



# **Update on Stone Mastic Asphalt**

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# Presentation Outline

- ❖ Background
- ❖ MTO/ OHMPA SMA Task Group
- ❖ MTO SMA Trials
- ❖ Reinstatement of SMA
- ❖ Specifications
- ❖ SMA Contracts and Next Steps

# Background

- ❖ Stone Mastic Asphalt (SMA) is a gap-graded, highly textured and durable surface mix with a much higher percentage of stone and more asphalt cement than conventional HMA
- ❖ Advantages of SMA over conventional HMA are:
  - excellent durability in terms of rutting resistance and cracking
  - extended pavement life
- ❖ The coarse surface texture of the SMA provides improved surface drainage (reduced splash), and noise reduction compared to conventional dense graded HMA

# Background

- ❖ MTO adopted the use of SMA as a premium surface course mix on its major highways in 2002 for its durability, resistance to rutting and cracking
- ❖ In 2005 MTO noted:
  - Low initial friction
  - Further testing and analysis showed surface friction improved with traffic wear over time
- ❖ A joint MTO/ OHMPA Task Group was formed in the Fall of 2005 to investigate different alternatives to improve the initial surface friction of SMA pavements (mix design and construction)

# MTO/OHMPA SMA Task Group

- ❖ Task Group membership evolved over time. Group looked at the impact of various options including:
  - Revising listed of SMA approved aggregates –*not effective*
  - Water blasting the surface –*not effective*
  - Reducing the AC content – *lab testing and modelling led to trials in 2009 with:*
    - Minimum AC content reduced by 0.3%
    - Percent passing the 75 µm sieve from 8-12% changed to 6-9%
    - VMA 17% minimum dropped to 16.5-18%
  - SMA 9.5 mix; aggregate blending
- ❖ November 2007 MTO paused the use of SMA to address our concerns with low early age friction

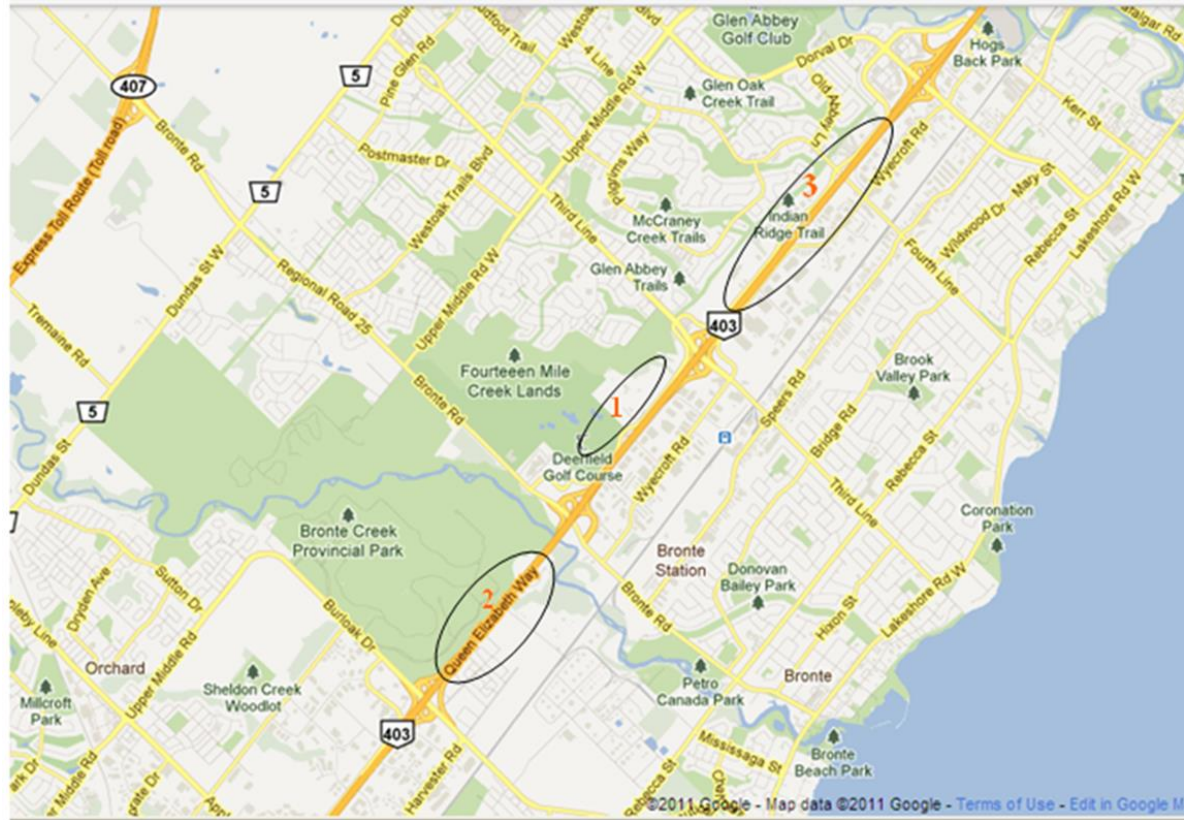
# 2009-2010 Mix Attribute Evaluation Trials

- ❖ 2009: MTO used the revised SMA mix design on a QEW trial at Red Hill Creek
- ❖ 2010: SMA trial sections were constructed on Highway 400 NB between Highway 407 and Bass Pro Drive using 3 aggregate sources and 2 filler sources
- ❖ Uncoated grit was sprayed over a compacted mat
- ❖ These mix changes and the uncoated grit on compacted mat trials did not improve the initial friction of the SMA surface

# 2011 SMA Embedded Grit Trials

❖ Based on other agencies practices, MTO next tried embedded grit on:

- Contract 2007-2026  
QEW at Burloak  
North Service Rd 200m  
EB Lanes 2 & 3
- Contract 2007-2125  
QEW at Third Line  
EB Lane 2



# Gritting Non-Standard SP

- ❖ Grit gradation specification was liberal:
  - No oversize and 0 to 3% passing the 75 micron
  - Coated and uncoated application used:
    - 1.0% AC for coated grit
    - Delivered hot
- ❖ Used a rate of about 1.0 kg/m<sup>2</sup>
  - Demonstration constructed to optimize spread rate and control
- ❖ No grit placed in vicinity of lane marking
- ❖ Removal of excess grit



# QEW, North Service Road Demonstration



**Coated  
Grit**

**Uncoated**



# 2011 SMA Embedded Grit Trials



QEW – EBL 3, Coated/Uncoated



# 2011 SMA Embedded Grit Trials

- ❖ Contract 2007-2026, QEW at Burloak
  - Used different uncoated application rates (1.0kg/m<sup>2</sup> and 0.75 kg/m<sup>2</sup>)
  - Used different coated application rates (0.9 and 0.50 kg/m<sup>2</sup>)
- ❖ Contract 2007-2125, QEW
  - Used 1% AC coated Ontario Trap Rock DFC Fines and Milton Quarry high stability sand, 0.75 kg/m<sup>2</sup>
- ❖ ***Coated grit definitely better: less dust, no pick-up issues, no removal of excess grit required!***

# 2011 MTO Trials with Embedded Grit Findings

- ❖ Placing the 0.8 to 1% asphalt cement coated sand immediately after initial compaction and then embedding it into the mat using normal compaction rollers was found to be effective in improving SMA low initial friction
- ❖ Within 6-8 weeks, friction values for both the gritted and ungritted sections were about the same

# 2012-2013 SMA Contracts Gritted

- ❖ MTO next constructed entire SMA contracts with coated gritting on:
  - Highway 6 in West Region in 2012, and
  - Highway 401 at Renforth in Central Region in 2013
- ❖ Highway 401 used the original SMA mix requirements
- ❖ Tests indicated acceptable initial friction for both contracts

# Reinstatement of SMA

- ❖ October 2014: with the endorsement of the SMA Task Group, MTO re-instated SMA for use as a premium surface course mix for roadways where traffic levels warrant its' use and MTO's Surface Course Directive (PLNG-C-003) was updated
- ❖ Any SMA placed requires:
  - the application of hot grit, coated with 1% asphalt cement during mix placement
  - use of the original SMA mix requirements

# Specifications

- ❖ OPSS.PROV 313 Construction Specification for Hot Mix Asphalt
- ❖ OPSS.PROV 1151 Material Specification for Superpave and Stone Mastic Asphalt Mixtures
- ❖ LS-311 Practice for SMA Mix Design
- ❖ NAPA Quality Improvement Series (QIS)122 Designing and Construction SMA Mixtures –State-of-the-Practice
- ❖ AASHTO M 325-08 Standard Specification for Designing Stone Matrix Asphalt (SMA)

# SMA Gradation Envelope

Sieve	SMA 9.5 mm	SMA 12.5 mm	SMA 19 mm
<b>25.0 mm</b>			100
<b>19.0 mm</b>		100	90 – 100
<b>12.5 mm</b>	100	90 – 100	50 – 88
<b>9.5 mm</b>	70 – 95	50 – 80	25 – 60
<b>4.75 mm</b>	30 – 50	20 – 35	20 – 28
<b>2.36 mm</b>	20 – 30	16 – 24	16 – 24
<b>75 µm</b>	8 – 12	8 – 11	8 – 11



# SMA Grit Gradation

Sieve Size	% Passing
4.75 mm	100
2.36 mm	90 - 100
1.18 mm	50 - 65
600 $\mu\text{m}$	25 - 35 *
150 $\mu\text{m}$	0 - 5 *
75 $\mu\text{m}$	0 - 3 *

\* A maximum tolerance of  $\pm 3\%$  is allowed on gradation requirements for gritting material

# SMA Contracts

Contract	Location (Hwy)	Length (km)	SMA 12.5 (t)	Gritting m <sup>2</sup>	Region
2013-2014	401	9	10300		Central
2015-2018	401	10	16641	162250	
2014-2038	427/ 401	4	15495	79171	
2014-2044	401	6	7939	9646	
2015-2035	401	11	15178	150482	
2015-2012	QEW	2	5360	5360	
2015-2023	QEW	4	5242	41934	
2015-2021	401	7	29733	179080	
2015-2033	400	4	21220	169763	
2016-2030	403	8	28278	226225	
2016-4014	401	6	16296	130366	Eastern
2014-3014	401	4	25230	187099	West
2016-3265	401	22	167	47509	
2016-3003	401	8	25409	203270	
<b>Total</b>		107	224784	1692919	

# Next Steps

- ❖ Specification be to updated to include:
  - Acceptance and repair criteria
  - Additional SMA mineral filler requirements
  - Gritting material gradation and physical requirements
  - Incorporating the application of coated grit in the standard
- ❖ MTO plans to continue to specify the use of SMA when warranted
- ❖ MTO will continue monitoring friction and performance of all SMA projects; and will continue to review the developments and practices of other agencies

# Questions?



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