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16. Abstract

Highway construction imposes substantial costs on the traveling public. Because of this, pressures exist to build projects faster and more efficiently. To make the most efficient use of funds for highway construction projects, and to minimize total road life cycle costs, a decision tool is needed for selecting the most appropriate methods to expedite highway construction, while maintaining value and quality.

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Development of a Tool for Expediting Highway Construction While Retaining Quality

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Conducted for the Texas Department of Transportation in cooperation with the U.S. Department of Transportation, Federal Highway Administration by the Center for Transportation Research, Bureau of Engineering Research, The University of Texas at Austin.

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Implementation Recommendations

Highway construction projects impose real costs on drivers who are delayed, on local businesses which may be interrupted, and on the environment. At the same time, drivers demand good roads. As a result, tremendous political and public pressure exists for DOTs to build highway projects better and faster. This pressure will continue to increase as traffic volumes grow and road user costs become higher owing 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 "state of the practice" methods to expedite construction. Concurrently, value and quality must be maintained.

This report provides an overview of the process chosen to identify those methods with the greatest impact on expediting highway construction. Fifty (50) expediting methods were identified, of which twenty six (26) were assessed as having a high potential impact for expediting highway projects by the participating TxDOT and construction industry personnel who attended the 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 following seven methods can and should be implemented throughout the state of Texas immediately, because of the potentially high impact and ease of implementation using currently available resources. These methods include the following:

- Formal partnering with design consultants, contractors, local authorities, and regulatory agencies;
- Precast/Modular components of construction;
- A+B contracting;
- Use of contractor milestone incentives;
- Increasing amount of liquidated damages;
- "No Excuse" incentives; and
- Calendar day project scheduling.

Immediate implementation of the following five expediting methods may not be possible because of long-term policy and/or legislative need. Their tremendous potential should be addressed by TxDOT with actions to increase ease of implementation. These methods include the following:

- Methods for expediting right-of-way (ROW) acquisition;
- Methods for expediting utility relocation work;
- Methods for improving environmental assessment during planning;
- Pre-qualification of bidders on the basis of past schedule performance; and
- Using the Design-Build approach as a contract delivery method.

This report outlines details of these expediting methods and others identified during the first year of this investigation. The results of this report will be used to develop a decision support tool to select appropriate expediting methods given type of project and its overarching features.

1. Introduction

It is control of project time, along with cost and quality, which comprise the basic goals for project management. The phrase "time is of the essence" is often found in the contract documents of many facility owners and is intended as a strong reminder to the engineer and/or constructor that the time milestones in the project have economic significance for the owner and that control of time is expected. Time control is important for the contractors as well, since time savings can improve profits and loss of time is costly.

Both proactive and reactive methods to expediting construction exist. The proactive methods are generally part of planning, which includes how the project stakeholders should organize their efforts to reduce the time required to achieve the engineering and construction objectives. Every planner must constantly challenge historical schedule performance on similar work with the objective of reducing time without sacrificing other project objectives. These proactive efforts have the potential to yield the greatest return. The reactive methods of expediting occur during the execution stage, when negative time variances threaten or begin to appear, and actions must be taken to overcome those variances. In both the proactive and reactive modes, the managers seek ways to reduce the total project time. Thus, knowledge of methods that can be used to expedite project delivery should be part of the skills and knowledge base of the professional project manager. Much research has been conducted to identify methods to reduce the time of project delivery. The Construction Industry Institute (CII), for example, has conducted extensive research in this area, identifying methods that can be used for expediting (CII 1988).

As used in this report, the term "expediting highway construction" refers to the shortening of the required time for accomplishing one or more planning, design, contracting and procurement, construction, or startup tasks (or a total project) to serve one of three purposes: (1) reducing total design-construct time from that considered normal; (2) accelerating a schedule to reduce road user cost and business cost impact; and (3) recovering lost time after falling behind schedule (CII 1988).

1.1 Background Information

Highway construction imposes real cost on drivers who are delayed, on local businesses which may be interrupted, and on the environment. At the same time, drivers demand good roads. As a result, tremendous political and public pressure exists for DOTs to build highway projects better and faster. This pressure will continue to increase as traffic volumes grow and 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 "state of the practice" methods to expedite construction. Concurrently, value and quality must be maintained. To minimize cost while maintaining quality and value, total life cycle cost analysis (LCCA) must be used (Memmott and Durek 1982; Peterson 1985). Life cycle cost analysis considers such factors as the following:

1. Construction costs,
2. User delay costs,
3. Expected accidents cost,
4. Business impact cost,
5. Environmental impact cost such as pollutants and run-off,
6. Maintenance and rehabilitation cost, and
7. Minimum performance levels.

Although construction costs can be estimated with relative accuracy, the remaining costs are more difficult to estimate, and their present values are affected by such factors as the discount rate used and driver delay cost rates. Figures 1.1 and 1.2 conceptually illustrate the potential savings to the highway user that are achieved through the use of construction phase expediting techniques (Long 1991). Figure 1.2 illustrates potential savings (benefits) from earlier project startup owing to early phase expediting techniques.

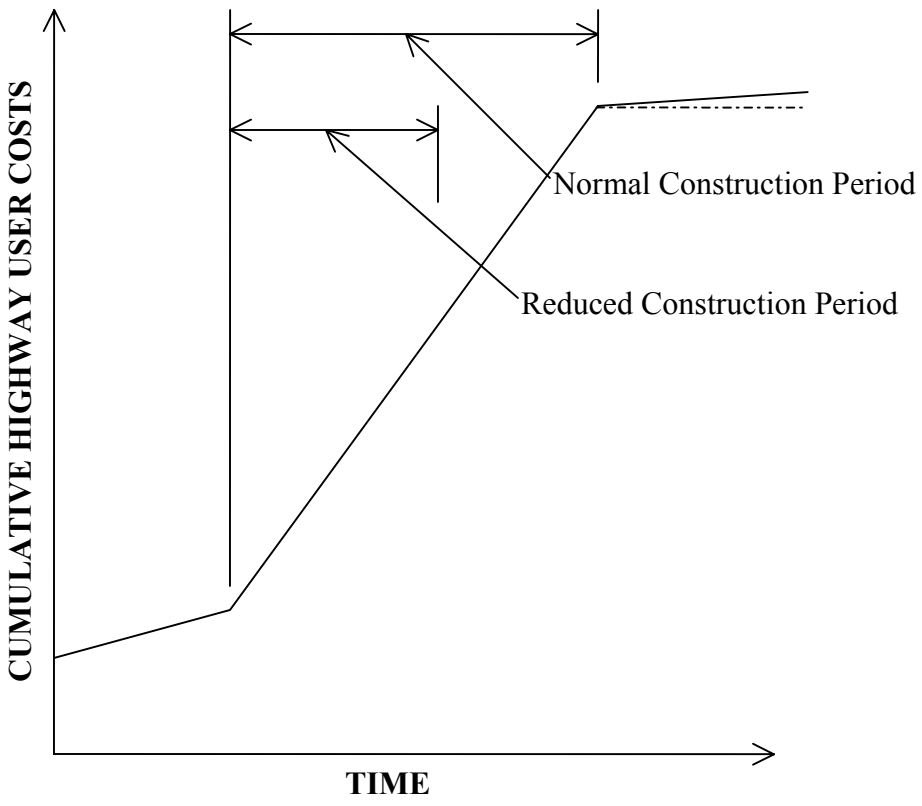

Figure 1.1 Accumulation of Highway User Costs During Construction

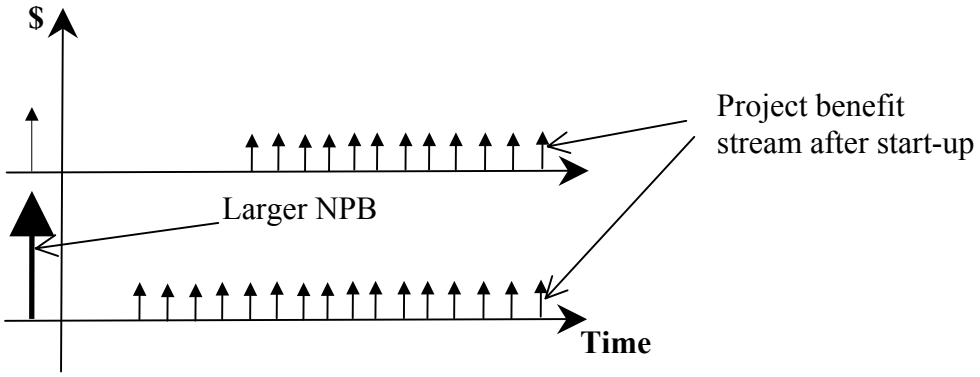

Figure 1.2 Conceptual Cash Flow Diagram Showing Impact of Expediting Techniques for Early Start-up on Net Present Benefit (NPB)

TxDOT has sought to place greater emphasis on the use of accelerated construction strategies on many of its projects in order to expedite planning, design, and construction

completion. The subject of expediting highway has long been an issue with TxDOT, the legislature, and the public and has generated many efforts to address the subject. The information in these documents is available to provide guidance to reduce project delivery time from conception through the end of construction. The following are some of these documents.

- "TxDOT's Form 1002." Rev. 9/2001, Attachment A, Alternative Contracting Procedures (TxDOT 2001).
- "Texas Transportation Partnerships...connecting you to the World, a report for the citizens of Texas." 8/2001 (TxDOT 2001).
- "Quicker & Cheaper." Review of cost and time savings on highway construction and maintenance contracts. As required by Senate Bill 370, 75th Texas Legislature, 11/1998 (TxDOT 2001).
- "Construction Contract Completion." Memorandum from Robert L.Wilson, Director, Design Division, 5/08/2001 (TxDOT 2001).
- "Senate Bill 370 Section 223.012 – Travel Delay Cost (Road User Cost)." Memorandum from Charles W. Heald, Executive Director, 7/14/1998 (TxDOT 2001).

1.2 Purpose of This Research

This research study will seek to identify, describe, and discuss proven expediting methods that can be used in highway construction to lessen the impact on users and property owners. This will be done through a comprehensive literature review. With the findings from the literature and with the aid of workshops conducted with key Texas Department of Transportation (TxDOT) personnel, a decision tool will be developed that gives TxDOT's Area Engineers and their subordinates guidance in choosing specific expediting methods for a particular project. This system will be developed with input from the TxDOT research committee and Project Director. The system will consist of an overall decision framework including the following:

1. guiding principles;
2. procedures;
3. decision tables;

4. support material such as relevant case studies, sample contract language, data on past performance of expediting methods, as well as their advantages and disadvantages; and
5. instructions for the use of analysis support software.

Procedures for implementation will also be drafted and will include high-level procedures, tasks, and user skills needed.

This report, as part of the research study, will cover the identification of the expediting methods and the interim workshops held for the purpose of ranking the expediting approaches that will have the most merit for TxDOT projects and for gathering feedback on applicability, anticipated ease of implementation, and participant support. The workshops were attended by key TxDOT district and division personnel along with some selected design consultant and contractor personnel. The prioritizing of the expediting methods and determination of subsequent research sets are considered. The following are some additional questions that were addressed in the workshops:

- Which methods require more effort or attention with respect to output performance impact measurements?
- What methods may require change of policy prior to implementation?
- What case studies are needed in order to better publicize the benefits and implementation details of high-priority methods?

1.3 Scope and Objectives

The first-year objectives of this two-year study for the Texas Department of Transportation by University of Texas at Austin/Center for Transportation Research are covered in this report. The objective is to present the findings from the literature search and workshops about the most appropriate expediting construction methods and also to serve as a starting point to determine areas where further research should be targeted. Specific objectives include the following:

1. Identify, describe, and catalog “best–practice” methods for expediting schedules.

2. Characterize (and where possible, quantify) both the positive and negative aspects (e.g., benefits, advantages, limitations, etc.) for each method, considering all life cycle cost.
3. Determine the applicability to and the impact on various types of projects performed by TxDOT through workshops conducted with TxDOT personnel for this purpose.
4. Develop a tool with which Area Engineers (and their subordinates) can easily determine the methods that are most appropriate given different project conditions. (Note that this is the second year objective and will be addressed in the final report)

This report includes the identification of concepts for expediting highway construction along with their advantages and limitations. The expediting methods considered are by no means exhaustive but are methods that are believed to have the most impact on the expediting process for highway construction undertaken by TxDOT. The methods will all have different impacts. The main purpose of the workshops was to identify those with the greatest impact on expediting highway construction.

1.4 Research Terminologies

For the purpose of this research, unless otherwise stated, the following definitions apply.

- *Relevancy to TxDOT* is defined as degree of relevancy of the method to TxDOT projects.
- *Doabilit*" is defined as ease of implementation of the method with the available resources and under existing constraints.
- *Positive Impact* is defined as Usefulness of the method in terms of schedule acceleration.
- *Pros* is defined as positive effects of a method.
- *Cons* is defined as negative effects of a method.
- *Limitations* of methods refers to legal and administrative limitations.

- *Description* of methods refers to the description and/or explanation of the method.
- *Applicability* of methods is defined as circumstances where the method can be used.

1.5 Report Structure

Following Chapter 1 (Introduction), Chapter 2 describes the methodology employed in the research. Chapter 3 provides descriptions of the expediting methods considered in the research. Chapter 4 describes the data analysis process. Chapter 5 presents the findings of the data analysis. Chapter 6 describes the possible path forward of the research effort. Chapter 7 presents conclusions and recommendations for the research.

2. Research Methodology

Figure 2.1 illustrates the methodology followed to accomplish the objectives of this research on expediting highway construction while retaining quality. The shaded areas are parts of the research that have not been completed as yet or are not covered in this report; the areas not shaded represents the areas covered in this report. In addition to the flow chart, the following sections of this chapter explain the research process in more detail.

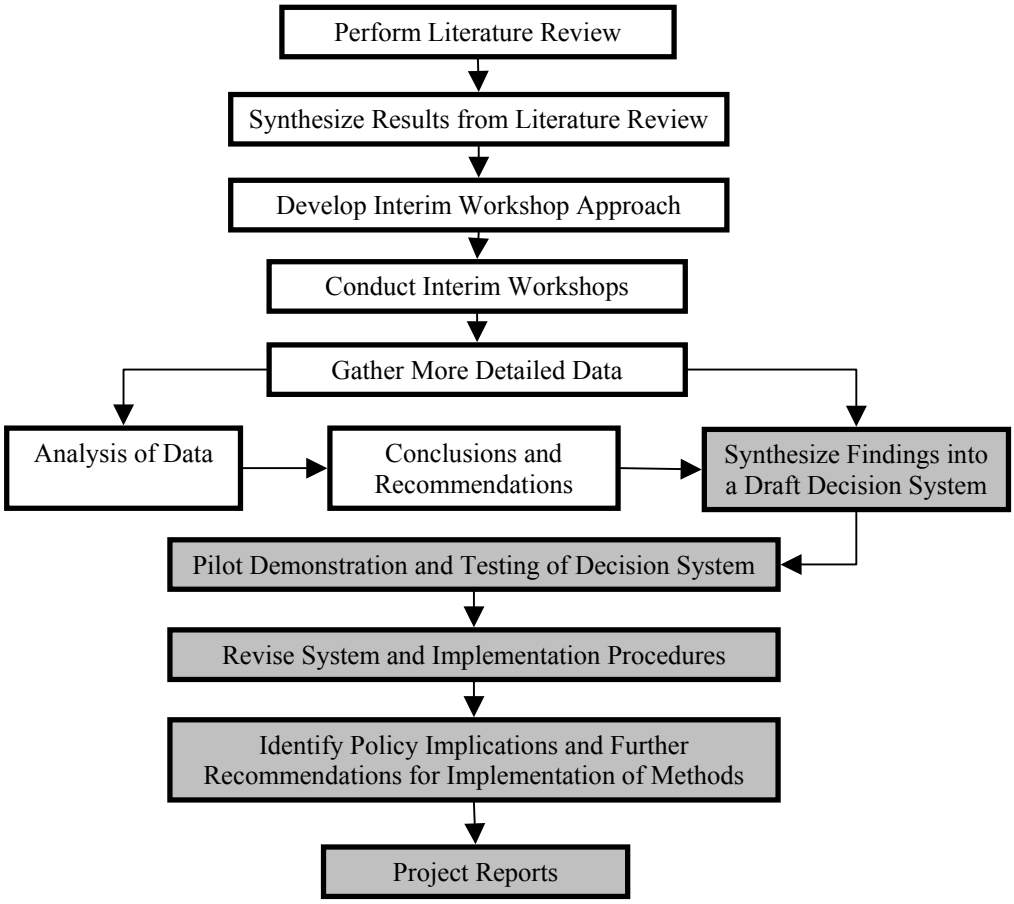

Figure 2.1 Methodology Flow Chart

2.2 Literature Review and Synthesis of Results from Literature Review

An extensive literature review was conducted to investigate and describe proven methods for expediting construction schedules. Sources for the review included Construction Industry Institute publications, industry journals and periodicals, conference

proceedings, trade publications, internet sources, books on specific methods, and other sources.

The methods were tabulated, and the tabulation included descriptions of the methods, their applicability and/or limitations, and pros and cons associated with the use of these methods. Chapter 3 and Appendix C describe the methods for expediting project schedules arranged by relevant project phase for implementation along with their descriptions, limitations, and pros and cons.

There are 50 methods listed in the final table. In developing this list, there were several evolutions in the presentation format: methods were added, and some methods were dropped or combined to form one method because of similarities. Concurrently, others were split into two or more methods to be more specific.

2.3 Develop Interim Workshop Approach

The information gathered through the literature review was synthesized into an assemblage of documents to form a workshop portfolio. The workshop portfolio included the following:

1. A summary matrix of the 50 expediting methods arranged by project phase. This first-level table is shown in Table 2.1.
2. An extended matrix of methods for expediting project schedules arranged by relevant project phase for implementation. This matrix contains descriptions, applicability and or limitations, and the pros and cons related to schedule reductions (Appendix C). These methods will be described in more detailed in chapter 3.
3. Workshop assessment sheets listing all the methods according to project phase. These were used for the individual voting process during the workshops. Three assessment areas were evaluated by the workshop participants for each of the methods, including the following:
    i. "Relevancy to TxDOT." The degree of relevancy of the method to TxDOT projects.
    ii. "Doability." The ease of implementation of the method with the available resources and under existing constraints for TxDOT projects.

iii. "Positive Impact." The usefulness of the method in terms of schedule acceleration to TxDOT projects.

A section for comments was included in the assessment sheets to encourage participants to note any concerns they may have with the methods (Appendix P shows some of the concerns of the participants, highlighted in the comments section). Also included was a form for participants to complete, giving their name, title, district or organization, phone number, e-mail address, number of years working in TxDOT, and number of years working in industry. The assessment sheets were returned at the end of the workshops. Figure 2.2 shows a sample page of the workshop assessment sheet. The complete assessment document is included in Appendix E.

These documents, along with an invitation letter (Appendix A), agenda, expected participant list, and participants of previous workshops (if applicable), made up the workshop portfolio. Appendices A through E contain elements of the workshop portfolio sent to each participant, including the summary matrix of methods and the extended matrix. These documents were developed by the research team over a period of several months with input from the TxDOT/FHWA oversight committee.

Table 2.1 Summary of Expediting Methods

Pro-Active Methods for Expediting Project Schedules Arranged by Relevant Project Phase for Implementation

I. Project Planning	II. Project Design	III. Contracting & Procurement	IV. Construction	V. Other/Multiple
1. Standardize Planning Approach; use comprehensive standard tools ensuring all areas are covered; 2. Programmatic (Corridor) approach to Planning, Design, and Construction; 3. Alternative Funding Methods; 4. Designate a single individual as Project Manager (PM) from early planning to construction; empower & equip PM with needed tools & data to select appropriate expediting methods; 5. Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.); 6. Formal partnering with design consultants, contractors, local authorities, and regulatory agencies; 7. Methods for expediting Right of Way (ROW) acquisition; 8. Methods for expediting utility relocation work; 9. Methods for improving environmental assessment during planning; 10. Intelligent Transportation Systems (ITS) & work-zone traffic control; 11. Public input on phasing of construction	1. Pavement type selection decisions; 2. Precast/Modular components; 3. Generate and evaluate multiple approaches to Traffic Control Plans (TCPs); 4. Develop a descriptive catalog of construction technologies that facilitate expedited schedules; 5. Phased-design to support phased-construction; 6. Develop Traffic Control Plans through partnering between TxDOT design & field organizations; 7. Increase levels of design component standardization; 8. Have Contactor prepare the Traffic Control Plan based on minimum requirements; 9. Using Linear Scheduling Method (LSM) & accurate productivity rate data to establish project target duration	1. A+B contracting; 2. Use of contractor milestone incentives; 3. Packaged multiple-primes approach to contracting; 4. Pre-qualify bidders on basis of past schedule performance; 5. Incentivize Traffic Control Plan development with a contractor Value Engineering cost-savings sharing provision; 6. Incentivize contractor work progress with a lane-rental approach; 7. Exploit e-commerce systems for procurement, employment, etc.; 8. Tools and best practices for implementing multiple work shifts and/or night work; 9. Increase amount of liquidated damages and routinely enforce; 10. Warranty Performance Bidding; 11. "No Excuse" incentives; 12. Change management practices* 13. Project-level dispute review board* 14. Alternative dispute resolution methods*	1. Exploit web-based team collaboration system for project communications through all phases of the project; 2. Encourage use of automated construction technologies; 3. Employ methods for continuous work zones; 4. Use of windowed milestones; 5. Schedule Calendar Day projects; 6. Crash schedules with use of the Linear Scheduling Method;* 7. Shorten construction time by full closure instead of partial closure of roadway; 8. Maturity Testing	1. Measure & track project schedule performance; use as basis for employee reward program as well as input to project duration database; 2. Track duration & productivity effects associated with different technologies; 3. Use pilot demonstration projects for introducing new methods for expediting schedules; 4. Create a "smart" database of activity productivity rates; 5. Study optimal approaches to crew shifts & scheduling; 6. Train all field personnel in scheduling methods and schedule claims; 7. Create a lessons-learned database on ways to expedite schedules; 8. Incentive-based pay for retaining key TxDOT personnel

Note: * denotes Reactive Methods

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

I. PROJECT PLANNING

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. Standardize Planning Approach										
2. Corridor Planning										
3. Alternative Funding Methods										
4. Designate a PM for Entire Life-Cycle										
5. Design-Build Approach										
6. Formal Partnering										
7. Expediting ROW Acquisition										
8. Expediting Utility Relocation										
9. Improving Environmental Assessment										
10. ITS & Work-zone Traffic Control										
11. Public Input on Construction Methods										

Figure 2.2 Sample Page of Workshop Assessment Sheet

2.4 Interim Workshops

This phase of the project involved getting practitioner's input into the methods by using interim workshops. Workshops are particularly useful for smaller groups of people who want to participate intensively, and the informality encourages discussion and give-and-take. A total of three workshops were conducted, and the objectives included the following:

1. To rank expediting methods on the basis of participants' opinions.
2. To gather feedback on applicability and ease of implementation of the expediting methods.
3. To encourage participant support and gain buy-in for the methods eventually chosen and deployed to TxDOT.
4. To reveal new information and practices used in specific districts to the participants.

The workshops were carefully planned to enhance effectiveness. Because of the size of the workshops, breakout groups were used for part of the sessions. Smaller groups met in separate rooms. Each group had a facilitator, and each participant had a chance to express an opinion. Afterward, groups reported back to the large meeting.

A few perceived benefits of conducting the workshops were the following:

- Obtaining constructive alternatives for expediting processes and input on expediting methods,
- Getting maximum participation from the attendees,
- Brainstorming of ideas,
- Combined expertise,
- Wisdom and real-life experience of workshop participants, and
- A comfortable setting where participants could share ideas and learn from each other.

The first workshop was held on February 8, 2002, at the Dallas District Office. The second workshop was held in Austin because of its central location, in an attempt to accommodate as many of the district offices as possible. This workshop was held on March 8, 2002, at the Thompson Conference Center, University of Texas at Austin. The Austin workshop was expected to be the last workshop, but because of concerns that all the

districts were not covered and because the project team wanted to have as much representation from throughout the state as possible, a third workshop was planned to accommodate personnel and districts that were unable to attend previously held workshops. Austin was again chosen because of its central location for the third workshop, held on July 26, 2002.

The workshop packages were mailed in advance of the workshops for the participants to familiarize themselves with the expediting methods and the workshop processes. The detailed workshop agenda for the interim is given in Appendix D. The agenda used in all three workshops was the same and followed this format:

- Welcome & Introductions
- Review of Expediting Methods & Individual Evaluations I
- Review of Expediting Methods & Individual Evaluations II
- Breakout Sessions
- Results from Breakout & Individual Evaluations
- Multi-Voting on Expediting Methods
- Wrap-up

During the welcome and introductions, the participants were given some background information about the research, introductions were made, and their contributions welcomed.

The Review of Expediting Methods and Individual Evaluations utilized most of the time. Each of the 50 expediting methods was reviewed, giving its description, applicability and/or limitations, and the pros and cons with respect to expediting (Appendix C). The participants were then asked to vote low, medium, or high for each of the three categories of (1) Relevancy to TxDOT, (2) Doability, and (3) Positive Impact, as previously discussed. The participants were also encouraged to make any comments or note any concerns they had about each method in the Comments section of the table (Figure 2.2).

In the breakout sessions, the participants were divided into two groups and were given specific methods to discuss. Care was taken to divide participants from the same district or division among the two breakouts. The following questions were posed to the participants during the breakouts:

- Are there any editorial comments that you would like to propose for the methods as given?
- Do you have any additional methods that you think should be added?
- Do you have any suggestions in terms of content or form for the proposed "Decision Tool?"

While the breakouts were being conducted, the results from the individual voting on the expediting methods were compiled to give the participants immediate feedback on their assessment of the methods. The total number of votes (lows, mediums, and highs) for each of the categories (relevancy, doability, and positive impact) were recorded for each expediting method on large wall-mounted assessment sheets similar to that shown in Figure 2.2. The results of the individual voting were then discussed.

The multi-voting process which followed made the overall workshop similar to a Delphi process, in which where the first cycle of voting was summarized before the next cycle began (Linstone and Turoff 1975). A participant could change his/her opinion in the direction of an emerging consensus. The workshop participants were instructed to vote on the methods that they thought, in a perfect world, would have the most value for expediting the construction process. Figure 2.3 shows a sample of the large sheets used for this process. The following rules governed the multi-voting process:

1. Each participant was given a number of votes for each of the phases of expediting construction methods, namely project planning, project design, contracting and procurement, contracting, and other/multiple. Each participant was given sticky dots to vote with.
2. The number of votes corresponded to the number of methods in each phase. The total number of votes was a half the number of methods in the phase plus one. For example, if there were ten methods in a phase, each participant was given six votes for that phase.
3. There were restrictions on how many votes could be given to a particular method within a phase. Participants could give up to approximately 50 percent of their votes to any method. For example, in the planning phase, in which participants were given seven votes, a maximum of four votes could be given to any one method within the phase. Participants were expected to give

the most votes to the method that they believed that, in a perfect world, would have the most benefit to TxDOT. How each person distributed his/her vote was up to the individual.

The results of the multi-voting process were then discussed and compared with the results of the individual voting process. Each workshop participant was then given one last vote (a single vote) to vote on the one method they thought would be the most beneficial for project expediting (results discussed later in Table 4.2). The workshop was then wrapped up.

I. PROJECT PLANNING

Methods	Votes
1. Standardize Planning Approach	
2. Corridor Planning	
3. Alternative Funding Methods	
4. Designate a PM for Entire Life-Cycle	
5. Design-Build Approach	
6. Formal Partnering	
7. Expediting ROW Acquisition	
8. Expediting Utility Relocation	
9. Improving Environmental Assessment	
10. ITS & Work-zone Traffic Control	
11. Public Input on Construction Methods	

Figure 2.3 Sample Voting Sheet

Each participant was asked to complete a sheet detailing his/her background and experience. A summary of the backgrounds of the individuals who attended the three interim workshops is given in Figure 2.4. Appendix F contains a list of all the interim workshop participants.

- **Sixty two (62) total participants**
  - **42 district personnel**
  - **9 division personnel**
  - **11 non-TxDOT** (selected consultants, FWHA and other agencies)
- **1223 total years of experience**
  - **1042 years working for TxDOT**
  - **181 years working in industry (non-TxDOT)**
- **24 districts represented**
- **5 divisions represented**
- **5 non-TxDOT agencies**

Figure 2.4 Summary of Workshop Participants Along with Years of Experience

2.5 Gather More Detailed Data

Gathering more detailed data concerning the 50 expediting methods has been an ongoing process during the research and has been accomplished by gathering information through various means from TxDOT's leadership, other state DOTs, experts from the construction industry, and others to further characterize selected expediting method. The workshops also served to identify individuals within TxDOT who can be contacted to further characterize the methods to be implemented in the decision tool and to obtain existing project performance data associated with the methods, if available.

2.6 Analysis of Data

The results collected from the workshops were analyzed to determine the expediting methods that should be incorporated into the draft decision tool. This was done by tallying up the number of votes received for each method in the interim workshops indicating low, medium, or high relevancy, doability, and potential positive impact of each. These data were then used to categorize the expediting methods on the basis of (i) how doable they were, and (ii) how positively they impacted TxDOT projects. Because of the high correlation in the votes for the relevancy and positive impact in the analysis, it was decided to use only doability and positive impact to categorize the methods (Albright 2002). The

results of these analyses were based on the workshop participants' knowledge and experience. The analysis of the data gathered in the interim workshops is presented in detail in Chapter 4.

3. Expediting Methods

From the literature review and in research team brainstorming activities, many approaches for expediting construction and contracting procedures were identified (see Table 2.1). These procedures can best be implemented at various stages of a project and are applicable depending on the specific project characteristics. These procedures may also be classified as proactive (usually implemented in the early stages of the project) or reactive (usually implemented after project has fallen below schedule) depending on the situation in which it is implemented.

Many of the methods considered in this research have been studied and used before. Some of these methods are described in the documents referenced in this report (CII 1988; Arditi 1997; Arditi, 1998; FHWA 1998a; FHWA 1998b; Gendell 1987; Geoffroy 1996; Herbsman 1995; Molenaar 1998; Sidney 1997; TRB 1987) whereas others are not as well documented and the literature available on their use for expediting is limited.

This chapter investigates the expediting methods that have been found in the literature review, their limitations, and their pros and cons. The methods are categorized by project phases as mentioned earlier, including project planning, project design, contracting and procurement, construction, and other/multiple.

3.1 Project Planning Phase

This phase has been shown by research to have tremendous impact on project success. Research has indicated that increased levels of pre-project planning efforts yield greater project success with the following results: (Gibson and Dumont 1995)

- Increased predictability of cost and schedule.
- Reduced probability of financial disaster.
- Improved operational performance.

The eleven (11) expediting methods identified for this phase and their descriptions follow.

1. *Standardize planning approach; use comprehensive standard tools ensuring all areas are covered.* Research has shown that organizations with a standardized front-end planning approach have better capital effectiveness. The methodology focuses on the "gateways" and required steps, which in turn ensure that the proper planning issues have been addressed.

   Overall, the workshop participants felt that there was much room for improvement on the process that exists. Selected comments from the workshops included "TxDOT planning is more or less standardized", "probably not done as well as could be," "uniformity in all districts is very important," and "the need the build flexibility to address the different applications" (Appendix O).

2. *Programmatic (Corridor) approach to planning, design, and construction.* A programmatic approach looks at an entire road "corridor," rather than breaking the corridor into segments that are tied to yearly funding limitations. Since the project can be pursued using larger multi-year contracts, the procurement steps are minimized, and the speed to delivery can be increased (TxDOT 2002b).

   The workshop participants felt that funding problems would limit the applicability of this method. Their comments included "funding restrictions in specified area is an applicability/limitation issue," "funding would be an issue statewide," "legislative limitation and financing," and "TxDOT is trying to use this method on some corridors with the Texas Mobility Fund" (Appendix O).

3. *Alternative funding methods.* Alternative funding methods such as Texas Mobility Funds, revenue bonds from toll roads, and Grant Anticipation Revenue Vehicle (GARVEE) bonds are some of the innovative funding mechanisms that are available to DOTs (e-Texas 2000; OBA 2001).

   Most participants generally thought that this method could have some negative impact on future project funding. Their comments included "long-term impact needs to be investigated. North Carolina has some experience,"

"reduces amount of funds available in the future, loss funds due to interest", and "I believe it's a quick fix but could cause funding problems later" (Appendix O).

4. *Designate a single individual as Project Manager (PM) from early planning to completion of construction; empower & equip PM with needed tools & data to select appropriate expediting methods.* This method entails the selection of a project manager who possesses leadership qualities and the ability to effectively handle intricate interpersonal relationships within the organization, while maintaining continuity throughout the project from initiation to end of construction. Motivation of the PM can be granted with the use of incentives such as salary bonuses, future assignments, etc. (Griffith 2001).

   The participants felt that this method would be difficult to implement for a variety of reasons including "would mean many changes in approach", "selection of and keeping of PM critical, and difficult. An experienced PM may retire before project is completed", and "not practical, decisions must be made on levels of authority based on experience of executive level" (Appendix O).

5. *Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.).* Design-Build (D-B) is an alternative to the traditional Design-Bid-Build system, with the difference being that the design and construction duties are performed by the same company (Molenaar 1998; Molenaar 1999; Gibson and Walewski 2001a).

   Variations to the Design-Build Concept:

   Bridging: The owner develops preliminary project design to the 30-50 percent level.

   Turnkey: When the owner requires outside expertise and then allows the entity to turn over the keys at project completion.

   Design-Build-Warranty (D-B-W): Combines a warranty provision with Design-Build.

Design-Build-Maintain (D-B-M): Combines maintenance provisions with Design-Build.

Privatization: When a private entity designs, builds, and maintains a section of roadway in return for a toll or fee.

The views of the participants on the implementation of this method were mixed, but most agreed on its expediting potential. Their comments included "should dramatically accelerate construction but will cost more," "quality of work is likely to suffer in the long term. Also cost will be higher," "frees up TxDOT personnel to work on other items," and "must watch quality of product – not as many checks and balances" (Appendix O).

6. *Formal partnering with design consultants, contractors, local authorities, and regulatory agencies.* Partnering is a formal management process in which all parties to a project voluntarily agree at the outset to adopt a cooperative, team-based approach to project development and problem resolution. Many mechanisms (e.g. meetings) can be used to promote partnering concepts, including project concept conferences, design concept conferences, and post-construction meetings (Grajek 2000; Thompson 1996; CII 1988).

   The views of the participants on this method were also mixed; for the most part, they thought it was already being implemented. Their comments included "already in place in metropolitan districts," "already doing to a large extent," and "it is best to partner additionally with utility companies, city and community agencies, major businesses and/or business associations" (Appendix O).

7. *Methods for expediting Right of Way (ROW) acquisition.* When private real estate is required for a Department of Transportation project, the Department must follow specific state and federal procedures in order to acquire the property. Initially, all affected owners will receive a written notice explaining the Department's need for the property. This notice will also explain the acquisition process as well as the owner's rights. Negotiations for sale follow. New approaches to speed the process may be developed.

8. *Methods for expediting utility relocation work.* Relocation of utilities such as telephone, electric power, water and gas, and so forth can greatly affect project delivery times. Methods should be implemented to expedite this process (FWHA 2002a; FWHA 2002b).
9. *Methods for improving environmental assessment during planning.* Adequate environmental assessment meeting NEPA requirements in a timely manner will help improve delivery speed. Standardizing the process and getting more local input will improve this process. Early identification of environmental and archeological concerns is important (TxDOT 2002).
10. *Intelligent Transportation Systems (ITS) & work-zone traffic control.* A variety of evolving technologies that offer new solutions to improving transportation conditions. These systems, based on electronic technologies, communications, information processing, and navigation technologies, are revolutionizing the interfaces between the driver, vehicle, and roadway to control traffic, thus facilitating more efficient construction (USDOT 2000).

    The participants had some concerns about this method. Several comments capture these concerns, such as "high cost and maintenance," "how does this expedite?" and "some elements of it are already in place on Dallas High 5 Project" (Appendix O).
11. *Public input on phasing of construction.* This method entails having the community more involved in highway construction projects, including choosing construction options that may allow a jurisdiction to close complete highways, which could lead to faster completion. Input should come from both local concerns and commuters.

    The participants' comments on this method included, "Some form of public involvement is already in place," "while we value the opinions of citizens, it is difficult at times to deal with uninformed or unreasonable citizens," "need to implement more than is presently" and "if we vote we will never get anything built" (Appendix O).

Each of the above mentioned expediting methods could be very effective for expediting highway construction. Table 3.1 shows the applicability, limitations, and the pros and cons of each of the methods.

Table 3.1 Table of the Applicability/Limitations and the Pros/Cons for Planning Phase Expediting Methods

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
1. Standardize planning approach	◆ Large owner organizations such as TxDOT benefit from a standard planning process ◆ Requires top management support	+ Better decision making process + More consistent approach + More predictable project outcomes + Cost and schedule savings - Less flexibility
2. Programmatic (Corridor) approach	◆ Multi-year funding and common contractor usage is standard procedure in the private sector ◆ This would require long-term planning ◆ Legislative limitations restrict this method	+ Faster delivery of project - Financing
3. Alternative funding methods	◆ GARVEE bonds or other methods are applicable to major highway projects where financing is not immediately available ◆ Legislative limitations restrict this method	+ Faster project completion due to adequate financing + Advancing completion dates saves money + Allows for "programmatic (corridor) planning" - Can over commit a state resulting in future funding restrictions
4. Designate a single individual as PM	◆ This method is probably most applicable for large and complex projects ◆ Legislation controls may preclude payment for bonuses	+ Incentives encourage PMs to develop more economical means and methods + Less formal documentation and communication improvement would shorten the project execution + Reduction of executive personnel + More continuity during project - Selection of PM is highly critical - Independent engineers may be needed to check PM's work - Must overcome "specialist mindset" of organization
5. Design-Build approach in various forms	◆ Although it is being used by almost half the states, D-B is not allowed legally in Texas ◆ Primarily, D-B is used when there are opportunities for the owner or agency to save time by having construction begin before the final design has been completed ◆ Not applicable to all projects; should be used on projects that have time constraints or have complex/ innovative project needs ◆ Legislative limitations restrict this method	+ Time Savings + Reduced cost due to accelerated schedules + Reduced administration and inspection costs + Eliminates conflicts between designer and contractor + Reduced number of in-house design personnel needed in TxDOT + Reduced change orders and claims + Increased final product quality by allowing innovations and new approaches - Singular responsibility - Reduces competitiveness of small companies

Table 3.1 Cont'd

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
6. Formal partnering	◆ Already used extensively in TxDOT ◆ Has not been applied very much to designers or other agencies ◆ Little training has been done and much skepticism is in place	+ Faster and cheaper construction process due to reduction of conflicts, litigation, and claims (win-win situation) + Continuous improvement in the quality of services and products + More effective utilization of resources + Can easily be implemented because already being used on an informal basis + Improves communication - Negative perception of partnering by some participants - Limits competitive market strategy - Creates strong dependency on the partners
7. Methods for expediting right-of-way (ROW) acquisition	◆ Methods should be implemented to expedite acquisition where property is needed for highway construction. All the necessary resources should be available to the team responsible for coordinating and managing right-of-way acquisition services involving first stage reviews, negotiations, closings, settlement recommendations, relocation assistance, etc. ◆ Legislative limitations restrict this method	+ Improving the efficiency of ROW acquisition can greatly increase delivery time by avoiding potential delays - Reluctance of the owners to sell property
8. Methods for expediting utility relocation work	◆ In highway construction the need for the relocation of utilities often arises ◆ Relocation is handled primarily by utility companies ◆ Little current recourse against utilities for delays ◆ Utilities have to pay for relocations	+ Incentives encourage PMs to develop more economical means and methods + Less formal documentation and communication improvement would shorten the project execution + Reduction of executive personnel + More continuity during project - Selection of PM is highly critical - Independent engineers may be needed to check PM's work - Must overcome "specialist mindset" of organization
9. Methods for improving environ-mental assessment during planning	◆ Environmental issues often cause delay ◆ An interface with many local and federal agencies can cause confusion over responsibility ◆ Getting contractor input prior to award can be difficult	+ Fewer "surprises" + More consistent estimates for schedule delays + Better understanding of submission/accountability problems - Reluctance to move fast

Table 3.1 Cont'd

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
10. Intelligent Transportation Systems (ITS) & work-zone traffic control	◆ Applicable areas include but not limited to: Traffic Control, Route Guidance, Automated Highway Systems, Collision Avoidance, En-route Driver Information, Transportation Demand Management, etc.	+ Increases safety + Reduces congestion + Enhances mobility + Minimizes environmental impact + Increases energy efficiency + Promotes economic productivity for healthier economy - Additional training of employees - Cost to implement
11. Public input on phasing of construction	◆ This method is applicable on construction projects where there is significant impact on the public ◆ Perhaps having the public vote on sequencing and methods of construction	+ More expeditious construction methods can be employed - Requires more public relations effort earlier

3.2 Project Design Phase

In the design phase, decisions are made that determine the life cycle of highway projects, the extent of a project's cost, and speed of implementation. These decisions concern choices of materials, construction methods, final roadway alignment, and items to be included in the structure, as well as labor and equipment requirements both during construction and throughout the lifetime of the structure. The choices made in the design phase also enable DOTs to meet future environmental requirements and the needs of the traveling public. The ten (10) expediting methods in this phase and their descriptions are as follows:

1. *Pavement type selection decisions.* The two types of pavement generally considered are rigid and flexible pavements as typified by Portland cement concrete pavement (PCCP) and asphalt concrete pavement (ACP), respectively. Quick-curing concrete, flexible pavements, and in-place recycling are additional options at this stage (Peterson 1985; Beg 1998; Haas 1994).

   Overall, the participants felt this method could have a high impact on expediting project schedules; however others were less enthusiastic. Their comments included "currently use this method to develop designs,"

"pavement construction often not critical to project completion," and "I believe this is done to the greatest extent possible" (Appendix O).

2. *Precast/Modular Components.* Construction zones can maximize concurrent work activity with the use of modular, prefabricated components. Precast modular components such as bridge sections or road slabs are common examples (CII 1988; CII 2002).

   Overall, the participants felt this method would have a high impact on expediting project schedules. Additional comments included "requires designers to have construction knowledge," "limited dimensional flexibility is really affecting this method," and "limitation – must make sure quality doesn't suffer" (Appendix O).

3. *Generate and evaluate multiple approaches to Traffic Control Plans (TCP's).* TCPs, in large part, drive both the project schedule and the impact of construction in traffic operations, but too often the first workable TCP solution is pursued during construction. TCPs deserve very vigorous analysis during design (Gibson 1996; Graham 1994).

   The comments of the participants on this method included "cost in investigating multiple TCPs may be prohibitive," "every TCP is a design itself. It may take too much time to come up with many different TCPs," and "contractors sometimes have better methods for TCPs and expediting TCP's" (Appendix O).

4. *Develop a descriptive catalog of construction technologies that facilitate expedited schedules.* New time-saving construction technologies are emerging every day. These need to be identified and assessed for their potential impact and use on TxDOT projects.

   The comments of the participants on this method included "dependent on contractor abilities and experience," "requires designers to have construction knowledge," "allows innovations to reach a wide audience," and "impact on specifications could be an issue" (Appendix O).

5. *Phased-design to support phased-construction.* Phased design and construction denotes a method in which construction is begun when

appropriate portions have been designed but before design of the entire structure or roadway has been completed. This method is also known as fast track construction (CII 1988; CII 1995).

The comments of the participants on this method included "dependent on contractor abilities and experience," "mainly applicable to large projects," "high amounts of change orders," "really not a desirable procedure," and "can be costly due to unknowns to contractors" (Appendix O).

6. *Develop Traffic Control Plans (TCPs) through partnering between TxDOT design and field organizations.* Partnering between TxDOT and contractors for the purpose of developing traffic control plans could lead to a more schedule-efficient approach and to more efficient design and construction (Graham 1994; Thompson 1996).

   The comments of the participants on this method included "TCPs are reviewed by construction office during design in Dallas," "can be used on the most complex projects with best results," "currently allow contractors to review TCP's for projects greater than $10 million," and "time consuming. Contractor interest could be low" (Appendix O).

7. *Increase levels of design component standardization.* When properly applied, increased levels of standardization can eliminate much "reinvention of the wheel" by designers.

   Overall, the participants thought that not much could be done concerning this method. Their comments included "currently have standards. Beneficial method but design can't be a cookbook," "largely done," "has limitations due to soil, traffic, etc.," and "cannot box engineering judgment. Geographic areas have different preferences and needs" (Appendix O).

8. *Have contactor prepare the Traffic Control Plan (TCP) based on minimum requirements.* Reduce constraints on the contractors by allowing/requiring them to develop an acceptable TCP prior to start of field construction (Graham 1994).

   Selected comments of the participants on this method included "have to make decisions on responsibilities for consequences of accepted TCPs,"

"harder to evaluate bidder," "would like to try this but we'd need TxDOT review," and "contractor would really want this, but would TxDOT be willing to let go?" (Appendix O).

9. *Using Linear Scheduling Method (LSM) and accurate productivity rate data to establish project target duration.* Linear scheduling allows an activity to be modeled as a line with dimensions of time and location, unlike traditional scheduling methods that model linear activities as having constant production rates (O'Connor and Yuksel 2000).

   The comments of the participants on this method included "more the responsibility of the contractor," "rates vary too much between contractors. Don't see how it could be used in our current bidding process," and "already utilized in some districts" (Appendix O).

Each of these expediting methods is believed to have potential for expediting highway construction. Table 3.2 shows the limitations and the pros and cons of each of the methods.

Table 3.2 Table of the Applicability/Limitations and the Pros/Cons for Design Phase Expediting Methods

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
1. Pavement type selection decisions	◆ Any pavement-related new construction or rehabilitation projects	+ Enhances optimal decision of pavement type for minimizing life cycle costs + May impact speed of construction - Extra data requirements
2. Precast / modular components	◆ Common approach for girders, bridge decks, retaining walls, piping, culverts	+ Enables concurrent activity + Offsite prefabrication can start early - Limited dimensional flexibility
3. Multiple approaches to Traffic Control Plans (TCPs)	◆ TCP solutions for small simple jobs are often apparent, but otherwise they should be thoroughly investigated earlier in the process	+ Optimal TCPs can lead to reductions in both construction cost and user costs - More thorough TCP analysis may require larger consultant fees for their development
4. Descriptive catalog of construction technologies	◆ Applicability of new technologies could be widespread, but TxDOT specs may be affected	+ An on-line catalog could easily be accessed and supported by FHWA and other states - Maintenance & upkeep of the catalog will entail effort
5. Phased-design to support phased-construction	◆ Can be used when the schedule is extremely tight ◆ Construction can begin only after the state's requirements are set, the overall (schematic) design is complete, and the complete drawings and specifications for the first construction phase are ready	+ In this approach construction can begin before design is complete for the entire project - This may require multiple prime contracts - Sequence & management of design will be critical for success - Conservative designs may result (e.g., over design) + Construction change orders often occur
6. Develop TCPs through partnering between TxDOT design & field personnel	◆ TCPs are often an integral part of a project design. Waiting until a construction firm is signed on to develop a partnered-TCP may be too late	+ Win-win TCPs may result from this approach - Timing of construction involvement in this may be problematic

Table 3.2 Cont'd

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
7. Increase levels of design component standardization	◆ A standard handbook may be needed in order to increase levels of design component standardization ◆ Design software would need to be developed	+ Design time & effort could be reduced + Materials management efforts could be made easier - Catalogs of standard components will have to be maintained - Competitive supplier agreements will be needed
8. Have contractor prepare the TCP based on minimum requirements	◆ This approach will encourage contractor innovation, but may be possible only on smaller, simpler projects	+ Reduction in efforts + Will provide incentive for construction innovation - Possible increase in costs - Possible exclusion of impact on local businesses - Contractor compliance with safety standards may be challenging (for TxDOT)
9. Using Linear Scheduling Method (LSM) & accurate productivity rate data to establish project target duration	◆ Can be used for repetitive projects in which there are no strict dependencies/constraints between project activities ◆ Resurfacing, shoulder improvement, and efforts to cold plane and hot plane are good types of projects for the LSM	+ Provides a better understanding of the project + Enables the planner to determine when and where a change in resources must take place to satisfy the goals set by the project + Helps identify existing relationships and encourages the project team to try different alternatives + Overlapping activities instead of sequencing can shorten overall schedule - Projects involving large cuts and fills might be more difficult to schedule with LSM

3.3 Contracting and Procurement Phase

The contracting and procurement phase is a multi-step process that brings TxDOT's requirements and the contractor's plan of action in to mutual agreement for the construction of a project. In this phase, contractual and procurement requirement that will result in expediting can be utilized. There are fourteen (14) expediting methods in this phase that were considered, and their descriptions follow.

1. *A+B Contracting.* A+B contracting (also called cost plus time) is a procedure that incorporates the lowest initial cost but also factors into the selection

process the time to complete the project (Gibson and Walewski 2001b; El-Rayes 2001; Herbsman 1995).

Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "can work well for emergency bridge replacement, but not for large long-term projects," "contractors have ways of manipulating this method to dilute it," "need to have clear ROW and utilities before letting," and "extreme demand on inspection personnel" (Appendix O).

2. *Use of contractor milestone incentives.* Contractors are financially rewarded for on-time delivery of specific work tasks.

   Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "delays and criticism of realistic milestones is a huge issue," "disagreement and disputes with contractor likely to increase" (Appendix O).

3. *Packaged multi-primes approach to contracting.* The owner is party to several separate prime contracts, each for the performance of a particular portion of the total project work, and acts as the "general contractor." Early construction activities can begin very early in the project (Arditi 1997; Arditi 1998).

   The comments of the participants on this method included "requirements for resources on TxDOT are too high. Also, low bid system would cloud the process," "negatives outweigh positives, disconnects project management," "this could be done but TxDOT loses control. Just pass the buck," and "tolerances would require very tight control" (Appendix O).

4. *Pre-qualify bidders on basis of past schedule performance.* This method eliminates those bidders with a poor record of schedule performance (CII 1988).

   The comments of the participants on this method included "political implications will probably make this impractical in Texas," "this would meet great resistance from the AGC," "sounds good but not sure if this is realistic," and "contractors will definitely take duration seriously (Appendix O).

5. *Incentivize TCP development with a contractor Value Engineering (VE) cost-savings sharing provision.* Utilize the VE change proposal contractual clause with special emphasis on time-saving or duration-reducing innovations on TCPs (CII 1988; Jaraiedi 1995).

   The comments of the participants on this method included "getting local municipalities to fund something like this would probably be difficult in rural districts," "difficult to coordinate with TxDOT financially," "we do this already without calling it V.E.," and "contractor would look more at money than at traffic impact" (Appendix O).

6. *Incentivize contractor work progress with a lane-rental approach.* Lane rental provisions assess the contractor daily or hourly rental fees for each lane, shoulder, or combination taken out of service during a project to minimize the time that roadway restrictions impact traffic flow (Arditi 1997; CII 1988; Jaraiedi 1995).

   Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "mainly applicable to highly urban projects. Rental rates are critical," "excellent for use on very special projects, but is time consuming to come with the numbers and schedule," and "using lane assessment fees rather than lane rental – possible liability issues" (Appendix O).

7. *Exploit e-commerce systems for procurement, employment, etc.* E-commerce systems include new electronic technology, ranging from project-specific web sites and online equipment auctioning to bid analysis software and negotiation tools. These systems can significantly improve document management and communication and may improve project speed (CII 1998b; CII 1999a).

   The comments of the participants on this method included "impact on some contractors may be unacceptable politically," "it will be some time before we see the benefit of e-commerce," and "site manager is trying to head in this direction" (Appendix O).

8. *Tools and best practices for implementing multiple work shifts and/or night work'* In developing the tools and best practices attention should be paid to

safety and implementing night TCPs. The traffic control used for night work is usually the same as that used for typical daytime work zones, despite the potential adverse conditions that may be encountered. For these reasons, there is a need to examine methods to improve traffic control and safety for night work zones. Multiple work shifts can lead to improved project speed.

The comments of the participants on this method included "at present staffing levels, additional shifts would be extremely difficult for TxDOT to cover", "great in urban areas. Safety becomes an issue," "night work is slower and more dangerous. Finite number of workers available, worker burnout possible," and "good when we need to do night work – prefer not to do at all" (Appendix O).

9. *Increase amount of liquidated damages and routinely enforce.* Liquidated damages provisions allow a contracting agency to reduce payment to the contractor by a certain amount of money for each delayed time unit. Liquidated damages can be used, perhaps in conjunction with incentives to improve project speed (Arditi 1997; Jaraiedi 1995).

   Overall, the participant believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "disincentives are not as effective as incentives," "contractors will build this into their bids," "requires a lot of documentation to resolve issues," and "AGC will oppose this without great justification" (Appendix O).

10. *Warranty Performance Bidding.* The constructor is responsible for the quality and performance of the work for a specific "warranty period." The constructor assumes more post construction risk than in traditional methods (Anderson and Russell 2001).

    The comments from the participants on this method included "may increase time between maintenance cycles, but has not worked well in TxDOT thus far," "based on past experience, this will be very hard to implement," "very difficult to administer to be effective and efficient," and "Discussions with AGC tell me they are opposed to this" (Appendix O).

11. *"No Excuse" incentives.* In this method the constructor is given a "firm delivery date" with no excuses for missing this date. Incentives are provided for early completion; however, there are no disincentives other than normal liquidated damages (Gibson and Walewski 2001b; Jaraiedi 1995).

    Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "if the incentive amount is appropriate it can yield excellent results", "change orders can be the downfall of this", "need to have clear ROW and utilities", and "AGC opposition to this is great" (Appendix O).

12. *Change management practices.* This method encompasses strategies and techniques implemented to manage the scope of each project. It identifies how changes will be handled, who should be informed, alternatives to changes (if any), and records the effect of the change on the overall project, including the schedule. It also ensures that changes are handled in a timely manner (CII 1988).

    The comments of the participants on this method included "not necessary with 'no excuse' incentives," and "hard to change way of doing business" (Appendix O).

13. *Project-level Dispute Review Board (DRB).* A DRB is a standing committee appointed at the start of a project to hear disputes. The DRB is formed of three members, one chosen by each party and the other chosen by mutual selection. The board convenes at the request of either party or at least every 3 months and is informed of progress. It issues non-binding decisions related to disputes that can help the parties resolve issues at the project level in a timely manner (CII 1996a).

    The comments of the participants on this method included "non-binding aspect will make this all but useless with current AGC posture. Will almost always favor contractor," 'highly recommended, can be part of partnering," "a good selection process has to be developed," and "lack of experienced Engineers available within TxDOT to resolve issues at project level" (Appendix O).

14. *Alternative dispute resolution methods.* Alternative methods to litigation for solving disputes such as negotiation, mediation, and arbitration have been proven to be successful in quickly resolving disputes for many construction projects throughout the years. Some other alternative methods include mini-trial, non binding arbitration, summary jury, and so forth (CII 1996a).

    The comments of the participants on this method included "favors contractor," "can already be done informally," "dispute process working, in place now," and "not much impact on expediting" (Appendix O).

Each of these expediting methods is believed to have potential for expediting highway construction when considered during the contracting and procurement phase. Table 3.3 shows the limitations and the pros and cons of each of the methods.

Table 3.3 Table of the Applicability/Limitations and the Pros/Cons for Contracting and Procurement Phase Expediting Methods

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
1. A+B contracting	◆ A+B bidding can be used to motivate the contractor to minimize the delivery time for high priority and highly trafficked roadways ◆ There must be a balance between the benefits of early completion and any increased cost of construction ◆ Approach requires incentives & disincentives to be effective	+ Consideration of the time component of a construction contract + Favorable treatment of contractors with the most available resources to complete the project + Incentives for contractors to compress the construction schedule + Greater potential for early project completion - Incentives & disincentives need to be carefully managed - Costs are concrete whereas benefits are distributed to the public
2. Use of contractor milestone incentives	◆ Incentives must be relevant ◆ Goals must be reachable ◆ Incentives cannot be conflicting	+ Encourages contractors to finish on time - Impacts to contractors are highly scrutinized - Disagreements over compensable delays may be problematic
3. Packaged multi-primes approach to contracting	◆ Can be used when a specific highway project is composed of several major segments or is very large	+ Increased competition among construction bidders + Reduced pyramiding of costs, particularly overhead and profit + Reduced project time through overlap of design and construction or from multiple work forces + More direct control by the project owner - Interface management challenges for TxDOT - Physical interferences between contractors
4. Pre-qualify bidders on basis of past schedule performance	Key items for the selection are: ◆ specific project type experience ◆ individual experience ◆ past performance ◆ capacity of firm ◆ primary firm location	+ Shorter and easier selection process + Possibly better contractors - Reduces the competition - Schedule performance data will need to be well kept - TxDOT & other non contractual schedule impacts will have to be recognized and equitably settled
5. Incentivize TCP development with a con-tractor Value Engineering cost-savings sharing provision	◆ Seek involvement of local municipalities in funding the incentive (e.g. 5% of estimated user cost savings) ◆ Requires close scrutiny to determine actual time savings	+ Leads to innovative ideas for successful TCPs - Savings are difficult to estimate

Table 3.3 Cont'd.

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
6. Incentivize contractor work progress with a lane-rental approach	◆ Must be explicitly described in the bid package ◆ Rental rates have to be significant and should address high impact lanes	+ Leads to innovative ideas for successful TCPs + Minimizes contractor impact on traffic - Not easy to administer
7. Exploit e-commerce systems for procurement, employment, etc.	◆ Hidden behind the technology's promise of greater efficiency, accountability, and speed are traditional issues of contract formation and enforcement, project relationships, and assessment of liability	+ Faster processes + Improved document management and tracking - New technology raises new concerns about security, reliability, and data integrity - Requires organizational changes and learning
8. Tools & best practices for implementing multiple work shift and/or night work	◆ New technologies (such as intrusion alarms), modified traffic control plans, and new methods to monitor traffic can potentially provide improvements in night work zone safety ◆ These improvements will lead to higher nighttime productivity	+ Increased safety for road users and workers + Reduced user costs + Faster completion time - Research and design costs
9. Increase amount of liquidated damages and routinely enforce	◆ Just as important as the damages happening in the contract are the claims made for damages. The time and effort involved in pursuing these claims is however, a limitation. This should be weighed against potential benefits ◆ Possibly provide incentives to finish projects ahead of time	+ Motivate better contractor performance - Requires rigorous documentation and quick Request for Information (RFI) response to enforce
10. Warranty performance bidding	◆ Performance specifications must be well developed ◆ If contractor goes out of business, who pays?	+ Usually results in a better quality product and therefore longer time between renovations + Encourages innovation by the contractor + Reduces the needs for agency resources - Contractors bid higher to offset increased risk
11. "No Excuse" incentives	◆ Precludes delay claims by contractors ◆ Gives contractor incentives to finish early ◆ Requires a realistic schedule	+ This method can result in considerable improvements in schedule performance - Transfers risk to contractor and therefore may increase costs on the average over time

Table 3.3 Cont'd.

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
12. Change management practices	◆ There are many tools available to help project teams to be adept at handling change management ◆ Planning and managing change is one of the most challenging elements of any project ◆ Understanding the key areas of change management and the associated traps and pitfalls is critical to project success	+ More efficient handling of changes in the construction environment and therefore faster delivery - Training and implementation costs
13. Project-level Dispute Review Board (DRB)	◆ The most common causes of disputes experienced by transportation agencies are design deficiencies, utility conflicts, and unknown site conditions ◆ Should be used only on large projects; a "standing neutral (one person)" can be used on smaller projects	+ Issues are resolved before they escalate + Formal & well-documented process + Speed and flexibility is emphasized + Written, non binding recommendations + Cost shared by each party - Extra personnel costs
14. Alternative dispute resolution methods	◆ These mechanisms facilitate dispute resolution at the project level while allowing involvement of district and central office managers to resolve disputes and then return the matter to project staff for implementation ◆ May not be available legislatively (especially binding methods)	+ Disputes are resolved in a much shorter time and at up to 10 times less than the cost of litigation + Helps to keep good relationship between client and contractor + Win-win results can be achieved + Sometimes tends to favor the contractor - Must be used in "good faith"

3.4 Construction Phase

The construction phase consists of methods performed in conjunction with or by the contractor. There are seven (7) expediting methods in this phase that were considered, and their descriptions follow.

1. *Exploit web-based team collaboration system for project communications through all phases of the project.* Web-based project management systems eliminate any apparent boundary between a project participant's computer and the project's folders and files. They can be as simple as a common e-Room or as complex as web-based central project databases, business-to-business capabilities, and intelligent software agents. Improving communication may speed the construction process (CII 1998b; CII 1999a).

   The comments of the participants on this method included "TxDOT very proprietary about the project info. Difficult to pick right product," "TxDOT is a long way from being ready for this," "helps communication, may not

accelerate construction," and "very expensive to implement, a lot of additional training" (Appendix O).

2. *Encourage use of automated construction technologies.* Geographical Positioning Systems (GPS) and laser-based positioning systems combined with robotic equipment controls linked to 3-D designs can result in faster, higher quality construction operations. Delays related to setting of grade stakes and quantity surveys can be eliminated. Slip form pavers and automated compaction are opportunities. Queue control for haul vehicles is another opportunity.

   The comments of the participants on this method included "cost will be high for contractor, skilled workers needed," "this is good when it works, but when it does not you are completely shut down," and "this should be the contractor's responsibility" (Appendix O).

3. *Employ methods for continuous work zones.* Larger work zones can be developed in the TCP and generally result in lower unit costs and schedule compression because relative impacts of mobilization and demobilization are reduced (Memmott 1982; FWHA 1998a).

   Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and observations included "still controlled by size of contractor and logical access for businesses," "not practical in most metro and urban projects," "increase in traffic congestion problems and complaints," and "we try to do this now. Site specific" (Appendix O).

4. *Use of windowed milestones.* Windowed milestones are milestones with float within a window. Traditional milestones can artificially constrain a schedule. Windowed milestones may provide more flexibility in scheduling and lead to improved project speed.

   Comments from the participants on this method included "could expedite construction but may cause administration problems," "difficult enough without floating milestones. May increase claims," and "need to watch impacts to incentive/disincentive clauses" (Appendix O).

5. *Schedule Calendar Day projects.* Scheduling the projects according to calendar days instead of working days enables better weather management and may lead to faster project completion.

   Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and concerns included "standard practice at North Texas Toll Authority," "good for projects with significant duration, greater than ten months," and "contractors need to work in bad weather to get done, lowers quality" (Appendix O).

6. *Crash schedule with use of the Linear Schedule Method.* Linear scheduling allows an activity to be modeled as a line with dimensions of time and location, unlike traditional scheduling methods that model linear activity as having constant production rates. Using this LSM schedule to crash tasks that are critical may reduce project time (O'Connor and Yuksel 2000; CII 1988).

   Comments from the participants on this method included "would have to include a provision to require the contractor to use it," "not applicable to larger or complex projects," and "TxDOT would need research on acceptable productivity rates" (Appendix O)

7. *Shorten construction time by full closure instead of partial closure of roadway.* Closing the roadway completely instead of partial closure can increase efficiency and decrease project duration significantly by freeing up space and reducing interferences.

   Comments from the participants on this method included "less likely to occur in urban area, even with alternate routes. Requires a lot of coordination", "may require significant public relations work," "only on low volume roads with good close detour route acceptable to the public," and "politics makes this hard to do on projects that would benefit the most" (Appendix O).

8. *Maturity Testing.* Maturity testing allows an engineer or manager to make appropriate decisions about the concrete placement options by considering the speed at which each option can achieve a certain strength and about the concrete placement cost by considering such aspects as the penalty or lost

opportunity costs for slow concrete development. For example, by stripping forms more rapidly, the forms can be reused more frequently and time savings can ensue. By attaining the specified strength more rapidly, the project can proceed more quickly (Phelan 1990).

Overall, the participants believed that this method would have a positive impact on expediting projects. Some of the comments and observations included "specialty field, lots of knowledge by inspectors and contractor plus cost" and "depends on project type. Concrete items will need to be prominent items on the critical path" (Appendix O).

Each of these expediting methods is believed to have potential for expediting highway construction when considered during the construction phase. Table 3.4 shows the limitations and the pros and cons of each of the methods.

Table 3.4 Table of the Applicability/Limitations and the Pros/Cons for Construction Phase Expediting Methods

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
1. Exploit web-based team collaboration system	◆ To be efficient, access to information is needed quickly and without hassle. Web-based system can be used to • track project deliverables – track project tasks on-line; receive email alerts as items become due • share documents – reduce administrative document production and delivery costs by uploading documents. This is handy for CAD drawings or anything else that needs to be shared with the project team	+ Enhances project communication + Eases collaboration with project managers, designers, contractors, vendors, and the public + Everyone is kept in the loop + Track project on-line – this minimizes time and enhances performance + High installation and learning costs + Unstable interfaces - Lack of standards
2. Encourage use of automated construction technologies	◆ Numerous research and implementation efforts are currently underway to automate conventional infrastructure construction, condition assessment, and maintenance activities such as earth moving, compaction, road construction and maintenance, and so forth ◆ Commercial systems are available from companies such as Trimble/Spectra-Physics	+ Can result in savings + Opportunity for significant schedule compression - Some training required - Contractor required to implement
3. Employ methods for continuous work zones	◆ Can be used where road geometry and weekend or night scheduling permit	+ Decrease duration and unit costs + Safer - May result in higher user costs and traffic congestion
4. Use of windowed milestone	◆ Can be used where milestone dates are not based on hard constraints. Milestones should be related to allow contractor maximum flexibility in efficiently allocating project resources	+ Lowers project costs + Possibly lower user costs - Reduces ability to "hold contractor's feet to the fire"
5. Schedule Calendar Day projects	◆ Applicable to projects where the completion is critical and a large volume of traffic is affected	+ Better weather management + Direct method of expediting

Table 3.4 Cont'd

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
6. Crash schedule with use of Linear Schedule Method	◆ Can be used for repetitive projects in which there are no strict dependencies/constraints between project activities ◆ Resurfacing, shoulder improvement, and efforts to cold plane and hot plane are good types of projects for the LSM	+ Provides a better understanding of the project + Enables the planner to determine when and where a change in resources must take place to satisfy the goals set by the project + Helps identify existing relationships and encourages the project team to try different alternatives + Overlapping activities instead of sequencing can shorten overall schedule - Projects involving large cuts and fills might be more difficult to schedule with LSM - Requires training
7. Shorten construction time by full closure instead of partial closure of roadway	◆ Full closure could be used in areas where there is at least one alternative route for drivers and where volume is limited	+ Shortens construction time - Possible traffic congestion on alternative routes
8. Maturity testing	◆ Any new concrete pavement construction or rehabilitation projects ◆ Special software requirements for the contractors	+ Cost and schedule savings + Improves reliability of mixes chosen - Reluctance of contractors to implement

3.5 Other/Multiple Phase

This area consists of the methods that do not fit directly into one of the project phases or may be associated with multiple phases. There are eight (8) expediting methods in this category, and their descriptions follow.

1. *Measure and track project schedule performance; use as basis for employee reward program as well as input to project duration database.* Owner and contractor employee incentives and compensation can be related to project schedule performance via either annual evaluations or direct incentive programs. This may result in faster delivery schedules (CII 1988).

The comments from participants concerning this method included "leaves many players out of any incentives," "this will be difficult to do and not well received," and "won't work but nice idea" (Appendix O).

2. *Track duration & productivity effects associated with different technologies.* Technology has improved productivity in the construction industry in the 21st century. Having a database of duration and productivity associated with different technologies can be very useful in deciding on the best technologies to be used on future projects and in suggesting or incentivizing technology use on projects. This can be used in qualification-based bidding and in best-value bid awards.

   The comments from participants concerning this method included "no immediate impact but develops good database for future application," "will help to transfer information to others," and "may need more personnel to track more items" (Appendix O).

3. *Use pilot demonstration projects for introducing new methods for expediting schedules.* Conducting a pilot study to test new expediting methods should be used to aid the transition process. Application to smaller projects and concentrated attention should minimize risk associated with this approach. Lessons can be learned from the application, and wider acceptance of the methods across TxDOT can be achieved.

   Comments from participants concerning this method included "could develop reward system for successful new innovations," "needs good contractors to have a good evaluation," "has been done successfully in the Dallas District," and "pilot projects are great but getting the results out to everyone does not happen" (Appendix O).

4. *Create a "smart" database of activity productivity rates.* Having a database of productivity rates of different construction methods can be very useful in providing scheduling on future projects, perhaps leading to more realistic schedule targets (CII 1996b).

   Selected comments from the participants concerning this method included "have to guard against user dependence on the database versus common

sense," "productivity varies too much by region, climate, personnel resources and materials," "may lead to more accurate schedule, but not necessarily faster," "reliability of data," and "need more personnel to maintain database" (Appendix O).

5. *Study optimal approaches to crew shifts and scheduling.* Optimization of crew shifts and scheduling could be studied carefully so that overly long work weeks and/or night work do not reduce productivity and therefore the rate of progress.

   Comments from participants concerning this method included "contractor issue, not TxDOT's," "takes more people, controlled by legislature," "better contractors already know and utilize this data," and "more an AGC/contractor issue" (Appendix O).

6. *Train selected field personnel in scheduling methods and schedule claims.* Expeditious schedule adjustments and good short interval planning can minimize schedule delays owing to missing materials or information. Having trained personnel who can assess schedule impacts and make good decisions can help to expedite schedule performance and lead to more effective and realistic time estimates (CII 1988).

   Selected comments from participants concerning this method included "may not necessarily expedite construction," "many competent field personnel can't handle this," "CPM takes some time to become proficient," and "some of the software is very complex, must continue to use it to remain proficient" (Appendix O).

7. *Create a lessons-learned database on ways to expedite schedules.* A database of lessons learned on ways to expedite schedules can be a key tool in deciding which methods to used on future projects. This database should capture lessons-learned for all phases of the project (CII 1996b).

   Comments from the participants concerning this method included "I highly recommend it… I started lessons learned recently in NTTA... it will be a good idea if lessons-learned can be shared with TxDOT and other public

agencies," and "good guidelines for young staff to utilize, will need to be maintained" (Appendix O).

8. *Incentive-based pay for retaining key TxDOT personnel.* Retention of personnel is a key to overall project time performance. Performance of project teams is enhanced tremendously with experienced and skilled personnel, particularly on the owner side. Checking the loss of expertise and organizational knowledge is very important (Davis-Blake 2001).

   Comments from the participants concerning this method included "legislative changes will be required… this will be a huge success though," "very important to maintain personnel with experience," and "keeping good, experienced project personnel can definitely expedite projects" (Appendix O).

Each of these expediting methods is believed to have potential for expediting highway construction. Table 3.5 shows the limitations and the pros and cons of each of the methods.

Table 3.5 Table of the Applicability/Limitations and the Pros/Cons for Other/Multiple Phase Expediting Methods

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
1. Measure and track project schedule performance	◆ Changes would have to be made via TxDOT's HR department and balanced with other aspects of project performance ◆ Consideration would have to be given to conditions beyond employee's control	+ Works in simple lump sum contracting situations in the private sector and is a motivator + Difficult to implement fairly - May encourage negligent or counterproductive behavior
2. Track duration & productivity effects asso-ciated with different technologies	◆ Data collected can be very useful in cost and time estimation for optimal plans ◆ Technology choices may be limited, however, by project conditions and logical equipment spreads	+ Quicker and more dependable exploitation of new technologies
3. Use pilot de-monstration projects for introducing new methods for expediting schedules	◆ The benefits/limitations of the new methods can be analyzed and a lessons learned database developed for future improvements ◆ A demonstration project may improve confidence and may be a good learning experience, but it seldom proves that a new method is advantageous ◆ A well known phenomenon in business experiments is that an observed change leads the participants to feel special and perform accordingly. The improvement may not persist	+ Eases the transition process + Leaves open the option to not fully implement + Costly experiment + Not proof of effectiveness - A poor demonstration may preclude a second chance
4. Create a "smart" database of activity productivity rates	◆ Data collected can be very useful in cost and time estimation	+ More accurate estimation of duration and cost of future projects - Complexity and cost to maintain
5. Study optimal approaches to crew shifts and scheduling	◆ The schedule can be shortened through use of additional crews on regular shift, multiple shifting, or selective overtime ◆ Scheduled overtime can be used where appropriate but effects should be evaluated carefully	+ Possible cost savings + Increase in productivity + Reduction in cycle time of tasks improves schedule + Careless planning may create negative results - Contractor must implement
6. Train selected field personnel in scheduling methods and scheduling claims	◆ Schedule flexibility may be minimal in practice, but for complex jobs a broad understanding of scheduling issues should help expedite progress	+ Flexible and quick-to-adapt project team + Faster project completion - Possibly too many people trying to manage

Table 3.5 Cont'd.

Expediting Method	Applicability/Limitations	Pros(+)/Cons(-)
7. Create a lessons-learned database on ways to expedite schedules	◆ This would be broadly applicable but limited by legal and policy constraints	+ Quick reference for implementation of expediting measures - Must be maintained
8. Incentive-based pay for retaining key TxDOT personnel	◆ Measures to retain key personnel should be implemented. Experience and institutional knowledge of these people is valuable; however, some with great experience may be resistant to constructive change	+ Enhances project performances owing to a more cohesive team. - Requires additional funding and institutional commitment

3.6 Summary of Expediting Methods

Several promising expediting methods have been covered in this chapter. Some are well established and are supported by research, where as others are relatively new without much information available on their successful use. Some have been used on TxDOT projects but are not widely adopted. Further research into these methods should produce results that could be beneficial to expediting highway construction.

4. Data Analysis

Chapter 2 described how the data on the expediting methods were collected and evaluated through workshops with key personnel experienced in highway construction and familiar with the operation and the current working environment faced by DOTs. This chapter will present analyses of the data collected from the three workshops.

It should be noted that there were 48 expediting methods identified before the workshops started. The matrix of expediting methods (Table 2.1) was revised after each workshop to address participants' comments and concerns. At the end of the three workshops, through the addition, elimination, splitting, and combining of methods on the basis of the recommendations of workshop participants, this list contained 50 expediting methods, as was presented in the previous chapter. Therefore a few of the methods were not evaluated in all three workshops; however, their evaluation is included on the basis of the data obtained.

4.1 Data Analysis Process

The data collected in the workshops via the Assessment Sheets were used to evaluate and rank the overall methods on the basis of the answers given by the interim workshop participants. The evaluation procedure is detailed in the subsequent sections.

4.1.1 Step 1: Tallying of Votes

All the votes of the 62 workshop participants were tallied up for the low, medium, or high section of each of the categories of relevancy to TxDOT, doability, and positive impact, as shown for the project planning results sample in Figure 4.1. Appendix G contains the results for all of the methods. When the total number of votes in any cell is less than 62, that method was evaluated in only one or two of the workshops. Note also that some participants provided no vote for some methods.

I. PROJECT PLANNING

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. Standardize Planning Approach	1	17	44	1	30	31	5	18	39
2. Programmatic Approach	4	20	38	21	34	7	5	27	30
3. Alternative Funding Methods	5	22	34	18	34	9	10	27	24
4. Designate a PM for Entire Life-Cycle	15	25	22	35	19	8	14	19	28
5. Design-Build Approach	12	22	27	22	29	11	14	22	26
6. Formal Partnering	5	16	41	7	15	40	10	17	35
7. Expediting ROW Acquisition	1	0	61	31	25	6	1	10	51
8. Expediting Utility Relocation	1	1	60	29	24	9	0	9	53
9. Improving Environmental Assessment	1	4	28	17	10	6	0	4	29
10. ITS & Work-zone Traffic Control	2	25	35	8	37	17	14	26	22
11. Public Input on Construction Methods	10	21	31	23	25	14	13	28	21

Figure 4.1 Participants Voting Sample (Raw Data), Project Planning Phase

4.1.2 Step 2: Calculation of Raw Scores

A score for each criterion (relevancy, doability, and positive impact) was determined. The "point method" was used for scaling: One (1) point was assigned for each "low" score, two (2) points for each "medium" score, and three (3) points for each "high" score. Using

this scale, a raw score was calculated. A sample of the calculated scores is shown in Figure 4.2. Appendix H contains the results of all the phases.

Example: For the first criterion (relevancy) of the first method (Standardize planning approach) in Figure 4.1, a total of one low, 17 medium and 44 high votes were counted totaling 62. The raw score was calculated as follows:

$$\frac{(1\times 1)+(17\times 2)+(44\times 3)}{62} = 2.69$$

I. PROJECT PLANNING

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. Standardize Planning Approach (n = 62)	2.69	2.48	2.55
2. Programmatic Approach (n = 62)	2.55	1.77	2.40
3. Alternative Funding Methods (n = 61)	2.48	1.85	2.23
4. Designate a PM for Entire Life-Cycle (n = 62)	2.11	1.56	2.23
5. Design-Build Approach (n = 62)	2.25	1.82	2.19
6. Formal Partnering (n = 62)	2.58	2.53	2.40
7. Expediting ROW Acquisition (n = 62)	2.97	1.60	2.81
8. Expediting Utility Relocation (n = 62)	2.95	1.68	2.85
9. Improving Environmental Assessment (n = 33)	2.82	1.67	2.88
10. ITS & Work-zone Traffic Control (n = 62)	2.53	2.15	2.13
11. Public Input on Construction Methods (n = 62)	2.34	1.85	2.13

Figure 4.2 Calculated Scores Sample, Project Planning Phase

4.1.3 Step 3: Classification of Methods

The values of the calculated raw scores ranged from 1 to 3. A score of 1 indicates that all the participants voted low on that criterion (relevancy to TxDOT, doability, or positive impact) for the particular method, and a score of 3 means that every participant voted high.

Using the calculated raw scores, each method was classified according to the following scale for each criterion as shown in Figures 4.2 and 4.3. Appendices H and I contain the results for all the expediting methods.

$1.0 \leq$ Average Raw Score ≤ 1.4	Very Low
$1.4 <$ Average Raw Score ≤ 1.8	Low
$1.8 <$ Average Raw Score ≤ 2.2	Medium
$2.2 <$ Average Raw Score ≤ 2.6	High
$2.6 <$ Average Raw Score ≤ 3.0	Very High

4.1.4 Step 4: Overall Score

An overall score, scaled from 0 to 10, was also given to each method, calculated for their raw scores. This score considers all three criteria equally weighted. Therefore, the raw scores for a criterion were summed up and divided by three. If the method's average raw score is 1, its overall score is 0; if its average raw score is 2, its overall score is 5; if its average raw score is 3, its overall score is 10, and so on. Figure 4.3 includes the overall score for the methods.

The equation for calculation of the overall score is as follows:

$$\left[\frac{(x_R)+(x_D)+(x_{PI})}{3}-1\right]\times\frac{10}{2}$$

where x_R is the relevancy score
x_D is the doability score
x_{PI} is the positive impact score

I. PROJECT PLANNING

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. Standardize Planning Approach	Very High	High	High	7.9
2. Corridor Planning	High	Low	High	6.2
3. Alternative Funding Methods	High	Medium	High	5.9
4. Designate a PM for Entire Life-Cycle	Medium	Low	High	4.8
5. Design-Build Approach	High	Medium	Medium	5.4
6. Formal Partnering	High	High	High	7.5
7. Expediting ROW Acquisition	Very High	Low	Very High	7.3
8. Expediting Utility Relocation	Very High	Low	Very High	7.5
9. Improving Environmental Assessment	Very High	Low	Very High	7.3
10. ITS & Work-zone Traffic Control	High	Medium	Medium	6.3
11. Public Input on Construction Methods	High	Medium	Medium	5.5

Figure 4.3 Classification Sample, Project Planning Phase

4.2 Categorization of Methods Based on Scores

In the investigation of ways to categorize the data, on the basis of the three evaluation criteria relevancy to TxDOT, doability, and positive impact for the expediting methods, it was found that the relevancy to TxDOT and positive impact criteria were highly correlated

based on the participants' responses. The correlation coefficient (R^2) based on the analysis was 0.87. Figure 4.4 illustrates this correlation.

Because of the high correlation between the relevancy to TxDOT and the positive impact criteria, the research team decided to use only one of these factors in the categorization of the methods. Doability and positive impact were chosen to categorize the methods.

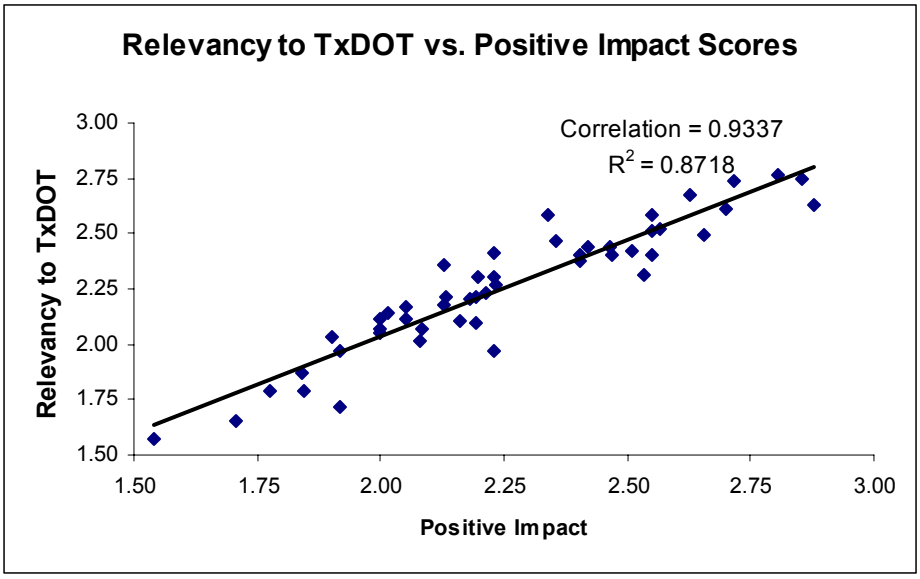

Figure 4.4 Relevancy to TxDOT vs. Positive Impact Criteria for the 50 Expediting Methods

Bases on the calculated raw scores, the methods could be classified into one of the following categories:

- *High – High* category. The methods that had a very high or high doability and a very high or high positive impact in terms of schedule acceleration score based on the workshop participants' responses were placed in this category.
- *Medium – High* category. The methods that had a medium doability and a very high or high positive impact in terms of schedule acceleration score based on the workshop participants' responses were placed in this category.
- *Low – High* category. The methods that had a low doability and a very high or high positive impact in terms of schedule acceleration score based on the workshop participants' responses were placed in this category.

- *Medium – Medium* category. The methods that had medium scores for both doability and positive impact based on the workshop participants' responses were placed in this category.
- *Low – Medium* category. The methods that had a low doability and a medium positive impact in terms of schedule acceleration score based on the workshop participants' responses were placed in this category.
- *Low – Low* category. The methods that had a low score for both doability and positive impact based on the workshop participants' responses were placed in this category.

Two methods were used to analyze participant workshop responses. Expediting methods were first ranked on the basis of their overall score, which takes into account relevancy, doability, and positive impact equally weighted as described earlier. Second, each was categorized as described above.

One advantage of this approach is that it helps to ensure that all the methods chosen for inclusion in the decision tool are available and can be implemented with the available resources and under existing constraints based on the workshop results. Another advantage is being able to identify the methods that could potentially have a high impact but cannot be implemented with available resources and under existing constraints. The top 25 expediting methods on the basis of overall score is included in section 4.5.

4.3 Data Analysis Results - High Positive Impact Methods

The previous sections explained the processes used to categorize the expediting methods. The following sections will discuss the methods that fell into some of the categories considered important for further investigation and inclusion in the decision tool.

It is important to note that the goal of the workshops was not to decide which methods were or were not being used by TxDOT, but rather the goal was to categorize these methods on the basis of the criteria mentioned for possible inclusion in the decision tool, which is the ultimate product of the research effort.

All the methods with high impact that should be considered for further analysis are highlighted in the following sections. The high positive impact methods are those that the workshop participants felt could have a very positive effect in terms of schedule

acceleration. These methods fall into one of the following three categories on the basis of how easily they can be implemented with available resources and under existing constraints.

1. High doabililty – high positive impact. A total of 13 methods in this "High – High" category out of the 50 expediting methods were identified and are discussed in the following sections according to project phases.
2. Medium doabililty – high positive impact. There were six methods in this "Medium – High" category that were identified and are discussed in the following sections according to project phases.
3. Low doabililty – high positive impact. From the analysis of the workshop results, some methods were estimated to be not easily implemented with available resources and under existing constraints but were estimated to have a very positive effect in terms of schedule acceleration. There were seven methods in this "Low – High" category

4.3.1 Project Planning Phase

Results from the characterization of the project planning phase are given in Figure 4.5. The two methods with high doability and high positive impact are the following:

- Standardize planning approach; use comprehensive standard tools ensuring all areas are covered;
- Formal partnering with design consultants, contractors, local authorities, and regulatory agencies.

There is one method with medium doability and high impact in this phase:

- Alternative funding methods.

The following five methods fell into the "Low – High" category:

- Programmatic (corridor) approach to planning, design, and construction;
- Designate a single individual as Project Manager (PM) from early planning to construction; empower and equip PM with needed tools and data to select appropriate expediting methods;
- Methods for expediting right-of-way (ROW) acquisition;
- Methods for expediting utility relocation work; and

- Methods for improving environmental assessment during planning.

I. PROJECT PLANNING

Method	Doability	Positive Impact
Standardize Planning Approach	High	High
Formal Partnering	High	High
Alternative Funding Methods	Medium	High
Design-Build Approach	Medium	Medium
ITS & Work-Zone Traffic Control	Medium	Medium
Public Input on Construction Methods	Medium	Medium
Expediting ROW Acquisition	Low	Very High
Expediting Utility Relocation	Low	Very High
Improving Environmental Assessment	Low	Very High
Corridor Planning	Low	High
Designate a PM for Entire Life Cycle	Low	High

Figure 4.5 Project Planning Phase Categorization

4.3.2 Project Design Phase

Results from the characterization of the project design phase are given in Figure 4.6. The four methods with high doability and high positive impact are as follows:

- Pavement type selection decisions;
- Precast/modular components;
- Generate and evaluate multiple approaches to Traffic Control Plans (TCPs); and
- Maturity testing.

There is one method with medium doability and high impact in this phase:

- Develop Traffic Control Plans (TCPs) through partnering between TxDOT design and field organizations.

None of the methods fell into the "Low – High category:

II. PROJECT DESIGN

Method	Doability	Positive Impact
Precast/Modular Components	Very High	Very High
Pavement Type Selection Decisions	Very High	High
Multiple Approaches to Traffic Control Plans (TCPs)	High	High
Maturity Testing	High	High
Increasing Levels of Design Component Standardization	High	Medium
TCP Through Partnering between TxDOT Design & Field Organizations	Medium	High
Descriptive Catalog of Construction Technologies	Medium	Medium
Linear Scheduling Method & Accurate Productivity Rate	Medium	Medium
Have Contractor Prepare the TCP	Low	Medium
Phased Design to Support Phased Construction	Low	Low

Note: Maturity testing was placed in the construction phase after the third workshop.

Figure 4.6 Project Design Phase Categorization

4.3.3 Contracting and Procurement Phase

Results from the characterization of the contracting and procurement phase are given in Figure 4.7. The five methods with high doability and high positive impact are as follows:

- A+B contracting;
- Use of contractor milestone incentives;
- Incentivize contractor work progress with a lane-rental approach;
- Increase amount of liquidated damages and routinely enforce;
- "No Excuse" incentives.

There is one method with medium doability and high impact in this phase:

- Tools and best practices for implementing multiple work shifts and/or night work.

The following method fell into the "Low – High" category:

- Pre-qualify bidders on basis of past schedule performance.

III. CONTRACTING AND PROCUREMENT

Method	Doability	Positive Impact
Use of Contractor Milestone Incentives	High	Very High
A+B Contracting	High	High
Incentivize Contractor Work with a Lane-Rental Approach	High	High
Increase Amount of Liquidated Damages	High	High
"No Excuse" Incentives	High	High
Implementing Multiple Work Shifts and/or Night Work	Medium	High
Packaged Multiple-Primes Approach to Contracting	Medium	Medium
Incentivize TCP Development with a Contractor VE Cost-saving Provision	Medium	Medium
Change Management Practices	Medium	Medium
Project-Level Dispute Review Board	Medium	Medium
Pre-Qualify Bidders on Basis of Past Schedule Performance	Low	High
Warranty Performance Bidding	Low	Medium
Alternative Dispute Resolution Methods	Low	Medium
E-Commerce Systems for Procurement, Employment, etc.	Low	Low

Figure 4.7 Contracting and Procurement Phase Categorization

4.3.4 Construction Phase

Results from the characterization of the construction phase are given in Figure 4.8. The three methods with high doability and high positive impact are as follows:

- Employ methods for continuous work zones; and
- Schedule Calendar Day projects.

There is one method with medium doability and high impact in this phase:

- Shorten construction time by full closure instead of partial closure of roadway.

None of the methods fell into the "Low – High" category:

IV. CONSTRUCTION

Method	Doability	Positive Impact
Schedule Calendar Day Projects	Very High	Very High
Maximizing Size of Work-Zones	High	High
Windowed Milestones	High	Medium
Full Closure Instead of Partial Closure Roadway	Medium	Very High
Automated Construction Technologies	Medium	Medium
Linear Scheduling Method	Medium	Medium
Web-Based Team Collaboration System	Low	Medium

Figure 4.8 Construction Phase Categorization

4.3.5 Other/Multiple Phase

Results from the characterization of the Other/Multiple phase are given in Figure 4.9. None of the methods was high doability and high positive impact.

There are two methods with medium doability and high impact in this phase:

- Train selected field personnel in scheduling methods and schedule claims; and
- Create a lessons-learned database on ways to expedite schedules.

The following method fell into the "Low – High" category:

- Incentive-based pay for retaining key TxDOT personnel.

V. OTHER / MULTIPLE

Method	Doability	Positive Impact
Pilot Demonstration Projects	High	Medium
Training Personnel in Scheduling Methods	Medium	High
Create a Lessons-Learned Database	Medium	High
Track Dururation & Productivity Effects Associated with Different Technologies	Medium	Medium
"Smart" Database of Activity Productivity Rates	Medium	Medium
Incentive-Based Pay for Retaining Key TxDOT Personnel	Low	High
Study Optimal Approaches to Crew Shifts & Scheduling	Low	Medium
Measure & Track Project Schedule Performance	Very Low	Low

Figure 4.9 Other/Multiple Phase Categorization

4.3.6 Lessons from Others

There was one recognized method that was not identified as high impact that the research team believes could have a very positive impact on project expediting on the basis of the literature review and success at other state DOTs. This method, which was rated medium doability and medium impact on the basis of the interim workshop results is from the project planning phase and is listed below.

- Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.).

Table 4.1 shows the 26 high impact methods. These methods, along with the one in the "Lessons from Others" category mentioned above (also included in the table in low doability – high impact category), had a high potential to impact the speed of highway construction based on the interim workshop results, and these methods should be the focus as research progresses, either to include in the decision tool for immediate use or to improve doability because of the potentially high impact.

Table 4.1 High Impact Methods

High Doability – High Impact Methods	Medium Doability – High Impact Methods	Low Doability – High Impact Methods
Standardize Planning Approach	Alternative Funding Methods	Programmatic (Corridor) Approach
Formal Partnering	TCP Through Partnering between. TxDOT Design & Field Organizations.	Designate a Single Project Manager
Pavement Type Selection Decisions	Implementing Multiple Work Shifts and/or Night Work	Expediting ROW Acquisition
Precast/Modular Components	Full Closure Instead of Partial Closure Roadway	Expediting Utility Relocation
Multiple Approaches to Traffic Control Plans	Training Personnel in Scheduling Methods	Improving Environmental Assessment
Maturity Testing	Create a Lessons-Learned Database on Ways to Expedite Schedules	Pre-Qualify Bidders on Basis of Past Schedule Performance
A+B Contracting		Incentive-Based Pay for Retaining Key TxDOT Personnel
Use of Contractor Milestone Incentives		*Design-Build Approach (medium doability – medium impact)
Incentivize Contractor Work with a Lane-Rental Approach		
Increase Amount of Liquidated Damages		
"No Excuse" Incentives		
Employ Methods for Continuous Work-zones		
Schedule Calendar Day Projects		

*Note: Design-Build Approach is included in the table as a "low – high" method

4.4 Multi-Voting Results

The workshop participants were instructed to vote on the methods that they thought, in a perfect world, would have the most value for expediting the construction process. The summary of the results for the multi-voting for each of the three workshops is shown in Figure 4.10. (Appendices K through M contain the complete results from each workshop.) One of the changes made after the first workshop is also reflected in the figure, where expediting ROW and utility relocation was split into expediting utility relocation and expediting ROW. Only methods that received at least 20 percent of the votes in the multi-

voting for at least one of the workshops were included. All of these are methods that the participants feel would be of value in expediting the construction process. Most are also included in the high impact list except for the following:

- Have contractor prepare the Traffic Control Plan (TCP) based on minimum requirements (Phase I)
- Pre-qualify bidders on basis of past schedule performance (Phase II)
- Use pilot demonstration projects for introducing new methods for expediting schedules (Phase V)
- Create a "smart" database of activity productivity rates (Phase V)

These four methods, on the basis of the results from the multi-voting, should also be considered for their potential impact on expediting.

Each workshop participant was then given one last vote (a single vote) to indicate the one method they thought would be the most beneficial for project expediting. The results are given in Table 4.2. The dominance of "methods of expediting right-of-way acquisition" and "methods of expediting utility relocation work" shows the participants' opinion that right-of-way acquisition and utility relocation are probably the two leading causes for project delays.

Table 4.2 Multi-Voting Single Vote Results

TOP VOTE GETTING METHODS	VOTES
Dallas Workshop	
Expediting ROW & Utility Relocation (Planning Phase)	48%
Pre-Qualify Bidders on the Basis of Performance Schedule (Contracting and Procurement)	25%
Full Closure Instead of Partial Closure of Roadway (Construction Phase)	20%
Precast/Modular Components (Design Phase)	4%
Use of Contractor Milestone Incentives (Contracting and Procurement)	4%
Austin Workshop I	
Expediting Utility Relocation (Planning Phase)	47%
Expediting ROW (Planning Phase)	27%
Incentive-Based Pay for Retaining Key TxDOT Personnel (Other/Multiple)	20%
Multiple Approaches to Traffic Control Plans (Design Phase)	7%
Austin Workshop II	
Expediting ROW (Planning Phase)	50%
Design-Build Approach (Planning Phase)	25%
Multiple Approaches to Traffic Control Plans (Design Phase)	7%
Expediting Utility Relocation (Planning Phase)	6%
Pre-Qualify Bidders on the Basis of Performance Schedule (Contracting and Procurement)	6%
Training Personnel in Scheduling Methods (Other/Multiple)	6%

	DALLAS WORKSHOP TOP VOTE-GETTING METHODS	Multi-Voting	AUSTIN I WORKSHOP TOP VOTE-GETTING METHODS	Multi-Voting	AUSTIN WORKSHOP II TOP VOTE-GETTING METHODS	Multi-Voting
Phase I	Expediting ROW & Utility Relocation	30%	Expediting Utility Relocation	34%	Expediting Utility Relocation	34%
			Expediting ROW	31%	Expediting ROW	29%
Phase II	Precast/Modular Components	30%	Pavement Type Selection Decisions	24%	Multiple Approaches to Traffic Control Plans	25%
	Have the Contractor Prepare the TCP	24%	Multiple Approaches to Traffic Control Plans	23%	TCP Through Partnering btw. TxDOT Design & Field Organizations	22%
Phase III	Pre-Qualify Bidders on Basis of Past Schedule Performance	20%	Increase Amount of Liquidated Damages	28%	Increase Amount of Liquidated Damages	21%
	Use of Contractor Milestone Incentives	20%	Use of Contractor Milestone Incentives	26%	A+B Contracting	20%
	Increase Amount of Liquidated Damages	13%	Pre-Qualify Bidders on Basis of Past Schedule Performance	14%	Pre-Qualify Bidders on Basis of Past Schedule Performance	16%
Phase IV	Full Closure Instead of Partial Closure of Roadway	33%	Schedule Calendar Day Projects	44%	Full Closure Instead of Partial Closure of Roadway	38%
	Schedule Calendar Day Projects	27%	Full Closure Instead of Partial Closure of Roadway	30%	Schedule Calendar Day Projects	21%
Phase V	Incentive-based Pay for Retaining Key TxDOT Personnel	27%	Incentive-Based Pay for Retaining Key TxDOT Personnel	38%	Training Personnel in Scheduling Methods	35%
	Measure & Track Project Schedule Performance	23%	"Smart" Database of Activity Productivity Rates	24%	Measure & Track Project Schedule Performance	32%
	"Smart" Database of Activity Productivity Rates	0%	Measure & Track Project Schedule Performance	0%	"Smart" Database of Activity Productivity Rates	12%

Figure 4.10 Multi-Voting Results for the Three Workshops Held

4.5 Top 25 Methods Based on Overall Score

The overall score takes into account relevancy to TxDOT, doability, and positive impact equally weighted. The top 25 expediting methods based on this score are ranked and shown in Table 4.3. The overall score and rank of all the methods are given in Appendix J. Comparisons between the Dallas workshop (29 participants), the first Austin workshop (16 participants), and the second Austin workshop (17 participants) are also provided in Appendix J. All the methods in Table 5.3 are on the high impact lists stated earlier in this chapter except for the four ranked 20 through 23.

Table 4.3 Top 25 Methods Based on Overall Score (*n* = 62 for most methods)

Rank	Project Phase	Expediting Methods *(Doability – Impact Category)*	Overall Score
1	IV	Schedule Calendar Day Projects *(H-H)*	9.3
2	II	Precast/Modular Components *(H-H)*	8.7
3	III	Use of Contractor Milestone Incentives *(H-H)*	8.4
4	II	Pavement Type Selection Decisions *(H-H)*	8.0
5	I	Standardize Planning Approach *(H-H)*	7.9
6	II	Multiple Approaches to Traffic Control Plans (TCPs) *(H-H)*	7.8
7	II	Maturity Testing *(H-H)*	7.5
8	I	Formal Partnering *(H-H)*	7.5
9	II	A+B Contracting *(H-H)*	7.5
10	I	Expediting Utility Relocation *(L-H)*	7.5
11	III	Implementing Multiple Work Shifts and/or Night Work *(M-H)*	7.4
12	III	Incentivize Contractor Work with a Lane-Rental Approach *(H-H)*	7.3
13	I	Expediting ROW Acquisition *(L-H)*	7.3
14	III	Increase Amount of Liquidated Damages *(H-H)*	7.3
15	I	Improving Environmental Assessment *(L-H)*	7.3
16	IV	Full Closure Instead of Partial Closure of Roadway *(M-H)*	7.2
17	III	"No Excuse" Incentives *(H-H)*	7.1
18	IV	Employ Methods for Continuous Work-Zones *(H-H)*	6.7
19	II	TCP Through Partnering between. TxDOT Design & Field Org. *(M-H)*	6.6
20	IV	Windowed Milestones *(H-M)*	6.6
21	II	Increasing Levels of Design Component Standardization *(H-M)*	6.5
22	I	ITS & Work-Zone Traffic Control *(M-M)*	6.3
23	V	Pilot Demonstration Projects *(H-M)*	6.3
24	I	Programmatic (Corridor) Approach *(L-M)*	6.2
25	V	Training Personnel in Scheduling Methods *(M-H)*	6.2

Key for terms in brackets: (Doability – Impact) H = High, M = Medium, and L = Low

4.6 Top Ten Methods Based on Overall Score for Each Workshop

For comparison, the top 10 methods on the basis of the overall score for each workshop is provided in Table 4.4. The results vary between workshops for the top 10 but

the top 20 are almost the same with regard to the expediting methods included (Appendix J).

Table 4.4 Top 10 Methods Based on Overall Score for Each Workshop

	DALLAS (*n* = 29)		AUSTIN (*n* = 16)		AUSTIN II (*n*=17)	
Rank	**Method**	**Score**	**Method**	**Score**	**Method**	**Score**
1	**Schedule Calendar Day Projects**	9.3	**Schedule Calendar Day Projects**	9.4	**Schedule Calendar Day Projects**	9.0
2	**Precast/Modular Components**	9.2	**Use of Contractor Milestone Incentives**	8.9	**Use of Contractor Milestone Incentives**	9.0
3	Pavement Type Selection Decisions	8.3	Standardize Planning Approach	8.6	"No Excuse" Incentives	9.0
4	**Use of Contractor Milestone Incentives**	7.9	**Precast/Modular Components**	8.6	Incentivize Contractor Work with a Lane-Rental Approach	7.9
5	*Full Closure Instead of Partial Closure of Roadway*	7.9	Multiple Approaches to Traffic Control Plans (TCPs)	8.4	*Increase Amount of Liquidated Damages*	7.9
6	Multiple approaches to Traffic Control Plans (TCPs)	7.8	Formal Partnering	8.3	**Precast/Modular Components**	7.8
7	*Implementing Multiple Work Shifts and/or Night Work*	7.8	Pavement Type Selection Decisions	8.3	*A+B Contracting*	7.7
8	Standardize Planning Approach	7.6	Incentivize Contractor Work with a Lane-Rental Approach	8.2	Standardize Planning Approach	7.5
9	Formal Partnering	7.5	*Linear Scheduling Method & Accurate Productivity Rate*	8.1	Expediting Utility Relocation	7.5
10	"No Excuse" Incentives	7.4	Expediting Utility Relocation	8.0	*Expediting ROW Acquisition*	7.5

Key: Methods in bold occur in the 10 ten of all three workshops. Methods in italics occur in the top 10 of only one workshop.

4.7 Presentation of Interim Results

The presentation of the interim results on June 14, 2002, to TxDOT leading officials was done to gather feedback on the results of the workshops, to get recommendations on a path forward, and also as a validation of the results. The participants of the meeting were presented with the findings of the expediting methods in the high – high and low – high categories and Lessons from Others Category. The low doability methods were given some special attention. The research team posed the question, "Are these low doability

methods, or is it just the perception of the workshop participants?" Changes needed to address the doability of these methods were also addressed, including policy changes and legislative changes. The list of attendees at the meeting to present the interim results is included in Appendix N.

For the low doability methods, it was discovered that "pre-qualify bidders on basis of past schedule performance" could be done by TxDOT (a database currently exists and it is being used in some cases) and therefore is not a low doability method.

4.8 Methods Requiring Policy Changes

Some of the high impact methods identified were found to need long-term, organization-based, strategic policy changes and for this reason may not be included in the decision system, whereas others were identified as having both long-term strategic needs and elements that can be implemented immediately.

Methods identified as requiring long-term organization-based, strategic policy changes included the following:

- Standardize planning approach; use comprehensive standard tools ensuring all areas are covered; and
- Tools and best practices for implementing multiple work shifts and/or night work.

Methods identified as having both long-term elements and elements that can be implemented immediately included the following:

- Methods for expediting right-of-way (ROW) acquisition;
- Methods for expediting utility relocation work; and
- Methods for improving environmental assessment during planning.

4.9 Summary of Data Analysis/Workshop Findings

In summary, this chapter described how the information collected in the interim workshops was used to categorize the expediting methods. This was the first step in determining the expediting methods that were of the most benefit to TxDOT. On the basis of the analysis, high impact methods were seen as the most promising for further investigation and incorporation into the draft decision tool.

The methods with potentially high doability and high impact will be the initial methods that are included in the decision tool, which is one of the products of the research project. Some of the methods with potentially high impact may not be considered in the final decision tool because of legislative and other limitations. Further investigations of these methods will be necessary to make recommendations to TxDOT about future implementation.

The next chapter briefly discusses some key methods requiring management action.

5. Management Action for Key Methods

This chapter discusses some low doability methods with high potential impact and notes some of the comments made by the participants in the interim workshops concerning these methods. Some of these methods may have been used very successfully in other states or by other agencies within Texas but because of procedural, legislative, or other limitations may not be available to TxDOT. Others may just require internal policy changes to implement successfully.

Actions to increase the ease of implementation of these methods are necessary to take advantage of their potential positive impact.

5.1 Programmatic (Corridor) Approach

Programmatic (corridor) approach to planning, design, and construction fell in the low – high category from the workshop results. Workshop participants are cognizant of the potential impact this could have on project schedules. On the basis of the comments collected from the workshops, the participants believe funding restrictions are the main barrier toward the implementation of effective corridor management strategies; however, one comment was "TxDOT is trying to do this on some corridors with the Texas Mobility Fund." There is also the concern that political considerations often prevent construction activity to be applied on a corridor basis. (Other comments given in Appendix O.)

5.2 Designate a Single Individual as Project Manager

Designating a single individual as Project Manager (PM) from early planning to construction; empower and equip PMs with needed tools and data to select appropriate expediting methods was also one of the methods that fell in the low doability category. This method is also being researched by many state DOTs. Some of the concerns that the workshop participants have about the success of this method and therefore its low doability included "high personnel turnover," "the length of time required to complete highway projects (the most experienced PM would be probably looking to retire within a few years)," "limited experience (specialization) of most engineers," "the planning design and construction are handled by different offices," "conflicts with other projects," and "the

availability of experienced personnel willing to work for TxDOT." (Other comments given in Appendix O.)

5.3 Methods for Expediting Right-of-Way Acquisition

Methods for expediting right-of-way (ROW) acquisition was also in the low – high category, but according to the workshop participants, this is one of the major causes of delay in highway construction. Improvement in this area is necessary not only because of its potential for expediting project time, but because many of the other methods have limited impact if the potential delays owing to ROW acquisition are not curtailed. The legislative limitation of this method was one of the participants' main concerns. The "Quick Take" ROW authority similar to the Texas Turnpikes Authority is one recommendation. Other limitations identified by the workshop participants included funding limitations, the evaluation of ROW purchases on a lowest cost basis, and Texas land rights and the surrounding political issues. (Other comments given in Appendix O.)

5.4 Methods for Expediting Utility Relocation Work

Methods for expediting utility relocation work in the low – high category is another key method, because utility relocation work is possibly the major cause of delay in highway construction, even more so than ROW acquisition. A recent National Cooperative Highway Research Program study noted that utility-related problems are a leading cause of delays in highway construction (FWHA 2002a). Frequent coordination, cooperation, and communication (CCC) between state transportation departments (DOTs) and utilities personnel typically result in more timely and efficient utility relocation activities (FWHA 2002a). Utilities will have to commit early to CCC and maintain the effort to curtail much of the utility-related delays. Some of the comments made by the workshop participants regarding utility relocation included "incorporation of utility plans and road plans work well," "getting utilities to follow-through is a problem," "legislative assistance is needed," "utility companies have limited budgets," "accountability needed in utility companies," and "TxDOT pays for utility work and get reimbursed later." (Other comments given in Appendix O.)

5.5 Methods for Improving Environmental Assessment

Methods for improving environmental assessment during planning was another high – low method. TxDOT is currently looking at ways to better streamline the process. The Transportation Equity Act for the 21st Century (TEA-21) calls for a coordinated environmental review process to expedite federal highway and transit projects. The environmental streamlining section establishes a coordinated review process by which the U.S. Department of Transportation (USDOT) would work with other federal agencies to assure that major highway and other transit projects are advanced according to cooperatively determined time frames. It emphasizes using concurrent, rather than sequential, reviews to save time. It allows states to include their environmental reviews in the coordinated environmental review process. TxDOT is working to incorporate environmental streamlining into its project approval process (TxDOT 2002a). Comments from the workshop participants included "depends on too many resource agencies," "laws are written so vague that personal interpretation causes problems," "a streamlined process would be great," and "Environmental Protection Agency and Corps of Engineers just do not seem to want to cooperate with TxDOT." (Other comments given in Appendix O.)

5.6 Pre-Qualify Bidders on Past Schedule Performance

Pre-qualifying bidders on the basis of past schedule performance was also believed to have a high impact on expediting with low doability. Currently, TxDOT's bidding process does not allow the agency to consider a contractor's past performance in awarding the contract and requires contractors only to have a performance bond through completion of the work (Rylander 2001). To expedite construction, it is important that TxDOT be able to consider past schedule performance and quality of work. Comments made by the workshop participants included "political implications will probably make this impractical in Texas," " 'fair' evaluations will be a sticking point, sounds good but not sure if realistic," "legislative restrictions," and "AGC will not support." (Other comments given in Appendix O.)

5.7 Design–Build Approach

The Design-Build (DB) project delivery approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.) fell in the medium – medium category. The FHWA

under Special Experimentation Project Number 14 (SEP-14) currently allows this method to be used on federal aid highway projects that exceed (1) $5 million for intelligent transportation system projects or (2) $50 million for any other projects if the state allows the approach legislatively. The medium doability reflects that the participants believe that this method will be available to TxDOT for other categories of projects sooner rather than later. As of March 2002, 24 state DOTs have pursued design-build projects in the past ten years under FHWA's SEP-14, which was implemented to demonstrate innovative contracting (Lord 2002). The TTA currently can employ a similar method under the name Exclusive Development Agreement, but it is not yet available otherwise in TxDOT. Some workshop participants' comments on this method included "should dramatically accelerate construction but will cost more," "ROW acquisitions need to be considered," and "D-B depends on type of projects (good for off-system projects/enhancement)." (Other comments given in Appendix O.)

6. Conclusions and Recommendations

This chapter concludes the workshops and workshops' results on expediting highway construction while retaining quality. It summarizes how the results will be used to further the research effort and makes a few viable recommendations.

6.1 A Overview of the Research Effort

The research effort described here was established to develop a user–friendly decision support system for selecting the most appropriate "state-of-the-practice" methods for expediting highway construction. This research was motivated by TxDOT's need 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. This interim report covers most of the work that has preceded development of the actual decision support system.

6.1.1 Summary of Research Objectives

The objective of this report is to present the findings concerning the most appropriate expediting construction methods from the interim workshops results and also to serve as a starting point to determine areas in which further research should be targeted. Specific objectives included the following:

- Identify, describe, and catalog "best-practice" methods for expediting schedules.
- Characterize (and, where possible, quantify) both the positive and negative aspects (e.g., benefits, advantages, limitations, etc.) for each method, considering all life cycle costs.
- Determine the applicability to and the impact on various types of projects performed by TxDOT through workshops conducted with TxDOT personnel for this purpose.
- Develop a tool with which Area Engineers (and their subordinates) can easily determine the methods that are most appropriate given different project conditions.

6.1.2 Summary of How the Research Objectives Were Met

The following points summarize how the research objectives were successfully met by the research effort:

- The research team identified, described, and catalogued 50 methods for expediting schedules.
- The benefits, advantages, and limitations were characterized for each expediting method. A description of each method was also provided.
- Three interim workshops were conducted to determine the applicability to and impact of the expediting methods on various types of projects performed by TxDOT.
- The methods were characterized on the basis of the results of these workshops and the methods with the highest potential impact on expediting project schedules were selected for further study and inclusion in the decision system.

The development of a tool with which Area Engineers (and their subordinates) can easily determine the methods that are most appropriate given different project conditions was being implemented at the same time this report was written and will be addressed in the final report.

6.2 Conclusions

From the workshops results, some conclusions can be made from the intermediate findings, including the following:

- The workshops were a good way of sharing information and identifying effective management methods being used, as well as narrowing a large list of methods to a shorter list specific to the context of TxDOT.
- Participants from 24 of the 25 districts in TxDOT attended the workshops. This was important in fostering participant buy-in for the research effort and in promoting acceptance of the products of the effort.
- The modified Delphi approach used in the workshops facilitated obtaining a consensus opinion from a group while simultaneously encouraging them to participate actively.

- The enthusiasm among the workshop participants indicates the need for a decision system, and that such a system will be well received, after development.
- The workshops identified the best methods for inclusion in this decision tool.
- The workshops identified several areas where further research will be needed; this was especially true among the low doability and high positive impact methods.
- The research approach described in this paper could be applied in other state DOTs.

The following methods can be used immediately for the decision system. They are characterized by their ease of implementation and potential impact. High impact methods which may require long-term strategic policy changes are not included.

1. Formal partnering with design consultants, contractors, local authorities, and regulatory agencies;
2. Pavement type selection decisions;
3. Precast/modular components;
4. Generate and evaluate multiple approaches to Traffic Control Plans (TCPs);
5. Maturity testing
6. Develop Traffic Control Plans (TCPs) through partnering between TxDOT design and field organizations;
7. A+B contracting;
8. Use of contractor milestone incentives;
9. Incentivize contractor work progress with a lane-rental approach;
10. Implement multiple work shifts and/or night work;
11. Increase amount of liquidated damages and routinely enforce;
12. “No Excuse” incentives;
13. Employ methods for continuous work zones;
14. Schedule Calendar Day projects;
15. Shorten construction time by full closure instead of partial closure of roadway; and
16. Train selected field personnel in scheduling methods.

The following methods need management action. They are characterized by their potential impact, lower doability, and/or long-term, organization-based, strategic policy needs.

1. Standardize planning approach;
2. Programmatic (corridor) approach to planning, design, and construction;
3. Designate a single individual as Project Manager (PM) from early planning to construction; empower and equip PM with needed tools and data to select appropriate expediting methods;
4. Alternative funding methods;
5. Methods for expediting right-of-way (ROW) acquisition;
6. Methods for expediting utility relocation work;
7. Methods for improving environmental assessment during planning;
8. Pre-qualify bidders on basis of past schedule performance;
9. Create a lessons-learned database; and
10. Incentive-based pay for retaining key TxDOT personnel.

6.3 Recommendations

From the information gathered during the research process, the following recommendations may be made to TxDOT.

- Districts and divisions need to better communicate innovative construction expediting methods that have been used, as identified in the workshops. Several methods had already been applied with good results but not publicized and systematized within the organization.
- Implementing policy changes on many of the methods may result in faster project delivery. Creating a lessons-learned data base on ways to expedite schedule for example, would be useful, but it would need to be mantory mandatory for all departments to enter data on any innovative strategies used and the use of the database by all the departments would need to be encouraged.

- 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 activities. Also, getting environmental agencies involved to identify environmental issues early in the planning phase before the design work is completed can circumvent a lot of the delays associated with rework owing to environmental issues.
- 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 the process of expediting highway construction in a manner that is satisfactory to all stakeholders.

6.4 Recommendations to TxDOT Management

Fifty (50) expediting methods were identified, of which twenty six (26) were assessed as having a high potential impact for expediting highway projects by the participating TxDOT and construction industry personnel who attended the workshops. Many of these methods are already used in some form by TxDOT, but their use is not as extensive as it 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 following seven methods can and should be implemented throughout the state of Texas immediately, because of the potentially high impact and ease of implementation using currently available resources. These methods include the following:

- Formal partnering with design consultants, contractors, local authorities, and regulatory agencies;
- Precast/modular components of construction;
- A+B contracting;
- Use of contractor milestone incentives;
- Increasing the amount of liquidated damages;
- "No Excuse" incentives; and
- Calendar day project scheduling.

Immediate implementation of the following five expediting methods may not be possible because of long-term policy and/or legislative needs. Their tremendous potential should be addressed by TxDOT with actions to increase ease of implementation. These methods include the following:

- Methods for expediting right-of-way (ROW) acquisition;
- Methods for expediting utility relocation work;
- Methods for improving environmental assessment during planning;
- Pre-qualification of bidders on the basis of past schedule performance; and
- Using Design-Build approach as a contract delivery method.

6.5 Recommendations for Decision Tool

It is expected that the resulting tool will be simple enough that it can be represented in paper form. The tool will consist of a matrix of methods with their descriptions, applicability and/or limitations, and the pros and cons of each one with regard to expediting. Section 7.2 and Table 5.1 summarize the high positive impact methods likely to be included in the decision tool. Further detailed information or instruction of where to find such information on each method will also be a part of the tool. To make this possible, the tool may also be implemented in computer software.

Because of the requirement to easily add methods at a later time to the decision system, it is believed that spreadsheet software will be most flexible and easier to work with for this purpose. The draft tool consists of approximately 20 parameters that are associated with one or more methods. Based on the project under consideration, the user will enter an answer for each parameter [e.g. the project type may be (a) a bridge, (b) interchange, (c) new freeway, (d) etc.]. There will be a "not known" answer for each parameter as well, given that certain information may not be available at the time the decision tool is used.

Each parameter will be associated with one or more potential expediting method and will be weighted. Based on the weights of each parameter, a score is calculated and normalized. Recommended methods will be chosen on the basis of these scores. Next, because a method may or may not be applicable depending on which phase the project is in at the time the evaluation is done a phase qualifier will be used to accept or reject the

method. The remaining methods are then ranked and returned to the user. This tool is still in development and has evolved several times; thus the form presented here may not exactly resemble the final form of the tool.

6.6 Recommendations for Future Research

During the course of the research effort, a few construction-related ideas with a high potential impact stood out as areas where further research can be valuable in attaining the full potential of the method. The construction-related ideas that emerged include the following:

- Developing methods for expediting utility relocation work for construction projects,
- Developing methods for expediting right-of-way (ROW) acquisition,
- Developing a standardized pre-project planning approach and project definition index,
- Evaluating the value and optimal application of calendar day contracts,
- Evaluating automated road construction technologies,
- Developing pre-qualification standards and methods for TxDOT construction projects,
- Developing means to increase the level of design component standardization,
- Evaluating approaches to increase the use of modularization to expedite construction projects, and
- Developing and implementing a statewide, web-based, searchable lessons-learned database for construction project management.
- The development of these areas through further research would provide a good approach to improving the speed of project delivery, which is the goal of this research effort. The benefits of expeditious highway construction are numerous. The significant reduction in possible conflicts, along with the avoidance of unnecessary delay and inconvenience to the highway user, creates a win-win situation for all stakeholders and creates a better image for the department and the construction industry as a whole.

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Appendix A

Workshop Portfolio Document: "Cover Letter for Last Workshop Held in Austin"

Re. PROJECT NO. 0-4386

EXPEDITING HIGHWAY CONSTRUCTION WHILE RETAINING QUALITY

June 28th, 2002

Dear expediting workshop participant,

On behalf of the 4386 research team, I welcome your participation in the third expediting workshop. Our team includes Professors Edward Gibson, Carl Haas, Jim O'Connor and Zhanmin Zhang and our two graduate research assistants Berkay Somali and Eugene Simon. Our project director is William Goodell from the Dallas District and our project coordinator is James Travis from FHWA.

Highway construction imposes real costs on drivers who are delayed, on local businesses which may be disrupted, and on the environment. At the same time, the traveling public demands good roads. As a result, tremendous political and public pressure exists for TxDOT to build highway projects better and faster. This pressure will only increase as traffic volumes increase, especially for high profile, critical projects.

To make the most efficient use of the available funds for highway construction projects, and to minimize total road life cycle costs, TxDOT needs a system for selecting the most appropriate "state of the practice" methods to expedite planning, design and construction of capital projects. Concurrently, value and quality must be maintained. The objective of this research is to provide such a system. We are conducting a series of workshops to get the effort started. Materials for the first workshop series are included in this package.

The materials in this package are color-coded. You will find a summary table of proven methods for expediting schedule (colored green) and the descriptions of each method (colored white). The methods in these tables will be evaluated in three workshops. The purpose of these workshops is to rank the expediting approaches that have the most merit for TxDOT projects and gather feedback on applicability, relevancy to TxDOT projects and positive impact. The workshops will also be used to prioritize expediting methods and to determine subsequent research steps.

The agenda of the workshop, the tentative invitees list and previous participant list are enclosed (colored blue). The enclosed assessment sheets (colored yellow) will be collected after the workshop. We encourage you to read through the table of methods and fill out the assessment sheets (with pencil) beforehand as much as possible. Please fill out the personal information as well.

Breakout sessions will be held at the workshop to add methods that may have been missed, to "wordsmith" existing methods and to add comments. Also the participants' expectations of the decision tool (a system to help engineers choose appropriate expediting methods to allow the department to complete projects in a shorter time and more cost effectively) will be solicited. Multi-voting will take place at the end of breakout sessions to choose the best options for further study.

Your feedback is extremely important to determine subsequent research steps and for the success of this project. We would like to take this opportunity to welcome you to the workshop and thank you in advance for your participation.

Sincerely,

Carl T. Haas, P.E., PhD
Professor in Civil Engineering
University of Texas at Austin

Cc: G. E. Gibson, P.E., PhD, Professor in Civil Engineering at UT Austin
J. T. O'Connor, P.E., PhD, Professor in Civil Engineering at UT Austin
Z. Zhang, P.E., PhD, Asst. Professor in Civil Engineering at UT Austin

Appendix B

Workshop Portfolio Document: "Summary Table of Proven Methods for Expediting Schedule"

Summary of Expediting Methods

Pro-Active Methods for Expediting Project Schedules Arranged by Relevant Project Phase for Implementation

I. Project Planning	II. Project Design	III. Contracting & Procurement	IV. Construction	V. Other/Multiple
12. Standardize Planning Approach; use comprehensive standard tools ensuring all areas are covered; 13. Programmatic (Corridor) approach to Planning, Design, and Construction; 14. Alternative Funding Methods 15. Designate a single individual as Project Manager (PM) from early planning to construction; empower & equip PM with needed tools & data to select appropriate expediting methods; 16. Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.); 17. Formal partnering with design consultants, contractors, local authorities, and regulatory agencies 18. Methods for expediting Right of Way (ROW) acquisition; 19. Methods for expediting utility relocation work; 20. Methods for improving environmental assessment during planning 21. Intelligent Transportation Systems (ITS) & work-zone traffic control; 22. Public input on phasing of construction	10. Pavement type selection decisions; 11. Precast/Modular components; 12. Generate and evaluate multiple approaches to Traffic Control Plans (TCPs); 13. Develop a descriptive catalog of construction technologies that facilitate expedited schedules; 14. Phased-design to support phased-construction; 15. Develop Traffic Control Plans through partnering between TxDOT design & field organizations; 16. Increase levels of design component standardization; 17. Have Contactor prepare the Traffic Control Plan based on minimum requirements; 18. Using Linear Scheduling Method (LSM) & accurate productivity rate data to establish project target duration;	15. A+B contracting; 16. Use of contractor milestone incentives; 17. Packaged multiple-primes approach to contracting; 18. Pre-qualify bidders on basis of past schedule performance; 19. Incentivize Traffic Control Plan development with a contractor Value Engineering cost-savings sharing provision; 20. Incentivize contractor work progress with a lane-rental approach; 21. Exploit e-commerce systems for procurement, employment, etc.; 22. Tools and best practices for implementing multiple work shifts and/or night work; 23. Increase amount of liquidated damages and routinely enforce; 24. Warranty Performance Bidding; 25. "No Excuse" incentives; 26. Change management practices* 27. Project-level dispute review board* 28. Alternative dispute resolution methods*	9. Exploit web-based team collaboration system for project communications through all phases of the project; 10. Encourage use of automated construction technologies; 11. Employ methods for continuous work zones; 12. Use of windowed milestones; 13. Schedule Calendar Day projects; 14. Crash schedules with use of the Linear Scheduling Method;* 15. Shorten construction time by full closure instead of partial closure of roadway; 16. Maturity Testing;	9. Measure & track project schedule performance; use as basis for employee reward program as well as input to project duration database; 10. Track duration & productivity effects associated with different technologies; 11. Use pilot demonstration projects for introducing new methods for expediting schedules; 12. Create a "smart" database of activity productivity rates; 13. Study optimal approaches to crew shifts & scheduling; 14. Train all field personnel in scheduling methods and schedule claims; 15. Create a lessons-learned database on ways to expedite schedules; 16. Incentive-based pay for retaining key TxDOT personnel;

Note: * denotes Reactive Methods

Appendix C

Workshop Portfolio Document: "Expanded Table of Expediting Methods"

Methods for Expediting Project Schedule Arranged by Relevant Project Phase for Implementation

I. PROJECT PLANNING

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(1) Standardize planning approach; use comprehensive standard tools ensuring all areas are covered	Research has shown that organizations with a standardized front end planning approach have better capital effectiveness. The methodology focuses on "gateways" and required steps, which in turn ensure that the proper planning issues have been addressed.	▪ Large owner organization such as TxDOT benefit from a standard planning process ▪ Requires top management support	+ Better decision making process + More consistent approach + More predictable project outcomes + Cost and schedule savings - Less flexibility
(2) Programmatic (Corridor) approach to planning, design, and construction	A programmatic approach looks at an entire road "corridor", rather than breaking the "corridor" into segments that are tied to yearly funding limitations. Since the project can be pursued using larger, multi-year contracts, the procurement steps are minimized and the speed to delivery can be increased.	▪ Multi-year funding and common contractor usage is standard procedure in the private sector ▪ This would require long term planning ▪ Legislative limitations restrict this method	+ Faster delivery of project - Financing
(3) Alternative funding methods	*Alternative funding methods such as Texas Mobility Funds, revenue bonds from toll roads and Grant Anticipation Revenue Vehicle (GARVEE) bonds are some of the innovative funding mechanisms that are available to DOT's.*	▪ GARVEE bonds or other methods are applicable to major highway projects where financing is not immediately available ▪ Legislative limitations restrict this method	+ Faster project completion due to adequate financing + Advancing completion dates saves money + Allows for "Programmatic (corridor) Planning" - Can over commit a state resulting in future funding restrictions
(4) Designate a single individual as Project Manager (PM) from early planning to completion of construction; empower & equip PM with needed tools & data to select appropriate expediting methods	Selection of a project manager who possesses the leadership quality and the ability to effectively handle intricate interpersonal relationships within the organization, while maintaining continuity throughout the project from initiation to end of construction. Motivation of the PM can be granted with the use of incentives, e.g. salary bonus.	▪ This method is probably most applicable for large and complex projects ▪ Legislation controls may preclude payment for bonuses	+ Incentives encourage PM's to develop more economical means and methods + Less formal documentation and communication improvement would shorten the project execution + Reduction of executive personnel + More continuity during project - Selection of PM is highly critical - Independent engineers may be needed to check PM's work - Must overcome "specialist mindset" of organization.

Description: Description and/or explanation of the method **Applicability:** Circumstances where the method can be used
Limitations: Legal or other administrative limitations (if any) **Pros:** Positive effects of the method **Cons :** Negative effects of the method

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(5) Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc)	Design-Build (D-B) is an alternative to the traditional Design-Bid-Build system with the difference being that the design and construction duties are performed by the same company. <u>Variations to the Design-Build Concept:</u> ▪ Bridging: the owner develops preliminary project design to the 30-50% level. ▪ Turnkey: when the owner requires outside expertise and then allows the entity to turn over the keys at project completion. ▪ Design-Build-Warranty (D-B-W): combines a warranty provision with Design-Build. ▪ Design-Build-Maintain (D-B-M): combines maintenance provisions with Design-Build. ▪ Privatization: when a private entity designs, builds, and maintains a section of roadway in turn for a toll or fee.	▪ Although it is being used by almost half the states, D-B is not allowed legally in Texas ▪ Primarily, D-B is used when there are opportunities for the owner or agency to save time by having construction begin before the final design has been completed ▪ Not applicable to all projects; should be used on projects that have time constraints or have complex/ innovative project needs ▪ Legislative limitations restrict this method	+ Time Savings + Reduced cost due to accelerated schedules + Reduced administration and inspection costs + Eliminates conflicts between designer and contractor + Reduced number of in-house design personnel needed in TxDOT + Reduced change orders and claims + Increased final product quality by allowing innovations and new approaches - Singular responsibility - Reduces competitiveness of small companies
(6) Formal partnering with design consultants, contractors, local authorities, and regulatory agencies	Partnering is a formal management process in which all parties to a project voluntarily agree at the outset to adopt a cooperative, team-based approach to project development and problem resolution. Many mechanisms (meetings) can be used to promote partnering concepts including project concept conferences, design concept conferences, and post construction meetings.	▪ Already used extensively in TxDOT ▪ Has not been applied very much to designers or other agencies ▪ Little training has been done and much skepticism is in place	+ Faster and cheaper construction process due to reduction of conflicts, litigation and claims (Win-Win situation) + Continuous improvement in the quality of services and products + More effective utilization of resources + Can easily be implemented because already being used on an informal basis + Improves communication - Negative perception of partnering by some participants - Limits competitive market strategy - Creates strong dependency on the partners
(7) Methods for expediting Right of Way (ROW) acquisition	When private real estate is required for a Department of Transportation project, the Department must follow specific state and federal procedures in order to acquire the property. Initially, all affected owners will receive a written notice explaining the Department's need for the property. This notice will also explain the acquisition process as well as the owner's rights.	▪ Methods should be implemented to expedite acquisition where property is needed for highway construction. All the necessary resources should be available to the team responsible for coordinating and managing right of way acquisition services involving first stage reviews, negotiations, closings, settlement recommendations, relocation assistance, etc. ▪ Legislative limitations restrict this method	+ Improving the efficiency of ROW acquisition can greatly increase delivery time by avoiding potential delays - Reluctance of the owners to sell property

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(8) Methods for expediting utility relocation work	Relocation of utilities such as telephone, electric power, water and gas, etc. can greatly effect project delivery times. Methods should be implemented to expedite this process.	▪ In highway construction the need for the relocation of utilities often arises ▪ Relocation is handled primarily by utility companies ▪ Little current recourse against utilities for delays ▪ Utilities have to pay for relocations	+ Improving the efficiency of utility relocation can greatly increase delivery time by avoiding potential delays - Reluctance of the utility companies to proceed with relocation, including ordering the necessary materials, until project plans are final and a project has been advertised - Utilities run out of funds to relocate because of their budgeting cycle
(9) Methods for improving environmental assessment during planning	Adequate environmental assessment meeting NEPA requirements in a timely manner will help improve delivery speed. Standardizing the process and getting more local input will improve this process. Early identification of hazardous materials and archeological concerns is important.	▪ Environmental issues often cause delay ▪ An interface with many local and federal agencies can cause confusion over responsibility. ▪ Getting contractor input prior to award can be difficult	+ Fewer "surprises" + More consistent estimates for schedule delays + Better understanding of submission/accountability problems - Reluctance to move fast
(10) Intelligent Transportation Systems (ITS) & work-zone traffic control	A variety of evolving technologies that offer new solutions to improving transportation conditions. These systems -- based on electronic technologies, communications, information processing and navigation technologies -- are revolutionizing the interfaces between the driver, vehicle, and roadway.	▪ Applicable areas include but not limited to: Traffic Control, Route Guidance, Automated Highway Systems, Collision Avoidance, En-route Driver Information, Transportation Demand Management, etc.	+ Increases safety + Reduces congestion + Enhance mobility + Minimizes environmental impact + Increases energy efficiency + Promotes economic productivity for healthier economy - Additional training of employees - Cost to implement
(11) Public Input on phasing of construction	Having the community more involved in highway construction projects including choosing construction options that may close complete highways, but be faster in completion. Input should come from both local concerns and commuters.	▪ This method is applicable on construction projects where there is significant impact on the public ▪ Perhaps having the public vote on sequencing and methods of construction	+ More expeditious construction methods can be employed - Requires more public relations effort, earlier

II. PROJECT DESIGN

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(1) Pavement type selection decisions	The two types of pavement generally considered are rigid and flexible pavements as typified by Portland cement concrete pavement (PCCP) and asphalt concrete pavement (ACP), respectively. Quick curing concrete and flexible pavement, in-place recycling are additional options at this stage.	▪ Any pavement-related new construction or rehabilitation projects	+ Enhances optimal decision of pavement type for minimizing life cycle costs + May impact speed of construction - Extra data requirements
(2) Precast/Modular Components	Maximize concurrent work activity with the use of modular prefabricated components. Precast modular components are a common example.	▪ Common approach for girders, bridge decks, retaining walls, piping, culverts	+ Enables concurrent activity + Off-site prefabrication can start early - Limited dimensional flexibility
(3) Generate & evaluate multiple approaches to Traffic Control Plans (TCPs)	TCPs, in large part, both drive project schedule and the impact of construction in traffic operations, but too often the first workable TCP solution is pursued during construction. TCPs deserve very vigorous analysis.	▪ TCP solutions for small simple jobs are often apparent, but otherwise they should be thoroughly investigated earlier in the process	+ Optimal TCPs can lead to reductions in both construction cost and user costs - More thorough TCP analysis may require larger consultant fees for their development
(4) Develop a descriptive catalog of construction technologies that facilitate expedited schedules	New time-saving construction technologies are emerging everyday. These need to be identified and assessed for their potential impact and use on TxDOT projects.	▪ Applicability of new technologies could be widespread, but TxDOT specs may be affected	+ An on-line catalog could be easily accessed and supported by FHWA and other states. - Maintenance & upkeep of the catalog will entail effort
(5) Phased-design to support phased-construction	Phased design and construction denotes a method in which construction is begun when appropriate portions have been designed but before design of the entire structure has been completed. This method is also known as fast track construction.	▪ Can be used when the schedule is extremely tight ▪ Construction can only begin after the State's requirements are set, the overall (schematic) design is complete, and the complete drawings and specifications for the first construction phase are ready	+ In this approach construction can begin before design is complete for the entire project - This may require multiple prime contracts. - Sequence & management of design will be critical for success - Conservative designs may result (e.g., over-design) - Construction change orders often occur
(6) Develop Traffic Control Plans (TCPs) through partnering between TxDOT design & field organizations	Partnering between TxDOT & contractors for the purpose of developing Traffic Control Plans could lead to schedule-efficient approach.	▪ TCPs are often an integral part of a project design. Waiting until a construction firm is signed-on to develop a partnered-TCP may be too late	+ Win-win TCPs may result from this approach - Timing of construction involvement in this may be problematic

Description: Description and/or explanation of the method **Applicability:** Circumstances where the method can be used
Limitations: Legal or other administrative limitations (if any) **Pros:** Positive effects of the method **Cons :** Negative effects of the method

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(7) Increase levels of design component standardization	When properly applied, increased levels of standardization can eliminate much "reinvention of the wheel" by designers.	▪ A standard handbook may be needed in order to increase levels of design component standardization ▪ Design software would need to be developed	+ Design time & effort could be reduced + Materials management efforts could be made easier - Catalogs of standard components will have to be maintained - Competitive supplier agreements will be needed
(8) Have Contactor prepare the Traffic Control Plan (TCP) based on minimum requirements	Reduce constraints on the contractor by allowing/requiring them to develop an acceptable TCP prior to start of field construction.	▪ This approach will encourage contractor innovation, but may only be possible on smaller, simpler projects	+ Reduction in efforts + Will provide incentive for construction innovation - Possible increase in costs - Possible exclusion of impact on local businesses - Contractor compliance with safety standards may be challenging (for TxDOT)
(9) Using Linear Scheduling Method (LSM) & accurate productivity rate data to establish project target duration	Linear scheduling allows an activity to be modeled as a line with dimensions of time and location, unlike traditional scheduling methods which models linear activities as having constant production rates.	▪ Can be used for repetitive projects where there are no strict dependencies/constraints between project activities ▪ Resurfacing, shoulder improvement, and efforts to cold plane and hot plane are good types of projects for the LSM	+ Provides a better understanding of the project + Enables the planner to determine when and where a change in resources must take place to satisfy the goals set by the project + Helps identify existing relationships and encourages the project team to try different alternatives + Overlapping activities instead of in sequence can shorten overall schedule - Projects involving large cuts and fills might be more difficult to schedule with LSM

Note: It was decided to put maturity testing in the construction phase after the final workshop.

III. CONTRACTING & PROCUREMENT

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(1) A + B contracting	A+B contracting (also called cost plus time) is a procedure that incorporates the lowest initial cost, but also factors into the selection process the time to complete the project.	▪ A+B Bidding can be used to motivate the contractor to minimize the delivery time for high priority and highly trafficked roadways ▪ There must be a balance between the benefits of early completion and any increased cost of construction ▪ Approach requires incentives & disincentives to be effective	+ Consideration of the time component of a construction contract + Favorable treatment of contractors with the most available resources to complete the project + Incentives for contractors to compress the construction schedule + Greater potential for early project completion - Incentives & disincentives need to be carefully managed - Costs are concrete whereas benefits are distributed to the public
(2) Use of contractor milestone incentives	Contractors are financially rewarded for on-time delivery of specific work tasks	▪ Incentives must be relevant ▪ Goals must be reachable ▪ Incentives cannot be conflicting	+ Encourages contractors to finish on time - Impacts to contractors are highly scrutinized - Disagreements over compensable delays may be problematic
(3) Packaged multi-primes approach to contracting	The owner is party to several separate prime contracts, each for the performance of a particular portion of the total project work.	▪ Can be used when a specific highway project is composed of several major segments or is very large	+ Increased competition among construction bidders + Reduced pyramiding of costs, particularly overhead and profit + Reduced project time through overlap of design and construction or from multiple work-forces + More direct control by the project owner. - Interface management challenges for TxDOT - Physical interferences between contractors
(4) Pre-qualify bidders on basis of past schedule performance	Eliminate those bidders with a poor record of schedule performance	Key items for the selection are: ▪ Specific project type experience ▪ Individual experience ▪ Past performance ▪ Capacity of firm ▪ Primary firm location	+ Shorter and easier selection process + Possibly better contractors - Reduces the competition - Schedule performance data will need to be well kept - TxDOT & other non-contractual schedule impacts will have to be recognized and equitably settled
(5) Incentivize TCP development with a contractor Value Engineering (VE) cost-savings sharing provision	Utilize the VE change proposal contractual clause with special emphasis on time-saving or duration-reducing innovations on TCPs.	▪ Seek involvement of local municipalities in funding the incentive (for example, 5% of estimated user cost savings) ▪ Requires close scrutiny to determine actual time savings	+ Leads to innovative ideas for successful TCP's - Savings are difficult to estimate
(6) Incentivize contractor work progress with a lane-rental approach	Lane Rental Provisions assess the contractor daily or hourly rental fees for each lane, shoulder, or combination taken out-of-service during a project to minimize the time that roadway restrictions impact traffic flow.	▪ Must be explicitly described in the bid package ▪ Rental rates have to be significant and should address high impact lanes	+ Leads to innovative ideas for successful TCP's + Minimizes contractor impact on traffic - Not easy to administer

Description: Description and/or explanation of the method **Applicability:** Circumstances where the method can be used
Limitations: Legal or other administrative limitations (if any) **Pros:** Positive effects of the method **Cons :** Negative effects of the method

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(7) Exploit e-commerce systems for procurement, employment, etc.	E-commerce systems include new electronic technology, ranging from project-specific web sites and online equipment auctioning to bid analysis software and negotiation tools. These systems can significantly improve document management.	▪ Hidden behind the technology's promise of greater efficiency, accountability and speed are traditional issues of contract formation and enforcement, project relationships and assessment of liability	+ Faster processes + Improved document management and tracking - New technology raises new concerns about security, reliability and data integrity - Requires organizational changes and learning
(8) Tools and best practices for implementing multiple work shifts and/or night work	In developing the tools and best practices attention should be paid to safety and implementing night TCP's. The traffic control used for night work is usually the same as that used for typical daytime work zones, despite the potential adverse conditions that may be encountered. For these reasons, there is a need to examine methods to improve traffic control and safety for night work zones.	▪ New technologies (such as intrusion alarms), modified traffic control plans, and new methods to monitor traffic can potentially provide improvements in night work zone safety ▪ These improvements will lead to higher night time productivity	+ Increased safety for road users and workers + Reduced user costs + Faster completion time - Research and design costs
(9) Increase amount of liquidated damages and routinely enforce	Liquidated damages provisions allow a contracting agency to reduce payment to the contractor of a certain amount of money for each delayed time unit.	▪ Just as important as the damages happening in the contract are the claims made for damages. The time and effort involved in pursuing these claims is however a limitation. This should be weighed against potential benefits ▪ Possibly provide incentives to finish projects ahead of time	+ Motivate better contractor performance - Requires rigorous documentation and quick Request for Information (RFI) response to enforce
(10) Warranty Performance Bidding	The Constructor is responsible for the Quality and Performance of the work for a specific "warranty period". The constructor assumes more post-construction risk than in traditional methods.	▪ Performance specifications must be well-developed ▪ If contractor goes out of business, who pays?	+ Usually results in a better quality product and therefore longer time between renovations + Encourages innovation by the contractor + Reduces the needs for agency resources - Contractors bid higher to offset increased risk.
(11) "No Excuse" incentives	In this method the Constructor is given a "firm delivery date" with no excuses for missing this date. Incentives are provided for early completion, however there are no disincentives other than normal liquidated damages.	▪ Precludes delay claims by contractors ▪ Gives contractor incentives to finish early ▪ Requires a realistic schedule	+ This method can result in considerable improvements in schedule performance. - Transfers risk to contractor and therefore may increase costs on the average over time
(12) Change management practices	The strategies and techniques implemented to manage the scope of each project. It identifies how changes will be handled, who should be informed, alternatives to changes if any, and also records the effect of the change on the overall project, including the schedule.	▪ There are many tools available to help project teams to be adept at handling change management ▪ Planning and managing change is one of the most challenging elements of any project ▪ Understanding the key areas of change management, and the associated traps and pitfalls is critical to project success	+ More efficient handling of changes in the construction environment, and therefore faster delivery - Training and implementation costs

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(13) Project-level Dispute Review Board (DRB)	A DRB is a standing committee appointed at the start of a project to hear disputes. The DRB is formed of three members-one by each party and the other by mutual selection. The Board convenes at the request of either party, or at least every 3 months and keeps informed of progress. It issues non-binding decisions related to disputes that can help the parties resolve issues at the project levels.	▪ The most common causes of disputes experienced by transportation agencies are design deficiencies, utility conflicts, and unknown site conditions ▪ Should be used only on large projects; a "standing neutral (one person)" can be used on smaller projects	+ Issues are resolved before they escalate + Formal & well documented process + Speed and flexibility is emphasized + Written, non-binding recommendations + Cost shared by each party - Extra personnel costs
(14) Alternative dispute resolution methods	Alternative methods to Litigation for solving disputes such as Negotiation, Mediation and Arbitration have proven to be successful in many construction projects throughout the years. Some other alternative methods include Mini-trial, non-binding arbitration, summary jury, etc.	▪ These mechanisms facilitate dispute resolution at the project level, while allowing involvement of district and central office managers to resolve disputes, and then returning the matter to project staff for implementation ▪ May not be available legislatively (especially binding methods)	+ Disputes are resolved in a much shorter time and at up to 10 times less than the cost of litigation + Helps to keep good relationship between client and contractor + Win-Win results can be achieved - Sometimes tends to favor the contractor - Must be used in "good faith"

IV. CONSTRUCTION

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(1) Exploit web-based team collaboration system for project communications through all phases of the project	Web based project management systems eliminate any apparent boundary between a project participant's computer and the project's folders and files. They can be as simple as a common e-Room or as complex as web-based central project databases, business-to-business capabilities, and intelligent software agents.	▪ To be efficient, access to information is needed quickly and without hassle. Web-based system can be used to: o Track Project Deliverables – Track project tasks on-line; receive email alerts as items become due o Share Documents – Reduce administrative document production and delivery costs by uploading documents. This is handy for CAD Drawings or anything else that needs to be shared with the project team	+ Enhances project communication + Eases collaboration with project managers, designers, contractors, vendors, and the public. + Everyone is kept in the loop. + Track project on-line – this minimizes time and enhance performance. - High installation and learning costs - Unstable interfaces - Lack of standards
(2) Encourage use of automated construction technologies	GPS and laser based positioning systems combined with robotic equipment controls linked to 3D designs can result in faster, higher quality construction operations. Delays related to setting of grade stakes and quantity surveys can be eliminated. Slip form pavers and automated compaction are opportunities. Queue control for haul vehicles is another opportunity.	▪ Numerous research and implementation efforts are currently underway to automate conventional infrastructure construction, condition assessment, and maintenance activities such as earth moving, compaction, road construction and maintenance, etc ▪ Commercial systems are available form companies such as Trimble/Spectra-Physics	+ Can result in savings + Opportunity for significant schedule compression - Some training required - Contractor required to implement
(3) Employ methods for continuous work zones	Larger work zones can be developed in the TCP and generally results in lower unit costs as well as schedule compression because relative impacts of mobilization and demobilization are reduced.	▪ Can be used where road geometry and weekend or night scheduling permit	+ Decrease duration and unit costs + Safer - May result in higher user costs and traffic congestion
(4) Use of windowed milestones	Windowed milestones are milestones with float within a window. Traditional milestones can artificially constrain a schedule.	▪ Can be used where milestone dates are not based on hard constraints. Milestones should be related to allow contractor maximum flexibility in efficiently allocating project resources ▪	+ Lowers project costs + Possibly lower user costs - Reduces ability to hold "contractor's feet to the fire"
(5) Schedule Calendar Day projects	Scheduling the projects according to calendar days instead of working days enables better weather management.	▪ Applicable to projects where the completion is critical and a large volume of traffic is affected	+ Better weather management + Direct method of expediting

Description: Description and/or explanation of the method **Applicability:** Circumstances where the method can be used
Limitations: Legal or other administrative limitations (if any) **Pros:** Positive effects of the method **Cons :** Negative effects of the method

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(6) Crash schedule with use of the Linear Schedule Method	Linear scheduling allows an activity to be modeled as a line with dimensions of time and location, unlike traditional scheduling methods which models linear activity as having constant production rates.	▪ Can be used for repetitive projects where there are no strict dependencies/constraints between project activities. ▪ Resurfacing, shoulder improvement, and efforts to cold plane and hot plane are good types of projects for the LSM	+ Provides a better understanding of the project + Enables the planner to determine when and where a change in resources must take place to satisfy the goals set by the project. + Helps identify existing relationships and encourages the project team to try different alternatives. + Overlapping activities instead of in sequence can shorten overall schedule. - Projects involving large cuts and fills might be more difficult to schedule with LSM - Requires training
(7) Shorten construction time by full closure instead of partial closure of roadway	Closing the roadway completely instead of partial closure can increase efficiency and decrease project duration significantly by freeing up space and reducing interferences.	▪ Full closure could be used in areas where there is at least one alternative route for drivers, and where volume is limited.	+ Shortens construction time - Possible traffic congestion on alternative routes
(10) Maturity Testing	Maturity testing can be used in the construction phase to monitor strength development of placed concrete in real time, so that it can be loaded at the earliest possible date and time. It can replace concrete cylinder testing, for acceptance of work. Maturity testing can also be used in the design phase simulation models for a systematic search for optimal concrete placement methods. It can indicate whether a particular concrete placement option is feasible or not. Maturity testing allows an engineer or manager to make appropriate decisions about the concrete placement options by considering the speed at which each option can achieve a certain strength and about the concrete placement cost by considering aspects such as the penalty or lost opportunity costs for slow concrete development for example by stripping forms more rapidly; the forms can be reused more frequently and savings ensue. By attaining the specified strength more rapidly, the project can proceed more quickly.	▪ Any new concrete pavement construction or rehabilitation projects ▪ Special software requirements for the contractors	+ Cost and schedule savings + Improves reliability of mixes chosen - Reluctance of contractors to implement

Note: It was decided to put maturity testing in the construction phase after the final workshop.

V. OTHER/MULTIPLE

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(1) Measure and track project schedule performance; use as basis for employee reward program as well as input to project duration database	Owner and contractor employee incentives and compensation can be related to project schedule performance either via annual evaluations or direct incentive programs.	▪ Changes would have to be made via TxDOT's HR department and balanced with other aspects of project performance ▪ Consideration would have to be given to conditions beyond employee's control	+ Works in simple lump sum contracting situations in the private sector and is a motivator - Difficult to implement fairly - May encourage negligent or counterproductive behavior
(2) Track duration & productivity effects associated with different technologies	Having a database of duration and productivity associated with different technologies can be very useful in deciding on best technologies to be used on future projects. This can be used in qualification based bidding and in Design-Build bid awarding. Technology has improved productivity in construction industry in the 21st century.	▪ Data collected can be very useful in cost and time estimation, for optimal plans ▪ Technology choices may be limited however by project conditions and logical equipment spreads	+ Quicker and more dependable exploitation of new technologies.
(3) Use pilot demonstration projects for introducing new methods for expediting schedules	Conducting a pilot study to test new expediting methods should be used to aid the transition process. Application to smaller projects and concentrated attention should minimize risk associated with this approach.	▪ The benefits/limitations of the new methods can be analyzed and a lessons learned data base developed for future improvements ▪ A demonstration project may improve confidence and be a good learning experience, but it seldom proves that a new method is advantageous. ▪ A well known phenomenon in business experiments is that an observed change leads the participants to feel special and perform accordingly. The improvement may not persist.	+ Eases the transition process. + Leaves open the option to not fully implement - Costly experiment - Not proof of effectiveness - A poor demonstration may preclude a second chance
(4) Create a "smart" database of activity productivity rates	Having a database of productivity rates of different technologies can be very useful in providing scheduling on the projects.	▪ Data collected can be very useful in cost and time estimation	+ More accurate estimation of duration and cost of future projects. - Complexity and cost to maintain
(5) Study optimal approaches to crew shifts & scheduling	Optimization of crew shifts & scheduling must be conducted carefully so that overly long workweeks and/or night work doesn't reduce productivity and therefore rate of progress.	▪ The schedule can be shortened through use of additional crews on regular shift, multiple shifting, or selective overtime ▪ Scheduled overtime can be used where appropriate but effects should be evaluated carefully	+ Possible cost savings + Increase in productivity + Reduction in cycle time of tasks improves schedule - Careless planning may create negative results - Contractor must implement

Description: Description and/or explanation of the method **Applicability:** Circumstances where the method can be used
Limitations: Legal or other administrative limitations (if any) **Pros:** Positive effects of the method **Cons :** Negative effects of the method

Method	Description	Applicability / Limitations	Pros (+) / Cons (-)
(6) Train selected field personnel in scheduling methods and schedule claims	Expeditious schedule adjustments and good short interval planning can minimize schedule delays due to missing materials or information, and due to assured equipment availability.	▪ Schedule flexibility may be minimal in practice, but for complex jobs a broad understanding of scheduling issues should help expedite progress	+ Flexible and quick to adapt project team + Faster project completion - Possibly too many people trying to manage
(7) Create a lessons-learned database on ways to expedite schedules	Having a database of lessons-learned on ways to expedite schedules can be a key tool in deciding the methods to be used on future projects. This database should capture lessons-learned for all phases of the project.	▪ This would be broadly applicable but limited by legal and policy constraints	+ Quick reference for implementation of expediting measures - Must be maintained
(8) Incentive-based pay for retaining key TxDOT personnel	Retention of Personnel is the key to overall project time performance. Performance of the Project Teams is enhanced tremendously the longer the team is intact. In such teams, roles and responsibilities are well defined.	▪ Measures to retain key personnel should be implemented. Experience and institutional knowledge of these people is valuable, however some with great experience may be resistant to constructive change	+ Enhances project performances due to a more cohesive team. - Requires additional funding and institutional commitment

Appendix D

Workshop Portfolio Document: "Workshop Agenda"

PROJECT NO. 0-4386
EXPEDITING HIGHWAY CONSTRUCTION WHILE RETAINING QUALITY

AUSTIN II WORKSHOP

Date: July 26th, 2002

Location: Thompson Conference Center, Room # 2.110

THE AGENDA

9:00 – 9:30	Welcome & Introductions
9:30 – 10:45	Review of Expediting Methods & Individual Evaluations I
10:45 – 11:00	Break
11:00 – 11:45	Review of Expediting Methods & Individual Evaluations II
11:45 – 12:30	Lunch Break
12:30 – 1:15	Breakout Sessions
1:15 – 1:30	Results from Breakouts & Individual Evaluations
1:30 – 1:50	Multi-voting on Expediting Methods
1:50 – 2:00	Wrap-up

Appendix E

Workshop Portfolio Document: "Workshop Assessment Sheet"

WORHSHOP ASSESSMENT SHEET

NAME : .....

TITLE : .....

DISTRICT OR ORGANIZATION : .....

PHONE NUMBER : .....

E-MAIL ADDRESS : .....

NUMBER OF YEARS WORKING FOR TXDOT : .....

NUMBER OF YEARS WORKING IN INDUSTRY : .....

GLOSSARY OF TERMS

Relevancy to TxDOT	:	Degree of relevancy of the method to TxDOT Projects
Doability	:	Ease of implementation of the method with the available resources and under existing constraints
Positive Impact	:	Usefulness of the method in terms of Schedule Acceleration

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

I. PROJECT PLANNING

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. Standardize Planning Approach										
2. Corridor Planning										
3. Alternative Funding Methods										
4. Designate a PM for Entire Life-Cycle										
5. Design-Build Approach										
6. Formal Partnering										
7. Expediting ROW Acquisition										
8. Expediting Utility Relocation										
9. Improving Environmental Assessment										
10. ITS & Work-zone Traffic Control										
11. Public Input on Construction Methods										

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

II. PROJECT DESIGN

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. Pavement type selection decisions										
2. Precast/Modular Components										
3. Multiple approaches to Traffic Control Plans (TCPs)										
4. Descriptive Catalog of Construction Technologies										
5. Phased-design to support phased construction										
6. TCP Through Partnering btw. TxDOT Design & Field Organizations										
7. Increase Levels of Design Component Standardization										
8. Have Contactor Prepare the TCP										
9. Linear Scheduling Method & Accurate Productivity Rate										
10. Maturity Testing										

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

III. CONTRACTING & PROCUREMENT

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. A+B Contracting										
2. Use of Contractor Milestone Incentives										
3. Packaged Multiple-primes Approach to Contracting										
4. Pre-qualify Bidders on Basis of Past Schedule Performance										
5. Incentivize TCP Dev. with a Contractor VE Cost-saving Provision										
6. Incentivize TCP Development with a Contractor Lane-rental Approach										
7. E-commerce Systems for Procurement, Employment, etc.										
8. Implementing Multiple Work Shifts and/or Night Work										
9. Increase Amount of Liquidated Damages										

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

III. CONTRACTING & PROCUREMENT (con't)

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
10. Warranty Performance Bidding										
11. "No Excuse" Incentives										
12. Change Management Practices										
13. Project-Level Dispute Review Board										
14. Alternative Dispute Resolution Methods										

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

IV. CONSTRUCTION

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. Web-based Team Collaboration System										
2. Automated Construction Technologies										
3. Continuous Work-zones										
4. Windowed Milestones										
5. Schedule Calendar Day Projects										
6. Linear Scheduling Method										
7. Full Closure Instead of Partial Closure Roadway										

WORKSHOP ASSESSMENT SHEET

NAME: .....

DISTRICT / ORG: .....

V. OTHER / MULTIPLE

Methods	Relevancy to TxDOT			Doability			Positive Impact			Comments
	Low	Medium	High	Low	Medium	High	Low	Medium	High	
1. Measure & Track Project Schedule Performance										
2. Track Dur. & Productivity Effects Associated with Different										
3. Pilot Demonstration Projects										
4. "Smart" Database of Activity Productivity Rates										
5. Study Optimal Approaches to Crew Shifts & Scheduling										
6. Training Personnel in Scheduling Methods										
7. Create a Lessons-learned Database										
8. Incentive-based Pay for Retaining Key TxDOT Personnel										

Appendix F

Interim Workshop Participants

Dallas Workshop Participants List, February 8, 2002

NAME	DISTRICT/ORG.
Scott E. Darrow	Abilene
Paul Hoelscher	Abilene
Daniel Richardson	Abilene
Thomas E. Nagel	Amarillo
Darwin Lankford	Childress
Nabeel Khwaja	CTR
Tracey Friggle	Dallas
James Hunt	Dallas
Ann Marie Mihm	Dallas
Joseph S. Jancuska	Dallas
Enrique Guillen	Dallas
Suja G. Mathew	Dallas
David Gan	Dallas
Robert E. Boykin	Dallas Const. Office
Antoinette Bacchus	Dallas County Pub. Works
Craig J. Goodroad	Dallas County Pub. Works
Irvin Griffin	Dallas County Pub. Works
Bob Julian	Fort Worth
Raymond T. Buzalsky	Fort Worth
John A. Terry	Fort Worth
Dennis Satre	Halff Asso./N Texas Toll. A.
Curtis Oppermann	Halliburton KBR
Chris Campbell	Halliburton KBR
Patric Ellis	HNTB (TxDOT Retired)
Noelle Ibrahim	N. Texas Tollway Authority
Walter H. Smith	Tyler
Randy Hopmann	Tyler
John Barton	Wichita Falls
Joe Anderson	Wichita Falls

Austin I Workshop Participants List, March 8, 2002

NAME	DISTRICT/ORG.
Gary Humes	Brownwood
Pat Williams	Bryan
Maria Garza	Corpus Christi
Charles E. Gaskin	Houston
James Koch	Houston
Gus Lopez	Pharr
Rosendo Garcia	Pharr
Elizabeth S. Boswell	TxDOT – Construction Div.
Robert B. Stone	TxDOT – Design Div.
Fred D. Kloodall	TxDOT – Design Div.
Joh Zimmerman	TxDOT – ROW Div.
Terri Evans	TxDOT – ROW div.
Duane A. Schwarz	Waco
Kirk Krause	Waco
John Obr	Waco
Wayne Ramert	Yoakum

Austin II Workshop Participants List, July 26, 2002

vhNAME	DISTRICT/ORG.
Lowell Choate	Austin
Donal Nyland	Austin
James Klotz	Austin
Jeff Tolson	Austin
David W. Hearnsberger	Beaumont
Brian Merrill	Bridge Division
Diane Venable	Design Division
Aurora (Rory) Meza	Design Division
David Head	El Paso
Jaun D. Villarreal	KBR
John A. Roberts	KBR
Tom Hunter	Lufkin
Stephen G. Smith	Odessa
Karl J Bednarz	San Angelo
David C. Kopp	San Antonio
Mike Lehman	San Antonio
Timothy J. Weight	TTA Division

Appendix G

Interim Workshop Results: "Tally of Votes"

I. PROJECT PLANNING

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. Standardize Planning Approach	1	17	44	1	30	31	5	18	39
2. Programmatic Approach	4	20	38	21	34	7	5	27	30
3. Alternative Funding Methods	5	22	34	18	34	9	10	27	24
4. Designate a PM for Entire Life-Cycle	15	25	22	35	19	8	14	19	28
5. Design-Build Approach	12	22	27	22	29	11	14	22	26
6. Formal Partnering	5	16	41	7	15	40	10	17	35
7. Expediting ROW Acquisition	1	0	61	31	25	6	1	10	51
8. Expediting Utility Relocation	1	1	60	29	24	9	0	9	53
9. Improving Environmental Assessment	1	4	28	17	10	6	0	4	29
10. ITS & Work-zone Traffic Control	2	25	35	8	37	17	14	26	22
11. Public Input on Construction Methods	10	21	31	23	25	14	13	28	21

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II. PROJECT DESIGN

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. Pavement Type Selection Decisions	3	8	50	4	11	46	11	19	32
2. Precast/Modular Components	1	10	49	0	18	41	1	16	43
3. Multiple Approaches to Traffic Control Plans (TCPs)	1	12	49	6	28	28	5	18	39
4. Descriptive Catalog of Construction Technologies	11	29	22	19	31	12	20	28	14
5. Phased Design to Support Phased Construction	16	35	11	31	25	6	25	26	11
6. TCP Through Partnering btw. TxDOT Design & Field Organizations	4	18	40	21	24	17	7	19	36
7. Increasing Levels of Design Component Standardization	8	17	37	9	29	24	11	27	23
8. Have Contractor Prepare the TCP	19	23	19	36	17	9	26	20	16
9. Linear Scheduling Method & Accurate Productivity Rate	6	28	25	11	30	18	11	34	14
10. Maturity Testing	1	5	11	0	8	9	1	8	8

III. CONTRACTING & PROCUREMENT

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. A+B Contracting	2	20	37	7	22	30	3	23	33
2. Use of Contractor Milestone Incentives	0	8	54	3	21	38	1	21	40
3. Packaged Multiple-Primes Approach to Contracting	18	27	13	18	33	7	17	33	8
4. Pre-Qualify Bidders on Basis of Past Schedule Performance	6	14	42	40	13	9	7	14	41
5. Incentivize TCP Dev. with a Contractor VE Cost-Saving Provision	5	37	18	18	33	9	7	41	12
6. Incentivize Contractor Work with a Lane-Rental Approach	2	19	39	8	26	26	4	24	32
7. E-commerce Systems for Procurement, Employment, etc.	26	27	7	28	27	5	32	22	5
8. Implementing Multiple Work Shifts and/or Night Work	2	14	46	12	26	24	3	21	38
9. Increase Amount of Liquidated Damages	3	16	43	9	21	32	6	28	28

III. CONTRACTING & PROCUREMENT (con't)

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
10. Warranty Performance Bidding	8	27	26	36	14	11	19	22	20
11. "No Excuse" Incentives	2	20	40	12	25	25	3	30	29
12. Change Management Practices	4	35	20	12	33	14	10	39	10
13. Project-Level Dispute Review Board	12	28	22	20	29	13	16	25	21
14. Alternative Dispute Resolution Methods	15	25	22	24	28	10	20	27	15

IV. CONSTRUCTION

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. Web-Based Team Collaboration System	7	36	19	24	31	6	14	33	14
2. Automated Construction Technologies	7	32	23	10	41	11	12	28	22
3. Maximizing Size of Work-Zones	2	21	38	6	36	19	7	33	21
4. Windowed Milestones	6	27	28	3	31	27	10	30	21
5. Schedule Calendar Day Projects	0	4	57	1	4	56	1	15	44
6. Linear Scheduling Method	5	33	21	9	35	15	10	36	13
7. Full Closure Instead of Partial of Closure Roadway	3	14	44	20	21	20	3	15	43

V. OTHER / MULTIPLE

Methods	Relevancy to TxDOT			Doability			Positive Impact		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
1. Measure & Track Project Schedule Performance	26	23	12	52	7	2	29	21	11
2. Track Dur. & Productivity Effects Associated with Different Technologies	11	26	24	16	33	12	18	25	18
3. Pilot Demonstration Projects	4	30	27	4	36	21	12	29	20
4. "Smart" Database of Activity Productivity Rates	7	25	30	12	34	16	12	26	24
5. Study Optimal Approaches to Crew Shifts & Scheduling	20	30	10	27	24	9	15	35	10
6. Training Personnel in Scheduling Methods	8	18	34	17	23	20	13	20	27
7. Create a Lessons-Learned Database	5	27	29	10	37	14	8	32	21
8. Incentive-Based Pay for Retaining Key TxDOT Personnel	10	11	39	34	18	8	10	8	42

Appendix H

Interim Workshop Results: “Calculated Raw Scores”

I. PROJECT PLANNING

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. Standardize Planning Approach (n = 62)	2.69	2.48	2.55
2. Programmatic Approach (n = 62)	2.55	1.77	2.40
3. Alternative Funding Methods (n = 61)	2.48	1.85	2.23
4. Designate a PM for Entire Life Cycle (n = 62)	2.11	1.56	2.23
5. Design-Build Approach (n = 62)	2.25	1.82	2.19
6. Formal Partnering (n = 62)	2.58	2.53	2.40
7. Expediting ROW Acquisition (n = 62)	2.97	1.60	2.81
8. Expediting Utility Relocation (n = 62)	2.95	1.68	2.85
9. Improving Environmental Assessment (n = 33)	2.82	1.67	2.88
10. ITS & Work-Zone Traffic Control (n = 62)	2.53	2.15	2.13
11. Public Input on Construction Methods (n = 62)	2.34	1.85	2.13

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II. PROJECT DESIGN

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. Pavement Type Selection Decisions (n = 62)	2.77	2.69	2.34
2. Precast/Modular Components (n = 60)	2.80	2.69	2.70
3. Multiple Approaches to Traffic Control Plans (TCPs) (n = 62)	2.77	2.35	2.55
4. Descriptive Catalog of Construction Technologies (n = 62)	2.18	1.89	1.90
5. Phased Design to Support Phased Construction (n = 62)	1.92	1.60	1.77
6. TCP Through Partnering btw. TxDOT Design & Field Organizations (n = 62)	2.58	1.94	2.47
7. Increasing Levels of Design Component Standardization (n = 62)	2.47	2.24	2.20
8. Have Contractor Prepare the TCP (n = 62)	2.00	1.56	1.84
9. Linear Scheduling Method & Accurate Productivity Rate (n = 59)	2.32	2.12	2.05
10. Maturity Testing (n = 17)	2.59	2.53	2.41

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. A+B Contracting (n = 59)	2.59	2.39	2.51
2. Use of Contractor Milestone Incentives (n = 62)	2.87	2.56	2.63
3. Packaged Multiple-Primes Approach to Contracting (n = 58)	1.91	1.81	1.84
4. Pre-Qualify Bidders on Basis of Past Schedule Performance (n = 62)	2.58	1.50	2.55
5. Incentivize TCP Dev. with a Contractor VE Cost-Saving Provision (n = 60)	2.22	1.85	2.08
6. Incentivize Contractor Work with a Lane-Rental Approach (n = 60)	2.62	2.30	2.47
7. E-Commerce Systems for Procurement, Employment, etc. (n = 60)	1.68	1.62	1.54
8. Implementing Multiple Work Shifts and/or Night Work (n = 62)	2.71	2.19	2.56
9. Increase Amount of Liquidated Damages (n = 62)	2.65	2.37	2.35

III. CONTRACTING & PROCUREMENT (con't)

Methods	Relevancy to TxDOT	Doability	Positive Impact
10. Warranty Performance Bidding (n = 61)	2.30	1.59	2.02
11. "No Excuse" Incentives (n = 62)	2.61	2.21	2.42
12. Change Management Practices (n = 59)	2.27	2.03	2.00
13. Project-Level Dispute Review Board (n = 62)	2.16	1.89	2.08
14. Alternative Dispute Resolution Methods (n = 62)	2.11	1.77	1.92

IV. CONSTRUCTION

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. Web-Based Team Collaboration System (n = 62)	2.19	1.70	2.00
2. Automated Construction Technologies (n = 62)	2.26	2.02	2.16
3. Maximizing Size of Work-Zones (n = 61)	2.59	2.21	2.23
4. Windowed Milestones (n = 61)	2.36	2.39	2.18
5. Schedule Calendar Day Projects (n = 61)	2.93	2.90	2.72
6. Linear Scheduling Method (n = 59)	2.27	2.10	2.05
7. Full Closure Instead of Partial Closure of Roadway (n = 61)	2.67	2.00	2.66

V. OTHER / MULTIPLE

Methods	Relevancy to TxDOT	Doability	Positive Impact
1. Measure & Track Project Schedule Performance (n = 61)	1.77	1.18	1.70
2. Track Dur. & Productivity Effects Associated with Different Technologies (n = 61)	2.21	1.93	2.00
3. Pilot Demonstration Projects (n = 61)	2.38	2.28	2.13
4. "Smart" Database of Activity Productivity Rates (n = 62)	2.37	2.06	2.19
5. Study Optimal Approaches to Crew Shifts & Scheduling (n = 60)	1.83	1.70	1.92
6. Training Personnel in Scheduling Methods (n = 60)	2.43	2.05	2.23
7. Create a Lessons-Learned Database (n = 61)	2.39	2.07	2.21
8. Incentive-Based Pay for Retaining Key TxDOT Personnel (n = 60)	2.48	1.57	2.53

Appendix I

Interim Workshop Results: "Classification of Methods and Overall Score"

I. PROJECT PLANNING

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. Standardize Planning Approach	Very High	High	High	7.9
2. Corridor Planning	High	Low	High	6.2
3. Alternative Funding Methods	High	Medium	High	5.9
4. Designate a PM for Entire Life Cycle	Medium	Low	High	4.8
5. Design-Build Approach	High	Medium	Medium	5.4
6. Formal Partnering	High	High	High	7.5
7. Expediting ROW Acquisition	Very High	Low	Very High	7.3
8. Expediting Utility Relocation	Very High	Low	Very High	7.5
9. Improving Environmental Assessment	Very High	Low	Very High	7.3
10. ITS & Work-Zone Traffic Control	High	Medium	Medium	6.3
11. Public Input on Construction Methods	High	Medium	Medium	5.5

II. PROJECT DESIGN

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. Pavement Type Selection Decisions	Very High	Very High	High	8.0
2. Precast/Modular Components	Very High	Very High	Very High	8.7
3. Multiple Approaches to Traffic Control Plans (TCPs)	Very High	High	High	7.8
4. Descriptive Catalog of Construction Technologies	Medium	Medium	Medium	4.9
5. Phased Design to Support Phased Construction	Medium	Low	Low	3.8
6. TCP Through Partnering btw. TxDOT Design & Field Organizations	High	Medium	High	6.6
7. Increasing Levels of Design Component Standardization	High	High	Medium	6.5
8. Have Contractor Prepare the TCP	Medium	Low	Medium	4.0
9. Linear Scheduling Method & Accurate Productivity Rate	High	Medium	Medium	5.8
10. Maturity Testing	High	High	High	7.5

III. CONTRACTING & PROCUREMENT

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. A+B Contracting	High	High	High	7.5
2. Use of Contractor Milestone Incentives	Very High	High	Very High	8.4
3. Packaged Multiple-Primes Approach to Contracting	Medium	Medium	Medium	4.3
4. Pre-Qualify Bidders on Basis of Past Schedule Performance	High	Low	High	6.0
5. Incentivize TCP Dev. with a Contractor VE Cost-Saving Provision	High	Medium	Medium	5.3
6. Incentivize Contractor Work with a Lane-Rental Approach	Very High	High	High	7.3
7. E-Commerce Systems for Procurement, Employment, etc.	Low	Low	Low	3.1
8. Implementing Multiple Work Shifts and/or Night Work	Very High	Medium	High	7.4
9. Increase Amount of Liquidated Damages	Very High	High	High	7.3

III. CONTRACTING & PROCUREMENT (cont'd)

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
10. Warranty Performance Bidding	High	Low	Medium	4.8
11. “No Excuse” Incentives	Very High	High	High	7.1
12. Change Management Practices	High	Medium	Medium	5.5
13. Project-Level Dispute Review Board	Medium	Medium	Medium	5.2
14. Alternative Dispute Resolution Methods	Medium	Low	Medium	4.7

IV. CONSTRUCTION

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. Web-Based Team Collaboration System	Medium	Low	Medium	4.8
2. Automated Construction Technologies	High	Medium	Medium	5.7
3. Maximizing Size of Work-Zones	High	High	High	6.7
4. Windowed Milestones	High	High	Medium	6.6
5. Schedule Calendar Day Projects	Very High	Very High	Very High	9.3
6. Linear Scheduling Method	High	Medium	Medium	5.7
7. Full Closure Instead of Partial Closure of Roadway	Very High	Medium	Very High	7.2

V. OTHER / MULTIPLE

Methods	Relevancy to TxDOT	Doability	Positive Impact	Overall Score
1. Measure & Track Project Schedule Performance	Low	Very Low	Low	2.8
2. Track Dur. & Productivity Effects Associated with Different Technologies	High	Medium	Medium	5.2
3. Pilot Demonstration Projects	High	High	Medium	6.3
4. "Smart" Database of Activity Productivity Rates	High	Medium	Medium	6.0
5. Study Optimal Approaches to Crew Shifts & Scheduling	Medium	Low	Medium	4.1
6. Training Personnel in Scheduling Methods	High	Medium	High	6.2
7. Create a Lessons-Learned Database	High	Medium	High	6.1
8. Incentive-Based Pay for Retaining Key TxDOT Personnel	High	Low	High	6.0

Appendix J

Interim Workshop Results: "Ranking of Expediting Methods Based on Overall Score for Each of the Workshops"

Phase rank *represents ranking of the method within the phase based on score*
Overall rank *represents ranking of the method among all 50 methods based on score*
Shaded area *represents top 25 methods*

I. PROJECT PLANNING	Scores				DALLAS		AUSTIN I		AUSTIN II		ALL	
					Phase	*Overall*	*Phase*	*Overall*	*Phase*	*Overall*	*Phase*	*Overall*
Methods	**Dallas**	**Austin**	**Austin II**	**All**	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*
Standardize Planning Approach	7.6	8.6	7.5	7.9	*1*	*8*	*1*	*3*	*1*	*8*	***1***	*5*
Formal Partnering	7.5	8.3	6.8	7.5	*2*	*9*	*2*	*6*	*5*	*16*	***2***	*8*
Expediting Utility Relocation	7.1	8.0	7.5	7.5	*3*	*12*	*3*	*10*	*1*	*8*	***3***	*10*
Expediting ROW Acquisition	7.1	7.3	7.5	7.3	*3*	*12*	*5*	*15*	*1*	*8*	***4***	*13*
Improving Environmental Assessment		7.7	6.9	7.3			*4*	*12*	*4*	*15*	***5***	*15*
ITS & Work-Zone Traffic Control	7.1	5.6	5.8	6.3	*5*	*14*	*7*	*31*	*9*	*27*	***6***	*22*
Programmatic Approach	5.8	6.7	6.5	6.2	*7*	*27*	*6*	*20*	*7*	*21*	***7***	*24*
Alternative Funding Methods	5.8	5.5	6.5	5.9	*6*	*25*	*8*	*33*	*6*	*20*	***8***	*30*
Public Input on Construction Methods	5.7	5.4	5.3	5.5	*8*	*29*	*9*	*35*	*10*	*32*	***9***	*34*
Design-Build Approach	5.4	4.8	6.1	5.4	*9*	*34*	*11*	*40*	*8*	*25*	***10***	*36*
Designate a PM for Entire Life Cycle	4.8	5.3	4.5	4.8	*10*	*42*	*10*	*36*	*11*	*44*	***11***	*41*

II. PROJECT DESIGN	Scores				DALLAS		AUSTIN I		AUSTIN II		ALL	
					Phase	*Overall*	*Phase*	*Overall*	*Phase*	*Overall*	*Phase*	*Overall*
Methods	**Dallas**	**Austin**	**Austin II**	**All**	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*	*Rank*
Precast/Modular Components	9.2	8.6	7.8	8.7	*1*	*2*	*1*	*4*	*1*	*6*	***1***	*2*
Pavement Type Selection Decisions	8.3	8.3	7.1	8.0	*2*	*3*	*3*	*6*	*3*	*14*	***2***	*4*
Multiple Approaches to Traffic Control Plans (TCPs)	7.8	8.4	7.3	7.8	*3*	*6*	*2*	*5*	*2*	*12*	***3***	*6*
TCP Through Partnering btw. TxDOT Design & Field Org.	6.6	6.7	6.7	6.6	*5*	*20*	*5*	*20*	*4*	*19*	***4***	*19*
Increasing Levels of Design Component Standardization	7.0	6.5	5.8	6.5	*4*	*15*	*6*	*23*	*5*	*27*	***5***	*21*
Linear Scheduling Method & Accurate Productivity Rate	5.2	8.1	5.1	5.8	*7*	*36*	*4*	*9*	*6*	*35*	***6***	*31*
Descriptive Catalog of Construction Technologies	5.0	5.6	4.2	4.9	*8*	*37*	*7*	*31*	*7*	*45*	***7***	*40*
Have Contractor Prepare the TCP	5.4	3.2	2.4	4.0	*6*	*33*	*9*	*47*	*9*	*50*	***8***	*47*
Phased Design to Support Phased Construction	3.4	4.3	4.1	3.8	*9*	*46*	*8*	*44*	*8*	*46*	***9***	*48*

III. CONTRACTING & PROCUREMENT	Scores				DALLAS		AUSTIN I		AUSTIN II		ALL	
Methods	Dallas	Austin	Austin II	All	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*
Use of Contractor Milestone Incentives	7.9	8.9	9.0	8.4	*1*	*4*	*1*	*2*	*1*	*2*	***1***	*3*
A+B Contracting	7.3	7.6	7.7	7.5	*4*	*11*	*5*	*14*	*5*	*7*	***2***	*9*
Implementing Multiple Work Shifts and/or Night Work	7.8	7.6	6.8	7.4	*2*	*6*	*4*	*13*	*6*	*16*	***3***	*11*
Incentivize Contractor Work with a Lane-Rental Approach	6.5	8.2	7.9	7.3	*6*	*22*	*2*	*8*	*3*	*4*	***4***	*12*
Increase Amount of Liquidated Damages	6.6	7.8	7.9	7.3	*5*	*19*	*3*	*11*	*3*	*4*	***5***	*13*
"No Excuse" Incentives	7.4	6.1	9.0	7.1	*3*	*10*	*7*	*28*	*1*	*2*	***6***	*17*
Pre-Qualify Bidders on Basis of Past Schedule Performance	6.0	6.5	4.5	6.0	*7*	*24*	*6*	*23*	*12*	*42*	***7***	*27*
Change Management Practices	5.8	5.5	5.0	5.5	*8*	*25*	*9*	*34*	*9*	*36*	***8***	*35*
Incentivize TCP Dev. with a Contractor VE Cost-Saving Provision	4.9	5.0	6.0	5.3	*11*	*40*	*10*	*37*	*7*	*26*	***9***	*37*
Project-Level Dispute Review Board	5.0	5.9	4.9	5.2	*9*	*37*	*8*	*30*	*10*	*37*	***10***	*39*
Warranty Performance Bidding	4.6	4.4	5.6	4.8	*12*	*43*	*12*	*42*	*8*	*29*	***11***	*42*
Alternative Dispute Resolution Methods	5.0	4.9	3.9	4.7	*9*	*37*	*11*	*39*	*14*	*48*	***12***	*44*
Packaged Multiple-Primes Approach to Contracting	4.1	4.1	4.7	4.3	*13*	*45*	*13*	*45*	*11*	*40*	***13***	*45*
E-Commerce Systems for Procurement, Employment, etc.	2.7	2.1	4.5	3.1	*14*	*48*	*14*	*48*	*12*	*42*	***14***	*49*

IV. CONSTRUCTION	Scores				DALLAS		AUSTIN I		AUSTIN II		ALL	
Methods	Dallas	Austin	Austin II	All	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*
Schedule Calendar Day Projects	9.3	9.4	9.0	9.3	*1*	*1*	*1*	*1*	*1*	*1*	***1***	*1*
Maturity Testing			7.5	7.5					*2*	*8*	***2***	*7*
Full Closure Instead of Partial Closure of Roadway	7.9	7.0	6.3	7.2	*2*	*4*	*3*	*18*	*5*	*24*	***3***	*16*
Maximizing Size of Work-Zones	7.0	6.7	6.4	6.7	*3*	*16*	*4*	*20*	*4*	*22*	***4***	*18*
Windowed Milestones	6.6	6.2	6.8	6.6	*5*	*20*	*5*	*27*	*3*	*16*	***5***	*20*
Automated Construction Technologies	6.8	4.6	4.9	5.7	*4*	*17*	*7*	*41*	*7*	*37*	***6***	*32*
Linear Scheduling Method	5.3	7.2	5.2	5.7	*6*	*35*	*2*	*16*	*6*	*33*	***7***	*33*
Web-Based Team Collaboration System	4.8	5.0	4.7	4.8	*7*	*41*	*6*	*38*	*8*	*40*	***8***	*43*

Note: It was decided to place maturity testing in the construction phase after the final workshop.

V. OTHER / MULTIPLE	Scores				DALLAS		AUSTIN I		AUSTIN II		ALL	
Methods	**Dallas**	**Austin**	**Austin II**	**All**	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*	*Phase Rank*	*Overall Rank*
Pilot Demonstration Projects	6.8	6.3	5.4	6.3	*1*	*17*	*4*	*26*	*4*	*31*	***1***	*23*
Training Personnel in Scheduling Methods	5.5	6.4	7.2	6.2	*6*	*32*	*3*	*25*	*1*	*13*	***2***	*25*
Create a Lessons-Learned Database	6.4	7.0	4.9	6.1	*2*	*23*	*2*	*18*	*6*	*37*	***3***	*26*
"Smart" Database of Activity Productivity Rates	5.8	6.1	6.4	6.0	*3*	*27*	*5*	*28*	*2*	*22*	***4***	*27*
Incentive-Based Pay for Retaining Key TxDOT Personnel	5.7	7.1	5.5	6.0	*5*	*31*	*1*	*17*	*3*	*30*	***5***	*29*
Track Dur. & Productivity Effects Associated with Different Technologies	5.7	4.3	5.2	5.2	*4*	*29*	*6*	*43*	*5*	*33*	***6***	*38*
Study Optimal Approaches to Crew Shifts & Scheduling	4.1	3.9	4.1	4.1	*7*	*44*	*7*	*46*	*7*	*46*	***7***	*46*
Measure & Track Project Schedule Performance	2.9	1.8	3.4	2.8	*8*	*47*	*8*	*49*	*8*	*49*	***8***	*50*

Appendix K

Interim Workshop Results: "Dallas Multi-Voting Results"

I. PROJECT PLANNING

Methods	%Votes
1. Standardize Planning Approach	16%
2. Programmatic Approach	0%
3. Alternative Funding Methods	3%
4. Designate a PM for Entire Life-Cycle	10%
5. Design-Build Approach	7%
6. Formal Partnering	17%
7. Linear Scheduling Method & Accurate Productivity Rate	0%
8. Expediting ROW Acquisition & Utility Relocation	**30%**
9. ITS & Work-zone Traffic Control	6%
10. Public Input on Construction Methods	11%

II. PROJECT DESIGN

Methods	Votes
1. Pavement type selection decisions	10%
2. Precast/Modular Components	**30%**
3. Multiple approaches to Traffic Control Plans (TCPs)	10%
4. Descriptive Catalog of Construction Technologies	1%
5. Phased-design to support phased construction	9%
6. TCP Through Partnering btw. TxDOT Design & Field Organizations	2%
7. Increasing Levels of Design Component Standardization	14%
8. Have Contactor Prepare the TCP	24%

III. CONTRACTING & PROCUREMENT

Methods	Votes
1. A+B Contracting	7%
2. Use of Contractor Milestone Incentives	**20%**
3. Packaged Multiple-primes Approach to Contracting	0%
4. Pre-qualify Bidders on Basis of Past Schedule Performance	**20%**
5. Incentivize TCP Dev. with a Contractor VE Cost-saving Provision	5%
6. Incentivize TCP Development with a Contractor Lane-rental Approach	2%
7. E-commerce Systems for Procurement, Employment, etc.	0%
8. Implementing Multiple Work Shifts and/or Night Work	8%
9. Increase Amount of Liquidated Damages	13%
10. Warranty Performance Bidding	4%
11. “No Excuse” Incentives	16%
12. Change Management Practices	1%
13. Project-Level Dispute Review Board	2%
14. Alternative Dispute Resolution Methods	2%

IV. CONSTRUCTION

Methods	Votes
1. Web-based Team Collaboration System	6%
2. Automated Construction Technologies	5%
3. Maximizing Size of Work-zones	13%
4. Windowed Milestones	14%
5. Schedule Calendar Day Projects	27%
6. Linear Scheduling Method	2%
7. Full Closure Instead of Partial Closure of Roadway	**33%**

V. OTHER

Methods	Votes
1. Measure & Track Project Schedule Performance	23%
2. Track Dur. & Productivity Effects Associated with Different Technologies	3%
3. Pilot Demonstration Projects	21%
4. “Smart” Database of Activity Productivity Rates	0%
5. Study Optimal Approaches to Crew Shifts & Scheduling	3%
6. Training Personnel in Scheduling Methods	8%
7. Create a Lessons-learned Database	15%
8. Incentive-based Pay for Retaining Key TxDOT Personnel	**27%**

Appendix L

Interim Workshop Results: "Austin I Multi-Voting Results"

I. PROJECT PLANNING

Methods	%Votes
1. Standardize Planning Approach	3%
2. Programmatic Approach	0%
3. Alternative Funding Methods	4%
4. Designate a PM for Entire Life-Cycle	2%
5. Design-Build Approach	5%
6. Formal Partnering	7%
7. Expediting ROW Acquisition	**31%**
8. Expediting Utility Relocation	**34%**
9. Improving Environmental Assessment	13%
10. ITS & Work-zone Traffic Control	0%
11. Public Input on Construction Methods	1%

II. PROJECT DESIGN

Methods	Votes
1. Pavement type selection decisions	**24%**
2. Precast/Modular Components	16%
3. Multiple approaches to Traffic Control Plans (TCPs)	**23%**
4. Descriptive Catalog of Construction Technologies	12%
5. Phased-design to support phased construction	4%
6. TCP Through Partnering btw. TxDOT Design & Field Organizations	11%
7. Increasing Levels of Design Component Standardization	6%
8. Have Contactor Prepare the TCP	0%
9. Linear Scheduling Method & Accurate Productivity Rate	4%

III. CONTRACTING & PROCUREMENT

Methods	Votes
1. A+B Contracting	1%
2. Use of Contractor Milestone Incentives	**26%**
3. Packaged Multiple-primes Approach to Contracting	0%
4. Pre-qualify Bidders on Basis of Past Schedule Performance	14%
5. Incentivize TCP Dev. with a Contractor VE Cost-saving Provision	0%
6. Incentivize Contractor Work with a Lane-rental Approach	6%
7. E-commerce Systems for Procurement, Employment, etc.	0%
8. Implementing Multiple Work Shifts and/or Night Work	13%
9. Increase Amount of Liquidated Damages	**28%**
10. Warranty Performance Bidding	1%
11. "No Excuse" Incentives	9%
12. Change Management Practices	1%
13. Project-Level Dispute Review Board	2%
14. Alternative Dispute Resolution Methods	1%

IV. CONSTRUCTION

Methods	Votes
1. Web-based Team Collaboration System	3%
2. Automated Construction Technologies	3%
3. Maximizing Size of Work-zones	14%
4. Windowed Milestones	5%
5. Schedule Calendar Day Projects	**44%**
6. Linear Scheduling Method	3%
7. Full Closure Instead of Partial Closure of Roadway	30%

V. OTHER

Methods	Votes
1. Measure & Track Project Schedule Performance	0%
2. Track Dur. & Productivity Effects Associated with Different Technologies	0%
3. Pilot Demonstration Projects	6%
4. "Smart" Database of Activity Productivity Rates	24%
5. Study Optimal Approaches to Crew Shifts & Scheduling	6%
6. Training Personnel in Scheduling Methods	10%
7. Create a Lessons-learned Database	16%
8. Incentive-based Pay for Retaining Key TxDOT Personnel	**38%**

Appendix M

Interim Workshop Results: "Austin II Multi-Voting Results"

I. PROJECT PLANNING

Methods	%Votes
1. Standardize Planning Approach	0%
2. Programmatic Approach	1%
3. Alternative Funding Methods	0%
4. Designate a PM for Entire Life-Cycle	2%
5. Design-Build Approach	17%
6. Formal Partnering	0%
7. Expediting ROW Acquisition	**29%**
8. Expediting Utility Relocation	**34%**
9. Improving Environmental Assessment	13%
10. ITS & Work-zone Traffic Control	4%
11. Public Input on Construction Methods	2%

II. PROJECT DESIGN

Methods	Votes
1. Pavement type selection decisions	2%
2. Precast/Modular Components	**20%**
3. Multiple approaches to Traffic Control Plans (TCPs)	**25%**
4. Descriptive Catalog of Construction Technologies	1%
5. Phased-design to support phased construction	6%
6. TCP Through Partnering btw. TxDOT Design & Field Organizations	**22%**
7. Increasing Levels of Design Component Standardization	2%
8. Have Contactor Prepare the TCP	7%
9. Linear Scheduling Method & Accurate Productivity Rate	14%
10. Maturity Testing	0%

III. CONTRACTING & PROCUREMENT

Methods	Votes
1. A+B Contracting	**20%**
2. Use of Contractor Milestone Incentives	6%
3. Packaged Multiple-primes Approach to Contracting	0%
4. Pre-qualify Bidders on Basis of Past Schedule Performance	16%
5. Incentivize TCP Dev. with a Contractor VE Cost-saving Provision	5%
6. Incentivize Contractor Work with a Lane-rental Approach	19%
7. E-commerce Systems for Procurement, Employment, etc.	0%
8. Implementing Multiple Work Shifts and/or Night Work	4%
9. Increase Amount of Liquidated Damages	**21%**
10. Warranty Performance Bidding	7%
11. "No Excuse" Incentives	2%
12. Change Management Practices	0%
13. Project-Level Dispute Review Board	1%
14. Alternative Dispute Resolution Methods	0%

IV. CONSTRUCTION

Methods	Votes
1. Web-based Team Collaboration System	1%
2. Automated Construction Technologies	4%
3. Maximizing Size of Work-zones	1%
4. Windowed Milestones	**21%**
5. Schedule Calendar Day Projects	**21%**
6. Linear Scheduling Method	14%
7. Full Closure Instead of Partial Closure of Roadway	38%

V. OTHER

Methods	Votes
1. Measure & Track Project Schedule Performance	**32%**
2. Track Dur. & Productivity Effects Associated with Different Technologies	3%
3. Pilot Demonstration Projects	1%
4. "Smart" Database of Activity Productivity Rates	12%
5. Study Optimal Approaches to Crew Shifts & Scheduling	11%
6. Training Personnel in Scheduling Methods	**35%**
7. Create a Lessons-learned Database	1%
8. Incentive-based Pay for Retaining Key TxDOT Personnel	4%

Appendix N

Interim Results Presentation Participants

PROJECT 0-4386 INTERIM RESULTS PRESENTATION
(06/14/2002)

Participants

Name	***Organization***
Thomas BOHUSLAV	Texas Department of Transportation
Randy COX	Texas Department of Transportation
Kirk FAWVER	Federal Highway Administration
Tracey FRIGGLE	Texas Department of Transportation
Bill GOODELL	Texas Department of Transportation
Rob HARRISON	Center for Transportation Research
Jim HUNT	Texas Department of Transportation
Brett JACKSON	Federal Highway Administration / Texas Turnpike Authority
Robert KOVAR	Texas Department of Transportation
Mike LARRY	Federal Highway Administration
Khali PERSAD	Center for Transportation Research
Amadeo SAENZ	Texas Department of Transportation

Appendix O

Interim Workshops Participants' Comments on Methods in the Individual Evaluations

I. PROJECT PLANNING

Method	Comments	Workshop
(1) Standardize planning approach	▪ Con: Potential for consumption of resources on unnecessary activities on some projects ▪ Standard practice reduces risk ▪ TxDOT planning is more or less standardized now ▪ Already using (primavera) esp. larger projects ▪ Standard approach could be broken down into type of roadway & ADT ▪ Good if not too constrained ▪ Probably not done as well as could be ▪ Already doing	DALLAS
	▪ Will require a mindset change ▪ Already setup ▪ Uniformity by all Districts is very important ▪ We already do this to some extent. Improvements can be made ▪ Already standardized. Need to engr. each project ▪ A problem is that requirements continually change ▪ May need to get top level TxDOT management to change way district engineers are evaluated. ▪ Less flexibility is a concern. Outside influences really impact any standard approach	AUSTIN
	▪ Loose knowledge & adaptability of personnel for special cases ▪ Development of this is already underway ▪ This may conflict other methods by limiting innovation. There is also an institutional resistance to this ▪ May leave out little items that may prove fatal. Today's contractors are picky ▪ Getting to management support (-), time to development (-) ▪ Need to build in flexibility to address different application ▪ Even with these high marks Texas is big with a lot of different opinions, doability? ▪ Basically being done this way; however each District given flexibility ▪ Development of a "CPM" for planning can be tailored to each district ▪ A standardized P.A. should be flexible as a guideline ▪ Low doability given 25 districts, multiple consultants involved ▪ I feel that this is done on large "corridor" projects	AUSTIN II
(2) Programmatic (Corridor) approach to planning, design, and construction	▪ Funding restrictions in specified areas is an applicability/limitations issue ▪ Would mean many changes in approach ▪ Applicable to large project "corridors." Not to all projects ▪ Doability with financing is the biggest drawback ▪ Funding would be issue over statewide ▪ TxDOT is doing this for most projects ▪ This would work if more cash was available	DALLAS
	▪ Cost limitations, helps with construction reducing field staff ▪ The amount of money required to do this approach is astronomical. Politics plays an enormous role in what and when projects are developed ▪ Legislative limitations & financing. TxDOT is trying to do this on some corridor. Texas Mobility Fund ▪ New UTP fund cost will help. Need supplementary $ ▪ For major projects ▪ May take a lot longer to get the project started, but once started gets over faster ▪ Would not be supported by industry – negative impact to small contractors. ▪ Better coordination and scheduling will result ▪ Money commitment a question. Political backlash possible	AUSTIN
	▪ TxDOT districts limit this if corridor crosses districts' lines ▪ Needs support of MPO and counties + cities ▪ Financing (-), will need $ from legislature ▪ Phil Russell (TTA) is point of contact ▪ Financing; basically based on priority ▪ Financing limitations mean low impact ▪ This is done on some projects. Funding expedition & "expirations" of documents are a problem ▪ Lack of funding, ROW, utilities are a large obstacle in this process	AUSTIN II

(3) Alternative funding methods	▪ Long term impacts need to be investigated. North Carolina has some experience ▪ Put the state in dept. Future project delayed in order to payoff ▪ Involves another step in going to bond market. It will add time in project phase. Only a "catch-up" one time step to overall funding problems ▪ Legislature not yet supportive ▪ "Borrowing" money from future highway funds is risky ▪ Funding would be issue over statewide ▪ Near future would be great. Long term could cause funding problems	DALLAS
	▪ Reduces amount of funds available in future, lost funds to interest payment ▪ We need this method but some states using GARVEE bonds have had financial trouble. No guarantee of federal funds each year ▪ Legislative limitations. GARVEES could help if you use the right limitations, but has failed to pass in last two legislative sessions. ▪ Needs legislative short term fix, could reduce future $ ▪ Not allowed yet ▪ I believe it's a quick fix but could cause funding problems later ▪ Unable to implement due to legislative constraints. ▪ Could have negative impact on future project funding, possible contractor issues ▪ For certain mega project only	AUSTIN
	▪ Over commit & not be able to let projects. Ck New Mexico DOT ▪ Could have high impact only if legislature is behind new methods ▪ TIFIA loans, GARVEE is bad idea ▪ Private/public partnership will help expedite – would have to be tied to Design/Build ▪ Do not agree with borrowing against future funds	AUSTIN II
(4) Designate a single individual as Project Manager (PM) for entire life-cycle; empower & equip PM with needed tools & data to select appropriate expediting methods	▪ Arizona DOT is researching this approach now, will meet with resistance in TxDOT ▪ High personnel turnover makes it almost impossible ▪ Too hard to keep a project mgr that long ▪ Benefit to consultant selection process if they hold personnel ▪ Most people's expertise are limited to certain field ▪ TxDOT typically break planning, design and construction to 3 different offices ▪ Would mean many changes in approach ▪ Applicable to area offices – Not larger projects – Expertise ▪ Selection of qualified PM that can handle all the duties ▪ Too many projects statewide to cover ▪ Use AE as manager for planning, design and construction ▪ Personnel turnover. Also TxDOT engineers tend to find a specialized area of expertise ▪ Very hard to implement due to TxDOT structure and personnel leaving ▪ Do not consider this approach to be in TxDOT's best interest ▪ PM would have to be confident in design and construction	DALLAS
	▪ May lead to conflicts with other projects ▪ This could be neg. or positive impact. TxDOT has lost a lot of experienced people because of low salaries, so we might be able to keep people ▪ The Area Engineer is already in place – Serves as PM on many projects in some areas ▪ Selection of and keeping PM critical, and difficult. An experienced PM may retire before project is completed ▪ Incentive pay limitations. Would require a reorganization of the way we do things ▪ For high profile projects ▪ For major projects ▪ Considering PM would work for TxDOT ▪ Turnover could be a problem – would require additional manpower ▪ For personal reasons	AUSTIN
	▪ It would be hard to know every part of projects w/legislation; great experience/knowledge for personnel ▪ Don't think this has been a real need, can help in some cases ▪ Availability of experienced personnel & keeping them in TxDOT is a problem ▪ Do not have enough engineers to accomplish this. Depends on size of projects ▪ May be hard to find people to stay with this. Need management buy-in ▪ FTE restriction limits the ability ▪ Positive impact is extremely high, but TxDOT structure now makes this very hard ▪ Very difficult to keep employees from moving around ▪ PM "burnout" on the longer projects ▪ Current internal staff. Limitations from the legislature prevent implementation w/o external assistance ▪ Insufficient staffing to do this ▪ Not practical – decisions must be made on levels of authority based on experience of executive level ▪ Lack of adequate staff. Long time from planning to construction	AUSTIN II

(5) Design-Build approach in various forms (Design-Build-Warrant, Design-Build-Maintain, etc.)	▪ Con: Legal issues of "get-out" provisions in agreements need to be clarified and addressed strongly ▪ Type of project would dictate if DB is effective ▪ Drives up the cost or lower the quality ▪ Subjective engineering criteria are compromised at minimal savings (1-2%) of total project cost ▪ Should dramatically accelerate construction but will cost more ▪ Quality of the product and legal liability issue: i.e. if someone got into accident due to design defect who is liable? ▪ Requires exp. TxDOT to guide private sector on policy/process/procedure ▪ Doability depends on whether the legislature will approve it ▪ Need change state policies & procedure to allow state beginning to participate ▪ NTTA may be able to implement this option with positive impact ▪ Not in TxDOT's best interest. D-B doesn't protect public ▪ Have to be watchful on how contractor spends taxpayer money. Contractor could go Cadillac on us	DALLAS
	▪ Need legislative action to have this done ▪ High cost ▪ Quality of work is likely to suffer in the long term. Also the cost is probably higher ▪ Loss of TxDOT inspection forces may cripple our inspection forces ▪ Depends on type of project. Good for off-system / enhancement ▪ High cost ▪ Can be applied on specific projects ▪ Legislative limitations. TTA currently using Exclusive Development Agreements (EDAs) ▪ For high profile projects ▪ Currently allowed as EDA at TTA only. Opposition from AGC ▪ ROW acquisition needs to be considered ▪ Possible backlash from small and/or minority contractors ▪ Special projects only that require certain expertise, time consideration	AUSTIN
	▪ Frees up TxDOT personnel to work on other items ▪ Must watch quality of product – not as many checks and balances ▪ This does not address the planning issues such as environmental which create biggest delays ▪ Involves legislature, will only be useful on large scale projects ▪ Really should change term to EXCLUSIVE DEVELOPMENT AGREEMENT ▪ Legislative limitations, AGC resistance ▪ Design-Build appears an expensive approach to me ▪ Under pros "eliminate conflicts between designer and contractor" assumes these conflicts are not necessary to protect owner interest ▪ More money & legislative action	AUSTIN II
(6) Formal partnering with design consultants, and/or contractors	▪ Already in place in metropolitan districts ▪ Sounds good at the beginning but seems to break down when profit is on the line ▪ Available now. Already partner with consultants and contractors ▪ Might take longer process unless they work together day in & out ▪ If it works, the project is the focus rather than conflicts on the job ▪ TxDOT already has partners ▪ Already doing it, larger extent ▪ More partnering in construction ▪ As long as we have a partnering "sprit" even if not formal ▪ Good ideology but not as effective as we would like ▪ Already doing ▪ I believe it best to "partner" additionally with utility companies, city and community agencies, major businesses and/or business associations	DALLAS
	▪ Mindset change required. Them vs. us attitude ▪ Helps in handling communication ▪ For major projects ▪ Doing now on I-69, limited success. Regulatory agency not – co-op ▪ Suggest calling partnering "Communication Management" ▪ Using extensively in our district ▪ To establish new relationships with consultants/contractors only	AUSTIN
	▪ I don't think partnering has that big an impact thus far on projects ▪ Used presently, but has not been a great success ▪ This process became a formality that the benefits seems to have fallen off over time ▪ Doing this already, not much room for improvement	AUSTIN II
(7) Methods for expediting Right of Way (ROW) acquisition (Austin I & II workshops only)	▪ Legislative constraints. Communication is required ▪ Legislative limitations. Right of entry. This could fit with #1 above ▪ Need new laws, outsourcing does not expedite ▪ Need to arrange to have planning processes revised to allow ROW acquisition to begin earlier ▪ Could speed up process for willing sellers ▪ How do you control entity process?	AUSTIN

	▪ Hard to reduce constraints ▪ Funding ▪ Env. & local planning input very restrictive ▪ Process is too slow and money is not there ▪ Should add "QUICK TAKE" authority that TTA has ▪ ROW offices at Districts and Division level appear to be stuck in old slow methods ▪ This areas slows projects, especially when condemnation occurs ▪ Funding limitations are negative. However will make a tremendous impact ▪ Will not happen as long as ROW purchases are evaluated on lowest cost ▪ Land of staff and funding is a problem. We will probably look like "bullies"	AUSTIN II
(8) Methods for expediting Right of Way (ROW) acquisition & utility relocation work (Dallas workshop only)	▪ Texas land rights are very precious to most politicians so changes will be difficult to achieve ▪ The process in place has inherent limitations ▪ Most important utility relocation and ROW. acquisition usually controls schedule ▪ Agree this is a major problem but unsure what can be done to expedite with Texas property rights ▪ Process can be optimized within current system ▪ Utilities don't generally cooperate ▪ This is key to keeping projects on track ▪ Something badly needed for TxDOT projects ▪ What is needed to really help	DALLAS
(8) Methods for expediting utility relocation work (Austin I & II workshops only)	▪ Partnering with utilities is needed, but again a mindset change by engineers in Districts required ▪ Legal hurdles will be difficult to overcome ▪ If it was easy to do we would not have so many problems now ▪ It would be great improvement if something can be done ▪ Pay for adjustment in contract reimbursed later. ▪ Allowing utility adjustments by TxDOT with contractor rather than wait for utility company to schedule, would help ▪ Are there any other means other than what we have been doing for years? ▪ Need to arrange to have planning processes revised to allow utility relocation acquisition to begin earlier ▪ Incorporate utility plans with roadway plans works well ▪ Very much needed	AUSTIN
	▪ Getting utilities to follow through ▪ There is no current means to make utilities faster ▪ Look at TTA legislation dealing with utilities ▪ Joint bidding could help doability. TxDOT contractor must control utility schedule. ▪ Need additional legislative assistance ▪ Utility company limited budget makes this low doability ▪ Need tool in place to get utility relocations expedited (legislative) ▪ Need accountability in utility companies ▪ Utility companies have a strong lobby. They also have budget constraints	AUSTIN II
(9) Methods for improving environmental assessment during planning	▪ Need federal law changes to make this doable. Districts need to begin work on this much sooner ▪ Laws are written so vague that personal interpretation causes problems ▪ Depends on to many resource agencies ▪ Streamline and standardize ▪ Cannot be done until design is substantially complete to evaluate impact ▪ Too many outside inputs with varying agendas	AUSTIN
	▪ Hard to do when working with so many resource agencies ▪ A streamlined process would be great. "One Stop Shopping" ▪ EPA + CORP slow the process ▪ Need people involved in moving environmental issues more proactively toward construction ▪ TxDOT policy limits our ability ▪ Changes of environmental regulations causes changes in the middle of projects ▪ This is usually critical path, but not much opportunity to streamline ▪ EPA and Corps of Engineers just don't seem to want to cooperate with TxDOT	AUSTIN II
(10) Intelligent Transportation Systems (ITS) & work-zone traffic control	▪ Cost to implement may not truly be a con when fully analyzed as a life cycle / road user cost ▪ Some elements of it are currently in place on Dallas High 5 Project ▪ Works better under construction ▪ Very useful if implemented consistently, bad if inconsistent ▪ High cost to implement – incident management vs. construction management ▪ TCP critical to match all projects, sequence of work	DALLAS

	▪ Any help in this area would be appreciated ▪ Best use in areas with alternative routes ▪ Do drivers really pay attention to this and change their routes? ▪ Most people don't pay attention to the simplest information on the road ▪ How will this method expedite planning, design, or construction? ▪ How does this expedite? ▪ Could have funding constraints ▪ We utilize Transtar and changeable message signs to help drivers ▪ Up to date, maintaining for current deformation	AUSTIN
	▪ High cost and maintenance ▪ Very selective projects and locations ▪ Very expensive to set up ▪ Maybe more effective in larger districts ▪ Positive impact is low ▪ None of the "pros" listed expedite construction	AUSTIN II
(11) Public input on construction methods	▪ Will experience resistance in TxDOT ▪ Some form of public involvement is already in place ▪ Public relations slow process ▪ Public relations effort won't "educate" public to make the right decision. They could digress to a longer time frame alternative. Backyard objectors are always most voiceful ▪ Too many cooks spoil the soup! ▪ Could slow down project delivery. More public involvement in scheduling/schedule delays by way of web page could make TxDOT more accountable ▪ Can be very useful if done properly ▪ Too many opinions and special interests ▪ While we value the opinion of citizens, it is difficult at times to deal with uninformed or unreasonable citizens ▪ Need to be implemented more than presently is ▪ A good cross-section of the public has to come to meeting. Government officials need to show up ▪ Early involvement is essential	DALLAS
	▪ Good public relations ▪ Change for group consensus is very low ▪ Public most times look at individual needs not overall impact. Usually get only the opinion of people against the projects ▪ Part of NEPA process ▪ Cannot have public voting on how to complete work ▪ Good concept – provides public buy-in ▪ May have positive impact with public in project acceptance ▪ Pandora Box! ▪ Questionable – common by mass expertise/motive	AUSTIN
	▪ Good public relations ▪ If we vote we will never get anything built ▪ A small but vocal minority can affect decisions ▪ Depends on the mood of the public ▪ Public don't have enough knowledge on construction ▪ Very important in urban areas ▪ More public buy-in ▪ Local communities don't care about global funding sources outside the community ▪ Impossible to get the majority of people to agree. IH 10 not only has local communities but out-of-state travelers. How will they get their input ?	AUSTIN II

II. PROJECT DESIGN

Method	Comments	Workshop
(1) Pavement type selection decisions	▪ Pro/Con: Full LCA and road user analysis is necessary, also planning is very dependent on material type ▪ Not a schedule issue in my opinion ▪ TxDOT typically uses concrete in urban districts regardless ▪ Any improvements in this area would result in positive impact ▪ Depends on project time ▪ Currently use this method to develop designs ▪ Con: Added cost of quick curing concrete ▪ Better technology will help in this determination ▪ Most promising	DALLAS
	▪ TxDOT has looked and looked at this. Need to focus on other areas to assist in expediting ▪ Pavement construction often not critical to project completion (Overpass structures often are) ▪ Already being done ▪ Hopefully increases pavement life, min impact to public ▪ Pavement selection should be done early as possible ▪ Political	AUSTIN
	▪ Life-cycle, use engineering judgment ▪ Must look at life cycle, "quick cure" usually doesn't last as long ▪ I believe this is already done to the greatest extent it can be ▪ Financing constraint ▪ Life cycle cost could drive pavement decision to a slower type ▪ Option is already utilized ▪ Should be done on every project	AUSTIN II
(2) Precast/modular components	▪ Need to encourage more use of composite materials ▪ Railroad bridge replacement techniques should be reviewed ▪ Requires designer to have construction knowledge ▪ Need experienced inspector ▪ Allow various types of design and technique for erection ▪ Limited dimensional flexibility is really affecting this option ▪ This would be a big contributor to traffic reduction and public attitude ▪ Good	DALLAS
	▪ Reduces curing time ▪ Consider cost. Must consider constructability and area contractor limitations ▪ Already being done ▪ On selected projects ▪ Modular pavement sections are now being evaluated ▪ Worked very well on pierce elevated potential uses over environmentally sensitive areas ▪ All depends on industry acceptance	AUSTIN
	▪ Limitations – must make sure quality doesn't suffer - - connection between pre-cast pieces ▪ Should expound on this – we've stated this – need more ▪ Pre-cast concrete. pavement, & pre-cast caps could help even more ▪ Pavement – Does not seem to be good practice ▪ Lack of flexibility. Local suppliers will oppose if used in any large scale. / Low % of application	AUSTIN II
(3) Generate & evaluate multiple approaches to Traffic Control Plans (TCPs)	▪ I believe it is more advantageous to allow contractor options with lane rentals, etc. ▪ Not enough time to develop more than one TCP ▪ Delay-day analysis during design. Hard to evaluate during bid process ▪ I believe we are emphasizing TCPs to expedite construction ▪ Every TCP is a design itself. It might take too much time to come up with many different TCPs ▪ Design schedule might not have time slotted for extensive analysis ▪ May not be cost effective ▪ Experience & personnel is critical - coordination with construction personnel ▪ Solicit the viewpoint and expertise of the contracting/construction community ▪ Always good to have alternate ways / give permission to change under construction ▪ Good idea but must refocus designers to do this ▪ We may need to coordinate with contractors and consultants. Methods of TCP and constructability review is highly recommended ▪ A lot more consideration should go into TCPs ▪ Do we still have only one included in the PS&E? ▪ Prefer #8	DALLAS

	▪ This could save TxDOT $ due to possible litigation ▪ Having workshops early in design with contractor helps the selection process ▪ This impacts contractors profits also they have a high liability ▪ Useful for large projects ▪ Model alterative using TSIS or similar software ▪ On high profile projects ▪ Depends on complexity of project phase ▪ More resources needed to develop plans ▪ We evaluate TCPs for large projects at 30%, 60%, 90% complete ▪ Consultants have big problem with this. $$$$	AUSTIN
	▪ Larger impact on traveling public delays. Depend on project size ▪ Hard to come up with TCPs needed exactly ▪ Contractor is given option to change to better option ▪ Contractor sometimes has better method for TCP and expediting TCP ▪ Implore AGC participation & Real Construction Reviews ▪ Multiple TCPs will add cost and time to projects ▪ This is done	AUSTIN II
(4) Develop a descriptive catalog of construction technologies that facilitate expedited schedules	▪ Dependent on contractor abilities and experience ▪ Can't see much benefit ▪ Requires designer to have construction knowledge ▪ Time consuming to get the approval of new specs ▪ More manpower needed to gather and evaluate data constantly ▪ Spl. Specs – untried products ▪ You may need to designate a person in every organization to update technology catalog keeping and search for new ways of technology ▪ What about cost? Initial usage would be high ▪ Catalog would be out of date upon completion	DALLAS
	▪ Allows innovations to reach a wide audience ▪ Would need to be detailed on how to implement ▪ This is the contractor's responsibility and relates to competition ▪ Good information for younger work force ▪ Would need to be maintained and updated regularly to be of benefit ▪ Spec. issue	AUSTIN
	▪ Specification limits some of those technologies ▪ This should be up to the contractor ▪ I thought our research branch was doing this ▪ Impact on spec approval could be an issue ▪ Construction techniques based on contractor's equipment ▪ Cuts out innovative bidding of contractors	AUSTIN II
(5) Phased-design to support phased-construction	▪ Mainly applicable to large , long duration projects ▪ High amount of change orders ▪ Does not always reduce total cost because of change orders ▪ Negatives outweigh positives in my opinion ▪ Can create problems in construction but speeds construction ▪ Really not a desirable procedure	DALLAS
	▪ ROW acquisition + utility adjustment could impact this ▪ Does not allow flexibility to change if problems encountered in latter phases of projects ▪ May work best for small very critical projects ▪ Can be costly due to unknowns to contractor ▪ Could result in disaster, risky, limited use ▪ Environmental requirements? could do by phased "contracts" ▪ Too many cooks in the kitchen ▪ Bidding documents may need to be modified ▪ May have coordination issues	AUSTIN
	▪ Project specific ▪ Have to change the way we do design & let projects ▪ Must allow Design-Build to do this ▪ This is done by funding constraints	AUSTIN II

(6) Develop Traffic Control Plans (TCPs) through partnering between TxDOT design & field organizations	▪ Could suggest requiring the contractor to submit a TCP at pre-construction conference ▪ TCPs are reviewed by construction office during design in Dallas ▪ Value Engineering option is currently available but not often used ▪ Not worth the time ▪ ROW and utility relocations can kill it ▪ Legal issues ▪ Have a basic TCP in place to begin with ▪ Can be used on the most complex projects with best results ▪ Problem with engineering board rules. Low bidder providing engr. drawings ▪ We need to invite as many contractors as we can to promote competitive bidding ▪ Need more contractor input but hard to do ▪ This need to be a face-to-face meeting (no memos)	DALLAS
	▪ Helps in looking at overall constructability ▪ Must be done during design phase if used ▪ Contractors may not be willing to give up ideas to other contractors. Constructability issues can be resolved ▪ Contractors reluctant to share ideas prior to letting ▪ Good idea if process can be implemented ▪ Constructability issues can be addressed earlier ▪ Done now on high profile projects ▪ Change partnering to "Cooperative Effort." May give contractor involved an advantage during bidding process In TxDOT the word "partnering," in some areas, carries with it a negative perception ▪ Currently allow contractors to review TCPs for projects > $10M ▪ On large projects	AUSTIN
	▪ Contractor can always submit one after award ▪ Would work with consultant; contractors I am not sure ▪ Contractors would really like to do this ▪ Already being done by District ▪ Time consuming. Contractor interest could be low. (and expensive to them)	AUSTIN II
(7) Increase levels of design component standardization	▪ All of the design tools needed are currently available! Just needs buy-in from participants ▪ Currently have many standards. Beneficial method but design can't be cookbook ▪ Don't think this would expedite a whole lot ▪ Largely done ▪ This could be used to accelerate construction ▪ Already doing	DALLAS
	▪ Allows contractors to become familiar with design, public may get tired of same look ▪ Commonly used now ▪ Need to look at combined District standard (state standards) ▪ Engr. Each project ▪ Would need to find way to maintain a file - possible environmental concerns ▪ Design is already the quickest/most standard piece of project	AUSTIN
	▪ Has limitation due to soil, traffic, etc. ▪ Some designers redesign something we already have ▪ Already done for structures, > 1000 std drawings ▪ Good to at least be consistent within a district ▪ Innovative projects seem to be the ones that need to be fast tracked & this would hinder those ▪ Size and complexity of Texas makes this difficult ▪ Already done, need to improve sharing: "lessons learned" ▪ Cannot box engineering judgment. Geographic areas have different preferences and needs	AUSTIN II
(8) Have Contractor prepare the Traffic Control Plan (TCP) based on minimum requirements	▪ Have to make decisions on responsibilities for consequences of accepted TCPs ▪ TCPs are provided to the contractor to have a standard baseline for bid preparation. It will complicate the bid review process tremendously ▪ VE option presently not utilized ▪ Have TxDOT do a rough draft TCP and then let contractor do theirs ▪ Harder to evaluate bidders ▪ Are there legal challenges here to demonstrate constructability? ▪ Possible high return. Low chance of being able to do it ▪ Safety very important, should not be compromised ▪ Contractor concern for public interests ▪ Contractor probably doesn't know all rules, policies, and regulations required by state. Let contractor change TCP as needed ▪ Provide only basic TCP with parameters to meet law & safety requirements ▪ Many contractors in our area do not have engineers on staff; therefore they must contract with design engineers. It is not cheap and they don't like doing ▪ Problem with engineering board rules. Low bidder providing engr. drawings ▪ Would like to try this but we'd need TxDOT review ▪ What about estimating the cost? ▪ Good	DALLAS

	▪ Contractor does not see impact to traffic the same as TxDOT ▪ Too many legal and liability issues ▪ Must be used on simple jobs (benefits are low) ▪ Don't even want to seal revised TCPs they propose ▪ Contractor don't look at overall picture; safety, etc. ▪ We may have experts more experienced and familiar with project background. Their concerns are more business ($) motivated ▪ Being done now. Contr. can submit alternative TCP for approval ▪ Contractors are production oriented, may not be sensitive to businesses or traffic need ▪ TxDOT needs to maintain control to assist businesses and traveling public	AUSTIN
	▪ Some contractors won't do this but they do not want to accept responsibility/ownership ▪ Responsibility control issues ▪ Many contractors do not want to take the responsibility for the TCP ▪ Need contractor to have larger stake ▪ Contractor would really want to do this, but would TxDOT be willing to let go? ▪ I recall some direction (legislative or TxDOT administration) requiring TxDOT provide TCP ▪ Stamping/sealing of TCP by PE leads to liability transfer, some contractors may not do	AUSTIN II
(9) Using Linear Scheduling Method (LSM) & accurate productivity rate data to establish project target duration	▪ Limited applicability. Productivity rate is key ▪ More the responsibility of the contractor ▪ Rates vary too much between contractors. Don't see how it could be used in our current bid process ▪ Accurate productivity rate is the real important issue here ▪ Better training and understanding of actual productivity rates ▪ Separate LSM and productivity rate ▪ This appears to just be good CPM scheduling	DALLAS
	▪ Great in determining impacts to progress ▪ Being done now ▪ Use this in reviewing disputes. See a plus in using it in design ▪ Already utilizing in our district	AUSTIN
(10) Maturity testing	▪ Specialty field, lots of knowledge by inspectors & contractor plus cost ▪ Again on selective projects, this can accelerate construction (not infallible) ▪ Have experience with this, some limitations – must still do physical testing. Doesn't affect other properties of concrete such as permeability ▪ Still in infancy ▪ It would be a positive all round + can verify strength anytime ▪ Depend on project type. Concrete items will need to be the prominent items on the critical path	AUSTIN II

III. CONTRACTING & PROCUREMENT

Method	Comments	Workshop
(1) A + B contracting	▪ Positive impact on expediting project is not always the way the successful bid is awarded, lower cost + longer time ▪ Can work well for emergency bridge replacement, but not for a large long term project ▪ Will work if certain requirements keep them to original commitments during construction ▪ Good method on certain projects ▪ Contractors have ways of manipulating this method to dilute it ▪ Applicable to large projects – could be combined with contractor TCP ▪ On large projects ▪ Fluctuations of budget hamper TxDOT funding procedures ▪ Difficult to implement. Project needs to have no ROW or utility problems ▪ Does apply to large districts ▪ Depending on project and impact on delay, very hard to manage ▪ This procedure most needed in urban areas. Could produce high positive results to the public	DALLAS
	▪ Need to have clear ROW & utilities before letting ▪ Cost goes up. Can create problems in dealing with contractor ▪ Can be applied to large complex projects ▪ Need clear ROW & utility (affects doability) ▪ For high profile projects ▪ We have not used it because we haven't had a project that we felt had a clear ROW & utilities ▪ Have used before, good for high traffic areas	AUSTIN
	▪ Special project only ▪ Use is limited to large value complex projects ▪ Contractor will meet schedule as per contract ▪ Extreme demand on inspection personnel ▪ Good tool for larger and high volume projects	AUSTIN II
(2) Use of contractor milestone incentives	▪ Delays and criticism of realistic milestones is a huge issue ▪ May affect the final project cost as compared with the bid price ▪ Good method on certain projects ▪ Normally effective as long as the schedule is realistic ▪ Another 'con' could be the quality of work? ▪ Disagreements, disputes with contractor likely to increase ▪ For this to work best, there should be no util. issues, ROW issues and good plans ▪ Funding restraints ▪ We are using milestone incentives. A thorough schedule is critical to develop the CPM ▪ Requires a lot of preliminary work ▪ We need to specify the max. incentive amount regardless of the expedition of construction time ▪ This would help expedite construction and produce positive impact to public	DALLAS
	▪ Clearly define criteria ▪ Must have well defined milestones (windowed milestones) ▪ Can be a very useful tool ▪ Only use on selective projects where milestones generate big benefit to public ▪ Heavily used in our district, must clearly define milestones	AUSTIN
	▪ Special areas/needs only ▪ Must have good disincentives ▪ This is becoming more necessary with traffic congestion ▪ TxDOT still appears reluctant to pay too much in incentives ▪ Lack of funding is negative ▪ Doing this already ▪ Arguments on delay would be insurmountable	AUSTIN II
(3) Packaged multi-primes approach to contracting	▪ Requirements for resources on TxDOT are too high. Also, low bid system would cloud this process ▪ Negatives outweigh positives, disconnects project management ▪ Used already – IH35W / IH30 / SH121 / SH114 ▪ You are only as fast as your slowest contractor ▪ Requires close management from the client	DALLAS
	▪ May help with number of construction crew available ▪ This could be done but TxDOT loses control. Just passes the buck ▪ Multiple coordination issues – possible issues with bonding requirements	AUSTIN

	▪ Need to separate parts, TxDOT becomes project manager ▪ Must have a good set of plans (unique projects) ▪ Who is responsible for delays? ▪ Looks good for very large projects ▪ Do not think is very beneficial, basically contractors sub-work separately ▪ Tolerances would require very tight control	AUSTIN II
(4) Pre-qualify bidders on basis of past schedule performance	▪ Political implications will probably make this impractical in Texas ▪ Looks like lawsuit to me ▪ "Fair" evaluations will be sticking point ▪ Legal issues ▪ This would meet great resistance from the AGC ▪ TxDOT needs to get up to speed with other states ▪ Not sure this is legal yet ▪ Requires effort from TxDOT and other public agencies ▪ TxDOT needs to employ this to a great extent – not presently done ▪ Are past schedules accurate enough to use? May cause legal problems ▪ Sounds good but not sure if this is realistic	DALLAS
	▪ Could be very subjective and biased ▪ Will make contractors more accountable ▪ Schedule evaluation over multiple projects likely to be too subjective to enforce ▪ Not sure, but would like to try it ▪ AGC would object. Legislative issue? ▪ Big legal issues ▪ Medium to high positive impact for public. Low positive impact on contractor ▪ Resistance from industry. Difficulty in producing selection criteria that is acceptable to industry ▪ May have political ramifications from contractors ▪ Subjective, prefer quality basis	AUSTIN
	▪ AGC input ▪ AGC will not support (subjective) (on Design/Build maybe) ▪ Good luck getting this past the AGC ▪ This would be tough to implement, but would be good in the long run ▪ Looks good on paper - Hard to do ▪ The legislature will have to get this idea past the AGC ▪ Very politically driven ▪ Too many factors involved in project execution ▪ AGC resistance ▪ Need legislative help to accomplish ▪ Contractors will definitely take duration seriously ▪ AGC isn't going to allow this, evaluation will be subjective. Would have hardly anybody to bid the work	AUSTIN II
(5) Incentivize TCP development with a contractor Value Engineering cost-savings sharing provision	▪ Getting local municipalities to fund something like this will probably be difficult in smaller rural districts ▪ VE extends the time ▪ Jury is still out on this one. Could lead to many project disputes ▪ Difficult to coordinate with TxDOT financially ▪ Too may unknowns – uncertainties ▪ You can still use VE without formalized procedure ▪ We do this already without calling it V.E. ▪ NTTA prefers this option and implements it as needed ▪ This would provide better project cost and accelerate time, minimize impact to public	DALLAS
	▪ Can be added to the VE process or independently ▪ Need to keep it simple, could just use current change order process ▪ Allowed now by plans without V.E money split ▪ Doing this in a small way – issues with collecting money	AUSTIN
	▪ Contractors look more at $ that, traffic impact ▪ Done presently, contractors propose this if it helps them ▪ Good for complex projects ▪ Need split definition of Value Engineering ▪ Too much arguing about cost savings	AUSTIN II
(6) Incentivize contractor work progress with a lane-rental approach	▪ Mainly applicable to highly urbanized projects. Rental rates are critical ▪ It is difficult to define standard baseline for comparison ▪ Big job issue only ▪ Certain large projects only ▪ Safety! ▪ Good for traffic, but not as a construction expedient ▪ Excellent to use on very special projects, but is time consuming to come up with the numbers and schedule	DALLAS

	▪ Need some constraints as to when contractors cannot rent a lane ▪ May not result in early project completion, but should minimize traffic impact ▪ Helps peak-hour impact to traffic and safety ▪ Beginning to use by TxDOT (Dallas, Houston, San Antonio) ▪ Not much value for rural districts – urban – probably works ▪ Using lane assessment fees rather than lane rental – possible liability issues	AUSTIN
	▪ Houston District uses this a lot ▪ Selective (high volume) projects ▪ New idea but needs to be taught state wide ▪ Lane rental very important to do very good cost estimates /lane / time ▪ Should reduce lane closure time	AUSTIN II
(7) Exploit e-commerce systems for procurement, employment, etc.	▪ Impact on some contractors may be unacceptable politically ▪ TxDOT is not set up for exploiting this ▪ Cost will be very high ▪ TxDOT already implementing ▪ It will take some time before we see benefits of the e-commerce	DALLAS
	▪ Requires additional manpower ▪ Need additional resources that are difficult to come by	AUSTIN
	▪ Site manager is trying to head this direction ▪ Already have Site Manager implemented ▪ What is Site Manage?	AUSTIN II
(8) Tools and best practices for implementing multiple work shifts and/or night work	▪ At present staffing levels additional shifts would be extremely difficult for TxDOT to cover ▪ Mandatory in tunneling jobs! Lighting is an issue as well as urban code enforcement concerning work hours near residence ▪ 2nd & 3rd shifts increase liability and reduce productivity. Project managers "B" term. ▪ Safety issues ▪ Balance risks with gains ▪ Great in urban areas. Safety becomes an issue ▪ Need to provide shift differential pay for employees ▪ Presents staffing problems for inspection in smaller offices ▪ Would aid meeting environmental concerns ▪ Good when we need to do night work – prefer not to do at all	DALLAS
	▪ Allows long work interval for contractors ▪ Not to a rural district – applicable to urban ▪ May not lead to earlier project completion due to limiting work hours ▪ Already utilizing extensively (20 hr days and night work)	AUSTIN
	▪ Only on selected projects ▪ Night work is slower + more dangerous. Finite # of workers available, worker burnout is possible ▪ More personnel ▪ Manpower, you have to have enough inspectors to go 24 hrs ▪ Having TxDOT inspector crews available to handle this will be a problem ▪ Hard to manage night (24 hr) inspection ▪ Tremendous demand for inspection ▪ Reduces traffic impact, less productivity ▪ Being done ▪ Lack of personnel is a problem. Disrupts family life. Who wants the night shift?	AUSTIN II
(9) Increase amount of liquidated damages and routinely enforce	▪ Term as disincentive, not liquidated damage ▪ Disincentives are not as effective as incentives ▪ Need administration to give support to local decisions ▪ High L.D. gets everyone's attention ▪ TxDOT already does it ▪ Contractor claims increase LDs ▪ Contractors will build into their bid LD dollars ▪ Proper documentation is required throughout construction	DALLAS
	▪ Requires a lot of documentation to resolve issues ▪ May work best if early completion incentives are used ▪ Contractor may add to cost of project if he knows he will be late ▪ For public – these projects finish quicker, others may fall behind because of shift of manpower ▪ Increases construction cost ▪ May be hard to collect – need for extensive documentation	AUSTIN

	▪ Need to have balance bonus/penalties, not just penalties ▪ Change law & work w/FHWA liquidated damages are direct cost. Incentive/disincentive is what you meant based on road user cost. An easier or generic way to figure road user cost is needed. ▪ AGC will fight this, add incentive to make more effective ▪ If you do a good job estimating workdays most contractors should be able to complete on time. ▪ Need to word smith actually incentive/disincentives ▪ AGC will be opposed to this w/o great justification ▪ Enforcement is the problem ▪ Best tool currently available ▪ Working days are always going to be an issue if the contractor goes into liquidated damages. A lot of potential arguments	AUSTIN II
(10) Warranty Performance Bidding	▪ May increase time between maintenance cycles, but has not worked well in TxDOT thus far ▪ Based on past experience, this will be very hard to implement ▪ Who can bond eliminates competitive bidding ▪ TxDOT needs warranty work but it will not help to expedite work ▪ Legal issues – contractor solvency ▪ Need to resolve question of design v. construction error ▪ Will help put burden for quality construction on contractor. Good contractor will thrive ▪ Costs too much ▪ May improve product quality and reduce productivity ▪ Would be great for maintenance type of work ▪ Very hard to implement. It will decrease competitive bidding ▪ State is one of few entities that doesn't require warranty ▪ Costs would skyrocket since contractor would assume he would have to do work later for "free" ▪ Yes	DALLAS
	▪ Warranty requirements need to clearly stated ▪ Stiff opposition from contractors to this approach ▪ Developing performance specs is very difficult ▪ Very difficult to administer to be effective and efficient ▪ Good idea – encourages better product ▪ Opportunity for increased litigation ▪ Great idea but would be difficult to enforce	AUSTIN
	▪ Have tried to implement warranty with little success ▪ Would be good to have but may have little impact on speed ▪ Discussions with AGC tell me they are opposed to this ▪ This needs to be phased in due to lack of in house FTE and expertise ▪ Most states already have this ▪ AGC opposition ▪ Requires legislative changes	AUSTIN II
(11) "No Excuse" incentives	▪ Who decides what is "realistic"? ▪ If the incentive amount is appropriate it can yield excellent results ▪ Incentives will expedite work but can't be used on all projects ▪ Effectiveness would depend on contractor ▪ Disputes over ▪ Could cost more at bid ▪ Needs to be CD project ▪ Not for all projects, but good for high profile, extremely time critical projects ▪ This is always implemented in NTTA projects ▪ Would produce positive public acceptance ▪ Change orders can be the downfall of this	DALLAS
	▪ Need to have clear ROW and utilities ▪ TxDOT's schedule development needs to be improved ▪ Valid excuses do regularly occur now. Could not afford this ▪ Could still see claim resulting from utility etc. ▪ Increase cost. May not be fair ▪ Incentive is a disincentive when the contractor bids incentive time into contract. ▪ A lot of "gray" areas may make "no excuses" impossible	AUSTIN
	▪ Other variations may work also ▪ Sometimes this causes cost of project to go up ▪ AGC opposition to this is great ▪ How does contractor bid this? ▪ Need good initial schedule	AUSTIN II

(12) Change management practices	▪ New rules concerning PE requirements may prevent this from taking hold ▪ Not necessary with "no excuse" incentives ▪ Partnering ▪ This would require change in attitude. "I have always done it this way" ▪ Yes	DALLAS
	▪ Vague! What the Area Engineer does now ▪ Problem with turnover rate with employers ▪ Partnering?	AUSTIN
	▪ Already doing some of this ▪ Hard to change ways of doing business	AUSTIN II
(13) Project-level Dispute Review Board (DRB)	▪ Non-binding aspect will make this all but useless with current AGC posture. Will almost always favor contractor ▪ Certain large projects ▪ Belt-method is "next-level" dispute resolution ▪ For mega projects > $50 million only ▪ Highly recommended, can be part of partnering ▪ Would help keep projects moving and eliminate late chains ▪ Would like to use this method	DALLAS
	▪ Sounds like partnering ▪ A good selection process has to be developed ▪ May improve resolution of disputes, but not necessarily accelerate project completion ▪ A good selection process has to be developed ▪ Get all parties involved earlier ▪ Used some now would need to hire additional employers	AUSTIN
	▪ Only good on very large and lengthy projects ▪ Might work on very large projects ▪ Lack of experience Engineers available within TxDOT to resolve issues at project level. ▪ After the fact, does not prevent delays ▪ Requires extensive contractor and TxDOT employees training and experience	AUSTIN II
(14) Alternative dispute resolution methods	▪ Favors contractor! ▪ How many jobs go to court? Low percentage ▪ How does this accelerate construction? ▪ TxDOT has a proven system that has worked well ▪ Can already be done very informally ▪ Can be implemented through partnering by the partnering consulting team. The team can meet once a month to discuss any problems & potential construction claims ▪ Yes	DALLAS
	▪ Dispute process working, in place now. Works good ▪ May improve resolution of disputes, but not necessarily accelerate proj. completion ▪ Being done now informally with construction division – Guide on how to handle ▪ I believe this would only require a change in our rules associated with the claims procedures. Not sure if this would require legislative changes	AUSTIN
	▪ Not much impact for expediting ▪ You will make it too easy to go to dispute instead of resolving in the field	AUSTIN II

IV. CONSTRUCTION

Method	Comments	Workshop
(1) Exploit web-based team collaboration system for project communications	▪ Sounds interesting ▪ TxDOT very proprietary about the project info. Difficult to pick right product ▪ Cost! Training would prohibit, exception mega projects ▪ TxDOT is a long way from being ready for this ▪ This could be really helpful to respond quickly to RFI ▪ Some TxDOT field personnel do not have computers or access to the web	DALLAS
	▪ Site Manager will help with this ▪ Limitations due to legislature mandating funds available for info recourses. Buy-in from users will be essential, but can be difficult to attain ▪ Helps communication, may not accelerate construction ▪ Not sure how this would expedite schedule. Site manager for construction projects forthcoming (Active in some areas) ▪ M-like laptops in field may not be practical ▪ Very expensive to implement, a lot of additional training ▪ Resource availability	AUSTIN
	▪ Personnel become computer geeks. ISD controls ▪ Bridge Division is looking at electronic shops drawing submittals (security issues) ▪ ISD controls this too much ▪ Requires standardize computer software ▪ In house security management ▪ Being done by the TTA on SH-130 ▪ Speeds communication but won't speed construction	AUSTIN II
(2) Encourage use of automated construction technologies	▪ 3D design is very time consuming and costly. Mostly being done now by heavy civil contractors ▪ Might be too dependent on the system? Quality of work? ▪ Some already being implemented ▪ More competitive as costs come down ▪ Automation filed changes too quickly ▪ Usually contractor driven, but could be special ▪ I encourage the use of technology	DALLAS
	▪ .Financial constraints within Dept. ▪ Cost will be high to contractor, skilled workers needed ▪ This is good when it works, but when it does not you are completely shut down ▪ For contractors ▪ Cost may be prohibitive ▪ Would require a paradigm shift for most of our contractors ▪ Very expensive to implement, more training needed ▪ Limited technical workforce ▪ Cost a factor	AUSTIN
	▪ Required in specs? Let contractors innovate ▪ This should be the contractor's responsibility ▪ Might work on larger projects for high positive impact ▪ Accuracy of these technologies have busted on some TxDOT projects ▪ Basically up to the contractor ▪ Changes may be more time consuming to implement ▪ We have a contractor using GPS for location and elevation, there is a big learning curve	AUSTIN II
(3) Employ methods for continuous work zones	▪ Must weigh impact to traffic vs. benefit. Includes full-width closures ▪ Higher costs ▪ Still controlled by size of contractor and logical access for businesses ▪ In construction, exact measurements can be much to determine feasibility of this ▪ Design – dependent. Often controlled by ROW ▪ Not practical in most metro and urban projects ▪ May cause complaints, may be in conflict with SW3P, NPDES rules ▪ Most of projects have some limitation on optimizing size of work zone ▪ Designers should be doing this	DALLAS
	▪ Try to do it now, access is a problem ▪ Increase traffic congestion is the opposite of what we are trying to do ▪ Must consider safety ▪ Highly project specific ▪ Increase traffic congestion problems & complaints ▪ Get more uniformity and less time. Must be careful in choosing areas used ▪ Phased reconstruction limits/drives possibilities	AUSTIN
	▪ Already available ▪ Impact to traffic can be tremendous ▪ We try to do this now. Site specific	AUSTIN II

(4) Use of windowed milestones	▪ Can actually protect the owner for incentive issues when contractor claims that he "owns" all float ▪ Could expedite construction but may cause administration problems ▪ Can be very effective ▪ How defined? Contractor agrees? ▪ Have been used with success in Dallas ▪ Needs clarification on "lowers project,s cost"	DALLAS
	▪ Difficult enough without floating milestones. May increase claims ▪ Need to watch impacts to incentive/disincentive clauses	AUSTIN
	▪ Flexible start day so contractor finishes other jobs before start of project ▪ Too subjective	AUSTIN II
(5) Schedule Calendar Day projects	▪ Have to be sensitive to public concerns, i.e. church, night work, etc. ▪ Standard practice at NTTA ▪ Good method, very common ▪ Never go above 6 days, always allow 1 day for rest/catch-up ▪ Common practice ▪ Good for projects with significant duration > 10 months ▪ NTTA does that all the time ▪ Already doing	DALLAS
	▪ Doing now ▪ Need more effort in design – setting up project work time ▪ Contractors may need to work in bad weather to get job done, lowers quality ▪ Doing now ▪ Increased risk to contractor ▪ Already in place working well, may require more staff	AUSTIN
	▪ No arguments with contractor on work day; have weather days ▪ More consistent project administration ▪ We should be able to pick which jobs we want calendar days on ▪ We use this almost exclusively now ▪ Helps define end date of project better ▪ The only benefit I see to this is that you do not argue about time changes	AUSTIN II
(6) Crash schedule with use of the Linear Schedule Method	▪ Would have to include a provision to require the contractor to use it ▪ Not applicable to larger or complex projects ▪ Lots of work, we don't currently have the know-how	DALLAS
	▪ Utility and ROW impacts limit progress some times ▪ TxDOT would need to do research on accepted production rates ▪ Resources	AUSTIN
	▪ Or use Primavera ▪ On large projects some form of further analysis may be desirable	AUSTIN II
(7) Shorten construction time by full closure instead of partial closure of roadway	▪ Not available on all projects ▪ If it is possible it saves a lot of time. Doesn't have to be the whole road, can be cross streets, bridges ▪ Hard to convince public ▪ Less likely to occur in urban area, even with alternative routes. Requires a lot of coordination ▪ Public outcry ▪ Need to provide large penalty for not meeting time frame ▪ May require significant PR work ▪ Very hard to implement full closure on arterial highway or tollway, but it could be the most viable option to shorten construction time if an alternative route is determined to be convenient ▪ Construction dream, I have seen this on an interstate in St. Louis	DALLAS
	▪ Needs public buy-in before. Requires a good early public awareness program ▪ Will work with few TxDOT projects ▪ Only on low volume roads with a good close detour route acceptable to the public ▪ Need careful consideration to traffic & people impacts ▪ Very few projects that could be applied ▪ Works well to expedite projects in the proper area ▪ Alternative route available? type of projects ▪ Excellent process	AUSTIN
	▪ Strong AGC support for this. Public support would be interesting ▪ Limited number of projects allow this ▪ Can greatly reduce time ▪ Politics make this hard to do on the projects that would benefit the most ▪ MY OPINION: the best way to expedite a project is to squeeze the schedule and be prepared to pay for it. The contractor will innovate as necessary to meet the schedule.	AUSTIN II

V. OTHER/MULTIPLE

Method	Comments	Workshop
(1) Measure and track project schedule performance; use as basis for employee reward program as well as input to project duration database	▪ Could lead to poorer quality work ▪ Not likely ▪ Leaves many other players out of any incentives ▪ This will be difficult to do and not well received ▪ Implement this ▪ Won't work but nice idea	DALLAS
	▪ Good for Company, but may not directly impact project ▪ Too much conflict could arise ▪ Poor quality	AUSTIN
	▪ TxDOT personnel need training in this	AUSTIN II
(2) Track duration & productivity effects associated with different technologies	▪ No immediate impact. Develops good database for future application	DALLAS
	▪ Will help to transfer information to others ▪ Used some now, will need to develop and maintain	AUSTIN
	▪ May need more personnel to track more items ▪ Productivity rate knowledge is critical. TxDOT must get better at this ▪ Good data needs to be shared ▪ Very time consuming. Too hard to get information to everyone that needs it. Someone has to maintain the database	AUSTIN II
(3) Use pilot demonstration projects for introducing new methods for expediting schedules	▪ Could develop reward system for successful new innovations ▪ Needs good contractor to be good evaluation ▪ Maturity, testing of concrete is good example of this in Dallas ▪ Could try in phases rather than in a whole ▪ Indefinite outcome ▪ Has been done successfully in the Dallas District ▪ I recommend it highly but not sure about doability with TxDOT ▪ This is good	DALLAS
	▪ Promotes research and new ideas ▪ Good to show an effort is being made to expedite ▪ Not for expediting ▪ Good methods have resulted, e.g. fast rack concrete	AUSTIN
	▪ Pilot projects are great but getting the results out to everyone does not happen ▪ Results may lead to improved methods. However pilot project may be slow ▪ Hard to get information around the state. May only work in certain regions	AUSTIN II
(4) Create a "smart" database of activity production rates	▪ Have to guard against user dependence on the database vs. common sense ▪ Does not change that much. Labor and materials control most of the time issues anyway ▪ Productivity varies too much by region, climate, personnel resources and materials ▪ Time consuming & more training is required ▪ No direct expedition, future gains ▪ Most projects are different in nature/be hard to have good info ▪ This type of data already exists; e.g. "Means heavy construction data" Probably could use some specializing to highway construction ▪ Needs frequent maintenance ▪ Could possibly provide a large saving to TxDOT	DALLAS
	▪ Will help in providing designers information for time, requires additional FTEs ▪ May lead to more accurate schedule, but not necessarily faster ▪ Would be very useful in scheduling. Need to differentiate by project type ▪ Reliability of data ▪ Hard to develop and maintain	AUSTIN
	▪ Contractor item ▪ Everyone benefits; good way to document. Basis of estimate ▪ Need more people. Someone has to maintain the database	AUSTIN II
(5) Study optimal approaches to crew shifts & scheduling	▪ Contractor issue, not TxDOT's ▪ More applicable to contractor organizations ▪ Staff requirements by TxDOT would be difficult to meet ▪ Best for contractor ▪ Takes more people, controlled by legislature ▪ If properly used, can improve ▪ This would be an issue the contractor would use ▪ Better contractors already "know" and utilize this info ▪ Not within our realm ▪ This would be more for contractor benefit since he would use	DALLAS
	▪ Will require contractor buy in ▪ The more equipment and manpower used will expedite ▪ Contractors may resist ▪ Already in use, 2-10hr shift for example	AUSTIN

	▪ Contractor issue ▪ More of an AGC/contractor issue ▪ Let AGC study this ▪ TxDOT knowledge of crew efficiencies is limited. Could improve a lot	AUSTIN II
(6) Train selected field personnel in scheduling methods and schedule claims	▪ Don't train all field personnel just a select few ▪ May not necessarily expedite actual construction ▪ Better understanding of tools. Depends on willingness to learn ▪ Even though they are trained, they wouldn't have to manage it would make them aware. ▪ Many competent field personnel can't handle this ▪ Our engineers don't get it. Doubt that inspectors will ▪ Most of field personnel are trained in scheduling ▪ Knowledge by all personnel would be good	DALLAS
	▪ Scheduling good, but must have reliable assumptions ▪ Hard to implement, already short handed in filed – lots of training ▪ Gets away from standardized approaches	AUSTIN
	▪ Contractor issue. Train only a few ▪ CPM takes some time to become proficient ▪ Currently done ▪ Some of the software is very complex. Must continue to use it to remain proficient	AUSTIN II
(7) Create a lessons-learned database on ways to expedite schedules	▪ Varies very much with contractor ▪ I highly recommend it. I started lessons-learned recently in NTTA. It will be a good idea if lessons-learned database can be shared with TxDOT and other public agencies, such as NTTA	DALLAS
	▪ How do you make the contractors read it? ▪ Good guidelines for young staff to utilize, will need to be maintained	AUSTIN
	▪ May be misleading ▪ Need more people to do it. I don't think it will be used	AUSTIN II
(8) Incentive-based pay for retaining key TxDOT personnel	▪ Legislative changes will be required. This would be a huge success though ▪ Higher pay will keep quality workers. Best way to help keep personnel ▪ Stop giving most of the work to consultants that take TxDOT personnel ▪ May not assist with expedition of construction activities ▪ Very important to maintain personnel with experience ▪ Prefer better, more comprehensive training & development ▪ Requires legislative approval ▪ Unfairness in how it's administered ▪ Who are key personnel? Projects managers? Inspectors? Pencil pushers? ▪ Sounds good	DALLAS
	▪ Keeping good, experienced project personnel can definitely expedite projects ▪ Budget constraints could impact quality too. Yeah, sure. I work for TxDOT ▪ High impact, providing incentive is fairly implemented ▪ Would need additional funding	AUSTIN
	▪ Why not just pay personnel? Favoritism is very high which causes dissatisfaction ▪ Pay is not the problem with retention ▪ Show me the $$ ▪ Needs $ allocated. Change policies ▪ Legislative ▪ This is real hard to do. We would need a commitment from the legislature, and we aren't going to get that	AUSTIN II