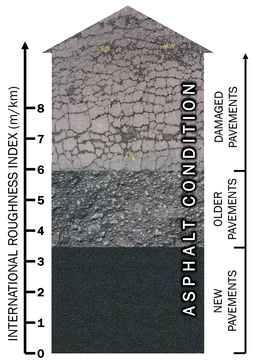
THE INTEGRITY OF IRI DATA AT LOW SPEED

INTRODUCTION AND OBJECTIVES

The International Roughness Index (IRI) is a standardized scale for measuring pavement roughness and is widely used as an indicator when evaluating pavement condition. IRI, measured in the units m/km, is calculated using the longitudinal profile data of a pavement surface and mathematically simulates the displacement of one wheel of a typical passenger car. Typical IRI values can vary depending on the classification of the roadway. Flexible pavement, for example, commonly includes the following ranges: 1.5 to 3.5 m/km for new pavements, 2.5 to 6 m/km for older pavements, and 4 to 11 m/km for damaged pavements.



Network level collection of longitudinal profile and IRI are typically conducted using a high-speed inertial profiler that utilizes a combination of high-speed lasers and accelerometers. Depending on the configuration and quality of the profiler's accelerometer, there is a low-speed limit for inertial profilers. A minimum speed of 25 km/h is generally used as a lower limit for obtaining valid longitudinal profiles.

Objectives for this study include: (1) a simple analysis of the behaviour of IRI collected at low testing speeds compared normal testing speeds; and (2) statistical analysis of how much of a pavement network's IRI data (urban and highway) is affected by low-speed testing.

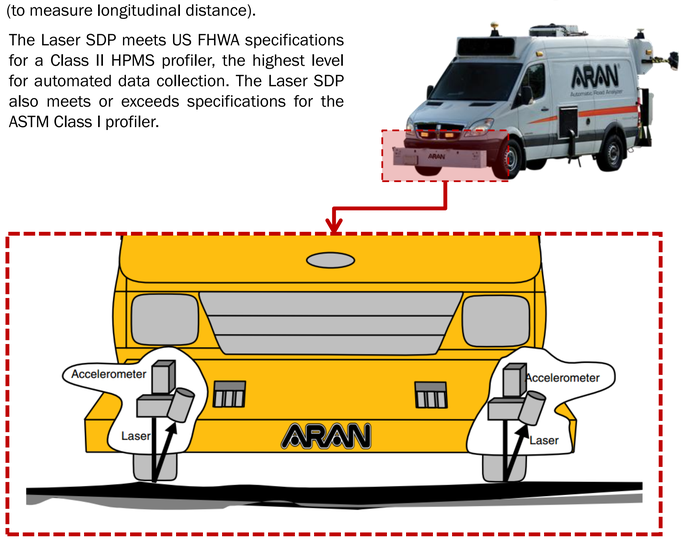
EXPERIMENTAL DESIGN

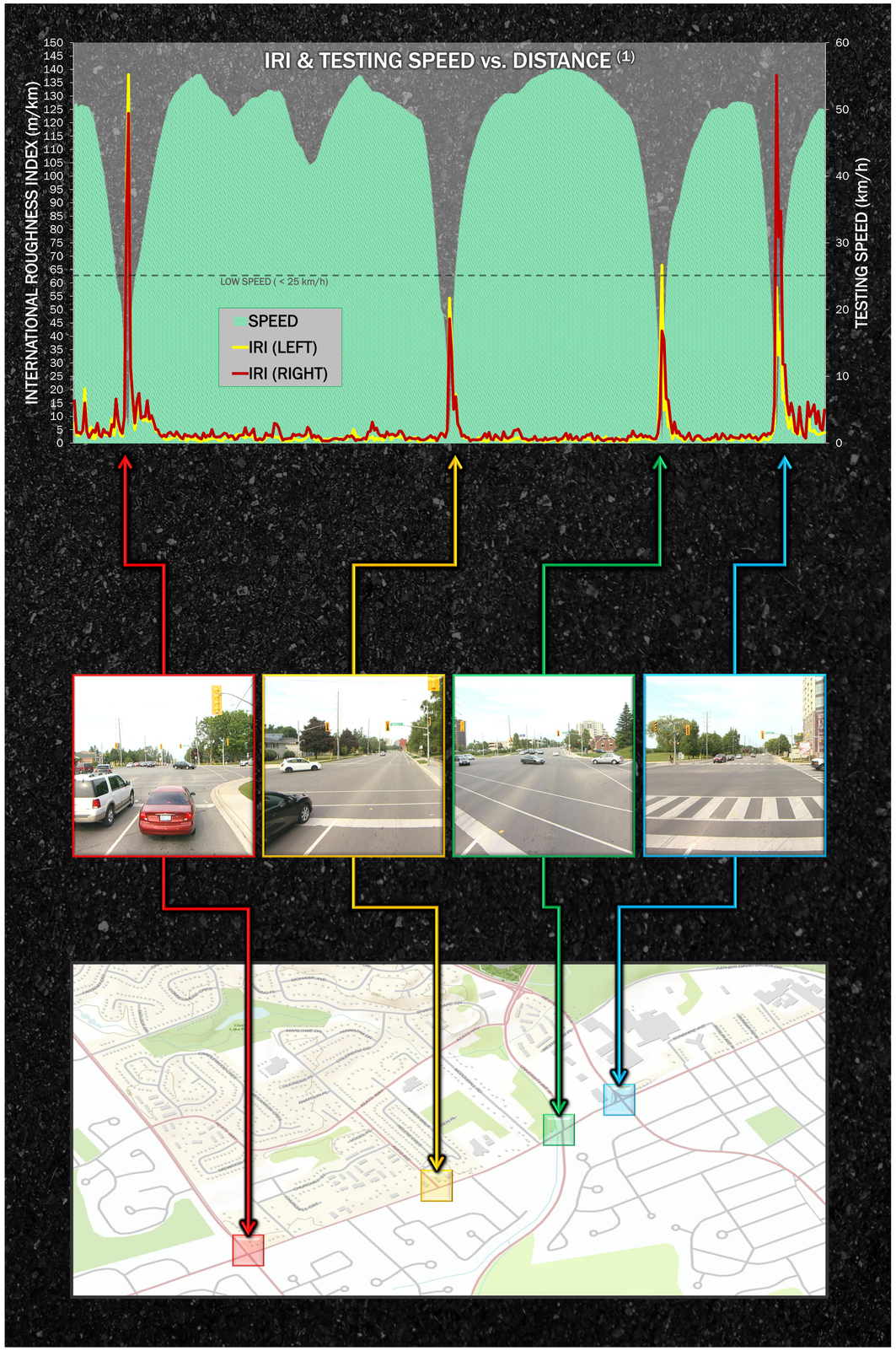
Data will be collected for both urban (where testing speeds vary and slow speeds are common) and highway (where collection speeds usually remain constant) pavement networks. For the urban pavement network data, IRI and testing speed data will be analyzed and investigated for common occurrences. Data from both the urban and highway pavement networks will be statistically analyzed to investigate the amount of data is affected due to low speed collection.

DATA COLLECTION METHOD

Experimental urban and highway pavement network data were both collected in Canada during summer of 2012 using the Laser South Dakota Profiler (SDP) subsystem on Fugro's high-speed inertial profiler called the Automatic Road Analyzer (ARAN). The Laser SDP is a longitudinal profile measurement system that provides road profile data capture and real-time IRI calculation and includes a laser height sensor (to calculate the height from the bumper to the pavement surface), an accelerometer (that removes vehicle motion to calculate the true height measurement), and a Distance Measuring Instrument (to measure longitudinal distance).

The Laser SDP meets US FHWA specifications for a Class II HPMS profiler, the highest level for automated data collection. The Laser SDP also meets or exceeds specifications for the ASTM Class I profiler.



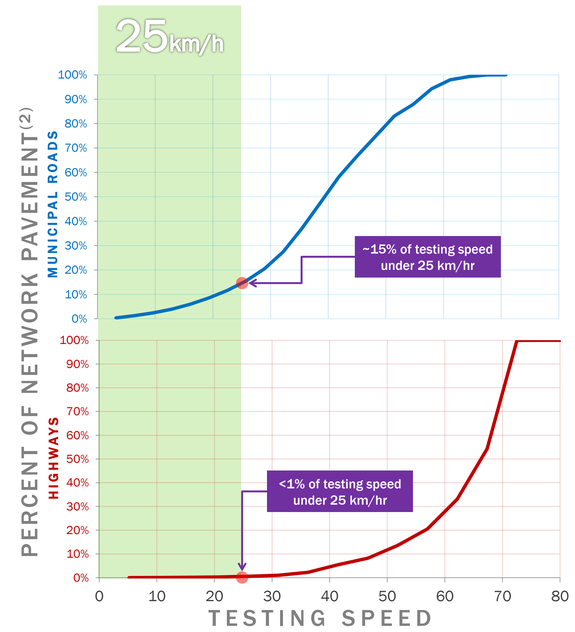


ANALYSIS OF COLLECTED DATA

Two graphs, IRI and collection speed vs. distance (1) and % of network pavement vs. collection speed (2), were created to summarize the collected data.

As seen in the IRI and testing speed vs. distance plot (1), IRI (left and right wheel paths) not only increases, but spikes when the ARAN stops at a red light (testing speed = 0). The data spikes extended well beyond typical IRI ranges and lay well beyond the standard deviation of the data set. The presence of these spikes indicate that IRI was calculated using invalid longitudinal profile data.

To see how much of municipal road and highway pavement networks could be affected by invalid IRI due to low-speed testing, statistical analyses was conducted create a relationship between the percentage of network pavement and testing speed (2).



As seen above(2), municipal road pavement networks are significantly affected (~15%) by low speed testing while highway pavement networks are not (<1%). Knowledge of the percent of network pavement affected by testing speed will help determine the course of action used when reviewing and reprocessing invalid IRI data.

CONCLUSIONS & RECOMDATIONS

Hardware limitations, primarily due to the quality and configuration of an inertial profiler's accelerometer, affects low-speed pavement longitudinal profile collection (< 25 km/h) causing the calculation of abnormally high and often invalid IRI data at these points. While low speed collection is uncommon on highway pavement networks, it occurs frequently in urban pavement networks.

Methods used to deal with invalid IRI data is specific to client specifications and may include the following solutions:

- ❖ Flagging and removing all invalid data
  - Recommended for highway pavement networks where the percent of network pavement affected by low speed is very low.
- ❖ Post processing of IRI data and linear interpolation of nearby data
  - Considered in municipal pavement networks where the invalidation and removal of a significant amount of data might be inappropriate
- ❖ Project level site investigation of areas showing invalid data
  - Considered when exact IRI data must be present and verified

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