Sandwich Chip Seal: Usage and Performance

Presented By: Chris Dechkoff, EIT
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Fibre-Reinforced Sandwich Chip Seal

- Highway 312
- Treatment selection
- Sandwich chip seal
  - Design
  - Placement
- Evaluation
Highway 312

- Roadway network – 26,000 km of highways
- Graded-aggregate seal coats majority of seal coating treatments
- Road candidates for various conditions
Highway 312

- Located near Rosthern, Sask.
  - *Granular base (Low volume Road)*
  - *Many graded-aggregate seal wearing courses*
  - *25 – 50 Commercial Vehicles / lane / day*
  - *Binder rich surface*
  - *Some potholing*
  - *Speed 80 Km/hr*
Highway 312
Potential treatments to correct flushing:

- *Single chip seal with adjusted binder application*
  - McLeod Method suggests a reduction of 0.04 - 0.27 L/m²
- *Inverted double chip seal*
  - In Australia used with some success
- *Sandwich chip seal*
  - Road Note 39 and NCHRP’s Chip Seal Best Practices
- Addition of fibre to mitigate further potholing
Sandwich Chip Seal

- Binder rich substrate
- Layer of large chip placed
- Binder placed on top of large chip
- Smaller chip placed closely behind binder
Fibre-Reinforcement

First Application of binder

Application of Fibres
(60mm length at 75 g/m²)

Second Application of binder
Aggregate / Binder Selection

- Graded-aggregate seal Type 95
- Sandwich chip seal
  - *Washed Type 95 for 6/10mm*
  - *Washed 2/6 mm chip*
- CRS-2P

<table>
<thead>
<tr>
<th>Sieve Designation</th>
<th>Percent By Weight Passing Canadian Metric Sieve Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0 mm</td>
<td></td>
</tr>
<tr>
<td>12.5 mm</td>
<td></td>
</tr>
<tr>
<td>9 mm</td>
<td>100</td>
</tr>
<tr>
<td>5 mm</td>
<td>0 – 40</td>
</tr>
<tr>
<td>2 mm</td>
<td>0 – 25</td>
</tr>
<tr>
<td>900 um</td>
<td></td>
</tr>
<tr>
<td>71 um</td>
<td>0 – 5</td>
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</tbody>
</table>

Tests on Aggregate
- Gradation
- Bulk density
- Absorption
- Loose Unit Weight
- Flakiness

<table>
<thead>
<tr>
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<th>PERCENT BY WEIGHT PASSING CANADIAN METRIC SIEVE SERIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 MM</td>
<td>100</td>
</tr>
<tr>
<td>10 MM</td>
<td>100</td>
</tr>
<tr>
<td>5 MM</td>
<td>95.5</td>
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<td>1.25 MM</td>
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<tr>
<td>0.63 MM</td>
<td>2.2</td>
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<tr>
<td>0.315 MM</td>
<td>1.6</td>
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<tr>
<td>0.160 MM</td>
<td>1.4</td>
</tr>
<tr>
<td>0.080 MM</td>
<td>1.2</td>
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</table>
Based on guidelines from Road Note 39 for a surface bleeding condition a “sandwich chip sealing system” was selected as the optimal treatment along with fibre-reinforcement.

- **Bottom layer of chips**
  - 10 to 10.5 Kg/m² at 80% coverage (6/10mm)

- **Emulsion and Fibres**
  - 1.80 L/m² (CRS-2P)
  - 75 g/m² (glass fibre)

- **Top layer of chips**
  - 6.5 to 7.9 Kg/m² at 110% Coverage (2/6mm)
Sandwich Chip Seal Placement

Sweep road surface and construction joint prior to chipping.

Large chips (6/10mm), placed directly on flushed surface of the roadway.

Distributor and fibre applicator places binder/fibre/binder over the large chips.

Sweep sandwich chip seal treatment the day after application.

Chippings are packed to properly orient the chips in the emulsion.

Small chips (2/6mm), placed over top binder and fibre applications.

Start of process

Process continued
# Sandwich Chip Seal Placement

<table>
<thead>
<tr>
<th>Lane</th>
<th>Chainage</th>
<th>Treatment</th>
<th>Chip Application Rate (kg/m²)</th>
<th>Binder Application Rate (L/m²)</th>
<th>Fibre Application Rate (g/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bottom 6/10 Top 2/6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Westbound</td>
<td>2+110-2+350</td>
<td>SWS w/FBR</td>
<td>1.8</td>
<td>1.8</td>
<td>75</td>
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<tr>
<td></td>
<td>2+350-6+000</td>
<td>SWS w/FBR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastbound</td>
<td>2+110-5+850</td>
<td>SWS w/FBR</td>
<td>6.1</td>
<td>10.5</td>
<td>75</td>
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<tr>
<td></td>
<td>5+850-6+000</td>
<td>SWS w/o FBR</td>
<td>6.1</td>
<td>10.5</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Sandwich Chip Seal Placement
Evaluation Test Sections

- Three 150m test sections placed and evaluated
  - Graded-aggregate seal coat
  - Fibre-reinforced sandwich chip seal
  - Sandwich chip seal with no fibre-reinforcement
- Defects mapped prior to and after treatment
- Evaluation at ~ one year of service
Hwy 312 before treatment
Evaluation – Graded Seal Coat

(a) August 2010 – Before Graded Seal

(b) May 2011 – After Graded Seal
Evaluation – Graded Seal Coat
Evaluation – No Fibre

(a) August 2010 Before Treatment

(b) May 2011 After Sandwich Chip Seal with no Fibre
Evaluation – No Fibre
Evaluation – Fibre-Reinforced
Evaluation – Fibre-Reinforced
Conclusion

Both Fibre-reinforced and regular sandwich chip seals indicate flushing condition remedied when compared to the graded-aggregate seal coat

- Performing well over a one year period
- Surface texture after 1 year satisfactory
- Further monitoring required over treatment life
- Fibre-reinforcement
  - Further monitoring and assessment required
Questions?

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