



Curtin University

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

Roger Thompson



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?



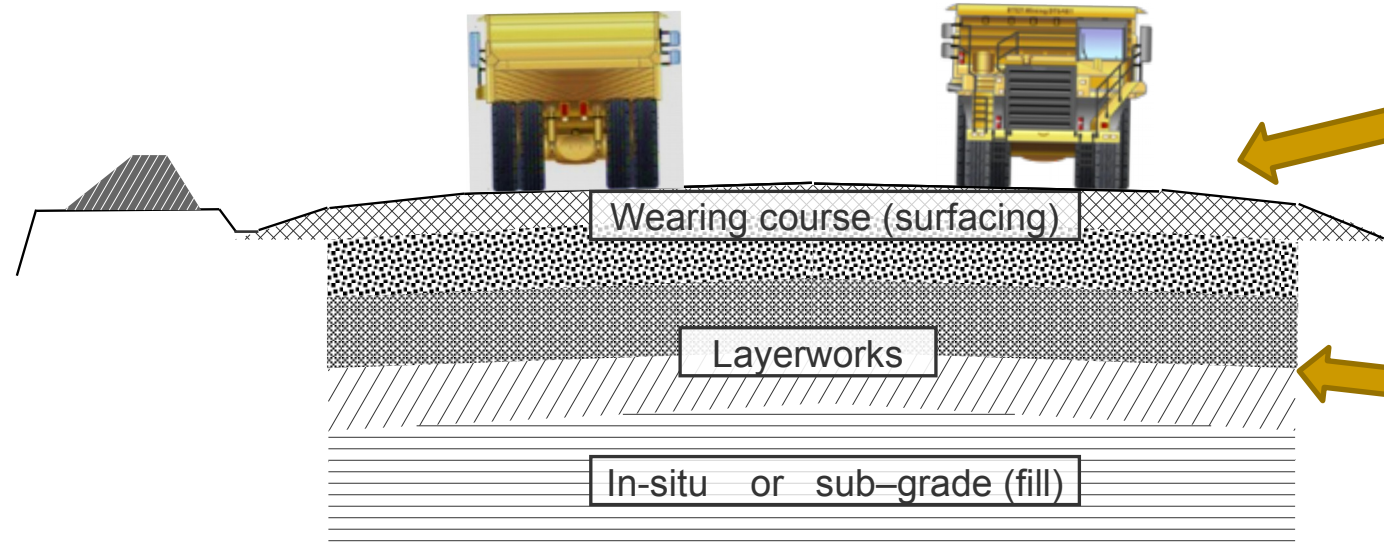
3 Do we want to fix our roads?
How to justify expenditure on road improvement



4 What's the value-add for road improvement?
Simple costing exercise to evaluate value-add of road improvement

1

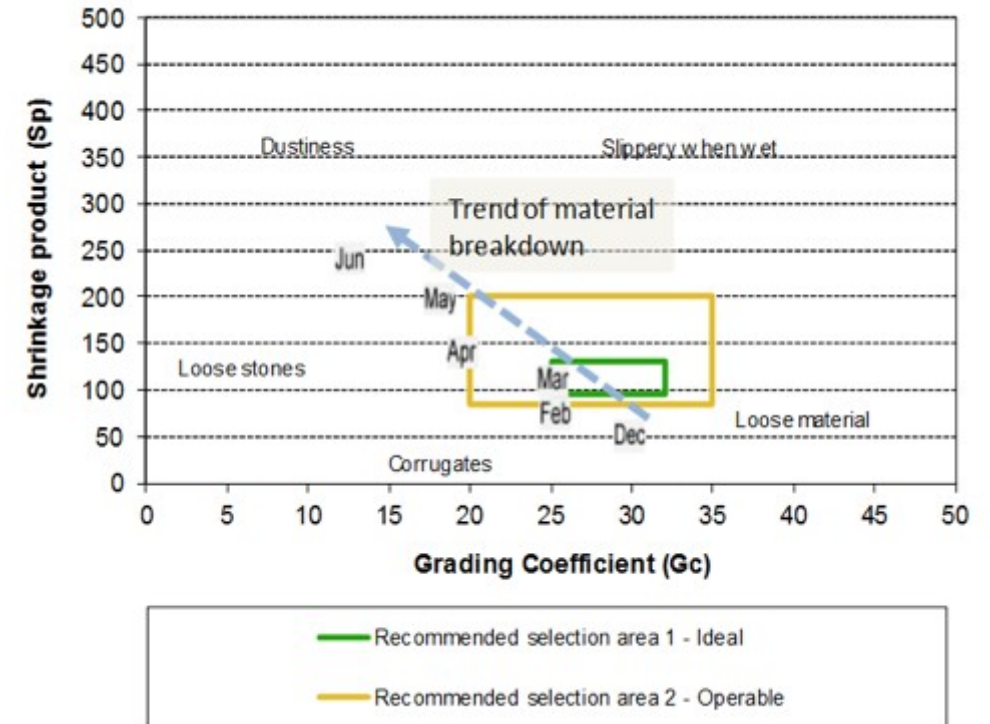
What's the problem?
Why do haul roads deteriorate?





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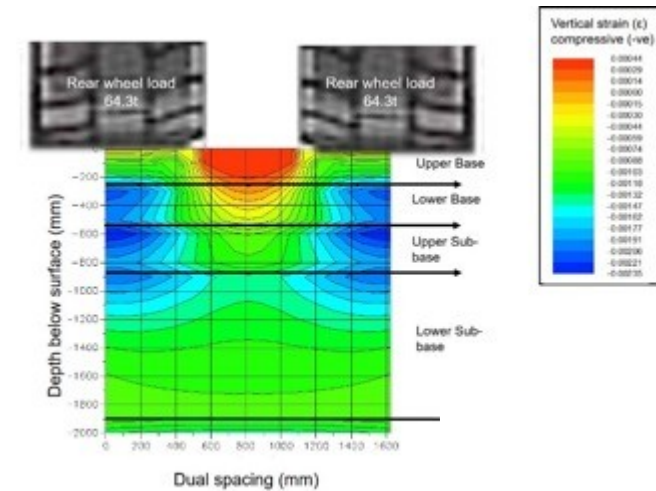
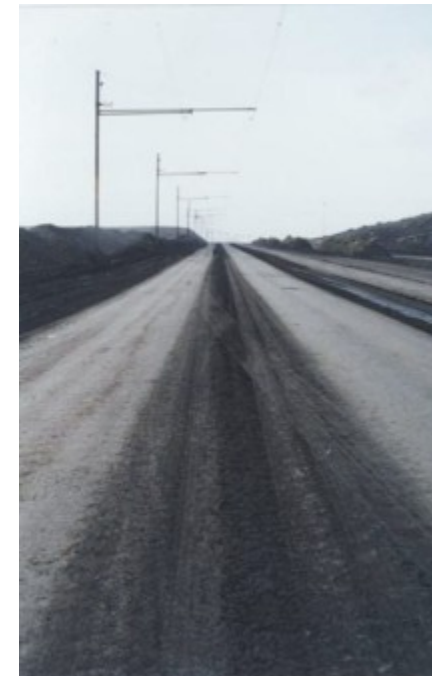
- Haul roads deteriorate due to;
 - Traffic induced damage to wearing course
 - Environmental degradation and weathering
 - Routine road maintenance (grading, watering)
 - Spillage and fines contamination.



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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.
- Deterioration can be minimised through;
 - Fit-for-purpose design;
 - Structural design and layerworks

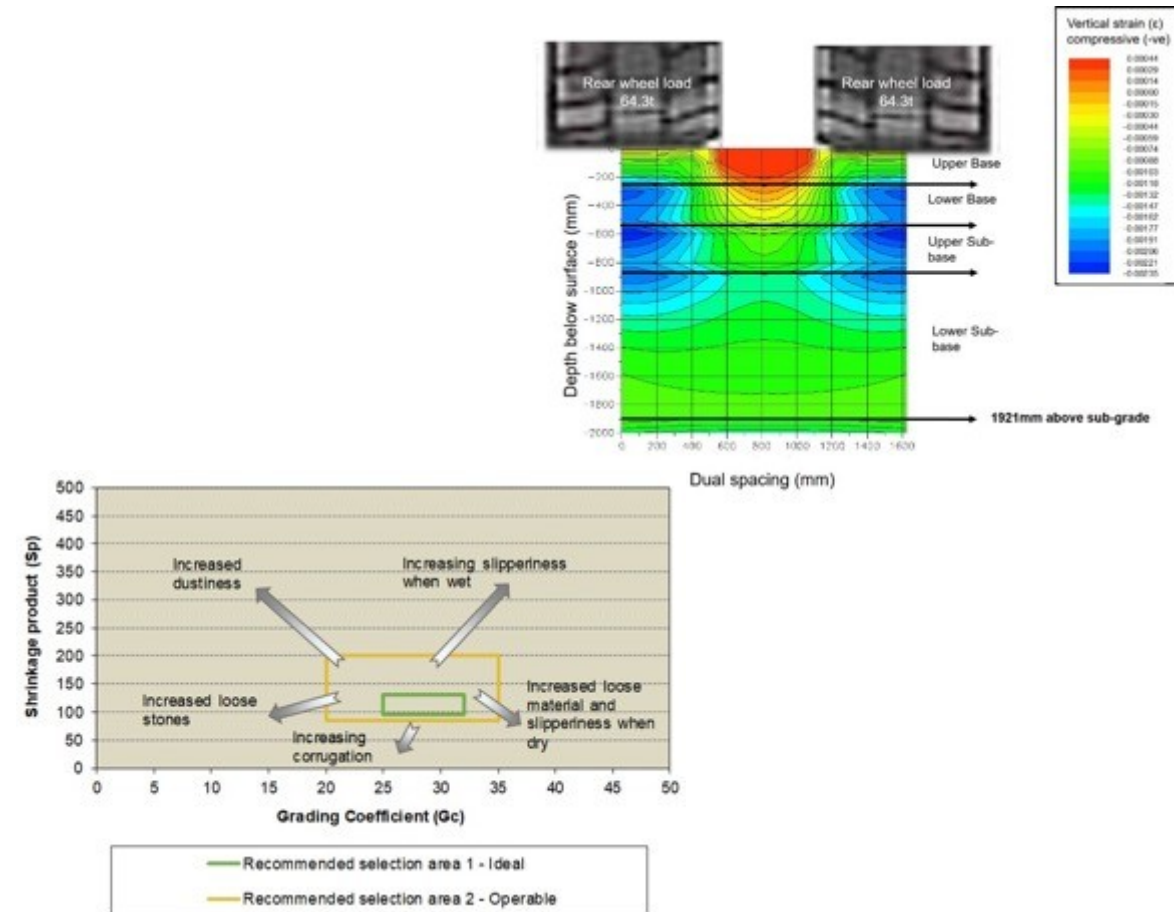


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- Deterioration can be minimised through;
 - Fit-for-purpose design;
 - Structural design and layerworks
 - Wearing course material selection
 - Construction quality control and
 - Haul road maintenance management



- RR occurs as a result of;
 - the effects of surface distress and progressive deterioration
 - deformation of the road's layerworks materials.

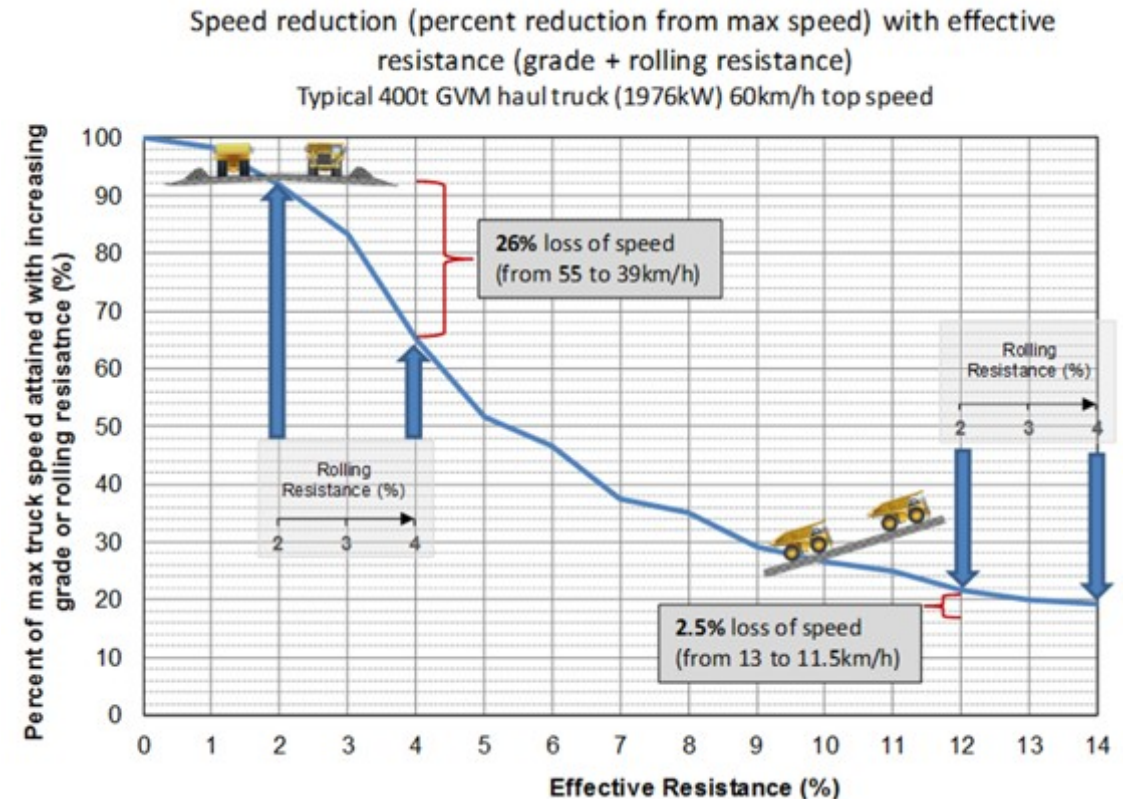
In the case of unsuitable layerworks materials or design, the lack of support below the surfacing (even if well selected material) will result in rapid deterioration, leading to further increases in rolling resistance.



2

How does the road influence haulage?
What's the role of rolling resistance in haulage operations?

- 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.
- Importantly, it directly effects truck performance and operating cost.



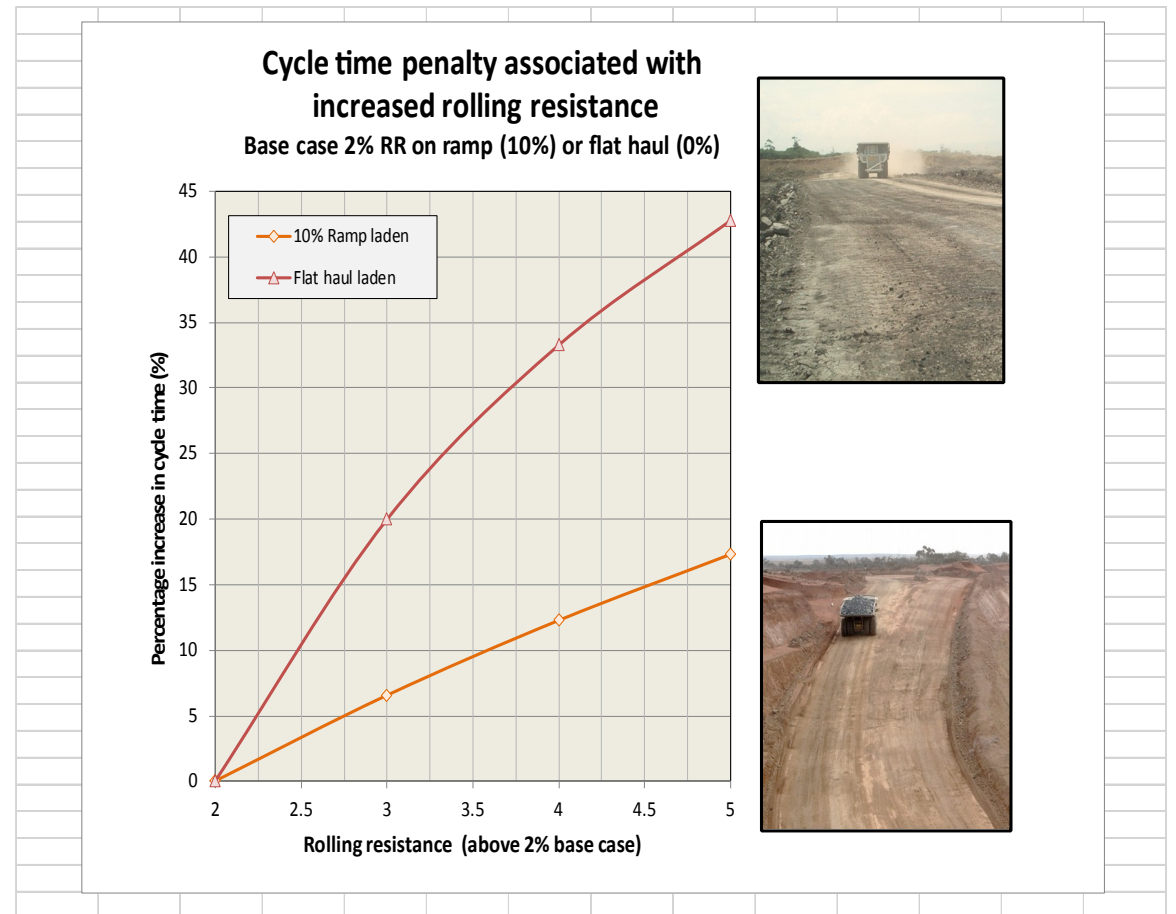
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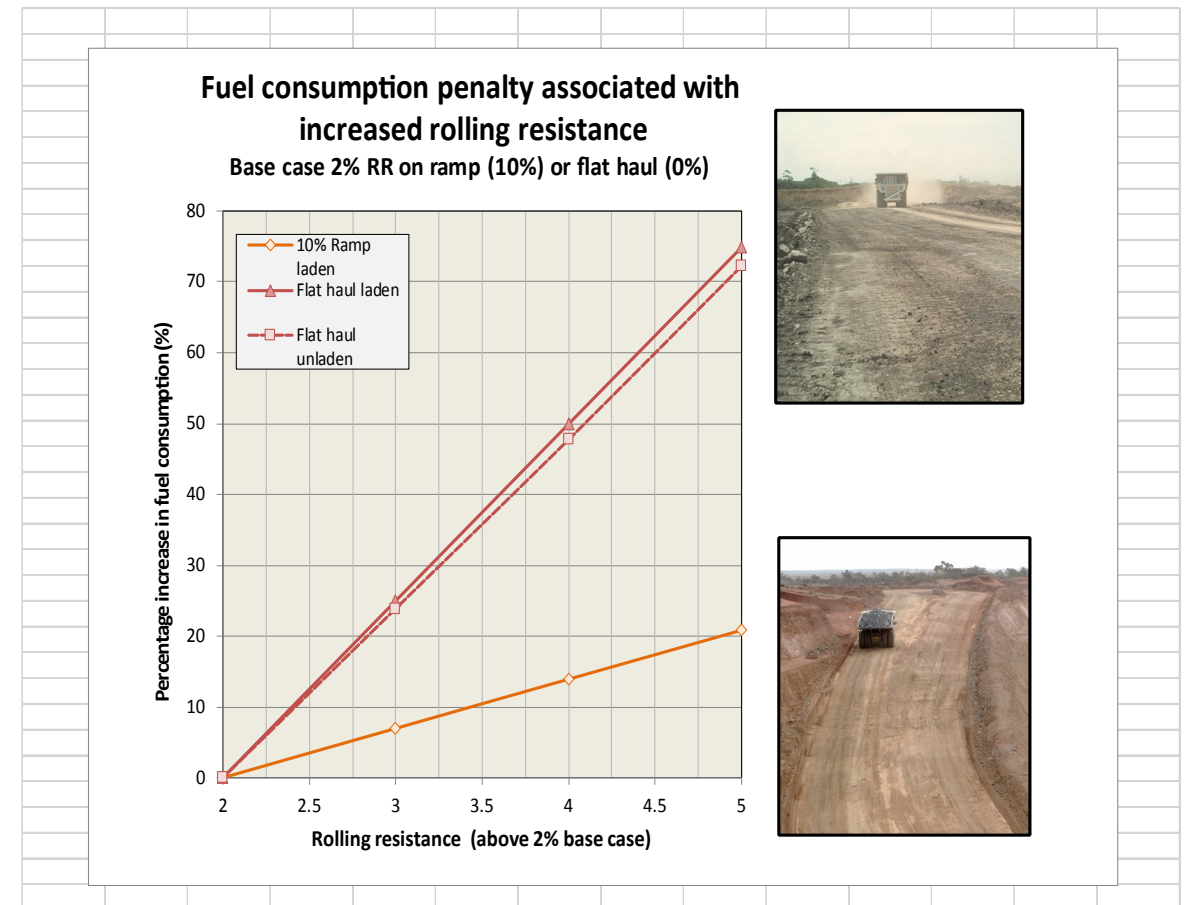
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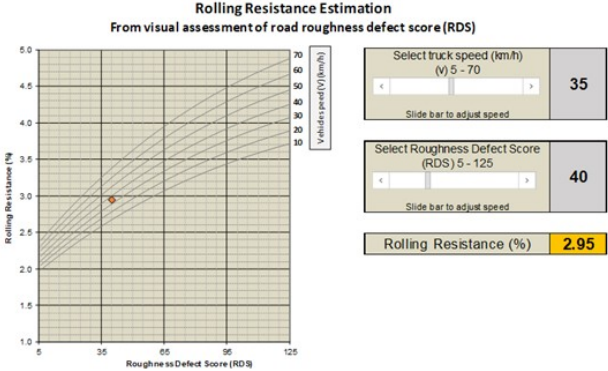


2

How does the road influence haulage?
 What's the role of rolling resistance in haulage operations?

- Various ways to assess rolling resistance;
 - Qualitative defect evaluation

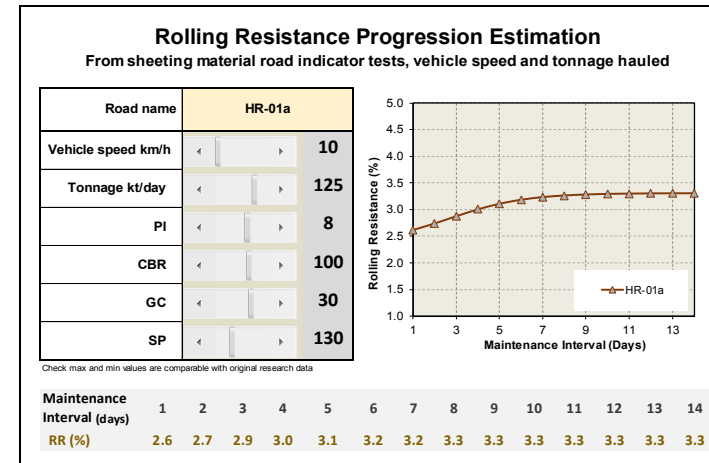
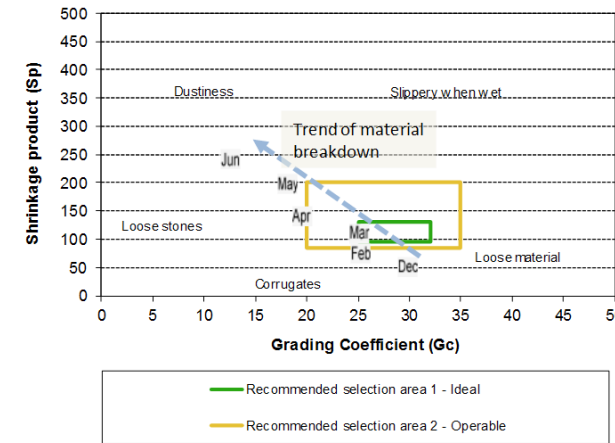
MINE HAUL ROAD FUNCTIONAL AND ROLLING RESISTANCE EVALUATION						
Complete defect degree and extent ratings. Add comments on drainage and/or erosion. Reporting sheets (4) are automatically created.						Back to Start
DATE	27-December-2017		EVALUATOR	AJT		
ROAD			TRUCK SPEED km/h/r	35		
LOCATION			TRAFFIC kt/day	100		
DEFECT	FUNCTIONALITY			ROLLING RESISTANCE		
	DEGREE (1-5)	EXTENT (1-5)	DEFECT SCORE	DEGREE (1-5)	EXTENT (1-5)	DEFECT SCORE
Potholes	4	4	16	4	4	16
Corrugations	1	2	2	1	2	2
Rutting	2	4	8	2	4	8
Loose material	2	4	8	2	4	8
Stoniness - fixed	3	2	6	3	2	6
Dustiness	1	2	2	TOTAL ROUGHNESS SCORE (RDS) 40		
Cracks - longitudinal	2	3	6			
Cracks - slip	4	5	20			
Cracks - circ	4	5	20			
Skid resistance - wet	1	2	2			
Skid resistance - dry	1	2	2	Rolling Resistance (%) 3.0		
Road Compliance Rating (%) 67			Rolling Resistance (%) 3.0			
Fair			Poor Fair Good			



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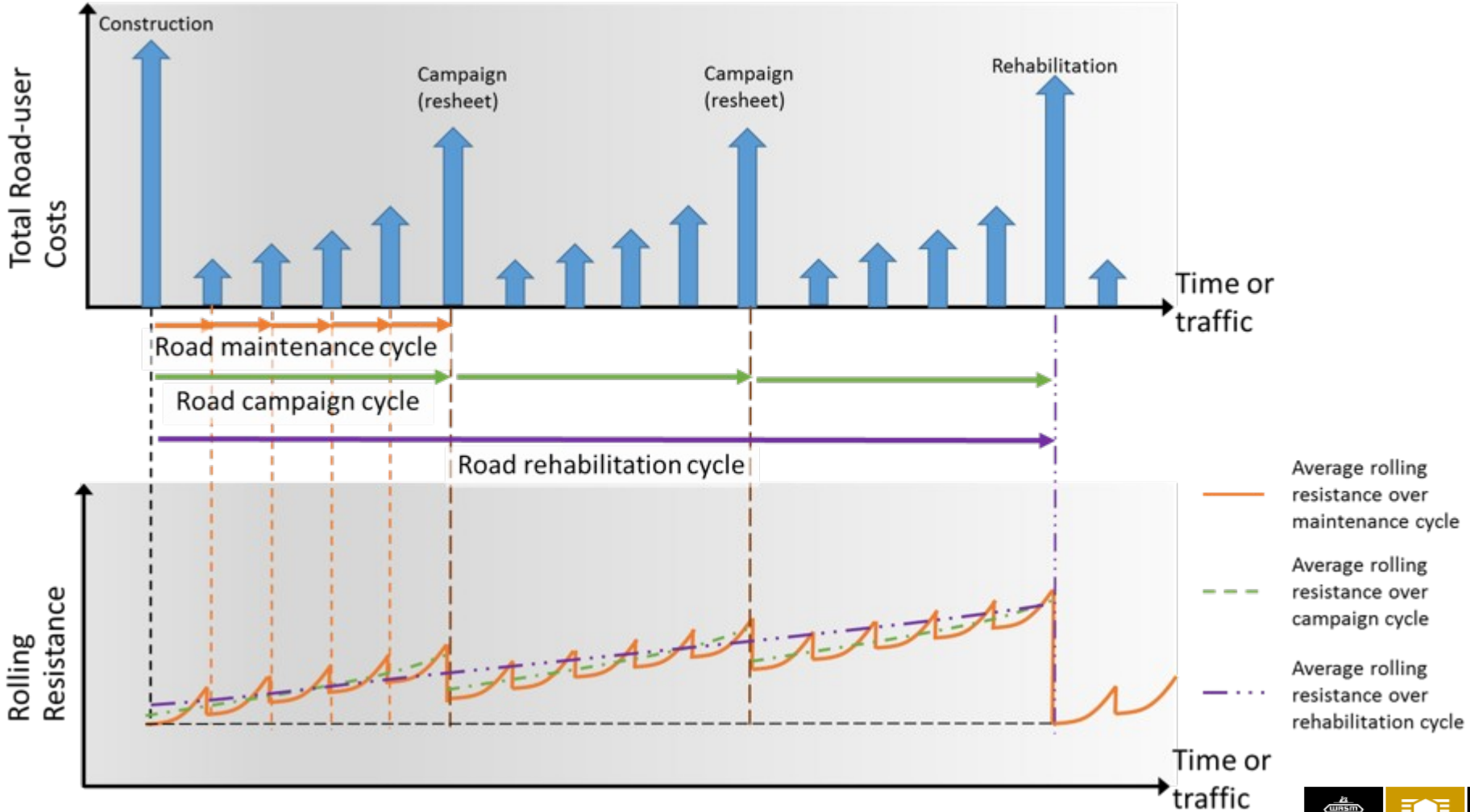
- Various ways to assess rolling resistance;
 - Qualitative defect evaluation
 - Quantitative wearing course testing



3

Do we want to fix our roads?

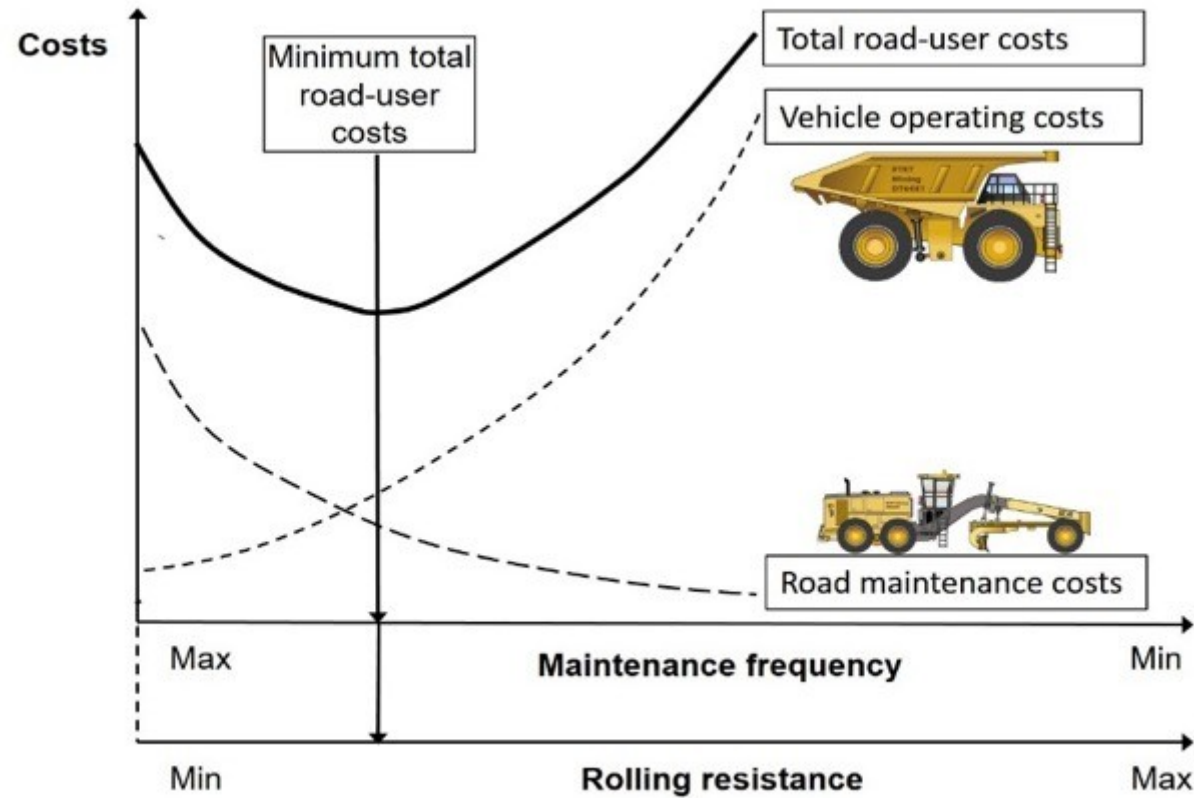
How to justify expenditure on road improvement



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Do we want to fix our roads?

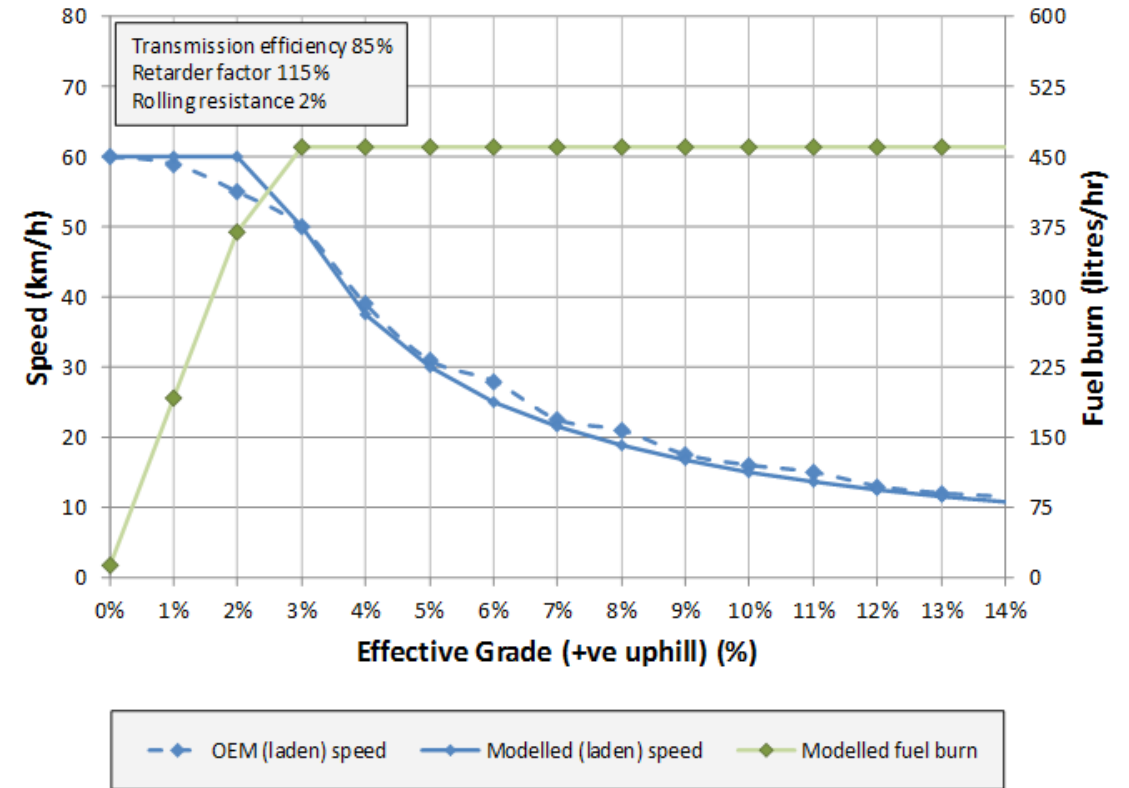
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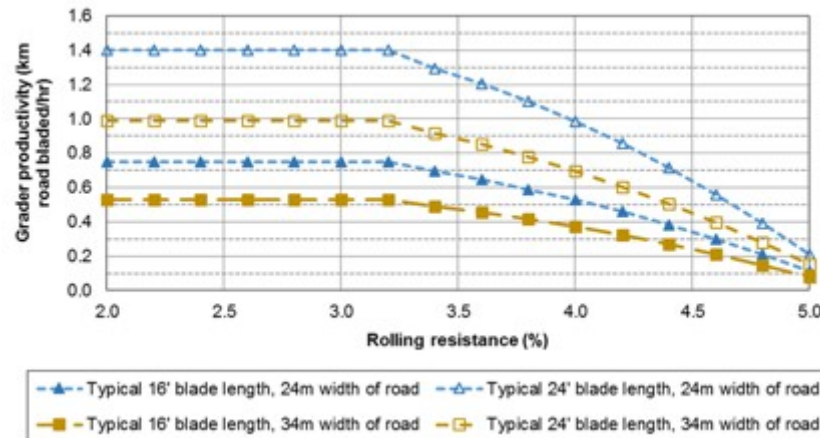
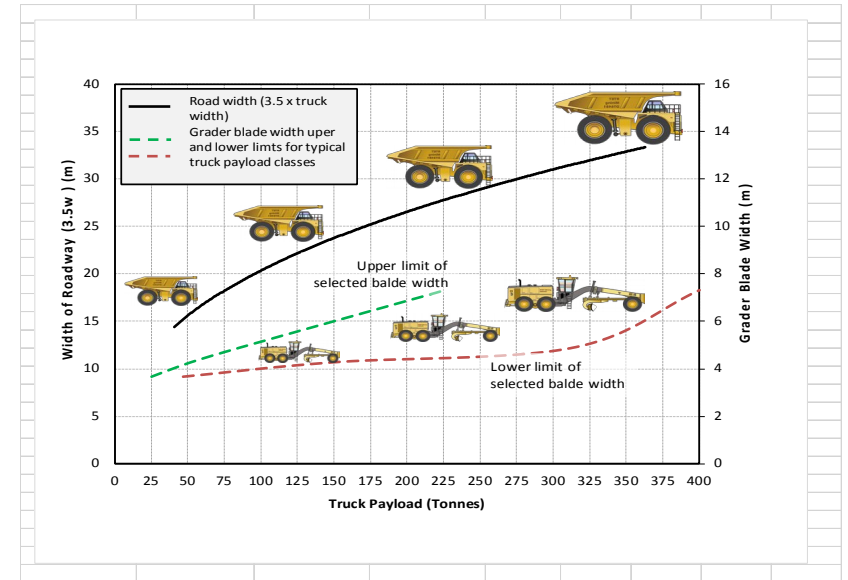
- Split haul into similar segments;
 - ✓ haul road geometry (width, grade)
 - ✓ sheeting material type and
 - ✓ daily tonnages.
- Cooper equations – reliable first approximation to model truck speeds and fuel burn.



3

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

- Cost models for;
 - ✓ Tires
 - ✓ Maintenance and spares
 - ✓ Labor
- Road maintenance costs



4

What's the value-add for road improvement?
Simple costing exercise to evaluate value-add of road improvement

■ Example case-study;

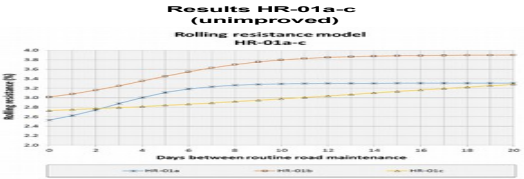
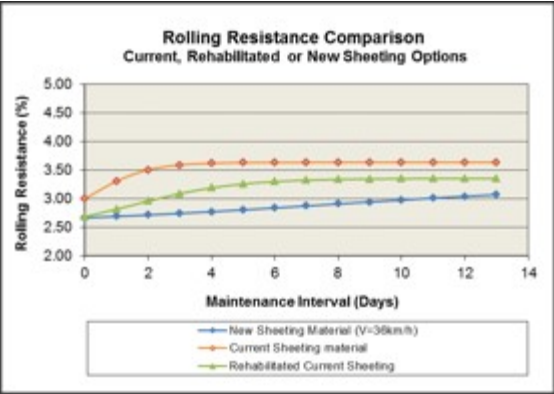
- Haul truck data;
 - GVM, EVM, Engine power etc.
 - Age, replacement cost etc.
- Road maintenance data;
 - Equipment numbers
 - Blade width, water cart capacity
- Generic data;
 - Unit costs
 - Productivity
 - Utilisation, availability etc.

Road segment data	HR-01a	HR-01b	HR-01c
Road length (m)	2,160	1,800	1,200
Width (m)	35	35	35
Grade (% uphill +ve)	10	0	3
Vehicle speed estimate (km/h)	10	50	35
Daily tonnage (kt)	125	125	125
Shrinkage product	130	60	170
Grading coefficient	70	18	25
Plasticity index	8	6	4
CBR (%) 100% Mod AASHTO	100	80	80

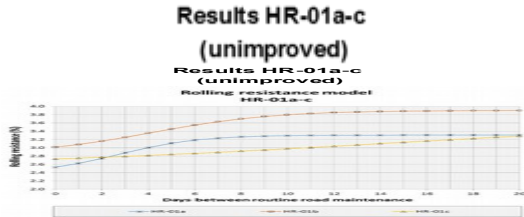
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What's the value-add for road improvement?
 Simple costing exercise to evaluate value-add of road improvement

- Example case-study;
 - 'Unimproved –vs- Improved'
 - Methodology to identify improvement business case



Results HR-01a-c
 (HR-01a HR-01b resheeted)

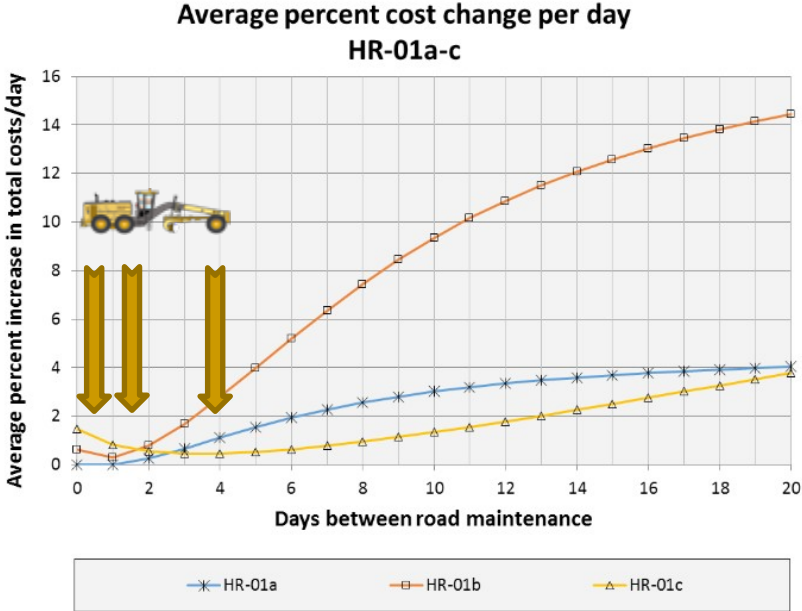


Results HR-01a-c
 (HR-01a HR-01b resheeted)

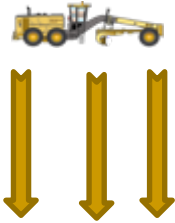
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**Results HR-01a-c
(unimproved)**



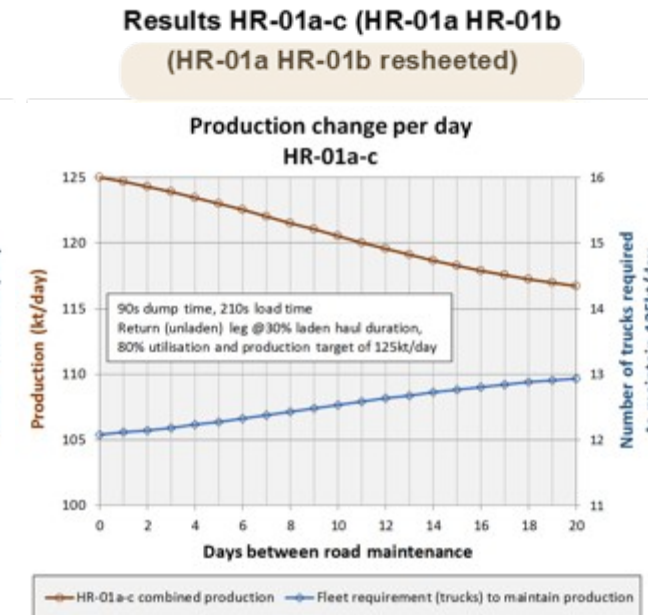
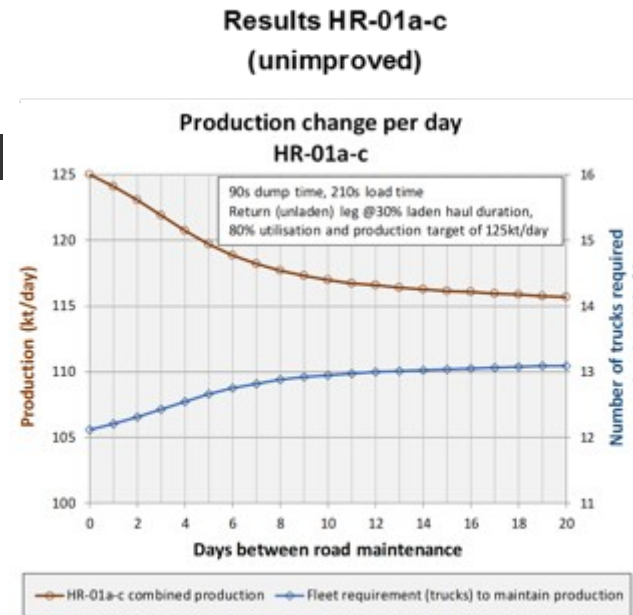
**Results HR-01a-c (HR-01a HR-01b
(HR-01a HR-01b resheeted))**



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Simple costing exercise to evaluate value-add of road improvement

- 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



Roger J. Thompson
Rodrigo Peroni
Alex T. Visser



 CRC Press
Taylor & Francis Group
A BALKEMA BOOK

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

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