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MANGERE ARCH FOOTBRIDGE, AUCKLAND, NEW ZEALAND
DESIGN OF A 60M TIED ARCH, HARBOUR CROSSING

John McNEIL

Technical Director
Aurecon
Auckland, New Zealand

john.mcneil@aurecongroup.com

Andrew REEVES

Assoicate
Aurecon
Auckland, New Zealand

andrew.reeves@aurecongroup.com

Summary

The Mangere footbridge provides a 250m long replacement footbridge across Auckland's Manukau Harbour and incorporates a main arch span of 60m. It replaces a 100 year old road bridge which has been closed to traffic since the 1970's and is now used only for pedestrians.

Designed in collaboration with an architect, urban designer and two local artists, the solution provides a delicate balance of attributes to meet the varied stakeholder expectations.

The main span consists of a single steel tied arch which supports steel box girder deck. The arch leans outwards at a 22 degree angle on the outside of a curved deck and is supported on post tensioned concrete "V piers".

Detailed design was completed in 2016 with construction to commence in 2017.

Fig. 1. Mangere Arch Footbridge Photo Montage

Keywords: design; arch bridges; aesthetics; community consultation; virtual reality

1. Introduction

The Old Mangere Bridge, built for vehicular use almost 100 years ago, is in poor condition and coming to the end of its serviceable life. The bridge is now a very popular community facility, closed to traffic and used by pedestrians and cyclists and is a renowned fishing spot.

A project objective was that the new bridge was to be designed to provide a destination in its own right, reflecting the popularity of the site for fishing and its cultural importance. A basic requirement for the new footbridge is to provide a minimum width of 8m. Local widenings to a width of 12m are provided at key locations. The bridge is designed to the loading specified in the NZTA Bridge Manual, including seismic design, as well as a project specific ship impact load case.

2. Structural arrangement

The replacement bridge is 250m long with an 8m wide deck over ten spans. Nine concrete approach spans of approximately 23m connect to a main span which is formed of a 60m steel tied-arch. The main span is supported by a single inclined arch on the outer edge of the curved span.

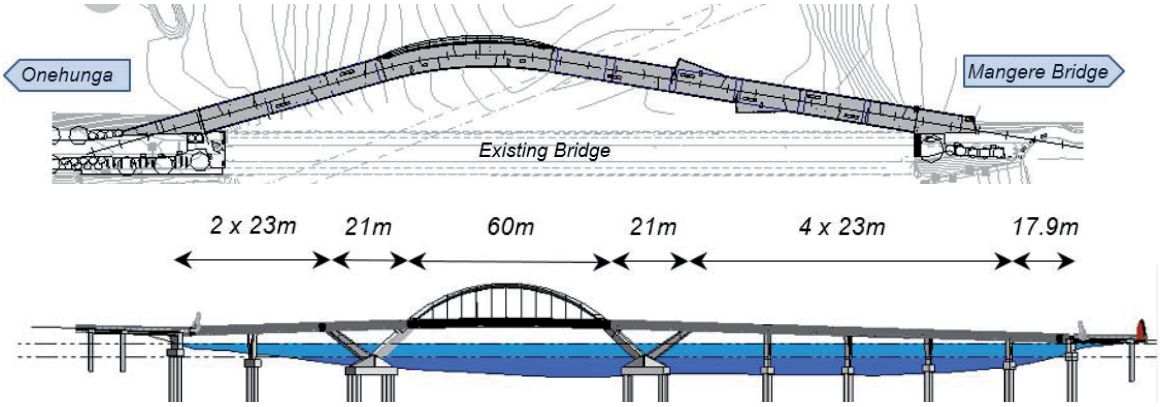

Fig. 2. Plan and elevation of the proposed replacement structure showing high and low tide levels

3. Alignment

The location of the main span is defined by the site constraints. The horizontal alignment is defined by two straight approaches which are orientated towards the volcanic cone landmarks of Mount Mangere and One Tree Hill (Maungakiekie). These are connected together with a horizontal radius which defines the length of the main span. The vertical alignment adopts a constant grade from each abutment meeting at an approximate third point along the bridge length. This intersection of vertical grade and horizontal axes also aligns with one of the navigation spans of the adjacent SH20 motorway bridges and therefore define the location of the main main span.

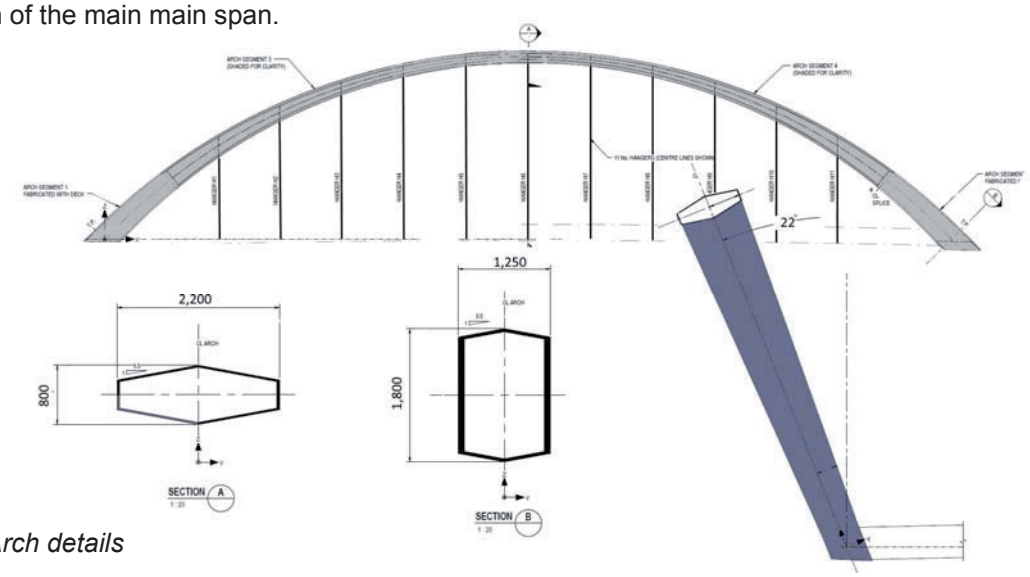

Fig. 3 Arch details

4. Conclusion

The solution provides an elegant but subtle structure that meets the requirements of stakeholders. The development and communication of the relatively complex geometry of the navigation span and its V piers was enhanced through the use of physical modelling, 3D printing of prototypes, and the conversion of the 3D concept sketches into a Virtual Reality model.

The bridge is considered to be a worthy successor to the existing structure, and will serve Auckland well for the next 100 years.