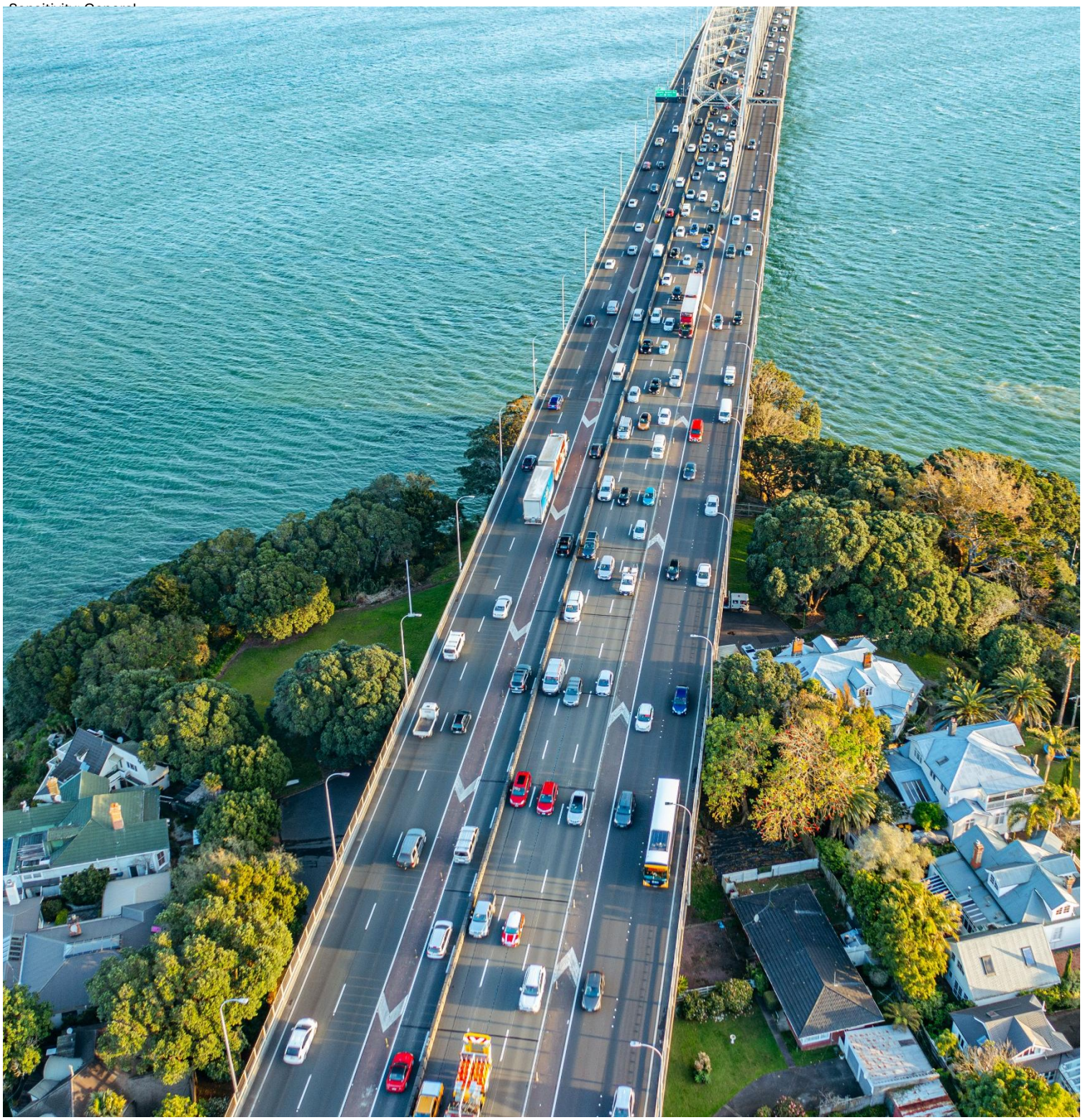

Standardised Precast Deck Panels for Steel Composite Bridges

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Abstract: Delivering infrastructure efficiently requires innovative solutions that balance speed, quality, and cost. This presentation focuses on the development and implementation of a standardised full thickness precast deck panel design for steel composite highway bridges, leveraging Design for Manufacture and Assembly (DfMA) principles to optimize constructability and accelerate delivery.

Traditionally steel composite bridge deck construction in New Zealand has consisted of an insitu topping on partial thickness structural precast reinforced planks, or non-structural planks. This approach has solved some of inefficiencies with fully insitu concrete decks by largely removing temporary formwork for the deck soffit and creating a stable working platform quickly after steel girder placement.

A shift to new full-thickness precast deck design represents a fundamental change in outcomes and construction philosophy. The design was developed and implemented to solve the challenges of the partial thickness precast bridge deck construction approach, transforming traditional approaches by moving the majority of the work to a controlled factory environment, and providing a repeatable and modular system. Applying DfMA principles shifted the design focus toward simplicity, repeatability, and buildability, enabling off-site fabrication, reducing onsite complexity, and improving safety. This approach has delivered significant programme gains, reduced on-site labour, enabling reduced traffic disruption and shortening construction timelines.

The full-thickness precast deck design was originally developed for NZTA's SH25A Taparahi bridge project, which was delivered in record time, with the entire 124m long by 11m wide bridge deck being placed within a week and insitu stitches poured over two weeks. Client and Contractor feedback has been overwhelmingly positive, centered around the simplicity of the solution enabling higher quality construction and speed. The design details were refined further on the No.4 Road bridge project for Western Bay of Plenty District Council. This design was then adopted directly for the SH29 Omanawa Bridge project (currently in construction) and the SH39 Mangati Bridge replacement project. It has since been adapted for the Waikawa Stream Bridge on the Otaki to North Levin project with a longer span and thicker deck design.

Key considerations as the designs have developed included; defining what is considered 'standard,' developing the details to manage tolerances, connections between the panels and steel girders, and coordinating across design, fabrication, and installation teams.

The panel arrangements have been optimised to suit transport and crane capacity, reinforcement detailing rationalised to minimise congestion and improve casting quality, and connection details between the precast panels simplified to allow rapid installation. Off-site fabrication has enabled improved quality assurance through controlled curing conditions, repeatable processes, and reduced variability compared to in-situ pours. It also reduces cost of construction in remote areas by reducing away from home labour costs.

The typical design utilises 300mm thick depth deck providing 40mm cover to the top and bottom reinforcement with DH20 main transverse reinforcement at 150mm centres (top and bottom), with DH12-100 in the longitudinal direction. The precast panels are a standard width of 1980mm, or 980mm, with lengths to suit the steel girder spacings. The 300mm thick deck has been designed to span up to 4.1m between girders. A deeper 315mm thick deck with heavier reinforcement has been designed to span up to 6.3m between girders. The precast deck panels are joined together and made composite with the steel girders via 620mm wide longitudinal concrete stitches over the girder top flanges, and either 370mm or 720mm wide transverse concrete stitches. The design requires limited additional site concrete and lapping bars to tie the panels together.

Onsite, the installation sequence is streamlined, with deck panels placed directly onto prepared steel girders, significantly reducing working at height and reliance on temporary works.

Looking forward, the lessons from these projects highlight a clear opportunity to further refine the system and implement it as an industry standard for steel composite bridges across New Zealand. With five bridges currently utilising the full-thickness precast deck design, wider adoption could enable economies of scale in fabrication, greater consistency in performance and quality, and faster delivery of bridges. Standardised precast deck solutions are also well aligned with broader industry goals around standardisation, sustainability, resilience, and whole-of-life efficiency.

Figure 1: LHS – Precast panels placed on the No.4 Road Bridge project. RHS – Precast panels placed for the SH25A Taparahi Bridge project.