Concrete Pavements In A Municipal Environment

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Outline

- Types of Concrete Pavements
- Project Locations/Descriptions
- Installation
- Conclusion
Types of Concrete Pavements

- Composite;
- Whitetopping;
- Jointed Plain Concrete;
- Jointed with Dowell Baskets;
- Roller Compacted Concrete
Composite

- 100-150 mm Hot Mix Asphalt
- 150 to 200 mm Portland Cement Concrete
- Subgrade

- Constructed from 1940’s through the early 1960’s
- Make up about 27% of roadway network
- Jointed Plain Concrete Pavement with no Reinforcement
Whitetopping / Ultra-Thin

- Whitetopping can be simply defined as the construction of a Portland Cement concrete pavement on top of an existing asphalt or concrete pavement.

Categories of Whitetopping:

- Conventional Whitetopping;
- Thin Whitetopping;
- Ultra-Thin Whitetopping
Whitetopping

- Intersection Treatment at 118 Avenue West and East Approaches at 170 Street (Ultra-Thin Whitetopping);

- Transit Bus-Stop pads on Arterial and Collector Roadways (Whitetopping);
Intersection Treatments
Transit Bus-Stop Pads
Milling depth was increased in certain locations to remove debonded or delaminated asphalt

Existing asphalt depth varied between different lanes in the intersection

Curb lane shows signs of cracking due to insufficient thickness of residual asphalt, less than 75mm.

The thin 50mm UTW section performs excellently in the left hand turn lane.

Cracks in transition slabs and at utility holes

<table>
<thead>
<tr>
<th>Project Details</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mississauga ON</td>
<td>Brampton ON</td>
</tr>
<tr>
<td>Type of Use</td>
<td>Intersection</td>
</tr>
<tr>
<td>UTW thickness mm</td>
<td>100mm (design)*</td>
</tr>
<tr>
<td>AC thickness, mm</td>
<td>80mm (design)**</td>
</tr>
<tr>
<td>Joint Spacing, m</td>
<td>1.6m</td>
</tr>
<tr>
<td>Synthetic fiber, kg/m³</td>
<td>Two lanes: 1.6 kg/m³ One lane: no fibers</td>
</tr>
<tr>
<td>General Performance Poor/ Good/ Excellent</td>
<td>Excellent (Lanes with fibers have fewer cracks)</td>
</tr>
</tbody>
</table>

* Milling depth was increased in certain locations to remove debonded or delaminated asphalt
** Existing asphalt depth varied between different lanes in the intersection
† Curb lane shows signs of cracking due to insufficient thickness of residual asphalt, less than 75mm.
The thin 50mm UTW section performs excellently in the left hand turn lane.
‡ Cracks in transition slabs and at utility holes
Field Investigations

Surveys / tests provide an understanding of the existing pavement structure:

- Coring of the existing pavement structure to determine total depth of structure
- Measurement of Rutting, Rut Bar data and visual evaluation of Existing pavement
- Deflection tests
Ultra-Thin Whitetopping

1. Mill out 100 mm of Existing Pavement Structure

2. Install 100 mm High Volume Synthetic Fiber Reinforced Concrete

Remaining Asphalt 200–250 mm
118 Avenue, East and Westbound Approaches to 170 Street
170 Street & 118 Avenue Intersection
Existing 118 Avenue & 170 Street

350-370mm Hot Mix Asphalt

200mm Soil Cement

65-75 mm

Actual Roadway Surface

Clay Subgrade
Rehabilitation Proposal

118 Avenue & 170 Street

Remove 100mm of Asphalt

Place 100mm High Volume Fiber Reinforced Concrete

Clean Surface

Wash and Blow Clean

Application of Sand/Cement Slurry
Traffic
Edge Thickening of Ultra-Thin Whitetopping

Saw cut face

T

Existing Asphalt

T + 75mm

L = Standard spacing Between Joints
Mix Design Requirements

UTW was designed to meet the following criteria:

- CSA A23.1-94 Class C1 exposure
- Maximum water/cement ratio: 0.40
- Air content 6.0 +/- 1.0%
- Minimum compressive strength 20 MPa at 2 days & 35 MPa at 28 days
- Slump 70 +/- 20 mm
- Up to 2.0% fibre volume
Reflective Cracking Fall 2012
Shrinkage Crack Fall 2012

Close-up of crack
Stop Bars
Jointed Plain Concrete

150 to 200 mm
Portland Cement Concrete
Jointed Plain Concrete

- Various roadways were originally constructed using Jointed plain Concrete but then were overlaid with Hot Mix Asphalt becoming Composite Pavements;
- Various Residential roads in the Eastwood Neighborhood (Fort Road to 90 Street, 118 to 122 Avenue) are some of the only existing true JPC pavements left in the City of Edmonton. (Constructed in 1949)
Jointed with Dowell Baskets

225 to 250 mm
Portland Cement Concrete
Jointed with Dowell Baskets

- Intersection Treatments and southbound bus lane 105 Street, 104 to 105 Avenue (1994 Construction);
- Heavy Traffic Roadways - Yellowhead Trail, 124 to 127 Streets Westbound lanes (1996 Construction);
- Transit Facilities; South Campus Station (2009 Construction), Lewis Estates (2012 Construction), etc.;
- Jasper Avenue, 100 to 102 Streets (2012 & 2013 Construction);
South Campus LRT Station
105 Street & 104 Avenue Intersection

Yellowhead Trail, 124 - 127 Streets Westbound
Jasper Avenue
Typical Roller Compacted Concrete
Rehabilitation Proposal

1. Mill out 200 - 300mm of Existing Pavement Structure
2. Soil Cement Base
3. Install 200-300mm Roller Compacted Concrete
   - 50mm SMA

Existing Asphalt/Base to Remain
What's New

Permeable Concrete Pavements
Conclusions

- Underground Utilities;
- Training;
- Concrete pavements have and can be utilized in an urban environment;
- Concrete pavements are viable strategies for rehabilitating heavily rutted asphalt pavements;
Questions?