0-7028: Capitalizing on Construction Records to Identify Relationships between Construction and Long-term Project Performance

Background

Study of the effect of materials properties on the long-term pavement performance requires significant amount of time and extensive resources as pavement performance needs to be measured and documented on a regular basis for years. As part of its quality control and quality assurance (QC/QA) process, TxDOT maintains pavement-related data in several databases: mixture design and QC/QA data in SiteManager (SMGR); construction, bid, and project related information in the Design and Construction Information System (DCIS); and pavement performance history in the Pavement Analyst (PA). Even though a significant amount of data and information are available in these databases this data has not been fully utilized to study the effect of material design factors and QC/QA efforts on the long-term project performance. The primary objectives of this study are to utilize these databases to identify (i) materials and construction practices that effect the long-term performance of the hot mix asphalt (HMA) pavements; (ii) gaps in the existing data management systems; and (iii) potential modifications or best practices that will lead to TxDOT getting more value for the money spent over the pavement life.

What the Researchers Did

For this study, an in-house data warehouse was developed integrating materials and project related data from the SMGR database and pavement performance from the PA database. Materials data from SMGR and project location, length, construction date were collected from the DCIS System. Pavement performances manifested in the form of surface distresses including cracking and rutting as well as performance measures, such as international roughness index (IRI) and condition score (CS) were collected from the PA database. Several traditional regression analysis tools as well as new computational data analysis tools, such as random forests and artificial neural network (ANN) model, were used to analyze the results. The effect of materials properties including the binder content, binder grade, aggregate absorption, mix type, and recycled binder content on the performance indices such as rutting, cracking, CS and IRI was studied. Based on the materials information collected from the SMGR database and performance reported in the PA database, thirteen projects from the dense graded hot mix asphalt mixture (specification item 341) were selected as a sample for site inspections.

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What They Found

Analysis from this study shows that asphalt content, binder grade, recycled binder content, and aggregate absorptions are the notable materials characteristics that influence the long-term pavement performance measured in terms of IRI. Limits could be set on these parameters for a given service life and traffic volume for the improved pavement performance. More than one standard for the PA data recording system have been found creating artificial data sparsity. Some of the results from the unified database were consistent with field observations, whereas many surfaces were found with crack sealants, chip seal, or overlays. The discrepancies between the site inspection and PA performance measures indicate that the "well performing" pavement sections were rated as such because of the maintenance activities that were not captured by this database.

What This Means

Recommendations from this study are to:

(i) incorporate overlay maintenance activities with the materials and performance information used for this study

(ii) develop a unified system with the integrated information for real-time updates

(ii) present the integrated information on a commercial tool, such as Tableau, for MTD, MNT, and districts for their use. It is expected that implementation of such a tool will significantly improve current business processes related to the construction and material inspection and management.