9th International Conference on MANAGING PAVEMENT ASSETS (ICMPA9)

The Australian 3D Roughness Experience

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ARRB Group

AASHTO THE VOICE OF TRANSPORTATION

VirginiaTech Transportation Institute

TRB

U.S. Department of Transportation Federal Highway Administration

WORLD ROAD ASSOCIATION MONDIALE DE LA ROUTE 1909-2009

VDOT Virginia Department of Transportation

Not to be confused with…..

'all you do is slow me down, And I'm trying to get on the other side of town'

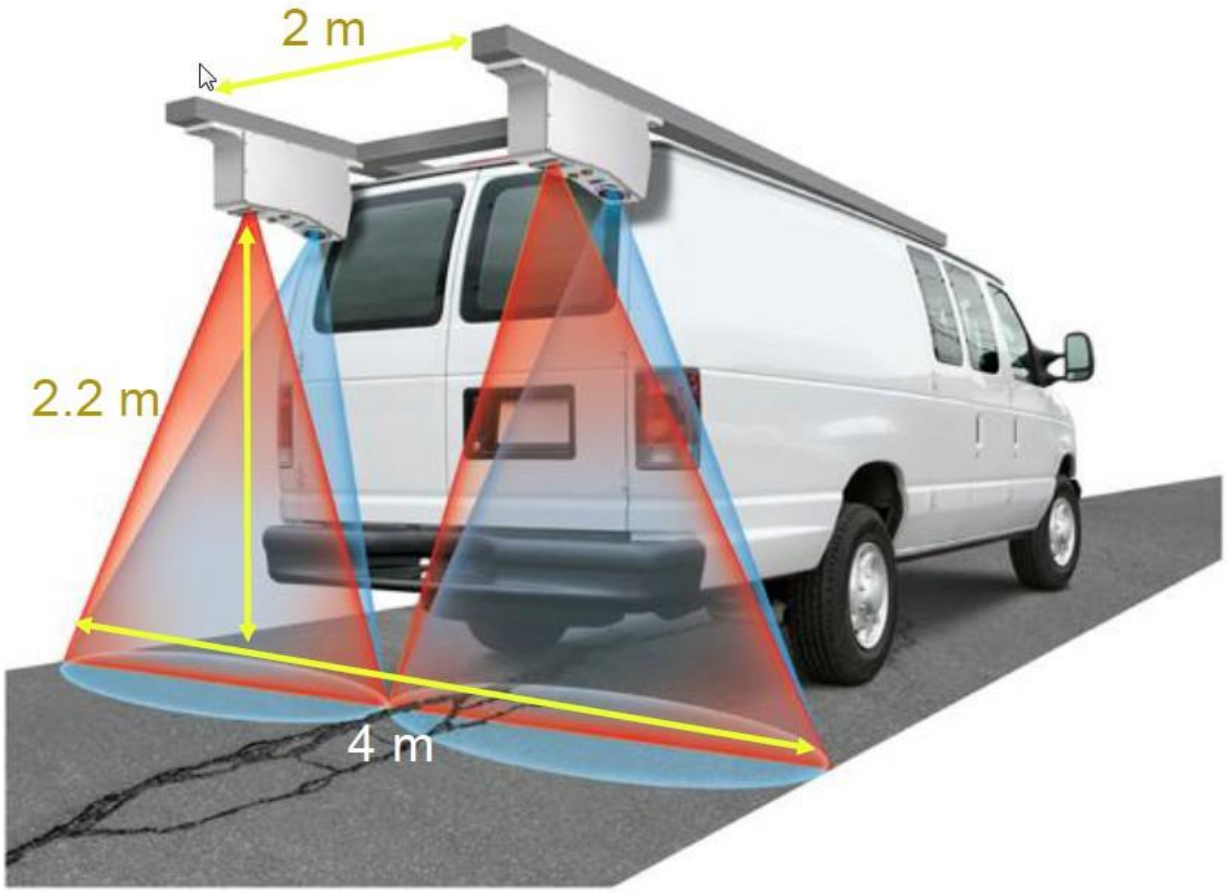
When you think of 3D, you probably think of….

- films
- 3D films were prominently featured in the 1950s in American cinema
- revival

"Avatar-Teaser-Poster" by Source. Licensed under Fair use via Wikipedia - http://en.wikipedia.org/wiki/File:Avatar-Teaser-Poster.jpg#/media/File:Avatar-Teaser-Poster.jpg

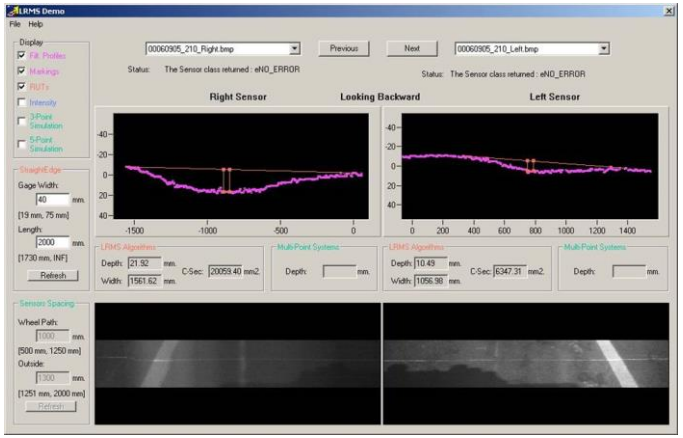
Did you bring your glasses?

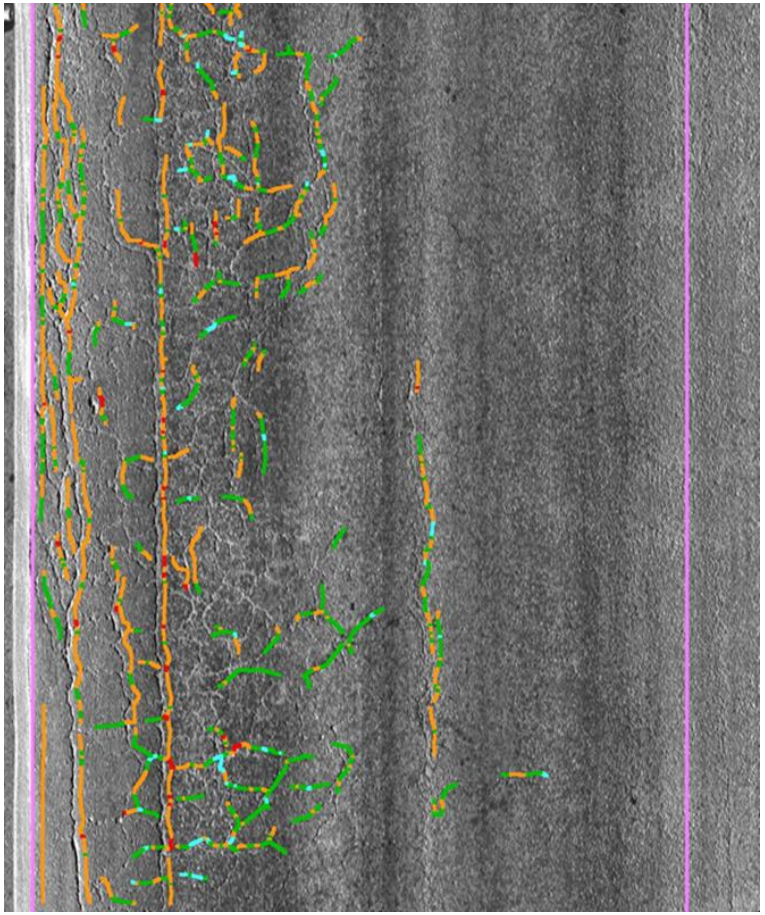
3D system



Typically used to measure….

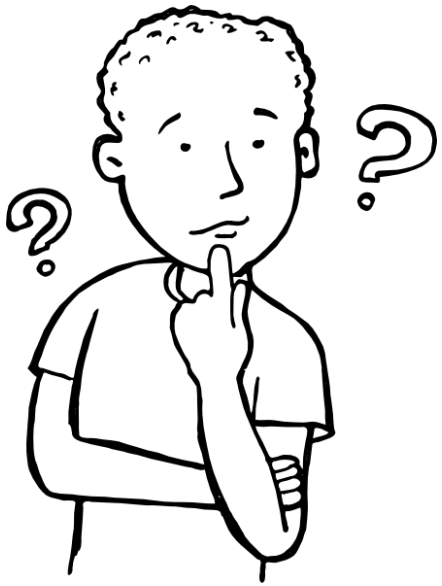
- transverse profile
- cracking and other pavement defects



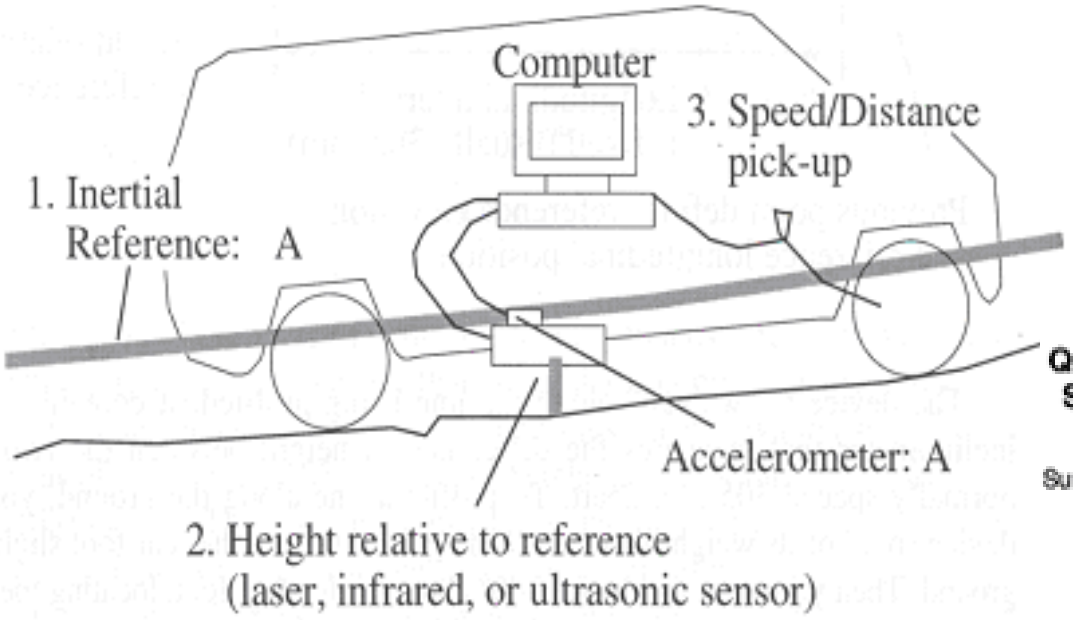


Wanted to determine…..

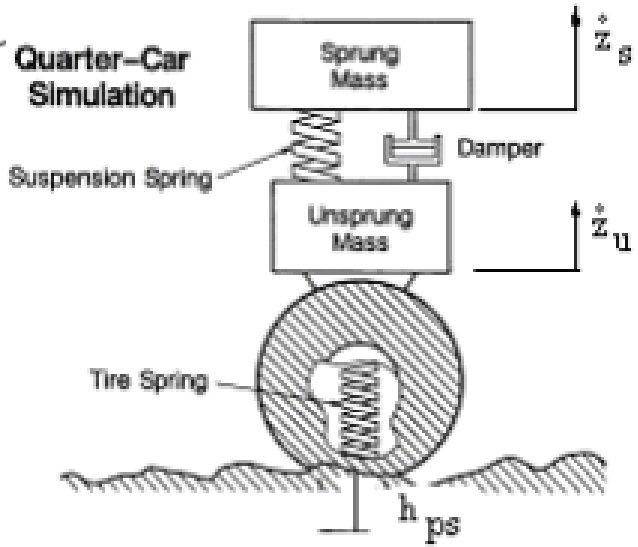
- Can 3D sensors be used to measure pavement roughness (smoothness)?
- Can the outputs meet current Australian standards?



Roughness - how measured?



Little Book of Profiling, Sayers & Karamihas



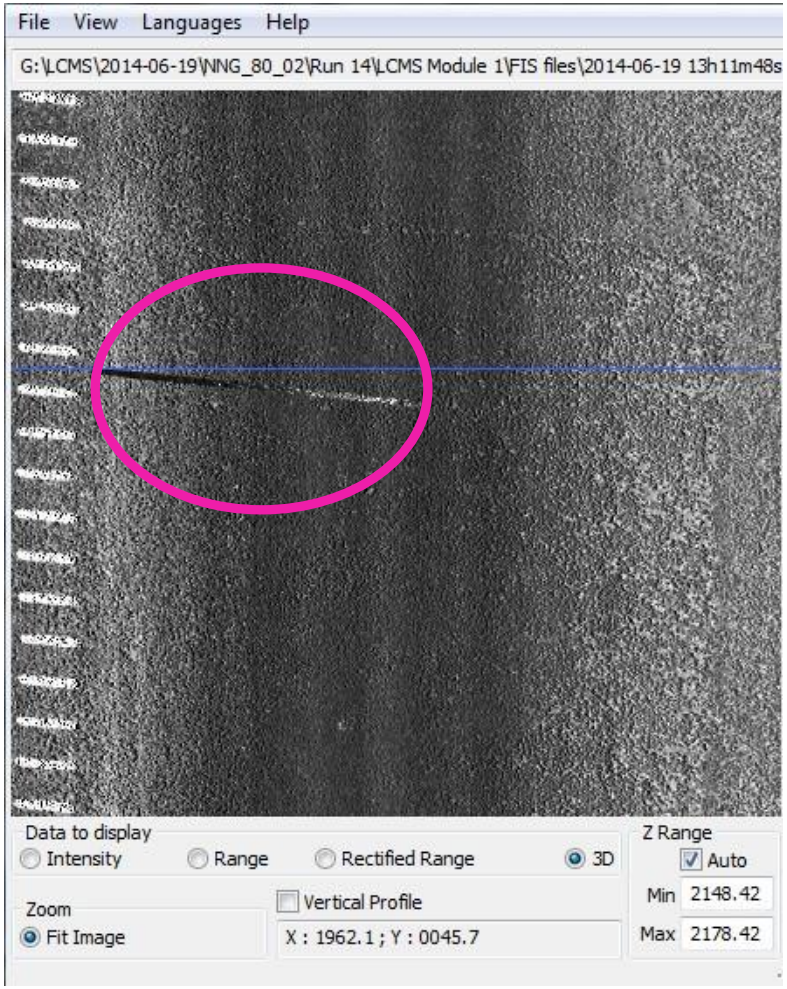
The missing piece…..

Test methods

- **Cover a variety of pavement condition parameters**
- **Roughness**
  - **reference device**
  - **loop**

Experimental method

Experimental method



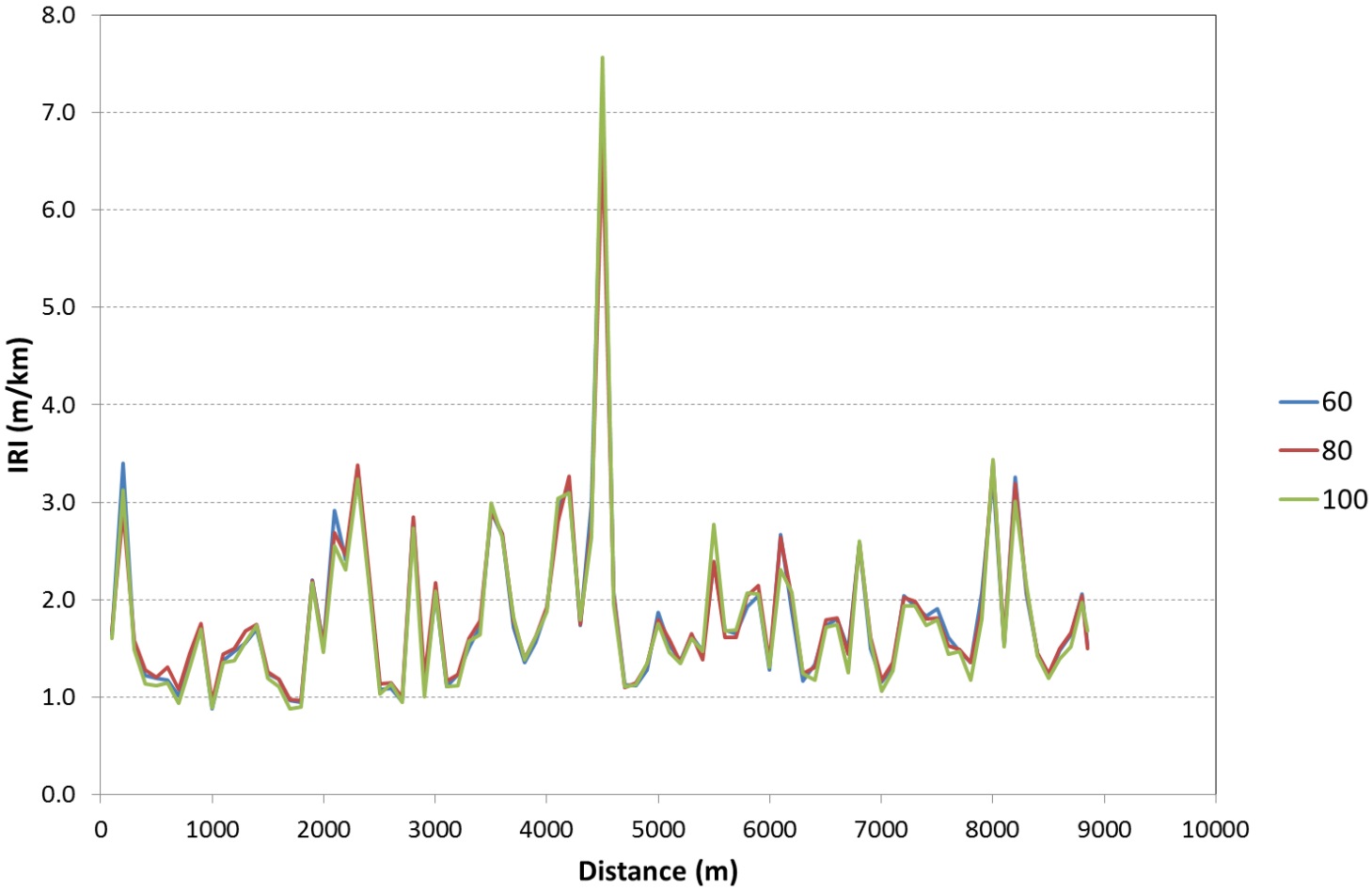
PROVAL
Pavement Profile
Viewing & Analysis

Loop method

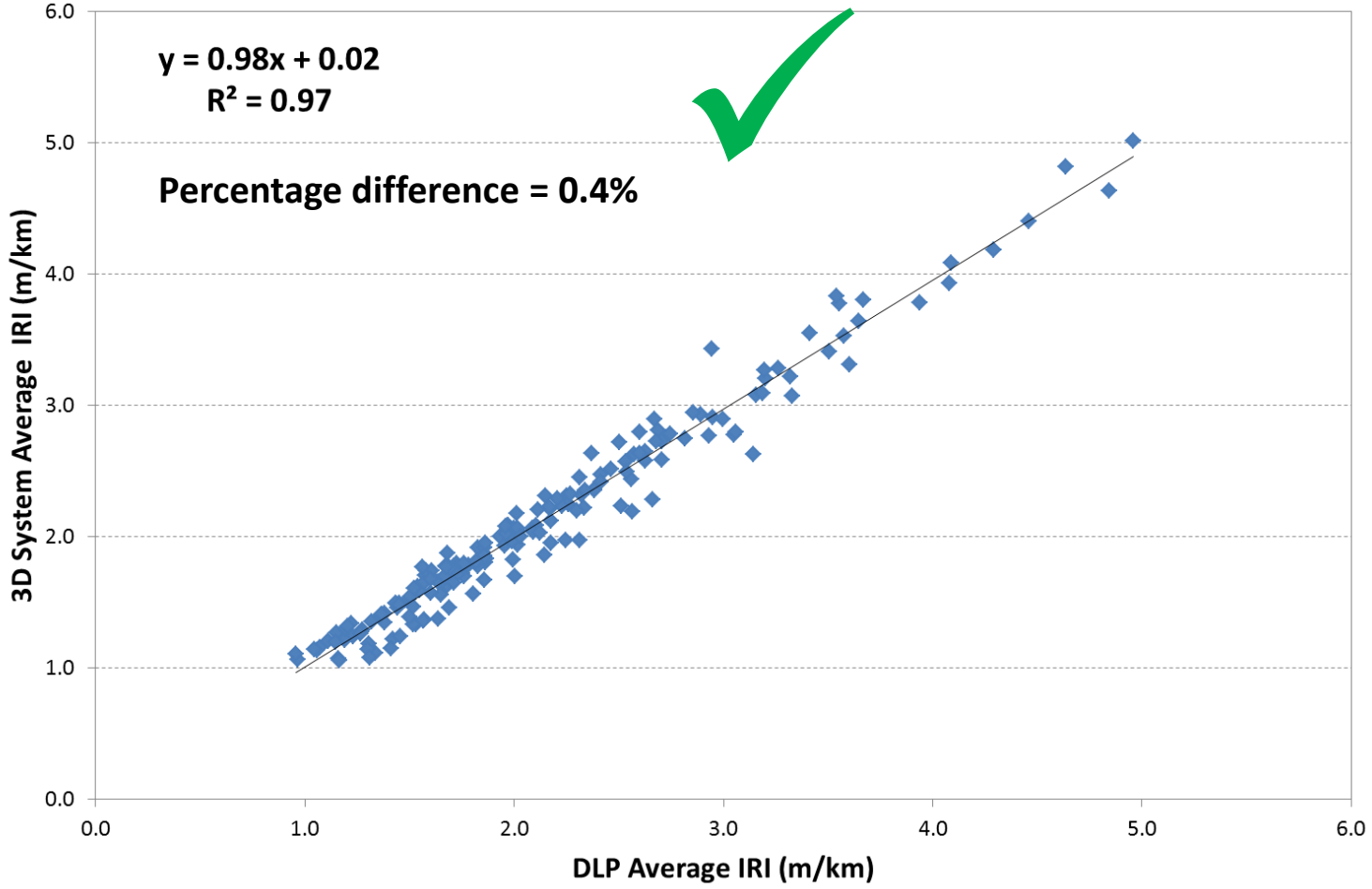
Loop method

- 5 repeat runs, loop length ≥10km
- compare against reference data set
- pass/fail criteria
  - $R^2 \geq 0.95$
  - Ave percentage difference ≤ 5%

Results – loop method



Results – loop method



Reference device method

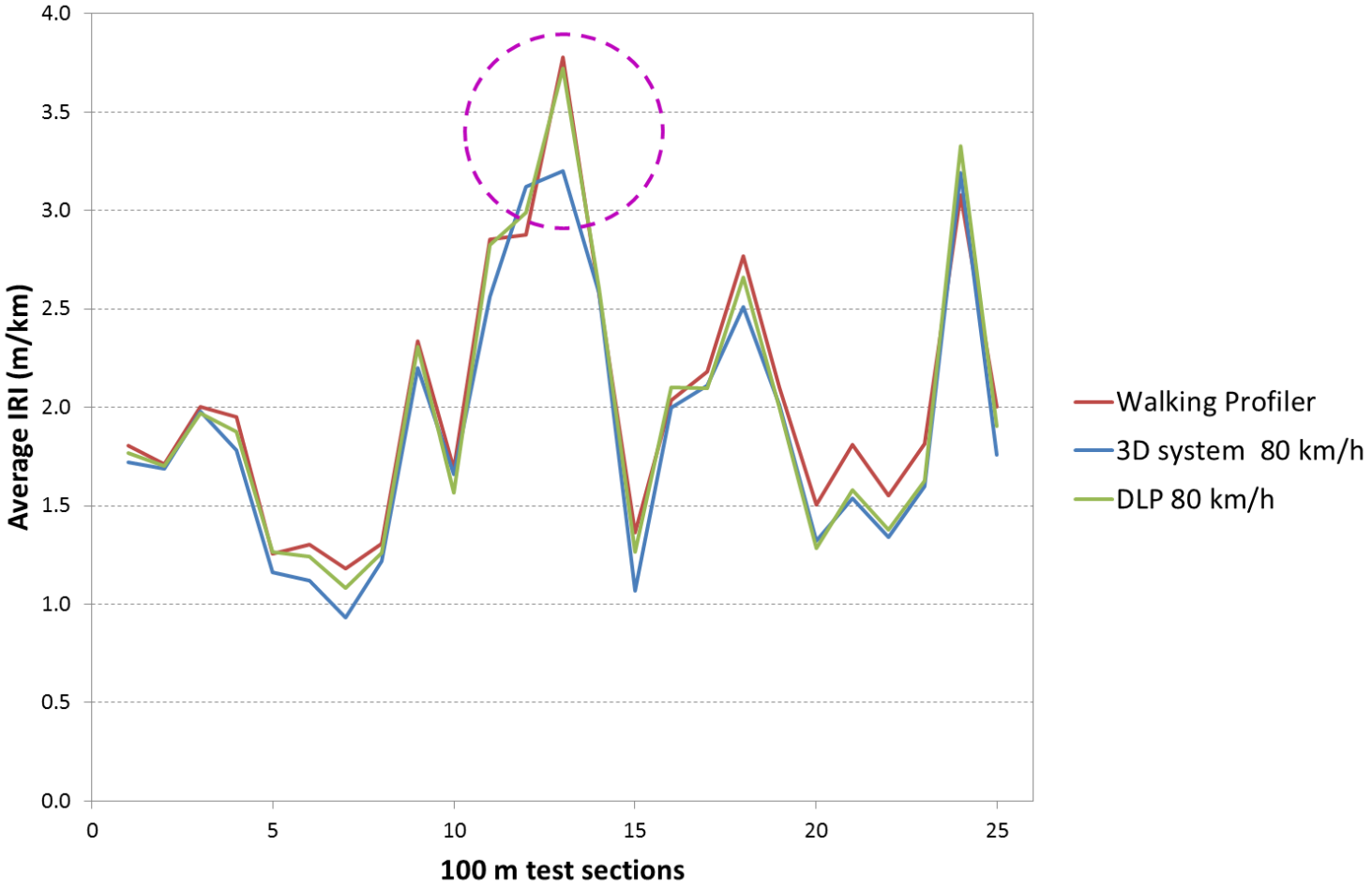
Reference device method

- five sites, 500m long, varying roughness
- three speeds plus combined
- pass/fail criteria
  - $R^2 \geq 0.95$
  - slope; $0.95 \leq A \leq 1.05$
  - Intercept; $-0.25 \leq B \leq 0.25$

Results – reference device method

Speed (km/h)	Parameter	Pass/Fail
60 (low)	Coefficient of determination (r^2)	
	Slope	
	Intercept (m/km)	
80 (medium)	Coefficient of determination (r^2)	
	Slope	
	Intercept (m/km)	
100 (high)	Coefficient of determination (r^2)	
	Slope	
	Intercept (m/km)	
Combined	Coefficient of determination (r^2)	
	Slope	
	Intercept (m/km)	

500m sites


4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Average IRI (m/km)
0
5
10
15
20
25
100 m test sections
Walking Profiler
3D system 80 km/h
DLP 80 km/h

Possible reasons for failure

- 15 months b/n collection of data sets
- differences in measurement line

Future work

- effect of curves
- frequency response
- third party validation
- undertake new reference device comparison
- assess texture measurement capability

Conclusion

- 3D sensors can be used to measure roughness
- meets the requirements of the loop test method but not the reference device
- possibly some minor speed dependency issues

Thank you

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