Title: Finite element analysis and checking the structural adequacy of non-standard twin steel box composite super-structure span for ROB at Mithapur, Danapur

Sponsoring Agency: IRCON International Limited, Patna

Project Leader: Dr. B.S.Sindu

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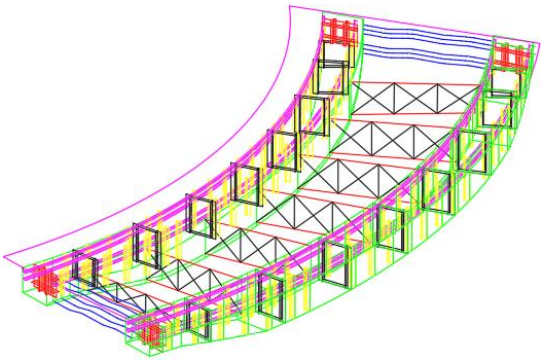
Scope/Objectives:

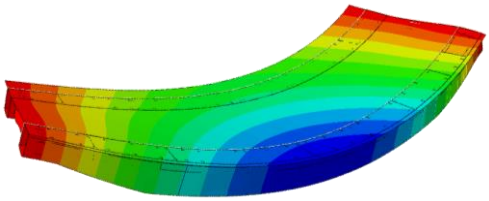
- Proof checking of the design of non-standard twin box steel composite girder over railway span
- Finite element modelling of the entire composite bridge girder system
- Numerical simulation and analysis of the composite girder with the design loading conditions and load combinations as per IRC
- Checking the structural adequacy of the composite girder and recommendations for design deficiency (if any) and retrofitting scheme, if found necessary
- Preparation of technical report including the structural adequacy of the existing super-structure, detailed finite element analysis studies and remedial measures (if any)

Objectives Achieved/ Progress made:

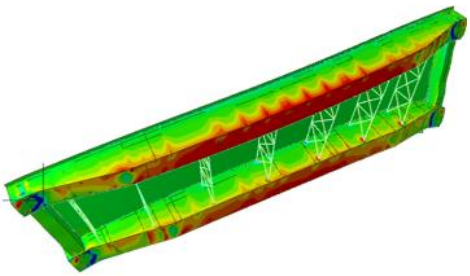
The bridge girder system under consideration is the proposed Road Over Bridge (ROB) on a railway span in Mithapur, Danapur. Due to the non-standard geometry, curved planar configuration, complex disposition, and safety concerns of ROB on railway span, M/s IRCON International Limited entrusted CSIR-SERC to evaluate the structural adequacy of the proposed bridge super-structure. In order to carry out investigations, it was decided to thoroughly proof check the design calculations submitted by the client to CSIR-SERC and to carry out numerical analysis under different loading conditions. A detailed 3D FE modelling of the composite bridge girder system along with the diaphragm, cross bracings and stiffeners was developed to evaluate the structural adequacy of the bridge girder system (as shown in Fig 1). Appropriate care was taken to reflect all dimensional details and to include all the minute details in the model to replicate the actual stress distribution for accurately evaluating the structural response parameters of the composite bridge. The FE model was analysed under different load conditions (and combinations thereof) as per the stipulations specified in IRC-6 and the stress-state of the super-structure was thoroughly checked. From both the design aspect and the FE analysis, final observations on the structural adequacy of the composite bridge girder system and the remedial measures for the insufficient structural members were provided.



(a) Configuration of the composite bridge girder system



(b) Deflection contour



(c) Strain contour

Fig. 1: Finite element analysis on the twin-steel box steel concrete composite bridge girder system (a) Configuration of the bridge with several components considered for FE analysis, (b) Deflection contour and c) Strain contour of the bridge girder system under combined DL, SIDL and LL (Class 70R vehicle at midspan near outer girder)