

Can 'big data' answer the big question – how do my haul roads perform?

Haulage & Loading 2017

Phoenix, Az., USA

RJ Thompson
May 2017

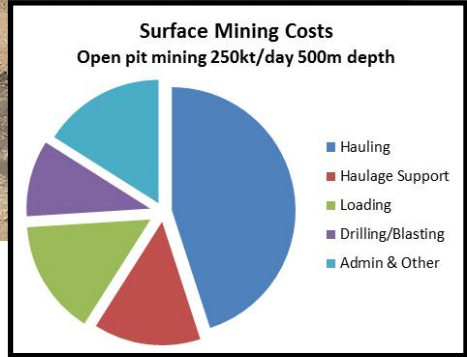
Overview

- 1** What's the problem?
Why haul road performance is critical to efficient and productive haulage
- 2** How can 'big data' help?
How existing data can assist us to manage haul roads in real-time
- 3** Analytics
Identifying and combining data to measure real-time rolling resistance
- 4** Application Scenario
Can 'big-data' analytics support real-time road management practices?

1

What's the problem?

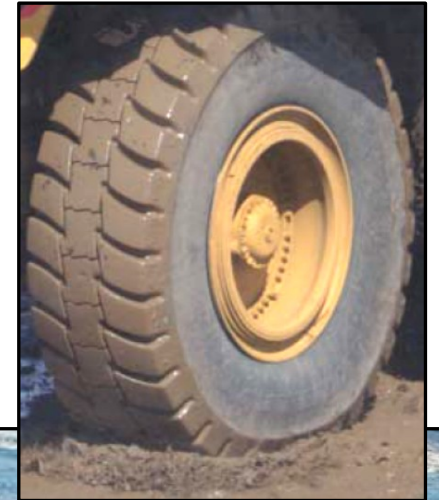
Why haul road performance is critical to efficient and productive haulage



① What's the problem?

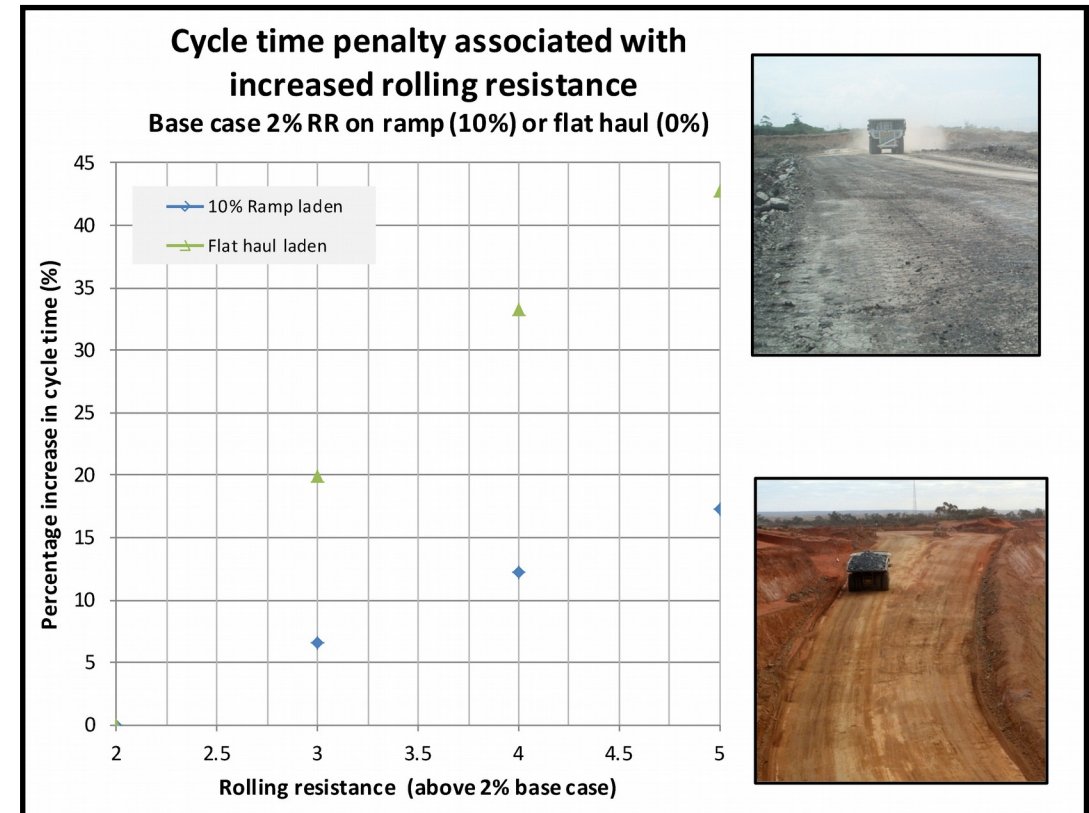
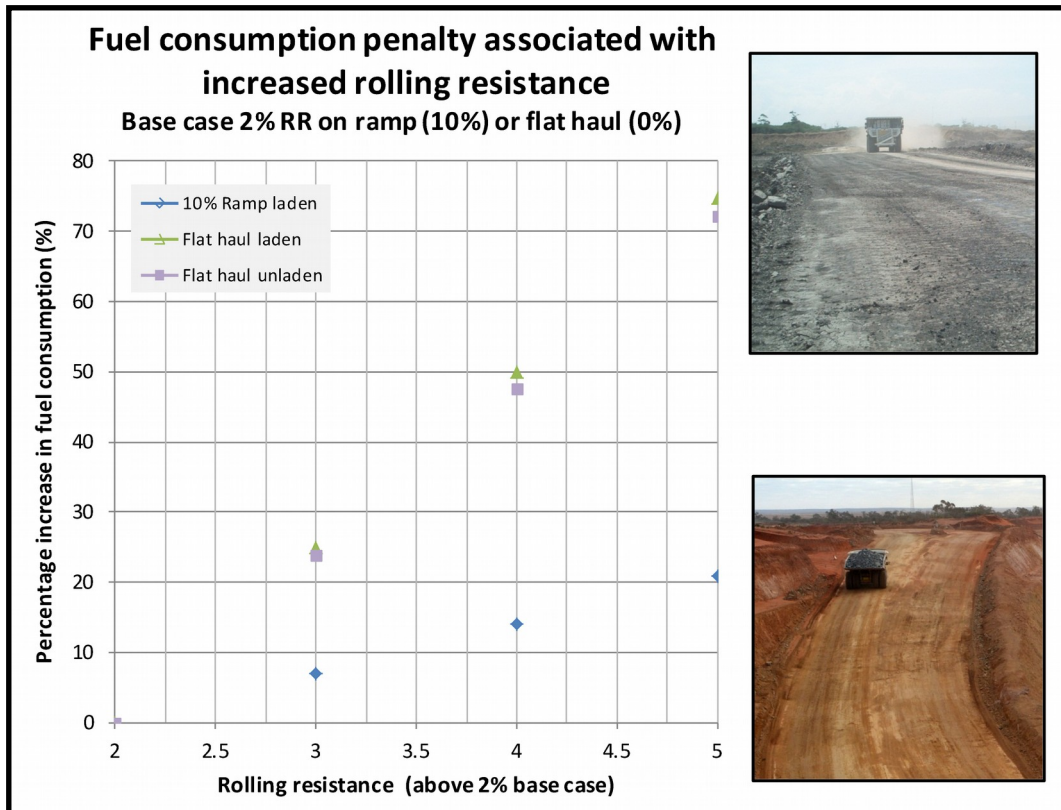
Why haul road performance is critical to efficient and productive haulage

- Primary measure of mine road 'performance' is often based on 'rolling resistance'
 - Frequently the focus of road improvement strategies and cost benefit evaluations, but...
 - ... what effect does rolling resistance exert on haulage productivity and costs?



1 What's the problem?

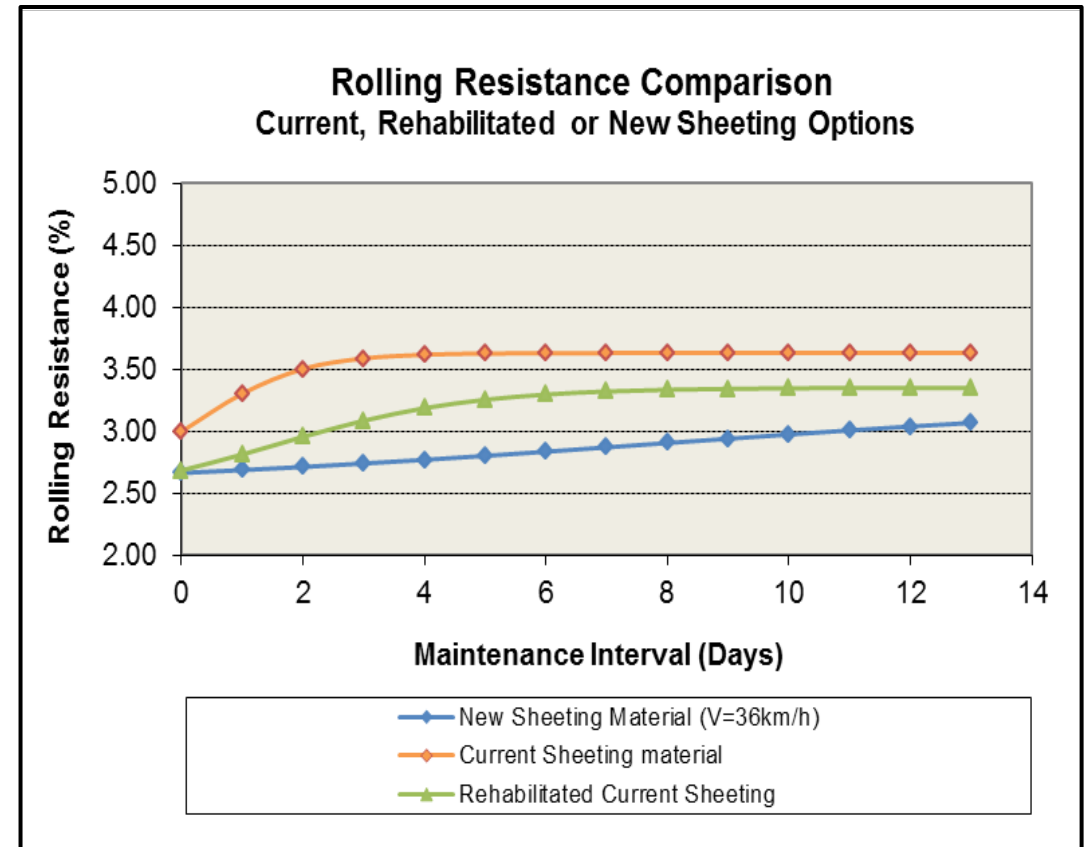
Why haul road performance is critical to efficient and productive haulage



1 What's the problem?

Why haul road performance is critical to efficient and productive haulage

- Value Proposition – the benefit of improved haul road performance on operations?
 - Haul cycle time improvements, increased tph, t.km/hr
 - Reduced fuel consumption, decreased unit costs
- But, where and how should
 - Routine road maintenance or
 - Rehabilitation campaignsbe focused for maximum economic benefit?



2

How can 'big data' help?

How existing data can assist us to manage haul roads in real-time



Using Proof Engineering's road condition monitoring tools and website: <http://www.mapping.ideame.com.au/home/>.

② How can 'big data' help?

How existing data can assist us to manage haul roads in real-time

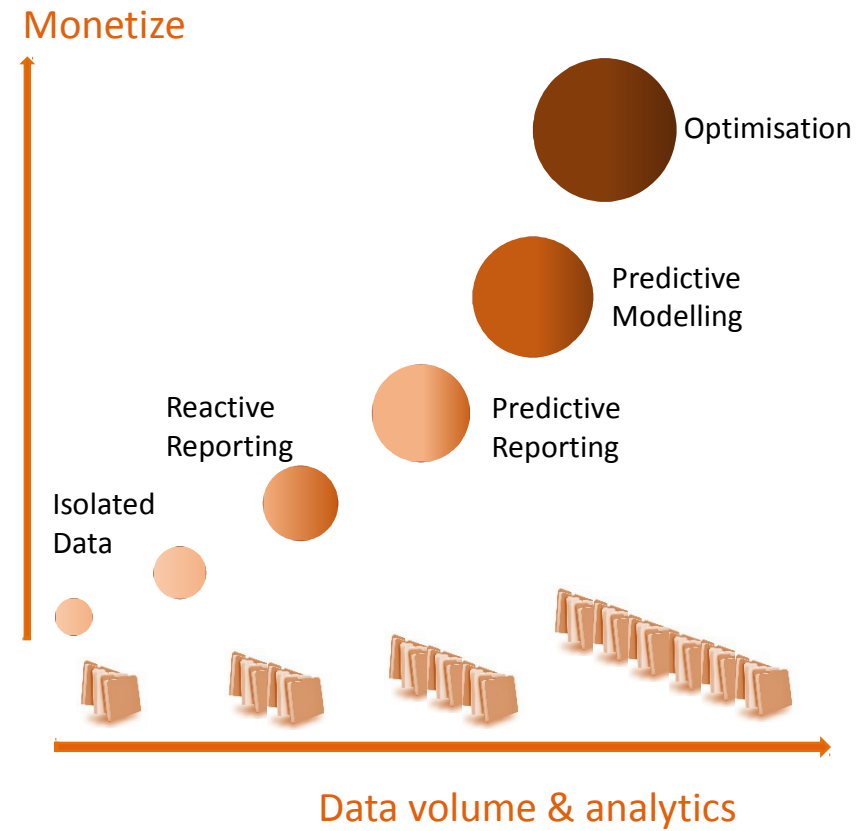
- Big data analytics - the process of examining large and varied data sets to uncover 'hidden' data, establish new correlations and performance measures that can help operations to;

•Optimize

•Monetize

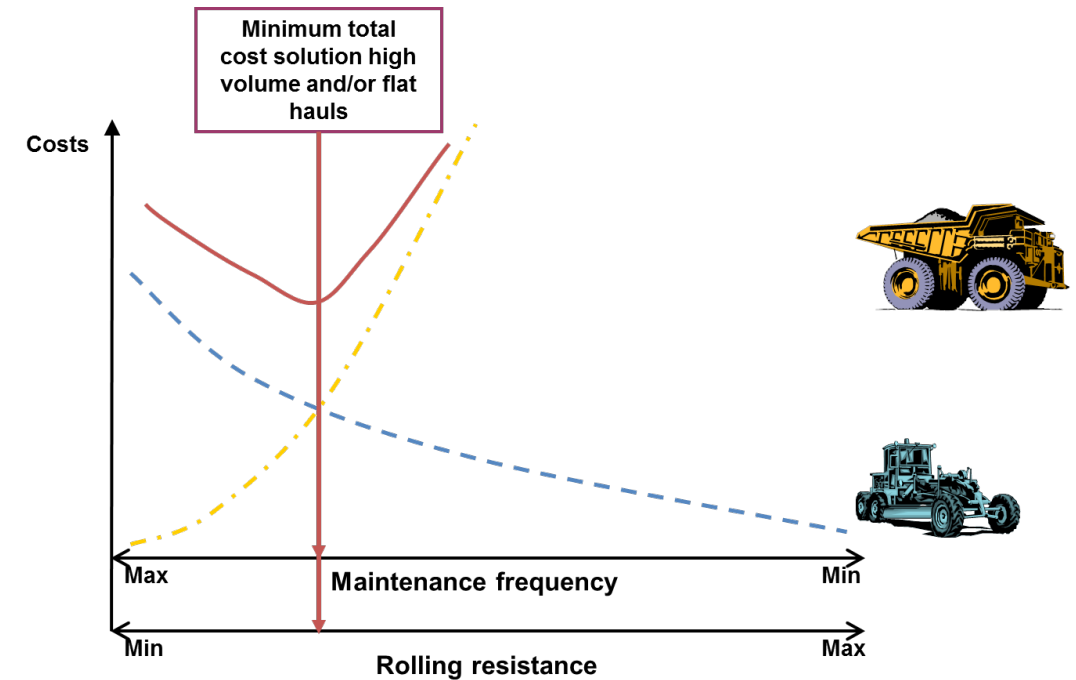
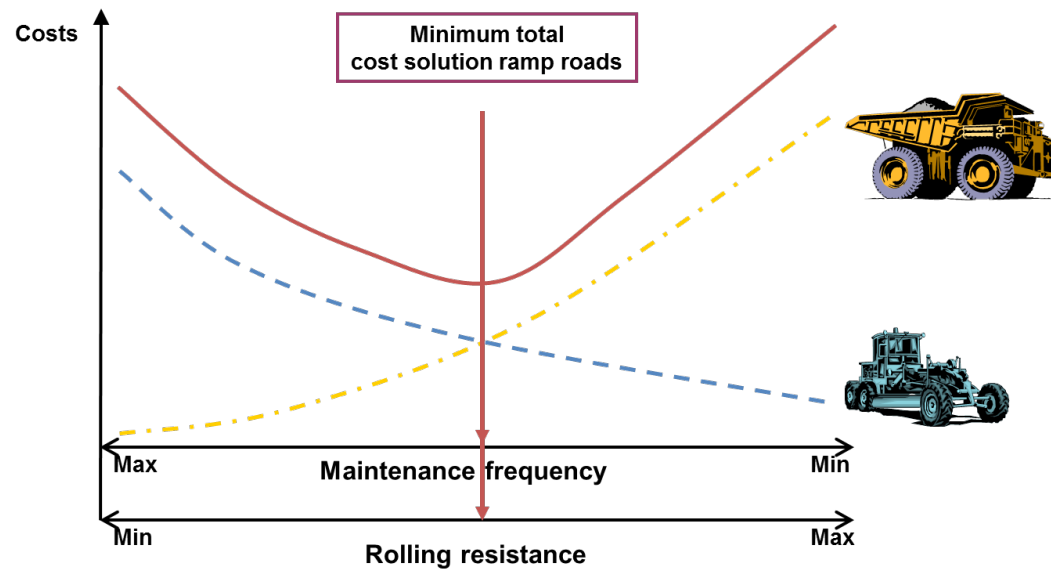
•Metamorphose

} **Value**



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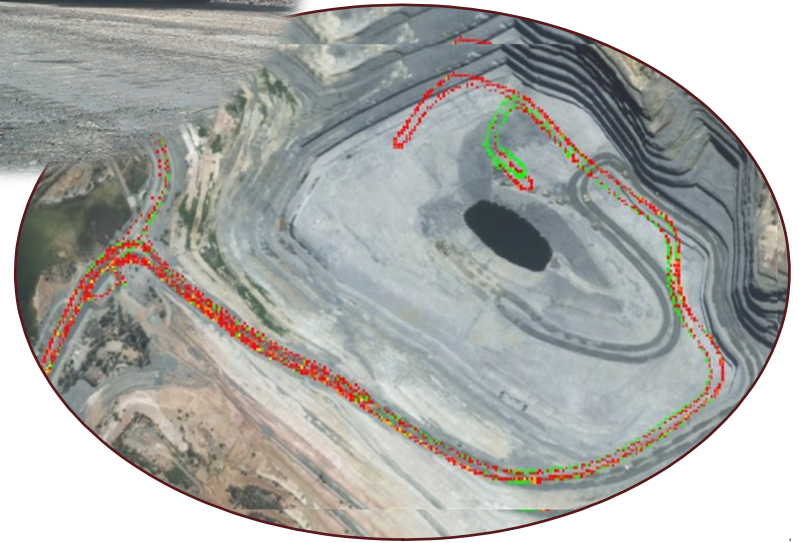
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3

Analytics

Identifying and combining data to measure real-time rolling resistance

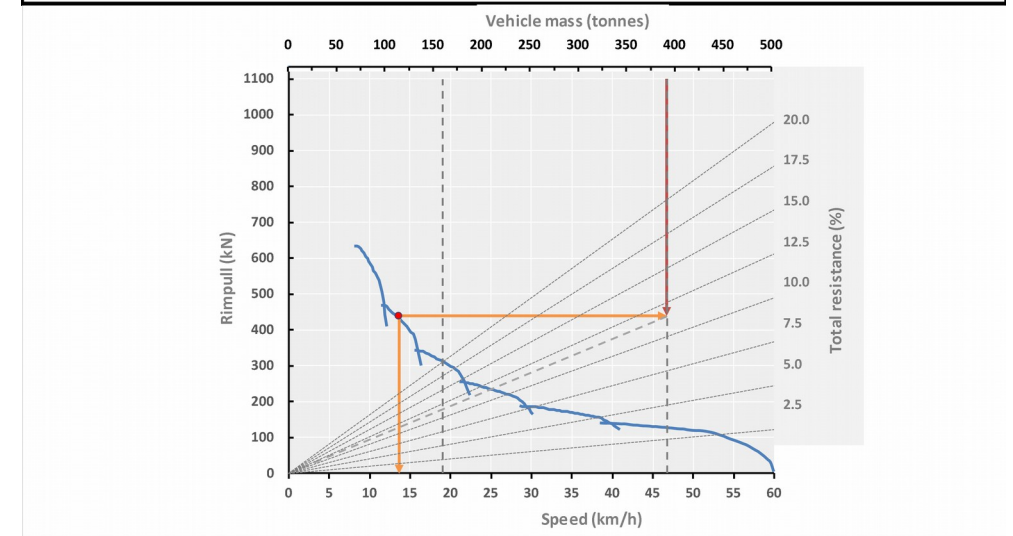


3 Analytics

Identifying and combining data to measure real-time rolling resistance

- Big data analytics - the process of examining large and varied data sets;
 - Haul truck RPM, speed, rimpull, gradeability performance model

ROLLING RESISTANCE ESTI						
From AEHQ6868-10 Engine CAT C17:						
ENGINE and TYRE DATA				OPERATING DATA		
Gross Actual Engine Power kW	RPM @ Gross Actual Engine Power	Operating Limit RPM	Wheel radius (m)	Gear (D1-D6)	RPM	Mass (tonnes)
SAE J1995	SAE J1995	Limiting RPM	Static loaded radius	Range 1-6 (No TC)	OK	Range 100-400t
2001	1750	1923	1.59	D2	1598	390

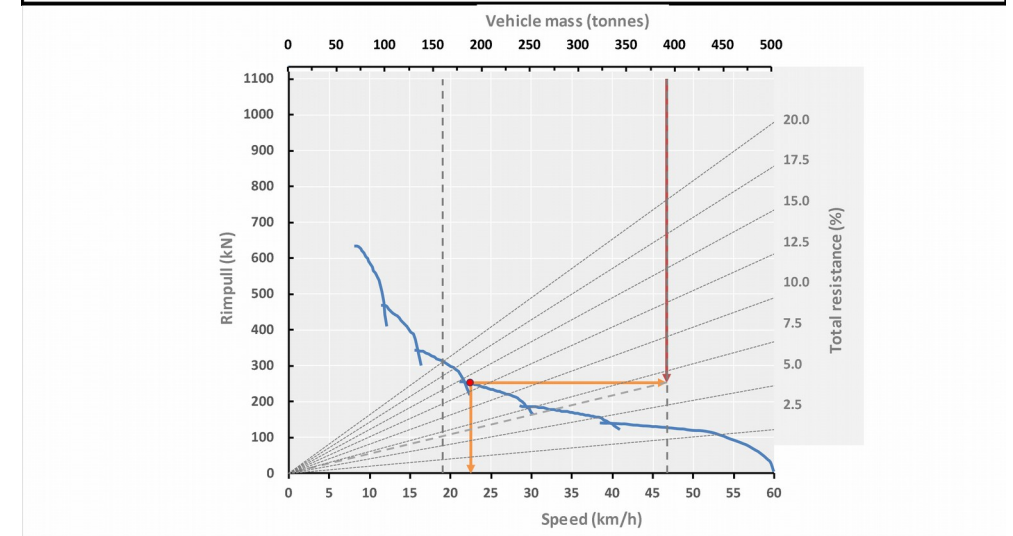


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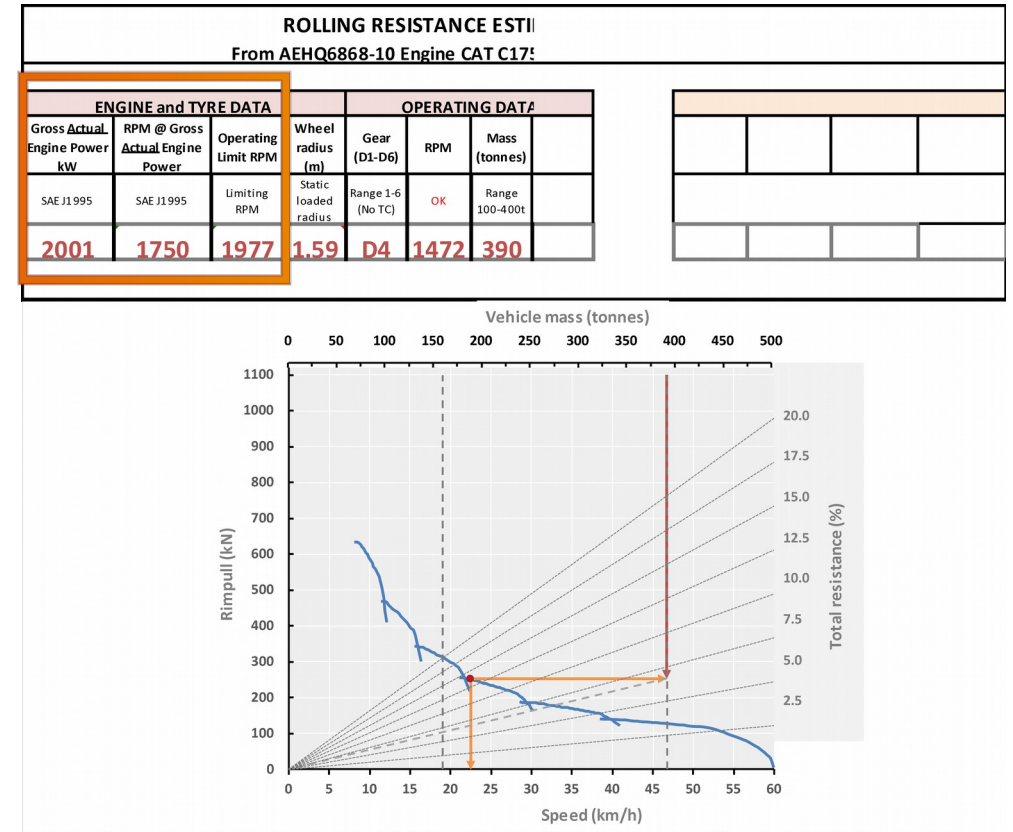
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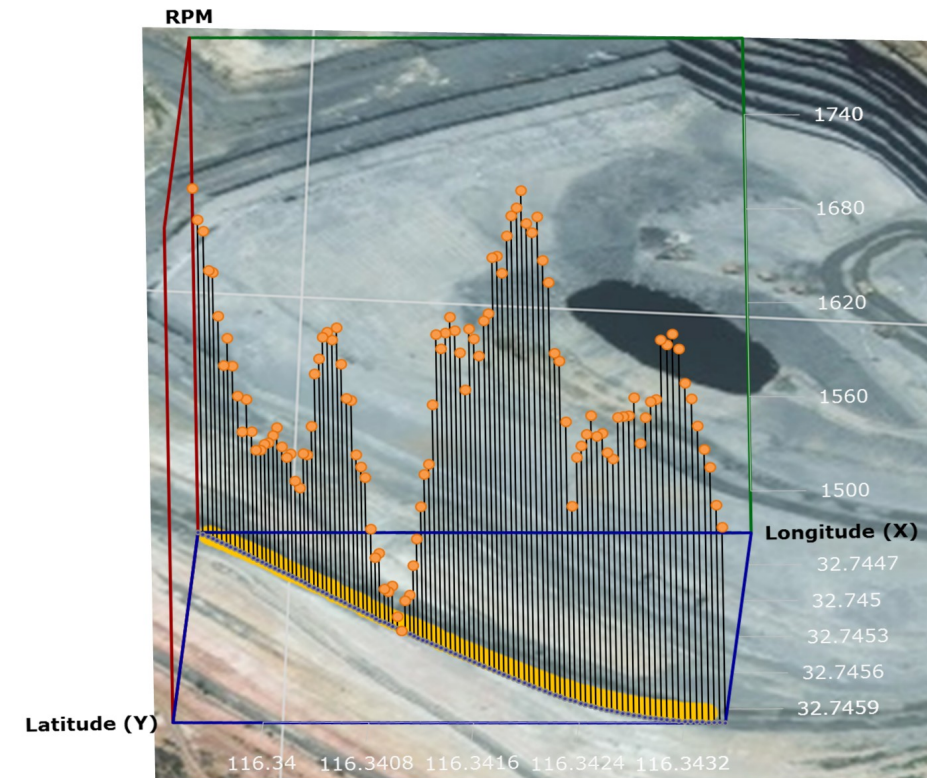
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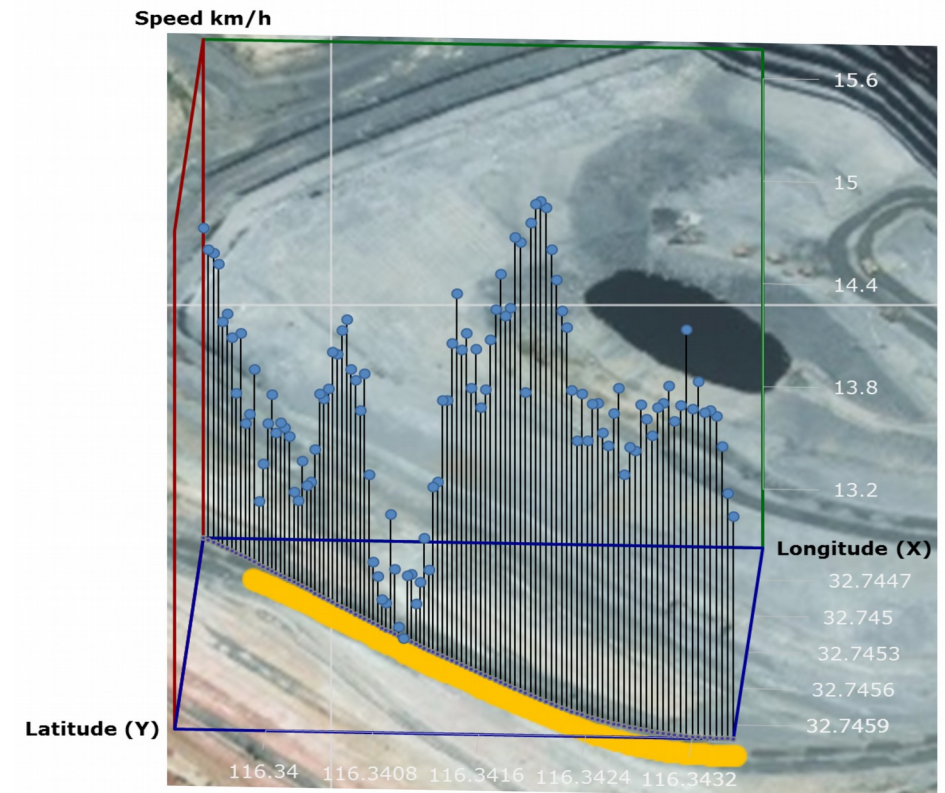
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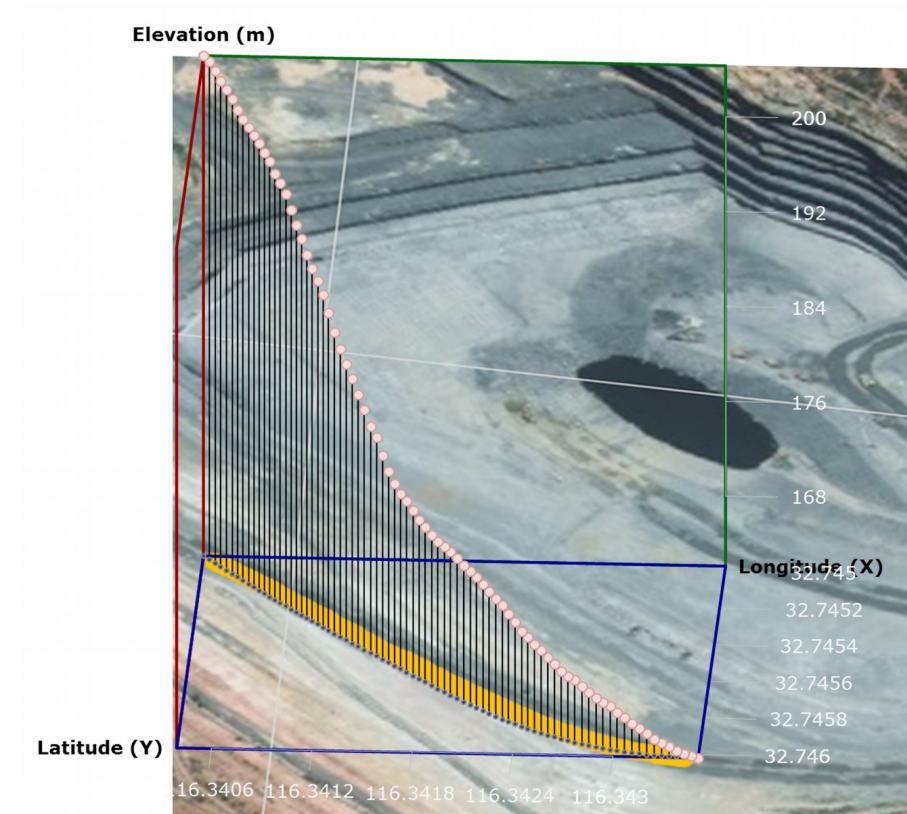
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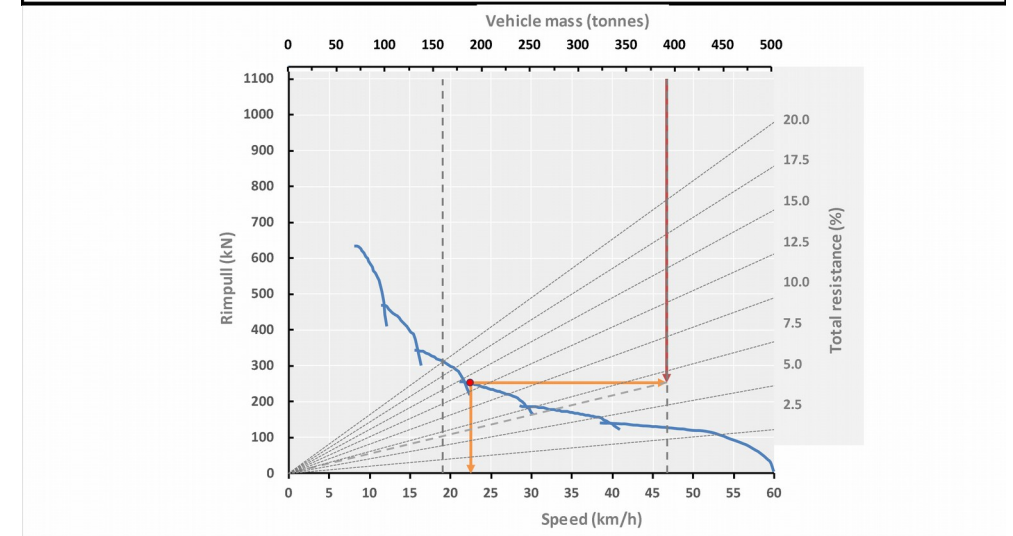


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4

Application Scenario

Can 'big-data' analytics support real-time road management practices?

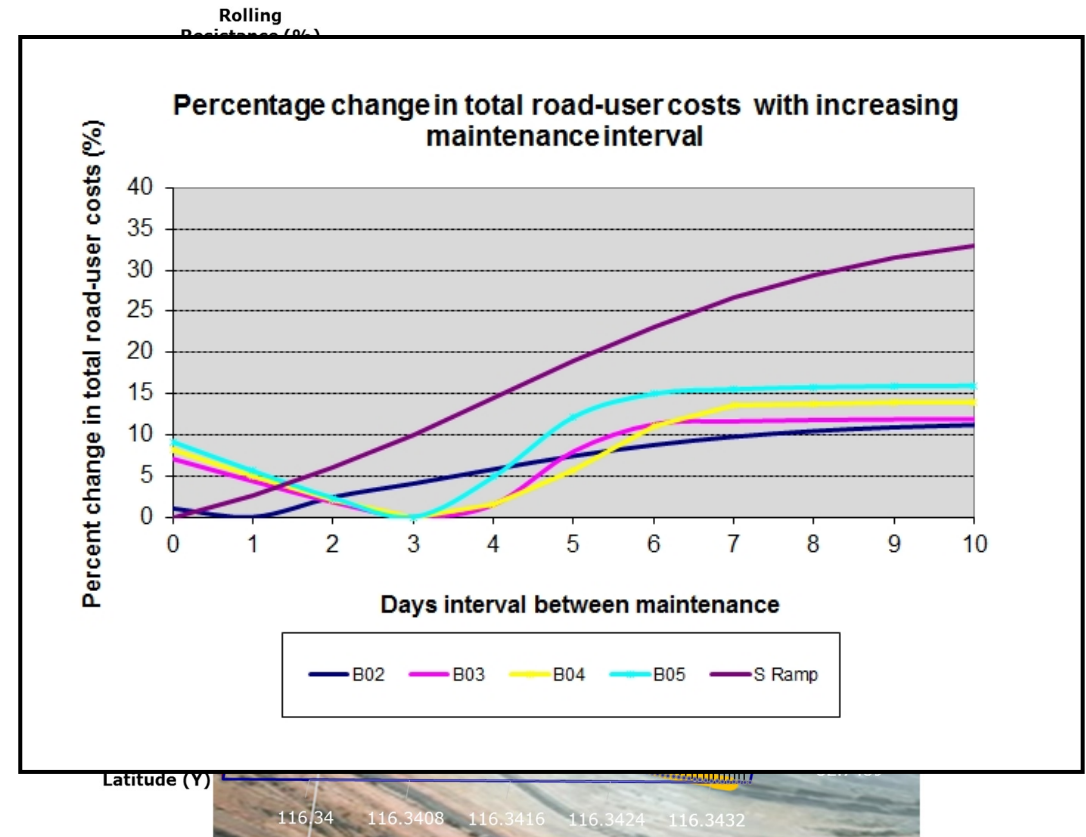


Engineering & Mining Journal, vol 210, n5 June 2009. Mining Media Ltd.

4 Application Scenario

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- Big data analytics - the process of examining large and varied data sets;
 - Haul truck RPM, speed, rimpull, gradeability performance model
 - Real-time truck performance data from *multiple* operating units
 - Survey profile data
 - Mine planning data;
 - Real-time traffic volumes and
 - future material movements
- Combining and analysing the various data sources to deliver real-time haulroad performance data.



Summary

1

Why is haul road performance is critical?

↑1%RR Ramps
↓7% KPH
↑7% Fuel burn

↑1%RR Flat hauls
↓20% KPH
↑25% Fuel burn

2

Can existing data assist us to manage haul roads in real-time?

Data exists but a 'big data' approach is required to produce new insights into road performance

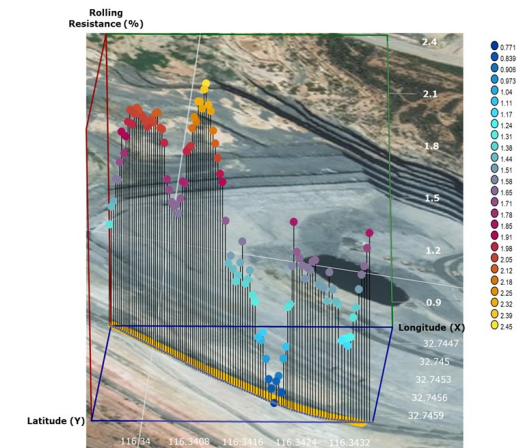
3

Analytics to identify and measure real-time rolling resistance.

Fundamental models indicates methodology is sound.
Need to consider volume, velocity, variety and veracity of data sources

4

Can 'big-data' analytics enhance real-time road management?



- Acknowledgements
 - This work forms part of the Mining3 Project 'S103: Improving Resilience of Mine Haul Roads - Delivery 24x7 trafficability and Increased Up-time'
 - Newmont USA Ltd for support of this research and provision of site facilities and data
 - Newmont Australia site staff for their assistance with testwork and haul road monitoring
 - Proof Engineering for real-time road condition monitoring software and hardware systems
 - Resolution Systems (MaxMine) for access to and data reduction of real time truck fleet operating data sets
 - Curtin University.