Pavement Design in Auckland - “Passion for the Unknown”

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Presentation Outline

- Five situations you may encounter …

- The importance of evaluating “Public Disruption Cost”
Situation 1.0 - Discovering the History
– Horse-drawn & Electric Tram Services (1884-1956)
Situation 1.1 - Solution

Concrete Repairs, Crack Mitigation Layer, Asphalt Resurfacing
Situation 2.0 - Utility Services Trenches

Shallow Services
(250-300mm below Surface)

You need a

“Ground Penetration Radar Survey” (+/- 100mm accuracy)

Reinstated with Clay-Contaminated Aggregate
Situation 3.0 - Loose Scoria Subbase

- 70mm Asphalt
- 100-150mm Basecourse
- 250-300mm Scoria Subbase
- 300mm CBR 2%
- Infinite CBR 3.5%

Often has ...

Can vary in thickness over short distance
Large size scoria aggregate will break due to construction traffic.

This layer can be …
Situation 3.2 - Cement Stabilised Scoria Subbase

- Higher percentage of cement is required for a bound and durable stabilised layer

<table>
<thead>
<tr>
<th>% of Cement</th>
<th>7 days UCS, at 20°C Moist Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>1.6MPa</td>
</tr>
<tr>
<td>7%</td>
<td>2.6MPa</td>
</tr>
</tbody>
</table>

- If not stabilisation, removal of this layer should be considered
Situation 4.0 - Boulders
- Size between 150-250mm

Boulders at 100-200mm below surface with subgrade CBR 2-3%

Often found underneath an arterial route …
(Right) Premixed Cement Stabilised New Aggregate, when you can close half of the carriageway continuously for 2 weeks

OR

(Left) Structural Asphalt with Concrete Base, if you only have the weekends (2 days)
Situation 5.0
- Tree Roots from a Protected/Scheduled Tree

You can’t
- Cut tree roots over 35mm diameter
- Place hot mix asphalt, or cemented material around the roots
Situation 5.1 - Solution

You can only
- Shift the kerb and channel
- Build an artificial cold mix asphalt channel

Don’t forget the arborist’s and the resource consent!
Evaluation of Public Disruption Cost

- Public Disruption Cost vs the least Physical Work Cost

Public disruption costs
= Travel Time Delay Cost During Construction

- Things to consider:
  - Day-time or night-time construction
  - Weekend or weekday construction
  - One-way or two-way traffic system
  - Productivities and working period
  - Speed restriction, detour route
### An Example – Public Disruption Cost Analysis

<table>
<thead>
<tr>
<th>Options</th>
<th>Working Period (Days)</th>
<th>Public Disruption Cost = Travel Time Delay Cost During Construction</th>
<th>Public Disruption Cost Saving (Between Options)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>$582,445</td>
<td>(Chosen Option) $0</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>$1,048,402</td>
<td>(Option 2 -1) $465,957</td>
</tr>
<tr>
<td>3</td>
<td>42</td>
<td>$1,223,135</td>
<td>(Option 3 – 1) $640,690</td>
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</table>

<table>
<thead>
<tr>
<th>Options</th>
<th>Total Public Disruption Cost Saving (A)</th>
<th>Total Physical Work Cost (B)</th>
<th>Total Cost (A+B)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>$0</td>
<td>$2,045,000</td>
<td>$2,045,000</td>
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<tr>
<td>2</td>
<td>$465,957</td>
<td>$1,587,000</td>
<td>$2,052,957</td>
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<tr>
<td>3</td>
<td>$640,690</td>
<td>$1,640,000</td>
<td>$2,280,690</td>
</tr>
</tbody>
</table>

Option 2 - the least physical work cost

OR

Option 1 - the least total cost
Closing Remarks

- Discoveries and lessons learnt:
  - Discovering the History – Old Tram Route
  - Utility Service Trenches
  - Loose Scoria Subbase
  - Boulders
  - Tree Roots
  - Evaluation of Public Disruption Cost

- Acknowledgements
  - Ramiz Iskander, Bruce Chappell, Ian Stenberg