Title: SH20 - Mt Roskill Extension Project

SH20 Mount Roskill Extension is a key part of the new Western Ring Route around Auckland. Once completed, the Western Ring Route will provide an alternative to SH1 between Manukau City and Albany via SH20, SH16 and SH18. The Mt Roskill section of the Ring Route is a $186m motorway extension, 4 km long and provides for 4 traffic lanes, a dedicated bus shoulder lane in each direction, a cycleway and a future rail line.

The design of the SH20-Mt Roskill extension project was completed in 2005. Construction is now substantially complete and the route will open to traffic in May 2009. There are 5 road bridges, 2 pedestrian bridges and several large anchored retaining walls along the route up to 10m in height. The road bridges vary in length up to 158m. Terroff girders and DHC beams were typically used for the superstructure with spans up to 25m. The substructure comprises reinforced concrete piers and footings. The pedestrian bridges are 170m long and comprise cable stayed main spans with precast deck units and columns.

The Hayr Road overbridge is 158m long and has been constructed without expansion joints at the abutments. This exceeds the length given in the TNZ Bridge Manual for integral abutments. It is believed to be the longest integral abutment bridge in New Zealand. Deletion of the expansion joints was considered beneficial as they typically require frequent inspections, ongoing maintenance and they are usually noisy and affect ride quality. The detailing and performance history of the integral abutments will be discussed during the presentation.

The two cable stayed footbridges provide for pedestrian and cycle traffic with 2500 people per day estimated to use the bridges. Several concept design options were considered. The cable stayed system was selected primarily for its minimal structural depth but also to create a landmark structure on the new motorway.

This paper presents an overview of the whole project and discusses in more detail the interesting design challenges mentioned above.
Title:  Design and Construction of the New Mangere Bridge

The New Mangere Bridge is a 643m long 21.5m wide bridge currently being constructed using balanced cantilever techniques alongside the existing crossing of the Manukau Harbour between Onehunga and Mangere, Auckland.

The bridge design and construction is being carried out for the New Zealand Transport Agency (NZTA) by the Manukau Harbour Crossing Alliance (Fletcher Construction, Beca Infrastructure, Higgins and NZTA) after the alliance team were successful in a competitive TOC (target outturn cost) process involving two alliance teams.

The bridge design employs twin cast-in-situ box girders with 100m main spans, with the box girders being continuous from abutment to abutment and a flexible pier design enabling the elimination of bearings from all main piers.

Particular attention is being given in the design and construction to the achieving of the desired whole-of-life performance and durability of the completed structure.

The paper describes the background and rationale behind the design concepts implemented in the final design, and the construction techniques being used to achieve completion by the required 2011 completion date.
The NZ Transport Agency (NZTA) is currently constructing a major improvement to the Wellington road system with the upgrade of SH2 in the Dowse to Petone area of the Hutt valley. Beca was awarded the investigation and design of this project in the mid-1990's and Fletcher Higgins Joint Venture was awarded the main construction contract in 2007.

The project will provide four traffic lanes on an improved alignment with a grade separated interchange and over bridges allowing existing signalised junctions to be removed, and will improve safety and reduce congestion on this important link.

The design and construction solutions for the upgrade not only had to meet the goals of the NZTA, but they also had to be responsive to the natural and man-made constraints that surround the site. Geographically, this section of SH2 is immediately adjacent to the Wellington Fault and shares a narrow strip of land with Hutt Road and the Melling and Wairarapa rail lines.

These challenges have been met by extensive use of precast bridge girders that allow safe and rapid construction of the bridges despite their complex geometry. In addition, careful attention has been paid to programming and sequencing to ensure the works are able to be carried out with minimal disturbance to traffic and the community.

This paper outlines the bridge design and construction solutions and showcases some innovative ways of dealing with the problems that may be encountered on geographically difficult sites in built-up urban environments.
Northern Busway Bridge Structures Linking Communities

This project provides a new two lane busway located adjacent to Auckland’s Northern Motorway. The structures included; several super tee girder interchange bridges at Onewa crossing the motorway and a challenging underpass bridge at Northcote constructed on one of North Shore’s busiest urban roads.

The Busway Project, the subject of several environmental awards, is a comprehensive shift towards providing an efficient public transport system reducing Auckland’s carbon footprint and providing expanded linkages between communities on either side of the Northern Motorway.

The super tee structures are constructed on tight radius alignments with the piers constructed on high skews requiring particular care with detailing of the pier heads.

Particular focus was given to urban design and bridge aesthetics, including designing “V” shaped “whale’s tail” piers and the use of dramatic “fish scale” edge facing panels all reflecting the former Maori fishing community on the site.

The most technically challenging structure was the underpass bridge constructed top down at Northcote Road supporting onramps and offramps to the Northern Motorway.

The bridge was asymmetrical and skewed with extensive flares requiring a combination of two bridge types - prestressed Double Hollow Core and poststressed in situ flares together providing a challenge for designers.

A comprehensive construction staging sequence was necessary for no lane reductions during the peak periods resulting in complex analysis of differential creep effects between the sections of bridge constructed in stages.

The Northcote bridge also had to avoid significant services such as; the International Telecommunication Cables (ITC) and carried seven figure costs per day for temporary disruption to this service, two 600mm diameter watermains and a 800mm diameter sewer line crossing at a high skew relative to the alignment.

Rationale
This paper discusses the difficulties of constructing bridges in a highly trafficked, high profile urban environment, and describes the solutions successfully implemented linking communities with a complex multidiscipline project.