Chapter 2

Freight Operations Information System in Indian Railways

Executive summary

Freight Operations Information System (FOIS) was implemented in Indian Railways as an initiative to leverage the use of Information Technology in the freight segment as an aid to decision making and to ultimately improve the freight services. After successful completion of trials and its implementation in Northern Railway, the system comprising two modules- Rake Management System and Terminal Management System- was rolled out to all the zones over Indian Railways. This was an ambitious project introduced, inter alia, to enhance the accuracy and reliability of operating data to provide a real time view of transactions and to serve as a decision making tool in allotment of rakes to customers and improved asset turnaround.

The Information Technology Audit conducted to assess the comprehensiveness of system design, accuracy and timely availability of reliable data apart from the adequacy and effectiveness of IT security disclosed several deficiencies. Indian Railways has since incorporated several features and developed additional software to strengthen the system and has addressed some of the issues pointed out by Audit. Indian Railways was of the view that the initial difficulties of field staff had considerably reduced and railway management responsible for planning and operation of trains was now maintaining checks at various activity points to ensure timely and sequential input of data.

However, much more needs to be done as system design still did not incorporate all the business rules relating to freight operations and interface mechanisms were not fully established. The input validation controls were inadequate and deficient leading to numerous errors in the master databases. FOIS required extensive manual interference and accounting of freight revenues also continued to be done manually in the field locations. The system, in its present state, was unable to provide an updated and reliable 'real time' information to assist the operating/ commercial management and field supervisors in short term planning as envisaged.

2.1 Highlights

The system was not comprehensively designed to incorporate all the relevant business rules relating to freight and posed operational constraints. Consequently, the perceived objectives of Freight Operations Information System were not fully achieved even after more than seven years of its implementation.

(Para 2.9.1.1)

Interface mechanisms with weighbridges and other applications were yet to be established limiting the utility of the application. Some processes were performed manually exposing the system to the risk of input and processing errors.

(Para 2.9.1.2)

The master data bases contained numerous errors and validations were either absent or deficient which adversely affected reliability of data. The operating data was also being input in the system belatedly due to weak monitoring mechanism in the zones. The system was, therefore, not geared to provide a real time view of the freight operations.

(Paras 2.9.2.1 to 2.9.2.3)

Decisions on rake allotment were being taken manually in the zones, defeating the objective of capturing elaborate details on registration of demands of customers in the system.

(Para 2.9.2.3)

Both physical and logical access controls were weak and maintenance of back up data was defective. Network security was inadequate exposing the system to increased Information Security risk.

(Paras 2.9.3)

2.2 Gist of recommendations

Indian Railways should rectify the system to incorporate all the relevant business rules relating to levy of freight.

Integration of the system with weighbridges and other applications needs to be expedited to eliminate manual interventions and attendant risk of data entry errors.

Inaccuracies in master data need to be rectified on priority. Indian Railways should institute appropriate checks for input and process validation as also for updating master data to enhance reliability.

The monitoring mechanism needs to be strengthened to ensure that field locations input the transaction details promptly so as to provide a real time view of operations and to facilitate decision making as envisaged.

Indian Railways should strengthen the physical and logical access controls to monitor and prevent unauthorised access. Effective off-site storage of back-up data needs to be maintained and network security needs to be strengthened.

2.3 Introduction

Indian Railways (IR) depends on freight traffic for the bulk of its revenues. Freight is subject to frequent changes based on the freight marketing policies and initiatives launched from time to time. The sheer size and complexity of

operations, lack of continuous cargo visibility and end-to-end commitment to freight customers necessitated development of a system for availability of information on freight operations as an aid to decision making. Freight Operations Information System (FOIS) was initially sanctioned in 1983-84. The application software -Traffic Reporting and Control System- procured from Canada, customised as centralised application for FOIS at a cost of Rs.74.38 crore (up to March 1996) failed at the trial stage as an interface could not be established with the subsystems indigenously developed by the Centre for Railway Information System (CRIS) and was abandoned in 1996.. Subsequently, IR developed and implemented FOIS with the help of M/s Computer Maintenance Corporation (CMC) Limited and CRIS.

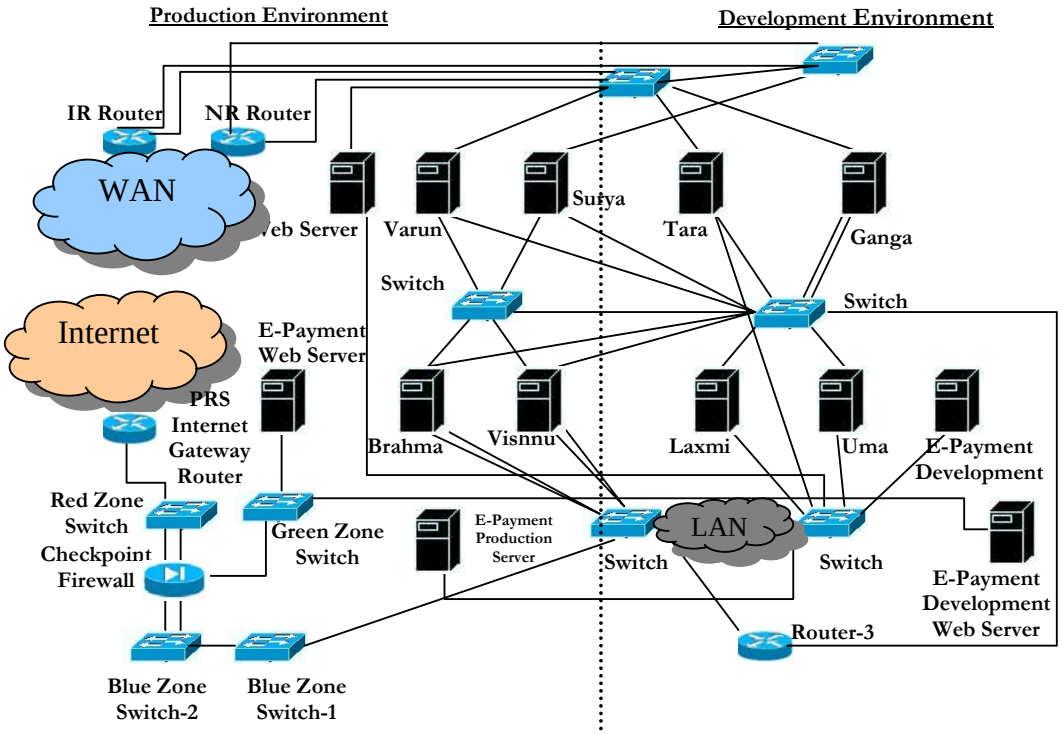
A prototype of FOIS application software comprising Rake Management System (RMS) and Terminal Management System (TMS) was developed and implemented in Northern Railway in 2000. RMS covered various operational functions relating to routing, tracking and yard activities and had seven sub-modules while TMS covered the commercial activities pertaining to goods' sheds such as generation and accounting of Railway Receipts etc and had 11 sub-modules. Subsequently, M/s CMC developed an upgraded production version of RMS and TMS to make it apposite for IR.

2.4 System architecture

The design conforms to the state of the art client server technology using middleware and a Relational Data Base Management System (RDBMS). Application servers at the CRIS are networked and linked to a central database for global level transactions. The central database acts as the repository of all current and historical data. The application is interface-ready for web-based services like connectivity to customers and e-payment gateway interface.

The hardware includes two Compaq/HP Alpha server ES-45, two Compaq/HP Alpha server DS-20 having RA-8000 storage system (3.2 TB storage space) with DAT drives, 16 ports SAN switch, personal computers (Client/Console machines), printers, UPS, Routers, Dial up modems, Switches, VSAT etc. System software includes Oracle 9.2.0 RBDMS as backend on TRU-64 UNIX 5.1B PK4 cluster platform with BEA Tuxedo 8.1 as middleware and Visual Basic as presentation layer, Pro-C as front end, PL-SQL for business logics and XML for MIS reports. The FOIS network plan utilises a mix of the available terrestrial network of IR, leased BSNL lines and a satellite network (V-SAT) to ensure reliability.

System architecture of FOIS



2.5 Objectives of computerisation

The objectives of computerisation of freight operations included:

- enhancing the accuracy, reliability and timely availability of basic operating data pertaining to events in the field locations;
- providing a wide range of information updated in 'real time' facilitating operating management for better planning, direction and control of freight operations and revenue accounting;
- efficient scheduling and quick turnaround of rakes to enable effective and optimum utilization of the assets and resources;
- facilitating acceptance of customers' orders, billing and cash accounting of freight traffic from identified nodal customer centers, which might not be the handling terminals; and
- global tracking of consignments in real time and seamless availability of pipeline of consignments for timely planning and just in time inventory management

2.6 Organisation structure

The organisation of Chief Administrative Officer (CAO), FOIS was created in 1994 for implementation of FOIS on Indian Railways. CAO (FOIS) works under administrative control of the General Manager, Northern Railway. The accounts and finance work is dealt with by Financial Advisor and Chief

Accounts Officer (Construction), Northern Railway. Field units for implementation of FOIS exist in all zones under Chief Operating Managers.

The RMS terminals in the divisions are managed by operating staff – train clerks and guards at yards, by controllers in divisional control office and are monitored by Senior Divisional Operating Manager. Similarly, the TMS terminals are managed by commercial staff- goods clerks/supervisors in goods sheds and by assistant officers in commercial branch in divisions and are monitored by Senior Divisional Commercial Manager.

2.7 Audit objectives

The IT Audit on Freight Operations Information System was conducted with a view to assessing whether the:

- System design was comprehensive and effective in providing information on freight operations and revenue accounting for review, coordination and monitoring;
- Mechanism to enhance accuracy, reliability and timely availability of basic operating data at locations was adequate and effective; and
- IT security was adequate and effective

2.8 Audit scope, criteria and methodology

The scope of audit covered audit of project management covering IT Plan, system analysis, design, development, implementation and post implementation review. Apart from the general controls covering change management mechanism, system and network security, disaster management and business continuity plan, the application controls covering input, processing and output controls were evaluated.

The rules and provisions contained in Indian Railway Conference Association's Goods Tariffs, Indian Railway Stores codes, decisions, guidelines and orders issued by Railway Board from time to time, procedures defined by FOIS administration and best practices prevalent in IT environment were used as audit criteria.

Audit methodology included scrutiny of records at CAO (FOIS) office, CRIS office at New Delhi and at different field units of various zones, online queries, discussions with concerned officials. Simulation tests were also conducted and FOIS data was analysed using Computer Assisted Audit Techniques (CAATs). The audit findings and recommendations were discussed in an exit conference held in February 2010 with Member (Traffic) in Railway Board, who stated that FOIS had been of great help to IR and the deficiencies pointed out in the system by Audit are being taken care of.

2.9 Audit findings

The audit findings are given in the following three sections:

- System design
- Data reliability
- Information System security

2.9.1 System design

The system was developed to computerise freight operations and to provide a wide range of information to enable planning, direction and control of freight operation. Additional features such as identifying nodal customer centers to facilitate acceptance of customers' orders, billing and cash accounting of freight traffic from other than handling terminals were also planned. For effective utilisation, it is essential that the system is comprehensively designed encompassing all the relevant rules and providing interface mechanisms to eliminate or alternatively minimise manual intervention. Audit observed deficiencies in the system design due to improper mapping and updation of rules and inadequacies in interface mechanism as brought out below:

2.9.1.1 Improper mapping of business rules

Business rules governing levy of freight were not fully incorporated while designing the system requiring frequent manual interventions. The system also imposed operational constraints as brought out below:

- **Generation of Railway Receipts**: The system did not have a provision to generate all types of RRs and to cancel a prepared RR as shown below:
  - Multiple RRs could not be generated in cases where customers were entitled for a number of RRs for booking multiple commodities under the Freight Forwarding scheme requiring manual intervention (SR).
  - In colliery sidings, destinations are changed even after issue of RRs due to operational reasons. There was, however, no provision to cancel the prepared RR and issue a fresh one. Despite repeated requests of the TMS locations at Asansol and Andal, Durgapur Steel Exchange Yard of ER to CRIS**,** the system was yet to be rectified (ER).
  - In sidings with inadequate capacity to accommodate an entire rake formation, loading was done in piecemeal and the system could not generate RRs until the entire work of loading or unloading was completed. Consequently, the system was not recognising the placement or withdrawal timings of wagons in such sidings and various charges leviable towards inadequate capacity of sidings could not be charged through TMS, requiring manual interference (New Jalpaiguri CS siding and Food Corporation of India/ NGC siding in NFR).
  - As a corollary, in most of the zones (NR, NER, WR, NFR, SECR, CR, SER, ER, SR, SCR, SWR, NWR and ECoR) manual corrections had to be carried out by the operators on the printed RRs due to generation of erroneous RRs.

  IR in its response (January 2010) stated that the manual interference in RR preparation has progressively come down and accepted that the system does not cancel RRs once issued. IR further stated that the locations where

complete consignment cannot be loaded at one time, rules exist for recording their times of placement and withdrawal.

The mechanism built in for generation of multiple RRs and RRs for consignments loaded in piecemeal was defective as observed in the zones mentioned above, which required rectification**.**

- **Computation of chargeable weight:** IR decided (Rate circular 76 of 20 July 2007) that all Broad Gauge routes would be treated as CC+6 routes (CC+6 tonnes over the carrying capacity allowed on such routes) with the exception of certain routes on which the chargeable weight of commodities was different from those on CC+6 routes. The logic was improperly built into the system and consequently freight charges were improperly levied as per CC+6 routes even on exempted routes resulting in refund claims from customers[10].

  IR mentioned (January 2010) that the business logic was built into the system and the process of updating the referential data was being followed. However the fact that cases of improper levy were detected in three zones indicated that the logic was improperly built in the system**.**

- **Levy of terminal charges:** As per extant provisions (Rate circular 58 of 29 May 2007), **a** terminal charge at the rate of Rs.10 per tonne (revised to Rs.20 per tonne for all traffic other than iron ore and container traffic with effect from 1 February 2008) was leviable for loading/unloading of loose or bulk commodities at both railway owned originating and destination terminals. The rule was not properly incorporated in the system and terminal charges were incorrectly levied on terminals/sidings owned by private parties and the RRs were manually modified to ensure correct levy of charges[11]. Conversely, terminal charges were not levied in some locations where both the originating and destination terminal were owned by Railways (e.g. Kalamboli in CR).

  IR mentioned (January 2010) that there was a provision in the system to periodically monitor the correct status of terminals and that the cases pointed out could pertain to sidings whose status were not corrected in the system. Though regular exercises have been done to update the data base in case of omission, users in the field have instructions to correct RR's before and after printing.

- **Levy of Busy Season surcharge**: Busy Season surcharge was imposed on the applicable base freight rates from 1 November 2006 to 31 March 2007 for certain classes of commodities. Due to an improper

[10] (Ambala to Simogha on NR, Fertilizer Siding, Rashtriya Chemical Factory, Trombay to Kadur via Miraj, Hubli and Kalamboli goods shed to Kalmeshwar on CR, BCSW/Satna to Raxaul via Manikpur Junction, Allahabad City, Varanasi and Chapra Kacheri, Jaypee Rewa Cement siding, Satna to Warshliganj, National Fertilizer siding, Vijaipur to Sharsa and Khageria on WCR)

[11] (Rajbandh of ER, Chambal Fertiliser Chemical Limited, Bhanora and BCSW/Satna of WCR, Bharat Petroleum siding Trombay, Associated Cements Company siding Wadi and Godhani locations of CR, BRPN siding of NFR, PGFC, Bargarh Road, Indian Oil Corporation siding Barauni of ECR, Food Corporation of India sidings in SEWR-ECoR, NR, and Hubli- SWR, GRPB/Bajva of WR, LIPL of SECR and Rudrapur City of NER)

logic built in, system computed the surcharge on total freight, instead of the base freight rate (SWR).

IR mentioned (January 2010) that application of the business logic was monitored. However, the monitoring mechanism was inadequate as the logic continued to be defectively implemented and the busy season surcharge levied by the system was incorrect.

- **Adjustment of Wagon Demand Registration fee:** There was no-provision for adjustment of the refundable portion of the Wagon Demand Registration Fee against the freight charges on the freight paid consignments (SCR, ER, ECR and WCR)**.** Similarly, though some customers were exempted from payment of this fee, the system did not have the provision to process the exemption. As such, the fee was shown as collected while booking the consignment and after loading of wagons it was shown as refunded though no real transaction had taken place (JVSL siding of SWR).

  Accepting the deficiency, IR mentioned (January 2010) that the business logic was being developed in consultation with CRIS**.**

- **Availing Train load benefit:** Though a minimum of 10 wagons should be loaded for each destination for availing Train load benefit, the system allowed this benefit to loads with less than 10 wagons (SR, ER and NWR). System also could not calculate freight on train load rates in case of mixed composition of rakes resulting in overcharges (SECR).

  IR **stated** (January 2010) that the provision of giving train load benefit **had been** incorporated in the system. However, it was seen in Audit that the system allowed the benefit to loads less than 10 wagons, which was contrary to extant rules**.**

- **Levy of demurrage charges:** Demurrage charges are levied when goods are not loaded into or unloaded from the wagons. At FOIS locations across all zones, the facility to compute demurrage charges were not provided in the system and were being manually calculated**.** IR replied (January 2010) that the feature would be incorporated in the system.

- **Availability of data for mining:** At present, FOIS data of the last 15 days could only be retrieved by the zones. In the absence of mining of data, the zones were unable to compile data for analysis. Further, accounts department in the zones was capturing the data again from RRs to prepare Machine Prepared Abstract and for other accounting purposes resulting in duplication of work.

  IR mentioned (January 2010) that the module for data warehouse and e-working was sanctioned, which would also address the provision for data mining**.**

- **Inbuilt help:** For providing a mechanism of error handling, error messages are displayed by the system. A review of the error message file revealed that multiple error codes were allotted to same error message.

Eleven error messages had multiple error codes. Thus, error handling procedure was not effective.

IR mentioned (January 2010) that all application based errors had a different code but accepted that for errors pertaining to database several error messages could have the same code**.**

2.9.1.2 Lack of an interface mechanism

The system did not have the planned interface mechanisms and was not integrated with other applications leading to manual calculations as shown below:

- **Interface with weighbridges:** As per Railway Board instructions, all wagons/rakes should be weighed before preparation of RRs and the system was to capture details of weighment of wagons from the weighbridges at the time of calculation of freight and generation of RRs. No interface was, however, developed between the TMS terminals and weighbridges. Consequently, the operators at TMS terminals were required to input the wagon details into the system manually exposing the system to the risk of data entry errors IR while accepting audit contention (January 2010) **stated** that such interface mechanism was being developed.

- **Integration of FOIS with other applications:** Integration of FOIS with other applications like Crew Management System, Integrated Coach Management System, Control Charting Operations and Web enabled Claim Application was not done in the zones**.** Similarly, despite specific instructions of Railway Board (June 2006), accounting freight earnings and its apportionment to the zones could not be achieved due to non–integration of FOIS with Advanced Financial and Railway Earnings and Expenditure System (AFRES) and as such the exercise was being carried out manually and input into AFRES .

  IR in its response (January 2010) accepted the audit contention and added that the Control Office application was proposed to be integrated with FOIS and the e-working module envisaging freight accountal using data generated by FOIS was under implementation**.**

Thus, the system was not comprehensively designed to incorporate all the relevant business rules and posed operational constraints. The system also did not have a mechanism to interface with weighbridges and other applications, which limited its utility. Consequently, the perceived objectives of FOIS were not fully achieved even though more than seven years have lapsed since FOIS became operational. Some processes are still being performed manually exposing the system to the risk of input and processing errors.

Recommendations

IR should rectify the system to incorporate all the relevant business rules relating to levy of freight.

IR needs to expedite integration of the system with weighbridges and other applications to eliminate manual interventions and attendant risk of data entry errors.

2.9.2 Data reliability

In order to achieve the perceived objectives of enhancing the accuracy and reliability of basic operating data pertaining to events in the locations, availability of a wide range of 'real time' information for better planning and monitoring of freight operations and global tracking of consignments in real time, the database needs to be complete with a high level of integrity and the events in the field need to be captured immediately on their occurrence. Further the successful functioning of FOIS - an input intensive system-largely depends on the effectiveness of the input control system. Audit observed that the master data contained errors, inputs were delayed and incomplete preventing real time view and input controls/validations were either absent or deficient as brought out below:

2.9.2.1 Deficiencies in the master data bases

Generation and updation of master data (i.e. geographical data/station booking profile, siding data etc.) suffered from weak validation controls, which led to discrepancies in the data maintained in the system as brought out below.

Wagon master

The wagon master contained master data of the total availability of wagons in the railway network. Deficiencies observed in the master wagon database were as follows:

- Even though Railway Board had adopted (2003) a system of allotting numbers to new wagons consisting of 11 numerical digits, which was subsequently revised to 10 numerical digits (first two digits indicating the type of wagon, the next two the owning railway, the subsequent two the year of manufacture, the next three the individual wagon number and the last digit indicating the check digit for validation), incorrect wagon numbers consisting of less than the prescribed 10 digits or inadmissible characters were present in the Wagon master (SCR, ER, WR, SR and SER) due to deficient validation control in the wagon number field. Instances of wagon numbers with the pre revised 11 digits were also seen in the computerised database at WCR (Jaypee Rewa siding).

  A review further revealed that when the wagon number was not found in the master, the TMS locations were allowed to prefix/suffix characters 'A'/'D" before/after the wagon numbers while generating RRs and releasing wagons with consignments. While this was solving the operational issue of clearing consignments, such cases were not validated/ reviewed before updating the master. As a result, the master data was inflated and did not reflect the actual wagon holding. A test check in four zones (ER, NR, CR and SR) alone disclosed that the database indicated an inventory of 65,630, 39,408, 54,907 and 25,125 active wagons against an

actual holding of 37,615, 17,563, 48,219 and 11,155 active wagons owned by these zones respectively.

- Details of tare weight and carrying capacity of wagons were incorrectly shown for 15,644 and 848 wagons respectively. In some cases these details were kept blank in the master file (NR, ER, CR, SR, SER, SCR, NFR and NWR).
- New types of wagon like BRNHE, BTAL and TORXC introduced in Railways was not updated in the Wagon master and the master file was therefore incomplete (ER, CR, NFR and ECoR).

IR in response (January 2010) mentioned that a pilot project on fitting RFID tags to the referential data base of wagons was being carried out in ECoR to facilitate automatic input of wagon details through reading of RFID tags by strategically placed readers.

Distance tables

Commercial Inspector and Traffic Inspector of Accounts are jointly responsible for entering the chargeable distances at a TMS terminal both for inward and outward traffic. The following irregularities were noticed regarding the authenticity and completeness of distances entered in the system:

- Users at TMS locations had the facility to directly feed routes/distances in the master tables which was not authenticated at supervisory levels leading to discrepancies in database.
- For several entries in the station index master table, the actual distances were not entered. Though freight calculations are generally based on chargeable distance, for routes falling in the ghat section freight is based on the actual distance. In the absence of actual distance figures, freight charges for such routes could not be calculated by the system requiring manual intervention. (SCR).
- A test check of a sample of ten pairs of stations indicated that the distances available in the database varied from two to 1,149 kilometers from their actual distance (SR). Similar discrepancies were noticed in other zones also (SCR, NWR, NR, SER and NFR). Further, discrepancies were noticed in the distance between pairs of stations in the 'Up' and 'Down' directions (NWR). The chargeable distance was also shown as zero against various cases (SCR and NWR).

IR in response (January 2010) stated that with the introduction of Rates Branch Software and its integration with FOIS, the chargeable distance was now calculated by the system and that timely updation of data was ensured. However, due to weak monitoring mechanism discrepancies with reference to the actual distance continued to exist in the system.

2.9.2.2 Inadequate input validation controls

Deficiencies in the input validation controls were observed as brought out below:

- Instances of inconsistencies in placement and release time of rakes were noticed in the zones (ER, CR, NR, SR, WR, SER, NWR, WCR and NFR) indicating that the information was either incorrect or deficient. In 24,005 cases it was observed that the commercial placement time (the time at which the operating department has placed the train for loading/unloading)and release time(the time at which the rake has been dispatched) of wagons were the same Further, in 294 rakes it was seen that the commercial placement and release times had a difference of one hour or less while in 30 rakes the difference was of five minutes, indicating that the entire train was loaded/unloaded in less than one hour /five minutes, which was impossible.

  IR in reply (January 2010) mentioned that with the proposed integration of Control Office application with FOIS the discrepancies between reporting of time would be eliminated**.**

- 'To-Pay' surcharge as applicable from time to time is to be levied in all cases where the freight exceeds the Credit Note Cum Cheque limit (CNCC limit- the monthly limit fixed for freight acceptance based on lumpsum deposits made with IR). Due to lack of input of basic data like "Lump Sum account of Customer" the system failed to levy 'To-Pay' surcharge amounting to Rs.0.16 crore (OCL Siding at Rajgangpur of SER). Similar cases were also noticed in ER, ECR and NER (Rudrapur City).

  IR mentioned (January 2010) that the CAO FOIS and the zones were responsible for feeding data in the data base. The reply only reiterated the defined responsibility without indicating the quality of implementation. Audit observed that the responsibility was not effectively discharged in the zones and the monitoring mechanism was weak.

- Instances of incorrect input were also noticed. Out of 42 BOST empty wagons placed at DSEY location of ER, only 17 were shown as loaded from DSEY and the rest were shown as loaded at some other location(s). Similarly, in NWR it was seen that out of 599 wagons loaded on 22 July 2008 for STPB, 238 were incorrectly shown in the system as diverted to some other station (Birdhwal), while the wagons were physically delivered at STPB.

  IR mentioned (January 2010) that regular update of referential data base and scrutiny of MIS reports served as internal checks for timely detection and correction of such mistakes. The fact, however, remained that incorrect input could be entered into the system due to inadequate input validation controls**.**

- Invalid transaction data were noticed in the zones. It was observed in NR that, in respect of 3,591 transactions, the delivery date was prior to RR date. The system even accepted future date for forwarding note such as dates for the years 2019 and 2021 (NR). Further, fields to capture details of forwarding note, invoice id, commodity code, RR notes etc contained either 'zeros' or were left blank in many records (SR, ER and NR).

IR mentioned (January 2010) that the system was built on the concept of sequential reporting and therefore delivery of goods could take place only after it was booked on the system against **a** particular RR. The response was partial**.** Inadequate validation controls **were** evident as the system accepted invalid values in date and other fields**.**

- All cash transactions done at FOIS locations/stations should be accounted for at locations and be reflected in monthly station balance sheets. A review of station balance sheets revealed that the opening and closing balances of different stations in the zones (NR- Patiala, Ambala, Chandigarh and SCPD, SCR-Ranajitpura, SR- Chettinad Cement siding, SER-Muri, ER-Dankuni) varied from the actual balances. In some Balance Sheets the balances were incorrectly shown as zero or as minus figures (SR and NR). Therefore manual cash records and balance sheets were being maintained at FOIS locations/stations. As such, financial data produced by FOIS system was not used for financial accounting.

  IR mentioned (January 2010) that the functionality was being developed as a part of e-working module and Chandigarh goods shed of NR was identified for conducting the pilot project**.**

2.9.2.3 Delayed and incomplete inputs

To enable the system to provide a real time view it is also essential for the field locations to update the system as and when the transactions take place. Deficiencies were observed in the process of updating data. These are brought out below:

- Various transactions were being input in the system after considerable delay. The system in fact accepts back reporting up to five hours (at present reduced to four hours). As such data pertaining to rake formation, wagon details, loco particulars etc. are not always entered in the system on real time basis. Therefore, one of the main objectives of FOIS- Global tracking of consignments in real time was not effective. Additionally instances of missing or unconnected wagons and payment of compensation continued to persist in the zones (SCR, SR and NER), which bear further evidence that the global tracking of consignments in real time was not fully achieved. IR mentioned (January 2010) that with integration of Control Office application, details of running of trains would be available on real time basis.

- Moreover, Railway Board's master policy circular of 14 January 2005 envisaged registration of demands received from customers in the system by capturing details such as load (rake/piecemeal), single or multi party consignor(s), rake commodity, traffic type, priority class, rake type, stock type etc to enable assessment of requirement and to facilitate a decision on allotment of rakes with the aid of FOIS. The demands were, however, initially recorded in a manual register and were input into the system only after a decision on allotment of rakes was taken manually, defeating the very objective of capturing such exhaustive details in the system.

IR mentioned (January 2010) that instructions already existed for registration of demands as soon as forwarding note is received at TMS locations. This, however, was not being ensured in the zones**.**

Thus, the master data bases contained numerous errors and validations were either absent or deficient which adversely affected reliability of data and reports generated by the system. The operating data was also input in the system belatedly due to weak monitoring mechanism in the zones. Further, decisions on rake allotment were being taken manually in the zones, defeating the objective of capturing elaborate details on registration of demands of customers in the system. The system was, therefore, not geared to provide a real time view of freight operations.

Recommendations

IR should initiate necessary action on priority to rectify the inaccuracies in master data and institute appropriate validation checks while updating master data to enhance reliability. Necessary checks and validation controls need to be incorporated to ensure that only correct data is entered and processed.

The monitoring mechanism needs to be strengthened to ensure that field locations input the transaction details promptly so as to provide a real time view of operations and to facilitate decision making as envisaged.

2.9.3 Information System security

The system which manages the railways' core activity of freight operations should have an efficient and time tested security in place to ensure Confidentiality, Integrity and Availability of information and communication system that store, process and transmit data. Though the system was equipped with a security module encompassing password and backup policies, Audit observed that the system suffered from security deficiencies posing unacceptable risks as shown below:

- **Physical access:** Access of unauthorised persons to the FOIS locations was not restricted. There was no mechanism for preventing any unauthorised physical movement of customers and for continuous surveillance, indicating that the physical access controls were weak (ER, SER and SR)**.**

  IR mentioned (January 2010) that instructions would be reiterated to zones to ensure segregation of areas and to prevent unauthorised access in both TMS and RMS locations**.**

- **Logical access:** Logical access controls protect the application and underlying data files from unauthorised access, amendment or deletion. The logical access controls were weak as shown below:

  - As per the defined procedure, usernames were to be created in the system only after assigning a specific role to the user depending upon the functions performed while Audit observed that the role of the users were not defined as per actual requirements and users had no logical

linkage with the actual functions entrusted. A common single user was defined in the system for various locations.

- Further, common User ID and password with all privileges were allotted to/shared by all level of users at various locations.
- The passwords were stored as plain text instead of in hash values in system tables. The User IDs and passwords were sent as open text through messages, which was not in consonance with good security practice. Further even though the system provided for changes of password periodically, the system accepted the same password repeatedly (SR).

- **Offsite back up:** There was no procedure for back-up of data in the zones. Off site back ups were not being maintained out of CRIS headquarters. Security of DAT tapes containing daily/ weekly/ monthly onsite backups was not ensured as it was not kept in a fire protected environment and the tapes were not properly labeled. Backups were never tested for restoration.

  IR mentioned (January 2010) that FOIS keeps off site back up of the application. The reply does not address the issue of back up of data. Audit had observed that off site back up of data was not ensured. Further, on site back ups were not secure and were never tested.

- **Disabling proxy location:** The system was designed to operate from a proxy location in case of a disruption to the original designated location. It was, however, seen that the proxy location had to be manually disabled when the original location was restored, which had an inherent risk of the proxy location remaining active for an indefinite period of time (NR and ER).

- **Network security:** Network security management encompasses deployment, maintenance and monitoring of the effectiveness of network security controls to safeguard information and information systems and protect supporting network infrastructure. Effective network security management practices also require established and documented procedures that provide instructions for system to restart and recover in the event of system failure in a short time. Network security was inadequate in the zones as shown below:

  - Anti-virus software was either not installed in terminals or not updated regularly at various locations of NR (Shakurbasti, Patiala, Ambala, Jallandhar City, Firozepur, Chandigarh, BPHT and Thuglakabad mineral siding) NER and SECR.
  - FOIS terminals were found infected with virus/Trojans at locations (TMS Chandigarh and Patiala) and were frequently shutting down at very short intervals due to virus, thus interrupting the smooth functioning at locations (NR).
  - The computers used at CRIS for database administration and software development for FOIS application had internet facility, in violation of

the Railway Board's orders (October 2004), exposing the system to the risk of external threats (NR).

IR mentioned (January 2010) that FOIS intranet was secure and there was no direct connection to the internet and that CRIS intranet was totally segregated from FOIS intranet. IR also mentioned that it was the responsibility of the zones to maintain the antivirus software through AMC contracts. However, FOIS terminals were found infected by virus and antivirus software were either not installed or not updated in locations, which required effective monitoring**.**

Thus, both physical and logical access controls were weak and maintenance of back up data was defective. Network security was inadequate exposing the system to increased Information Security risk.

Recommendations

IR should strengthen the physical and logical access controls to monitor and prevent unauthorised access. Effective off-site storage of back-up data needs to be maintained and network security needs to be strengthened.