LESSONS LEARNT FROM THE MEASUREMENT OF GRAVEL ROAD ROUGHNESS IN KWAZULU-NATAL

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Outline

• Introduction
• KZN Gravel Road Network
• Gravel Road Condition Assessments
• Measuring Road Roughness
• The Roughometer III
• Typical Roughness Results
• Limitations of Roughometer III
• Conclusions
Introduction

• Gravel roads play a vital role in the economy
• GRMS used to ensure they are maintained economically (strategic network analysis)
• Roughness (Riding Quality) is a crucial input parameter into a GRMS as a measure of gravel road condition
• Roughness measured via visual condition assessments are subjective
• Roughometer III provides less subjective alternative
## KZN Provincial Road Network

<table>
<thead>
<tr>
<th>Functional Class</th>
<th>Length (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paved</strong></td>
<td></td>
</tr>
<tr>
<td>Main Roads</td>
<td>7 090</td>
</tr>
<tr>
<td>District Roads</td>
<td>598</td>
</tr>
<tr>
<td>Local Roads</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total Paved</strong></td>
<td><strong>7 749</strong></td>
</tr>
<tr>
<td><strong>Unpaved</strong></td>
<td></td>
</tr>
<tr>
<td>Main Roads</td>
<td>6 075</td>
</tr>
<tr>
<td>District Roads</td>
<td>11 065</td>
</tr>
<tr>
<td>Local Roads</td>
<td>6 278</td>
</tr>
<tr>
<td><strong>Total Unpaved</strong></td>
<td><strong>23 418</strong></td>
</tr>
</tbody>
</table>

**Total KZN Provincial Network** 31 167

75%
Gravel Road Condition Assessments

- Visual condition assessments – TMH12
- Riding quality used as a measure of roughness
- Other factors affecting roughness also assessed.
- Manual rating usually in Degree and Extent.
Estimating Riding Quality

<table>
<thead>
<tr>
<th>Rating</th>
<th>Descriptor</th>
<th>Comfortable, Safe Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Good</td>
<td>&gt; 100km/h</td>
</tr>
<tr>
<td>2</td>
<td>Good</td>
<td>80 - 100km/h</td>
</tr>
<tr>
<td>3</td>
<td>Average</td>
<td>60 - 80km/h</td>
</tr>
<tr>
<td>4</td>
<td>Poor</td>
<td>40 - 60km/h</td>
</tr>
<tr>
<td>5</td>
<td>Very Poor</td>
<td>&lt; 40km/h</td>
</tr>
</tbody>
</table>
International Roughness Index (IRI)

• “The deviation of a surface from a true planar surface with characteristic dimensions that affect vehicle dynamics and ride quality” (*ASTM E867*)
International Roughness Index (IRI)

- Roughness measured in terms of IRI in units of m/km or mm/m
- IRI based of quarter-car model
- IRI influences vehicle delay and maintenance costs
- Also influences fuel consumption.
- IRI therefore good measure of road condition.
## Indicative IRI Scale

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Approx. IRI (m/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>True plane surface</td>
<td>0</td>
</tr>
<tr>
<td>Paved roads in good condition</td>
<td>2</td>
</tr>
<tr>
<td>Rough paved road</td>
<td>12</td>
</tr>
<tr>
<td>Very rough unpaved road</td>
<td>20</td>
</tr>
</tbody>
</table>

*Typical values of IRI (Little Book of Profiling, Sayers and Karamihhas, 1998)*
IRI Measuring Devices

- Rod & Level
- Dip Stick Profilers
- Profilographs

- High Speed Inertial Profilers

- Response Type Road Roughness Meters (RTRRMs)
The Roughometer III

- Response-Type device
Measurements of Roughness in KZN

- TMH12 and Roughometer III used to assess roads
- Roughometer III outputs IRI over 100m intervals
- IRI may be averaged over road sections or whole roads, or an entire network

Typical results...
IRI Variations Along Road
Comparison - IRI and Visual Riding Quality

![Graph comparing IRI and Visual Riding Quality](image)

- **Average IRI m/km**
- **Distance (km)**

Legend:
- Orange line: Visual Riding Quality
- Blue line: Roughometer IRI
Comparison - IRI and Overall Condition

![Graph showing comparison of IRI and Overall Condition Index over distance](image-url)
Roughometer III Limitations

• Roughometer III sometimes malfunctions on very rough gravel roads.
• Malfunctions not always easy to fix.
• Does not assess non riding quality parameters
Conclusions

• Visual condition assessments are subjective at best
• Experience may reduce subjectivity
• Roughometer III eliminates subjectivity
• Results give good indication of gravel road condition
• Measurements are fast and cost effective
• Can be used for both project and network level assessments
• Roughometer III does not address all gravel road defects.
END!

THANK YOU FOR LISTENING