Matahorua Gorge Bridge

Between Napier and Wairoa, State Highway 2 used to wind and twist its way through the Matahorua Gorge. On average about 4,000 vehicles a day ran the narrow gauntlet of sharp bends, among them logging and farming trucks en route to & from the port of Napier. During winter, slips caused closures; accidents and delays were frequent. So the NZ Transport Agency tackled the problem with one of the largest and most important projects ever seen in the Hawke's Bay region. It involved re-aligning SH2 to go over the gorge instead of through it, on a bridge that would have to be 137m long.

Three consortia submitted competing designs and prices. Downer, Concrete Structures Limited and the Holmes Consulting Group emerged as the winners with a design for a ladder deck plate girder bridge. Napier-based Eastbridge, which has an impressive track record with bridges all over New Zealand, was appointed as the fabricator; SteelPencil of Palmerston North did the detailing.

Although located in an area of high seismic activity, the gorge's steep sandstone slopes presented the consulting engineer with a design opportunity. Ian Hills of Holmes Consulting Group (Wellington) immediately explored the possibility of using inclined piers. "The advantage of sandstone was that it could be prepared for piling using hand-held compressed-air tools. This obviated the need for heavy plant and installing temporary concrete benches. Instead, Concrete Structures was able to install 10.5m-long reinforced concrete piles at 45º angles, in preparation for the raked piers."

Concrete Structures had 250-tonne cranes, but as this design-build project progressed it became apparent that to optimise construction efficiency a bigger crane was essential. Concrete Structures boss Mike Romanes purchased a 450-tonne crane from the USA at a cost of $7-million. It has a boom length of 180m. After commissioning and testing at Rotorua, it was delivered to the gorge in 24 truck loads. Concrete foundation beams were laid down on the Gisborne side of the gorge, from which the giant crawler crane set the 27m raked and braced steel piers onto the piles, holding the 65 tonnes of steel in place until the piers could be tied to the abutments with high-strength steel tendons.

Ian Hills resumes his story: "The frame bridge had three spans, 42-53-42 metres respectively. From the Gisborne side, the first short span was to cantilever out over the gorge. The plate girders forming the two sides of the ladder deck superstructure were 2.8m deep. At an extension of 30m, this weighed more than 60 tonnes, justifying the use of the crane for economic and safety reasons. Once this structure was bolted, the crane was disassembled and taken to the Napier side of the gorge for the exercise to be repeated. Finally, the centre span at 53m was hoisted into position and bolted. At 58m above the Matahorua Stream, this is as high as the top of Auckland Harbour Bridge."

Eastbridge General Manager Andre Van Heerden says the use of long-span steel kept the structure relatively light in weight, a total of 420 tonnes. "One of the main advantages from this is that less concrete is needed to anchor the bridge piers. By eliminating a central pier, we made little impact on the environment. The steel took only 12,700 hours to fabricate and 4,800 bolts to erect. It was given a protective coating of zinc, which allows at least 25 years to first maintenance. We are confident the bridge will have no trouble fulfilling its 100 year design life. As Ian Hills put it: Simplicity of form usually gives the best value for money."

The new bridge will shorten the route from Napier to Wairoa and cut 12 minutes from the daily journey. NZTA's Regional Manager Mark Kinvig says: "It will save time and petrol, but more importantly it will reduce the accident risk and inject millions into the local economy over and above the value of its 60, 000 hectares of pine forests."

1. Once in place, the centre span effectively props the raked piers on either side.
2. From the Gisborne side, the raked pier supports the first short span as it cantilevers out over the gorge.
3. The exercise is repeated from the Napier side.
4. The underside of the deck affords safe access. With a protective coating of zinc, it will be at least 25 years to first maintenance.
5. The 3-D model drawn by SteelPencil.