Costing Haul Road Construction or Rebuilds – Where's the Value?

Roger Thompson
Overview

1. What’s the problem? Why do haul roads deteriorate?

2. How does the road influence haulage? What’s the role of rolling resistance in haulage operations?

3. Do we want to fix our roads? How to justify expenditure on road improvement

4. What’s the value-add for road improvement? Simple costing exercise to evaluate value-add of road improvement
What’s the problem?
Why do haul roads deteriorate?
Haul roads deteriorate due to;

- Traffic induced damage to wearing course
- Environmental degradation and weathering
- Routine road maintenance (grading, watering)
- Spillage and fines contamination.
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- Fit-for-purpose design;
  - Structural design and layerworks
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Deterioration can be minimised through:
- Fit-for-purpose design;
- Structural design and layerworks
- Wearing course material selection
- Construction quality control and
- Haul road maintenance management
RR occurs as a result of:

- the effects of surface distress and progressive deterioration
- deformation of the road’s layerworks materials.

In the case of unsuitable layerworks materials or design, the lack of support below the surfacing (even if well selected material) will result in rapid deterioration, leading to further increases in rolling resistance.
Deterioration on haul roads is commonly measured as rolling resistance (RR);

Expressed in terms of kg (or N) resistance per ton of GVM, where 10kg/t = 1% RR or 1% equivalent grade against the load.

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Various ways to assess rolling resistance;

- Qualitative defect evaluation
Various ways to assess rolling resistance;
- Qualitative defect evaluation
- Quantitative wearing course testing
Do we want to fix our roads?
How to justify expenditure on road improvement
Split haul into similar segments;
- haul road geometry (width, grade)
- sheeting material type and
- daily tonnages.

Cooper equations – reliable first approximation to model truck speeds and fuel burn.
Cost models for:

- Tires
- Maintenance and spares
- Labor

Road maintenance costs
Example case-study:

- Haul truck data;
  - GVM, EVM, Engine power etc.
  - Age, replacement cost etc.
- Road maintenance data;
  - Equipment numbers
  - Blade width, water cart capacity
- Generic data;
  - Unit costs
  - Productivity
  - Utilisation, availability etc.

<table>
<thead>
<tr>
<th>Road segment data</th>
<th>HR-01a</th>
<th>HR-01b</th>
<th>HR-01c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road length (m)</td>
<td>2,160</td>
<td>1,800</td>
<td>1,200</td>
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<tr>
<td>Width (m)</td>
<td>35</td>
<td>35</td>
<td>35</td>
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<tr>
<td>Grade (%, uphill +ve)</td>
<td>10</td>
<td>0</td>
<td>3</td>
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<tr>
<td>Vehicle speed estimate (km/h)</td>
<td>10</td>
<td>50</td>
<td>35</td>
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<tr>
<td>Daily tonnage (kt)</td>
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<td>125</td>
<td>125</td>
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<tr>
<td>Shrinkage product</td>
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<td>60</td>
<td>170</td>
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<tr>
<td>Grading coefficient</td>
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<td>18</td>
<td>25</td>
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<tr>
<td>Plasticity index</td>
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<td>6</td>
<td>4</td>
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<tr>
<td>CBR (%) 100% Mod AASHTO</td>
<td>100</td>
<td>80</td>
<td>80</td>
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</tbody>
</table>

RR%
Example case-study;
• ‘Unimproved –vs- Improved’
  • Methodology to identify improvement business case
What’s the value-add for road improvement?
Simple costing exercise to evaluate value-add of road improvement

Results HR-01a-c (unimproved)

Average percent cost change per day
HR-01a-c

Results HR-01a-c (HR-01a HR-01b resheeted)
- Improved (125ktpd target)
  - Cycle time increases - production falls by 0.3%/day up to a routine maintenance interval of 7-days.
  - 1.2mtpa production increase
  - Total road-user cost reduction of 1.4million cost units per annum.
    - Other losses likewise reduced.
Summary

1. What’s the problem?
   Investment in road maintenance, resheeting and rehabilitation – how to develop the business case?

2. How does the road influence haulage?
   - **↑1%RR Ramps**
     - ↓7% KPH
     - ↑7% Fuel burn
   - **↑1%RR Flat hauls**
     - ↓20% KPH
     - ↑25% Fuel burn

3. Do we want to fix our roads?
   Safety must always be paramount in any improvement campaign. Return road surfacing to close to original condition, to minimise rolling resistance and further deterioration rates.

4. What’s the value-add for road improvement?
   Minimise cost-penalty associated with increased cycle time, fuel burn, VOCs. Minimise production losses due to increased cycle times and lower productivity.
Mining Haul Roads – Theory and Practice

Complete practical reference for mining operations, contractors and mine planners

“This book is the most definitive treatise on mining haul roads ever written [...] There has never been a text that addresses the many facets of mining haul roads on such a scope [..].”

From the Foreword by Jim Humphrey, Professional Engineer, Autonomous haulage systems developer and Distinguished Member of the Society of Mining, Metallurgy and Exploration.

mininghaulroads.com/technical-resources.html