RESEARCH
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TECHNOLOGY TRANSFER PROGRAM

Development of Surface Friction Guidelines for LADOTD

JUST THE FACTS:

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Mehodology Used Implementation Potential

PROBLEM

The current friction guideline of the Louisiana Department of Transportation and Development (LADOTD) for a wearing course mixture design deals with the polished stone value (PSV) of coarse aggregate (which is a relative British Pendulum skid-resistance number measured on polished stones). The basic assumption is that the aggregates with a high PSV will automatically provide high friction or skid resistance for a wearing course mixture. However, the field measurement on skid resistance sometimes does not necessarily support such an assumption. In fact, there are many parameters that may affect the friction resistance of a wearing course mixture, and the polished stone value is just one of these parameters. The National Cooperative Highway Research Program (NCHRP) Project 1-43: *Guide for Pavement Friction* examined several friction-influential parameters related to a mixture design. Among them include mixture type, surface textures (micro- and macro-textures), polished stone value and other aggregate properties, and binder properties. Obviously, the use of only polish stone values of coarse aggregates would have somewhat clouded the fundamental issues related to skid resistance. In addition, since very limited highly skid-resistant aggregates are locally produced in Louisiana, such friction guidelines tend to screen out locally available materials by requiring the imported highly skid-resistant aggregates in a wearing course construction, which is usually not cost-effective. Therefore, there is a need to re-examine the current friction guidelines and develop new guidelines in which more frictional characteristics (such as micro- and macro-textures) can be considered in a wearing course mixture design. Ideally, the new guidelines will allow more locally available aggregates to be used in a wearing course mixture.

OBJECTIVE

The main objective of this study is to develop Louisiana pavement surface friction guidelines that will consider polished stone values and mixture types alike in terms of both micro- and macro-surface textures.

METHODOLOGY

In this study, a partial factorial experiment (Table 1) is designed to study the relationship between pavement surface textures and pavement friction through measuring those properties on various asphalt mixture types and a range of aggregates. In general, four typical mixture types

currently used by LADOTD will be selected: open grade frictional course (OGFC), stone matrix asphalt (SMA), and 0.5-in. and 0.75-in., respectively, Superpave Level 2 mixtures. Only one binder type and one gradation type will be used in the mix design. However, three aggregate blends (with different PSVs) will be considered for each selected mixture type, resulting in a total of 12 asphalt mixtures (Table 1). Sufficient amounts of each HMA mixture will be produced in the LTRC asphalt laboratory and shipped to the National Center of Asphalt Technology (NCAT) for friction/polishing tests. Laboratory polishing tests will be performed on kneading-compacted asphalt concrete slabs (each size of 20 in. x 20 in. x 2 in.) at the NCAT using the NCAT three-wheel polishing device (Figure 1), and the "after-polishing" friction characteristics (i.e., mean profile depth and friction number) will be measured by a circular texture meter and dynamic friction tester (Figure 2) at every 20,000 polishing cycles up to 100,000. A total of 36 slabs will be tested (Table 1). The obtained test results will be used to establish a relationship for surface friction resistance of mixtures in terms of an aggregate friction rating and a mixture mean depth of texture, and specification changes will be initiated in the surface friction guidelines for LADOTD's wearing course mixtures. It is anticipated that a suite of surface friction versus various levels of macro- and micro-texture plots (similar to the one showed in Figure 3) will be developed for each mixture type considered.

IMPLEMENTATION POTENTIAL

Revised pavement surface friction guidelines based on both requirements of the micro- and macro-textures will have the potential to be implemented in designing a high-friction-required surface mixture using less-expensive, locally available aggregates.

Table 1
Laboratory experiment factorials

Mix Type	Binder/Gradation	Type of Aggregate Blend	Aggregate Blend PSV	No. of Slabs
Open Grade Frictional Course (OGFC)	76-22M 12.5mm Gradation	100% Sandstone (SS)	>35	3
		30%SS+70%LS	30~34	3
		100% Limestone (LS)	20~29	3
Stone Matrix Asphalt (SMA)	76-22M 12.5mm Gradation	100% SS	>35	3
		30%SS+70%LS	30~34	3
		100% LS	20~29	3
0.5 in. Superpave Level 2	76-22M fine-graded	100% SS	>35	3
		30%SS+70%LS	30~34	3
		100% LS	20~29	3
0.75 in. Superpave Level 2	76-22M fine-graded	100% SS	>35	3
		30%SS+70%LS	30~34	3
		100% LS	20~29	3

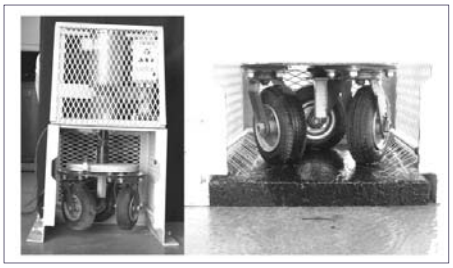

Figure 1
The NCAT three wheel polishing device (TWPD)

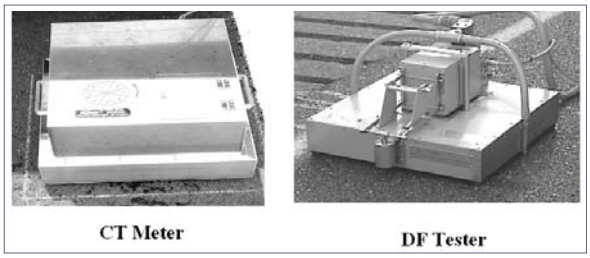

Figure 2
Circular track meter and dynamic friction tester

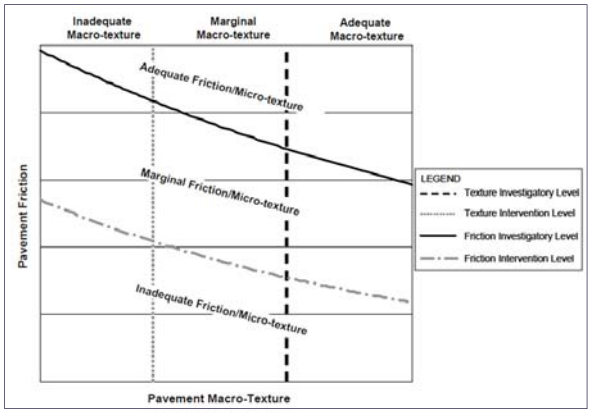

Figure 3
Relationship between micro-/macro-texture and surface friction

(After Hall, J.W., et al. , Guide for pavement friction. NCHRP 1-43 final report, web-only document 108, 2009)