SUMMARY OF RESULTS for Mitigating Damage Caused by Studded Tires on Concrete Pavement

FUTURE DIRECTIONS
WSDOT will continue to monitor the performance of the various test sections and investigate additional potential methods for mitigating the damage caused by studded tires. In addition, WSDOT is in the process of evaluating the wear rates on hot mix asphalt pavements. This effort has been delayed due to software limitations and the challenges in distinguishing rutting (caused by heavy trucks) versus wear (caused by studded tires on passenger cars).

CARPET DRAG
Surface texturing technique that drags either a burlap or Astroturf™ across the wet concrete surface to create the required texture.

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Previously, damage caused by studded tires was difficult to quantify. With improved technology it is now possible to measure the amount of damage on concrete pavements (WSDOT is working diligently to estimate the amount of damage on hot mix asphalt pavements). It is estimated that the damage caused by studded tires on concrete pavements will require $18.2 million for rehabilitation.

**INTRODUCTION**

**SUMMARY OF RESULTS for Mitigating Damage Caused by Studded Tires on Concrete Pavement**

The following table illustrates the amount of wear due to studded tires that is present on the concrete pavements of Washington State compared to comparable pavements (in age) to those in California, Texas and Minnesota.

<table>
<thead>
<tr>
<th>State</th>
<th>Roadway</th>
<th>Age</th>
<th>Average Daily Traffic (ADT)</th>
<th>Average Depth of Wear (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
<td>SR-395 Ritzville</td>
<td>11 years</td>
<td>6,000</td>
<td>1</td>
</tr>
<tr>
<td>Texas</td>
<td>I-45 Houston</td>
<td>16 years</td>
<td>178,000</td>
<td>0</td>
</tr>
<tr>
<td>Washington</td>
<td>I-90 Seattle – Rainier Avenue</td>
<td>16 years</td>
<td>120,000</td>
<td>2</td>
</tr>
<tr>
<td>Minnesota</td>
<td>I-94 Minneapolis</td>
<td>28 years</td>
<td>130,000</td>
<td>0</td>
</tr>
<tr>
<td>Washington</td>
<td>I-90 Preston-Fall City</td>
<td>28 years</td>
<td>50,000</td>
<td>7</td>
</tr>
<tr>
<td>California</td>
<td>SR 101 Uxian</td>
<td>34 years</td>
<td>26,000</td>
<td>0</td>
</tr>
<tr>
<td>Washington</td>
<td>I-5 Seattle – Boeing Field</td>
<td>34 years</td>
<td>304,000</td>
<td>6</td>
</tr>
<tr>
<td>Washington</td>
<td>I-5 Tacoma</td>
<td>40 years</td>
<td>194,000</td>
<td>7</td>
</tr>
<tr>
<td>Washington</td>
<td>I-90 Spokane</td>
<td>48 years</td>
<td>100,000</td>
<td>7</td>
</tr>
</tbody>
</table>

**STUDDED TIRE DAMAGE ON CONCRETE PAVEMENTS**

The carbide steel in the studs is several times stronger than the surface of the concrete pavement. Over time the studded tires grind away at the concrete pavements surface. The amount of wear can become severe and requires pavement rehabilitation to restore a smooth, even surface.

**WHAT IS BEING DONE TO MITIGATE THE DAMAGE?**

Over the last several years, WSDOT has constructed several experimental projects in the Eastern Region, specifically SR-395 south of Ritzville and I-90 in Spokane, in an effort to mitigate the damage caused by studded tires on concrete pavements. These projects have investigated the following:

- Increasing the amount of cement to increase the strength of the concrete (increasing the strength would make the concrete surface harder and potentially more resistant to studded tires).
- Modifying the aggregate to get a more uniform gradation (this would result in a more even distribution of aggregate sizes which would minimize the amount of finer aggregate, which are more susceptible to damage from studded tires).
- Evaluation of a carpet drag surface texture.
- Addition of Hard-Cem (concrete additive that is reported to improve the abrasion resistance of concrete, this product is often used on industrial floors).

**PRELIMINARY RESULTS**

Though many of these sections have less than five years of service, preliminary results indicate:

- Higher strength concrete is showing less studded tire wear, while in the less strength mixes most of the tinging has been worn away from the wheel paths.
- Modifying the aggregate gradation has not shown a difference in studded tire wear rates.
- Though there is no one mix that is outperforming any of the other mixes, the sections that were carpet dragged are performing better than the standard WSDOT practice of transverse tining.
- Addition of Hard-Cem does not appear to minimize the amount of studded tire wear.