

Chapter 3 – Electrical – Signalling and Telecommunication units

The Electrical department is responsible for safe train operations and maximizing the utilization of fixed and moving assets such as train rakes, locos and tracks etc. At RB level, the Electrical department is headed by Member (Electrical) who is assisted by three Additional Members for Electrical, Telecommunication and Signalling.

At Zonal level, the Electrical department is headed by Chief Electrical Engineer (CEE) who is responsible for operation and maintenance of Electric Locos, Electric Multiple Unit train (EMU), Mainline Electric Multiple Unit train (MEMU), Overhead Electrical Equipment (OHE) its maintenance and operation, planning, electrical coaching stock, operation & maintenance and electrical general power supply, air conditioning, diesel generating set operation and maintenance and water supply. The Signalling & Telecommunication department is headed by Chief Signal & Telecommunication Engineer (CSTE) who is responsible for maintenance of signaling assets.

The total expenditure of the Electrical and Signal department during the year 2014-15 was ` 22,356.21crore. During the year, apart from regular audit of vouchers and tenders, 573 offices of Electrical and Signalling & Telecommunication department of Railways were inspected by Audit.

This chapter includes one review on 'Working of Signal Production Units on Indian Railways including their modernization' wherein Audit reviewed the working and performance of six Signal Workshops, manufacturing S&T equipment/ items for use on IR. In addition, a paragraph pertaining to East Central Railway is also included on lack of inter-departmental co-ordination for replacement of old and worn out lever frames.

3.1 Working of Signal Production Units in Indian Railways

3.1.1 Introduction

A controlled, smooth and safe running of trains on Indian Railways (IR) requires an effective signalling and telecommunication (S&T) system. Signalling System is essential for safe and smooth train operations and optimum utilization of available line capacity whereas telecommunication system plays an important role in train control, operation and safety of travelling passengers. IR has been relying progressively upon advanced signalling systems and state-of-the-art telecommunication network to increase the efficiency as well as safety of train operations. A number of special/ specific equipment is utilized in various installations. With up-gradation in technology and shift towards electrical/electronic system, the demand for modern electronic equipment/devices has gone up.

On IR, the requirements of S&T equipment / devices are met through production at Signal Workshops established at various Zonal Railways or through procurement from open market. There are 10 Signal Workshops in IR. Out of these, six³⁰ are major Workshops and they have been classified as Signal Production Units (SPUs) by RB (RB). The remaining four³¹ have been notified as Repair and Overhauling Centers/Workshops.

3.1.2 Background

The SPUs over IR were producing signalling items routinely used in existing S&T system. Production of different signalling items was assigned to different SPUs. As such, the product mix of one PSU was largely different from the other SPUs. Changing global trends and rapid technological advancements taking place in S&T system of Railways necessitate switchover to equipment of higher reliability to mitigate the risk of obsolescence and to keep pace with international developments.

The Working Group on Railway Programmes for XI Five Year Plan (2007-2012) recommended up-gradation and modernisation of Signal workshops in areas such as:

- automated assembly lines for manufacturing relays³²
- facilities for manufacturing clamp lock type point machines³³

³⁰ Podanur (PTJ) at SR, Ghaziabad (GZB) at NR, Gorakhpur (GKP) at NER, Byculla (BY) at CR, Howrah (HWH) at ER and Mettuguda (MFT) at SCR.

³¹ Ajmer at NWR, Pandu at NEFR, Sabarmati at WR and Kharagpur at SER.

³² Electromagnetic switching devices used in Railway Signalling and interlocking circuits.

³³ Electronic device used to operate railway turnouts with clamp lock.



- facilities for integration, simulation, testing and certification of Electrical and Electronic systems such as,
 - Axle Counters (ACs)³⁴
 - Audio Frequency Track Circuits (AFTC)³⁵
 - Electronic interlocking (EI)³⁶.

The Working Group also recommended that the procedures and activities performed at Workshops like assembly lines for relay manufacturing required to be automated. Capacity augmentation was also required for manufacturing certain items like IRS point machines³⁷, token-less block instruments³⁸, special purpose Relays and Electric lifting barriers³⁹.

The thrust areas identified in the XII Plan (2012-17) included complete track circuiting of stations (CTC), increasing line capacity through use of technology option such as Automatic Block Signalling (ABS)⁴⁰, intermittent block signalling (IBS)⁴¹, Cab signalling (CS) and integrating train control and signal system. The desired advancement would require switch over to systems and equipment of higher reliability in regard to safety.

High Level Safety Review Committee (Anil Kakodkar Committee) set up by RB (September 2011) to review safety on the Indian Railways, observed (February 2012) that demands of Railway system were growing rapidly without commensurate investment & up-gradation of technology and modernization consistent with modern times. The Committee strongly recommended adoption of an advanced Signalling system based on continuous track circuiting and cab signalling similar to European Train Control system Level II on the entire trunk route of IR (19,000 KMs).

The Expert Group on modernization of IR (Sam Pitroda Committee) set up in September 2011 for suggesting measures for improvement in the safety of IR workers and travelling passengers, recommended (February 2012)

³⁴ A device used to detect passing of train between two points on a track.

³⁵ A device unaffected by the interface on account of traction harmonics in electrified area and suitable for longer length track sections and automatic signalling sections.

³⁶ Micro processor based interlocking equipment to read the yard and panel inputs, process them in fail-safe manner as per selection table and generate required output.

³⁷ A device used to operate railway turnouts.

³⁸ Instrument used to control and ensure absolute safety of running trains by admitting only one train at a time into the section from either of the two ends.

³⁹ An electrically operated barricade kept in Railway level crossings to prevent passage of pedestrians and vehicles at the time of passing of train.

⁴⁰ A system consisting of a series of signals that divides a railway line into a series of sections, or blocks which allow trains operating in the same direction to follow each other safely without risk of rear and collision.

⁴¹ A technique which splits a block section between two adjoining stations into two through provision of an additional signal, remotely controlled from the station.

- implementation of ABS on all A & B routes⁴² with train management system;
- provision of communication based train control system such as moving block system⁴³ on C class routes(Suburban section) of CR and WR;
- deployment of on-board train protection system⁴⁴ with CS system on A and B routes;
- introduction of GSM based mobile train control communication system on A, B and C routes;
- establishment of centralized maintenance control centers.

The Vision 2020 Document of IR sets out the road map for quantum increase in capacity creation and technological up-gradation of infrastructure. It envisaged banishing accidents from IR operations through, inter-alia, use of advanced Signalling technology and improved communication. This document stated that IR has adopted the route of technology transfer in several areas including Signalling and that a conscious strategy to mitigate the risk of obsolescence and to continuously stay ahead in the technology race would be put in place.

To keep pace with the requirements of changing trends and technological advancements and comply with various recommendations brought out above, the Signal workshops were required to reorient their product mix and acquire advanced production technology.

Audit conducted a review (2004) of the working and performance of Signal Workshop, Gorakhpur at NER and findings were included in the report of the CAG of India (Railways) - Report No.9 of 2005. In their Action Taken Note (ATN), Ministry stated (April 2006) that-

- production capacity of the workshop had not been evaluated
- there was no costing system in the workshop

Later, to assess the overall performance of S & T department in IR, Audit conducted (2008) Performance Audit (PA) on 'Signalling and Telecommunication in Indian Railways' As regards Signal Workshops, the coverage was very limited and the aspects like non-utilization of man-hours and uneconomical manufacture of S&T items were investigated. The findings of PA

⁴² 'A' route – speeds up to 160 km/hour; 'B' route – speeds up to 130 km/hour

⁴³ A system where computers calculate a 'safe zone' around each moving train wherein no other train is allowed to enter.

⁴⁴ system that provides an automatic application of emergency brakes if the loco pilot overshoots the red signal.



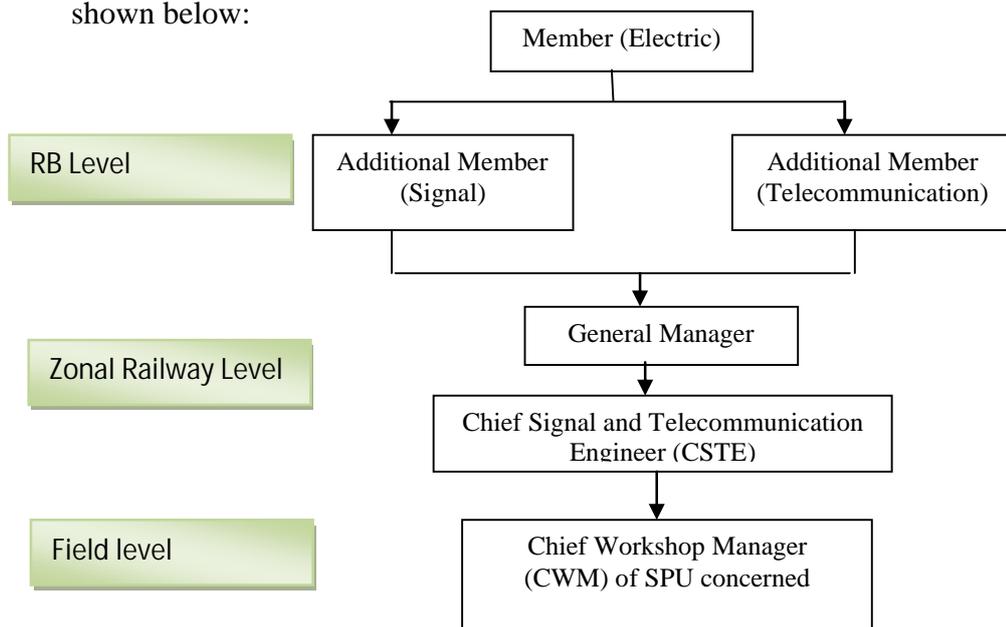
were communicated to the Ministry through the report of CAG of India (Railways) - No.PA 26 of 2008-09.

Audit had also reviewed (2011-12) 'Performance efficiency of Signalling assets in Indian Railways'. During examination of records the failure of Signalling assets was not linked with the Workshops who manufactured them. These findings were communicated to Ministry vide the report of CAG of India - Report No.11 of 2013.

In the above noted background, Audit conducted (2015) a Performance Review on 'Working of SPUs on IR including their modernisation'.

3.1.3 Organizational structure

The organization chart relating to signaling and telecommunication function is shown below:



At the RB Level, the policy decisions on S&T matters are taken by S&T Directorate which is headed by Member (Electrical). He is assisted by Additional Member (Signal) and Additional Member (Telecommunication). At Zonal level, S&T department is headed by Chief Signal and Telecommunication Engineer (CSTE) under the overall control of the General Manager. Signal Workshops (SPUs) are headed by the Chief Workshop Manager (CWM).

3.1.4 Audit objectives

The Performance Review on working of SPUs was conducted with a view to assess the following:

- The extent of modernization and product line changes undertaken in SPUs to meet the challenges of technological advancement.
- Capability of SPUs to meet the present day requirements of IR.
- Whether the performance of SPUs was economical.

3.1.5 Audit criteria, methodology and scope

3.1.5.1 Audit criteria

RB has issued instructions (July 2010) for modernization of SPUs. These instructions have been made the main criteria for the study. Besides, examination of various provisions on job costing system, incentive and Overtime Allowance (OTA) schemes in the Workshops contained in IR Code for Mechanical department were adopted as criteria for this Performance Review.

3.1.5.2 Scope and Audit methodology

Audit reviewed the working and performance of all the six Signal Workshops (SPUs) manufacturing S&T equipments/ items for use on IR during 2011-15. The methodology followed for the study involved, inter-alia examination of the records related with the guidelines and instructions issued by RB on modernization and working of SPUs. Besides, the records available in the office of CSTE of Zonal Railways, CWMs /Dy. CSTE/WM at SPUs and at Signal Stores Depots of Railway Projects & Construction Organisations related with the requirements on Zonal Railways and their availability through production in SPUs and open market were also examined.

3.1.6 Sample size

The S&T items manufactured at six SPUs are utilized at Railway Divisions or at Construction Projects. The sample size adopted for studying the Working and Performance of SPUs was as under-



Table 3.1

No.	Nature of Check	Sample Selection	Extent of check
1	Collection of data to assess the share of contribution of SPUs against the actual requirement of IR.	35 Divisions, 13 Signal Project Stores Depots and 17 Signal Stores Depots of Construction Organization	Eight items as given below: i) Relay (all types) ii) Colour Light Signalling Units iii) Single Section Digital Axle Counter (SSDAC) ⁴⁵ iv) Universal Axle Counter (UAC) v) Control Panel/Panel vi) LED signal units (all types) vii) Point Machines (all types) viii) Block instruments (all types)

3.1.7 Audit findings

Audit examined the evolution of SPUs, their production trend, extent of modernization, their contribution to present day needs of IR and their overall performance.

3.1.7.1 Evolution, production pattern and need for modernizing SPUs

Signalling items (equipment /devices) are vital components of Signaling system. Their installation ensures safe running of trains. Signalling system is maintained by Signal department and operated by the Operating department.

All the six SPUs had been in existence for over 56 years (HWH-1901, BY-1911, MFT-1916, GZB-1947, GKP and PTJ-1958). SPU/Podanur (PTJ) at SR is the biggest SPU. The total staff strength of these six SPUs as at end of March 2015 was 2,461(HWH-275, GZB-276, MFT-298,BY-332, GKP-570 and PTJ-710).

The total outturn of all the six SPUs during 2014-15 was `171.22 crore wherein the minimum share was of SPU/HWH /ER (`12.03 crore-seven *per cent*) and maximum of SPU/PTJ/SR (`60.48 crore- 35 *per cent*). The share of other four SPUs ranged between 10 and 20 *per cent* . During the period under review (2011-15), the value of outturn in all SPUs increased year after year except for SPU/GKP at NER where the outturn was less in 2013-14 (`19.63 crore) in comparison to 2012-13 (`26.74 crore).

RB decided (July 2010) to modernize the SPUs to meet the challenges of technological advancement of Signalling department and consequent need for

⁴⁵ This equipment is used for detecting the presence of a train in a block section based on the principle of axle counting..

modern electronic signalling items. They, with the objective of formulating an Action Plan to achieve Vision 2020 goals and to develop in-house capacity in manufacturing electronic based signalling equipment to manage technical obsolescence, envisaged (July 2010) modernization programs for SPUs.

Modernization Plan (2010) was to be implemented in two phases. Phase I of the Plan was to meet the requirements of IR up to the year 2015 and Phase II to meet the requirements of IR for five years 2015-2020. In order to develop core competency and develop specialization in manufacture of specific Signal items, RB designated six Signal Workshops as Signal Production units (SPUs). These required inputs and resources to meet the changed product line required by IR. Audit analysed the major products of these SPUs and their product mix and our findings are given below:

These six SPUs manufactured 134 signalling items. Out of these some items were major items. RB has assigned the production of different signalling items to different SPUs. As such, the items manufactured in one SPU are different from those manufactured in other SPUs. SPU-wise major products (production ` 3 crore or above per year) are given below:

Table 3.2 – Major products of SPUs in Indian Railways

SPU	Major products
Podanur (SR)	Relays, Point machines and Apparatus cases
Gorakhpur (NER)	Relays, Points machines, Apparatus cases and Lifting barrier gate,
Ghaziabad (NR)	Apparatus cases and Sliding booms.
Mettuguda (SCR)	Apparatus cases, Lifting barrier gate, and Colour light signal aspect.
Byculla (CR)	Block instruments
Howrah (ER)	Block Instruments,

The product mix of six SPUs for the year 2014-15 was as given below:

Table 3.3 – Product mix of SPUs – 2014-15 (in crore)

No.	Equipments/devices	PTJ/SR	HWH/ER	GZB/NR	BY/CR	GKP/NER	MFT/SCR
1	Relays (all types)	27.64	0	0	0	3.24	0
2	Apparatus/Location boxes (all size)	3.96	1.67	3.19	1.31	4.92	4.07
3	Point machines	14.16	0	0	0.00	4.52	0.00
4	Lifting Barrier Gate (all types)	0.22	0	1.88	0.36	7.67	6.32



5	Block Instruments (all types)	2.32	9.14	0.00	4.26	0	0.06
6	CLS (all aspects)	0.00	0.00	1.07	2.43	0	3.02
7	Sliding booms	1.85	0.34	3.53	1.94	0.72	0
8	Other equipment/items	10.33	0.88	7.85	24.2	0	12.2
	Total Outturn	60.48	12.03	17.51	34.51	21.07	25.62

Out of the total items outturned at a cost of `171.22 crore during 2014-15, 'Relays' with outturn value of `30.88 crore (18 *per cent*), manufactured at PTJ/SR and GKP/NER, emerged as the main product. Next to it were 'Apparatus cases/ Location boxes' (`19.12 crore- 11 *per cent*), Point machines (`18.68 crore- 11 *per cent*), Lifting barrier gate (`16.44 crore - 10 *per cent*) and Block instruments, CLS units, Sliding booms constituted less than 10 *per cent* each. Miscellaneous items manufactured in five PSUs (except GKP/NER) contributed to `55.41 crore (32 *per cent*).

Product mix of items manufactured during 2014 -15 indicated that the six SPUs were still focusing on the manufacture of conventional signalling items instead of producing items of advanced technologies, as envisaged. This indicates that development of in-house facilities and technology acquirement in SPUs for manufacturing modernized electronic based signalling items⁴⁶ was poor making SPUs' Administration helpless to utilize production capacity on manufacture of conventional S&T items.

3.1.7.2 Modernization of SPUs

As per RB instructions (July 2010), for Phase I of modernization proposed by RB, the six SPUs were required to submit comprehensive modernization proposals for:

- upgrading the infrastructure
- requirement of assembly line equipment
- requirement of testing and measurement equipment
- up-gradation of skills of existing staff, supervisors and engineers
- requirement of technology transfer documents
- substantial improvement of productivity index

⁴⁶ equipment such as SSDAC, EI, LED signal units etc.

RB instructed SPUs of four ZRs (SR, ER, NER, and CR) to submit proposals for inclusion in Works Programme (Machinery & Plant) on an out-of-turn basis. Railway Administration of remaining two SPUs (NR and SCR) was advised that proposals may be sent through the regular works programme.

Audit examined in detail the efforts made and progress of modernization undertaken in six SPUs in Phase I as well as the preparatory action taken by ZRs Administration to implement Phase II. Audit also examined modernization proposals other than those specified in Phase I and II of Modernization Plan. Results of Audit examination SPU-wise are furnished below:

- Of the four SPUs that were required to submit modernization proposal on out-of-turn basis, no comprehensive modernization proposal was made by three SPUs (PTJ-SR, HWH-ER, GKP-NER).
- Although required to submit modernization proposal on out-of-turn basis, SPU/BY (CR) submitted a proposal for `6.66 crore to RB in November 2014 after a delay of four years. The proposal related only to procurement of Plant & Machinery necessary for the SPU to enhance the capacity for production/value addition. The proposal indicated that the modernisation would result in enhancement of 40 *per cent* of its current production level. Further, cost reduction of 30 *per cent* was expected. However, the desired benefits could not be realised as approval of the RB was awaited (October 2015).
- Modernization proposal at a cost of `7.86 crore was submitted (September 2010) by SPU/GZB (NR) to RB. The proposal was incomplete as it did not contain details for developing automated assembly lines, up-gradation of skills of existing staff, supervisors and Engineers, requirement of technology transfer documents and proposals for substantial improvement of productivity index. The estimated cost was subsequently revised (June 2011) to `11.05 crore. However, sanction for taking up modernisation works was awaited (October 2015).
- SPU/MFT (SCR) submitted (January 2012) a proposal for Modernisation at cost of `2.48 crore for up-grading of infrastructure. During 2011-12 to 2014-15, RB allotted a sum of `1.96 crore out of which `1.12 crore was utilized (March 2015) and balance amount (`0.84 crore) surrendered (March 2015). Even after three years of sanction, none of the works had been completed (October 2015).



- For modernization Phase II, none of the six SPUs submitted (till October 2015) any proposal.

Modernization proposals other than those specified in Phase I and II are discussed in subsequent paragraphs-

(i) SPU/ Podanur (PTJ) at SR

- Although MOU of transfer of technology for manufacture of SSDAC was signed in March 2000, the technology was obtained in July 2015 only. Manufacture of SSDAC has not yet commenced (October 2015) as brought out in Para 3.1.7.5.
- SPU initiated no proposals related to requirement of assembly line equipment, requirement of testing and measurement equipment, up-gradation of skills of existing staff, supervisors and engineers etc. SPU made a proposal (2011-12) to RB for construction of Research and Development (R&D) facilities at an estimated cost of `4.69 crore to customize proposed manufacture of hardware and software of sophisticated electronic items. The proposal had not been approved (October 2015).
- Centralized Enterprise Resource planning (ERP) was to be developed by SPU/Byculla at the earliest. However as this was not developed as brought out in sub-Para (iv) below, SPU/ PTJ proposed (2013-14) to develop and commission an ERP system at a cost of `4.67 crore. The proposal had not yet been approved by RB (October 2015).

(ii) SPU /Howrah (ER)

A proposal for augmentation/renovation of Electrical and Engineering set-up (cost of `1.47 crore) was made in 2011-12. The proposal was modified (cost `1.02 crore) during 2014-15. RB sanction to the proposal was awaited (October 2015).

(iii) SPU/Gorakhpur (NER)

SPU Administration stated that adequate infrastructure was available with them to manufacture new products. However, despite availability of infrastructure, regular production of new items was yet to commence (October 2015) as brought out in Para 3.1.7.5

(iv) SPU, Byculla (CR)

To manage production planning and control, RB entrusted under Modernization Phase I the development and implementation of Enterprise Resource Planning (ERP) and its interlinking with all SPUs to SPU/Byculla (July 2010). No centralized ERP had been developed (October 2015). SPU/BY Administration stated that the implementation of ERP depended on the standardization of procedures for all workshops and, therefore, would entail obtaining expertise of IT firms experienced in implementing such modules across various units. Due to non-development of ERP, the intended benefits like centralized management of production planning and control over SPUs could not be achieved.

The SPU-wise developments under Modernisation Plan under Phase I and II indicate that proposals for modernization of SPUs did not take off and no funds were sanctioned specifically for comprehensive modernization. SPUs proposals for modernisation sent to RB for approval and funds allotment were lying with RB as un-disposed.

Audit further noticed that:

- Although the progress of implementation of modernization was stated to have been monitored through meetings of Chief Workshop Managers of the SPUs and three meetings were held (May 2012, July 2013 and January 2015), no follow-up was done by RB to ensure implementation of Modernization Plans.
- SPUs did not have their own Research and Development facilities. No proposal for setting up R&D facilities was sent to RB by any of the six SPUs.
- ERP system was yet to be established and interlinked among SPUs. As a consequence, proposals for modernization were not actively pursued resulting in SPUs not being geared up to develop in-house capacity for manufacturing electronic based signalling equipment to manage technical obsolescence.

These findings indicate that due and sincere efforts were not being made at any level to modernize SPUs to manufacture electronic based signalling equipment of improved/modern technology. Also, the production of conventional signalling items suiting the existing infrastructure continued and some signalling items, production of which was decided to be discontinued in phased manner, were still being produced.

3.1.7.3 New establishment for production of Electronic Components



RB approved a proposal (2010-11) on out-of-turn basis to set up Rail Electronic Component Factory at Cooch Behar, West Bengal at a cost of `78.38 crore. The factory was to manufacture various signalling items. The foundation stone for the Factory was laid on 29.01.2011. Ministry of Railways invited (November 2012) Request for Qualification (RFQ) to pre-qualify the prospective bidders for setting up of the factory through Public Private Partnership (PPP). Even after four years of sanction no work except construction of a shed at a cost of `1.13 crore had been executed. No work was in progress (March 2015). Thus, commissioning of the factory at Cooch Behar has not yet gained any momentum.

3.1.7.4 Modern electronic items not manufactured in SPUs

Audit reviewed the records of SPUs, Zonal Headquarters and RB (2015) to see as to what extent the production of modern electronic S&T equipment had started in SPUs. An analysis revealed that following items had gained wide acceptance in IR during previous five years –

- Data Logger
- Single Section Digital Axle Counter (SSDAC)
- Multi Section Digital Axle Counter (MSDAC)
- Electronic Interlocking (EI)
- Integrated Power Supply (IPS)
- Train Protection and Warning System (TPWS)
- Anti Collision Device (ACD)
- Block Proving by Axle Counter Units (MUX & SM Panel)
- Audio Frequency Track Circuiting (AFTC)
- LED main signalling units.

Audit examined the production schedules of all the six SPUs and observed that none of SPU was producing these identified items (October 2015). All items were being procured from open market to fulfil IR requirements.

RB communicated to Audit (August 2015) that Data Logger, TPWS and MSDAC were electronic based proprietary items and the knowhow and technical aspects thereof required to manufacture them in Railway SPUs were not available. This indicates lack of knowhow and technical aspects of IR regarding important electronic based items. As a result, IR had to depend on private firms which have monopoly on manufacture of these items.

Audit also observed that:

- Although as per RB's Planning (July 2010) manufacture of Single Section Digital Axle Counter (SSDAC) at SPU/ PTJ at SR and SPU/BY at CR was a part of Modernisation Plan Phase I, SSDAC were not being manufactured there and only some initiatives had been taken since December 2012 by SPU/PTJ.
- As per Phase II (2015-20) of Modernisation Plan, SPU/ PTJ (SR), SPU/HWH (ER), SPU/BY (CR) and SPU/GKP (NER) were required to manufacture units for EI, IPS, AFTC and BPAC. Production of these items was yet to commence (October 2015).
- Although LED signalling units were being manufactured at SPU/PTJ (SR) since 2011, their use was limited to 'Road warning signals' in level crossing gates because these were not usable as main signalling units for want of approval from RDSO. The issue of approval was pending with RDSO since December 2012 on account of non- submission of improved sample by SPU/PTJ at SR as brought out in Paragraph 3.1.7.7.
- Cables like Quad cables, Optical Fiber Cables widely used in IR were also not being manufactured by SPUs. There were successive proposals (2013-14 and 2014-15) from Sabarmati workshop/ Ahemdabad (WR) to establish a cable manufacturing Unit at a cost of `15.55 crore. This proposal was not approved by finance department of Zonal Railway and kept pending for want of adequate feasibility and financial studies.

RB stated (August 2015) that there was adequate manufacturing capacity for cables in the country and cut throat competition existed. Moreover, an item like cable was highly process intensive requiring major infrastructure and machinery not justifying it only for railway requirements. RB's contention was not tenable as it was justified in the proposal that there was continuous demand for signalling cables and procurement of cables from trade which led to large lead time resulting in time overrun in signalling works.

It may be concluded that IR limited its role in manufacturing mainly the conventional items, specifically for want of technical knowhow. SPUs were yet to move into the area of manufacture of any of the signalling equipment of latest technology to meet the requirements of IR. SPUs indeed required a conscious strategy to manufacture at least some of the advanced signalling items through technology transfer etc., as visualised in Vision 2020.

3.1.7.5 Product line change



RB planning (July 2010) contains a list of new items to be introduced at the six SPUs under Modernization Plan. It also specified capacity enhancement of existing items. RB had also planned to discontinue production of certain items. As per recommendations of the Working Group on Railway Programmes for the XI Five Year Plan (2007-2012), capacity augmentation of SPUs was also required for manufacture of certain items such as IRS point machines, tokenless block instruments, special purpose and Electric lifting barriers.

Audit reviewed the records to evaluate the efforts made in this regard by IR and noticed that:

I. Introduction of new items

New signal items that were to be manufactured by each SPU under Phase-I and Phase-II were as under-

Table 3.4 - New items proposed under modernization of SPUs

SPU	New items to be manufactured under modernization	
	Phase I	Phase II
PTJ at SR	(1) SSDAC	(1) AFTC (2) IPS (3) EI
HWH at ER	(1) Block instruments – Tokenless push button type (Non-RE)	(1) Block Proving by axle counter units (MUX and SM Panel)
GZB at NR	No new items were specified	(1) Pre-wired porta, cabins for ABS/IBS/LC Gate works (2) Electric Lifting Barriers
BY at CR	(1) SSDAC (2) Workshop ERP including networking of all workshops (3) Electric Lifting Barriers	(1) Block Proving by axle counter units (MUX and SM Panel) (2) Pre-wired porta, cabins for ABS/IBS/LC Gate works
GKP at NER	(1) Relay QB3 (2) Relay LED ECR	(1) Pre-wired porta, cabins for ABS/IBS/LC Gate works (2) IPS
MFT at SCR	(1) FRP based items like markers and warning boards	(1) Block Proving by axle counter units (MUX and SM Panel) (2) IPS

Audit examined the progress made so far by SPUs in manufacturing new signal items and findings are given under Sub-Para 'A' and 'B':

A. Progress on production of new items identified for Phase I

(i) Single Section Digital Axle Counter (SSDAC)

As per instructions of RB, production of SSDAC was to be commenced in SPU/PTJ (SR) and SPU/BY (CR) during Phase I (2010-15). The progress made by SPU/PTJ and SPU/BY to develop and commence production of SSDAC was negligible as narrated under:

RB had entered into (April 2000) an agreement (cost- to `1.46 crore) with Central Electronics Limited, Sahibabad (CEL) for developing technology for manufacturing SSDAC with the assistance of Department of Scientific Industrial Research (DSIR) within 24 months. There was inordinate delay in transfer of technology (TOT) from CEL as they were not able to develop the requisite cards required for manufacturing SSDAC. CEL informed in a meeting (July 2013) with RB that the delay in in-house development of cards was on account of paucity of resources. It added that in order to maintain the continuity in manufacturing and supply of SSDAC, the cards were developed by another agency (using their own resources) which had the Intellectual Property rights for these cards.

As there was demand for SSDAC from all zonal Railways, a Purchase Order was placed (October 2012) on a firm for `1.73 crore for supplying 50 Nos. of populated Printed Circuit Boards and sub-assemblies required for SSDAC as per RDSO specification. As per terms and conditions, five sets were to be supplied by 10.12.2012 and the balance by 15.06.2013. The firm supplied five cards in February 2015 and the balance supply of 45 items was still awaited (December 2015).

Meanwhile, technical details required for manufacture of SSDAC was transferred by CEL to SPU/PTJ (July 2015). However, CEL was unable to develop the requisite cards (event logger card, modem card and inter-face card) necessary for manufacturing SSDAC and thus violated the MoU signed among DSIR, CEL and RDSO due to non-furnishing of technical details of requisite cards for SSDAC. RDSO had not decided on the issue of breach of contract by CEL and approval of final design of SSDAC (December 2015).

Thus, even after the transfer of technology to SPU/PTJ for production of SSDAC SPU/PTJ could not commence mass scale production of the item as approval of RDSO to final design and specification was awaited.

Thus, although the process for developing technology for manufacturing SSDAC commenced in April 2000, the manufacturing of SSDAC by SPU/PTJ did not commence even after fifteen years due to delay in developing and



transferring the technology. Besides, the facilities for testing SSDAC created at SPU/PTJ at a cost of `0.35 crore could not be put to effective use.

SPU/PTJ Administration stated (July 2015) that the facilities were utilized for testing various new electronic products manufactured at SPU/PTJ. However, they did not furnish details of electronic products tested there.

SPU/Byculla had not included manufacture of SSDAC in its production plan so far.

The development and supply of the new item (SSDAC) proposed to be manufactured as a part of Vision 2020 had not materialized (December 2015) even after lapse of 15 years from signing of the agreement for TOT and IR still depends upon the market for supply.

(ii) Block Instrument – Tokenless Push Button Type (Non – RE)

As per instructions of RB (July 2010), SPU/Howrah (ER) was to manufacture Block Instruments – Tokenless Push Button Type (Non-electrified section). Audit noticed that production of the item had not been commenced there in view of a decision (May 2012) in CWMs meeting that the requirement of this item was diminishing and there was enough capacity for production of the subject item in SPU/PTJ.

It indicates that the RB's planning and instructions (July 2010) related to new items to be taken up for production in SPUs were based on inadequate inputs of demand on IR and the existing capacity of SPUs to meet these requirements.

(iii) Electrical lifting barrier

Manufacture of Electrical lifting barrier was to be added in the production line of SPU/BY (CR) during Phase I of Modernization Plan. However, manufacture of the item could not commence (October 2015) for want of RDSO's approval due to reasons brought out under Para 3.1.7.7.

(iv) ERP including networking of all SPUs

Under Phase I of Modernisation Plan, SPU/ BY was to develop and implement Enterprise Resource Planning (ERP) and interlink all SPUs for managing production planning and control over it. Audit observed that no centralized ERP had been developed so far (October 2015) as brought out in Para 3.1.7.2

(v) Relay QB3

Production of Relay QB3, a new item was to be introduced in SPU/GKP (NER) and adequate infrastructure was available there for manufacturing the new item, However, RB decided (May 2012) not to take up production in view of no demand from Zonal Railways.

(vi) Relay LED ECR

Relay LED ECR (Electronic Control Relay) was to be manufactured by SPU/ GKP (NER) for which infrastructure was available there. Although manufacture of this item commenced during 2014-15, mass scale regular production was yet to start due to non-availability of adequate magnetic and moulding components.

(vii) Fibre Re-inforced Plastic (FRP) based markers and warning boards

Fibre Re-inforced Plastic (FRP) based markers and warning boards were to be manufactured by SPU/MFT (SCR). The SPU viewed (September 2015) that markers and warning boards made of FRP were easily susceptible to wear and tear and may not last long when exposed to open wind. In view of this, SPU Administration did not manufacture the item. Audit observed that the cited constraints were not brought to the notice of the RB by the SPU. Instead of FRP based markers, markers and sign boards made from Mild steel (MS) Sheets were supplied to end users. This is indicative of inadequate monitoring by RB of compliance with its instructions.

It may be seen that none of the seven items identified by RB as new items for manufacture in Phase I of Modernisation Plan had been taken up so far (October 2015) for regular production.

Audit noticed that although the period specified for implementation of Phase I of Modernization Plan was already over (March 2015), production of new items as envisaged for this Phase was yet to commence in any of the SPUs. Also, SPUs were not geared to manufacture already envisaged new signal items under Phase-II of Modernization Plan.

B. Preparedness for manufacturing new items under Modernization Phase II

As per RB instructions six new items were to be manufactured at SPUs during Phase II of Modernisation Plan (Table No.3.4). Audit reviewed the records of SPUs to know the status of commencement of production/ actual production in respect of these items and observed that:

(i) AFTC and Electronic Interlocking

Production of these new items was assigned (July 2010) to SPU/PTJ. However, SPU/PTJ Administration conveyed to RB that developing of EI and AFTC was



not within the capacity of SPU and requested RB to give clear directions regarding acquiring of technology for manufacture of such item.

(ii) Block Proving by axle counter units (MUX and SM Panel)

The manufacture of this new item was assigned (July 2010) to SPU/HWH (ER), SPU/BY (CR) and SPU/MFT (SCR). No proposals were made by SPU/BY (CR) and MFT (SCR) in this regard. However, at SPU/HWH (ER) only test room facility had been developed under Phase I Modernisation Plan. The measuring instruments under Machinery & Plant Programme were yet (December 2015) to be procured.

(iii) Integrated Power Supply (IPS)

IPS was to be manufactured by SPU/PTJ (SR), SPU/GKP (NER) and SPU/MFT (SCR). SPU/PTJ (SR) took initiatives to commence the manufacture of item. Although the Chief Workshop Manager sanctioned (June 2014) the Estimates for manufacturing 100 sets of IPS, the regular production of this item was yet to start (October 2015). No proposals were made by SPU/GKP (NER) and SPU/MFT (SCR) for manufacturing IPS.

SPU/PTJ (SR) Administration stated that the tender for procurement of populated PCBs and sub-assemblies were discharged due to non-resolving of issues related to procurement process and non-allotment of sufficient funds by Zonal Railway.

(iv) Pre-wire porta cabins for ABS/IBS/LC

Production of Pre-wire porta cabins for ABS/IBS/LC was assigned to SPU/GZB (NR), SPU/BY (CR) and SPU/GKP (NER). No proposals were made by these SPUs to manufacture the subject item.

(v) Electric lifting Barrier

SPU/GZB (NR) was advised to add in their production line the production of Electric lifting Barrier. No action for manufacture of this item was taken up so far (October 2015) by SPU.

Thus, preparedness for manufacture of new items in Phase II of Modernisation Plan was not at all adequate. Only conventional items were being manufactured in SPUs and it was unlikely that any of the identified new items would be manufactured by the SPUs in the near future.

II Progressive discontinuance of existing items from production

In order to meet the changed product line, RB specified (July 2010) a list of 12 items the production of which was to be discontinued /phased out by six SPUs.

Audit observed that six items were still being produced by five SPUs. A detailed examination of the position in this regard revealed the following:

(i) SPU/PTJ (SR)

Production of GRS Apparatus cases continued till 2014-15 and the production of Apparatus Boxes (Half) was in fact enhanced from 200 in 2010-11 to 330 in 2014-15. During the review period, SPU manufactured 6,339 Apparatus Cases (both full and half) worth `15.10 crore.

The production of Control Panels was also continued and 165 Control Panels worth `5.26 crore were manufactured during review period.

Audit observed that there was no recorded reason for continuing the manufacturing of Control Panels. No target had been set by SR to reduce the production progressively.

SPU/PTJ (SR) Administration stated that production of GRS Apparatus Cases would continue till such time SPU/ GKP (NER), SPU/GZB (NR) and SPU/MFT (SCR) augment their production capacity and were able to cater the requirements. Regarding Control Panel, SPU/PTJ stated that production of Control Panels would be phased out within a year as it was decided by Open Line to provide visual display units (VDU) in lieu of Control Panels for all new installations.

Audit contention is that non-augmentation /non-enhancement of production capacity of two SPUs has resulted in the continuance of production of Apparatus cases in SPU/PTJ. Further, the production of these metallic boxes did not involve any sophisticated process. As such, there production might be outsourced and production capacity saved utilised on production of other important items.

(ii). SPU/HWH (ER)

In SPU/HWH (ER), manufacture of Apparatus Cases was to be discontinued. However, 528 Apparatus Cases were manufactured during the review period at a cost of `2.32 crore.

(iii). SPU/GZB(NR)

SPU/GZB (NR) did not discontinue the manufacture of CLS units. SPU manufactured over 600 CLS units at a cost of `3.51 crore during review period. It would be important to mention that the manufacturing cost of CLS units was higher by `2.80 crore than the prevailing market price.



(iv). SPU/BY (CR)

SPU/BY (CR) continued to manufacture Point machine ground connection in view of demands from Railway consignees. Around 1348 Nos. of item worth `3.32 crore were manufactured by the SPU during the review period.

(v). SPU/GKP (NER)

In SPU/GKP (NER), production of three items (CLS base, 'A' type foundation and track feed charger) was planned for discontinuance. Audit noticed that during 2011-15, these items were manufactured (total value `1.09 crore).

(vi). SPU /MFT (SCR)

In SPU/MFT (SCR), Double Line Block Instrument and Lifting Barriers were identified for discontinuance. However, production of these items had not been discontinued and Lifting Barriers costing (`0.10 crore) and Double Line Block Instruments (`0.04 crore) were manufactured during 2011-15.

It is clear from the above that the main objective of discontinuation of the items with a view to focus on manufacturing modern electronic signalling equipment was not achieved notwithstanding RB's instruction (July 2010) to the effect that high value items like SSDAC, Block instruments – (UFSBI) were not focused for manufacture.

However, all the items that were identified for discontinuation but produced by these six SPUs were issued to end users and not lying in SPU premises.

III Capacity enhancement of certain existing items

RB specified (July 2010) a list of existing items in respect of which the capacity of production of SPUs was to be enhanced to meet the increased safety needs. Audit examined the progress of enhancement of production capacities in respect to these existing items and observed that:

- In SPU/PTJ (SR), although the production of Block Instruments was to be augmented from 562 (March 2010), the actual production of the instruments after 2010 reduced drastically (344 in 2011-12, 174 in 2012-13, 40 in 2013-14 and 60 in 2014-15).

SPU/PTJ Administration stated (July 2015) that the TLBs manufactured were suitable for single line non-electrified sections only. Due to this demand for TLB had drastically come down. The reply suggests that RB's July 2010 instructions to augment the production of TLB at this SPU were not based on adequate inputs about present and future requirements of IR.

Further, though the SPU was scheduled to manufacture during 2013-14 and 2014-15 as many as 200 TLB Instrument with Universal Fail Safe Block Instrument (UFSBI) interface, a new version of Block Instrument, the new version was not approved for large scale production from RDSO (March 2015). It is important to mention here that this new version would be an essential requirement for double line and electrified routes.

- In SPU/HWH (ER), the production of Block Instruments was to be enhanced. However, as against the annual target of 180 for years 2011-12, 2012-13, 2013-14, the actual production was 98, 112 and 123 respectively. For the year 2014-15, the target was reduced to 120 from 180 and the achievement was 122. The shortfall in production during 2011-12 to 2013-14 was attributed to non-availability of materials.
- In SPU/GZB (NR), production of two items viz. Point Machine roddings (Ground connection) and Lifting Barrier was to be increased. The target for production of point machine roddings (Point fittings for point machine) for 2011-12 was increased to 1200 from 600 in 2010-11. The target could not be achieved as actual production during 2011-12 was 390 only. The target was reduced from 1200 to 720 in 2012-13 against which the achievement was 365. Then the target was again brought down to 600 against which the actual production was 255 and 186 in 2013-14 and 2014-15 only.

Similarly, the target for manufacture of lifting barriers was increased from 120 in 2010-11 to 180 in 2011-12 against which the production was 68 only. For 2012-13, the target was again brought down to 120. The actual production against the revised target was 59, 92 and 42 during 2012-13, 2013-14 and 2014-15 only. Thus, instead of enhancing the production, the target was reduced and there was shortfall in achieving even the reduced target. No reasons for shortfall in production were available on records.

- In SPU/BY, the production of UAC was to be enhanced. However, there was shortfall in the production of this item during the review period. The target was set as 60 for 2012-13 and 2013-14 and 72 for 2014-15. Against it, the production was 58, 34 and 51 respectively.

SPU/BY Administration stated that UAC was manufactured as per demands from the consignees and the item was being phased out. It indicates that the decision to enhance the production capacity under RB planning of July 2010 was not based on adequate input for needs for present and future requirements of IR.



- In SPU/GKP (NER), production of two items Panel Domino type and Point Machines (clamp type & IRS) with ground connections was to be enhanced. The Panel Domino was not manufactured for want of demand. For Point Machines (Clamp type & IRS) with ground connections, the production target was increased from 600 in 2010-11 to 720 in 2013-14. It was further decreased to 600 in 2014-15. Against these, the actual production was 362, 484, 503 and 469 during 2011-12, 2012-13, 2013-14 and 2014-15 respectively.

SPU/GKP Administration stated (January 2015) that the shortfall in production was due to non availability of required material from trade. This, however, indicates inadequate planning on the part of SPU.

- In SPU/MFT (SCR), three items viz. Electrical Lifting Barrier (EOLB), Track Feed Battery Charger (TFBC) and FRP Track Lead Junction Boxes (FRPTLJ) were identified for enhancement of production in SPU/MFT. The target for production of EOLB fixed at 120 in 2011-12 was increased to 180, 200 and 240 for the years 2012-13, 2013-14 and 2014-15 whereas actual production was 128, 92, 112 and 182 during 2011-12, 2012-13, 2013-14 and 2014-15 respectively. The target could be met during 2011-12 only.

The target for manufacture of TFBCs was increased from 1,800 in 2010-11 to 2,400 in 2011-12 and 2012-13 and further to 5000 in 2013-14. However, the target was reduced to 3,600 in 2014-15. The target was not achieved during 2011-12, 2013-14 and 2014-15 as actual production was 1500, 2300, 1725 during 2011-12, 2013-14 and 2014-15 respectively. The target was achieved during 2012-13 where the production was 2905.

The target for manufacture of FRPTLJ Boxes increased from 16000 in 2010-11 to 18000 in 2011-12 but reduced to 12000 during 2012-13 and 2013-14. Subsequently during 2014-15, the target was further reduced to 10000. The target was not achieved during 2011-12, 2012-13, 2013-14 as actual production was 3749, 930 and 8600 respectively. However, the target was achieved in 2014-15 with a production of 12850. Shortfall was attributed to non-availability of stores (raw materials).

Thus, the objective of increasing the production of identified items had not materialized in any of the SPUs. RB had not properly assessed the items required for enhancement.

3.1.7.6 Development of new products

With the advancement in technology and increase in safety requirements, the needs of Signalling items on IR are ever changing. This necessitates in-house manufacture of improved version of signalling items in SPUs. The prototype of the item is manufactured in the SPU and RDSO approves it. They conduct various tests and field trials to evaluate the performance of the item. After RDSO approval, SPU commences large scale production of the item duly procuring materials required for the production through Stores department.

3.1.7.7 Items pending approval with RDSO

SPUs send proposals to RDSO/Lucknow for approval of new products for future production. Audit examined the position of items pending for RDSO's approval and observed that the pendency in most cases was with the Zonal Railway as explained below:

- In SPU/PTJ (SR), the initial approval of RDSO in respect to seven new signalling items was pending at various stages for six to 28 months. A review of records at RDSO revealed that reasons for pendency were as under:
 - Deficiencies pointed out (November 2015) by RDSO were yet to be addressed in respect of Handle type diado block instrument;
 - In respect of QNIK and QNAIK relays the sample failed in initial type test. SPU/PTJ was requested (February 2015) by RDSO to submit improved sample;
 - RDSO accorded permission (November 2014) for extended field trail of three months in respect of 'Double line block instrument with BPAC using UFSBI and MUX combiner'. The extended field trial was still being continued (October 2015).
 - In respect of DC motor for point machine, the case was closed (March 2015) by RDSO as STR submitted by SPU/PTJ was incomplete.
 - Deficiencies pointed out (November 2015) by RDSO in respect of Track feed battery chargers were to be addressed by SPU/PTJ.
 - Sample of LED signals submitted (December 2012) by SPU/PTJ failed in testing by RDSO. They advised (October 2013) SPU to carry out safety validation as per CENLEC SIL-4 standards for LED main signalling units. SPU/PTJ (SR) had failed to obtain this validation so far (October 2015). Improved samples had also not been submitted by SPU/PTJ to RDSO so far (October 2015).



- SPU/HWH(ER) forwarded a proposal for manufacturing of “Battery Charger Track Feed” in October 2014. RDSO approval was pending (October 2015) as deficiencies pointed out (June 2015) by RDSO were yet to be addressed by SPU/HWH.
- SPU/BY had developed two types of Electrically Operated Lifting Barriers viz. EOLB 110 V AC and 24V DC. SPU submitted the prototypes in July 2014 for RDSO approval. Although the acceptance tests had been completed, approval was awaited (October 2015). As a result, the manufacture of the item could not commence (October 2015). RDSO’s approval for 24V DC) EOLB was pending for want of complete acceptance test report. In respect of EOLB (110V AC), RDSO had permitted (October 2014) SPU/BY to submit EOLB but the same was awaited in RDSO (October 2015).
- SPU/GKP had developed Relay QT-2 and submitted it to RDSO for approval in May 2013 along with Quality Assurance Plan (QAP) and other relevant documents. RDSO approval was accorded only during October, 2015.

Although ongoing developmental activities at different SPUs was a positive aspect, up-gradation of infrastructure and modernisation of manufacturing process, as envisaged by RB did not make much headway. Facilities had not been developed for in-house manufacturing of advanced electronic signalling items and IR largely depended upon the open market for the procurement of major signalling systems/ devices. In fact, lack of Research and Development (R&D) facilities and time taken by SPUs in addressing the issues raised by RDSO for approval of the designs and prototypes were the constraints in developing new items. Unless these developmental effort gains momentum, the SPUs’ share in the fulfilling the requirements of the Signal department of the Indian Railways might not go up significantly in coming years.

3.1.8 Capability to meet day-to-day requirement

Whenever a demand for a signalling equipment/ device arises at open line for maintenance and at Construction Organisation for creation of new assets, demand is placed on SPUs through an indent. To meet the requirement, ZRs also procure items from open market through Purchase Orders and Works Contracts. Thus, the items are either manufactured by SPUs or purchased from open market. Signal equipment/parts manufactured by SPUs are utilized by Open Line Divisions, Signal Construction units and Signal Project units of ZRs.

Audit examined the details of annual production, share contribution of SPUs in meeting the requirement of end users. Results of Audit examination are furnished in the succeeding sub-paragraphs.

3.1.8.1 Share of contribution by Signal Production Units

In order to augment capacity of SPUs, it is essential that estimated annual requirement of signal items and proposed contribution by SPUs is required to be assessed. However, Audit noted that annual requirement of signal items for IR / ZR as a whole and share of contribution of SPUs in manufacture and supply of various signal equipment against the actual requirement of Railways had not been assessed.

Audit examined the contribution of SPUs in meeting the requirement of ZRs in respect of selected eight signal items consisting of both conventional and modern electronic based signal items in 35 Signal Stores Depots of Railway Divisions, 13 Signal Stores Depots of Railway Projects and 17 Signal Stores Depot of Zonal Railways' Construction Organization in all ZRs including Metro Railway/Kolkata. One or more of these items are manufactured in all six SPUs. Shares of procurement from Railway SPU and from open market by these signal depots during 2011-12 to 2014-15 are given below:

Table No.3.5 - Contribution of SPUs

Sl. No.	Name of the signal items	Sources of Supply		Contribution by SPUs (in per cent)
		SPUs	Trade	
1	Relays (all types)	114023	288513	28
2	Colour Light Signal (CLS) aspects	1560	9999	13
3	Single section digital axle counter (SSDAC)	0	1820	Nil
4	Universal Axle Counter (UAC)	344	95	78
5	Control Panels	42	256	14
6	LED signal units	7307	79285	9
7	Point machines (all types)	4152	5131	45
8	Block instruments (all types)	1228	161	88

Source: Ledgers of concerned Stores Depots

A further analysis of the details of contribution by SPUs in Audit revealed the following:



- In respect of modern advanced electronic equipment, contribution of SPUs was meagre⁴⁷. RB had emphasized that SPU/PTJ (SR) would be the frontline SPU to develop electronic signalling equipment such as SSDAC, AFTC and IPS. However, SPU/PTJ (SR) did not equip itself adequately to manufacture and supply these electronic signalling items.
- In respect of Block Instruments (all types), SPUs were able to meet major portion (88 *per cent*) of the requirement. Audit further noticed that the requirement of Tokenless Block Instruments (TLBs) in IR was decreasing continuously due to doubling and electrification. The mass scale production to meet present day requirement of advanced Block Instruments such as Tokenless Block (TLB) instrument with Universal Failsafe Block Instrument (UFSBI) interface was yet to start in designated SPUs.
- It is relevant to note that FA & CAO, SR had pointed out (June 2015) that the manufacture of TLB-UFSBI in SPU/PTJ (SR) was a mere assembling of components and the process involved was of insignificant importance. Mere assembling of manufactured components may not be cost effective as observed by Finance and SPU/PTJ needs to acquire technology for manufacturing components so that value addition by SPU would be substantial.
- SPUs are able to meet major requirement (78 *per cent*) of UAC. But UAC is the analog version of axle counter. Present day requirement for major track circuiting works, BPAC works is advanced digital version i.e. SSDAC. But SPUs were not able to meet the requirement of SSDACs.
- Relays and Point Machines formed major share of the outturn of SPUs. However, in respect of these items also, ZRs had to depend heavily upon Trade. Around 72 *per cent* of requirement of Relays and 55 *per cent* of requirement of Point Machines were met from Trade.
- It is pertinent to mention here that CSTE/SR expressed (July 2015) inability to meet the current requirement of demand of Point machines and Relays in view of inability of COS/SR in making available in time the raw materials. This indicated the poor material planning at Zonal Railway level.
- On ECoR, the share of procurement in respect of all the eight items from open market was more than 90 *per cent*. The reasons for this unique pattern stated by the Zonal Railway were short supply/ delayed supply of materials unavailability/ unsuitability of materials transportation and shortage of staff for collection of bulk materials from distant workshops.

⁴⁷ SSDAC: Nil, LED Signal units: Nine per cent, CLS aspects: 13 per cent, Control panels: 14 per cent

It is quite obvious from the above mentioned instances that the contribution of SPUs towards the requirement of modern electronically advanced items was inadequate. Apart from this, items that were not being manufactured in SPUs⁴⁸ were procured fully from open market by ZRs.

3.1.8.2 Production capacity and production schedule of Workshops

Assessment of installed production capacity is essential for production planning and control. Production capacity is required to be assessed taking into account the available infrastructure and manpower. However, in none of the six SPUs the production capacity was assessed. Instead, production schedule for each year was based on budgeted outturn and demand and the approval of CSTE.

Table No.3.6 - Achievement of Production schedule (2011-12 to 2014-15)

Name of SPU	Targeted Outturn (` in crore)	Actual Outturn (` in crore)	Shortfall (` in crore)
PTJ (SR)	374.45	225.56	148.89
HWH (ER)	66.14	42.30	23.84
GZB (NR)	108.10	51.07	57.03
BY (CR)*	58.94	48.21	10.73
GKP (NER)	105.84	87.25	18.59
MFT (SCR)	109.97	94.64	15.33
Total	823.44	549.03	274.41

* Figures pertain to 2012-13 and 2014-15 as details were not available for 2011-12. In 2013-14, the Actual Outturn was

Audit examined the details of actual production vis-a-vis Annual production schedule fixed for the SPUs. Results of Audit examination are furnished below:

- Actual quantity manufactured fell short of quantity projected in Annual production schedule in respect of all SPUs. The average shortfall in achievement of annual production schedule by all SPUs was 33 per cent, the lowest being one per cent in SPU/MFT (SCR) and the highest 62 per cent in SPU/GZB (NR).
- During 2013-14, none of the SPUs achieved the targeted Outturn except SPU/ BY (CR).

Table No.3.7 - Statement showing pending Work Orders

Name of the SPU	Total number of pending Work Orders	Value of the WOs (` in crore)	Oldest WO pending from
PTJ	11	13.71	March 2011 (over four years)
HWH	2	22.65	2012 (over three years)
GZB	18	124.29	July 2008 (over six years)
BY	10	10.90	October 2010 (over four years)
GKP	7	87.04	March 2008 (over seven

⁴⁸ Data loggers, Integrated Power Supply equipment, latest type of Relays, LED main signal units, Cables etc.

- During the review period, the shortfall in actual outturn over the scheduled outturn by the SPUs was ` 276.44 crore.

Since the production schedules were prepared taking into consideration the available infrastructure, men and materials, the non-achievement of target fixed for production indicates underutilization of available resources. Of course, the actual outturn fell short by `276.44 crore of budgeted outturn during the review period and the consignees had to depend upon outside suppliers to meet their requirement.

3.1.8.3 Pending Indents and Work Orders

(i) Work Orders

Based on the indents received from various ZRs, SPU prepares work order (WO) for manufacture and supply of items. After the issue of WO, the manufacture of item for the mentioned quantity is taken up in SPU. Audit observed that there was delay in completing the production as per WOs by all the SPUs.

As on March 2015, manufacture of Signal items against 620 WOs worth `295.40 crore were pending in the SPUs. The oldest pending WO pertained to 2008. In SPU/GZB (NR), 18 WOs valuing `124.29 crore were pending. In SPU/MFT, there was pendency of 498 WOs valuing `37.71 crore.

Table No. 3.8 - Statement showing item wise pending work orders

Sl. No.	Name of Signal item	No. of W.O.s pending	Amount (crore)
1	Apparatus case/SS Location Box	89	18.77
2	CLS (all aspects)	54	75.87
3	LB Gate	18	32.94
4	Relays (all types)	7	28.23
5	Point Machine	2	45.4
6	Block Instruments (all types)	5	24.93
Total		175	226.14

Audit further noticed that out of total pending 620 WOs valuing `295.40 crore the major portion of 175 WOs related to production of six items only (Value `226.14 crore).

Since these items were in use in IR since long time and were not new/ latest or technologically advanced items, SPUs should have manufactured them speedily.

Indents

Work Orders are prepared based on the indents placed by the consignees. Audit examined the details of compliance of indents by SPUs and noted that –

- SPU/PTJ (SR) was able to comply with only four *per cent* of total indents in 2014-15. In respect of other SPUs, the compliance ranged between 15 (GKP) and 62 *per cent* (GZB).
- The value of indents complied by SPUs ranged from 13 (MFT) to 49 (GZB) *per cent* during 2014-15.
- Out of 3,20,586 indents to be complied for the year 2014-15, 21,082 indents were complied and 2,99,504 indents were pending by the end of March 2015. Value of indents not complied with was `354 crore.
- The average compliance of indents was only 29 *per cent* by SPUs.

Table No.3.9 - Statement showing pending indents as on 31st March 2015

Name of SPU	Total No. of indents in 2014-15	No. of Indents complied	No. of indents pending	Value of pending indents (in crore)	Percentage of indents complied with (per cent)	Value of indents complied (in per cent)
PTJ	248921	9993	238928	111.27	4	36
HWH	721	218	503	22.65	30	29
GZB	128	79	49	0.25	62	49
BY	1559	457	1102	70.00	29	18
GKP	68496	10098	58398	87.04	15	19
MFT	761	237	524	62.68	31	13
Total	320586	21082	299504	353.89		

- Delay in timely completion of WOs ultimately results in non-achievement of scheduled annual production and extra expenditure to consignees on account of revision of rate by SPUs. The delay in completing the WOs will result in short receipt of vital and safety signal



equipment by various consignees and affect the maintenance of signal system adversely.

Non-compliance of indents indicates that SPUs were unable to meet the present day requirement of end users. As there are more demands from consignees, the SPUs have to take all efforts to enhance their core competence to meet the requirement of open line and construction organization. Share of contribution of SPUs in respect of selected items identified for manufacture in SPUs was not adequate and major requirement was being met from open market. SPUs are concentrating on conventional signalling items only. Actual production of SPUs is far below projected annual production schedules.

3.1.9 Performance of workshops

3.1.9.1 Financial position

Important indicators of financial position of SPUs are:

- availability and utilization of funds
- credit realized from manufacture
- WMS turnover ratio - Ratio of average investment in WMS to credit realized on account of outturn i.e. achieving optimum production with minimum investment.

Audit examined the financial position of SPUs and the results of examination are as under:

(i) Utilization of funds by SPUs

Workshop Manufacture Suspense (WMS) of a Workshop/ Production Unit is intended to book cost of manufacture of products temporarily till they are transferred to end users. Whereas credit to WMS means the value of items dispatched by SPUs and accepted by consignees, a debit includes the cost of manufacturing such as labour, material and overheads. A credit to WMS can be equated to 'sales' in a trading firm.

Audit observed that funds required to meet the cost of production viz. cost of raw materials, labour and overheads are provided under the head 'Workshop Manufacture suspense – debit'. During the review period, out of `730.29 crore allotted as budget grant for this head, SPUs utilized only `635.64 crore.

Audit examined the details of utilization of funds by SPUs and observed the following:

- There was no underutilization of funds in SPU/GZB.
- The total under-utilization of allotted fund during review period (2011-15) in remaining five SPUs was to the tune of `116.97 crore⁴⁹. Shortfall in utilization of funds provided in budget grant for these five SPUs ranged between three *per cent* (SPU/MFT) and 35 *per cent* (SPU/PTJ). In SPU/GZB, SPU/BY and SPU/MFT there was excess over the budget grant to the tune of `22.32⁵⁰ crore.
- In SPUs PTJ (SR), SPU/HWH (ER) and SPU/BY (CR) there was under-utilisation of funds provided in the budget grant during all the four years

Under-utilisation of allotted funds against budget grant indicates inadequate efforts by SPUs not only in production of conventional items but also new items required during planning for modernisation.

(ii) Credit to Workshop Manufacture suspense

Audit examined the position of credit to WMS in SPUs and observed the following:

- Credit to WMS showed an increasing trend⁵¹. This indicated that the overall turnover of six SPUs was increasing year after year.
- During the review period, there was a total shortfall of `130.04 crore⁵² in realisation of credit from production (WMS credit) in five SPUs compared to the projection made in budget. This indicated that the outturn was not up to the projected level.
- In SPU/BY(CR), there was excess realization of credit to the extent of `5.21 crore during 2013-14 and 2014-15.

There were no reasons available on records for less credit to WMS in comparison to budget credit. This indicated that SPUs' Administration had not identified the factors contributing for lower financial performance. There was no monitoring on the issue by RB also.

(iii) Workshop manufacture suspense turnover ratio

⁴⁹ PTJ- `77.36 crore, HWH-`7.70 crore, BY-`1.85 crore, GKP- `27.04 crore and MFT-`3.12 crore

⁵⁰ SPU/GZB `14.99 crore (2011-12 to 2014-15), SPU/BY `4.36 crore (2014-15), SPU/MFT `2.97 crore (2014-15)

⁵¹ 2011-12- `122.07 crore, 2012-13-`157.90 crore, 2013-14- `164.63 crore and 2014-15-`194.01 crore

⁵² PTJ- `73.55 crore, HWH-`8.84 crore, GZB-`6.11 crore, GKP-`39.58 crore and MFT-`2.26 crore



WMS outturn ratio is the ratio of ‘value of issues to end users during the year’ to balance under the head ‘WMS’ as at the end March of that year’. This is the percentage of WMS closing balance at the end of March to the WMS credit during the year.

Year	PTJ	HWH	GZB	BY	GKP	MFT
2011-12	3.19	100.88	43.44	NA	98.00	1.69
2012-13	-4.6	104.96	57.06	19.94	95.00	1.23
2013-14	0.47	106.95	46.64	5.06	101.00	1.72
2014-15	-2.5	NA	43.88	2.48	70.00	1.58

RB has directed that WMS outturn ratio should not exceed 3.5 *per cent* for repair Workshop and six *per cent* for Production Shops. Thus, in the case of SPUs, rate of six *per cent* will be applicable.

Balance under the head ‘WMS’ would generally refer to amount invested in ‘work in progress’. Funds should be in rotation and not be blocked up under ‘work-in-progress’ for a long time. For this, products should be manufactured and delivered to users with adequate pace and bills got accepted as expeditiously as possible.

Audit examined the details of outturn ratio of SPUs and observed the following:

- WMS turnover ratio of SPU/ MFT (SCR) was within the prescribed limit.
- WMS turnover ratio of SPU/HWH (ER), SPU/ GZB (NR), SPU/BY (CR) and SPU/GKP (NER) was alarmingly high (332 *per cent* to 1783 *per cent*) in comparison to the benchmark limit (six *per cent*) fixed by RB. This denoted the alarming position of blocking up of funds in these SPUs in ‘WMS’.
- Reasons for high turnover ratio were-
 - Non-availability of raw materials in time (SPU/HWH –ER)
 - Decline in production (SPU/BY-CR)
 - Non-receiving of transfer certificates from consuming departments (SPU/GZB-NR)
 - Finished products lying in workshop (SPU/GKP-NER)
- WMS closing balance at the end of the financial year reflects the expenditure incurred on the unfinished products. As per Indian Railway Code for Mechanical department (Para 1224) there should not be any credit item under WMS closing balance.

Audit observed that in SPU/PTJ (SR) the closing balance of WMS at the end of 2012-13 and 2014-15 was (-) `2.67 crore and (-) `1.49 crore during 2012-13 and 2014-15 respectively. This indicated that the SPU's manufacturing accounts were not properly prepared /reviewed and credit item (s) adjusted to WMS. Although the review of balances was being carried out by Accounts Officer, the same was ineffective as it failed to analyze and bring out the reasons for the negative balance.

- Para 1225 of the ibid code stipulates that WMS balances are required to be reviewed by Accounts officer. A Workshop General Register (WGR) is also required to be maintained by Accounts department.⁵³ Audit observed that-
 - In SPU/BY-CR, neither WMS balances were reviewed nor Workshop General Register maintained.
 - In SPU/PTJ-SR and SPU/MFT-SCR, WMS balances were reviewed by Accounts Officer and submitted to FA&CAO. Workshop General Register was maintained by these two SPUs.
 - In SPU/GZB-NR, no records were available showing that results of review were submitted to FA&CAO. However, Workshop General Register was maintained.
 - In SPU/GKP-NER, Workshop General Register was not being maintained. However, WMS balances were being reviewed by Accounts officer and results submitted to FA&CAO.
 - In SPU/HWH-ER, Workshop General Register was not being maintained. Although WMS balances were being reviewed, the results of review were not submitted to FA&CAO.
- Para 1204 of the ibid code stipulates that charges appearing in WGR against various Work Orders are required to be summarized in out-turn statements Part I and Part II⁵⁴ which are also meant for raising debits and effecting recoveries. Both these statements are meant for a review with WMS balances.

Audit observed that WMS outturn statement Part I and II were not prepared in all the six SPUs clearly indicating that the codal provisions were not being followed in SPUs resulting in non-ensuring the correctness of WMS balances.

⁵⁴ Part I statements indicate details for completed Work Orders and Part II statement is meant for details related to Work Order under process.



Thus, there was inefficient utilization as well as monitoring of funds by all SPUs except SPU/GZB (NR). This resulted in very alarming turnover ratios. The amounts blocked up under 'work- in -progress' exceeded the prescribed limit in all SPUs except SPU/MFT. Further, credit to WMS fell short of projection in all SPUs.

3.1.9.2 Costing in Signal workshops

(i) Costing system in SPUs

As per Para 902 of IR Code for Mechanical department, the main objectives of a job costing system is to compare the cost of similar articles manufactured from time to time in the Workshops, to determine reasons for variation in cost and comparison between the cost of articles manufactured in the Workshops with those manufactured by other Railways/open market.

RB issued (September 1962) guidelines and instructions for the introduction of Job Costing in SPU/PTJ (SR). GM, SR informed (July 1987) RB that there were difficulties in introduction of Job Costing in SPU/PTJ, considering the higher number of operations involved in production of many items and requested to continue the existing system of costing. RB instructed (May 1990) SPU/PTJ (SR) to adopt the system of Assembly Costing (as stipulated in para 943 of the *ibid* code) instead of components wise Job Costing. Audit observed that Assembly costing was not implemented in SPU/PTJ (SR).

Audit observed that RB had not communicated any instructions applicable across all SPUs in regard to the method of costing to be adopted. As such, there was no proper costing system in SPUs as the deficiencies listed below would indicate:

- Route card, the authority for the shops to undertake manufacture of the component/assembly (para 916 of the *ibid* code) was not prepared except in SPU/HWH (ER) and SPU /MFT (SCR).
- No idle time card was prepared in all SPUs except GZB where the causes for idle time were stated to be power failure, non-working of crane and want of materials etc.
- In all SPUs, the cost card and working sheet for Final Costing were not being prepared. Comparison between estimated cost and actual cost was also not being carried out.
- The reconciliation between Cost Accounts and Finance Accounts (refer para 943 of the *ibid* code) was not being done except at SPU/MFT (SCR).

However, documents in support of reconciliation were not made available to Audit by SPU/GZB (NR).

- Cost sheet was not prepared for work orders/job orders in all SPUs except PTJ
- Cost components of selected products were not analyzed and compared with trade cost/ cost of products of other SPUs.

All the irregularities stated above establish the fact that there was no proper costing system in SPUs

(ii) Analysis of components of cost in SPUs

Audit analyzed the position of components of cost (labour, material and overhead) prevailing in SPUs and noted the following:

- Details of cost of each component was not being worked out at SPU/HWH (ER), and SPU/ BY (CR) in absence of which the data was not available with Audit for comparison with other SPUs.
- Position of components of cost in respect of SPU/PTJ (SR), SPU/GZB (NR), SPU/GKP (SER) and SPU/MTF (SCR) was as under.

Table No.3.11 - Components of cost (value ` in crore)

Components of cost	SPU PTJ		SPU/GZB		SPU/GKP		SPU/MFT	
	Value	per cent	value	per cent	value	per cent	value	per cent
Labour	51.82	24	37.44	50	70.85	50	22.89	22
Material	130.52	62	6.27	8	52.83	36	48.85	48
Overheads	29.06	14	31.05	42	19.32	14	31.18	30
Total	211.40	100	74.76	100	143.00	100	102.92	100

It may be seen that Labour emerged as major component (50 per cent) of cost in SPU/GZB (NR) and SPU/GKP (NER), Material in SPU/PTJ (SR)- 62 per cent and SPU/MTF (SCR)- 48 per cent. Further, Overheads as a per cent of total ranged from 14 per cent (SR and NER) to 30 to 42 per cent (NR).

SPUs are material oriented Production Units where production is through assembling of various components purchased from open market instead of their individual manufacture in the Workshop at lesser rates. As such, the cost of material component should be major. Taking into account this aspect, it may be understood that:

- (a) Costing components in respect to SPU/PTJ (SR) were realistic.



(b) At SPU/GZB (NR) the cost of labour and overheads did not seem to be reasonable keeping in view the cost of material utilized for production.

(c) In comparison to material utilized on production, the labour cost at SPU/GKP (NER) and overheads at SPU/MFT (SCR) were on some higher side denoting under-utilisation of labour and over-utilisation of overheads respectively.

(iii) Comparison of cost – rates of SPU vis-à-vis open market

Audit attempted to compare the cost of production in SPU with rates obtained from trade in respect of 17 widely used signalling items. Results of comparison made by Audit are furnished below:

- Rates obtained from open market during comparable period were cheaper than rates of SPUs in respect of all products selected for comparison. However, only during the year 2011-12 the cost of production of Lifting Barrier was cheaper in SPU/MFT compared to the open market rates. Position of rates of SPU as well as open market in respect of 17 products was as under-

Table No. 3.12 - Trade cost vs SPUs' rate (Amount in `)

Name of signal item	SPU rate	Rate purchased from open market	Excess rate	Excess percentage	Name of SPU/Year
Relay QTA 2	5890	3534	2356	67	PTJ (2012-13)
Relay plug in type 4F/4B	4635	3044	1591	52	PTJ (2013-14)
Relay QTA2 2F/1B	6032	2363	3669	155	PTJ (2013-14)
Relay QSPA1 8F/4B	6990	3465	3525	102	PTJ (2013-14)
LED signalling units	9224	7500	1724	23	PTJ (2012-13)
Steel Apparatus Case	47660	12724	34936	275	HWH (2014-15)
Apparatus Case GKP-Single	39577	11110	28467	256	MFT (2014-15)
Color Light Signal 3 Aspects	65895	12000	53895	449	GZB (2014-15)
Color Light Signal 3 Aspects	57000	21209	35791	169	BY (2014-15)
Color Light Signal 3 Aspects	47785	15029	32756	218	MFT (2014-15)
Color Light Signal 2 Aspects	37844	11263	26581	236	MFT (2014-15)
Lifting Barrier (10 mtr)	446826	155220	291606	188	GZB (2014-15)
Electric Lifting Barrier Gate	381487	341033	40454	12	MFT (2013-14)
Lifting Barrier Boom	8501	4851	3650	75	BY (2014-15)
Winch Gear Assembly E Type	52316	39953	12363	31	GZB (2014-15)
Relay QN1	3950	2287	1663	73	GKP (2014-15)
Route Indicator 4Way	106326	24079	82247	342	MFT (2014-15)

It is evident from the above table that price of production of these 17 items in SPUs was higher than that of the rate available from open market. The excess rate ranged between 12 per cent and 449 per cent.

Since these 17 items were available in open market at cheaper rates, their production in SPUs at higher production costs resulted in extra expenditure of `22.99 crore⁵⁵. In the prevailing conditions either SPUs' Administration could have explored the possibilities for cost reduction (particularly in cost of labour and overheads) or the extra expenditure could have been avoided by procuring the component from open market.

- In respect of following two products for which production was yet to commence, the estimated cost of production in SPU was higher than the trade rate.
 - The estimated cost of “Single Section Digital Axle Counter” in SPU/PTJ (SR) was `5.70 lakh (from 2011-12 onwards). Signal Project Organisation at PTJ had procured the same item, in July 2012, for `4.35 lakh through a works contract for a work being executed by them.
 - The estimated cost of “Block Instrument Diado Type” in SPU/PTJ was `4.50 lakh (2012-13). Controller of Stores/SR had procured the same item in September 2012 for `3.10 lakh only.
 - It is pertinent to note that the SPU rate of ‘Color Light Signal 3 Aspects’ in 2014-15 varied widely between SPU/GZB, SPU/BY and SPU/MFT (item No. 8,9 and 10 of Table No.3.12). Also, the rate at which this item was procured from trade by these three SPUs varied widely.

(iii) Comparison of position of cost of production among SPUs

With the idea to compare the costs of production in 2014-15 of certain items among the SPUs Audit selected five items widely used. The results of comparison are summarized below-

Table No.3.13 - Cost of production of selected products

Name of SPU	Name of the item manufactured	Workshop Rate (2014-15) (amount in `)			
		Direct labour	Direct material	On-cost	Total
Apparatus case					
PTJ	GRS Apparatus Case Full	10653	9318	6629	26600
HWH	Steel apparatus case	10686	16740	20228	47654

⁵⁵ PTJ - `1.28 crore, HWH - `1.63 crore, GZB - `7.39 crore, BY - `0.66 crore, GKP - `2.04 crore and MFT - `9.99 crore



GKP	Apparatus case (single)	5841	11072	21688	38600
MFT	Apparatus Case(Single)	11754	11831	15992	39577
CLS units 3 aspects					
BY	CLS units 3 aspects	19464	16125	21411	57000
MFT	CLS units 3 aspects	14276	15271	18238	47785
Lifting barrier					
GZB	Lifting barrier	70786	182288	193752	446826
GKP	Lifting barrier	58056	126300	175644	360000
MFT	Lifting barrier	68108	121089	93835	283032
Relay QN series					
PTJ	RelayQN1 8F/8B	1417	1971	815	4203
PTJ	RelayQNA1 8F/8B	1221	2246	704	4171
GKP	Relay QN-1	452	2030	1468	3950

Source: Records of Accounts office of SPUs

It may be seen that:

- There was significant difference in rates of 'lifting barrier' among SPUs. Whereas the production cost at SPU/MFT was ` 2.83 lakh per barrier, it was ` 4.47 lakh per barrier at SPU/GZB (158 per cent).
- Comparison could not be made in respect of some products as there was no uniformity in description/ specification of items among SPUs.
- Percentage of Overheads (on cost) on direct labour was higher in SPU/GKP in respect of all the products as brought out in Table No.3.13.

Costing is a tool for effective management and introduction of appropriate costing system facilitates cost management, cost control and cost reduction. It brings out the exact cost incurred for manufacture of various items in SPU, so that the rate of products of SPU can be compared with the cost of items manufactured in other SPUs or by outsiders. However, no proper costing system was available in any of the SPUs.

SPU/PTJ Administration stated (July 2015) that justification for manufacturing signal items in SPUs was not solely based on cost consideration, but to achieve self-sufficiency and self-reliance in manufacturing signalling products. This would avoid total dependence on outside firms and would take care of emergency situations occurring due to non-availability of supply and services in the event of closing down of firms. They also stated that in the long run it might work out to be beneficial for Railways in getting the products manufactured from SPUs. Audit is of the view that in such conditions, IR needs to analyze the reasons for higher cost of manufacture in SPU duly introducing appropriate costing system in SPUs and take suitable cost reduction measures.

3.1.9.3 Value additions made in respect of certain items

Value addition may be derived by deducting from the total cost of finished product the cost of raw material inclusive of cost of material and services outsourced. In case of some items, the cost of value addition in SPUs is very less. Audit examined the details of value addition in respect of selected advanced electronic items.

- In SPU/PTJ, in respect of the three electronic items (LED signalling units, SMS alert equipment and LED torch light) test-checked, the value addition by the SPU during the review period was very low (three to 11 *per cent* of the total cost). Though the value addition by the SPU was very low, manufacture of such items would inflate the turnover of the SPU as the bought out cost of the raw material/ product forms major portion of the output and value addition was not significant.
- In SPU/BY, in respect of four electronic items (Gate Warning Bell, Rx coil, TX coil and LED signal shunt) test-checked, the value addition by the SPU during 2014-15 was 44, 80, 84 and 49 *per cent* of total cost respectively.
- In SPU/MFT, in respect of Track Feed Battery charger and LED signals, the value addition by the SPU was 62 *per cent* and 66 *per cent* of the total cost respectively.
- No test- check of value addition could be done in SPU/ HWH, SPU/GZB and SPU/GKP\ as no advanced electronic item was manufactured there.

3.1.9.4 Productivity index

Productivity is an average measure of the efficiency of production. It can be expressed as the ratio of output to inputs used in the production process, i.e. output per unit of input. Results Frame work documents (RFD) for the year 2011-12 of Ministry of Railways fixed a target turnover of `10.64 lakh per employee per annum for the staff of workshops and production units. But, no such target was fixed since 2012-13. As per Results Framework Document (RFD) of Ministry of Railways, rating is as per norms depicted in the table (Column 2) below:

Table No.3.14 - Rating of labour productivity

Rating	Turnover per employee in lakh of Rupees per employee per annum	Method of calculating turnover per employee
(1)	(2)	(3)



Excellent	11.00	Credit to WMS during the year divided by total number of employees in the workshop.
Very good	10.64	
Good	10.37	
Fair	10.10	
Poor	9.90	

RB instructions (July 2010) based on Vision 2020 envisaged substantial improvement in productivity index of all the Workshops by introducing required automation, outsourcing of parts, components and sub-systems and production of high value items in larger volumes. It was proposed during meeting of CWMs of SPUs at RB on 18.5.2012 that turnover of the Workshop has to be three to four times of the staff wages. To achieve this, the production capacity needs to be increased by choosing right mix of high value items at the same time the cost of the product needs to be optimized and the cost of the material produced should be competitive with the trade.

Audit examined the productivity of SPUs and noted the following:

- No benchmark productivity index had been fixed and monitored. Even the RFD norms had not been communicated to the SPUs.
- No specific action for improving productivity such as automation and outsourcing for the purpose of improving productivity was initiated.
- Actual production was less than three times of staff wages and the shortfall was `127.19 crore.
- Turnover of SPU/PTJ was less than three times the staff wages as against the target of three to four times of wages. Turnover of SPUs/MFT, BY and GZB was less than two times of wages paid to staff. The turnover was less than annual wages paid in SPUs at HWH and GKP. This indicated that the productivity of staff was very poor in HWH and GKP

SPU	(` in crore)			
	Wages	3 times of wages	Actual production	Shortfall
PTJ	23.43	70.29	60.48	9.81
HWH	12.95	38.85	12.03	26.82
GZB	11.05	33.15	17.51	15.64
BY	15.92	47.76	34.51	13.25
GKP	21.87	65.61	21.07	44.54
MFT	14.25	42.75	25.62	17.13
Total	99.47	298.41	171.22	127.19

Average turnover per employee of SPUs during the review period was `5.48 lakhs; far less than the target set in RFD document in 2011-12. As per the rating mentioned in RFD documents, the productivity of SPUs was poor.

Table No.3.16 - Average Outturn per employee per annum

Name of SPU	Range of Outturn per employee in lakh of Rupees per employee per annum during the review period	Average Turnover per employee per annum (in lakh)
PTJ	6.6 to 8.2	7.63
HWH	3.4 to 4.7	3.98
GZB	2.3 to 5.7	4.21
BY	3.1 to 7.5	4.74
GKP	3 to 7	4.30
MFT	6 to 8	6.66
IR		5.48

- Though average turnover per employee was the highest in SPU/PTJ among SPUs in IR, yet it was poor as per ratings of RFD document. Average turnover per employee of other SPUs is lower than that of SPU/PTJ.
- Average outturn per employee per annum was less than `five lakhs in SPUs/HWH, GKP, GZB and BY.

3.1.9.5 Human Resource Management

(i) Strength of staff

Right sizing of manpower is essential to achieve economy in labour cost.

Audit examined the size of staff working in all the six SPUs and observed that there were 757 vacant posts (PTJ-150, HWH-198, GZB-36, BY-116, GKP-148 and MFT-109) which worked out to 20 per cent of staff strength during 2014-15.

(ii) Non-Revision of allowed time

Allowed Time was fixed for each operation in five SPUs (PTJ, HWH, GZB, BY, MFT). Of the five SPUs,

- The Allowed Time was not revised after taking into account Automation/Outsourcing, in two SPUs viz. SPU/GZB-NR and SPU/BY/CR.
- In SPU/GZB-NR, the basis of fixation of allowed time for manufacture of various items was not found on record.
- In SPU/HWH-ER, details of revision of allowed time was not maintained.



- In SPU/PTJ, the “allowed time” fixed as 70 hours in 1998 for manufacture of IRS Point Machine was revised to 37 hours in 2009 as some activities for manufacture of Point Machine were outsourced. The allowed time was revised as 26.66 hours from September 2014 based on the time study as recommended by AGM under the supervision of CSTE/CN/N/MS. It was stated by Workshop Administration that the allowed time for Q Relays, TLB Instruments, and Control panels was not revised as no operation was outsourced. No time study was conducted for the above items during the last 25 years.
- In SPU/MFT-SCR, the allowed time was re-fixed by reducing five *per cent* each time on 1.10.2005 and 1.12.2009.

(iii) Labour utilization

Instructions relating to maintenance of records of utilization of labour (recording time and allocation of labour) are contained in chapter 5 of IR code for Mechanical department. Audit examined the records of labour utilization and noted that –

- Man-hours unutilized in four SPUs (other than HWH and GKP) were 31 lakh hours equivalent to `39.43 crore approx.⁵⁶ during the review period.
- In SPU/HWH-ER, the man hours utilized/unutilized as per GA card were not maintained.
- In SPU/MFT, punching of cards for idle time for various purposes was not being done. The total idle cost was not distributed and allocated to concerned Job cards. This practice hindered the exercise of mandatory checks by the Accounts Office as prescribed in Para 423 and 433 of IR code for Mechanical department. Audit could not review the reasons for the idle time booked that caused production loss.

Thus, labour utilization was not adequate and maintenance of records for booking of idle time etc was lacking.

3.1.9.6 Availability of machinery and plants

Effective utilization of Machines and Plants (M&P) items is very important in running a production unit efficiently. Audit examined the availability of M&P in the SPUs and observed that:

⁵⁶ PTJ- `10.94 crore, GZB - `0.33 crore, BY - `24.22 crore and MFT` 3.94 crore

- Majority of the M&P items in SPUs outlived its codal life. Out of the 317 M&P items in SPU/PTJ, 241 items (76 *per cent*) had completed their code lives and were still in operation. Interestingly, 39 machines which were installed in 1958 at the time of commissioning of the SPU were still being operated. One machine viz; Injection Molding Machine installed in 1972 (codal life 15 years) installed in Machine Shop was not working since 2005.
- In SPU/HWH, 98 *per cent* of the machines were over-aged and crossed their codal lives. Also, 57 *per cent* machines had exceeded 50 years of operational existence. Although 32 machines became out of order during 2010 to 2014, no action for their condemnation or replacement had been initiated.
- In SPU/GZB, two machines were not in working condition. A machine worth `10.31 lakh has not been commissioned since procurement in 2012. Another machine costing `19.94 lakh commissioned in the year 2008 was not in working condition since commissioning.
- In SPU/BY, out of 76 machines, 60 machines had outlived their codal life. No proposal to replace/commission plant and machinery had been made by the SPU during the review period, except for the modernization proposal during the year 2014-15. There were six machines which were over 50 years and had outlived their codal life of 15 years.
- In SPU/GKP, two machines were over-aged and not in working condition. Out of this, one 'Old Sand Mixture' machine and one 'Engraving Machine' required replacement for which the proposal was sent during year 2014 and 2013 respectively and was sanctioned in 2014.
- In SPU/MFT, three machines had not been working for the last one year and one machine for more than five years. All the four machines had outlived their codal lives of 15 years. Replacement process of these machines had not yet been started. Further, out of 204 machines, more than 50 *per cent* (106 machines) had served for more than 30 years and only 25 *per cent* of machines was less than 15 years old.

Operation of obsolete machines which had completed its code life might result in utilization of more materials and more time for completion of the process. In other words, production of items with old machines will result in incurrence of extra expenditure.

3.1.10 Conclusion



The latest pattern of production of Signalling items in all the six SPUs on IR showed that SPUs were still focusing on the manufacture of conventional signalling items instead of producing items of advanced technologies.

The efforts made by ZRs as per RB's decision (2010) to modernize SPUs to meet the challenges of technological advancement of Signal department and consequent need for modern electronic signalling items were insignificant. As a result, the Modernisation Plan (Phase I and Phase II) formulated to achieve goals of Vision 2020 and develop in-house capacity to manufacture electronic based signalling equipment for managing technical obsolescence was badly affected leaving SPUs' Administration with no option but to utilize production capacity to manufacture conventional S&T items.

The SPU-wise developments under Modernisation Plan (Phase I & Phase II) indicated that proposals for modernization did not take off and no funds were sanctioned specifically for comprehensive modernization. SPUs proposals for modernisation sent to RB for approval and funds allotment were lying with RB un-disposed.

The product line changes in SPUs were very little as some signalling items, production of which was decided to be discontinued in phased manner, were still being produced and also the introduction of new items for large scale production was awaited.

Development of new items was very slow specifically on account of approval of the prototypes by the RDSO.

The shortfall in actual outturn over the scheduled outturn by the SPUs during three years covered in review was `276.44 crore and as on March 2015, manufacture of Signal items against 620 Work Orders worth `295.40 crore was pending out of which 175 WOs related to production of six items only (Value `226.14 crore). Out of 3,20,586 indents to be complied for the year 2014-15, 2,99,504 indents were pending by the end of March 2015, value of indents not complied with being `354 crore. Thus, actual production of SPUs fell far below the projected annual production schedules and SPUs were not able to meet the present day requirement of IR.

There was no proper costing system in SPUs. Rates obtained from trade during comparable period were cheaper than rates of SPUs. SPUs are working with over-aged machines. Thus, the performance of SPUs was not economical. Further, IR largely depends upon the open market for procuring latest signal items.

3.1.11 Recommendations

- MoR should take urgent steps to enhance the core competence and commercial viability of the SPUs
 - By evolving a mechanism for speedy modernization of SPUs and up-gradation of infrastructure to manufacture advanced signalling equipment/devices.
 - By reviewing the product line changes equipping SPUs to commence production of high value electronic items on a significant scale to contribute in a more meaningful way to the requirements of IR and by ensuring an efficient costing system in SPUs to facilitate variance analysis, value engineering, cost control, cost reduction and cost management.
- Alternatively, MoR may explore the feasibility of closure of commercially unviable SPUs.

3.2 East Central Railway (ECR): Unproductive expenditure due to improper planning in signaling works

Railway's indecisiveness in deciding the scope of signaling works and lack of inter-departmental co-ordination for replacement of old and worn out lever frames by Panel Interlocking (PI) led to unproductive expenditure of `6.97 crore

With a view to replace age old and worn out lever frames⁵⁷ and to maintain punctuality & safe running of trains, RB sanctioned the work for providing Panel Interlocking (PI) through replacement of worn out lever frames at Jhajha, Danapur and Kiul stations of ECR vide Pink Book for the year 2000-01.

Audit reviewed the records relating to works in Construction department and noticed that the detailed estimates for these works were sanctioned in October 2002, November 2002 and May 2003 respectively at a total cost of `19.62 crore. However, contracts against them were awarded between June 2007 and January 2008. The details of execution of these three works are as under:

Table 3.17

Stations	Date and cost of detailed estimate sanctioned	Date and cost of revised estimate sanctioned	Date and cost of contracts awarded for signaling works	Original date of completion and extended date of completion	Date of termination / short closure of contracts	Amount paid to the contractor on account of supply of materials
Jhajha	October 2002 at `5.14 crore	March 2007 at `5.76 crore	June 2007 at `3.26 crore	December 2007/ January 2010	January 2010	`2.28 crore
Danapur	November 2002 at `4.49 crore	NA	July 2007 at `3.75 crore	January 2008/ April 2011	May 2014	`2.18 crore
Kiul	May 2003 at `9.99 crore	December 2006 at `11.88 crore	January 2008 at `4.03	July 2008/ June 2011	May 2013	`2.51 crore

⁵⁷ Lever frames function as signal interlocking for safe and smooth movement of trains.

	Total					₹ 6.97 crore
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ECR Administration revised the estimates after 3.5 years to 4.5 years after the date of sanction of detailed estimate to accommodate the price and quantity variations through inclusion of new items as well as actual site requirement. Also, even after giving extensions of two to three years to the contractors, works could not be completed and had to be terminated/ short closed. Further, material worth ₹ 6.97 crore supplied by the contractors for the above three works remained unutilized since December 2010. Audit analyzed the reasons for delay in awarding and termination of contracts and noticed that –

- (i) Initially, the work of replacement of worn out lever frames was sanctioned (Pink Book of the year 2000-01) for PI works at Jhajha, Danapur and Kiul stations. Later General Manager (GM), ER decided (June 2000) for provision of Route Relay Interlocking (RRI) works at Jhajha and Danapur being bigger stations. But Chief Operation Manager (COM)/ER separately took a decision (July 2001) for providing PI with end panel for Jhajha station and RRI at Danapur station. Despite decision of higher authority (GM/ER) for RRI at these two stations (Jhajha and Danapur), the detailed estimate for work was sanctioned for PI by Chief Signaling and Telecommunication Engineer (CSTE)/ER in October - November 2002 for above two stations. After formation of ECR (October 2002), GM/ECR also decided to propose (January 2003) RRI works at Jhajha station by replacing lever frames. Due to this indecisiveness on the part of Railway Administration, the scope of works was changed and consequently awarding of contracts was also delayed.
- (ii) The signaling work of replacement of worn out lever frame by PI at Kiul stations was awarded in January 2008 after four and half years of sanctioning of detail estimates (May 2003). The work was short closed in May 2013 due to non-completion of civil engineering work and signaling plan. As of March 2015, no tender has been processed for this work.
- (iii) Further, the contracts were extended a number of times (four to eight times) as the S&T contracts for all the three stations were awarded without completion of civil engineering work and approval of signaling plan.

Due to change in scope and non-approval of Engineering and signaling plans, the contracts were terminated mid way and the works of PI/RRI at these stations are still not completed even after lapse of 15 years of the sanction of work by the RB (2000-01).



In this connection the following audit observations are made:

- (i) The contractor had received payment for supply of materials worth `6.97 crore till December 2010 which proved unfruitful as the materials remained unutilized for more than four years due to non-commissioning of PI/RRI at these stations. Besides, the warranty period (18 months) for these materials had already lapsed and repair and replacement against any future defects after their commissioning is at risk.
- (ii) From the above findings, it could be concluded that S&T works were awarded without completion of primary works of preparation of Engineering and Signaling plans. This was contrary to RB's instructions (August 1980), wherein it was stipulated that contracts should be awarded after completion of all preliminary works.
- (iii) Further, delay in commissioning of PI/RRI works at these stations also affected smooth movement of trains compromising the safety of train operation as stated in justification of work that due to extensive use of lever frames of these stations, gears had worn out and lever frames had out lived their codal life of 25 years long back.

Thus, indecisiveness in planning and lack of co-ordination between Civil and Signaling department of Railway led to un-productive expenditure of `6.97 crore besides compromising the passenger safety.

On the matter being referred to Railway Board in January 2016, they contended (February 2016) that -

- (i) Payment to contractor for the whole amount of `6.97 crore has been made only against supply of material, which have been utilized for other projects within the warrantee period. Credit to the works for utilization of the material in other projects will be done in a normal course.
- (ii) Delay in execution of these projects took place primarily due to dovetailing of other sanctioned works along with the work of replacement of existing signaling system and executing them together as a composite work. This resulted in short closure of earlier tender and issue of fresh tender with the comprehensive scheme. Going ahead with earlier approved plan/scheme would have resulted in permanent shortcoming/bottleneck and also compromised safety and efficiency in train operation causing recurring loss. Any attempt to remove these bottlenecks at later stage would have resulted in much larger infructuous expenditure –

almost redoing the whole work again including multiple round Non-Interlocking working.

The above contention is not accepted in view of the following:

- (i) During inspection, Audit noticed that in the depot of Deputy CSTE/Danapur, where material was received, there were no records to show the issue of such material to other works.
- (ii) Contrary to the decision taken by GM/ECR (January 2003) to undertake RRI works at Kiul and Jhajha stations, the ECR's construction organization awarded contracts for PI work at these stations. Thus, indecision in ECR on whether to replace the worn out lever frames by PI or by RRI at these stations before awarding the contract resulting in termination of contract mid-way.