



Project Summary

Texas Department of Transportation

0-4681: Further Development of Binder Quality Assurance Program

Background

The current Texas Department of Transportation (TxDOT) binder Quality Control/Quality Assurance (QC/QA) system uses two asphalt binder supplier categories: suppliers who have an approved quality control plan (QCP) on file with TxDOT and those who do not. Suppliers who maintain a current QCP can obtain approval to supply binders on either a monthly or a quantity basis, while for others, each load of asphalt must be tested for specification compliance. This binder QC/QA system has worked reasonably well until recently. A few binder supplier-grade combinations have experienced higher failure rates than in the past, and some TxDOT districts have had to resort to taking frequent field samples, as frequently as one per each transport load. Many TxDOT practitioners indicated that an approved binder source does not always provide acceptable quality binders. A more robust QC/QA system is needed to ensure a supply of binders that both meet specifications and maintain a consistent level of quality. This research project was launched to create a quality management system that utilizes the latest QC/QA principles by sharing the quality management burden between the supplier and the client TxDOT.

What the Researchers Did

Texas Tech University, Center for Multidisciplinary Research in Transportation (TechMRT), undertook a constructability review of binder quality for TxDOT operations. All TxDOT districts were contacted to solicit their viewpoints on the existing binder quality management program. Issues such as binder usage, quality problems and possible solutions were also discussed. In addition, eight major binder suppliers, along with several contractors, were interviewed.

TechMRT also performed a comprehensive statistical analysis of binder test data. Researchers analyzed 3 years of test results (QA data) from TxDOT's Laboratory Information Management System (LIMS). Since the analysis of results from all binder plant-grade combinations was impractical, plant-binder grade combinations were selected based on an analysis of binder supply quantities for the past 10 years. In addition, the quality control test data provided by the suppliers were analyzed. The methodologies that were used in the statistical analysis of data included the following:

- Specification compliance for raw test data.
- Outlier analysis of raw test data.
- Tests for normality of data.
- Process control charts (X- and R- charts) for quarterly averaged test data.
- Analysis for quality trend signals that provides information on the consistency of quality.
- Process capability prediction using available test data.

Research Performed by:

Center for Multidisciplinary Research in Transportation (TechMRT),
Texas Tech University

Research Supervisor:
Sanjaya Senadheera, TechMRT

Researcher:
John Kobza, TechMRT

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TechMRT also conducted a limited round-robin test program for selected binder types, sources and grades to evaluate the feasibility of implementing such a program in the future. Results from that analysis were compared to both within- and between-laboratory variability guidelines available from AASHTO and ASTM standards.

At the end of the data analysis phase, the researchers developed a 25-page research product titled *A Framework for TxDOT Binder Quality Management*.

What They Found

TechMRT quickly found from the constructability review that there exists a great need for an updated quality management tool that will provide concrete guidelines for binder suppliers to provide asphalt binders that both meet specifications and have consistent quality. Many TxDOT districts indicated they had problems with binder quality, while a few districts indicated they did not have such problems. The QA data available from the LIMS database was comprehensive. However, the supplier QC database was incomplete, and the data had not been submitted to TxDOT in a timely and comprehensive manner. This prevented the researchers from conducting a comprehensive statistical analysis as intended for the QC data. However, the available data were analyzed using the methods indicated above.

The statistical analysis revealed some quality concerns with certain supplier-grade combinations. However, this was not a widespread problem. A rate of 5 percent was used to identify out-of-specification source-grade combinations for raw test data. A 5 percent cut-off failure rate was also used to identify problem source-grade combinations for the process capability prediction, which indicates the accuracy of test data in predicting the process quality. Several source-grade combinations showed violations in several quality trend signals using statistical process control charts. These signals were used to test the consistency of binder quality. Using findings from the research tasks, the researchers were able to develop a quality management framework for TxDOT to review.

What This Means

A sound binder supply quality management scheme requires cooperation between binder suppliers and TxDOT. The burden of producing an asphalt binder that meets specifications and maintains a consistent level of quality lies primarily with the supplier. TxDOT has the responsibility to provide clear and specific guidelines for suppliers to follow, and to conduct random quality assurance tests. Based on this premise, a framework has been developed in this research by TechMRT. The researchers believe that it is a comprehensive and technically sound framework that is also practical and fair for all parties concerned.

For More Information:

Research Engineer - German Claros, TxDOT, 512-465-7403
Project Director - Jerry Peterson, TxDOT, 512-506-5821
Research Supervisor - Sanjaya Senadheera, TechMRT, 806-742-3037

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Research and Technology
Implementation Office
P.O. Box 5080
Austin, Texas 78763-5080
512-465-7403

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