Chapter 1– Introduction

The Crew Management System (CMS) is a critical IT application of the Indian Railways (IR) for managing crew assignment to the various trains which impacts the safety of train operations. The application aims at managing over one lakh drivers and guards to ensure round the clock safe operations of IR. Though the overall financial investment in the project is only ₹ 80 crore, it assumes significance on account of the nature of business transacted on this application.

1.1   CMS Objectives

The objectives of CMS are:

a.   **To improve the efficiency in operations by:**

i.   Optimum and effective utilization of crew by maintaining inventory of all crew.

ii.   Effective scheduling and assignment of train crew.

iii.   Crew booking through SMS, thus eliminating call boy/book system.

iv.   Generating computerized mileage reports for direct submission to Personnel branch for payment.

v.   Using as a tool for making the crew lobbies more or less paperless.

b.   **To effectively monitor crew and to comply with the safety requirements relating to crew management by:**

i.   Monitoring road learning and training of crew to operate the locomotive of different traction and gauges.

ii.   Monitoring of training of staff due for refresher courses and also the staff whose competency certificates are due for renewal.

iii.   Monitoring 10 hours duty in accordance with HOER[1]/HER[2] rules.

iv.   Scheduling periodic rests.

v.   Assisting in monitoring by the Loco Inspector/Traffic Inspector of the drivers and appropriately grading of the crew.

vi.   Serving as a tool for upgrading knowledge of the crew and continuously evaluating their performance.

c.   **To improve the financial management and monitoring by:**

i.   Serving as a tool for controlling payment of overtime and kilometer allowance.

ii.   Monitoring crew productivity by calculating total hours of duty worked and total kilometers earned by each staff.

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[1] *Hours of Employment and Period of Rest Rules*
[2] *Hours of Employment Rules*

iii.   Providing for cases of acts of malingering like late turning up and leave in excess of 30 days.

The work of CMS was sanctioned in 2005-06. The CMS application was developed by Centre for Railway Information Systems (CRIS), an IT development unit of Indian Railways. The application was hosted at the Computer Data Centre (CDC) managed by CRIS, at Chanakyapuri, New Delhi to run on the Freight Operations Information System (FOIS) network[3] of Indian Railways.

The project was planned for implementation at 747 lobbies/locations over different zones of IR and was expected to be completed by 2010. As on 31 March 2015, CMS was under implementation. It was rolled-out in 372 lobbies/locations[4], constituting around 50 *per cent* of the total lobbies/locations, against the target of completion of integration and implementation of CMS as one of the modules of Freight Operations Information System (FOIS), among others modules of FOIS[5] by 2010[6].

1.2   System Architecture

The design is modeled on three-tier client server technology[7] using middleware[8] and a Relational Data Base Management System (RDBMS)[9].

Data from lobbies is captured through thin clients[10]/kiosks[11] and sent to the CDC at CRIS through communication links[12] for transaction processing. Application servers at the CRIS are networked and linked to a central database for global level transactions[13]. The central database provides management reports both at zonal level and divisional levels. It is also a repository of all current and historical data. A diagram of the server architecture is given in *Appendix I.*

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[3]*A network consisted of physical communication lines, microwave channels and Very Small Aperture Terminal (VAST) devices (A device used to transmit & receive data signal through a satellite)*

[4]*For lobbies, refer to glossary. Location refers to places other than lobbies like Training Centre, CRIS Headquarters etc.*

[5] *Rolling Stock Maintenance and Examination, Revenue Apportionment, Crew Management, Control Charting, COIS etc.*

[6]*As per Railway Budget speech of Minister for Railways for the year 2007-08.*

[7]*A special type of client/server architecture consisting of three well-defined and separate processes, each running on a different platform: i.e. User Interface, Middleware and Database Management system. User Interface, runs on the user's computer (client machine), middle tier which actually process data, runs on a server called Application server and database management system (DBMS) that stores the data required by the middle tier, runs on a server called the database server.*

[8] *Middleware is a programme that mediates between two separate but existing programs and allow a program written for one database to access other databases.*

[9]*Relational Database Management System is a programme that lets one create, update and manage a relational database, data in different tables can be accessed by linking different tables through a common field.*

[10] *A thin client is a low cost, devoid of CD-ROM drive, diskette drive and expansion slots computer.*

[11]*Kiosk is a type of computer linked with central servers and is used by a user (crew) for various functions like signing on/signing off his attendance, view circulars, report abnormality noticed en route etc.*

[12]*FOIS Network*

[13] *A transaction generated in CMS from any of the terminal/machines having connectivity with CMS which can also be viewed from any terminal/machine having access to CMS (including those viewed from website).*

1.3   Organization

There is no uniformity in organizational hierarchy prescribed by the Railway Board, for operation, control and maintenance of CMS application at zonal level. At zonal level, it was seen that generally offices of the Chief Mechanical Engineer/Chief Rolling Stock Engineer (Operations & Freight), Chief Electrical Engineer/Chief Electric Loco Engineer &Chief Operations Manager are responsible for implementation of policies decided by Railway Board(RB)/monitoring of working of lobbies.

At Divisional level, offices of Senior Divisional Mechanical Engineer(Operations and Fuel)/Senior Divisional Electrical Engineer (Rolling Stock Organization/Traction Rolling Organization)/Senior Divisional Operations Manager are responsible for providing manpower/infrastructure/monitoring of crew lobbies.

At lobby level, Senior/Chief Crew Controller is Administrative in-charge of the lobby and is assisted by Crew Controller. He is responsible for smooth and proper working of crew/lobby pertaining to various issues of crew/lobby like crew booking, crew sign on/off operations, breath analysis, crew leaves, report generation etc.

1.4   Audit Objectives

The IT Audit of CMS was conducted with a view to:

i.   Assess the extent to which the CMS was effective in improving the train operations by evaluating:

- Whether inventory of crew, loco, stations, route etc. was properly maintained and scheduling and assignment of train crew was effective.

- Whether crew booking through SMS was effective in eliminating the call boy/book system.

- Whether CMS was generating computerized mileage reports for direct submission to Personnel branch for payments and the extent to which lobbies became paperless through CMS.

- Whether monitoring of crew training, crew grading, crew counselling etc. was effective.

- Whether CMS was effective in controlling payment of overtime and kilometer allowance, monitoring of crew productivity and cases of acts of malingering.

ii.   Review the application controls to ensure that proper authorization, completeness, accuracy and validity of transactions, their maintenance and other types of data input were in place.

iii. Review the IT security to ensure that it was capable of reasonably protecting all business critical information and information technology

assets from loss, damage or abuse. Review the Disaster Recovery Plan (DRP)/Business Continuity Plan (BCP) to ensure the continuity of the organization's business in the event of unforeseen events.

iv. Review contracting issues, IT operations and project management/monitoring to ensure that various contracts, IT operations, project management and monitoring aspects were adequately addressed.

v. Review the effectiveness of change management and outsourcing of activities.

1.5 Sample Size and Audit Scope

- For CMS audit, one division of each zonal railway (ZR) was selected, on random basis, as sample which constituted around 24 per cent of the all divisions of IR. All 109lobbies of the selected divisions were included in the sample. Details of the divisions and lobbies included in the sample are given in *Annexure – 1.*

- The analysis of the transaction data[14] of the most recent nine months, i.e. March 2014 to 5 December 2014, collected from CRIS, was done.

- Online CMS reports available during the period of Audit were reviewed, Joint Traffic Reports (JTR) of Crew and Guards were compared with crew mileage reports and Control office Application (COA) data was also used to verify completeness and other aspects of CMS data.

- For other aspects relating to project management and implementation, audit reviewed CMS project from inception during 2005-06 till 31 March 2015.

- The IT Security evaluation primarily focused on application level security[15].

1.6. Audit Methodology

Audit methodology included scrutiny of records relating to implementation of project over different zones/divisions at the zonal/divisional Headquarters and at lobbies. The CMS reports were reviewed, information pertaining to different aspects of CMS was gathered from various lobbies of the selected divisions using questionnaire, interview and discussion with divisional/lobby officials. Simulation tests were conducted and data was analyzed using Computer Assisted Audit Techniques. For issues related to security, change management, documentation etc., records at CRIS office at New Delhi and at zonal/divisional headquarters/different lobbies were scrutinized.

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[14]*Transaction data is the information pertaining to various crew operations like crew booking, crew signing on/off, crew allowances, grading, rest etc.*
[15]*Application level security encompasses measures taken throughout the code's life-cycle to prevent gaps in the security policy of an application or the underlying system (vulnerabilities) through flaws in the design, development, deployment, upgradation or maintenance of the application etc.*

The Entry Conferences were held at zonal level with Railway Administration. The draft review report was issued to Railway Board on 16 June 2015 which was followed by an updated draft review report, issued on 5 August 2015. The Exit Conferences were held at zonal level with Railway Administration. The Railway Board gave the replies to the draft review report in September 2015 and the same have been duly incorporated in the Audit Report. An Exit Conference was also held at Railway Board in which the audit observations were discussed and Railway Administration assured for the remedial action.

1.7   Acknowledgement

The Audit team wishes to express its appreciation to the management and staff of the Railway Administration at Railway Board, Zonal/Divisional Headquarters and lobby level as well as CRIS CMS team for the assistance and cooperation extended to the Auditors during this assignment.