Waikato Expressway: Tamahere to Cambridge

A focus on pavement design, in-situ subgrades and the use of materials
Waikato Expressway: Tamahere to Cambridge

Statistics:
• Pavement Area = 500,000m²
• Length = 16km
• Earthworks Volume = 1 Million m³
• Bridges = 8
• AADT = 30,000
• HCVs = 10%
• Dual 2-lane plus shoulder
• Safe systems
• Completion Date: 16 July 2016
Principles Requirements

Overall

• Design traffic loadings
  – AADT 30,000 vpd, 10% HCVs, 1.1% growth rate
• Benkelman Beam deflection limits:
  – 95th percentile: 0.90mm
  – Max: 1.30mm
  – Curvature: 0.28mm
• 10mm added to critical layer

Subgrade

• Maximum SIL Modulus 100MPa
• Subgrade CBR ≤ 3% requires geotextile, working platform or stabilisation
Principals Requirements

Subbase
- WHAP 40/65 - 2% cement modified / 5% cement stabilised

Basecourse
- NZTA M/4 - 2% cement modified
- Minimum 180mm basecourse cover over stabilised subbase

Surfacing
- SMA surfacing included / OGPA surfacing excluded
- OGPA surfacing north of Karapiro Stream Gully
- 12 months chipseal bedding prior to OGPA (possibly sooner)

Other requirements
- 1km Hi-Lab trial section NZTA requested

Overriding design criteria
- Deflections on the completed pavement.
• The 2007 NZTA Supplement to the above document (NZTA 2007)
• All relevant NZTA Specifications, notes to specifications and NZTA Technical Memorandum
• The specific requirements of the Principal’s Requirements
• Local roads to DC manuals
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Construction

• Basecourse/subbase materials from Winstone’s Whitehall Quarry

• SIL material
  – Preferably sand won from site
  – Imported blue/brown rock

• Benkelman Beam testing on each pavement layer
Main Alignment Pavement Trial

- Pavement designs subject to trial (PR)
- Variable subgrade
- Variable SIL options
- What is the optimum cement content?
Pre-cracking & Results of the Trial

- Cemented subbase not viable
- Brown Rock SIL produced better performance in low CBR areas
- Sand SIL produced satisfactory performance
Subgrade Materials

- Silts and sands derived from volcanic ash
- Allophane content = 5% to 7%
- Lose strength when subjected to physical influence (i.e. vibration/wetting)
- Non-conventional behaviour: High CBR, Low E
**Trial Pavement Subgrade Response**

- $E = 3.5$ CBR
  - Silty subgrade typically $10 \times$ CBR
  - Minimal effect on subgrade rutting
  - Significant effect on overall deflection and bound layers
  - Reason for bound subbase in weak subgrade areas

- Stress dependent
Pavement Design Conclusions

- Modified Subbase can be constructed
- Brown Rock SIL used for areas of CBR < 5%
- Sand SIL used for areas of CBR ≥ 5%
Pavement trial SPR SIL
Note the lack of setting out
Trimmed subgrade
Machine control in cab of grader
Haul road/SIL
Blue/brown rock
Southbound lanes used as haul road
Uncompacted modified subbase
Compacted modified subbase
Questions?