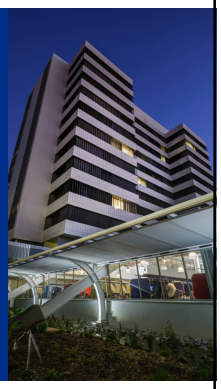
SARF RIDING QUALITY COURSE

5 November 2015



Contents

- 8:00 to 9:00
  Introduction to road riding quality
  Definitions and concepts involved in riding quality
- 9:00 to 10:00
  Measuring riding quality
- 10:30 to 12:30
  Analysing riding quality data
- **13:30 to 15:00**
  Interpreting riding quality data
  Riding quality and Vehicle-Pavement Interaction
- 15:30 to 16:30
  Effects of riding quality on road users and costs

Interpreting riding quality data

- What do the data mean
- What do the data not mean
- Examples of erroneous interpretation
- Examples of similar IRI, different roads etc
- Analysis of base effects on final surfacing effects
- Evaluation of pre-milling effects on after placement riding quality

What do the data mean / not mean

- Indication of riding quality for certain vehicle at certain speed
- Other vehicles may experience different
- Same vehicle at different speeds and loads will experience different
- Statistic / indication for comparative purposes
- Changes over time

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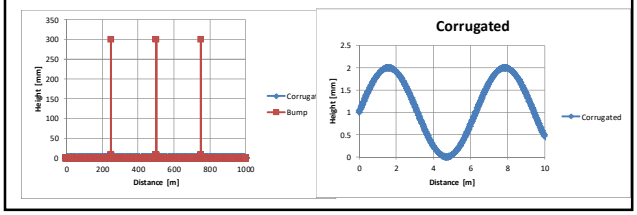
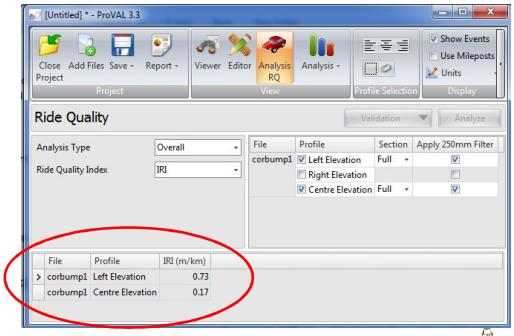
Examples of erroneous interpretation

- Flat road with a major bump
- Corrugated road
- Requirement to conduct spectral analysis



Examples of erroneous interpretation



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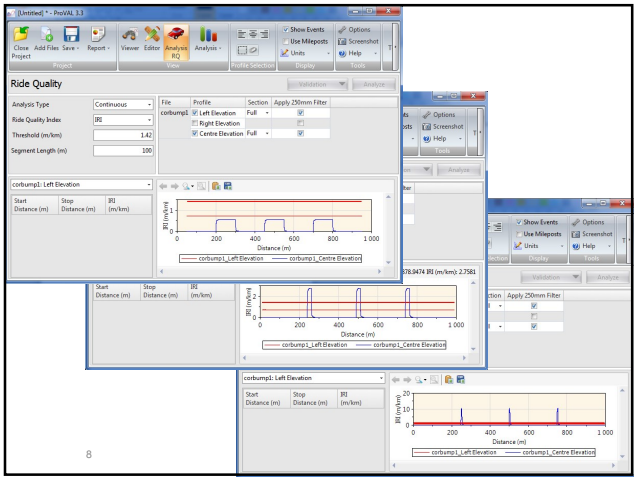
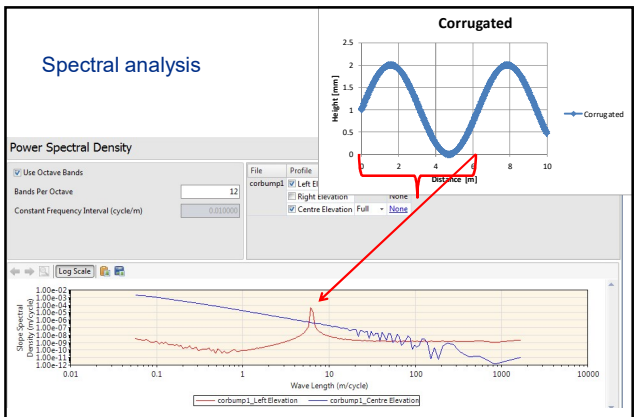


Spectral analysis



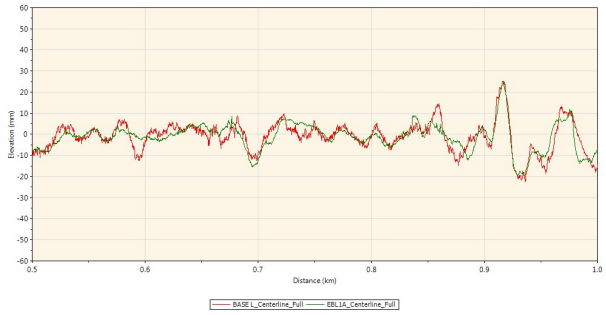
Does it make sense?

Base and surfacing example

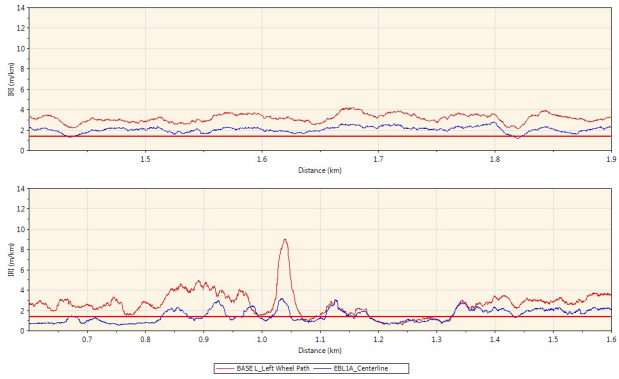
Base and surfacing example

- Data from South African project
- Initial analysis of data
- What is the best that can be done in terms of final surfacing riding quality in relation to base riding quality
- Factors
  - Base RQ
  - Surfacing thickness
  - Overlay properties (aggregate size etc)
  - Compaction effort

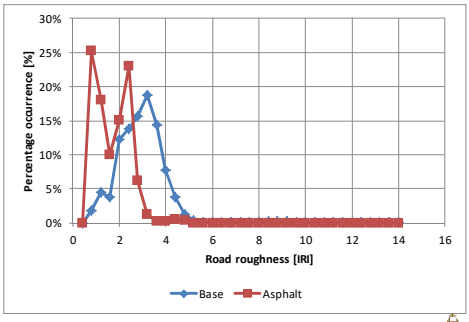
Base and surfacing example - Profiles



Base and surfacing example – Riding Quality



Distribution of roughnesses



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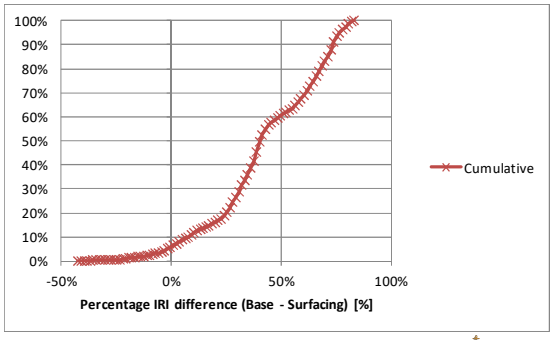
Cumulative distribution of improvements



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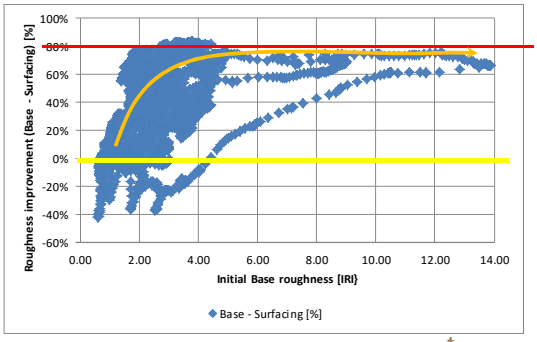
Improvements vs Base roughness



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Mill and overlay example

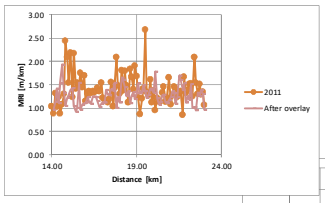
17

Mill and overlay example

- Data from South African project
- Similar effort initiating in California
- Initial analysis of data
- What is the best that can be done in terms of final surfacing riding quality in relation to initial riding quality
- Factors
  - Initial RQ
  - Milling thickness
  - Overlay thickness
  - Overlay properties (aggregate size etc)
  - Compaction effort

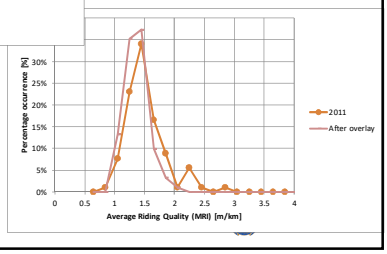
18

Mill and overlay example



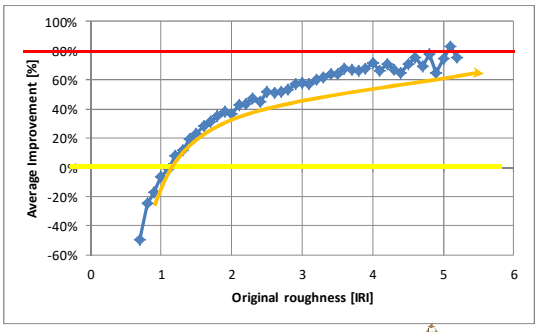
Difference in Riding quality

	Before milling	After construction
Average	1.42	1.27
Min	0.85	0.92
Max	2.68	1.94



19

Improvements vs Original roughness



20

Riding quality and Vehicle-Pavement Interaction

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Riding quality and Vehicle-Pavement Interaction

- 4 standard components in V-PI frameworks
  - pavement profile;
  - vehicle;
  - pavement structure, and
  - decision making process
- Viewed as main components
  - cause of the problem (pavement profile);
  - load history generator (the vehicle);
  - component on which the forces are exerted (the pavement structure), and
  - final evaluation criteria (decision making process).

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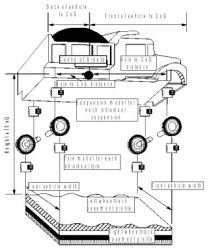
Parameters to incorporate

- Tyres
- Suspension
- Vehicle dimensions
- Vehicle loads
- Vehicle speed
- Spatial repeatability effe



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V-PI and Riding quality effects

- State of Logistics examples – last section
- SARF paper examples potholes
- KZN bridge example
- Moving Dynamic Loads

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SARF / CAPSA paper examples

What is the problem

- Economy dependent on good transport
- Uneven roads affect dynamic tyre loads
- Therefore
- A good economy depends on adequate road network management and maintenance
- or
- ***The price of your TV / bread / beer depends on the effectiveness of your PMS***

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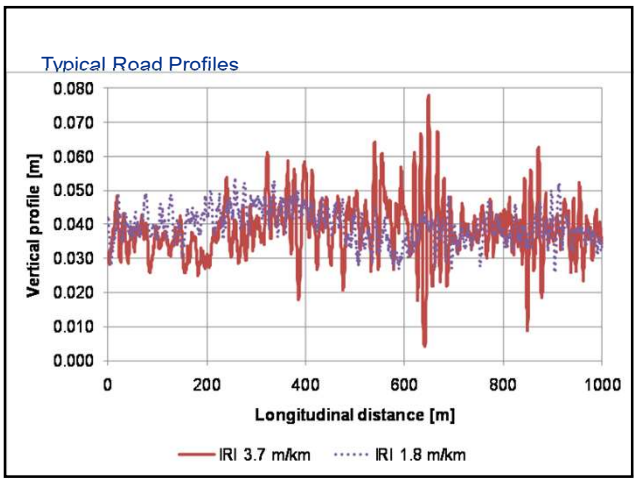
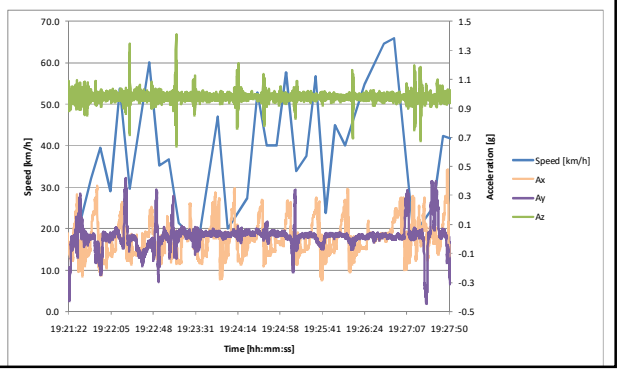
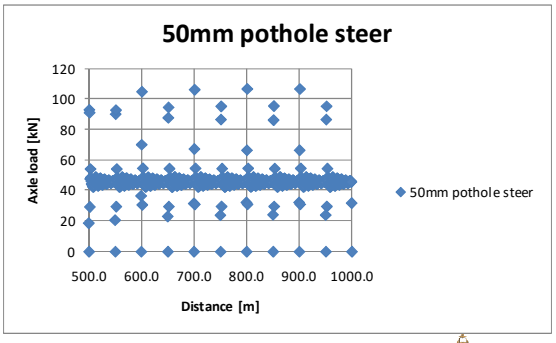


Measured accelerations due to road unevenness



TruckSim Simulated Axle load
Rigid 2-axle truck



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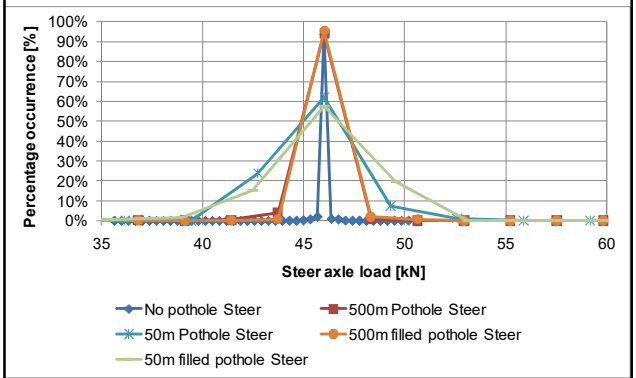
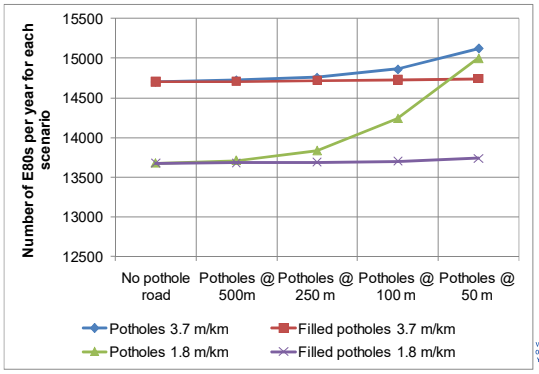
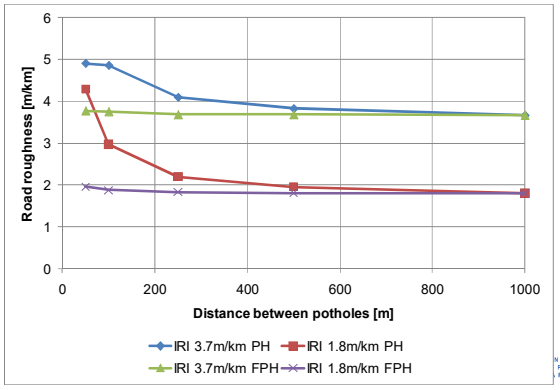
Distribution of Steer Axle Loads



E80s Generated per Year

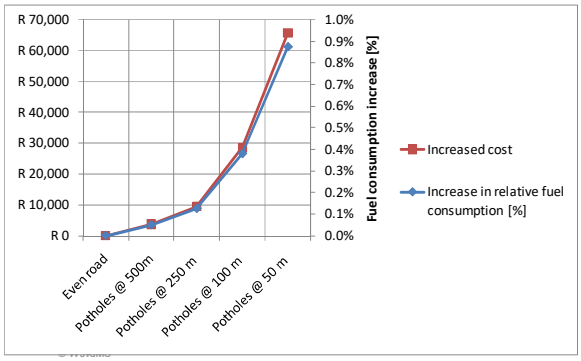


Effect of Potholes on Road Roughness



Effect of potholes on fuel consumption

100 vehicles, 250 days, 300 km, R8/l



Conclusions

- Riding quality of roads deteriorate with use leading to increases in road roughness
- Increases in road roughness leads to increased dynamic loads and increased number of higher-than-average tyre loads
- This leads to a decrease in the potential service life of a pavement
- Situation can be averted through adequate, planned and timeous maintenance of the road

35
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Conclusions

- Presence of potholes in road causes
  - Deterioration in road roughness
  - Increase in dynamic loads and excessive overloads
- Maintenance of these potholes (filling them) **assists** in
  - Improving road roughness
  - Decreasing excessive overloads
- Road with filled potholes generate less excessive overloads than road with open potholes
- Effect of good maintenance practices is beneficial

Single Bottom-line

Best riding quality and lowest excessive overloads
- Road without any additional unevenness caused by open or filled potholes

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- Medical analogy
  - Fever
  - Blood pressure
- It does not tell you the exact type of illness
- It tells you something is wrong and needs attention

KZN bridge deck joint example

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Bridge deck joint uneveness

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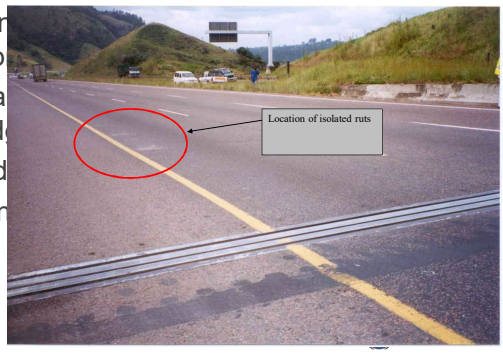

Generated Moving Dynamic Loads

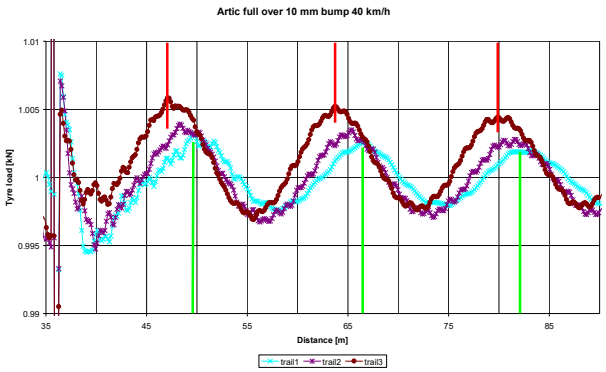

Table 2: Summary of percentages of average for Moving Variable Loads calculated for the 123 vehicle and a 10 mm bump.

Percentile	Steer axle	Drive axle 1	Drive axle 2	Trail axle 1	Trail axle 2	Trail axle 3
Minimum [%]	96.92%	97.79%	97.50%	95.53%	95.44%	95.43%
25th percentile [%]	99.84%	99.82%	99.83%	99.87%	99.84%	99.92%
50th percentile [%]	100.00%	100.00%	100.01%	100.00%	100.00%	100.11%
75th percentile [%]	100.16%	100.17%	100.14%	100.11%	100.15%	100.28%
Maximum [%]	108.77%	111.49%	110.21%	**112.14%**	111.43%	111.20%
Average [%]	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Coefficient of Variation [%]	0.63%	0.49%	0.55%	0.51%	0.50%	3.64%

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