Capitol Area Pavement Engineers Council (CAPEC)

Scope for the Development of Regional Pavement Design Methodology and Pavement Construction Specifications

Introduction

The purpose of this project is to develop a unified set of pavement design procedures and pavement material specifications and standards for use in the Austin and Central Texas area for local agencies to use on all urban and county roadways.

Critical Issues

The counties and municipalities in the Central Texas area currently use various versions of the AASHTO pavement design software and even older mid 70's design procedures to determine structural numbers for pavement designs. The results are largely dependent upon the structural support values determined in the laboratory and design traffic numbers. Results have been analyzed for fatigue failure over the past five years. Fatigue failure is calculated by measuring the strains in the asphalt concrete through elastic layered analyses. The resulting ESALs to failure have repeatedly exhibited lower values than the design ESALs. We believe the procedures should be adjusted for the soils encountered in the area to produce pavement sections that do not fail prematurely, resulting in enormous funding requirements for maintenance and early reconstruction.

Historically, pavements in the Austin and Central Texas area have exhibited failure when the moisture contents of clay soils vary from their optimum moisture. When moisture contents are allowed to vary substantially it causes large volume changes in these highly expansive clays. Current construction practices allow contractors to prepare subgrade within two percent of the optimum moisture content. Design procedures primarily consider the strength of the soils at optimum moisture contents. A methodology should be developed to consider the effects of changes and ways to control moisture content during the pavement life.

Another major contributor to pavement failures is the increasing tire pressures and axle loads of vehicles using the public transportation system. In conjunction to the increased loads, stop and go traffic patterns contribute to structural failures in pavement systems. Consideration in the design methodology should be given to these unique loads and situations with updated truck traffic predictions for urban streets.

Considerable work has been performed to locate areas of high swelling soils in Central Texas. As homebuilders are changing construction techniques to protect homeowners' investments from swelling soils, the taxpayers should be protected from increased fund requirements to maintain pavements in these high swell areas. The currently employed rudimentary mitigation requirements for areas of high swelling soils have largely been ineffective. Given today's experience and technology, swelling subgrade should be addressed in each subgrade design report.

The increase in construction costs of pavement due to improved designs and mitigation measures should be countered by decreased maintenance costs over the design life of the pavement. Innovative use of materials should be considered to reduce the life cycle costs of pavement systems. The consideration of both flexible and rigid pavement options should be allowed within the proposed methodologies including a life cycle cost analysis.

It should also be noted that urban pavement designs are highly focused on residential areas such as lighter duty local streets, neighborhood collectors, and cul de sacs. These roadways are substantially different than the highway environment and even different than urban arterials in many ways: much thinner cross sections overall, highly variable

roadway geometries, less uniform drainage and grading, extensive utilities under the pavement, less funding per mile of street, etc.

Implementation of the new design standards and specifications will require ongoing support from the project team. Consideration should be given to local consultants and their experience with unique problems encountered in the area.

Project Objective

The major objectives of the Project will be to develop pavement thickness design methodology, produce a design procedure and construction specifications.

The following task descriptions are intended to provide a framework for conducting the project. CAPEC is seeking the insights of proposers on how best to achieve the objective. Proposers are expected to describe the effort that can realistically be accomplished within the constraints of available funds and contract time. Proposals must present the proposers' current thinking in sufficient detail to demonstrate their understanding of the problem and the soundness of their approach for accomplishing the project objective.

Phase 1

Task 1 – Literature Review / Partnering – will review current information relevant to the project which will be utilized to provide a clear understanding of the study topics and to develop consensus in the paving and development community.

Subtask 1 - Literature Review

* Review of the existing Austin Area Design Methodologies in use by the various area agencies
* Review current standards, testing, and construction inspection practices
* Review examples of failed streets concentrating on the poor soils (high plasticity clay) areas
* Review of applicable research studies
* Interview CAPEC members and participating consulting engineers
* Review of AASHTO 200x research/design methodology
* Develop best practices summary for pavement design

Subtask 2 – Partnering

* Information Dissemination
* Public Request for Comment to Foster Consensus
  - Texas Asphalt Pavement Association
  - Texas Concrete Pavement Association
  - Austin Contractor's & Engineers Association
  - Central Texas Geotechnical Engineers
  - American General Contractors (AGC)
  - Home Builders Association
  - Real Estate Council (RECCA)
* Local Material Suppliers

Task 2 – Work plan – prepare a detailed outline of the roadway design project and a plan for developing the design method in Phase 2. The outline shall consider the performance parameters of subgrade model, testing requirements, traffic characterizations and soil stabilization strategies.

Task 3 – Interim Report – Prepare an interim report that documents the results of the effort in Task 1. Following review of the interim report by CAPEC, the team will be required to make a presentation to the CAPEC members. Work on Phase 2 of the project will not begin until the interim report is approved and the Phase 2 work plan is authorized by CAPEC.

Phase 2

Task 4 – Development of Soil Subgrade Model – will provide the study with physical data on the local soil conditions and development of soil models for use in design, specifically two models one for limestone/granular subgrade and one for expansive subgrade.

* Collection/Collation of data summarizing pavement performance of typical sections by subgrade type.
* Developing subgrade support characteristics and typical design parameters including Resilient Modulus, Mr, and representative Elastic Modulus, E.

Task 5 – Development of Soil Testing Correlations – will concentrate on development of correlations between M_r (resilient modulus) values and more conventional geotechnical tests and information to allow for representative characterization and reasonable cost, time, and effort to perform testing.

Task 6 – Development of Traffic Characterization and Parameters – will study traffic conditions and vehicle impacts in light of the new transportation policies, heavier vehicles, tire configuration, and suspension systems.

* Characterize traffic for urban Local / Collector / Arterial streets with average and high volume recommendations for new street designs.
* Develop methodology for determining traffic impact i.e. FHWA classes & truck percentage, load spectra, etc..

Task 7 – Development of Soil Stabilization Strategies – will study soil stabilization strategies

* Develop zones of subgrade treatment and stabilization, strategies, and recommendations for effective use.
* These recommendations may entail several treatments or elements that are effective in combination.

Task 8 – Work plan – Prepare a detailed plan for developing the design method in Phase 3. The plan shall consider the development of software or the adoption of existing software and a method for integrating pavement design with material and construction specifications.

Task 9– Final Report – Prepare a final report that documents the results of the effort in Task 1– 7. Following review of the final report by CAPEC, the team will be required to make a presentation to the CAPEC members. Work on Phase 3 of the project will not begin until the final report and work plan for Phase 3 is approved.

Phase 3

Task 10 – Development of Design Program and/or Methodology and Material and Construction Specifications – will provide an integrated pavement design program and/or methodology and set of material and construction specifications for all key pavement related items which are based upon and tied to the design.

* Develop Pavement Material Specifications tied to the new design methodology: aggregates; asphalts, oils, and emulsions; concrete; flexible base; recommended pavement reinforcement products; and any others specifically related to pavements
* Develop Construction specifications: compaction; lime stabilization; cement stabilization; concrete pavements
* Issue Final Report including Manual of Recommended Design and Construction Practices for Flexible Pavements. This report shall cover the theory, procedures, analysis, and engineering data.
* New rigid pavement design procedures will not be a part of this initial project. We will continue to use MRPS for the immediate future.
* Design procedures should be focused on providing adequate pavement designs for residential areas such as cul-de-sacs, local streets, neighborhood collectors. These lighter street classifications comprise a high percentage of our street networks and tend to be the most under-designed from the start.
* Life Cycle C-ost Analysis (LCCA) methodologies shall be included and addressed for comparing design alternatives.