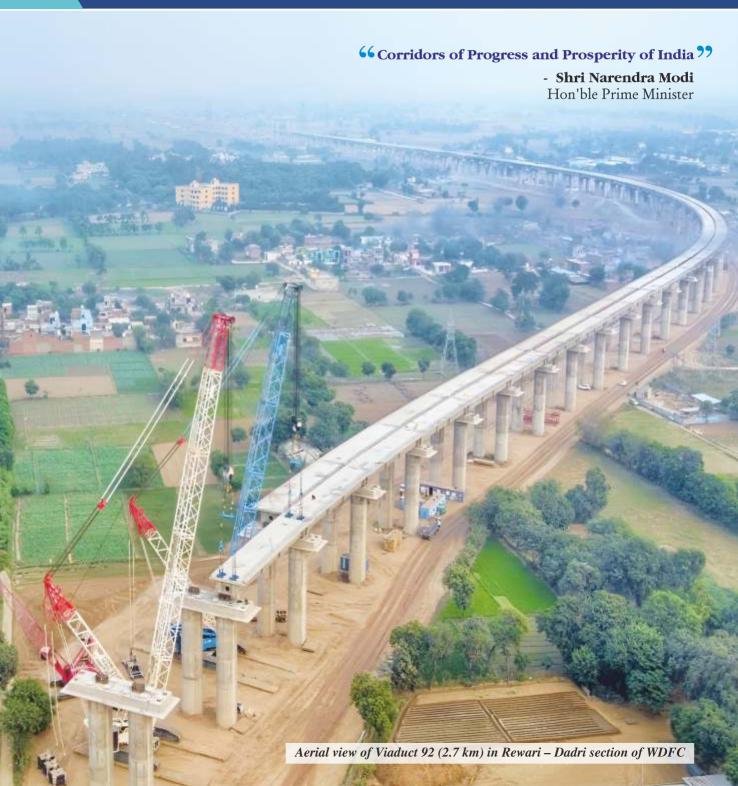


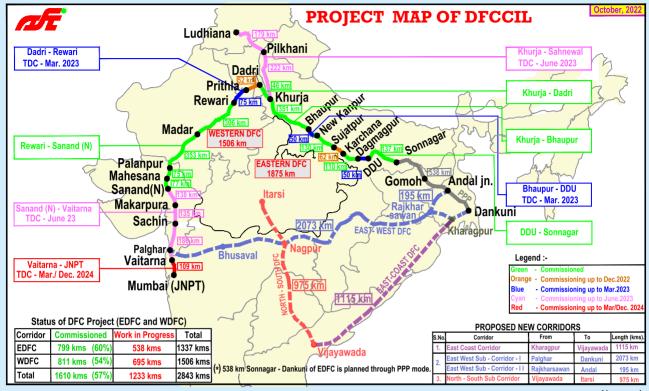


Dedicated Freight Corridors

Game Changer in India's freight transportation

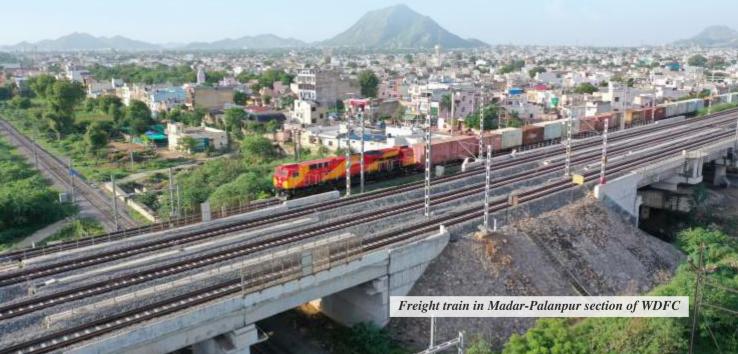
Issue 01, October 2022





Not to scale

- 1610 km (57%) of DFCCIL have been commissioned.
- Three new sections are completed in October 2022.
 - a. Chheoki Chunar 110 km
 - b. Mahesana Sanand (N) 77 km
 - c. New Bhimsen New Kanpur 25 km
- 90% of DFC is targeted to be commissioned by June 2023.



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Narmada bridge in Palanpur-Makarpura section



Bridge on river Yamuna at Prayagraj



NTC machine used in DFC

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Sh. Love Shukla JGM/Corporate Co-ordination

From the Editor's desk



Ravindra Kumar Jain Managing Director, DFCCIL

Dear Readers,

It gives me immense pleasure to present to you the first edition of DFCCIL magazine. DFCCIL is gradually progressing towards completion of the grand project of Dedicated Freight Corridors. Dedicated Freight Corridors are the largest railway infrastructure project ever attempted in independent India. Dedicated freight corridors are the project of national importance with many aspirations of our rising nation associated with it. Hon'ble PM Shri Narendra Modi has called DFCs "The Corridors of Prosperity" and bestowed a great responsibility on our shoulders. DFC has a pivotal role in National Infrastructure Pipeline and PM Gatishakti Master Plan as development of complementary infrastructure and industrial hubs will take place around it. Even more significant is its potential to create an impact in the life of the common man, who will have timely, faster, assured delivery of essential items at lower cost, who will find employment in the industrial hubs developed around DFC, whose skills and produce will find access to global markets. DFC will pilot India from a 20th Century developing nation to the global superpower of 21st Century.

DFCCIL is achieving milestones after milestones, latest being opening of Palanpur-Mahesana Section of WDFC which was dedicated to the nation by Hon'ble Prime Minister Shri Narendra Modi on 30th September 2022. DFCCIL has now completed more than 50% of the network and is targeting to complete more than 90% by June 2023. DFCCIL family has come together towards this endeavour and contributed its 100% to make it a grand success. This journey became a significant part of our lives when we got the good fortune to be a part of this historic project. It is essential to archive this journey to cherish the hardships, the struggles and the joys of success which is experienced by us all in this journey. This magazine is

conceived as a medium to bring out the voices of DFCCIL family and exchange ideas. It will have a technical part explaining technological innovations used in DFC as well as sections where creative writings of DFC family will be showcased. It will cover events at DFC which brings the DFC family together as well as news from Indian Railways. In this first edition of DFC magazine, we have collated articles of different nature from the members of DFCCIL family and also from our partners and stakeholders. In this issue, we talk about the technological innovations employed in DFC with special emphasis on Auto Fault Locators (AFLs) and Machine Vision Inspection System (MVIS). These well written articles will demystify innovative technology in easy-to-understand language for our readers. We also briefly touch upon the challenges we faced in the execution of this game changing project. This first edition also commemorates the inaugurations of different sections of the DFC. This edition also shares the perspective of CARE ratings about DFC and its role in the country's transport infrastructure.

As we celebrate the 17th Foundation Day of the DFCCIL, I feel this is an apt occasion to dedicate this first edition to our DFC family and all its stakeholders. I acknowledge with sincere gratitude and appreciation, all the members who have contributed to this first edition of DFCCIL magazine. I believe you will find this issue containing articles on a wide range of topics, informative as well as entertaining.

Happy Reading.

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Ravindra Kumar Jain

Chairman's Message

विनय कुमार त्रिपाठी VINAY KUMAR TRIPATHI





अध्यक्ष एवं मुख्य कार्यकारी अधिकारी,
रेलवे बोर्ड
पदेन प्रमुख सचिव, भारत सरकार
रेल मंत्रालय
CHAIRMAN & CHIEF EXECUTIVE OFFICER.
RAILWAY BOARD
EX OFFICIO PRINCIPAL SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

CHAIRMAN'S MESSAGE

Dear Readers,

It gives me immense pleasure to put my views before you through this first edition of DFCCIL magazine 'Game Changer in India's freight transportation'. I appreciate DFCCIL for this initiative to bring forth the voices and opinions of stakeholders of DFCCIL and give them a medium to express it.

Recently, Ministry of Railways has developed the roadmap for Mission 3000 MT, which aims to achieve freight loading of 3000 Million Tons per annum by the year 2027. DFCCIL will be an important stakeholder to achieve this milestone. With the increase in modal share of Indian Railways in freight transportation, the overall cost of transportation will come down and economy of the nation will get further impetus.

DFCCIL has demonstrated significant progress in the last few years and projects have picked up after the pandemic. Last month, Hon'ble PM Shri Narendra Modi dedicated Palanpur-Mahesana line along with Palanpur Connecting line of WDFC to the nation. This line was of critical importance as ports of Gujarat are now connected with WDFC, giving the ports a dedicated track access of around 700 kms upto Rewari. This line will also eliminate bottlenecks around Palanpur, which will make freight traffic movement seamless. DFCCIL should continue progress in the same way.

I see this magazine has collated beautiful contributions of diverse nature; it has articles on core technical topics like Auto Fault Detector (AFL) and Machine Vision Inspection System (MVIS) as well as viewpoints of our stakeholders. It talks about initial days of DFCCIL by a railway veteran and celebrates the individuals who were at the helm of DFCCIL since beginning. The photo feature on bridges is a delight to see for any railway enthusiast. These engineering marvels are not only an important part of railway infrastructure but also a shining example of engineering prowess of India.

I hope that DFCCIL v ill keep up the good work and complete the project in a time bound manner. I believe that future editions of DFCCIL magazine will give us all to read about this amazing journey

With Best Wishes!

(Vinay Kumar Tripathi)



VISION

To create a partnership with IR for retaining and expanding the market share of rail through efficient and reliable service with customer focus.

MISSION

As the dedicated agency to make the vision into reality, DFCCIL's mission is

- i. To build a corridor with appropriate technology that enables Indian Railways to regain its market share of freight transport by creating additional capacity and guaranteeing efficient, reliable, safe and cheaper options for mobility to its customers.
- ii. To support the Government's initiatives toward ecological sustainability by encouraging users to adopt Railways as the most environment friendly mode for their transport requirements.



At the Helm

Managing Directors of

DFCCIL since 2007



Vijay Kumar Kaul 15.09.2007 - 06.10.2010



Sushil Kumar Malik (L/A) 07.10.2010 - 30.11.2010



BN Shekhar Rao (L/A) 01.12.2010 - 14.03.2011



A.K Dutta (L/A) 22.03.2011 - 10.05.2011



R.K Gupta 10.05.2011 - 28.07.2014



Anshuman Sharma(L/A) 28.07.2014 - 20.10.2014 & 01.07.2017 - 03.08.2018



Adesh Sharma 20.10.2014 - 30.06.2017



Anurag Kumar Sachan 04.08.2018 - 31.07.2020



R.N Singh (L/A) 06.08.2020 - 11.12.2020



R.K Jain 11.12.2020 -

As a leader, it is important to not just see your own success but focus on the success of others. ??

— Sundar Pichai



DFCCIL in the service of Nation —

Khurja-Bhaupur (29.12.2020)

The stretch of New Bhaupur- New Khurja (351 km) & state-of-art operation control centre (OCC) inaugurated by Hon'ble Prime Minister, Shri Narendra Modi on 29.12.2020. It transits through Uttar Pradesh and was built with an investment of more than Rs. 6000 cr. This section crosses different cities of Uttar Pradesh which will be a boost to small industries in transporting their products. The industrial areas connecting this section are Aligarh, Khurja, Firozabad, Agra. The section has 10 stations, 19 major bridges and 7 RFOs.







Inauguration of Khurja-Bhaupur section & OCC Prayagraj





Inauguration of Rewari-Madar section of WDFC

Rewari-Madar (07.01.2021)

The stretch of Rewari-Madar (306 km) inaugurated by Hon'ble Prime Minister, Shri Narendra Modi on 07.01.2021. It transits through Haryana and Rajasthan was built with an investment of more than 4000 cr. This section crosses different cities of Haryana and Rajasthan which will boost small industries in transporting their products. The industrial areas connecting this section are Rewari, Mehandragarh, Sikar, Jaipur and Ajmer. The section has 9 stations, 15 Major Bridges, and 4 RFO and 19 ROBs. The section is level crossing free.



Madar- Palanpur

(18.06.2022)

The stretch of Madar-New Palanpur (353 km) inaugurated by Hon'ble Prime Minister, Shri Narendra Modi on 18.06.2022. It transits through Rajasthan and Gujarat was built with an investment of more than 6000 cr. The section crosses different cities of Rajasthan and Gujarat which will boost ports connectivity with the rail network. The section has 11 stations, 86 major bridges, 2 Rail fly over and 13 Road over bridges and 129 level crossing eliminated in this section.



Freight Train in Bangurgram-Haripur section of WDFC





Inauguration of Mahesana-Palanpur section

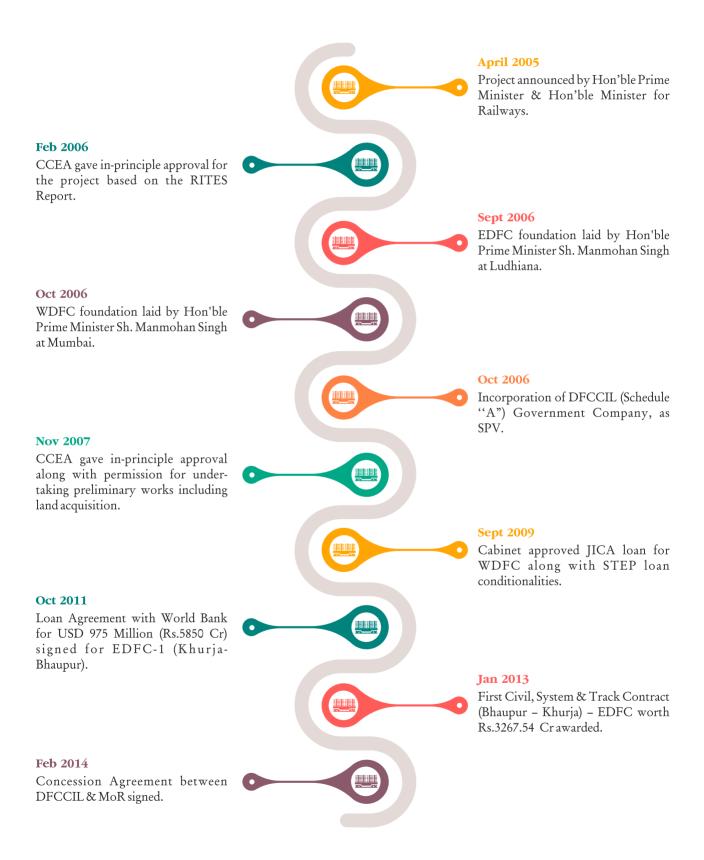
Mahesana-Palanpur (30.09.2022)

This section including Palanpur link line of stretch 75 km transits through Gujarat. Hon'ble PM Narendra Modi dedicated the New Palanpur-New Mahesana (New Bhandu) section including Palanpur Connecting Line (PCL) of WDFC to the nation on 30.09.2022.

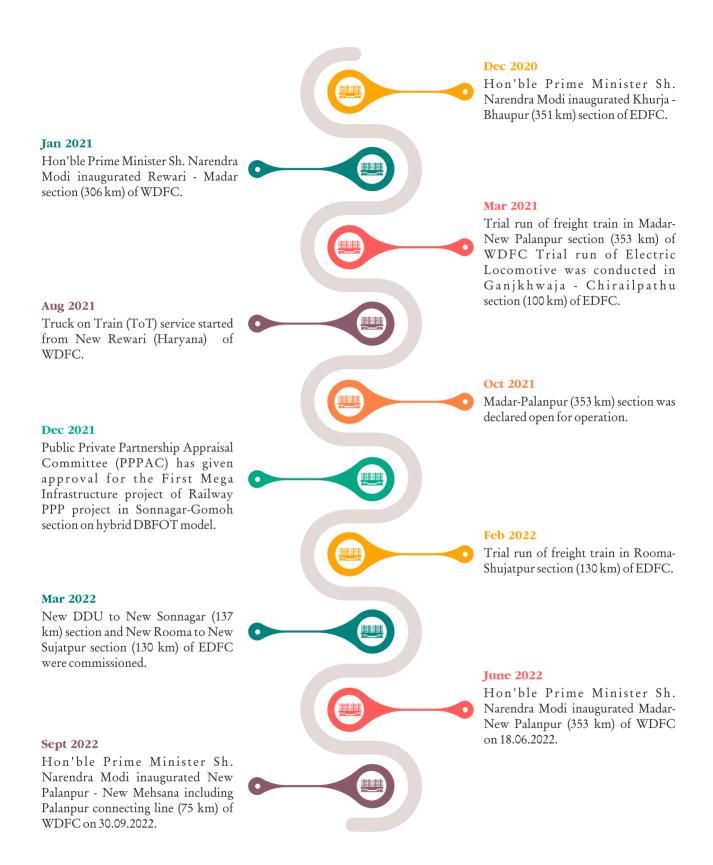
The section has 12 major bridges, 2 viaducts & 1 Rail flyover crosses two stations. It will greatly enhance the connectivity of Pipavav, Kandla, Mundra and other ports of Gujarat by linking it to the WDFC network.



DFC Milestones







P. N. Shukla Ex-Director/OP&BD DFCCIL

India's economic liberalisation beginning 1991 triggered a new growth story across all sectors of economy. These developments also threw up wide cracks in logistics infrastructure closely connected with industrialisation. The cement, power, coal, fertiliser, foodgrains, petroleum sectors in bulk cement and trade globalisation with growing exports/imports had put pressure on rail transport system. The changing economic scenario also demanded faster transit and assured fulfilment of Industry demand. This challenge was unprecedented for Railways and lack of line capacity became a drag for industrial growth. The situation was particularly critical on Rajdhani routes of Delhi – Kolkata and Delhi-Mumbai.

Railway Board commissioned RITES in July 2005 to prepare a feasibility report and then undertake engineering cum traffic survey to see the economic viability. RITES made two teams to undertake survey of Eastern and Western Corridors along Rajdhani Routes. The first report established feasibility of two routes on Eastern side from Ludhiana to Sonnagar via Khurja (1290 Kms) and Western side from Dadri/Tughlakabad to JN Port (1505 kms). This report was submitted in Feb 2006 and engineering cum traffic survey report was also submitted in August 2006. While Eastern Corridor was suggested largely parallel the Rajdhani route, the Western Corridor was suggested via Rewari- Palanpur-Ahmadabad partly away from Western

Rajdhani route. Another portion of 550 kms from Sonnagar to Dankuni was added to Eastern DFC in August 2006. On receipt of RITES report Railway Board also drew concept of other future DFCs along golden quadrilateral which though is 16% of IR but carries 60% of overall IR cargo.

Proposals of Eastern and Western Freight Corridors were announced in Railway Budget of February 2006. After inclusion in Budget a monitoring committee was formed in Railway Board and alongwith DFC organisation was approved by Cabinet with MD and four Directors with terms of 5 years or upto age of 65. While committee started its action to coordinate with RITES who were doing the survey Government also decided to fast track Board level appointments.

The company got incorporated on 30th October 2006. The Board level appointments were also made by July 2007 and MD was in position in September 2007. The work really started to freeze the blueprint on the ground which was a mega task as the project extended over 7 states and 60 districts. Government decided that the project will be executed with 30% Government equity participation and balance with multilateral long term funding from international financial institutions. It was also decided that land will be procured with Government as owner and to be leased to DFC at nominal charges.



When the company management took over the task of alignment and details of junctions was being finalised by RITES. However alignment and other details required to be done in coordination with Zonal Railways, State Governments and on ground topographical challenges. DFC management took over all the ground planning by appointing 9 Chief Project Managers on deputation from along the corridors. These officers were generally Sr Divisional Engineers from adjoining zones who were familiar with routes and had good knowledge of local area.

To begin with each CPM was given an agency engaged by Corporate office called Facilitation Contractor who would prepare drawings of alignment, estimation of engineering works and land plan preparation for land acquisition. Another setback in the beginning was changes at MD level four times in 5 years (from 2007 to 2012) which slowed the decision making at initial stages. There were numerous challenges to carry the project blue print to footprints on the ground. Some of these challenges needed to be decided before finalising project parameters for estimating costs and take financial approvals. These challenges are enumerated below:

- The first challenge was to freeze the alignment so that land acquisition could start as soon as possible. The land requirement on Eastern and Western corridors was about 12000 hectares which pointed to serious future challenges on land acquisition front. Next major challenge was to freeze the technical track parameters for 32.5t axle load which was first time in history of Indian Railways. Another major challenge was to tackle level crossings as proposed inter stations on DFC were 40 kms whereas it was 7-8 kms on adjoining tracks.
- The second area of challenge was to finalise junction

- arrangements in consultation with adjoining Railways. RITES report had planned junctions in a manner that future operations would be such that freight handling terminals would continue on existing pattern. However the DFC management had to take a long term view integrating present system to be future ready for seprating freight business. The junctions therefore had to be recasted from RITES plans due to local land acquisition constraints without compromising the operational efficiency.
- The third challenge area was type of electric traction systems and signalling systems to be adopted on DFC. In RITES report Western Corridor was proposed on Diesel traction and there was loan condition of JICA to adopt only Electric Traction. However there was challenge of unproven electric traction at 7.1m height anywhere in the world. Then there was recommendation for absolute block system signalling for single line on 420 kms on Khurja-Ludhiana section and automatic signalling with signal spacing of 2 kms. on double line of balance 2370 kms EDFC and WDFC. It was also critical to finalise General Rules for DFC working based on new technologies being adopted.
- Another major challenge was preparation of Business Plan for DFC which would lay down revenue streams, future DFC organisation with international benchmarks and its technology oriented O&M practices to achieve half the unit cost of IR with average train speeds of 70 kmph. The commercial aspects of freight business was to be done by Railways and the O & M cost of DFC was to be reimbursed as Track Access charge as revenue stream. The task to prepare business plan was very challenging as it had no past precedent in India.



Freight Train in Bangurgram-Haripur section of WDFC

Dedicated Freight Corridor company was also to be defined through a Concession Agreement which was to be drafted by DFC and then to be approved by Ministry of Railways. For Concession Agreement the Government of India had mandated to have arms length relationship between Railways and DFC. This implied no day to day interference by Railway in DFC functioning and only policy issues to be decided through Railway's representation in Board of Directors.

The task of tailoring Blue Print to Foot print was onerous and would have permanent impact for future decades both in Railway working and economic development of the country. The Western Corridor was to serve export/import of the country where containers would take about a week to reach from North India to JN Port or Mundra port. The DFC had target to bring transit time down from three days to one day and also freight reduction of 25% by double stack container service. The Eastern Corridor was to serve mining areas of coal and transporting it to power houses up north travelling upto 1500 kms in just 24 hour as against 3-4 days of present transit time. Steel plants of Tata and SAIL would also have access to North markets in 24-48 hours as against 4 days transit.

cost of Rs 18000cr. If these LCs were to be replaced by ROBs it would have costed about Rs 54000 cr. There were many other issues relating to track which needed immediate decision viz. increasing inter track distance to 6.5m compared to 5.5m on IR and fixing axle load of 32.5t for bridges design as well as earth work needed for banks on DFC. It was also decided to retain normal 60kg rail and 25t axle load equivalent sleepers.

With settling of standards for DFC by 2011-12, the estimates got finalised and contracts awarding got initiated . A first time policy of design and build contract process was mandated by Government of India for DFC which was new to all and lot of learning eforts were made with help of World Bank assistance. The lenders had fixed condition of environmental impact assessment with mitigation measures and minimum acquisition of 80% land acquisition of contract portion.

The project was divided for loan purposes in two phases for Eastern Corridor from Khurja to Bhaupur and Bhaupur to Mughalsarai & Khurja Dadri as advised by World Bank for that portion. On Western Corridor there were three phases viz. Rewari-Makarpura (Vadodara), Makarpura-JN Port and Rewari-Dadri as suggested by JICA who are lenders. These portions were further staggered as per final land acquisition progress and contracts were awarded from 2012 to 2018 over 6 years period.



DFCC track parallel to DDU yard of Indian Railways

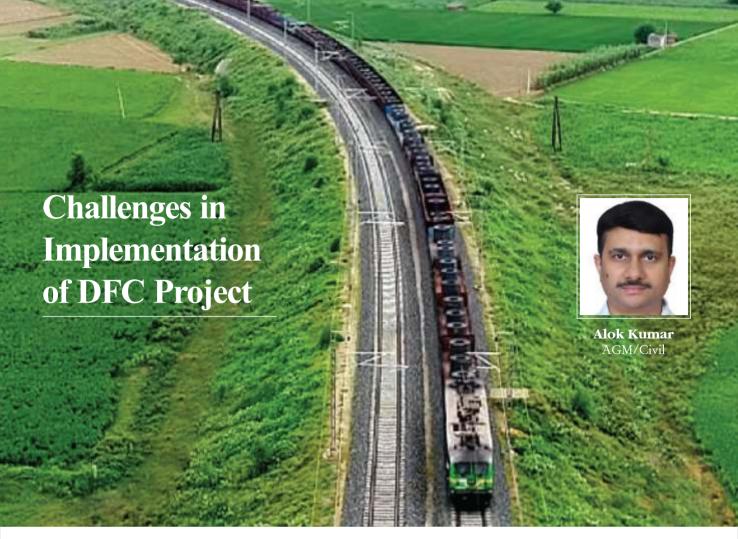
Pic courtesy : Aaryan Media Productions Captured by Aiay Pandey

All the challenges relating to land acquisition, fixing DFC track parameters, issues pertaining to best suited alignment, issues relating to traction and signalling were resolved as estimate preparation and land acquisition was dependent on them. The junction issues were very critical and needed modification from RITES proposal considering ground realities. Similarly operating and safety issues also had to be backed by new General Rules independent from Indian Railways. It was also decided that DFC will have its Corporate office in 40 acres area acquired at NOIDA near junction of EDFC and WDFC and not in vicinity to appear as adjunct of IR located in Railway area.

The issue of level crossings took almost 5 years to get finalised when in 2012 Railway Board agreed for LC free DFC. 820 LCs on both DFCs were surveyed and decided to be replaced with about 250 ROBs and 570 RUBs at estimated

The latest footprint is opening of about 610 kms on Eastern Corridor (Khurja –Bhaupur, Shujatpur-Ruma and Sonnagar-Mughalsarai . On Western Corridor the portion opened so far is from Rewari to Mehsana which is about 760 kms . The targeted opening of entire Dedicated Freight Corridor is likely to be by 31.03.2023 excepting small portion of Virar to JN Port which may be opened sometime later.

The new Freight Corridors would also enable attention to non bulk traffic which has been left out by Railways. The new capacity created would offer an opportunity to induct customer specific wagons and shifting from WAGON STANDARDISATION to need based WAGON CUSTOMISATION. DFC would bring paradigm shift by market orientation where capacity would be chasing the demand and developing multimodal logistics.



Synopsis

Implementation of a linear project of mammoth size & reach is no easy feat. While, it is well understood that the cornerstones of impeccable planning and adequate resource allocation are imperative for smooth execution of projects, still a lot of constraints and variables do exist in the real world which affect each & every project throughout its life cycle. DFC Project being no exception, has also faced its own share of issues & hurdles and has successfully dealt with them along the way. With concerted efforts of all the stakeholders, approx. 60% of the project has now been commissioned for freight movement and the balance work is in progress. A lot of insights have been gained during the course of project implementation and same are being utilized for tackling new hindrances with a more prudent approach, so that early completion of the entire project can be achieved.

Project Inception

The idea of Dedicated Freight Corridors (DFCs) was conceived in the backdrop of slow movement of freight trains in the Indian Railway network; especially on the golden quadrilateral routes, due to over-utilization of track capacity and prioritisation of passenger movement over freight movement. Accordingly, need for a separate corridor was felt which would enable fast, efficient and time-tabled movement of freight trains and bring down the cost of logistics in the country. Thus, one of the most ambitious railway infrastructure projects in modern India, i.e. creation of DFCs, was announced by the Hon'ble Prime Minister & Hon'ble Minister for Railways in the year 2005.

CCEA Sanction, Project Funding: After rounds of detailed deliberation and formulation of Preliminary Engineering & Traffic Survey (PETS) Report, approval of CCEA for the Eastern & Western Dedicated Freight Corridors along with authorization for expenditure, was obtained in 2008. Since such projects are difficult to fund only through equity, it was decided to supplement the MoR equity with external funding from JICA (for WDFC) & World Bank (for EDFC) as well. After signing of required MoUs, loan agreements for first phase of the project were signed with JICA and World Bank in the year 2010 & 2011, respectively. Whereas, JICA loan for WDFC Phase-II was signed in March 2013 & subsequent World Bank loans were signed based on achievement of the milestones.

It would be worthwhile to note that five to six years elapsed in finalizing the 1st phase loan agreements with the funding agencies. Since the planned debt: equity ratio for the Project was 2:1, it was obvious that the procurement process for all major works would commence only after such funding arrangements were in place.

Land Acquisition

It is one of the most difficult & time consuming tasks in linear mega projects and entails relief & rehabilitation of Project affected Persons (PAPs) spread over many States. For the DFC Project, 10,619 Ha of land has been acquired in 09 States involving more than 03 lakh PAPs. During the acquisition



process, apart from resistance from the PAPs in parting with their land, there were also considerable delays in finalization of land compensation/enhanced land compensation by the local authorities. In the section between Vaitarana-JNPT, out of 3215 Non-Title Holders (NTH) PAPs, about 70 PAPs occupying a length of approx. 430M of alignment still remain to be relocated.

Various court cases also resulted in delayed handing over of encumbrance-free ROW to the contractors. One case of encroachment in Panvel suburban yard of Central Railway, affecting about 1.4 km length of alignment and pending before the Hon'ble Mumbai High Court, was decided only recently. Moreover, certain stretches of the alignment have been declared as forest land after the land acquisition process was over, causing major delays in obtaining clearances from the MOEF&CC.

clearances obtained for the project are summarised as under:

- CRZ-1 Clearance Obtained on 17th Nov-2014, took about 3 years to obtain MoEF&CC clearance.
- Mumbai High Court clearance for cutting of Mangrove trees is
 a mandatory requirement. After CRZ approval, Hon'ble
 Mumbai High Court's approval was obtained on 02nd
 March 2015. However, Hon'ble High Court's approval
 for the mangrove trees of the supplementary proposal is
 still awaited.
- DTEPA clearance Obtained on 2nd June 2015, took almost 5 years.
- Forest clearances & permission for tree & mangrove cutting DFCCIL got final approval for diversion of 58.1498 Ha. of forest land from MOEF in December 2015. Due to revised notification of 2017, even private land with mangrove area



Aerial view of Land acquired by DFCCIL

Change of Alignment -

Due to protest by the PAPs, alignment at a few locations were changed from detour to parallel section or vice versa. One of the major changes was in Kalol-Palanpur-Iqbalgarh section in which about 140 kms length of alignment was made parallel to IR alignment from the approved detour alignment, involving redoing of alignment survey, EIA, SIA, designs etc., resulting in major delay.

Statutory Clearances & NOCs (2010-till date): Obtaining statutory clearances from various Authorities also took considerable time and the process is still continuing. Major

have been declared deemed forest land resulting in additional forest clearances in the Mumbai area. This process took considerable time, necessitating processing for Hon'ble Mumbai High Court Clearance for cutting of mangroves in such areas, which is still pending before the Hon'ble High Court.

- Clearance from Inland Waterways Authority on construction of bridges over Major bridges required due to issue of notification by IWAI in 2015, obtained on 21st November 2016, resulting in modification in span/heights of important bridges.
- Clearance of Standing Committee on NWLB of Hon'ble Supreme Court, on Sanjay Gandhi National Park (SGNP)



Mumbai received on 24th January 2013.

- Permission under Wildlife Protection Act 1972 for land falling in Balaram Ambaji Sanctuary obtained on 19th March 2013.
- Environmental clearance for construction in Aravali Hills obtained on 20th April 2015.
- Taj Trapezium Zone (TTZ) clearance.

Further, revision of requirement by local authorities for road-under-bridges (RUBs)/road-over-bridges (ROBs); increasing width, addition of span, increasing clearances, introduction of new bridges etc., led to variation in design-build contracts and delayed the execution of work. For shifting of utilities, NOCs were initially obtained from different utility owners while framing the scope of the contracts, however, at the time of approval of GADs, the owners revised their requirements, causing unnecessary delays in shifting of utilities.

In addition, the time-consuming process of obtaining royalty permission for borrow earth for construction of embankments, especially in Maharashtra State, has been one of the major impediments in timely execution of the work. Further, compliance of additional requirement of proof checking of designs from IITs/CBEs for RFOs and other important bridges also took its own time.

Procurement -

Due to external funding of the project, procurement process began with selection of Engineering Services (General) Consultant for preparation of Pkg. cost estimates, duly factoring in the Special Terms for Economic Partnership (STEP) component in the case of WDFC. Thereafter, the process of International Competitive Bidding (ICB) with JICA/WB guidelines followed by a five stage evaluation process, including continued compliance with PQ requirements, was carried out for each contract package. The process has been a long drawn one; spanning up to approx. 1.5 years in each case, more so due to the requirement of approvals/NOCs by funding agencies at each stage of the tendering process; Bid Documents, PQ, RFP, Bid Opening, Evaluation, LOA, Agreement, Commencement, Effectuation etc., coupled with repeated requests by the bidders to postpone the Bid opening date.

In a few cases, retendering also took place due to cancellation of offers as well as very high rates quoted by bidders. Further, limited participation from Japanese firms in the bidding process for WDFC also delayed the procurement to some extent. JICA loan agreement stipulates that the lead partner in the bidding consortium/JV has to be a Japanese firm, however, only a few such consortiums could bid for the works, despite having various road shows by MoR/DFCCIL in Japan.

Execution

The project is being executed with Design Build Lump Sum (DBLS) contracting methodology, wherein the design is to be



Twin ROB in Palanpur - Mahesana section of WDFC

Pic courtesy : Aaryan Media Productions Captured by Ajay Pandey



prepared by the Contractor and scrutinized by the Engineer/PMC. There have been numerous instances of inordinate delays in finalization of designs & drawings, leading to delay in commencement of the execution itself.

Further, post-contract award statutory clearances given by Authorities; MoEF&CC, CRZ, IWAI, came with additional requirements, e.g. construction of stilt/viaduct instead of earthen embankment in 1.67 kms of the Coastal Regulatory Zone (CRZ-1), alteration of water spans in the bridge over river Narmada, etc., which also affected the pace of execution of work. Discovery of more number of utilities during the execution, than initially envisaged, coupled with delay in shifting of utilities by the utility owners, also shifted the timelines forward.

Limited experience of the stakeholders; Contractor, PMC & DFCCIL, in Design Build Lump Sum contracting system for implementation of railway project in India, also delayed the process of conclusion of issues/designs/variations etc. In addition, poor planning and inadequate resource mobilization by the Contractors too affected the project to a great extent. Frequent replacement of Sub-Contractors/Vendors and irregular payments to them caused unsolicited delays, despite relaxing the stringent Design & Build contract conditions regarding stage completion of work which had earlier caused cash flow constraints in the contracts. Further, there has also been an acute paucity of funds with State Govts. for construction of ROB approaches, leading to delay in completion of ROBs and closure of LCs. The issue has been

addressed through tripartite MoUs; signed with State Govts. & MoR, for release of advance payment for the purpose.

Limited working season, especially in Gujarat & Maharashtra area due to heavy Monsoon rains, also affected the progress of works.

In Delhi NCR Region, ban on construction activities by National Green Tribunal (NGT) to check air pollution during winter months also affected project progress every year. Further, widespread impact of the COVID-19 Pandemic and consequent lockdowns on construction activities is well known to everyone. Apart from causing cashflow issues in contracts and low morale among the workforce, the pandemic also affected the entire supply chain and made it very difficult to arrange adequate resources for the project, i.e. raw material, labour, skilled staff for operation of various construction machineries etc., creating a considerable gap in the execution process.

Conclusion

Work on 1662 Route km (58.50%) of the Western & Eastern Dedicated Freight Corridors has been completed. Having faced various challenges during each stage of project implementation and new insights gained in the process, execution of remaining work is being taken up with utmost vigour & positive approach to complete the balance sections as per the timelines given by PMO & MoR. With collective efforts of all the stakeholders, the objective can definitely be achieved.



Railway flyover (ETMJ - 4) in Bhaupur-Khurja section of EDFC

Pic courtesy : Aaryan Media Productions Captured by Ajay Pandey

Whenever there is a challenge, there is also an opportunity to face it, to demonstrate and develop our will and determination.

— Dalai Lama



Stakeholders Speaks



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JICA

JICA is committed towards the development of infrastructure in India. Western Dedicated Freight Corridor project, begging funded by JICA will make a far-reaching contribution towards India's economic development. Dedicated Freight Corridor Corporation of India Ltd (DFCCIL) has been relentlessly working with contractors of Indian & Japanese consortium to achieve the completion of the entire 1500 km corridor between Dadri-Delhi and Mumbai. We look forward to continue working with our Indian friends on this important project.

SAITO Mitsunori Chief Representative, JICA India office





Ministry of Coal

Dedicated Freight Corridor Corporation of India Ltd. (DFCCIL) is one of the largest infrastructure projects in India formulated to transport Goods along the two major routes of the Golden Quadrilateral. Its Eastern corridor will give a big boost to coal transport from the mines in the eastern part of the country to the power houses in Northern India and reduce the transit time substantially. DFCCIL will play a major role in reducing transportation cost in the country and even lead to softer electricity prices.

Dr. Anil Kumar Jain IAS Secretary, Ministry of Coal





World Bank

The Dedicated Freight Corridor being built by DFCCIL is a world-class project that will transform the way freight is carried across the country. The corridor will support longer, faster and heavier trains, going a long way in reducing India's high logistics costs and making rail transportation more efficient. Moving freight from road to electrified rail will also consume far less energy and substantially reduce GHG emissions. The World Bank is proud to be associated with DFCCIL in this endeavour, one of India's most ambitious railway projects since independence., the World Bank's Country Director for India.

Auguste Tano Kouamé Country Director, World Bank India (







L&T



Dedicated Freight Corridor is part of India's most ambitious railway project since independence. DFCCIL has pioneered the construction of Heavy Haul Dedicated Freight Corridor connecting major ports in the western and eastern shores to the hinterlands and other economic zones.

L&T is proud to be associated with DFCCIL in these prestigious projects. We are executing significant scope in WDFC and EDFC projects across all domains viz. Civil & Track, Special Bridges, 2*25kV Overhead Electrification, advanced Signalling & Telecom systems on a design build basis.

My heartfelt appreciation to the DFC leadership and its team who have worked tirelessly in leading these enormous projects and bringing them to fruition.

S. N. Subrahmanyan

. Subranmany CEO/L&T





GMR



It is a matter of great pride and privilege for GMR Group to be associated with the Indian Railways' prestigious Eastern Dedicated Freight Corridor Project.

Completion of this Marquee Project will boost sustainable economic development of Industries and MMLPs along the Corridor and redefine the dynamics of goods/minerals transportation.

The Dedicated Freight Corridors and Gati Shakti National Master Plan will provide multimodal connectivity infrastructure in line with Hon'ble Prime Minister's vision to enhance railway market share in the country's cargo handling.

GMR Group is committed to create world class state-of-the-art sustainable assets and shall continue to foray into the sectors of National importance for developing New India.

GM Rao

Chairman, GMR Group





ALSTOM



Alstom takes this opportunity to congratulate entire DFFCIL family on its FOUNDATION DAY. It has already been proven beyond doubt that Dedicated Freight Corridor is a major game changer in our country's landscape and is one of the major contributors to Gati Shakti initiative of GOI.

In association with DFFCIL, Alstom is proud to have successfully delivered India's 1st Dedicated Freight Corridor from Khurja to Bhaupur (351 Rkm) on 29thDec 2020, inaugurated by Hon'ble Prime Minister of India Shri Narendra Modi. Alstom is proud to introduce many technological firsts in this project including construction of State-of-the-Art Operational Control Centre at Prayagraj. Alstom is proud to be part of this nation building exercise under the leadership of DFCCIL team."

Mr. Pradeep Takale

Director ALSTOM System IPL





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SIEMENS

India is among the fastest-growing major economies in the world. To ensure sustainable growth it is necessary to introduce a cleaner mode of transport and raise the efficiency of its freight transportation system. The Indian Railways, the fourth-largest rail network in the world and transporting over one billion tons of freight traffic annually is enabling this growth prospect. The Dedicated Freight Corridor (DFC) is instrumental in realizing this goal, with PM Gati Shakti set to enable faster implementation of DFC in the country.

DFC is one of the largest rail infrastructure projects in the country. It is poised to revolutionize the freight transport system by enhancing speed, reducing costs, and increasing connectivity with its state-of-the-art technologies. Siemens has been part of this rail transformation journey for the past 70 years in India. As part of this long-standing partnership, we are implementing state-of-the-art signalling and telecommunication system. DFC is also seen as a catalyst for the development of economic zones alongside the corridor. Under the Gati Shakti plan, DFC will connect major ports and industrial zones for faster movement of goods.

We are proud of our association with DFCCIL in nation-building. With our solutions, we aim to improve capacity, punctuality and reliability whilst maintaining a very high degree of safety in rail operations.

Gunjan Vakharia, Head of Mobility, Siemens Limited





MINISTRY OF FINANCE



There is no doubt that Dedicated Freight Corridors will bring revolution in the freight movement in India. They will play a key enabler role in the economic and social growth of the country in the coming years, by providing unprecedented connectivity and market access to the local industries. Thus, the role of DFCCIL has been envisaged as one of the major partners in achieving the Infrastructure Vision 2047.

Aman Garg,
Director, Department of Economic affairs,
Ministry of Finance

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Modal Shift to Rail- Prospects and Challenges



Dedicated freight corridor boosts modal shift from road to rail

Container cargo transported through railways (Rail volumes) grew by a healthy year-over-year rate of 17.63% to 74.38 million metric tonne (MMT) during FY22 as compared to 12.51% growth in overall container cargo volumes. The rail coefficient also expanded by 115 bps to 26.70% during FY22, mainly supported by partial connectivity of the dedicated freight corridor (DFC) with Mundra and Pipavav ports on the western coast. This marks the beginning of the modal shift from roads to rail.

Slated completion of the prestigious DFC project by June 2023, growing movement of cost-effective double-stack container trains and incremental volumes of cement cargo through railways are prominent factors for the switch from roads to rail. CareEdge Ratings believes that transit assurance under DFC with a reduction in transit period by 40-50% for some of the routes shall accelerate this transition. Based on estimates, inventory carrying cost constitutes 43% of the overall cost of logistics. Thus, a significant reduction in transit duration is

expected to help in achieving Just-In-Time based inventory management thereby boosting the cost competitiveness of domestic goods. Nevertheless, establishing first-mile last-mile connectivity through electrification of feeder routes, container freight terminal and warehousing capacities are crucial for achieving the envisaged modal shift.





Modal shift expected in some of the bulk cargo categories

Indian railway's freight is dominated by a few bulk commodities like Coal, Fertilizer, Iron-ore and raw materials for steel. The government of India allowed transportation of bulk cement in containers in FY22, which is beginning to aid rail volume growth for containers and could add incremental annual volumes of 10-12 MMT by FY25. Rail volumes are expected to be buoyant due to DFC benefits and cargo diversification in container volumes.

Care Edge Ratings expects container rail volumes to grow at a healthy compounded annual growth rate (CAGR) of 15.60% for FY2022 to FY2025 with steady improvement of the rail-coefficient to 31% and incremental volumes from cement.

Growth in rail container volume Vs overall container volume and Rail-Coefficient _____



Land lease policy to improve privatization prospects and aid multimodal logistics ____

Higher land lease payment to Railways is one of the hurdles for the rail logistics segment. However, in September 2022, the Union cabinet approved a reduction in the railway land lease fee from 6% of the market rate of land per acre to 1.5%. The lease period has also been extended from the prevailing period of five years to 35 years. The new railways land lease policy is also a positive catalyst for the privatisation of the rail logistics sector and the development of 300 cargo terminals (in line with PM Gati Shakti framework).

National Logistics Policy to integrate data exchange among stakeholders

National Logistics Policy (NLP) aims to bring down the logistics cost of India to less than 10% of Gross Domestic Product (GDP), in line with other developed countries from the existing level of 14%.

Development of the Unified Logistics Interface Platform (ULIP) allows data exchange among stakeholders, which will improve work efficiency in the logistics sector by providing real-time information to all stakeholders and thus strengthen India's international competitiveness.

Higher haulage rates and need for regulator for railways continue to be a challenge _____

The haulage rates are periodically notified by the Indian Railways and the charges paid by container train operators form 65-75% of their total operating expenses. As per a World Bank report, while $\sim 60\%$ of the capacity of the rail network is deployed for passenger transport, the segment contributes only $\sim 30\%$ to Indian Railway's freight revenue. This translates into extensive cross-subsidisation of passenger fares with freight fares reducing the competitiveness of rail freight over roads.

CareEdge Ratings opines the need for an independent regulator in railways from three key perspectives: (i) rationalising the freight tariff by determining the optimum level of cross-subsidisation of the passenger segment with the freight segment (ii) facilitating private participation by ensuring the protection of their interests, and (iii) transparent dispute resolution mechanism.

Conclusion

The rail co-efficient expanded by 115 bps to 26.70% during FY22, mainly supported by partial connectivity of the dedicated freight corridor (DFC) with Mundra and Pipavav ports on the western coast. CareEdge Ratings expects container rail volumes to grow at a healthy CAGR of 15.60% for FY2022 to FY2025 with a steady improvement of the rail-coefficient by 430 bps to 31% and incremental volumes from cement.

CareEdge Ratings believes that transit assurance under DFC with a reduction in transit period by 40-50% for some of the routes and over 3 x growth in the movement of cost-effective double stacker container trains by FY25 shall accelerate this transition. The new railways land lease policy is also a positive catalyst for the privatization of the rail logistics sector and the development of 300 cargo terminals.

Nevertheless, prevailing high haulage rates for operating container trains due to extensive cross-subsidization with passenger freight, challenges in establishing first-mile last-mile connectivity and the absence of regulators in Railways unlike roads and airports are the major bottlenecks for the modal shift of cargo from roads to rails.

How Gati Shakti is transforming Indian Logistics



Nav Goel, IRAS DGM/Finance



A recent paper by IMF on "Road Quality and Mean Speed Score" ranked India 127th among 162 countries in terms of road transport speed. The USA is the fastest country, with a mean speed score of 107 kmph, while India has a mean speed score of 58 kmph. Unsurprisingly India has high logistics costs of around 13-14% of GDP as against 8-10% in the USA and Europe.

Reducing logistics costs is a sine qua non for India, one of the fastest growing economies and where freight activity is expected to grow five-fold by 2050. India's Logistics Ecosystem plays a critical role in achieving the national priorities of Atmanirbhar and globally competitive Bharat by ensuring quick, efficient, and economical transport of goods across India.

Often disjointed planning lacking synergy amongst the various ministries leads to infrastructure being under-utilised, outdated, or congested by the time it's finally completed. Out of the ambitious investment plan of Rs 111,30,428 Crores under the National Infrastructure Pipeline (NIP), 36,66,028 Crores is envisaged for Road, Rail, Ports, and Airports, i.e., approximately 33% of NIP is towards the Logistics Sector Projects. With such a vast investment plan, India cannot afford business as usual, and there is a need for holistic, integrated, and synchronised planning between the various modes of Logistics.

PM Gati Shakti Master Plan is aimed to tackle the above challenges. It provides a comprehensive database of ongoing and

future projects of Infrastructure Ministries of Centre and States. The data will be integrated with 200+ GIS layers with visibility to various stakeholders so that planning, designing, and execution can be done with a shared vision. Project delivery will achieve efficiency through collaboration, coordination, data-backed project planning and real-time data analysis.

One of the main themes of Gati Shakti is multi-modal connectivity. It aims at seamless integration of systems and policies alongside efficient project management. Gati Shakti projects will leverage technology extensively including spatial planning and data analysis tools. This techno-enabled approach to Infrastructure development where data on project geography, with multiple layers of project information of 16 Infrastructure ministries, all integrated into a single database will ultimately break the silos of information management and enable faster decision making creating a targeted pace of development hence appropriately named as Gati Shakti.

For instance, road construction involves multiple stakeholders, NHAI being responsible for the roads till district headquarters, State PWD or Rural Development Department comes into the picture thereafter and BRO looks after border areas. Gati Shakti will help in the coordinated completion of roads at the same time, thereby providing seamless connectivity and opening various opportunities. Similarly, though the creation of new or



upgradation of existing Railway Station is the responsibility of the respective Division of Indian Railways, but the approach road comes under the ambit of the State Government. The lack of coordination between the two executing bodies may result in the non-utilisation of newly created public infrastructure. Dynamic mapping of brownfield and greenfield projects on the Gati Shakti GIS Portal, with real-time updation, will provide visibility to implementing agencies to align their priorities properly.

Gati Shakti plan also aims to develop a nationwide network integrating digital systems of various ministries dealing with logistics under one platform known as ULIP (Unified Logistics Interface Platform) for facilitating minimal documentation, real-time information and faster movement of goods. Availability of quality data in ULIP integrating various data sets such as LDB of NICDC, FOIS of Indian Railways, Vahan Saarthi of MORTH, ICEGATE of Customs Department, FAST'ag of NPCI etc opens a plethora of opportunities and use-cases for increasing the efficiency of Indian Logistics.

One such use case can be finding the most appropriate mix of the fleet, and the most optimal route. With the help of ULIP Data and AI-driven route optimisation solutions, a Zardozi Saree manufacturer sitting in Bareilly and exporting Sarees to Berlin can accurately choose the shortest, most efficient, and most cost-effective routes suiting his requirements. This may look like present-day Google Maps, which shows various alternate modes of commuting and their respective times.

As of today, there is not much visibility about the predictive freight rate trend, supply-demand gaps, truck utilisation factors,

corridor congestion data etc. Combining ULIP Data with AI and ML tools can lead to a prediction of trends and evidence-based intervention can be done both by Government and private entities.

The Indian logistics industry is still largely disorganised and fragmented and suffers from a skewed intermodal mix. For instance, in 2020, Rail's share stood at merely 18% as compared to Road's share of 71%. In India, the average lead of freight transport is around 550 Km, and for such long-haul transport on dense corridors, it is known that Rail transport is economical and environment friendly. However, hassles of multiple loading and unloading owing to lack of last mile connectivity have resulted in a lower share of Rail vis-à-vis Road Transport.

With greater emphasis on data-backed based holistic planning, enhancement of infrastructure to cater for the needs of the future, multimodal connectivity, and rationalisation of processes, it is expected that pieces of the Indian logistical puzzle will fall in right place to make India, globally competitive.



Self-driving vehicles will automatically choose the most efficient route.

Artificial intelligence will dramatically improve logistics ??

Dave Waters

Auto Fault Locator For 2x25 kV AC Traction System Ravi Bhushan GM/EL/WC-II Pradeep Kumar Bhatt DGM/EL/WC-I

Abstract

In conventional 25 kV AC traction system, being linear in nature, the protection given by numerical relays is generally satisfactory and distance and impedance measured by relay are linear and hence are within limits. However, in $2 \times 25 \, \text{kV}$ system (also known as 25 kV AT Feed System), due to installation of autotransformers at regular intervals, distance protection relays does not give precise location of ground faults. The reason is that the ratio between impedance and distance to the fault point is not linear in these electrification systems, unlike in $1 \times 25 \, \text{kV}$ power systems. Therefore, the location of ground faults represents a complicated task in $2 \times 25 \, \text{kV}$ railway power supply systems.

In DFCCIL stations are about 40 km apart and TSS are about 60 km apart. To find location of fault is very difficult and time consuming and thus adversely affects train operation.

This paper discusses technique employed in WDFC for accurate location of fault within ± 200 m by use of Auto Fault Locator which work on the principle of AT neutral current sensing. The location given by the fault locator can be integrated with SCADA for localization of fault.

Introduction .

Currently, the most widely used electrical configuration to feed heavy haul freight trains is the 2 × 25 kV ac traction power system. The use of this system, compared to the traditional $1 \times$ 25 kV ac traction power system, allows the required number of traction substations erected along the line to be reduced, because it has lower losses and lower voltage drops along the line. In 2×25 kV system, each traction substation feeds two sections, one in each direction of the line. Each section consists of several subsections of similar length that are delimited by auto transformer stations (ATS). These autotransformers have two terminals; one is connected to the positive conductor at 25 kV (catenary), while the other is connected to the negative conductor, also at 25 kV (feeder). The midpoint of its winding is connected to the rail and ground. Another auto transformer is installed at the end of the section and is connected in the same manner as the intermediate auto transformers (Figure 1).

Figure 1.Simplified diagram of a 2×25kV ac traction power system and current distribution while a train travels in subsection B.

Electrical installations need adequate protection to ensure a reliable and safe operation. Faults in the system cause severe disruption in train services. Therefore, it is very important to detect and locate the point where the ground fault has occurred in order to isolate the subsection of the fault so as to quickly restore traction supply in other sections for train operation and repair the failure as soon as possible.

In AC electrical traction systems, the most-used method for measuring the distance from a traction substation to a ground fault is the impedance method due to its stability, reliability and simplicity. However, in $2\times25~kV$ traction power systems, it is not possible to determine the distance from the traction substation to the ground faults in an acceptable manner with this method. This is due to the presence of auto transformers that make the ratio impedance to distance non-linear. This necessitates the use of a technology, which is independent of the system impedance measured by the protection relays.

In order to overcome this problem Auto fault Locator based on Auto Transformer neutral current sensing has been adopted in the electrification works of Western DFC project.

Behavior of fault in 2x25 kV system

Figure-1 shows the simplified scheme of an electric section that is fed by a 2×25 kV power system with three subsections (A, B and C) delimited by intermediate auto transformers ATS1 and ATS2. At the end of the section, an auto transformer ATS3 connects the three conductors. Also, the distribution of currents in the conductors is represented when a train travels in the intermediate section B. Accordingly, when a fault occurs between the catenary and rail or between the feeder and rail, there is a significant increase in the current flowing in the windings of the closest auto transformers to the position where the fault has occurred. In addition, the angles between these currents and voltages between the catenary and rail change at the location of the auto transformers. The power factor of modern 3-phase locomotive driven trains is close to the unity, so the

impedance seen from the auto transformer is mainly resistive. In a line feeding trains in normal operation without any faults, these angles are close to 180. But if a ground fault arises, the impedance seen from the autotransformer can be the catenary

or feeder inductance. So, the angle between currents and voltages in the auto transformers closest to the fault changes increasing 90° or decreasing 90° because they are reactive currents without resistance component. In the case of ground fault between the catenary and ground, the angle between the currents and voltages in the nearest auto transformers is approximately 90°. However, if the fault occurs between the feeder and ground, the angle between the currents and voltages in the nearest auto transformers is now approximately 270°.



Generator



During last type of fault (Feeder to Ground) the angles between the currents and voltages in the nearest auto transformers are shown in Figure 2.

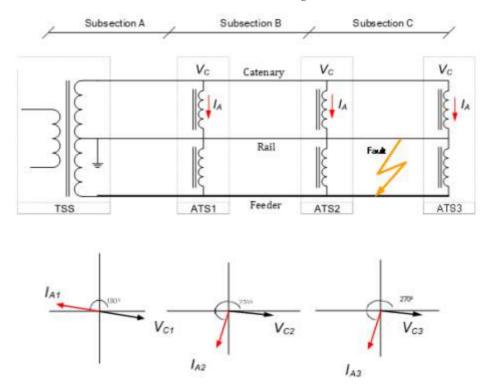


Figure 2. Angular difference between currents (IA) and voltages in catenary (VC) in auto transformers with fault between feeder and ground in subsection-C.

Similarly, for the fault between catenary and rail related phase angle between voltages and currents is indicated in Figure-3.

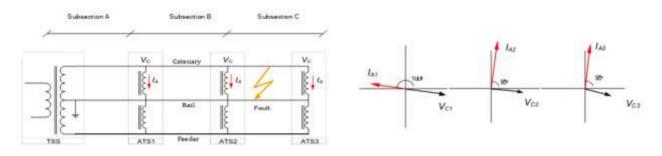


Figure 3. Angular difference between currents (IA) and voltages in catenary (VC) in auto transformers with fault between catenary and ground in subsection C

Therefore, if the currents and voltage values, including the phase angle difference between them, are measured in the autotransformers, when a fault occurs between any conductor and the ground, it is possible to identify in which subsection the fault took place, and which conductor had such a fault.

History of Automatic Fault Locator

AFL is a co-developed product by TSUDA electric meters and Japanese National Railways in 1971. In Indian railways the AFL was first provided in Bina-Katni section in the year 1993. It has been introduced 100 % on $2\times25\mathrm{kV}$ (AT) feeding system represented by Shinkansen in Japan. In addition, AFL has been introduced in South Korea, Australia and Taiwan.



AFL being supplied in EMP-4 project has been developed by M/s Tsuda electric meters CO.,LTD, Japan

Working principle of Auto Fault Locator

Automatic Fault Locator (AFL)is an equipment to calculate the fault point distance when a short-circuit fault (or earth fault) occurs between T-R (Trolley or catenary and Rail) or F-R (Feeder and Rail). AFL calculates fault point distance using the following characteristics of 2x25kV Feeding circuit:

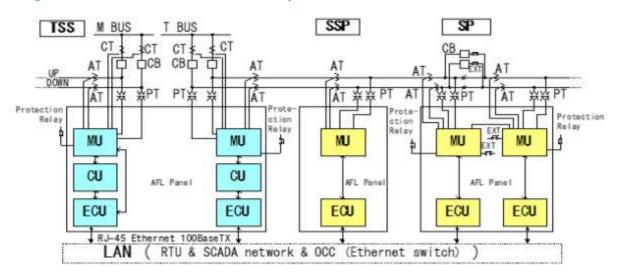
- a) In 2x25kV Feeding circuit, AT at each supply control post works as power supply source.
- b) ATs at either side of fault point, the current caused by short-circuit (or earth fault) flows to AT neutral point through rails those are connected each other.
- c) AT neutral current is inversely proportional to the distance from each AT to the fault point.
- d) When a short circuit-fault (or earth fault) occurs, AFL

- measures each AT neutral current at the same time and calculates the fault point distance.
- e) To measure the current, current transformers are installed in the neutral bushing of AT.

When a short circuit or earth fault occurs, the operation of protection relay acts as a trigger and AFL starts measuring each AT neutral current at the same time and calculates the fault point distance. Furthermore, AFL calculates phase angle by comparing voltage between T-R and AT neutral current so that AFL can judge whether a short circuit fault (or earth fault) has occurred between T-R or F-R.

However, any fault between feeder and catenary will not be detected as AT neutral current is not sensed.

Configuration of Automatic Fault Locator system



AFL unit consists of the following components:

- Measuring Unit (MU): This is provided in TSS, SP, SSP-A & ATS locations. MU measures the voltage and current and sends to CU.
- ii) Calculating Unit (CU):- This is Calculating Unit for AFL installed in TSS. This unit collects the data measured by MU(TSS), MU(SSP/ATS) and MU(SP).
 - CU sends the following data to OCC.
 - a) fault point distance.
 - b) AT neutral currents measured at each post.

- c) feeder currents measured at TSS.
- d) T-R and F-R ground fault judged result
- iii) Ethernet Converter Unit (ECU)- This is Ethernet Convertor Unit for AFL installed in TSS, SP, SSP and ATS. This converts the data between CU and RTU and has the data storage function. This also converts the data between MU(TSS) and MU(SP) and MU(SSP/ATS).
- iv) Ethernet Switch (ESW): This is Ethernet switch for AFL installed in TSS, SP, SSP and ATS. The communication between ESW and RTU has dual redundancy.

AFL operation during fault

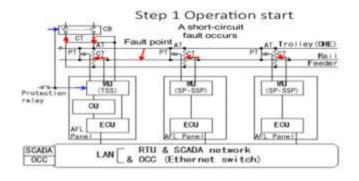
When a fault occurs, a feeder protection relay output triggers signal for circuit breaker and Automatic fault locator. On receiving the trigger signal, MU (TSS) starts to measure the neutral currents, feeder current and the potential of Trolley (contact wire) line. At the same time, MU(TSS) sends operation command to MU(SP) and MU(SSP • ATS).

Measured data at MU (TSS) are sent to CU. Simultaneously, CU receives the measured data from MU(SP) and MU(SSP • ATS). CU further analyzes the input data and sends the information to OCC.

The sequence of operation of AFL after initiation of fault is indicated in following steps:

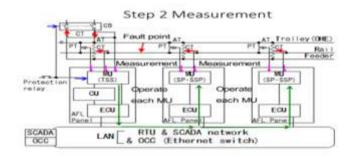
Step 1: Operation start

When a short-circuit fault occurs between OHE and rail or between Feeder and rail, a protection relay in TSS operates. Protection relay outputs a trip-signal to the Circuit Breaker and MU. MU starts operation in TSS.



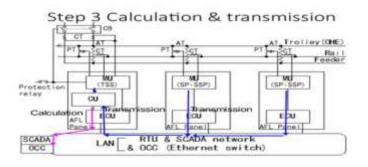
Step 2: measurement

MU in TSS transmits a start signal to MU in SP and SSP/ATS through ECU and LAN. Then MU in SP and SSP/ATS start its operation. Each MU starts measuring current and voltage at their respective location.



Step 3: calculation and transmission

After measurement, MU(TSS) transmits the data to CU. Also, MU in other posts transmit measured data to CU through ECU and LAN. CU calculates fault point distance based on the transmitted data. The calculation result is transmitted to Operational Control Center through ECU and LAN.



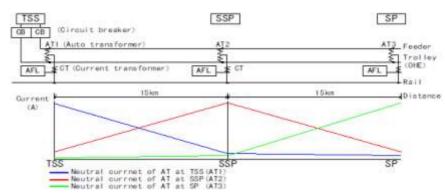


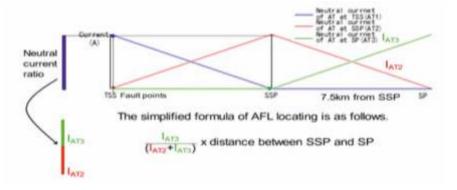
Fault Locating Methodology

In 2x25kV feeding system, neutral current measured at both side ATs from the fault point is proportional to the fault point distance. AFL locates the fault point based on this feature.

This is the neutral current graph and simplified feeding system that is composed of TSS, SSP and SP.

If there is a fault point in between TSS and SSP, current of TSS decreases linearly with distance from the fault point. On the other hand, current of SSP increases linearly. Similarly, if there is the fault point in between SSP and SP, current of SSP decreases linearly with distance from the fault point and current of SP increases linearly. The graph below is the simplified model of neutral current ratio against fault point distance from TSS. When the fault occurs in the middle point between SSP and SP, the simplified formula of AFL locating is as follows. IAT3 is divided by IAT2+IAT3 and multiply it by the distance between SSP and SP. This formula gives fault location from SSP.





System Requirement

For proper working of the AFL system following system requirement has to be complied.

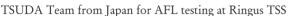
Item s	Specification
Aux. power supply	DC 110V \pm 20%, less than 15W
& power consumption	
Measuring range	Neutral current (AT and/or transformer) AC 0A to AC 50A Fault current (Trolley and/or Feeder) AC 0A to AC 50A Voltage between Trolley and Rail (OHE and Rail) AC 0V to AC 220V
Accuracy	Measuring accuracy of Fault locator is ±1.0% except CT accuracy
T-R or F-R short-circuit fault judging function	T-R or F-R short circuit fault judging from phase angle of AT neutral current and T-R voltage
Network Interface	RJ-45 Ethernet 100BASETX
Communication Req.	Two optical fiber channels for communication between AFLs should be connected to each post Communication speed minimum 5 mbps or higher Transmission delay time less than 5 ms (latency)
Trigger signal from protection relay	Potential Free contact



Field trials of AFL system

For proper working of the AFL system following system requirement has to be complied.







AFL at Ringus TSS

AFL has been supplied by M/s TSUDA Electric Meters Co., Ltd, Japan, which is the only manufacturer in the world. Prototype testing the AFL was done at manufacturers facility in Japan. However, there have been accuracy (± 200 m) issues during commissioning in Rewari-Madar section. It was also noticed that there were issues with communication network stability and Q values derived for the sections The issue was taken up with OEM. The OEM visited the site in April-2022 and carried out extensive trials at 72 locations with actual fault simulations in normal and extended feed scenario.

Initially the results were not within the limits. Same was analysed by the team and found that during switch on to fault (SOTF), fault current contain significant proportion of inrush current which in turn lead to inaccuracies in the result. After changing the scheme (insertion of fault in pre-energized system), the results were found to be within desired accuracy limits. Based on these outcomes methodology for testing of the AFL system in other sections has been finalized. Some of the results are tabulated below:



Aerial view of Ateli TSS



	Sub- sector	Mast Location No.	Continuous Chainage in kM	Distance from TSS in kM	Type of Fault	AFL Dis Fault Point (FP)	play Fault Type	Difference in Fault Point in Mtr	Result
Test-1	Hanspur	Kanwat	1214.069	22.654	T-R	22.65	T-R	-004	
	SSP- SP Kanwat SP 1214.069	1214.069	22.654	F-R	22.66	F-R	006	OK	
Test-2	Ringus	SMPR	1191.8225	0.408	T-R	0.31	T-R	-098	2.77
	TSS-Hanspur SSP	South 1191.8225	1191.8225	0.408	F-R	0.45	F-R	042	OK
t-3	Ringus TSS	1124 (40	1124.649	0	T-R	0.03	T-R	030	
Test-3	to Phulera TSS	1124.649	1124.649	0	F-R	0.01	F-R	010	OK



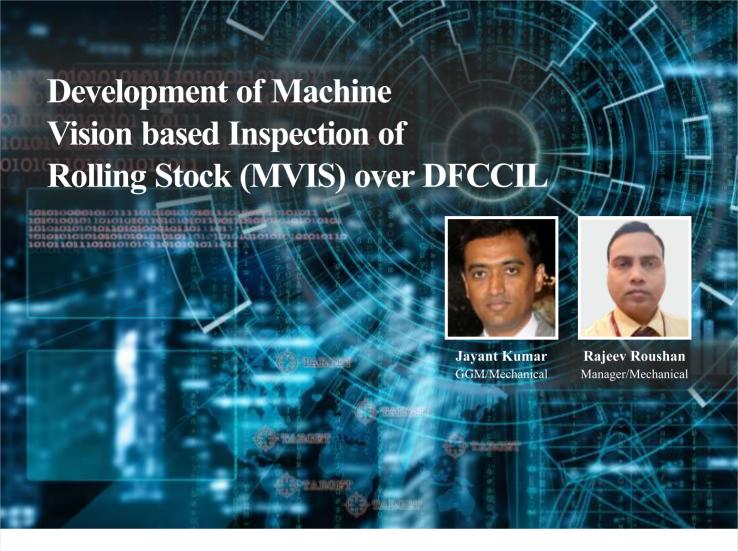
Ringus TSS in Rewari - Madar section of WDFC

Conclusion

Auto Fault Locator is an aid to the protection system that is used to determine precise fault location in $2x25 \, kV$ system. It works on AT neutral current sensing principle. The accuracy of the system is subject to maintaining stable communication link and AT spacing of 13-17 km. The system is still under monitoring and commissioning in the subsequent sections will provide the required inputs for maintaining this system to achieve the accuracy. Proper working of AFL will certainly help in timely attention of breakdowns and isolation of faulty section through SCADA. The knowhow gathered in due course of time will help in implementing this system in railways where $2x25 \, kV$ system is being implemented in large scale.

Enthusiasm is the electric current that keeps the engine of life going at top speed. Enthusiasm is the very propeller of progress.

— B. C. Forbes



Introduction

Machine Vision Inspection System (MVIS) is an automated inspection system consisting of high-speed, high-definition cameras, servers and sophisticated software for capturing high resolution images of the rolling stock defects and its analysis. It uses Artificial Intelligence (AI)/Machine Learning (ML)

algorithms to analyse data and generate alert for rolling stock. MVIS can effectively replace manual rolling in & out examination system. Presently, no such MVIS system has been installed in India for freight or coaching stock.

Need of MVIS

To detect enroute defects, rolling in examination has been started at some locations on DFCCIL but the manual rolling in examination has limitations viz. defects can be detected at very low speeds, poor visibility during night etc. One system which can overcome these limitations is **Machine Vision** Inspection System (MVIS).

Benefits.

MVIS will help in:-

- Saving of manpower and time.
- The system can detect defects in train moving upto 100 kmphwhich otherwise human eye is incapable of detecting.
- Analyzing multiple components simultaneously.
- Storing data for analysis at a later date.



MoU with IISc, Bengaluru for Development of MVIS

DFC has taken a lead to develop and install MVIS system on its corridor. An Expression of Interest (EOI) for development of customized MVIS as per DFC requirements was floated to explore likely sources. After scrutinizing the responses received against the EOI and detailed interaction with the applicants, Indian Institute of Science (IISc), Bengaluru was selected as the partner for this ambitious project. An MOU has been signed on 22.03.2022 between IISc and DFCCIL in this regard. As per this MOU, on successful development of the technology, the

Intellectual Property Rights (IPR) will be shared between DFCCIL and IISc.

IISc is a premier institute for advance scientific and technological research, centrally funded institution, a deemed university & an autonomous body under Ministry of Education, Government of India. Also selecting IISc as a partner for this project meant that DFCCIL in true letter and spirit is encouraging and supporting the 'Make in India' vision & 'AtmaNirbhar Bharat Abhiyan' of GoI.



MoU signing moment between IISc Bangalore and DFCCIL

Development of MVIS

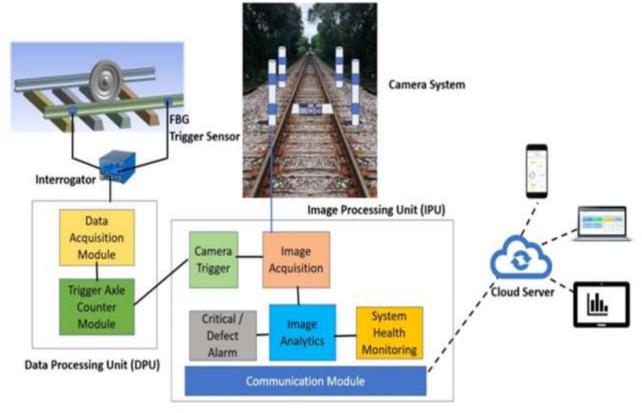
The work is being undertaken in two phases – Phase I is demonstration of Proof of Concept (POC)at one location (New Daudkhan on EDFC)wherein IISc will identify suitable method of installation of cameras, lighting, acquiring of images at different train speeds, development of software for analysis

of images, testing accuracy of software on BOXN variant wagon and development of dashboard. In Phase 2, IISc will undertake improvement of hardware design, fine tuning of machine learning model, development of algorithms for defect detection on other type of wagons.

The list of defects to be captured by MVIS is tabulated below.

SL	Defects	Captured by
1	Broken/Missing Axle Box Covers, Canted Adapter, Missing/burnt/	Side view Camera
	perished EM Pad, Missing/Loose Axle End Cap Screw	
2	Laterally displaced Springs	
3	Broken or missing suspension springs	
4	Open/Hanging Doors of Wagon	
5	Hanging Parts	
6	Missing/bent CBC operating handle	
7	Broken or missing brake beams	
8	Visually detectable structural integrity defects like cracks etc. of underframe,	
	as visible from ground below the underframe between the tracks	
9	Yoke pin support plate bolts missing or broken for CBC stock	Track mounted Camera
10	Damaged Centre sill or other under frame members as visible to the human	
	inspector's naked eye.	
11	Missing or broken Brake gear items (push rod, end pull rod etc)	





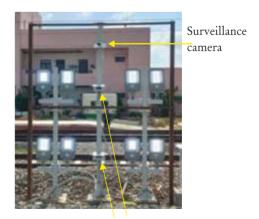
A conceptual overview of the system is given below:

Status of installation of MVIS

The MVIS system consists of 6 area scan cameras (3 on either side of the track) that are positioned in weather-proof enclosures to capture side view images of trains passing through the MVIS zone. One line scan camera is installed between the sleepers (on-track) to capture undercarriage images. A special purpose enclosure has been designed and fabricated to house the line scan camera and LED lighting arrangements. Surveillance camera has also been installed for the safety of the equipments.



Line scan camera with lighting system



Area scan cameras with lighting system

Software development has been completed for identification of defects of springs, Elastomeric pads, axle cap screw bolts, axle cover, open door. Identification of wagon number has been completed. Design and development of image acquisition module has been completed. The annotated images are given into the model for training. The model's output is tested on a running train data where the labelled images are detected.



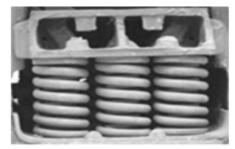






Annotated images of bearing Annotated images of springs Annotated images of bearing parts, springs, EM Pads parts EM Pad & Adapters

Software development for classification of images as healthy and defective has been completed for bogie components & door.



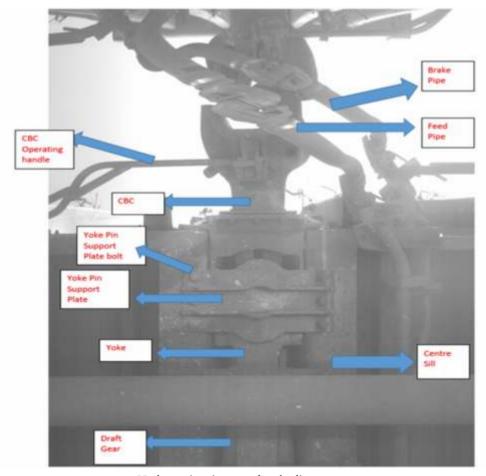




Identified as no missing spring

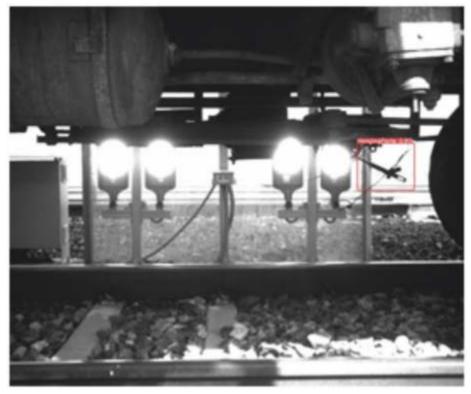
Identified as open door

Identified as closed door



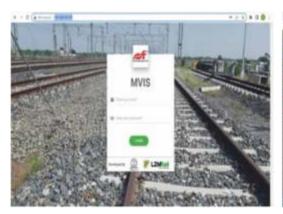
Undercarriage images taken by line scan camera



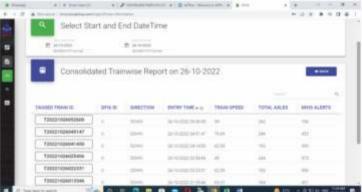


Hanging part (Empty load device) detected

Web Application for user interface has been developed for accessing the system in which train information, alert generation, defect identification, images of defects, various customizable reports would be available. The application will also send alerts via email and SMS.







Analysis of alerts on web portal

The Road Ahead

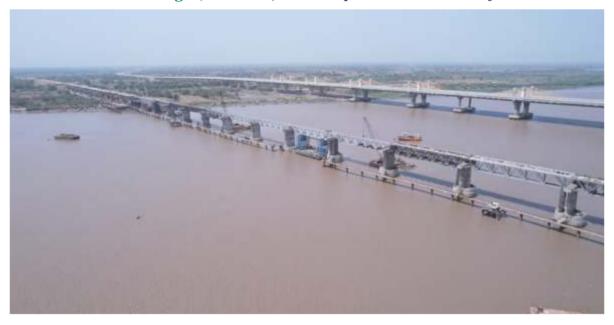
DFCCIL is planning to have a first of its kind integrated system in India - ICMRS (Integrated System for Condition Monitoring of Rolling Stock). Various detection & measuring systems like MVIS, WILD (Wheel Impact Load Detector for wheel condition monitoring) and HABD (Hot Axle Box Detector for measuring axle box temperature), ABD (Acoustic Bearing

Detectorfor monitoring health of axle bearing) will be installed at one location, called Super Site. These systems will be integrated and accessible through single application which will consolidate all vehicle exceptions across installed monitoring systems to facilitate analysis and safe train operation.



Bridges... Backbone of DFC

Narmada Bridge (Bharuch) in Makarpura-Sachin section of WDFC



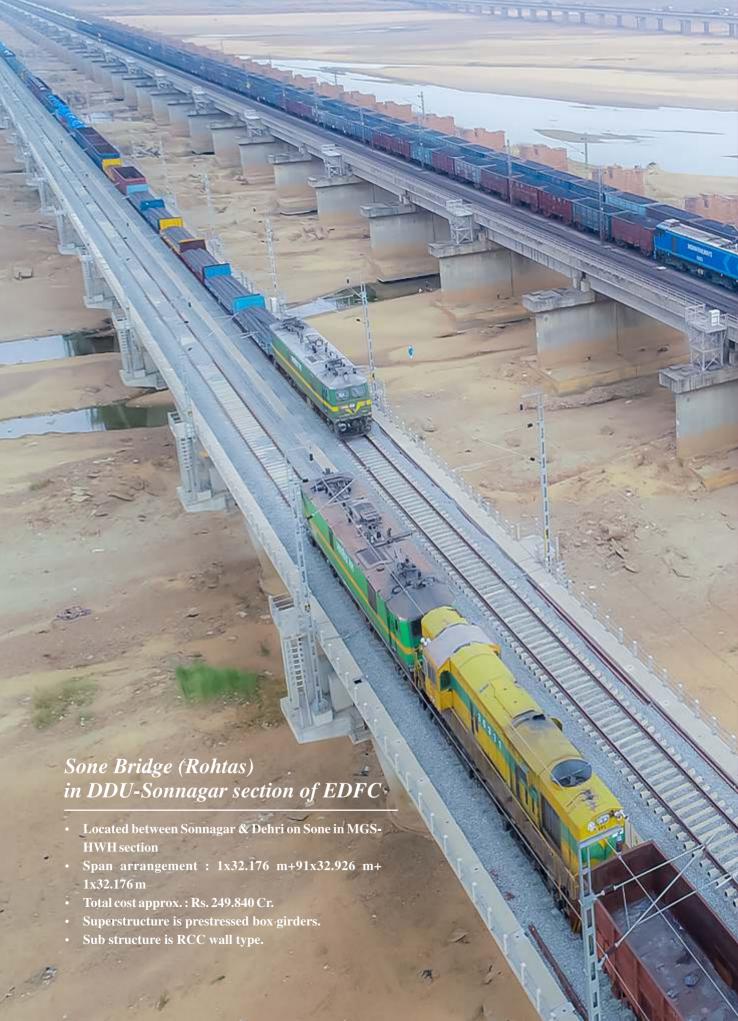
- Steel girder bridge
- Span arrangement 29x48.15 m

- Cost Rs. 330.705 Cr.
- Revised cost Rs. 382.08 Cr.

RFO-25 (Banaskantha) on Palanpur connecting line in Palanpur Makarpura section of WDFC



- Span arrangement: 1x49.703 m + 1x28.595 m.
- Super structure has steel plate girder, RCC composite slab & Prestressed concrete beam slab
- Substructure is RCC wall type
- Foundation used in the RFO is bored cast in situ piles of diameter 1.2 m.







Ulhas Bridge (Thane) in Vaitarna-JNPT section of WDFC



- Span arrangement: 6x79.980 m.
- Total approx. cost: Rs.80 Cr.

- Steel Open Web through type girder
- Substructure is RCC solid

Sabarmati Bridge (Ahmedabad) in Palanpur- Makarpura section of WDFC



- Special type steel bridge
- Span arrangement: length 48.75 m.

- Well foundation
- Steel welded under slung girder with RCC deck slab



Mahi Bridge (Anand) in Palanpur-Makarpura section of WDFC



- Special type steel bridge
- Span arrangement: 12 x 48.75 m.

- Steel welded girder with ballasted RCC deck slab
- Well foundation

Damanganga (Valsad) Bridge in Sachin-Vaitarna section of WDFC



- Span arrangement: 6x 48.5 m.
- Total initial cost: Rs. 70.62 Cr.

- Open foundation
- Open Web through type steel girder



Major Bridge 07 at Narmada Canal in Palanpur- Makarpura section of WDFC



- Major bridge no. 7 on Narmada canal
- Span arrangement: 3x 48.5 m.

- Superstructure as open through type steel girder
- Rail level = 70.571 m., formation level = 69.799 m.

Par Bridge (Valsad) in Sachin-Vaitrana section of WDFC



- Span arrangement: 5x 48.5 m.
- Total initial cost: Rs. 60.63 Cr

- Open web through type steel girder
- Well and pile foundation



Hindon Bridge (Gautam Budhha Nagar) in Rewari-Dadri section of WDFC



- Bridge no. 188 on Hindon river
- Span arrangement: 4x 48.5 m.

- Steel Open Web through type girder
- Well foundation

Tonse Bridge (Prayagraj) in Bhaupur-DDU section of EDFC



- Bridge no. 180 on Yamuna river
- Span arrangement: 11x 48.5 m.

- Steel Open Web through type girder
- Well foundation



Etawah Major Bridge-4 (Etawah) Bridge in Khurja- Bhaupur section of EDFC



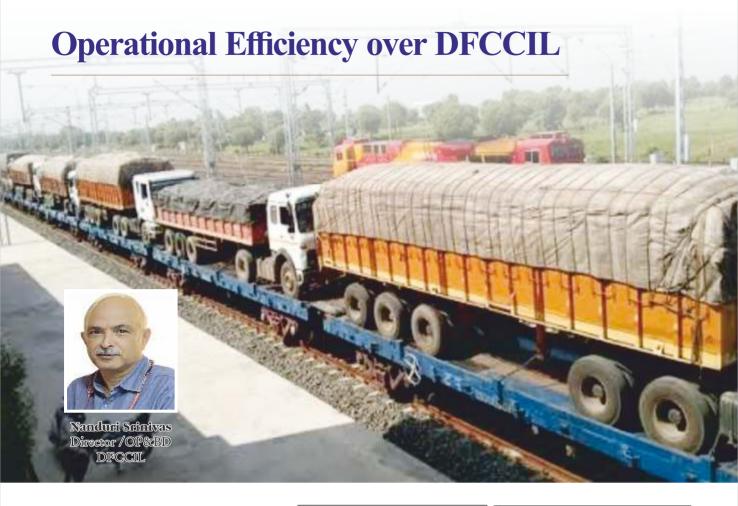
- Span arrangement: 1x67.529 m + 1x75.335 m.
- Open web girder with steel channel slipper
- Substructure is RCC solid type
- Pile foundation

Dadri RFO (Gautam Budhha Nagar) in Khurja-Dadri section of EDFC



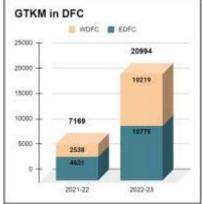
- Span arrangement: 1x76.2 m + 2x45.7 m.
- Total approx. cost: Rs.172.8 Cr.

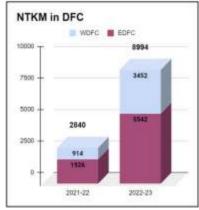
- Two approach viaduct: Dadri & New Boraki side
- Open web steel girders



- DFCCIL have been created as a Line capacity augmentation project with a focussed approach on freight transportation.
- With IT packaging, ease of doing business, Quality of service to be improved
- Overall reduction in unit cost of logistics.
- DFCCIL have been able to bring in enhanced line capacity, improved punctuality and better speeds in DFC and adjoining zones
- Average speeds of freight trains on DFC more than 60 kmph with record maximum average speed of 99.6 kmph.
- Assured / improved transit time of cargo moving via DFC
- System availability being monitored as a result of effective maintenance practices
- Significant improvement in parameters (Apr-Sep)
- Innovative modal shift practices (Trucks on Train)
- Marching towards Net Zero emission









Operation Control Centre: The Nerve Centre of EDFC



The Operation Control Centre for entire EDFC section from Ludhiana to Son nagar is located in Subedargunj Prayagraj, Uttar Pradesh. This state of art of Operation Control Centre was dedicated to the nation by Hon'ble Prime Minister Narendra Modi on 29.12.2022. The Operation Control Centre (OCC) serves as command and control facility of DFC system. Our integrated Operation Control Centre (OCC) platform provides operators with complete visualization and control of every subsystem to guarantee smooth, continuous operations. The OCC control room is the hub of the entire DFC rail service operations. OCC theatre layout will involve all requirement and technology deployed to monitor, control and management of train movement through an intuitive user interface.

Civil Structure- The Building

The tentative area of OCC building is about 6350sq.m (excluding basement parking). The building has basement & 3-floors with central Atrium. It is fully air-conditioned and fully Wi-Fi enabled building and under CCTV surveillance with

dedicated security control room. Building block has Office space with service areas and space for S&T Equipment, Theatre for Control Centre Hall and a Cafeteria. 2 lifts and 3 nos (including 2 Fire escape) of staircases have been provided.



Inauguration of Operation Control Centre in Prayagraj, Uttar Pradesh



Building of Operation Control Centre in Prayagraj, Uttar Pradesh

Site - Services _

The site level services provided for building management include 33KVA Sub Station(1+1) and 2000KVA DG Set (1+1). Sewage Treatment Plant (STP), Bore Hole (BH), UnderGround Water Tank (UGWT), Rain Water Harvesting Pit (RWHP) have been provided to achieve water conservation. Cafeteria has been provided on the ground floor with service access.

Server and Equipment rooms

The space of S&T equipment, signalling service & diagnostic room and telecom networks management system is given on the ground floor. where all NMS workstation will be placed for 24X7 monitoring. All servers Signalling, Telecom & SCADA are installed in server room at Ground floor just below OCC Theatre. SACDA servers and networking eqipments has been provided to monitor 2x25KV OHE system of entire EDFC network.



Monitoring and Maintenance _

Monitoring of Telecom systems such as SDH, PDH, Data Network system, Telephone systems, Video Servilance system, Master Clock system, Voice Recording system, GSM-R system, 48 V Telecom supply and Signalling system through data logger and S&D networks are being done at Ground Floor.







Power Supply for Telecom & Signalling

Ground floor has dedicated space for 48V Telecom supply system and 230V UPS supply system for uninterrupted power back up.



Theatre Block and Video Wall

Theatre and video wall arrangement has been planned to accommodate entire EDFC network. Build up area of theatre block is 1373 sqrmtr. Its layout has been designed to provide unobstructed view of the mimic panels for all operators of OCC. The control room house controllers whose duty is to oversee the train service operation. These controllers include Chief

Controller, Deputy Chief Controller, traffic controllers, signal controller, Telecom controller, Track controller, traction controllers and crew controllers.

Video Wall refers to the common display system provided for the easy monitoring by different operating personnel at the OCC. 90mtr video wall has been planned to cover EDFC section. The display is of rear projection type driven from controller which receives the image to be displayed from TMS & SCADA systems respectively.

TMS Work stations are presently provided to supervise the train traffic in Bhaupur-Khurja section of Eastern Dedicated Freight Corridor from OCC. A viewing gallery has been provided for visitors to the OCC theatre.

Green Building _

The OCC Building has been build to comply 5 star Rating of BEE star rated programme and TERI GRIHA 4 star rating for green building. Grid connected Solar Power System of 50KW has been provided for OCC Buildings. Solar power has been used for street lighting and can also be used for hot water requirement. Appropriate insulation in walls and roof has been used to achieve thermal comfort. Used recycled material (fly ash) has been used for building construction.



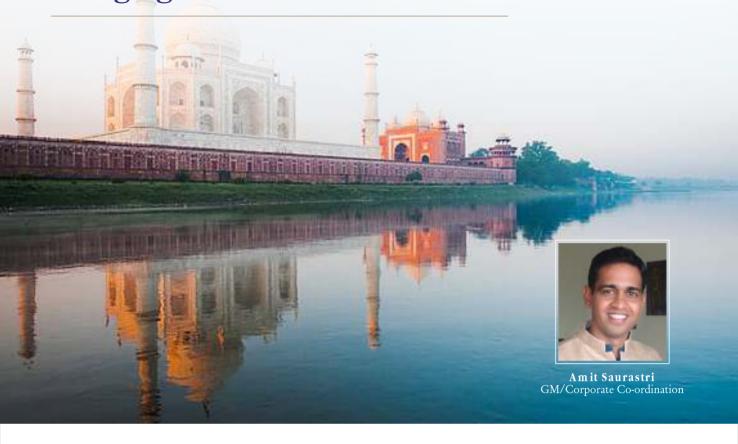


Theatre Block and Video Wall of OCC, Prayagraj

The aim of art is to represent not the outward appearance of things, but their inward significance.

Aristotle

Bridging the Great Yamuna River



The Yamuna also spelt Jumna, is the longest tributary of the river Ganges. Yamuna is also the fourth largest river in India. Originating from the Yamunotri glacier at a height of about 4,500 m on the southwestern slopes of Bandarpunch peaks of the Lower Himalaya in Uttarakhand, it travels a total length of 1,376 km passing through states of Uttarakhand, Uttar Pradesh, Haryana, and Delhi. The Yamuna River basin spread over nearly 10,86,000 square kilometers, is also the land of one of the most ancient known civilizations. A population of 500 million depends on this river basin.

Though river Yamuna is extremely important for civilization, it also poses unique challenge for transportation of men and material across the river at various locations. Following the track of this grand old river, Eastern DFC(EDFC) & Western DFC(WDFC) serves the cities which evolved along its bank. Alignment of EDFC stretches from Ludhiana (Sahnewal) to Kolkata (Dankuni) and WDFC stretches from Dadri(Uttar Pradesh) to Jawahar Lal Nehru Port, Mumbai (Maharashtra). DFC alignment crosses river Yamuna at three locations at

Rohtak, Faridabad and Prayagraj. Bridging the river Yamuna is a feat of engineering Marvel. Construction of large bridges was not easy feat, but imperative, impeccable planning and adequate resource allocation done by DFC and its stakeholders for smooth execution of these three Bridges.

Bridge at Prayagraj in Kanpur-DeenDayal Upadhaya Nagar section of EDFC _____

This 1034 m long bridge is constructed at Prayagraj. It is also the handshake point of two field units of EDFC – Paryagraj(E) and Paryagraj(W). Constructed at a cost of Rs.210 Crs. bridge is an important steel girder bridge having span arrangement 17x60.830m. Superstructure having weight of 9520MT and the bridge has 34 Open Web Girders and sub structure of bridge have well foundations. The bridge is designed by M/s GIL-SIL JV while fabrication of girders was done by M/S P&R Infra Projects Ltd at its workshop in Ropar, Chandigarh under supervision of PMC & RITES.



Arial view of Yamuna bridge



Girder launching on Yamuna bridge, Prayagraj



Pic courtesy : Aaryan Media Productions Captured by Ajay Pandey



Panoramic view of Yamuna bridge (Prayagraj) at twilight



Bridge at Rohtak in Ludhiana - Saharanpur section of EDFC

Another Important Bridge over Yamuna river is constructed near Kalanaur in Haryana State. This 455 m long'Open Web Girder' steel bridge has 7-spans, each having length of 200 feet has been constructed at a cost of Rs.70 Crs. Horizontal center to center spacing of girders is 6.50 m. The bridge can take 32.5T axle loading of Broad Gauge. The foundation of this bridge is made on group of pile foundations. High strength concrete of M35/M40 grade has been used to construct substructure &

foundations. Track structure has 60 Kg rails with steel channel slippers. The bridge has been constructed in less than 3 years timeby M/s. Tata Projects Limited. Each steel girder weighs about 412 tons & total steel used in girder is 2890 tons. The foundation work has been executed in running stream using coffer dams & superstructure has been put in place by cantilever launching overflowing stream.



Yamuna bridge (Rohtak) in Pilkhani - Sahnewal section of EDFC



Bridge at Faridabad in Rewari-Dadri section of WDFC

Third bridge with well type foundation on river Yamuna is constructed at Faridabad at a cost of Rs. 150 Cr. This double line bridge is 534 m long and has Open Web Girder design. Designed and built by M/s Larsen & Toubro, bridge has 11

spans of 48.5 m each. Bridge is suitable for running heavy haul trains of 32.5 T axle load. This bridge is one of the engineering marvel of Rewari-Dadri section.



Yamuna bridge(Faridabad) in Rewari – Dadri section of WDFC

66 If you love a bridge, you must also love the abyss beneath it, because if it wasn't for the abyss, that bridge wouldn't be there either! 99

Mehmet Murat Ildan

DFC's footprint in the World Heavy Haul Railway Systems



World over a heavy haul train is one which transports at least $5,000\,\mathrm{MT}$, and all freight revenue of at least $20\,\mathrm{MT}$ per year with axle loads of $25\,\mathrm{T}$ and more. Such trains would normally consist of uniform wagons and carry a single commodity moving uninterruptedly from a single origin like mine to a single destination like a port.

The International Heavy Haul Association was founded in 1976 and has 10 member countries namely Russia, South Africa, China, USA, India, Brazil, Sweden, Norway, Australia, and Canada with UIC as an associate member. Since then, the association has led the effort to disseminate technical knowledge and best practice in the heavy haul industry. Each of these systems has a local heavy haul association. In India it is headed by the infrastructure directorate of Railway Board. The South African Heavy Haul Association (SAHHA) was set up on 2010, and includes academicians from the WITS University, University of Pretoria, University of Cape Town, and Members of Transnet.

Mission of IHHA

The purpose of IHHA is to promote excellence in heavy haul operations and through advancements in technology innovation and engineering. It strives to accomplish this mission through the acquisition of knowledge relevant to this goal by sponsoring and organizing international and regional conferences, specialist technical sessions and specialist seminars; by commissioning guideline manuals, by preparing and distributing conference proceedings and technical documentation and by related activities as recommended by the Board of Directors.

The IHHA engages in a continual process of adaptation to ensure it satisfies the demands of state-of-the-art technical information that is relevant in a changing and developing industry. It also provides strategic view of the future, benchmarking of best practices and promotes the chapter of heavy haul in each member country. Themes and innovations highlighted at previous heavy haul conferences since 1978 are as under:

The SAHHA Conference was organised in Johannesburg with the intent of safe, resilient, and efficient heavy haul system. The intent was to have a globally competitive heavy haul logistics value chain and bring about a significant shift from road to rail. The discussions looked at all elements of the value chain starting from mining, train loading, rail transportation train of loading and storage, material reclaim and vessel loading and shipping. The presentation on behalf of Indian Heavy Haul Association was done by DFCCIL on the topic "IR's successful modal shift – DFC Transforming Transportation". Through the presentation,





the authors share this remarkable journey of Indian Railways in bringing about a modal shift and provide an update on the construction and operation on the DFC. The 500 delegates in Johannesburg were amazed at the success of DFC and heavy haul. The gist of the presentation is as below:

Indian Railways has been the lifeline of the country carrying 23 million passengers and 3.9 million tonnes of cargo daily. It carries its operations 24x7 in a sustainable manner and operates about 23,000 trains daily. For the past few decades, it has been losing its modal share to the road sector due to insufficient investment and capacity creation.

As part of the national rail plan the government has infused capital for planned capacity augmentation to bring about a modal shift. Various strategic initiatives like the development of the Dedicated Freight Corridors will help Railways improve its share of freight transportation to 45% like the benchmarks in the other developing countries. This is essential because the Railways are the most efficient means of transport (other than water ways) and there are high economic costs of road transportation as well as negative externalities.

The Dedicated Freight Corridors will help transform transportation and will help to reduce the logistics cost which is currently about 13%. The cost of operations on DFC will be reduced by 40% due to induction of new technology and maintenance practices. The DFC will also help in timetabled services and in meeting the aspirations and demands of the customers.

The world has moved on in heavy haul operations. On the safety side, successful stories include wheel/rail friction management, ultrasonic rail inspection, wayside equipment condition monitoring, rail longitudinal stress management and bearing temperature trending. On the operations side, longer and heavier trains with disturbed power, high grade, hardened rail and wheel steels, remote yard operation, ECP braking, AC locomotive fraction with increased power, automation of train loading and unloading, improved train tracking and reporting and improved train scheduling and engineering. On the capacity enhancement side, signalling systems that allow shorter headways. Technologies that allow heavier and longer trains e.g., distributed power, increased locomotive traction





with high power output, remote signalling and switching equipment and less train handling steps or stoppages (conveyor belt system). On the sustainability side, locomotive cruise



The world has moved on and Australia is running some of the heaviest train of greater than 40 T axle load and gross load of 40,000 T. Railways like Rio Tinto are also running driver less



Figure 3: North America 30,000 T Train

control, locomotive fleet modernisation, regenerative braking, and more AC power for traction. On the people side,



Figure 4: South Africa Longest Train

standardised work procedures, pride in delivering high tonnage, operational discipline, exposure to cutting edge technologies and technical skill development. trains. Brazil is running trains of 35,000 T with distributed power and single person crew. North America is running 30,000 T trains with distributed power and positive train control in mixed traffic corridors and rolling stock monitoring. South Africa has run the longest production train of 04 Kms length with 342 Iron ore wagons. It has also run 04 kms long trains with 375 manganese loaded wagons with electronically controlled pneumatic brakes. China is running 30,000 T trains in hight density and heavy grade rail corridors. Norway is managing the stress management on very sharp curves and extreme weather conditions. Indian Railways and DFC are new in the field with 11,000 T 1.5 kms long trains.

The vision for 2030 is a safe, competitive, responsible, reliable, integrated, and intelligent heavy haul system powered by Rail



Figure 5: 30,000 T Train in China





Figure 6: India 11,000 T Train

4.0. This is only possible if all the 10 members collaborate and share the best practices and innovation. An added advantage with DFC is the knowledge of project, planning and implementation which can be shared with the world as other systems had been created much earlier. Also, other systems are primarily carrying one commodity, but DFC would be carrying different commodities like coal, container traffic etc. and this experience will also be unique to share with the world in future.

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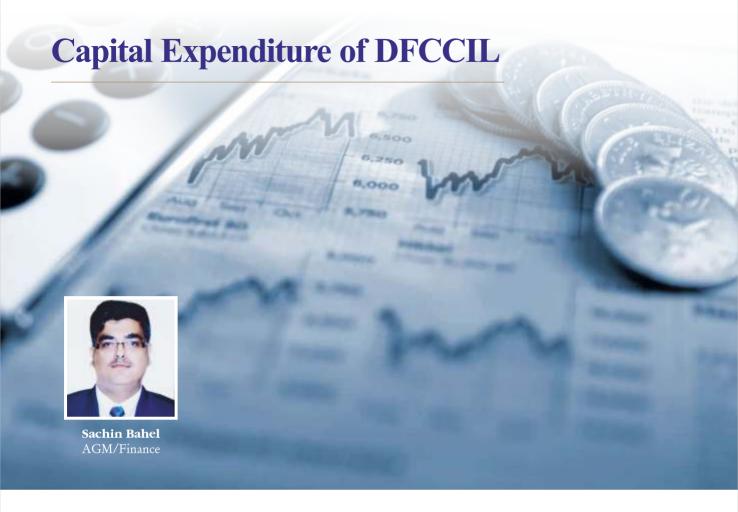
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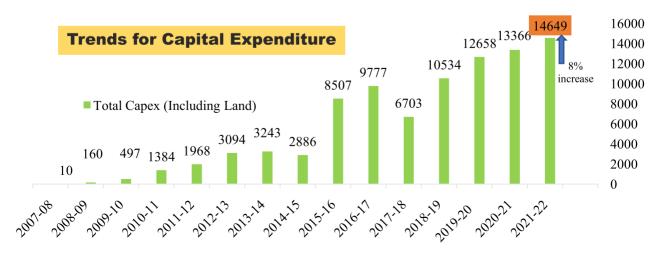
Whether you think you can or think you can't you're right.Henry Ford



Dedicated Freight Corridor Corporation of India Limited (DFCCIL) has been established to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the dedicated freight corridors. The sanctioned cost of project is Rs. 81459 Cr.

In order to meet the cost of construction, loans from Multilateral Agencies have been tied up to the tune of Rs. 51265 Cr. (Yen 580787 Million from JICA and USD 1775 Million from IBRD). Out of the total tied up loan, Rs. 35347 Cr. (Yen 367920 Million from JICA and USD 1722 Million from IBRD) has already been drawn upto 30.09.2022.

The Cumulative Capital Expenditure (CAPEX) has reached to Rs. 94718 Cr. (Including expenditure on Land amounting to Rs. 19144 Cr.) till 30.09.2022,out of this Rs. 35347 Cr. has been met from loans and balance from Equity component by Ministry of Railways. Year wise status of CAPEX is as under:





It may be mentioned here that the construction activities in DFCCIL has gained momentum since FY 2014-15. Prior to that the major expenditure was incurred only on Land acquisition. The expenditure incurred upto March 2014 vs beyond March 2014 is summarized below:

Description	2007-14	2014-Sept'22	Total
Commissioning	Nil	1508 Km	1508 km completed (53% DFC length)
		commissioned	(734 km in WDFC, 774 km in EDFC)
CAPEX	Rs. 4,169 Cr	Rs. 71405 Cr	Rs. 75,574 Cr
			(17 times expenditure during 2014-22)
CAPEX on Land	Rs. 6,188 Cr	Rs. 12,956 Cr	Rs. 19,144 Cr
			(109% increase on land)
CAPEX (Total)	Rs.10,357 Cr	Rs. 84,361 Cr	Rs. 94,718 Cr
			(around 8 times increase)

The Company has made all out efforts to complete the project earliest possible. The highest CAPEX has been achieved in the year 2021-22 amounting to Rs. 14649 Cr which is despite the Covid-19 restrictions and many other hurdles.

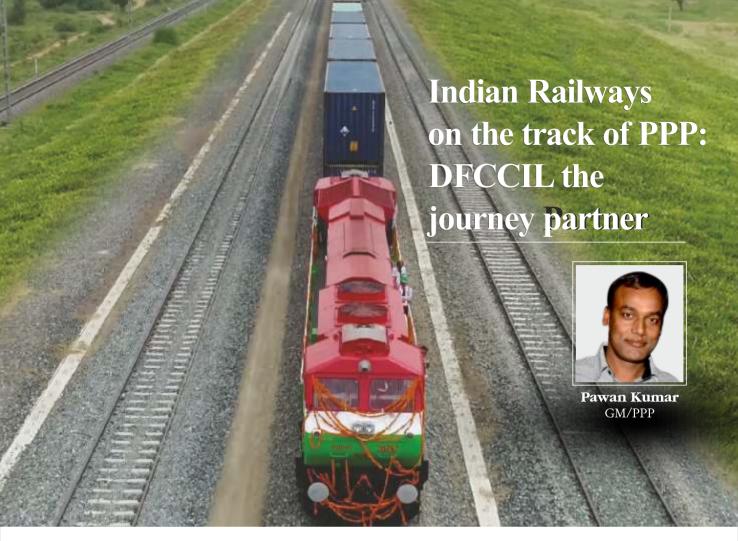
The management has been successful in handling the imminent danger of project execution being stalled due to acute cash flow problem faced by agencies (particularly as a result of Covid-19 Pandemic leading to nation-wide lockdown). The idling of Capital Cost and loss of Opportunity Cost was the major worry of management. Timely action was taken up to overcome from unprecedented slow-down of work by initiating various relief measures like releasing payments to Contractors as per Sub Clause 14.6 of FIDIC guidelines and

quick implementation of measures announced by the Ministry of Finance (MoF). In addition to these, deferment of recovery of mobilization advance, release of additional 5% mobilization advance were taken up as extraordinary measures.

All these actions, not only saved the projects from being stalled but also increased the pace of work which ultimately led to Khurja-Bhaupur section in EDFC and Rewari-Madar section in WDFC being completed and inaugurated by Hon'ble Prime Minister amidst the ongoing Covid-19 pandemic. The completion of Madar-Palanpur was another milestone. The close monitoring by leadership and financial support of Ministry of Railway has been a major catalyst in this process.

Financial peace isn't the acquisition of stuff. It's learning to live on less than you make, so you can give money back and have money to invest. You can't win until you do this.

- Dave Ramsey



1. Background

In August 2008, Cabinet Committee on Economic Affairs (CCEA) approved extension of EDFC (Ludhiana in Punjab to Sonnagar in Jharkhand) upto Dankuni in West Bengal. Further, in September 2010, Railway Board decided to develop Sonnagar-Dankuni section on Design, Build, Finance, Maintain and Transfer (DBFMT) model of Public Private Partnership (PPP). The Project was split in two phases i.e. Dankuni-Gomoh, Phase-I and Gomoh-Sonnagar, Phase-II. Subsequently, based on the instruction of the Railway Board, the priority has been given to Sonnagar-Gomoh and Annuity Model has been adopted. Proposal on Annuity mode submitted to Public Private Partnership Appraisal Committee (PPPAC) was turned down in March 2021. After detailed deliberations with various Stakeholders, DFCCIL came with a new idea of Hybrid-Design, Build, Finance, Operate & Maintain and Transfer (Hybrid-DBFOT) model of PPP. The details of the Hybrid-DBFOT model will be discussed later in this article.

Infrastructure development with public-private partnership (PPP) contracts has been claimed to deliver better performance compared to regular contracts.

2. PPP in India

The infrastructure sectors in the country such as Road, Airport and Port are at the forefront of developing projects on PPP basis.

In road sector, PPP models such as Hybrid Annuity Model (HAM) and BOT are some of the models on which infrastructure projects are being implemented. In Airport and Port sector, BOT model is being used for implementing projects.

Success of PPP in these sectors has encouraged the Government for PPP in other sectors also. Indian Railways has also started to

3. Indian Railway's thrust on PPP –

The Indian Railways is trying to facilitate the completion of more projects through PPP model after finding it successful in providing last mile rail connectivity to ports and industrial clusters. The Indian Railways had formulated a Participative Policy-2012 aimed at encouraging the investment in developing rail connectivity by associating strategic partners and other investors through PPP mode.

Further, as part of the new 2014 PPP policy, the new policy framework allowed PPP in several other areas such as Suburban Corridors, Mass Rapid Transport System, High-Speed Trains, Dedicated Freight Lines, Rolling Stock, Train Sets, Locomotives, Railway Electrification, Signalling Systems, Freight and Passengers Terminals and Industrial Parks etc.



Concept to develop New Delhi Station on PPP mode

Source : Google

4. Public-Private Partnership in Indian Railways: Key to infrastructure development

PPP refers to an arrangement between the public and private sectors with clear agreement on shared objectives for the delivery of public goods (e. g. infrastructure) and / or public services (e. g. ambulance services).

"PPP is any medium-to-long term relationship between the public and private sectors, involving the sharing of risks and rewards of multisector skills, expertise, and finance to deliver desired policy outcomes."

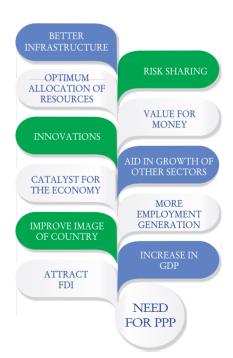
It is an approach that public authorities adopt to increase private sector involvement in the delivery of public services to:

- Increase total investment in public goods & services
- Reduce Costs
- Access expertise.
- The Government of India defines a PPP as "a partnership between a public sector entity (sponsoring authority) and a private sector entity (a legal entity in which 51% or more of equity is with the private partner/s) for the creation and / or management of infrastructure for public purpose for a specified period of time (concession period) on commercial terms and in which the private partner has been procured through a transparent and open procurement system."

The Government of India has laid an ambitious target to allocate USD 1.4 trillion between 2019 and 2023, including investment to the tune of USD 750 billion on the railway infrastructure by 2030. Other initiatives to incentivize infrastructure development include the INR 102 trillion- worth National Infrastructure Pipeline (NIP) encompassing sectors such as roads, railways, ports, airports, urban, power, telecom, etc.

The collaboration between various stakeholders is a prudent measure to jointly address the bottlenecks. Over the years, Public-Private Partnership (PPP) has emerged as a resilient model to undertake infrastructural development. PPP refers to a cooperative agreement between the government organization and a private firm to execute a project or provide services to the citizens for the long-term. The fulfilling of the public interest objective by the public sector and the rendering of technical expertise and professionalism by the corporate sector are the hallmarks of this model.

The Indian Railways is just an example of realizing the benefits of PPP to accelerate infrastructural development. Fostering innovation and incorporating learning from across the world will be the key to unlocking its pleothra of benefits and realizing dream of the 5 trillion-dollar economy by 2024.





5. Features of PPP.

- The Government does not need to own infrastructure to deliver services.
- Private partner investing in public infrastructure and providing related services to the Government. The Government retaining responsibility for the delivery of core processes/services.
- The Government and private party working together for achieving certain standards.

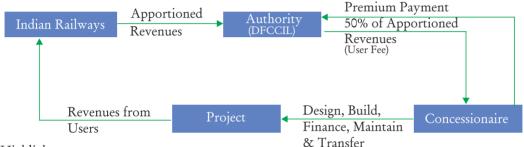
6. Success Factors of PPP Models

- Political Will
- Project addresses a real need
- Clear definition of the Scope, Roles, Risks & obligations
- Legal Framework

- Consultation with stakeholders
- Transparent Selection Procedures
- Security and Privacy

7. Various PPP models explored in DFCCIL

A. DBFMT Structure - Premium Payment



Key Highlights:

- Concession Tenure 30 years (5 years construction period + 25 years maintenance period)
- Bid Variable Premium as a percentage of User Fee
- User Fee 50% of Apportioned Revenues
- User fee to be based on commodity wise tariff set forth in the RFP Year.
- Base tariff to be escalated at 3% annually from the RFP Year.
- User fee to be paid monthly.
- Premium to be paid by Concessionaire to Authority annually during maintenance period as percentage of User Fee paid during a year.

B. Annuity Model



DFCCIL

- Provide land to the Concessionaire
- Procure Forest and Environmental Clearances
- Approval of General Arrangement Drawing (GAD) from respective Authorities for Construction by Concessionaire
- Provide Annuity payments to the Concessionaire

CONCESSIONAIRE

- Design, develop, construct and finance the project
- Receive fixed Annuity payments for a period of Operation Date

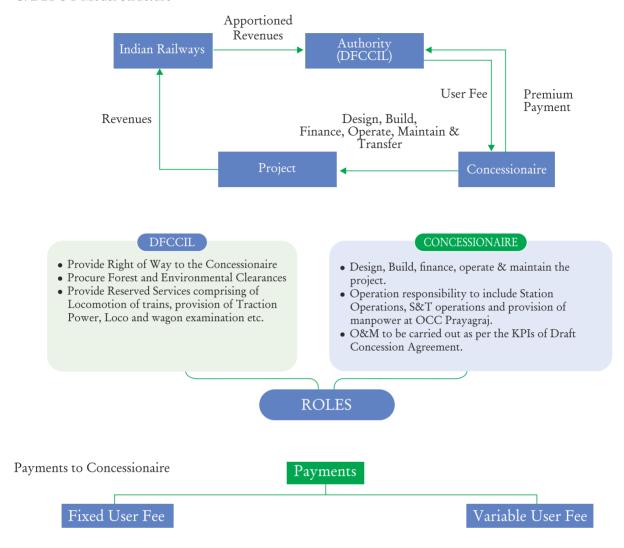
DFCCIL & MOR COMMITMENTS

- Sonnagar- Gomoh Section of EDFC to be backed by Sovereign guarantee for Annuity Payments
- 90% of land to be available at Bid Stage
- Environmental and Forest clearance would be obtained by DFCCIL before signing of Agreement

ROLES

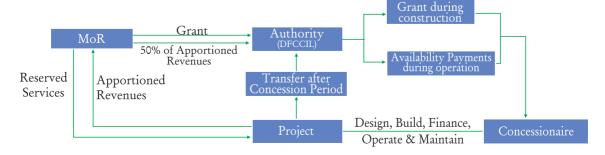


C. DBFOT Model Structure



- Annual Fixed User Fee for each operational year post COD till termination of Concession Agreement determined as Estimated Project Cost/30.
- Variable User Fee (Bid Variable) Variable user fee as a percentage of revenue apportionment.

D. Hybrid-DBFOT Model Structure





Authority's Risk



Pre -Construction Risk

- Land Acquisition
- Utility Shifting
- Forest and Wildlife clearances



Construction Risk

- Construction of ROBs/RUBs/FOBs
- Cost towards unforeseen Utility Shifting
- Financing/funding of construction Grant
- Deployment of Security Forces



Revenue Risk

- Traffic Risk
- Tariff Risk



O&M Risk:

- Financing/ funding of Availability Payment
- Performance of Reserved Services
- Deployment of Security Forces

Concessionaire's Risk



Pre -Construction Risk

- Design
- Detailed Project Report



Construction Risk

- Construction of the Project
- Electrical Utility Shifting upto 33 KV
- Felling of Trees



Financing Risk



O&M Risk

8. PROS & CONS OF VAROUS PPP MODELS

(i) BOT Model (Operation with Authority)

PROS

- Concessionaire has an assured visibility in escalation in Tariff which is de-linked from tariff orders issued by Authority.
- Linking of traffic to concessionaire's earnings helps the concessionaire bring in efficiencies to ensure asset availability.
- Availability of minimum Revenue Guarantee helps in increasing the bankability of the project.

CONS

- Traffic diversions and changes in business cycles can impact the returns to both Concessionaire and Authority.
- Difficult to provide rebates to the customer while maintaining the pay-outs to the Concessionaire.
- Maintenance and adherence to KPIs at point of interface with Authority can be point of conflict.

(ii) Annuity Model without Maintenance

PROS

- Revenue Assurance through fixed annuity payments which are not linked to tariff and traffic risk for Concessionaire
- Insulation of the concessionaire from business cycles
- No maintenance risk to be borne by the Concessionaire
- Increase in tariff and traffic -directly beneficial to the Authority
- Absence of any commercial risk may invite more bidders

CONS

- No potential upside available to the concessionaire for any incremental traffic or tariff escalation.
- No incentive available to Concessionaire to do any Value Engineering.
- Quality of asset may be compromised and post DLP there shall have no remedy for sub-optimal performance of asset due to workmanship or material used or design.
- No private sector efficiencies in maintenance of the asset.
- Entire commercial risk is with Authority.

(iii) Annuity Model with Maintenance

PROS

- Value Engineering in asset construction could benefit overall project
- Revenue Assurance for concessionaire through fixed annuity payments which are not linked to tariff.
- Private sector efficiencies and international best practices will be beneficial for the project

CONS

- Maintenance and adherence to KPIs at point of interface with Authority can be point of conflict.
- During Accident- the issue of maintenance, cause and realisation of damages can be a point of conflict.
- Entire commercial risk is with Authority.



9. Comparison of various PPP Models _____

Model Contours	Annuity Model	DBFMT Model	HAM Model (Highways Sector)	Hybrid-DBFOT Model (Current Model)
Bid Variable	Total Project Cost (including both hard and soft cost)	Premium as % of User Fee will be paid by Concessionaire annually	Bid Price is the summation of (a) NPV of Bid Project Cost during the Concession Period, and (b) NPV of first year O&M cost. Annuity is derived by the Authority from Bid price.	Availability Payment ((Based on the availability of rail system)
Construction Support	No Construction support to be paid to the Concessionaire by the Authority	No Construction support to be paid to the Concessionaire by the Authority	Construction Support amounting to 40% of the Bid Project Cost in five instalments during the Construction Period. The instalment being paid as Construction Support is adjusted for Price Inflation Index.	Construction Support as Grant of 40% of Estimated Project Cost (excl. of IDC) to be paid to Concessionaire in 10 equal instalments during Construction Period.
Operations	Authority/IR has entire operational responsibility of the PPP section.	Authority/IR has entire operational responsibility of the PPP section.	Operations of the Highway is undertaken by the Concessionaire as follows: • Permitting safe, smooth and uninterrupted flow of traffic; • Collection and appropriation of fee;	Concessionaire to have operational responsibility of: • Station operation, • Section control through Operation Control Centre • S&T Operations Authority / IR to undertake the following operational responsibilities: • locomotion of trains including loco and wagon examination
Revenue for the Concessionaire	Instalment payments to the Concessionaire from Authority comprised of Project Cost Payment (Annuity) and interest payment on the outstanding project cost to be paid to the Concessionaire	Authority to pay 50% of the revenue apportionment as User Fee to be computed based on the actual traffic carried over the Project and escalated tariff.	Revenues of the Concessionaire comprise of summation of the following: • Annuity: Balance 60% of the Bid Project Cost is price indexed and is paid as Annuity during the O&M Period. The Annuity is paid bi-annually. • Interest Payment: The interest payment is made on reducing balance of Annuity. • O&M Payment: Based on the first year O&M cost quoted as part of the Bid Variable.	Availability Payment to be paid to the Concessionaire subject to fulfilment of KPIs related to Minimum Number of hours per day the section is available for operations and Minimum Average Speed (as a percentage of booked speed) available on the PPP section. The availability payment to the concessionaire is indexed
Payments to the Concessionaire	The Annuity Payments will be paid to the Concessionaire for 15 years	User Fee	The Annuity and O&M payments to the Concessionaire under HAM model are paid bi-annually.	The Availability Payments will be paid to the Concessionaire quarterly
ROW in Conditions Precedent	90% of the ROW	90% of the ROW	70-90% of ROW	95% of Core land



10. Government Initiative towards PPP.

Public-Private Partnership (PPP) was proposed by the Union Minister of Finance and Corporate Affairs, Smt. Nirmala Sitharaman, while presenting the Union Budget 2019-20 in Parliament to unleash faster development and completion of tracks, rolling stock manufacturing and delivery of passenger freight services.

The finance minister said that it is estimated that Railway Infrastructure would need an investment of Rs. 50 lakh crores between 2018-2030. Given that the capital expenditure outlays of Railways are around 1.5 to 1.6 lakh crores per annum, completing even all sanctioned projects would take decades.

The Minister added that "I propose to enhance the metrorailway initiatives by encouraging more PPP initiatives and ensuring completion of sanctioned works, while supporting transit-oriented development (TOD) to ensure commercial activity around transit hubs".

Emphasising railway projects like the dedicated freight corridor (DFC), Finance Minister Sitharaman had said in the Budget speech: "Railways will monetise dedicated freight corridor assets for operations and maintenance, after commissioning. The Sonnagar-Gomoh Section (263.7km) of Eastern DFC will be taken up in PPP mode in 2021-22. Gomoh-Dankuni section of 274.3km will also be taken up in short succession."

11. Benefits to IR from PPP project

1. Private player will bring construction, O&M efficiency

- by optimizing the cost of the project along with technological upgradation.
- 2. IR's balance sheet will be freed up to invest in other economic value but low financial viability projects.
- 3. Crowding in of private capital through providing 40% Grant.
- 4. Possibility to impose KPIs and ensure high up time of the section with accountability transferred to private player in an equitable manner.
- 5. Timely commissioning of the project (less cost overrun and time overrun) likely to increase Railways model share increase in Railways revenue.
- 6. The project will open the door for further PPP investments, enabling explosive growth in rail development like growth story witnessed in highways aligned with Government asset monetization plan.
- 7. Reduced need for hiring of O&M staff in IR will reduce the fixed costs.

12. Conclusion

In the finalized model of PPP i.e. HYBOT Model, for the first time in Indian Railways, it has been proposed to give Operation and Maintenance of Railway system in the hands of Private Players which will go a long way in modernisation and improvement in performance of Railways.



Rani Kamlapati Railway Station in Bhopal, Madhya Pradesh developed on PPP mode

Source : Google

News from Indian Railways

The Chenab Rail Bridge completed on 15th August, 2022





The World's Highest Railway bridge- Chenab Bridge's Golden Joint was inaugurated on 75th Independence Day of India. The Golden Join is connecting two ends of the deck of the world's highest railway bridge. An Indian engineering feat, the 1,315-metrelong bridge forms a crucial link in the 111-km stretch from Katra to Banihal, which is part of the Udhampur-Srinagar-Baramulla section of the Kashmir railway project. The highest railway bridge in the world, Chenab Bridge is 359 metres above the river bed, which is 35 metres higher than the Eiffel Tower. The bridge is the key link in providing direct connectivity to Kashmir valley. The design life of the bridge is at least 120 years. Chenab Bridge has already taken enthusiasts by storm. Social media calls it 'connectivity to the paradise on the earth'. During Monsoon, the bridge almost looks like something out of a fairy-tale drowned in a sea of clouds.

PM Modi Flags Off New Vande Bharat Express From Gandhinagar -

Prime Minister Narendra Modi inaugurated the Gandhinagar-Mumbai Vande Bharat Express train, the third in the Vande Bharat series that was launched in 2019. The two other Vande Bharat Express trains, introduced in the months of February and October 2019 by PM Modi, run from New Delhi to Varanasi and Katra, respectively. Being referred to as the 'Vande Bharat 2.0,' the Gandhinagar-Mumbai Express train covers a distance of about 540 kilometres in 6 hours 30 minutes. It can accelerate to 100 kmph in just 52 seconds. The train will run to-and-from between Gandhinagar Capital and Mumbai Central, six days of the week, except Sunday.





IR registers Record Freight Loading -

Indian railways has recorded best ever September monthly freight loading of 115.80 MT in Sep'22. The incremental loading in the

month of September has been 9.7 MT i.e. a growth of 9.15% over the previous best September figures achieved in 2021. With this, Indian Railways has had 25straight months of best ever monthly freight loading.

The Railways has achieved an incremental loading of 6.8 MT in Coal, followed by 1.2 in Iron Ore and 1.22 MT in Balance other goods, 0.4 MT in Cement & Clinker and 0.3 MT in Fertilizers. Increase in automobile loading has been another highlight of Freight Business in FY 2022-23 and 2712 rakes have been loaded in FY 2022-23 till September as compared to 1575 rakes during the same period of last year i.e. a growth of 72.2 %.

The cumulative freight loading from 1st April'2022 to 30th September'2022 has been 736.68 MT as against 668.86 MT achieved in 2021-22 i.e. an incremental loading of 67.83 MT, with a growth of 10.14 % over same period last year. The freight NTKMs (Net tonne kilometers) have increased from 63.43 Billion in September '21 to 69.97 Billion in September'22 registering a growth of 10.3 %. The cumulative NTKMs in the first half of the year have also grown by 17.1 %.



Nagaland CM flag-off Donyi Polo Exp. from Shokhuvi station to Naharlagun station

Passenger train services commenced for the first time from Shokhuvi Railway Station in Nagaland to Naharlagun Railway station in Arunachal Pradesh. In a historic occasion for connectivity and transportation in the North Eastern Region, passenger train services commenced for the first time on 26th August 2022 from Shokhuvi in Nagaland Railway station to Naharlagun Railway station in Arunachal Pradesh. The inaugural service of this train was flagged off on August 26 by Nagaland Chief Minister Neiphiu Rio in presence of Northeast Frontier Railway General Manager Anshul Gupta and Lumding Divisional Railway Manager JS Lakra along with other dignitaries.



Indian Railways: 3.5 km long Super Vasuki, India's longest train

The Indian Railways recently conducted a test run of the 3.5-km-long freight train, Super Vasuki, with 295 loaded wagons carrying over 27,000 tonnes of coal between Korba in Chhattisgarh & Rajnandgaon in Nagpur, making it India's longest and heaviest train. In comparison, Australia's BHP Iron Ore has a length of 7.352 km, making it the longest freight train in the world (also the longest train overall). This is the longest and heaviest freight train ever run by the Railways, the national transporter said, adding the train takes about four minutes to cross a station.



India's first Hydrogen Power Train to be ready by 2023

Sh. Ashwini Vaishnaw, Union Minister for Railways stated that India is developing hydrogen-powered trains, and they will be ready by 2023. There are a number of advantages with the use of hydrogen, important ones green hydrogen as a rail fuel, including supporting zero carbon goals as a clean energy source. Until now, only Germany has developed hydrogen powered trains. Last month India got its first hydrogen fuel cell based bus, developed indigeniously by KPIT-CSIR in Pune.



Elsewhere in World Railways

InnoTrans 2022 attracts 140,000 visitors



INNOTRANS made its return following a four-year hiatus. Around 140,000 visitors attended technology fair organised over the four days from September 20-23. Record number of 2834 exhibitors displayed their products across 42 exhibition halls. The outdoor area featured 124 vehicles and exhibits, while overall the show was host to 250 world premieres. InnoTrans is also a platform for international exchange for a trans-European transport network. After the pandemic-induced break, InnoTrans 2022 has made a phenomenal return. At last the industry family has come together again. After a long wait we were able to exchange ideas in person and look each other in the eye. Messe Berlin says 56% of visitors were first time attendees, while 57.3% of attendees were from outside of Germany. The 14th show is scheduled to be held from September 24-27 2024.

UP and ZTR announce plan to introduce hybrid-electric locomotives

NORTH American Class 1 Union Pacific (UP) and ZTR, a locomotive control systems supplier, have announced a partnership to introduce hybrid-electric locomotives. The work will focus on what UP describes as "mother-slug" sets, where two diesel locomotives are replaced with one diesel locomotive coupled with an accessory or slug. The slug unit will be converted and equipped with batteries, power electronics and controls supplied by ZTR, helping to "achieve fuel and maintenance savings and offer environmental benefits" allowing the hybrid-electric mother-slug to operate in single-engine, battery charging or electric only modes. The locomotives will be built at UP's North Little Rock facility in Arkansas and the first prototype is expected to be delivered in



late 2023 with five additional units arriving in 2024. In line with its sustainability commitments, UP says conversions will focus on older locomotives, typically with higher emissions. UP says the locomotives can operate in multiple modes with several ways to charge the locomotive batteries, including wayside and onboard charging.



SMRT Trains and Thales to develop next-generation rail signalling technologies

SMRT Trains has collaborated with France-based Thales to develop next-generation rail signalling technologies for greener rides in Singapore.Both entities will work on an initiative called "The Next-Generation Green CBTC Project," which is expected to help SMRT Trains to attain net zero emissions by 2050.The project mainly focuses on lowering electricity consumption besides further improving the traction energy efficiency of the North-South and East-West lines (NSEWL).In 2017, Thales' SelTrac communications-based train control (CBTC) system was first deployed on NSEWL.Given that



NSEWL is managed by CBTC signalling, the traction-related actions of acceleration, braking, and coasting are controlled by the automatic train operation (ATO) system.

DB investing a record €19bn in new vehicles by 2030

GERMAN Rail (DB) says it has launched the largest modernisation programme for its vehicle fleet to date, claiming that by 2030 the group will invest more than €19bn in new locomotives and trains.DB made the announcement at the InnoTrans 2022 trade fair in Berlin, where the rail company also had exhibits of rolling stock showing what modern regional fleets and freight trains could soon look like."We are now investing in the trains of the future," said CEO of DB, Dr Richard Lutz. "With the record sum of more than €19bn, we are creating the capacity for even higher demand. Modern vehicles not only make the railways more climate-friendly, but also more reliable and customer-friendly."



Driverless heavy haul railway expanded to serve automated iron ore mine

A 166 km branch has been built to connect Rio Tinto's new Gudai-Darri iron ore mine in the Pilbara to its 1700 km heavy haul network, which is operated using Auto Haul driverless trains. The first loaded train ran in June, with production scheduled to ramp up to reach full capacityduring2023. Rio Tinto's 17th and 'most technologically advanced' iron ore mine in the Pilbara was developed at a capital cost of A\$4·3bn. It has an expected life of more than 40 years and an annual capacity of 43 million tonnes. As well as being served by the driverless trains, the new mine features autonomous haul trucks and water trucks, robotics for the ore sampling laboratory and distribution of parts in the workshop, and a 34 MW photovoltaic solar farm.



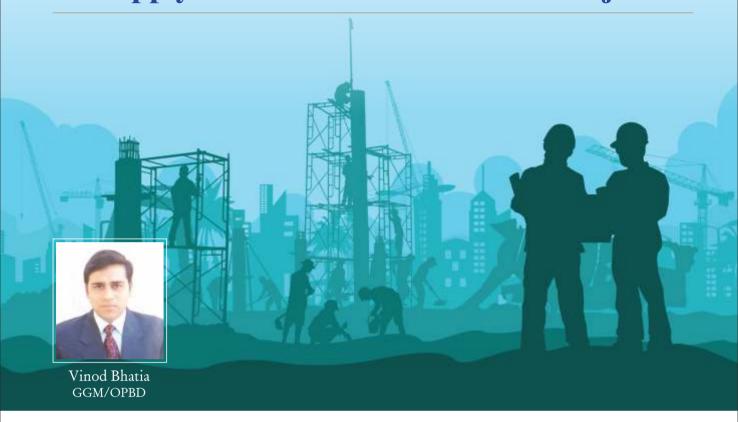
Jakarta - Bandung high-speed line of Indonesia to be commissioned in 2023

THE 142km Jakarta - Bandung high-speed rail line in Indonesia is \$US 2Bn over budget, although the Chinese-built project is now 88.8% complete and is on course to open in June 2023. The 350km/h line will shorten the rail journey between the cities to from three hours to 40 minutes. PT KCIC has said the cost of the project has risen to \$US 7.36bn, \$US 2bn over budget, while China estimates the project is less than \$US 1bn over budget. KCIC is 60% controlled by Indonesian state companies



including Wijaya Karya and PT KAI, while China Railway Engineering and other Chinese companies control the remaining 40%. The project is funded by a loan from China Development Bank. China Railway Engineering says that since full construction began in June 2018, all 13 tunnels have been completed, while civil works and stations are more than 92% complete. Tracklaying is now underway. The line has stations at Halim, Karawang, Padalarang and Tegalluar in Bandung, West Java. The first batch of high-speed train cars to be manufactured in China for the new line arrived at the port of Jakarta at the start of September, before being transported by road to Tegalluar depot to be assembled initially into one train.

Mitigating Impact of COVID-19 on Supply Chains and Construction Projects



COVID-19 has been documented as the greatest humanitarian challenge the world has ever faced. This turbulent and volatile situation, restricted economic activity in economically significant areas of several emerging economies. The situation is a big economic challenge and now it is possible to draw some conclusions on the magnitude of the effects of this economic challenge.

The COVID-19 has badly impacted the transport sector and slowed down the pace of construction of big infrastructure projects. There is a need to develop a resilient transport sector in case of future pandemic outbreaks. COVID-19 pandemic has altered the interaction between producers and consumers. There is a big push to the e-commerce sector. The share of e-commerce has grown significantly even in rural India. The e-commerce in India is expected to grow at CAGR of around 19% between 2019 and 2023 with a market of US \$98.4 billion by 2023.

Lessons for Supply Chains

During lockdown, road transport and air transport witnessed significant challenges, but rail freight transport operated mostly without restrictions and smoothly conveyed goods and commodities across the country. The most of essential products were carried by railways across length and breadth of country. For 2021-22, IR carried 1418 MT of traffic in contrast to 1223 MT carried in FY 2020-21.

COVID pandemic gave India its best opportunity to shift towards multimodal transport as the period witnessed the close coordination between rail and truck industry for moving shipments to their final destinations. Now there is a time to encourage transport of aggregated assortments of goods by a rail and promotion of 'Truck on Train' services can be a step in right direction. The suggested course of action must focus upon transportation disruptions and risk management for revival and recovery of different sectors. The transport disruption risk management involves meticulous decision-making at every stage: indentifying the sources of risks and inherent vulnerabilities, analysis of risk and initiating risk management.

The risk management strategy can be short term or long term. In short term strategy, there should be a crisis response team, contingency planning and third-party intervention, outsourcing, audit, vendor collaboration and flexible contract management. A crisis response team may identify the planning gaps and requisite internal and external resources for an effective response. Contingency planning involves exploring



alternate supplies and utilizing services of third party. These are the innovative ways to reduce the contact distance between suppliers, manufacturers, and consumers. Hour to hour focus of various activities with suitable documentation, real time tracking and outsourcing are a few possibilities as short-term interventions.

The long-term risk management strategy includes use of digital technology, vendor management system and intelligent transportation systems. Sharing of information, resources and technology between different stakeholders shall create synergy. The operations management and decision making should involve strong application of Information technology. Inter-connection of different information systems to capture, communicate, compute, and assist the decision making shall be a step in right direction. Vendor managed inventory can help in analyzing demand and supply requirements.

Lessons for Projects_____

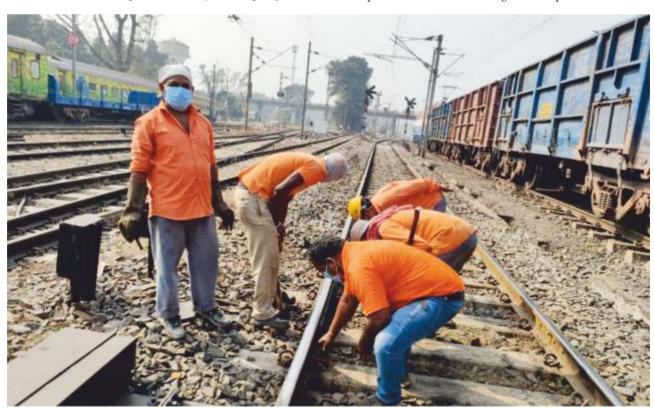
COVID-19 has severely impacted construction industry and various issues regarding contractual obligations, availability of resources, project delays or cancellations have emerged. Stakeholders have to assess the contractual obligations and validate non-performance with respect to agreed milestones. If a pandemic has not been defined under a force majeure event, then discussions must take place between stakeholders to develop a project approach. The assessment of impact, updating of risk register, development, and execution of new plan after proper communication of new plan to all stakeholders are a few important recovery road map stages.

To implement above stated strategies there is a need of cooperative and responsive collaboration between stakeholders such as government, private sector, and academic research institutions.

Measures taken by DFC _

Construction work was hampered on account of COVID-19 pandemic. Several innovative steps were taken by DFC & stakeholders to ensure works were carried out at fast pace once the lockdown was relaxed and put the best foot forward to ensure commissioning of sections within targeted time frame. DFC has taken several actions like empowered field units to break down cost centers on Covid ground to improve cash flow, granting ad-hoc Extension of Time (EOT), pending final determination, early finalization of pending variations and release of part-payment against agreed variations pending final approval, deferment in recovery of mobilization advance till 90% progress, resolving bottleneck land issues with State Governments. In testing time of Covid our stakeholder has also taken several actions like bringing back the Labor to site through charted buses after their Covid testing at originating point, Labor camps/barracks to have all Covid safety measures in place, Strict adherence to Covid safety norms/ protocols at site & camps, priority vaccination of all labor/supervisors at site, Weekly testing of labor/supervisor at site to identify & isolate the infected staff, additional mobilization for making up loss of time.

Covid-19 has significantly affected the work but our indispensable valiant efforts mitigated its impact.





Transparency International, the global movement working in over 100 countries to end the injustice of corruption has said that - "To end corruption, we advocate for power to be held accountable. Everywhere."

We are well aware that Corruption is a menace in our society. Besides causing financial losses, it also affects the organization's reputation adversely. Therefore, the menace of corruption has to be fought tooth and nail by the people and organizations as well. Preventive Vigilance is one of the most important functions of the Vigilance branch of an organization that, inter alia, helps fight corruption. It is also a very important tool to achieve and ensure 'Good Governance'. Preventive Vigilance primarily intends to analyse the systems and procedures to understand the loopholes and inadequacies and thereby suggest corrective measures. It helps in simplifying the complexities in the system and promoting transparency. This, in turn, results in improving the efficiency of an organization comprehensively.

Therefore, the Vigilance branch is as important as any other branch in an organization. Besides promoting honesty, integrity, transparency and accountability, Vigilance contributes in achieving the larger objective of 'Good Governance'. Transparency and accountability initiatives lie at the core of good governance practices. These practices, in turn, substantially minimizes the scope and flourishing of corruption. Therefore, Vigilance is also a potent management tool.

DCCIL Vigilance has given paramount importance to the Preventive Vigilance Activities. As a result, many system improvements have been suggested to the management in the past. Moreover, it is felt that Information Technology (IT) can be one of the effective tools that can significantly enhance

transparency as well as corruption-free delivery of the services besides, enhancing the overall efficiency of the system. The Central Vigilance Commission (CVC), as part of Vigilance Awareness Week -2022, has instructed all the organizations concerned to undertake Preventive Vigilance cum internal housekeeping activities including Technological Initiatives. All organizations are required to identify new areas/services to be brought on online platform and initiate for creation of an online portal. It is learnt that the IT department is working on developing an online portal for land records etc. Hence, on a similar pattern, DFCCIL should take this opportunity to identify and list out more areas and functionalities that can be brought to an online portal for better, accurate and timely delivery of services. It may include functionalities related to HR and finance too. Besides, it shall also ensure righteous use of resources and avoid any possible wastage of man, materials and money. These initiatives, if implemented, can go a long way in achieving corruption-free delivery and 'Good Governance'.

Moreover, we should also make concerted efforts to disseminate the idea of Anti-corruption and awareness generation. Training and re-training of officials on Vigilance related issues especially the younger professionals shall help them inculcating the right ideas, moral values and best organizational practices. This would also help in capacity building as well as sensitization.

Efforts such as these shall help the organization in minimizing the scope of corruption as well as promoting 'Good Governance' and transparency in our work. Let us not forget the words of Mr. Kofi Annan, former UN Secretary-General and Nobel Peace prize laureate - 'If Corruption is a disease, Transparency is an essential part of its treatment.'

Passage of a Monk from India to Chicago



Almost 129 years back, a Monk from India set sail for Chicago in America to address World's Parliament of Religions. This journey was funded by his followers from Madras (now Chennai) and one Raja of Khetri, a princely State in preindependent India. The passage of this Monk from India to Chicago changed the course of Indian history and also the perception of Westerners towards civilizational values of India. This Monk was Swami Vivekanand who, against all odds, reached Chicago in the year 1893 and by his historical address at the Parliament of Religions stirred the very soul of mankind.

Swami Vivekananda was born as Narendranath Datta on 12th January 1863 at Calcutta (now Kolkata) into an upper-middle-class family. He graduated from Calcutta University and during this period he acquired a vast knowledge of different subjects, especially Western Philosophy and History. His quest for answers of searing questions about existence of God led him to Sri Ramakrishna, the saint who had experienced and established essential unity of all religions by professing "so many paths to reach one and the same goal". There began his relationship with Sri Ramakrishna as his Guru, Guide and Philosopher. After the passing away of Sri Ramakrishna, Swami Vivekananda formed a new monastic brotherhood and formally took sannyasa. In the middle of 1890, Swami Vivekananda left Calcutta and embarked on the journey of exploring the country.

During this period, Swami Vivekananda heard about the World's Parliament of Religions to be held in Chicago, America. His friends and admirers in India wanted him to attend this Parliament. He too felt that the Parliament would provide the right forum to present his Guru's message to the world. With arrangements of funds by his disciples, he embarked on his journey to Chicago on 31st May, 1893 from Bombay (now Mumbai).

His journey from India to Chicago was no less arduous. From Bombay he took the route of Colombo, Penang, Singapore, Hong Kong to Japan. The first Port he touched in Japan was Nagasaki. In his letters, he described the Japanese as one of the cleanest people on earth. He found everything neat and tidy in Japan. He wrote that "the short-statured, fair-skinned, quaintly dressed Japs, their movements, attitudes, gestures, everything is picturesque". From Nagasaki, he reached Kobe by steamer and to Yokohama through land route with a view to seeing the interiors of Japan. He visited Osaka, Kyoto and Tokyo. From Tokyo, Swamiji reached Vancouver, Canada and from Canada to his final destination at Chicago in America. He had to bear starvation, extreme cold and also became object of hooting due to his quaint dress. Though he never lost sight of his goal and remained in high spirit being a believer that no great things were ever done without great labour.

Significance of Swami Vivekananda's passage to Chicago and his address to World's Parliament of Religions in the year 1893 is now imprinted in the history. It is interesting to note that Swamiji was not the only Indian speaker in the World's Parliament of Religions. Representatives of Brahmo Samaj and Theosophical Society were also there. Six to seven thousand people were gathered at the Hall. In his letter dated 2nd November, 1893 written to his follower Mr Alasinga from Chicago, Swami Vivekanand himself wrote that unlike other participants, he had not prepared any speech for this occasion. He bowed to Mother Saraswati and stepped up and made a short speech with opening his address as "Sisters and Brothers of America", as a result a deafening applause of two minutes followed and then he proceeded and when it was finished, he sat down, almost exhausted. The next day all the papers announced that his speech was hit of the day and he became a celebrity in America. New Yok Herald newspaper wrote that "Vivekananda is undoubtedly the greatest figure in the Parliament of Religion".

He spent the next two and a half years in America and founded the Vedanta Society of New York in the year 1894. His address at Chicago catapulted him to a heroic figure. This helped him to garner public attention and raise funds through public lectures in America and Europe.

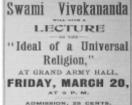
Swami Vivekananda returned to India in the year 1897 and thereafter on 1st May 1897 he set in motion Ramakrishna Mission dedicated to the service of mankind. Swamiji established a new, universal pattern of monastic life open to all men without any distinction of religion, race or caste.

Swami Vivakananda was a seeker of truth and never shied to speak his mind and exhort his followers to be always ready to go extra mile in achieving the desired goals in life. Even while travelling to far off countries, he regularly wrote letters to his followers often chalking out plans for future endeavors to help poor and downtrodden sections of society. He was against creation of any cult and even emphasized to his followers to spread message of Sri Ramkrishna rather than emphasizing that he was an incarnation.

Even before anybody could talk about rights of poor and downtrodden, Swami Vivekananda exhorted Indians about importance of having free thoughts. In his letter dated 24th January 1894 to his disciples in Madras, he wrote that "caste or no caste, creed or no creed, any man or class or caste or nation or institution which bars the power of free thought and action of an individual- even so long as that power does not injure others- is devilish and must go down." He further wrote that "my whole ambition in life is to set in motion a machinery which will bring noble ideas to the door of everybody, and then let men and women settle their own fate." Conviction of powers of goodness, absence of jealousy and suspicion and helping those who are trying to be and do good were outlined by Swami Vivekananda to make every man great and every nation great.

Swami Vivekananda build a bridge between Indian and Western cultures. He showed that, in spite of her poverty and backwardness, India had a great contribution to make to world









Swami Vivekananda with Margaret Noble later on famously known as Sister Nivedita

culture. He charmed scores of Westerners who came to India following him. Prominent among them were Margaret Noble (later known as Sister Nivedita), Captain and Mrs Sevier, Josephine McLeod and Sara Chapman Bull. On the other hand, Swami Vivekananda taught Indians how to master Western Science and Technology and to adapt Western humanism (especially the ideas of individual freedom, social equality and justice and respect for women) to Indian ethos.

Rise of Swami Vivekananda and his tireless efforts in awakening the consciousness of Indian society is also termed as a precursor to the rise of nationalist moment in preindependent India. "Rooted in the past, full of pride in India's prestige, Vivekananda was yet modern in his approach to life's problems, and was a kind of bridge between the past of India and her present ..." so wrote Pandit Jawaharlal Nehru about Swami Vivekananda. As per Netaji Subhash Chandra Bose "Swamiji harmonized the East and the West, religion and science, past and present. And that is why he is great. Our countrymen have gained unprecedented self-respect, self-reliance and self-assertion from his teachings."

More than 129 years back, a Monk travelled to USA and Europe and became famous with option of leading a fanciful life there permanently. But, he chose to return back to his motherland to contribute in emancipation of his fellow countryman. Though even in present day and age we often dream about settling in USA and Europe to enjoy richness and material progress made by Western world. No doubt, whatever part of the world we decide to make our home, the clarion call given by Swami Vivekananda to "Arise, awake, and stop not till the goal is reached" is even more relevant today in the quest of mankind for liberty and freedom of thought and action. Before he took his last breath on the night of 4 July 1902 at Calcutta he had written to a Western follower that "It may be that I shall find it good to get outside my body, to cast it off like a worn out garment. But I shall not cease to work. I shall inspire men everywhere until the whole world shall know that it is one with God."

Exploring the Healing Effects of Yoga and Its Ability to Increase Quality of Life



As modern media and publicity may have us believe that yoga is all about physical poses, the entirety of yoga comprises a broad variety of thoughtful and self-disciplinary practices, such as meditation, chanting mantras, entreaty, breath work, rites, and even selfless acts. The word "yoga" comes from the root word "yuj," which means "to yoke" or "to bind." The word itself has many meanings with the fundamental subject being connected.

The scientific research into yoga's benefits is still rather preliminary, but much of the evidence suggests what practitioners seem to have recognized for millennia: "Yoga is very beneficial to our overall well-being."

Yoga, a very old practice and meditation, has become more and more well-liked in today's busy society. For a lot of people, yoga provides a retreat from their busy lives. While all those yoga poses can seem intimidating at first, it's in fact a very approachable form of exercise.

In spite of the popular belief, yoga is more than just a physical practice—yoga is a complete program of how to live in the world. The knowledge of yoga is one of our connections, referring to the union of our own body and mind. This way, yoga is an organic method of helping us keep our mind and body in the same place together. People who practice yoga are more likely to be lively in other forms of exercise.

What Went Before

Yoga began in India and has been around for about 5,000 years. At first, it was taught in a one-on-one method to only men of the uppermost class. Traditionally, yoga is a system to promote well-being on the physical, mental, emotional and spiritual levels. These days, yoga is not considered as a set of spiritual philosophy; it can be practiced in a completely worldly way.

One significant instant in yoga's spread was when Swami Vivekananda spoke at the World Parliament of Religions in Chicago in 1893. Another milestone was Paramahansa Yogananda's book, Autobiography of a Yogi, published in 1946 and still read by a lot of yoga students.



Does Yoga Count as Exercise?

Yoga didn't originate as an exercise program, but some styles have been modified into workouts focused on the physical parts of the practice. Anything that elevates heart rate for a consistent period of time is helpful to overall health. The heart is a muscle, and elevation of heart rate makes it stronger.

Yoga certainly isn't in the same category of aerobic exercise as running or biking. But the amount of aerobic benefit a person could get from yoga depends a lot on the style and pace of the type of yoga done.

It's a good way to get resistance training, because yoga builds functional strength.

How Does Yoga Benefit Health?

The benefits of yoga are different for different individual. Overall, it has components that can help with flexibility, strength, balance, and stability. It can also help with specific measures of health, like eating habits, weight loss and weight loss maintenance, and cardiovascular health. People who practiced yoga saw modest improvements in anxiety, stress, body composition, blood pressure, inflammation, and metabolic markers.

The benefits were greater when the yoga intervention includes breathing techniques and meditation. Yoga may help people with certain health conditions and chronic diseases manage pain and other symptoms, and with overall quality of life. The popularity of yoga has gone up considerably in recent times. Research also backs the benefits of yoga. Not only that, many medical professionals and celebrities have taken on and are endorsing it for its many health benefits.

The heightened stress and fast pace of today's world make yoga more pertinent than ever. When one does yoga, the nervous system calms down and the person dodges the fight-or-flight state. Just sitting and breathing can be yoga.

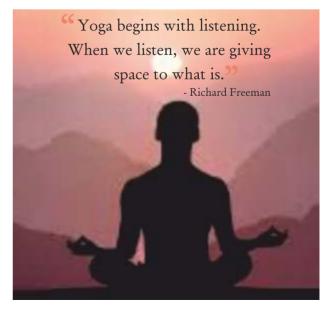
It can actually benefit in unexpected ways:

- 1. Improves flexibility
- 2. Helps with stress relief
- 3. Improves mental health
- 4. Reduces inflammation
- 5. Increases your strength
- 6. Reduces anxiety
- 7. Boosts immunity
- 3. Improves balance
- 9. Improves cardiovascular functioning
- 10. Helps improve sleep
- 11. Improves self-esteem
- 12. Improves bone health
- 13. Promotes better posture and body awareness
- 14. Improves brain functioning
- 15. Helps with burnout

The Outcome_

While this consideration is still young, the results are promising and corroborate what yoga practitioners have been touting for thousands of years. Even karmic or philanthropic action can qualify as yoga!

Because yoga is not limited to physical movement, it's a practice you can do every day. Find the modality that works best for you and remember: Investing in a yoga practice is investing in you!



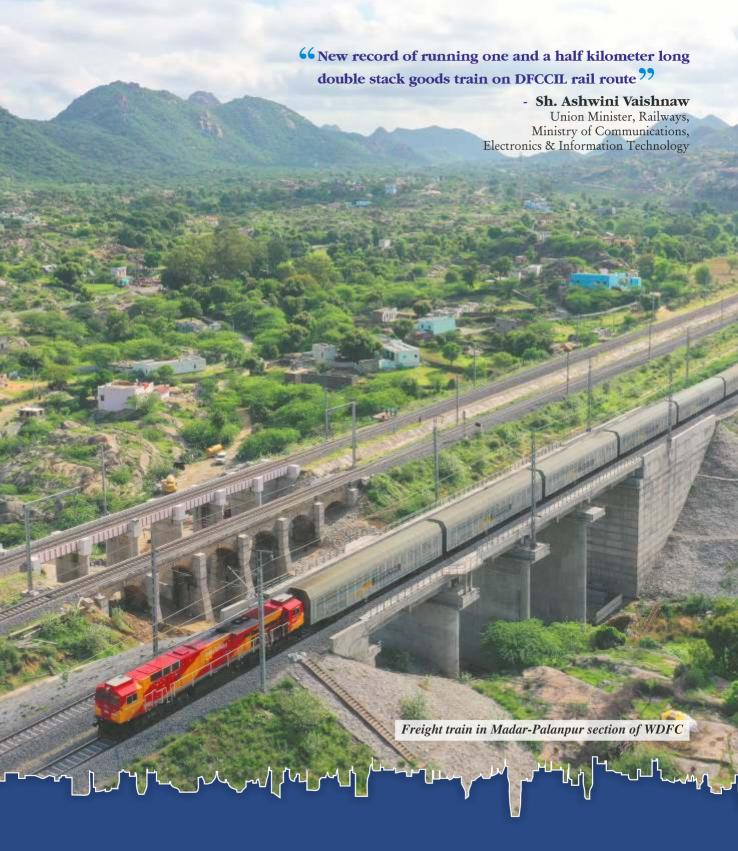
Railway flyover (ETMJ-4) in Bhaupur-Khurja section



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