CHAPTER – II (SECTION A): COMPLIANCE AUDIT

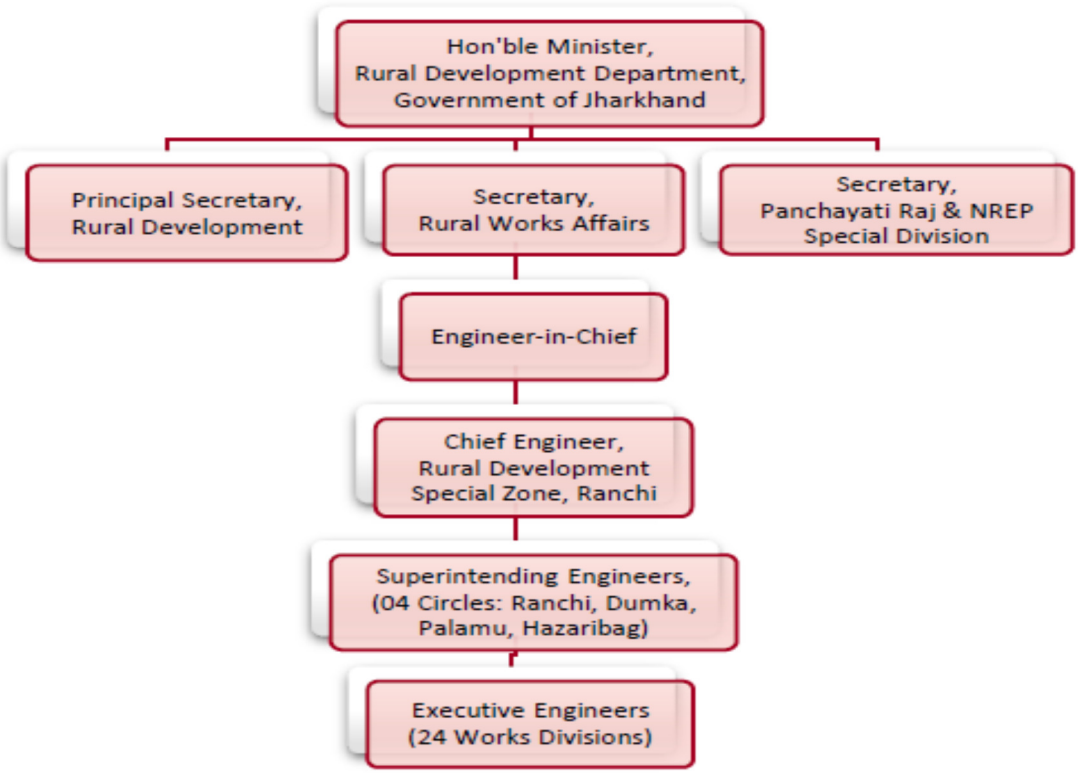
RURAL DEVELOPMENT DEPARTMENT (RURAL WORKS AFFAIRS)

2.1 Implementation of *Mukhya Mantri Gram Setu Yojana* in Jharkhand

2.1.1 Introduction

Government of Jharkhand (GoJ) launched (September 2001) *Mukhya Mantri Gram Setu Yojana* (MMGSY) for construction of bridges over rivers and *nallas* falling in the alignment of rural roads. The aim of the Scheme was to connect every village (32,394 villages) to gram panchayat, every gram panchayat (4,423 gram panchayats) to block headquarters and every block (260 blocks) with district headquarters (24 districts). It is an ongoing Scheme under the Rural Development Department (RDD) and funded out of the State own resources. The Secretary, Rural Works Affairs (under Rural Development Department) is responsible for implementation of MMGSY in the State as shown in the organogram below:

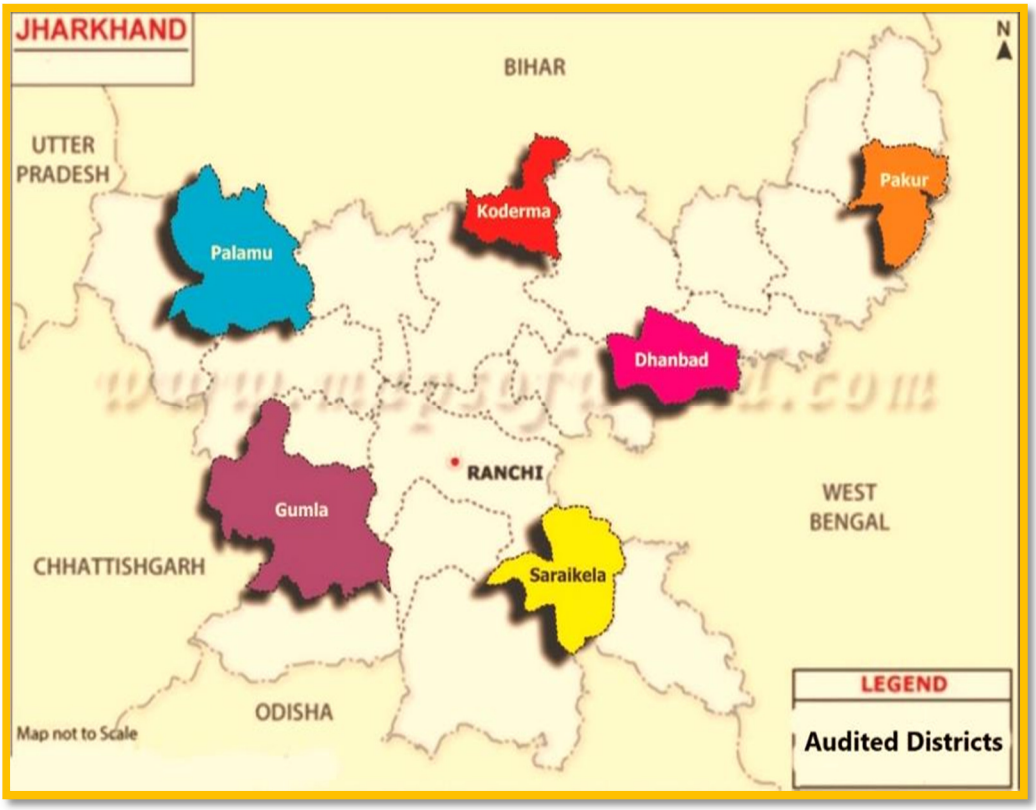
Chart 2.1



Audit was conducted between September 2019 and March 2020 covering the period 2014-19 in six[1] out of eight sampled districts, office of the Chief Engineer (CE) and at the Departmental level to assess whether (i) selection and approval of the bridges were granted after proper survey; (ii) construction of bridges and approach roads were undertaken economically as per codal provisions with due regard to quality, workmanship and timeliness; and (iii) post-execution maintenance of the bridges and approach roads were ensured. Joint physical verification of selected bridges was also carried out along with the engineers of the audited divisions.

The sampling of audit units (divisions) was done in two steps, first by stratification of the districts/divisions as per geographical spread and then by applying the Probability Proportional to Size without replacement (PPSWOR) sampling technique. Accordingly, the 24 districts/divisions were stratified into four circles (Ranchi, Dumka, Hazaribag and Palamu) and from each stratum, 33.3 *per* cent of districts/divisions (eight) were selected using expenditure incurred during 2014-19 as the criteria for applying PPSWOR sampling method. The Audit sample of six districts/divisions represents 26 *per cent* of total expenditure incurred on the MMGSY bridges in the State during 2014-19. In these sampled districts, 214 bridges were taken up for construction during 2014-19 and of these, 57 (27 *per cent)* were examined in detail by Audit.

Chart: 2.2



[1] Due to Covid 19 lockdown measures, field audit was suspended in the districts of Ranchi and Deoghar.

An entry conference was held on 24 September 2019 with the Secretary, RDD (RWA), GoJ, in which the audit objectives, criteria and methodology were discussed. The exit conference was held with the Secretary of the Department on 19 February 2021. The Department accepted (February 2021) all the audit recommendations and the replies have been suitably incorporated in the report.

Audit findings

2.1.2 Connectivity through bridges

As per the mandate of the Scheme, connectivity was to be provided by constructing bridges over rivers and *nallas* falling in the alignment of rural roads to link villages with GPs, GPs with block headquarters and blocks with district headquarters.

2.1.2.1 Planning

The Department issued circulars/letters during September 2001 to June 2017 for managing the Scheme. These instructions included:

- Selection of bridge works at block level;
- From selected bridges at block level, perspective district bridge plan (PDBP) for each district was to be prepared;
- From PDBP, annual action plan was to be prepared by *Prabandh Parishad*[2] (PP) giving priority to the recommendations of the MPs/MLAs;
- From annual action plan, construction of the bridges were to be taken up by Rural Development Special Divisions (RDSDs);
- For monitoring and inspection of the works including quality of execution of works, Project Implementation Units (PIU) were to be constituted for each district under the chairmanship of the Deputy Commissioner.

2.1.2.2 Execution of plans

During 2014-19, the State had 32,394 villages, 4,423 GPs, 260 blocks and 24 district headquarters within which the Scheme was to be implemented. Audit observed that the Department did not adhere to its own instructions issued, as discussed in the following paragraphs:

- The Department had not prepared any operational guidelines for implementation of the Scheme for reasons not on record. In the entry conference (September 2019), the Secretary stated that guidelines were not prepared as it is a State scheme;
- The Department didn't conduct any survey for identification of gaps in the rural roads connecting villages/panchayats/blocks/district headquarters for

[2] A governing body of District Rural Development Agency.

reasons not available on records. The EEs of the sampled districts accepted that no survey has been done for assessing the gaps;

- Though the Department conducted (2000-01) a survey of the entire rural road network to prepare district rural road plan (DRRP) for every district of Jharkhand under PMGSY, the DRRP was also not utilised by the Department under MMGSY for assessing the gaps;

- The Department did not adhere to its own instructions (except execution of the work through Special Divisions) for implementation of the Scheme. It requested all the MLAs and MPs of Jharkhand to recommend construction of maximum two bridges under the Scheme which have public utility. However, examination of bridge files by Audit revealed that the bridges recommended by the MPs/MLAs/others did not contain any information about their locations on the DRRP. As a result, the Department was not in a position to ensure that the bridges approved under the Scheme met the connectivity mandate.

Cross-check of the locations of the bridge sites in the test-checked districts and in the office of the CE with the DRRP of PMGSY, along with joint physical verification (in test-checked districts only) revealed the following:

(i) 1,881 bridges were taken up for construction during 2001-2019 under the Scheme. However, the Department could not provide any information to Audit about the connectivity provided through these bridges to the unconnected villages/GPs/Blocks as of March 2019, though requisitioned during August-September 2019;

(ii) During 2014-19, 496 bridges were approved for construction on the recommendation of MLAs and 39 bridges for other administrative reasons (by Deputy Commissioners, Superintendents of Police, starred questions raised in State Legislature etc.) in the 24 districts of Jharkhand. Of these, 214 bridges were taken up for construction in the six test-checked districts. Detailed audit scrutiny of 57 (27 *per cent)* out of 214 bridges, revealed the following:

(a) Out of 57 bridges, 26 were not in the DRRP and thus were outside the rural road network.

(b) Fourteen out of 57 bridges required acquisition of private/forest lands for bridge structures and approach roads. These requirements were not mentioned while selecting the bridges. Even in the estimates, requirement of lands were not factored in. During the course of execution, the concerned EEs reported about the need of land for completing the bridges. It was noticed that nine (***Appendix 2.1.1***) out of the 14 bridges could not be completed after more than six months to six years of their stipulated dates of completion due to non-acquisition of land resulting in unfruitful expenditure of ₹ 25.27 crore.

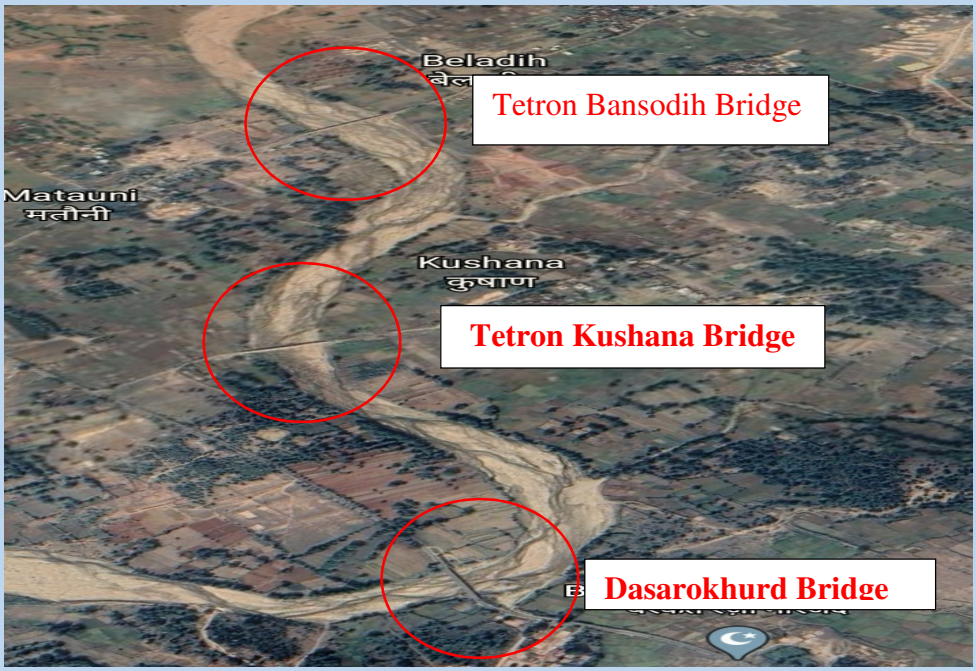
(c) Six out of 57 bridges costing ₹ 18.48 crore were taken up (between September 2013 and July 2018) under the Scheme despite pre-existence of one or more MMGSY/PMGSY/RCD bridges within a distance ranging between

100 metres and one KM on the same river for connecting the same/nearby habitats (***Appendix 2.1.2***) and ₹ 14.97 crore was spent on these bridges till May 2020. In the DPRs of these bridges, the concerned EEs had given undertakings that no bridge existed within one KM up-stream or down-stream of the proposed bridge. In addition, one bridge taken up at a cost of ₹ 4.14 crore in Gumla district outside DRRP co-existed with a PMGSY bridge (on DRRP) which was just 500 metres away from the approved site. Thus, sanction of these bridges were avoidable as illustrated through the following case studies:

Case Study 1

In Koderma district, a bridge under MMGSY over *Kesho* river between *Tetron and Bansodih* village was completed (sanction year 2008) in March 2014 at a cost of ₹ 4.10 crore. The Department further sanctioned (years 2014 and 2017) two additional MMGSY bridges in the downstream of the same *Kesho* river between *Tetron-Kushana* (costing ₹ 4.60 crore) and *Dasharokhurd- Parsabad* railway station (costing ₹ 4.44 crore).

During joint physical verification (28 February 2020), Audit noticed that the distance between the first two bridges (*Tetron-Bansodih* and *Tetron-Kushana)* was one km and the last two bridges (*Tetron-Kushana* and *Dasharokhurd- Parsabad* railway station) was 500 metres. These three completed bridges were providing connectivity to the same habitats of nearby locations. The following satellite picture taken by Audit from *Google Earth* using coordinates of the bridges clearly shows the adjacent bridges.



Picture 2.1: *Google Earth* image of Tetron-Kushana and adjoining bridges (Joint physical verification done on 28 February 2020)

Case study 2

In a span of four years (2011-14), the Department sanctioned two bridges on *Shankh* river in Raidih block of Gumla district for connecting habitats of same location under MMGSY (March 2011 at a cost of ₹ 4.14 crore) and PMGSY (June 2014 at a cost of ₹ 6.71 crore). During joint physical verification (19 November 2019), Audit noticed that the PMGSY bridge was under the DRRP, and was being utilised. The MMGSY bridge on the other hand was not under DRRP and had remained incomplete (November 2019). The distance between the two bridges is only 500 metres. The Department had incurred an expenditure of ₹ 2.20 crore on the bridge which could not be completed in more than nine years and proved unfruitful.

Picture 2.2: Incomplete MMGSY bridge and complete PMGSY bridge at a distance of about 500 m at *Khursurta* and *Bardih* in Gumla district (Joint physical verification done on 19 November 2019)

Picture 2.3 : Incomplete MMGSY bridge at *Khursurta* and *Bardih* in Gumla district from a different angle

(d) Though MMGSY was exclusively launched for rural areas, six bridges in three out of six test-checked districts were irregularly approved and constructed at a total cost of ₹ 13.35 crore in Municipal areas by the Department on the recommendations of the local MLAs (***Appendix 2.1.3***). The EEs of the concerned districts forwarded the recommendations of the MLAs to the Department for approval without mentioning that these bridges were located in

urban (Municipal) areas over which Urban Development Department (UDD) has administrative jurisdiction. Permission sought from UDD, if any, before approval of these bridges was not found on record. In response to audit query, Secretary of the Department accepted that the Scheme was only for rural areas and stated that henceforth construction of bridges under the scheme would be avoided in urban areas. Construction of bridges under MMGSY in urban areas are illustrated through the following case studies:

Case Study 3

The Department sanctioned (July 2018 at a cost of ₹ 1.13 crore) a bridge under MMGSY over an urban river *in Matkuria*, Dhanbad on the recommendation of the local MLA. During joint physical verification (27 November 2019), Audit noticed the carriage way of the bridge was obstructed (1.5 metres out of total carriage width of 5.5 metres) by pre-existing buildings in the alignment of the bridge. Thus, the bridge was not suitable for heavy vehicles and was being mainly utilised for parking purposes and as cattle sheds as shown in photographs below:

Picture 2.4: MMGSY bridge in urban area of Dhanbad city and existence of buildings in the alignment of bridge (Joint physical verification done on 27 November 2019)

Case Study 4

On the recommendation of local MLA, the Department sanctioned (September 2013) a bridge under MMGSY over *Harmu* river between *Vidyanagar-Mahavirnagar lane, road no.2,* at *Harmu colony* in Ranchi at a cost of ₹ 2.75 crore. During joint physical verification, Audit noticed that the location of the bridge was in a municipal area. It was further seen that there was obstruction of the river current due to unauthorised construction under the bridge compromising its safety as can be seen from the photographs below:

Picture 2.5: MMGSY bridge in urban area of Ranchi city and unauthorised construction under the bridge (Joint physical verification done on 20 March 2020)

(e) DPRs of 50 (10 *per cent*) out of 535 bridges were examined in the office of the CE. Of these, coordinates of the bridges were recorded in only 31 DPRs. Upon verification of these coordinates with the images of bridge sites on *Google Earth*, 20 bridges were found to have no connecting roads ahead of the approach roads. Thus, selection of these bridges without any link road was in violation of the Scheme mandate. An illustrative case study is given below.

Case Study 5

A bridge under MMGSY over *Kharkai* river between *Hudgangada and Dharmadiha village* in Saraikela- Kharsawan district was sanctioned (December, 2016) by the Department at a cost of ₹ 4.88 crore. The location of the bridge was not found on DRRP. Audit verified the geographical coordinates of the bridge site ($22^0$38'14.4" N, $85^0$52'52.8" E) on *Google Earth* and found no connecting roads ahead of the approach roads of the bridge. This fact was confirmed during joint physical verification (7 January 2020) with the departmental engineers.

Picture 2.6: *Google Earth* image (Coordinates-$22^0$38'14.4" N, $85^0$52'52.8" E)

Picture 2.7: Photograph taken during joint physical verification on 7 January 2020

(iii) The Department had not established PIU in any of the six test-checked districts for monitoring and inspection of the bridge works for reasons neither on record nor furnished to Audit. None of the six test-checked divisions maintained bridge registers while four out of six divisions did not have pile registers. The Department had also not drawn up any inspection schedule of the bridges. As a result, the Department could not monitor the works as envisaged under the Scheme to achieve the intended objective of providing connectivity through the bridges.

While accepting the facts, the Department stated (February 2021) that standard operating procedures for selection of bridges, role of consultants, preparation of DPR, execution of schemes and monitoring mechanism etc., would be prepared. The Department further added that henceforth, the DRRP of PMGSY would be taken into consideration at the time of obtaining the feasibility report of the bridges to avoid irregularities such as duplication of bridge works, selection of bridges in municipal areas, absence of connecting roads ahead of approach roads etc.

2.1.3 Construction activities

2.1.3.1 Status of bridge works

The status of bridge works in the State and sampled districts as on March 2019 is shown in **Table 2.1.1**.

Table 2.1.1 : Status of complete and incomplete bridge works in the State

Status	2001-19	2014-19 (Audit period)	
	State Position	State Position	Six test-checked districts
Total bridge works	1,881	820 (including 243 spill over works)	214
Complete	1,673	612	154
Incomplete	208	208	60

(Source: Monthly progress reports provided by the CE's office)

From **Table 2.1.1,** it can be seen that 208 bridge works were ongoing in the State as on March 2019. Of these, 169 bridges were within their stipulated dates of completion while 39 bridges were beyond the stipulated dates of completion

by two months to nine years and six months. The Department had incurred an expenditure of ₹ 144.74 crore on these 39 bridges till March 2019 without realising the intended benefits of providing connectivity to the villages/GPs/blocks.

In the test-checked districts, 154 out of 214 bridges were completed and 60 bridges were incomplete as on March 2019. Of the 154 completed bridges, 72 were completed with delays ranging between two and 75 months. Of the 60 incomplete bridges, Audit observed that in seven works in five sampled districts, delays ranged between seven and 82 months beyond their scheduled dates of completion.

2.1.3.2 Consultancy works

The Department decided (May 2015) to engage consultants for preparation of DPRs for the MMGSY bridges. The DPRs were to be prepared at the divisional level and were to be technically sanctioned by the CE. Scrutiny of records revealed the following:

(i) Empanelment of consultants

On the directions of the CE, the EE, Rural Development Special Division (RDSD), Ranchi invited (May 2015) a short notice e-tender[3] for empanelment of consultants for preparation of DPRs of MMGSY bridges. In response, 11 firms participated in the tender for empanelment of which 10 firms were technically qualified. During financial evaluation (June 2015) one consultant[4] who quoted the rate of one *per* cent of estimated cost of civil work of bridge *plus* service tax was declared the lowest bidder.

Audit observed that the CE empanelled (June 2015) eight technically qualified consultants after obtaining consent from each of them to work at the rate quoted by the lowest bidder. The CE executed agreements individually with these consultants for preparation of DPRs for the entire State and distributed the existing divisions among them. However, the periods for which these contracts would remain valid was not mentioned. Thus, these agreements remained open ended and continued till completion of Audit (March 2020).

In reply, the Department assured (February 2021) that the fresh tenders would be invited for empanelment of consultants under MMGSY and terms of engagement would be reviewed adopting the best practices.

(ii) Terms of engagements of consultants

Audit noticed that the department had not prescribed any operational guideline for engagement of consultants for implementation of the scheme. In the absence of any guideline, Audit compared the guidelines for empanelment and engagement of consultants for preparation of DPRs under PMGSY with the

[3] From 11 May 2015 to 16 May 2015.
[4] M/s Smitan Project Pvt. Ltd, Ranchi.

actual procedure followed by the Department for implementing the MMGSY. The findings are detailed in **Table 2.1.2** below:

Table 2.1.2: Comparison in empanelment of consultants

Particulars	PMGSY	MMGSY	Deficiencies noticed by Audit
Selection method	Quality cum cost based selection	Least cost method	Under PMGSY, the weightage of quality and cost was in the ratio of 80:20 whereas in MMGSY, no weightage to quality was given during selection of consultants.
Validity of period of consultancy	Three years	Not defined	Under MMGSY, validity of consultancy continued for more than four years and six months and despite unsatisfactory performance of several empanelled consultants the department only changed (August 2017 and September 2018) the allotted divisions among eight consultants without giving any opportunity to fresh consultants.
Opportunity to fresh consultants	Every six months	Not defined	
Time period for preparation of DPR	90 days	67 days	Lesser time period for preparation of DPR under MMGSY may be one of the factors for deficient preparation of DPRs as reported in paragraphs ***2.1.3.2 (iv) (a), (b)*** *and* ***(c)***.
Monitoring and penal provisions	Defined	Not defined	Under PMGSY, 25 *per cent* of DPRs are to be fully checked at site by an independent agency, while maintenance of performance report and provision for penalty is included as deterrent measures. These provisions are absent in MMGSY.

(Source: PMGSY guideline and audit analysis of MMGSY records)

As a result of the above deficiencies in the terms of engagement of consultants for preparation of DPRs for the MMGSY bridges, Audit observed that the consultants escaped contract obligations of preparing preliminary project reports, though required. In addition, soil investigation, hydrological survey, traffic survey etc., have also not been properly undertaken as discussed in paragraphs ***2.1.3.2 (iv) (a), (b) and (c)***. Further, the Department has not taken any step to adopt the good practices of PMGSY to strengthen the management of MMGSY and for commanding supervisory control by pressing for maintenance of performance report of consultants based on assessment criteria, review of DPRs of consultants by independent agencies etc.

In reply, the Department assured (February 2021) that the fresh tenders would be invited for empanelment of consultants under MMGSY and terms of engagement would be reviewed adopting the best practices.

(iii) Technical inputs on consultancy

As per Rule 22 of JPWD code, the CE/CE (Design) is responsible for approval of designs, drawings and specification of all structures.

Audit noticed that the Department did not have its own design cell to examine the DPRs submitted by the consultants. The CE of the Department had noted (June 2017) in the files that technical sanctions were being granted on the designs submitted by the consultants without applying necessary checks of the hydrological data, geotechnical survey and structural design of the bridges prepared by the consultants.

In the absence of technical examination by the CE, the consultants had not dug the required numbers of boreholes for soil investigations, collected and collated highest flood level (HFL) and discharge data of rivers for hydrological tests, prepared preliminary project reports or conducted traffic surveys as discussed in paragraphs ***2.1.3.2 (iv) (b), (c)*** *and* ***(d)***.

In reply, the Department stated (February 2021) that independent agencies would be engaged for vetting of DPRs in the absence of design cell. However, Audit observed that the Department may compare the risks and benefits of setting up its own design cell vis-à-vis engaging another set of consultants without any departmental oversight.

(iv) Delivery of Consultancy Services

(a) Preparation of Preliminary Project Report

Indian Road Congress (IRC) 54 (SP) provides for preparation of project reports in three stages as detailed in **Table 2.1.3**:

Table 2.1.3: Stages of preparation of project reports

Stages	Particulars	Purpose
One	Prefeasibility report	for identification of two to four sites for feasibility
Two	Preliminary project report	for taking decision on best suitable site, approach alignment, design parameters including type of bridge and span arrangement (by analysing various factors such as traffic survey and analysis, preliminary design, project cost estimates, economic evaluation etc.)
Three	Detailed project report	for finalisation of alignment and bridge sites, detailed investigations are to be carried out

(Source: Provisions of Indian Road Congress)

As per departmental order (June 2015) for engagement of consultants, payments were to be made in three stages as detailed in **Table 2.1.4**.

Table 2.1.4: Stages of submission and payment schedule to consultant

Submission (within days)	Payment schedule	Payment (*per cent*)
Within seven days, site mobilisation including inception report and after 15 days PPR	On the approval of PPR	20
DPR after 45 days of submission of PPR	Upon administrative approval of the DPR	70
-	On the layout of bridge	10

(Source: Terms of reference for empanelment of consultants)

Audit examined 50 payment orders in the office of the CE in respect of consultancy fees paid to eight consultants for preparation of 182 DPRs during

2014-19. The consultants had submitted these DPRs to 23 divisions for approval.

It was noticed that the CE paid ₹ 8.38 crore (90 *per cent* of consultancy fee) upfront (in one lump) to the consultants after approving the DPRs instead of making stage-wise payments for PPRs and DPRs as stipulated in the payment schedule. While making payments, the CE did not ensure submission of PPRs by the consultants in violation of terms of engagement of the consultants.

Examination of 57 DPRs in the six test-checked districts revealed that the consultants had not submitted PPRs in 55 cases[5] while in one case in Pakur district, the PPR, though submitted with the DPR on the same day, was not approved. This confirmed the fact that PPRs were not submitted by the consultants for approval before preparation of the DPRs. In addition, the consultants had not done analysis of traffic census data in any of the 57 DPRs though mandated under clause 5.3.2 of IRC 54 (SP) for determining the basic design parameters such as number of lanes required, the approach gradient, need for central verges etc.

Non-submission and non-approval of the PPRs resulted in excess payment of ₹ 1.68 crore (20 *per cent* of consultancy fee).

In reply, the Department stated (February 2021) that only after ensuring approval of PPR, the earmarked 20 per cent of consultancy fee would be released.

(b) Soil analysis and bridge design by consultants

Clause 2402.1 and 2403 of MORTH Specifications for Road and Bridge works provides that sub-soil investigation (Geo-Technical Investigation) shall be done for the entire length of the bridge. Boreholes shall be dug at the location of each pier, abutment, and additionally two boreholes (minimum) in the approaches on either side. The depth of boreholes shall be below the proposed foundation level by at least one and half times the width of the foundation.

In six test-checked districts, out of 57 sampled bridge works, the consultants dug only 336 boreholes against the requirement of 510 in 42 bridge works. This resulted in short boring by 174 numbers which ranged between two and 15 in these 42 bridges.

Further, in five of these bridges where boreholes were dug, digging were not carried up to the desired depth (1.5 times of the foundation width). The shortages in the explored depth ranged between 70 centimetres and 10 metres. Hence, verification of sub-soil profile through digging boreholes for proposing the required foundation of bridges in respect of these DPRs was not ensured. As a result, eight bridges out of these 42 bridge works were found fully or partly damaged. The sub-soil profile under each of these foundations were either not

[5] Out of two cases, in one case in Pakur district, PPRs and DPRs were submitted on same date. Further, instead of studying alternative sites only one site was studied in both the cases.

investigated or investigated up to the required depth. Hence, preparation of DPR without ascertaining the exact foundation levels of the piers/abutments had caused foundation failures and damages to the bridges.

It was further noticed that IRC and the approved DPRs stipulated confirmatory boring before taking up construction work. However, the requirement was not included in the BOQ. Resultantly, the opportunity to examine the sub-soil before commencement of work was lost. Some impacts of these deficiencies are illustrated through the case studies below:

Case Study 6

In Gumla district, a bridge under MMGSY over *Charki* river between *Natwal-Dina Road*, completed in May 2012 at a cost of ₹ 1.16 crore, collapsed in February 2017. Audit noticed that in the DPR of the bridge, open foundation was provided for two abutments and five piers of the bridge on the basis of soil investigation of only four boreholes against the requirement of nine. The depth of these boreholes which ranged between 0.95 metres and 1.38 metres were also short. After collapse of the bridge, the enquiry committee noticed (August 2017) that the river bed was sandy and river water was flowing below the four foundations. As a result, soil below the foundation scoured and the bridge collapsed. Thus, at the time of designing the bridge, nature of soil was not properly investigated and provision of open foundation which was not suitable for sandy soil was made in the DPR.

Picture 2.8: Photograph of collapsed bridge over *Charki* river between *Natwal-Dina Road.)*

Case Study 7

A bridge under MMGSY over *South Koel* river between *Balkhatanga-Lorengo road* in Sisai block of Gumla district was completed in September 2010 at a cost of ₹ 2.95 crore. The bridge collapsed in July 2017 as four piers and five deck slabs were completely washed away due to heavy flow of water in the river. The enquiry committee reported (August 2017) excessive flow

of water as the *prima facie* cause of the damage. Audit noticed that in the DPR of the bridge, open foundations were provided for two abutments and nine piers of the bridge on the basis of soil investigation done in only three boreholes against the requirement of 13. Thus, designing of foundation type was done without conducting soil investigation as required.


Picture 2.9: Photograph of collapsed bridge over *South Koel* river between *Balkhatanga-Lorengo road* in Sisai block

Case study 8

In Gumla district, a bridge under MMGSY over *Sankh* river between *Mariyam toli-Sarnatoli* in Raidih block was completed in March 2015 at a cost of ₹ 3.89 crore. The bridge was damaged in July 2017 as two piers sank and three slabs tilted. The enquiry committee reported (August 2017) that the *prima facie* cause of the damage was excessive sand excavation. Audit noticed that in the DPR of the bridge, open foundations were provided for two abutments and 19 piers of the bridge on the basis of soil investigation done in only four boreholes against the requirement of 23. Thus, designing of foundations were not backed by required soil investigation as stipulated by MORTH.


Picture 2.10: Photograph of damaged bridge over *Sankh* river between *Mariyam toli-Sarnatoli* in Raidih block

As a result of deficiencies in soil investigation, it was also noticed that changes were made in foundations in eight out of 57 sampled bridges in four test-checked districts after commencement of work. This increased the cost of construction (by ₹ 8.77 crore in five cases) and delayed the execution of works (ranging between three and 58 months).

In reply, the Department stated (February 2021) that directions have been issued to the consultants and the EEs for ensuring sub-soil investigation through digging boreholes at each and every point of piers and abutments. The Department further stated that it would be the duty of the EEs to ensure that confirmatory borings are done by the contractors. The Department also issued (November 2020) a circular in this regard. However, the Department did not inform Audit about the action taken, if any, against the defaulting consultants.

(c) Hydrological reporting by consultants

As per clause 101.1 of IRC 5, a high level (HL) bridge is a bridge which carries the roadway above the HFL[6] of the channel. Clause 103 of IRC 5 further provides that the design discharge, for which the waterway of the bridge is to be designed, shall be based on maximum flood discharge of 50 years return cycle. In case where the requisite information is not available, the design discharge shall be the maximum estimated discharge determined by consideration of empirical formula method, area velocity method or any other rational method.

Examination of 57 DPRs of bridge works across rivers/*nallas* in sampled districts revealed that data of maximum flood discharge for 50 years return cycle were not available with the divisions for any of the rivers/*nallas*. The consultants adopted the design discharge of bridges by taking highest value by comparing the design discharge arrived at by three methods (area velocity method, empirical formula method and rational method). Audit observed that different consultants had taken different values of catchment areas of the same river to work out the design discharges and the CE had given TS to all these designs. This resulted in variations in design discharges of the same rivers as shown in **Table 2.1.5**:

Table 2.1.5: Variations in design discharges in DPRs of three rivers

Name of bridge	Block/ district	River	Year of construction	Cost of bridge (in crore)	Design discharge (Cumecs[7])	Location
Kechki Awsane village (collapsed)	Chainpur/ Palamu	North Koel	October 2008	5.49	6,603.15	Same location (New bridge constructed after collapse of old bridge)
Kechki Awsane village (New)			Ongoing (March 2020)	8.86	8,738.00	
Jolo Murkunda (collapsed)	Basia/ Gumla	South Koel	July 2010	5.22	6,466.00	At a distance of nine metres, the new bridge was constructed after collapse of old bridge
Jolo Murkunda (New)			July 2019	7.75	7,116.00	
Nawdih-Kaira (New)	Satgawan/ Koderma	Sakri	Ongoing (March 2020)	9.58	4,686.93	Basodih-Marchoi bridge was two km down-stream of Nawadih Kaira bridge
Basodih- Marchoi (one pier sank)			July 2010	8.49	3,116.00	

(Source: Hydrological data available in the DPRs of the concerned bridges)

[6] Highest flood level is the level of the highest flood ever recorded or the calculated level for the design discharge.

[7] Cumecs is Cubic metre per second (a unit for design discharge of river flow).

Audit analysis revealed the following:

- **Bridges on North Koel River:** In Palamu district, hydrological data of the bridge across *Kechki Awsane* village mentioned in DPRs revealed that the old bridge (collapsed on 23 September 2011) was constructed by adopting design discharge of 6603.15 cumecs (based on empirical formula), HFL at RL 95.607 metres and wearing coat level at RL 99.657 metres. The Department appointed (April 2012) BIT Mesra for investigation of the cause of damage. The team reported (October 2013) that failure of the bridge was due to the fact that (i) high flood water had flown about 60 cm above the deck slab of the bridge which caused enormous horizontal thrust on the beams and slabs; (ii) water should never flow over beam and slab of HL bridge because normally it is not designed for horizontal thrust; and (iii) due to heavy rain at the time of collapse, the actual flood level surpassed the 100 years period i.e., 8,036 cumecs.

Audit observed that the EE, RDSD Palamu took up (June 2018) construction of a new bridge at the same site after dismantling the old collapsed bridge by adopting design discharge of 8,738 cumecs and HFL at RL 97.558 metres.

Audit, however, observed that the HFL of the new bridge should have been at RL 100.257 metres (wearing coat level at RL 99.657 +0.6 metres) as at the time of collapse of old bridge, the flood water had surpassed 60 cm above deck-slab/formation level. This resulted in reduced HFL by 2.699 metres (RL 100.257 metres- RL 97.558 metres). Audit further observed that the main reason for reduction of HFL was suppression of design discharge (from actual 9,244 cumecs as worked out by Audit to 8,738 cumecs) by another consultant (by reducing the catchment area from 5,750 square km to 3419.17 square km for the same river) which was derived through empirical formula. Further, length of the new bridge was also reduced from 309.18 metres (old bridge) to 292.36 metres which reduced the linear waterway[8] of the river.

Thus, the structural safety of the new bridge is doubtful and is fraught with the risk of collapse if subjected to the highest flood or maximum discharge of the river. Till date of audit (March 2020), expenditure of ₹ 2.32 crore was incurred on construction of the new bridge.

- **Bridges on South Koel River:** In Gumla district, after collapse (August 2010) of an old bridge, a new bridge was constructed (July 2019) at a distance of nine metres from the old collapsed bridge.

Scrutiny of design discharge recorded in DPR of the old bridge revealed that the consultant had reported maximum value of design discharge of 6,466 cumecs through empirical formula method using catchment area of 2,988 square km. In the case of the new bridge, another consultant reported catchment area as 3,179.90 square km for the same river and worked out maximum design discharge of 7,116 cumecs through area velocity method.

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[8] Linear waterway of a bridge is the width of the waterway between the extreme edges of water surface at the highest flood level measured at right angles to the abutment faces.

Had catchment area for the old bridge been accurately calculated (3179.79 sq. km), the design discharge would have been 6,776 cumecs instead of 6,466 cumecs. During joint physical verification, it was also noticed that height of deck slab of the new bridge had been increased by two metres (approximately) in comparison to the old bridge. Thus, the hydrological data analysis by the consultants' to arrive at the bridge designs cannot be relied upon without investigation by an expert team.

- **Bridges on Sakri River**: In Koderma district, pier 8 of a bridge (costing ₹ 8.49 crore) across Sakri river for connecting *Basodih- Marchoi*[9] sank (August 2014) four years after its construction (July 2010). The Department again took up (August 2019) construction of another bridge for connecting *Nawdih-Kaira* in the upstream of the *Basodih-Marchoi* bridge at a distance of two km.

As per DPRs, the design discharge for *Basodih- Marchoi* bridge (3,118 cumecs) was less than that for bridge (4686.93 cumecs). The decrease in design discharge in the downstream of *Nawdih-Kaira* bridge without any partition of stream from the river was not possible. Thus, the design discharge was not realistic.

As per IRC, a bridge is designed considering the maximum flood discharge of 50 years' return cycle. However, significant variations in the design discharges of the above six bridges in a span of 12 years raises doubt on their reliability. As a result, the existing bridge structures based on unreliable design discharge are fraught with risk of damage/collapse and needs investigation by an expert team.

In reply, the Department stated (February 2021) that the consultants have been directed to recalculate the hydrological reporting in respect of North Koel river. Further, directions have also been issued to the consultants for meticulously conducting hydrological surveys.

(d) Designing approach roads of bridge

Clause 120.1 of the IRC-5 provides that the approach roads on both sides of the bridge should be straight for a minimum length of 15 metres which shall be suitably increased, where necessary, to provide for the minimum sight distance for the design speed. Further, the width of approaches should be equal to the carriage width of bridge (i.e. 7.5 metres).

In six test checked districts, sharp curves (up to 90 degree) at the entry/exit point of 16 bridges and shorter width (3.75 metres to 4.1 metres) of approaches in comparison to width of bridges in 28 bridge works were found. These design faults made the areas accident prone in the absence of clear vision and also slowdown in traffic while entering and exiting the bridges.

[9] 24 degree 44 minutes and 31 second North and 85 degree 48 minutes and 04 second east.

Picture 2.11: Sharp turn (90 degree) in approach road in the bridge across Bardubi to Lakharkhawari village, in Dhanbad district

Picture 2.12: Sharp turn in approach road in the bridge across Damodar river between Tetulia-2, Bhatdih Dhoura and Chechka mandir in Baghmara block

In reply, the Department stated (February 2021) that due to involvement of private land in approaches it was not possible to give straight approach roads and these limitations were mitigated through moderate curve and curve protection works. The reply was not factually correct as the approach roads were almost at right angles as could be seen in the photographs above taken during joint physical verification with the auditees in violation to IRC provisions of road safety. Further, availability of required land was not ensured before taking up the work as per rule.

(e) Estimation work by consultants

Steel is used in bridge work in foundation, sub-structure, superstructure, railing work, wearing coat work and RCC concrete work in approach slab. In pile foundation, wherever required, additional steel in form of steel linear is also required.

In the schedule of rate (SOR), extra provision of five *per cent* for laps and wastage of steel is included in item rates for steel reinforcement in foundation, sub-structure, superstructure and steel linear items.

In the six test-checked districts, scrutiny of 32 DPRs revealed that the consultants, while estimating the requirement of steel for the bridge works, added extra provision of steel of 324.34 MT at the rate of five *per cent* for the above items of work though these were already included in the SOR. Thus, the estimation of requirement of steel was incorrect and inflated the bill of quantity (BOQ) and agreement value for these four items.

During the course of execution of these 32 bridges, 7,911.17 MT steel was booked as consumption on these four items as noticed from MBs of these works. This included 383.76 MT for laps and wastages on which excess payment of ₹ 2.39 crore was made. These payments stand recoverable from the consultants who prepared incorrect estimates and the contractors who received undue benefit. The EEs of all test checked districts accepted (between November 2019

and March 2020) the fact of excess provision of steel in the DPRs and BOQs and stated that recurrence of this would be avoided in future.

In reply, the Department stated (February 2021) that corrective steps in estimation as well as payment have been taken in this regard to rectify the excess provisions of steel in laps and wastages. However, the reply was not backed by any documentary evidence.

2.1.3.3 Tender and Agreement

(i) Allotment of multiple bridge works to contractors

According to Rule 16 of the "Revised Enlistment of Contractors (REC) Rules, 1992", a contractor will generally be allotted one work at a time. Even if they are valid and lowest tenderer in other bids, until and unless they complete the work allotted to them or the progress of the allotted work is at least up to 75 *per cent*, other works would not be allotted.

During 2014-19, 571 bridge works were tendered in the State. Of these, 57 bridge works with a total agreement value ₹ 251.41 crore were awarded to 13 contractors with each contractor getting two to seven works.

Audit observed from scrutiny of bridge/tender files in the office of the CE that at the time of allotment of works to these contractors, the progress of their earlier allotted works were less than 75 *per cent* and ranged between zero and 65 *per cent*. Further, 22 of these 57 bridge works having a total agreement value of ₹ 115.89 crore were awarded to seven contractors on the same day.

As a result of allotment of multiple works to contractors in violation of REC Rules, 13 contractors delayed completion of 26 works ranging from one to 25 months while five works remained incomplete beyond their stipulated dates of completion (ranging from 13 days to 22 months).

In reply, the Department stated (February 2021) that tenders were decided in light of departmental circulars issued from time to time. However, specific replies to the audit observation were not furnished.

(ii) Ambiguity in tender and agreement documents

As per Rule 169 of JPWD Code 2012, standard forms of contract should be adopted and such standard forms of contract will be prescribed by the Department in consultation with Law and Finance departments.

In six sampled districts, scrutiny of standard bidding documents (SBD) of MMGSY and agreement papers of 57 sampled bridge works revealed discrepancies as detailed in **Table 2.1.6**:

Table 2.1.6 - Changes in provisions in tender documents of MMGSY during 2014-19

Period	Defect liability period	Validity of performance security	Insurance of bridge	Insurance of Works, plants, equipment etc.
Up to 2011-12	Six months from date of completion	45 days after the end of defect liability period	10 years from date of completion of work	From start of work to end of defect liability period
2012-13 to 2014-15	Five years from date of completion		Removed	Removed
2015-16 to 2018-19	Two years from date of completion		Removed	Removed

(Source: Tender documents of MMGSY)

Changes in the defect liability period (DLP) and insurance clause, as seen from the table above, was made by the Department without consultation with Law and Finance departments in violation of JPWD code.

Further, the Principal Secretary, RWD instructed (August 2014) that SBD of Road Construction Department (RCD) be adopted by the RWD. Examination of files in the Department revealed that SBD of RCD has five important clauses but, except for inclusion of DLP in a truncated form (reduced by one year) in SBD of MMGSY, all other clauses were not factored in. Thus, SBD of MMGSY provided undue benefit to the contractors in the absence of these four clauses and reduced DLP.

Rule 169 of the code *ibid*, stipulates that the terms of the contract must be precise and definite and there must be no room for ambiguity or misconstruction. As per instructions to bidder in notice inviting tender of MMGSY, the agreement was executed on F_2 form (a fixed price contract) and tender document (SBD) was made part of the agreement.

Audit observed that clause 16 of F_2 form stipulates release of security deposits six months after completion of work whereas clause 30.1 of SBD envisage that the performance security is to be released after two years and 45 days from date of completion of the work. Thus, contradictions in the contract documents created ambiguity in release of security deposit.

As a result, five test-checked divisions (except Koderma) provided undue benefit to eight contractors by refunding performance security of ₹ 1.99 crore before the end of DLP in nine works while in five test-checked divisions (except Gumla) performance security of ₹ 3.12 crore lapsed before the end of DLP in 10 works.

In reply, the Department stated (February 2021) that instructions were issued to the EEs for making SBD as part of F_2 agreement and to hold the performance security of contractors for at least 45 days from date of DLP.

Audit observed that instead of pick and choose between SBD and F_2 documents, the Department should adopt a standard format for agreements with contractors duly vetted by the Law and Finance department.

Case Study 9

A bridge over *Bansloi* river completed (15 June 2015) at a cost of ₹ 5.98 crore for connecting *Chandalmara-Ghatchhora* in Pakur district collapsed (30 September 2019) within five years of its completion (discussed in **paragraph 2.1.3.4 (i)**). As per SBD, DLP of the bridge was five years and accordingly, the performance security should have been valid up to 20 July 2020 (45 days after the end of DLP).

At the time of agreement with the contractor, the EE irregularly reduced the DLP (vide clause 48 of agreement) to six months and consequently, the validity of performance security (clause 39.1) was reduced from five years and 45 days to six months.

Resultantly, the performance security of ₹ 30 lakh was refunded to the contractor in December 2015. Had DLP and validity of performance security not been reduced, the contractor would have been legally bound to reconstruct the bridge at his cost. In addition, the Department would have also been in a position to forfeit the security.

(iii) Verification of performance security given with tender

As per Rule 172 of JPWD code 2012, securities furnished by the successful agency should be verified within the shortest possible time from the issuing authorities.

Audit scrutiny of the securities furnished by the contractors for fulfilment of the contract obligations revealed that in four incomplete works under three divisions (Gumla, Pakur and Saraikella), performance securities of ₹ 92.78 lakh were not verified (March 2020) by the concerned EEs from the issuing authorities. Thus, the authenticity of these securities could not be ascertained.

In reply, the Department stated (February 2021) that instructions have been issued to the EEs for verification of performance security from the issuing authorities.

2.1.3.4 Construction of bridges

In the six test-checked districts, 13 bridges constructed between February 2007 and August 2016 at a cost of ₹ 67.39 crore was damaged/collapsed during 2014-19 (between August 2014 and September 2019) due to sub-standard bridge works.

As per inquiry reports (submitted between January 2016 and December 2019) of the Department, the main reasons for the collapse were crossing of flooded water over designed HFL, excessive sand excavation near foundation, scouring below foundation, non-embedment of piles in soft/hard rock and weak joints between piles and pile cap, etc.

Keeping in view the various reasons of collapse, damages to the bridge works and provisions of IRC, Audit examined 57 bridge works in detail and noticed

execution of sub-standard works of ₹ 52.07 crore in six bridges. The audit findings in this regard are discussed below:

(i) Construction of bridge over Bansloi river in Pakur district

In Pakur, a 13 span bridge across *Bansloi river*, constructed (June 2015) at a cost of ₹ 5.98 crore for connecting *Chandalmara and Ghatchhora* collapsed on 30 September 2019. The Committee headed by CE reported (December 2019) that pier P10 along with two slabs (between P9-P10 and P10-P11) had dislodged and fallen down (shown in photograph below) due to execution of shorter depth of pile foundation than actually envisaged in the DPR, inferior reinforcement in pile and sand excavation near bridge.

Picture 2.13: Damaged spans of bridge over Bansloi river in Chandalmara in Pakur district

The conclusions of the Committee were based on the following facts:

a) Length of one of the exposed piles of P10 was only 4.7 metres but the length recorded in the MB for this pile was 10.96 metres.

b) As per bridge design, the pile cap[10] and pile shall be below the river bed. However, the piles (1-1.5 metres) of other standing piers were visible below the pile cap. The committee attributed this fault to sand excavation.

c) Instead of 25 numbers of vertical reinforcement (recorded in MB), only 24 numbers of vertical reinforcement was found in the exposed pile of P10.

Audit also conducted (23 January 2020) joint physical verification with the EE, RDSD Pakur and noticed the following deficiencies:

- Construction of shorter length of shaft by 2.2 metres to 2.76 metres and pile cap by 0.2 metres to 0.3 metres which resulted in exposure of piles of the standing piers (P6, P8 and P9). Had the shaft and pile cap been constructed as envisaged in the approved DPR, these piles would have been below river bed level and would not be exposed. The EE agreed to the audit findings.

[10] A pile cap is a thick concrete mat that rests on concrete or timber piles that have been driven into soft or unstable ground to provide a suitable stable foundation.

- Utilisation of unapproved specifications of steel[11] in bridge foundation and brick soling under exposed pile cap of P9.

- The bridge was designed for socketing of pile (by 1.4 metres) in hard rock layer and bridge structure was protected against the scour in upper layer. The Committee had reported that length of pile was shorter than the design depth. As a result, socketing of pile in hard rock was not done by the contractor. Thus, failure of the EE to ensure socketing of piles to the desired depth by the contractor was instrumental in the damage of the bridge.

Thus, the fundamental reasons for damage of the bridge were non-socketing of pile in rock layer due to shorter depth of pile foundation, construction of shorter length of shaft and utilisation of inferior quality steel. This resulted in sub-standard execution and expenditure of ₹ 5.98 crore proved wasteful.

The Department agreed (February 2021) to the points raised in audit and stated that this bridge needed redesigning and the EE was instructed to prepare a fresh DPR through the empanelled consultant. It was further stated that the contractor had given an undertaking to complete the bridge work at his own cost.

(ii) Construction of bridge over Khatti river in Godda district

In Godda, a six span bridge across *Khatti river* costing ₹ 4.40 crore was constructed (March 2016) for connecting *Kanhai Pakaria* village and *Karra* village. Audit noticed that a span of the bridge was damaged (December 2018) when two loaded trucks were passing over it.

Picture 2.14: Damaged span of bridge over Korka to Pakaria road in Pathargama block of Godda district (Photo taken from files of the division)

Scrutiny of image taken (8 August 2019) from *Google Earth* and report of the Superintendent Engineer revealed that the broken portion of the bridge (deck slab and girder) was actually located between Pier 4 and Pier 5 but the Committee headed by CE reported (December 2018) that the broken portion of

[11] Utilisation of local brand STAR STEEL, CS POWER instead of approved steel of SAIL, TATA STEEL etc.

bridge was between Pier 1 and Pier 2 (the other end). The Committee stated that the damage was due to inferior quality of concrete work in the girder.

Audit noticed design fault in the DPR. As per the DPR, the Pier piles were designed for socketing to 0.6 metres inside the rock layers for resistance. However, the pile foundation of Pier 5 was designed to terminate in soil layer which was 1.973 metres above rock level while the other piers were to be socketed to the desired depth.

Due to non-socketing of pile of Pier 5 in rock layer during construction of the bridge, the possibility of sinking of the pile due to the load of two trucks cannot be ruled out.

Instead of examining and reporting the real cause of damage to the bridge, the CE reported damage to the girder over pier P1 and pier P2 as the main cause of collapse of the bridge. The main aim of misreporting was to conceal the fact that the pile of Pier 5 was not designed to be socketed to the desired depth which might have been instrumental in the sinking of Pier 5 and collapse of the bridge and needs further investigation.

The Department stated (February 2021) that the damaged portion of the bridge have now been reconstructed by the contractor and that the EE, AE and JE were suspended and the contractor blacklisted.

(iii) Construction of bridge over Damodar river in Dhanbad

In Dhanbad district, a bridge *across Damodar* river for connecting *Gansadih-Suyiadih road* was taken up (March 2009) at a cost of ₹ 4.41 crore on turnkey basis for completion by November 2010. After incurring expenditure of ₹ 1.64 crore, the contractor filed (March 2012) a pleader notice to the EE to make available private land which was required for construction of one abutment (A1), approach slab and approach road of the bridge. The contractor was relieved (July 2012) from the contract as the private land could not be acquired.

Audit observed from the communication (September 2012 and December 2016) between the EE and the CE that the requirement of private land had arisen due to the fact that the bridge site, approved (January 2010) in the General Arrangement Drawing (GAD) submitted by the contractor, was changed to 730 metres upstream by the contractor. It was noticed that the CE accorded (January 2010) technical sanction to the GAD of the contractor subject to verification of all data submitted by the contractor. However, the EE neither ensured that construction was taken up at the approved bridge site nor reported the change in site of the bridge till the matter surfaced. There was also no evidence that the EE had verified any data submitted by the contractor.

After three years of stoppage of work, Birla Institute of Technology, Mesra, Ranchi, on the instructions of the CE, investigated (July 2015) the bridge work

and reported (January 2016) execution of substandard works in abutments[12] and recommended jacketing with cement concrete. A revised DPR valued at ₹ 7.44 crore (inclusive of earlier work of ₹ 1.64 crore) was prepared by the consultant and technically sanctioned (March 2016) by the CE.

In the revised DPR, the consultant increased the length of the bridge by 15 metres (from 256.72 metres to 271.72 metres) and recommended abandoning the existing abutment (A2) as river water flows beyond it during the rainy season. The consultant also suggested dismantling of the existing abutment (A1) and pier shaft (2.5 metres from upper side) of existing piers- P4 to P8 for removal of sub-standard works. Meanwhile (June 2015), the Circle Officer, Dhanbad granted no objection certificate for construction of approach road on plot number 640 but no clearance was given for plot number 963 on which abutment (A1) and approach slab was to be constructed.

Upon fresh tendering (February 2017), the Department allotted (May 2017) the balance bridge work at ₹ 4.89 crore to the same contractor who had executed substandard works earlier. The work was to be completed by November 2018. Scrutiny of MB revealed that the contractor again executed substandard works in the superstructure where four deck slabs over piers- P4 to P8 was constructed without dismantling 2.5 metres from the upper side of the shafts. Till date of audit (March 2020), the work was incomplete as shown in the photograph below:

Picture 2.15: Partly constructed substructure P9, P11, old A2 (to be dismantled) and under construction A2 in bridge over Damodar river between *Gansadih-Suyiadih* road in Dhanbad

Thus, the Department failed to provide connectivity through the bridge after more than 11 years of commencement of work due to change in work site, execution of substandard works, delayed resumption of stalled works etc. This also led to cost escalation of ₹ 2.12 crore besides compromising the structural stability of the bridge.

The Department accepted (February 2021) the facts and stated that no objection certificate from the concerned Circle Officer was obtained and the work was under progress.

[12] A bridge abutment is a structure which connects the deck of a bridge to the ground, at the ends of a bridge span, helping support its weight both horizontally and vertically.

(iv) Construction of bridge over Khudia river in Dhanbad district

In a bridge work completed (December 2016) at a cost of ₹ 6.76 crore *over Khudia river between Baidyanathpur and Nutan Gaon under Nirsa block* in Dhanbad, 119.04 MT steel was required as per bar-bending schedule for construction of eight deck slabs.

Audit observed that the consultant provided 69.98 MT steel in the DPR against the requirement of 119.04 MT due to incorrect estimation. This deficiency remained undetected and TS was granted. Even during execution, no corrective action was taken to recheck the requirement.

Consequently, only 73.18 MT steel was shown utilised in MB against the required quantity of 119.04 MT. Thus, use of lesser quantity steel in superstructure work resulted in substandard work and compromised the strength of the bridge.

The Department agreed (February 2021) that there was mistake in estimation of steel in foundation and superstructure. However, the DPR was neither corrected/ revised nor the quantity of steel in superstructure were properly measured and recorded.

(v) Construction of bridge over Kans river in Gumla district

A seven span bridge *across Kans River in Sisai block* at Gumla was completed in June 2018 at a cost of ₹ 6.61 crore. Audit scrutiny of DPR of the bridge revealed that in the approved (March 2016) General Arrangement Drawing (GAD), the consultant had proposed open foundation for all the eight foundations (six piers and two abutments). During execution of work, the EE, RDSD, Gumla reported change in soil strata and consequently, the CE approved (November 2017) the change in foundations of Pier 3 and Pier 4 from open to pile foundation through a letter without any revised GAD.

Scrutiny of the bridge file in the office of the EE, RDSD, Gumla revealed that the consultant submitted (undated) a revised GAD recommending pile foundation for three piers (P1, P2, and P3).

Audit observed that open foundations were made for Pier 1 and Pier 2 instead of pile foundations and pile foundation for Pier 4 instead of open foundation in contravention of the recommendation of the consultant.

Further, the foundation depth of two piers (P1 and P2) was reduced (by 4.2 metres for P1 and 1.9 metres for P2). It was also noticed from the initial sub-soil investigation report that the executed foundation depth of P1 and P2 were terminated in soil. The foundation of these two piers was also above the maximum scour depth. The termination of foundation in soil for P2 and above scour level for both piers is against clause 705.2 of IRC-78, which states that the minimum depth of open foundation in soil shall be up to stratum having safe bearing capacity but not less than 2.0 metres below the scour level.

Thus, inter-change of foundation type of the piers of the bridge in contravention of the design of consultant besides having shorter depth than required is fraught

with the risk of collapse/damage of the bridge in the event of maximum design discharge of water or maximum load.

The Department stated (February 2021) that foundation type of the concerned work required changes during execution as per site requirement and in the interest of safety of the bridge. The reply was not convincing as the Department neither approved any GAD before taking up the work as per actual site condition nor followed the GAD submitted by the consultant.

(vi) Construction of bridge over Sakri river in Koderma district

In Koderma district, construction of a 32 span bridge across Sakri river was taken up (March 2012) at a cost ₹ 20.88 crore for providing connectivity between *Ghorsimar* and *Modideeh* path. The bridge was completed (October 2016) after incurring expenditure of ₹ 20.52 crore. The consultant provisioned 136 piles (four piles in each pier and six piles in each abutment) in foundation works of the 31 piers (length of each pile 25 metres) and two abutments (length of each pile 27 metres).

During inspection (January 2013) of the bridge work by SE, the EE reported about absence of rock strata till design depth. The SE instructed that casting of pile should be done after inserting in hard rock. Scrutiny of MB revealed that in 15 piles of three piers (P1, P2 and P10) and two abutments (A1 and A2), the depth of piles was shorter (ranging between one metre and 14.94 metres) than the design depth (25 metres for pier and 27 metres for abutments). Thus, socketing of piles in hard rock strata in these cases was not ensured since piling was not done even up to design depth.

Audit also noticed that the depth of pile number 3 of P14 and P15 was 27.03 metres. But, RCC work (up to 27.03 metres) in these two piles was done after providing vertical reinforcement (providing steel bars) measuring 19.95 metres for P14 and 14.80 metres for P15. This resulted in less vertical reinforcement (7.08 metres in P14 and 12.23 metres P15) in these two piles.

As a result of non-socketing of piles to the desired depth and shorter vertical reinforcement (in piles), the work was substandard and compromised the strength of the bridge which might collapse or get damaged in the event of higher load or maximum design discharge.

The Department stated (February 2021) that the work was executed as per site condition and there was mistake in recording length of vertical reinforcement in MB. Audit observed that the DPR was not revised post facto and recommended that the depth and vertical reinforcement of piles may be checked using sonic integrity test as was done while examining the reasons for collapsed bridges in Palamu.

2.1.3.5. Excess payments to contractors

(i) In Dhanbad district, scrutiny of MB and joint physical verification (November 2019) of the incomplete bridge on Damodar river at *Gansadih-Suyiadih* path revealed that out of total nine spans recorded in MB, only eight

spans were actually found constructed at site. Thus, due to recording of consumption of steel (14.965 MT) and RCC works (83.98 cubic metre) in superstructure for one span (P5-P6) twice in MB, excess payment of ₹ 13.12 lakh was made to the contractor which stands recoverable.

(ii) In Gumla and Koderma districts, scrutiny of MBs of two bridge works revealed that excess quantity of steel reinforcement work (42.69 MT) for substructure and superstructure works in two bridges was brought forward from detailed measurement (197.56 MT) to abstract measurement MB (240.25 MT). This resulted in excess payment of ₹ 28.91 lakh to the contractors which stands recoverable.

In reply, the Department stated (February 2021) that recovery of excess payments have been made in respect of Dhanbad. However, no replies were furnished in respect of the excess payments in Gumla and Koderma.

2.1.3.6 Short levy of compensation

As per clause 2 of F_2 form of contract, the time allowed for carrying out the work should be strictly observed by the contractor. The contractor shall pay as compensation an amount equal to 0.5 *per cent* of the estimated cost of the whole work for every day that the work remains un-commenced or unfinished after the stipulated date and the entire amount of compensation to be paid under the provisions of the clause shall not exceed 10 *per cent.*

In six sampled districts, the EEs levied and deducted compensation of ₹ 2.62 crore from the contractor's bills for delayed execution of works (ranging between six months and 57 months) against leviable amount of ₹ 6.83 crore in 13 out of 57 test-checked works in violation of the aforesaid provision. This resulted in short levy of compensation of ₹ 4.21 crore besides extending undue benefit to the contractors.

The Department neither explained the reasons for non-enforcement of concerned agreement clause for delayed completion of works nor recovered the balance compensation amounts as pointed out by Audit.

2.1.4 Post execution maintenance of bridges

IRC-SP 18 manual for bridge maintenance and inspection requires maintenance of bridge register by the concerned Works Division in which details of different structure of bridges (foundation, substructure and superstructure) and annual inspection report by engineer for their special areas of attention are required to be entered.

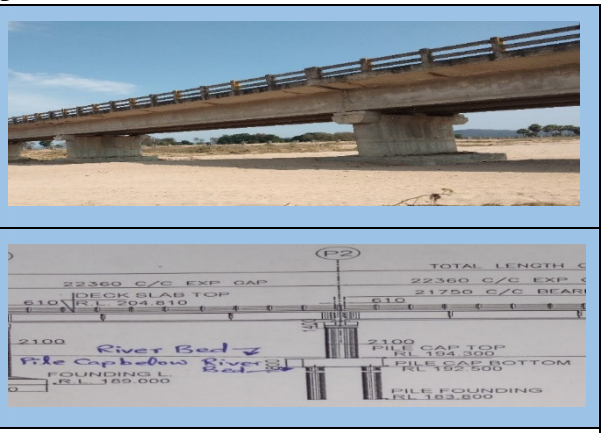
The minimum useful life of bridges is about 30 years. The Department had constructed 1,673 bridges during 2002-19 under MMGSY. However, no funds were provided for repair and maintenance work of these bridges during 2014-19. On the contrary, under PMGSY, the Department provides around 2.4 *per cent* of the cost of the bridge for repair and maintenance works. Though both the schemes which involves construction of bridges are managed by the same Department, there is no uniformity in implementing these two schemes.

Further, none of the test-checked divisions maintained bridge register, though required.

To ascertain the physical conditions of the bridges arising from absence of repair and maintenance work by the Department, Audit conducted joint physical verification of 38 (20 complete and 18 incomplete) out of 57 sampled bridges between November 2019 and March 2020 with the engineers of the six test-checked divisions. The physical damages noticed in respect of these 20 completed bridges (***Appendix 2.1.4***) are as under (also shown in photographs below):

- six bridges required urgent repair and maintenance due to scouring in foundation;
- in four bridges, wear and tear in expansion joints and wearing coat were noticed;
- in two bridges, cracks in RCC works of approach slab were found;
- elastomeric bearing of one bridge was damaged;
- eight bridges have damaged approach roads or flanks at the entry/exit points which makes them accidents prone.

Picture 2.16: Washed away approach in the flank near approach slab in bridge across Amanat river between Saraiya-Jhalkhandi, block Panki of Palamu district



Picture 2.17: Pile cap visible due to scouring in bridge foundation in bridge across Sakri river between Marchoi and Basodih, block Satgawan of Koderma district

Picture 2.18: Absence of expansion joints in bridge across Swarnrekha river between Khokro-Karkidih road in Ichagarh block of Saraikela district

Picture 2.19: Broken slab in footpath in bridge across Swarnrekha river between Khokro-Karkidih road in Ichagarh block of Saraikela district

In reply, the Department stated (February 2021) that instructions have been issued to the EEs to conduct a survey of completed bridges for ascertaining the requirement of repair and maintenance.

2.1.5 Conclusion

The Department neither framed any operational guidelines nor conducted any survey to assess the un-bridged gaps in rural roads requiring construction of a bridge even after 19 years of launch of the Scheme. The DRRP prepared under PMGSY with information on gaps in rural road network were also not utilised. Though the Department issued instructions through circulars/letters to manage the Scheme, these were not adhered to.

The bridges under the Scheme were selected on the recommendations of MPs/MLAs/others without examining their feasibility or factoring in the un-bridged gaps in DRRP. Resultantly, 20 out of 31 bridges examined through *Google Earth* maps in CE office by Audit were found to have no connecting roads on either side of the bridges. Likewise, out of 57 sampled bridges in the six test checked districts, 26 were outside the DRRP, six were taken up at places having pre-existing bridges constructed under PMGSY/RCD or MMGSY within one KM connecting same/nearby habitats and six bridges were taken up in municipal areas. Thus, deficiencies in the selection of bridges defeated the mandate of the Scheme to connect the villages to GPs, GPs to blocks and blocks to district headquarters.

Of the 208 incomplete bridge works in the State as on March 2019, 39 bridges could not be completed by six months to nine years and six months beyond their stipulated dates of completion. The Department incurred expenditure of ₹ 144.74 crore on these bridges till March 2019 without realising the intended benefits of providing connectivity to the villages/GPs/blocks.

The Department did not have any operational guideline for engagement of consultants for preparation of DPRs. It has empanelled eight consultants and kept their period of engagement open ended leaving no scope for entry of new consultants. In the test-checked districts, the consultants were able to evade contract obligations of preparing PPRs, though required, in 57 sampled cases during 2014-19 before preparing DPRs. In these cases, no penalty was imposed, rather payments of ₹ 1.68 crore for PPRs were made upfront along with the payments for the DPRs.

While departmental control over the consultants was superficial, absence of technical support system in the CE office restricted examination of the DPRs before according technical sanctions. Hence, professional and technical inputs to detect and correct faults or to make possible value additions on the drawings and designs of bridges submitted by the consultants were absent.

The consultants did not conduct the required geo-technical investigations, hydrological surveys and traffic data analysis. As against 510 boreholes required for conducting sub-soil analysis for 42 sampled bridge works in six test-checked districts, the consultants dug only 336 boreholes resulting in short boring by 174 numbers. As a result, eight bridges constructed at a cost of ₹ 52.12 crore out of these 42 bridge works got fully or partly damaged. Likewise, different

consultants had worked out different design discharge of same rivers while designing six bridges. In designing approach roads, the consultants provided sharp curves (up to 90 degree) at the entry/exit point of 16 bridges and shortened the width (3.75 metres to 4.1 metres) of approaches in comparison to width of bridges in 28 bridge works. The consultants had also made extra provision of five *per cent* for laps and wastage of steel valued at ₹ 2.39 crore in 32 sampled bridge works resulting in undue benefit to the contractors.

There was sub-standard execution of 13 bridge works due to deficient drawings and designs prepared by the consultants and approved by the CE. These bridges, constructed in eight districts between February 2007 and August 2016 at a cost of ₹ 67.39 crore, was damaged or had collapsed between August 2014 and September 2019. In 57 sampled bridge works, Audit noticed execution of sub-standard works of ₹ 52.07 crore in six bridges for which no responsibility was fixed. The tender and agreement documents were loaded in favour of contractors such as reduction in defect liability period etc.

The Department constructed 1,673 bridges during 2002-19 but did not allocate any funds for repair and maintenance of the completed bridges. In the absence of periodic maintenance of the completed bridges, Audit noticed scouring in bridge foundations, wear and tear in expansion joints and wearing coats, cracks in RCC works and damages in elastomeric bearing, damages to railings, footpaths, approach roads and flanks etc., during physical verification of 20 completed bridges. These damages are fraught with the risk of accidents and may also lead to collapse of the bridges.

2.1.6 Recommendations

- The Department should fix responsibility and take appropriate action against the contractors/consultants and engineers responsible for substandard execution of work, deficiencies in design, unfruitful/wasteful expenditure and damage/collapse of bridges.
- The Department should prepare an operational guideline for engagement of consultants for the Scheme incorporating the good practices of PMGSY and other schemes. A technical cell should be established at CE's office for proper vetting of designs, drawings and estimates before according technical sanctions to the DPRs.
- The Department should work out the excess payments made to contractors in the State due to excess provision of steel in the estimates and initiate action to recover the same. Responsibility may also be fixed on officials who failed to detect the excess provision made in the estimates.
- The Department should conduct a Safety Audit of all the bridges in the State and carry out necessary repair and maintenance work. Bridge registers should be maintained and schedule of repairs should be recorded. The load bearing capacity of each bridge should be clearly displayed at its entry/exit point.

लोकहितार्थ सत्यनिष्ठा

Dedicated to Truth in Public Interest

This Paragraph is an excerpt from the Audit Report No. 1 of 2021 - General, Social, Economic and Revenue Sectors including PSUs, Government of Jharkhand. The full Report can be accessed through https://cag.gov.in/en/audit-report/details/114291