Chapter III

Information Technology Audit of Statutory Corporation

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Computerisation of e-ticketing system in Maharashtra State Road Transport Corporation

Highlights

Maharashtra State Road Transport Corporation (Corporation) incorporated in July 1961 under Section 3 of the State Road Transport Corporations Act, 1950, is mandated to provide an efficient, adequate, economical and properly coordinated road transport system within the State of Maharashtra. The Information Technology (IT) Audit of Computerisation of e-ticketing system revealed the following:

(Paragraphs 3.1)

There was deficient systems design resulting in non-capturing of data for grant of concessions. The deficient input control and validation checks resulted in low assurance regarding completeness and reliability of data as observed from the tables containing details of freedom fighters, Arjuna awardees etc.

(Paragraphs 3.9.1, 3.9.2, 3.10.4 and 3.10.5)

The system could not be used for an effective Management Information System, data integration and data mining as envisaged in the scope of the contract due to non-capturing of details of buses available with depots, manual pass collection data, digitised routes and bus stops, digitisation of data of pass holders *etc*.

(Paragraphs 3.8.8 and 3.11)

Inadequate accounting arrangements and control mechanism for monetary transactions resulted in retention of amount by Authorised Booking Agents in excess of permissible limits.

(Paragraphs 3.8.7)

Introduction

3.1   Maharashtra State Road Transport Corporation (Corporation), incorporated in July 1961 under Section 3 of the State Road Transport Corporations Act, 1950, is mandated to provide an efficient, adequate, economical and properly coordinated road transport system within the State of Maharashtra.

The Corporation had six Regional Offices (ROs), 30 Divisional Offices (DOs) and 250 Depots in the State as on 31 March 2014. The Information Technology (IT) needs of the Corporation are overseen by the Electronic Data Processing (EDP) Centre at Head Office (HO), Mumbai. EDP is headed by a Deputy General Manager who is assisted by Senior Programmers, Junior Programmers and Data Processing Officers.

IT ticketing system

3.2   In order to facilitate online/web-based reservation system and to adopt software technology in its day to day operations, the Corporation invited (June 2008) Request for Proposal (RFP) from interested parties for the project of providing, computerising, implementing and maintaining - i) Electronic Ticket Issuing Machine (ETIM) and ii) Online Reservation System (ORS) with web facility on Build, Operate and Transfer (BOT) basis.

The Corporation awarded (December 2008) the project to Trimax IT Infrastructure and Services Limited, Mumbai (Trimax) on BOT basis for six years from the date of award. The scope of the project included provisioning of required hardware and software for:

➢ ETIM machines across 247 depots together with required supporting staff during the first year of operation to enable its staff members to familiarise with the system;

➢ computerised ORS with web facility at its 327[36] locations and its authorised booking agents along with facilities to the traveling public such as payment gateway and bus trip information;

➢ adequately secured Local/Wide Area Network connectivity for ETIM and ORS with an assurance on high uptime;

➢ Data Centre and Disaster Recovery Centre to ensure business continuity; and

➢ Necessary training to all levels of Corporation's officials.

Further, Trimax was to provide services in data digitisation, data migration and data mining for advanced business intelligence applications related information system and bus trip management. Besides, Trimax was to provide 10 lakh 'yearly re-chargeable' smart cards at the start of the project with an addition of 10 *per cent* new cards every year and a minimum guaranteed quantity of 5 lakh 'One time/use and throw' smart cards every year.

The project was to be implemented in two phases *viz.*, the pilot phase in ten depot locations was to be completed by 18 June 2009 and rollout phase with commercial deployment in all other locations to be completed till 8 April 2010 in three rollouts. The agreement with Trimax was executed on 22 July 2010.

As per terms of agreement, Trimax was to be paid at a unit rate of ₹ 0.21 per ticket issued through ETIM and ORS, on which passengers actually traveled

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[36] Includes 247 depots and 80 bus stations

and also on the cancelled tickets if booked through ORS, subject to an annual minimum of 75 crore tickets. On expiry of contractual period, all the assets including Hardware and System Software (excluding proprietary software) was to be transferred to the Corporation at no extra cost with a guarantee for functioning of equipments for a further period of two years. The platform adopted by the Corporation was custom developed using open source technology Linux-Apache-MySQL and PHP (LAMP).

The Management had not, however, framed any IT policy laying down procedures, rules and regulations till date (December 2014) to oversee and monitor its IT environment.

Audit objectives

3.3 The audit objectives were to ensure as to whether:

- The requirements of users and other stake holders were assessed and adequately addressed;

- The contract terms were duly adhered to and payments to the contractor were made as per the terms of Contract;

- The general controls were adequate and system was operating in an adequately controlled environment;

- The application controls were adequate and the system was in compliance with laid down business rules and adequately secured from possibilities of fraud; and

- The accounting arrangements and control mechanism for monetary transactions were adequate.

Audit criteria

3.4 In pursuing audit objectives, audit adopted the following criteria;

- State Road Transport Corporations Act and Rules made thereunder;

- e-Governance Policy of the Government of Maharashtra (GoM);

- Terms and conditions of contract with Trimax; and

- Policy decisions, business rules *etc.* related to ticketing and other operating parameters.

Scope of Audit

3.5 The scope of IT Audit included scrutiny of contract with Trimax, evaluation of ETIM and ORS with specific reference to the security and control measures; evaluation of operating parameters of routes and crew with specific reference to the revenue earnings. The scope also included evaluation of performance of authorised booking agents and payment gateway agencies with specific reference to timely collection of revenues earned through ORS. The period covered by Audit was from the date of implementation of the e-ticketing system (May 2009) upto October 2014.

Audit methodology and sample selection

3.6 The objectives and scope of audit were explained to the Management in the Entry Conference held on 18 September 2014 seeking their co-operation in understanding the table structures and content of the soft data furnished. For, its inference, audit relied on the detailed analysis of data pertaining to 146 locations of 12[37] DOs being the sample selected out of 320 locations from 30 DOs where ETIM and ORS were implemented (February 2014). The data analysis was carried out through IDEA software package.

The sample selection was made by utilising Sampling Techniques. Two Divisions each from the six[38] Regions was selected by stratifying the data in terms of highest traffic revenue generated and highest quantum of online reservation done in the Region.

The audit findings were discussed in an Exit Conference held on 24 December 2014 which was attended by Vice Chairman and Managing Director of the Corporation. The views expressed by the Corporation in the meeting/replies (December 2014) have been considered while finalising the IT Audit Report.

Audit findings

The audit findings are discussed in the following paragraphs broadly classified into two major headings *viz*., 'Contract Management' and 'IT Ticketing Database Management'.

Contract Management

3.7 In the implementation of the ETIM and ORS projects, Trimax had not adhered to certain terms and conditions of Work Order and Master Service Agreement (MSA) inclusive of Service Level Agreement (SLA) as discussed below:

Advertising rights foregone

3.7.1 As per terms of MSA, Trimax was to supply ticket rolls free of cost and the Corporation reserved its right of advertisements on the backside of the ticket rolls to supplement its revenue. Trimax had also offered (August 2011) ₹ 0.01 per ticket for the advertisement rights but the offer was not considered (November 2011) on the ground that it would be dealt separately. However, no such efforts were made till date (December 2014). Considering total 417.15 crore tickets actually issued between September 2011 and October 2014, the potential revenue thus foregone by the Corporation worked out to ₹ 4.17 crore.

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[37] Aurangabad, Beed, Bhandara, Buldhana, Dhule, Kolhapur, Mumbai, Nagpur, Nasik, Pune, Ratnagiri, and Yavatmal

[38] Amravati, Aurangabad, Mumbai, Nagpur, Nasik and Pune

The Management accepted (December 2014) the views of audit and agreed to finalise the issue at the earliest.

Non recovery of infrastructure cost

3.7.2   As per terms of MSA and Clause 9.28.1 of RFP, Trimax was to be provided sufficient space at each depot/bus stand by the Corporation for preparing infrastructure work as per their needs. Trimax was to make provision for furniture, electrical fixtures and civil work including cooling systems for entire project. It was noticed that the Corporation provided the infrastructure to Trimax at EDP centre and depot/bus stand. The infrastructure provided includes furniture, electrical fixtures and civil work including cooling systems at a cost of ₹ 2.45 crore, which was not recovered from them till date (December 2014).

The Management stated (December 2014) that amount of ₹ 2.45 crore was withheld from Trimax and the decision would be taken for its adjustment after due diligence.

Violation of e-Governance policy

3.7.3   The e-Governance policy issued (September 2011) by the GoM provided for maintaining online record of Hardware & Software Inventory (H&SI). However, neither online H&SI nor a physical H&SI was maintained by the Corporation thereby, violating the directions given in the e-Governance policy of the GoM.

The e-Governance policy also provided for constitution of a Departmental Project Implementation Committee (PIC) for overseeing departmental e-Governance projects with representatives from the Planning, Finance, Industries and IT department, apart from members from the parent department. Further, Schedule IV-Governance Schedule of the MSA directed the appointment of Project Manager and a Core Team, which was not adhered to by the Corporation till date (December 2014).

The Management stated (December 2014) that due care would be taken to follow the norms of e-Governance policy issued by the GoM.

IT ticketing database management

3.8.1   The IT ticketing system in the Corporation comprises mainly of two databases *i.e.*, ETIM with 296 tables including Radio Frequency Identification Device (RFID) tables and ORS with 781 tables. In the absence of data dictionary, for understanding the tables with reference to their objective, design, contents, relation to other tables, embedded controls *etc.*, audit relied on the information furnished by the Corporation.

System design

3.8.2   The Corporation has also been operating its buses outside the State

under Reciprocal Transport Agreements[39] executed with the respective State Road Transport Corporations (SRTCs) to cater to the needs of passengers. Keeping in view its network, the Corporation has created master tables *viz.*, State, Region, District, Division and Depot with required fields. Even though the Corporation had executed inter-state agreements with eight[40] neighbouring SRTCs, data fields for only five states were created in the table containing ticket details in ORS database.

In the master table "District", names of the States with codes meant for Districts, have been incorporated. Similarly, in the table "Depot", details of 253 depots[41] as against its existing 250 depots were captured. In so long as the correct data was not captured in the correct table and correct field, besides the error generation, the prospect of migration to new system in future, without incurring additional cost, was inherent.

The Management, while accepting (December 2014) audit contention, agreed to review and address the issues adequately in the new contract being finalised.

3.8.3 On scrutiny of the tables, it was observed that almost one-third of the tables under the ETIM database and more than half of the tables under ORS database were blank and devoid of data. It was also noticed that fields to capture Divisionname, Divisioncode, Deponame and Depocode though created were blank and devoid of data in most of the Master tables. The purpose of their creation was, thus, not achieved.

The Management stated (December 2014) that in ETIM database only required tables were synchronised from central database therefore there may be few tables in depot ETIM database which doesn't have any records. It was further stated that data fields such as division name, division code, depot name, depot code *etc.* were added keeping in mind the future requirement and currently these fields were not in use. Therefore presently these table/fields remained blank.

The reply was not correct as all mandatory fields were overridden and kept blank. In the event of migration or upgradation or centralisation at a future date, the database cannot be integrated without remedial measures at additional cost.

3.8.4 Table created and designed to capture waybill details and lock the date of waybill was found to be blank and locking date of way bill was being captured as a Character data field instead of a date field in a separate table recording waybill time details. Thus, the data captured in the waybill during the operation of bus schedules was susceptible to the risk of modification.

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[39] In the absence of any agreement between RTCs of two States for interstate operations, the respective State Governments execute such agreements and impose the terms and conditions on such RTCs. Revenue sharing is the major element addressed in such agreements

[40] Andhra Pradesh, Goa, Gujarat, Karnataka, Madhya Pradesh, Rajasthan, Chattisgarh and Dadra and Nagar Haveli

[41] Payment Gateway, Sambhaji Nagar Rank and Borivali Nancy Colony, though not, are included as Depots

The Management stated (December 2014) that the process of waybill issuance and allocation functionality was designed in such a way that ETIM can be operated only within the schedule operation hours or within the pre-defined locking date and there was no possibility of modification as apprehended by audit.

The contention of the Management was not acceptable as in the absence of capturing relevant data in the table, any happening of such incidences could not be ruled out.

3.8.5 As per the policy of GoM, the Corporation has been allowing concession in fares, with or without a limiting factor[42] to different category of passengers like physically handicapped, senior citizens, press reporters, various sport and other awardees, MP/MLAs *etc*. The amount of concession so allowed was periodically claimed from the State Government. In the ORS database there was provision to capture data on documentary proof of the passengers eligible for concession. In case of ETIM database at least one field to capture the identity proof should have been incorporated in the TICKET table.

The Management stated (December 2014) that capturing proof of record at the time of ticket issuance may lead to the delay, thereby leaving scope for de-boarding the passenger without tickets. It was also stated that the Corporation had not evolved database of relevant ID proof for verification at the time of issue of tickets.

The reply was not convincing as there should have been separate field for indicating type of proof used for concessional tickets.

3.8.6 To facilitate mobile based advance booking, table was created in ORS database to capture personal details of passengers availing the facility for the first time. Audit observed that out of 247 distinct users captured in the table during audit period on the basis of their email IDs, the mobile or landline contact numbers in respect of 204 users were not captured as the relevant field was not defined mandatory.

Similarly in the transaction table under ORS, the passenger name field designed to capture the name of passengers booking in advance was blank in 54,65,107 out of 2,69,50,237 records of tickets booked through Authorised Booking Agents (ABA).

The Management accepted (December 2014) the audit views and agreed to take due care in this regard.

3.8.7 In the ORS database, the advance bookings are being allowed through three sources *viz.*, window booking, ABA and web-booking. While in window booking, the amount collected through sale of tickets are remitted and accounted for on the same day, in the other two types of bookings the sale value is being received by the Corporation after lapse of period involved in the

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[42]Limiting factors are put on the number of times a concession holder can travel and/or the total kilometres of travel permitted and/or on the total amount of concession allowed

process of remittance by the agents/payment gateway banks. Hence, it was imperative that a set of transaction tables be designed within the ORS database to depict details of the total value of tickets sold but remittances yet to be received from those two sources so as to monitor and reconcile the actual receipt of ticket values with ticket sales preferably before the commencement of journey. We, however, observed that the ORS database was not designed to capture the details of cash receipt transactions. In one instance, ABA at Parel Depot exploited the deficient system and retained an amount of ₹ 58 lakh, out of which ₹ 38.94 lakh was pending for recovery (December 2014) subject to settlement of litigation raised by him.

The Management while accepting the observation stated (December 2014) that they were in the process of implementing pre-paid payment system *i.e.* online wallet for booking agent by using payment gateway and this functionality would be enabled soon.

3.8.8   As per terms of MSA, Trimax should integrate both ETIM and ORS databases within 17 weeks *i.e.*, up to 16 April 2009 from the date of issue of work order. By virtue of data integration, the Corporation could have reaped the benefits of standardisation and the Conductors operating ETIM would have got the system data on the seats booked through advance reservation for his scheduled trip as against the procedure adopted of relying on manual intervention by way of printed copy of details of ORS booked tickets (WBR-Window Booking Returns). It showed that the desired data integration was not achieved.

The Management stated (December 2014) that System Integration of ETIM with ORS and payment gateway was done. WBR printing facility has been provided in ORS system for checking the details about advance reserved seats and it is up to the user to take printouts or to check the details on ETIM.

However, Audit observed that no deliverables were presented by Trimax to notify the occurrence of system integration as contended. Further, the User Manuals stipulated for taking a print of WBR and option to check ORS details in ETIM was not given.

3.8.9   Audit observed that the sale of passes and the revenue earned there from either manually or through smart cards, were not being captured in the database by designing relevant tables to enable the Corporation to estimate the future cash flow as also to ensure the validity of passes at the time of travel through the system without human intervention.

The Management stated (December 2014) that the revenue through sale of passes through EPIM was by using smart card and could be seen on the common revenue portal of the Corporation and revenue from sale of passes manually was accounted as per prescribed procedure. The smart cards issued to passengers were checked by using ETIM machine whereas Manual passes issued to passengers were physically checked by conductor on board.

The fact remained that any IT system should be ideally designed to avoid human intervention and the Corporation may design master table to capture the passes issued manually to passengers.

Mapping of business rules

3.9.1   Scrutiny of the table capturing ticket details in ORS database revealed that 27,405 concession tickets under the "Freedom Fighter (FF) Quota" were issued by ABA during audit period without capturing identity proof and concession proof.

The Management stated (December 2014) that in the absence of specific criterion for age validation, the seats were reserved against FF quota and the conductor checks the identity proof of FF.

The reply was not convincing as the system shows that benefit was also given to FF below 18 years in 146 cases which was not possible and should not have been granted.

3.9.2   Recognition of outstanding achievement in National sports, specific awards like Arjuna, Dronacharya *etc*., is given by the Ministry of Youth Affairs and Sports, Government of India (GoI) from time to time. As per GoM order dated 27 February 1998, such specific awardees were allowed to travel by public road transport along with one escort free of cost and the fare would be reimbursed by the GoM on the basis of claims from the transport operators. Scrutiny of the table capturing ticket details under ORS database revealed that 155 tickets were issued to 75 Arjuna Awardees during audit period, of which none of the names of awardees captured in the system tallied with the names appeared on the website of the GoI. Unlike the FFs, such awardees were limited in numbers and it would be possible to create their master data for verification without manual intervention before granting the concession whereby threat of fraud could have been minimised.

The Management accepted (December 2014) the contention of audit and agreed to collect relevant data from the concerned sport authorities.

Application controls

3.10.1 Application controls are those checks and balances that are incorporated in the developed application for maintaining data integrity. These include input control, processing control and output control. Lack of any of these controls would impact the integrity and reliability of the database. Some of such lapses of control indicators observed during audit analysis are discussed in the succeeding Paragraphs:

3.10.2 Scrutiny of the table Conductor Master revealed that 14[43] out of 146 locations test checked showed duplicate records for 22 conductors due to failure of constraint (Not_Null) defined for the data fields.

Similarly in ETIM database, a few tables containing fields though defined with Not_Null constraints were blank or devoid of data.

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[43] Depots at Gangapur, Paithan, Soygaon, Mumbai Central, Nasik 2, Satana, Sinnar, Baramati, Bhor, Chinchwad, Indapur, Narayangaon, Shirur and Shivajinagar

The Management stated (December 2014) that despite 'Not_Null' constraint, if blank is forcefully inserted, there is possibility of devoid of data and that care would be taken in future system implementation.

3.10.3 As per terms of MSA, Trimax was to update the system considering changes in the situation. Accordingly Trimax updated the ETIM system from time to time. However, Audit observed that 9,761 out of 12,072 ETIMs in operation were still functioning in Mofussil areas with the older version.

The Management stated (December 2014) that efforts were being made to monitor usage of updated version of ETIM.

3.10.4 Test check of columns containing ticket identification of the table ticket at all locations revealed 1,58,80,897 missing TICKET_IDs. Missing TICKET_ID raises doubt on the integrity and completeness of the data.

The Management stated (December 2014) that the said gaps in the ticket ID may exist due to standard rollback feature at Relational Data Base Management System (RDBMS) level operated to maintain the accuracy and integrity of transaction data.

The reply was not correct as the rollback operation in an IT system was intended to rectify a failed transaction and restore the database to a previous state even after erroneous operations were performed.

3.10.5 In all 118.96 crore ETIM concession tickets were generated in aggregate up to 31 March 2014 as detailed below:

Sl. No.	CN _ID	Particulars of concession facility	2009-10	2010-11	2011-12	2012-13	2013-14	Total tickets
1	0	Null	1,829	28	25,98,17,330	27,62,93,018	3	**53,61,12,208**
2	11	Senior Citizen	94,43,423	16,07,35,384	4,43,57,248	4,45,20,226	27,15,14,561	**53,05,70,842**
3	19	Handicapped/ Mentally Retarded Person	12,33,202	2,32,60,516	59,54,661	66,04,372	3,90,53,086	**7,61,05,837**
4	2	Annual Concession Card	4,58,580	83,36,578	21,65,350	31,45,474	1,99,78,049	**3,40,84,031**
5	9	Blind	1,70,023	19,52,506	5,20,037	6,49,600	37,75,917	**70,68,083**
6	45	Handicapped/ Mentally Retarded Person C	15,378	6,52,698	1,43,765	2,02,337	11,89,254	**22,03,432**
7	20	Handicapped/ Mentally Retarded Escort	13,414	4,03,844	1,19,334	1,20,940	7,23,339	**13,80,871**
8	*	100 *per cent* Concession*	1,827	21,783	11,306	10,032	71,338	**1,16,286**
9	**	Partial Concession**	36,611	7,08,177	1,40,442	1,24,431	9,35,804	**19,45,465**
10	***	No Concession***	54	469	32	54	8,423	**9,032**
		Total	**1,13,74,341**	**19,60,71,983**	**31,32,29,505**	**33,16,70,484**	**33,72,49,774**	**1,18,95,96,087**

   * Includes Freedom Fighters, Arjuna Awardees, *etc.*
  ** Includes T.B. Patients, Cancer Patients, Blind, Handicapped persons, *etc.*
*** Includes Staff on Duty, Employee Free Pass, *etc.*

It was further observed that 53.61 crore tickets were categorised as concession tickets without capturing the type of concession availed by the passengers.

These concession details were the foundation on the basis of which reimbursement were claimed by the Corporation from GoM.

In the absence of reliable and correct data for concessions to passengers, the reliability and correctness of the claims raised by the Corporation on the GoM for reimbursement of differential fare could not be vouchsafed. On verification of data related to the claims made during 2013-14 against the concession of senior citizens pertaining to selected 12 Divisions, Audit observed that in 11 Divisions (except Buldhana), the Corporation claimed reimbursement of ₹ 180.55 crore based on manual data as against the fare amount of ₹ 166.37 crore collected from senior citizens as per data generated by the system. This needs reconciliation between system data and manual data.

The Management stated (December 2014) that proof of concession was not captured in the ETIM and it was physically verified by conductor before issue of ticket. It was further stated that concession wise ticket codes were captured at depot level server and was not pulled centrally till December 2011 and that for preferring the claims, monthly reports were being obtained from the depots and manually consolidated at central level.

The fact remained that the Corporation had not made use of system generated reports and data was also not reconciled.

3.10.6 The table for capturing waybill trip details was designed to generate analytical report on trip-wise revenue earned for decision making process.

- Scrutiny revealed that in 21,235 records, ticket income of ₹ 4.44 lakh was reported to have been generated against route number "0", which was not available in the master table containing routes.

- In Akola Depot in 9,661 records, cumulative revenue income of ₹ 1,00,03,845 was reported against analogous Trip number "00000000".

- It is pertinent to note that in Akola Depot in the case of conductor badge no 43,365 against waybill number 3,994 duty was assigned on 15 January 2011 for the trips assigned for two days on 15 and 16 January 2011 and the Trip numbers assigned were also not in sequential order *i.e.*, Trip number 0S254131 and 0S254137 to 0S254138 were assigned for 15 January 2011 whereas Trip numbers 0S254132 to 0S254136 were assigned for 16 January 2011, which indicates manual intervention.

The Management stated (December 2014) that this was related to Depot Crew operation and there were various routes, bus services created in the reservation system, which were later on synchronised with depot ETIM application. Further in regard to the case of "0" route number, it was stated that route data string may not be loaded properly and in respect of Trip number "00000", it was stated that these trips referred to extra trip.

The reply was not acceptable as the fact remained that in an IT system human intervention should be minimal.

3.10.7 Gaps of 134 crew ID numbers in the table recording crew duty in 41 locations were observed which raises doubt on the completeness, integrity and reliability of data

The Management stated (December 2014) that crew id may have gaps due to standard usage of roll back feature at RDBMS level to maintain the accuracy and integrity of transaction data.

The reply was not correct as the rollback operation in an IT system was intended to rectify a failed transaction and restore the database to a previous state even after erroneous operations were performed.

3.10.8 Audit trail in a system is essential to verify the veracity of the output with reference to keyed input to ensure that its process control is proper and for security of database was maintained. In ORS database, a table though created, was being maintained only from 12 March 2014.

The Management stated (December 2014) that Audit trail data for all the functionalities are captured and available with it. The reply was not convincing as verification of database revealed that the audit trail was available only for 15 tables as against 781 tables in ORS database.

3.10.9 Besides its own staff for window booking, ABAs were allowed to book advance tickets for the prospective passengers by collecting fare from them. As per contractual terms, credit limit approval[44] was specified and the money so collected was to be deposited in the designated bank account within specific period. To enable them to perform their contractual obligations, limited access to the ORS database was allowed and for capturing the details of agents, irrespective of whether own employees or private booking agents, master table for booking agents was maintained in ORS database. Scrutiny of the same revealed the following deficiencies:

- In none of the ABAs, the data on money value limit specified in the contractual terms was captured in the limit column contained in the master table and hence the method of monitoring money value limit was not known;

- In 12 cases, even though agent codes were allocated, the addresses of ABAs were not captured in the relevant columns lacking input controls;

- In another 109 cases though Agent codes were available, details of Booking Centre (BC) Code and BC Names were not captured to limit their access over database;

- In the case of its own employees as Booking Agents, 119 cases where same Agent code with access to more than one BCs falling in various locations were detected;

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[44] Aggregate limit of value of tickets beyond which Corporation's money could not be retained by ABAs

- In other 29 cases, different BC Codes were created for the same Agent at the same location thereby facilitating the ABAs to avail more credit limits.

The Management (December 2014) accepted the observations and stated that they were in the process of implementing pre-paid payment system *i.e.* online wallet for booking agent by using payment gateway and this functionality will be enabled soon.

3.10.10 On an analysis of table recording receipts generated, Audit observed that in 12[45] locations, 76,471 duplicate receipt numbers were generated. This demonstrates the lack of process control in ensuring issue of unique receipt for every collection transaction recorded in the table.

The Management stated (December 2014) that the process of generation of Conductors Waybill Abstract (CWA) unique number is that, if no ticket block has been sold from the tray then same CWA number will be continued. In case if any sale from the tray, then new CWA number will be generated. By using this process log of each duty ticket sale will be maintained. Cash collection is recorded against each waybill number. Thus, there was no duplication or inconsistency in generation of duplicate CWA numbers.

The reply of the Management did not address the issue of non-generation of unique receipt number for each transaction distinctly but addressed the CWA which was not the point of issue.

3.10.11 The Government of Maharashtra decided (February 2009) to extend concessional ticket facility to Handicapped Exemplary Worker Awardee (HEWA) along with escort. However, this concession was not codified and included in the "Concessions" Master table and the same was being computed manually by the Corporation.

The Management accepted (December 2014) the observation and assured that care would be taken in future system implementation.

Management information system

3.11 Master Service Agreement envisaged the implementation of an effective Management Information System (MIS) for Data Analysis, Data Mining of various bus operations, revenue collected, passenger load, operating profitability (ABC trips Analysis) *etc*. Audit, however, observed that ETIM and ORS database did not contain tables to depict the details of buses available with depots, manual pass collection data, digitised routes and bus stops, digitisation of data of pass holders, ABA cash collection and remittance data, data pertaining to all passengers eligible to different types of concessions *etc*., as reported in different parts of the report.

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[45] Depots at Kurla, Mumbai Central, Panvel, Parel, Kolhapur, Sambhajinagar, Baramati, Chinchwad, Narayangaon, Shivajinagar, Swargate and Talegaon.

The Management stated (December 2014) that in all around 200 MIS reports are being generated from the system and made use of at depot level in its day to day traffic operation, which facilitated to have overall control on traffic operation, mechanical operation, KPTL, CPKM, EPKM, *etc*. During the exit conference, Management also agreed for improvement in analysis of data for suitable decision making.

Deficient services to passengers

3.12   To make the e-ticketing more successful and increase the efficiency and profitability of operations, a table was created in ETIM and ORS database to define all the routes and all service stops on the routes. In respect of Aurangabad-1 depot, Audit observed that out of 6,470 routes captured in the aforesaid table, service stops were defined only for 837 routes leaving 5,633 routes.

The Management stated (December 2014) that v_routes' is prepared for only Routes information present in routes table and 'v_all_service_stops' has only those route stops on which the bus service is defined for the own depot only.

The fact remained that as long as all the service stops of all routes were not defined and captured in the relevant tables, the services of Trimax was deficient and the Corporation could not derive expected benefits of e-ticketing by allowing prospective passengers to avail advance tickets as per their requirement.

System performance audit

3.13   Clause 1.24 of MSA, stipulated that the operator should allow the Corporation to access the network monitoring system located centrally or locally for the purpose of verifying performance by way of quarterly audit that would verify all service levels during the contractual period through the necessary software/tools provided by the operator. It further stipulated that the Corporation may, at its discretion, appoint a third party for carrying out Performance Audit and the third party so appointed would be responsible for verification, validation of all invoices under the terms and conditions of the agreement and would recommend on the eligible payment within two days.

It was observed that Corporation did not carry out such audits during the initial five years of the contract. Since the cost of such audits and inspections was to be borne by the operator, the lapse of the Corporation in not carrying out the audit had resulted in an extension of undue benefit to Trimax.

The Management, while explaining the constraints faced in carrying out the system performance audit as envisaged in the contract, stated (December 2014) that the Corporation had retained ₹ 3.50 crore from the payment of Trimax for this lapse.

Disaster recovery and management

3.14   Adequate Disaster Recovery (DR) infrastructure has to be maintained for ensuring recovery and business continuity in case of any disastrous

scenario. It was observed that even though DR centre at Pune was established, mock drills were not carried out periodically to ensure sound health of equipments and cables deployed for the purpose as a preventive measure.

The Management has agreed (December 2014) to take due care in future to conduct mock drills periodically.

Business continuity plan

3.15   As per contractual terms and conditions Trimax was to cover all the aspects of providing, computerising, implementing and maintaining ETIM and ORS with web facility for six years ending 11 December 2014. It also included providing training (including hand holding training) to the Corporation's employees/officials, transferring ownership of all the assets including Hardware and System Software (excluding proprietary software) to the Corporation at free of cost. The contract envisaged that Trimax was to submit an exit management plan in writing within 90 days from the effective date of agreement. There was delay in handing over the exit plan which was handed over only in October 2014 instead of within 90 days from the date of agreement (22 July 2010).

The Management stated (December 2014) that Trimax has already complied with submission of Exit Management plan, submission of source code, imparting hand holding training to Corporation officials and data dictionary as per contractual terms. However, after due "MAKE and BUY" Analysis discussion, it was examined on whether Corporation can take over the ETIM and ORS project and operate on its own. Non-availability of adequate and suitable technical manpower, technical support (for operations and maintenance) financial implication (for manpower, hardware, software, *etc.*) and the constraints on recruitment, etc. were the reasons for not taking the complete operations independently. In the mean time, Corporation has initiated the process for selection of a new system integrator for up-gradation of ETIM & ORS project. The new system integrator shall require a lead time of approximately nine months for the development and deployment of the new/upgraded ETIM & ORS system. Moreover, in order to have a complete hand holding without any disruption in the operations of ticketing system between the existing and the new system integrator there will be a requirement of additional lead time. Hence, considering the overall impact on the business it has been concluded by the Corporation for extending the existing contract with Trimax for one year.

The fact remained that the aim of business continuity plan was to carry on the business independently without any hindrance after completion of validity of contract period. Under the circumstances, the Corporation, for its business continuity, has no alternative but to rely on the support of either Trimax or third parties in so far as its e-ticketing and on-line reservations are concerned. It is pertinent to note that pending initiation/finalisation of tendering process for next term, the Corporation initiated extension of existing contract with Trimax for one year which indicated the fact of its incapability to continue the business of e-ticketing and on-line reservations independently.

Miscellaneous issues

3.16.1 The transaction table 'ticket' contains departure date and time of the bus. Audit however, observed that record entries in these columns appeared as 0/0/0000 and 00:00:00 respectively. In so long as the conductors are not instructed to punch the date and time of the actual departure of the bus through ETIM by making it mandatory, the objective of designing the system for improving the operations was defeated.

3.16.2 As per terms of contract ETIM was to be kept ready 40 minutes before the scheduled departure time (*30 minutes* before the sign on time and Sign on to be done before *10 minutes* of the departure of the buses). The penalty of ₹ 1,50,000 per depot/per month was recoverable if the average delay was between 0 and 10 *minutes* before schedule sign on time. Scrutiny of conductors' availability table revealed monthly average delay between 21 and 39 minutes in Asti Depot (District: Beed) during July 2011 to March 2012. The penalty recoverable as per contract worked out to ₹ 13.50 lakh. However, the same was not recovered from Trimax till date (December 2014).

The Management stated (December 2014) that all SLA parameters were considered as per SLA business rules. SLA Formula's was used as per the business rule document and penalty was applicable after applying the SLA business rules.

The reply was not acceptable as the SLA software developed and deployed was kept by Trimax outside the database.

3.16.3 As per terms of contract, the application development should be made free from any vulnerability and provide a 'bug' free environment for the entire solution during the contractual period. The 'Correctness of the delivery' requirement clause of the SLA also stipulated that the software component should be bug/defect free after the completion of the User Acceptance Testing (UAT) and that the service provider would be liable to pay a penalty of ₹ 5,000 per bug/error/defect reported after UAT. The UAT of the ORS and the ETIM was conducted on 29 December 2009 and 16 January 2010 respectively.

Scrutiny of data revealed reporting of 59,794 errors (ORS 197 and ETIM 59,597) logged after the UAT and up to 9 May 2014.

The Management replied (December 2014) that these tables were created to handle exceptional conditions to maintain transactional data integrity so that later on, these logs can be further examined for application performance tuning & enhancement in the system and these findings would not hamper the operations or business.

The reply was not correct as verified from the SLA which, in its correctness of delivery definition, inter alia, stipulated that "Correctness would mean that submission of all software components/ source code etc after the completion of the UAT (or the 1 UAT), should be defect/bug free".

3.17   Conclusion and Recommendations

The Corporation had not framed any IT policy laying down procedures, rules and regulations to oversee and monitor its IT environment.

The Corporation may formulate IT policy laying down procedures, rules and regulations.

The deficient input control and validation checks resulted in low assurance regarding completeness and reliability of data as observed from the tables containing details of freedom fighters, Arjuna awardees *etc*. There was deficient systems design resulting in non-capturing of data for grant of concessions.

The Corporation may ensure sufficient input controls and validation checks to have assurance of completeness and reliability of data.

The system could not be used for an effective MIS, data mining and data integration as envisaged in the scope of the contract due to non-capturing of details of buses available with depots, manual pass collection data, digitised routes and bus stops, digitisation of data of pass holders.

The Corporation may evolve a system to make use of the data captured in the e-ticketing database as business intelligent tool for improving the business operations.

The Corporation provided the infrastructure to Trimax at EDP centre and depot/bus stand without recovery of charges and also did not conduct the System performance audit as provided in the agreement with Trimax.

The terms and conditions of agreement may be adhered to avoid any financial loss to the Corporation.

Audit findings were reported (December 2014) to GoM; the reply was awaited (December 2014).