Impacts of Cold Joint Construction on Pavement Functional and Structural Performance

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Study Objective

- How does the construction of a cold centerline joint impact general pavement performance?
- Will it impact the permeability, pavement density, structural capacity and performance ?

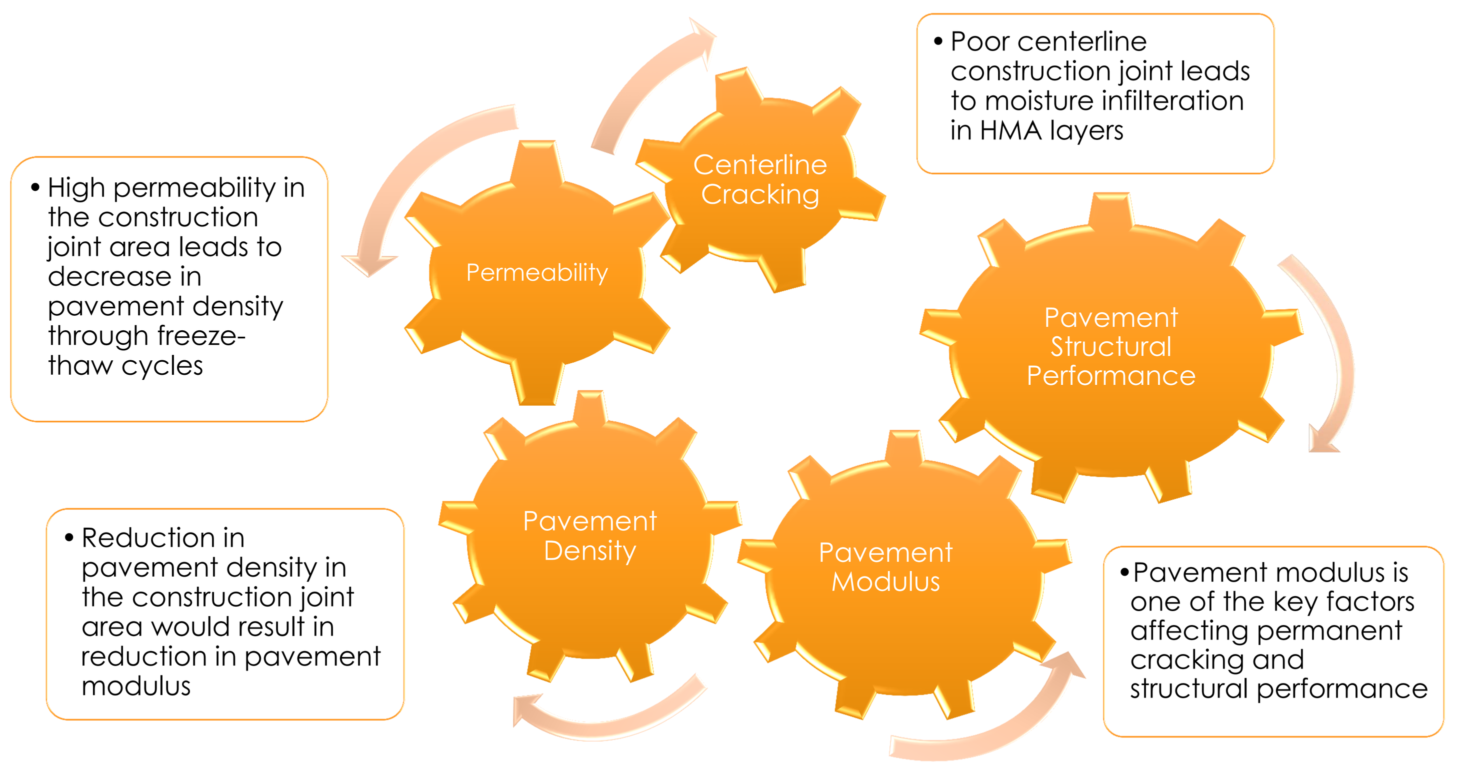
Hypothesis

- Poor construction of centerline joints leads to development of a weak point at the pavement surface
- The higher the severity of the centerline joint crack width the lower pavement performance
- Centerline joints represent the initiation point for several distresses

Project Overview

The City of Hamilton is currently evaluating innovative treatments to mitigate poorly constructed and damaged centerline joints in flexible pavements. Twelve test sections were selected to evaluate the impacts of poorly constructed joints on pavement structural performance. An investigation will be completed before and after the application of a maintenance treatment. Pre-treatment and post-treatment evaluations represent the backbone of this project. This poster presents analysis of the pre-treatment evaluation of the twelve test sections. Application of the treatment is scheduled in Summer 2014 and post-treatment evaluation will be presented at a subsequent TAC annual meeting.

Variables / Research



TRANSPORTATION ASSOCIATION OF CANADA

Field Investigation Program

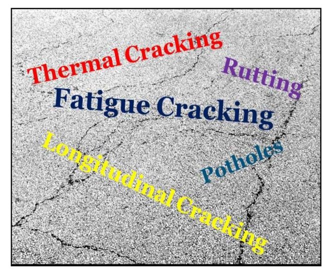
Field Test	Number of Test points in 12 sites
Deflection (LWD)	1,980 test
Permeability	48 tests
Density (Nuclear Gauge)	1,188 readings
Cores	48 cores
Distress Survey	12 Sections

Procedure

Step 1

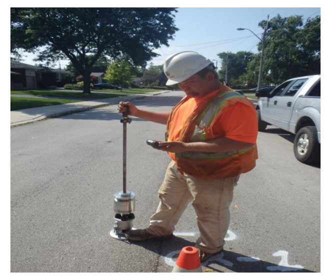
Sample roads with centerline joint quality ranging from good to poor

Step 2



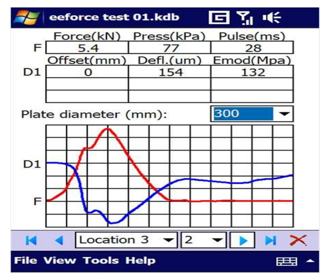
Identify distresses associated with poor construction joints

Step 3



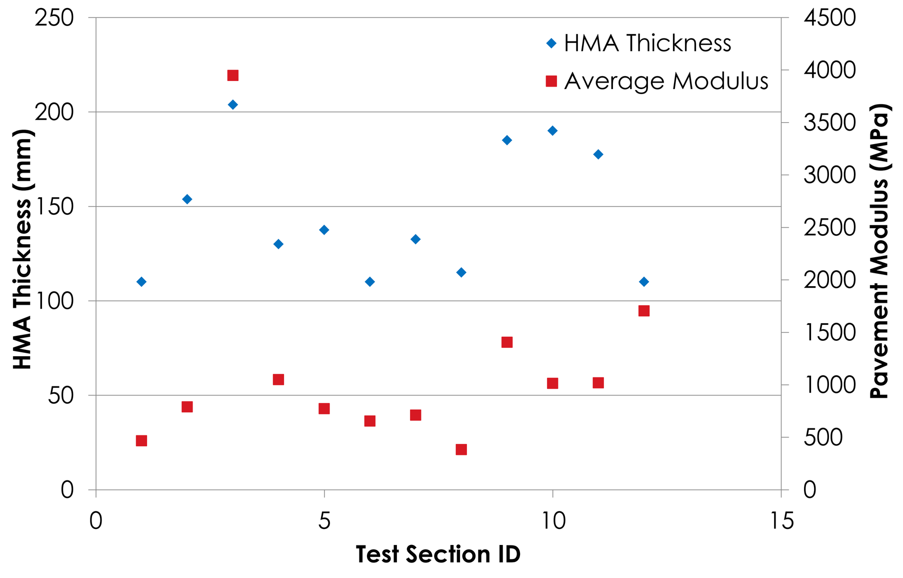
Develop experimental matrix to monitor various distresses

Step 4



Analyze field performance data

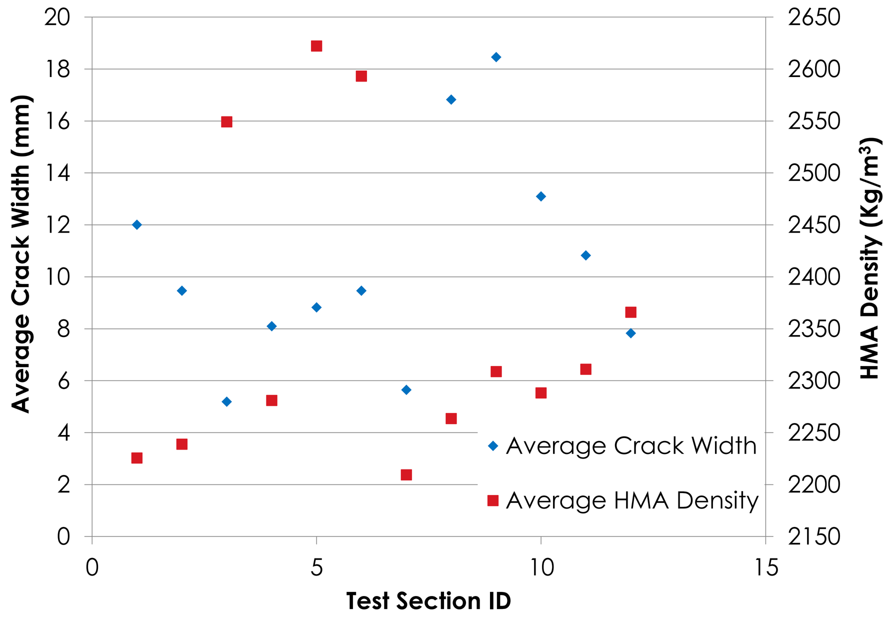
Data / Observations



Data collected from 12 test sections(100 m each). Crack width, HMA density (nuclear gauge) and LWD testing performed every 100 m in each section. Permeability and coring performed at 4 stations in each test section.

Nuclear Density Gauge, permeability and LWD testing were performed at three locations per station:

- Left of centerline joint crack
- Right of centerline joint crack
- Wheel path



Analysis

Assumptions:

- Crack width classes: Low severity (<12 mm) and High severity (≥12 mm) cracking
- HMA thickness classes: Thin (<150 mm) and Thick (≥150 mm) HMA

Permeability (K)	Thin Pavement	Thick Pavement	Low Cracking	High Cracking
Mean	0.00796	0.0016	0.003	0.009
Percentage Difference in mean	400%		200%	
Variance	0.0003	4.86E-06	0.0001	0.0003
Observations	28	20	87	45
Hypothesized Mean Difference	0		0	
Degree of Freedom	28		62	
T-Statistic	1.9		-2.1	
P(T<=t) one-tail	0.03		0.02	
T Critical one-tail	1.7		1.67	

Nuclear Gauge -HMA Density (Kg/m³)	Thin Pavement	Thick Pavement	Low Cracking	High Cracking
Mean	2,366	2,339	2,384	2,271
Percentage Difference in mean	1%		5%	
Variance	26,757	12,401	27,078	2,884
Observations	77	55	261	135
Hypothesized Mean Difference	0		0	
Degree of Freedom	130		349	
T-Statistic	1.1		10.1	
P(T<=t) one-tail	0.13		1.43E-21	
T Critical one-tail	1.66		1.65	

Conclusion

- Permeability in pavement is significantly impacted by HMA thickness and crack width
- Permeability measured on Thin Pavements is <u>80%</u> higher than that measured in Thick Pavements
- Permeability measured in sections with High severity cracking is <u>188%</u> higher than those measured in Low severity cracking sections
- Insignificant statistical difference (5%) between Thickness of Asphalt in High severity cracking versus Low severity cracking. This proves crack width is due to construction methodology rather than loading and structural defects
- HMA density is significantly impacted by crack width
- HMA density measured in High severity cracking sections is <u>5%</u> lower than those measured in Low severity cracking sections
- Insignificant statistical difference (1%) between HMA density in thin and thick pavement. There is no correlation between pavement density and HMA thickness