

REPORT

THIRD PARTY AUDITING OF RAILWAY BRIDGES (PHASE I)

(Job No: CED/CON/TMMP/SAS/2019312)

**Br. No. 1233 DN (12 × 12.19m) PSC Girder at km. 854/700 – 900
between Kumbla & Uppala stations**

CLIENT



SOUTHERN RAILWAY PALGHAT DIVISION

CONSULTANT



**Department of Civil Engineering
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT**

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1. PREAMBLE

Director, NIT Calicut received a request from Chief Bridge Engineer, Headquarters office, Chennai Works Branch, Southern Railway vide letter No. W.439/4/61/Vol.IV(W.245/I/1 Spl. Drive) dated 18 – 09 - 2018, exploring the possibility of whether NIT Calicut can undertake a one - time third party auditing of some selected railway bridges. This was consequent to the instruction issued by Railway Board to various railway divisions for undertaking such inspections of railway bridges through expert institutions. The letter was forwarded to the Civil Engineering Department (CED) and the Structural Consultancy Group of CED followed the matter up. The Railway Board was represented by Palakkad division of Indian Railway. Subsequently, on 05 – 10 - 2018 railway officials came to CED, NITC for discussions. Soft copies of the available drawings of some of the bridges were also shared by Railways to CED for initial assessments. Subsequently, CED expressed its willingness to take up the work and communicated the matter by letter, No. CED/CON/RLY/TPAUD/2018/1 dated 08-11- 2018. Through this letter it was conveyed to Railways that the work could be taken up in two phases, outlining the scope of work to be carried out in the different phases. This was accepted by Railways and they requested the details of consultancy charges for carrying out phase I of the work.

CED replied vide letter No. CED/CON/RLY/TPAUD/2019/1 dated 10 - 01- 2019, the requisite details regarding consultancy charges and scope of the work. Railways replied to this letter showing their interest to award the work to NITC and sought the signing of an MoU to proceed further. Mutual discussions followed and an MoU was signed in the FN of 19-09-2019.

The details of communications are given below:

- i. W.439/4/61/Vol.IV(W.245/I/1 Spl. Drive) dated 18-09-2018.
- ii. Meeting held on 28-09-2018 at NIT Calicut with railway officials.
- iii. J/W/71/G dated 23-10-2018 from Divisional Office, Palakkad division furnishing details of some of the bridges.
- iv. CED/CON/RLY/TPAUD/2019/1, dated 10th January 2019
- v. MoU between Southern Railway and NIT Calicut, dated 19-09-2019.
- vi. CED/CON/HOD/TMMP/SAS/2019312, dated 3rd October 2019
- vii. J/W.71/G, dated 03-12-2019
- viii. CED/CON/HOD/TMMP/SAS/2019312/1, dated 02-01-2020
- ix. CED/CON/HOD/TMMP/SAS/2019312/2, dated 02-01-2020
- x. CED/CON/HOD/TMMP/SAS/2019312/3 dated 23-01-2020

- xi. CED/CON/HOD/TMMP/SAS/2019312/4 dated 11-03-2020
- xii. CED/CON/HOD/TMMP/SAS/2019312/5 dated 12-03-2020
- xiii. CED/CON/HOD/TMMP/SAS/2019312/6 dated 13-03-2020
- xiv. CED/CON/HOD/TMMP/SAS/2019312/7 dated 11-05-2020
- xv. No. J/W.71/G dated 27-07-2020
- xvi. CED/CON/HOD/TMMP/SAS/2019312/8 dated 22-07-2020
- xvii. CED/CON/HOD/TMMP/SAS/2019312/9 dated 22-07-2020
- xviii. CED/CON/HOD/TMMP/SAS/2019312/10 dated 14-08-2020
- xix. No. J/W.71/G dated 26-09-2020
- xx. CED/CON/HOD/TMMP/SAS/2019312/13 dated 21-09-2020
- xxi. CED/CON/HOD/TMMP/SAS/2019312/15 dated 17-11-2020
- xxii. CED/CON/HOD/TMMP/SAS/2019312/17 dated 24-12-2020
- xxiii. CED/CON/HOD/TMMP/SAS/2019312/18 dated 19-01-2021
- xxiv. CED/CON/HOD/TMMP/SAS/2019312/19 dated 10-03-2021
- xxv. CED/CON/HOD/TMMP/SAS/2019312/20 dated 18-03-2021

2. SCOPE AND METHODOLOGY

Railway bridges, which are known for their permanent resistance to heavy movable loads, are exposed to large load ranges and severe environmental conditions that may lead to damage and failure of the system. Keeping in mind the large risk and economic ramifications, it is necessary to assess the health of these structures systematically by considering all loading types namely, gravity loading, wind loading and seismic loading and effect of corrosion and fatigue.

The present bridge (Br. No. 1322 DN) is a 12 span PSC girder bridge between Kumbala and Uppala stations. As per the drawings it is learnt that this is a relatively new bridge (date of completion 10-02-1999). *The complete details for modeling the bridge span including cable profiles are not available to NITC. Hence the detailed modeling, structural analysis and design check for the PSC girder span could not be carried out.*

In view of the above and based on the terms and conditions laid down in the MoU, the scopes of the investigation in phase I are identified as below.

- i. Inspection of the superstructure of the bridge, bearings, piers and abutments and top surface of the bridge.
- ii. Visual assessment of corrosion in steel components of the bridge, if any.
- iii. Collection of data pertaining to the state of the bearings and water drainage.
- iv. Checking the conformity of the overall dimensions and primary details with the available drawings.

3. INSPECTION OF BRIDGE

3.1 Visual Examination

The visual inspections were carried out on the bridge on 10-01-2020 (Friday) at 9:30 am. Officials from Kannur Railway section were also present during the inspection. Photograph of the bridge is shown in Fig.1. The bridge is a PSC box girder bridge with twelve spans each of 12.19 m, supported on RCC piers. It was noted that the abutments were also of RCC.



Figure 1. View of Br.1233 DN between Kumbla and Uppala stations

3.2 Field Measurements and condition assessment

Based on the drawings available (Figures 2 to 4 shows the plan, elevation, and section of bridge) dimensions of various elements were verified. Overall conformity of the bridge with the available drawings were ensured. No distresses were noted and all the elements were assessed to be in good condition based on the visual examination conducted.

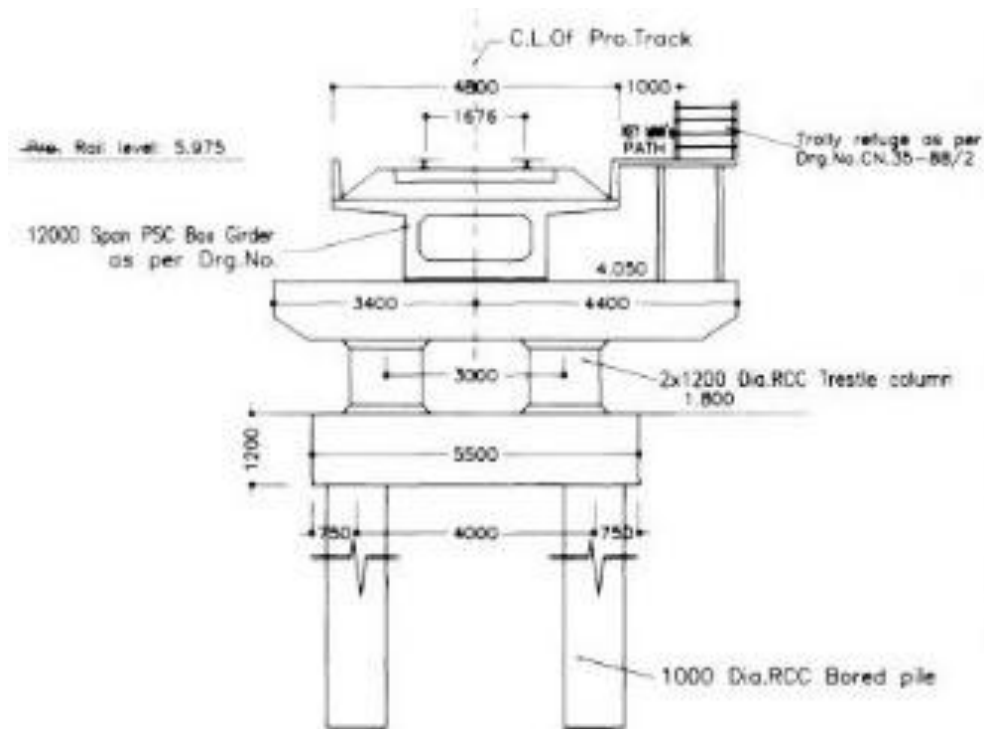


Figure 4. Section of PSC Girder of Br.No. 1233 DN

3.2.1 Condition of the bearings

All the bearings were examined and were found in very good condition. Figure 5 to 9 show details of typical bearings.



Figure 5 Bearing



Figure 6 Close view of a bearing



Figure 7 Staff conducting the inspections



Figure 8 Close view of another bearing



Figure 9 Another bearing – a different view

4. COMMENTS AND INFERENCE

As mentioned at beginning, the scope of investigation of this particular bridge in phase I is limited to checking the overall conformity of the bridge and its elements to the available drawings and the condition assesemt. The bridge is relatively new and there are no distresses noted in any of the elements in the superstructure. All the bearings were intact and found to be in **very good condition**. Dimensions and constructions standards are conforming to the drawings available.

On the basis of the above points it is felt that conclusions on the stability and safety of the bridge can be made only after conducting phase II of the audit, which shall include assessing the details pertaining to the substructure and its condition by underwater inspection and measurements. The modeling and design check for the PSC girder span also shall be carried out along with that.

Members of the Investigation team

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REFERENCES

1. Bridge Rules, 1964. Rules Specifying the Loads for the Design of Super-Structure and Sub-Structure of Bridges and for Assessment of the Strength of Existing Bridges. *Government of India, Ministry of Railways (Railway Board)*.
2. Standard, I.R., 2013. Code of practice for the design of sub-structures and foundation of bridges. *Research Designs and Standards Organisation, Lucknow*.
3. Calgaro, J.A., Tschumi, M. and Gulvanessian, H., 2010. *Designers' Guide to Eurocode 1: Actions on Bridges: EN 1991-2, EN 1991-1-1,-1-3 TO-1-7 and EN 1990 Annex A2*. Thomas Telford Ltd.