Ontario

HMA Surface Permeability for HMA Acceptance

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Outline

- Background
- Development of Field Permeability Test Equipment
- Permeability Limits for HMA Acceptance - Jurisdictional Scan
- Development of Field Permeability Criteria for Ontario
- Next Steps

Background

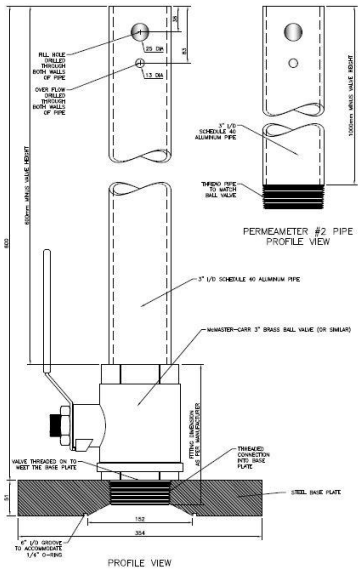
- 2012: First AMIR trials started with MTO / Carleton
- 2014 to 2016:
  - 4 bridge decks compacted side by side using conventional compaction equipment (static steel roller) and AMIR
- 2013-2019: Two HIIFP Studies awarded to Carleton University
  - Objectives were to develop permeability criteria for hot-mix asphalt pavements and develop in-situ permeability apparatus for use with a new surface permeability specification
- Nov. 2017: Field trial at Didsbury Road (Ottawa) was constructed using various available compaction technologies and gather permeability test data
- Nov. 2018: Hwy 401 at LaRue Mills

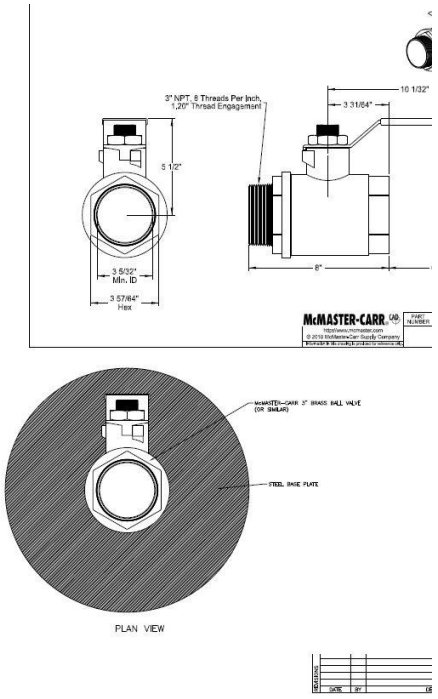
Development of Field Permeability Test Equipment

- Previous equipment was NCAT
  - Difficult to achieve a seal, messy, time consuming
  - Plastic
  - Readings done visually

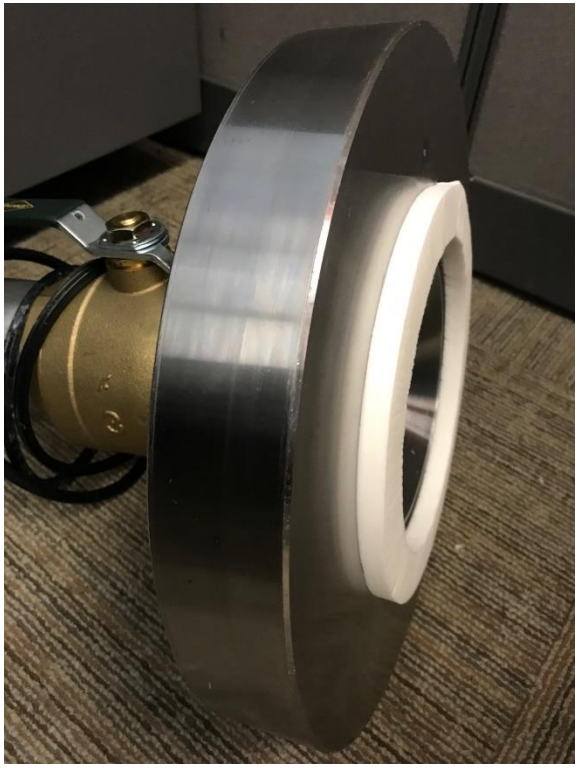
Development of Field Permeability Test Equipment

- Iterative approach:
  - Needs to be heavy to seal; seal to be reusable material (not silicone, plumbers putty)





Development of Field Permeability Test Equipment



- Too Heavy, seal material hand cut

Development of Field Permeability Test Equipment

Development of Field Permeability Test Equipment

- Carleton developed software to be used with electronic sensors to facilitate readings that are now done automatically and objectively

Lab Permeability Test Equipment

- Lab test to establish how each mix will perform under ideal conditions for permeability
- Target:
  - Permeability at 8% air voids; corresponding to asphalt compaction meeting MTO specification

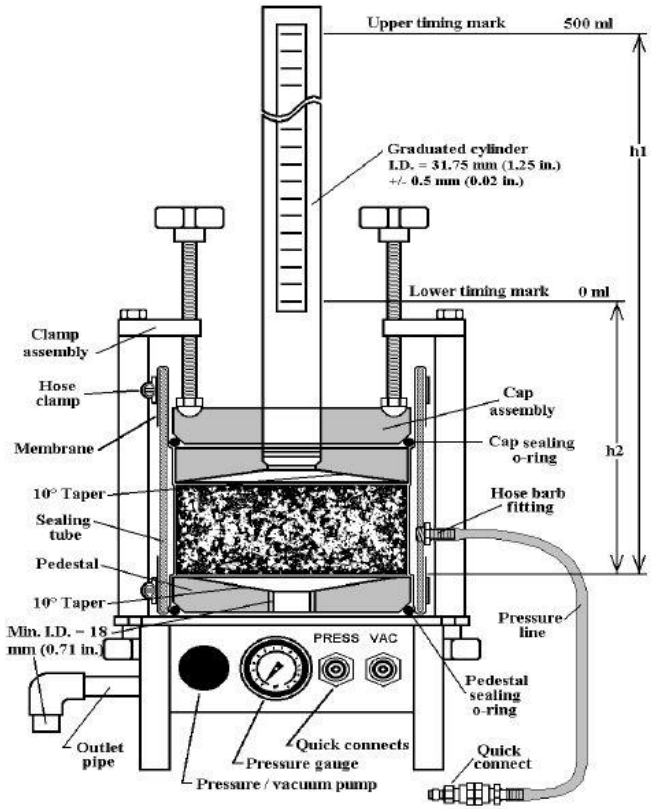


Figure 1 - Water Permeability Testing Apparatus (not to scale).

- **Florida DOT test method FM 5-565**

Jurisdictional Scan: Permeability Limits for HMA Acceptance

- NCHRP Report 531: Relationship of Air Voids, Lift Thickness, and Permeability in Hot Mix Asphalt Pavements

State	Critical Permeability(cm/s)
New Mexico(Proposed)	125E-5
Florida	125E-5
Oklahoma	125E-5
Virginia	125E-5

Source: Rafi Tarefder, University of New Mexico

Development of Field Permeability Criteria for Ontario

- Field permeability test data collected from Didsbury Road and 5 others bridge paving trials
  - Test data analyzed to establish/validate criteria for field permeability for Superpave 12.5 mixes
- Lab permeability testing also carried out on field cores and lab compacted samples from loose mix collected from the site
- Varied mat thicknesses (40mm to 100mm)

Development of Field Permeability Criteria for Ontario

- Results:

Trials	Mix Type	Ave. Permeability ($x10^{-5}$)	
		Steel	AMIR
Didsbury Rd	12.5FC2 Cat E	390	90
Hwy 28	12.5 FC1 Cat C	360	110
Hwy 417/34 bridge	12.5 FC2 Cat D	640	200
Hwy 401 Holt Rd bridge	12.5 FC2 Cat E	1010	400
Hwy 520 Distress River bridge	12.5 WMA Cat B	560	210

Draft NSSP: Low Permeability Specification for Surface Course Mix

- Low permeability specification is incentive based to raise the compacted asphalt quality bar
  - No penalty
  - Any contractor can try to meet the requirements
  - No equipment specified
  - Other types of equipment / processes other may also be able to produce lower permeability asphalt
- No incentive if mix is rejectable for other ERS mix attributes

Draft NSSP: Low Permeability Specification for Surface Course Mix

- Low Permeability Surface Incentive Criteria
  - The application of the low permeability surface incentive will be assessed based on the lot Incentive Factor
    - based on the lot average field permeability and average laboratory permeability

Permeability Criteria and Lot Incentive Factors (When Lot Lab Permeability (LP_L) ≤ 25 x 10^{-5} cm/s)

Field Permeability of Lot (FP_L), 10^{-5} cm/s	Lot Incentive Factors
$FP_L < 125$	1
$126 \leq FP_L \leq 250$	0.75
$251 \leq FP_L \leq 350$	0.50
$351 \geq FP_L$	0

Draft NSSP: Low Permeability Specification for Surface Course Mix

Permeability Criteria and Lot Incentive Factors
(When Lot Lab Permeability ≥ 25 x 10^{-5} cm/s)

Lot Field Permeability (FP_L), 10^{-5} cm/s	Lot Incentive Factors
$FP_L < (2 \times LP_L)$	1
$(2 \times LP_L) + 0.1 \leq FP_L \leq 3 \times LP_L$	0.75
$(3 \times LP_L) + 0.1 \leq FP_L < 4 \times LP_L$	0.50
$(4 \times LP_L) + 0.1 \geq FP_L$	0

Testing Requirements

Attributes	Testing Method
Field Permeability	MTO test procedure using automated Carleton In-Situ Permeability Apparatus (CIPA)
Lab Permeability	Florida DOT test method FM 5-565

Draft NSSP: Low Permeability Specification for Surface Course Mix

- Acceptance Testing for Determining Low Permeability Surface Incentive
  - In-Situ Permeability measurements shall be conducted on the compacted HMA surface, from each sublot after the completion and prior to opening to the traffic
  - 1 test per sublot, 10 sublots per lot, Ave. for the lot = Field permeability
  - Lab permeability is the permeability of a Superpave gyratory compacted specimen, compacted to 8% air voids
    - 3 gyratory samples compacted to approximately 6, 8 and 10% air voids
    - Permeability at 8% air voids is interpolated from a laboratory plot

Next Steps

- Finalize draft low permeability incentive specification
- Implement permeability specification in select contracts on a trial basis
- Monitor low permeability trials performance and continue to update specification

Questions?

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