Pavement Rehabilitation Design – Case Study

Rehabilitation Investigation and Design of a Major Arterial
Project Details

- Major Freight Route
- 4 Lane Dual carriageway
- Current Traffic Volume 25,000 v/p/d
- Heavy Vehicles 11.5% (HVAGs/HV = 2.77)
- Commercial Vehicle Growth Rate = 8.6%
- 40 year design life requested
Investigation Methodology

1. Visual assessment of condition
2. Review construction history & performance
3. Deflection testing
4. Pavement coring and sampling
5. Pavement backanalysis
6. Determine design alternatives
Step 1 - Visual Assessment
Step 1 (cont) – Visual Assessment

- Predominant distress in left hand lane
- Fatigue Cracking
- Numerous closely spaced transverse cracks
- Potholing
Step 2 - Review of Construction History

- Original construction 1990
  - Sprayed Seal Surfacing
  - 150mm Granular Type 1.2 layer
  - 230mm CT SB
- Pavement overlaid with 50mm AC in mid 98
Step 2 (cont) - Review of Past Pavement Performance

- 50mm AC Overlay design life = $3.5 \times 10^6$ ESA’s or 4 years (pavement failure by mid 2002)
- Design life of CTSB layer = $8.5 \times 10^5$ ESA’s or 4-5 years after construction (CTSB fatigue cracking in 1995) – some post cracking life after CTSB fatigue
Step 3 – Deflection Testing

- Heavy Weight Deflectometer (HWD) used at 60, 80 and 120kn
- HWD used due to the presence of cemented layers
- Deflection testing undertaken in the OWP at 25m intervals
Step 3 (cont) - 120Kn Deflection and Curvature Results
Step 4 – Field Investigations

• FWD data plus visual survey used to determine areas for coring and sampling
• 10 full depth cores undertaken through pavement layers (layer depths recorded)
• Dynamic Cone Penetrometers (DCP) testing undertaken through the core hole (for determination of subgrade CBR)
• Samples of the granular base layer were taken by cutting 300mm x 300mm squares from pavement
Step 4 (cont) – Field Investigations
Step 4 (cont) – Field Investigations

• Field Investigations indicated
  o Granular layer was well compacted and sound (appeared almost lightly bound)
  o CTSB layer appeared to be failing (layers broke up when coring)
  o Thickness of asphalt surfacing was generally in the 60-70mm range (not 50mm as per design)
  o DCP results indicated subgrade CBR’s in the range of 4- >60
Step 5 – Pavement Backanalysis

- Pavement back analysis undertaken using EfromD2
- Model adopted for backanalysis was based on results of field investigations
- Backanalysis undertaken using 60, 80 and 120kn data so the results of the analysis could be compared

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<tr>
<th>Layer</th>
<th>Minimum Modulus</th>
<th>Maximum Modulus</th>
<th>Seed Modulus</th>
<th>Poisson Ratio</th>
<th>Type</th>
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Step 5 (contd) - Backanalysis Results
– Granular 60kn FWD

90 Percentile
350Mpa
Step 5 (contd) - Backanalysis Results – Granular 120kn FWD

![Graph showing backanalysis results with 90 Percentile of 460Mpa](image)
Step 5 (contd) - Backanalysis Results – 120kn FWD - CTSB layer

Low CTSB Values – CTSB Failing?
Failed CTSB
Step 5 (contd) - Backanalysis Results – Subgrade
Step 5 (cont’d) –
Findings From Backanalysis

- Backanalysis agreed with field observations
  - CTSB was weak/failing in some areas
  - Granular layer sound
  - Backcalculated subgrade CBR’s similar to DCP results
  - Extend of full depth asphalt section able to be identified
Step 6 - Design Alternatives

• Pavement design to be designed to meet the requirements of QDMR heavy duty asphalt pavement design manual.

• Options
  ▪ Reconstruction ?
  ▪ Asphalt Overlay ?
  ▪ Stabilise Existing and Asphalt Overlay ?
## Step 6 - Design Moduli

<table>
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<th>Layer</th>
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Step 6 - Design Alternatives
Reconstruction
Step 6 - Design Alternatives Asphalt Overlay

- 45mm DG14
- 40mm OG14
- 225mm DG20
- Existing Pavement
- Subgrade
- SAMI Seal 14mm (2.5 l/m²)
Step 6 - Design Alternatives Asphalt Overlay
Step 6 - Design Alternatives
Asphalt Overlay

• Pros
  o Relatively easy to do (overlay at night)

• Cons
  o Expensive (calculated 310mm AC required)
  o Failed CTSB layer may cause future problems (problem buried - not treated)
  o Large increase in grade line required (issues with bridges, guardrail heights, edge drop off)
Step 6 - Design Alternatives

Insitu Stabilisation & Asphalt Overlay
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Insitu Stabilisation & Asphalt Overlay
Step 6 (cont) - Design Alternatives

Insitu Stabilisation & Asphalt Overlay

• Pros
  o Cheaper than reconstruction or asphalt overlay
  o Failed CTSB layer is restabilised
  o Existing pavement reused
  o Some confidence in previous performance

• Cons
  o Gradeline raised by approximately 180mm (not as bad as AC overlay option however)
  o Lane closures during day required
  o Reflective cracking – still be an issue?
Adopted Solution

- Insitu stabilisation option chosen:–
  - Cost
  - Time
  - Re-use of existing pavement materials
Questions ???????