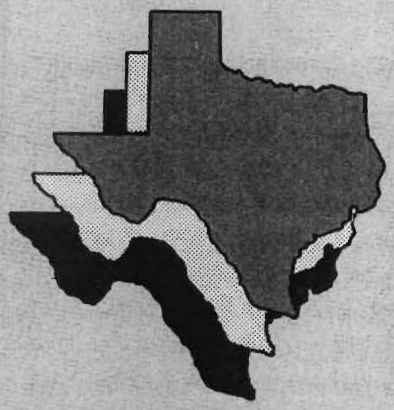

DEPARTMENTAL
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EXCHANGE

Summary Report 1259-1S
July 1993

ENGINEERING PROCESSES FOR A TEXAS BRIDGE MANAGEMENT SYSTEM

PROBLEM STATEMENT

The Strategic Highway Mobility Plan for Texas indicates that at a cost of $67 million, 370 on-system bridges will become deficient during the five-year period starting in the year 2000. There is no estimate of the corresponding preventive maintenance needed to maintain the deterioration on these 370 bridges at the same level as the average of the 1990-95 period. Most Texas Department of Transportation (TxDOT) bridge maintenance is done on an as-needed basis, and there are few, if any, programs for scheduled or preventive maintenance. As a result, maintenance costs and benefits have not been optimized as an integral element of a bridge management system (BMS). This is not uncommon; most bridge maintenance managers are confronted with increasing demands on resources. Nevertheless, there is a need for greater preventive maintenance efforts to prolong the service life of bridges. Maintenance will achieve these benefits by reducing the rate of deterioration, but it is difficult to quantify the benefits of preventive maintenance in the same fashion as rehabilitation, improvement, and replacement. Thus, there is a need to develop and suggest a Texas BMS which seriously accounts for the maintenance component, rather than focusing mostly on rehabilitation or replacement.

OBJECTIVES

The Texas Transportation Institute (TTI) conducted Study 1259, *Development of Engineering Processes For A Comprehensive Bridge Management System for Texas*, for the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA) to identify and analyze the models and procedures (engineering processes) necessary for programming and implementing a proposed comprehensive bridge management system (BMS) for Texas. The following three tasks are detailed:

1) Develop and recommend engineering aspects of analytical tools and procedures to accomplish bridge management activities;
2) Establish minimum and desirable engineering information requirements for the BMS;
3) Recommend processes and platforms for implementation of proposed BMS.

Researchers studied various models of bridge deterioration, along with other BMS components such as the Feasible Alternatives Synthesizer, the Bridge Maintenance Model, the Bridge Cost Model, the Benefits Model, the Optimization Model, and the Bridge Inspection procedures. To establish minimum and desirable engineering information requirements for the BMS, the following were also reviewed:

- other existing and developing BMS,

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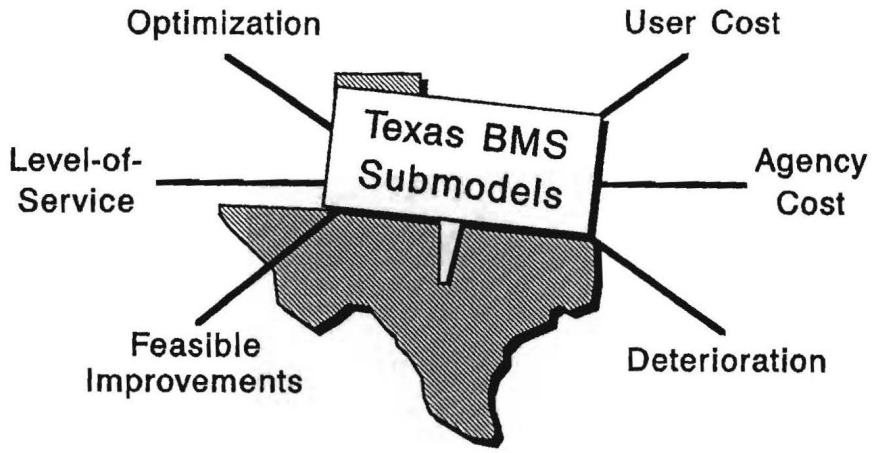

The proposed Texas Bridge Management System would provide several types of information.

- existing procedures used by TxDOT for accomplishing BMS, and
- data reporting requirements of FHWA.

FINDINGS

The proposed Texas BMS should consist of several submodels performing independent tasks:

- a level-of-service submodel to determine needs and improvement priorities;

- a feasible improvements submodel to generate lists of alternatives for maintenance, rehabilitation, or replacement,

- a deterioration submodel,

- an agency-cost submodel to create a work hierarchy and develop a life-cycle cost database,

- a user-cost submodel to determine user benefits or savings for a preselected range of feasible improvements, and

- an optimization submodel to analyze work alternatives and compare choices.

The BMS should collect, store, and manage the different data to predict structural deterioration and life-cycle costs of different bridge management alternatives. The system would then use optimization techniques to synthesize all alternatives and recommend specific actions. Because of the wide range of differences in population density, climate and average daily travel, the Texas BMS should be implemented at the district level.

For collection of future cost data, the report recommends that TxDOT use the agency-cost model called the Bridge Breakdown Structure. This would allow decisions of rehabilitation and replacement to be made with consideration of life-cycle cost analyses and not measures of need or sufficiency ratings.

Routine preventive maintenance should be a central element of a BMS. Bridge maintenance needs should be defined by levels of service using the results of the expert opinion survey in TTI Research Report 1212-1, "Study for a Comprehensive Bridge Management System for Texas." The maintenance tasks defined in 1212-1 can be used to set strategies reflecting varying levels of service. Inspection and reporting of preventive maintenance should identify current bridge conditions for each level of deterioration.

CONCLUSIONS

In developing engineering processes for integrating submodel processes into an overall BMS, officials must address computer programming, hardware platform, and software language choices and implementation.

First, computer programming should be performed with direct interaction and preferably supervision by TTI Study 1259 researchers. Secondly, decisions establishing hardware and software choices must be made early in the programming phase with the cooperative input of representatives from the Bridge Division (D-5), the Automation Division (D-19), district bridge engineers, and members of the TTI Study Staff.

Thirdly, initial implementation of the BMS needs to be carried out on a central mainframe computer, and pre- and post-processing tools development should be deferred until the basic BMS is implemented. However, programmers should retain the option of portability (to microcomputers) of the end product. This will allow for a more rapid implementation of a basic BMS system. Planned enhancements to the BMS include a GIS-linked, PC-based, user-customized preprocessor that will allow for sophisticated report modules and development of a bridge ID file and the various required databases.

–Prepared by Kelly West, Technical Writer, Texas Transportation Institute

The information described in this summary is reported in detail in TTI Research Report 1259-1F, "A Proposed Bridge Management System Implementation Plan for Texas," Ray W. James, George Stukhart, W. Frank McFarland, Alberto Garcia-Diaz, Roger P. Bligh, Satindar Baweja, and John O. Sobanjo, November 1992. The contents of the summary do not necessarily reflect the official views or policies of the FHWA or TxDOT. The FHWA did not approve publication of the report or the summary.