RESEARCH

Research Notes

RSN 07-09 June 2007

Geosynthetic Materials in Reflective Crack Prevention

Extension of transverse cracks across roadway travel lanes is common in Oregon. Cracks form as a result of shrinkage and brittleness during very cold temperatures. These cracks deteriorate over time, spalling and creating bumpy riding surfaces. Premature transverse cracking shortens the design life of pavement, and thus increases maintenance costs. After highways are repaved cracks often appear or "reflect" at the same location on the new pavement overlay.

One location where reflective cracking has continuously occurred is on the southern portion of Oregon State Highway Number 4 (US 97). A four mile section (MP 213.6 - 217.6) of this highway, located south of the town of Chemult, OR, was selected as a test site to evaluate the effectiveness of five geosynthetic materials at delaying, lessening, or preventing reflective cracking. The five geosynthetic products tested were: Glasgrid 8502®, GeoTac®, PavePrep SA®, Polyguard Cold Flex 2000 SA™, and Polyguard 665™.

In 1998 total of 140 transverse cracks were divided into seven test sections. Crack fill and geosynthetic material was installed in five of the sections (Figure 1); crack fill only was applied in one of the other sections; and the remaining section was left alone. Just after the treatments were installed, an asphalt concrete overlay was constructed.

Figure 1. Crew installing Geosynthetic.

The project test sites were visited once a year from 1999 to 2007. The location of each of the 140 original cracks was revisited to see if the crack had reflected through the new overlay. If a crack was visible, its length was measured, as well as its width. The width of the crack determined its severity, so that narrow cracks were low severity and wider cracks were rated as medium or high severity.

Data from each of the on-site evaluations was compiled and compared from year to year. The two main factors in assessing the effectiveness of the material were how much of the original crack reflected (percent of length) and how wide the crack got (severity). Percent of crack length calculations showed that all geosynthetic products except Polyguard 665™ outperformed both the control and crack fill only test sites until 2004 (Figure 2). In 2005 most products appeared to fail, and by 2007 percent crack length of geosynthetic materials was worse than both control and crack fill only sections.

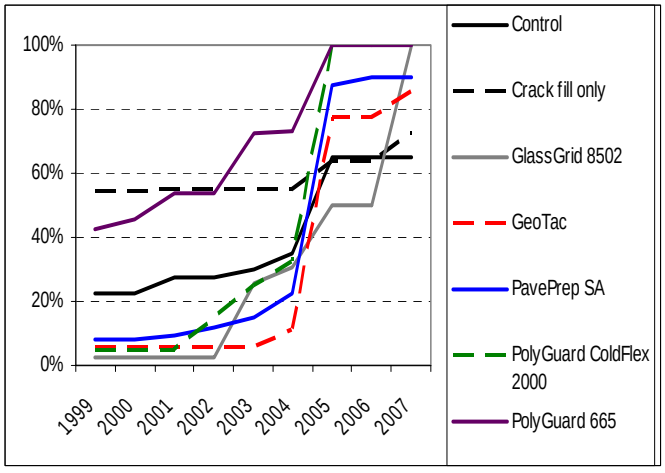

Figure 2. Chart showing the percentage of original crack length reflected from 1999 to 2007.

The tested geosynthetic materials seemed to perform worst in coldest years. In years when extreme temperatures were low, geotextile percent crack length increased (Figure 3).

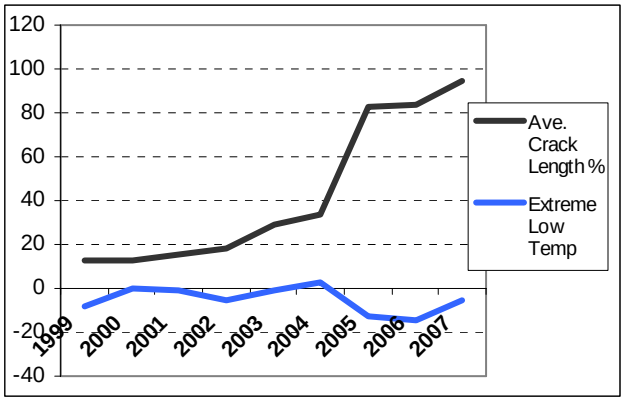

Figure 3. Chart showing the correlation of extreme low temperatures and percentage increases in average crack length of geosynthetic test sections.

Though no geosynthetic material was effective at preventing cracks from returning, most stopped or stunted the worsening of cracks (i.e. from becoming wider). Prior to test implementation in 1998, out of a total of 98 cracks in the geosynthetic test sections, 49 of the cracks were rated as medium severity and 49 as high severity. In comparison, with the use of geotextiles from 1998 to 2007 all 98 cracks returned, but 42 were ranked as low severity, 46 as medium, and only 10 as high severity. The geotextile material was effective in reducing the number of high severity cracks by 80 percent.

After eight years of geosynthetic evaluations, Glasgrid 8502® had the least number of high severity cracks (none) as well as the fewest total medium severity cracks (1). Glasgrid 8502® appeared to perform the best at reducing reflective crack severity.

When transverse cracks worsen to high severities, or when cracks begin to spall, road surfaces require repaving. If reflective transverse cracking is the only factor in road deterioration, then it appears to be economically beneficial to apply certain geosynthetic materials prior to an overlay to improve the life span of the pavement surface. In the case of US 97, however, other factors, such as the appearance of fatigue cracks, rutting and minimal longitudinal cracking, resulted in the need for the test section to be resurfaced in 2007.

For more information, contact Amanda Bush at 503-986-2848,
or via e-mail at *amanda.bush@odot.state.or.us*

The full report for this project is available on the Research Unit web page:
http://www.oregon.gov/ODOT/TD/TP_RES/ResearchReports.shtml

Oregon Department of Transportation

Research Unit
200 Hawthorne Ave. SE, Suite B-240
Salem, OR 97301-5192

Telephone: 503-986-2700
FAX: 503-986-2844

For more information on ODOT's Research Program and Projects, check our website at
http://egov.oregon.gov/ODOT/TD/TP_RES/