Instrumentation in Red Hill Valley Parkway Providing Data for Long Term Pavement Management

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Introduction

- City of Hamilton Red Hill Valley Parkway (RHVP) perpetual pavement constructed 2007
- 7.5 km, 4 lanes (2 lanes each direction), 90 km/hour posted speed limit with controlled access
- Designed for 90 million Equivalent Single Axle Loads (ESAL's) over 50 years
- Perpetual pavement structure (total 760 mm)

40 mm	SMA
50 mm	SP 19.0
70 mm	SP 25.0
80 mm	Rich Bottom Mix (RBM)
150 mm	Granular Base
370 mm	Granular Subbase

Objectives

- Description of two instrumentation information systems in RHVP pavement
- Use of data and analysis in pavement management

Instrumentation Systems

Pavement Response System

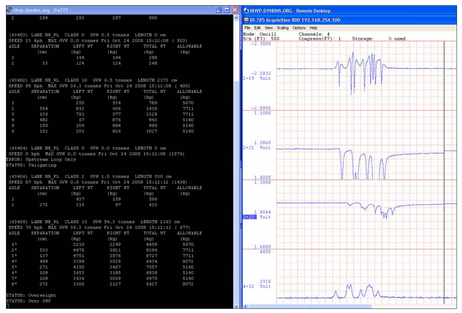
- Verify design parameters and assumptions
- Pressure and moisture gauges in the subgrade
- Asphalt strain gauges at bottom of RBM, lower binder course and surface layers
- Temperature sensors in subgrade, subbase, granular base and each asphalt layer

Traffic System

- Weight of the vehicle/axle, speed, axle pattern
- Traffic loops and weigh-in-motion (WIM) sensors
- Traffic loops in all 4 lanes
- Kistler WIM sensors in both northbound lanes
- Piezoelectric sensors in both southbound lanes

Instrumentation Data Analysis

- Traffic data is synchronized with the pavement response data
- Analysis of strains in pavement
- Relationship between induced strains and pressures and loads that cause strains.

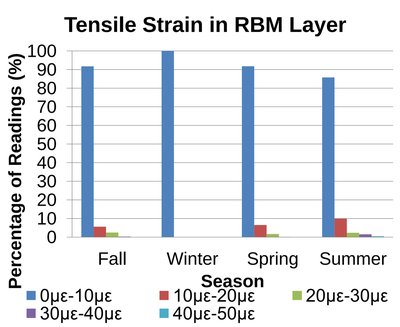


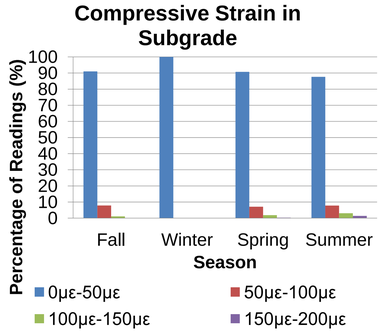
Pavement Management Aspects

- Instrumentation data intended to verify assumptions made in design and validate predicted performance

Strain in Perpetual Pavement

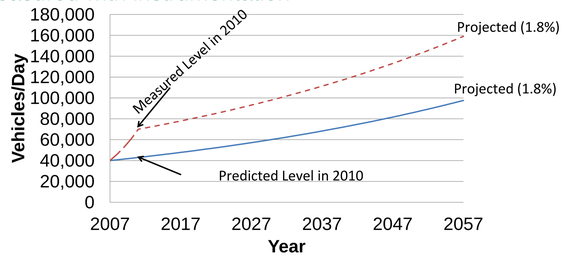
- Design assumes tensile strains in RBM < 70 με and compressive strain in subgrade < 200 με
- Measured tensile strain in RBM < 50 με, generally < 20 με during rush hour
- Measured compressive strain in subgrade < 100 με





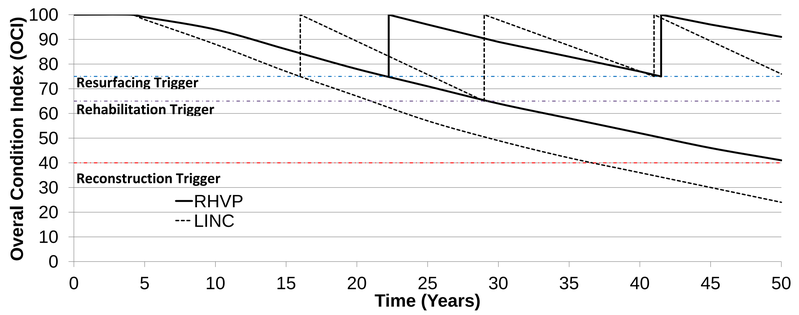
Traffic Loading

- Anticipated AADT in 2057 was 100,000
- AADT in 2011 70,000 measured with instrumentation
- Initial growth was 15 %, assumed to be 1.8 % in design



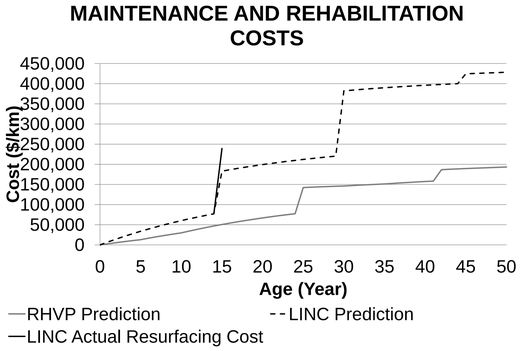
Pavement Performance Curves

- Overall Condition Index (OCI) curves were prepared for RHVP perpetual pavement and conventional pavement on Lincoln Alexander Parkway (Linc) (also in Hamilton, ON, similar traffic volume)
- OCI curves were developed using verified information from instrumentation data



Cost Analysis

- LCCA for RHVP and Linc
- Including actual cost of Linc rehabilitation in 2011



Summary

- Collected data from instrumentation shows that the RHVP pavement is perpetual and should not develop fatigue or rutting distresses in 50 year design period
- Measured tensile strain at bottom of RBM is less than 70με
- Calculated compressive strain at top of subgrade is less than 200με. However, rutting due to subgrade deformation is considered to be the control distress.
- The perpetual pavement on the RHVP should require only two resurfacings in 50 years compared to two resurfacing and a major rehabilitation that the Linc will require.
- Discounted cost of maintenance and rehabilitation for RHVP is anticipated to be 2.5 times less than the Linc