Research Problem Statement

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I. TITLE

17-068 Employing iRLPD Test Methods for Optimal Asphalt Mixture Performance

II. PROBLEM

Due to recent changes in aggregate and binder specifications and due to the increased use of additives, RAP, and RAS, asphalt mixtures are becoming significantly stiffer than before. While these changes have improved rutting resistance; they have resulted in significant reduction in the mixture durability (cracking resistance).

In response to the needs of the state highway agencies for simple, practical and reliable tests for evaluating performance of asphalt mixtures, a new testing methodology called incremental Repeated Load Permanent Deformation (iRLPD) has been developed by Pavement Systems LLC. The optimal design concept would prevent making the mixtures too stiff. The iRLPD tests may be utilized to determine how much a mixture can be stiffened before it loses its durability and become vulnerable to cracking. The Optimal design tool may also be used to modify mix design when the quality of RAP changes during the production so that the mixture remains within the acceptable performance range.

III. PROPOSED RESEARCH, DEVELOPMENT, OR TECHNICAL TRANSFER ACTIVITY

The optimal design of asphalt mixture is possible through a new test parameter, called Minimum Strain Rate (MSR) for rutting and fatigue cracking. The MSR endurance limits for rutting are defined in AASHTO TP 116. The MSR of 1.0 microstrain (ms) corresponds to the highest rutting resistance of mixture with the allowable traffic level of over 30 million ESALs. The MSR of 24 ms corresponds to the least rutting resistance (less than 1 million allowable ESALs). The endurance limits of MSR for fatigue cracking have also been defined. Typically, MSR of over 50 ms corresponds to excellent fatigue resistant and MSR of less than 20 corresponds to poor fatigue resistance.

IV. POTENTIAL BENEFITS

The objective of the optimal design is to achieve mixtures with MSR values for rutting and cracking within the acceptable range. This optimal design will assists in optimizing the virgin binder grade, recycled binders and aggregate structure to increase the pavement life.

V. IMPLEMENTATION

Based on the results of testing a conceptual diagram of the correlation of cracking index (iRLPD fatigue MSR) and rutting index (iRLPD rutting MSR) for optimal asphalt mixture design can developed as shown in Figure 1. The figure shows that there is an optimum range of MSR values for acceptable rutting and fatigue performance. The MSR values from fatigue test below 20 ms (y-axis) would indicate durability problem and the MSR values from rutting test above 24 ms (x-axis) would indicate rutting problem.

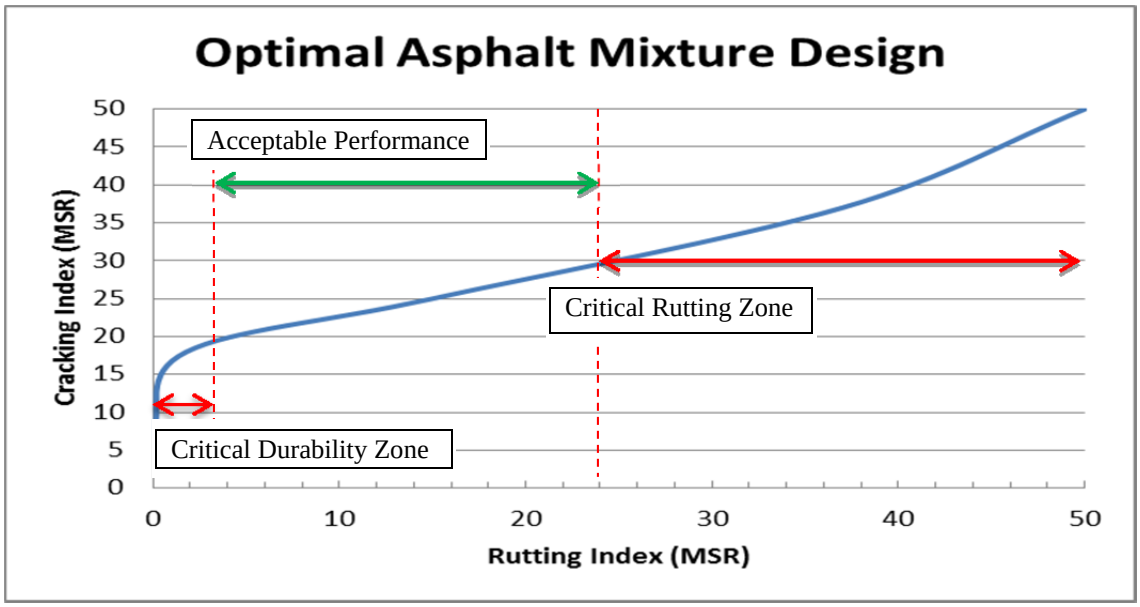

Figure 1- iRLPD Rutting Index (MSR) versus iRLPD Cracking Index (MSR)

Research would include laboratory testing, software for ODOT, training for ODOT and implementation consultation.
ODOT's Pavement Services would update the ODOT Asphalt Mix Design Guidelines with the new test procedures and requirements.

VI. LIST OF REFERENCES *(optional)*

1. AASHTO TP 116, "Rutting Resistance of Asphalt Mixtures using Incremental Repeated Load Permanent Deformation (iRLPD)," AASHTO Provisional Standards, 35th Edition, 2015
2. Mohseni, A. and Azari, H., 2014, "Effective Temperature for Permanent Deformation Testing of Asphalt Mixtures", ISAP 2014.
3. Azari, H. and Mohseni, M., 2012, "Incremental Repeated Load Permanent Deformation Testing of Asphalt Mixtures," TRB No. 12-4381, 2012.
4. Azari, H. and Mohseni, A., "Permanent Deformation Characterization of Asphalt Mixtures using Incremental Repeated Load Testing," TRB 2013.
5. Azari, H. and Mohseni, A., 2013, "Effect of Short-Term Conditioning and Long-Term Aging on Permanent Deformation Characteristics of Asphalt Mixtures," AAPT Journal, Volume 82, 2013.

VII. CONTACT INFORMATION

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