/2020	1	JE/SSE/P. Way
20620	Refresher Course (P. Way)	12/10/2020	29/10/2020	3	JE/SSE/P. Way

NOVEMBER					
20621	Refresher (USFD)	23/11/2020	27/11/2020	1	JE/SSE (USFD)
20622	Refresher Course (Works)	23-11-2020	04/12/2020	2	JE/SSE/ Works
20623	Refresher Course (P. Way)	01/12/2020	18/12/2020	3	JE/SSE/P. Way
DECEMBER					
20819	Concrete Technology	14/12/2020	18/12/2020	1	JE/SSE/ Works
20820	RWI (P. Way)	21/12/2020	24/12/2020	1	JE/SSE/P. Way
20821	TMS	28/12/2020	01/01/2021	1	JE/SSE/P. Way

Rally During RASHTIYA EKTA DIWAS.

Group Photo of Silver Jubilee IRSE Batch 1993 with Shri Anilkumar Gupta, DG/NAIR & Shri Sanjeev Mittal, GM/CR on the occassion of 62nd IRICEN Day

IRICEN Calender of Courses (CoC) for 2020 (Revision 3 Dated 14/02/2020)

Month & Year	FEB.2020				MAR.2020					Apr.2020				May.2020				June.2020					July.2020				Aug.2020					SEPT.2020				Oct.2020				Nov.2020					Dec.2020			
Date (Monday)	3	10	17	24	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	##	16	23	30	7	14	21	28
Institute holidays			19&21			10		25		10			1	7			25											15							2				30		13	16		30			25	
IRSE 2017																																																	
IRSE 2018						20003 First Midterm Review					20006 (P) IRSE PROB 2018 Phase 2																						20009 Second Midterm Review				Induction at NAIR									20010 Posting Exam-2018	20011 Orientation 2018	
IRSE 2018														20008 (Q) IRSE PROB 2018 Phase 2																																			
IRSE 2019											20004 Joining IRSE (P) 2019											20007 IRSE PROB 2019 Phase 1 . (P Batch)																											
IRSE 2019																								20012 IRSE PROB 2019 Phase 1 . (Q Batch)																										
Integrated courses	NTEG	ALD		20101 INTEGRATED								20102 INTEGRATED					ALD		20102 INTEGRATED																	20103 INTEGRATED						ALD	20103 INTEGRATED					
Sr.Prof. courses							20203 Sr. Prof. P.Way Part-1		20204 Sr. Prof. P.Way Part-2			20205 Sr.Prof.Bridge Part-1	20206 Sr.Prof.Bridge Part-2				20207 Sr. Prof. P.Way Part-1		20208 Sr. Prof. P.Way Part-2													20209 Sr.Prof.Bridge Part-1		20210 Sr.Prof.Bridge Part-2		20211 Sr. Prof. P.Way Part-1		20212 Sr. Prof. P.Way Part-2									
Track courses	20402 Advance Track			20404 RWI					20409 Basic Track		20410 Advance Track Maintenance		20411 RWI																					20415		20416		20418										
Bridge Courses								20406 Bridge Planning, const & Maintenance				20424 Bridge Girder Inspection							20414 Bridge Planning, const & Maintenance											20408 Bridge Design Assistant						20421 Bridge Planning, const & Maintenance												
Contract, Arbit & PM, survey , Geotech courses		20403 Geotech Engg.						20407 Contract & Arbitration																							20417 Contract & Arbitration			20412 Tunneling		20419 Geotech Engg								20422 Construction Engineers				
Software courses					20405 STAADPRO					20413 MIDAS																						20420 STAADPRO														20423 MIDAS			
Courses for PSU				20502 DMRC																									20503 MES			20504 DMRC												20505 DMRC				
AWARENESS COURSES																						20701 G-1	20702 G-2	20703 G-3	20704 G-4	20705 G-5	20706 G-6	20707 G-7	20708 G-8																			
Trainees																						30	30	30	30	30	30	30	30																				
HAG/SAG SEMINARS			20301			20302	20303			20304	20305										20312	20313								20308	20309	20310	20311								IRICENDAY	20315		20316	20317				
Trainees		35				35				35											35										35	35									35	35		35					
Misc		CBE				SLOT, SJV				SLOT, EPC&PP											CTE, CAO										SLOT, CE/TP	SLOT, CEW/CPDE									CE/TMC		DY.CE/D/SJV						
										DYCE/Br, PCE																																						

SSTW Calender of Courses (CoC) for 2020

Month & Year	JAN.2020				FEB.2020				MAR.2020					Apr.2020				May.2020				June.2020					July.2020				Aug.2020				SEPT.2020				Oct.2020				Nov.2020					Dec.2020			
Date (Monday)	6	13	20	27	3	10	17	24	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28
Institute holidays							19-21		4		21					17						5										12& 15								2	8					12							25
Track courses	Refresher Course (P.Way) - 20601				Refresher Course (P.Way) - 20603				Refresher Course (P.Way) - 20605				Refresher Course (P.Way) - 20607				Refresher Course (P.Way) - 20609				Refresher Course (P.Way) - 20611				Refresher Course (P.Way) - 20614				Refresher Course (P.Way) - 20615				Refresher Course (P.Way) - 20616				Refresher Course (P.Way) - 20618				Refresher Course (P.Way) - 20620							Refresher Course (P.Way) - 20623				
Trainees	35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35		35	35	35					35	35	35	
Track courses				RWI 20802				20604 Refresher Course (USFD)				RWI 20805									20610 Refresher Course (USFD)								RWI 20810								RWI (TFC) 20813				TMS 20818							Refresher Course (USFD) 20824				RWI 20820	TMS 20821
Trainees				35				25				35									25								35								35				35							25				35	35
Bridge courses		Refresher Course (Bridges) 20602													Refresher Course (Bridges) 20608									Refresher Course (Bridges) 20613																	Refresher Course (Bridges) 20619												
Works courses										Refresher Course (Works) 20606						IRICEN							Refresher Course (Works) 20612										Refresher Course (Works) 20617													Refresher Course (Works) 20622						
Works courses	Geotech 20801							Conc Tech 20803	Survey 20804			Cont Mgmt 20806				Land Mgmt 20807						Bldg Cons 20809									Geotech 20811	Conc Tech 20812			Survey 20814	Cont Mgmt 20815	Land Mgmt 20816	Bldg Cons 20817											Conc Tech 20819			
PSU courses					20901 TCB-1 RVNL ENGRS.									20904 RITES Engrs				20902 TCB-2 RVNL ENGRS.										20903 TCB-3 RVNL ENGRS.																								
TOT courses																																																		

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