The DFCCIL JOURNAL

ISSUE V, DECEMBER 2019

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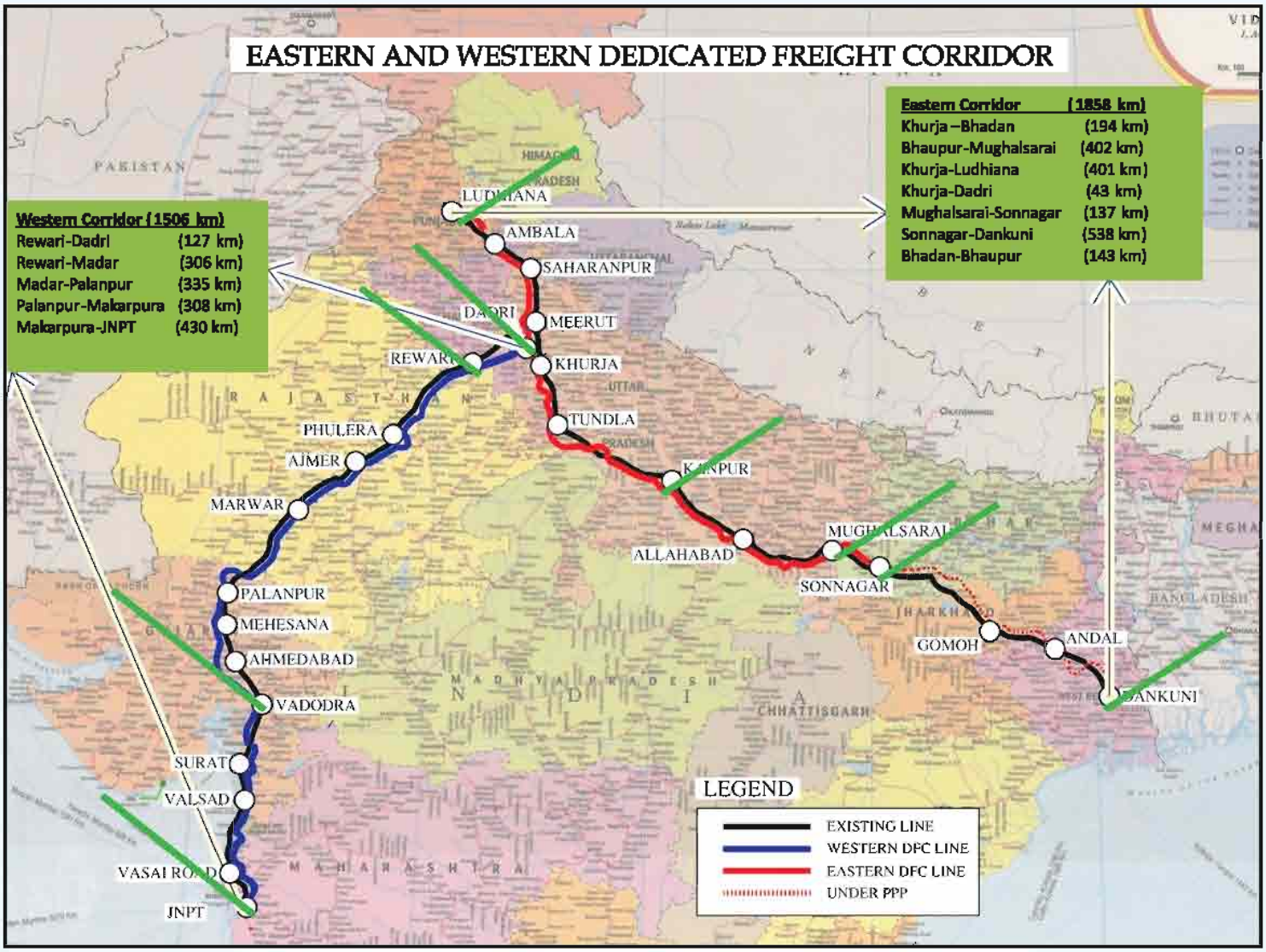

Targets

Western Corridor

SN	Sections	Targets
1	Dadri – Rewari (127 Km)	March-2021
2	Rewari – Madar (306 Km)	Commercial Trial Run started from 27.12.2019.
3	Madar – Palanpur (335 Km)	March-2020
4	Palanpur – Makarpura (308 Km)	September-2021
5	Makarpura – JNPT (430 Km)	December-2021

Eastern Corridor

SN	Sections	Targets
1	Ludhiana -Khurja (401 Km)	December-2021
2	Khurja – Bhadan (194 Km)	Commercial Trial Run started from 02.10.2019. More than 640 trains run till date
3	Khurja – Dadri (43 Km)	December-2020
4	Bhadan – Bhaupur (143 Km)	March-2020
5	Bhaupur – Mughalsarai (402 Km)	December-2020
6	Mughalsarai – Sonnagar (137 Km)	December-2020
7	Sonnagar – Dankuni (538 Km)	Proposed to be done through PPP

Anurag Kumar Sachan
Managing Director, DFCCIL

FROM THE EDITOR's DESK

Dear Readers,

To quote a few luminaries,

A capacity and taste for reading gives access to whatever has already been discovered by others – ***Abraham Lincoln***

Reading is to the mind what exercise is to the body. – ***Joseph Addison***

The benefits of Reading comes to the fore. Reading opens new vistas, unexplored by the mind of the Reader, and makes him richer, both in knowledge and experience. Reading can make you a better person, better, effective Speaker sans Fear, better & efficient professional. To encourage and inculcate 'Reading' as a regular habit to overall betterment, we, at DFCCIL, decided to bring out this Quarterly called DFCCIL Journal.

It is my great pleasure in presenting the Vth issue (December-2019) of DFCCIL Journal. It is heartening to note that now, a year old DFCCIL Journal has grown in stature since its inception during December 2018 bringing with consistent regularity a welcome bouquet of scholarly Articles on variety of Multidisciplinary Technical or Non-Technical Issues to the delight and enrichment of our beloved Readers.

In this issue, we have made a conscious effort to touch upon topics which, apart from being informative, are contextually relevant in the current temporal frame. The Issue contains an interesting and Informative array of Articles on Electrification, End Launching Scheme for Open Web Girders, Articles related with Dispute Adjudication like UNCITRAL Model Law on Arbitration, FIDIC Provisions on Dispute adjudicatory mechanism provided in FIDIC against Legal perspective and some very informative Articles related with Environment like Noise mitigation measures, Carbon sequestration and Temporary but safe Labour Camps which carry the potential of enhancing the reader's comprehension /grasp of the subjects, dwelt upon.

Readers, I feel privileged and great pride in conveying that DFCCIL, as an organisation, has taken substantive leaps towards serving our great Nation. In this direction, on 27-12-2019, a trial run of a double-stack freight train on the newly built 306km long Rewari-Madar section of the Western Dedicated Freight Corridor (WDFC) was, successfully, conducted, an event which was extensively reported in Print and Social media and well received by one and all. The Day is not far, when Railway would sustainably recapture its fair share of Transportation modal share by the DFCCIL, post full implementation, running Freight Trains to the pre-circulated Time table.

In addition, earlier during the year, DFCCIL, achieved significant Mile Stones e.g. on 02-10-2019, in EDFC, the 194 km long section- Khurja-Bhadan was opened with 1.5 km long & 9000 MT Long Haul Freight Train operation, resulting in successful operation of about 700 Goods Trains. As one of the First for Goods Train operation in India, in Ateli-Phulera section [WDFC], 25 MT Capacity BOXNS Wagons were successfully tested at Max speed of 110 kmph by RDSO.

As the wondrous Year 2019 is drawing to a glorious close and incipient New Year 2020 is virtually knocking at the doors, I would take this opportunity to wish our Readers a very happy, prosperous New Year during which , I am certain that DFCCIL shall scale further dizzying heights.

जिन्दगी की असली उड़ान अभी बाकी है,
जिन्दगी के कई इम्तिहान अभी बाकी है,
अभी तो नापी है मुट्ठी भर जमीन हमने,
आगे अभी सारा आसमान बाकी है....

Enjoy reading.

Anurag Kumar Sachan
Managing Director, DFCCIL

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Tunnel Work in Progress in Aravalli Range Between Rewari-Dadri Section

Front cover picture

Auto Launching Arrangement for Launching of PSC Box Girders on Viaduct No. 92 in Rewari-Dadri Section

Back cover picture

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PHOTO

Concreting of pier Cap P2 at Br. No. 141 (CTP-14)

Abutment (A1) pedestal casting completed at PAR Br. No. 60 (CTP 15A)

Fabrication of 2nd steel Girder (Up track) at RFO Site (CTP-15C)

1st lift of Column completed & Beam Shuttering in progress (Ancheli Station Building)

Concreting in progress (2nd lift) at Abutment (A1) of Bridge no. 69 of WDFC

GALLERY

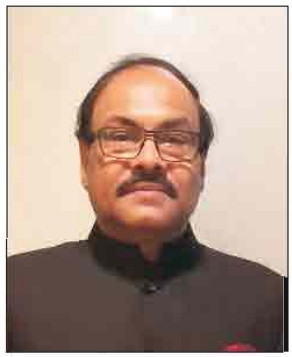
RCC Toe Wall in progress at Minor Bridge No. 147 of WDFC

P1 Bearing inspection plate form work in Progress at Br. No. 240 Tapi

Main Assembling B/w P2-P3 Piers and Bottom Chord Assembling in Progress at Yamuna Bridge

2nd Stage HSFG Bolt Tightening in Progress for Down Track Side Girder at RFO Site

Final lift reinforcement for well steining of Pier P-12 in progress at Narmada Br. No. 57



Railway Electrification for Double Stack Container movement – A successful trial run

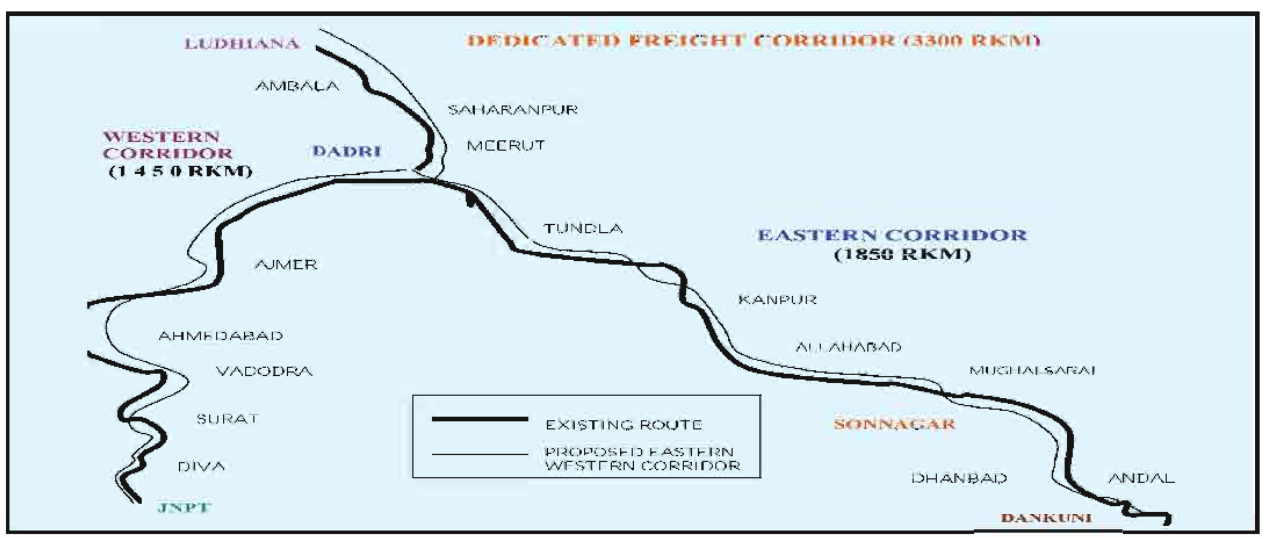
P.C. NAYAK, CPM/RE/BBS

ABSTRACT

Burgeoning population rise, fast development in economic and infrastructural growth of the country has put extra thrust on Indian Railways to carry more passengers and freight, a thrust continuously increasing over the years. While speed of coaching trains is a prime requirement for both railways and the customers, volume of freight transported is paramount. Significant speed difference between coaching trains and freight trains leads to reduction in through put of railway tracks for mixed transportation. This type of mixed traffic movement on the same track along with operating requirements truncate the movement of freight traffic.

The increase in transport volume of domestic freight shows a growth rate of 15 to 18 % per annum. Keeping in view the rapid growth of freight transportation, Ministry of Railways initiated strategies for strengthening of freight transport capacity of railways considering the economic viability and environmental sustainability. As a part of this strategy, Indian Railways have planned to build a 10,000 KM network of dedicated heavy-haul freight corridor for 30 ton axle load (or possibly more) movement called Dedicated Freight Corridor (DFC).

The DFC route is planned to be designed for running of double stack container (DSC) service in electrified territory. The first two routes of DFC are Eastern Corridor of 866 KM double track electrified section from Sonnagar to Dadri and a 412 KM single track electrified section from Khurja to Ludhiana, Western Corridor of 1483 KM double track electrified section from Jawaharlal Nehru Port Trust (JNPT) to Dadri. Electrification of these routes are planned with high rise overhead equipment (OHE) of contact wire height at 7.45 m to suit the height of DSC rolling stock. Special design of OHE to be adopted at the merging point of high rise OHE with standard OHE for smooth transition.



Background of the project and need for the trial run

In the summit meeting held in April, 2005 it was jointly decided by the Government of India and Government of Japan to implement the DFC project with inputs of Japanese technology and expertise using Japan's Special Terms for Economic Partnership (STEP) scheme as precondition. In May, 2006 Japan International Cooperation Agency (JICA) commenced the feasibility study on the development of DFC for Delhi-Mumbai and Ludhiana-Sonnagar section named as the Western corridor and Eastern corridor respectively and concluded in October, 2007. Based on the results of the JICA feasibility study, construction of DFC was sanctioned in principle in Nov, 2007.

Initially, JICA had recommended for use of well type wagons for transport of DSC on electric traction. However, Indian Railways preferred to go for flat type wagons for DSC transport on electric traction on the consideration of higher transport capacity. JICA emphasized the necessity of carrying out a verification test to examine the safety of DSC transport by flat type wagons before its commissioning.

Following the recommendation, it was decided to carry out proof examination on technical feasibility of flat type wagons for DSC with high-rise pantograph and OHE.

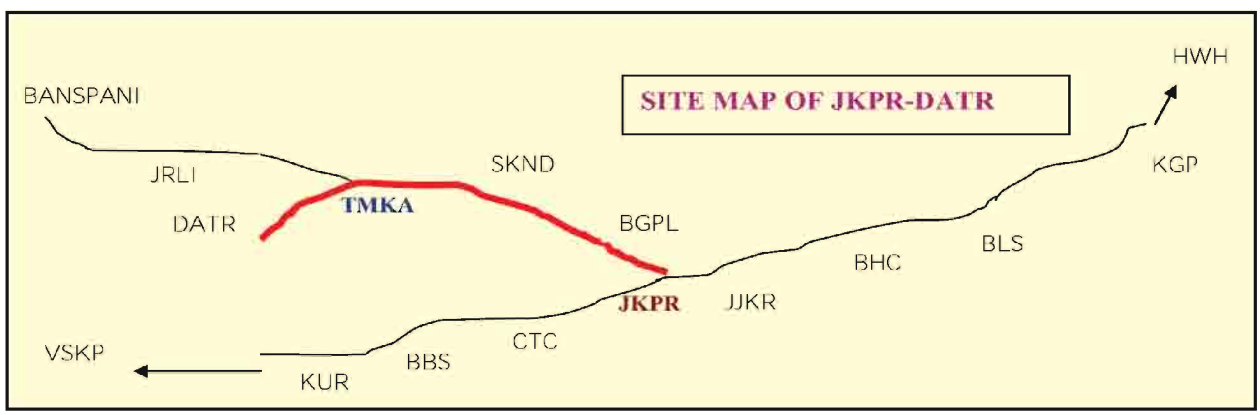
The proof examination and trial run was divided into two sections. One is the trial of DSC on flat type wagons to establish stability, actual applicability and speed of run to confirm stability of flat type wagon against lateral wind force and dynamic lateral force under running conditions and hazard analysis. The other part is trial run of electric locomotive fitted with specially designed high reach pantograph under high rise OHE to establish smooth transition while negotiating from the existing OHE to high rise OHE, smooth and spark less current collection, stability of high reach pantograph along with other design parameters of high rise OHE.

Site for conducting the trial run

The first part of the trial for running tests of DSC on flat type wagons was conducted on 10th and 11th June, 2008 between Dhasa Jn. and Savarkundla of Western Railway. During this trial, containers were loaded on flat wagons in double stack and run at maximum speed of 110 KMPH. The train was hauled by diesel locomotive. The trial results were analysed and report was submitted by JICA to Railway Board. Further discussions on details of the DSC trial is beyond the scope of this paper.

The second part of the trial was running of trains hauled by electric locomotive fitted with high reach pantographs in light and loaded conditions under high rise OHE. This necessitated erection of new OHE with higher contact wire height and design of special pantograph to be fitted on locomotives to be used for the trial.

Electrification of Jakhapura-Daitari section of East-Coast Railway was sanctioned as material modification to the Kharagpur-Bhubaneswar project



in Jan-2007. During July-2007, Railway Board decided for electrification of Jakhapura -Daitari section suitable for DSC movement. It was clarified by the Railway Board that, this route is not designated as DSC route for normal traffic movement. As such, it was decided to erect the OHE with contact wire height of 7.45m for conducting the trial with high reach pantograph and bring down the OHE to standard contact wire height of 5.6m after successful completion of the trial run.

The section was nominated for conducting the trial run of OHE for DSC on the consideration that there was no overhead structure like ROB, FOB and bridges etc. in the section which could have posed obstruction for erection of OHE at 7.45m height. Moreover, sanction existed for electrification of the section so that immediate action could be taken for execution of the work.

Design of OHE

The design of OHE was assigned to Research Designs and Standards Organisation (RDSO), Lucknow, the research and design wing of Indian Railways. Complete design of OHE was done by RDSO indigenously in consultation with Central Organisation for Railway Electrification (CORE), Allahabad. The OHE design was based on maximum moving dimensions (MMD) of DSC i.e. width-3.66m and height-7.10m. The contact wire height of OHE was kept at 7.45m from the rail level keeping in view the maximum height of rolling stock which is 7.10 m.

Broad design features of OHE are given below-

OHE - Polygonal conventional regulated	Catenary wire height-8. 65 m
Foundations- Same as conventional OHE, more volume due to higher bending moment because of longer masts.	Minimum implantation- 2. 80 m
	Span length- 63 m
Length of mast- 10. 85m	Standard Encumbrance-1. 2 m
Type of mast- K-175/K-200/K-225/K-250 (Fabricated steel masts)	Tension in contact and catenary each- 1000 kgf
Type of ATD-3 pulley type	Maximum tension length- 1500 m
Height of contact wire at mid span-7. 40 m from rail level	SS wire rope length-10. 5 m
	Anchoring height-8. 35 m
Maximum stagger at curves- +/_ 250mm	Maximum stagger at tangent track- +/_ 150mm
Merging with existing OHE- The gradient of contact wire to be @ 10mm/m and relative gradient of contact wire between two adjacent spans should not be more than 1. 5 mm/m	

Agency for execution of the project

The OHE contract was awarded to M/s L&T, Chennai through open tendering system by CORE/Allahabad. Letter of acceptance was issued to M/s L&T on 28.2.08 with completion period of six months. As per terms and conditions of the contract, the OHE has to be erected as per given design and after the trial is completed it had to be lowered to standard height of 5.6 m.

Since the high rise OHE was executed for the first in India, many technical clarifications were to be obtained from RDSO as well as CORE before physical activities started. The foundation work started from 6.3.08.K series masts of higher length were to be specially manufactured for this project and transported to the site which took substantial time. Mast erection activities ultimately started from 23.5.08.

Execution of field works

Preparatory works - After award of OHE contract, foundation activities and subsequent mast erection progressed at fast rate. Some logistics support was exclusively necessary for erecting high rise OHE. Such activities were organized on priority basis in advance to ensure that progress of field works does not suffer for want of these facilities.

Such activities are:-

1. Security arrangement –This was required to take care of any untoward incident in the field and also any theft of contact and catenary wire during wiring stage. Special platoon of RPSF was deputed for this purpose.
2. The pantograph mounted on the existing 8 wheeler tower car does not have height to reach contact wire at 7. 45m height during tower car checking. Special arrangement was made to raise the height of pantograph by 1.1m. This modification had to done at site since the modified pantograph can not move in the electrified territory because of extra height of pantograph.
3. For wiring , deck coach of suitable platform height was fabricated at site. The deck coach was designed in such a manner that after wiring is completed for DSC, the deck coach can be used for wiring of conventional OHE.
4. The NETRA (Network of Electrification Testing and Recording Apparatus) car of RDSO which was to be used for OHE testing and recording was suitably calibrated and the pantograph base was raised to work at 7. 45 m contact wire height. This modification was also done at site.
5. Special ladders of extra length were arranged for use during bracket adjustment and SED (Structure Erection Diagram) checking.
6. All T&P items were kept ready well in time to ensure that there is no delay in progress of the work on this account.
7. All arrangements for lighting were made for night working.
8. All technical clarifications were obtained from RDSO and CORE well before execution of field works to ensure no hold up in work for technical reasons .This was very essential since such work was done for the first time and so many doubts were raised on the OHE parameters and the materials used.
9. All material planning was meticulously done and close liaison was maintained with the manufacturers. Since steel was the most critical item, lorry wise loading position from manufacture premises, type of steel loaded, movement of the lorries for enroute detention were very closely coordinated. In fact, crane was ready at site waiting for the lorry to arrive and on arrival, masts were directly loaded to the wagons and taken to site for erection.
10. The erection of OHE for DSC was only for conducting the trial run. Therefore, to save time, it was decided to wire the main line up to Tomka, which is one block section short of Daitari and only one loop in each station. The design was accordingly done.
11. The transition zone with the mainline OHE which was incidentally in 8 degree curve. For better current collection, OHE was designed with gradient of 10 mm/m taking care that relative gradient of contact wire of two adjacent spans do not exceed 1. 5mm/m after the curved track.

Problems faced, Bottlenecks, Strategies for overcoming the obstacles

The most difficult task of this project was the time of starting field work and the toughest target given for completion of both erection of OHE and conducting the trial. The work started in summer. Scorching heat and non-availability of water for foundation work put the real challenge .Water was carried by tankers in the most arduous terrain as there was no road approach to most of the locations. Rocky and hard soil made it more difficult for foundations. To overcome this problem mechanized drilling machines were deployed. By the time wiring started, monsoon set in. To keep the target, day and night wiring was done even if it was raining heavily.

When the target was tough and all efforts were made to achieve it, nature also tried to test the strength and

patience. There was complete dislocation of train services between Kharagpur and Balasore due to flood as both bridges were washed away. For few months all goods trains were diverted via Jakhapura –Tomka. Getting traffic block for wiring and other OHE works became very difficult. When the work was in its peak of progress, absenteeism amongst the labour due to local festival and loss of few working days due to local strikes and road block made the job more difficult to commission the section within the target date.

All stations in Jakhapura-Daitari section are loading stations. Due to this almost all lines in every station yard were lying occupied by either empty rakes or loaded trains. Close watch was kept for availability of free lines through out the day and night. Constant chasing of the divisional control to get free lines to work was causing delay in progress besides wastage of man-hours. These are few obstacles which had serious repercussion but there were number of other hurdles which put a real challenge to energise the OHE within the target date.

Albeit, all efforts were made from all corners for timely completion, few special factors had miraculous impact. A general motivation was created in the minds of all officers and staff, both of Railways and the contractor to achieve the success and prove that "we could do it". This motivating factor made everybody to work day and night, sun and rain and ultimately with or without food. The most important silver lining within all adversities was that there was not a single case of theft or break down during the entire period of work. Involvement and repeated pursuation by the top management of open line railway, CORE and railway board acted as a great catalyst. To save time, food packets were distributed to the workmen at site so that they don't waste time going out for food. This has in deed increased the productivity substantially. Minute to minute monitoring of progress, day and night working, parallel processing of papers for EIG sanction, proper coordination in the field, technical inputs at the right time in the field during execution of the work for saving time and ultimately the willpower made it possible just in time.

Design and testing of high reach pantograph

The conventional pantographs used in the electric locomotives in IR are not suitable to reach 7.45m height. Moreover, since the high rise OHE had to ultimately merge with the conventional OHE at some point, the pantograph should be able to negotiate the transition zone and work at 7.45m height as well as contact wire height of 5.6m for the conventional OHE. A special type of pantograph was, therefore, required to be designed and manufactured for the purpose.

The assignment was entrusted by Railway Board to RDSO for designing and preparing the specifications for the pantograph and Cittaranjan Locomotive Works (CLW), the lone electric locomotive manufacturing unit of IR to manufacture electric locomotives fitted with high reach pantograph.

Salient technical features of high reach pantograph-

Pantograph type	Omniversal Intelli Panto	Distance between mounting	807 mm x 1160 mm
Mounting	4 points	Rated current	600 Amps
Operating Voltage	25 kv ac	Static up thrust	6.5 to 8.5 kg
Weight(without insulator)	198 kg	Maximum folded height	326 +/- 5 mm
Working range	100 to 3500 mm	Maximum extension	7.7 m from rail level
Collector strips	Metalised carbon	Pan width	1800 +/- 5 mm
Pan length	400+/- 5 mm	Total length	3285 mm
Minimum pressure to raise	5.6 kg/cm sq	Minimum pressure to lower	3.6 kg/ cm sq
Maximum permissible pressure	10 kg/ cm sq	Raising time for 3.5 m	14 sec
		Lowering time from 3.5 m	12 sec

The pantograph was designed for working under existing OHE as well as high rise OHE as per IEC-60494-1. It uses air operated actuators along with pneumatic control panel for raising and lowering, also to ensure improved dynamic behaviour during current collection. Structural design of the pantograph ensures stable operation at maximum raised height. Air is fed to the actuators through pneumatic control panel for operation thus obviating the need for springs and servomotor, making the pantograph more maintenance friendly and reliable. The weight of the pantograph was kept as low as possible despite increase in size.

Two pantographs were manufactured by M/s Stone India Ltd., Kolkata for the purpose of conducting trial which were accepted after carrying out necessary tests at manufacturer's premises including wind tunnel test at Department of Aero Space Engineering, Indian Institute of Science, Bangalore. One pantograph was fitted on each locomotive ie.WAG7 loco no. 27980 and 27982 by CLW which were used during the trial.

Commissioning of OHE and Energisation on 25 KV

After completion of all works of bracket adjustment, SED checking and tower car checking the OHE was energised on 25 kV ac on 5th July, 2008 after getting the EIG sanction. The NETRA (Networks of Electrification Testing and Recording Apparatus) of RDSO was modified by raising the height of its pantograph by 1.1m. Calibration of NETRA car was also carried out for condition monitoring of OHE with contact wire height of 7.45 m. Before starting of trial, NETRA car was run from Tomka to Jakhapura and back with pantograph in raised condition and OHE parameters like height of contact wire, stagger and implantation were checked. Minor defects and aberrations were immediately rectified and the OHE was made ready for the trial run.

Test Trial of high rise OHE

The trial was conducted primarily to establish the working compatibility of high reach pantograph with high rise OHE, negotiation of the transition portion between the high rise OHE and the conventional OHE, quality of current collection and moving stability of the pantograph at high speed. The maximum speed of trial in this section was 70 KMPH due to sectional constraint.

The trial was conducted in the following sequence-

Test sequence-

Railway Board had nominated Chief Project Manager, Railway Electrification, Bhubaneswar as test manager. The trial started from 6.7.08. The tests and trials were conducted in the presence of representatives from RDSO, JICA/Japan, CLW/ Chittaranjan, Railway Board and East Coast Railway.

Tower car checking- This was done with pantograph of the tower car in raised condition and OHE in dead condition. Minor rectifications were done based on the tower car run observations.


TOWER CAR CHECKING

NETRA Car recording- NETRA car was run in the entire section from Jakhapura to Tomka with OHE energised. Print out was taken for NETRA recording parameters mainly for height of contact wire, stagger, contact force, contact loss. Minor rectifications were done immediately.


NETRA CAR FOR OHE TESTING

Light engine run- An electric light engine fitted with high reach pantograph was run from Jakhapura to Tomka and back. No abnormality was observed during this run.

Empty goods train run- An empty N-Box rake was run from Jakhapura to Tomka. The locomotive was fitted with OLIVIR –G recording apparatus to record the quality of current collection. No other physical abnormality was noticed during the run.

Loaded goods train run - A loaded N-Box rake was run from Tomka to Jakhapura with same locomotive fitted with OLIVIR –G recording apparatus. This was repeated three times. No abnormality was noticed during the run.

During every run, the locomotive was covering a distance of 22 km under 7.45m high OHE and negotiating the transition between the existing OHE and 7.45m high OHE.

OLIVIR-G PLUS recording- This is an apparatus which was fitted on the roof of the locomotive. The apparatus has facility to record the sparks occurred between the contact wire and the pantograph through a video camera. It can record and give print out for the number of sparks and duration of sparks in milli seconds with the help of a special software. Details of recording shows no significant sparks during the current collection up to speed of 70 KMPH.

Conclusion of the trials-

The following conclusions were drawn by the committee nominated for conducting the trial-

i. The pantograph is able to work satisfactorily under the existing OHE as well as 7.45m high OHE suitable for DSC without any problem

ii. The pantograph is able to negotiate the transition of OHE rising from 5.6m to 7.45m smoothly.

iii. No abnormality was noticed in current collection during light engine run and load run by locomotive fitted with high reach pantograph.

iv. OLIVIR-G PLUS recording shows very smooth and satisfactory current collection.

v. No functional deterioration was observed on pantograph and OHE during and after the trial.

vi. The contact loss ratio as recorded by NETRA car was 3.17% which is within the permissible value of 5% adopted in Indian Railways and 20% as adopted in Japanese Railways.

vii. Successful trial of high reach pantograph under 7.45m high rise OHE establishes suitability of running electric locomotive hauled train under high rise OHE for movement of double stack container.

Conclusion

Successful trial of high reach pantograph under 7.45m OHE has put a feather in the cap of Indian Railways. India is now the first country in the world to conduct such trial. The other countries in the world running DSC on electric traction are USA with OHE height of 7.1m and China with OHE height of 6.6m using well type wagons. Implementation of the project of running DSC under high rise OHE on both Eastern and Western corridor will help railways in segregating passenger and freight traffic while maximizing the line capacity to carry increased traffic in future.

Electric traction has emerged as the eclectic choice for its fuel efficiency, lower operating cost, better rate of acceleration and deceleration, higher average speed, environment friendly, regeneration of power and after all there will be no dependence on imported crude oil thereby saving foreign exchange and earning carbon credits under the Kyoto protocol for the energy generated.

Design Considerations for Noise Barriers for Railways

Tamosi Bhattacharya
(Environmental Planner)
Consultant/ Environment / SEMU

ABSTRACT

Abatement of air borne noise and ground borne vibration and noise generated due to railway operations are essential. Efforts are also being made by the stakeholders to design and construct noise abating measures but with little success because there is no specific guideline prepared on Indian perspective for design of noise barriers for railways. Guidelines for Noise & Vibrations, Metro Rail Transit system, CT-38, 2015 prepared by the Railways Track Design Directorate, Research Designs & Standards Organisation (RDSO), Ministry of Railways, India gives a good insight of Metro noise and vibration that can be referred. However, there still remains the requirement for a comprehensive guideline on Noise and Vibration for Indian Railways running through various landscapes including noise and vibration measurement& analysis methodology and standards, noise and vibration abating measures, barrier material specification, land use context, design criteria, typical design cross section etc. This will help the engineers and contractors to design and construct effective noise barriers and incorporate vibration abatement measures in railway line design. This paper however will focus only on the design consideration of acoustic barriers.

1. INTRODUCTION

Railway transportation is the most sustainable, energy efficient, less CO2 emission intensive and environment friendly mode compared to other transportation modes. In terms of noise, the dose response relationship of rail noise is lesser than that of roads for instance the extent of annoyance caused by exposure to 60 dB (A)Ldn of rail noise is almost the same caused by 52dB (A) Ldn of road noise. The difference can be termed as 'Railway Bonus'[i] .However, noise both air borne and vibration induced or ground borne is a major implication of rail operation awaiting priority response from the policy makers, planners, engineers for effective attenuation. This paper intends to highlight the design considerations of barrier for air borne or radiated noise.

2. DESIGN CONSIDERATION FOR NOISE BARRIER

Design of a noise barrier viz. Nature, material type, thickness, height, length,shape, gap and height- width ratio would depend on the location, extent, height and type of sensitive receptors in the surrounding;source height of noise and desired Insertion Loss.

A. POSITIONING OF BARRIERS

Positioning of the noise barrier shall depend upon the surrounding landscape, density of sensitive receptorsalong the railway line. Either it can be an "On railway line treatment" or "building treatment". "On railway line treatment" pertains to barriers that are installed along the railway line to curb noise at source. This is feasible in an urban area or densely settled area

where density of sensitive receptor is likely to be high. This is feasible also along wildlife habitats, where sensitive receptors are mobile or not static."On railway treatment" would also include measures taken up for reduction in ground borne vibration and noise viz. use of welded tracks, floating slab track beds, ballast mats, high resilience fasteners, resiliently supported ties etc[ii].

Building treatment is feasible where sensitive receptors are discrete and static viz. Schools or Hospitals in rural areas. This includes increasing the height of boundary walls and planting them with hedges or doubling the wall thickness, carpeting with heavy (0.3 sound absorption co-efficient) or light porous concrete (0.34 sound absorption co-efficient), hollow block concrete (0.34 sound absorption co-efficient) walls, unglazed brick walls (absorption co-efficient of 0.04).

B. NATUREOF BARRIER

Depending on types of barrier material their nature can be that of absorptive or reflective. Absorbing Noise Barriers are the most efficient noise barriers panels as they not only isolate sound from the receptor but also absorb and thus reduce the sound from the environment making them useful in both urban and rural environments. Even in case of Wildlife Sanctuaries, absorbing panels are better otherwise, it will create a linear invisible wall of sound for avifaunal and arboreal species at the airspace above a railway corridor. In their environment birds and mammals must be able to discriminate between their own species calls and any other background noise because calls are important factor in the isolation of species, pair bond formation, territorial defence, danger, flock cohesion and advertisement of food sources etc[iii].

Absorbing barriers usually consist of outer casing which are usually made of powder coated steel, aluminium or Wood filled with absorbing materials such as Rock Wool or Mineral Wool. The Barrier usually consists of a porous or perforated absorbing face towards the source of the noise and a reflective side towards the receptor **(Fig.1)**. Turfed or geo-textile reinforced earthen bermalso act as noise absorbing barrier but land availability is often a major constraint in railway projects.

Reflective noise barriers are unidimensional in nature and only isolate the sound from the protected receptor by reflecting it back towards the source. They also provide transparency and can be used in conjunction with Absorbing Panels to get desired efficiency while avoiding tunnelling effects. Poly Methyl Meta Acrylate (PMMA) Sheets, Poly Carbonate Sheets, Toughened Glass Panels, Concrete Barriers, Metal Sheeting, Concrete Hollow Block Barriers.

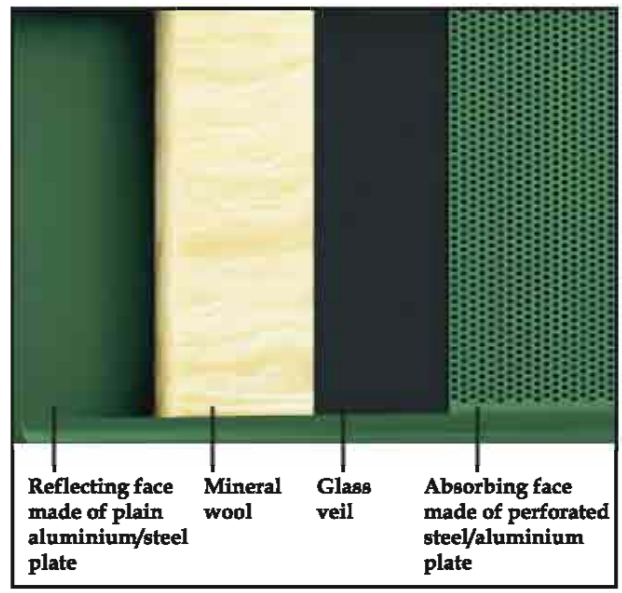


Fig.1 A typical metallic absorbing noise barrier

C. TRANSMISSION LOSS OF BARRIER MATERIALS

All materials permit sound energy to pass through, although in varying degrees depending on the material and the frequency of sound. The attenuation of sound passing through a material is referred to as Transmission Loss (TL).

For a barrier to be fully effective the amount of sound energy passing through it must be significantly less than that passing over the top (or around the edge). When noise levels of two sources LAand LBare added, if difference between them is larger than 10 dB, addition result will be less than 0.5 dB to the higher level.

For Example: $L_A = 80$ dB & $L_B = 70$ dB; $L_{A+B} = 80.4$ dB

Thus, if the portion of sound transmitted through the barrier is 10 dB lower than that which goes over the barrier, the overall sound received is essentially determined by the energy travelling over the barrier.

For acoustical purposes, any material may be used for a barrier between a noise source and a noise receiver as long as it has a TL of at least 10 dB(A) greater than the desired noise reduction (i.e. Insertion Loss (IL) determined in the EIA studies). For example, if a noise barrier is designed to reduce the noise level at a receiver by 8 dB(A), the TL of the barrier must be at least 18 dB(A). The transmitted noise may then be ignored, because the diffracted noise is at least 10 dB(A) greater and hence the noise propagation path must be over the barrier.Figure 1 depicts the transmitted and diffracted noise paths.Table 1 gives approximate TL values for some common materials, tested for typical A-weighted traffic noise frequency spectra that can be roughly referred while choosing barrier material type. In terms of noise reduction, the maximum value that can be achieved theoretically is 20 dB(A) for thin screens (walls) and 23 dB(A) for berms[iv] .

Table 1. Approximate TL values for various noise barrier materials

Material	Thickness (mm)	Surface Density (kg/sqm)	Transmission Loss* (TL) in dB(A)
Polycarbonate	8 – 12	10 – 14	30 – 33
Acrylic [Poly-Methyl-Meta-Acrylate (PMMA)]	15	18	32
Concrete Block (200x200x 400) light weight	200	151	34
Dense concrete	100	244	40
Light concrete	150	244	39
Light concrete	100	161	36
Brick	150	288	40
Steel, 18 ga	1.27	9.8	25
Steel, 20 ga	0.95	7.3	22
Steel, 22 ga	0.79	6.1	20
Steel, 24 ga	0.64	4.9	18
Aluminum Sheet	1.59	4.4	23
Aluminum Sheet	3.18	8.8	25
Aluminum Sheet	6.35	17.1	27
Wood	25	18	21
Plywood	13	8.3	20
Plywood	25	16.1	23
Absorptive panels with polyester film backed by metal sheet	50 – 125	20 – 30	30 – 47
*Values assuming no opening or gaps in the barrier			

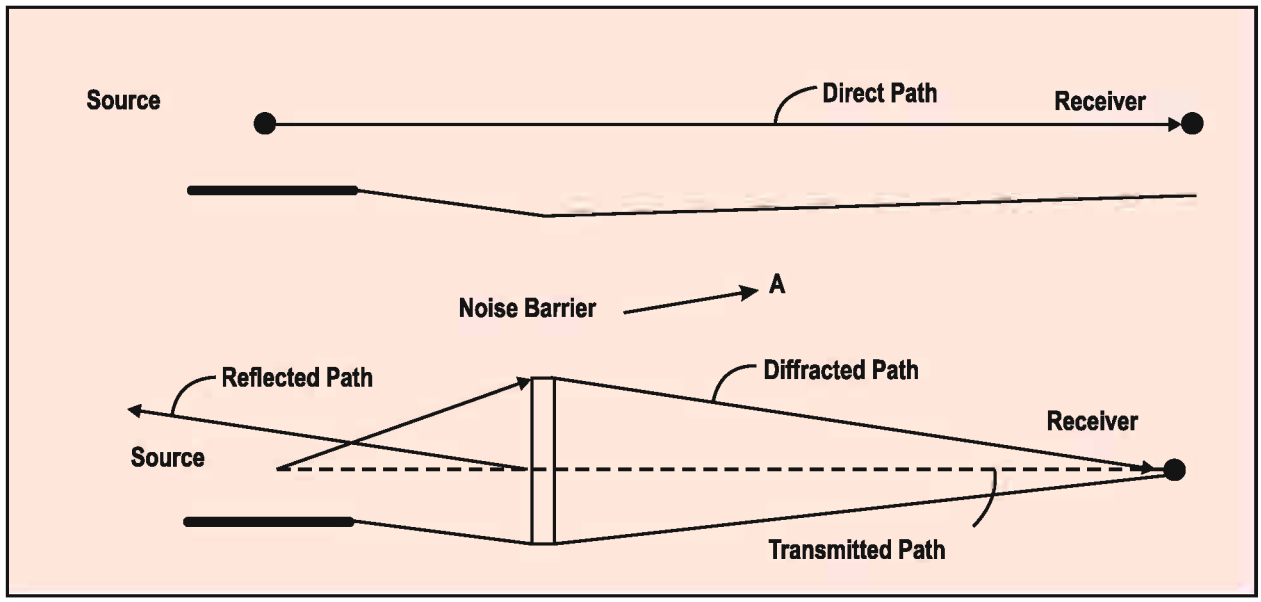


Fig.1 Transmitted and Diffracted noise paths

D. HEIGHT OF BARRIER

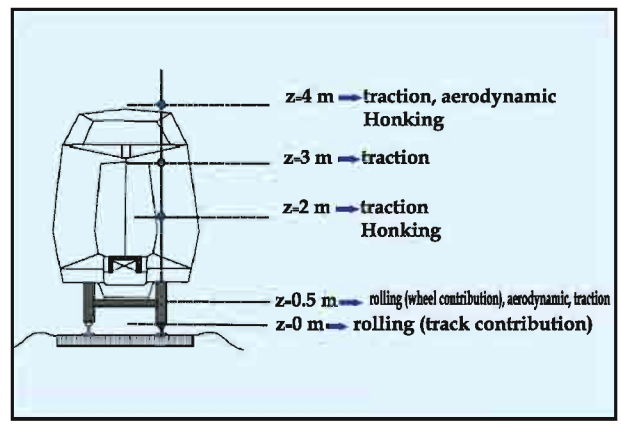


Fig.2 Sources of Noise at various height[9]

Height of a noise barrier shall be as much as to obstruct the sightline of a human being i.e. 1.8m. For instance if the surrounding area is plain and first row of receptor buildings are single storey, then a noise barrier of at-least 1.8m to 2m height above ground shall be installed.A height of 1.8m is effective in reducing the noise level by around 5dB (A) because the view of moving train getting cut acts as a psychological factor in reducing the noise. Basically the concept of out of sight out of mind gets applicable here. Each additional 1m height would reduce the noise level by 1.5 dB (A). To curb honking and aerodynamic noise sourced at 4m, barrier height needs to be increased but it will invite cost constraint. Sources of noise at various height is given in Fig.2. In such cases dense foliage of creepers supported on iron railing and barbed wire can be used up to a certain height (needs to be site specific) above the barrier. This will however need to be pruned periodically.

E. PATH LENGTH DIFFERENCE AND SHAPE OF BARRIER

Amount of diffraction resulted by the top edge of the noise barrier is an important factor in reducing noise as well. Noise attenuation is directly proportionate to diffraction angle represented by the distance (δ). To increase the diffraction angle it is either required to increase the height or provide a half T or half Y section at the top. Out of both, the second option of providing tilted top is feasible considering space availability. For instance, with 0.3 m sheet projected on the rail sideat an angle of 124°additional noise attenuation would be higher by 4 to 5 dB (A) at points where receptor position is higher than that of the source. Hence, it is better to use half Y section at the top (Fig.3) where there are multi storey receptors along the railway line instead of increasing the height. All these dimensions however need to be calculated based on site specific conditions before designing. Formula used for path length difference is:

Path length difference (δ) = $R_1 + R_2 - R_0$

Where, R1 is the distance (m) from source height to top edge of the barrier

R2 is the distance receptor height to top edge of the barrier

R0 is the distance between the source and receptor

F. WIDTH-HEIGHT RATIO

Since providing one side barrier would increase the noise level by 2 dB (A) than existing it is always preferable to provide parallel barriers on opposite side of the railway track and for an effective noise attenuation the distance between the two shall be 10 times the average height of the barriers. If the ratio of width to height is less than 10:1 then an insertion loss degradation of >3dB (A) is possible.

G. GAPLESS BARRIERS

Sound "leaks", due to holes, slits cracks or gaps through or beneath a noise barrier, can seriously reduce the barrier performance, and should be avoided. Any gaps represent segments of the barrier with zero Transmission Loss; that is, the gap can be considered to transmit 100% of the energy incident on it. Therefore, extra efforts should be spent at design and construction stages to avoid holes, slits or gaps, either with the adjoining panels, along the bottom edge or gaps, construction joint or expansion joints.

H. LENGTH OF BARRIERS

Noise barriers should be long enough so that only a small portion of sound diffracts around the edges. If a barrier is not long enough, degradations in barrier performance of up to 5 dB (A) less than the barrier's design noise reduction may be observed for receivers near the barrier ends. A rule of thumb is that a barrier should be long enough such that the distance between a receiver and a barrier end is at least four times the perpendicular distance from the receiver to the barrier along a line drawn between the receiver and the railway line. Or angle subtended from the receiver to a barrier end should be at least 80 degrees, as measured from the perpendicular line from the receiver to the rail way **(Fig.4).** In case it is not possible to increase the length due to site constraints, the end of the noise barrier ends can be curved in ward towards the receptor [vi].

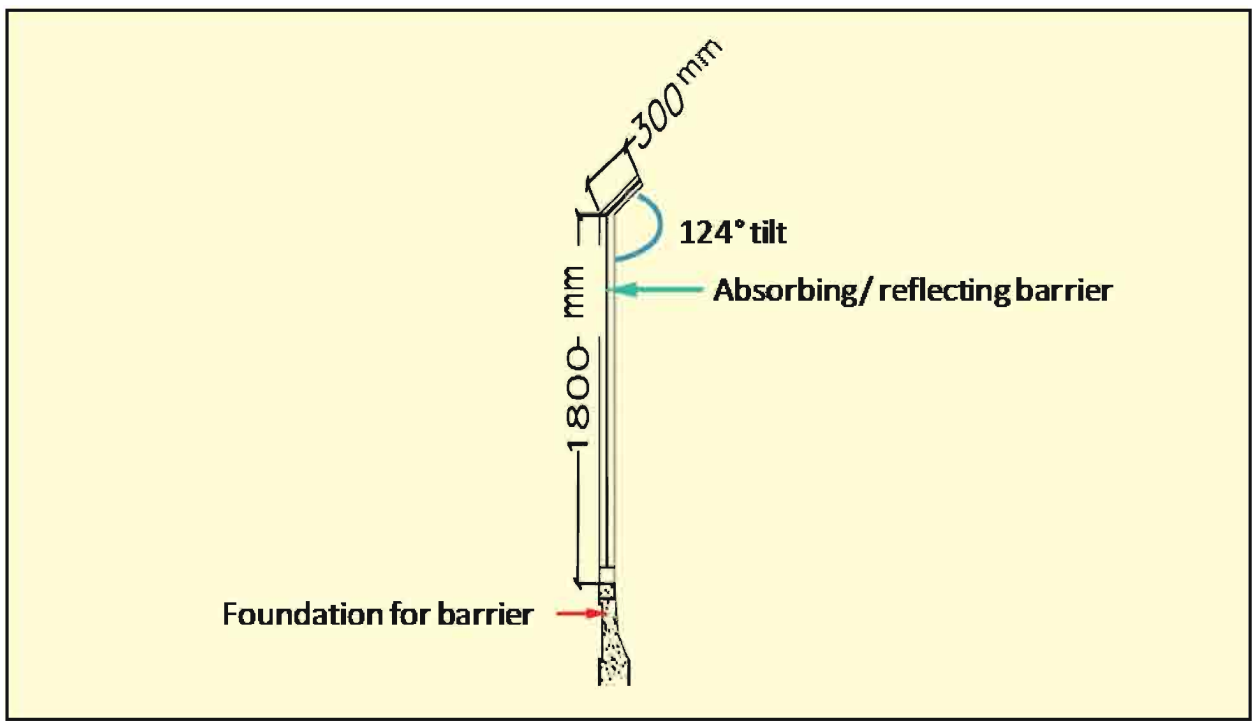


Fig 3. Barrier with half Y section at the top

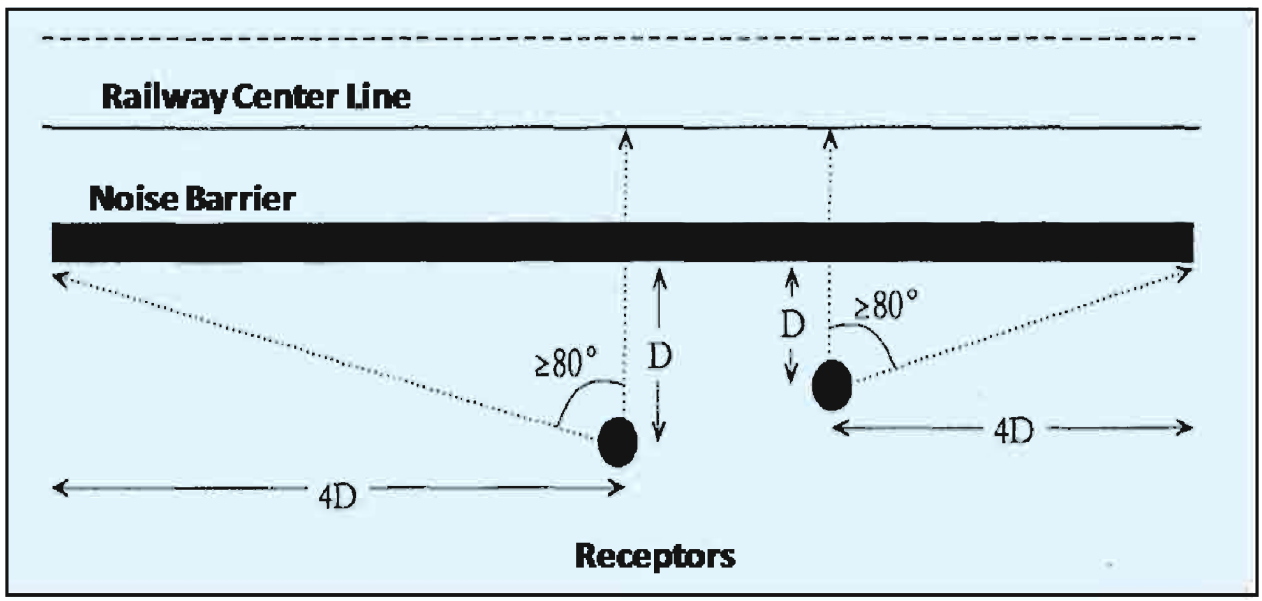


Fig.4 Barrier Length

3. CONCLUSION

All the above factors discussed in this paper needs to be analysed based on site specific conditions to get accurate dimensions to achieve desired insertion loss of noise. Through this paper the author intends to highlight the need for a comprehensive guideline for attenuation of railway generated noise and vibration so as to address the prevalent environmental implication of railway operations effectively.

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MECHANISED TRACK LAYING WITH NEW TRACK CONSTRUCTION (NTC) MACHINE IN CTP-1&2, WDFC

V. K. Govil
Retd. IRSE

ABSTRACT

In a first of its kind attempt for India, Dedicated Freight Corridor Corporation of India Limited (DFCCIL) is using New Track Construction (NTC) machines to expedite track laying work on freight corridors. Machines being used on freight corridors are imported from US based firm "HARSCO" and Australia based firm "PLASSER & THEURER" and deployed on the dedicated rail freight corridors by Contractors such as Sojitz -L&T , TATA- ADELSA (JV), etc. which won the bids to implement the projects on Western DFC & Eastern DFC. These track laying machines are able to lay 1.50 km of track per day in continuous operation. Paper brings out the details pertaining to these machines and their working on Western DFC. With the construction of two freight corridors Western DFC (WDFC) & Eastern DFC (EDFC), Indian Railways are all setto revive freight transport. In fact, dedicated freight corridors will not just help in revitalizing freight transport but will ensure efficient, reliable and economical movement of goods.

1. New Track Construction (NTC) Machine

1.1 Main Components

(i) Truss Frame

Truss frame is supported on wheels/crawler in the front and on power wagon in the rear and comprises of following units:

(a) A conveyor system for carrying the PSC sleepers down to the sleeper laying mechanism, which places the PSC sleepers on the ballast bed at a precise and predetermined spacing.

(b) Control panel

(c) Crawler on which truss frame is supported in front and moves on ballast bed during working.

(ii) Power Wagon

This contains a conveyor system (where sleepers are placed by a gantry) and engine for movement during working.

(iii) Transition Wagon

This contains a rail pulling arrangement for pulling the rails from wagons in the rear and supplying up to front of NTC.

(iv) Gantries

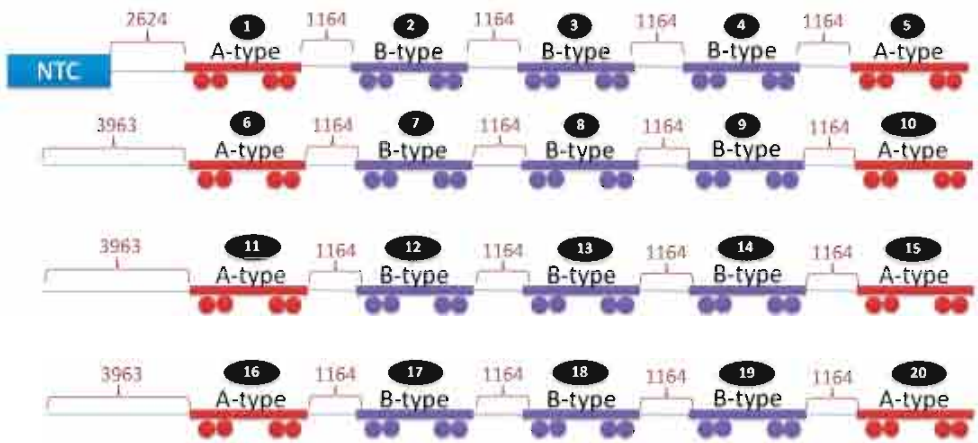
Two self-propelled gantries, requiring one operator each keeps the PSC sleepers supplied to the conveyor system. After being deposited by the gantry, PSC sleepers move via the conveyor system to the sleeper drop area.

(v) Rail laying/ Threading Unit

250m long rail panels are unloaded through a rail puller and laid along the prepared ballast bed (150mm to 200mm thick). NTC machine threads the rails on the sleepers through the guides located at the rear end of the unit, driving them inwards. Final placing of rails on the new sleepers is controlled by an operator who guides the rails preciously on to the sleeper seat.

1.2 Feeding rakes of NTC:

(a) Each NTC is supported by two P. Way material feeding rakes. Each rake carries P. Way material for 1.50 km track, i.e. 12 nos. of 250m rail panels, 2490 PSC sleepers & matching fastenings. Each rake comprises of 20 nos. modified BLC wagons with removable beams in between.



Set-1 (21Nos)

Removable Rail beam Type-1: Length- 2624mm---- Total Required Qty- **1 Nos.**
Removable Rail beam Type-2: Length- 1164mm---- Total Required Qty- **16 Nos.**
Removable Rail beam Type-3: Length- 3963mm---- Total Required Qty- **4 Nos.**

Set-2 (21Nos)

Removable Rail beam Type-1: Length- 2624mm---- Total Required Qty- **1 Nos.**
Removable Rail beam Type-2: Length- 1164mm---- Total Required Qty- **16 Nos.**
Removable Rail beam Type-3: Length- 3963mm---- Total Required Qty- **4 Nos.**

(b) Modified BLC wagons have arrangements of rollers for placing 2 rail panels on each sideand 8 rail panels in the center, PSC sleepers and arrangement for movement of gantries.

(c) Feeding material rakes are moved into/out of section using a locomotive

1.3 SPECIFICATIONS

HARSCO NTC

- Width - on bogie – 3.24m
- Height - 4.72m
- Working speed – 10 sleepers per minute
- Travel speed – up to 80kmph.
- Rails capable of being laid - up to 136 lbs.
- Minimum curve radius – Working – 144m, 12 degree – Travelling –97.5 m, 18 degree

PLASSER NTC

- Width - on bogie – 3.262m
- Height - 4.260m
- Working speed –10 sleepers per minute
- Travel speed – up to 100kmph
- Rails capable of being laid –UIC60
- Minimum curve radius – Working radius – 230m, 7.60 degree

Travelling radius – 175m, 10.0 degree

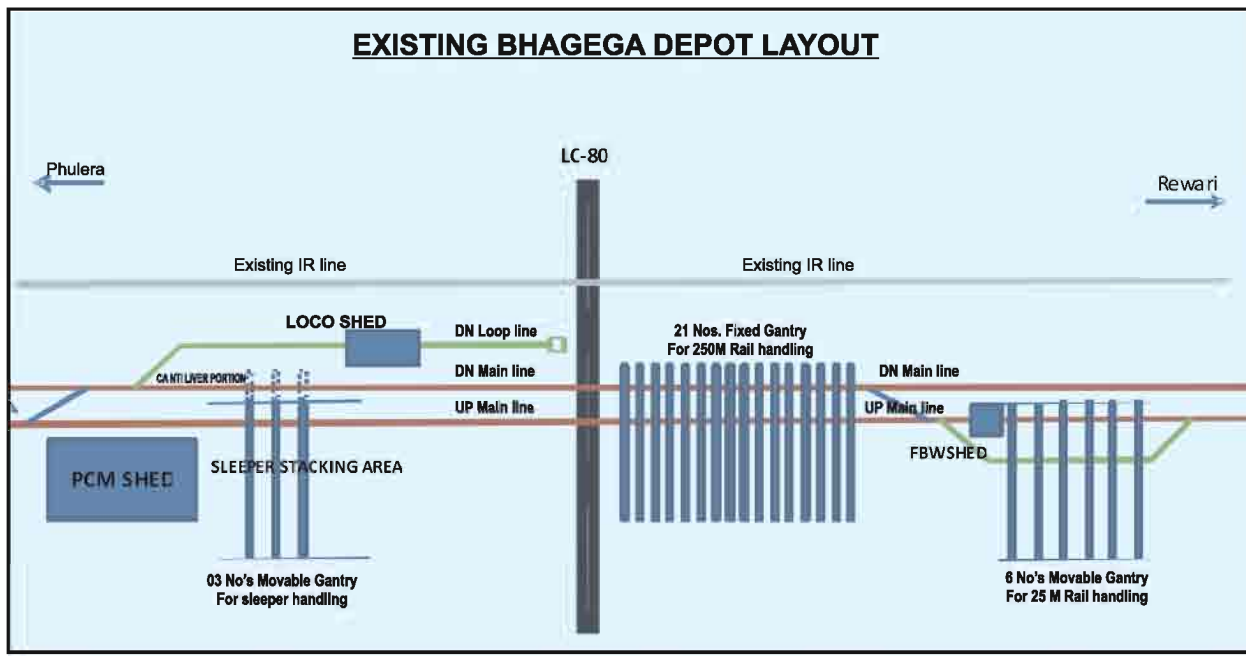
1.4 Advantages

- About three times faster than manual laying.
- Mechanized flow of PSC sleepers through moving gantries.
- Placement of sleepers at pre-decided spacing.
- Capable of laying rails up to 136 lbs. and 260m long.

2. Sequence of working

2.1 Setting up of base depot

All the track components are stocked and transported from a well-designed Base Depot, which is essentially a yard with connection to nearest station yard of IR to facilitate bringing heavy P. Way materials like rails. On Rewari - Madar section, one base depot has been set up at Bhagega. Typical yard layout adopted is as below.



25 m long rails imported from Japan are shipped to Mundra port from where these are moved on IR network in the rakes and brought into DFCCIL's base depot through connecting IR yard. The following are essential features of this base depot: -

(i) Reception and dispatch lines to bring material rakes from IR.

(ii) 6 nos. of overhead gantries have been provided for unloading 25 m rails from incoming rail rake.

(iii) These 25m length rails are converted into 250m long panels by FB welding.

(iv) Base depot also has a welding line and Mobile Flash Butt Welding unit is used to weld the 25 mrails into 250m panels. A weld testing laboratory with facilities to conduct essential tests on welds like Brinell hardness test, tensile test etc. has been provided.

(v) 21 nos. of overhead gantries have been provided for loading 250m long panels in NTC

(vi) 3 nos. of overhead gantries have been provided for loading PSC sleepers in NTC

(vii) A separate area is earmarked for stacking of sleepers in layers

(viii) Lighting all along the yard length is essential as most of loading and other activities are performed during night time. Construction yard has to be in action round the clock to achieve a production of 1.5 km of skeleton track per day.

(ix) Covered stores for storing track fittings, machine spares, consumable and fuel etc, are also provided in base depot

2.2 Base depot activities

Following activities are performed: -

(a) Unloading of 25m 60kg 1080 HH rails (imported from Japan) from incoming rail rakes with overhead gantries and stacking these rails at nominated places.

(b) Welding of 25m 60kg 1080 HH rails into 250m length panels by FBW plants. Welding parameters & QAP of FBW plant have been approved by RDSO in terms of para 5.6 of IR FBW manual.

(c) Loading of 12 Nos. of 250m long rail panels on NTC feeding rakes using overhead gantries. 2 Nos. of 250m long rail panels are placed on rollers on each side of wagons whereas 8 Nos. of 250m long rail panels are placed on rollers in middle of wagons. Loading of rails is completed in about 2 hours.

(d) Feeding rakes are then moved to sleeper stacking area and 2490 Nos. of sleepers are loaded in layers and each layer separated by wooden battens using gantries. Each layer has 40 PSC sleepers.

12.5 wagon x120 sleepers	=	1500 sleepers
5.5 wagon x 160 sleepers	=	880 sleepers
1 wagon x 110 sleepers	=	110 sleepers
Total	**=**	**2490 sleepers**

PSC sleepers are loaded in feeding rakes in about 6-8hours. Sleepers (RDSO T-7008) are manufactured in sleeper plants set up at base depots which have been validated by RDSO. Fastenings are loaded in one wagon.

2.3 Feeding rake is than taken out of the depot and moved in section (for place of work) with locomotive at a speed of about 25kmph..

2.4 Field Activities

(a) Preparation of ballast bed

Ballast is spread on finished formation in required width with thickness of 150 – 200mm in two layers of 75 – 100mm thick. Each layer of ballast bed is compacted by 8 ton roller for achieving initial uniform ballast cushion of 150 – 200mm.

(b) Marking alignment on ballast bed

Centre line of alignment is marked on the above prepared ballast bed using lime powder for guiding the movement of NTC machine. NTC machine is moved on this centre line with a hand remote.

(d) Pulling out rail panels:

Ends of first two rail panels (250m each) in feeder rails are pulled and treaded into the roller lines on NTC machine with the rail puller arrangement in the transition wagon and these are then pulled up to the front end of NTC machine. Ends are then clamped using friction based web clamps having eye on one end which is tied to pulling dozer. 250m long rail panels supported over rollers at evenly 6 – 10m is then gradually lowered on the ballast bed. Further rail panels are drawn by attaching their webs with the preceding one by using web based special friction rail clamps. Rail panels are unloaded on both sides at a lateral spacing of about 3500mm leaving space for working of NTC machine

(e) PSC sleeper laying, placing CGRSP and threading rail panels:

NTC machine is self-propelledat a speed of 15 kmph during track laying. Machine has an on board computer which ensures precisions in laying PSC sleepers with speed. Sleepers (20 no.) are picked up by moving gantries in each movement and brought up to conveyor belt and dropped there. CGRSP (RDSO T-7010) are installed on each sleeper by two pad operators (who sit on two chairs in the truss), who places pads on the sleepers while sleepers move on conveyor system. Sleeper laying mechanism lowers and drops first sleeper onto the ballast bed. Computer system uses the provision of first dropped sleeper as reference point and determines the locations for further sleepers dropped with the movement of machine. A sleeper spacer lowers down to ballast bed and adjust the sleeper dropped to the designed spacing. This activity continues for further sleepers dropped and adjusted to their proper location. For ensuring centerline movement, NTC machine has a pointer attached at the centre of truss beam in front end of it. Using hand remote control, operator ensures that pointer under truss beam remains aligned over the centre line.

(e) Provision ERC Mk-V:

After rail treading, ERC Mark V are provided manually.

(f) Check of skeleton track:

Alignment, levels and sleeper spacing are checked. Minor corrections as required are given by competent gang under competent supervisor before clipping of sleepers using ERC Mk-V (RDSO - T-5919).

(g) Feeding rake is moved back to base depot for further loading

(h) Post NTC works:

- Ballasting.
- Tamping
- DTS

3.0 CONCLUSION

With the increase in axle loads, track structure has become heavier. Besides the length of rail panels to be laid has increased primarily to reduce field welding. Arduous task of laying these heavy components lead to advent of semi – mechanized means like PQRS. In the recent times efficient and high performance machines like New Track Construction machines (NTC) have been deployed for efficient and high quality initial laying with integrated logistic arrangement for mechanized handling and movement.

Carbon Sequestration through Green Belt Development to offset the tree cutting impacts and a comprehensive statement on Compensatory Afforestation in Lieu of Forest land Diversion for Non-forestry use by Forest Department due to freight Construction in Khurja - Bhaupur Section of EDFC

Sushma Sharma
Consultant/Env./EC/WC

Satish Kumar Gambhir
JGM/SEMU/EC

ABSTRACT

This paper discuss the tree plantation and CO2 Sequestration by total numbers of tree planted vis a vis tree cut and details of Compensatory afforestation to rationalize tree felling during forest Diversion for railway projects. It is not an easy task but we have to work hard to ensure that activities involved in infrastructure development causes least harm to the environment and has a net positive impact on our quality of life and society. For linear infrastructure project, massive landbeing acquired and utilities like Cable/Structure trees etc. falling in RoW (Right of Way) being dismantled/shifted.The process of transplanting trees is complicated and successfully conducted only if trees that don't have deep roots.Even though Efforts for minimum no. of trees cutting has been considered, impacted trees had been cut with all precaution to not harm other one. To Compensate the loss triggered due to tree cutting, tree have been planted in close proximity of tree cut to maintain the ecosystem of that area where the cut tree was imbibed.

1.0 INTRODUCTION

Dedicated Freight Corridor Corporation of India Limited (DFCCIL), a mega infrastructure project of the Ministry of Railways which will be a game changer in the freight logistics scenario of the country. The Eastern Dedicated Freight Corridor with a route length of 1856 km consists of two distinct segments.

- An electrified double-track segment of 1409 km between Dankuni in West Bengal & Khurja in Uttar Pradesh
- An electrified single-track segment of 447 km between Ludhiana (Dhandarikalan) - Khurja - Dadri in the state of Punjab, Haryana and Uttar Pradesh.

Due to non - availability of space along the existing corridor particularly near important city centers and industrial townships, the alignment of the corridor takes a detour to bypass densely populated towns such as Mughalsarai, Allahabad, Kanpur, Etawah, Ferozabad, Tundla, Barhan, Hathras, Aligarh, Hapur, Meerut, Saharanpur, Ambala, Rajpura, Sirhind, Doraha and Sanehwal. The Eastern Corridor will traverse through 6 states.

Eastern Corridor is projected to cater to a number of traffic streams-coal for the power plants in the northern region of U.P., Delhi, Haryana, Punjab and parts of Rajasthan from the Eastern Coal fields, finished steel, food grains, cement, fertilizers, lime stone from Rajasthan to steel plants in the east and general goods.

2.0 Project EDFC-I (Bhaupur–Khurja 343 km) Details

The EDFC-I, Bhaupur-Khurja section has a route length of 343 km traversing through 8 districts; Kanpur Dehat, Etawah, Auraiya, Ferozabad, Agra, Hathras, Aligarh and Bulandshahr districts in Uttar Pradesh State. 5 detours, Achalda, Bharthana, Etawah, Hathras & Aligarh are planned due to heavy settlement along the existing track. Bhaupur-Khurja is an important section of Howrah - Delhi, double line electrified main trunk route of Northern Central Railway connecting the Northern, Central and Eastern regions of the Country.

The entire stretch is divided in to three lots along with detour section.

- **Lot 101** (Bhaupur- Bhatuara section 135 km) transverse through district Kanpur Dehat, Etawah, Auraiya in Uttarpradesh
- **Lot102** (kaistbirauni section 30 km) transverse through district Firozabad, Agra in Uttar Pradesh. Karorachamrola section also form part of lot 102
- **Lot 103** (Jamal Nagar to Khurja107 km) transverse through district Aligarh, Hathras in Uttar Pradesh.

Description	Bhaupur -Etawah Bypass End Section EDFC1	Etawah Bypass End to Chamrola Bypass End Section EDFC 1	Chamrola Bypass End to Khurja Section EDFC1	Total
Legth Parallel (in km)	95	72	69	236
Length Detour (in km)	0	0	0	0
Bypass Length (in km)	40	29.56	38	107.6
No. of Villages	110	76	100	286
No. of Districts	3	3	3	9

Environmentally proactive approach of DFCCIL is reflected from the initiatives taken with DFC alignments being so selected that while acquisition of land where it can't be avoided, forest land diversion and impact to environment is minimum possible. It is evident from analysis of land acquisition data, that out of Total 1405 ha. acquired land area (168 ha. Government Land + 1237 Pvt. Land)only 10.595 ha. inclusive of Reserve and Protected forest land has been diverted for non-forest use.

Section Wise Progress of Land Acquisition for the month of June 2018		Total			
		Length (Km.)	Pvt. Land	Govt. Land	Area (Ha.)
Eastern Corridor					
EDFC-1 (Khurja - Bhaupur Section)	Uttar Pradesh	343	1237	168	1405
	Total	**343**	**1237**	**168**	**1405**

3.0 Green Belt Development

What is Green Belt?

When Plants / Trees are grown in a row that can be single or multiple in green belt space provided along the infrastructure projects are known as Green Belt. When Trees grown in single row that acts as oxygen generator, pollutant absorber or if in multiple row they have add on benefits like noise attenuator.

The development of green belt has been recommended as one of the major components of the Environmental Management Plan which will further enhance the environmental quality and lead to compensate the loss caused due to cutting of trees. Even though the loss is not completely counterbalance but planting 1:2 or more trees may to an extent can help in balancing the damage.

Generally for double track laying and associated ancillary activities approx. RoW width estimated to be around 60-70m. length and Single is 30m. For Single line formation width approximately 8m and Double is 14m and at approx. 1m from toe of embankment/formationS &T cable laid down after that space is available for plantation activity beside plantation at station building/Yard.

In DFC how and where it has been developed

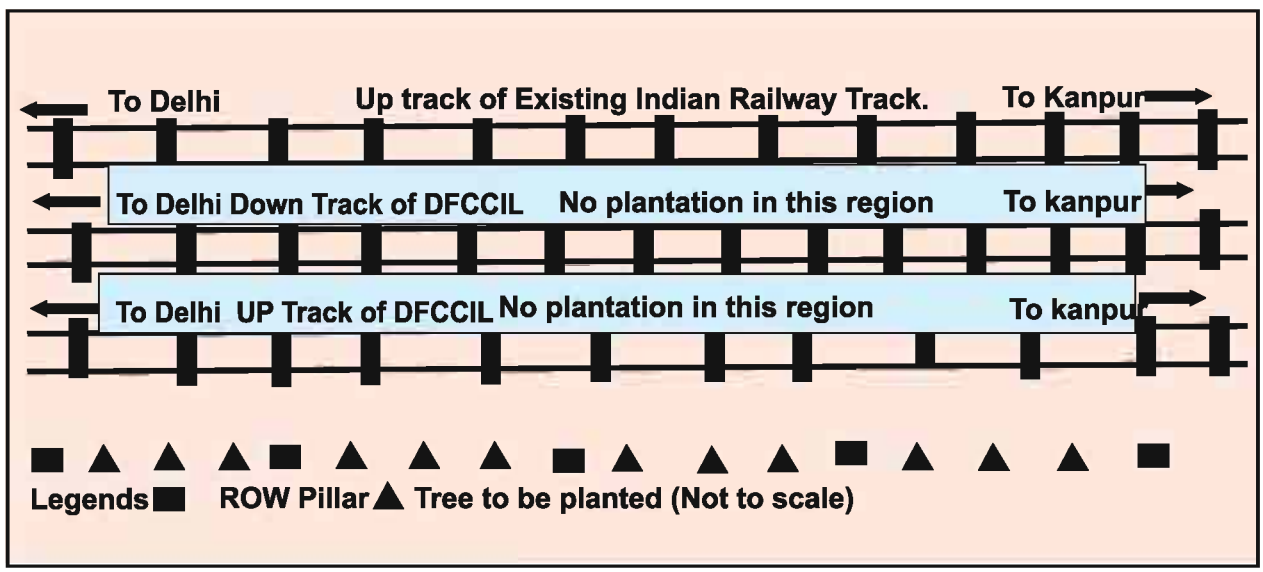


Figure : 1, Plantation in parallel Section

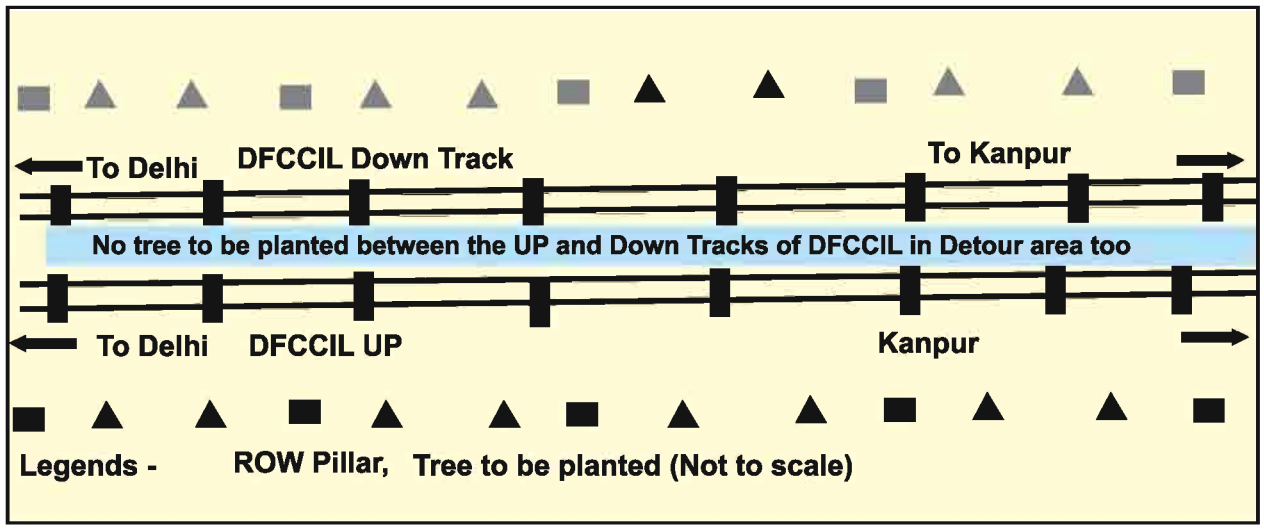


Figure : 2, Plantation in Detour Section

- Minimum 6 feet above ground and 2 years old saplings are being preferred for plantation.
- Native Species have been preferred for plantations prescribed in EA Reports.
- Plantation should be done two weeks after the rain starts, as the trees benefit from the seasonal rains.

Benefits of Green Belt

Green Vegetal cover is not only pleasing to eyes but also beneficial in many ways as follows;

- ❖ Bio diversity retention
- ❖ Soil moisture retention
- ❖ Ground water recharge
- ❖ Microclimate moderation
- ❖ Acting as a carbon sink
- ❖ Mitigation of air pollution problems
- ❖ Attenuation of noise level
- ❖ Mainta in the Green area and improve aesthetics.
- ❖ Thrive in pollutants atmosphere.

The major species affected due to construction of alignment are Babool, Neem, Shisam, Peepal, Mango, Bargad, Kanji, Labhera, Ashok, Sirsa, Guler, Jamun, Ber even though many efforts have been taken to reduce the no. of trees to be cut. There are approximately 17901 private trees affected due to Railway line construction activity.

DFCCIL has its corporate Environment Policy and EMF, there is a provision to compensate the tree felling as per the state tree cutting act accordingly double the Tree planation vis a vis tree cut and additional 10 Trees /Km tree planation too. Hence 36079 Trees will be planted to compensate the 17901 tree cutting loss.

Mainly Ashok, Karanj, Neem, Mango, Bakul, Imli, Ashok, Satparna, Mahua, Bel, Tendu, Mar Maharakha, Bakain, Imli, Arjuna, Neem, Savukkamaram. Shrubs and grasses: Akand, Harsingar, Kaner. Trees have been planted in Green Belt Development Activities. Green Belt development within the DFCCIL Right-of-Way been carried out. The status of plantation undertaken by JV as on date are as below:

Sl No.	Particulars	LOT-101	LOT-102	LOT-103	Total in EDFC-1
1.	No of saplings to be Planted	16921	8515	10643	36079
2.	No of saplings Planted till date	9500	7200	10000	26700




Plantation undertaken in single row.

4.0 Detail of District wise Forest Land is as below

Total 10.595 ha. Forest land is diverted under EDFC-1 for non-forest Purpose. 10. 496 ha. (1.8765 ha. protected forest land + 8.6195 forest land Reserve Forest Land + 0.123 forest land unclassified).

Applicable statutory Clearances like Forest Clearance and NoC for tree cutting in TTZ has been taken prior commencement of construction activity. District wise breakup of forest land and trees details is tabulated below:-

District	Forest Land in ha.	Total Forest Land in ha.	Protected Forest (PF) /Reserve Forest (RF)	No. of cut Trees in Forest Land
Kanpur Dehat (Ramabai)	0.1230		RF	
Auraiya	3.395		3.395 RF + 0.0032 PF	395+300
Etawah	1.1622		0.4382 RF + 0.7240 PF	30
Firozabad	4.039	10.595	RF	24 trees +600 plants
Agra	0.59		RF	178
Hathras (Mahamaya Naagar)	0.1589		0.0559 RF + 0.103 PF	13
Aligarh	0.5223		0.5223 PF	46 trees +112 plants +19 Plants
Mirzapur	0.0983			-
Total Trees to be cut				**1646**

5.0 Statutory Provisions for Compensatory Afforestation

As per the Forest (Conservation) Act 1980, whenever forest land is to be diverted for no forestry purpose usually the conditions relating to transfer, mutation and declaration as Reserve Forest/ Protected Forest the equivalent non forest land for compensatory afforestation and funds for raising compensatory afforestation etc. are to be imposed.

The Forest (Conservation) Act, 1980 and The Indian Forest Act, 1927 governs; Diversion of Forest Land for non-forest land, Compensatory Afforestation (CA), Tree Felling permission and Permission for Transportation of wooden log after cutting of trees and Hon'ble Supreme Court's permission for Tree Felling in Taj Trapezium Zone (TTZ) Area in the project corridor under EDFC-I in the State of Uttar Pradesh., Forest Land Diversion proposals, Compensatory Afforestation and Tree Cutting Permission is being executed in association with Social Forestry Division and Forest & Wildlife Department, Government of Uttar Pradesh and Ministry of Environment, Forest & Climate Change, Government of India.

5.1 Compensatory Afforestation in lieu of Diversion of Forest Land

According to the provisions of The Forest (Conservation) Act, 1980, whenever Forest Land is proposed to be diverted for non-forestry purposes, the conditions for raising Compensatory Afforestation (CA) are imposed in In-Principle approval of Forest Diversion Proposal along with payment for NPV (Net Payment value) . Funds for compensatory afforestation scheme are provided by the Project Proponent diverting the Forest Land and to be deposited in "Compensatory Afforestation Management Planning Fund Authority" (CAMPA) of the Government of India.

For EDFC-I (Bhaupur-Khurja) section, diversion of 10.595 hectares Forest Land is proposed in 8 districts ; Kanpur Dehat, Etawah, Auraiya, Hathras, Aligarh, Firozabad and Agra districts. In-principle approval (Stage-I Forest Clearance) and Final Approval (Stage-II Forest Clearance) have been issued by Ministry of Environment, Forest & Climate Change, Government of India, respectively vide order dated 29.05.2013 & 02.05.2017.

As per stipulated conditions of Stage-I Forest Clearance, Compensatory afforestation in 4.6182 ha at Behmi (Land to be provided by DFCCIL to Forest Dept.) and was to be carried out by Forest Dept. Further under stipulated at S.No. 2 "Additional Compensatory Afforestation" along the proposed alignment was to be carried out by Forest Dept. Necessary fund of Rupees 5840264/- has been deposited in CAMPA account by DFCCIL The funds deposited in CAMPA account by DFCCIL have been confirmed by OSD, CAMPA, MOEF, New Delhi vide letter No-1-33/2014-CAMPA dated 26.06.2015.

Compensatory Afforestation has been done in Kanpur Nagar and Firozabad District in total 12.5472 ha. area. As per stipulated conditions of Stage-I Forest Clearance, Compensatory afforestation in 7.929 ha(4.039 ha in shankarpur& 3.89 ha in DevriFaridpur) was to be carried out by Forest Dept. Further under stipulated at S.No. 2 "Additional Compensatory Afforestation" along the proposed alignment was to be carried out by Forest Dept.Necessary fund of Rupees 37,51,953/- has been deposited in CAMPA account by DFCCIL The funds deposited in CAMPA account by DFCCIL have been confirmed by OSD, CAMPA, MOEF, New Delhi vide letter No-1-33/2014-CAMPA dated 26.06.2015.

DFCCIL had been instructed to provide 8.6572 hectare non Forest Land for Compensatory Afforestation. Accordingly DFCCIL acquired and transferred 8.6572 Hectares non-forest Land (4.6182 hectares non Forest Land at village Behmai, Kanpur Dehat District & 4.039 hectares non-forest Land at village Shankarpur, Firozabad) in the favour of Forest Department, Government of Uttar Pradesh.

The Forest Department, Uttar Pradesh Government has earmarked 3.89 Hectare, Forest Land for raising Compensatory Afforestation in DevriFaridpur Forest Block, and 4.039 hactare in shankaerpur Forest Block. CA had been proposed in total 12.5472 ha.CA had been completed in total 12.5472 ha as per the CCF/Lucknow letter dated 26.12.2018.

District	Forest Land in ha	Total Forest Land in ha	PF/RF	No. of cut Trees in Forest Land	Compensatory Afforestation by Forest Dept.	Additional Compensatory Afforestation.
Kanpur Dehat (Ramabai)	0.1230	10.595	Reserve Forest (RF)		CA in total 12.5472 ha. Land has been completed by the Forest Dept. Total tree planted by Forest Dept. = 17173 (4950+ 4443+ 7780)	After Completion of Track Laying Forest Dept. will start Plantation
Auraiya	3.395		3.395 RF + 0.0032 PF	395+300		
Etawah	1.1622		0.4382 RF + 0.7240 PF	30		
Firozabad	4.039		RF	24 trees+ 600 plants		
Agra	0.59		RF	178		
Hathras (Mahamaya Nagar)	0.1589		0.0559 RF + 0.103 PF	13		
Aligarh	0.5223		0.5223 Protected Forest (PF)	46 trees + 112 plants +19 Plants		
Mirzapur	0.0983			-		
Total Forest Area	10.595 Ha.			1646 total tree		
TTZ AREA in Agra, firozabad & Hathras				4314	25000 (Completed)	Not Applicable
132 KV Transmission line in TTZ AREA				473	5000 completed in Raunakata Village under Agra Forest Division	Not Applicable
Total tree Cut under Forest Land Diversion				**6433**	**47173**	

5.2 Additional Compensatory Afforestation

In addition to Compensatory Afforestation, MOEF has imposed condition for raising Additional Compensatory Afforestation on the vacant land along the proposed alignment of Dedicated Freight Corridor. On the basis of technical feasibility & joint assessment with Forest Department, availability of vacant land for undertaking Additional Compensatory Afforestation along the proposed alignment of Dedicated Freight Corridor in Mirzapur, Aligarh and Kanpur Dehat districts have been finalized.

As on date Firozababd Social Forestry Division, have undertaken compensatory afforestation and planted 2000 saplings at Devri Faridpur & 4443 saplings at Shankarpur respectively. CA in total 12.5472 ha. Land has been completed by the Forest Dept. (Ref. CCF/U.P Report dated 26.12.2018). Additional Compensatory Afforestation along the DFCCIL proposed track would be undertaken by Forest Department after completion of track laying and S&T work of DFCCIL.

5.3 Funds deposited by DFCCIL for Compensatory Afforestation and Additional Compensatory Afforestation

The district wise details of funds deposited by DFCCIL for Compensatory Afforestation and Additional Compensatory Afforestation are as below:

S.No of condition under Stage-I Forest Clearance	Condition	Fund Deposited under CAMPA account.
1.	Compensatory Afforestation	(i) Non-Forest Land • Firozabad - Rs. 4,56,488/- • Agra - Rs 13,92,000/- • Kanpur Dehat - Rs. 21,55,514/ • Mirzapur - Rs. 3,76,000/- • Aligarh - Rs 1,22,649 /- **Total = Rs 4502651/-** (ii) Double Degraded Forest Land = Rs. 4,52,524 **Total= Rs4,95,5175/- (4502651 + 452524).**
2.	Additional Compensatory Afforestation	• Mirzapur - Rupees 3,76,000/- • Aligarh - Rupees 1,51,846 /- • Kanpur Dehat- Rupees 36,84,750/- • Ferozabad - Rupees13,28,292 /- **Total = Rs. 5840264/-**
Grand Total		**Rs 1,04,96,063 /-**

Total Rs 1,04,96,063/- have been paid to the CAMPA, MOEF account for undertaking Compensatory Afforestation and Additional Compensatory Afforestation.

5.4 Tree Cutting and Compensatory Afforestation in Taj Trapezium Zone(TTZ) Area

(a) The Administration Division of the Taj Trapezium Zone(TTZ) Area

The TTZ is spread over 6 Districts; Agra, Mathura, Firozababd, Hathras and Etawah in the state of Uttar Pradesh and Bharatpur in Rajasthan. The region as a whole encompasses an area of 10,400 sq.kms. Further, MoEF, Government of India in the year 1998 notified Taj Trapezium Zone Pollution (Prevention & Control) Authority, Agra for protection and improvement of the environment in the TTZ area. Three (3) districts i.e. Agra, Firozabad

and Hathras under EDFC-1 falls in TTZ area. As per Hon'ble Supreme Court order in Writ Petition No.13381/1984 M.C.Mehta versus Government of India & others, permission for tree cutting in TTZ Area is required to be obtained from Hon'ble Supreme Court.

(b) I.A no- 496 of 2012 in writ petition (Civil)13381/1984 in May 2012

In 2012 DFCCIL had filled IA no- 496 of 2012 and obtained approval of Hon'ble Supreme Court for felling of 4314 trees in Agra, Firozabad & Hathras Districts. In the order dated 19.11.2012, Hon'ble Supreme Court has permitted cutting of 4314 Trees in Taj Trapezium Zone Area with the condition that Compensatory Plantation of 25,000 trees, in lieu of cutting of 4314 trees to be undertaken at the project cost. DFCCIL have deposited Rs.1,28,560,42 for undertaking Compensatory Afforestation in 22.73 hectares land at Agra, Firozabad & Hathras districts.

CF,Agra vide his letter dated 01.03.2016 have confirmed that CA of 25,000 nos. plants have been undertaken.

S.No	Division	No of Plantation Done	Forest Range	Place
1	Agra	11000	Jaitpur	Khilawali Block
2	Firozabad	5500	Firozabad	Police Line Parisar,Dabrai
		3300	Narakhi	Balipur TAPRAIYA Forest Land
		3000	Narakhi	Fariha Land Forest Land
	Sub Total	11800	-	-
3	Hathras	2200	Sadabad	SADABAD Mursan Marg Km 02-12
	Total	**25000**		

Picture showing Compensatory Afforestation under TTZ approval at Police Line Campus, Firozabad.

(c) I.A no- 562 of 2016 in writ petition (Civil)13381/1984, May 2016

For shifting of existing 132 KV Transmission Line in Agra &Ferozabad districts under TTZ area,DFCCIL has filed IA no- 562 of 2016 in writ petition (Civil)13381/1984 in May 2016 to obtain tree felling permission of 493 trees. In the order dated 09.12.2016, Hon'ble Supreme Court has approved the DFCCIL's application and permitted cutting of 473 Trees in Taj Trapezium Zone Area with the conditions of compensatory afforestation as below:

(i) Compensatory Plantation of 5,000 trees that is ten times in lieu of 473 trees required to be felled will be undertaken at the project cost.

(ii) A scheme for Compensatory Plantation for 5,000 trees has been prepared in consultation with the Forest Department of State of U.P.

Compensatory afforestation of 5,000 trees, on 1:10 ratio which is ten times in lieu of 473 trees required to be felled, have been undertaken at the project cost. For compensatory afforestation, Forest Department has identified 8 hectares land in Runakta Forest Block, Kirawali Range, Agra district. Detailed CA scheme have been prepared with budgetary provision of Rupees 4,10,6000.00/- for undertaking Compensatory Afforestation. The demand of Rs 4,10, 6000.00/- for CA have been deposited by the DFCCIL. Total 5000 trees in Runakta Forest Block have been planted by the Forest Dept.

Trees affected in TTZ

132 KV Transmission Line tower infringing DFC Track

Picture showing Compensatory Afforestation under TTZ approval at Runakta Forest Dept.

Picture showing Compensatory Afforestation under TTZ approval at Runakta Forest Dept.

6.0 Carbon Sequestration

Tree cover acts as a carbon sink. Certain species of plants can even absorb the pollutants while others can thrive in polluted atmosphere.As a thumb rule it is estimated that "A tree can absorb as much as 48 pounds of Carbon Dioxide per year and can sequester 1 ton of carbon dioxide by the time it reaches 40 years old".

It is found that a tree can absorb as much as approx. 48 pounds of carbon dioxide per year hence total tree plantation to be carried out is 36079. It is estimated to sequester total 865.896 tons (36079 X48= 1731792 pounds) Co2 through plantation activity annually. And over the period of 40 years as thumb rule 39770.28 tonns of carbon dioxide by the time it reaches 40 years old.

DFC through tree plantation, only in EDFC-1 along the corridor beside Compensatory Afforestation and Additional Compensatory Afforestation "estimated to sequester 865.89 tons Co2 through plantation activity annually. It is also has been calculated that a tree can sequester 1 ton of carbon dioxide by the time it reaches 40 years old hence over the 40 years total 36079.01 tons CO2 will be sequester ".

7.0 Recommendation:

Although it is very hard to retrieve the losses caused due to cutting of mature tree, but while adopting 1:2 or 1: 10 tree plantation will help in minimizing the impact induced due to felling of tree. This paper focuses the benefits of green belts and adopting rational tree policy we can help in undo the loss caused due to unavoidable activities involved due to construction of corridor. Now a days many tree translocation with good survival rates techniques are available same can be opted while formulating DFCCIL own tree policy.

UNCITRAL Model Law on International Commercial Arbitration 1985

Ajay Kumar
ED/EDPC

ABSTRACT

Execution of Project using Multilateral Funding brings requirement of International Competitive Bidding. To bring new technology and create interest among International bidders, Country policy should be conducive for dispute resolution mechanism acceptable to International community and well understood by them to mitigate risk perception.

DFCCIL is dealing with ICB and it is necessary that officials are aware about important provision of International Arbitration and well equipped to defend DFCCIL interest during International Arbitration.

The UNCITRAL (UNICITRAL stands for United Nations Commission on International Trade Law) Model Law on International Commercial Arbitration was adopted by the United Nations Commission on International Trade Law (UNCITRAL) on 21 June 1985 and its recommendation are that all States give due consideration to the Model Law on International Commercial Arbitration, in view of the desirability of uniformity of the law of arbitral procedures and the specific needs of international commercial arbitration practice. The Model Law constitutes a sound and promising basis for the desired harmonization and improvement of national laws.

Some of the important features of UNICITRAL Model Law are covered in this article for the beneficial of DFCCIL official.

Article-1 Scope of Application-

This Law applies to international commercial arbitration, subject to any agreement in force

between this State and any other State or States.

An Arbitration is international if the parties to an arbitration agreement have, at the time of conclusion of the agreement, their places of business in different states.

Article 3- Receipt of written communications

any written communication is deemed to have been received if it is delivered to the addressee personally or if it is delivered at his place of business, habitual residence or mailing address.

The communication is deemed to have been received on the day it is so delivered.

Article 4-Waiver of right to object

A party who knows that any provision of this Law from which the parties may derogate or any requirement under the arbitration agreement has not been complied with and yet proceeds with the arbitration without stating his objection to such non-compliance without undue delay or, if a time-limit is provided therefor, within such period of time, shall be deemed to have waived his right to object.

Article 5- Extent of court intervention

In matters governed by this Law, no court shall intervene except where so provided in this Law.

Article 6- Court or other authority for certain functions of arbitration assistance and supervision.

The functions referred to in Article11(3),11(4),14, 16(3) and 34(2) shall be performed by.....(To be specified by the state enacting this model law.)

Article 7- Definition and Form of arbitration agreement

Arbitration agreement is an agreement by the parties to submit to arbitration all or certain disputes which have arisen or which may arise between them in respect of a defined legal relationship, whether contractual or not. An arbitration agreement may be in the form of an arbitration clause in a contract or in the form of a separate agreement. The arbitration agreement shall be in writing.

Article 8- Arbitration agreement and substantive claim before court

(1) A court before which an action is brought in a matter which is the subject of an arbitration agreement shall, if a party so requests not later than when submitting his first statement on the substance of the dispute, refer the parties to arbitration unless it finds that the agreement is null and void, in operative or incapable of being performed.

(2) Where an action referred to in paragraph (1) of this article has been brought, arbitral proceedings may nevertheless be commenced or continued, and an award may be made, while the issue is pending before the court.

Article 9- Arbitration agreement and inter im measures by court

It is not incompatible with an arbitration agreement for a party to request, before or during arbitral proceedings, from a court an interim measure of protection and for a court to grant such measure.

Article 10- Number of arbitrators

(1) The parties are free to determine the number of arbitrators.

(2) Failing such determination, the number of arbitrators shall be three.

Article 11- Appointment ofarbitrators

(1) No person shall be precluded by reason of his nationality from acting as an arbitrator, unless otherwise a greed by the parties.

(2) The parties are free to agree on a procedure of appointing the arbitrator or arbitrators.

(3) Failing such agreement,

(a) in an arbitration with three arbitrators, each party shall appoint one arbitrator, and the two arbitrators thus appointed shall appoint the third arbitrator; if a party fails to appoint the arbitrator within thirty days of receipt of a request to do so from the other party, or if the two arbitrators fail to agree on the third arbitrator within thirty days of their appointment,the appointment shall be made, upon request of a party, by the court or other authority specified in article6;

(b) in an arbitration with a sole arbitrator, if the parties are unable to agree on the arbitrator, he shall be appointed, upon request of a party, by the court or

other authority specified in article6.

(4) Where, under an appointment procedure a greed up on by the parties,

(a) a party fails to act as required under such procedure, or

(b) the parties, or two arbitrators, are unable to reach an agreement expected of them under such procedure, or

(c) a third party, including an institution, fails to perform any function entrusted to it under such procedure, any party may request the court or other authority specified in article 6 to take the necessary measure, unless the agreement on the appointment procedure provides other means for securing the appointment.

(5) A decision on a matter entrusted by paragraph (3) or (4) of this article to the court or other authority specified in article 6 shall be subject to no appeal.

Article 12- Grounds for challenge

(1) When a person is approached in connection with his possible appointment as an arbitrator, he shall disclose any circumstances likely to give rise to justifiable doubts as to his impartiality or independence. An arbitrator, from the time of his appointment and throughout the arbitral proceedings, shall without delay disclose any such circumstances to the parties unless they have already been in formed of them by him.

(2) An arbitrator may be challenged only if circumstances exist that give rise to justifiable doubts as to his impartiality or independence, or if he does not possess qualifications agreed to by the parties. A party may challenge an arbitrator appointed by him, or in whose appointment he has participated, only for reasons of which he becomes aware after the appointment has been made.

Article 13- Challeng e procedure

(1) The parties are free to agree on a procedure for challenging an arbitrator.

(2) Failing such agreement, a party who intends to challenge an arbitrator shall, within fifteen days after becoming aware of the constitution of the arbitral tribunal or after becoming aware of any circumstance referred to in article 12(2), send a written statement of the reasons for the challenge to the arbitral tribunal. Unless the challenged arbitrator withdraws from his office or the other party agrees to the challenge, the arbitral tribunal shall decide on the challenge.

(3) If a challenge under any procedure agreed upon by the parties or under the procedure of paragraph (2) of this article is not successful, the challenging party may request, within thirty days after having received notice of the decision rejecting the challenge, the court or other authority specified in article 6 to decide on the challenge, which decision shall be subject to no appeal; while such a request is pending, the arbitral tribunal, including the challenged arbitrator, may continue the arbitral proceedings and make an award.

Article 14- Failure or impossibility to act

(1) If an arbitrator becomes de jure or de facto unable to perform his functions or for other reasons fails to act without undue delay, his mandate terminates if he withdraws from his office or if the parties agree on the termination. Otherwise, if a controversy remains concerning any of these grounds, any party may request the court or other authority specified in article 6 to decide on the termination of the mandate, which decision shall be subject to no appeal.

Article 15- Appointment of substitute arbitrator

Where the mandate of an arbitrator terminates or because of his withdrawal from office for any other reason or because of the revocation of his mandate by agreement of the parties or in any other case of termination of his mandate, a substitute arbitrator shall be appointed according to the rules that were applicable to the appointment of the arbitrator being replaced.

Article 16- Competence of arbitral tribunal to rule on its jurisdiction

(1) The arbitral tribunal may rule on its own jurisdiction, including any objections with respect to the existence or validity of the arbitration agreement. For that purpose, an arbitration clause which forms

part of a contract shall be treated as an agreement independent of the other terms of the contract. A decision by the arbitral tribunal that the contract is null and void shall not entail ipso jure the invalidity of the arbitration clause.

(2) A plea that the arbitral tribunal does not have jurisdiction shall be raised not later than the submission of the statement of defence. A party is not precluded from raising such a plea by the fact that he has appointed, or participated in the appointment of, an arbitrator. A plea that the arbitral tribunal is exceeding the scope of its authority shall be raised as soon as the matter alleged to be beyond the scope of its authority is raised during the arbitral proceedings. The arbitral tribunal may, in either case, admit a later plea if it considers the delay justified.

(3) The arbitral tribunal may rule on a plea referred to in paragraph (2) of this article either as a preliminary question or in an award on the merits. If the arbitral tribunal rules as a preliminary question that it has jurisdiction, any party may request, within thirty days after having received notice of that ruling, the court specified in article 6 to decide the matter, which decision shall be subject to no appeal; while such a request is pending, the arbitral tribunal may continue the arbitral proceedings and make an award.

Article 17- Power of arbitral tribunal to order interim measures

Unless otherwise agreed by the parties, the arbitral tribunal may, at the request of a party ,order any party to take such interim measure of protection as the arbitration tribunal may consider necessary in respect of the subject-matter of the dispute. The arbitral tribunal may require any party to provide appropriate security in connection with such measure.

Article 18- Equal treatment of parties

The parties shall be treated with equality and each party shall be given a full opportunity of presenting his case.

Article 19- Determination of rules of procedure

(1) Subject to the provisions of this Law, the parties are free to agree on the procedure to be followed by the arbitral tribunal in conducting the proceedings.

(2) Failing such agreement, the arbitral tribunal may, subject to the provisions of this Law, conduct the arbitration in such manner as it considers appropriate. The power conferred upon the arbitral tribunal includes the power to determine the admissibility, relevance, materiality and weight of any evidence.

Article 20- Place of arbitration

(1) The parties are free to agree on the place of arbitration. Failing such agreement, the place of arbitration shall be determined by the arbitral tribunal having regard to the circumstances of the case, including the convenience of the parties.

(2) Notwithstanding the provisions of paragraph (1) of this article, the arbitral tribunal may, unless otherwise agreed by the parties, meet at any place it considers appropriate for consultation among its members, for hearing witnesses, experts or the parties, or for inspection of goods, other property or documents.

Article 21- Commencement of arbitral proceedings

Unless otherwise agreed by the parties, the arbitral proceedings in respect of a particular dispute commence on the date on which a request for that dispute to be referred to arbitration is received by the respondent.

Article 22- Language

(1) The parties are free to agree on the language or languages to be used in the arbitral proceedings. Failing such agreement, the arbitral tribunal shall determine the language or languages to be used in the proceedings. This agreement or determination, unless otherwise specified therein, shall apply to any written statement by a party, any hearing and any award, decision or other communication by the arbitral tribunal.

(2) The arbitral tribunal may order that any documentary evidence shall be accompanied by a translation into the language or languages agreed upon by the parties or determined by the arbitral tribunal.

Article 23- Statements of claim and defence

(1) Within the period of time agreed by the parties or determined by the arbitral tribunal, the claimant shall state the facts supporting his claim, the points at issue and the relief or remedy sought, and the respondent shall state his defence in respect of these particulars, unless the parties have other- wise agreed as to the required elements of such statements. The parties may submit with their statements all documents they consider to be relevant or may add a reference to the documents or other evidence they will submit.

(2) Unless otherwise agreed by the parties, either party may amend or supplement his claim or defence during the course of the arbitral proceedings, unless the arbitral tribunal considers it inappropriate to allow such amendment having regard to the delay in making it.

Article 24- Hearings and written proceedings

(1) Subject to any contrary agreement by the parties, the arbitral tribunal shall decide whether to hold oral hearings for the presentation of evidence or for oral argument, or whether the proceedings shall be conducted on the basis of documents and other materials. However, unless the parties have agreed that no hearings shall be held, the arbitral tribunal shall hold such hearings at an appropriate stage of the proceedings, if so requested by a party.

(2) The parties shall be given sufficient advance notice of any hearing and of any meeting of the arbitral tribunal for the purposes of inspection of goods, other property or documents.

(3) All statements, documents or other information supplied to the arbitral tribunal by one party shall be communicated to the other party. Also any expert report or evidentiary document on which the arbitral tribunal may rely in making its decision shall be communicated to the parties.

Article 25- Default of a party

1. Unless otherwise agreed by the parties, if, without showing sufficient cause,

(a) the claimant fails to communicate his statement of claim in accordance with article 23(1), the arbitral tribunal shall terminate the proceedings;

(b) the respondent fails to communicate his statement of defence in accordance with article 23(1), the arbitral tribunal shall continue the proceedings without treating such failure in itself as an admission of the claimant's allegations.

(c) any party fails to appear at a hearing or to produce documentary evidence, the arbitral tribunal may continue the proceedings and make the award on the evidence before it.

Article 26- Expert appointed by arbitral tribunal

(1) Unless otherwise agreed by the parties, the arbitral tribunal

(a) may appoint one or more experts to report to it on specific issues to be determined by the arbitral tribunal;

(b) may require a party to give the expert any relevant information or to produce, or to provide access to, any relevant documents, goods or other property for his inspection.

(2) Unless otherwise agreed by the parties, if a party so requests or if the arbitral tribunal considers it necessary, the expert shall, after delivery of his written or oral report, participate in a hearing where the parties have the opportunity to put questions to him and to present expert witnesses in order to testify on the points at issue.

Article 27- Court assistance in taking evidence

The arbitral tribunal or a party with the approval of the arbitral tribunal may request from a competent court of this State assistance in taking evidence. The court may execute the request within its competence and according to its rules on taking evidence.

Article 28- Rules applicable to substance of dispute

(1) The arbitral tribunal shall decide the dispute in accordance with such rules of law as are chosen by the parties as applicable to the substance of the dispute. Any designation of the law or legal system of a given State shall be construed, unless otherwise expressed, as directly referring to the substantive law of that State and not to its conflict of laws rules.

(2) Failing any designation by the parties, the arbitral tribunal shall apply the law determined by the conflict of laws rules which it considers applicable.

(3) The arbitral tribunal shall decide ex aequoet bono or as amiable composite ur only if the parties have expressly authorized it to do so.

(4) In all cases, the arbitral tribunal shall decide in accordance with the terms of the contract and shall take into account the usages of the trade applicable to the transaction.

Article 29- Decision-making by panel of arbitrators

In arbitral proceedings with more than one arbitrator, any decision of the arbitral tribunal shall be made, unless otherwise agreed by the parties, by a majority of all its members. However, questions of procedure may be decided by a presiding arbitrator, if so authorized by the parties or all members of the arbitral tribunal.

Article 30- Settlement

(1) If, during arbitral proceedings, the parties settle the dispute, the arbitral tribunal shall terminate the proceedings and, if requested by the parties and not objected to by the arbitral tribunal, record the settlement in the form of an arbitral award on a greed terms.

(2) An award on agreed terms shall be made in accordance with the provisions of article 31 and shall state that it is an award. Such an award has the same status and effect as any other award on the merits of the case.

Article 31-Form and contents of award

(1) The award shall be made in writing and shall be signed by the arbitrator or arbitrators. In arbitral proceedings with more than one arbitrator, the signatures of the majority of all members of the arbitral tribunal shall suffice, provided that the reason for any omitted signature is stated.

(2) The award shall state the reasons upon which it is based, unless the parties have agreed that no reasons are to be given or the award is an award on a greed terms under article 30.

(3) The award shall state its date and the place of arbitration as determined in accordance with article 20(1). The award shall be deemed to have been made at that place.

(4) After the award is made, a copy signed by the arbitrators in accordance with paragraph (1) of this article shall be delivered to each party.

Article 32- Termination of proceedings

(1) The arbitral proceedings are terminated by the final award or by an order of the arbitral tribunal in accordance with paragraph (2) of this article.

(2) The arbitral tribunal shall issue an order for the termination of the arbitral proceedings when:

(a) the claimant withdraws his claim, unless the respondent objects thereto and the arbitral tribunal recognizes a legitimate interest on his part in obtaining a final settlement of the dispute;

(b) the parties agree on the termination of the proceedings;

(c) the arbitral tribunal finds that the continuation of the proceedings has for any other reason become unnecessary or impossible.

(3) The mandate of the arbitral tribunal terminates with the termination of the arbitral proceedings, subject to the provisions of articles33and34(4).

Article 33- Correction and interpretation of award; additional award

(1) Within thirty days of receipt of the award, unless another period of time has been agreed upon by the parties:

(a) a party, with notice to the other party, may request the arbitral tribunal to correct in the award any errors in computation, any clerical or typographical errors or any errors of similar nature;

(b) if so agreed by the parties, a party, with notice to the other party, may request the arbitral tribunal to give an interpretation of a specific point or part of theaward.

If the arbitral tribunal considers the request to be justified, it shall make the correction or give the interpretation within thirty days of receipt of the request. The interpretation shall form part of the award.

(2) The arbitral tribunal may correct any error of the type referred to in paragraph (1)(a) of this article on its own initiative within thirty days of the date of the award.

(3) Unless otherwise agreed by the parties, a party, with notice to the other party, may request, within thirty days of receipt of the award, the arbitral tribunal to make an additional award as to claims presented in the arbitral proceedings but omitted from the award. If the arbitral tribunal considers the request to be justified, it shall make the additional award within sixty days.

(4) The arbitral tribunal may extend, if necessary, the period of time within which it shall make a correction, interpretation or an additional award under paragraph(1)or(3)ofthisarticle.

(5) The provisions of article 31 shall apply to a correction or interpretation of the award or to an additional award.

Article 34-Application for setting aside as exclusive recourse against arbitral award

(1) Recourse to a court against an arbitral award may be made only by an application for setting aside in accordance with paragraphs (2) and (3) of this article.

(2) An arbitral award may be set aside by the court specified in article 6 only if:

(a) the party making the application furnishes proof that:

(i) a party to the arbitration agreement referred to in article 7 was under some incapacity; or the said agreement is not

(ii) valid under the law to which the parties have subjected it or, failing any indication thereon, under the law of this State; or

(iii) the party making the application was not given proper notice of the appointment of an arbitrator or of the arbitral proceedings or was otherwise unable to present his case; or

(iv) the award deals with a dispute not contemplated by or not falling within the terms of the submission to arbitration, or contains decisions on matters beyond the scope of the submission to arbitration, provided that, if the decisions on matters submitted to arbitration can be separated from those not so submitted, only that part of the award which contains decisions on matters not submitted to arbitration may be set a side; or

(v) the composition of the arbitral tribunal or the arbitral procedure was not in accordance with the agreement of the parties, unless such agreement was in conflict with a provision of this Law from which the parties cannot derogate, or, failing such agreement, was not in accordance with this Law; or

(b) the court finds that;

(i) the subject-matter of the dispute is not capable of settlement by arbitration under the law of this State; or

(ii) the award is in conflict with the public policy of this State.

(3) An application for setting aside may not be made after three months have elapsed from the date on which the party making that application had received the award or, if a request had been made under article 33, from the date on which that request had been disposed of by the arbitral tribunal.

(4) The court, when asked to set aside an award, may, where appropriate and so requested by a party, suspend the setting aside proceedings for a period of time determined by it in order to give the arbitral tribunal an opportunity to resume the arbitral proceedings or to take such other action as in the arbitral tribunal's opinion will eliminate the grounds for setting aside.

Article 35- Recognition and enforcement

(1) An arbitral award, irrespective of the country in which it was made, shall be recognized as binding and, upon application in writing to the competent court, shall be enforced subject to the provisions of this article and of article36.

(2) The party relying on an award or applying for its enforcement shall supply the original award or a copy thereof. If the award is not made in an official language of this State, the court may request the party to supply a translation thereof into suchlanguage.

Article 36- Grounds for refusing recognition or enforcement

(1) Recognition or enforcement of an arbitral award, irrespective of the country in which it was made, may be refused only:

(a) at the request of the party against whom it is invoked, if that party furnishes to the competent court where recognition or enforcement is sought proof that:

(i) a party to the arbitration agreement referred to in article 7 was under some incapacity; or the said agreement isnot valid under the law to which the parties have subjected it or, failing any indication thereon, under the law of the country where the award was made; or

(ii) the party against whom the award is invoked was not given proper notice of the appointment of an arbitrator or of the arbitral proceedings or was otherwise unable to present his case; or

(iii) the award deals with a dispute not contemplated by or not falling within the terms of the submission to arbitration, or it contains decisions on matters beyond the scope of the submission to arbitration, provided that, if the decisions on matters submitted to arbitration can be separated from those not so submitted, that part of the award which contains decisions on matters submitted to arbitration may be recognized and enforced; or

(iv) the composition of the arbitral tribunal or the arbitral procedure was not in accordance with the agreement of the parties or, failing such agreement, was not in accordance with the law of the country where the arbitration took place; or

(v) the award has not yet become binding on the parties or has been set aside or suspended by a court of the country in which, or under the law of which, that award was made; or

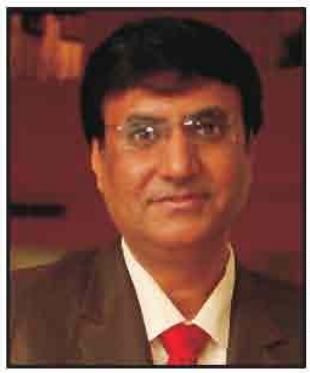
(b) if the court finds that;

(i) the subject-matter of the dispute is not capable of settlement by arbitration under the law of this State; or

(ii) the recognition or enforcement of the award would be contrary to the public policy of this State.

(2) If an application for setting aside or suspension of an award has been made to a court referred to in paragraph (1)(a)(v) of this article, the court where recognition or enforcement is sought may, if it considers it proper, adjourn its decision and may also, on the application of the party claiming recognition or enforcement of the award, order the other party to provide appropriate security.

Launching of Open Web Girders by End Launching over Running Railway lines in Eastern Dedicated Freight Corridor



Veer Narayan
Vice President/ PMC,
Rlys. and Metro, Systra India

Sanjay Singh,
Chief Bridge Engineer,
EDFC-1,
SAI-TYPSA JV

ABSTRACT

Launching of an OWG is a challenging work and one of the most important task. It requires a lot of experience and learning from the past mistakes to execute these works. With a view to promote the awareness and the problems faced the work done in launching in Bridges over running lines (RFOs) EDFC-1 , Khurja-Bhaupur section has been discussed in this article.

1. Introduction:

The Open Web Girders (OWG) are provided over the longer span usually more than 40 Metres. Open Web Girders are truss type designed without requiring the height of beam to increase beyond practical limit. The load from superstructure is transferred to the substructure through the truss. OWG consists of two trusses positioned vertically side by side acting as a web and joined together by assembling individual members (Ties & Struts) forming triangles or quadrilaterals along its length. These take the advantage of distribution of load over the members resulting in reduction of depth below the sleepers . Individual members are subjected to compression & tension forces. These trusses are connected to each other by cross girders & bottom lateral bracings at the bottom and by sway girders & top lateral bracings at the top.

Fig 1: Open Web Girder (OWG)

The launching of OWG poses a great challenge especially over the Running line or over the flowing water when the access to the span over which these are to be positioned is limited. The assembly of OWG requires lot of space & time and therefore is done at a convenient place outside its span location . In such situation, properly planned and designed launching scheme is required to pull the assembled OWG to its proper span location.

In this article the launching schemes to launch OWG over the running Railway lines adopted in Khurja-Bhaupur section of Eastern Dedicated Freight corridor is discussed to give the practical aspect of the schemes in detail. In this article the launching of HTMJ (2+3) ETMJ-1 and ETMJ-2 have been discussed. The discussion on ETMJ-4 has not been done as the bridge itself is very challenging and need to be discussed separately.

2. Brief details of various Launching Schemes Executed

2.1 Conventional Launching Method : This method is also called End Launching Method and generally adopted on new constructions. In this method, the girder is assembled on the approach bank and it is longitudinally traversed over the opening it has to span and lowered in position. We will explain the method by actual execution adopted in EDFC.

2.2 Launching of HTMJ-(2+3) : This major structure has been constructed across Hathras – Kasganj Rail Section under NER zone. This has span length of 46.2 M crossing over three IR tracks near Mendu Station. This is massive steel structure weighing 700 Ton approx (excluding dead load of RCC decks) designed to accommodate both tracks (UP-line & DN-line) in single OWG. The End Launching method was adopted in the launching.

Temporary Structure: For supporting the structure during launching , the properly designed temporary structure - **(Fig-2)** was erected in the space between abutment (A1) and pier (P1). It consisted of a pair of built-up I-girders connected together& placed over the trestles. The temporary structure was designed to withstand the loads of dead load as well as the loads coming due to movement of OWG. A pair of Rails were fixed over the top flange of each I-girder to facilitate the four wheeled trolley (See Fig-3) to move over it.

Fig-2 (a) Temporary arrangement

Fig-2(b) Temporary Arrangement

Fig3: 4 Wheeled Trolley

Pulling mechanism consisted of pulling winch & restraining winch of 20 Ton & 10 Ton capacity respectively, steel wire rope and pulley. One pair of pulleys was fixed to the front end of OWG with one pulley at either side. Other pair of pulleys was fixed on the vertical frame installed (over pier) at the other end near winch machine. The pulling winch and vertical frame are shown in Fig 4 & 5.

Fig-4: Winch Machine

Fig-5: Vertical Frame

The arrangement of vertical frame over the pier P1 is shown in Fig 6

Fig-6: Instalation of Winch Machine & Vertical Frame

OWG was connected with pulling winch by wire rope passing round the pulley. The two pulling winches were installed, one on either side. In order to avoid the risk of differential pulling, the electric motor of both pulling winch m/c (LHS & RHS) were set to run in synchronized way. Pulling speed of OWG is usually kept as 200 mm per minute. Two restraining winches were also installed at the rear end of OWG so as to restrain the movement in case of any exigency.The assembled OWG was lifted on hydraulic jack and placed over the set of six trolley on each side as per the design requirement with one trolley placed below one the bottom chord joint (Fig-4). By this arrangement OWG was made ready to move over rail lines laid over the temporary staging across the gap.

After all technical & safety check, trial pulling of OWG was done to check any discrepancy in the entire system and later on final pulling was done in the traffic block. The OWG was moved in slow speed to prevent any damage to the Temporary arrangement due to higher stresses coming on account of higher speed. Further checks were made regularly of the general alignment of OWG to ensure that it does not go out of defined alignment.

The various stages of the movements of OWG from trial pulling to final position are are shown in Fig 7 to Fig 11.

Fig-7: Start of movement of OWG

Fig-8: Movement of OWG supported on 4 Wheeled Trolley

Fig-9: Pulling of OWG in progress showing the vertical frames

Fig-10: Pulley & Wire Rope Connected to OWG in pulling

Fig-11: OWG after completion of Pulling

Precautions to be taken:

(i) All the rail joints should be made smooth properly by grinding. There should not be any lateral or vertical offset between two rail segments at joints.

(ii) The alignment of track laid over staging should be straight and should also be free from any kink or any abrupt change in rail top level.

(iii) Rail top should have the same level all along its length.

(iv) Rail top as well as all the moving parts like trolley wheels & pulley etc should be lubricated properly before start of pulling OWG. It reduces the friction and thus facilitates smooth movement of trolley over rail.

2.3 Launching of RFO - ETMJ-2: This major structure has been constructed across Etawah – Mainpuri Rail Section in NCR zone. It has span length of 54.9 M crossing over one existing IR track & two future tracks.

The OWG is weighing 500 Ton approx and is having non-ballasted deck to accommodate one track. Thus there are two separate OWGs – one for UP-line & other for DN-line. This was also launched in position by the Conventional Launching Method. Every process was same as followed in HTMJ-(2+3) above except the following changes :-

(i) The trolley was replaced by the sliding block. Refer to Fig-12. It contains nearly 250 mm long & 50 mm wide PTFE strip fit in the groove cut under the block. It slides smoothly over the rail.

(ii) As the pulling winch machine was installed on the approach bank constructed behind abutment (A2), in same level as of the bottom chord of OWG, there was no need installation of any vertical frame.

The various preparations and the launching is shown from Fig 12 to 17. For the sake of brevity discussions on these are not repeated.

Fig-12: PTFE Sliding Block

Fig-13: Temporary Staging

Fig-14: Pulley & Wire Rope Connection

Fig-15: Pulling Winch

Fig-16: Restraining Winch

Fig-17: OWG after completion of pulling

Precautions :

(i) All the rail joints should be made smooth properly by grinding. There should not be any lateral or vertical offset between two rail segments at joints. Vertical offset should strictly avoided otherwise PTFE strip will be trapped and crush.

(ii) The alignment of track laid over staging should be straight and should also be free from any kink or any abrupt change in rail top level.

(iii) Rail top should have the same level all along its length.

(iv) Rail top as well as all the moving parts like pulley etc. should be lubricated properly before start of pulling OWG. It reduces the friction and thus facilitates smooth movement of sliding block over rail.

(V) Lateral Guide Angle fitted in the sliding block should be strong enough and its fitting should be strong so as not to yield under lateral thrust.

(vi) All the key persons of commanding team including winch operators should be in contact with each other by walky-talky.

NOTE : Use of PTFE sliding block is convenient and facilitates smooth movement over rail. Therefore it is best preferred in conventional pulling.

2.4 Launching of RFO - ETMJ-1 : This major structure has been constructed across Kanpur – Delhi Main Line of NCR zone near Ekdil Station in Etawah. This is single span skew bridge having span length of 75 Mand having skew angle of 54. This OWG is having non-ballasted deck weighing 700 Ton approx. Two separate OWGs have been constructed here for UP-line & DN-line. This was launched in position by the Cantilever Launching with Launching Nose.

The Cantilever launching with Launching nose is generally adopted where the unsupported part of the span is very long due to the site condition and the unsupported length is not been supported due to site constraints.

A launching nose is light weight truss of suitable length fabricated with lighter sections. It is connected to the front portion of OWG with the help of suitably designed temporary connections. During pulling of girder, it acts as cantilever till its nose tip reaches the support at the other end and therefore it is designed to take the cantilever stress during launching. The launching nose reduces the cantilever weight of OWG resulting in minimum suspended load and thus higher safety . In ETMJ-1 , the launching nose of same skew angle (54) was assembled having length of 14.725 M on LHS & 5.250 M on RHS. It was attached to the front end of OWG by suitably designed connections as shown in Fig-18 & 19.

Fig-18: Cantilever pulling of OWG with the help of Launching Nose

Fig-19: Launching Nose

The girder was assembled on the approach behind the abutment. The properly designed temporary structure was erected in the gap between abutment and IR boundary which consisted of group of trestles braced together & the built-up joist beams placed over the trestles.

Fig-20: Temporary arrangements

Bottom chord joints of OWG contained HSFG bolts projected downward which obstruct rolling of OWG over Hillman Rollers. So, launching beams were fixed under the bottom chords (LHS & RHS) all along the length with the help of stools and joined with each other in such a way as to provide smooth and continuous bottom flange surface to roll over the Hillman rollers smoothly.

Fig-21: Launching Beam fitting under Bottom Chord

Hillman rollers of designed capacity were fixed over the top of joist beams. Hillman rollers are stationary rolling platforms provided on each abutment, pier and any intermediate trestles. Hillman rollers were fitted at the bottom chord joints of OWG so as to roll over the rolling platform fitted over trestles. The combination of OWG & launching nose was then pulled longitudinally with the help of a winch machine till OWG reached its desired position and then was lowered in position. The launching beam attached under the bottom chord of OWG rested on the Hillman roller fixed over trestles and hence was free to move in transverse direction also. As a result, there was a risk that OWG may laterally slip off the Hillman roller leading to accident. To avoid this, lateral guide roller was installed on every trestle on LHS & RHS to restrain the lateral movement of OWG.

Fig-22: Hillman Roller

Fig-23: Lateral Guide Roller

Pulling mechanism adopted was similar to was in HTMJ-(2+3). It consisted of pulling winch & restraining winch of 25 Ton & 15 Ton capacity respectively, steel wire rope and pulley. Their arrangement is also same except the slight change,as per site condition, in the vertical frame installed at the other end near winch machine.The two restraining winches, each of 15 Ton capacity, were installed at the rear end of OWG, like in ETMJ-2 above, so as to restrain the movement in case of any exigency. Rear end of OWG has been connected with these winches by wire ropes. During normal pulling of OWG, these wire ropes are gradually released according to the pulling speed so as not to restrain the pulling.

Refer to Fig-16. In order to avoid the risk of differential pulling, the electric motor of both pulling winch m/c (LHS & RHS) were set to run in synchronized way. Here, pulling speed of OWG was 600 mm/min. Wire ropes were pulled across the overhead 25kV OHE wire with the help of cranes and Manlift under Railway Traffic Block.

Fig-24: Pulling Mechanism

Pulling Operation : After all technical & safety check, trial pulling of OWG was done to check and rectify any discrepancy in the entire system. Later on, final pulling was done in three stages :-

In first stage,pulling was done outside the IR boundary and hence without Railway Traffic Block till the tip of launching nose reached the support over the trestles before IR boundary. Refer to Fig-25.

The second & third stage pulling were done under Railway Traffic Block sanctioned by IR Authority. During the second stage pulling, the launching nose crossed IR track and its tip reached the support over trestles on the other side of IR track.Refer to Fig-26. Inthird stage/final pulling, OWG reached in the desired position on abutment - A2. Refer to Fig-27.

Finally after dismantling of launching beams and launching nose, OWG was lowered in position.

Fig-25: First Stage Pulling of OWG

Fig-26: Second Stage Pulling of OWG

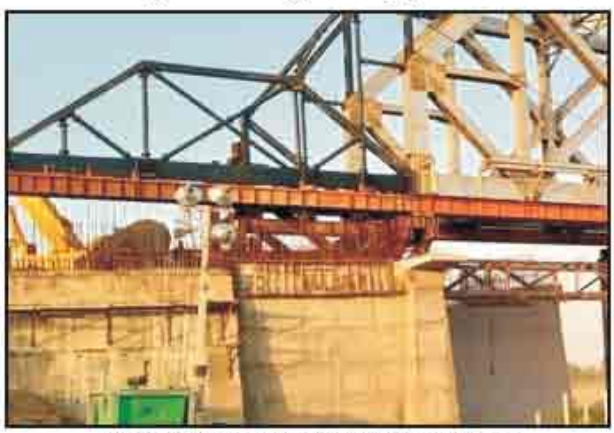


Fig-27: Third Stage/Final Pulling of OWG

Precautions :

(i) Jointing of launching beam segments should be done in manner to ensure the bearing surface of the bottom flange smooth and continuous leaving no gap to facilitate smooth rolling over Hillman rollers. There should not be any lateral or vertical offset between the bearing surfaces of bottom flanges at joints. Vertical offset should strictly be avoided otherwise Hillman roller pin will be trapped and crushed during pulling.

(ii) Hillman rollers' top should in the same level,everywhere.

(iii) All the moving parts like Hillman roller pins, pulley etc should be lubricated properly before start of pulling OWG to reduce the friction and facilitating smooth rolling .

(iv) Some wedges (strips made of plate of varying thickness from 10 mm to 20 mm with one end wedge shaped) should be kept at site. In case, OWG shifts laterally during pulling, these wedges can be inserted between the lateral guide roller and the top flange of launching beam so as to bring OWG in proper alignment.

(v) The vertical post on which Lateral Guide Roller is fitted should be strong enough so as not to yield under lateral thrust during pulling operation.

(vi) All the key persons of team should be in close contact with each other by walky-talky during launching.

Challenges Faced During Pulling Operation :

At one joint of launching beam (LHS), a vertical offset between the bottom flange surface was left which could not be noticed. During third stage pulling, this joint reached over the trestle on the other side of IR track. At the same time, it was accompanied by some lateral shift in OWG. Consequently, the bottom flange at this joint infringed with the collar of Hillman roller. See Fig-28. As the pulling winch was running, excessive longitudinal force was exerted on the trestle. As a result, anchor bolts holding down the trestle to concrete foundation got uprooted, bolts in the bracings sheared, bracings of trestle broken at their weld locations with cracking bursting sound and further pulling was stopped immediately. Trestle leant in the direction of pulling. The tip of launching nose was hanging in air just behind the support over abutment.Any further pulling would result in falling down of trestle. It was very embarrassing situation.

Fig-28: Bottom Flange of Launching Beam trapped by Collar of Hillman Roller

Remedial Measure : The engineer decided to provide a horizontal support to the trestle at its top in the direction opposite to the pulling direction with the reaction born by the abutment. For this purpose, a horizontal reaction truss along the pulling direction was erected as shown in Fig-29. After completion of reaction truss, further pulling was done safely and successfully.

Fig-29: Rection Truss erected to support the trestle

3.0 Conclusions:

The launching scheme of an OWG is the most important and most critical activity of the construction of an OWG. It gains more importance when the work of launching has to be done over the running railway lines. The launching scheme need to be designed meticulously to the last details by an experienced Engineer as any small mistake can result in the serious accident. Most of the activities in the launching are sequential in nature so sufficient time should be allowed for planning and execution of the launching schemes. Usually these form part of the critical activities , so these should be planned well in advance by the contractor to avoid arising of situation of urgencies which may result in adoption of shortcuts by the field staffs. We should remember that these activities are to be planned well as any small lapse can result in big accident and may lead to serious time delays.

FIDIC Yellow book (Claim, Adjudication V/S Indian Law provisions) CTP-14 Contract-A case Study

R.K.Rastogi
PM/Civil/Noida

Synopsis

Prime Minister of India expresses his wishes to make India a 05 trillion $ economy by the year 2024. It needs massive investment on infrastructures and logistics in order to remove impediments for faster movement.

Large investments, public as well as the private, will be needed in various infrastructure sectors to meet the growing needs of the Indian economy. The public sector would continue to play an important role in building infrastructure and would need to ensure efficient and timely construction of the project in agreed cost by formulating proper Contract document.

Due to the inherent risks and increasing complexity of modern construction projects, delays and cost overruns have become common facts in the industry. One of the major problems that face the construction projects in general is being behind the schedule, i.e., delay in submission, land acquisition complexities due to geo political reasons and disputes, lack of decisions, defective Contract document formation.

The various other reasons for delays are, late handing over of site, late issue of drawings, late supply of materials, delayed payments, delay on the part of sub-Contractor, Force Major, change of legislation, variations, change in employer's requirement etc. There might be more than one reason to be responsible for delay, etc.

Various types of claims raised by the Contractors due to reasons mentioned above under 'Time Delay and Extension', some of the claims are mentioned as under.

- Time Extension and Price Escalation due to delayed handing over of land
- Reimbursement of variation due to change in scope of work, Employer's requirement.
- Delay in decisions making by Employer/Engineer, Drawing approvals
- Delayed & withheld payments.
- Force Major, change in legislation
- Granting extension of time for delays
- De/Remobilization charges for carrying out delayed work.
- Compensation for idling resources due to delays/Compensation for loss of overheads and profits
- Compensation for extra expenditure incurred on overheads, establishment and other supervisory expenditure due to extended stay
- Release of amount withheld towards liquidated damages
- Compensation for mental agony, torture, stress and defaming

As per flash report released by Ministry of Statistics in August 2014, as many as 295 infrastructure sector projects worth Rs 150 crore or more were delayed with total cost overrun of over Rs 1 lakh crore.

According to Times of India report published on 11 Oct-2011 exorbitant claims by Highway developers could be staring at Rs 17000 -18000/- crore pay-out for NHAI in next 2-3 years. Around 180 arbitration cases are going on with claim of Highway Builders and concessionaires totalling nearly Rs 71000/- crore. M/S Madhucon made a claim of Rs 8199/- crore against a total project cost of Rs 629 crore for Madurai Tuticorin Project, (13 times of Project cost). Soma Isolux has made a claim of Rs7036 crore, two & half time of the Project cost. These claims are eye openers for the Project Managers.

Legal disputes between developers and executing agencies (Contractors) related to time overruns appear to have been increasing over the past few years. These rising incidences have serious time and cost implications, not only for these two sets of parties, but also for the project at large & despite huge investment the public at large unable to be benefitted due these project delays. It is, thus, important to demystify the conundrum of construction disputes, so that India can accelerate its infrastructure growth and wasteful disputes are avoided.

Being a topic of relevance, the various clauses pertaining to raising a claim by Contractor and Employer, the dispute adjudication in FIDIC Contracts and relevant provisions as per Indian laws are discussed in this write up to familiarize the Project Managers involved in execution of FIDIC Contracts, to the legal issues, in Indian context.

1.0 Part-I What is FIDIC:

FIDIC -The International Federation of Consulting Engineers (commonly known as FIDIC, acronym for its French name Fédération Internationale Des Ingénieurs-Conseils) is an international standards organization for the consulting engineering & construction best known for the FIDIC family of Contract templates

1.1 Why FIDIC Contracts:

FIDIC Contracts have been developed over 50 years as the international standard for the Consulting Industry. ... For this reason, the fundamental principle behind the FIDIC Contracts is the use of General Conditions of Contract, deemed to be suitable in all cases, based on thousands of successful projects around the world. However specific conditions can be developed to suite the local conditions of Individual country, where the work proposed to be executed.

1.2 FIDIC Contracts in DFC:

As mandated by Government of India all Contracts in commissioning of EDFC & WDFC are being executed as Design & Build Lump sum Contracts based on FIDIC Yellow book.

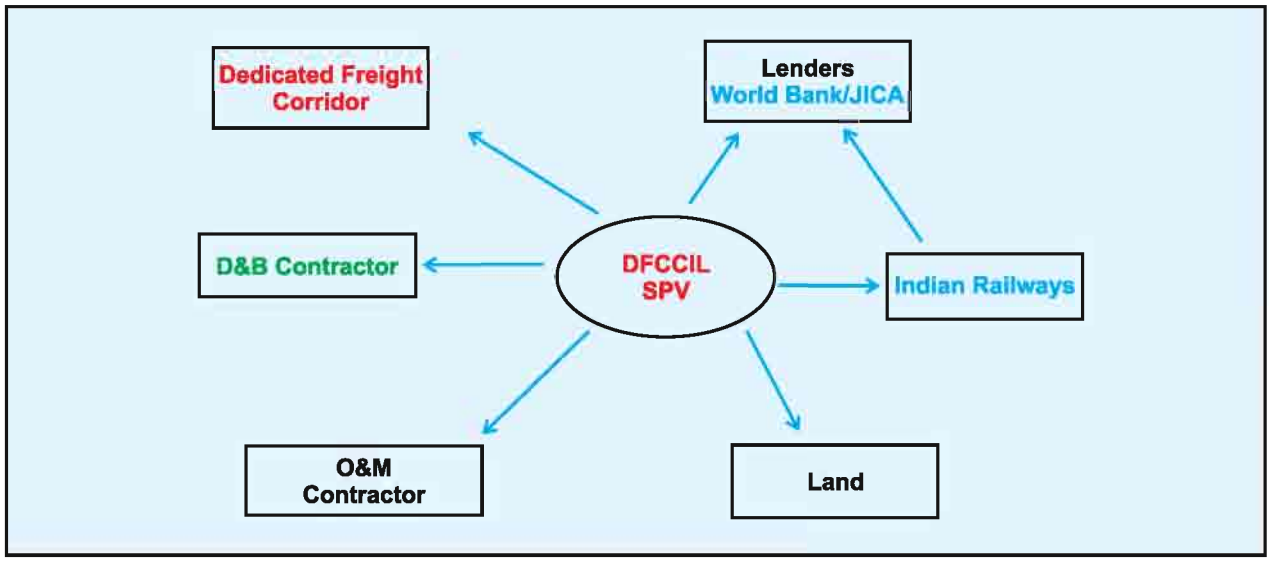


Fig-1 Concept of execution of Project in DFCC

1.3 FIDIC Yellow Book:-

FIDIC published the second edition of its standard form Contracts in December 2017. First edition was published in 1999. The **Yellow Book** is a lump sum Contract intended for use where the work is designed by the Contractor, and under which the Contractor accepts all design risks and the risk of quantities. DFC contracts are awarded on the basis of 1999 edition.

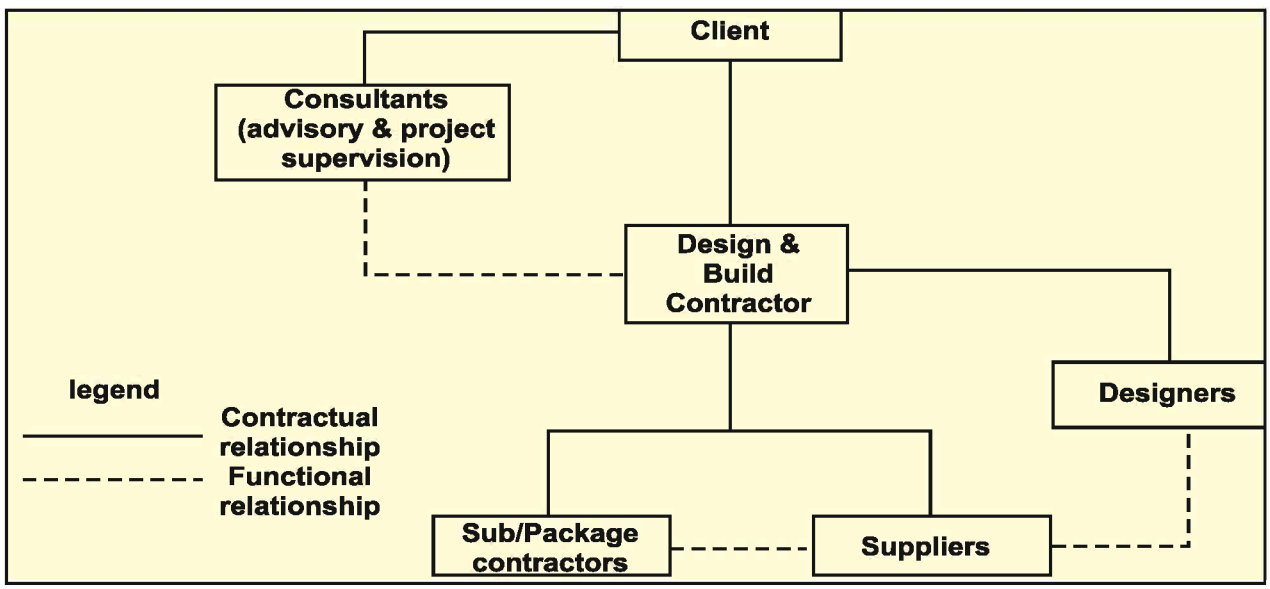


Fig-2 Relation diagram [Client, Consultant & Contractor] as per yellow book [FIDIC]

2.0 Part -II FIDIC Yellow book Sub clauses related to claim by the Contractor

Normally the Contractor's claims are dealt in FIDIC Contracts according to the provisions of following Sub clauses.

2.1 Sub Clause 1.9-Errors in the Employer's Requirements:

If the Contractor suffers delay and/or incurs Cost as a result of an error in the Employer's Requirements, and an experienced Contractor exercising due care would not have discovered the error when scrutinising the Employer's Requirements under Sub-Clause 5.1 [General Design Obligations], the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) ***An extension of time for any such delay, if completion is or will be delayed,*** under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost plus reasonable profit,*** which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been so discovered, and (ii) the matters described in Sub-paragraphs (a) and (b) above related to this extent.

2.2 Sub Clause 2.1 Access to site: Employer shall give the Contractor right of access to, and possession of, all parts of the site within the time (or times) stated in the Appendix to Tender.

If the Contractor suffers delay and/or incur costs a result of failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to subclause20.1 [Contractor's claim] to:

(a) ***An extension of time for any such delay, if completion is or will be delayed,*** under sub clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost plus reasonable profit*** which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

2.3 Sub-Clause 4.7 Setting out: Employer shall be responsible for any notified items in Relation to original points, lines ,levels of reference and contractor is entitled subject to sub clause 20.1 [Contractor's claim] to

(a) ***An extension of time for any such delay, if completion is or will be delayed,*** under sub clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost plus reasonable profit*** which shall be included in the Contract Price.

2.4 Sub-Clause 4.12 Unforeseeable Physical Conditions:

In this Sub-Clause, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If, and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) ***An extension of time for any such delay, if completion is or will be delayed,*** under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost,*** which shall be included in the Contract Price.

2.5 Sub-Clause 7.4 Testing: If the contractor suffers delay in testing specified in the document and /or incurs cost with instructions or a result of a delay for which the Employer is responsible, the contractor shall give notice to the Engineer and shall be entitled subject to sub clause 20.1[Contractor's claim] to

(c) ***An extension of time for any such delay ,if completion is or will be delayed,*** under sub clause 8.4 [Extension of Time for Completion], and

(d) ***Payment of any such Cost plus reasonable profit*** which shall be included in the Contract Price.

2.6 Sub-Clause 8.4 Extension of Time for Completion:

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:

(a) A Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]),

(b) A cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions

(c) Exceptionally adverse climatic conditions,

(d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or

(e) Any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other Contractors on the Site.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of Time.

2.7 Sub Clause 8.5 Delays Caused by Authorities:

If the following conditions apply, namely

(a) The Contractor has diligently following the procedures laid down by the relevant legally constituted public authorities in the Country.

(b) These authorities delay or disrupt the Contractor's work and

(c) The delay or disruption was unforeseeable.

Then this delay or disruption will be considered as a cause of delay under sub paragraph (b) of Sub-Clause 8.4 [Extension of Time for completion]

2.8 Sub-Clause 8.9 Consequence of Suspension:

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions under Sub-Clause 8.8 [Suspension of Work] and/or from resuming the work, the ***Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:***

(a) ***An extension of time for any such, delay, if completion is or will be delayed,*** under Sub-Clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost, which shall be included in the Contract Price,***

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

2.9 Sub Clause 8.10 Payment for Plant and Materials in Event of Suspension:

The contractor shall be entitled to payment of the value (as at the date of Suspension) of Plant and/or Materials which have been delivered to site, if

(a) The work on Plant or delivery of Plant and/or Materials has been suspended for more than 28 days, and

(b) The Contractor has marked the Plant and/or materials as the Employer's property in accordance with the Engineer's instructions.

2.10 Sub Clause 8.11 Prolonged Suspension:

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Engineer's permission to proceed, if the Engineer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat

the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

2.11 Sub-Clause 10.2 Taking over Part of the Work: After issuance of taking over certificate for a part of the work by the engineer the contractor shall be given the earliest opportunity to carry out any outstanding test on completion before expiry of defect notification period.

If the contractor incurs a cost as a result of Employer's taking over and/or using a part of the works, other than such use as specified in the Contract or as agreed by the Contractor, the contractor shall (i) Give notice to the Engineer and (ii) be entitled subject to sub clause 20.1[Contractor's claim] to payment of any such cost +reasonable profit, which shall be included in the contract price.

2.12 Sub-Clause 10.3 Interference with Test on completion: If the contractor suffers delay and/or incur cost as a result of carrying out tests on completion. The contractor shall give notice to the Engineer and shall be entitled subject to sub clause 20.1[Contractor's claim] to

(e) An extension of time for any such delay ,if completion is or will be delayed, under sub clause 8.4 [Extension of Time for Completion], and

(f) Payment of any such Cost plus reasonable profit which shall be included in the Contract Price.

2.13 Sub clause 12.2 Delayed Tests

If the Contractor incurs Cost as a result of any unreasonable delay by the Employer to the tests after Completion, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus reasonable profit, which shall be included in the Contract Price.

If, for reasons not attributable to the Contractor, a Test after completion on the works or any Section cannot be completed during the Defects Notification Period (or any other period agreed upon by both Parties), then the Works or Section shall be deemed to have passed this Test after Completion.

2.14 Sub-Clause 12.4 Failure to pass tests on completion:

If the work or a section, fail to pass a Test after completion and the contractor proposes to make adjustments or modifications to works or such section. The contractor then shall remain liable to carry out the adjustments or modifications and to satisfy this test, within a reasonable period after receiving notice by the Employer. However, if the Contractor does not receive this Notice during the relevant Defect Notification period, the Contractor may shall be relieved of his obligation and the work or section shall be deemed to have pass the tests after completion.

If the Contractor incurs additional cost as a result of any unreasonable delay by the Employer in permitting access to the Works or Plant by the contractor, either to investigate the causes of a failure to pass the tests after completion or to carry out any adjustments or Modifications, the contractor shall (i) Give notice to the Engineer and (ii) be entitled subject to sub clause 20.1[Contractor's claim] to payment of any such cost +reasonable profit, which shall be included in the contract price.

2.15 Sub-Clause 13.3 Variation Procedure:

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

(a) A description of the proposed design and/or work to be performed and a programme for its execution,

(b) The Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion, and

(c) The Contractor's proposal for adjustment to the Contract Price.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise], respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any

requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt,.

Upon instruction or approving a Variation, the Engineer shall proceed in accordance with Sub-clause 3.5 [Determinations], ***to agree or determine adjustments to the Contract Price and the Schedule of Payments. These adjustments shall include reasonable profit,*** and shall take account of the Contractor's submissions under Sub-Clause 13.2 [Value engineering] if applicable.

2.16 Sub-Clause 13.7 Adjustments for Changes in Legislation:

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result, of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

(a) ***An extension of time for any such delay, if completion is or will be delayed,*** under sub-Clause 8.4 [Extension of Time for Completion], and

(b) ***Payment of any such Cost,*** which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

2.17Sub Clause 13.8 Adjustment for Changes in Cost:

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data included in the Appendix to Tender. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, ***the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause to the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs***

2.18 Sub-Clause 14.8 Delayed Payment:

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, and shall be paid in such currency

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

2.19 Sub Clause 17.4 Consequences of Employer's Risks:

If and to the extent that any of the risks listed in Sub-Clause 17.3, results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claim] to:

an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and Payment of any such Cost, which shall be included in the Contract Price. In the case of sub-paragraphs (f) and (g) of Sub-Clause 17.3 [Employer's Risks], reasonable profit on the Cost shall also be included.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

2.20 Sub Clause 19.4 Consequences of Force Majeure:

If the Contractor is prevented from performing any of his obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claim] to:

an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause- 8.4 [Extension of Time for Completion], and if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in the case of sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

2.21 Sub Clause 20.1 Contractor's Claim: If the Contractor considers himself to be entitled to any extension of time for completion and/or any additional payment, under any clause of these conditions or otherwise in connection with the Contract, the contractor shall give notice to the Engineer, describing the events or circumstance giving rise to the claim. The notice shall be given as soon as practicable as and not later than 28 days after the contractor became aware, or should have become aware, of the event or circumstances. If the Contractor fails to give notice of a claim within such period of 28 days ,the time for completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim.

The Engineer shall proceed in accordance with sub clause3.5[Determination] to agree or to determine(i) the extension ,(if any) of the time for completion(before or after its expiry) in accordance with sub clause 8.4[Extension of time for completion], and/or(ii) the additional payment(if any) to which the contractor is entitled under the contract.

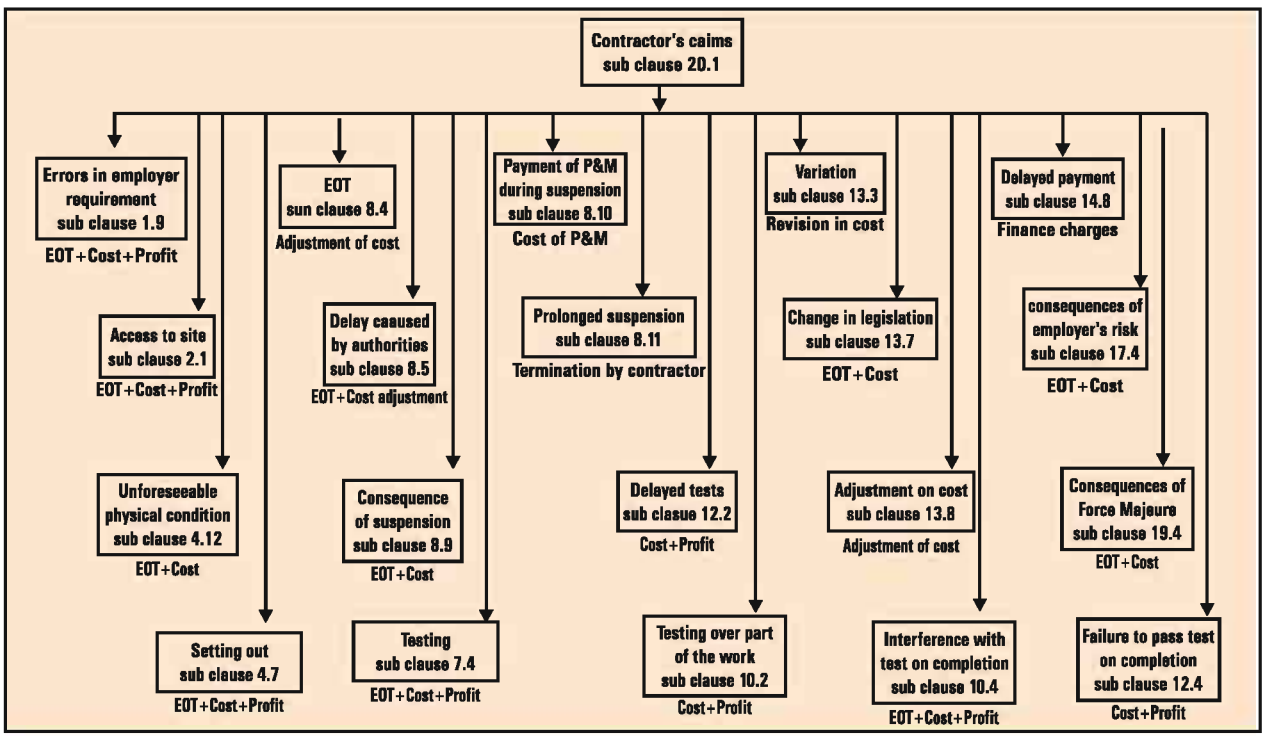


Fig-3: Contractor's Claims (An Illustration)

In addition to above there might be several other Contractors' claims according to the Employer's requirements, Appendix to Bid & Particular Conditions and as per statuary provisions of the Country, where the work is being executed.

3.0 Part-III FIDIC Yellow book Sub clauses related to claim by the Employer: Employer's claims are governed by sub-clause 2.5 in the Yellow and Book of FIDIC.

3.1 Sub-Clause2.5 Employer claim "If the Employer considers himself to be entitled to any payment under any Clause under these Conditions, or otherwise in connection with the Contract..... the Employer or the Engineer shall give notice and particulars to the Contractor.

A notice shall be given as soon as practicable after the Employer became aware of the event or circumstance giving rise to the claim.....The particulars shall specify the clause or other basis of the claim, and shall include substantiation of the amount, to which the Employer considers himself to be entitled in connection with the Contract. The Engineer shall then proceed in accordance with sub-clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor.....

This amount may be included as a deduction in the Contract Price and Payment Certificates. The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this sub-clause.

3.2 Sub-Clause 7.5 Rejection- If as a result of an Examination, Inspection, Measurement or testing, any Plant, Material, Design or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Material, Design or workmanship by giving notice to the Contractor. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Engineer requires this Plant, Materials, Design or workmanship to be retested, the tests shall be repeated under the same terms and conditions, if the rejection and the retesting cause the Employer to incur additional costs, the contractor shall subject to sub Clause2.5[Employer's claims] pay these costs to Employer.

3.3 Sub-Clause 7.6 Remedial work: Not withstanding with the previous tests or certification, the Engineer may instruct the Contractor to:

(a) Remove from the site and replace any plant or materials, which is not in accordance with the contract.

(b) Remove and re-execute any other work which is not in accordance with the contract, and

(c) Execute any work which is urgently required for the safety of the works, whether because of an accident, unforeseeable event or otherwise.

If the Contractor fails to comply with the instruction within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the work, except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to sub-clause 2.5[Employer's claim] pay to the Employer all costs arising from this failure.

3.4 Sub clause 8.6 Rate of Progress:

If, at any time:

(a) actual progress is too slow to complete within the Time for Completion and/or

(b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme]; other than as a result of a cause listed in Sub-Clause

8.4 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless, the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims]

pay these costs to the Employer in addition to delay damages (if any) under Sub-Clause 8.7 above.

3.5 Sub-Clause 8.7 Delay Damages-

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Appendix to Tender, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking - Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Appendix to Tender.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer]

3.6 Sub-Clause 9.4 Failure to pass test on completion: If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause-9.3 (Retesting), the Engineer shall be entitled to:

(a) Order further repetition of Tests on Completion under Sub-Clause-9.3;

(b) If the failure deprives the Employer substantially the whole benefit of the Works or section, reject the works or section (as the case may be), in which event the Employer shall have the same remedies as are provided in Sub-Paragraph (c) of Sub-Clause-11.4 [Failure to Remedy Defects]; or

(c) Issue a Taking - Over Certificate, if the Employer so requests.

In the event of sub-paragraph (c), the Contractor shall then proceed in accordance with all other obligation under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover, the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking - Over Certificates is issued, or (ii) determined and paid under Sub-Clause-2.5 [Employer's Claims] and Sub-Clause-3.5 [Determinations].

3.7 Sub Clause 11.2 Cost of Remedying Defects:

All work referred to in sub-paragraph (b) of Sub-Clause-11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

(a) The design of the Works, other than a part of the design for which the Employer is responsible (if any),

(b) Plant, Materials or workmanship not being in accordance with the Contract.

(c) Improper operation or maintenance which was attributable to matters for which the Contractor is responsible (under Sub-Clause-5.5 to 5.7 or otherwise), or

(d) Failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer and Sub-Clause-13.3 [Variation Procedure] shall apply.

3.8 Sub-Clause 11.3 Extension of Defects Notification Period:

The Employer shall be entitled subject to the Sub-Clause 2.5 [Employer's Claim] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or damage. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Works] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects

Notification Period for the Plant and/or Materials would otherwise have expired.

3.9 Sub-Clause 11.4 failure to remedying defects:

If the Contractor fails to remedy any defector damage by this notified time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2[Cost of Remedying Defects], the Employer may (at his option):

(a) Carry out the work himself or by other, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work and the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;

(b) Require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or

(c) If the defect or damage deprives the Employer of substantially the whole benefit of the works or any major part which cannot be put to the intended use Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant Materials to the Contractor.

3.10 Sub-Clause 12.3 Retesting:

If the Works, or a Section, fail to pass the Tests after Completion:

(a) Sub-Paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall apply, and

(b) Either Party may then require the failed Tests and the Tests after Completion on any related work, to be repeated under the same terms and Conditions.

If and to the extent that this failure and retesting are attributable to any of the matters listed in sub-paragraphs (a) to (d) of Sub-Clause 11.2 [Cost of Remedying Defects] and cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claim] pay these costs to the Employer.

3.11 Sub-Clause 13.2 Value Engineering:

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

Normally Employer retains a larger chunk of savings due to value Engineering and smaller chunk transferred to contractor as per condition of Particular application and contract price reduced accordingly.

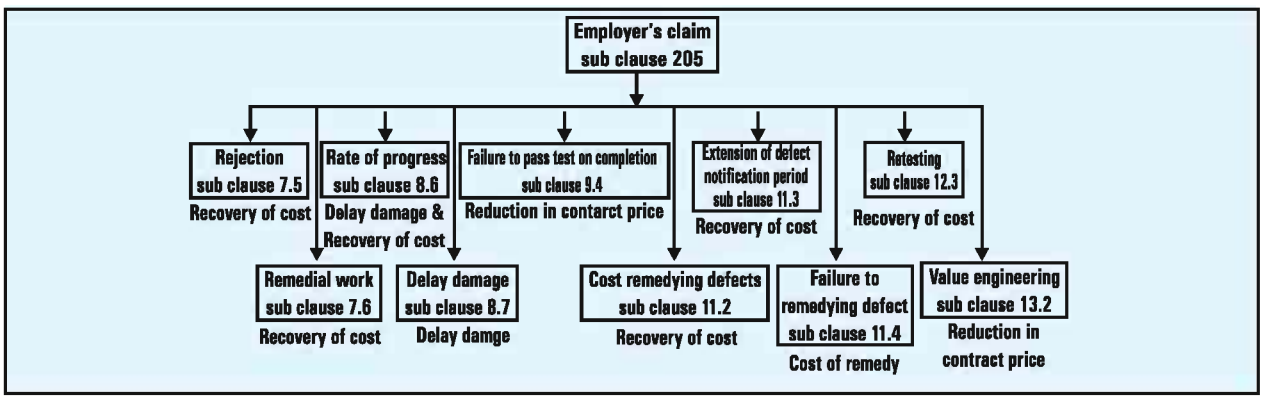


Fig-4 Employer's Claim (An Illustration)

In addition to above claims, if, contractor use the facilities of Electricity, Water & Gas provided by the Employer [Sub-Clause 4.19 of General Conditions], or the equipment of the Employer [Sub Clause 4.20 of General Conditions] the Employer can claim the cost of the same under Sub-Clause 2.5[Employer's Claim], as per agreed terms in contract. [Sub Clause 4.19 & 4.20 is not discussed in details, as the same are not applicable to CTP-14 contract].

Additionally there might be several other Employers' claims according to the Employer's requirements, Appendix to Bid & Particular Conditions and as per statuary provisions of the Country, where the work is being executed.

4.0 Part-IV Governing Law as per Fidic Yellow Book: - Following the other circumstances which may or may not covered under FIDIC sub clauses, but largely covered by the law of the country of execution of work or by the Particular Condition (PC) through Appendix to Bid.

4.1 Sub Clause 1.4: Law & Language:

Contract shall be governed by the law of the country (or other jurisdiction) stated in the Appendix to tender. The ruling language of the Contract shall be that stated in the Contract Data.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

4.2 Sub-Clause 17.6 Limitation of Liability-

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss

of any Contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than under Sub-Clause 16.4 (Payment on Termination] and Sub-Clause 17.1 [Indemnities].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Employer's Equipment and Free-Issue Material], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum stated in the Particular Conditions or (if a sum is not so stated) the Accepted Contract Amount.

This Sub-Clause shall not limit liability I any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

4.3 Circumstances under which Both Employer and Contractor can raise their claim:

4.3.1 Sub-Clause 19.6 Optional Termination, Payment and Release:

If the execution of substantially all the works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, than either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment]

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include.

The amounts payable for any work carried out for which a price is stated in the contract

The cost of Plant and Materials ordered for the Works which have been delivered to the Contractor or of which the Contractor is contractor is liable to accept delivery this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal

Any other Cost or liability which in the circumstances was reasonably incurred by the Contractor in the

expectation of completing the work.

The cost of removal of temporary Works and contractor's works in his country (or to any other destination at no greater cost).and the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

4.3.2 Sub-Clause 19.7 Release from performance under the Law

Not with standing any other provision of this clause, if any event or circumstance outside the control of the parties (including, but not limited to force majeure) arises which makes it impossible or unlawful for either or both parties to ful-fill its or their contractual obligation or which under the law governing the contract, entitles the Parties to be released from further performance of the contract, then upon notice by either party to the other party of such event or circumstances.

the Parties shall be discharged from further performance, without prejudice to the right of either Party in respect of any previous breach of the Contract, and the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

4.3.3 Concurrent Delays (Not covered in FIDIC yellow book)

is where the employer and Contractor delay events occur at the same time and cause a delay to progress for the same period sharing the same start and finish dates, either of which, in the absence of the other, is likely to cause the same delay to the completion of the works.

In one US court judgement excerpts in case of JBL company-"When the delay result from a combination of causes, and both the parties are at fault to such extent that it is not possible to determine the degree of guilt of each, the Government loses its right to assess liquidated damages and the Contractor loses the right to collect delay cost"

However FIDIC-1999 conditions are silent on this issue. But employer must give notice to contractor under sub clause 2.5[Employer's claim to get relief in DAB/ICC/Litigation over concurrent delays.

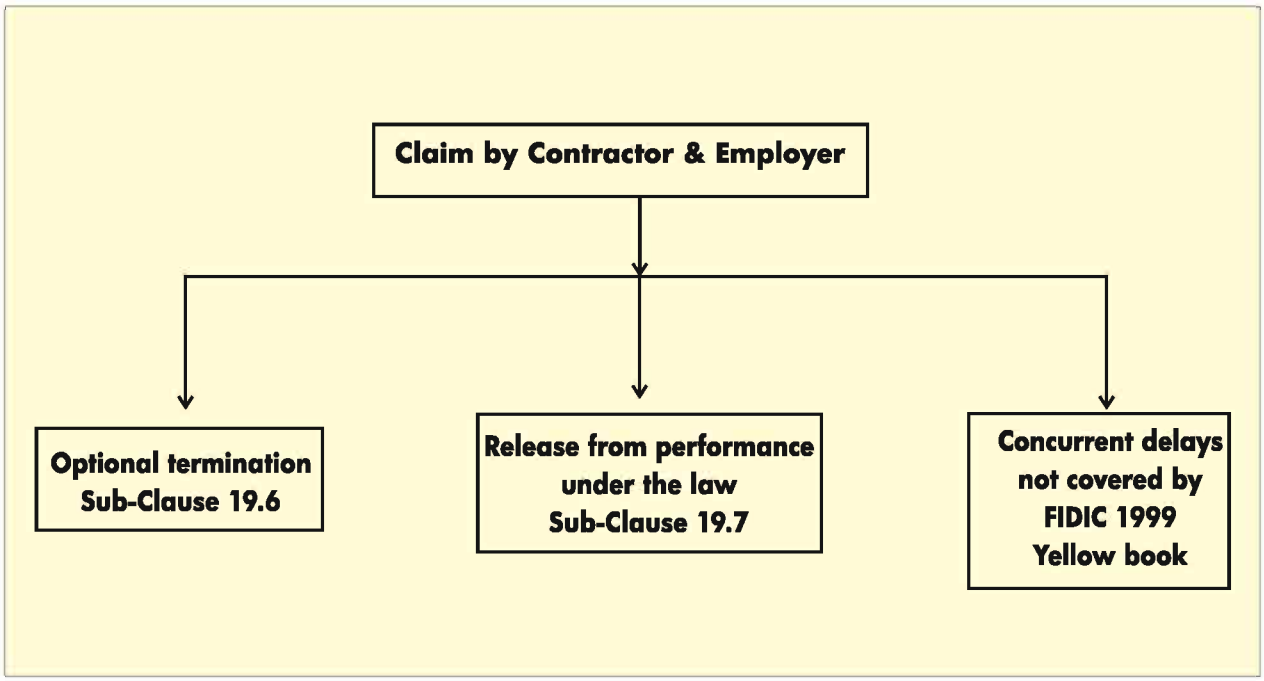


Fig-4 Employer's Claim (An Illustration)

V.Imp- An employer is therefore well advised to give notice of any claim, which it considers it may be entitled to, in writing to the contractor and as soon as practicable after it has become aware of the event or circumstance given rise to the claim. The notice is to contain sufficient particularity of the claim and shall specify the clause or other basis, including the substantiation of the amount to which the employer considers itself to be entitled to from the contractor. If the employer fails to comply with the notification requirements as set out in Sub-Clause 2.5, the back door to raising the claim at a later stage is firmly shut. It follows that the employer is not entitled to set-off or counterclaim against any amount owing to the contractor, unless a notice has been given to the contractor as provided for in Sub-Clause 2.5.

5.0 Part-V Various sub clauses related to Claim Adjudication under FIDIC Contracts:

5.1 Sub-Clause 3.5 of GCC Determination: - This clause pertains to Determination of Contractor's claim by Engineer.

"Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances. The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration]."

Pre-Arbitral Settlement of Disputes by the Engineer -

Clause 3.5 of FIDIC general condition of Contract gives the power of determination to Engineer in case of dispute between Employer & Contractor

Engineer's dual role in dispute resolution:

(1) Employer's agent in some cases; and (2) In others, duty to act impartially between the Employer and the Contractor including when deciding disputes between them.

5.2 Sub-Clause-20 of GCC Claims, Disputes & Arbitration:

Clause 20 of GCC of FIDIC Yellow book deals with Claims, dispute & Arbitrations

1.Clause 20.1 Contractor's claim & Determination by Engineer as per Clause 3.5

2.Clause 20.2 deals with referring the matter to DAB in case of disagreement by the determination of Engineer by either the party (Employer/Contractor).

3.Clause 20.3 Failure to agree for DAB by Contractor/Client, then appointing entity to nominate Chairmen /third member of DAB in consultation with both parties.

4.Clause 20.4, Obtaining DAB decision & serve notice of dissatisfaction within 28 days if either party is dissatisfied with the decision of DAB. In case either party fails to give notice of dissatisfaction within 28 days after receipt of DAB decision, then the decision become final and binding on both the parties.

5.Clause 20.5 is regarding amicable settlement after serving notice of dissatisfaction (within 28 days of DAB decision). In case of non-settlement, Arbitration may be commenced on or after 56 days after the day, on which notice of dissatisfaction was given.

6.Clause 20.6 Arbitration, both the parties can put their paper to Arbitrator for a fair decision.

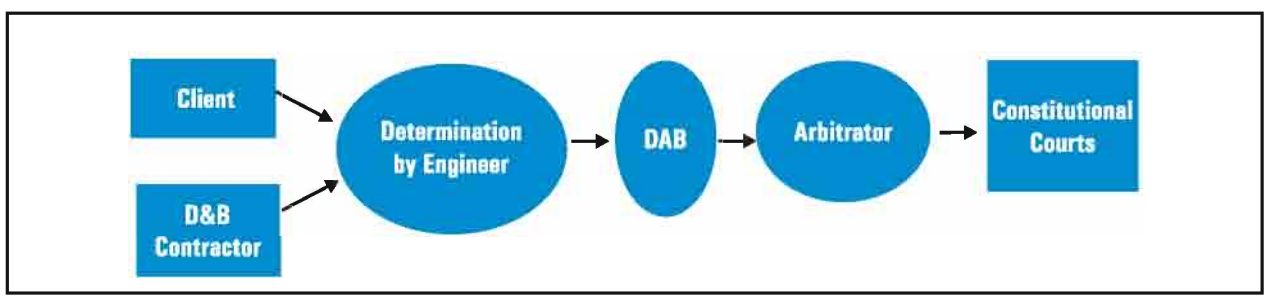


Fig-6-Adjudication Flow chart

5.3 DISPUTE ADJUDICATION BOARD (DAB) AGREEMENT:

Provided the Contractor or the Employer, are not satisfied, with the determination, by the Engineer. Then as per Clause 20.2 of General conditions matter to be referred to Dispute Adjudication Board (DAB).

5.3.1 Sub-Clause 20.2: Appointment of Dispute Adjudication Board:

Whereas the Employer and the Contractor have entered into the Contract and desire jointly to appoint the Member to act as one of the three persons who are jointly called the "DAB" [and desire the Member to act as chairman of the DAB] to adjudicate a dispute which has arisen in relation to

The Employer, Contractor and Member jointly agree as follows:

1. The conditions of this Dispute Adjudication Agreement comprise the "General Conditions of Dispute Adjudication Agreement", which is appended to the General Conditions of the "Conditions of Contract for Plant and Design-Build" First Edition 1999 published by the Federation Internationale des Ingenieurs-Conseils (FIDIC), and the following provisions. In these provisions, which include amendments and additions to the General Conditions of Dispute Adjudication Agreement, words and expressions shall have the same meanings as are assigned to them in the General Conditions of Dispute Adjudication Agreement.

2. [Details of amendments to the General Conditions of Dispute Adjudication Agreement, if any]

3. In accordance with Clause 6 of the General Conditions of Dispute Adjudication Agreement, the Member shall be paid a daily fee of — per day.

4. In consideration of these fees and other payments to be made by .the Employer and the Contractor in accordance with Clause 6 of the General Conditions of Dispute Adjudication Agreement, the Member undertakes to serve, as described in this Dispute Adjudication Agreement, as one of the three persons who are jointly to act as the DAB.

5. The Employer and the Contractor jointly and severally undertake to pay the Member, in consideration of the carrying out of these services, in accordance with Clause 6 of the General Conditions of Dispute Adjudication Agreement.

6. This dispute Adjudication Agreement shall be governed by the law of the country of work execution

5.3.2 Sub-Clause 20.3 Failure to Agree Dispute Adjudication Board

If any of the following conditions apply, namely:

a. the Parties fail to agree upon the appointment of the sole member of the DAB by the date stated in the first paragraph of Sub-Clause 20.2,

b. either Party fails to nominate a member (for approval by the other Party) of a DAB of three persons by such date,

c. the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DAB by such date, or

d. the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official named in the Appendix to Tender or the Particular Conditions shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DAB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

5.3.3 Sub Clause 20.6 Arbitration

Unless settled amicably, any dispute in respect of which the DAB's decision (if any) has not become final and binding shall be finally settled by international arbitration. Unless otherwise agreed by both Parties:

(a) The dispute shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce,

(b) The dispute shall be settled by three arbitrators appointed in accordance with these Rules, and

(c) The arbitration shall be conducted in the language for communications defined in Sub Clause 1.4 [Law and Language].

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DAB, relevant to the dispute. Nothing shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither, Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the DAB to obtain its decision or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DAB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DAB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

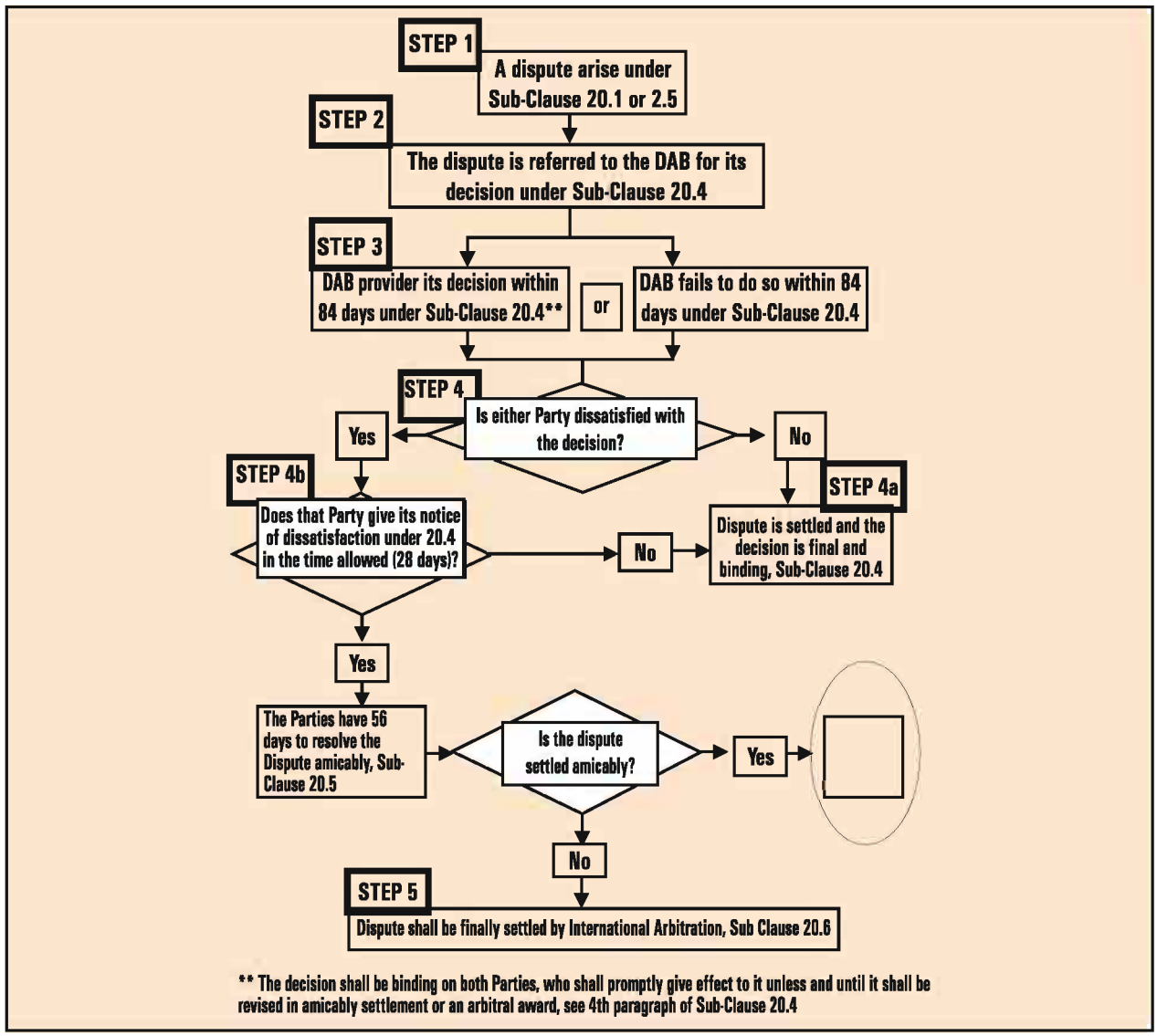


Fig-7: Dispute Resolution process as per FIDIC Yellow Book

6.0 Part VI-Modification in FIDIC conditions under CTP-14 Contract of WDFC

CTP-14 Contract of WDFC Ph-II was studied With respect to FIDIC GCC & following modification in Appendix to Bid & Particular conditions were observed in relation to Major claims between Employer & Contractor.

6.1 Volume-I Part-II Part A Appendix to Bid:

6.1.1 Modified sub Clause 1.4 been redefined as under in Appendix to Bid of CTP-14 contract.

1.4 Law & language	**Indian laws & English language**

Thus the CTP-14 work shall be carried out as per Indian Law. So now it became important to study the Indian Law also.

6.1.2 Modified Sub Clause 2.1- Right to access to site-

Possession of site for work will be handed-over to the Contractor in continuous stretches of at least 10kms. Thereafter Employer shall make efforts to handover access in chunks of at least 5 kms length in isolated locations or minimum 1.0 km in stretches in continuation to the previously possessed stretch.

S. N.	Period after Commencement Date in days	Cumulative percentage of land to be handed over for work with respect to total length
1	28	80%
2	91	90%
3	182	100%

Further, in condition of particular application Sub-Clause 2.1 modified as under: - Delete Sub-Clause (b) in para 3 and replace with:

"Payment of any such cost plus reasonable profit subject to a maximum of Rs. 2000/- (Two Thousand) per day for every Km. For length less than a kilometre, pro rata amount shall be calculated. Provided further that if such delay in handing over does not affect the execution of formation works for laying of tracks, provisions under para 2.1(b) of this sub clause shall not apply".

6.1.3 Modified Sub-Clause 8.2-Time of Completion- In condition of particular application Part-B sub clause 8.2 modified as under:

The Completion period shall be 208 Weeks (1456 days) The permanent works shall be completed by achieving the following milestones (MS):

MS-1: Completion of Track Skelton for entire Package: 180 weeks (1260 days) for temporary use by the Employer or by other Employer's Contractors for construction and/or for running of material trains, tower wagons, rail cum road vehicle etc.

MS-2: Completion of all Civil, Building, Track, E&M and S&T Works for commencement of Integrated Testing and Commissioning: 196 weeks (1372 days)

MS-3: Completion of all the Works by the Contractor and Taking Over of the Works by the Employer: 208 Weeks (1456 days)

6.1.4 Modified Sub Clause 8.7-Amount of Delay Damages- In condition of particular application sub clause 8.7 modified as under: -

The following delay damages shall be applied for each of the Milestone as defined in Sub-Clause 8.2 above:

MS-1: 0.25% of the Contract Price per week of delay or part thereof;

MS2: 0.50% of the Contract Price per week of delay or part thereof; and

MS-3: 0.50% of the Contract Price per week of delay or part thereof.

Limit of Delay Damages for the whole of the Works-

(Five) 05 per cent of the Accepted Contract Amount, in each of the respective currency portion.

6.2Volume-I Part B Appendix to Bid;-

6.2.1 Modified Sub-Clause 1.9-Errors in Employer's Requirements- in condition of particular application Part-B sub clause 1.9 replaced as under: -

"If the Contractor suffers delay and/or incurs Cost as a result of an error in the Employer's Requirements with reference to purpose, scope, design, other technical criteria for the works and Installation, Testing, and Commissioning and an experienced Contractor exercising due care would not have discovered the error when scrutinizing the Employer's Requirements with respect to purpose, scope, design, other technical criteria for the works and Installation, testing and Commissioning under Sub-Clause 5.1 [General Design

Obligations], the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

a) An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for completion], and

b) Payment of any such Cost plus reasonable profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been so discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

6.2.2 Modified Sub-Clause 4.12-Unforeseeable Physical conditions- In condition of particular application sub clause 4.12 modified as under: -

Delete Sub-Clause 4.12 and replace with:

In this Sub clause, Unforeseeable physical conditions means unforeseeable natural physical conditions which the Contractor encounters at Site during the execution of the Works such as existence of quicksand phenomenon, rock vice soil, peaks and valleys in rock profile, voids and material prone to settlements and unforeseeable man made physical conditions such as unchartered utilities, pilling artifacts, embedment in reclamation area, flooding the project area by way of canal cutting, industrial disaster resulting in sudden release of poisonous gases/chemicals.

6.2.3 Modified Sub-Clause 8.4-Extension of Time for Completion- In condition of particular application sub clause 8.4 modified as under: -

Delete Sub-Clause (c).

Delete Sub-Clause (d) substitute as under:-

Unforeseeable shortages in the availability of Goods caused due to changes in laws in accordance with the provisions of Sub-Clause 13.7,"

Add Sub-Clause (f):

"A cause of delay in handing over possession of Site in accordance with the provisions of Sub-Clause 2.1."

6.2.4 Modified Sub-Clause 13.2-Value Engineering- In condition of particular application sub clause 13.2 (c) modified as under: -

Supplement of this Sub-Clause with the following:-

"The value engineering proposal shall not impair the essential character, functions or characteristics of the work, including service life, economy of operation, ease of maintenance, desired appearance, or design, safety standards would not result in any reduction to the standard, or quality of the Works, or the performance of the Contractor and his obligations under the Contract.

If the proposal of variation as a result of Value Engineering is approved, the reasonable share to be given to the Contractor shall be 30% of the net saving resulted due to Value Engineering.

6.2.5 Modified Sub-Clause 13.3 (c)- Variation Procedure- In condition of particular application sub clause 13.3 (c) modified as under: -

15% towards profit and overheads for both works and supply of goods.

6.2.6 Modified Sub-Clause13.7- Adjustments for Changes in Legislation- In condition of particular application sub clause 13.7 modified as under: -

Delete first paragraph of the Sub-Clause and Substitute deletion by the following:

"The Contract Price shall be adjusted to take account of any increase or decrease in Cost after the Base Date resulting from:

a.A change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws): or

b.In the judicial or official governmental interpretation of such Laws, or

c.The commencement of any Indian law which has not entered into effect until the Base Date; or

d.Any change in the rates of any of the Taxes or royalties on Materials that have a direct effect on the Project

Which affect the Contractor in the performance of obligations under the Contract?"

Insert at the end of the Sub-Clause:

"If as a result of change in law, interpretation, or rates of taxes or royalties, the Contractor benefits from any reduction in costs for the execution of this Contract, save and except as expressly provided for in this Sub-Clause or in accordance with the provisions of this Contract, the Contractor shall within [28] days from the date he becomes reasonably aware of such reduction in cost, notify the Employer with a copy to the Engineer of such reduction in cost."

6.2.7 Modified Sub-Clause 14.8 -Delayed Payment- In condition of particular application sub clause 14.8 modified as under: -

These financing charges shall be calculated

1.At an annual rate of LIBOR rate +2% for foreign currency and

2.At a flat rate of 8% per annum for Indian currency shall be paid in such currencies.

6.2.8 Modified Sub-Clause 17.6 Limitation of Liability- In condition of particular application sub clause 17.6 modified as under: -

Add the following at the end of this Sub-Clause:

"Limitation of liability shall be 100% cost of the Work Segment(s) as applicable.

The Work segments shall be as proposed by the Contractor consented by Engineer & approved by the Employer in accordance with the requirements specified:

(a)For Civil, Building & Track Works: In Appendix-14 to the Employer's Requirements (Volume II of the Bid documents)

(b)For E&M and S&T Works: In accordance with the requirement of specification

6.2.9 Modified Sub Clause-19 Force Majure: All GCC Clause were kept same except-V of second Para, V of 2nd Para modified as under

Natural catastrophe which may include earthquake, volcanic activity, floods & storms of high intensity such as typhoons and hurricanes

6.2.10 FIDIC YELLOW BOOK GCC clause 20.2, 20.3 & 20.6 has been modified in Particular conditions to suit local requirement:-

6.2.10.1 Modified Sub-Clause 20.2 Appointment of the Dispute Adjudication Board:- Sub-Clause of 20.2 of GCC is replaced with following

"Disputes shall be adjudicated by a DAB in accordance with Sub-Clause 20.4 [Obtaining Dispute Adjudication Board's Decision]. The Parties shall jointly appoint a DAB within 90 days of signing of the Contract Agreement.

The DAB shall comprise of three members. One member each shall be appointed by the respective parties within 30 days of signing of the Contract Agreement and the two members so nominated shall select the chairperson within 60 days of the signing of the Contract Agreement. The DAB shall meet only when a dispute is referred to it.

The agreement between the Parties and each of the three members shall incorporate by reference the General Conditions of Dispute Adjudication

Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of each of the three members shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may appoint a suitably qualified person or persons to replace any one or more members of the DAB. Unless the Parties agree otherwise, the appointment will come into effect if a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment. The replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DAB (including each member) shall expire upon expiry of this agreement but only after the DAB has given its decision on the dispute referred to it under Sub-Clause 20.4 [Obtaining Dispute Adjudication Board's Decision]."

6.2.10.2 Modified Sub-Clause 20.3 Failure to Agree on Dispute Adjudication Board Sub Clause of 20.3 of GCC is replaced with following

"If any of the following conditions apply, namely:

(a) Either Party fails to nominate a member of the DAB by the date, stated in the second paragraph of Sub Clause 20.2 (Appointment of the Dispute Adjudication Board), or

(b) the two members appointed by the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DAB by such date, or

(c) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, then the appointing entity or official named in the Appendix to Tender shall upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DAB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official."

6.2.10.3 Modified Sub-Clause 20.6 Arbitration Sub Clause of 20.6 of GCC is replaced with following

"Any dispute not settled amicably and in respect of which the DAB's decision (if any) has not become final and binding shall be finally settled by arbitration. Unless otherwise agreed by both parties, arbitration shall be conducted as follows:

(a) For Contract with foreign Contractors

(i) International arbitration in accordance with the rules of arbitration of the International Chamber of Commerce.

(ii) The seat of arbitration shall be Singapore or Dubai or Delhi as decided mutually by both parties during the Contract Negotiations

(iii) The number of Arbitrators shall be three (3) and language of communication will be English.

(b) For Contract with domestic Contractors (For the purpose of this Sub-Clause, the term "Domestic Contractor" means a Contractor who is registered in India and is juridic person created under Indian Law as well as a joint venture/Association/Consortium between an Indian partner and a foreign partner where Indian partner is authorized representative of the (JV)/Association/Consortium or Lead Member).

(i) In accordance with rules of Arbitration of the International Centre for Alternative Dispute Resolution, New Delhi or such other rule as may be mutually agreed by the parties and shall be subject to the provision Indian Arbitration and Conciliation Act, 1996

(ii) The seat of arbitration shall be New Delhi.

(iii) The number of Arbitrators shall be three (3) and language of communication will be English.

The arbitrator(s) shall have full power to open up,

review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DAB, relevant to the dispute. Nothing shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither, Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the DAB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DAB shall be admissible in evidence in the arbitration.

Arbitration may be commended prior to or after completion of the works. The obligations of the Parties the Engineer and the DAB shall not be altered by reason of any arbitration being conducted during the progress of the Works."

6.3 How Employer interest can be protected through Appendix to Bid & Particular Condition(PC) -An illustration of CTP-14 Contract:-

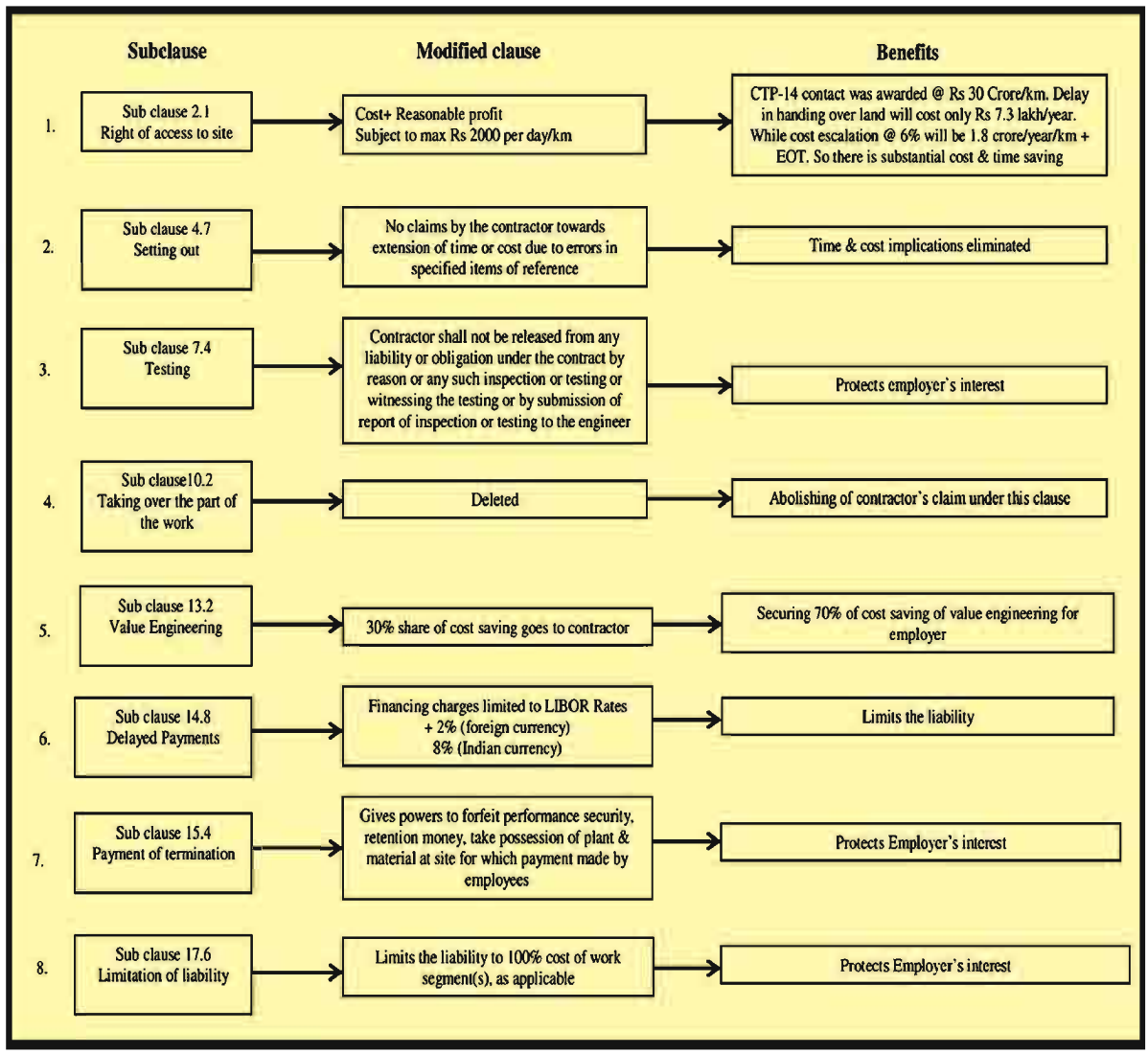


Fig-8 CTP-14 Appendix to Bid & Particular Condition (PC)[An illustration]

6.4 Employer's Claims for not complying Employer Requirements(ER): Another important area to safeguard the interest of Employer to define The Employer requirement judiciously in the Bid document. Employer can also raise the claims under FIDIC GCC clause 2.5, if the Employer's requirement mentioned in the Bid documents agreed by the Contractor not complied.

One such requirement was inserted in CTP-14 Contract to provide Temporary site facilities to Employer/ Engineer. Employer has also raised the claim against Contractor for not fulfilling the Contract obligations under this head.

However the Employer must be very careful in amending the General Conditions through Particular Conditions in order to ensure that balance of the Contract should not change. The Soul of the FIDIC is formation of balanced equitable type of Contract and misbalanced contracts often discouraged by DAB/ICC and the Courts during the process of Litigations. The basis of the decisions must be done based on the role and responsibilities of the Parties and Risk allocation.

7.0 Part-VII Arbitration & International Chamber of Commerce(ICC)

7.1 Arbitration Arbitration is the process of bringing a business dispute before a disinterested third party for resolution. The third party, an arbitrator, hears the evidence brought by both sides and makes a decision. Sometimes that decision is binding on the parties.

An arbitration award is legally binding on both sides and enforceable in the courts. Arbitration is a proceeding in which a dispute is resolved by an impartial adjudicator whose decision the parties to the dispute have agreed, or legislation has decreed, will be final and binding.

7.2 Arbitration Procedure in FIDIC Contracts: - As mentioned in condition of Particular application Para 3.15.1.3(a)(i) For Foreign Contractor the Arbitration case shall be "in accordance with the rules of arbitration of the International Chamber of Commerce"(ICC). The seat of Arbitrator shall be In Singapore, Dubai or in Delhi as decided mutually by both parties during the Contract Negotiations. As M/S Sotiz Corporation is an International firm. So the Arbitration shall be carried out as per rules of Arbitration of ICC.

7.3 International Chamber of Commerce (ICC)-

The International Chamber of Commerce was founded in 1919 to serve world business by promoting trade and investment, open markets for goods and services, and the free flow of capital. The organization's international secretariat was established in Paris and the ICC's International Court of Arbitration was created in 1923.

The International Chamber of Commerce (ICC) has been selected by the International Federation of Consulting Engineers – more commonly known by its French acronym FIDIC – as the trusted dispute settlement body to decide on challenges filed against its Dispute Adjudication/Avoidance Boards (DAAB) Members.

FIDIC Contracts are notable for the requirement that the parties constitute a Dispute Avoidance and Adjudication Board (DAAB). All disputes must go through the DAAB process and may only be submitted to arbitration if this process fails.

7.4 The International Court of Arbitration - is an institution for the resolution of international commercial disputes. The International Court of Arbitration is part of the International Chamber of Commerce. The court comprises more than 100 members from about 90 countries. ICC headquarters is in Paris, France.

The Court does not itself resolve disputes. It administers the resolution of disputes by arbitral tribunals, in accordance with the Rules of Arbitration of the ICC (the "Rules"). The Court is the only body authorized to administer arbitrations under the Rules, including the scrutiny and approval of awards rendered in accordance with the Rules. It draws up its own internal rules, which are set forth in Appendix II (the "Internal Rules").

7.5 Excerpts from Internal Rules of ICC

7.5.1 COMMENCING THE ARBITRATION: - The brief procedure is as under

7.5.1.1 Article 4: Request for Arbitration

1. A party wishing to have recourse to arbitration under the Rules shall submit its Request for Arbitration (the "Request") to the Secretariat at any of the offices specified in the Internal Rules. The Secretariat shall notify the claimant and respondent of the receipt of the Request and the date of such receipt.

2. The date on which the Request is received by the Secretariat shall, for all purposes, be deemed to be the date of the commencement of the arbitration.

The Secretariat shall transmit a copy of the Request and the documents annexed thereto to the respondent for its Answer to the Request once the Secretariat has sufficient copies of the Request and the required filing fee.

7.5.1.2 Article 5: Answer to the Request; Counter claims

1. Within 30 days from the receipt of the Request from the Secretariat, the respondent shall submit an Answer. The respondent may submit such other documents or information with the Answer as it considers appropriate or as may contribute to the efficient resolution of the dispute including the counter claim, if any.

The Secretariat shall communicate the Answer and the documents annexed thereto to all other parties.

7.5.1.3 Article 6: Effect of the Arbitration Agreement

Where the parties have agreed to submit to arbitration under the Rules, they shall be deemed to have submitted ipso facto to the Rules in effect on the date of commencement of the arbitration, unless they have agreed to submit to the Rules in effect on the date of their arbitration agreement. By agreeing to arbitration under the Rules, the parties have accepted that the arbitration shall be administered by the Court.

The arbitral tribunal shall continue to have jurisdiction to determine the parties' respective rights and to decide their claims and pleas even though the Contract itself may be non-existent or null and void.

7.5.1.4 Article 19: Rules Governing the Proceedings

The proceedings before the arbitral tribunal shall be governed by the Rules and, where the Rules are silent, by any rules which the parties or, failing them, the arbitral tribunal may settle on, whether or not reference is thereby made to the rules of procedure of a national law to be applied to the arbitration.

7.5.1.5 Article 14: Challenge of Arbitrators

A challenge of an arbitrator, whether for an alleged lack of impartiality or independence, or otherwise, shall be made by the submission to the Secretariat of a written statement specifying the facts and circumstances on which the challenge is based.

7.5.1.6 Article 19: Rules Governing the Proceedings

The proceedings before the arbitral tribunal shall be governed by the Rules and, where the Rules are silent, by any rules which the parties or, failing them, the arbitral tribunal may settle on, whether or not reference is thereby made to the rules of procedure of a national law to be applied to the arbitration.

7.5.1.7Article 21: Applicable Rules of Law

1) The parties shall be free to agree upon the rules of law to be applied by the arbitral tribunal to the merits of the dispute. In the absence of any such agreement, the arbitral tribunal shall apply the rules of law which it determines to be appropriate.

2) The arbitral tribunal shall take account of the provisions of the Contract, if any, between the parties and of any relevant trade usages.

3) The arbitral tribunal shall assume the powers of an amiable compositeur or decide ex aequo et bono only if the parties have agreed to give it such powers

7.5.1.8 Article 31: Time Limit for the Final Award

1)The time limit within which the arbitral tribunal must render its final award is six months. Such time limit shall start to run from the date of the last signature by the arbitral tribunal or by the parties of the Terms of Reference or, in the case of application of Article 23(3), the date of the notification to the arbitral tribunal by the Secretariat of the approval of the Terms of Reference by the Court. The Court may fix a different time limit based upon the procedural timetable established pursuant to Article 24(2).

2)The Court may extend the time limit pursuant to a reasoned request from the arbitral tribunal or on its own initiative if it decides it is necessary to do so.

7.5.1.9 Article 35: Notification, Deposit and Enforceability of the Award

Every award shall be binding on the parties. By submitting the dispute to arbitration under the Rules, the parties undertake to carry out any award without delay and shall be deemed to have waived their right to any form of recourse in sofar as such waiver can validly be made.

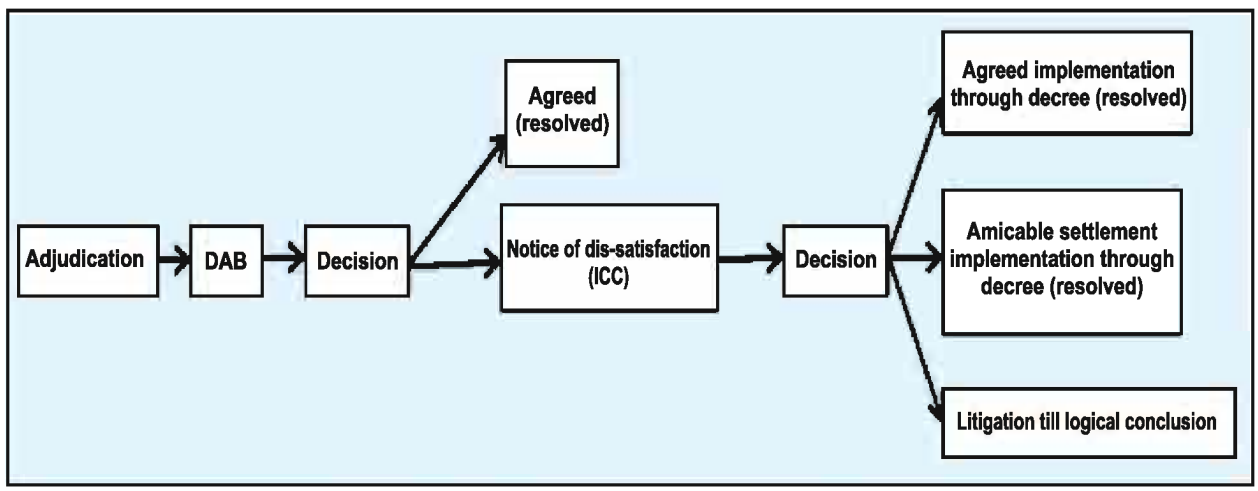


Fig-9 Flow Chart showing implementation of ICC decision

8.0 Part-VIII Applicability of Indian Law on CTP-14 Contract:-

8.1 Importance of Governing Law & Jurisdiction:- The governing law clause pertains to the law of the jurisdiction which will apply to the contract, such as contracts in a particular jurisdiction like India are governed by the Indian Contract Act-1872. Jurisdiction on the other hand, determines where any dispute arising between the contracting parties in relation to the contract will be adjudicated, whether it shall dealt by the Particular bench of a court or through DAB seated at Delhi, Dubai or Singapore or the appeal shall be with ICC at any jurisdiction mentioned in the Contract.

8.2 Indian Law applicable on contracts:

According to condition of Appendix-A to tender clause 1.4 "Indian law shall be applicable on CTP-14 Contract" Apart from Minimum Wages Acts, Labour laws, EPF Act, Payment of wages Act, HOER, Insurance Act, IPC, CrPC, Electricity Act, Income tax Act, Consumer Protection Act, Environment laws, Factory Act, Petroleum & Explosive Act, Mining Act, Forest Act following Acts in respect of claim settlement of the Contractors are also applicable.

1. Indian Contracts Act-1872.

2. Code of Civil Procedure(CPC)-1908

3. Arbitration & Reconciliation Act-1996

4. Limitation Act-1963

5. Goods Act 1930

8.2.1 Indian Contracts Act-1872

In India the construction Contracts are governed as per the provisions of Indian Contracts Act-1872. For any binding Contract come in to existence under the preview of this law, there should be a legally valid agreement between the parties (Two or more), who are competent to Contract. All the parties must be entered in to an agreement at their free will for a lawful consideration and object mandated by Section -10 of the said Act.

8.2.1.1 Section 56 of Indian Contract Act 1872-(Sub-Clause 19 of FIDIC yellow book-Force Majeure)

Section-56 of Indian Act

Agreement to do impossible act.- An agreement to do an act impossible in itself is void." Contract to do act afterwards becoming impossible or unlawful.—A Contract to do an act which, after the Contract is made, becomes impossible, or, by reason of some event which the promisor could not prevent, unlawful, becomes void when the act becomes impossible or unlawful.

1--A Contract to do an act which, after the Contract is made, becomes impossible, or, by reason of some event which the promisor could not prevent, unlawful, becomes void when the act becomes impossible or unlawful.

2-- Compensation for loss through non-performance of act known to be impossible or unlawful.—Where one person has promised to do something which he knew, or, with reasonable diligence, might have known, and which the promisee did not know, to be impossible or unlawful, such promisor must make compensation to such promisee for any loss which such promisee sustains through the non-performance of the promise. —Where one person has promised to do something which he knew, or, with reasonable diligence, might have known, and which the promisee did not know, to be impossible or unlawful, such promisor must make compensation to such promisee for any loss which such promisee sustains through the non-performance of the promise." Illustrations

➢ A agrees with B to discover treasure by magic. The agreement is void. (a) A agrees with B to discover treasure by magic. The agreement is void."

➢ A and B Contract to marry each other. Before the time fixed for the marriage, A goes mad. The Contract becomes void.

➢ A Contract to marry B, being already married to C, and being forbidden by the law to which he is subject to practise polygamy. A must make compensation to B for the loss caused to her by the non-performance of his promise. (c) A Contracts to marry B, being already married to C, and being forbidden by the law to which he is subject to practise polygamy. A must make compensation to B for the loss caused to her by the non-performance of his promise."

➢ A Contract to take in cargo for B at a foreign port. A's Government afterwards declares war against the country in which the port is situated. The Contract becomes void when war is declared. (d) A Contracts to take in cargo for B at a foreign port. A's Government afterwards declares war against the country in which the port is situated. The Contract becomes void when war is declared."

➢ A Contract to act at a theatre for six months in consideration of a sum paid in advance by B. On several occasions A is too ill to act. The Contract to act on those occasions becomes void.

➢ A Contract to act at a theatre for six months in consideration of a sum paid in advance by B. On several occasions A is too ill to act. The Contract to act on those occasions becomes void."

8.2.2 Code of Civil Procedure (CPC)-

The Code of Civil Procedure, 1908 is a procedural law related to the administration of civil proceedings in India. The Code is divided into two parts: the first part contains 158 sections and the second part contains the First Schedule, which has 51 Orders and Rules.

The sections provide provisions related to general principles of jurisdiction whereas the Orders and Rules prescribe procedures and method that govern civil proceedings in India.

8.2.2.1 Decree

Decree is defined u/s 2(2) of Civil Procedure Code, 1908. It means the formal expression of an adjudication which conclusively determines the rights of the parties with regard to all or any of the matter in controversy in the suit.

A decree may be either preliminary or final.

A decree is preliminary when a further procedure has to be taken before the suit can be completely disposed off. When adjudication completely disposes of the suit such decree is final.

8.2.3 Arbitration & Reconciliation Act-1996:-

The procedure for enforcement and execution of decrees in India is governed by the Code of Civil Procedure, 1908 ("CPC") while that of arbitral awards in India is primarily governed by the Arbitration &

Conciliation Act, 1996 ("Act") as well as the CPC.

Domestic and foreign awards are enforced in the same manner as a decree of the Indian court. This is true even for consent awards obtained pursuant to a settlement between parties. However, there is a distinction in the process for enforcement of an award based on the seat of arbitration. While the enforcement and execution of an India - seated arbitral award ("domestic award") would be governed by the provisions of Part I of the Act, enforcement of foreign - seated awards ("foreign award") would be governed by the provisions of Part II of the Act.

8.2.3.1 Enforcement of foreign Award in India

India is a signatory to the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, 1958 ("New York Convention") as well as the Geneva Convention on the Execution of Foreign Arbitral Awards, 1927 ("Geneva Convention"). If a party receives a binding award from a country which is a signatory to the New York Convention or the Geneva Convention and the award is made in a territory which has been notified as a convention country by India, the award would then be enforceable in India. Out of the 196 countries in the world only few countries have been notified by the Central Government as reciprocating countries, with the most recent addition being Mauritius.

The enforcement of a foreign award in India is a two-stage process which is initiated by filing an execution petition. Initially, a court would determine whether the award adhered to the requirements of the Act. Once an award is found to be enforceable it may be enforced like a decree of that court. However at this stage parties would have to be mindful of the various challenges that may arise such as frivolous objections taken by the opposite party, and requirements such as filing original/ authenticated copy of the award and the underlying agreement before the court.

8.2.3.2 Requirements for enforcement of foreign awards

- Original award or a duly authenticated copy in the manner required by the country where it is made.
- Original agreement or duly certified copy.
- Evidence necessary to prove the award is a foreign award, wherever applicable.

Section 47 of the Indian Arbitration Act provides that the above "shall" be produced before the court, at the time of the application for enforcement of the foreign award.

Once the Court is satisfied that the foreign award is found to be enforceable, the same shall be enforced like a decree of that Court.

8.2.3.3 To challenge Foreign Arbitration Award in Court of Law-Indian Scenario:

The parties cannot appeal against an arbitral award as to its merits and the court cannot interfere on its merits. But on the same time While enforcing the arbitration Award, Indian Courts are mindful of the following conditions as set out under Section 48 of the Indian Arbitration Act, which may be met before execution of such awards. These conditions can also be the grounds adopted by the other/aggrieved party for challenging the said award. These conditions/grounds which shall render the foreign award unenforceable are listed as under:

1. That the subject agreement is not in accordance with the law to which the parties have subjected it or under the law of the country where the foreign award was made.

2. The award is ultra vires to the agreement.

3. The award contains decision on matters beyond the scope of arbitration.

4. The arbitral procedure was not in accordance with the law of the country where the arbitration took place.

5. The foreign award has not yet become binding on the parties or was set aside by the higher authority of the country in which that award was made.

6. Enforcement of foreign award will be contrary to public policy of India.

7. Subject matter of the dispute is not capable of settlement under the Indian Arbitration & Conciliation Act, 1996.

8.2.3.4 Why decree is necessary for implantation of Foreign Award:-

A foreign judgment is defined under section 2 (6) of the CPC as a judgment of a foreign court. A foreign court, under section 2(5) of CPC, means a court situated outside India and not established or continued by the authority of the Central Government.

A foreign decree is defined in Explanation II to section 44A of the CPC as, "Decree" with reference to a superior court means any decree or judgment of such court under which a sum of money is payable, not being a sum payable in respect of taxes or other charges of a like nature or in respect of a fine or other penalty, but shall in no case include an arbitral award, even if such an award is enforceable as a decree or judgment.

By virtue of section 44A of the CPC, a decree of any superior court of a reciprocating territory shall be executed in India as a decree passed by the Indian district court.

A reciprocating territory is defined in Explanation I to section 44A as: "Reciprocating territory" means any country or territory outside India which the Central Government may, by notification in the Official Gazette, declare to be a reciprocating territory for the purposes of this section, and "superior courts", with reference to any such territory, means such courts as may be specified in the said notification.

A judgment from a court of a reciprocating territory can be directly enforced in India by filing an execution application. Section 44A (1) of the CPC states that where a certified copy of a decree of any superior court of a reciprocating territory has been filed in a District Court, the decree may be executed in India as if it had been passed by the District Court (meaning that the entire scheme of execution of decrees as laid down in Order 21 of the CPC will be applicable).

While filing the execution application the original certified copy of the decree along with a certificate from the superior court stating the extent to which the decree has been satisfied or adjusted has to be annexed to the application.

Where a judgment or decree is not of a superior court of a reciprocating territory, a suit has to be filed in a court of competent jurisdiction in India on that foreign judgment or on the original cause of action or both.

In Marine Geotechnics LLC v/s Coastal Marine Construction & Engineering Ltd. 2014 (2) Bom CR 769, the Bombay High Court observed that in case of a decree from a non-reciprocating foreign territory, the decree holder should file, in a domestic Indian court of competent jurisdiction, a suit on that foreign decree or on the original, underlying cause of action, or both.

He cannot simply execute such a foreign decree. He can only execute the resulting domestic decree. To obtain that decree, he must show that the foreign decree, if he sues on it, satisfies the tests of section 13 of the CPC (as discussed above).

A suit on a foreign judgment/decree must be filed within a period of three years from the date of the judgment/decree

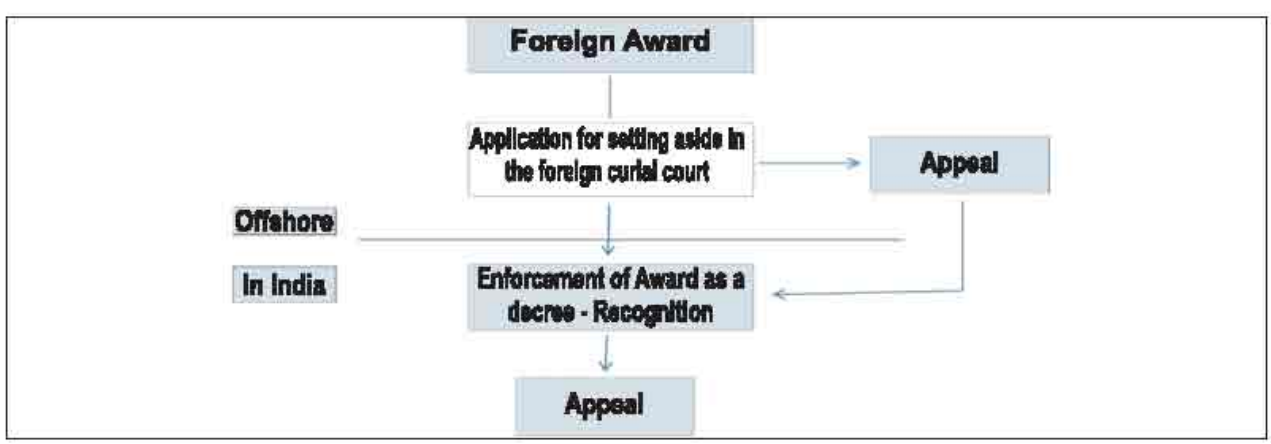


Fig-10 Execution of Foreign Award

8.2.4 Limitation Act-1963:- Limit the time for Appeal against an Arbitration award.

Limitation period. A maximum period set by statute within which a legal action can be brought or a right enforced. A statute may prohibit any individual or legal entity from bringing an action for breach of Contract more than prescribed time period after the breach occurred. Also, called prescription period.

The word limitation means a restriction or the rule or circumstances which are limited. The law of limitation has been prescribed as the time limit which is given for different suits to the aggrieved person within which they can approach the court for redress or justice.

Part-II of Limitation Act deals with "SUIT RELATED TO CONTRACTS"

Article 55 of Part-II is having following Provisions

	Description of suits	Period of limitation	Time from which period begins to run
55	For compensation for the breach of any Contract, express or implied not herein specially provided for.	Three Years	The time fixed for completing the sale, or (where the title is accepted after the time fixed for completion) the date of the acceptance. The date fixed for the performance, or, if no such date is fixed, when the plaintiff has noticed that performance is refused. When the Contract is broken or (where there are successive breaches) when the breach in respect of which the suit is instituted occurs or (where the breach is continuing) when it ceases.

In CTP-14 Contract, condition of Particular Application in Appendix to Bid Part-B, defines that an Arbitration application may be filed during currency of the Contract or after completion of the work- So this limitation period of 03 years under the limitation Act-1963 starts from the date of completion of the work.

8.2.5 Section-64A of Goods Act 1930:- It deals with change of legislation on construction Contracts (Sub Clause 13.7 of FIDIC Yellow book GCC Adjustment for change in Legislation)

Section 64A of the Goods Act -1930 clarifies that "In Contracts of sale, amount of increased or decreased to tax to be added or deducted"

➢ Unless a different intention appears from the terms of the Contract, in the event of any tax of the nature described in sub-section

➢ being imposed, increased, decreased or remitted in respect of any goods after the making of any Contract for the sale or purchase of such goods without stipulations as to the payment of tax where tax was not chargeable at the time of the making of the Contract, or for the sale or purchase of such good tax- paid where tax was chargeable at that time.

(i) if such imposition or increase so takes effect that the tax or increased tax, as the case may be, or any part of such tax is paid or is payable, the seller may add so much to the Contract price as will be equivalent to the amount paid or payable in respect of such tax or increase of tax, and he shall be entitled to be paid and to sue for and recover such addition, and

(ii) if such decrease or remission so takes effect that the decreased tax only, or no tax, as the case may be, is paid or is payable, the buyer made deduct so much from the Contract price as will be equivalent to the decrease of tax

or remitted tax, and he shall not be liable to pay, or be sued for, or in respect of, such deduction.

➢ The provisions of sub-section (1) apply to the following taxes, namely:

(a) any duty of customs or excise on goods.

(b) any tax on the sale or purchase of goods.

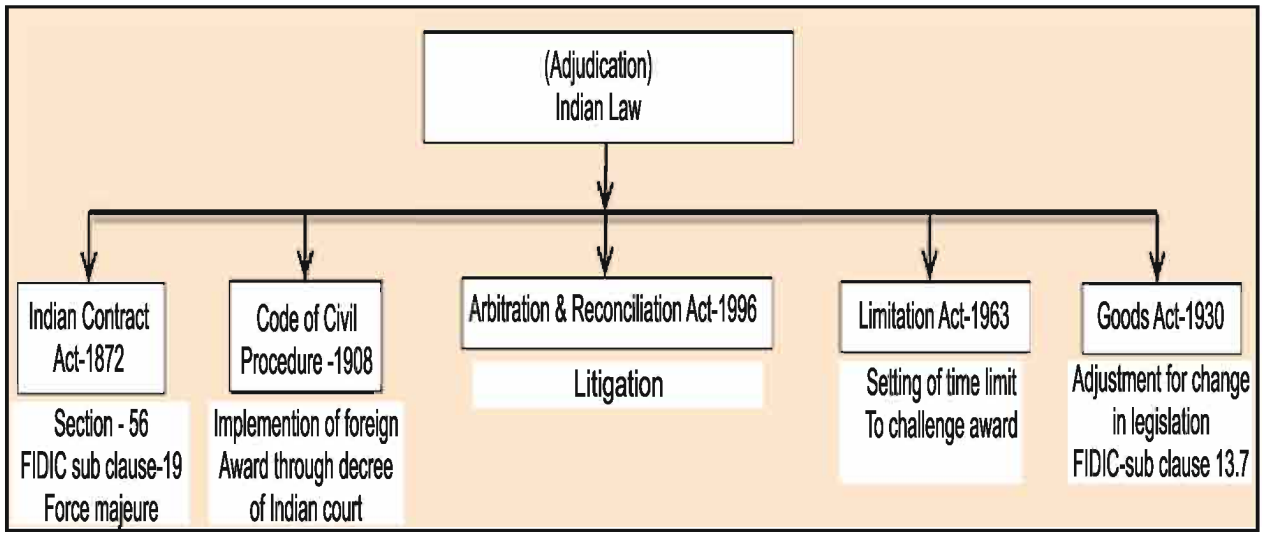


Fig-11 Adjudication & Indian Law

9.0 Part-IX-Lesson learnt from above readings-

From above reading it is evidently clear that litigation is a very long / cumbersome & costly process and should be avoided. Before preparation of Tender documents enough homework, site investigations, General conditions to be studied and there should not be ambiguity or contradiction in the document itself, so that every reader of the document should reach on the same conclusion. Ambiguity & contradiction in document itself may lead to multiple conclusions by various stockholders leading to confrontations and litigations. It results in abnormal Project delays and financial losses to both Employer as well as the Contractor and is a National loss due to loss of productivity.

9.1 How to Minimize Litigation in Construction Contracts:-

The construction dispute starts with the construction contract. To reduce the chance of arguments arising, one has to ensure that the project team spends time in preparing the schedule, negotiating the rates, executing contract sensibly and fully understanding it. The failure to understand the contract is the main source of arguments and litigation in the construction field. Sometimes Engineer/Employer don't want to clear contract related questions with Contractors sitting next to lawyers or attorneys. Following yard sticks might be helpful in order to reduce litigations and Project delays.

9.1.1 Contract Preparation & Scheduling

➢ Make sure schedules are realistic and flexible enough to include any defects or anticipated disruptions.

➢ In D&B contracts the contractor can take risk of quantities, but cannot take the risk of unprecedented situations. Prepare tender documents accordingly.

➢ Try to give maximum inputs regarding utility shifting, and other inputs regarding subsoil investigations and Ground water table, HFL, Flood zones, water retaining structures around the Project vicinity etc.

➢ Document clearly defining Employer requirements with no contradictory provisions in various chapters or in various volumes.

➢ Upfront planning and scheduling before work can guarantee you to that you will finish on time.

9.1.2 Pre-bid conferences

➢ Carefully understand and negotiate all the contract terms and conditions with your Contractors

➢ Quarry raised should be answered with clarity and in case of any confusion in document; it should promptly be rectified by issuance of proper addendum/ corrigendum.

9.1.3 Execution of work

➢ Project sub activities to be watched as per construction Program and any deviation/slackness should be reported promptly.

➢ Document daily reports for any defects that may arise during execution

➢ Follow the contract and insist that the other party do so to avoid litigation on the two parties' legal rights

➢ Do not postpone any new problems, deal with them as they arise

➢ Keep your communication mails formal and reasonable, always

➢ Be aware of the danger zone in construction e.g. delays, quality, and design issues

➢ Follow risk management strategy and consult specialist in each technical field

➢ Ensure critical problems are discussed in meetings, not by email

➢ Perform any contractual obligations as scheduled

➢ Remember your duty to mitigate if the other party breaches the contract

➢ Adopt technology systems that increase the effective communication and information transparency between the project parties. A counsel with experience and practice might help making the right decision.

10. Conclusion

DFCCIL must learn lesson from NHAI, who are facing claims of over Rs 71000 Crores from Highway developers. Training session should be organized jointly with NHAI to learn from the previous mistakes in order to reduce/mitigate future claims by DFCCIL contractors. Every effort made to reduce claim by timely decisions, and by finding alternative ways.

NHAI finds alternative ways to reduce arbitration cases & set up an Independent Settlement Advisory Committee (ISAC) headed by a retired High court Judge in 2013.The panel has settled 124 cases of 19424 Crores claims with Rs 1814 Crores, which was only 10.7% of the claim amount. It indicates how exorbitant the claims of private contractors are.

Since June 2017, the Authority has put in place a Conciliation Committee of Independent Experts (CCIE) which has settled 16 cases and conciliation process is going on in 15 cases.

There are certain risk allocations that an Employer and Contractor should accept as standard. Early acknowledgement and consideration of these risks, and the incorporation of them into a bankable draft contract, will benefit the Employer and Contractor as it will clarify their obligations at the outset and avoid misunderstandings later on. Following this, clear communication by an Employer or their Engineer with funding agencies technical adviser and legal team can help ensure that a joined up and common sense approach is taken to contract negotiation, and the funding agencies due diligence process.

There is a need to work on fine detailing while preparing the contract documents in orders to avoid contradictions leading to claims at execution stage. Document must be clear, understandable and to be interpreted in the similar manner by two sets of persons sitting on opposite side of the table. The Employer's requirement should be drafted after considering all aspects of risk as well as Employer's obligations. The General Conditions (GC) of Contract are fixed in, FIDIC Contracts. Special attention should be given in defining Employer's requirement, Particular Conditions (PC), Appendix to bid, and adopt efficient contract Management mechanism in order to minimize disputes & claims & to ensure the project is delivered on time and on budget.

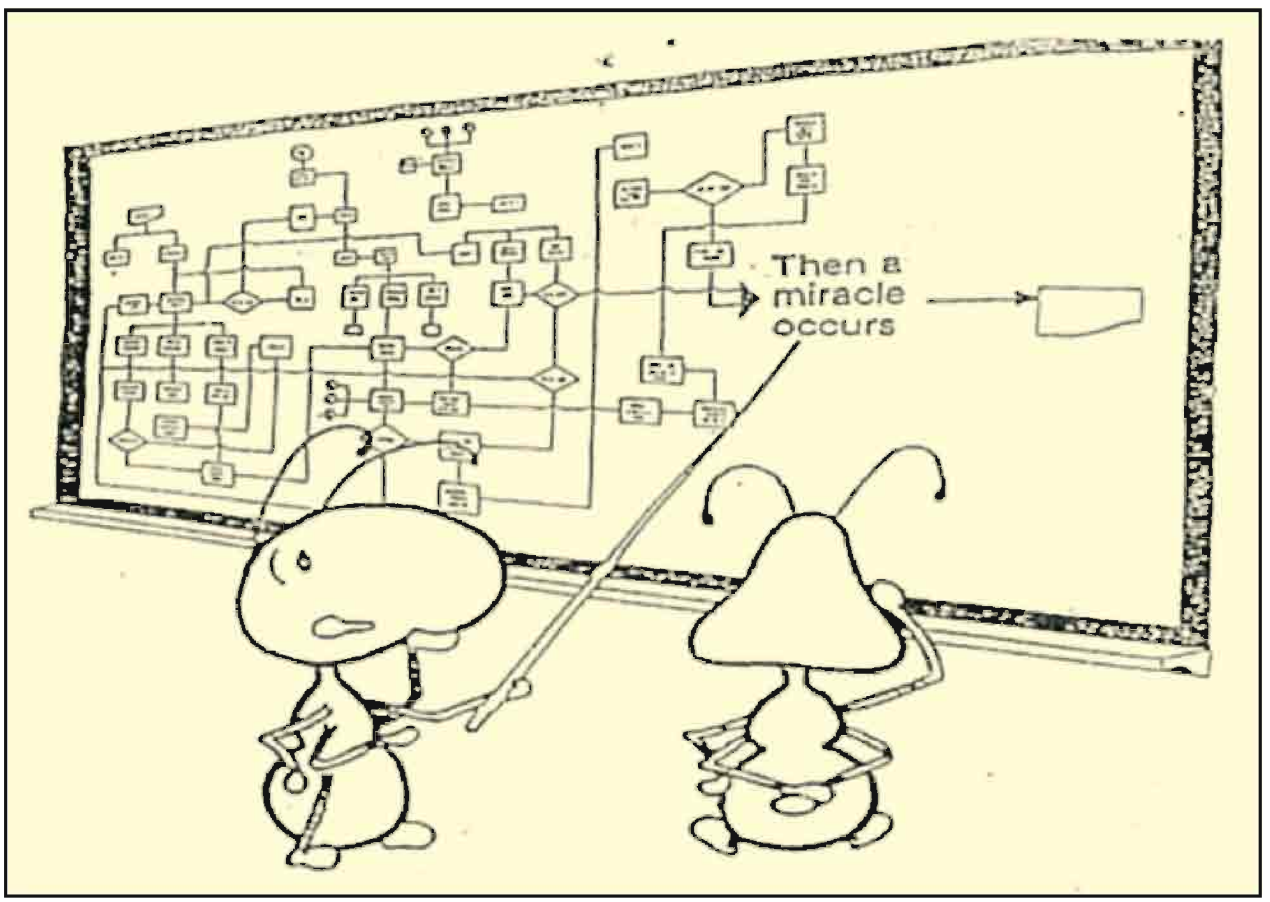


Fig-12 Good work, but a slight detailing here would results in better outcome

References:-

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A Process Approach: Temporary Workman Camp in the Construction Workplace- A Case Study for the Rajpura Workman Camp, Pilkhani-Sahnewal Section (EDFC-301)

S.BALADIVAKAR (Chief Safety Expert)
DB Engineering & Consulting GmbH,
Asia Pacific, India

Ram Singh (Environmental Specialist)
DB Engineering & Consulting GmbH,
Asia Pacific, India

Synopsis

This paper discusses on the workeraccommodation process and standards to establish and operate the temporary workman-camp formigrant workerin the Project, considering the international and National standards. To provide proper adequate housing to all the migrant workersis the major issue in the construction sites such as location, constructed or rented housing, impact on community, transportation, adequate facilities, health, safety, social and operations.

On paper, the project temporary workman-camp has been selected as per minimum requirement of standards and management of workers accommodation in accordance with the national standards. Planning and assessing, standard facilities, management and cost estimation have been discussed in paper. In Rajpura (Punjab) the temporary workman camp having capacity of 121 number of workers consisting of 30 rooms provided on rentedpremises in November 2017. Approx. INR 15 Lakh Rupees have been invested to install basic amenities and monthly cost of estimated INR 3 Lakh rupees with monthly per-capita cost of INR 2500.

1.0 Introduction:

The project section (Pilkahi-Sahnewal) EDFC-301 covers three states starting from Pilkhani in Uttar Pradesh, passing through Haryana and finally terminating at Sahnewal near Ludhiana city. In Punjab covering districts of Saharanpur, Yamunanagar, Ambala, Fatehgarh Sahib, Patiala and Ludhiana. Surrounding of the Project area, the main economy of the people is based on the agriculture. The project required operator, carpenter, painter, welder, bar bending and cutting workers, supervisor engineer etc..,mainly this type of workers not availablewithin local base communities.Based on the nature of the project work and working condition skill-base local labour supply is inadequate in project. Therefore, particular skills can only be satisfied by the migrant workers.In Project area, major workers aremigrated from the State of Utter Pradesh, Bihar, Odisa and Kolkata etc…

The provision of worker's temporary accommodation is a frequent component of large-scale projects funded by institutions such as the World Bank. The main aim is to promote "safe and healthy working conditions and to protect and promote the healthy life of workers" on site.

Temporary workman camp at Rajpura is an appropriate location and clean, safe and adquiate basic needs of workers as per hierarchy. Presently, the capacity of workman camp is 121 workers consisting of four blocks A,B,C and D consisting of 12, 12, 6 and 10 rooms of different dimension. In particular, theaccommodation is meeting national legislation and international good practice in relation but not restricted to the following: the practice for non-charging for accommodation, the provision of minimum amounts of space for each worker, provision of sanitary, laundry and cooking facilities and good quality water, the location of accommodation in relation to the workplace, health, fire safety and local public facilities, the provision of first aid and medical facilities, and heaters & ventilation. Worker's freedom of movement to and fro the Contractor-provided accommodation is not unduly restricted.

In the study, contractual covenants related to worker's accommodation standards, reviewing contractor agreements, implementing reporting mechanisms and monitoring the implementation of worker's accommodation standards have included.

A process approach:

There are many stages of process and addressing the issues, raised by :

- Assessing whether housing is needed for the project and if so, what sort.
- Assessing impacts on local communities and planning mitigation of potential negative impacts
- Awareness of the national and local regulatory framework
- Determining the standards to apply to the location of facilities, the construction of housing and provision of facilities
- Managing accommodation.

2.0 Planning and Assessing Requirement for Workman Camp:

Contract condition, the Contractor has need to make adequate arrangements for the housing, supply of drinking water and provision of bathrooms, latrines and urinals, with adequate water supply, for his staff and workmen as per the Contract Labour (Regulation & Abolition) Act 1970 and Rules. During planning, the ILO Workers Housing Recommendation - 115 has considered.

Table-1 Planning and Assessing of the Workman Camp

S. No.	Attribute	Assessment/Impact
I- Assessing the need forworkman camp		
i	Availability of workforce	At the initial scoping phase of a project, it was considered the workers accommodation is needed at all. In this respect, it is worth analysing the project's workforce requirements including skills and likely numbers over the project cycle and to assess the capacity of the local population to meet those workforce (maximum) requirements either from its current base are because of training. It is preferable to source labour from the local communities as this has many advantages; not only in terms of reducing the need for worker's accommodation, but also as it will increase the direct and indirect benefits to the community arising from the project.
ii	Availability of existing housing	Decision has taken to utilise host-community accommodation considering factors the major Project facilities and construction sites is located 5KM to 10KM from the existing rented housing.
II-Assessing impacts of workman camp on communities		
I	Specific impacts during the construction phase	The Rajpura workman camp has hired on rented. Therefore, there are no issues from construction (dust, noise and vibration and involuntary resettlement issues.
2.2	Community infrastructure	In 500m radius, there is no community. So, worker's influx in the vicinity of a community is not strained existing infrastructure, in particular the water and sanitation, electricity and transport.
2.3	Community services and facilities	Based on the size (121 nos. workers), negligible impacts of workers on local medical, social, educational and recreational services and facilities of local communities.
2.4	Local businesses and local employment	One shop (General store &tea Shop) has established near the workman camp.
2.5	Community Health and Safety	Regular mass HIV/AIDS camps are being organised by the Contractor. • HIV-AIDS & sexual transmitted diseases: Introduction/ Overview and Preventive/ Control & Corrective Measures etc. • Various Information Education & Communication (IEC) activities to change the mind-set of the employees at workplace and project stakeholders and community (who lived near the project area) about the HIV-AIDS & sexual transmitted diseases.

		Objective of Awareness Programme: • To discuss the human behaviour/ habits associated HIV-AIDS & sexual transmitted diseases. • In Site induction Training for all new workers, conducting and explaining the Gender Based Violation to all workman. • To educate/trigger HIV-AIDS Preventive/ Control & Corrective Measures etc. to workers and project stakeholders and community • Screening, counselling & testing in mass level in the Project area • To use the effective tools of Information Education & Communication (IEC) including demonstrations, display of posters & banners and distribution of IEC material to change the mind-set of the workers, employees of M/s GIL-TPL (JV) and DFCCIL and PMC official deputed at workplace, drivers, and communities about the workplace HIV-AIDS. Target Groups of Awareness Programme: • Workers & Employee of M/s GIL-TPL (JV) and Project Sub -Contractor & • Staff of DFCCIL, Ambala & DB Engineering & Consulting GmbH (PMC)
2.6	Community cohesion	No community structure within the radius of 500m. In West direction adjacent to worker camp, one Radha Swami Satsang (community property resource) is located. Regular behaviour based training are being conducted to aware about lifestyle, local tradition, culture, backgrounds etc.
2.7	Land acquisition and resettlement	Not required, existing structure has hired on rented.
2.8	Dismantling and reinstatement	Facilities shall be handed over to the structure owner after completion of Project.
III.Types of workers accommodation		
It is a temporary worker camp for the migrant male workers. Rajpura worker camp has established near to Patiala-Rajpura Bypass (30°29'46.62"N, 76°34'31.67"E). Major Project facilities like Rajpura batching plant, Rajpura Depo and construction sites are at the distance of 1KM to 5KM from the worker camp.		

3. WORKMAN CAMP - 'STANDARDS & FACILITIES'

Table-2 Installation of Workman Facilities & Management

I-Standards for workers' accommodation

1.1 National/International standards

The Contract key standards have taken in consideration, as a baselineis those contained in the Contract Labour (Regulation & Abolition) Act 1970 and Rules and ILO Workers Housing Recommendation 115.

Building construction

Brick works, resistance to earthquake

Fire safety facility

Fire extinguishers

Electricity, plumbing, water and sanitation

Provisions of electricity, Plumbing fixtures/fittings, water and sanitation connection/LED light, ceiling fan, cooler to control the climatic condition

General health, safety and security

Laying of bricks to provide slip resistant,opening provided for crossing the natural air (window and ventilation), 1.5 m boundary wall, gate (in and out) to restrict the unauthorised entry.

Emergency Protocol

Emergency alarm

DG facility

62.5 kVA DG set to supply of electricity

1.2 General living facilities

Drainage

Pucca drainage system to avoid the stagnant water

Wastewater and solid waste

Dust bin, pucca drainage and septic tank with soak pit provided, no waste water disposed of out of the premises.

Drinking Water

Installation of RO (capacity 500L/H), regular monitoring of drinking water (inlet and outlet)

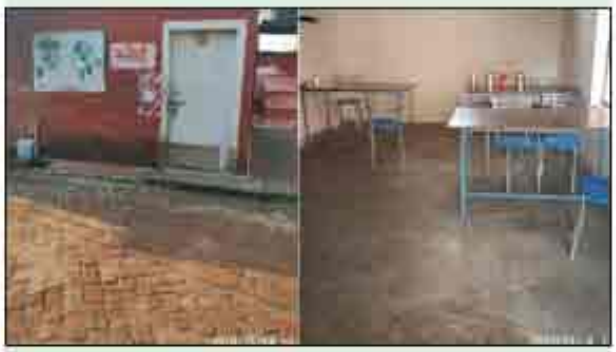
1.3 Room facilities

Rooms are built with easily cleanable flooring material, A minimum ceiling height of 3.10 metres is provided, All doors and windows are lockable, and provided with mosquito screens and maintaining space 0.7m to 1m distance between beds with decent, safe and hygienic condition to rest.

1.4 Sanitary and toilet facilities

24 nos. toilet and 22 nos. bathrooms with adequate facilities has provided. Two number fulltime cleaner has deployed to clean and maintain the worker camp. Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors Showers/bathrooms and other sanitary facilities. Hand washbasins and showers are provided in conjunction with rooms.

1.5 Canteen, cooking and laundry facilities



Kitchens are provided with facilities to maintain adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water and materials. Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment are provided.
Kitchen floors, ceiling and wall surfaces adjacent to and above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials. Food waste is handed over to the villagers to feeding cattle.

1.6 Standards for nutrition and food safety

Food provided to workers contains an appropriate level of nutritional value and takes into account religious/cultural backgrounds; different choices of food are served as workers have different cultural/religious background. Food is prepared by cooks.

1.7 Medical facilities

Full time MBBS doctor has been deployed for regular worker's health check-up

First aid facilities

24/7 First aid service/facility is available. 2 Nos. of staff (day/night) is trained to provide First aid, 24/7 ambulance provided

1.8 Leisure, social and telecommunication facilities.

Exercise equipment badminton court has provided near the workman camp.

2. Managing workman camp

2.1 Management and staff

A written management plan including plans on health and safety, security, living conditions, workers right, grievance process, well-being of workers has prepared and implemented.

One full time welfare officer has deployed to implementation of workman camp standards and management plan.

2.2 Charging fees for workman camp and services

No charges have taken from the workers for existing housing and facilities.

2.3 Security of workman camp

A security plan including clear measures to protect workers against theft and attack is implemented Security staff have a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers.

2.4 Workers' rights, rules and regulations on workman camp (Alcohol Policy)

Decisions has made to prohibit alcohol, tobacco and third party access and relevant rules have clearly communicated to all residents and workers and implemented.

2.5 Consultation and grievance

Mechanisms for workers consultation have been designed and implemented. It is best practice to set up a review committee which includes representatives elected by workers.

2.6 Management of community relations

In 500m radius, there is no community. Meanwhile, Project has organised regular community consultation program who living near the Project construction site.

4. Basis needs of hierarchy for the safe living of workers on site:

As per the requirements, workers required proper worker-camp on site to live healthy life without any hindrance and do the work at site in safely manner to increase the productivity. Normally a personal psychology tool, Large / small-business owner scan adapt it to the workplace. By helping their employees meet important needs at work, employers can create a highly motivated and happy workforce, which is more likely to be increase productive and reduce the cost.

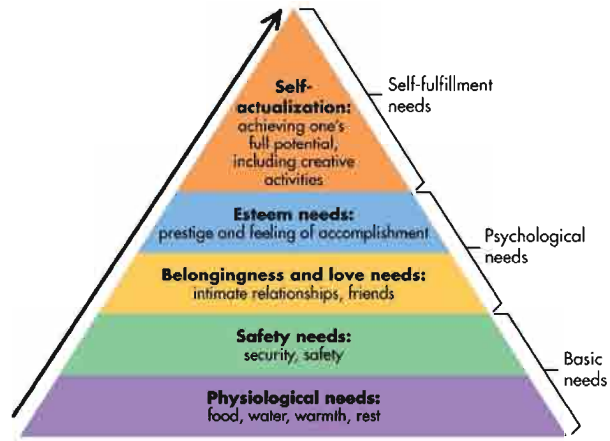


Fig1 : Needs of hierarchy for the safe living of workers

5. Cost estimation of existing housing maintenance, facilities and management of workman camp

Based on the data and interview of workers and staff, cost has estimated for the followings:

I) Cost of existing housing maintenance and facilities for capacity of 121 nos. workers

It has included approx. cost of electric and light work, fixing of cooler and ceiling fans, installation of DG set, almirah, beds with mattress, RO installation, freeze, table and chair, white wash, fixing of mosquito metal net in window and ventilation, installation of fire extinguisher, alarm system, construction of badminton court, exercising equipment, display of awareness poster. These listed item cost are onetime investment and need to maintain though out the Project.Total approx. cost has estimated **INR. 14,95,250** to establish the basic facility in the rented workman camp for the capacity of 121 nos. workers.

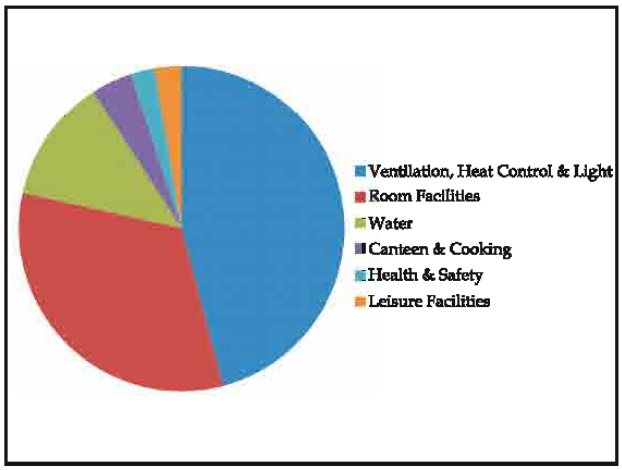


Fig2: Installation Cost (INR.) of Worker Facility in Rajpura Workman Camp

ii) Cost of management of workman camp

Monthly existing housing rent, electrical bill, DG set diesel cost, security, caretaker, cook, medical facilities and toilet cleaner approx. minimum cost excluding meal has estimated to operate the workman camp. Total approx. cost has estimated INR 3, 02,374 (average annual cost INR. 36, 28,488) to operate the workman camp. Average per capita cost has **estimated approx. INR. 2,500/** Person for 121 nos. workers. Workers numbers is not constant; presentably 72nos. workers are living in the Rajpura workman camp.

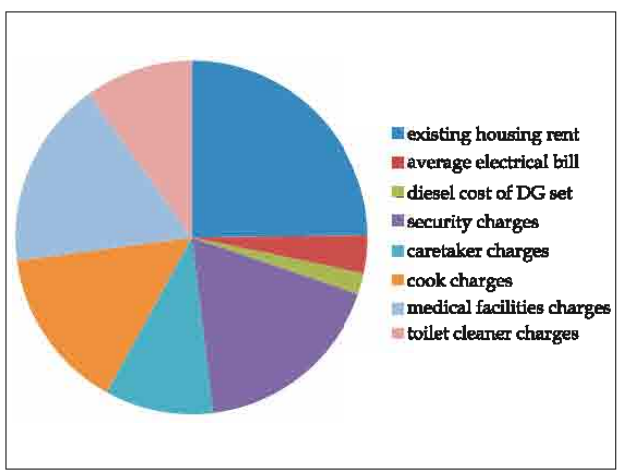


Fig 3: Monthly Average Management Cost (INR.) to Operate the Workman Camp

6. Conclusion

This paper has focused on the process of addressing issues raised by workman camp, reviews of international and national standards and guidance compliance with at least the minimum standard is expected. Issues for consideration are organised in terms of a stage-by-stage process has undertaken in planning, selection of existing housing near major Project facilities and then operation of workman camp.These issues are relevant to the contractor undertaking particular element of the project such as hiring of existing houses near to Project and management of facilities.

At the initial stage of Project, it was decided to hire the existing housing on rented basisto operate the temporary workman camp for migrant workers. In this connection, impacts have evaluated such as impacts of construction, community services such as health and on community cohesion and safety.

Contract, National and ILO Workers Housing Recommendation 115 Standards have applied for a safe and healthy location, adequate and sanitary living conditions and provision of appropriate leisure and good health facilities. Cost of existing housing maintenance, facilities and management of workman camp has estimated to better planning and operation of temporary workman camp in Project area without any delay.

References

1. Contract of EDFC 301
2. The Contract Labour (Regulation & Abolition) Act 1970 and Rules.
3. ILO Workers' Housing Recommendation 115
4. Workers Accommodation: Processes and Standards, A Guidance Note by IFC and the EBRD
5. Safety, Health and Welfare on Construction Sites, A Training Manual, International Labour Organization 1995
6. ISO 45001:2018, Clause 5.4 Consultation & Participation of Workers.

Adopting INDUSTRY 4.0 practices for optimized maintenance of Signalling Assets – a pilot study.

K.Madhusudan
GGM/S&T/WC-I

Synopsis

DFCCIL has entered the Operation phase both in EDFC and WDFC and by March 2020, DFC will operationalize around 1000 route km of Double line electrified track with State of art Signalling systems. Hence it is high time that we take up the latest Industry's norms to create a Maintenance strategy which has multiplier effect on the efficiency of the Freight train operations on DFCCIL in addition to DFCCIL assuming a leadership role and create a path which can be emulated by IR as well as in future corridors.

Introduction:

Sweeping changes are expected to take place in all spheres of life at the advent of INDUTRY 4.0. Optimized use of resources, improved productivity, reduced costs, realisation of intended value from the products & persons areits hallmarks. This paper suggests the ways of adopting state of the art technologies driving INDUSTRY 4.0 for the advantage of signalling assets management.

Industry 4.0 refers to a new phase in the Industrial Revolution that deals with interconnectivity, automation, machine learning, and real-time data usage. Industry 4.0, also sometimes referred to as IIoT or smart manufacturing, integrates production and operations with smart digital technology, machine learning, and big data to create a better connected ecosystem for companies that focus on manufacturing and supply chain. This is where Industry 4.0 comes into play.

A.Objectives of S&T department

S&T department assistsrailway operations by augmenting safety & efficiency of operations by –

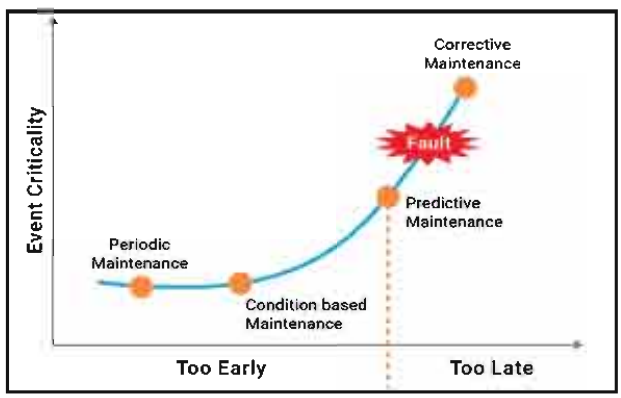
- Ensuring high availability of signaling system by reduced MTTR & increased MTBF
- Controlling the maintenance costs by adopting efficient processes

B.Challenges of S&T department

1. Distributed assets
2. Sophisticated equipment affected by temperature, dust, voltage surges etc.

3. Rapid introduction of new technologies
4. Insufficient skilled personnel for maintenance
5. Continuing age-old practices / processes
6. Equipment performance dependence on other departments
7. Insufficient time for planned maintenance of equipment
8. Containing the cost of maintenance

C. Overview of Asset Maintenance practices – present & future



- An organization may adopt one of the two maintenance strategies – correctiveorpreventive – based on the availability requirements of the system.
- In corrective maintenance, asset is attended to after it fails. Hence, every failure causes system unavailability. Since Indian Railways requirement is high availability, IR has not chosen corrective maintenance practice. Corrective maintenance is done when the system fails in spite of preventive maintenance.
- Three strategies can be adopted for implementation of preventive maintenance

- Periodical maintenance
- Condition based maintenance
- Predictive maintenance

i. Periodical maintenance

In periodical maintenance, equipment is attended within a specified time interval irrespective of its state. This has two disadvantages -

a. Unnecessary maintenance activities requiring more maintenance effort
b. Attending to maintenance leads to down time of equipment, reducing its availability

ii. Condition Based Maintenance

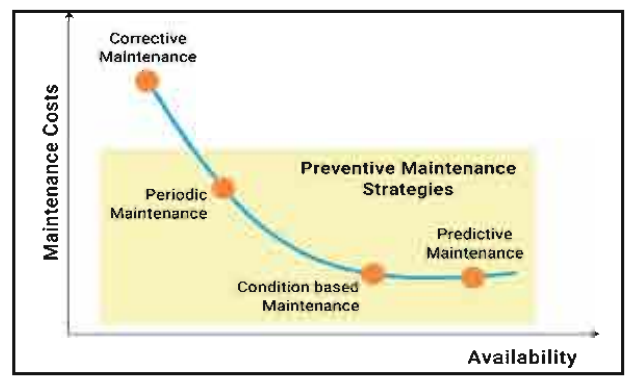
In condition-based maintenance, health of the equipment is assessed based on the variation in the values of certain parameters of the equipment. Human element decides whether the equipment requires maintenance or not.

iii. Predictive maintenance

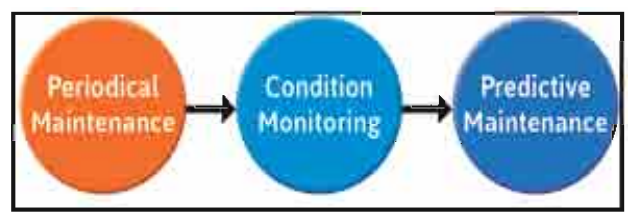
In predictive maintenance, equipment health is monitored by measuring its health parameters. The system decides the value at which the equipment is required to be attended. It takes into consideration – age of the equipment, intensity of usage, environmental conditions etc.

This practice is more scientific, it requires less efforts and improves availability of equipment.

Predictive maintenance provides maximum availability at least cost



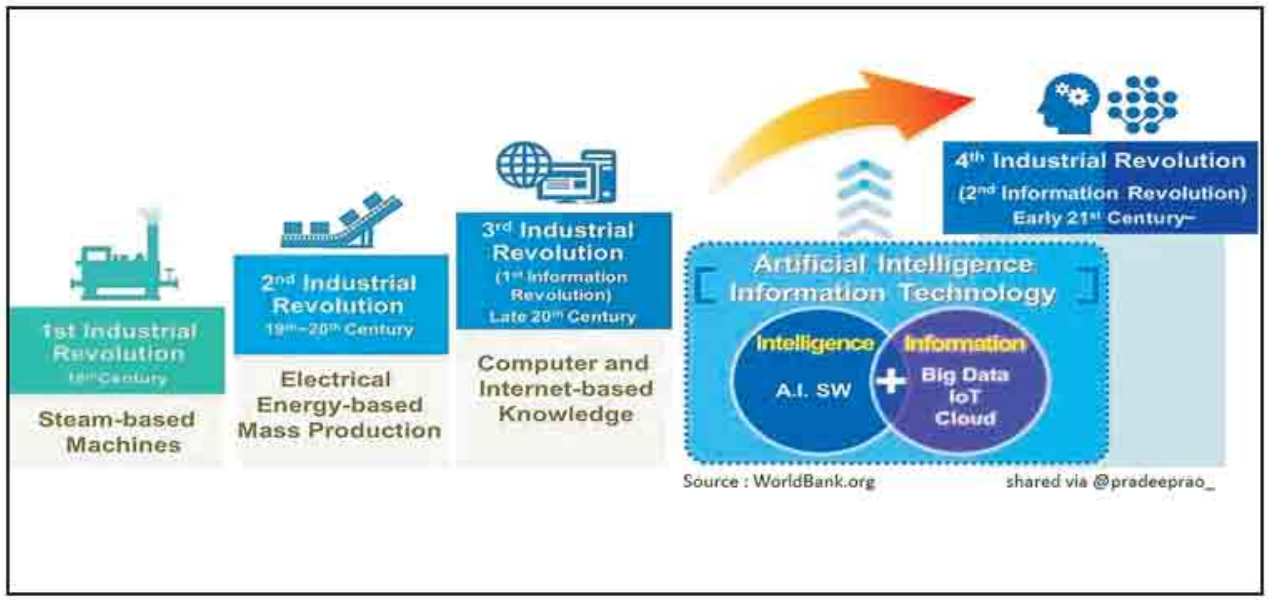
Condition monitoring of equipment is prerequisite for implementation of predictive maintenance.



Switching over from conventional periodic maintenance to predictive maintenance requires adopting the technologies driving INDUSTRY 4.0.

D. Technologies driving the INDUSTRY 4.0

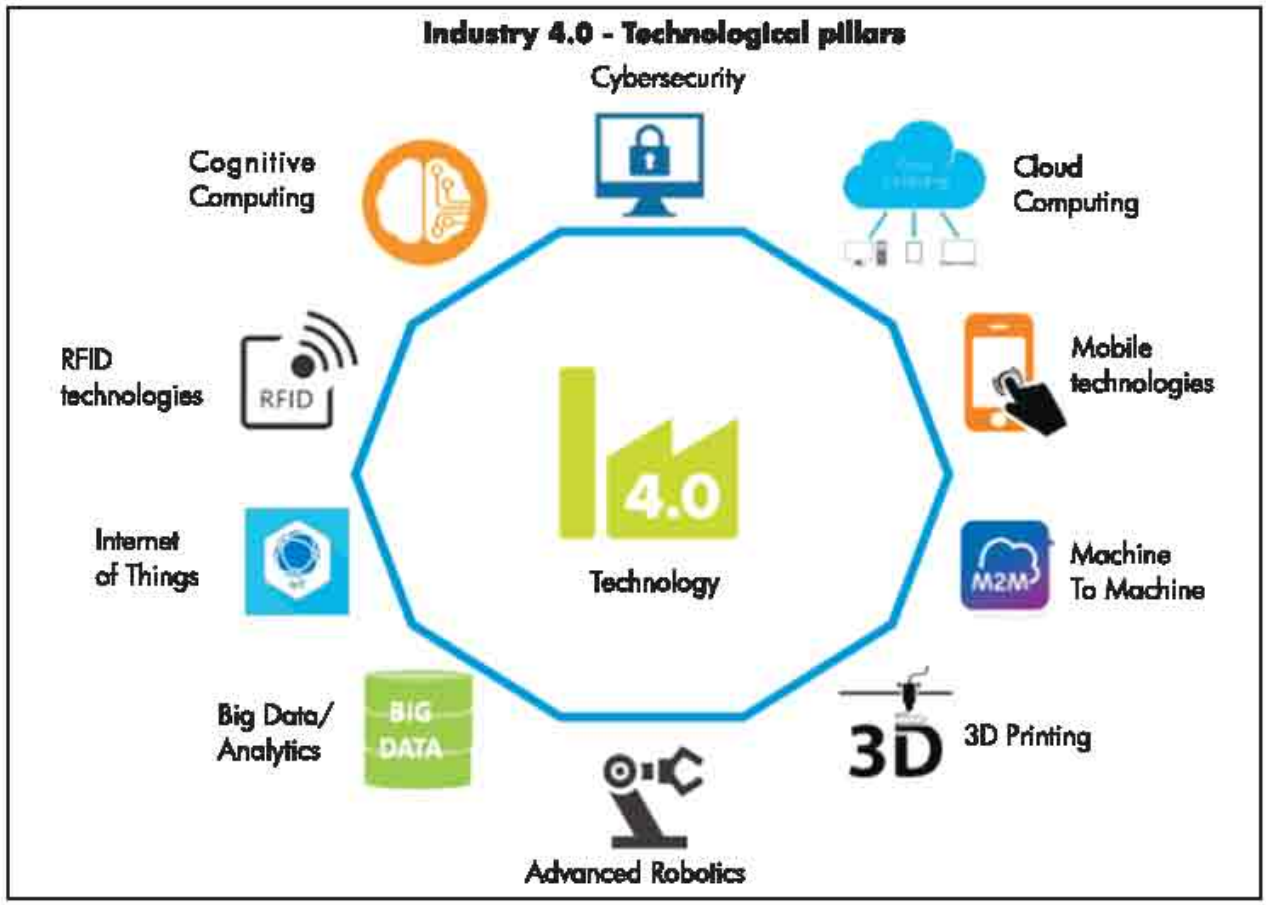
What is INDUSTRY 4.0



Four industrial revolutions

		Hallmarks	Examples
1	**Industrial revolution 1**	Human & animal muscle power replaced / augmented by mechanical power	Coal fired steam engines mechanised spinning mills, steam trains
2	**Industrial revolution 2**	Electrical energy augmented mechanical – lead to conveyer belt system – leading to mass production	Power handlooms
3	**Industrial revolution 3**	Processor based systems improved productivity by partial automation	CNC lathes, Industrial PLCs, SCADA
4	**Industrial revolution 4**	Things started cooperating with one another intelligently by generation & consumption of data. Things with complex relationships are made to cooperate on real time basis by adaptive algorithms to form System of systems	Autonomous cars, factories

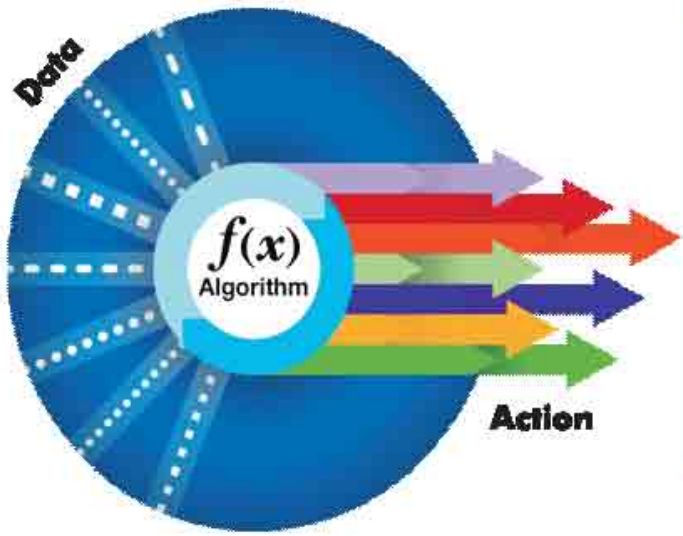
Features of Industry 4.0



- **Things work collaboratively through IOT[Internet Of Things] to improve productivity**
  Thing means – any device which can send and receive data from internet.
- **4 stages of implementing IOT**

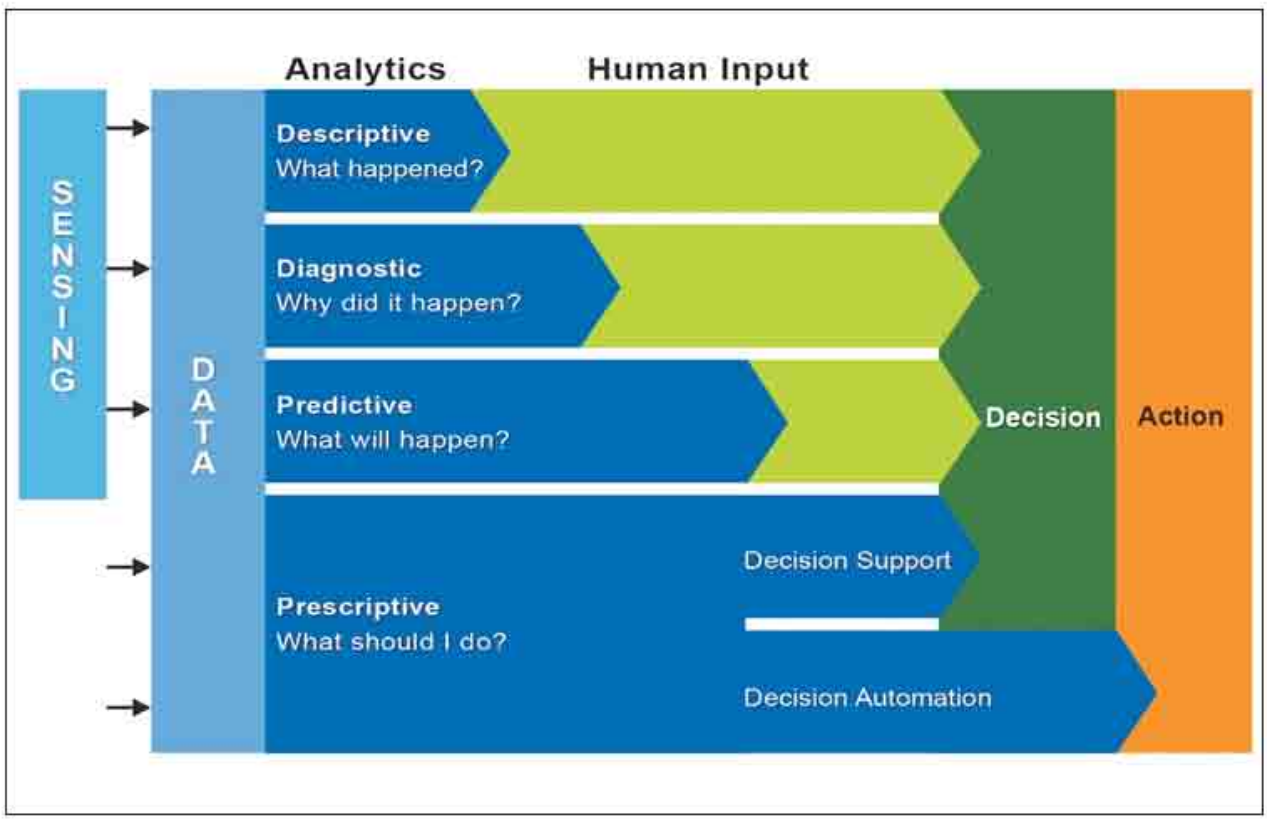
1. **SENSE**–Sense parameters from which health of the asset can be assessed& generate data
2. **COMMUNICATE** – Send the data to central location for analysis
3. **ANALYSE** – Analyse the data to find the health state of the asset
4. **ACT** – provide actionable decisions to ensure continued satisfactory performance of the asset

- **Data is processed by suitable algorithms to generate decisions**



1. Algorithm can be mathematical formula / detection of deviation to process
2. A company value is decided by the algorithms held by it

- **Spectrum of analytics**



	Type of analytics	Value creation	Technology
1.	**Descriptive**	Provides status of the thing / asset – based on which humans does further analysis and make decisions to act on the thing / asset	Simple to complex algorithms
2.	**Diagnostic**	Provides reason for the status of the thing - based on which humans does further analysis and make decisions to act on the thing / asset	Cause & effect relationship establishment – use of Machine learning
3.	**Predictive**	Provides likelihood of failure based on the present status of the asset - based on which humans does further analysis and make decisions to act on the asset	Machine learning along with big data analytics
4.	**Prescriptive –** decision support	It prescribes the action to be taken to prevent the failure of the asset - based on which humans must decide whether to act as prescribed or not	Machine learning, Deep learning along with big data analytics
5.	**Prescriptive –** decision automation	By continuously monitoring the **asset actions are taken without human intervention** to ensure that the asset functions as desired	Machine learning, Deep learning along with big data analytics augmented by automation

- **3 types of Machine learning**

1. Supervised learning

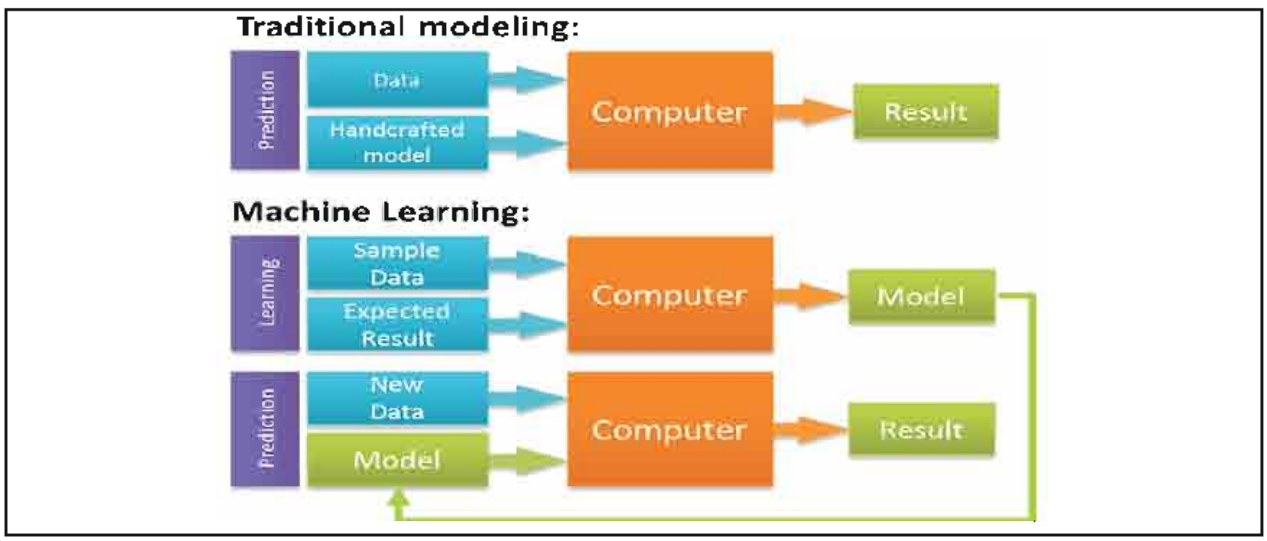
- Sample data of failure state is fed to the machine [ML software meant to detect the failure states]
- Software learns the pattern of data for different failure states
- Historical data consisting of failure and healthy states of the equipment is fed to the software and its success is assessed. Where required, software modifications are done to improve the success rate.
- New data of the asset is fed to find out failure states. In case certain failure states are missed, on real time application – data of the new failure state is added to the sample data – and the machine software is modified to enable the new learning

2. Unsupervised learning

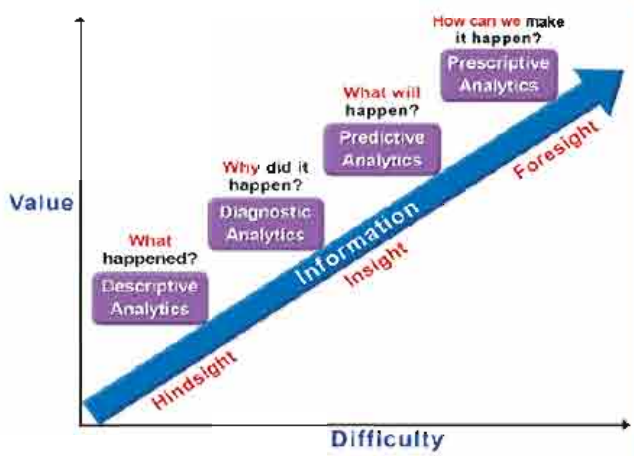
- Large data is fed to the machine [ML software]
- ML software brings out patterns out of the data – from which, an unknown state is found
- The evaluation of the result is qualitative – no specific action is suggested

3. Reinforcement learning

- Advanced ML – an approach to Artificial Intelligence
- Reward based learning – EX: CHESS game – every next move by machine is predicted based on the last move of the opponent – which is ever changing. Reward is given to the machine for correct / proper moves.
- Machine learns how to act based on maximization of rewards

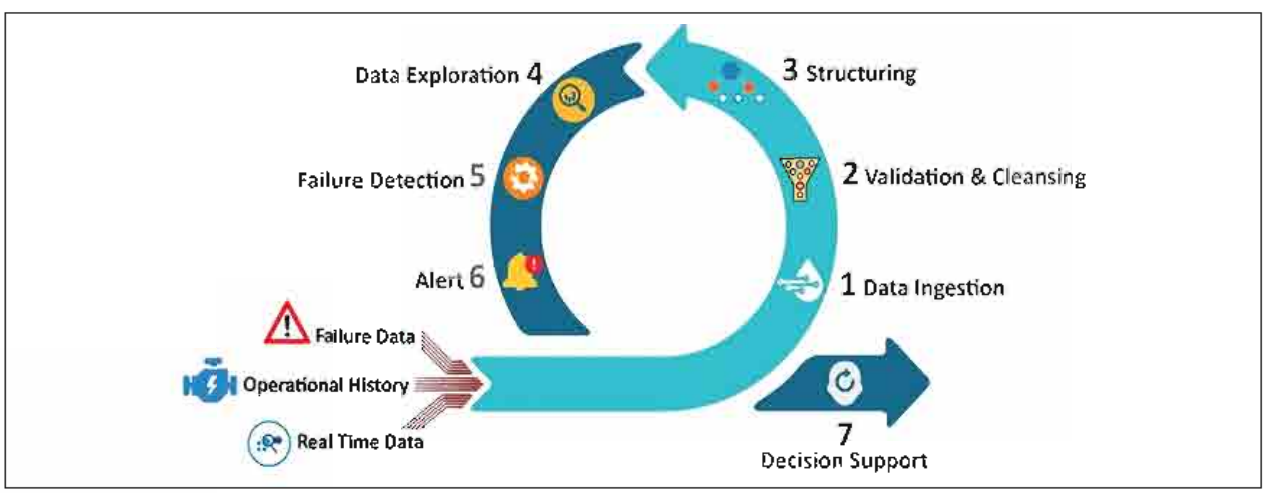


- **Value created by analytics**



1. Value created increase as the level of analytics increases from descriptive to prescriptive
2. Difficulty level also increase – hence the cost
3. It is for the user to decide level of analytics based on the value

- **7 stages of processing the data for predictive maintenance**



	Stage	
1	Data Ingestion	Data consisting of – Real time data, failure data & operational history is fed to the application software
2	Validation & cleansing	Data is validated for integrity and quality, ensuring correctness and usefulness
3	Structuring	Data is structured to enable easy exploration
4	Data exploration	Statistical and mathematical analysis is done on the data
5	Failure detection	Detection of failure state
6	Alert generation	Generation of suitable alert
7	Decision support	Providing decision support system – to enable acting

E. STEPs for implementation of predictive maintenance

STEP 1: Failure mode analysis of the asset / equipment / system [which includes the frequency of its occurrence and its overall impact on the functioning of the system]

STEP 2: Parameters to be monitored to detect the failure mode of the asset

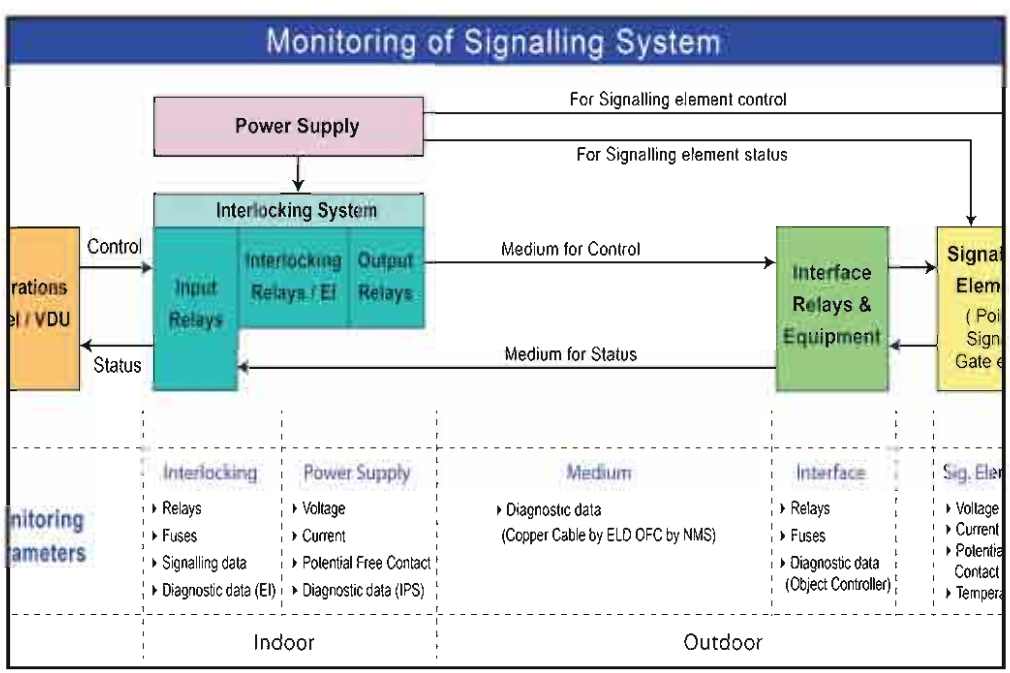
STEP 3: Selecting sensors to detect the parameters – non-intrusively without degrading the asset's performance

STEP 4: Deciding the mode of communication of the data generated by the sensor [including edge processing]

STEP 5: Applying data analysis technologies to generate actionable decisions

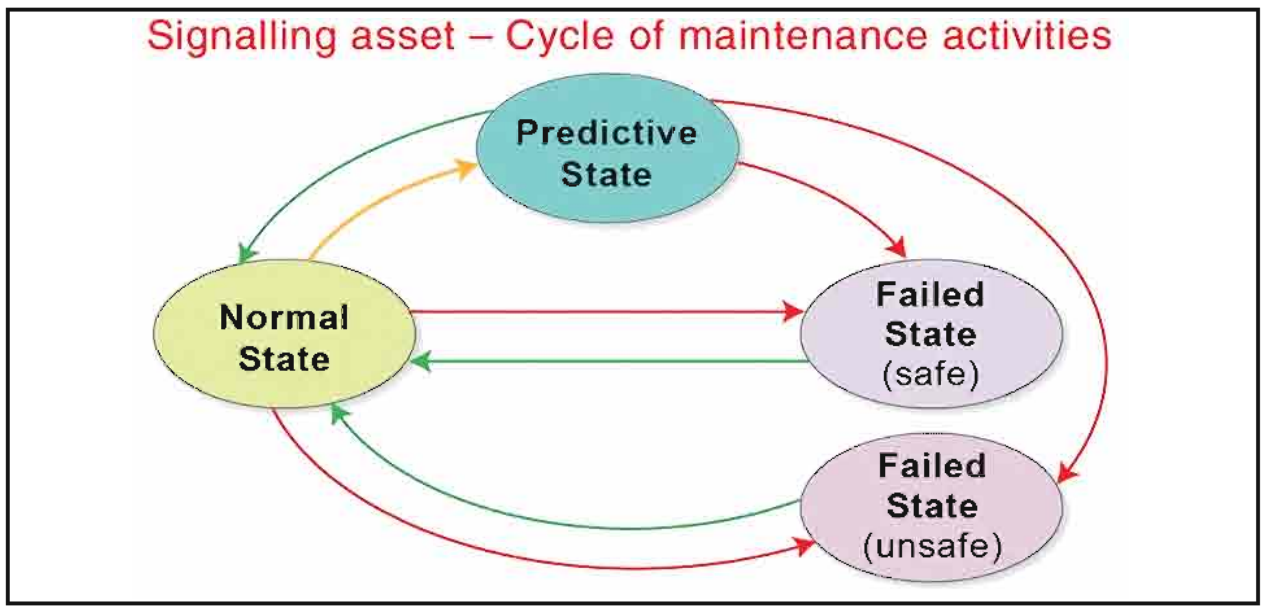
STEP 6: Dissemination of decisions to the required maintenance personnel to take remedial actions

Typical monitoring parameters for an outdoor signalling element



Failure mode analysis of various signalling elements

- **4 states of signalling element**



The following 4 transitions are undesirable:

1. Normal to failed [unsafe]
2. Normal to failed [safe]
3. Predictive state to failed [safe]
4. Predictive state to failed [unsafe]

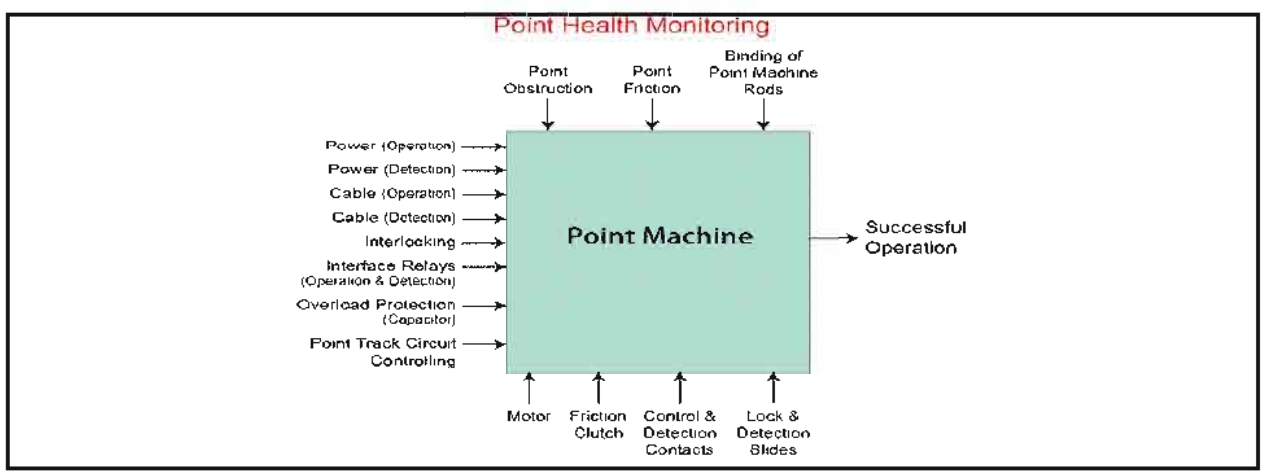
The following two transitions are imperative:

1. Failed state [safe] to normal
2. Failed state [unsafe] to normal

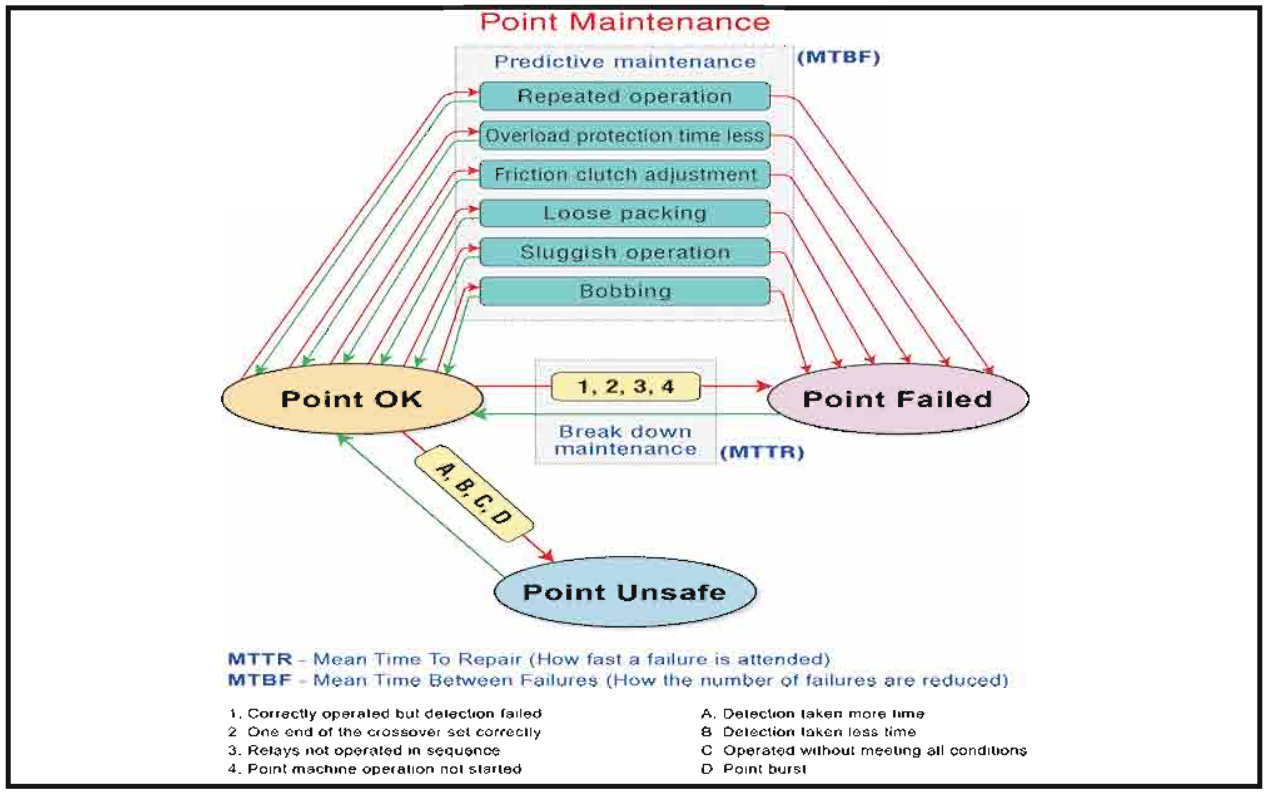
The following two state transitions are desirable:

1. Normal to predictive
2. Predictive to normal

- Point health monitoring–various parameters/ operations/conditions–affecting point' performance



- **Failure mode diagram of point**



Cause &affect of failure state and means of identifying the cause & affect plays important role in the maintenance of any asset.

Point failure analysis:

	Sub-system	Failure mode
1	Interlocking	Conditions does not permit operation
		Conditions permit operation, but failure of interface relay
		Conditions permit operation, but failure of interlocking
2	Power supply	Operating voltage beyond limits
		Detection voltage beyond limits
3	Medium – copper cable	Low insulation
		High resistance
4	Medium – OFC	Cable parameters beyond limit
		OFC connecting port failure
5	Point – external	External object between stock and switch rails prevent setting
		Point fittings obstructing the point from setting
		Increase in friction of slide chairs
		External interference
6	Point machine	Carbon brushes worn out
		Friction clutch needs adjustment
		Point machine requires adjustment

Cause – affect analysis

	Cause	Affect	Detection of Cause	Detection of Affect
	Poor packing of point	Point flashes under wheels	From the affect only	When point track is occupied, point detection flashes
	Obstruction of point / lock fouled	Point is not detected	Current signature	Point detection relay is down
	Point operating supply is low	Taking more time for operation	Operating Voltage measurement	Current signature
	Point friction increased	Taking more time for operation	Current signature	Current signature
	Point motor failed	Point detection failure	Current measurement	
	Point detection failed			
1	110v DC supply low	Point takes more time to operate	Operating voltage measurement	Current signature
		Point fails to operate	Operating voltage measurement	Current signature
2	110v DC supply earth fault	Point takes more time to operate	ELD	Current signature
		Point fails to operate	ELD	Current signature
3	24v DC supply low detected	Point is operated measurement	Detection voltage	Current signature but not and detection relays status
4	24v DC supply earth fault	Point is operated but not detected	ELD	Current signature and ELD status
5	Point destructed	Point fails	-	Current signature

POINT alarms / incidences

	Alarms / incidence	HMU
1	Point failure (Cause not known)	DL
2	Point loose packing	DL
3	Point Sluggish Operation	DL
4	Point Emergency operation	DL
5	Point failed – point machines operated	PHMU
6	Point failed – point machine not operated	PHMU
7	Point failed – Point machines correctly operated - Detection failed	PHMU
8	Point friction clutch worn out	PHMU
9	Point overload protection time delay less	DL
10	Point failed – Point operation (110VDC) circuit leakage	DL, ELD
11	Point failed – Point control (24VDC) Circuit leakage	DL, ELD

12	Point failed – Point detection (24VDC) Circuit leakage	DL, ELD
13	Point failed – Point operation voltage low	DL
14	Point failed – Point control Voltage low	DL
15	Point failed – Point detection Voltage low	DL
16	Point failed – Point operation attempted when locked	DL
17	Point failed – Point Control circuit (internal) failure	DL
18	Point failed – 110 V DC supply drop at point location	DL, PVD
19	Point likely to fail – Point operation (110VDC) circuit leakage	DL, ELD
20	Point likely to fail – Point control (24VDC) Circuit leakage	DL, ELD
21	Point likely to fail – Point detection (24VDC) Circuit leakage	DL, ELD
22	Point likely to fail – Point operation voltage low	DL
23	Point likely to fail – Point control Voltage low	DL
24	Point likely to fail – Point detection Voltage low	DL
25	Point likely to fail – battery failed	DL, BMU
26	Point likely to fail – 110 V DC supply drop high at point location	DL, PVD
27	Point likely to fail – Point bobbing	DL
28	Point burst	DL
29	Taken abnormally more time to get detection after operation is initiated	DL
30	Taken abnormally less time to get detection after operation is initiated	DL
31	Point operated without satisfying safety conditions	DL
32	FAILED to Set the point against occupied line	DL
33	Point indication changed without attempt to operate	DL

Conclusion: Due to large scale induction of the high technology Signalling and Telecommunication Equipments and systems into service, it becomes imperative for us to embrace Maintenance Technology in step with the current Industry standards so that we can reap the benefit from the synergy and the knowledge gained by way of use-cases developed and generated in the Industrial environment. Predictive Maintenance of assets should be the basis on which the futuristic maintenance strategies should be based along with Remote monitoring concept so that the time taken by the Maintenance team to reach the site and investigate the failure is saved as the system itself will guide the team where to look to as the rectification can start from the place the maintainer is located at that point by use of IOT. With adoption of the latest Industry standard 4.0 which lays down the platform to create products that suit the current maintenance needs, the maintenance will become smooth and easy. With introduction of the analytics based maintenance systems in which any Signalling system is thoroughly researched and the causes of any failure are analysed before hand, the maintenance team finds it easy to replace the Unit in which the faulty component is situated. Gone are the days when Maintenance of Signalling assets was considered a drudgery and time consuming due to lack of analytical tools and the maintenance expertise was individualistic in nature. With the induction of current trends of industry into the maintenance strategy, the maintenance of assets can be learnt easily, assimilated as the structured approach makes this possible. Great future awaits firms who will invest in developing systems on the Industry 4.0 platform.

News and Views from all Over:

Renewals in DB Germany: A 54% increase in spending on infrastructure renewals will see 86 billion Euros invested in the rail network over the next decade. Unveiling a 10 year plan for 2020-29 which is described as the biggest railway modernisation programme in Germany history, the German Transport minister said the aim is to provide a high performance, high quality network as a basis for active climate protection in the transport sector. This would also mean doubling the ridership by 2030. (RGI Sept '19 pp7)

Policy initiatives by IU: The international Union for Road-rail combined transport has published a list of 13 policy emasures it would like to see implemented in the 2019-24 EU legislative period. These include transforming the EU agency for Railways into an EU agency for Land transport. (RGI Sept '19 pp7)

Trenitalia has invited expressions of interest by October 1 for two four year framework agreements to supply a total upto 250 regional EMUs with an estimated value of 2.7 Bn Euros. (RGI Sept '19 pp7)

Westbahn sells fleet to DB: Deutsche Bahn announced an agreement to acquire Austrian open access operator Westbahn's fleet of 17 Stadler Kiss double-deck EMUs on July 22.(RGI Sept '19 pp8)

Amsterdam-Brussels Trainsets: NS has awarded Alstom a contract to supply a further 18 Intercity New Generation 200 km/h electric multiple units, which will provide it with a pool of 20 units equipped for use on Amsterdam – Brussels services as well as domestic routes. This will enable loco-hauled ICR stock to be withdrawn in 2025 when it will be life-expired.(RGI Sept '19 pp8)

Battery Power EMUs: An order for Siemens Mobility to supply and maintain 20 Mireo battery-electric multiple-units for use on Nertz 8 Ortenau regional services was announced by the Land of Baden-Wurt-temberg on August 2. The Land's rolling stock body had run a technology-neutral procurement process seeking 'emissions-free' vehicles for use by the future winner of a contract to operate 2.1 million train-km/year on a mix of electrified and non-electrified routes for 13 years from December 2022. Batteries offer a more economical alternative to fuel cells when running on and off electrified routes, the Land decided. Commissioning is scheduled for June 2023 and Siemens will maintain the fleet for 29 ½ years, guaranteeing energy consumption and power costs throughout this time. 'As we are breaking new ground technologically, we wanted to ensure that the supplier was responsible for the entire life of the vehicles', said Transport Minister Winfried Hermann. 'Manufacturers need to ensure that their vehicles are always available on a daily basis, and there are serious penalties if they do not comply'.(RGI Sept '19 pp10)

Revival of Freight operations in Tanzania: A ceremony at Moshi on July 20 marked the revival of freight operations on Tanzania's 438 km Usambara

Railway after 12 years. The government hopes this will stimulate agricultural development and local industries as well as tourism.(RGI Sept '19 pp11)

Safety initiatives:Network Rail has launched a track worker safety task force backed with a €70m fund. This will bring together multiple programmes across the company including the development of protection and warning systems, a fatigue improvement programme, rewarding contractors for positive safety performance and holding weekly 'safety hours' to encourage greater staff involvement.(RGI Sept '19 pp11)

Autium friendly Railway:Northern has developed 'the UK's first autism-friendly railway line' near Manchester. Specialist resources available include sunglasses and ear defenders to assist passengers who may have sensory needs, and detailed line guides covering key travel information.(RGI Sept '19 pp11)

Denmark's Driver Less strategy: Danish state operator DSB has alunched a markert sounding exercise in preparation ofor the procurement of a fleet of driverless trains to operate the Kabenhavn S –bane. Building on work which is under way to equip the S-bane with CBTC, the government decided in 2017 to convert the stand alone 1.5 KV DC network to fully automatic operation under the grade automation 4. This would support 'growth and mobility' in the metropolitan area and contribute to climate friendly urban environment creating capacity for more passengers and reducing congestion. Conversion is intended to coincide with replacement of the current fleet from 2026 for completion within 15 years. The market engagement programme is intended to define the strategy looking at rolling stock and technology options and determining which companies can assist with delivery. (RGI Sept '19 pp12).

Gauge Conversion in Russia: The first 1520 mm gauge long distance overnight passenger services on the island of Sakahlin began with the conversion of the 500 km Vzmorye-Nogliki route from 1067 to broad gauge. This marks the latest stage in the programme launched in 2003 to regauge the island's network from the 1067mm gauge which was the legacy of Japanese rule before WW II. Completion is envisaged in next year.(RGI Sept '19 pp12)

Higher capacity double decker coaches on Israel Railways: Bombardier make double decker coaches with a revised interior layout designed to provide 20% increase in capacity in routes with average journey times under 30 minutes. In order to accommodate more standing passengers, the seats and tables have been removed from the lower deck and replaced with same number of longitudinal folding seats, along with grab rails and holding handles. The upper deck remains unchanged.(RGI Sept '19 pp12).

Driverless train: Hitachi Rail Italy (HRI) has delivered the first driverless trainset for the future metro line M4 in Milan in Italy. HRI is supplying 47 four car train sets from its Reggio Calabria factory. The 50 m long sets have capacity of 600 passengers. They have a maximum speed of 80 kmph and will draw power from the 750V DC from a third rail. (RGI Sept '19 pp14).

Egypt Mono rail: A Design, Build and operate contract for two driverless monorail lines serving Cairo have been signed by the National Authority for Tunnels and a consortium of Bombardier Transportation, Orascom Construction and Arab Contractors. The Contract includes 30 years of operation. Orascom will be responsible for civil works, Bombardier for E&M systems including Signalling, telecommunications operations control centre, platform screen doors, fare collection system, power supplies and depot equipment. (RGI Sept '19 pp14).

4G in London Underground: Transport for London has shortlisted four bidders for a contract to roll out 4G mobile connectivity across the underground sections of the London Underground network and aims to award the contract by mid 2020. (RGI Sept '19 pp15).

Catenary free route in Australia: Dynamic testing has started on the catenary free section of the CBD and South East Light Rail line in Sydney. The 2 km section from Town Hall to the northern terminus at

Circular Quay is equipped with Alsthom's APS ground level power supply to allow catenary free operation. (RGI Sept '19 pp16)

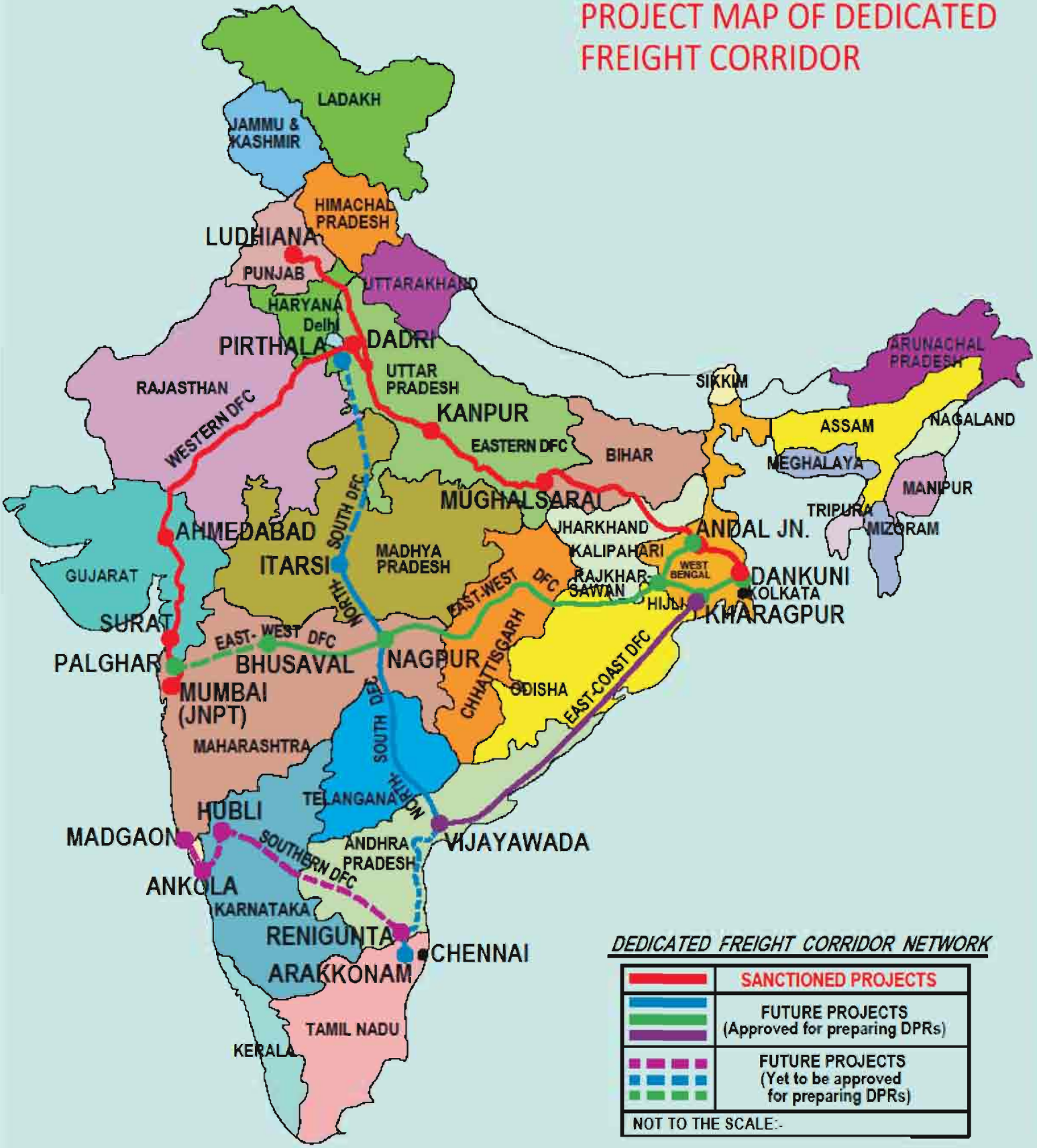
ETCS in Bulgaria: NRIC has awarded the Consortium of AER and CAF Signalling a contract to design and supply ETCS Level 1, GSM-R and Electronic Interlockings for the 12 km route from Sofia's main station to Voluyak. (RGI Sept '19 pp16).

Czech Republic: AZD Praha is installing ETCS-Level 2 on the 108 km CeskaTrebova – Prerov route and on 54 km route of Praha to Votice section of Corridor 4 (RGI Sept '19 pp16).

Slovenia: The Ministry of Infrastructure has awarded a consortium of CAF Signalling and local company ISKRA a contract to design, supply and install and commission Electronic Interlockings to replace relay based technology on the 117km route between Zidani Most and Sentilji. (RGI Sept '19 pp16).

S&T Maintenance contract in Spain: ADIF has awarded a consortium of Thales and CAF Signalling a contract to supply and maintain Signalling equipment for the La Encina-Xativa- Valencia section of the Mediterranean corridor. This includes ETCS levels 1 and 2, interlockings and train detection, protection and traffic control systems, power supplies and telecom for both braod gauge and future standard gauge services. The Contract includes 25 years of maintenance on the 1435 mm gauge and 20 years on the 1668 mm gauge (RGI Sept '19 pp16).

PROJECT MAP OF DEDICATED FREIGHT CORRIDOR



DEDICATED FREIGHT CORRIDOR NETWORK

	SANCTIONED PROJECTS
	FUTURE PROJECTS (Approved for preparing DPRs)
	FUTURE PROJECTS (Yet to be approved for preparing DPRs)
NOT TO THE SCALE:-	

डेडीकेटेड फ्रेट कारीडोर कारपोरेशन ऑफ इंडिया लि.

Dedicated Freight Corridor Corporation of India Limited

(भारत सरकार का उपक्रम)

(A Govt. of India Enterprises)

5th Floor, Pragati Maidan Metro Station Building Complex,
New Delhi -110001 Ph-011-23454700, Fax-23454701

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