Hwy 401 Heavy Weight Deflectometer (HWD) Composite Pavement Research Study

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Study Objective

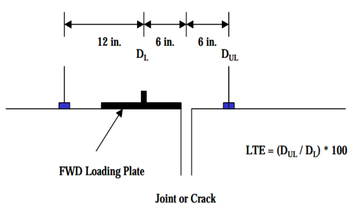
- Asses if an increase in load level from an HWD provides better representation of the load transfer efficiency (LTE) at joints/cracks in composite pavements
- Determine if differential deflection analysis provides a better assessment of joint condition
- Review the existing composite pavement FWD testing protocols for potential improvements

Project Background

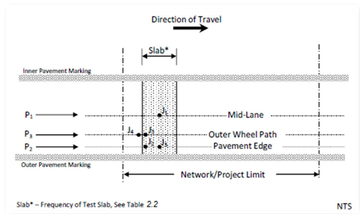
- 300-meter test section near Cornwall, ON
- Hwy 401 in the vicinity is a 4-lane divided highway (only tested Eastbound lanes)
- Originally constructed in 1963 as a 230 mm Joint Plain Concrete Pavement (JPCP) with dowels and 21.3 m (70-foot) joint spacing
- Overlaid in 1984 with 130 mm of Asphalt Concrete (AC)
- Rehabilitation treatment in 1999 consisted of milling 50 mm and overlaying 80 mm
- Total structure thickness – 160 mm AC / 230 mm JPCP
- HWD testing performed on composite AC surface, and again on milled JPCP surface at same locations

Testing Plan

LTE Testing



HWD Test Passes



Field Investigation Program

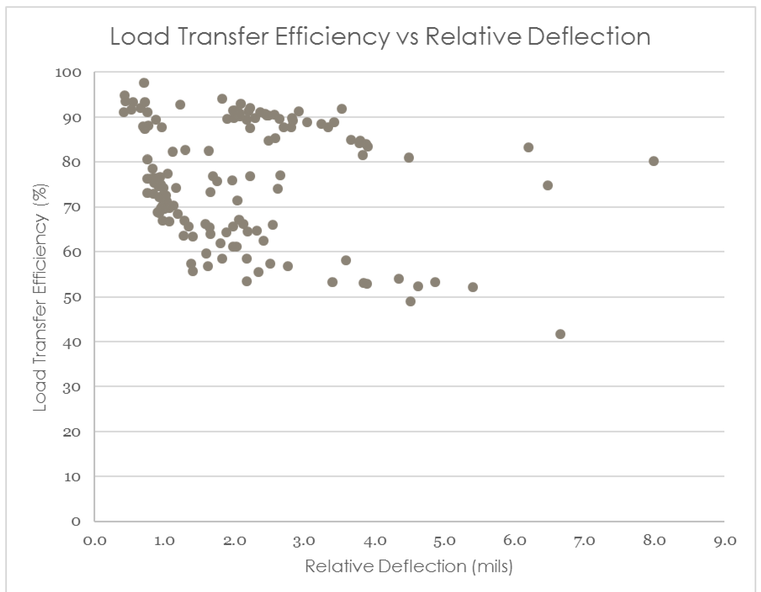
Pass	Test Location	Frequency
Mid-Lane	Mid-Slab	2 Tests Total
Wheel Path	Transverse Cracks / Joints	100%
Pavement Edge	Slab Corner and Edge	2 Tests Each

Weight Package	Target Load (kN)
Regular	40, 53, and 71
Heavy	100, 150, 200, and 250

Field Observations

Lane	Severity	Number of Cracks
Truck Lane	Very Slight	12
	Slight	10
	Moderate	11
	Severe	5
	Very Severe	13
Passing Lane	Very Slight	26
	Slight	14
	Moderate	6
	Severe	9
	Very Severe	7

Data / Observations



Analysis

Summary of the % difference of the load transfer efficiency for the heavy drops vs low drops of the joints

% Difference Heavy vs Low	Truck Lane Composite (# of Occurrences)	Truck Lane Concrete (# of Occurrences)	Passing Lane Composite (# of Occurrences)	Passing Lane Concrete (# of Occurrences)	Total
25%+	1	-	-	-	1
10% to 25%	2	-	-	-	2
5% to 10%	2	-	5	-	4
-5% to 5%	5	6	12	15	38
-5% to -10%	-	-	-	1	1
-10% to -30%	-	-	-	-	0

Summary of the percent difference of the load transfer efficiency for the composite vs concrete pavement

Crack Type	Passing Lane Min	Passing Lane Max	Passing Lane Average	Truck Lane Min	Truck Lane Max	Truck Lane Average
Original Joints	18%	34%	23%	-22%	57%	33%
Repaired Slab Joints	25%	30%	28%	-24%	44%	11%
Cracks	15%	57%	34%	18%	146%	66%
Saw Cuts	11%	27%	20%	-	-	-
Total	**11%**	**57%**	**27%**	**-24%**	**146%**	**40%**

Conclusion

- 10 of the existing 31 joints were correctly identified as joints and 22 concrete cracks were incorrectly identified as joints
- Increasing the load level had no visible correlation with load transfer efficiency values
- Weak correlation between load transfer efficiency and distress (composite and concrete surfaces)
- Composite load transfer efficiencies were approximately 32% lower than those completed on the concrete surface
- Relative deflection and the normalized load plate deflection increased at poor joints and high severity cracks (only relative to the joints / cracks in the same lane)
- Relative deflection and normalized load plate deflection values in the truck lane was twice as high as the passing lane
- It is recommended that any further studies be completed with varying asphalt thickness and tighter joint spacing to help determine the relationships between the composite load transfer efficiency and joint / crack condition

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