

# THE USE OF ROADROID APPLICATION AND SMART PHONES FOR ROAD CONDITION MONITORING IN DEVELOPING COUNTRIES

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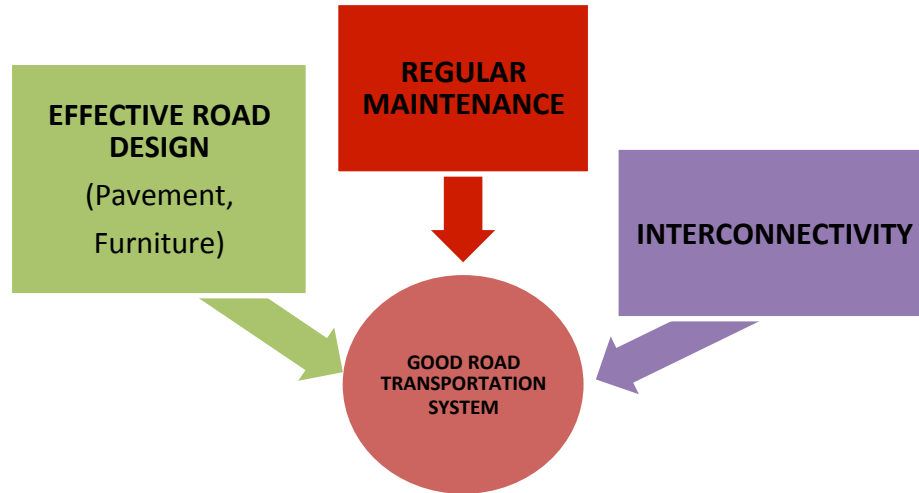
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holding from the 8<sup>th</sup>-10<sup>th</sup> May at Livingstone, Zambia.*

# OUTLINE

- INTRODUCTION
- ROADROID™
- CASE STUDY
- RESULTS
- CONCLUSION
- QUESTIONS & ANSWERS

# INTRODUCTION (1/4)

- Roads are means of transporting persons, goods and services facilitating business and social interaction through vehicle use.



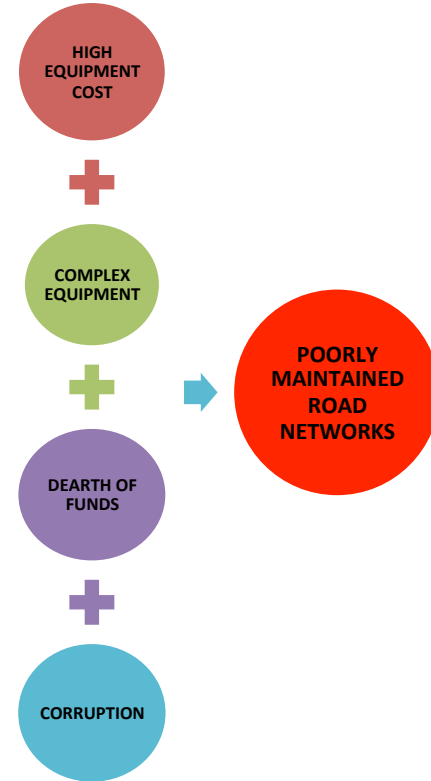
- Ride comfort, lower vehicle maintenance cost, traffic safety

# INTRODUCTION (2/4)

- Pavement maintenance
  - ❖ Maintenance should be predicated on road condition surveys.
  - ❖ Regular surveys required to adequately schedule maintenance.
- **Road Roughness defines road condition**; a reflection of the riding quality and road serviceability (Gillespie, 1992)
- International Roughness Index (IRI) which is **"a scale for roughness based on the response of a generic motor vehicle to roughness of the road surface"** (Gillespie, 1992); Units (m/km)
  - ❖ There are 4 four generic classes of road roughness measuring methods (Forslöf & Jones, 2015)
    - Class 1 - Precision profiles (laser beam methods)
    - **Class 2 - Other profile-metric methods**
    - **Class 3 - IRI estimates from correlation equations**
    - Class 4 - Subjective ratings and uncalibrated measures

# INTRODUCTION (3/4)

- Techniques and equipment used for measurement of road roughness
  - ❖ Specially built trucks or wagons with laser scanners
  - ❖ Bump-wagons
  - ❖ Manually operated rolling straight edges
- Expensive equipment!! (Forsslöf & Jones, 2015)
  - ❖ Complexity in the hard ware
  - ❖ Low volume of production of accessories and systems
  - ❖ Specialist skills to operate equipment and process results
  - ❖ Difficult to mobilize and operate



# INTRODUCTION (4/4)

- Driven by the ubiquity of computing, smartphone are used as **R**esponse-**T**ype **R**oad **R**oughness **M**easuring **S**ystem (**RTRRMS**)
  - ❖ Using accelerometer and GPS data (Astarita et al., 2012 & Vittorio et al., 2014)
- Benefits of smartphone based systems
  - ❖ Low cost; purchase and operation.
  - ❖ Portable and easier to operate
  - ❖ Operate under adverse weather conditions (rains, floods etc.)
  - ❖ Useful for performance-based contracts and research on road deterioration.

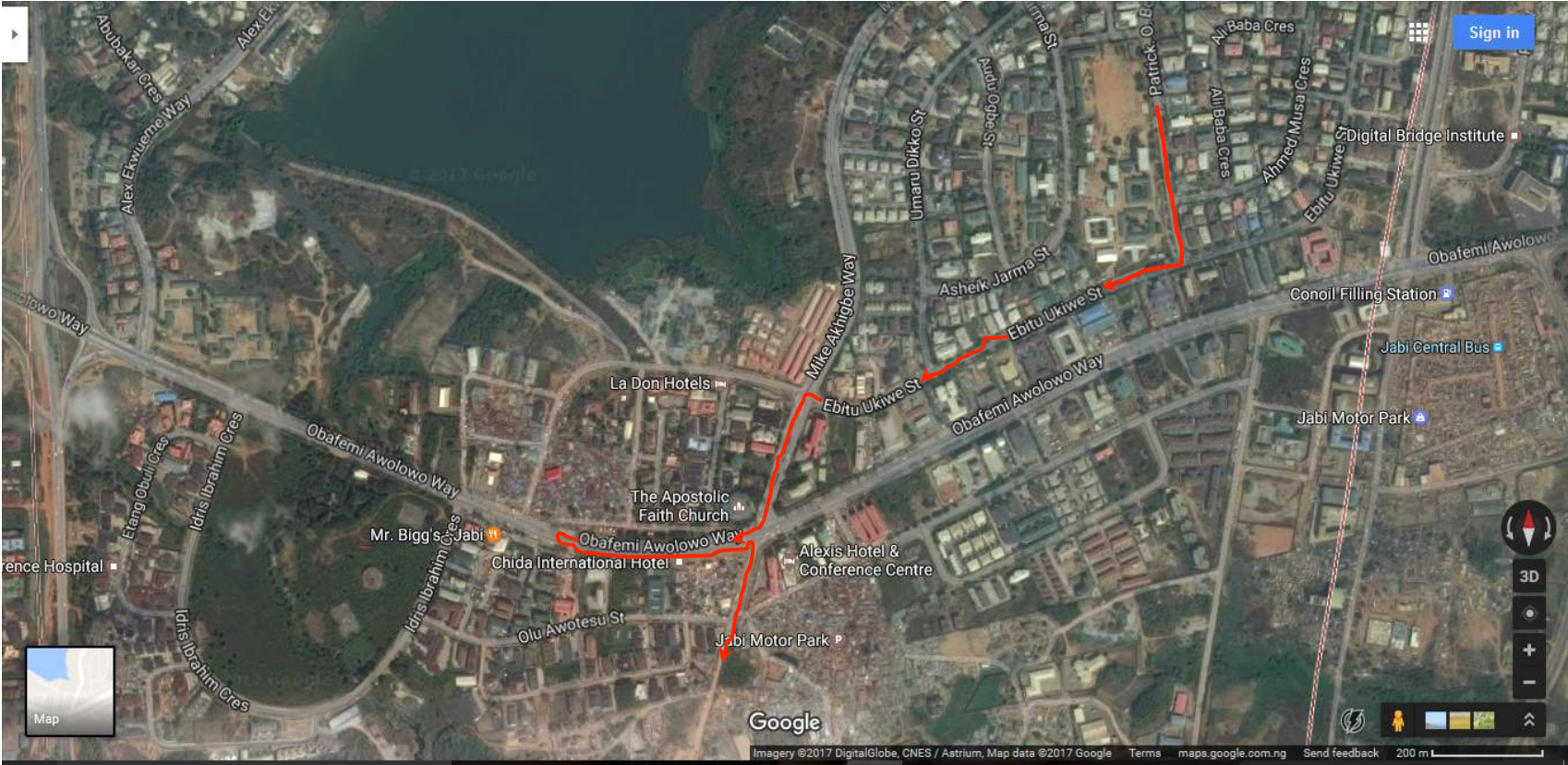
# ROADROID™



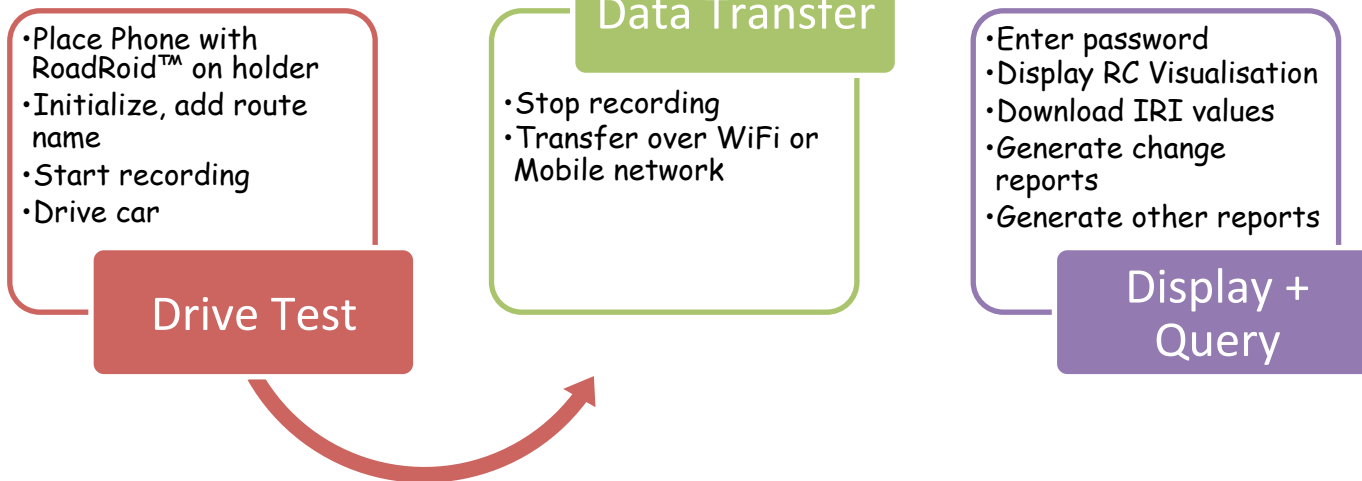
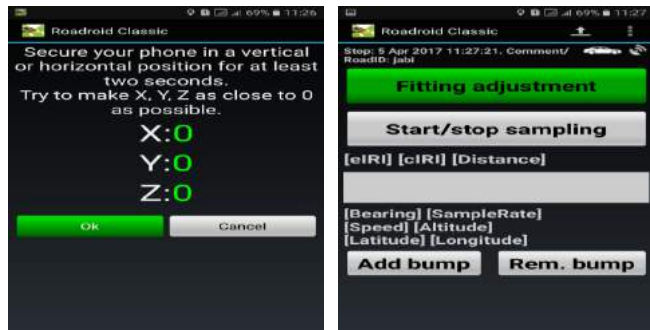
- Roadroid is a road condition monitoring system based on smart phone sensors; especially the **accelerometer and GPS** ([www.roadroid.com](http://www.roadroid.com)).
  - ❖ Vibrations from surface unevenness are sampled at 100 Hz
  - ❖ Vibration data is saved with corresponding GPS data to enable the location of road anomaly.
  - ❖ Signal analysis enables the generation of the globally recognized IRI
  - ❖ The data and results can be transferred to the web server for further processing and visualization
- Roadroid proposes to be placed in between class 1 to 4 roughness measurement systems.



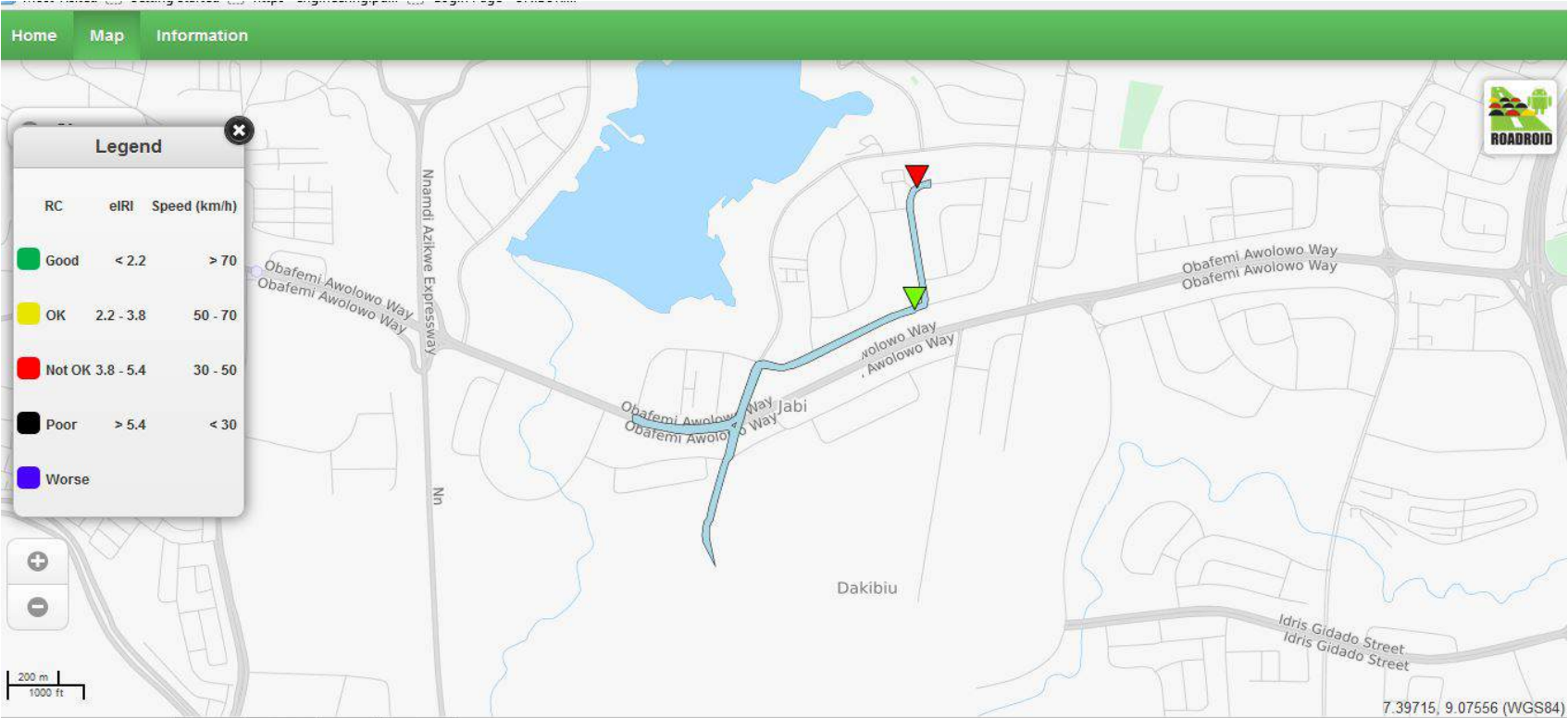
# CASE STUDY AREA



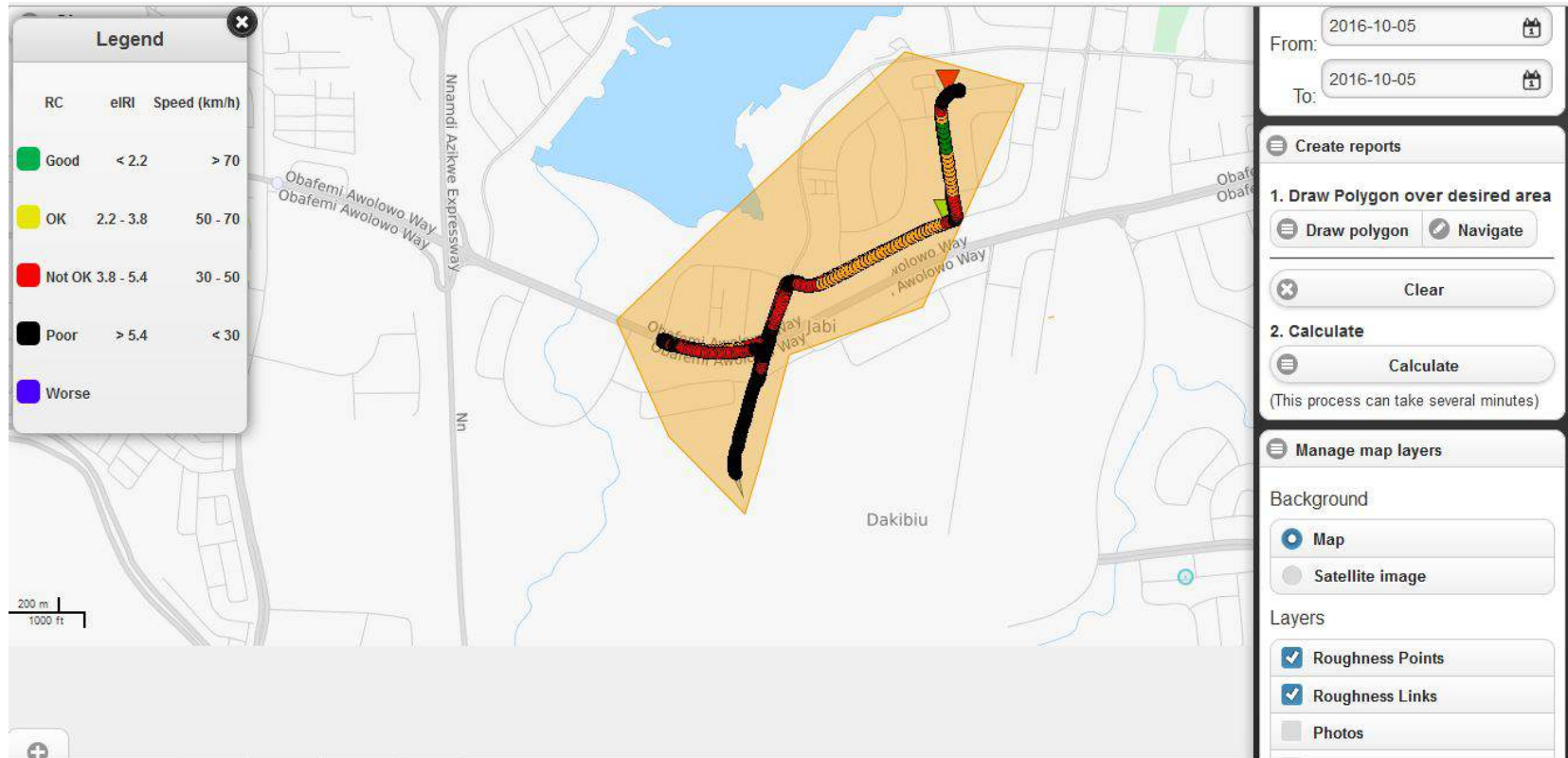
# METHOD



# RESULTS



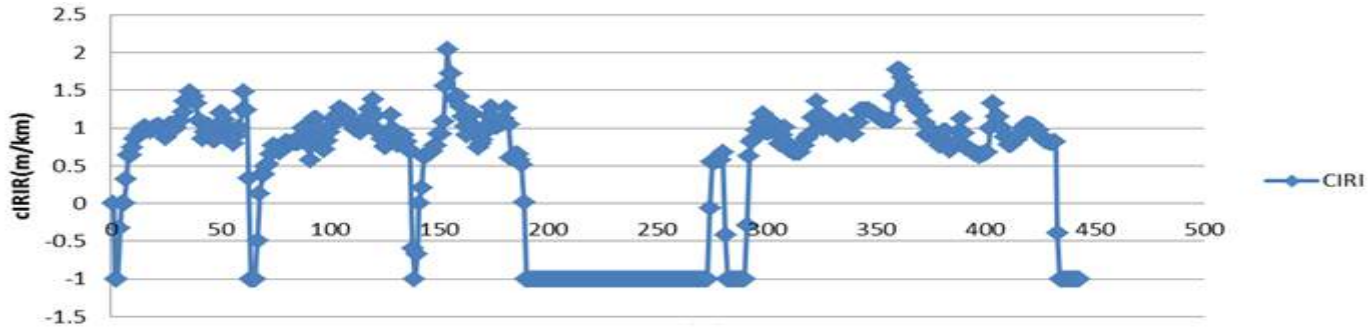
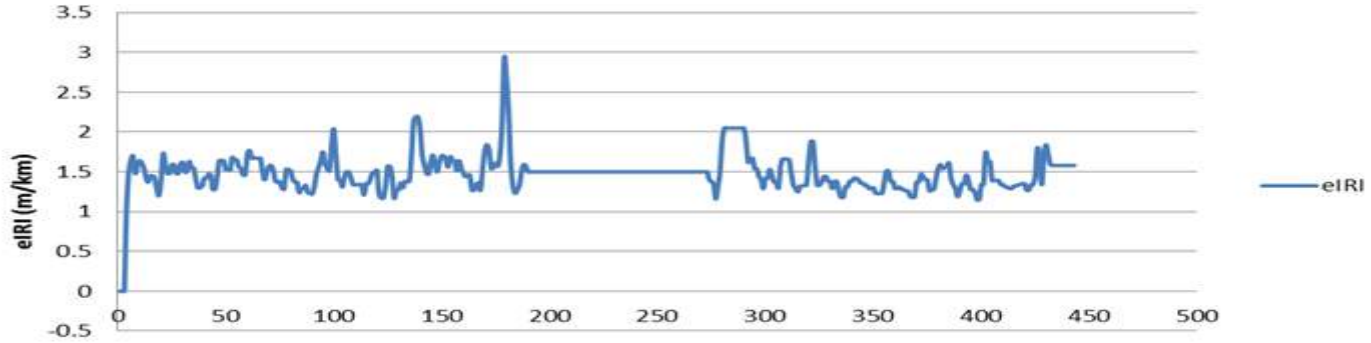
# ROAD CONDITION VISUALISATION



# PICTURES



# eIRI Vs cIRI



# CONCLUSION

- Smart phone-based systems like Roadroid would challenge subsisting road roughness measurement systems with regards to standards and procedures.
- Advantage smart phone based system becomes clearly visible on a network level where data needs to be collected for a large road network.
- The web service that allows further processing ; filter by geographic areas and special queries, visualization and raw data access.
- It is capable of interfacing with other road asset management systems
- RoadRoid™ with 81% correlation to laser measurement systems is useful for IRI measurement for road assets management. Eliminates need for sophisticated equipment and expertise for road monitoring.

THANK YOU!

QUESTIONS ?