

## ZWELITSHA PEDESTRIAN BRIDGE, EAST LONDON

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### INTRODUCTION

The Zwelitsha pedestrian bridge exemplifies the principle of "attractive structures at a reasonable cost". Built for R1 750 000 this striking 58m long and 1.5m wide rural footbridge was bolted together on site with minimal temporary works.

The standard stock of rural pedestrian bridges is U-frame steel truss bridges as they are considered the most economical option. Typically these structures are fabricated in sections that can be easily transported, handled and bolted together. Their construction on remote sites is therefore possible without the use of heavy equipment. The Zwelitsha pedestrian bridge project team took this concept and adapted it for an attractive cable stayed bridge.

### PURPOSE OF THE BRIDGE

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### DESIGN DEVELOPMENT

U-frame structural steel pratt trusses are often used in South Africa for pedestrian bridges in rural areas. In this case the client accepted a more attractive alternative, a three span cable stayed structure with a main span of 27m and back-spans of 17m.

The design had two main goals: The first was to create a cable stayed structure that could be built for a price comparable to that of a simple truss bridge; the second was to detail a durable, low maintenance structure that could be easily erected in a remote area.

The bridge design responds to the natural surrounds of the Buffalo River. Low towers with a limited amount of stays give the bridge an appropriate scale.

The steel towers are integral with the concrete piers. Their stiffness is relied upon to limit the deflection in the deck due to asymmetric pedestrian loading. The resulting high moments in the towers are transferred to the concrete pier bases that are dowelled into the river's rock bed.

The deck section floats independently of the towers and its longitudinal restraint is provided by the stays. This was the only alternative that maintained adequate tension forces in the stays during the thermal expansion and contraction of the deck. The resulting structural system is relatively complex. Parametric studies showed that as the stiffness of the beam increased so did the non-linear behaviour of the structure.



A key element in the detailing of the bridge was to restrict the length of the individual elements. Thus the sections were easy to handle on-site and could be galvanized. This allowed the specification of a 'duplex' paint system that will ensure the bridge requires minimal future maintenance. An important benefit of bolting the bridge together was that no on-site welding was required. This ensured that the galvanising was not damaged during the erection process.

All the bridge elements are commonly used standard sections such as H-section towers support stays that are constructed from standard steel flats. These stays connect with a simple spade and fork connection detail to the I-beams (356 x 171 x 45) used in the deck section. A simple handrail, fabricated into independent panels was bolted into place with sufficient tolerance to easily align it.

### CONSTRUCTION

The erection process was quick and simple. Trestle towers supported the main beam during the installation of the stays. The concrete deck was then poured onto the permanent formwork. The stays were then stressed by the system's dead weight as the trestle towers were removed. The vertical alignment of the deck achieved by this simple construction method was very satisfactory, as shown in the photographs.

With the main piers located on either side of the river, the construction process had minimal environmental impact. The serviceability performance of the structure has been good, as predicted by the dynamic analysis.

### CONCLUSION

The end result of this project is a satisfied client and a grateful local community. Without paying a premium, the client has a visually striking and durable bridge that reflects positively on the local municipality. The community has a structure that allows safe passage to essential services for themselves and their children. Although a small project, it was a rewarding one for all involved.