Title: Trackstar Alliance

In early 2006 Queensland Rail selected the Trackstar Alliance as a method to deliver four (4) major metropolitan rail projects in the South East Queensland area.

The alliance partners are:

Queensland Rail (The client)
Thiess
United Group
Connell Wagner
Maunsell AECOM

Trackstar is the first Program Alliance to be formed in Australia. Unlike the usual alliance model set up to deliver a single project, Trackstar’s scope of works is to design, price and construct various projects for the Queensland Government.

Initially four separate projects were identified for delivery through the alliance:

• Caboolture to Beerburrum Rail Realignment and Duplication - 14.7 km, $225 m, 6 bridges, 25 culverts and numerous retaining walls, all bridges completed August 2008 including the first Queensland Rail bridge utilising super T girders
• Robina to Varsity Lakes Extension of the Gold Coast line - 4.2 km, $220 m, 3 bridges, 300m long cut & cover tunnel, numerous retaining walls, all bridges completed April 2008 tunnel to be completed December 2008
• Corinda to Darra - 6.5 km, $189 m, augmentation of 2 bridges under traffic, design and construction of 2 new bridges, numerous major retaining walls, all structures to be completed October 2008
• Beerburrum to Landsborough Rail Duplication - 17 km, $300 m, 11 bridges, numerous retaining walls

The bridges and civil structures are being constructed under a variety of conditions, from green field sites in farm/forest areas, to very constrained brown field sites in suburban areas. Geotechnical conditions which vary from very soft alluvials, extremely hard rock and deep contaminated landfill sites, provided challenging foundation designs. Environmental and community diversity had to be sensitively accommodated during the design, consultation and construction phases.

Each of these projects involved the extension or duplication, and upgrade of existing facilities, which were in significant need to enable the current and future patronage of the metropolitan rail services in the ever increasing population growth in South East Queensland.

A unique aspect of this alliance was the first project for Qld Rail to be self certifying, all phases of the project, i.e. design, construction and commissioning.
Title: Highway Traffic Load Models for Bridge Design and Assessment

Vehicular load models for use in design and assessment of long span highway traffic bridges are published in many national bridge design codes. These load models are usually accepted without question by their users even though their origins are frequently obscure. They are usually considered to be safe enough provided that failures cannot be attributed to their use. This approach leaves clients and designers with two problems. Firstly: the number of long span bridges against which design codes can be compared is relatively small. Therefore the fact of survival is not in itself proof that design provisions are adequate.

Secondly: the fact of survival tells us nothing about the amount by which design codes might be wastefully over-safe, and might thus be leading to widespread misuse of scarce resources. This issue is particularly important where existing structures are being reviewed since it is normally much more costly to enhance the strength of an existing structure than it is to incorporate enhanced strength in new designs.

This paper presents a method of deriving highway traffic load models for use in bridge design and assessment, based on statistical analysis of traffic data and of ‘Monte Carlo’ simulation of traffic load effects. The methodology is based on that recommended by the UK Highways Agency for producing bridge-specific live load models for bridge assessments. The rationale of this procedure is discussed with reference to other design standards, including the recently published Eurocode load models. A discussion of theoretical structural reliability aspects is included, including the relationship between load and structural resistance models.

The application of the procedures is illustrated by reference to the load model that is currently being applied to the West Gate Bridge in Melbourne during the current bridge refurbishment works. Some comparisons are also drawn between load models that have been developed by the author for other major road bridges around the world.
Bakewell Underpass ECI: Innovation in Design and Delivery

The Bakewell Underpass, the construction of which was completed in early 2008 in Adelaide, South Australia, was an extremely complex engineering project. It involved the replacement of an 80 year old concrete road bridge with a new 4 lane twin deck underpass. The underpass structures accommodate the main suburban and interstate rail lines from Adelaide’s south and a busy commercial road near the edge of the CBD.

The technical complexity and stakeholder issues led the Principal – the Department for Transport, Energy & Infrastructure – to adopt a previously untried procurement method. The project was one of the first to be delivered by the “ECI” (Early Contractor Involvement) delivery method in Australia. This collaborative approach paid dividends by allowing the many risks to be thoroughly investigated and innovations to be encouraged and realized.

The most unusual feature of the project is the rail bridge deck, which was successfully designed to be launched into place during a four day track occupation, thus minimising disruption to the critical train services. This 3000t deck, which accommodates 6 sets of rail tracks and a shared path, was constructed entirely offline. Preparatory piling and headstock construction was undertaken during short occupations. The deck spans 28m and is comprised of prestressed concrete Super T girders. The foundations consist of 1.35m diameter concrete bored piles, with shotcrete retaining arches between piles. Unusually for this span, the deck acts as a prop, catering for massive forces associated with the long term behaviour of the clay.

A road deck, similarly comprised of prestressed Super T girders, was conventionally constructed parallel to the rail deck, with traffic temporarily diverted around the highly constrained site of the bridge. The approach retaining walls for the underpass, which reach heights of up to 7.5m, consist of soil nailed and shotcrete cut slopes. This extensive use of soil nailing was a first for South Australia.

Many other aspects of this tightly constrained, challenging bridge project will be described in this paper.
The Queensland Department of Main Roads formed an Alliance in August 2006 to fast track the replacement of 28 ageing timber bridges in the Southern Queensland Region as part of the Accelerated Road Rehabilitation Project ("ARRP").

The Alliance formed includes the Department of Main Roads, Connell Wagner as designer, Civil Mining & Construction ("CMC") and Queensland Bridge and Civil ("QBC") as the Constructors, Humes as the precast supplier and Wagstaff as the piling contractor.

The PAA was signed in May 2007 and construction began almost immediately in June 2007. The first five bridges were delivered in packages to accelerate the start of construction:

- Precast piles or pad footings
- Precast deck and kerb units
- The remaining substructure

After the first five bridges were issued there was no need to continue to issue the bridges in various packages however the design verification and DMR review/approval were continued as a parallel process which accelerated the programme considerably.

Precast piles and transversely stressed deck units have been utilised throughout the project to reduce the amount of in situ work required at the remote sites. A key innovation has been the use of precast kerb units for spans up to and including 20 m as this has provided significant cost and programme savings.

The project has been in the construction stage for 18 months with 16 of the 28 bridges at practical completion and 11 currently under construction and due to be complete by the end of 2009. The remaining timber bridge will be replaced by culverts. All of the bridges have been issued for construction.

This project falls into the design category and is relevant to the conference theme ‘Bridges Linking Communities’ as the acceleration of the replacement of the timber has a number of benefits to the community:

- Providing economic and social benefits such as safety, design speeds, load capacities, travel times, and cheaper freight costs much sooner.
- Savings on maintenance and capital works.
- Provided the community with better alternate travel routes.