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Project Summary Report 0-4386-S
Project 0-4386: Expediting Highway Construction While Retaining Quality
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PROJECT SUMMARY REPORT

Development and Validation of a Method Selection Tool for Expediting Highway Construction

Highway construction projects impose real costs on drivers who are delayed, on local businesses that may be affected, and on the environment. At the same time, drivers demand good roads. As a result, tremendous political and public pressure exists for state departments of transportation (DOTs) to build highway projects better and faster. This pressure will continue to increase as traffic volumes grow and as road user costs become higher due to delays. To deliver highway construction projects faster, to make the most efficient use of the available funds for these projects, and to minimize total road life-cycle cost, DOTs need a system for selecting the most appropriate methods by which to expedite construction. Concurrently, value and quality must be maintained. The expediting tool described in this summary offers such a system.

The intent of this research was to investigate a wide array of project expediting methods used in any project phase, determine method applicability to TxDOT, and then incorporate the preferred methods into a method selection tool. The specific objectives of Project 0-4386 included the following:

1. Identify, describe, and catalog "best practice" methods for expediting project schedules.
2. Characterize both the positive and negative aspects (i.e., benefits, advantages, and limitations) for each method, considering all life-cycle aspects.
3. For each method, determine the applicability to and the impact on various types of TxDOT projects through workshops with TxDOT and other personnel.
4. Develop a tool with which Area Engineers and their assistants can easily determine which methods are most appropriate to their projects given different project conditions.

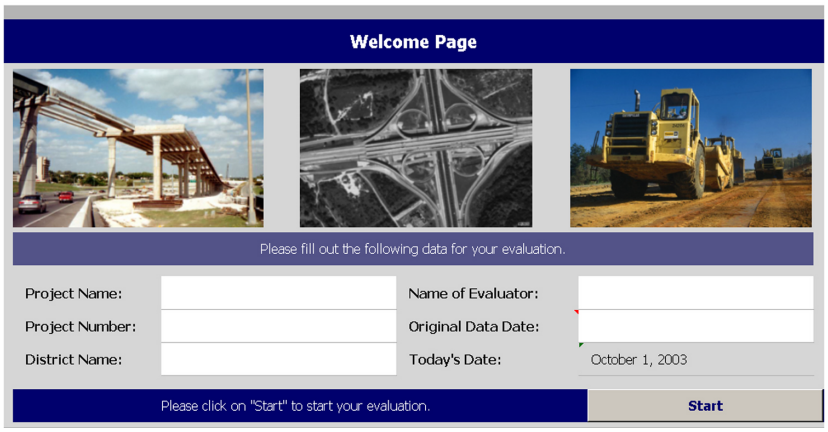

Figure 1: Introductory page of the software program "Expediting Method Selection Tool" (EMST)

What We Did...

Initially, the research identified and investigated fifty project expediting methods. The fifty expediting methods were chosen based on their occurrence in transportation literature and within DOTs. A description of each method was developed along with a characterization of the benefits, advantages, and limitations. These methods were then categorized by optimal project phase of initial implementation. In order to determine the applicability of methods within TxDOT, three workshops were held in order to gain input from individuals most familiar with the methods. Other objectives of the workshops included gathering feedback to rank the expediting methods and obtain a prioritization of methods to determine which ones to include in the selection tool. Sixty-two participants attended the three workshops and voted on the "doability" and "high impact" of each of the fifty methods. Participants from twenty-four of the twenty-five districts in TxDOT attended the workshops, and most participants were TxDOT or FHWA personnel. Based on the participants' votes, the number of methods was reduced from fifty to sixteen highly "doable," high impact methods.

With the methods for inclusion in the selection tool established, the project team sought to identify and quantify circumstances that act as a promoter, or as a barrier, to the use of each expediting method.

In order to establish the link between circumstances and methods, an Internet ballot was prepared so that pre-identified transportation personnel could provide feedback in a timely and concise manner. The use of this medium greatly facilitated data accumulation and aided in building the prototype tool.

The prototype tool passed through many iterations as the research team sought to clarify questions and incorporate feedback. The research team critically considered the quantitative values that link the circumstances and methods. Demonstration seminars were held in three major Texas cities to test the tool on specific projects and solicit recommendations for implementation of the tool. These demonstration seminars provided an opportunity for attendees to observe use of the tool on three volunteered projects. The demonstration seminar participants provided invaluable feedback that was used to enhance and refine the prototype tool through subsequent versions leading to the final tool. Eleven TxDOT districts participated in the demonstration seminars. The research team also tested the tool on five other projects in a variety of project phases.

The final tool is a software program titled "Expediting Method Selection Tool" (EMST). The tool runs from a Microsoft® Excel platform and uses macros and Visual Basic Applications. The project team selected Excel as the tool platform because it is one of the most familiar and widely used computer programs among TxDOT and transportation personnel. The introductory page of the EMST is displayed in figure 1.

The EMST consists of the following sequence of screens: welcome page, instructions, questionnaires (fifty-nine questions on four pages), results page, and references. On page 1 of the questionnaire, the user answers basic questions that are common to virtually all highway construction projects. Pages 2-4 of the questionnaire contain 'yes' or 'no' questions about different circumstances or situations that may be present in the subject highway construction project. The tool then evaluates these answers through quantitative tables and assesses a score for each method. All methods are ranked and displayed in the tool. Relevant and instructive resources, associated with each method, are displayed for the tool user's reference.

The tool is designed for easy navigation between different screens to allow the user to modify responses as appropriate. The user may save data, reopen at a later date, and then modify. The user may also print the results of the method ranking and the references, if desired. The reference page contains related TxDOT specifications when available, along with other references listed in reverse chronological order. The tool is also available in paper form for those who prefer this medium, although use of the computer version is encouraged.

Organization of categories and circumstances in a manner that provides a useable framework for selection of appropriate methods to expedite major highway projects was a key component of the tool design. The tool is not a decision-making tool, but rather a decision-assisting or support tool. Decisions on whether or not to utilize a given expediting method are left to the individual user, or group of users. The tool may also aid in project team alignment.

What We Found...

Fifty expediting methods were identified, of which twenty-six were assessed as having high potential impact for expediting highway projects by the participating TxDOT and construction industry personnel who attended the three workshops. Many of these methods are already used in some form by TxDOT, but their use is not as extensive as could be to obtain the full benefits of the method, or there may be limiting constraints that prevent TxDOT from using the method to its full potential. The sixteen high impact methods that were included in the Expediting Method Selection Tool by virtue of their ease of implementation and potential impact are listed here:

1. Use a Calendar Day Schedule
2. Precast/Modular Components
3. Use of Contractor Milestone Incentives
4. Generate and Evaluate Multiple Approaches to Traffic Control Plans
5. A+B Contracting
6. Incentivize Contractor Work Progress with a Lane Rental Approach
7. "No Excuse" Incentives
8. Maturity Testing
9. Partnering
10. Set Liquidated Damages to the Appropriate Level and Enforce
11. Pavement Type Selection Decisions
12. Seek to Maximize Work-Zone Size
13. Full Closure Instead of Partial Closure of Roadway
14. Implement Multiple Work Shifts and/or Night Work
15. Develop Traffic Control Plans (TCP's) through Partnering between TxDOT Design and Field Organizations
16. Train Selected Field Personnel in Scheduling Methods and Schedule Claims Prevention

Some of the methods with high potential impact scores were considered to have low "doability" due to legislative and other constraints. Those methods were emphasized by many workshops participants as some of the most promising methods in terms of expediting highway construction. Unfortunately, the fact that they require further management action in order to become applicable has currently exempted them from inclusion in the EMST. However, the expandability of the tool will make it possible to incorporate those methods once the necessary actions are taken by the Texas Legislature and/or TxDOT management. The ten additional methods that need further management emphasis and long-term policy changes are the following, listed in no particular order:

- Standardize planning approach; use comprehensive standard tools ensuring all planning issues are covered
- Programmatic (Corridor) approach to planning, design, and construction
- Designate a single individual as Project Manager (PM) from early planning to completion of construction
- Alternative funding methods
- Methods for expediting Right of Way (ROW) acquisition

- Methods for expediting utility relocation work
- Methods for improving environmental assessment during planning
- Pre-qualify bidders on basis of past schedule performance
- Create a lessons-learned database on ways to expedite schedules
- Incentive-based pay for retaining key TxDOT personnel

The workshops and demonstration seminars provided an important setting to discuss expediting methods and to exchange knowledge among participants. The demonstration seminar participants provided suggestions for improvements to the tool and also provided excellent guidance for implementation. Enthusiasm among the workshop participants indicated the need for a method selection tool, and that such a tool would be well received after development. This finding was confirmed in the demonstration seminars, as more than 93% of the seminar attendees answered that they would use the tool or recommend it to others on future projects. Nearly 97% of participants agreed that the tool is useful, with the same percentage agreeing that the tool appears easy to use.

The tool may have great value as a project alignment assessment mechanism. The value of the tool in facilitating alignment was evident during the assessment of the three projects in the demonstration seminars. In all of the seminars, this assessment was done by more than one individual within the group, which brought multiple insights together. At times, some within the group volunteered information about which others in the group had no previous knowledge. The process of assessing these projects fostered open and frank discussion between the project participants.

Other findings from the demonstration seminars indicated that there is considerable confusion among TxDOT personnel on how to calculate road user costs. The EMST contains one question about the approximate level of road user cost during construction; demonstration seminar project participants hesitated the most during consideration of this answer. Moreover, the research team found that determining the road user cost of a given highway project is probably the most restrictive factor in implementing A+B contracting and other incentive/disincentive based methods.

The Researchers Recommend...

Planning is the optimum phase for initiating use of the Expediting Method Selection Tool. The research team also recommends use of the tool during the project feasibility study, design summary report, and plan specification and estimate (PS&E) phases. Furthermore, during the demonstration seminars, an Area Engineer suggested that the tool be used at the 10%, 30%, 60%, and 90% review stages during PS&E. The tool permits Area Engineers and assistants to easily determine the methods that are most appropriate given different project conditions. The tool may be particularly useful for major projects with high road user costs and by personnel who are less experienced. The tool may also have great value in facilitating project team alignment.

A major component of this research was to provide procedures for implementation of the EMST. Procedures and suggestions for implementing the tool were gathered from the demonstration seminars and the research team. The primary actions were refined by the research team and include:

- Distribute copies of EMST and instructions to TxDOT employees who participated in the research.
- Present the tool at the next TxDOT Design and Construction conferences.
- Develop a related Short Course curriculum and conduct multiple sessions to train personnel.
- Provide the tool on the TxDOT Intranet system.
- Provide the tool to the 25 TxDOT District Engineers who may suggest its use on projects.
- Mandate use of the tool on projects with high road user cost liquidated damages.

From the information gathered during the research process, the following recommendations may be made to TxDOT concerning project expediting methods. Districts and divisions need to better communicate innovative construction expediting methods that have been used. Several methods had already been applied with good results but not publicized and systematized within the organization. Creating a lessons-learned database on ways to expedite schedule for example, would be useful, but it would need to be mandatory for all departments to enter data on any innovative strategies used. Partnering with non-TxDOT agencies such as local and regulatory agencies and utility companies cannot be over-emphasized. Early and frequent communication among the DOTs and utility personnel can result in more timely and efficient utility relocation. Also, getting environmental agencies involved to identify environmental issues early in the planning phase before the design work is completed can circumvent many delays. Clearly, more research must be performed on methods to expedite: environmental assessment, utility relocation work, and right-of-way acquisition. Emphasis should be placed on development and evaluation of multiple traffic control plans. Development and use of a standardized pre-project planning approach to assess project alignment may also be valuable. Continued research must focus on clarifying the calculation of road user cost and providing a unified software tool to aid in these computations. Further research into some of the methods covered by the investigation, combined with the Department's willingness to implement policy changes and work for legislative changes, will contribute to expediting highway project delivery from the planning to construction and operation phases.

With continued emphasis on these methods and frequent use of EMST, the speed of project delivery may improve and project life-cycle costs may be reduced. The benefits of expediting highway project delivery from planning through construction and operation are numerous. The avoidance of unnecessary delays and inconvenience to the user creates a beneficial situation for all stakeholders and produces a better image for the Department and the entire construction industry.

For More Details...

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TxDOT Project Director: Bill Goodell, P.E.

The research is documented in the following reports:

0-4386-1 *Expediting Highway Construction While Retaining Quality* October 2002
0-4386-2 *Development and Validation of a Method Selection Tool for Expediting Highway Construction* March 2004

To obtain copies of a report: CTR Library, Center for Transportation Research,
(512) 232-3138, email: ctrlib@uts.cc.utexas.edu

TxDOT Implementation Status July 2004

The findings of this project have been initially implemented by training seminars conducted during the life of the project. Additional training seminars are being planned for the future. It is also planned to post the software developed by this project at the Web-based training site hosted by CTR. An implementation project will be developed for this project and other related projects in the coming months.

For more information, contact: Dr. German Claros, P.E., Research and Technology Implementation Office, (512) 465-7403, gclaros@dot.state.tx.us.

Your Involvement Is Welcome!

Disclaimer

This research was performed in cooperation with the Texas Department of Transportation and the U. S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not for product endorsement. The engineer in charge was Carl Haas, P.E. (Texas No. 72047).

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