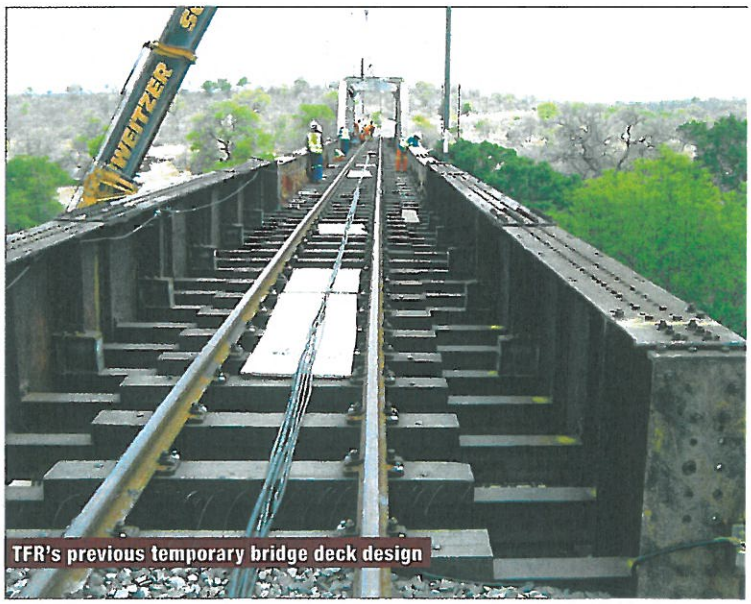
Temporary emergency train-carrying bridges

BACKGROUND

Transnet Freight Rail (TFR) experiences destruction or loss of its permanent train-carrying bridge decks during severe weather conditions, and derailment of trains. Consequently, train lines are out of service until such time that permanent decks are repaired or temporary decks placed, resulting in a loss of revenue.

TFR's previous temporary emergency bridge decks were not of a modular-type design, resulting in time-consuming and costly preparations to accommodate the fixed-length temporary emergency bridge decks. TFR needed to procure temporary bridge decks which are designed to be assembled, taken apart and reused during fabrication/construction of the permanent structure. Temporary bridge decks can be erected relatively quickly, thus allowing less out-of-service time. When permanent decks are eventually replaced, the temporary ones can be used elsewhere.

The project entailed the full scope of design, shop-detailing, fabrication, painting, quality control and delivery of temporary bridge deck components to TFR's yard in Sentrarand, Gauteng.



TFR's previous temporary bridge deck design

PROJECT TEAM

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Project Manager/TFR Principal Engineer (TFR) Jan Homan

AIMS AND OBJECTIVES

The objectives were to provide TFR with a solution that would fulfil all the requirements and specifications related to the design, manufacturing and delivery of the temporary bridge decks, and fulfil the scope within a reasonable time frame and at a competitive cost. Some of these requirements were:

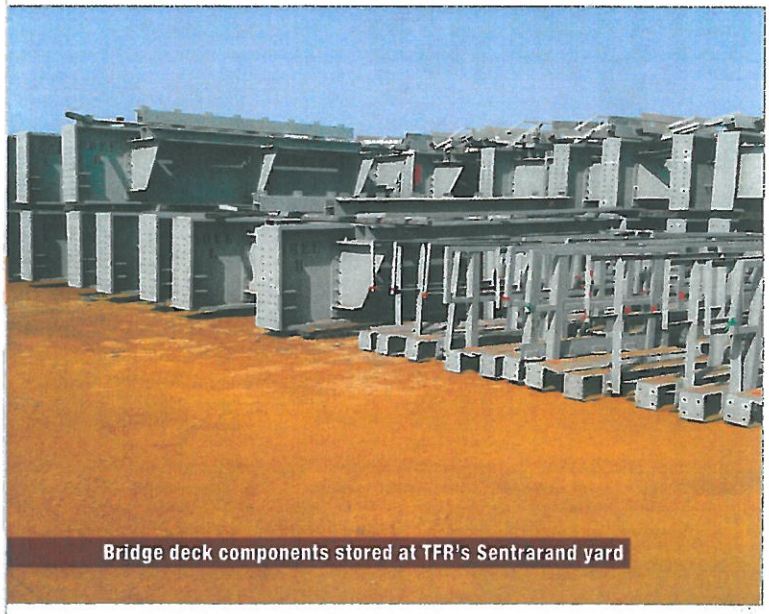
- The bridge deck components needed to have an innovative design, unlike that of TFR's existing half-through span and through spans, with walkways on either side of the track and with beams at the bottom of sleepers.

Bridge deck components transported to TFR's Sentrarand yard on a normal load

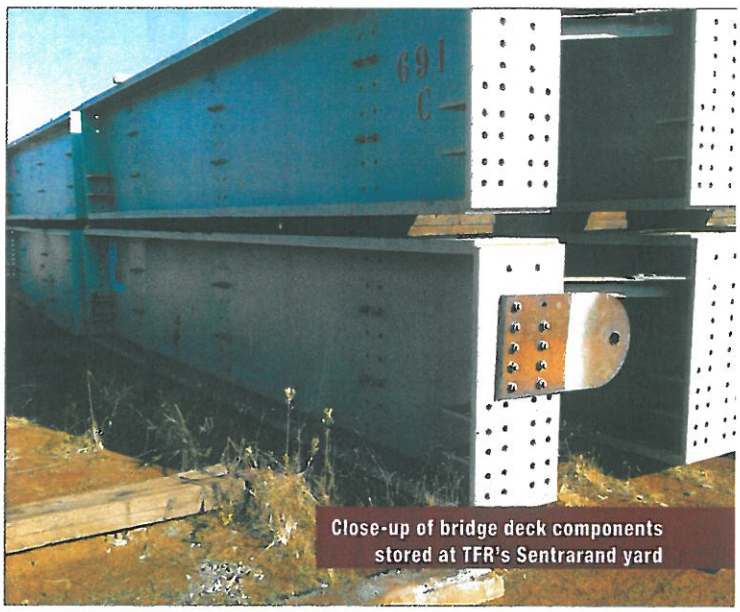
- The bridge deck components had to be transportable by standard road vehicles, i.e. no abnormal loads allowed.
- Ease of erection of temporary deck spans.
- Faster erection time for the bridge decks.
- Durability.
- Modular design, and the ability to adapt to varying deck-span lengths without sacrificing ease of erection or erection time. Module lengths had to be 3.2 m, 6.6 m and 6.9 m to be able to make up various lengths of decks and/or deck configurations.
- Various criteria and specifications specified by Transnet, which included meeting the maximum deck deflections, deck profile specification, surface preparation specification, paint specification, design specifications, and loads specifications.

SUPPLYING TEMPORARY EMERGENCY BRIDGE DECK COMPONENTS

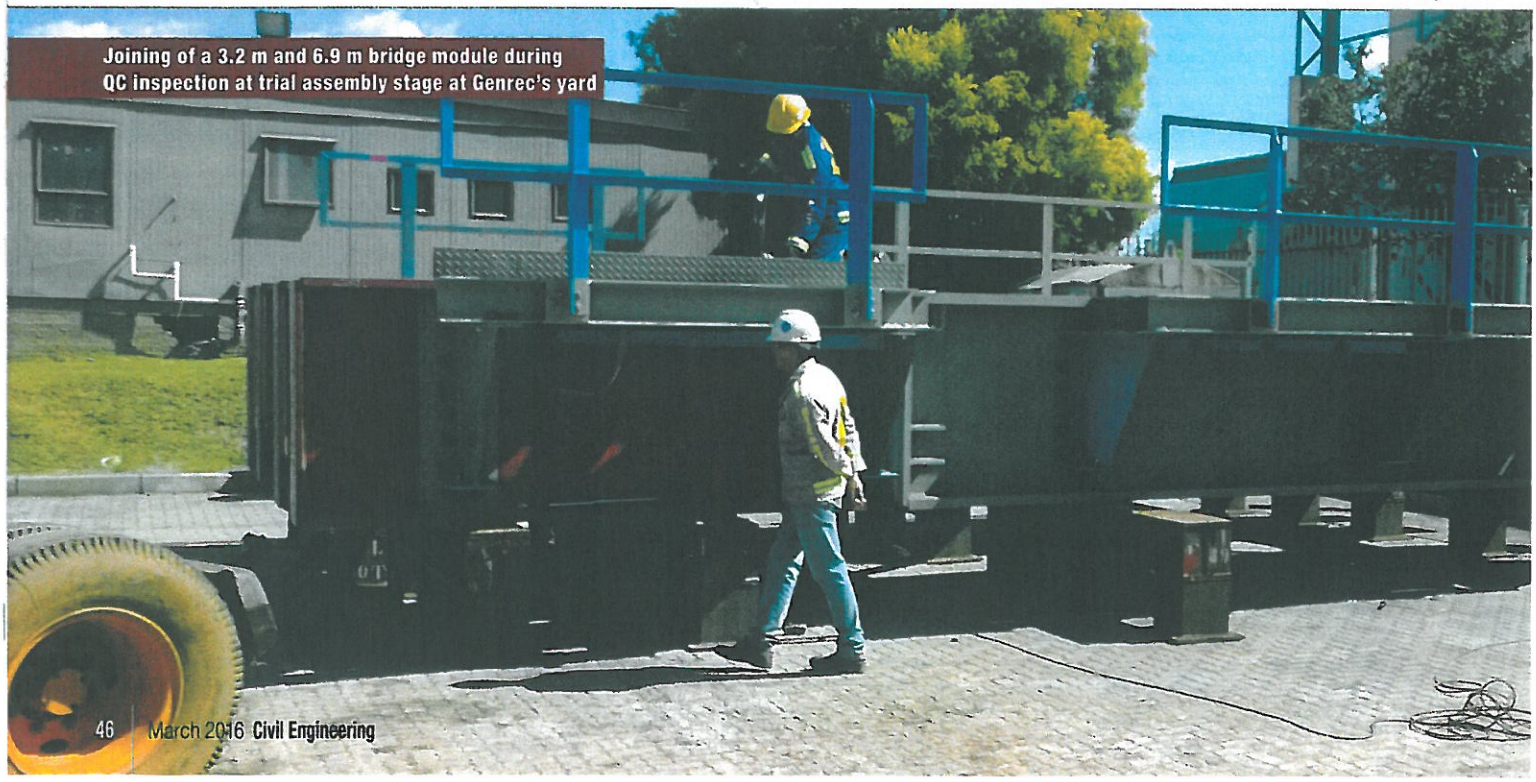
Genrec was awarded the contract to supply temporary emergency bridge deck components of three types of module lengths and quantities, specified by TFR, to be utilised for different spans of its permanent conventional train-carrying bridges. The 15off 3.2 m, 18off



Bridge deck components stored at TFR's Sentrarand yard



Close-up of bridge deck components stored at TFR's Sentrarand yard



Joining of a 3.2 m and 6.9 m bridge module during QC inspection at trial assembly stage at Genrec's yard

6.6 m and 15off 6.9 m modules, collectively making up a whopping total 1 140 t of structural steel, had to be interchangeable and joined together by bolting. By joining one or several of these modules, bridge spans of 20 ft, 30 ft, 40 ft, 50 ft, 60 ft, 75 ft, 80 ft, 100 ft and 150 ft can be catered for by placing the joined modules on existing abutments and existing or temporary piers (bridge spans specified in feet as per the venerable naming convention from TFR's Spoornet days).

The interchangeability of these modules meant stringent manufacturing tolerances. The modules were the same in cross-section and only differed in length, as they would be joined end-to-end. The modules were primarily made up of 4off 1 250 mm high mild-steel plate girders. They were fabricated using jigs to achieve the stringent tolerances, with web thicknesses of up to 35 mm and flange thicknesses of up to 60 mm, arranged adjacent to each other, extending the full length of the module and joined by 830 mm high plate girder sections. The 40 mm thick endplates on the 1 250 mm high plate girders would enable the joining of the module ends by means of M30 Gr10.9 bolts. The walkway steel was made up of 203x203x52 mild steel Universal Beams to meet the design specifications and derailment load criteria, and extended the full length of the modules.

DESIGN CHANGE

Following the client's acceptance of the tender design, a variation order was issued to also include a requirement that the decks should allow for bearing on a 3 m wide pier head. This design change meant extensive discussions and brainstorming from both Genrec and TFR engineers to swiftly find a practical design solution. Fortunately the two parties managed to resolve this without compromising on the other design characteristics, while keeping the costs to a minimum.

CONCLUSION

Genrec was able to supply a robust, fit-for-purpose, cost-effective solution of modular temporary train-carrying bridge deck components to fulfil TFR's need. The project was completed on time and within budget.

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