Procurement of Design-Build Services: Two-Phase Selection for Highway Projects

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Abstract: In the United States, public agencies are adopting the design-build (DB) delivery method for delivering highway projects after having used the traditional design-bid-build method for generations. In the 2002 design-build contracting final rule, the Federal Highway Administration (FHWA) strongly encourages the use of two-phase selection procedures for DB procurement. This paper takes a case study approach to investigating the use of a two-phase process for selecting providers of highway design-build services. Using two DB projects in central Texas as case studies, the writers have analyzed project documentation and performed interviews with 37 project participants involved in procurement, including owner representatives and legal consultants. For the first case, the writers selected the $1.3 billion SH-130 tolled expressway project in central Texas. Procurement of the SH-130 DB contract was performed before the FHWA rule on DB contracting was released. In addition, the writers examined procurement activities for the $154 million DB contract for the SH-45 SE tolled expressway, which was procured by the same owner in 2004 following procedures identified in the FHWA rule. As a result, a process was developed that included activities to be performed between the delivery method decision and the contract execution. This process model tracks the differences between the SH-130 and the SH-45 SE processes that are attributable to the latter's adoption of the FHWA Rule.

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Introduction

In the United States, highway projects have traditionally been delivered through the design-bid-build (DBB) project delivery method, which separately procures engineering and construction services. Under DBB, the procurement of engineering services is a qualification-based process, whereas the procurement of construction services is largely done by low-bid selection on sealed offers based on a completed design (Molenaar and Gransberg 2001). Over the last decade, another delivery method, design build (DB), has been increasingly adopted by state transportation agencies (STAs) (Molenaar and Gransberg 2001; Yates 1995). In contrast to DBB, this method combines the procurement of construction services with a variable amount of engineering services in one contract. The purpose of the DB procurement phase is both to select an entity, the design builder, and to establish a contractual framework that allocates risks between parties.

Delivering construction projects with DB offers many advantages including decreased delivery time, single point of responsibility, and improved coordination among different functional areas (Konchar and Sanvido 1998). Additional advantages include early price certainty, reduction of change orders and claims, opportunity for contractor-induced innovations and, if multicriteria procurement methods are adopted, the opportunity to consider cost, price, and schedule in selecting the design builder (Songer and Molenaar 1996). However, the primary reason to select DB is its potential for reducing the total project delivery time (Palaneeswaran and Kumaraswamy 2000; Songer and Molenaar 1996). However, DB may offer some disadvantages. To owners, the most cited disadvantage is a loss of control on the design phase. To contractors and designers, a disadvantage is represented by the potential loss of respective identity, but this can be mitigated when designers and contractors have established relationships (Yates 1995).

Although DOTs are increasingly applying DB, most of them do not have an institutional culture suitable for the new approach (Molenaar and Gransberg 2001; Molenaar et al. 1999). This aspect of early DB implementations was observed directly by the writers: "the transition to DB procurement is not easy for traditional DOT employees who feel they are losing control of the process to which they are accustomed. This lack of control makes owner representatives uncomfortable about the new process" (O'Connor et al. 2006, p. 58). In a concurrent study conducted by the writers, a panel of industry experts identified an additional aspect of culture that may create obstacles, a distrust of change by DOT employees and advisors that results in the "failure to consider alternative forms of execution because 'we don't do it that way here.'" In addition, DOTs are often pervaded by a widespread fear of criticism that may be one of the causes for limiting the involvement of industry providers into the procurement pro-

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cess. As a result, lengthy and inefficient project procurement processes may hinder agency credibility and result in lower industry competition (Migliaccio 2007, p. 387).

Because most STAs lack experience with DB, their achievement of reduced delivery times can be endangered by incomplete DB procurement information. Although combining the procurement of services is expected to reduce transactional costs for delivering a project (Pietroforte and Miller 2002), the different nature of DB procurement usually results in state personnel spending extensive amounts of time experimenting with and developing new organizational routines to support the procurement change (USDOT-FHWA 2004). Additionally, the existence of cultural barriers provides other challenges for a successful DB implementation. In their research, Molenaar and Gransberg (2001, p. 221) found that, "as agencies attempt design-build for the first time, they are constrained by the low-bid culture in their organizations." In a recent report, the U.S. Department of Transportation (USDOT-FHWA 2004) recognized that implementing innovative delivery methods can offer a serious challenge to state agencies.

Although DB selection procedures have been widely investigated (Gransberg et al. 2004), and major categories of DB procurement have been identified (Molenaar and Gransberg 2001), the literature does not offer detailed information on activities performed during the procurement phase. Using two Central Texas DB projects as case studies, the writers have developed a detailed description of two-phase selection procedures. The investigations were focused on activities needed for selecting the DB entity and for preparing the contractual document. For the first case, the writers selected the $1.3 billion SH-130 tolled expressway project. Procurement of the SH-130 DB contract was performed before the FHWA rule was released. The project documentation was analyzed, and owner and design-builder representatives involved in the procurement of this DB contract were interviewed. For the second case, the writers studied procurement activities for the $154 million contract for delivering the SH-45 SE tolled expressway, which was procured by the same owner in 2004 in accordance with the procedures detailed in the FHWA rule. The research outcome is a comprehensive procurement process, which includes activities to be performed between the delivery method decision and the contract execution. These activities are proposed along with general guidelines for preparing procurement documents; chief among these is a breakdown of the critical sequencing of document preparation activities with respect to other external processes. The model also highlights differences between the two cases attributable to the SH-45 SE adoption of the FHWA Rule.

This paper first summarizes previous research and industry practices on highway DB procurement. The methodology for the research study is then described. Finally, the developed DB procurement flowchart is discussed with a focus on procurement activities related to the preparation of contractual documentation and selection of the design builder.

Highway Design-Build Procurement

The transportation sector first showed interest in DB and other innovative approaches in 1988, when a Transportation Research Board task force was formed to study such innovative contracting processes. The task force study recommended that the Federal Highway Administration (FHWA) initiate an experimental program on innovative contracting practices with the objective of identifying practices that could reduce life-cycle costs for state highway agencies (Byrd and Grant 1993). This program, the Special Experimental Project (SEP) No. 14—Innovative Contracting Practices, was initiated in 1990 to evaluate four innovative practices: design build, cost plus time, lane rental, and warranty contracting.

In 1998, the Transportation Equity Act for the 21st Century (TEA-21) allowed the use of DB contracting for selected projects approved by the Secretary of Transportation. TEA-21 also required FHWA to promulgate regulations on DB procurement (TEA-21, Public Law, Title 1, Subtitle C, Sec. 1307). This legislative requirement was enacted by FHWA with the release of the "Design-Build Contracting Final Rule" in December 2002. The rule strongly encourages the use of two-phase selection procedures for procurement of DB services.

In 2001, the state of Texas introduced a statutory approach that allows the Texas Department of Transportation (TXDOT) to adopt delivery methods other than DBB for delivering toll road projects. Using this legal approach, in June 2002 the TXDOT Texas Turnpike Authority (TTA) division awarded a $1.3 billion DB contract for the delivery of the State Highway 130 (SH-130) project by the end of 2007. In 2004, the TXDOT Austin district procured a $154 million DB contract for the delivery of the State Highway 45 Southeast (SH-45 SE) project, also to be completed by the end of 2007. More recently, TXDOT has been using the same statutory approach for experimenting with a totally new approach to integrated delivery methods that lead to the adoption of public-private partnerships (PPPs) for financing large infrastructure projects. The procurement of these PPP agreements has been conducted using a two-step process similar to the one described in this paper.

Likewise, many other states authorized the use of integrated delivery methods for delivering highway projects. As mentioned above, DB procurement combines the procurement of engineering and construction under one contract. Although owners have developed different customized selection processes, most can be classified in the following few categories (Molenaar and Gransberg 2001; Palaneeswaran and Kumaraswamy 2000): (1) low bid; (2) one-step best value; (3) two-step best value; and (4) negotiated selection. According to Molenaar and Gransberg (2001), owners adopt two criteria, project quality and project price, for selecting DB procurement process. Quality-driven owners select contractors by negotiation whereas price-driven owners adopt by low-bid selection. When both price and quality have to be considered, owners prefer the "best value" category of procurement. The final goal of these procurement categories is to assign a score to each project that includes price and quality considerations with price and quality evaluations usually performed separately. Best-value award algorithms are used to select the best value to the owner by combining each assigned score (Gransberg et al. 2004). Best-value DB procurement can be performed with one-step or two-step selection procedures. One-step procedures select the design builder in a single stage by determining the best value as a combination of price and quality considerations. This procedure is practiced mostly for simple projects where the proposal evaluation is not expensive. Two-step procedures include prequalification/short listing and proposal evaluation phases. Because evaluating proposals becomes more expensive as projects become more complex, owners prefer to short list interested parties based on qualifications before evaluating their proposals.

Table 1. SH-130 Procurement Process Phases

Phase subphase		Duration (months) SH130	SH45SE	Objective milestone	Procurement documentation
1	Toll feasibility study	NA	NA	Identify financing options	
2	Request for qualifications (RFQ)	15	5	Shortlist perspective proposers	
2.1	Prepare RFQ	6	2	RFQ	RFQ
2.2	Develop proposals and qualifications submittal (QS)	5	2	QS	RFQ addenda
2.3	Evaluate QS	4	1	Shortlisted firms	
3	Request for proposals (RFP)	23	9	Select design builder	
3.1	Prepare RFP	15	6	RFP	Instructions to proposers (ITP) contract+technical provisions (TP)
3.2	Develop proposals	6	2	Proposals	RFP addenda
3.3	Evaluate proposals	2	1	Best-value proposal	
4	Contract finalization	3	2	Award design-build contract	
4.1	Develop final price	2	1	Final price	Contract, TP
4.2	Contract execution	1	1	Contract signature	Signed contract
	TOTAL	35	14		

Research Methodology

This study on procurement is part of a multiobjective research project investigating issues related to the adoption of the DB approach from an owner's perspective. In the literature review, little descriptive information was found on how DB services are procured by owner organizations. Subsequently, the writers designed this study to observe actual implementation of DB procurement by TXDOT. The goal was to collect enough descriptive information to illuminate how this process takes place with the goal of modeling processes for procuring the SH-130 and SH-45 SE DB contracts. To this end, a qualitative research approach was selected to increase data richness beyond topics from the literature. Initially, observations by project participants and legal consultants were captured through a qualitative interview-based research method (King 1994). This method for data collection was selected because it allows researchers to use a semistructured interview guide during the interview process, but it also allows interviewers to explore new topics and issues during the course of the interviews.

Using this approach, the writers interviewed 27 individuals involved in the procurement of the SH-130 and SH-45 SE DB contracts. The anonymity of the interviewees was guaranteed to encourage more input. These individuals included representatives of the three major project parties: (a) TXDOT as the project owner; (b) HDR project team, serving as the program manager; and (c) Lone Star Infrastructure, as the design builder for the SH-130 project. Interviewees included representatives of executive management (i.e., division director) and of several project functions, including contract procurement, design, construction, quality assurance, right of way, utility relocation, and environmental permitting and compliance. The semistructured interview process entailed in the research approach allowed interviewers to explore topics and issues as they emerged during the course of the interviews. The same member of the research team conducted all of the interviews to assure consistency. He also analyzed the interviews' recordings to identify and select observations related to the procurement process, which were transcribed.

Interview excerpts and project documentation served as primary data sources for the analysis that was conducted using the template analysis technique (King 1994). Using this data analysis technique, initially, data were stratified according to constituent parties and were then grouped under topical categories. Observations related to the procurement process were subdivided into two categories (activity related and process related). Process-related lessons learned were used in structuring the procurement process. These observations provided information on sequencing between activities, and on feedback loops among groups of activities. Activity-related observations, instead, provided further understanding of specific activities necessary to procure design-build services. These observations provided information on what the scope of specific activities was, and on how a specific activity could be streamlined. The set of activities necessary for the procurement of a DB project was identified through analysis of interview excerpts, procurement documentation, project newsletters, and project presentations. Next, these activities were weighted against identified industry practices, which were identified through an accurate review of procurement documentation of DB transportation projects in other states. As a result, a first draft of the procurement process at the phase/subphase level was outlined. This draft was tested and used to elicit feedback through a first round of interviews with the two officers in charge of the procurement for the SH-130 and SH-45 SE projects. A detailed draft of the DB procurement process at the activity level was then developed with schedules of actions, responsibilities, and duration targets. These documents were tested through a second round of interviews with the same two officers. Information collected through both rounds of interviews also helped identify essential elements of SH-130 and SH-45 SE contractual documentation. Findings from this research task were presented in two research reports (O'Connor et al. 2004a,b).

Design-Build Procurement Process Model

To procure the SH-130 and SH-45 SE contracts, a two-phase best-value selection process was used as prescribed by the existing Texas legislation (Transportation Code, Title 6, Sec. 223.203). Although procurement of these two contracts followed similar paths, the SH-130 procurement process included two additional phases for activities unrelated to the selection process: an initial toll viability study (absent for SH-45 SE) and additional activities during the contract finalization phase. Table 1 illustrates the breakdown of the phases and subphases. Procurement phases are

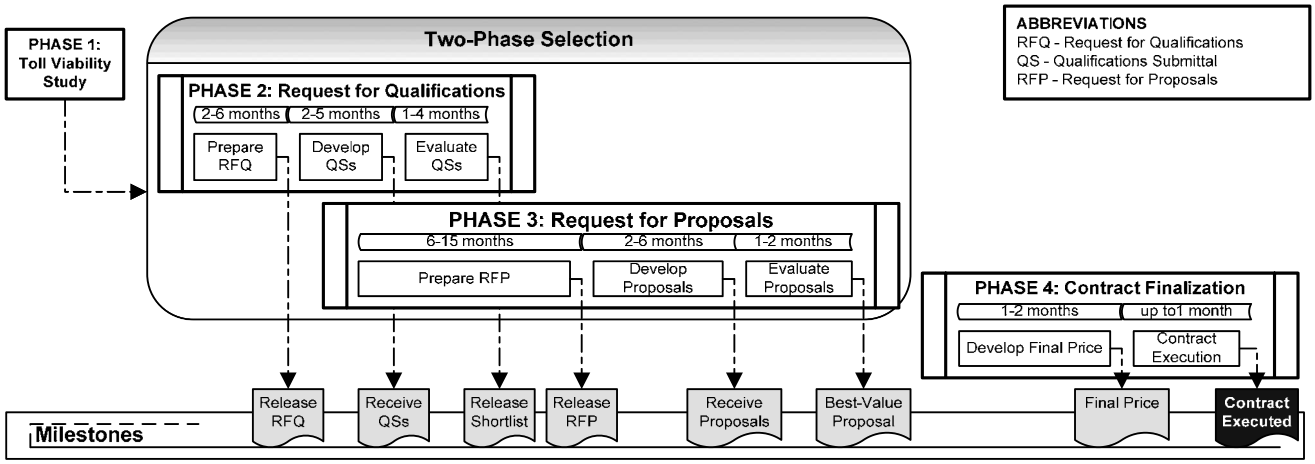

Fig. 1. Overview of procurement process with phase durations and milestones

identified by four intermediate objectives and are further broken down into subphases identified by milestones. A list of major procurement documents produced during procurement is also included in Table 1. A single person, hereafter called the procurement officer (PO), was in charge of SH-130 procurement. The PO selected a designee to oversee specific tasks and subphases.

A graphical representation of the complete process is found in Fig. 1. This process flowchart exemplifies the overlapping of phases and identifies the range of durations at the subphase level. These measures of duration resulted from the analysis of procurement activities for the SH-130 and SH-45 SE projects with the former having longer durations. According to all the interviewees, two major factors contributed to the reduced duration of the SH-45 SE procurement: (1) increased familiarity of TXDOT employees with the process, and (2) less project complexity. First, the experience of the SH-130 project team was very beneficial to the SH-45 SE procurement staff members, who often consulted key SH-130 personnel to help them identify sequences and shortcuts in the process. Second, project complexity was critical for the preparation of the request for proposals (RFP) package (subphase 3.1). In fact, this subphase was shortened in the case of the SH-45 SE procurement because private financing and maintenance options were not included in the tendered contract.

Phase 1—Toll Viability Study

As previously mentioned, TXDOT is allowed to adopt innovative delivery methods for toll road projects. When these projects are to be financed through issuance of toll revenue bonds, TXDOT needs to assess the feasibility of such a financing method before initiating the procurement. In this kind of situation, a toll viability study is performed during project planning before the procurement starts. This initial phase is beyond the scope of this paper. Further information can be obtained in the TXDOT online guide to conducting the toll viability study.

Phase 2—Request for Qualifications

Under the FHWA final rule for DB contracting, the request for qualification (RFQ) phase is denominated "phase one Solicitation" (FHWA 2002). During this phase, the SH-130 and SH-45 SE procurement teams performed three groups of activities with the goal of prequalifying firms. Tasks relating to this phase and its three subphases are shown in Fig. 2 and described below.

Subphase 2.1—Prepare RFQ Package

This subphase ended with the public release of the RFQ package. In order to issue this documentation package, the procurement team needed to carry out a group of iterative activities (subprocess 2.1.1) to write the document for issuance, including the forms for submittal. Concurrently, the procurement team defined all the details for evaluating submitted qualifications, including rules for evaluations, roles and responsibilities, and a tentative procurement schedule. Outputs of this subphase were the RFQ documentation and a detailed evaluation process. The SH-130 and SH-45 SE RFQ documents included the following information:

- Project description;
- Procurement process overview;
- Requirement for competing qualifications submittal (QS) with forms for submittal and required financial documents;
- Evaluation process, including information on schedule and criteria for evaluation; and
- Submittal procedures with indication of the main point of contact.

Subphase 2.2—Develop Competing Qualification Submittals

After the RFQ release, the procurement team, including legal and engineering consultants, interacted with interested parties in order to facilitate the submittal of qualification packages. During this interactive phase, any interested party analyzed the RFQ and submitted requests for clarifications to the procurement team. According to some interviewees, this process can be modified such that owners can investigate industry providers' availability to contribute to the financing scheme. In such a case, if the project includes bonds or design-builder financing options, the procurement also includes a few rounds of one-on-one meetings with interested firms to make any necessary corrective action (e.g., SH-130 case).

Subphase 2.3—Evaluate Qualifications Submittals

When QSs were received, the evaluation committee and subcommittees reviewed the submitted packages for responsiveness, evaluating them according to the criteria provided in the RFQ

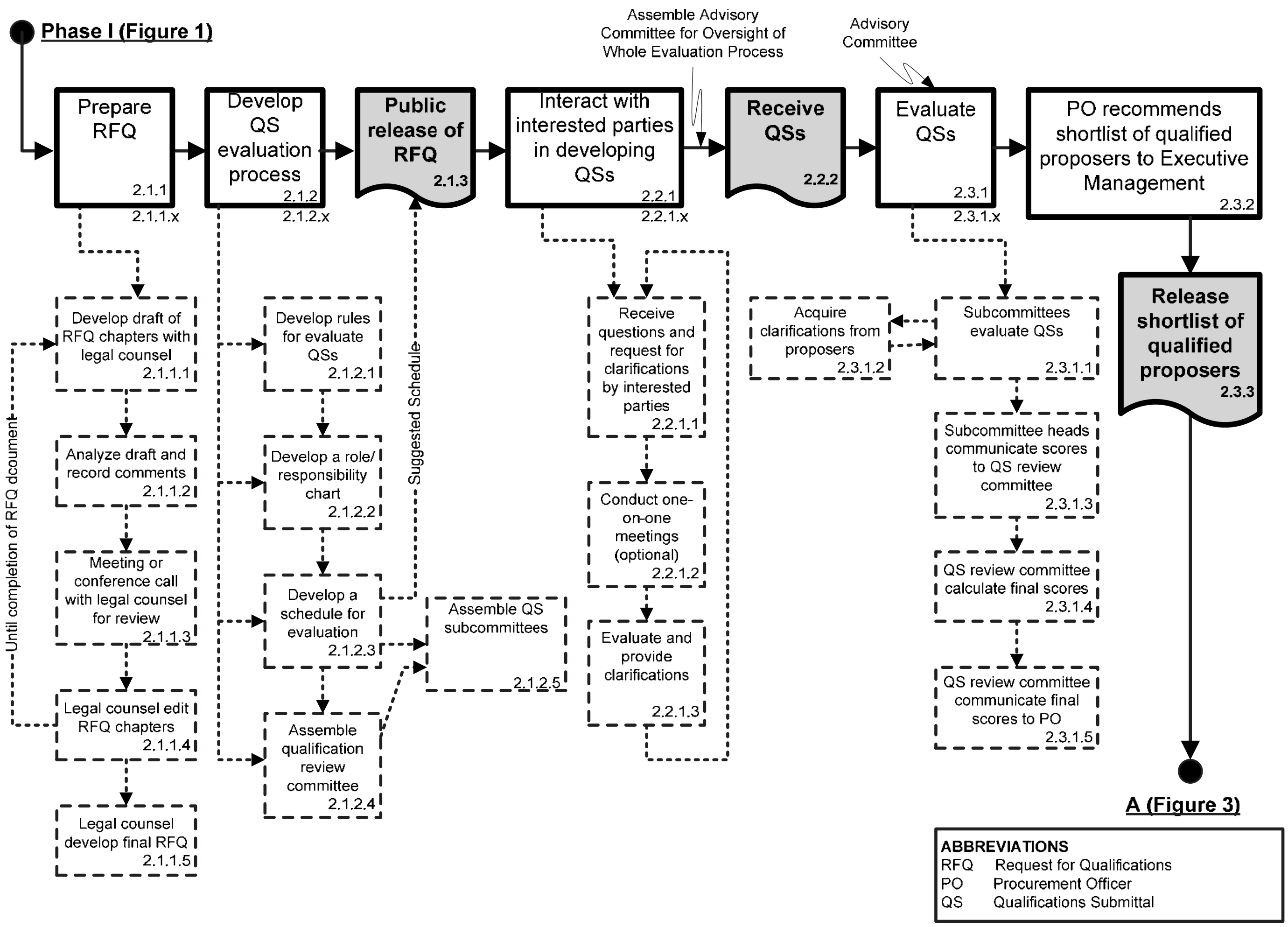

Fig. 2. Phase 2: RFQ process

package. Finally, these scores were communicated to the PO, who recommended the shortlist of qualified proposers to TXDOT executive management.

Phase 3—Request for Proposals

Under the FHWA final rule for design-build contracting, the request for proposal phase is denominated “Phase Two Solicitation” (FHWA 2002). Activities performed during this phase are broken down into three flowcharts, one for each of its subphases.

Subphase 3.1—Prepare Request for Proposals

For this subphase, the TXDOT personnel, technical consultants (i.e., program manager), and legal consultants who comprised the procurement team prepared a draft of the RFP package. Committees for evaluating proposals were also assembled. The RFP draft was released to the shortlisted firms for feedback through an interactive review process denominated “industry review.” When completed, the industry review produced a final RFP that was issued to the qualified proposers. Fig. 3 illustrates this subphase and its tasks.

To prepare the final RFP draft, as much information as possible was collected to reduce uncertainties associated with project characteristics and risks. A typical RFP package for procurement of design-build services has four parts: (1) the instructions to proposers (ITP); (2) the DB contract; (3) the technical provisions (TP); and (4) a set of attachments. The first document describes what the proposals have to include and how they will be evaluated. The second includes the contractual agreement and its abbreviations and definitions. The technical provisions include the scope of work, project specifications, and any other technical criteria. Finally, the attachments include all the preliminary engineering work performed by the owner and available as a guide to developing a proposal (e.g., schematic design, utility survey maps, existing right-of-way information, etc.). To develop the RFP draft, the owner procurement team performed the following activities:

- Defined the process for evaluating proposals and identifying information to be included in a proposal, and appointed the evaluation committees;
- Prepared draft of the DB contract;
- Identified design criteria and developed a draft of the technical provisions; and
- Completed preliminary engineering activities as necessary to identify risks and reduce contingencies.

Two groups of interrelated activities were conducted concurrently during this phase: (a) performing preliminary engineering and developing environmental impact documentation; and (b) developing contractual documents. The preliminary engineering activities were initiated long before this phase, but they were continued

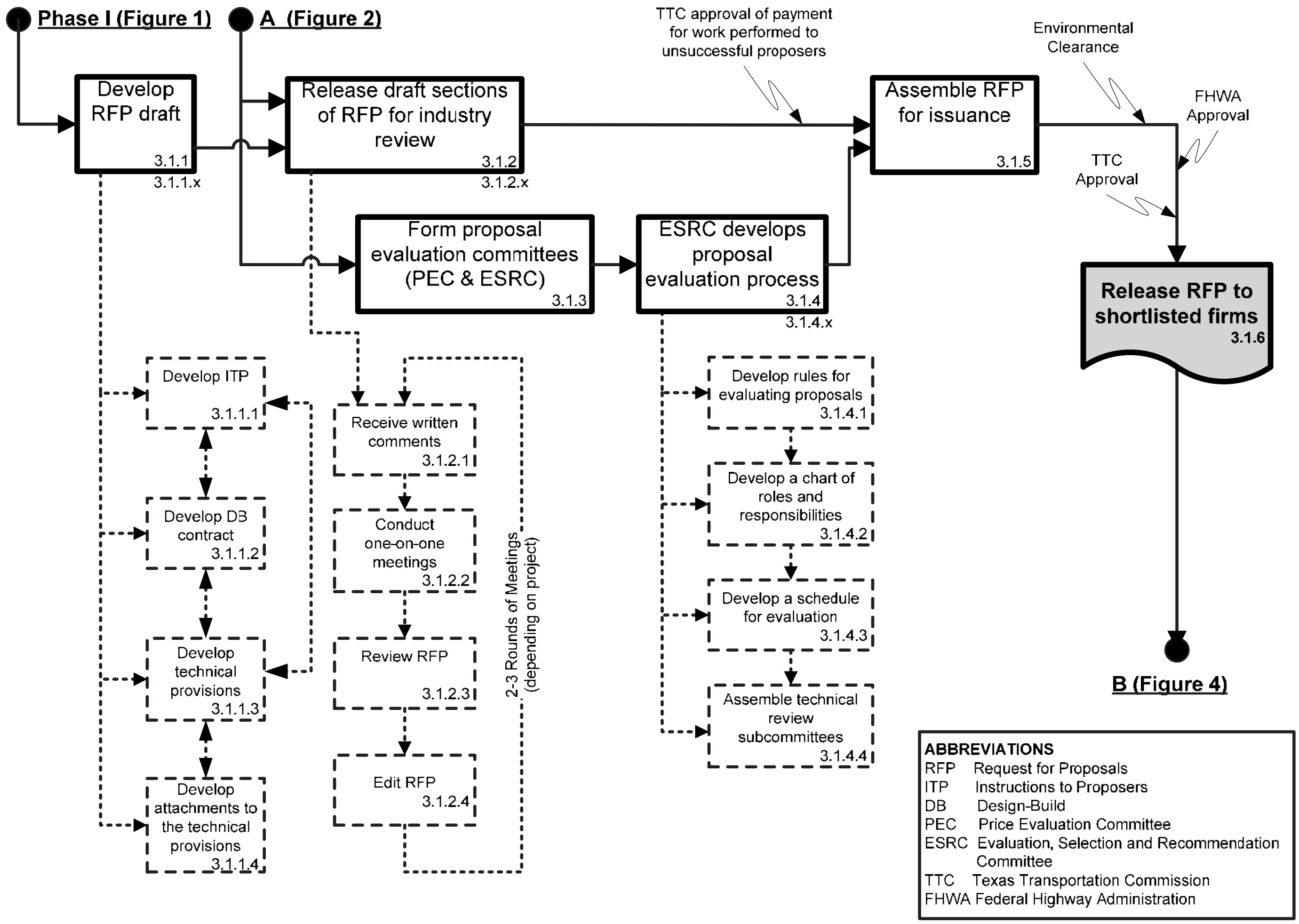

Fig. 3. Phase 3.1: prepare RFP

concurrently to the development of the RFP documentation. The TXDOT project team could begin to develop ITP, DB contract, and TP. At the outset, these documents could be outlined, but gaps were present that could not be filled until preliminary engineering was completed. The project team had to fill these gaps before the release of the RFP. Moreover, ITP, DB contract, and TP were developed concurrently because information from any of these documents is needed for the others to maintain congruence (i.e., in terms of risk allocation). Two engineering processes substantially affected the duration of subphase 3.1 for the SH-130 project: (1) the development of the schematic design (~6 months); and (2) the environmental clearance process (~12 months). In the activity sequencing, these processes are predecessors to the issuance of the final RFP.

At this stage, the PO was also in charge of appointing members of two proposal evaluation committees: (1) the price evaluation committee (PEC); and (2) the evaluation, selection, and recommendation committee (ESRC), which was in charge of evaluating technical aspects. Although these committees included only TXDOT employees, they were assisted by discipline-specific subcommittees comprised of outside consultants who provided advice on technical, financial, legal, and maintenance aspects of the projects. In addition, TXDOT invited observers from other state and federal agencies with specific interests and responsibilities associated with the projects to form an advisory committee. All outside consultants and observers were required to endorse confidentiality statements.

Concurrent with the committee appointment process, the industry review process was critical to refining the contractual component of the RFP documentation and included a reiterative cycle of subtasks. The final goal was to achieve trade offs with the proposers in terms of risk allocation. In the case of SH-130, the department released draft sections of the RFP to the shortlisted firms and waited for their written comments. A round of one-on-one meetings was then scheduled to address these comments. The contractual documentation was reviewed, modified, and edited by the legal consultants and resubmitted to the proposers with other draft sections. How the industry review process is conducted depends on three factors. First, it is affected by the STA's previous experience with similar projects. Ultimately, risk allocation during this phase can be limited because the DB contract and the ITP document would be developed following an organization-wide model. In such a circumstance, the PO can use RFP documentation from previous projects as a model or the STA can develop a master RFP package. The second factor affecting the industry review is project complexity. The industry review process usually requires between two and four rounds of meetings. For example, firms shortlisted for the SH-45 SE projects were provided a nearly complete copy of the RFP. As a result, two rounds of industry review meetings were carried out during this project's procurement. On the other hand, three rounds of meetings were conducted for the SH-130 project where industry review was conducted section by section. Finally, the presence of external pressures on the procurement schedule also affected the industry

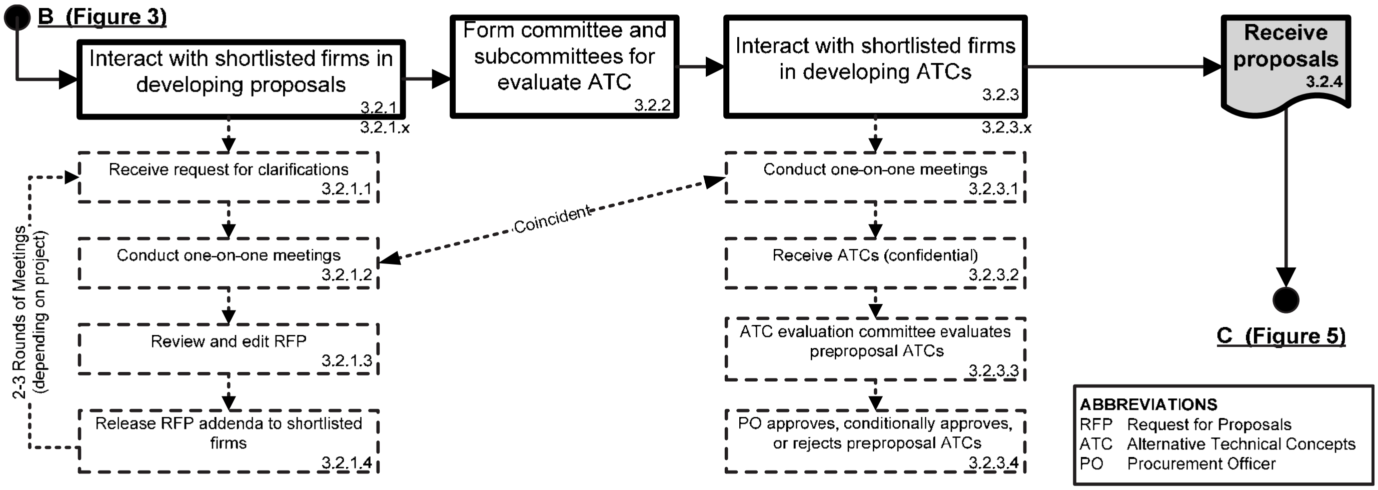

Fig. 4. Phase 3.2: develop proposals

review process. Two external processes are predecessors to the issuance of the final RFP: (1) the development of the schematic design (~6 months for SH-130); and (2) the environmental clearance process (~12 months for SH-130). In fact, the FHWA rule for DB contracting prescribes that the federally mandated environmental compliance review process has to be concluded, and the approval of the FHWA division administrator on the RFP document has to be obtained before the RFP is issued (FHWA 2002). For both projects, environmental clearance was obtained before the RFP was issued, but waiting for necessary authorization of environmental clearance at federal level (i.e., FHWA approval of final record of decision) and state level (i.e., Texas Transportation Commission approval of environmental review) delayed the SH-130 RFP issuance. According to an interviewee, waiting for these approvals afforded the team an opportunity to conduct a more thorough industry review, which improved the final RFP document.

Subphase 3.2—Develop Proposals

In the next subphase, TXDOT personnel and external consultants interacted with short-listed firms in order to facilitate the submittal of qualification packages. Fig. 4 represents this subphase and its tasks. First, proposers submitted questions and requests for clarification; then, a round of one-on-one meetings was conducted to discuss these comments, and finally, the documentation was reviewed and edited by the legal consultants. After each round of meetings, the TXDOT project team issued addenda of the RFP in a redline format of the original document. The duration of this activity was predetermined because the department set a deadline for getting the last clarification request from the proposers and an end date for issuing the last addendum. On the two observed projects, two or three rounds of meetings were sufficient, but on more complicated projects, this number is believed to increase.

At this point, the procurement process includes a feature designed to promote and reward innovative ideas by proposers, the alternative technical concepts (ATCs). ATCs are innovative solutions given as exceptions to the provided technical provisions. Both case studies allowed two categories of ATCs: cost saving and value added. The ATC approach is designed to facilitate the implementation of value engineering concepts during the procurement phase. However, it requires TXDOT personnel to interact with the proposers to review and approve their ATC. Although submittal, negotiation, and evaluation of ATCs happened during the same one-on-one meetings used for providing clarifications on the RFP requirements, performing this task needed attention because value-added ATCs needed to be managed differently from cost-saving ATCs. Proposers could decide to include approved cost-saving ATCs in the final proposal. Under such a circumstance, they would have an advantage in the price evaluation while TXDOT would receive lower bids. Conversely, value-added ATCs could be included in the proposal to receive an advantage in the technical evaluation, but they could be included in the final price only after a firm was selected for contract finalization.

Subphase 3.3—Evaluate Proposals

The purpose of this subphase, schematized in Fig. 5, was to conduct an evaluation of proposals in order to identify the best value proposal. The process described in this paper adopted a best-value contract award method. This method is a radical change from the traditional low-bid approach and has been a source of concern and dispute on the objectivity of the selection process. The description provided here elucidates how the evaluation process embedded levels of safeguards comparable to the ones in a traditional contract award method based on low bid.

As a requirement of the RFP, price information was submitted in individual sealed envelopes, separate from the other portions of the proposal. At first, the PO's designee received and separated each contractor's price proposal from the remaining documentation and assigned an identification code to each. The record tying the generic identifiers to the actual proposers was sealed and held by the designee. The designee then passed the two proposal packages to the two evaluating committees: the price proposal to the PEC and the technical proposal to the ESRC.

Thereafter, the evaluation was conducted on two parallel tracks, price and technical, and followed three steps: responsiveness, pass/fail, and score assignment. First, the committees reviewed proposals for irregularities and responsiveness to the requested format. Second, a pass/fail assessment was conducted according to prefixed criteria (i.e., submittal of proposal bond, use of required forms). Finally, proposals were evaluated in terms of the preestablished scoring criteria. During this last step of the evaluation process, each proposal received a score against each criterion. Using evaluation algorithms that were established in the RFP, these scores were combined producing a final technical

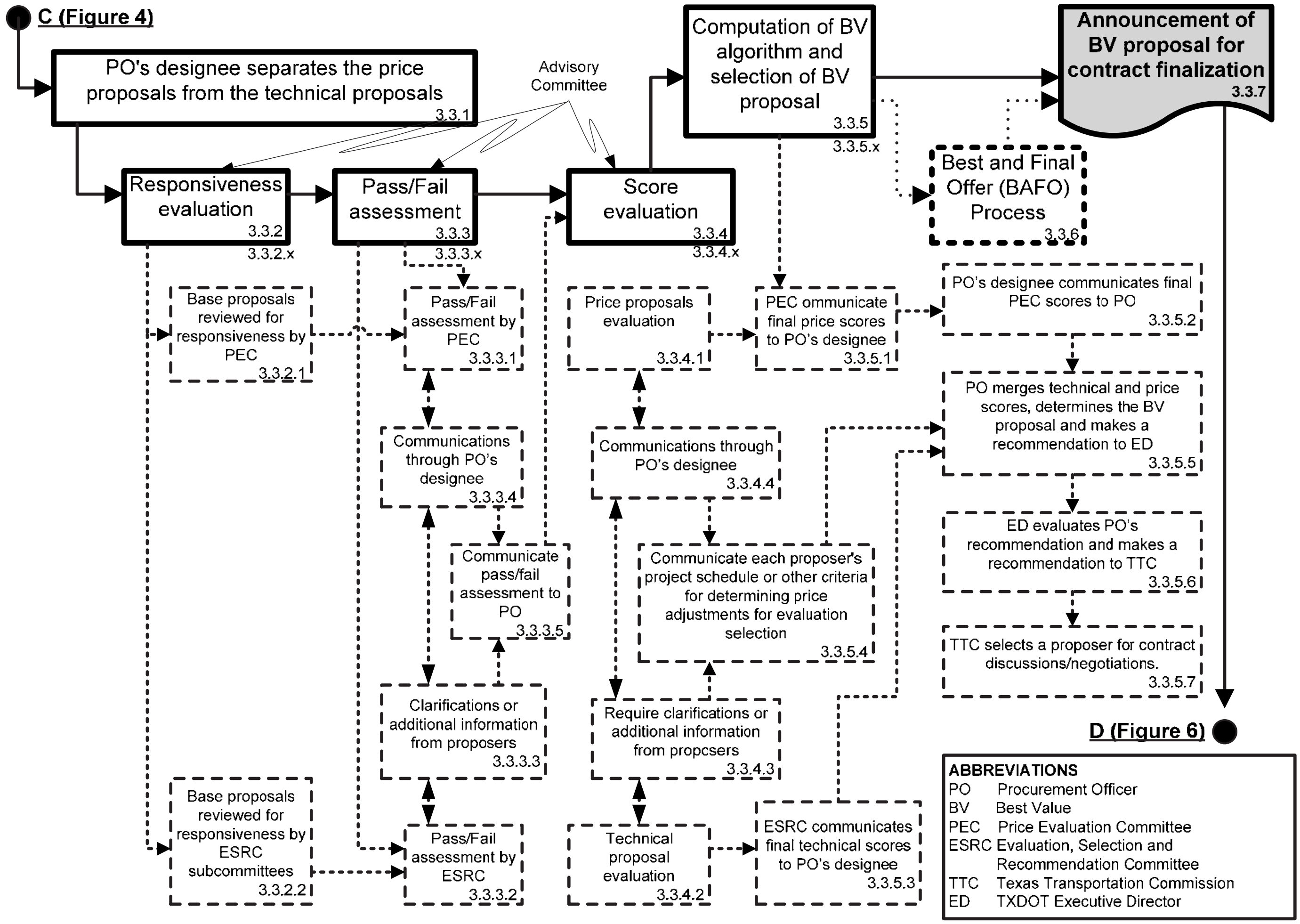

Fig. 5. Phase 3.3: evaluate proposals

score for each proposal. Exchange of information during this phase was strictly regulated because price and technical committees were not allowed to communicate with each other until after the scores were assigned. The entire evaluating process was supervised by an advisory committee, which included at least one representative from each of the following entities: the state attorney general's office; the FHWA (essential for validating processes related to federally funded projects); the TXDOT internal counselor representative, and the state comptroller. A chart representing the different committees involved in the evaluation of proposals for SH-130 is included in Fig. 6.

After the evaluation was concluded, the PO merged price and technical scores to determine the best value proposal and then recommended it to the executive management. The two projects adopted two different algorithms as represented in Tables 2 and 3. Finally, the TXDOT executive director communicated the best value proposal to the Texas Transportation Commission (TTC) and requested authorization to proceed for contract finalization.

At this stage, both SH-130 and SH-45 SE procurement included an additional and optional step, the best and final offers (BAFO) phase. Although this option was not exercised, a very detailed process for it was outlined in the two ITP documents. For both projects, the owner could initiate the BAFO process if the submitted proposals did not meet the maximum budget amount. If a BAFO process was going to be initiated, TXDOT could enter into discussion with one or more proposers, revise the RFP, and request BAFO submittals. Proposers invited to participate in the BAFO process would be advised of deficiencies in their proposals and given the opportunity to correct such deficiencies and reprice their proposals. In addition, TXDOT could change the scope of work. At the end of the BAFO process, TXDOT would consider the revised information and reevaluate and revise ratings accordingly.

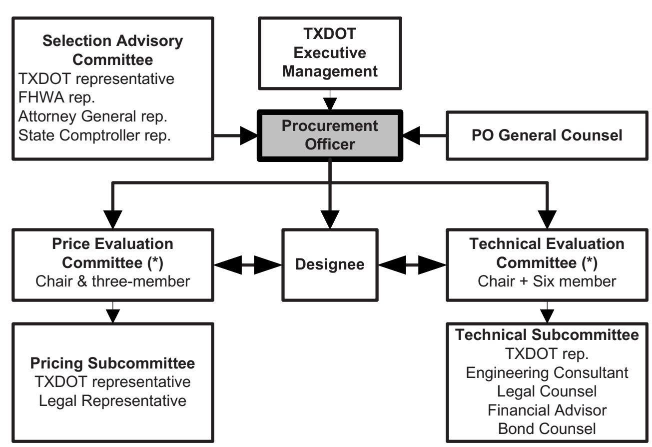

Fig. 6. SH-130 evaluation committees organization chart

Table 2. SH-130 Project: Algorithm to Select Best-Value Proposal

Formula	(Technical score/highest technical score)*15+(Lowest PPV/PPV)*85
Components	PPV (Price proposal value)=DPPPV+MPPV+AA+$\Sigma_{i=1}^{6}$SA$_i$
DPPPV=Development price proposal present value (The present value of the development price was determined based on a discount rate of 5/12% per month)	
MPPV=maintenance price proposal value	
AA=asphalt adjustment	
SA$_i$=schedule adjustment per segment (the present value of adjustments for advantage from early completion. The advantage for early completion was worth between $30,000 and $15,000 per calendar day depending on the segment)	

Phase 4—Contract Finalization

During this phase, the procurement team performed two sets of activities. Fig. 7 includes the tasks relating to this phase, and its two subphases.

Subphase 4.1—Develop Final Price

For the SH-130 project, the purpose of this subphase was to incorporate aspects of unsuccessful proposals into the selected proposal and to include them in the final price. Moreover, the process allowed TXDOT to enter into discussions with other proposers in case the selected proposer was not collaborative on a particular issue. On the SH-45 SE project, interactions between TXDOT and design builder were postponed until after the contract award.

According to some interviewees, two factors affect whether and when aspects of unsuccessful proposals can be included in later design activities. First, in Texas, the state transportation commission has to approve the payment of work performed (i.e., stipends) to unsuccessful proposers. In that case, TXDOT can acquire the right to use aspects of unsuccessful proposals in later design activities. While both of the observed projects received this permission, two different strategies were adopted. TXDOT acquired rights to use any proposals during SH-45 SE procurement. Conversely, only proposals with a minimum evaluation score were acquired during SH-130 procurement. The second determining factor is that the pricing of other proposal aspects can happen at different stages of the project life cycle depending upon the FHWA process adopted for the procurement. The SH-130 project was procured under the SEP-14 program, so some aspects of the acquired proposals were included in the contractual agreement with all necessary price adjustments made. In performing this activity, TXDOT began discussions with the selected proposer about the incorporation of aspects of other proposals for achieving the overall best value for the department. In the case of SH-130 procurement, this discussion phase was denominated "postproposal ATCs." Conversely, the SH-45 SE project was procured according to the FHWA rule, so the postproposal ATCs were treated as change orders or value engineering after the contract signature.

Table 3. SH-45 SE Project: Algorithm to Select Best-Value Proposal

Formula	{PV+PVCA+[(highest pp from any proposer−PP) ×(0.20)(lowest PV from any proposer)]}/100
Components	PV=present value of price (the present value of the price was determined based on a discount rate of 0.25% per month);
	PVCA=net present value of cost adjustments (the present value of adjustments for advantage from early completion and cost-saving ATC. The advantage for early completion was worth $15,000 per calendar day);
	PP=proposal points

Subphase 4.2—Contract Execution

During this subphase, TXDOT executed the agreement with the selected proposer. Any details needed for contract signature were also defined.

Conclusions

Using a case study methodological approach, the writers have performed a detailed study on the use of two-phase selection procedures. Investigations were focused on activities needed for selecting the DB entity and for preparing the contractual document. A process model has been developed for the procurement of design-build services through a two-phase selection procedure. Using two DB projects in central Texas as case studies, the writers identified procurement activities and then mapped their sequencing taking into consideration external processes. Activities were grouped in phases depending on the milestone they were aimed at achieving, and phase durations were identified for the two case studies. Last, the writers have developed a detailed DB procurement process.

The duration of the procurement for each of the two projects shows that this type of procurement can be time consuming. Procurement activities for the SH-130 project took around 35 months, whereas the contract stipulated a period of 65 months for the execution of the contracted work. As a result, procuring the contract required a period of time equal to 35% of the total delivery time. Similarly, procurement activities for the SH-45 SE project took 14 months, whereas the contract stipulated a period of 40 months for the execution of the contracted work. In this case, procuring the contract required a period of time equal to 26% of the total delivery time.

The analysis of procurement activities for these two DB projects suggests that procurement of design-build services is lengthier than usual procurement of construction contracts under DBB. However, the identification of activities and of their sequencing suggests constraints and opportunities for streamlining the process. The writers found that two processes external to procurement were shown to particularly affect the procurement schedule: (1) preliminary investigations to identify project risks; (2) environmental clearance. During Phase 3 (i.e., RFP), preliminary engineering activities are performed by the owner to identify

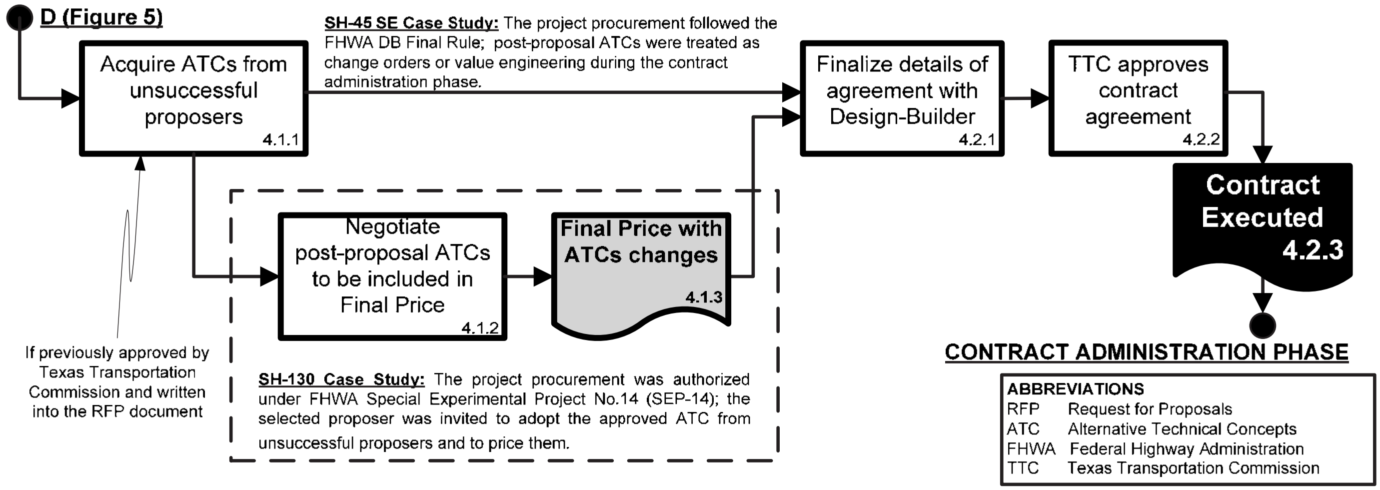

Fig. 7. Phase 4: contract finalization

project risks. Analyzing the developed process, it seems that Phase 3 can be initiated early in the process because the preparation of the RFP documentation is minimally affected by the prequalification process. This would allow to reduce the total duration to the sum of duration of Phases 3 and 4. If this change were implemented on the analyzed projects, the duration of their procurement would have been reduced by one-fifth to 26 months (SH-130) and 11 months (SH-45 SE). Other opportunities for streamlining the process are provided at the activity level. The writers recently published a set of lessons learned to streamline procurement of design-build services. These lessons suggest ways to reduce duration of procurement activities.

Although procurement of DB services is cumbersome, the literature does not offer detailed information on activities performed during DB procurement. With this paper, the writers have filled this research gap for the highway project sector. The process developed here can be used by practitioners as guidance for implementing the two-phase selection procurement encouraged by the FHWA DB final rule. The writers expect that state highway officers will be able to gain several advantages from this research. First, knowledge of information flow across procurement activities is important. For instance, specific information included in the ITP document, such as the rules for managing the ATC process directly affects the duration of the proposal development. Are these rules inherited from previous projects or are they rationally determined to fit the project objectives? The mapping of the information flows provided in this paper can facilitate efforts to plan efficient project procurement. Second, information on activity sequencing can reduce the amount of time that officers spend experimenting and developing new organizational routines to implement the new procurement approach. Third, an understanding of how DB procurement activities provide the same levels of safeguards as traditional DBB procurement can help agencies overcome existing cultural barriers and concerns over the new methods.

While the proposed process presented here forms the basis for understanding this new type of highway procurement, further research is required in three specific directions. First, a systematic study of which factors affect duration of DB procurement is necessary. Such research can only be done by means of a wide collection of data on procurement schedule durations and project characteristics. It is also necessary to identify variations within the two-phase selection scheme and to explain under which circumstances these variations occur. This information can be beneficial for mapping decision trees. Finally, it would also provide insights into designing software for DB projects that would better reflect and assist modified procurement processes. For instance, specifications for Project Information Management Systems (PIMS) that facilitate the procurement document exchange between owner, technical and legal consultants, FHWA officers and proposers can be built upon a general characterization of innovative procurement processes. Such systems would streamline procurement, allowing a real-time distribution of document versions and addenda.

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References

Byrd, L. G., and Grant, A. A. (1993). “Prerequisites for a successful design/build/warranty highway construction contract.” ⟨http://www.fhwa.dot.gov/programadmin/contracts/byrd.htm⟩ (Aug. 15, 2005).

FHWA. (2002). “Design-build contracting: Final rule.” *Federal Register*, 67(237), 75901–75935.

Gransberg, D. D., Molenaar, K. R., and Scott, S. (2004). “A framework for classifying best-value award systems for highway construction projects.” *Proc., Conf. on Design-Build for Transportation*, FHWA/ASHTO/DBIA, Baltimore, Md.

King, N. (1994). “The qualitative research interview.” *Qualitative methods in organizational research: A practical guide*, C. Cassel and G. Symon, eds., Sage Publications, London, 14–36.

Konchar, M., and Sanvido, V. (1998). “Comparison of U.S. project delivery systems.” *J. Constr. Eng. Manage.*, 124(6), 435–444.

Migliaccio, G. C. (2007). “Planning for strategic change in the project delivery strategy.” Ph.D. thesis, Univ. of Texas at Austin, Austin, Tex.

Molenaar, K. R., and Gransberg, D. D. (2001). "Design-builder selection for small highway projects." *J. Manage. Eng.*, 17(4), 214–223.
Molenaar, K. R., Songer, A. D., and Barash, M. (1999). "Public-sector design/build evolution and performance." *J. Manage. Eng.*, 15(2), 54–62.
O'Connor, J. T., Gibson, G. E., Jr., and Migliaccio, G. C. (2004a). "CDA procurement process model." Center for Transportation Research, Univ. of Texas at Austin, Austin, Tex.
O'Connor, J. T., Gibson, G. E., Jr., and Migliaccio, G. C. (2004b). "Essential elements of CDA master contract." Center for Transportation Research, Univ. of Texas at Austin, Austin, Tex.
O'Connor, J. T., Gibson, G. E., Jr., Migliaccio, G. C., and Shrestha, P. P. (2006). "Organizational structures and communications on the SH 130 project." Center for Transportation Research, Univ. of Texas at Austin, Austin, Tex.
Palaneeswaran, E., and Kumaraswamy, M. M. (2000). "Contractor selection for design/build projects." *J. Constr. Eng. Manage.*, 126(5), 331–229.
Pietroforte, R., and Miller, J. B. (2002). "Procurement methods for US infrastructure: Historical perspectives and recent trends." *Build. Res. Inf.*, 30(6), 425–434.
Songer, A. D., and Molenaar, K. R. (1996). "Selecting design-build: Public and private sector owner attitudes." *J. Manage. Eng.*, 12(6), 47–53.
USDOT-FHWA. (2004). "Report to congress on public-private partnerships." 〈http://www.fhwa.dot.gov/reports/pppdec2004/pppdec2004.pdf〉 (Apr. 2, 2007).
Yates, J. K. (1995). "Use of design/build in E/C industry." *J. Manage. Eng.*, 11(6), 33–38.