

# FREIGHT OPERATIONS INFORMATION SYSTEM (FOIS)



By: Raman Arora (Emp Id 1751) and Nidhi Mahajan (Emp Id 1868)

## Background and History

---

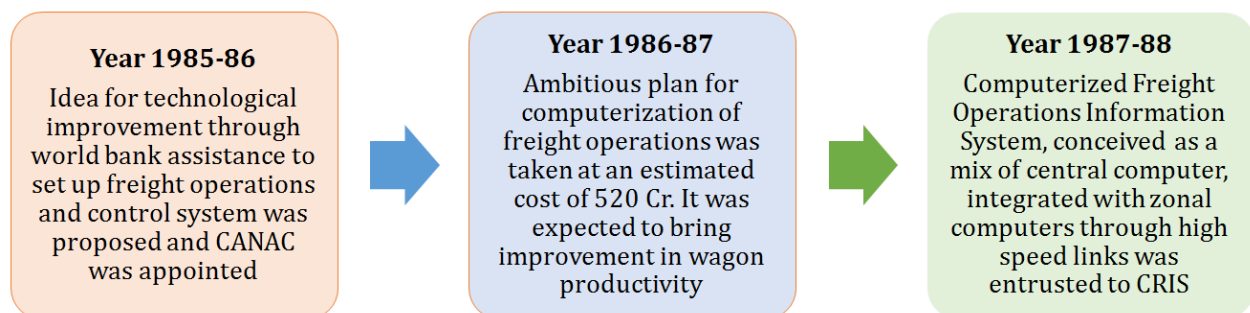
Since Independence, our country has experienced profound transformations and rapid industrialization growth. To facilitate this progress, efficient system of freight transportation was essential to improve the economic standards and competitiveness of the nation.

Indian railways with its large infrastructure of more than 66,687 Km of rail network and carrying more than 1200 MT of freight in a year, is one of the biggest player in this domain connecting agricultural and natural resources areas, mines to thermal power plants, ports to inland container depots and major industrial hubs across the length and breadth of the country.



If we go back to year 1985, IR loaded about 230 MT of revenue traffic, fulfilling transport needs of every principle sector of the economy carrying all major commodities such as Steel, Iron Ore for Export, Food Grains, Fertilizers, Coal, Cement and Petroleum Products. The challenge of scarce resources coupled with growing business opportunities i.e. rising demand, fast developing container traffic and major industrial policy resolutions gave rise to putting more emphasis on improving wagon turn-round.

IT enablement in freight operations was immensely required to facilitate in planning, monitoring and reviewing the day to day operations and was expected to speed up the decision-making process, leading to a qualitative change in the overall performance IR freight business. The system would provide effective and economical utilization of rolling stock and other assets.



FOIS project was approved by Planning Commission in Nov-1989 at a cost of Rs 1098 Cr with the stipulation that it should be implemented, to begin with, on the Northern Railway. The Detailed Estimate was sanctioned in Dec-1992 at a cost of Rs 267.2 Cr (Rs 121 Cr for computer segment and 146.2 Cr for Telecom Segment). Target Date for implementation was 31.12.1995.

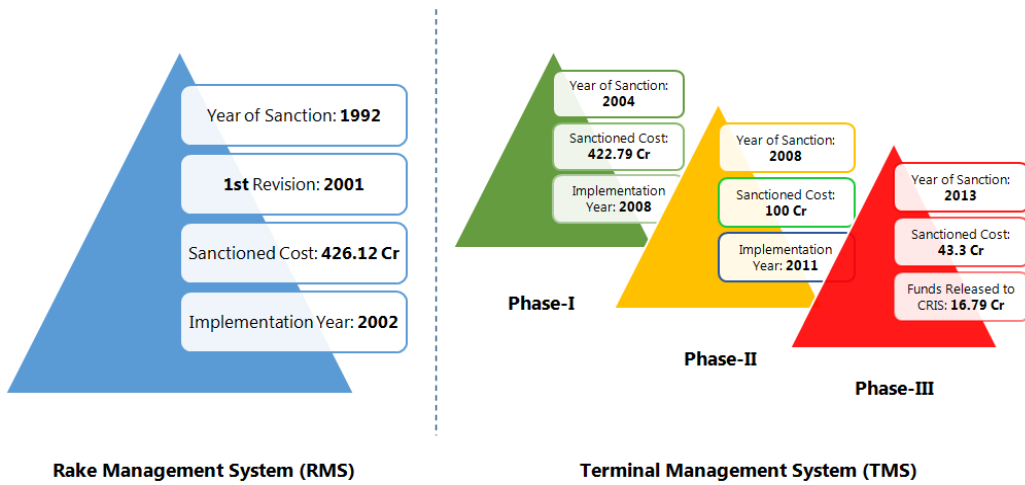
Initially in 1990's, on the directions of CANAC (Canadian National Railway Consultants), TRAC System from Canadian Railways was customized to IR's environment. Central Online System (COLS) for movement and routing of wagons, Zonal Online System (ZOLS) for Terminal Management and Zonal Offline System (ZOFLS) for Freight Revenue Accounting were provided. Any customization to these systems proved highly expensive and limited as the design was too rigid. Installations were done for each zone separately.

Later, CRIS in association with CMC Ltd took up the challenge to implement IR's own system for freight business. Two subsystems for FOIS, Rake Management System (RMS) for operating aspects and Terminal Management System (TMS) for Commercial aspects were rolled out in early 2000, which marked the beginning of a new era: **Digital Transformation of IR Freight Business**.

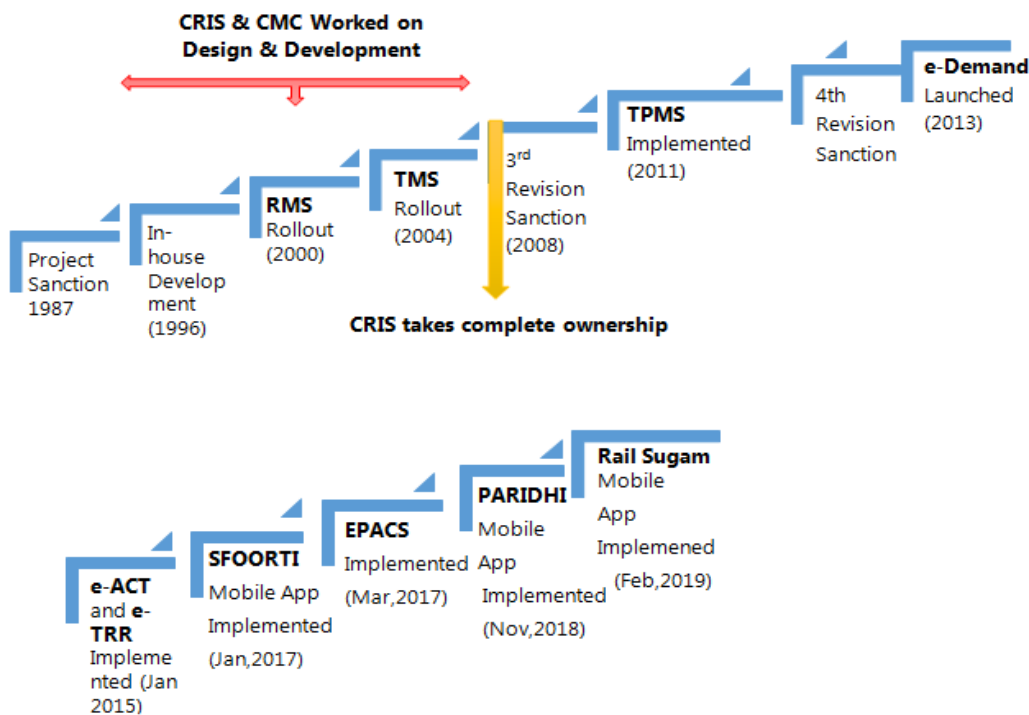
## Financial Aspects

---

FOIS, was sanctioned in the year 1987 and has undergone 4 Revisions since then for a total estimated cost of 835.04 Cr. The Application has been in O&M stage since year 2013-14.



The last sanctioned cost for FOIS O&M was for the financial year 2018-19 as 27.58 Cr.



RMS and TMS are the core modules, which capture all the data pertaining to train movement and terminal handling across Indian Railways. The data collected through these modules forms the basis of other applications in FOIS. The sanctions for O&M were effectively utilized to offer innovations through new additions.

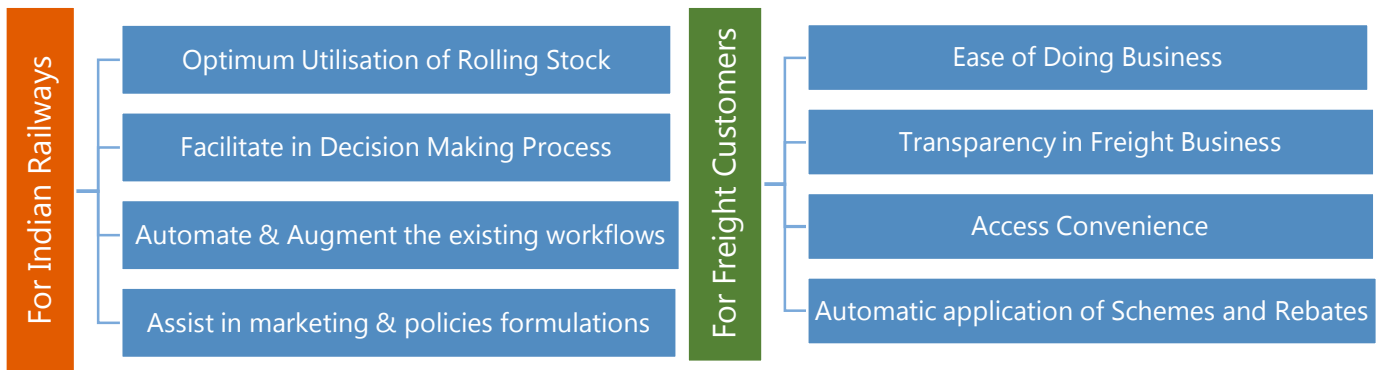
## Objectives

**Freight Operations Information System (FOIS)** was envisaged to facilitate effective monitoring and efficient utilization of rolling stock. The principal objective was to improve monitoring and control of railway operations and to optimize the utilization of railway assets, particularly wagons and locomotives, thereby help increase productivity and profitability. The system was expected to integrate the information required and ensure its availability, either on enquiry, or through unsolicited or scheduled reports in real time to assist management in efficient decision making.

## Specific Objectives:

- To optimize utilization of assets and resources by improving distribution of wagons, scheduling and routing of traffic and regulation of traffic to minimize congestion.
- Eliminating drudgery of collection and conciliation and repetition of operational data, saving time for operating officers and staff.
- Eliminating gaps in information and decision making inherent in manual system
- Ensure timely maintenance of Rolling stock and monitoring of equipment failures
- Ensure prompt way billings and accounting of freight earnings
- Improve quality of service to customers and to assist in developing realistic long-term plans.

The system was initially planned to capture operating data of freight movement in Indian Railways along with their commercial aspects and terminal handling activities. The data thus generated would expedite the decision-making process leading to improved rail freight business. Advancements in technology and burgeoning demand for rail freight transportation, opened more frontiers and shifted the focus to bring advantages for all the stakeholders.



System integrations with country's major players (governmental and non-governmental) for exchange of information would also help planning reforms and to fuel the economic growth.

## Salient Features and Benefits

---

Leveraging state of the art technologies, FOIS has evolved into a multitier architecture, offering unique advantages to all of its stakeholders. Commissioned with a basic two-tier architecture, it has now become a full-fledged application with modernized ways of monitoring assets, entailing decision support systems, integrations with related IT systems of Indian Railways and other governmental entities for exchange of critical information. The system ensures its accessibility anytime-anywhere through easy to use web interfaces and on mobile devices.

The application comprises of number of modules catering to different requirements for freight operations in Indian Railways.

### **Rake Management System (RMS) – Complete Rake Lifecycle**

An application which capture operational information related to complete life cycle of rake from formation to dissipation, Train running (automatic through COA), en-route exceptions (Diversion, Wagon attachment/detachment), detentions, stabling, yarding, operating placements, vehicle guidance, equipment failure, maintenance of rolling stock, interchange, forecast and planning for locomotives, wagons and unit trains. FOIS presently manages more than 2,81,000 Wagons and 12,700+ locomotives through this module. Integration with Electronic In-motion weighbridge ensures quicker and accurate weighment.

## **Terminal Management System (TMS)- *Complete Consignment Lifecycle***

An application which records the commercial aspects from booking till delivery of goods. Rake allotment, loading particulars, calculation of freight charges and rebates, generation, printing and **e-Transmission of Railway Receipts**, Collection of WRF, Demurrage & Wharfage collection. Integration with IRCTC Common Payment Gateway for handling monetary transactions. Average Daily Collection recorded is more than 360Cr with more than 22 lakh transactions per day. Application of rebates and schemes: Long Term Tariff Contract, LWIS, GWIS, Station to Station Rebates, Empty Flow Direction Rebate etc. is provided through this module.

## **Rake Allotment and Allocation System (RAS)**

An application module which facilitates automatic allocation & allotment of Coal and Iron Ore Rakes, the major commodities for IR freight business.

## **Web Reports**

Web-based module available to freight management and staff for accessing real-time information of traffic movement and performance analysis. The information is also published for different periods through Ad-hoc reports on various aspects for better monitoring and decision making.

## **e-Demand Registration Module and e-Customer**

Web application helping freight customers book their consignments anywhere anytime in a more transparent manner. A quicker, convenient and secure way of transacting with Indian Railways. Presently more than 2000 customers are registered with majority of the demands, booked through this system. Detail of bookings, history and continuous cargo visibility can also be accessed through e-Customer module.

## **e-Diversion**

Authoritative diversion of Coal Rakes ensuring optimum utilization of stock and ensuring better supply of rakes for Coal.

## **TPMS & e-ACT**

Decision support systems providing assistance with congestion prediction at destination station arising due to specific rake supplies leading to better utilization of line capacity.

## **e-Payment Module**

Facility for electronic payment of charges through integrations with leading nationalized banks bringing convenience to transact with IR and immediate accrual of freight earnings for railways. More than 1100 Freight Customers across Indian Railways are using this B2B service.

## **Integrations with key IT systems of IR**

Enterprise Integrations with other key modules like Rates Branch System (RBS), Crew Management System (CMS), Integrated Coaching Management System (ICMS) and Control Office Automation (COA), Web-Claims, Rolling Assets Management System (ROAMS), Rail Drishti Portal, Accounting Management System (TAMS) for accessing and sharing allied information on real-time basis.

## **Integrations with Logistics Partners**

The system is integrated with number of logistics partners for exchange of information on real-time or periodic basis. The leading national players like NTPC, CONCOR, IRCTC, CBEC, Karnataka State Government (Department of Mines), Gateway Rail, DFCCIL, i3MS, CTOs, Delhi Mumbai Industrial Corridor Development Corporation (DMICDC), Indian Ports Association and MILRAIL. The information helps them monitoring and planning their assets in a comprehensive manner for an effective decision making and strategic movements.

## **B2B Integrations with Freight Customers**

The data captured in FOIS System is transferred to ecosystems of major freight customers like SAIL, West Bengal Power Development Corporation, NTPC, CEA, Pre-weight bin System, Ministry of Commerce for National Logistics Portal and Law Enforcement Agencies through secure integrations. Thus, helping them run their business efficiently.

## **FOIS Web Portal**

A single window access through [www.fois.indianrail.gov.in](http://www.fois.indianrail.gov.in), to all the web modules, enquiries and important links, providing convenience and information security to all the stakeholders of IR Freight Business.

## **Mobile Apps: Innovative ways to access information**

Information is made available through state-of-the-art GIS Views, Dashboards and Interactive Maps in the form of Mobile Apps. The apps are available for freight managers facilitating performance monitoring on set of KPIs and assets tracking. PARICHAALAN, SFOORTI and Rail PARIDHI are new additions towards these offerings. To provide access convenience, transparency and ease of doing business, Rail SUGAM is a unique initiative for freight customers.

## **Standards Followed**

---

Information is at the core of Freight Operations Information System, securing this vital component is one of the key area where the system plays an active role.

### **ISO 27001:2013**

Is an International standard, allowing secure exchange of information and manages risks, thus helps in retaining clients and their trust. To manage the risks and security of the information lying with FOIS, the system is getting aligned with this globally recognized standard.

### **OWASP Top 10**

Web Application modules of FOIS comply with Internationally Accredited, Open Web Application Security Project (OWASP),eradicating the top 10 vulnerabilities as reported in their awareness document. The system also follows the guidelines provided by country's leading security risk consulting firms like **CERT-IN, NCIIPC (National Critical Information Infrastructure Protection Centre) and Mahindra SSG.**

### **GIGW (Guidelines for Indian Government Websites)**

To ensure transparency, accessibility, effectiveness and easy access to benefit the citizens, FOIS follows GIGW in most of its customer centric web application modules.

### **IEEE Standards**

The quality of the software which produces the information must be dealt strongly at the code level itself to build a robust foundation. The FOIS System makes use of IEEE coding standards for quality of the product, easy customization and timely delivery.

## **Technology Architecture**

---

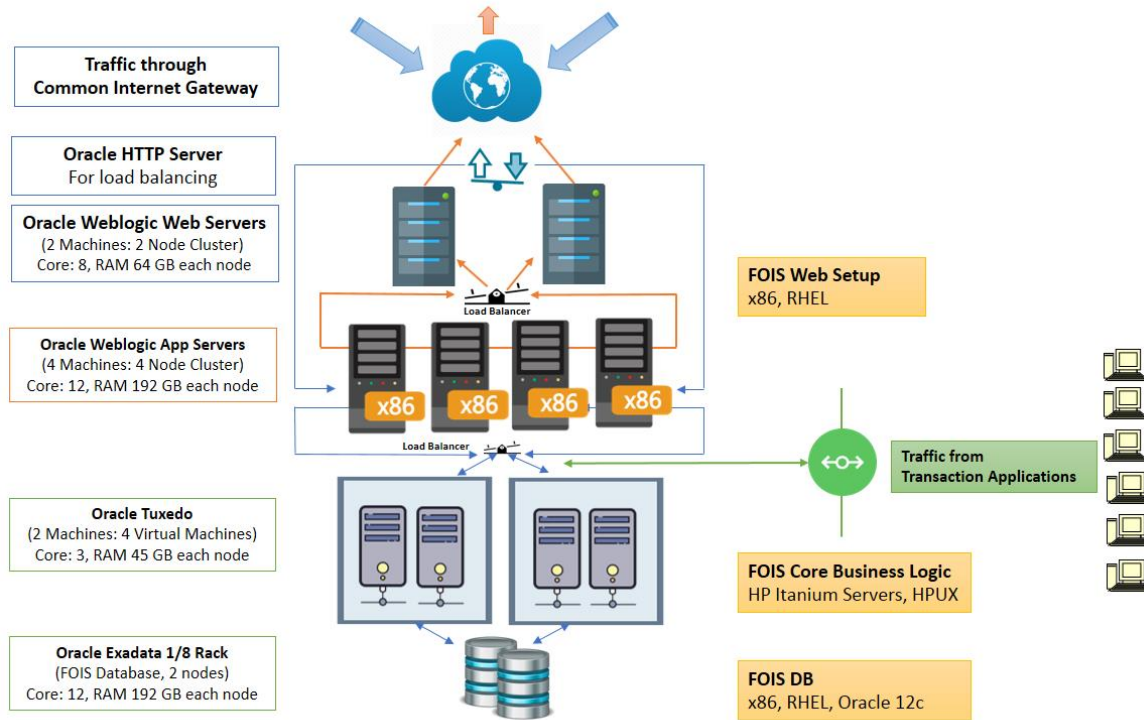
Freight Operations Information System has been engineered with state-of-the-art technology on all fronts: hardware, software and process.

The processes for system configuration, securing the access and auditing are well established to monitor the performance and identification of any potential risk. Industry's best practices are used to evade any internal or external threat.

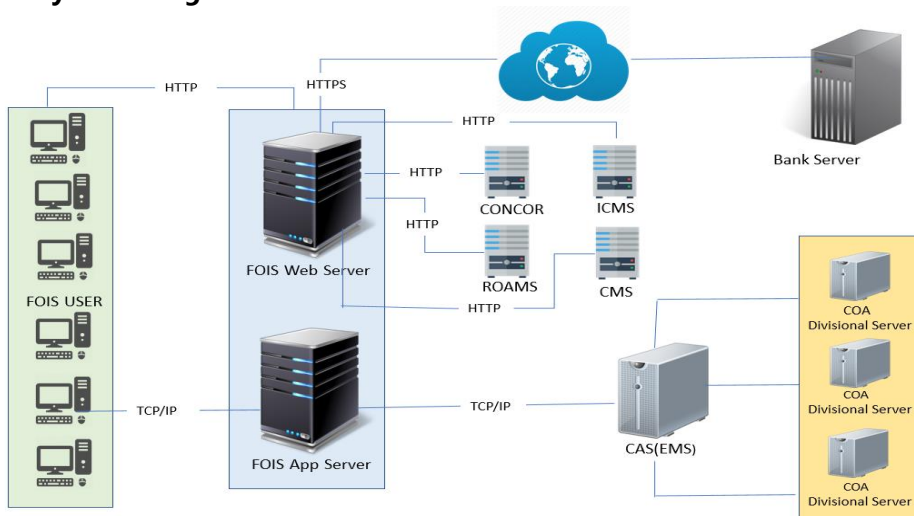
The system stands on a complex architecture of ultra-high configuration server clusters with auto load balancing and fail over modes.

## Server Architecture

Clients	Windows, Android, iOS	Visual Basic, J2EE and Mobile Devices
Middleware	Oracle Tuxedo 11g (HA/FT)	HP Itanium Rx600, HPUx 11iV3 (3 Core, 45 GB)
Database	Oracle 12c (RAC) on EXADATA	Rx6600, HPUx 11i & RHEL 6.1 (32 GB Quad core)
Storage		HP 3PAR, EVA 8100



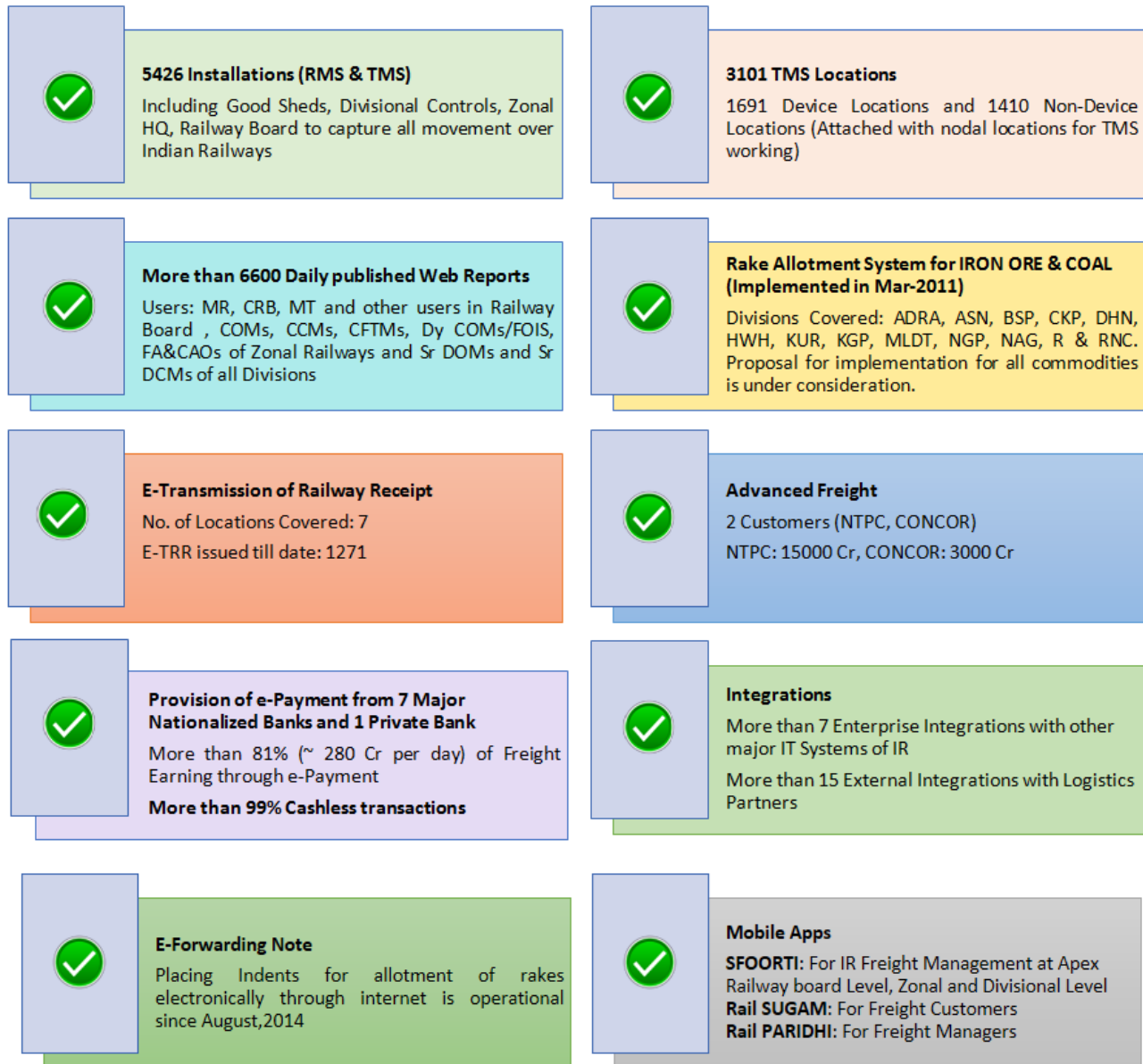
## FOIS System Integration Architecture:



Keeping pace with the technological change, the system has demonstrated its excellence by delivering Highly Available, Secure, Scalable and Agile applications from time to time.

# Implementation Status

Freight Operations Information System (FOIS) has been implemented successfully. The system has digitized majority of the workflows in freight operations with data capturing enabled throughout Indian Railways.



*\*Status as on 24-06-2019*

With large number of applications in offering, further changes are being carried out to give enhanced user experience. Enterprise wide integration and dashboards to give a comprehensive perspective for planning and monitoring. New features, rate circulars and innovative schemes are being implemented to improve the freight business. Live tracking of IR locomotives through GPS/Satellite Communication is being updated in FOIS system which will facilitate real time monitoring of freight trains.



# Roadmap Ahead

---

The system, with its substantial amount of data about freight operations in Indian Railways is of utmost importance not just for IR freight customers but entire freight transportation sector of the country. Although it has completed its implementation yet is serving several logistics partners to build and innovate new ways of freight movement for domestic as well as international segments.

**First-Mile Last-Mile Connectivity** will revolutionize the logistics ecosystem improving logistical cost efficiency and bringing convenience. Picking the consignment at the customers' doorstep and delivering it to the ultimate destination through systems integration of rail and road transportation with real-time exchange of data, will fuel the economic growth and would help offer better services to citizens of this country.

Containerization has also become essential in respect of Multi modal transportation and international trade. Door to door service facilitates quicker, safe and convenient transit with cost efficiency. Integration with CONCOR via rail, road, shipping and inland water ways with warehousing can be effective in driving the transformation for sustainable growth. Data exchange between waterways and rail can complement each other in river ports on Domestic as well as International Segments.

**Route Optimization** would help railways decongest its network and faster delivery of freight. The analysis of large chunk of FOIS database will not only lead to decongestion, but also the optimum utilization of rolling stock, line capacity utilization and decrease in WTR.

**Prediction of Demand and Empty Allocation** through Machine Learning and Artificial Intelligence algorithms, the system would assist the freight managers make informed decisions and serve freight customers in the best possible way for timely supply of appropriate number of rakes/wagons for their consignments. Impact of industrial policy reforms on the demand could also be analyzed for long-term planning of the same.

**Driving the Future** of freight transportation in the country, the FOIS System and its large pool of data would continue to provide commercial dynamism for offering new schemes and rebates to freight customers, planning new routes and innovating new models of freight transportation paving the way for regaining market share of freight transportation in India. The system would also act as a basic IT foundation for Dedicated Freight Corridors connecting major economic hubs of the country.

**Developments in Progress** are meant to automate the manual workflows and to bring in more transparency and new ways to transact with IR freight business.

- **Real-time capturing of train running information** through Satellite/GPS communication by the way of devices installed on locomotives along with their health monitoring would enable better utilization of rolling stock and minimize the chances of exceptions en-route.
- **Enterprise Data Warehouse** will facilitate analyzing large pool of FOIS data and monitoring the performance in tandem with the passenger trains movement. The system will help in effective decision making for the profitability and efficiency in freight operations.
- **e-CRM** will help manage and deepen the relationships with existing & potential customers and other stakeholders. The continuous connection, feedback would help forecasting of demands and promotion of new schemes and benefits for the customers.
- **Disaster Recovery (DR) Site** will limit the risk and get the system as close to normal as possible after an unexpected interruption, if any. This is immensely required to ensure business continuity not just for Indian Railways, but for logistics partners who rely heavily on FOIS Data.

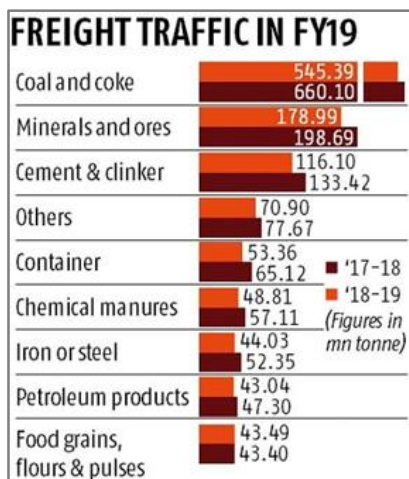
FOIS would ensure continuing Digital Transformation of Indian Railways incorporating Mobility, Analytics, Artificial Intelligence, IoT and Application Integrations and would fuel the economic growth.

## Value Additions to Indian Railways

Freight Operations Information System (FOIS) has revolutionized the way Freight business was conducted earlier in Indian Railways. The system has automated the manual workflows, brought in transparency, effective monitoring of assets and remarkable improvement in KPIs. The information presented through different modules help freight management take decisions and run the freight business more efficiently now.

### Visible indicators are:

- Reduction in WTR and Increase in Revenue Loading over the period of time
- Earnings getting directly credited to Railways in real time
- Integrations with legacy systems through SOA
- Cashless Freight Earnings increased from 79% to 99%
- Decision Support Systems providing assistance with congestion prediction
- Zero manual input and all electronic invoice generation for GST
- Effective Rolling Stock Utilization



Despite the challenge of passenger cross-subsidisation, the out-priced freight sector has been able to retain the trust of its clients. The system has not only assisted management for analysis of its position and launch new policies and schemes but also customers started availing the benefits of these schemes in no time.

B2B Integrations have served other logistics partners to run their business more effectively. The rail freight information in their ecosystems facilitate in short-term and long-term planning and help strengthen their position in the market by offering better services.

Adding transparency in one of the biggest sector of the economy and bringing customer close to the freight business, FOIS has added feather in Indian Railways' Cap, bagging an award of **"Outstanding Contribution in the category of Vigilance Innovation"** by Central Vigilance Commission of India in the year 2017-18.

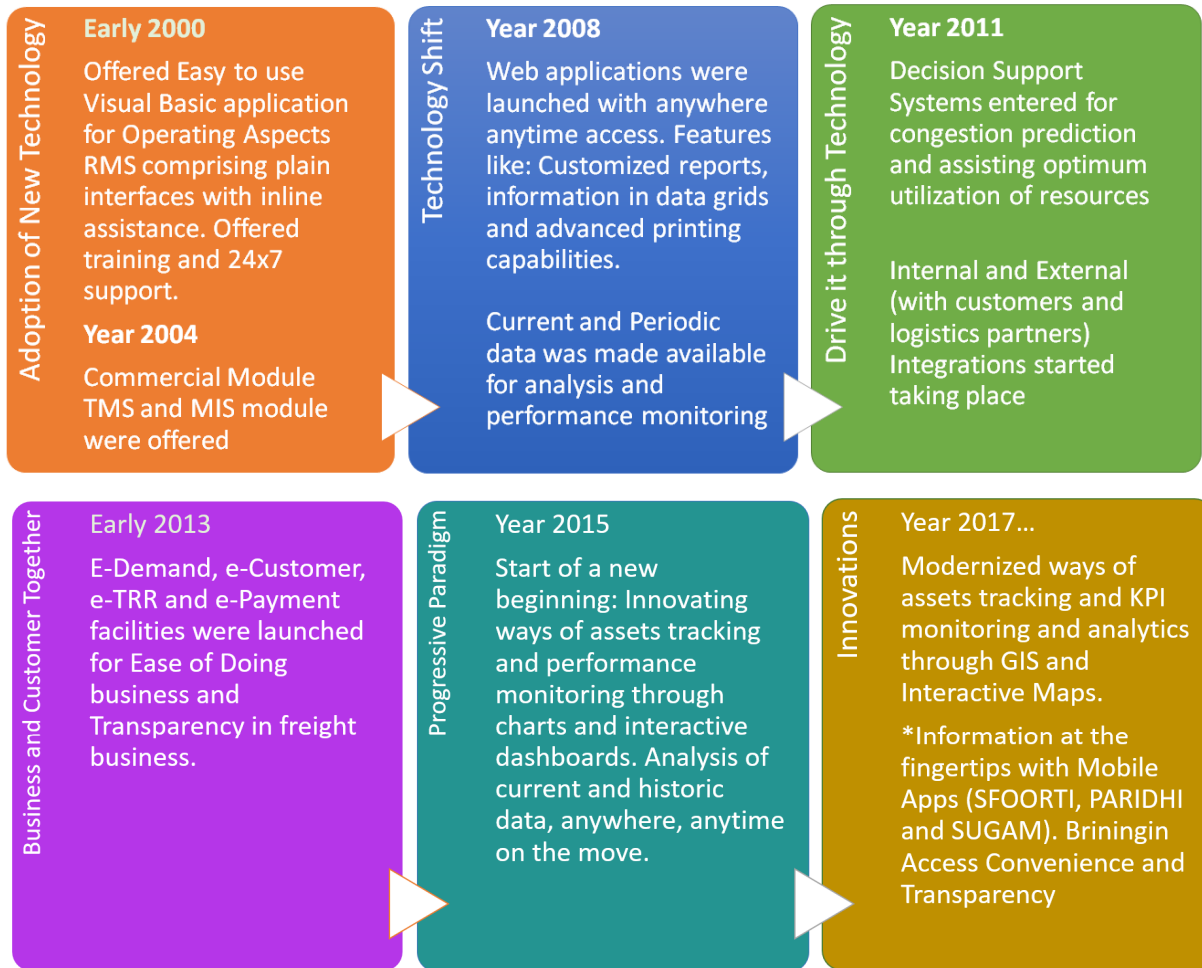
## Learnings

With FOIS, Indian Railways and its IT arm, CRIS have gained two essential learnings

- 1) Keeping pace with technological change is a key to success in this competitive marketplace
- 2) A satisfied customer is the best business strategy

Continuous improvement requires commitment to learning, the journey of FOIS would not have been successful if the due attention had not been given to these learnings.

## Learning the progressive aspects



## Learning the Quality and Delivery Aspects

### Not having clear requirements and expectations of what the system will deliver

System has witnessed a significant code redundancy and duplication of efforts due to unclear requirements leading to lags in optimum utilization of resources. Publishing of more than 6600 reports, on daily basis is a result of this conduct.

### It's not just about the system

The system has demonstrated its excellence by digitizing many workflows, yet since it relies heavily on user reporting and data feeding, any misappropriation in these inputs results in inadequate information for decision-making process.

### Aggressive, unrealistic implementation timelines

Any change in such mission critical system with unrealistic implementation timelines may result in compromise to quality of the product. Rectifying the bugs at later stage leads to extra efforts and miss-utilization of precious time of experienced taskforce.

### Lack of Proper Documentation and Record Keeping

Implementations should be process dependent and not the person dependent. Training a new resource or referring the features of an old module immensely require the proper documentation of the applications. Insufficiency of these features have significant impact on delivery of outputs at the later stage.