RESEARCH NOTES

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ASPHALT-RUBBER CONCRETE (ARC) AND RUBBER MODIFIED ASPHALT CONCRETE (METRO RUMAC)

N.E. 181st Avenue - Troutdale Section
Columbia River Highway (U.S. I-84)

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The disposal of worn automobile and truck rubber tires may cause environmental problems, such as the potential of tire fires which emit hazardous substances into the air, and tires using large amounts of landfill space. In response to these concerns, the Oregon Legislature recently required the Oregon Department of Transportation (ODOT) to conduct two paving projects using rubber from waste tires, and the U.S. Congress required that some of the federally funded highway projects built during or after 1994 use pavements containing recycled tire rubber.

In order to find suitable ways of adding tire rubber to hot mix asphalt concrete, the ODOT Research Unit is studying the construction and initial performance of rubberized asphalt concrete pavement test sections on three projects built in 1991, one project built in May 1992, and four projects scheduled for construction in 1992 and 1993.

One project was constructed in September 1991 on U.S. I-84 from NE 181st Avenue to Troutdale (ten miles east of Portland). The project included some inlays and a 2-inch overlay. In the westbound lanes, test section and control section overlays were placed; the test section is an open-graded asphalt-rubber concrete (ARC) of modified ODOT Class "F" gradation and the control section is a conventional open-graded asphalt concrete of ODOT Class "F" gradation. In the eastbound lanes, test section and control section overlays were placed; the test section is a dense-graded rubber modified asphalt concrete (RUMAC) of ODOT Class "B" gradation, and the control section is a conventional dense-graded asphalt concrete of ODOT Class "B" gradation. Lime treated aggregate (3/4-inch to 0-inch) was used in all mixes.

Asphalt-rubber supplied by International Surfacing Incorporated (ISI) of Chandler, Arizona, was used in the ARC mix. This mix, ISI ARC, was made by mixing the asphalt-rubber with the hot aggregate in the mix plant's drum. The asphalt-rubber was added to the drum by the plant's asphalt feed system and a large capacity pump supplied by ISI. The asphalt-rubber was blended by ISI near the mix plant by adding shredded tire rubber to hot asphalt. This is often referred to as the "wet" process because a liquid mixture of rubber and asphalt is pumped into the plant. Several features of the ISI ARC procedures are patented.

The RUMAC mix used a process developed for the Metropolitan Services District (METRO) of the Portland, Oregon, urban area. This mix, METRO RUMAC, was made by adding crumb rubber to the drum along with hot aggregate and conventional asphalt. The rubber was injected into the drum by a screw auger located below the asphalt spray bar, and the hot aggregate and asphalt were added to the drum in the normal fashion. This is often called the "dry" process because the rubber is added directly to the plant's mixing chamber. The METRO RUMAC procedures are not patented.

No problems were encountered when the ISI ARC, Class "F", or Class "B" mixes were made. Problems occurred when the METRO RUMAC was mixed, as the feed for adding the rubber into the drum was hard to control and monitor. As a result, the amount of rubber added to the mix varied from the desired proportions.

The laydown and compaction of the ISI ARC and METRO RUMAC were similar to their conventional counterparts, except that the rubber tired (pneumatic) roller used on the conventional mixes was not used on the rubberized mixes, as previous experience with ARC and RUMAC has shown that these mixes may adhere to the roller's tires. No significant compaction problems were encountered with the ARC mix. However, sections of the METRO RUMAC mix did not reach the desired density. The compaction problem may be due to a high rubber content of the mix or other causes.

Based on unit bid prices, the rubberized mixes cost more than their conventional counterparts. The ISI ARC cost over twice as much as the Class "F" mix per square yard of coverage, and the METRO RUMAC cost over 1-1/2 times as much as the Class "B" mix per square yard of coverage.

Immediately after placement, the sections were inspected and they were in good condition. All sections had non-rutted, uncracked and smooth surfaces without ravelling. The surface friction values, ride values, and deflection reductions of the test sections were similar to the control sections and typical ODOT overlays.

Experience on this project indicates that the sampling and testing methods for the ISI ARC and METRO RUMAC are different and more expensive than the methods used for conventional mixes. For the ARC, the asphalt-rubber and its components may need to be tested to assure compliance with specifications. For the METRO RUMAC, the rubber may need to be tested for specification compliance. In some cases, these asphalt-rubber and rubber tests require special test methods and equipment. Also, special tests may be needed to verify that the correct amount of rubber is added to the asphalt-rubber or mix.

The construction report, "Asphalt-Rubber Concrete (ARC) and Rubber Modified Asphalt Concrete (METRO RUMAC) Evaluation, NE 181st Avenue - Troutdale Section, Columbia River Highway (US I-84)" has just been published by the Research Unit. It covers the construction and initial condition of these test and control pavements. To obtain a copy of this report or additional information regarding this topic, please contact:

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