Accelerated Construction Guidelines

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Introduction

The time required for the delivery of a typical major highway project is in the range of 8 to 15 years from inception to completion of construction. Planning, programming, financing, scoping, development including environmental clearances and preliminary and final design, bidding/letting, and construction are all key parts of the delivery process. A reduction in project delivery time can result in significant cost savings for the public agency, roadway users, and non-users such as adjacent businesses. Savings to the public agency and the public during pre-construction project activities can range from $100,000 to $500,000 per month of time saved, regardless of whether the savings is associated with the planning, financing, scoping, development, or design phases (1).

The costs of delays during construction are more costly than delays associated with other elements of the project delivery process. Traffic delays due to construction operations are extremely costly on high traffic volume facilities. These user costs can be in excess of the actual construction cost of the project. In addition, adjacent business impacts, a form of non-user costs, can also be significant and should be considered in the economic impact analysis.

The combination of these economic impacts, which are felt directly by the public agency and society, and the realization that the construction zone is the visible and perhaps only connection between the driving public and the delivery of the roadway for public use, necessitate that additional attention be directed to accelerated construction on selected highway projects (2).

Since construction is in view of the public on a daily basis, it is important that we complete projects on time. It is also important that we tell the public the duration of the project and then complete the project on time. Public perception can become political reality. Timeliness of construction is very important to “traditional” as well as “accelerated” construction projects.

Definition of Accelerated Construction

For the purposes of discussion, construction is a broadly defined concept that encompasses capacity improvement, reconstruction, rehabilitation, major maintenance, and minor maintenance. Accelerated construction entails all the aspects of getting a project built rapidly including project selection, planning, contracting, design, traffic control, construction methods, publicity, and contingencies.

While acceleration could result in 10 to 20% time savings, ultimately the goal should be to reduce project delivery time by 20 to 50%. The barriers as well as the opportunities associated with accelerated construction operations include materials availability and delivery, equipment capabilities and limitations, quality control/quality assurance (QC/QA) procedures, workforce availability, economic incentives, public information, and safety considerations among others.

In order to obtain a substantial time savings, a multi-disciplinary approach including all involved parties will be needed.

Public agencies need to be open to new approaches and allowing more innovation by contractors to deliver projects in short periods of time. Contractors need opportunity to provide input to design and delivering the final product at a high level of quality and safety. Material suppliers need to ensure adequate quantities of materials and timely delivery to the job site. Equipment manufacturers need to develop new methods for delivering, placing, and compacting paving materials. Workforce specialists need to provide training and incentives for employees who may have to work longer hours and more shifts in compressed time schedules. Financial institutions need to provide adequate funding at all stages of construction and to recognize the potential cost savings of innovations. Public information personnel need to provide effective and timely messages concerning road or lane closures and to encourage motorists to avoid the construction areas. Finally, the public must understand the need for infrastructure improvement and the need to avoid or carefully negotiate work zones.

Accelerated Construction in Texas

In 2015, the State Demographer of Texas estimated that the population of the state could double by the year 2050. This population growth is predicted to take place in and around the metropolitan areas, the I-35 corridor, and along the border with Mexico in El Paso and South Texas (Figure 1). The areas of Texas identified above currently have congested roadways and the congestion will get worse with growth in these areas as well as many additional areas in the state as shown on the figure.

Accelerated construction, if properly developed and deployed within the Texas Department of Transportation (TxDOT), can help reduce the time for construction on selected key highway sections in the ever expanding congested areas of Texas. Reduced construction time will greatly reduce highway user and non-user costs and the saving to society will be large. Note that accelerated construction is not intended for use on all projects in congested work zones, but only selected projects with favorable economics that include both user and non-user costs.

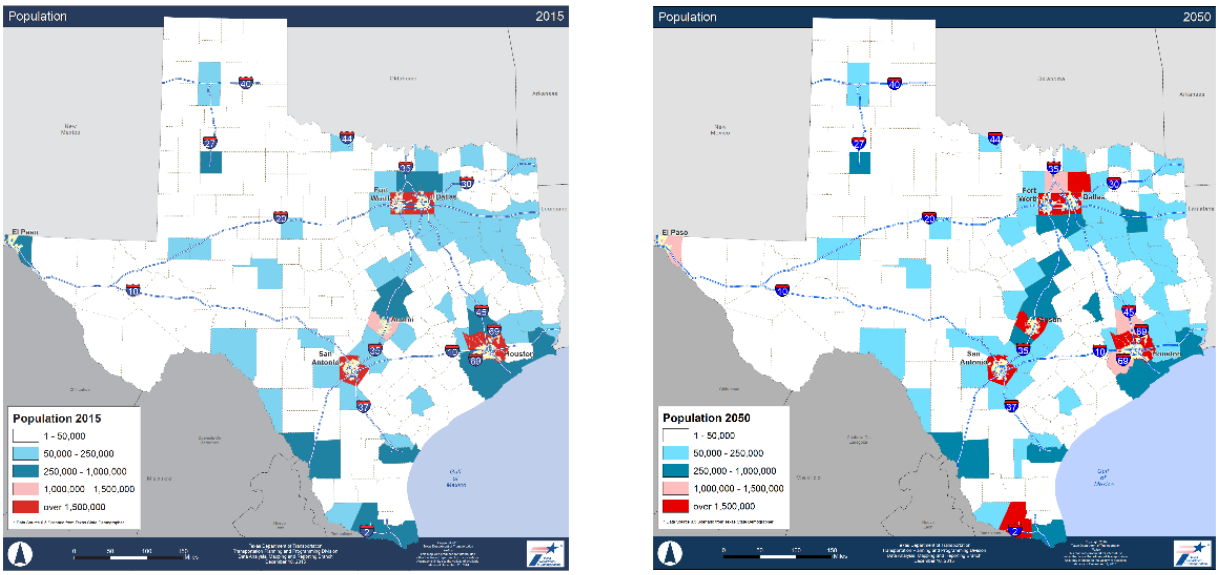

Figure 1. Texas Population Growth by Area from 2015–2050

On July 14, 1998, Mr. Wes Heald (then Executive Director of TxDOT) recognized that the public, legislature, and Commission desired reduced construction time and issued a memorandum to implement strategies to address the request (3). This memorandum was issued in partial response to Senate Bill 370 passed by the 75th Legislative Session to include the administrative and user cost into liquidated damage considerations. The memorandum indicated that user costs should be considered in determining liquidated damage considerations, and incentives should be used with disincentives when user costs are considered.

Mr. Amadeo Saenz (then Assistant Executive Director of Engineering Operations, TxDOT) issued a memorandum in November of 2002 to further extend the use of accelerated construction concept on Texas highways to areas where businesses and traffic flow will be significantly impacted (4). This memo cites the Transportation Working Group Report of August 22, 2001 (Texas Transportation Partnerships…Connecting You to the World), which established a goal of improved project delivery from conception to ribbon cutting, on average, by 15 percent within 5 years. This goal was established to address the cost of disruption to traffic flow.

Saenz's memorandum, to be implemented in the May 2002 letting, provided general guidance on accelerated construction relative to the following key items.

- Calendar Day Definition for Working Day
- Incentive Using Contract Administrative Cost
- Milestones with Incentives/Disincentives
- Substantial Completion Incentives/Disincentives
- Lane Rental Disincentive
- A + B Provisions
- Contractor Lead Time for Mobilization
- Engagement of Local Communities
- Public Information Sign Management
- Increase Use of Detailed Project Scheduling Tools

In 2003 TxDOT issued "Accelerated Construction Strategies Guidelines" (5). This guide provided both general and specific information for District use when planning an accelerated construction project. This information is incorporated in the discussion provided below.

Mr. Saenz provided additional guidance in a memorandum dated July 22, 2004, indicating that "accelerated completion should be only considered for very high volume locations, projects that have a significant impact on safety or businesses, or other specific project-related reasons" (6).

In 2009, an American Association of State Highway and Transportation Officials (AASHTO) scan toured states to assess the current status of accelerated construction practices in the United States (7). This report indicated two types of accelerated construction projects.

- Emergency
- Planned

The report also contained key items that are associated with successful accelerated construction as shown below.

- People critical-align goals, delegate to the lowest level, timely decisions
- Materials availability and logistics
- Detailed execution of plan
- Contracting strategies
- New business model to serve public

TxDOT, the Associated General Contractors (AGC) of Texas and the Texas A&M Transportation Institute (TTI) conducted a workshop on Accelerated Construction on July 25–26, 2016. The objectives of the workshop were to identify methodologies to accelerate construction and to identify gaps in information needed to successfully implement an accelerated construction program. Presentations from TxDOT, AGC, and the academic community provided background to participants followed by workshop breakout groups to examine details associated with specific accelerated construction projects (8).

In March of 2017, TxDOT and the AGC of Texas published a "Field Guide to Successful Project Delivery" (9). This document was prepared in part as a response to the need of TxDOT and AGC to deliver an increased number of highway projects that will be let and constructed over the next 10 years. Increased funding has been provided by the Texas Legislature and the voters of Texas to improve the State's roadway network. While this document is directed toward identifying and providing guidance to complete the typical design-bid-build format of contracting without acceleration, it contains numerous guides that are directly applicable to accelerated construction projects. Contents of that document as well as other sources are incorporated into this document.

Summary

Accelerated construction is directed toward minimizing construction zone impacts to the driving public. When the goals of accelerated construction are aligned among the DOT, contactor, and public, and a partnering atmosphere is created, construction projects can be delivered to the public with time savings on the order of 20 to 50 percent.

Accelerated construction projects are useful to address special needs projects associated with "emergency projects" and "planned projects." The primary factors associated with successful accelerated construction projects based on the literature and interviews with state DOTs include partnerships and collaboration between

the DOT and the contractor as well as a supportive design process (7). Procurement, contract provisions, and construction management methods need to be aligned with the goals of the customer, owner, and contractor. Teams of DOT and contractor personnel need to be formed early in the project development, design, and construction process associated with accelerated construction delivery.

Background

The literature provides general and specific guidance for accelerated construction based on the use of this technique in several states. References of interest include those developed by the National Cooperative Highway Research Program (NCHRP) (7, 10–14), AASHTO and the Federal Highway Administration (FHWA) (15–18). The NCHRP Report on "Best Practices in Accelerated Construction Techniques" (7) provides one of the best overall summaries. Users of this "TxDOT Guide" are encouraged to review the NCHRP document for details that are summarized below. In addition, this document contains several case histories for both bridges and roadways. Key items for "emergency" and "planned" accelerated construction projects are provided below.

Emergency Accelerated Construction

Emergency contracts are used to quickly repair bridges or highways on high traffic volume roadways. Emergency projects usually require accelerated construction contracting methods and techniques. Emergencies are typically associated with major weather related events and catastrophic traffic impacts on bridges, such as overturned and burned fuel trucks and bridge hits by vehicles that exceed height restrictions. Key items for successful accelerated construction on these types of projects include selecting contractors with the following characteristics.

- Resources (equipment and workforce) to mobilize and start immediately
- Technical capability
- Financial capacity
- Relationships with material suppliers and fabricators to speed purchase and delivery of these items
- Ability to facilitate communications among suppliers, fabricators, public agency, contractor personnel, and the public

Designers on these types of projects typically use very conservative designs, as project parameters will likely change during construction. Flexible designs are important. Consideration should be given to materials availability as well as the logistics of moving materials to and from the job site. Design experts and other technical experts must be available on site or readily available. Decisions need to be made as much as possible at the project site at the lowest possible level of the organizations.

Planned Accelerated Construction

Planned project accelerated construction should evolve from a statewide effort. A process should be developed to identify key individual projects for accelerated construction. Bridge construction is the most common form of project-level accelerated construction at the present time. Key recommendations that should be considered by DOTs when developing a program level and project selection approach include the following (7).

- Identification of an agency champion
- Development of an agency special support team to help address issues at the project level
- Development of a vision with goals and objectives

- Development of policies and procedures
- Improving the partnering process
- Identifying alternative project contracting methods
- Stimulating a cultural change
- Trying new, viable technologies
- Considering total costs including management, construction, road user, non-user, and other societal costs including safety and environmental features
- Engaging the construction and materials industries
- Developing and using performance measurements
- Learning from the past
- Continually improving the process

Accelerated construction practices for both “emergency” and “planned” projects have been used by several states on a significant number of projects. Adoption of accelerated construction practices are expected to continue in the future in a number of states including Texas.

Guidelines for Texas Projects

Guidelines for TxDOT District use when considering accelerated construction practices on projects are provided below. Information on project planning and selection, designing, contracting, and construction practices is included. These guidelines will change in the short term and long term. The guidelines will be modified based on information gained from constructing projects in Texas as well as other states. Table 1 provides a "Checklist" of key items that should be considered when developing an Accelerated Construction project.

Table: Accelerated Construction Checklist

Project Selection
▪ Controlled access highways with lane closures
▪ Bridge closure
▪ Road closure
▪ Added capacity projects
▪ Access to nearby schools or emergency service facilities
▪ Affect adjacent businesses
▪ Adding lanes to facilities
▪ Roadway widening
▪ Intersections
▪ Small cities
▪ Urban streets
▪ Ramps
Strategies for Traffic Control
▪ Construction phasing/staging
▪ Lane shifts or closures
▪ Two-way traffic on one side of divided highway
▪ Ramp closures/relocations
▪ Off-site detours/alternative routes
▪ Innovative construction techniques
▪ Full road closures
▪ One-lane two-way operations
▪ Reversible lanes
▪ Night/weekend work
▪ Business access improvements/coordination
▪ Accelerated construction strategies
Strategies for Transportation Operations
▪ Signal timing/coordination improvements
▪ Street/intersection improvements
▪ Turn/parking restrictions
▪ Truck lanes
▪ Ramp closures

- Coordination with adjacent construction
- Temporary or moveable traffic barriers
- Crash cushions
- Intrusion alarms
- Review by District Safety Review Team
- Safety award incentives
- Transportation management center
- Towing/service patrol
- Police presence/enforcement
- Speed trailers or fixed radar units
- Bus turnouts
- Truck/heavy vehicle restrictions
- Reversible lanes
- Railroad crossing controls
- Construction speed zone
- Shadow vehicles with truck mounted attenuators
- Temporary rumble strips
- Warning lights
- ITS for traffic monitoring/management
- Surveillance for incidents
- Incident/emergency response plan
- Local detour routes
- Traffic fines double

Strategies for Public Information

- Coordinate with District Public Information Officer
- Press releases/media alerts
- Public information centers
- Planned lane closure web site
- Coordination with schools, businesses
- Work zone education/safety campaigns
- Traffic radio
- Highway advisory radio
- Transportation Management Center
- Brochures/mailers
- Paid advertisement
- Telephone hotline
- Public meetings/hearings
- Coordination with emergency services
- Rideshare promotions
- Changeable/dynamic message signs
- Contracted public information services

▪ Social media
▪ Temporary motorist information signs
Economic Considerations
▪ Agency administrative costs
▪ Road user costs
▪ Non-user costs (adjacent businesses for example)
▪ Construction costs
▪ Premium for accelerated construction
▪ Contractor management costs
Major Risks
▪ Right-of-way acquisition
▪ Utility moves
▪ Environmental requirements
▪ Historic preservation
▪ Archaeologic
▪ Railroads
▪ Risk register or matrix
Contracting Methods
▪ Incentives/disincentives
▪ Incentive using administrative cost or daily road user costs and non-user costs
▪ Milestones with incentives/disincentives
▪ Substantial completion incentive/disincentive
▪ Lane rental disincentive
▪ Cost-Plus-Time bidding (A + B)
▪ No excuse incentive
▪ Design-build
▪ Calendar day definitions for working day
Design
▪ Minimize mobilization/demobilization
▪ Minimize materials logistics
▪ Minimize profile changes
▪ Design repeatable features
▪ Create workspace for contractor
▪ Contractor input in design process
▪ Bridge design accelerated construction approach
▪ Drainage design
▪ Pavement design and materials selection
▪ Roadside safety
▪ Traffic control and job sequencing
▪ Project duration

Contractor Selection
▪ Administrative prequalification
▪ Performance-based prequalification
▪ Project specific prequalification-special equipment, skill sets, etc.
Contractor Involvement
▪ Planning and design reviews
▪ AGC contact for contractors
▪ Partnering
▪ Workforce availability
Construction Considerations
▪ Safety
▪ Quality
▪ Timeliness
▪ Relationships
▪ Perception
▪ Activities prior to letting
▪ Post-letting activities
▪ Work plan and work sequence
▪ Workforce availability and skill sets
▪ Work space
▪ Materials storage and staging
▪ Equipment availability
▪ Information exchange

Project Selection and Planning

The TxDOT "Project Development Process" is described in reference 19. This manual should be consulted prior to the initiation of any project selection and planning process. The manual provides guidance on the following items.

- Planning and programming
- Preliminary design
- Environmental items
- Right-of-way and utilities
- Development of plans, specifications, and estimates
- Letting

Note that not all projects are suitable for accelerated construction.

General Guidelines

Project selection guides for accelerated construction according to the FHWA (20, 21) should be directed to those projects with the following characteristics.

- High traffic volumes generally found in urban areas
- Work that will complete a gap in the highway system
- Major reconstruction or rehabilitation on an existing facility that will severely disrupt traffic
- Major bridges out of service
- Lengthy detours

TxDOT guidelines for accelerated construction project selection were initially included on Attachment A to Form 1002, which was contained in TxDOT's "Accelerated Construction Strategies Guidelines" (5). Form A is no longer used by TxDOT; however, it did contain some specific guidelines worthy of consideration. These guides are shown below.

- Interstate or freeway project with lane closures during one or more phases of construction
- Bridge closure (either on the entire project or as a portion of a larger project)
- Road closure
- Added capacity projects
- Non-freeways with a high volume of traffic and lane closures during one or more phases of construction
- Provides access to a nearby school or emergency services (hospital, fire, etc.) or other major traffic generators
- Project affects access to adjacent businesses

TxDOT Form 2229 "Significant Project Procedures," which is part of the TxDOT's "2008 Guidelines for Traffic Safety in Work Zones," defines projects that are identified as "Significant Projects." Projects that meet the definition of "Significant Project: require a "Transportation Management Plan" (TMP) consisting of a temporary "Traffic Control Plan" (TCP) as well as "Transportation Operations" (TO) strategies and "Public Information" (PI) strategies. "Traffic Control Plan" strategies identified in the document include the following.

- Construction phasing/staging
- Lane shifts or closures
- Two-way traffic on one side of divided highway
- Ramp closures/relocations
- Work hour restrictions
- Off-site detours/alternative routes
- Innovative construction techniques (precast or rapid-cure materials)

- Full road closures
- One-lane two-way operations
- Reversible lanes
- Night/weekend work
- Business access improvements/coordination
- Accelerated construction strategies

The document also includes strategies for “Transportation Operations” and “Public Information” as outlined below. The strategies for “Transportation Operations” include the following.

- Signal timing/coordination improvements
- Street/intersection improvements
- Turn/parking restrictions
- Truck lanes
- Ramp closures
- Coordination with adjacent construction
- Temporary or moveable traffic barriers
- Crash cushions
- Intrusion alarms
- Review by District Safety Review Team
- Safety awards incentives
- Transportation management center
- Towing/service patrol
- Police presence/enforcement
- Speed trailers or fixed radar units
- Temporary signals (fixed or portable)
- Bus turnouts
- Truck/heavy vehicle restrictions
- Reversible lanes
- Railroad crossing controls
- Construction speed zone
- Shadow vehicles with truck mounted attenuators

- Temporary rumble strips
- Warning lights
- ITS for traffic monitoring/management
- Surveillance for incidents (video, loop detectors)
- Incident/emergency response plan
- Local detour routes
- Traffic fines double

Strategies for Public Information include the following.

- Coordinate with District PI officer
- Press releases/media alerts
- Public information centers
- Planned lane closure web site
- Coordination with schools, businesses
- Work zone education/safety campaigns
- Traffic radio
- Highway advisory radio (HAR)
- Transportation Management center (TMC)
- Brochures/mailers
- Paid advertisements
- Telephone hotline
- Public meetings/hearings
- Coordination with emergency services
- Rideshare promotions
- Changeable/dynamic message signs
- Contracted PI services
- Temporary motorist information signs

It is important to note that while many projects that meet these general criteria are located in urban high-traffic areas, projects in rural areas that have large economic impacts on smaller cities and on adjacent businesses should also be considered. In addition, major intersections in rural areas are also greatly impacted by construction time and should be considered for accelerated construction. Projects that are key transportation

routes for major industries such as those associated with energy development and production, agriculture, or mining are also candidates for accelerated construction.

Another category of project that should be considered for accelerated construction are two-lane roadways that need to be widened by adding lanes, shoulders, or a combination of lanes and shoulders. These roadways are often located near developing urban areas and/or in rural locations where major industries or businesses require improved transportation facilities. Since these projects must be constructed under traffic and often with limited right-of-way and little room for traffic control and the work zone, construction must be completed as soon as possible to avoid major disruption to traffic.

Economic Considerations

The use of accelerated construction may be justified in a number of ways in terms of economics. The economy of accelerated construction is a balance among various considerations including the following.

- Agency administrative costs
- Road user costs
- Non-user costs (adjacent businesses, for example)
- Construction costs
- Contractor management costs

Over-accelerating a project may be more expensive for the contractor, as a premium for materials, materials delivery, and overtime for both skilled and management employees are likely. Increased costs for over-accelerating a project may also be incurred by the public agency due to overtime for quality assurance personnel and management personnel. Likewise projects that have long project construction times will result in added costs in terms of user and non-user costs as well as lost opportunity for the contractor's workforce (skilled and management) and equipment. Public agency costs also increase due to administrative costs as well as the time value of money and inflation of material and labor costs.

While a number of economic models are available to help screen projects for possible acceleration of the construction operations, four are briefly discussed below and referenced. These economic screening tools are currently available. More detailed economic tools have been used in Texas associated with the accelerated construction of the Katy Freeway in the Houston area (IH-10) but are not in a convenient format for easy use.

TxDOT Road User Cost Calculator. TxDOT currently uses a calculation spreadsheet that considers inputs for project description, traffic, construction segments, and travel time costs for passenger cars and multi-unit trucks. This process provides information on road user costs for the project.

Preliminary Economic Screening Tool. (22, 23) This economic screening tool is intended to be used as an initial, generalized, economic evaluation of a possible accelerated construction project. This evaluation is the first step to justify the possibility of accelerating the timeline. The inputs needed are readily available from TxDOT data sources. Once the preliminary economic screen has been conducted on a project and a favorable

benefit-cost ratio is evident, the project should be subjected to a more in-depth technical and economic analysis.

The preliminary economic screening tool is a spreadsheet-based model that determines a cost-benefit ratio for a project using general inputs for the following.

- Project timing
- Description of work
- Geographic location
- Traffic data
- Construction costs
- Other costs

Original project start and end dates (project "timing") are considered in the analysis as well as the accelerated construction start and end dates. A calculation of costs savings associated with inflation is included in the analysis associated with the start and top dates.

The inputs for this analysis for "type of work" allows for capacity increase to be considered, and calculations are provided for the economic value for increased business efficiencies, business profit/income, and aggregate economic activity statewide.

Traffic inputs allow for the calculation of cost savings associated with vehicle operations, time savings, freight, and logistics as well as safety and environmental savings. Cost information for construction and other items such as insurance and interest are included as input or in the analysis

Total benefits associated with accelerated construction are provided as output. A benefit-cost ratio is also calculated. References 22 and 23 provide additional details.

Project-Level Economic Screening Tool. (24, 25) This screening tools allow the user to obtain a benefit-cost ratio on an individual project using more detailed inputs on project timing, traffic, and surrounding businesses. The benefit-cost compares the road user cost saving and the economic loss savings (non-user costs) to the additional cost of accelerating the construction. User inputs include: traffic data, geographic location, costs to accelerate construction, project timing, construction segments, and adjacent retail businesses. A more detailed analysis is provided for user and non-user costs in this project level screening tool as compared to the preliminary screening tool. Details for this methodology are available in references 18 and 19.

CA4PRS Economic Tool. (26) This economic analysis methodology was developed for the States of California, Florida, Minnesota, Texas, and Washington. The tool is used for evaluating construction alternatives and is described as a "scheduling and traffic analysis tool to select the most economical strategies for highway rehabilitation given various project constraints" (26). The model can be used to determine "what-if" scenarios

during the planning and design stage of a project. This tool requires detailed input information at the project level including scheduling and resource profiles.

Right-of-Way, Utilities, Environmental, Historic Preservation, Archaeologic, and Railroads

Right-of-way (ROW) and utility issues can be some of the most time-consuming problems on a construction project. ROW considerations need to be addressed early in the project planning stages. For example, on projects that add capacity (additional lanes or shoulders), additional ROW is often required. Purchase of ROW on one side of the existing roadway or on both sides of the existing roadway should be considered in regards to the number of purchases needed and the amount of space needed to facilitate construction. Purchase of ROW on only one side of the existing roadway will reduce the number of parcels to be purchase and will likely reduce agency time and effort. Sequencing of construction and traffic handling considerations should also be major inputs to considering the approach to ROW purchases.

Right-of-Way problems may also include having to provide fencing and construction of driveways, noise barriers, and/or drainage improvements. Allowing the contractor to address ROW work ahead of the accelerated portion of the construction will remove potential conflicts from the work zone, thus avoiding delays and confusion. All ROW issues should be solved prior to the initiation of the actual construction.

Utility work usually involves the relocation of utilities to avoid construction or operational problems. Working with the utility companies to complete this portion of the work ahead of the start of the main portion of the accelerated project construction will keep the schedule from being stalled at critical times. As much utility relocation as possible should be performed without interrupting traffic flow and performed to allow safe and efficient movement of traffic in the work zone.

The use of a Utility Coordinator should be considered. The coordinator is typically a subcontractor to the contractor who works with the utilities to complete relocation ahead of the main construction. A utility coordinator with the public agency may also be needed on large, complex project involving multiple utilities and relocations.

Environmental permitting is also a critical element that must be addressed in the planning process. Accelerated construction projects should be free of permitting concerns and future legal difficulties associated with permitting.

Historic preservation and archaeology-related project impacts should be addressed early in the planning process and should be free of concerns as much as possible prior to initiation of construction and traffic disruption.

When *railroad* right-of-way access is required on a project, considerable time and effort will be needed to address issues imposed by railroads. The project schedule should consider the additional time required for coordinating work with railroads and the construction delays that may be associated with train movements.

Risk Assessment

Projects slated for accelerated construction must be identified during the planning phase in order to take full advantage of the time saving opportunities. This includes identification of obstacles and opportunities as well as developing strategies to deal with perceived obstacles. The use of risk assessment is a tool that can be used to identify potential problems as well as to provide an evaluation of the magnitude of the impacts of the various factors identified. This tool can be used for preliminary project planning as well as for scheduling and planning purposes during the construction operations.

Risk assessment information can be fed into a risk register that can be used to track the potential problems and reassess threats at various times during the construction of the project. Treatments for the various problems are identified to help develop possible contingencies in a risk management plan that also contains implementation strategies, contingency evaluations, and revision at various time intervals within the project. This detailed planning is justified in high-profile construction projects where the risk of project delays presents agencies with potentially enormous road user costs due to delays and contractors are faced with substantial rewards or penalties based on their ability to complete the project on time according to the project time frame.

Public Information

Involving the public in accelerated construction projects is extremely important. The public should be informed that accelerated construction is being considered as part of the delivery of the project. Public input on accelerated construction alternatives, involving the public in the decision making process, and providing information of the pluses and minuses of the alternatives relative to cost, time, and safety are important considerations. For example, alternative A may have more short and severe inconvenience than alternative B, which will be longer term and not as severe (weekend closures versus night time construction over an extended period of time).

Public information prior to the start of the project and during the project development will likely develop the public's tolerance for the short time discomfort for the longer term gain (give me 8 weekends and I will give you 30 years). Along with the announcement of the roadwork schedules, alternate routes, public transportation options, and other information should be passed along to the road users and affected businesses and residential areas. It is also beneficial to define the amount of delays that can be expected. Public information should be delivered early and often during the process.

Other Considerations

In addition to the economic justification, in certain instances the need to minimize exposures to roadway hazards and inconvenience in rural areas may dictate the need to accelerate roadway construction. For instance, reconstruction of a two-lane road with minimal shoulders in the energy sector may require the maintenance of one lane of traffic with a pilot car using a conventional construction approach. However, because of only being able to work on one-half the road at a time, having to work under traffic, and having frequent mobilization/demobilization, it may actually be faster to close the whole roadway and allow the contractor to work continuously to get the project completed. While the travelling public loses use of the road during certain periods of the construction and a lengthy detour may be needed, the actual inconvenience may

be reduced. Also, the construction personnel do not have to be concerned with intrusions into the work zone, and the chances for head-on collisions during pilot car movements is eliminated.

Accelerated construction also presents an opportunity to minimize impact on adjacent businesses. When conventional construction is performed on roads and streets where businesses are located, there is a need to provide temporary cross-overs to allow customers access. These temporary cross-overs may be problematic both operationally and in terms of safety. Construction equipment must start and stop for traffic, there is a need to provide extra traffic control personnel, and traffic marking materials can result in built in pavement roughness.

Contracting Methods

Accelerated construction projects often use alternative construction methods to both speed construction and to ensure that significant contractor input is provided in the design and construction phases. Several different alternative construction methods are available for use on accelerated construction projects. Selection of the appropriate method for a particular project is dependent upon a number of factors. On some accelerated construction projects, several alternative construction methods could be used with equal success. Alternative construction methods are described below.

Introduction

The implementation of alternative contracting methods (ACM) in the Federal-Aid Highway Program was initiated in the early 1980s with the use of incentive/disincentive provisions for early completion (National Experimental Project and Evaluation No. 24). A Transportation Research Board Task Force was formed in 1988 and published a Circular on innovative construction practices in 1991. The FHWA initiated Special Experimental Project No. 14 to allow for the evaluation of innovative practices. Some of these alternative contracting methods are suitable for use on accelerated construction projects.

DOTs have expressed concerns associated with the use of Alternative Contracting Methods (ACM) to deliver projects faster. These concerns include the ability of alternative contracting methods to consistently deliver projects faster to the driving public as well as maintaining control of key performance indictors including costs, quality, and safety (11).

Background – Types of Alternative Contracting

The AASHTO/FHWA “Primer on Contracting for the Twenty-First Century” (10) identified seventeen alternative contracting methods that were used by states in 2006. These methods were considered for use in accelerating contract completion in an NCHRP Synthesis in 2008 (11). According to a 2008 survey of states and an assessment of available information, some of the ACMs that show the highest potential for accelerating project completion include the following.

- Incentives and Disincentives
- Cost-Plus-Time Bidding
- Interim Completion Dates

- No-Excuse Incentives

All of these methods reduce schedule duration and some can reduce duration of the project by more than 10 percent (cost-plus-time, incentive/disincentive). Although the literature indicates that accelerated construction using these alternative contracting methods will increase cost, the survey conducted in the NCHRP study does not support that statement. Costs associated with the use of these methods generally varied plus or minus 5 percent from the budget. Data obtained in the study indicate that quality is not adversely impacted with the use of these methods (11).

Most state DOTs do not have a systematic methodology to select a specific alternative construction method for a given project. In addition, few states perform a systematic analysis of the benefits derived from the use of ACMs to accelerate project completion. Some states have established special groups within the agency to focus on the implementation of these methods to accelerate construction projects (11).

Each method has advantages and disadvantages as described by state DOTs and the literature. Reduction in construction time and roadway occupancy time can be common to all methods, provided proper incentives are provided. Reduced construction and inspection costs can result from accelerated projects under certain conditions. The use of user costs to determine incentives is questioned by some. Non-user costs including the impact on adjacent businesses should be considered when calculating incentives/disincentives. Reduced number of potential bidders, increase in claims, and concerns for quality were identified in the literature as issues of concern.

A brief definition of each form of alternative contracting as stated in reference 10 is provided below.

Incentive/Disincentive. This form of contracting is intended to motivate the contractor to complete the project ahead of schedule. It allows the contracting agency to compensate a contractor a certain amount of money for each day identified that critical work is completed ahead of schedule and assess a deduction for each day the contractor overruns the time. The contracting agency specifies the time required for critical work and uses this provision for those critical projects where traffic inconvenience and delays are to be held to minimum. Incentive/Disincentive (I/D) amounts are based on estimates of user and non-user costs and include considerations for traffic, safety, environmental, adjacent businesses, and other factors.

Interim Completion Dates. Interim completion dates encourage early completion of specific phases of a contract such as a ramp, an interchange, or another component of a larger construction contract. For example, a particular section of a larger project may be near a business, school, public events center, or other critical adjacent property, and this segment of the roadway has a heightened importance as compared to the overall project. The particular phase or component should be selected with great caution as this will impact the scheduling of the overall project.

Cost-Plus-Time Bidding. Cost-plus-time bidding, more commonly referred to as the A + B method, involves time, with an associated cost, in the low bid determination. Under the A + B method, each bid submitted consists of

two components: (1) the "A" component is the traditional bid for the contract items and is the dollar amount for all work to be performed under the contract, and (2) the "B" component is a "bid" of the total number of calendar days required to complete the project, as estimated by the bidder. Calendar days are used to avoid any potential for controversy that may arise if work days are used. The bid for the award consideration is based on a combination of the bid for the contract items and the associated costs of the time, according to the formula.

Bid Award Cost=A + (B x Road User Cost/Day)

This formula is used only to determine the lowest bid for award and is not used to determine payment to the contractor. The contractor's estimate for the completion of critical work becomes the contract time, and an I/D provision is used to keep the bidding playing field level.

No-Excuse Incentives. The contractor is given a "drop-dead date" for completion of a phase of work or the entire project. If the work is completed in advance of this date, the contractor will receive a bonus. There are no excuses, such as weather delays, for not making the completion date. On the other hand, there are not disincentives for not meeting the completion date other than liquidated damages.

Background – Selecting Alternative Contracting Methods

State DOTs have not developed detailed guidelines for selecting the form of alternative contracting for a specific project. Some states use special groups to make this assessment and select the form of contracting. Based on the literature (10) the most frequently cited influencing parameters for selection of alternative contracting methods include the following.

- Project size – typically estimated cost of project
- Project type – new construction, reconstruction, rehabilitation, or maintenance
- Project complexity – location (urban or rural), bridges, pavements, utilities, traffic, railroads, etc.
- Critical completion time – traffic disruption, target date, within one construction season, etc.

Reference 11 provides a schematic process for selecting projects. The use of state DOT special groups for selection of alternative contracting method deserves consideration until more detailed methods are available.

The contracting method should be aligned with the project's technical requirements, time constraints, type of work, traffic, and the project site conditions. Risk should be allocated to the party best able to exercise control of the item. The contract should clearly define work restrictions including work hour, vibrations, noise, and environmental regulations. The contracting method should provide opportunity for the designer, contractor, and public agency to work closely together.

TxDOT Recommendations

TxDOT recognizes several contracting methodologies to accelerate construction (5). General guidelines are provided by TxDOT for selecting these strategies and are shown below with the listing of the strategies. While

the decision of strategy is a district decision, the district may want to consult appropriate divisions in Austin or other districts with experience in accelerated construction.

Calendar Day (CD) Definition for Working Day. Calendar day definition for working day was required with all TxDOT accelerated construction contracting strategies. When the calendar day definition is used, the contractor is charged for a day regardless of weather. The risk of weather construction delay is a contractor risk.

Incentive Using Contract Administrative Cost or Daily Road User Cost (RUC). Payment for early completion may be made based on "Contract Administration Liquidated Damages" (CALD) rate and/or daily "Road User Costs." A maximum allowable bonus payment must be established as well as a no excuse bonus provision for incentives. Special provision 008-006 will default to a 30-day maximum incentive if not specified in the plans (28). A "no excuse bonus" provision disallows time adjustments for the bonus time requirement when factors outside the contractor's control delay completion.

Milestones with Incentives/Disincentives (I/D). This concept should be applied to specific project phases that have a significant impact on traffic and/or businesses. According to Special Provision 008-006 (28), incentives should be based on road user costs and/or Contract Administration Liquidated Damages (CALD). Disincentives should be based on road user cost and may be used without incentives. Time is based on substantial completion of the project phase for which the milestone is established. A maximum allowable bonus payment must be established as well as a no excuse bonus provision for incentives. TxDOT uses milestone incentives (30).

Substantial Completion Incentive/Disincentive. Incentives and disincentives should be based on road user costs and Contract Administration Liquidated Damages as described above. Disincentives may be used without incentives. A maximum allowable bonus payment in terms of maximum number of days for the incentive must be established as well as a no excuse bonus provision for incentives. A maximum allowable bonus payment must be established.

Lane Rental Disincentive. This type of contract language can be used for maintenance work and managing intermittent lane closures to minimize impact to traffic. The disincentive should be based on road user costs on an hourly basis. Consideration can be given to varying road user costs for daytime and night time work.

A + B Provisions. This type of contract should be considered for large and/or highly critical projects where early completion is of great value. Incentives and disincentives can be considered for milestones or substantial completion.

Design-Build. By state law, TxDOT may execute up to three design-build projects each fiscal year, for contracts valued at more than $150 million each (30).

A + B Contracting

This form of contracting can be selected by the district engineer and may be selected for the following types of projects.

- Added capacity projects where congestion levels are already significantly above roadway capacity (this may include grade separation projects)
- Projects that have a substantial economic impact on local communities or businesses
- Projects with minimal utility conflicts, railroads, design uncertainties, or right-of-way issues that may impact the letting date or project construction schedule
- Rehabilitation projects in very high traffic volume areas

A + B contracting is appropriate on high-volume roads where early completion of the entire project and/or a phase of the project will result in a significant benefit to the public in terms of traffic, safety, and adjacent businesses.

The TxDOT form of the A + B contract is defined in Section 11.5.1 of the Standard Specifications (27). The total bid amount is determined by the summation of the contact amount and the time element. The contract amount, equal to A in the formula, is determined by the summation of the products of the approximate quantities shown in the proposal and the unit bid prices bid, and the time element, equal to B of the bid, is determined by multiplying the number of working days bid to substantially complete the project, or phases, by the daily road-user cost provided on the plans. The formula determines the low Bidder and establishes the contract time.

The contract should specify a minimum and maximum completion time to avoid contractors submitting bids with zero working days and from accepting bids that exceed TxDOT-acceptable maximum project construction days. Seasonal project-specific weather conditions, holiday periods, and area public events should be considered in establishing project completions schedules and/or individual construction phase schedules. The contractor-bid “time” for the project is the “time” used for contract amount adjustments.

For projects where the calculated road user costs are high in relation to the total value of the project (value of A), the product of the estimated B value should not be greater than 40 percent of the value of A. A high road user cost may deter the contractors from reducing calendar day bids as the risk is high. If the need for early completion is great, consideration should be given to another alternative contracting process such as incentives/disincentives.

During the design phase of the project development, particular emphasis should be placed on constructability reviews both internal and external to TxDOT. Contractor input will be valuable to determine phasing projection rates and construction times. It is important that the scope of the project be thoroughly defined and adequate provisions be provided for quality assurance and administration.

A + B provisions in a contract can apply to the entire project or to specific work phases. Potential third-party conflicts involving utilities, railroad agreements, environmental issues, archaeological issues, hazardous materials, public support issues, and other problems should be addressed in the constructability reviews and resolved prior to project letting.

Additional guidance on A + B contracting can be found in TxDOT's "Accelerating Construction Strategies Guideline" (5).

Road User Costs

The daily rate for road user cost may only be applied to the point of completion (end of phase or point of substantial completion of the total project). Reference 29 provides some additional guidance for determining road user costs.

Substantial Completion

Substantial completion is defined as occurring when all project work requiring lane or shoulder closure or obstructions is completed and traffic is flowing in the lane arrangement as shown on the plans for the finished roadway or phase. The district has the option of setting the time between substantial completion and project acceptance by general note or setting the total time for the project regardless of the time bid by the contractor.

Design

General Considerations

TxDOT uses two manuals for the development of plans, specifications, and estimates. The "PS&E Preparation Manual" (31) and the "Roadway Design Manual" (32) should be consulted to aid in the development of the design of a project. Key elements of the design process include geometric design, bridge design, drainage design, pavement design, and the design for roadside safety.

There are certain general design features that should be considered in every accelerated construction project. These include the following.

- Minimize Mobilization/Demobilization
- Minimize Materials Logistics
- Minimize Profile Changes
- Repeatable Features

Mobilization/Demobilization. Mobilization and demobilization of construction crews can be the most time-consuming activities that take place in a work zone. The establishment of signage, placement of cones, unloading equipment, staging materials, etc. can easily take two to three hours out of an eight or nine hour work window if done each day. Examination of traffic patterns may suggest that longer periods of lane or road closures during less busy times could be tolerated to accomplish more of the work in less time. For instance, during the rehabilitation of the I-710 freeway outside of the Port of Long Beach in California, a complete shutdown of one direction of the road for 55-hour windows on weekends was used. A 2.7-mile length of the

freeway was rehabilitated in 8 weekends including reconstruction under bridges, and break-and-seat of the concrete pavement with the placement of an overlay. Using 10-hour work windows at night would have required approximately two years to complete the project.

Materials Logistics. The logistics of moving materials into and out of the work zone is very important to productivity. The design of the roadway is the first step to facilitating logistics by minimizing the amount of material removed from the right-of-way (ROW). This requires a thorough site condition survey and planning to keep as much of the existing materials in the ROW as possible. If sites for staging materials close to the work zone can be identified, the uncertainties associated with long haul distances and possible problems with traffic congestion can be reduced. Staging areas allow for materials to be stockpiled during off-peak traffic periods and construction operations to increase productivity.

The selection of materials with greater load-carry capacity in a pavement structural section will reduce the amount of materials as well as speed construction in some cases. For example, hot mix asphalt can be used "full depth" rather than placing flexible base and hot mix asphalt.

Profile Changes. Minimizing profile changes in the roadway will aid in speeding construction by reducing the amount of earthwork that needs to be accomplished associated with adjusting side slopes, back slopes, and medians. It will also help to avoid having to make provisions due to drastic changes in drainage features, which will save on excavation and imported materials.

Repeatable Features. The use of repeatable construction operations will result in construction crews developing knowledge and a rhythm to their work. Project data has indicated that demolition and excavation types of activities can increase about 75 percent with repetition and hot mix asphalt paving by 20 percent (33).

Design should be conservative and flexible so that changes during construction can be reasonably accommodated. An experienced design team should be used on accelerated construction projects.

Geometric Design

Geometric design should follow standards established by TxDOT (32). Consideration for the final geometric design should consider project construction sequencing, traffic handling, and space during construction. Temporary lanes that are used during construction to carry traffic should be as wide as possible. It is desirable to provide the driving public with the same or more lanes during construction as existed prior to construction on rehabilitation projects.

The work space within a project is never adequate. Final geometric design should consider the temporary need for workspace as well as traffic during the construction phase. Thus geometric design should consider the final placement of lanes in the right-of-way as well as the width of shoulders on both the inside and outside of the traveled way. The geometric design should consider the need for additional lanes in the future to handle mobility needs. The design of bridge spans should also consider the need for future widening.

Design reviews for constructability should be scheduled early in the design process and near the completion of the design process by the contracting community. Existing TxDOT design elements should be evaluated for constructability.

Design should be conservative and flexible so that changes during construction can be reasonably accommodated. An experienced geometric design team should be used on accelerated construction projects.

Bridge Design

TxDOT bridge development, design guides, and standards are available in the "Bridge Project Development Manual" (34), "Bridge Design Manual" (35), "Bridge Standards" (36), and "Bridge Detailing Guide" (37). TxDOT has been active in the national program on accelerated bridge construction (ABC) and has placed several bridges under accelerated conditions.

Bridge construction or bridge widening is typically a time consuming construction operation and is a major factor to consider on accelerated construction projects. In general, as much off-site manufacturing of bridge components should be performed as possible. Bridge components can then be placed with minimum disruption to traffic, provided storage near the bridge site is possible for some of the bridge components.

The time required for obtaining steel for bridge construction and the lead time for traffic signals, overhead, and cantilever signs should be considered in design because of potential availability issues. Contract delayed start provision for materials procurement may need to be considered.

The use of portland cement concrete materials that have accelerated strength gain are also widely used when concrete is placed on site. This allows for early form removal and/or opening to traffic.

Alternate bridge rail design should be considered, and alternate plans should be developed in some cases. Constructability is a problem with some bridge rail designs.

Bridge widening projects require the removal of certain components of existing bridges and the addition of substructures, superstructures, and driving surfaces. Specialists in bridge design and construction within the Bridge Division and in districts with experience in accelerated bridge construction should be consulted.

Drainage Design

TxDOT's "Hydraulic Design Manual" (38) is available to guide the design of drainage inlets, piping, structures, and other features associated with water removal. The removal and replacement of existing drainage systems on lane widening projects is a time-consuming construction operation. Design should consider constructability, the type of piping and structures, and the interference of site utilities. Some new technology is available to retrofit existing culvert-type drainage structures.

Pavement Design

The TxDOT "Pavement Design Guide" (39) is available for materials selection and thickness design. In general, a pavement design should be established that requires the least amount of material to be removed and

replaced on acceleration construction projects. Overlay projects and widening projects that use the existing pavement structure should use pavement evaluation tools to determine the load-carrying ability of the existing pavement.

Pavement recycling should be considered on all projects. Cold and hot in-place recycling methods are available and can be performed at reasonably high production rates. In-place recycling avoids the removal and replacement of materials from the job site. The location of cold or hot recycling production plants at the job site should also be considered for using existing pavement materials and/or pavement materials that are used for temporary detours or temporary shoulder widening needed to carry traffic during construction.

The use of materials that have high load-carry capacity will minimize the amounts of materials that must be removed and replaced on a job site. For example, the use of asphalt stabilized base materials rather than flexible base will reduce the overall thickness of the pavement layer. In addition, asphalt stabilized base can be placed at a higher production rate than flexible base materials.

Stabilization of subgrade materials with hydrated lime, portland cement, or asphalt is an alternative that will provide a pavement layer that provides strength. The length of time required to cure some materials prior to placing subsequent layers should be evaluated on a project-by-project basis. For example, hydrated lime-stabilized subgrade can be used to provide strength to the pavement as well as reduce the volume change associated with moisture changes in clay soils. The length of time to construct with lime may be longer than the placement of flexible base to provide equal benefit from a load-carrying capacity point of view.

Reconstruction of old portland cement concrete pavement can be accomplished by several techniques, including: overlaying with a bonded portland cement concrete pavement, overlaying with an unbonded portland cement pavement, cracking and seating or rubblizing the existing concrete pavement prior to overlaying with hot mix asphalt, or overlaying with hot mix asphalt pavement without pre-treatment for the old portland cement concrete. These alternatives should be evaluated from a performance and constructability point of view. Alternatives could be available in the project plans, and the contractor could then select the pavement section that provides the shortest construction time. This approach is referred to as alternative bidding.

On widening projects, special consideration needs to be given to “cross pavement” drainage in granular or flexible base courses. Ponding of water due to inadequate cross drainage should be avoided. Matching of cross sections to some extent is required. Cross section design should also consider traffic control needs on the project. For example, traffic may need to be carried on a newly widened shoulder during construction.

When curb and gutter sections are required on the project, the pavement thickness designs should be such that the curb and gutter can be conveniently placed on the top of a designated pavement layer to provide a good foundation.

The number of materials that need to be placed in a pavement section should be minimized. The use of stabilized layers often reduces the number of materials that are required.

Roadside Safety Design

Roadside safety hardware is designed according to TxDOT's "Roadway Design Manual (32). Hardware selected for accelerated construction projects should be subjected to a constructability review by the contracting community.

Traffic Control and Job Sequencing

Job sequencing of construction activities is a key part of accelerated construction. Input on job sequencing should be obtained from the contracting community.

Traffic control associated with the job sequencing is of vital importance. The "Texas Manual on Uniform Traffic Control Devices" (40) should be used for all traffic control needs. The length of time required to deploy and remove temporary traffic control device in the work zone is critical for accelerated construction.

Detour geometrics including lane widths are important for reduced user costs in a work zone. Work zones that allow higher traffic speeds with safety will reduce user costs substantially on high traffic volume facilities.

Traffic control plans should also give substantial consideration to creating as large a work zone as possible for the contractor to not only perform the work but to also stage materials and equipment. Work zones that allow relatively free flow of materials and equipment will greatly accelerate construction operations.

Project Duration

During the design phase of a project, an estimate of construction time is developed. It is very important that the project duration time be as accurate as possible, as incentives/disincentives will be dependent on this time estimate. It is important that consideration be given to the following, as a minimum.

- Right-of-way, utilities, railroad, environmental, historic preservation, and archaeological considerations are at a status such that construction can progress unimpeded by these items
- Completeness of plans and specifications and reviews by the contracting community
- Quantities of work
- Impacts of weather
- Temperature requirements for certain materials installations
- Vegetation establishment time of year requirements
- Materials availability for construction and their lead times
- Production rates

Contractor Selection

Introduction

Pre-qualification of contractors for project bidding and awarding has long been practiced by state DOTS in the form of requirements for bonding and insurances prior to the award of the contract. This is a form of financial prequalification and is typically provided by the surety industry. The criteria for issuing the bond and insurances are typically based on financial assets and contractor's performance record from a general point of view. A contractor with a marginal track record but the same level of financial assets will receive roughly the same bonding capacity, hence the same opportunity to bid as other contractors with a record of outstanding performance.

Contractor performance-based pre-qualification provides an additional set of requirements that measure construction quality, timely performance, safety record, and other criteria. Contractor performance-based prequalification is typically used on alternate contracting methods including design-build, A + B + C, and construction manager at risk (CMAR) type projects. These methods are also used on the more typical design-bid-build contracts. The goal of the performance-based pre-qualification process is to furnish an incentive for good contracting, while influencing marginal contractors to improve their performance to remain competitive in the industry. The pre-qualification system must be both "justifiable and defensible" as well as adding value to the project in terms of reducing performance risk (12).

Background

The use of performance-based pre-qualification provides an opportunity to develop a best value procurement method. Several elements can be considered in these methodologies, including the following (5).

- Objective Elements – contractor experience with similar projects, completion within schedule, compliance with materials and workmanship requirements, timeliness and accuracy of submittals, and safety record
- Subjective Elements – management of subcontractors, proactive measures to mitigate impacts to adjacent properties and businesses, training and employee development programs, corporate commitment to achieving customer satisfaction and client relations

The elements not only affect the performance and overall cost of the project but they also contribute to the efficient execution of the work and enhanced public satisfaction.

Methodologies that use formula that attempt to weight various performance factors vary from state to state. The use of selected formula from various states on example projects have resulted in different contractors being selected for a project (12-14).

NCHRP Synthesis 390 (12) identifies three forms of contractor pre-qualification: administrative, performance-based, and project-specific.

Administrative pre-qualifications are typically associated with the development of an agency's bidders list. Information of interest in this process of pre-qualification include: financial statements, dollar amount of work

remaining under contract, available equipment and personnel, and previous work experience. This information is required on a project-by-project basis or for a specific time period.

Performance-based pre-qualification methodologies are usually based on quality, past performance, safety, specialized technical capability, project-specific work experience, key personnel, as well as other factors. This information can be required on a project-by-project basis or for a specific time period.

Project-specific pre-qualifications exist for only a single project and address project technical and procurement factors that are essential for the success of the given project. Requirements may include specific skill sets, equipment, production facility, or contractual flexibility.

The literature also suggests that pre-qualification processes can add value to projects, as less oversight is needed to obtain a quality project delivered on time and on budget. This is an important feature of this process in that it may require less public agency oversight and less quality assurance testing and inspection.

The implementation of a rigorous post-project performance evaluation will greatly help facilitate the use of a performance-based pre-qualification program. Typically, the factors considered in post-project performance evaluation are included in performance-based pre-qualification programs.

With the implementation of rigorous pre-qualification programs, some states no longer require performance bonds. In other situations, the amount of required bonding can be reduced with the use of pre-qualification programs, thereby reducing costs.

TxDOT Pre-Qualification

TxDOT has two levels of pre-qualification for contractors: Confidential Questionnaire or Bidder's Questionnaire. Pre-qualification is required to bid or receive a bid proposal. The pre-qualification must be renewed annually.

The "Confidential Questionnaire" process requires the bidder to provide an audited financial statement prepared by an independent certified public accountant as outlined in a TxDOT bulletin. Financial statements must be less than one year old. In addition, the contractor must complete the Confidential Questionnaire form.

The "Bidder's Questionnaire" process is for bidding on projects for which the full requirements as described above are waived. These are normally smaller construction, routine maintenance, emergency, and specialty projects. The bidder must complete the Bidder's Questionnaire form. Details associated with these processes are available in TxDOT documents.

TxDOT Unsatisfactory Contractor Performance

In Item 8 of TxDOT's *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*, information is provided on unsatisfactory contractor performance. Item 8, Article 4 indicates that the Engineer may suspend the work, wholly or in part, and will provide notice and reason for the suspension in writing. The contractor is required in Item 8, Article 5 to maintain and submit a monthly schedule for use by both the contractor and engineer. Item 8, Article 6 addresses "Failure to Complete Work on Time." Failure to

complete work will result in liquidated damages. Articles 7 and 8 address “Default of Contract” and “Termination of Contract” issues. The engineer may declare the contract in default of terminate for a number of reasons as identified in Item 8.

Involvement of Contractor

On accelerated construction projects, the contractors should be involved in project planning and one or more design (plan) review(s) as well as be an active participant in partnering and workforce issues.

Planning and Design Reviews

Detailed planning is critical to the success of an accelerated construction project. More up-front and more detailed planning is required to successfully implement accelerated construction projects. Planning and design reviews should include material suppliers and fabricators, equipment suppliers, contingency plans, and scheduling when possible. Look-ahead plans should be developed at regular intervals.

Partnering

Formal partnering is a tool that can be used to initiate discussion between all parties and disciplines. Meetings by themselves are not sufficient. Team members on accelerated construction projects must agree to do the following.

- Solve issues at the lowest level in the organizations
- Have an openness to change as additional information becomes available
- Provide attention to detail
- Focus on the project with an unselfish effort
- Take steps to ensure that no interruptions take place
- Co-locate key project personnel

Appropriate people should be empowered to make immediate decisions. Technical expertise should be at the project site or available at all times.

Partnering should include DOT and contractor staff as well as designers, subcontractors, materials suppliers, and fabricators, as well as local governmental agencies, utility companies, and railroad personnel as needed.

Workforce

Because extended work intervals are used, contractors must be very cognizant of worker fatigue and plan to have redundant critical personnel on call. Since multiple shifts will be required, the contractor will need to determine work schedules, plan coordination meetings to hand off the work between shifts, and account for equipment maintenance downtime. Regular weekly meetings should be held between the contractor, agency, material suppliers, and subcontractors to review any unresolved issues and to anticipate potential problems.

Construction Considerations

The “We Build Texas – Field Guide to Successful Project Delivery” (9) contains numerous suggestions for the successful delivery of projects. This document identifies key elements of a successful project as follows.

- Safety
- Money
- Timeliness
- Relationships
- Perception
- Quality

Specific activities that produce successful projects are defined in terms of four critical areas.

- Contract Relationships
- Activities Prior to Letting
- Post-Letting to Construction Start Activities
- Construction Start to Contract Completion Activities

This document should be reviewed and used to help provide successful accelerated construction projects.

Work Plan and Work Sequence

Development of the work plan and work sequence of construction is of critical importance. Space, time, traffic control, and construction activities are married during this process and critical path scheduling results. Advanced scheduling tools should be used and the information shared between the contractor and TxDOT. Accelerated construction is not possible without a carefully crafted plan prior to construction and one that is adjusted continuously and at key intervals during the construction process.

Workforce

Decision makers representing both the contractor and TxDOT need to be available on the project at all times or as a minimum can be contacted and on the job site quickly. Decisions need to be made at the lowest workforce level on the project as possible. Key individuals need to be empowered to make decisions. If problems cannot be quickly solved on the project, a clear decision making path needs to be established prior to the initiation of work. These decisions include plan changes, materials selection, etc.

Work Space

It is critical to provide as much work space on the project or immediately next to the project as possible. Work flow and production are typically increased as work space is increased. Space for equipment and the workforce to construct the elements and for materials to be staged or stockpiled prior to use will accelerate construction. Securing right-of-way to provide this space should be considered by TxDOT and made available to all contractors.

Equipment

It is important to have well maintained, operational equipment on the project. The work plan should allow for equipment downtime for maintenance and repair.

Redundant critical equipment should be on hand so that in the event of a breakdown, the job is not waiting for equipment to be shipped from other locations. As accelerated construction becomes more important in Texas, contractors and equipment manufacturers will identify new equipment that can increase production. The development of equipment that is capable of moving materials quickly from one location to another (perhaps across several lanes) will be needed if production is to be increased and the projects are to be completed in an accelerated fashion.

Quality Control/Quality Assurance/Acceptance

Quality acceptance programs face special problems during accelerated construction as larger amounts of materials are placed in a shorter period of time. Quality cannot be sacrificed on accelerated construction projects. Increases in the workforce to meet increased materials production and placement may be needed and/or more rapid and reliable test methods may need to be developed. Decisions relative to materials acceptance need to be made in a timely fashion.

Technicians used for sampling and testing should be certified, and laboratories in which testing is performed should be accredited.

Information Exchange

Information needs to flow at a rapid rate and in considerable quantities between the contractor and TxDOT. E-construction tools and e-tools for quality acceptance programs should be used as much as possible.

Regularly scheduled meetings should be established at the initiation of the project. Additional meetings should be held when necessary. Key Contractor and TxDOT personnel should be expected to attend.

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