

# Eight Year Performance of a Recycled Freeway Surface in Ontario



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# Presentation Outline

- **Background**
- **Pre-Construction Conditions**
- **Construction of Trial Sections**
- **Evaluation of Trial Sections**
- **Findings**
- **Summary**
- **Concluding Remarks**

# Background...

- **MTO has used reclaimed asphalt pavement (RAP) in HMA pavements since 1970's**
- **Policy restricted RAP from surface course on heavily trafficked roads to reduce risks associated with its' use**
- **MTO supports a “zero waste” approach and in late 1990's implemented a pavement recycling program to provide sustainable rehabilitation options**

## ...Background

- **Project proposed to find cost effective rehabilitation strategies to address early deterioration of DFC mixes on MTO highways**
  
- **Strategies included:**
  - **HIR**
  
  - **RHM surface course**
  
  - **Microsurfacing**

# Pre-Construction Conditions...

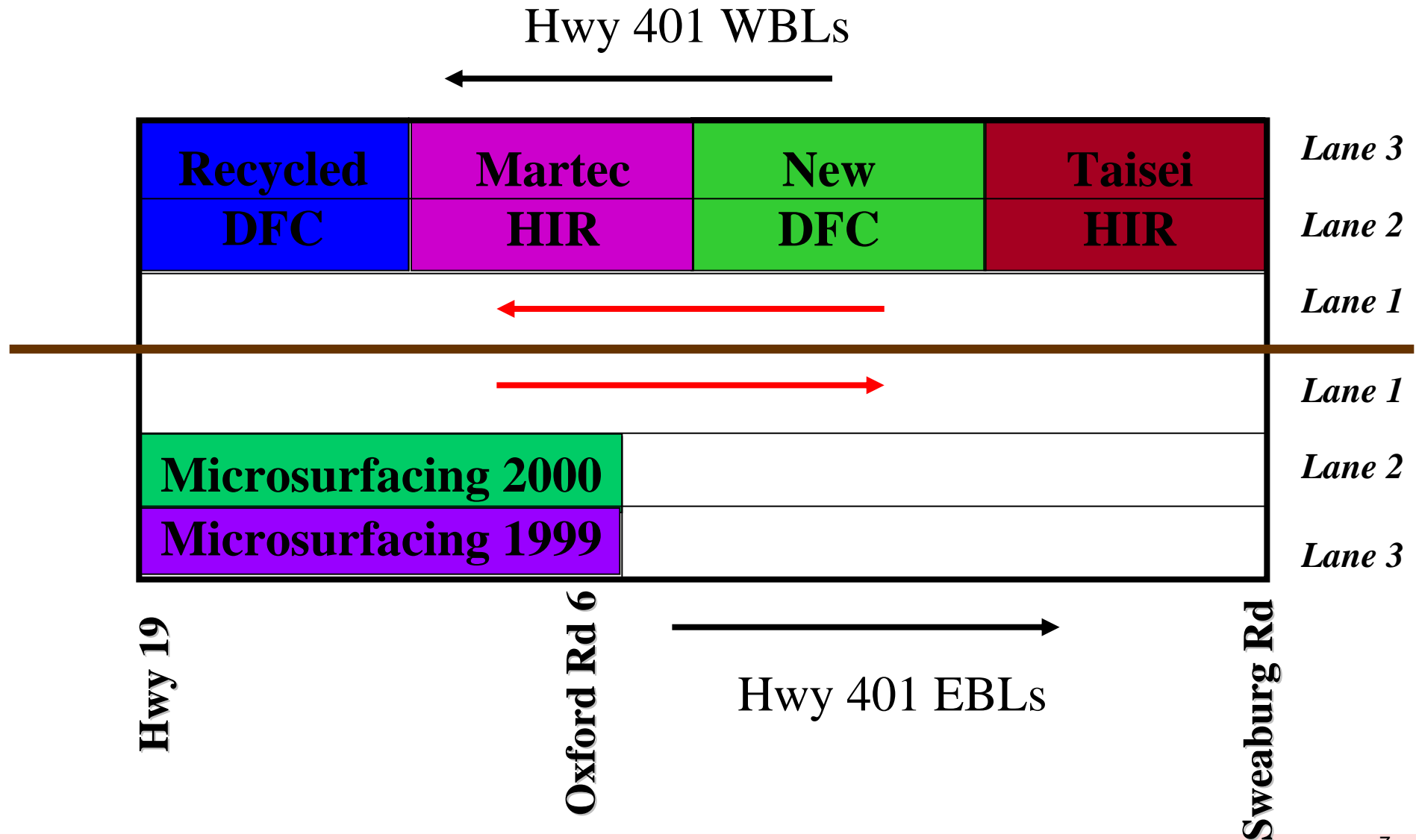


## ...Pre-Construction Conditions

- Road Radar survey found 340 mm HMA over 910 mm granular material
- Material Properties better than usual

<b>Property</b>	<b>WB Section Average</b>
<b>Compaction</b>	96 %
<b>Air Voids</b>	3.8 %
<b>Asphalt Cement</b>	5.1 %

# Construction of Trial Sections



## Material Properties After Construction

	<b>Taisei Rotec HIR</b>	<b>New DFC</b>	<b>Martec HIR</b>	<b>RHM DFC</b>
<b>Compaction %</b>	<b>95</b>	<b>93</b>	<b>91</b>	<b>92</b>
<b>Air Voids %</b>	<b>3.8</b>	<b>3.7</b>	<b>3.8</b>	<b>3.2</b>
<b>A. C. Content %</b>	<b>4.7</b>	<b>5.2</b>	<b>4.8</b>	<b>5.1</b>



# Construction Conditions & Observations...

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## ■ Taisei Rotec Section:

- 0.44 L/m<sup>3</sup> rejuvenating oil & 15 mm HMA (PG 58-28 & diabase agg)
- Paved at 26°C to 18°C
- Distresses included:
  - moderate midlane segregation throughout
  - Intermittent slight segregation along longitudinal joint



## ...Construction Conditions & Observations...

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### ■ **New DFC:**

- Milled 55 mm and resurfaced with 54 mm
- PG 64-28 and meta-arkose agg
- Paved at 20°C to 12°C
- Distresses noted:
  - moderate to severe segregation throughout
  - coarse aggregate loss
  - poor longitudinal joint construction

## ...Construction Conditions & Observations...

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### ■ Martec HIR:

- Material removed in two stages
- 0.43 L/m<sup>3</sup> rejuvenating oil & 10 mm HMA (PG 58-28 & meta-arkose agg)
- Paved at 24°C to 13°C
- Distresses included:
  - Isolated areas of moderate segregation
  - slight segregation along longitudinal joint





## ...Construction Conditions & Observations...

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### ■ Recycled DFC:

- Milled 59 mm and placed 52 mm RHM DFC
- 30 % RAP, 70 % new meta-arkose aggregate with PG 58-28
- Paved at 16°C to 12°C
- Distresses included:
  - intermittent moderate end-load segregation
  - L2 and L3 longitudinal joint was poor

## ...Construction Conditions & Observations...

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- Lane 3 Microsurfacing:
  - Placed at 16°C to 10°C
  - Slow curing process kept lane closed till late afternoon.
  - Distresses included
    - Streaks & gouges from dragged oversize agg
    - Rich transverse joints
    - Coarse texture resulted in a noisier ride

## ...Construction Conditions & Observations

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- Lane 2 Microsurfacing:
  - Delayed, placed following year
  - Distresses included:
    - Poor transverse joints
    - 50 mm double groove in centre of Lane 2



# Year 8 Evaluation of Trial Sections...

- **Roughness (IRI ~1)**– reflect bumps associated with patches
- **Rutting (~4 mm)**– very slight
- **Pavement Friction (>40)**– reflective of high quality agg's used
- **Visual Observations**
  - Distortions throughout
  - ...

# Findings – Taisei Rotec HIR



# Findings – New DFC





# Findings – Martec HIR





# Findings – RHM DFC



# Findings – L3 Microsurfacing





# Findings – L2 Microsurfacing



# Summary...

## Microsurfacing Sections

- **Did not meet their 5 to 7 year life expectancy**
- **MTO now routinely tack coats surfaces prior to microsurfacing**
- **Not expected to hold a dry and ravelling pavement for more than a few years**



# ...Summary...

## Recycling Sections...

- **Martec HIR provided best initial performance. Recently ravelling & cracking has increased. Expect 9 to 10 yr life.**
- **RHM DFC similar long term performance. Expect 9 to 10 yr life.**
- **New DFC's un-repaired end-load segregation shortened life expectancy - 7 to 8 years.**
- **Taisei Rotec HIR's material segregation defects & scallops provide an expected 7 to 8 yr life.**

# ...Summary...

## ...Recycling Sections

- **HIR longitudinal joints performing better than DFC & RHM DFC joints.**
- **Recycled mixes can meet same ERS requirements as conventional new HMA.**
- **Although sections do not meet 12 yr expected life for new overlay, found properly constructed RHM can perform equal to new HMA.**

# Concluding Remarks...

- **HIR & central plant recycling are:**
  - **Cost effective**
  - **Environmental friendly rehabilitation options**
  - **Re-use existing non-renewable resources**
  - **Minimize use of new material**
  - **Reduce transportation of construction materials**
  - **Lower GHG emissions**

## ...Concluding Remarks

- **MTO is committed to increased recycling**
  - **Helps address our emission reduction commitments**
  - **Refines our highway rehabilitation strategies to achieve zero waste**
- **MTO has and will continue to protect the environment by promoting & implementing innovative pavement recycling techniques such as HIR and central plant recycling.**

# **Thank you!**

# **Questions?**

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