Tauranga Eastern Link

- outline of the project
- design/construction challenges faced.
- key innovations the team developed from both a design and construction aspect
- Questions
TEL - Project Outline

- 22km 4 lane Motorway
  - 6km duplication from SH2/26 to Domain Road
  - 16km green field Toll Road from Domain Road to SH2/33 at Paengaroa

- 9 Structures
  - 2 Grade Separated Interchanges
  - Kaituna River Bridge

- 3 million m$^3$ of Earthworks
  - 1.5 million m$^3$ fill
  - 1.5 million m$^3$ pre-load & Surcharge
  - 1,000 km of Wick drains

- 500,000m$^2$ Pavement
  - Foam Bitumen & Structural Asphalt
Procurement Innovation

- Largest NZTA D+C contract $350M
- D+C model drives innovation at tender
- Fulton Hogan & HEB formed Construction Alliance

Designers:
- URS Head Designer
- Assisted by Opus, Peters & Cheung and Bartley Consultants.
Tauranga Eastern Link

Design challenges - Technical

- Geotechnical
  - Settlement
    - Lots of it
  - Liquefaction
    - Highly liquifiable
    - To 35m deep in places
  - Low lying, flat, little grade

Fulton Hogan  |  HEB Construction  |  URS  |  Opus  |  Peters & Cheung  |  Bartley Consultants
Geotechnical Strategy

- **Overview**
  - Many areas of the TEL underlain with thick layers of fibrous peat and compressible silts.
  - Peat has high primary compression
  - Soft silt is highly compressible with low permeability and high primary consolidation over a long duration
Geotechnical Strategy

- 9 Trial embankments constructed early in programme

- Trial embankments used to measure the primary consolidation and secondary compression characteristics of the underlying peat and silts.

- Both lab tests and trial embankment data used in the earthworks design
Earthworks Settlement Design Philosophy
Innovation in Design

- Surcharge Commencement
- 25/02/2012
- Predicted Surcharge Removal 25/05/2012

95% Primary Settlement = 0.037m
90% Total Settlement = 0.077m

Predicted settlement curve with no surcharge

Post-construction settlement = <5mm

Predicted surcharge embankment settlement curve using back-analysis parameters

Total Settlement (Fill = 1.9m)
Total Settlement (Fill = 1.2m)
Peat Settlement (Fill = 1.9m)
Peat Settlement (Fill = 1.2m)
Innovation in Design

- Predicted Surcharge Removal: 24/08/2012
- Matching Settlement Curve using Monitored Results
- 95% Primary Settlement = 0.20m
- 90% Total Settlement = 0.294m
- Post Surcharge Settlement = 25mm
- 25 years
- PR1E10 (left axis in 42.5m)
- Total Settlement (Fill = 9.1m)
- Total Settlement (Fill = 6.5m)
Earthworks Strategy

- Trial embankments constructed early – extensive monitoring.
- Lay geofabric directly over topsoil
- Settlement plates every 25m
Earthworks Strategy

Wick drains

- Sand blanket and wick drains to speed up settlement.
- Used in locations where the less permeable compressible silts are found.
- Speeds up by providing a path for the water to squeeze out.
- Reductions in settlement durations.
Earthworks Strategy

- Fill and pre-load placed based on a pre-determined depth, not RL.
- Surcharge re-assessed based on initial settlement and data from trial embankments.
- Surcharge removed and re-used to reduce volume required.
Innovations in designs

- David Clarke
Innovations in designs

- Domain Road
  - Extensive Ground Improvements
    - Wick drains and preload fills.
    - Foundation raft of sand fills with geogrid and high tensile geotextile reinforcement.
    - Settlements of up to 4.5m are anticipated.
  - EPS embankments
    - Weight of conventional fill in the approach embankments would have caused settlement and seismic issues.
    - Settlements would result in pavement distortions and have an impact on the piles.
    - 48,000 m³ of lightweight fill.
    - EPS blocks less than 1% weight of conventional earth fill but has the necessary strength and durability.
    - Eliminate potential requirements of excessive deep ground stabilization.
Domain Road Interchange
Domain Road interchange
Domain Road Embankment

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Innovation in Design
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Innovation in Design
Innovation in Design
Innovation in design

- Monofall section
  - Decrease in fill heights of up to 2.7m in settlement prone soils
  - Allows stormwater runoff from the carriageway to directly enter the Maranui Swale without the need for piped reticulation.
  - In flood conditions the mono-fall provides for a consistent depth of flow across the carriageway, and no ponding on the west-bound carriageway of the TEL.
Discussion

• Questions?