

## Chapter 5 - Post project utilisation of Railway Electrification Projects

The abstract estimate of a project includes justification and benefits from the RE Projects including projected savings due to lesser fuel consumption, reduced detention, faster and greater Traffic (both Goods and Passengers) and avoiding traction change. Review of Post project utilisation of the electrified routes is done to assess the benefits derived from the project. This includes comparison of traffic projections as given in abstract estimates and actual traffic running on electric traction as well as actual savings vis-à-vis expected savings. Incomplete / balance activities (non-completion of TSS, SCADA, Electrification of Sidings, Traction availability, crew availability etc.) also has an impact on the benefits derived from the project. Audit reviewed the balance action remaining after CRS sanction and extent of utilisation of electrified section after completion of the works in selected 17 completed projects. Audit finding are described below:

### 5.1 Balance activities yet to be completed after CRS sanction

RE projects are monitored by the Railway Board on parameters of extent of energisation of 2.2 KV, energisation of 25 KV and sanction of Commissioner for Railway Safety (CRS). Railway Administration treated the project completed after CRS sanction. It was seen in Audit that despite sanction of CRS, a number of activities remains to be completed and financial transactions in the projects continue to take place in subsequent years after sanction of CRS. These balance activities include completion of work of transmission lines, completion of work of TSS, electrification of sidings, construction of residential quarters for maintenance staff, activities in yard, work of supervisory remote control attributable to implementing agencies for Railway electrification. However, in absence of the completion of these balance activities, the utilisation of the electrical section has remained negligible to at the most marginal. Besides, activities like availability of electric crew, locomotives, maintenance staff and general reluctance to change are other factors which are within the control for open line railway formations, and result in sub-optimal utilisation of these electrified sections.

The balance activities which were yet to be completed despite CRS sanction and treating the project as complete, in respect of 17 selected completed projects, were as follows:

Table 5.1 – Post project utilization of projects reviewed in sample			
Project	Date of CRS sanction	Balance Activities yet to be completed	Responsible Department/ Agency
Bhubaneswar-Kottavalasa	26.08.99 01.05.00, 25.04.01, 9.03.02 and 31.12.2004	Commissioning of one TSS at Malatiur on Khurda Road-Puri section has not been completed even after lapse of over 12 years of electrification of the section.	Electrical Department
Krishnanagar-Lalgola	Nov-07	While authorizing the introduction of 25 KV AC single phase electric Traction (November 2007), the Commissioner of Railway Safety pointed out that as the Debagram TSS was feeding the entire section, it was to be ensured that the voltage at the furthest point did not drop below the prescribed limit, under any circumstances. Trains were to be regulated if required. Thus, to cope up with the low voltage problem, only 50 per cent of trains were converted from Diesel to Electric Traction. Out of 11 pairs of Passenger/Express trains in the Krishnanagar-Lalgola section, five pairs of train were running in Diesel Traction after completion of the Cossimbazar TSS in October 2009.	Electrical Department
Karepalli-Bhadrachalam-Manuguru	Nov-09	No work pending	--
Andal – Ukhra – Pandabeswar	19.11.10	No work pending	--
Ujjain-Indore and Dewas-Maksi	23.06.2012 & 05.01.2013	Due to non- electrification of Ruthiyai – Maksi section of WCR which is a missing link being an island diesel territory surrounded by electrified sections of Kota – Ruthiyai – Bina and Nagda – Ujjain – Maksi sections is an impediment in the optimum utilisation of this project.	NAP
Tiruchchi rappalli-Madurai	30.06.11 and 06.02.14	Lightning arrester counters not provided, DG-TSS-PTFE yet to be provided, MDU yard road no. 5, 6, 8 to 10 not wired, DG TSS & SER TSS not commissioned	Electrical Department
Barabanki-Gonda-Gorakhpur-Chhapra-Barauni	Jan 2012 and Nov 2016	There were severe leakages of transformer oil at Hajipur TSS which indicated that the transformers were of poor quality. The works of Noonkhar/TSS, Govind Nagar/TSS, Burhwal/TSS, Bachhawara/TSS and Ramdayalunagar/TSS were still incomplete even after more than one year of CRS sanction.	Electrical and Civil Engineering Department
Shakurbasti-Rohtak	10.01.2013	SCADA was not yet commissioned and the post was being manned.	Electrical Department
Jhansi-Kanpur	17.9.12, 17.9.13 and 12.3.15	The work of Sarsoki TSS got delayed due to delays in land acquisition, Tower Wagon Shed and Siding were not ready at Chirgaon OHE Depot, incomplete work at Jhansi FP & SP; SCADA work was pending at JHS/SP main line, work of staff quarters at Orai, Pokhrayan, Chirgaon etc. were pending, which required to be done.	Electrical Department
Madurai-Tuticorin-Vanchim aniyachi-Nagercoil	15.12.2014	Oil filtration plants not supplied for Dindigul, Virudunagar & Kovilpatti/TSS and Split capacitor banks at 5 TSS in TNEB area to be provided	Electrical Department
Varanasi-Lohta-Janghai-Unchahar incl. Phaphamau-Allahabad	31.12.2015	The works of staff quarters in Varanasi, Bhadohi, Prayag and Unchahar are still pending. In addition to this some telecom works like earthing, PIJF cable laying and handing over of OFC in PFM-UCR section is in progress.	Civil Engineering and S&T Department

Project	Date of CRS sanction	Balance Activities yet to be completed	Responsible Department/ Agency
Daund-Manmad	10.08.14 and 30.01.16	Stabilization of SCADA system, isolator at location 269/12 with flexible copper shunt and painting of SP/SSP structure bonds with green colour are still to be completed.	Electrical and Civil Engineering Department
Mathura-Alwar	23.03.2015	Deeg/TSS is yet to be charged, SCADA space is to be provided by NCR Hd. Qtrs and Railway Board for putting the servers, 6 new stations are yet to be electrified by CAO/NCR from this estimates.	Electrical & Construction Department
Ghaziabad-Moradabad	Jan-16	In SCADA work, out of nine Remote Terminal Units (RTUs), seven RTUs were installed and joint inspection had been done with Divisional Authorities. All the seven RTUs of SCADA are operational in the section. Rest work of two RTUs is still in progress. Miscellaneous work of Signalling & Telecommunication and Civil work are in progress.	Electrical Department
Gooty-Dharmavaram-Yelhenka	July-16	Works on two Traction Sub Stations (TSS) at Someshwara and Malugur was yet to be commissioned by the contractor.	Electrical Department
Roza-Sitapur-Burhwal	October and November 2016	Not made available to audit	
Alwar-Rewari	26.03.2016	Construction of Tower wagon shed at Alwar and Rewari. Balance work of RE's SP & SSP, Submission of erected drawing, emergency power supply arrangement at TRD depot, staff quarters at Alwar and Rewari.	Civil Engineering, Electrical Department

As can be seen from the above a number of balance activities were yet to be completed in these projects despite CRS sanction. Many of these balance activities have been critical for effective post project utilisation of the electrified sections.

## 5.2 Post completion utilisation of the electrified section

The justification given for taking up these RE projects reflected anticipated passenger and goods train to be run on electrified section using electric traction after completion. The same was compared with the actual traffic running on electric traction on the electrified sections and project wise details are given below:

S. no	Project Name	Estimated saving per annum as per Abstract Estimate (₹ in crore)	Date of last CRS sanction	Percentage utilization wrt projected utilization (%)	Percentage present utilisation (%)	Shortfall in achievement of projected savings (₹ in crore)		Reasons
						Projected	Present	
1	Bhubaneswar-Kottavalasa	NA	Mar 2002	199.64	100.00	nil	nil	Not applicable
2	Krishnanagar-Lalgola	NA	Nov 2007	NA	100.00	NA	nil	While authorizing the introduction of 25 KV AC single phase electric Traction (November 2007), CRS pointed out that the Debagram TSS was feeding the entire section and it

Table 5.2 - Post project utilisation of 17 completed projects reviewed in audit

S. no	Project Name	Estimated saving per annum as per Abstract Estimate (₹ in crore)	Date of last CRS sanction	Percentage utilization wrt projected utilization (%)	Percentage present utilisation (%)	Shortfall in achievement of projected savings (₹ in crore)		Reasons
						Projected	Present	
								was to be ensured that the voltage at the furthest point did not drop below the prescribed limit, under any circumstances. Trains were to be regulated if required. Thus, to cope up with the low voltage problem, only 50 per cent of trains were converted from Diesel to Electric Traction. Out of 11 pairs of Passenger/ Express trains in the Krishnanagar-Lalgola section, five pairs of train were running in Diesel Traction after completion of the Cossimbazar TSS in October 2009.
3	Karepalli-Bhadrachalam-Manuguru	8.68	Nov 2009	NA	97.83	NA	16.04	One DEMU running on the section, all other are running on electric traction.
4	Andal – Ukhra Pandabeswar	17.44	Nov 2010	NAV	NAV	NAV	NAV	Section next to this section are under electrification.
5	Ujjain-Indore and Dewas-Maksi	17.45	Jan 2013	154.46	82.05	0.00	12.27	Due to non- electrification of Ruthiyai – Maksi section of WCR which is a missing link being an island diesel territory surrounded by electrified sections of Kota – Ruthiyai – Bina and Nagda – Ujjain – Maksi sections is an impediment in the optimum utilisation of this project.
6	Tiruchchirappalli-Madurai	23.29	Feb 2014	38.84	58.39	40.36	27.46	Due to non-availability of adequate AC trained loco pilots in Madurai division. Most of the goods trains running in Dindigul-Madurai section are coming from Karur, which is non-electrified section. Traction change facilities at Dindigul are inadequate. Sub-stations at Samayanallur has been commissioned only on 16 Nov 2016, 2 years 9 months after the last CRS sanction.
7	Barabanki-Gonda-Gorakhpur-Chhapra-Barauni	122.85	Nov 2016	6.29	42.18	19.19	11.84	There is lack of adequate electric locos which led to partial utilisation of the electrified section. Two TSS at Burhwal and Nunkhar are yet to be commissioned and line no. 7 to 15 of Gorakhpur Station have

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						Projected	Present	
								also not been electrified. Further, there are nine junction points in this section viz. Gonda, Manakpur, Gorakhpur, Gorakhpur Cantt., Bhatni, Siwan, Chhapra, Muzaffarpur and Samastipur. The branch lines from these junction points have not been planned for electrification Traction change point has also not been planned at each junction point.
8	Shakurbasti-Rohtak	28.21	Jan 2013	19.80	7.45	82.95	95.73	Reasons not available.
9	Jhansi-Kanpur	32.3	Mar 2015	72.68	55.23	28.68	47.00	TSS at Sarkosi, Tower Wagon Shed and siding at Chirgaon, SCADA yet to be completed.
10	Madurai-Tuticorin-VanchiManiyachchi-Nagercoil	29.73	Dec 2014	52.96	48.71	27.97	30.50	Due to non-availability of adequate AC trained loco pilots in Madurai division. Most of the goods trains running in Dindigul-Madurai section are coming from Karur, which is non-electrified section. Traction change facilities at Dindigul are inadequate. Sub-stations at VanchiManyachi Jn. have been commissioned only on 16 Nov 2016, 1 year 11 months after the CRS sanction.
11	Varanasi-Lohta-Janghai-Unchahar incl. Phaphamau-Allahabad	36.43	Dec 2015	15.38	14.16	28.26	28.67	Reasons not available.
12	Daund - Manmad	61.34	Jan 2016	5.95	4.01	52.89	53.98	Trains coming from Solapur-Manmad and Miraj-Daund-Manmad sections are running on diesel power as Solapur-Daund and Miraj-Pune sections are not electrified.
13	Mathura-Alwar	29.68	Mar-15	16.67	28.57	43.28	37.10	Deeg/TSS is yet to be charged, SCADA space is to be provided by NCR Hd. Qtrs and Railway Board for putting the servers, 6 new stations are yet to be electrified by CAO/NCR from this estimates. The section remains underutilised as the traction

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						Projected	Present	
								change point was not shifter to Alwar.
14	Gaziabad-Muradabad	42.31	Jan-16	22.22	15.79	27.42	29.69	Reasons not available.
15	Gooty-Dharmavaram-Yelhenka including Dharmavaram-Sri Satya Sai Prashanthi nilayam-Penukonda	16.79	July 2016		18.92	7.00	5.67	TSS at Someshwara and Malagur are yet to be commissioned. However, The Commissioner of Railway Safety (CRS) sanctioned running of trains on the entire Section in July 2016. Thus, the full quota of trains was not run on the section due to non-completion of residual works.
16	Roza-Sitapur-Burhwal	30.74	Nov 2016	8.40	3.83	2.35	2.46	Reasons not available.
17	Alwar-Rewari	8	Mar 2016	23.67	5.76	4.58	5.65	The connecting sections of Alwar-Bandikui, Rewari-Delhi, Rewari-Bhiwani are not electrified. 12 coal rakes were projected, which were to come from Mathura side. As in Mathura-Alwar section, Deeg TSS is yet to be commissioned, trains are not being run on this section on electric traction.
<b>Total</b>						<b>364.92</b>	<b>404.05</b>	

It was seen that the extent of utilisation of the electrified sections was sub-optimal.

It was seen that

- Only in two sections, the utilization was equal to or more than the projected utilisation.
- In one section, though the utilisation was more than projected utilisation, it remained 82.05 per cent of the present overall utilisation.
- In two projects the present utilisation was 97.83 and 82.05 per cent of the projected figures.
- In 12 electrified sections, up to 59 per cent trains were being run with electric traction only. On an average the percentage utilisation was 25.25 per cent with median of 17.36 per cent.
- The shortfall in achievement of projected savings was ₹ 364.92 crore for 12 projects.

- The shortfall in achievement of projected savings with respect to present utilisation was ₹ 404.05 crore in 14 projects.

The main reasons for such under-utilisation of electrified sections were non-completion of balance activities, missing links which did not allow seamless operations of trains with electric traction on these routes, lack of planning in identifying traction change points and inadequate coordination between Zonal Railways, non-availability of adequate electric locos and loco pilots etc.

#### Annexure 5.1

### 5.3 Use of diesel traction on electrified section

One of the impacts of balance activities yet to be completed and missing links in seamless operations of trains on electric traction is that despite sections being electrified, trains are being run on diesel traction. Audit test checked data in respect of 15 Divisions of eight Zonal Railways involving 66 electrified sections of 15286 RKM where 345 trains were being run on electrified sections through Diesel Traction. Analysis of reasons for operation of Diesel Locomotives revealed the following main reasons as stated by eight Zonal Railway Administrations in respect of 345 trains:

- Missing links between electrified sections yet to be electrified. Running of trains with electric traction on these electrified section, requires tractions change at one or more points, which leads to detention and delays.
- Balance activities like commissioning of traction sub-stations yet to be completed.
- Coordination issues between Zonal Railways.
- Terminal constraints
- Shortage of electrical locomotives for passenger and goods trains.
- Paucity of MEMU rakes

The significant cases of use of diesel traction on electrified track were attributable to missing links. Railway Board has also identified a number of missing links affecting utilization of existing electrified sections (**Appendix IV**). All such missing links should be taken up on priority so as to derive maximum benefits of the electrified sections. Non-completion of balance activities on time has also led to underutilization of electrified sections. Thus, post project utilisation was an area of concern, and IR needs to monitor projects for post project utilisation as well.

#### Annexure 5.2

During Exit Conference (March 2017) with NCR Administration the following reasons for meagre/sub-optimal post project utilisation emerged:

- Non-electrification of siding for two Power Houses at Rewari impacting utilisation of electrified Mathura-Alwar Section in North Western Railway.
- Lack of an overall view as officials of Zonal Railway do not look beyond their jurisdiction. Priority given to other Zonal Railways involved is always lower.
- Shortage of Crew and Electric Locos
- Traction change and interchange point lie in another Zonal Railway and there is a lack of co-ordination between the Zonal Railways involved.
- Terminal constraints, like, entry to any station takes much time (even from calling on signal) due to less number of platforms, availability of land, change in Planning during the execution stage, prior or even post completion of any Plan/Construction owing to lack of long term vision. They felt that Terminal constraints would render the electrification ineffective as regards to projected savings and efficiency and works for terminal facilities were needed to be taken up simultaneously with electrification.

NCR Administration felt that to optimally utilize the electrified section, pan-India view needs to be taken at Railway Board level. They were of the view that staff recruitment for electrified routes (both maintenance and loco drivers) should be a part of the project at its planning stage. Permanent cadre for CORE was stated to be required to reduce pressure on Zonal Railways, which themselves have considerable vacancies.

***It is recommended that***

- 21. Missing links should be identified and accorded highest priority as missing links adversely impact the utilization of electric traction on electrified routes.***
- 22. Completion of balance activities after CRS sanction and its impact on post CRS sanction utilization of the project should be a part of monitoring mechanism by the Railway Board.***
- 23. Critical activities/issues having an impact on project utilisation such as commissioning of Traction sub-station, shifting of traction change point, work related to SCADA, availability of terminal infrastructure, electrification of sidings, availability of electric locos, crew and MEMU rakes and missing links, should be identified and monitored separately. Monitoring of RE projects should include monitoring activities of the project implementing agency as well as open line so that RE projects are effectively utilized.***



***24. The utilization of the electrified section for using electric traction is the real objective of RE projects and should be monitored by the Railway Board to ensure that diesel traction on the electrified sections is not used except for unavoidable reasons.***

Railway Board in their reply (March 2017) noted the Audit recommendation and stated that Railway Board is already monitoring critical activities of RE projects not only with Zonal Railways, but also with State Authority for release of power supply for traction sub-stations.

However, as can be seen from the impact of balance critical activities pending on utilisation of sections post electrification, there is a need to incorporate internal control mechanism for monitoring post project utilisation of electrified sections. The constraints as discussed above further limit the extent of utilisation of electrified sections and holistic monitoring mechanism would ensure optimal utilisation of the assets created through railway electrification.