Calculating the Cost of Road Wear on Local Roads

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Background

- Local Governments seek mechanisms to quantify cost of road wear
- Impact of road wear much higher on local roads
- Various methods have been tried – too expensive, specialised skills.
- Seek simple method
Methods for Evaluating the Cost of Road Wear

- Routine Maintenance Determination
- Evidence Based Reporting
- Pavement Design Approach
- Single Marginal Cost
- Catalogue of Marginal Costs
MRWA Policy

• For vehicles operating 23.5 t triaxles the charge will be 0.4 cents per tonne per kilometre of payload (over and above the initial 300,000 tonne per annum).

• For alternative mass limits the charge will be determined on the basis of 5.5c per additional ESA.km

• Is this sufficient for Local Roads?
For any given axle weight there will be less damage on stronger roads (location).
Road Wear Cost – Farm or Mine to Port

Journey from Farm or Mine to Port

Price Charged

Price required for cost recovery

- Farm
- Port

- Urban Highway or Freeway
- State Rural Highway
- Regional Local Road
- Minor Main Road
- Minor Local Road
Calculating the Cost of Road Wear on Local Roads

1. Determine Vehicle type and loading
2. Calculate Equivalent Standard Axles for Transport Task
3. Determine road class and distance of transport route
4. Determine appropriate marginal cost for road type
5. Calculate cost of road wear

• Cost of road wear = ESA x Marginal Cost x Distance
Austroads project AT 1394
Calculation Example: Yalgoo – Ningham Road

Quad Road Train
Concessional Load – 23.5t per triaxle
58.1 km task
1 400 000 tonne/ annum
Sealed Rural Collector / Arterial Road

- ESA / payload tonne = 0.18
  Therefore 1.4 m tonne = 252 000 ESA

- For rural collector 30c / SAR km
  For Arterial = 5c / SARkm(Austroads)
Using 7c:
  Therefore cost = 252000 x 58.1 x 0.07

= $1 024 884 per annum
FAMLIT Background

- FAMLIT is a sealed pavement life-cycle costing analysis tool (Austroads project AT1165)
- Other similar tools are:
  - HDM-4
  - PLATO
- FAMLIT was used in Austroads project AT 1394 due to its relatively simple input data requirements

“Preliminary methodology for estimating cost implications of incremental loads on road pavements”
FAMLIT Description

• Life cycle costs are calculated over a 50-year analysis period
• Routine and periodic maintenance costs are combined in a constant annual value for a given traffic load
• Structural works are triggered based on condition
• FAMLIT implementation used two models for triggering structural works:
  – Rutting/roughness model
  – Pavement strength model
• Model parameters/coefficients are similar to those used in the ROMAN II dTIMS set-up
Model Variables

- Road Types
- Cost Zones
- Climate Zones
- Road Condition
- Treatment Types
- Pavement Loading
## Road Types

<table>
<thead>
<tr>
<th>Road Type</th>
<th>Design Traffic (ESA X 10^6)</th>
<th>Adopted Design Traffic (ESA X 10^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Road</td>
<td>&lt; 0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>Local Distributor</td>
<td>0.08 – 0.4</td>
<td>0.2</td>
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<tr>
<td>Regional Distributor</td>
<td>0.4 – 2.0</td>
<td>1.2</td>
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<tr>
<td>District Distributor</td>
<td>2.0 - 6.0</td>
<td>4.0</td>
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<tr>
<td>Climate Zone</td>
<td>Zone Description</td>
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<tr>
<td>1</td>
<td>North West</td>
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</tr>
<tr>
<td>3</td>
<td>Gascoyne / East Pilbara</td>
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<tr>
<td>4</td>
<td>Central</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>West Coast</td>
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<tr>
<td>6</td>
<td>South West</td>
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</table>
Pavement Loading

• Base Case
  Design traffic
  50 years

• Alternative Case
  0.8 x 10^6 ESA
  3 years
# Road Condition

<table>
<thead>
<tr>
<th>Pavement Strengths</th>
<th>Factor</th>
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<td>Weak</td>
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<tr>
<td>Moderate</td>
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<tr>
<td>Strong</td>
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</table>
Treatment Types

• Routine Maintenance
• Reseal – single seal
• Rehabilitation – 100mm + single seal
• Reconstruction – to existing standards
Cost Zones

1. METRO
   - Wheatbelt North Region
   - Perth Metropolitan Region
   - Wheatbelt South Region
   - Great Southern Region
   - South West Region

2. GS/WB/MW
   - Gascoyne Region
   - Mid West Region
   - Wheatbelt North Region

3. SW
   - Wheatbelt South Region
   - Great Southern Region

4. GAS/PB/KIM/GF
   - Kimberley Region
   - Pilbara Region
   - Goldfields-Esperance Region

WALGA
## Work Standards

### Maintenance Alternative
- **Base Case**

#### Works Types

<table>
<thead>
<tr>
<th>Operation</th>
<th>District Distributor</th>
<th>Regional Distributor</th>
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</table>
LRDS structural deterioration model

SNP ratio = 2 - (EXP(Age*[(0.222/SL)+(0.0407*MESA)]))
Access Road
South West
Moderate Condition
Road Types: Access Road, Local Distributor, Regional Distributor, District Distributor

Cost Zone: 1, 2, 3 and 4

Loading Scenario (ESA/annum): 0.2, 0.4, 0.6, 0.8 million ESA

Pavement Strength: weak, moderate, strong

Loading duration (years): 1, 2, 3, 5 and 10.
Questions?

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