Best Practices in Design-Build Contracting for Highway Projects in Texas

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Report Number: TX-97-7-3916-1R
Project Number: 7-3916

Research Sponsor:
Texas Department of Transportation

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April 30, 1997

IMPLEMENTATION STATEMENT

At this point in time, it is impossible to implement this research due to legal restrictions which are detailed in the report. In short, legislation will need to be promulgated which makes it lawful for the Texas Department of Transportation to implement Design-Build contracting procedures before the State can accrue the potential benefits of this innovative contracting method. If it eventually becomes legal, the major benefits of this research will be tied to the Districts' ability to optimize the allocation of engineering and design resources by contractually shifting the responsibility for the design of low-volume highway projects to industry. This permits the allocation of in-house design capability to high priority projects while continuing to provide a responsive level of service to users of low volume highways. The net benefit of implementing Design-Build contracting for these types of projects is a higher standard of pavement management throughout the State of Texas. Ancillary benefits include a reallocation of risk and an ability to capture the creative energy available in the industry. This will hopefully provide a reduction in both construction and life cycle costs for the long term.

The best method to convey the research findings to operational staff members will be through a combination of a manual on the use of the Design-Build Evaluation Model and training classes to a level deemed appropriate by the Project Director. The training classes will consist of a hands-on demonstration of how to analyze a given project, extract the necessary input parameters, run the model, and interpret the results. The model will come in the form of a computer spreadsheet template and will be distributed with the operations manual.

DISCLAIMER

ACKNOWLEDGEMENTS

The authors would like to take this opportunity to acknowledge the valuable contributions made by the following members of the Texas Department of Transportation:

Joe Higgins, P.E., Project Director, Abilene District
David Casteel, P.E., Project Advisor, Childress District
Doug Eichorst, P.E., Project Advisor, Abilene District
Jim Hamm, P.E., Project Advisor, Construction and Maintenance Division
Joanne Wright, Project Legal Advisor, General Counsel's Office

Without their help, professional guidance, and direction, the work, to date, would have been much more difficult and time consuming.

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BEST PRACTICES IN DESIGN-BUILD CONTRACTING FOR HIGHWAY PROJECTS IN TEXAS

Interim Report: TxDOT Project 7-3916; "Turn Key Construction for Highway Construction."

PROJECT ABSTRACT

The "Turn Key Construction" project involves the development of a statistically based specification for the procurement of low volume highway projects using the Design-Build (DB) method of contracting. This project takes the current DB procurement techniques to a point which will permit contract awards on a lowest and best bid basis. This is possible due to the relatively simple nature of highway design (as opposed to building design). TxDOT has done extensive research into pavement life cycle cost and its relationship to pavement design parameters. FPS-19 permits the Department to evaluate proposed designs against the standard of the design generated by FPS-19. It also allows evaluation on expected life cycle maintenance costs of proposed designs using the FPS-19 algorithm and an adaptation of utility theory. Finally, because of the large body of pavement performance data available through TxDOT, the project is able to produce a statistically based specification for the delivery of a DB project without the need for guarantees or warranties.

INTRODUCTION

The Turn Key (hereafter referred to as Design-Build or DB) method of construction contracting is becoming more accepted for use in the United States. In the twelve month period ending in December 1996, nearly $16 billion worth of projects were procured using this method. Of these, about $10.2 billion were completed by public agencies, and of that amount nearly 35 percent were transportation projects (DBIA, 1996). Transportation was the largest single public sector market for DB contracting. The literature documents potential savings in both time and **initial** cost when this method is used instead of the traditional Design-Bid-Build (DBB) method (Ellis, et al, 1991). These savings are accrued from many aspects of the process from being able to start construction before design is complete to utilizing a best value rather than a low bid basis of contract award (Ellicott, 1994). However, to achieve these benefits a public agency like the Texas Department of Transportation (TxDOT) with a long history of successful DBB contracts must undergo a serious paradigm shift. Not only must an agency surrender time-worn attitudes and policies regarding competitively bid contracts, but it must also develop a method to objectively evaluate the subjective differences between competing offers. This shift forces the institution to use the maximum latitude available within its policies and regulations and forces it to become creative in its approach to evaluate contractual risk while ensuring fair and open competition. Utility theory or some similar approach offers a structure on which to build just such an evaluation system (Gransberg, 1995; Dozzi, et al,1995).

In pavement design and construction, TxDOT currently adopts a system where TxDOT personnel performs pavement design and provides the design for construction contractors to bid on. The bidder with the lowest and the best bid is awarded the contract (Attorney General, 1990).

When the construction is complete, TxDOT takes over the completed project once the contractor has proven that the constructed pavement meets certain acceptance criteria. Once TxDOT accepts the project, it also accepts the full responsibility of maintaining the pavement to provide its intended function. The Abilene District along with the Pavements Division in Austin is looking into the feasibility of adopting the Design-Build (DB) contracting system for the rehabilitation and/or construction of their low-volume roads. Under this system, a contractor would be able to bid for both the design and the construction aspects of the project. The current TxDOT pavement design methodology for new pavements is an automated system where the FPS-19 computer program aids the TxDOT pavement designers to arrive at a design that would satisfy the design requirements. These design requirements are:

- Design life of pavement
- Traffic volume
- Geometrics
- Reliability

In addition to the design requirements, it also requires several types of design parameters indicated below:

- Trial pavement layer configuration
- Trial pavement layer thicknesses
- Climatic conditions
- Material properties

For the design of pavement rehabilitation projects, in addition to the above, data on pavement performance such as distress data and structural condition data are available for the pavement designer.

The current TxDOT pavement design provides the lowest life-cycle cost for all candidate designs to be evaluated. The design procedure incorporates pavement distress prediction models for each significant form of distress. The design methodology is based on statistical methods incorporating a reliability level for the pavement structure. This level of reliability is governed by the reliability of available data, distress prediction models, and the functional classification of the pavement.

Once a pavement is constructed, TxDOT accepts the project provided that the construction meets specified acceptance criteria. These acceptance criteria currently include pavement layer thicknesses and pavement ride quality. The quality of materials used by the contractor is currently monitored under TxDOT Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT, **1993**) and the TxDOT Manual of Testing Procedures (TxDOT, 1994).

REVIEW OF PREVIOUS WORK

The U. S. Congress recognized the value of institutionalizing nontraditional procurement methods and directed the Department of Defense to expand their uses (Procedures, 1990). Design-Build's (DB) single biggest advantage is that it provides a single point of responsibility for the owner on all a project's technical aspects (Fisk, 1992). No longer can the construction contractor and the designer point fingers at each other when something goes awry. With Design-Build, the contractor and the designer are one in the same. This opens up a new avenue for project risk management. Because the contractor is liable for both design and final product, the project can start construction without a totally completed design. In fact, because the designer is also the builder, a 100% detailed design may not be required to complete a high quality project (Gransberg and Bell, 1996). The other advantages of DB (Barrie, 1978) are as follows:

- Single contract to administer.
- Interdisciplinary process knowledge combined with interdisciplinary design expertise.
- Minimal coordination between major project elements.
- Adaptable to phased construction to reduce project delivery time.
- Simplified change order process.
- Increased construction efficiency (Tenah and Guevara, 1985).

A study done at the University of Colorado (Songer and Molenaar, 1996) focused on reasons owners, both public and private, opt for DB over DBB in their routine facility procurement process. These reasons in order of their priority are as follows:

1. Shorten duration: Reduce the time from concept to project delivery.
2. Establish cost: Secure a fixed construction cost on a complex project.
3. Reduce cost: Accrue savings due to reduced time and increased constructability.
4. Constructability/Innovation: Compete several design concepts with direct contractor input to the design.
5. Establish schedule: Secure a fixed delivery date by lowering the risk of time growth due to design problems found in construction.
6. Reduce claims: DB single source of responsibility eliminates design-related claims against the owner.
7. Large project size/complexity: Single source of responsibility eliminates one layer of administration (i.e. owner to designer) and allows the contractor to establish an optimum schedule based on his own constraints rather than being forced to conform to a complex schedule established by the owner.

An after-action report written by the Corridor Design Manager of the Eastern Transportation Corridor Project in Orange County, California (Quinn, 1996) confirms the Colorado findings. This project and ones in the San Joaquin Hills Corridor and Foothill Transportation Corridor totaled approximately $2.5 billion of DB transportation projects to furnish 96 kilometers of new freeways (FHWA,1996). The analysis by Quinn cites the following benefits for using DB on major highway projects:

- "Early lock on total project costs."
- "No owner responsibility for design errors."
- "Defined areas of risk."
- "Guaranteed completion date."
- "Shorter overall time frame for project completion." "Earlier opening of project."
- "Less overall funds needed for bond projects."

Finally, Florida, the state with the most transportation DB experience dating back to 1987, sponsored a study on its program. The study looked at thirteen projects worth about $40 million and had the following conclusions (FHWA,1996). (This report is summarized in detail in Appendix A):

- "Total time for design-build projects was up to 40% less than that required for conventional design-bid-build projects."
- "There was no significant change in project costs."
- "Claims were essentially eliminated."
- "Both State and industry participants indicated a majority supported the concept."

To reconcile DB contracting with government procurement regulations, a public agency must devise a "fair and equitable system" of evaluating offerors' proposals (Procedures, 1990). To do this, an objective methodology for individually comparing each proposal must be developed and its content published in the RFP (Federal, 1994). There have been many solutions to this problem in the past ten years. Some are relatively simple and parallel the existing evaluation systems for Architect/Engineer design service contracts. Others are very complex (Napier, 1989) and require computer based expert systems and special technical knowledge to understand. One such system was developed by Construction Engineering Research Laboratory and uses fuzzy logic and a myriad of input to identify the optimal condition (Paek, et al, 1992). This type of system is probably justified for use on huge, complex DB projects with a large number of competitors. However, its effectiveness is probably reduced when applied to routine facility procurement. To achieve wide spread acceptance, an evaluation methodology must be simple enough to be understood by both engineers and procurement professionals and flexible enough to be applied to the full gamut of possible project types without the help of outside expertise.

Utility theory is an uncomplicated, flexible means to take a common sense approach to quantifying qualitative data (Riggs and West, 1994) and will be explored as a possible means to facilitate this computation(Dozzi, et al, 1995). DB inherently requires the evaluation of qualitative information (Gransberg, 1995). Such things as professional competence or past experience are difficult to describe in quantitative terms. To compare these qualities in a manner which is both fair and objective requires the evaluator to rank the qualities of each offeror in each category of requested information. This ranking can then be the basis for assigning a relative utility value to each piece of data, and the sum of the relative values in each category for each offeror becomes the quantified value of each proposal when compared to all other proposals (Dozzi, et al, 1995).

Other categories of requested information such as price or calendar days to complete the contract are already in quantitative form. Requiring a preliminary highway design cross-section permits the evaluators to quantify expected life cycle costs based on historical data. Thus, the rank ordering of each proposal in these categories takes care of itself. When the relative values of both quantitative and qualitative categories are added up, an overall value can be assigned to each proposal, and the proposals can then be compared to one another. To make the methodology more responsive to the owner's concerns and desires, a relative weight can be assigned to each category. The product of the category weight and its relative value becomes the category value and the sum of the "weighted category values" becomes the overall value for a given proposal. The evaluation system should consider establishing minimum standards for each category which would disqualify a proposal if not met (Gransberg and Bell, 1996). For example, the RFP would state that the project delivery date shall be no later than a given date. Thus, proposals which promise delivery after that date are disqualified. On the other hand, proposals that purport to deliver the project before the deadline would be given a higher relative value than those which promise delivery on the milestone. Most solicitations required contractors to submit the following categories of information in their DB proposals:

- Technical Excellence,
- Management Capability,
- Financial Capability,
- Personnel Qualifications,
- Prior Experience,
- Past Performance,
- Projected Performance Milestones, and
- Project Pricing Information.

Utility theory is an orderly process which assigns a relative value to a set of interrelated parameters which permits the analyst to rate each parameter's preferential outcome against the same outcomes for all other parameters. This value is called the parameter's "utility" and provides the means to quantify the qualitative. Through this mechanism, an interdisciplinary team of experts can apply their expertise in a manner which permits the owner to select a Design-Build contractor and get the best value within a system of constraints established by both the quantitative and qualitative needs of the owner. In essence, it provides a conduit to bring together two interdisciplinary teams: the owner's evaluation team and the contractor's DB project team. With utility theory as their common ground, the Design-Build evaluation team can come together with maximum interdisciplinary cooperation and make a contractor selection which optimizes the needs of each discipline and produces a successful project. It should be noted that if, during the course of the investigation, utility theory proves to be inadequate, there are a number of other promising approaches available in the literature.

RESEARCH APPROACH/PROCEDURES

This project takes the current DB evaluation approach a step further and attempts to devise a Request For Proposals and RFP evaluation scheme which will permit the award on a lowest and best bid basis. This will be possible due to the relatively simple nature of highway design (as opposed to building design). TxDOT has done extensive research into pavement life cycle cost and its relationship to pavement design parameters. FPS-19 will permit the Department to evaluate proposed designs against the standard of the design generated by FPS- 19. It will also allow the evaluation team to quantify expected life cycle maintenance costs of proposed designs using the FPS- 19 algorithm. This feature will greatly simplify the development of the evaluation model. Finally, it appears very possible that the large body of pavement performance data available through TxDOT will directly permit the research team to develop a statistically based specification for the delivery of a DB project without the need for guarantees or warranties beyond those currently in use.

The project has two separate and distinct types of tasks. The first are those associated with the development and fielding of the Design-Build contract, including the review of current State law regarding this type of procurement. The second group are those associated with the development of the statistically based pavement design and construction specification itself. Work in these two areas is proceeding in parallel and will converge at the end of the project in the production of the final report and recommended specification. The work accomplished to date is summarized by Proposal Task Number in the following paragraphs. Details of the work in each task can be found in the appendices to this report.

Task 1, Literature Review

A comprehensive review of the literature regarding Design-Build was made to identify the state-of-the-art in the use of this method for public project procurement. Special attention was paid to types and content of contracts which attempt to award projects on a low and/or best bid basis. Current state and federal guide specifications and contract boilerplate were reviewed to find "tried and true" examples of contract language which has been successfully used to procure transportation facilities. Additionally, detailed research was made into the requirements for the bonding of Texas contractors on highway projects and the impact of construction guarantees and warrantees on company bonding capacity. The previous section entitled "Review of Previous Work" details the results to date of work on this task. Appendix A is a critical review of the literature and Appendix B contains the findings on bonding and guarantees.

Task 2, Legal Review

A comprehensive review of State law regarding the use of Design-Build as a legal mechanism to procure public projects was made by the TxDOT General Counsel's Office to identify any restrictions on the legal use of this procurement method for TxDOT projects. The assistance of the Texas Society of Professional Engineers and the State Board of Registration for Professional Engineers was sought to expedite this search. All actual and possible restrictions and constraints were cataloged and recommendations for legislative changes were made to permit TxDOT to maximize the benefits of using this innovative contracting method to deliver public projects for the State. Appendix C contains the brief produced by TxDOT Attorney Joanne Wright and an analysis of the nationwide status of the law with regard to DB contracting on public highway projects.

Task 3, Evaluation of the Current TxDOT Procedures in Design and Contracts

In this task, a complete evaluation of the current TxDOT procedures pertaining to pavement design, construction and contracting was conducted. Possible future developments in these areas as identified in ongoing research projects and the TxDOT Long-Range Research Plan were also looked into. In order to do this, the researchers analyzed pavement design and evaluation computer programs such as FPS-19. Also, the researchers obtained additional information through interviews with TxDOT personnel in the Abilene district and pavement sections in Austin who are involved in the design and construction phases of the pavement related projects. Appendix D contains the details of work accomplished to date on this task.

Task 4, Best Practice Survey

Surveys were developed and sent to all State DOT's and Federal agencies including the Federal Highway Administration and the Corps of Engineers, who routinely procure design and construction services using DB, to identify the "best practice" in use throughout the nation. A preliminary survey, which only asked for the name of a point of contact who handles DB and whether or not each state had experience with DB, was sent. This permitted the research team to home in on those DOT's which had actual experience. Based on the response from the initial survey, a detailed survey was prepared and sent directly to the designated state point of contact. This survey was customized for each group and focused on identifying policies, procedures, and contract language which has been successfully used on the types of projects TxDOT will attempt in the future. Specific emphasis was placed on gaining knowledge on the evaluation of pavement design proposals, construction costs, and the quantifying of life cycle costs based on statistical performance data. Appendix E contains the results of these surveys. Additionally, a survey of all states regarding DB practices was performed by the Design-Build Institute of America. A copy of the report of this survey was obtained and is summarized in the appendix.

Task 5, Identification of Design Aspects and Acceptance Criteria Relating to the Design-Build Contract Procedure

During this task, the researchers identified the following information relating to the design-build contract procedure. The identification of these factors will facilitate the development of the DB Evaluation Model in Task 6. The primary factors are design criteria, design data, and acceptance criteria.

Task 6, Develop DB Evaluation Model

This task involves applying Utility Theory to the problem of evaluating DB proposals and providing an objective means to award a DB contract based on some form of lowest and best bid basis. In essence, the task will have three components. First, a list of evaluation factors and performance criteria must be made. This list will include, as a minimum, the items listed below.

- Construction cost
- Construction period

- Design approach
- Proposed design life cycle cost
- Design comparison to FPS-19 standard
- Contractor experience
- Contractor management plan
- Contractor traffic control plan
- User costs of construction
- Other factors found from surveys and literature review

Next, an algorithm to assign a Utility Value and weight to each evaluation factor was developed. The algorithm will permit TxDOT management personnel to compare each proposal to a predetermined standard which can be published in the RFP and rank order each proposal on a technical value and life cycle cost basis. Thus, the contract award group can then do a cost-technical value trade-off to make an award on the lowest and best bid basis. This algorithm will become a Design-Build Evaluation Model and take the form of a computer spreadsheet which can easily be manipulated with minimal training. Figure F- 1 in Appendix F is a flow chart which describes the process. The final component will be the development of the necessary documentation and training manuals to allow a smooth transition and implementation of this form of contracting. Appendix F contains a detailed description of the model and information regarding its use.

Task 7, Development of the Specification for Design-Build Contracting of Low-Volume Pavement Construction and Rehabilitation

This task will involve the writing of specifications for DB projects based on the DB Evaluation Model developed in Task 6 and work is expected to begin in June 1997. The researchers hope to request assistance from TxDOT personnel in writing the specifications in a format acceptable to TxDOT.

Task 8, Development of the Implementation Plan

As it is currently impossible to implement DB contracting in TxDOT due to legal constraints, Task 8 will be dropped from this project.

Task 9, Final Report

The final report will include information collected in tasks 1-7. The DB specification will be attached to the final report.

FINDINGS/DISCUSSION

The major findings to date are summarized in the following list and discussed in details in the appendices to this report.

1. It is currently impossible to legally implement Design-Build contracting on most public projects in the State of Texas.

2. TxDOT pavement construction and rehabilitation projects appear to be suitable to implement DB contracts. However, prior to implementation, important decisions need to be made on the following issues:
   - Level of detail needed for the contractor's design submission.
   - Evaluation method for contractor's design.
   - How to relate material quality and quality control/quality assurance procedures.
   - Acceptance criteria for the completed pavement.
3. The pavement design software package, FPS-19, can be used as an effective design evaluation tool. FPS-19's ability to estimate design life and life cycle cost can be adapted to provide easily interpreted output information for a utility theory based evaluation model.

4. Only thirteen out of fifty state DOT's are currently using Design-Build to procure highway and highway related projects, and the FHWA has approved DB projects in the following thirteen states: Alaska, Arizona, California, Colorado, Florida, Maine, Michigan, Minnesota, New Jersey, North Carolina, Ohio, South Carolina, and Utah (FHWA, 1996).

5. Four states not currently using DB expressed an interest on the survey response in using Design-Build, and some are planning to begin using DB in the near future.

6. Support for the use of Design-Build can be found in the design/engineering community. However, Texas construction contractors as represented by the AGC do not currently support the concept.

7. The Federal government has been using Design-Build for nearly two decades with a geometric increase in its use coming in the past five years.

8. Based on experience at both Federal and State DOT level, there is a sufficient body of contract clauses, formats, and content to easily develop a model set of Design-Build specifications for use in Texas.

9. Design-Build is a viable method for procuring both design and construction services for public projects and promises to reduce delivery time, life cycle cost, and both contract cost and time growth.

10. The researchers have not found any evidence at this writing that the furnishing of standard construction guarantees and/or warranties adversely impacts a contractor's capacity procure either bid or performance bonds. However, additional research will be done before this statement can be made definitively.

CONCLUSIONS AND RECOMMENDATIONS

First it must be remembered that this is an interim report. Therefore the conclusions reached at this point in the study are tentative, and recommendations are generally for information only. The most definitive conclusion to date is that legislation must be introduced to enable the Department to accrue the potential benefits of DB contracting. Enacting such legislation will not be simple. Contacts with the State Board of Registration for Professional Engineers, the Texas Society of Professional Engineers, and the Consulting Engineers Council indicate that there is support for the concept among the design community. An interview with the Associated General Contractors of America's Austin office found distinct opposition to the idea among the contractors who would be expected to form partnerships with the designers and perform the work on a DB basis. This is not to mean that passing DB legislation would be impossible. The research team is not in a position to render a judgment either way.

Next, assuming that DB can be made legal at some point in time, there is a considerable amount of documentation and experience in the federal sector and in other state DOT's to make implementing this innovative concept a quite straightforward affair. Standard contract language has been devised and tested. Forms and format for the development of requests for proposals is available. All this can easily be tailored for use by TxDOT. The one weak point in other states' DB programs is a simple method to evaluate DB proposals on a standard basis. The work done so far in developing the evaluation model will permit Texas to bring the entire system on line in a standard form and avoid many of the problems encountered by other states who did recognize the ultimate importance of having a simple, standard method to evaluate proposals which is solidly founded on current pavement design practice.

Finally, with the above discussion in mind, the major recommendation at this point in time deals with preparing the political road to permit the introduction of DB legislation in the next legislative session. Based on the results of the literature survey, DB promises to reduce both the cost and the time required to complete most highway construction projects. Therefore, it is in the best interests of the State to make this contracting mechanism available for future projects. Department policy makers should investigate the potential for opposition and begin addressing the specific concerns of each interest group, and thereby, paving the way to the development of a legislative act which is both supportable and implementable. Here the experience of other states might help identify the salient feature of a DB program which satisfies the concerns of all involved.

With respect to the purely engineering aspects of evaluating contractor proposed pavement designs, the following recommendations are made:

1. The pavement rehabilitation design proposed by the contractor should be the final design. Any fundamental changes to design after award may invalidate the evaluation and lead to potential legal protest actions.
2. The proposed design should be evaluated on a multitude of factors including constructability, total life cycle cost, traffic control plan, safety, and comparison with the benchmark TxDOT design criteria.

3. At this stage and until some experience with DB contracting is gained in the Department, the contractor's proposal should be based on existing TxDOT materials specifications.

APPENDIX A: Literature Review

Introduction

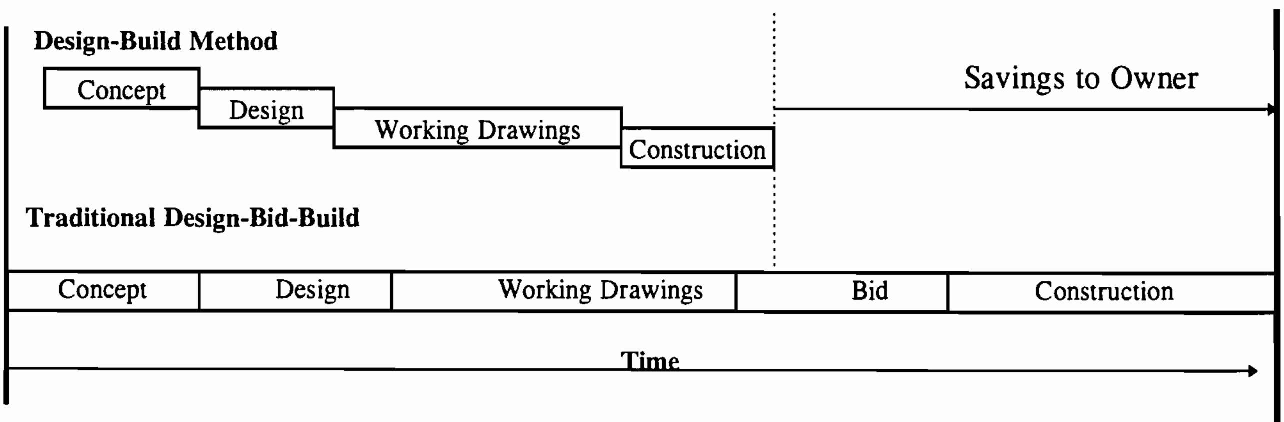
The Design-Build (DB) method of contracting was prevalent in this country around the turn of the century. Through the years, however, the process of design was separated from construction. This separation of designer and builder evolved to the current Design-Bid-Build (DBB) system. There are a number of reasons why this evolution occurred. The principal reason was to produce a viable infrastructure for the least cost to the public. Construction costs are based on competitive bids. The winner is the lowest-bidding responsive and responsible contractor. In the last decade the DB method of contracting has been increasing steadily (Quinn, 1996). Since 1982, the volume of domestic DB contracts has grown from $6 billion to $56 billion and now represents 23 percent of the non-residential U.S. market (Smith. 1996).

The term "turnkey" is often used interchangeably with DB. In many cases the two terms are used for the same type of project contracting. However, there is a difference between the two. The term "turnkey" is used to refer to a special case of DB contracting. In a turnkey contract the constructor performs a complete construction service for the owner. The contractor obtains project financing, procures the land, designs and constructs the project, and turns it over to the owner ready for use (Slough, 1986). Originally the two terms were used for the same type of contracting. In recent years, however, a turnkey contract has separated itself from DB as another alternative contracting method in and of itself.

Design-Build Vs. Design-Bid-Build Contracting

Design-build is a method of contracting in which one entity forges a single contract with the owner to provide both architectural or engineering design services and construction services. Traditionally the method of project delivery has been design-bid-build. In DBB the owner commissions an architect or engineer to prepare drawings and specifications under a design contract, and subsequently selects a construction contractor by competitive bidding to build the facility under a construction contract. Perhaps the greatest advantage that DB has over DBB is the time reduction from conception to completion of the project. See figure 1.

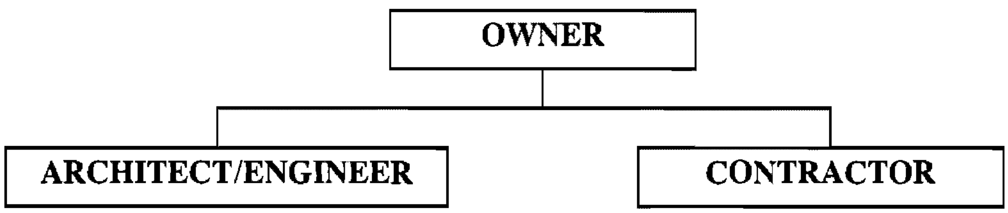
Figure A-1: Conceptual Comparison of Design-Build Time Scale to that of Design-Bid-Build.



Design-Bid-Build Contracting

The DBB method is the one that can be thought of as the "traditional" method of contracting, specifically on public projects. Design-Bid-Build is also referred to as Competitive bidding. In this system the Architect/Engineering (A/E) designer is selected by the owner first. The selection of an A/E firm can be accomplished three ways: comparative selection, direct selection, or a design competition (Bell, 1996). Once the designer has been selected and the design has been completed, a notice is sent out called an invitation for bid (IFB). Contractors interested in the project will respond by submitting a bid. Once the owner has received all bids by the deadline stated in the IFB, they are opened. The contract is awarded to the lowest responsible bidder. Usually the A/E firm acts as the owners representative, making sure that the project is being built as to the specifications in the contract. A possible organizational format can be seen in figure 2.

Figure A-2: Design-Bid-Build Hierarchy of Organization



Advantages And Disadvantages
Some of the advantages to DBB are: (Barrie, 1992)

- This system is accepted and historically supported with well-established legal and contractual precedents.
- Permits overall cost to be determined before the construction contract is awarded.
- Minimal involvement of the owner is required in the construction process.
- Owner may benefit from price competition because oF the competitive nature of the bid process.
- Contractor takes all of the construction risk (except for unforeseen circumstances or impacts).

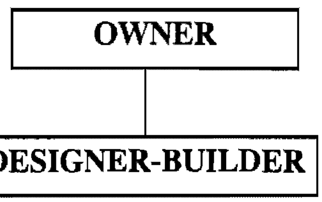
Some of the disadvantages to DBB are:

- Overall design-construct time is longest.
- The owner is often in an adversarial position with the general contractor, as is the A/E firm.
- Changes to the work or unforeseen difficulties will often end in disputes and litigation that can drive up costs in spite of the lowest price concept.
- The owner has minimal control over the performance of the work.
- Contractor pressures to submit the lowest bid may result in use of marginal subcontractors.

Design-Build Contracting

As mentioned earlier, DB combines design and construction responsibilities into one contract and thus one entity. The DB entity is totally responsible for the completed project. It may be said that integration is the key to DB. Designers and constructors work together to produce a project that meets or exceeds the client's performance criteria. See figure 3. Each member of the DB entity is a team member working to achieve one goal, that of producing a product that will satisfy the client's requirements. Design-build, by nature, will produce the a project for the lowest cost and reduced time because full responsibility is placed on the team (Wesely, 1996).

Figure A-3: Design-Build Hierarchy of Organization.



Advantages

There are a number of reasons why DB may be selected over other types of project delivery (Business *Digest,* 1997). Specifically some advantages are:

- Early cost input establishing and controlling budgets.
- Guaranteed construction costs are known far earlier. The decision to proceed with a project is made before considerable design costs are incurred, and with a secure knowledge of final cost.
- Total project time is reduced since design and construction overlap. This time savings results in lower costs and early use of the facility.
- The owner has single source responsibility. The contractor and architect/engineer work together as a team. This gives the owner an opportunity to focus on scope and needs definition rather than spending time coordinating between the builder and designer.
- Quality is higher with single-source responsibility. The owner outlines the terms and the designer-builder furnishes the documents.
- Change orders are reduced since the designer-builder is responsible for correcting decision errors.
- Architectural, engineering and contractor fees are determined from the beginning and kept to a minimum.
- Misunderstandings are minimized. Legal fees are minimized since most adversarial roles are eliminated.

Disadvantages

Despite numerous attractive advantages, DB is not without its drawbacks (Friedlander and Roberts, 1997). Some of the disadvantages of DB contracting are:

- Loss of checks and balances. The designer and constructor are on the same team. This means that the designer is no longer the owner's representative and, as such, does not keep a watchful eye on the constructor.
- Less owner control. Since the designer is on the contractor's team, the owner may find itself without access to the kind of information that it would have on a traditional project.
- Difficulty obtaining competitive bidding. Design-build projects are not easy to competitively bid.
- Institutional obstacles. In some areas of the United States, state and municipal laws and regulations severely limit or prohibit the use of design build.

Most of the disadvantages of DB contracting can be overcome by carefully establishing a contract that will protect the owner. Institutional obstacles, for public projects, are the most difficult to overcome. These issues will have to be resolved legislatively. However, these issues are being resolved as the popularity of DB increases. States are rapidly recognizing the need to change the current laws in order to allow DB contracting.

Legal issues are of great concern when it comes to design/build contracts. Most states have specific laws regarding the DB method of contracting for public works projects. Many states, including Texas, have prohibited the use of DB for public projects. According to the Design-Build Institute of America (DBIA) Florida, California, Massachusetts, New York, New Hampshire, Virginia, Idaho and Washington specifically authorize and/or encourage the use of DB contracting methods.

Florida leads all states in DB contracting of transportation projects. They compiled a comprehensive study of their DB program (see subpart 1 in appendix A). Florida recognized the need to revise their statutes in the mid 1980s. With the rapid growth of the DB process during the 1980s Florida legislature began to selectively remove questions of authority of particular public agencies to use the design/build concept. In 1986, the legislature provided statutory authority for both "turn key bidding" and "design/build bidding" for the construction of schools (Fla. Stat. ~ 235.211). Also, (Fla. Stat. ~ 337.11(5)(a)) added by the Florida legislature effective July 1, 1987 expressly permits combined design and construction contracts for FDOT work. In 1989 the Florida legislature further expanded the scope of their laws, in regards to design/build, by expanding the scope of the Consultants Competitive Negotition Act (CCNA) exemption to cover design/build contracts involving any public agency in the State of Florida (Ellis, et al. 1991).

TAB A 1: Florida Department of Transportation (FDOT) Design-Build Evaluation Report Summary

Introduction

Issues addressed in the evaluation are: time, cost, bid selection criteria and opinions of design-build participants. Objective of study was to evaluate the design-build pilot program. In 1987, Florida legislature authorized FDOT to conduct a combined design and construction contract demonstration program. The categories of projects included: (1) resurfacing, (2) bridge replacement or new, (3) multi-lane new or reconstruction, and (4) fixed capital outlay and parking garages. Eleven projects were awarded in the design-build program consisting of six resurfacing projects, one major bridge replacement project, one bridge widening project, one multilane highway project, and two fixed capital outlay projects.

Overview of Design-Build in Florida

Florida legislature provided statutory authority for both "turn key bidding" and "design and build bidding" in 1986. Pre-qualification of applicants and evaluation of proposals are based on the capabilities of a design and construction team to perform in a timely manner, past performance, lowest cost, and technical content.

A typical FDOT design-build procurement procedure has the following steps:

1. advertisement
2. letters of interest
3. pre-qualification
4. solicitation of design and bids
5. selection of team
6. awarding contract

FDOT utilizes the following proposal evaluation method:

The short-listing and evaluation of technical proposals is done using scoring and subsequently grading the proposals. Criteria on which ratings for each firm is based are technical criteria, management plan, and proposed project schedule. The firm which obtains the lowest adjusted score is selected. The study found the average design-build direct cost was 4.59% higher than non design-build cost. However, because of the small sample size and data variability, the result of the direct cost comparison is inconclusive. Average design-build construction time was 21. 1% shorter, and actual design-build procurement times were 54% shorter. Design-build projects produced significant reduction in change orders and cost of change orders. Change order costs were reduced by 1.99% compared to non design-build increase in cost of 8.78%. 74% of surveyed participants indicated that the design-build program should be continued with some changes.

Reasons for success:

The report cited the following reasons behind the success of the FDOT program:

- Combining construction and design enhanced project efficiency
- Maintenance of high qualification standards resulted in project team composed of exceptional designers and builders.
- Project time as a major award scoring criteria established an incentive for reducing project time.
- Types of projects selected.

The Florida program clearly demonstrates the potential for significant savings on a variety of routine transportation projects by implementing DB contracting as a procurement mechanism. The strength of this pilot program was the variety of projects that were investigated. Although the sample size was far from being statistically significant, it certainly shows the trend toward savings in both time and cost. The fact that DB is by nature a Best Value selection (Gransberg and Ellicott, 1996), explains the slight increase in first cost. The fact that change orders were significantly reduced leads one to hypothesize that the increment in initial cost is probably more than balanced by the decrease in cost growth due to change orders and the savings in user construction costs by earlier opening of vital transportation facilities.

APPENDIX B: Warranties and Bonds

Design build is an increasingly popular project delivery method. The owner hires a single entity (or joint venture) both to design and construct the project. Most aspects of typical construction contracts are incorporated into D-B contracts as well as several additional provisions made possible by the different relationship. The structure of the D-B relationship allows the owner to obtain additional types of warranties not usually found in construction contracts. For further information on construction warranties see subpart B-1.

Warranties have the purpose of minimizing one of the party's risks. According to Mark Friedlander, "Warranties of quality can be divided into two categories. The first category is warranties of performance. This warranty is usually quantifiable, the contractor guaranteeing that the operation of the facility will meet certain minimum performance criteria mutually established and agreed by owner and contractor. The second category is qualitative warranties of particular facts. These facts are capable of being described generically in a contract, but are unquantifiable, such as a piece of equipment being 'new' or 'free from defects' or services being 'good and workmanlike'

The following three sections: Performance Warranties, Qualitative Warranties, and Distinctions Between Performance and Qualitative Warranties along with Tab-1 were written by Mark Friedlander. Mr. Friedlander is an attorney with Schiff, Hardin, and Waite and has published numerous articles on construction contractual issues. Permission to reprint Mr. Friedlander's work was received by electronic mail on April 24, 1997

Performance (Quantifiable) Warranties

One of the warranties unique to D-B contracts is a warranty of professional services. Traditionally, a design professional refuses to warrant the adequacy of its services. Most courts that have analyzed the issue consider a D-B contract to be more nearly akin to a construction contract than to a design professional agreement and hold that the design-builder does warrant the adequacy of its professional services. It is not ordinarily possible to formulate this warranty in qualitative terms, such as by warranting accuracy and completeness of the design, because in a D-B project the design-builder often does not prepare fully detailed plans and specifications, preferring less formal and more efficient means of communicating the design intent to the constructors. Instead, this warranty often takes the form of a performance warranty, whereby the contractor warrants that the completed project will meet certain minimum performance levels, which will depend on the nature of the facility. The performance warranty is a combination of design and construction warranties in which the contractor warrants that both the design and the construction will be adequate to achieve the performance criteria.

A performance warranty may warrant the actual performance of the facility while in use for some period of time, or it may simply warrant that at substantial or mechanical completion the facility will pass a performance test designed to simulate or predict its actual performance.

There are two differences between these warranties. First, a warranty of actual performance depends on the actual operation of the facility, a concern that is ordinarily not present in a performance test warranty. Secondly, an actual performance warranty extends for a fixed and agreed period of time after completion, whereas a performance test warranty does not have this element of duration. Design-builders are often hesitant to give actual performance warranties because they usually cover a period of time during which the contractor has turned over operating control of the facility to the owner.

Qualitative (Unquantifiable) Warranties

It is customary for a design-builder to make unquantifiable warranties of quality in addition to the quantifiable warranties described above. Unquantifiable warranties differ depending on whether they apply to equipment/materials or to services, and the warranties applicable to services differ depending on whether the services are considered professional or not.

Unquantifiable material/equipment warranties cover a broad range of issues. The contractor ordinarily attempts to limit its risks under these warranties by requiring similar or identical warranties from the vendor or material supplier. A typical equipment warranty will look something like this:

"Contractor warrants to Owner that all material, equipment and other products to be supplied hereunder (i) will be constructed in a good and workmanlike manner; (ii) will conform in all material respects to the contract documents, Owner's criteria for the project, sound construction practices and all applicable laws, codes, regulations and other similar requirements; (iii) will include only equipment and materials that are new, merchantable, of suitable grade, free from defects and fit for their intended purposes; and (iv) will be free from defects in engineering, design, material, construction, manufacture and workmanship."

There are a smaller number of issues involved in warranties of services. Contractors typically promise that its non-professional services will meet the stated (in contract) standards and achieve the specified results. However, warranties of professional services are different because a professional, by definition, does not impliedly warrant a satisfactory result. Just as doctors do not guarantee to cure a patient and lawyers do not guarantee to win a lawsuit, design professionals do not guarantee the results of their services. Under the law in every jurisdiction throughout the country, professionals are required to perform their services with the levels of knowledge, skill, and care that the average, similarly situated professional would employ. As stated earlier this is one of the benefits of a D-B contract (Friedlander, b, 1997).

Some Distinctions Between Performance and Qualitative Warranties

The distinctions between performance and qualitative warranties are not entirely clear. On the surface it appears that they are largely redundant. If all of the contractor's services were performed properly and all of the materials and equipment are appropriate and free from defects, then the facility should function properly. Additionally, warranting proper operation of the facility might logically render it unnecessary to make individual warranties for each and every service or piece of equipment.

However, there are some differences in the scope of performance and qualitative warranties. One such difference is that qualitative warranties apply to issues not directly affecting performance of the facility. The flooring or roofing systems might not be directly important to the operation of a plant, and therefore would not be covered under a quantifiable warranty of plant performance. However, such items would be warranted under the general, unquantifiable warranties of the quality of the materials and services provided.

Probably the most important difference between performance and qualitative warranties concerns the issue of latent defects. By definition, a latent defect is an item of construction which was defective when installed but whose defective nature and the consequences of the defect do not become apparent until after the passage of a period of time. Qualitative warranties cover such latent defects because the equipment/materials or services were, by definition, defective at the time of installation. However, latent defects may or may not be covered under a quantifiable warranty of facility performance depending on whether their consequences become apparent and are first detected within the time period during which the warranty is effective.

This is why an owner needs to have both performance and qualitative warranties in a D-B contract. A performance warranty guarantees facility performance without fault, but it lasts for a limited duration. The qualitative warranty protects against facility failure due to fault, it applies only if the contractor's equipment/materials or services were defective, but there is no time limitation the time (other than any applicable statute of limitations) during which it can be enforced (Friedlander, c, 1997).

Owner's Liability

It appears that a D-B contract frees the owner from the risk of a defective design. However, this is not entirely true. Despite the general rule, a D-B contract does not guarantee an owner complete immunity from liability to the design-builder for defective design. The information that the owner initially provides the design-builder may itself create liability for the owner if that information is in error and the contractor's reliance on the erroneous information results in a defective design. This is illustrated by two recent cases, *Pitt-Des Moines, Inc. v. U.S. Government* and *M.A. Mortenson Co. v. U. S. Government.*

Pitt-Des Moines, Inc. was contracted to design, fabricate and install a large acoustical tank as well as major structural modifications to an existing building which was to house the tank. The contract included some remedial clauses typically found in traditional construction contracts, including a changes clause, a differing sites conditions clause, and a site investigation clause. In the request for proposal (RFP) were some as-built drawings of the building and offered more information at the site, but warned that the drawings "may not be accurate and shall be field-checked."

The contractor reviewed the RFP drawings, inspected the site, and attended a pre-proposal conference with the Government. Since the RFP drawings did not have dimensions and the legibility was poor, the contractor requested additional drawings. The Government responded that there were no other drawings available and that the RFP drawings would have to serve as the basis for the proposed design. Other problems were also brought up at the meeting, but the Government said there would be no such problems. The contractor had to make certain assumptions, based on the information that was available, in their technical proposal.

Well it turns out that the RFP drawings were not the only drawings available. After the contractor discovered these drawings, significant changes had to be made in the project's design. The contractor asserted a claim for differing site conditions on the basis of the actual condition of the preexisting building and a separate claim for the condition of an adjacent building, which affected the work on the other building.

The Board of Contract Appeals hearing the dispute accepted the contractor's factual allegations and agreed that the contractor did not miscalculate or misread the RFP drawings. The Government's argument was that under a D-B contract the contractor assumed greater responsibility to obtain better drawings or field check the RFP drawings and that the contractor acted unreasonably in failing to do so, particularly considering the disclaimer about the RFP drawings.

The Board stated the general rule for what constitutes reasonable reliance on the part of a contractor as follows: Potential contractors are required to take all steps reasonably necessary to ascertain the nature and location of the work, and to satisfy themselves as to the general and local conditions affecting the work. However, the contractor is not required to conduct a costly or time consuming technical investigation to determine the accuracy of Governmental drawings. This is a rule that applies to firm-fixed construction contracts. The Board concluded that the same rule should apply to D-B contractors.

The Board found that the contractor met the standard and reasonably relied on the RFP drawings. Additionally, the contractor did express concerns about the accuracy of the drawings and tried to obtain additional information but was rebuffed by the Government. The disclaimer on the RFP drawings did not relieve the Government of the liability since the contractor showed reasonable effort to investigate the site. Also noted was that the Government's responses to questions at the pre-proposal meeting suggested nothing contrary to the contractor's expectations. The Board found that the Government had an affirmative duty to turn over the information regarding the condition of the adjacent building and breached that duty (Sweeney, 1997).

Bonds

At this time there is no information that shows warranties have an adverse influence on the bonding capacity of contractors in regard to D-B projects. Several insurance firms have been

contacted to determine what the current requirements are for the bonding of Texas contractors on highway projects. All of the companies essentially have the same requirements. They are as follows:

- Audited financial statements - typically last three years
- Bank letter - a commitment to back contractor financially
- Supplier letter - supplier's comments about timely payments and overall opinion of company
- Prior performance record
- Character, capacity, and credit are judged
- Equipment required
- Past jobs - experience
- Status of work on hand
- Amount of contract for which bond is needed
- General questionnaire for company to fill out
- Performance and payment bond request forms filled out by contractor

None of the insurance companies indicated that construction guarantees and/or warrantees have any effect on the bonding capacity of a company.

APPENDIX C: Legal Review of Texas Department of Transportation Design/Build Contracting and a Comparison with Other States' Laws

The TxDOT General Counsel's Office was asked to prepare a brief regarding the state of the law regarding the procurement of design and construction services in the same contract. The paragraphs below is that brief as written by Joanne Wright, Associate General Counsel, Texas Department of Transportation.

Design-build Contracting in Texas

"A design/build," or "turnkey," construction contract is one in which a single contractor provides both the design and the construction of a facility for the owner. The owner presents the contractor with a general description of the facility to be built, and the contractor is responsible for designing the facility and building it within the parameters of the owner's description. Current Texas law does not provide a mechanism for the Texas Department of Transportation (TxDOT) to utilize this type of contract for the design and construction of highways.

"TxDOT's contracting procedures are directed by statute with the applicable statutes making a distinction between construction services and pre-construction services. Each type of service is governed by its own law, and the two laws conflict to the extent that they cannot be reconciled, precluding the possibility of combining both types of services into a single contract. A contract made in violation of a statute is void. *Mayfield v. Troutman,* 613 S.W. 2d 339,344 (Tex Civ. App--Tyler 1981, writ ref'd n.r.e.).

"Section 223.001 of the Transportation Code states, "The department shall submit for competitive bids each contract for the improvement of a highway that is part of the state highway system." Attorney General Opinion JM-282 (1984) outlines the distinction between contracts for construction and contracts for the planning of construction, holding that the former does not include the latter. Section 233.001, then, applies only to the actual construction of the highway. Pre-construction contracts require the services of professionals or consultants and are governed by the Professional Services Procurement Act, Chapter 2254 of the Government Code. See Op. Tex. Att'y Gen. No. JM-940 (1988).

"The provisions of the Engineering Practice Act, article 3271a, V.T.C.S., require that design work on a construction project be performed by a registered professional engineer. Section 19 of the Act prohibits the State from constructing a public work unless the plans and specifications and estimates have been prepared by a professional engineer and the engineering construction is executed under the direct supervision of a professional engineer. State agency procurement of engineering services is governed by §2254.003 of the Government Code, which requires that such contracts be awarded "on basis of demonstrated competence and qualifications" of the provider. In the same statute, the legislature goes a step farther than simply exempting professional services from the competitive bid requirement: "A government entity may not select a provider of professional services . . . or award a contract for the services on the basis of competitive bids." Any contract made, whether directly or indirectly, in violation of this statute is void as against public policy (§2254.005, Government Code). See also, *State v. Steck*, 236 S.W. 2d 836 (Tex. Civ. App.--Austin 1951, writ ref'd).

"While neither the Engineering Practice Act §2254.001 of the Transportation Code requires that the plans and specifications be complete prior to the award of the construction contract, such requirement is implicit in the competitive bidding statute. There is a great deal of case law that gives credence to the theory that a contract is not competitively bid unless bidders are presented a completed set of plans and specifications on which to bid. *Headlee v. Fryer*, 208 S.W. 213 (Tex. Civ. App.--Dallas 1918, writ dism'd), involved a contract to build a county courthouse, with the county being subject to much the same competitive bid statute as TxDOT. The county provided tentative specifications with pencil sketches of floor plans and a drawing of the building provided by an architect for the contractors to bid on. The court, in holding the resultant contract void as violating the competitive bid statute, stated:

". . . it can hardly be denied there could and would be no bids received, at least in good faith, in the absence of some specifications of what the county required to be done or furnished by prospective bidders on a contract requiring the expenditure of such a large sum. That some step on the part of the county officials was contemplated is a necessary deduction from the act requiring them to submit all such contracts to competition. Certainly responsible contractors are not going to undertake the financial liability involved in so important a matter as constructing a county courthouse without first being precisely informed what is required by the county particularly when it is commonly known that intelligent bids are out of the question in the absence of such information. The most ordinary prudence would require in such cases considerable particularity."

"In *Superior Incinerator Co.of Texas v. Tompkins*, 37 S.W.2d 391 (Tex. Civ. App.--Dallas 1931). *aff'd* 59 S.W.2d 102(Tex. Comm'n App. 1933, holding approved), the court stated, "A competitive bidding statute is fundamentally violated where the bidder is asked to furnish plans and specifications, and an award made under such circumstances is void."
"The Texas Supreme Court, in *Texas Highway Comm'n v. Texas Ass'n of Steel Importers*, 372 S.W.2d 525 (Tex. 1963), cited with approval the following description of competitive bidding stated in *Sterrett v. Bell*, 240 S.W.2d 516, 520 (Tex. Civ. App.--Dallas 1951, no writ):

"'Competitive bidding' requires due advertisement, giving opportunity to bid, and contemplates a bidding on the same undertaking upon each of the same material items covered by the contract upon the same thing. It requires that all bidders be placed upon the same plane of equality and that they each bid upon the same terms and conditions involved in all the items and parts of the contract, and that the proposal specify as to all bids the same, or substantially similar specifications."

"Therefore, TxDOT does not have the authority to award a design/build highway improvement contract by competitive bid if such contract will include engineering services. Likewise, §2254.002 of the Transportation Code prohibits award of a contract through the Request for Proposal process if it will include the construction of improvements to the highway system.

Because the two statutes contain mutually exclusive contracting requirements, TxDOT is without legislative authority to enter into design/build contacts."

Design-Build Contracting in Other States

Laws across the rest of the United States vary widely with respect to the use of DB to procure public projects. In fact, Texas currently is operating on an exemption to the laws discussed by Attorney Wright for school districts. See Appendix E for details found by DBIA.

THE ATTORNEY GENERAL
OF TEXAS

JIM MATTOX
ATTORNEY GENERAL

July 24, 1990

Honorable D. C. (Jim) Dozier
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Mr. Charles E. Nemir, P.E.
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Texas State Board of
Registration for Professional Engineers
P. O. Drawer 18329
Austin, Texas 78760

Opinion No. JM-1189

Re: Authority of a commissioners court to award "design/build" contracts for construction of public buildings on the basis of competitive bids and related questions (RQ-1895)

Gentlemen:

Mr. Dozier advises us that the commissioners court of Montgomery County is considering the construction of certain public works through the award of so-called "design/build" contracts. His description of the design/build concept is "the award of a single contract for both architectural design and construction to a single contractor for a lump sum fee."

Mr. Dozier asks the following questions:

1. Does the proposed design/build procedure comply with the requirements of applicable competitive bidding laws?

2. In light of article 664-4, V.T.C.S. the Professional Services Procurement Act, does the inclusion of architectural design services as a component of the design/build contract violate the prohibition on award of professional services through a competitive bidding process?

3. Assuming the application of article 249a, section 16, V.T.C.S. must the preparation of the required architectural plans and specifications precede competitive bidding to serve as a foundation for bid specifications or may

Owner

↓

Design/Build Team
Architect/Engineering firm and/or Contractor

See Practicing Law Institute, supra. The entity contracting with the owner undertakes either to design and build the entire project using the owner's financial resources and present the owner with a finished product or to present the owner with the finished product on a "turn-key" basis.[1] Block, supra, at 8; see, e.g., Seaview Hosp., Inc. v. Medicenters of America, Inc., 570 S.W.2d 35 (Tex. Civ. App. - Corpus Christi 1978, no writ).

The design/build approach to construction contracting offers the distinct advantages of reducing the time necessary to negotiate a contract for the entire project, reducing the time required to complete the project, and affording the owner considerable flexibility in the ultimate design of the project. See Grant, A New Look at Design/Build, 7 The Construction Lawyer 3 (April 1987). However, the design/build method also has its disadvantages. For example, the arms-length relationship between the design professional and the builder is eliminated. Id. The traditional contracting method delegates various functions to different contractors, creating what has been called a "healthy tension" and installing a check-and-balance mechanism into the process. Id. By combining the design and construction functions, the design/build contract is said to make the architect less of an agent for the owner since he is essentially acting in partnership with the builder. Practicing Law Institute, supra.

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1. A "turn-key" project is one in which the contractor agrees to complete the construction process to the point of readiness for occupancy, assuming responsibility for design of the project and for all risks, unless such responsibility is waived or limited by contract. See Mobile Hous. Env'ts v. Barton & Barton, 432 F.Supp. 1343, 1346 (D. Colo. 1977); Gantt v. Van der Hoek, 162 S.E.2d 267, 270 (S.C. 1968). At the time of occupancy, all that is required of the buyer is that he simply "turn the key" to open the door. See Glassman Const. Co. v. Maryland City Plaza, Inc., 371 F.Supp. 1154, 1159 (D. Md. 1974).

Parsing this provision to its essential elements, section 3 reads: "No . . . county . . . shall make any contract for, or engage the professional services of, any licensed . . . architect . . . or registered engineer . . . selected on the basis of competitive bids . . . , but shall select and award such contracts and engage such services on the basis of demonstrated competence and qualifications for the type of professional services to be performed and at fair and reasonable prices."

"Professional services" are declared by the act to be, among other things,

> those within the scope of the practice of . . . architecture . . . or professional engineering as defined by the laws of the State of Texas or those performed by any licensed architect . . . or professional engineer in connection with his professional employment or practice.

V.T.C.S. art. 664-4, § 2. The act thus prohibits the procurement through competitive bids of services within the scope of the practice of architecture or engineering, even though the contract may not call for the services of a licensed architect or registered engineer.[2] Contracts for such services must be made in accordance with the procedures described in section 3A of the act. Contracts made in violation of any of the provisions of the act are declared void. Id. § 4.

A commissioners court, or for that matter any entity subject to article 664-4, is thus prohibited from awarding a contract for architectural services, engineering services, or any other service specified in the act, on the basis of competitive bidding. Cf. Attorney General Opinion JM-282 (1984) (distinguishing contracts for the construction of a building and contracts for the planning of the construction of a building; the former are subject to competitive bidding

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2. Architectural and engineering plans and specifications for certain public works of a specified cost must be prepared only by architects and engineers registered with the state. See V.T.C.S. arts. 249a, § 16 (architectural plans for public buildings whose construction costs exceed $100,000); 3271a, § 19 (engineering plans for public works whose cost is more than $8,000).

Hunter v. Whiteaker & Washington, 230 S.W. 1096, 1098 (Tex. Civ. App. - San Antonio 1921, writ ref'd) (involving a contract for engineering services); see also Stephens v. J.N. McCammon, Inc., 52 S.W.2d 53 (Tex. 1932) (architectural services); Attorney General Opinion JM-940 (1988) (services of a construction management consultant).

The legislature has incorporated this thinking into competitive bidding statutes by enacting exemptions for professional services. See, e.g., Local Gov't Code § 262.024(a)(4). As for the services covered by article 664-4, the legislature has gone a step further by expressly prohibiting their procurement on the basis of competitive bidding. Thus, while it might be argued that competitive bidding statutes do not require, but at the same time do not forbid, contracts for architectural and engineering services to be awarded by competitive bids, article 664-4 affirmatively bars counties from awarding such contracts on that basis.

Taking into account Mr. Nemir's request, the third question becomes whether section 16 of article 249a or section 19 of article 3271a requires the preparation of architectural or engineering plans and specifications in advance of competitive bidding to serve as a foundation for bid specifications, or whether such plans may be prepared following the award of a design/build construction contract.

Section 16 of article 249a, effective January 1, 1990, provides the following:

> To protect the public health, safety, and welfare of the citizens of the State of Texas, an architect registered in accordance with this Act must prepare the architectural plans and specifications for a new building intended for education, assembly, or office occupancy whose construction costs exceed One Hundred Thousand Dollars ($100,000.00) which is to be constructed by a State agency, a political subdivision of this State, or any other public entity in this State.

Acts 1989, 71st Leg., ch. 858, at 3839. A county is a political subdivision of the state. Childress County v. State, supra.

Section 19 of the Texas Engineering Practice Act, V.T.C.S. article 3271a, provides the following:

Purchasing 45 (3rd ed. 1989). There are numerous Texas authorities which suggest that competitive bidding requires the preparation of detailed architectural and engineering plans prior to the invitation of bids for a construction project.

In his letter Mr. Dozier cites Headlee v. Fryer, 208 S.W. 213 (Tex. Civ. App. - Dallas 1918, writ dism'd), a case involving the award of a contract for the construction of a county courthouse based only upon "a tentative synopsis of specifications and pencil sketches of floor plans and a drawing of the building." He quotes language from the case describing the role of the commissioners court prior to inviting bids for construction:

> [I]t occurs to us that they are put to the necessity of being prepared to present to those who may appear to bid upon the contract some intelligent and concrete statement of the work required to be done or the structure to be erected as would tend to induce competition, depending in every instance upon the character of the undertaking.

208 S.W. at 216. The court emphasized that without a precise description of what the county required, no responsible contractor acting in good faith could bid on the project, and thus competition would be stifled. See also 35 D. Brooks, County and Special District Law § 18.7 (Texas Practice 1989).

In another case, a court upheld the action of a city board of commissioners that rescinded a contract for the construction of an incinerator that the board concluded had been awarded in violation of the city's competitive bidding ordinance. The specifications for the project contained several material omissions, including the size of the building to house the incinerator, number and dimensions of furnaces, size of flues, chimney dimensions, and number of stairways and doors.[4] Superior Incinerator Co. of Texas

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4. In fact, the specifications called for the prospective bidder to design the incinerator and to submit complete working drawings covering the design with the bid. The court, responding to this provision and citing numerous authorities, adopted a broad rule: "A competitive bidding
(Footnote Continued)

The opinion then quoted the following language from Sterrett v. Bell, 240 S.W.2d 516, 520 (Tex. Civ. App. - Dallas 1951, no writ), cited with approval in Texas Highway Comm'n v. Texas Ass'n of Steel Importers, 372 S.W.2d 525 (Tex. 1963):

> 'Competitive bidding' requires due advertisement, giving opportunity to bid, and contemplates a bidding on the same undertaking upon each of the same material items covered by the contract; upon the same thing. It requires that all bidders be placed upon the same plane of equality and that they each bid upon the same terms and conditions involved in all the items and parts of the contract, and that the proposal specify as to all bids the same, or substantially similar specifications. . . . There can be no competitive bidding in a legal sense where the terms of the letting of the contract prevent or restrict competition, favor a contractor or materialman, or increase the cost of the work or of the materials or other items going into the project.

Admittedly, these authorities do not hold that final architectural and engineering plans and specifications must be drawn in advance of competitive bidding in every case, but they make it clear that a particular bidding procedure may be faulted for being non-competitive if detailed plans and specifications are not prepared in advance. Furthermore, the award of a contract on the basis of nothing more than a general project description might also alter the duties and liabilities of the public entity and the construction contractor. Cf. Board of Regents of the Univ. of Texas v. S & G Constr. Co., 529 S.W.2d 90 (Tex. Civ. App. - Austin 1975, writ ref'd n.r.e.) (builder held not liable for delays in completion of construction resulting from owner's failure to provide builder with "correct plans and specifications" and additional instructions and detail drawings necessary to carry out work under contract; rather, owner found in breach of contract, entitling builder to damages).

Accordingly, neither section 16 of article 249a nor section 19 of article 3271a expressly requires the preparation of architectural and engineering plans and specifications prior to the invitation of bids by a county for a construction contract. But absent a provision to the contrary, such a requirement is implicit in competitive bidding statutes.

APPENDIX D: Pavement Design

Introduction

The primary aim of this research project is to address design-build construction contracts for pavement construction and rehabilitation projects. Therefore, this section addresses TxDOT pavement design aspects on such projects. TxDOT currently follows the traditional design-bid-build (DBB) approach for their pavement construction activities where TxDOT engineers use computer-based methods to design both pavement construction and rehabilitation projects. These designs, together with TxDOT materials specifications, serve as the technical basis for Request for Proposals (RFP's).

In a design-build contract scenario, the contract will generally include all aspects of a construction project, including design, construction and quality control. However, depending on the characteristics of the industry and the needs of the funding agency, variations do exist in the way design-build contracts are stipulated. Ellis et al. (1991) identified the following bid evaluation method adopted by Florida DOT:

1. 35 to 50 percent weight for technical criteria including aspects such as constructability, future expansion, maintenance of traffic flow, safety, environmental impacts, innovation of design/construction, application of sound design criteria, and understanding of the scope of services.
2. 30 to 45 percent for management criteria including aspects such as contractor's experience, adverse effects of construction on public, achievement of special level of quality, experience of the firm with design-build, location of firm, previous joint contractor-consultant experience, and the experience of the design team.
3. 20 percent for project schedule including contractor's and consultant's schedules and the ability to meet the schedules.

Deen (1990) identified the following design-related features unique to the design-build contracting practices of some states.

1. In the state of Kentucky, all designs are the responsibility of the contractor.
2. In the states of Georgia and West Virginia, the contractor's designs are allowed as alternates to the contract plans furnished by the state highway agencies.

In any event, from a technical evaluation standpoint, the following issues require serious consideration in the implementation of a design-build contracting practice for new pavement construction or rehabilitation projects.

1. Design responsibility (either sole responsibility or alternative choices)
2. Level of design detail required at the time of evaluating proposals
3. A procedure and a basis to evaluate the contractor's design
4. The need to evaluate a proposal based on the total life-cycle cost for the project
5. Traffic control plan during construction

6. Specifications for materials to be used in the project (TxDOT 1995)
7. Quality control/quality assurance issues (TxDOT 1995)
8. Acceptance criteria (based on method, performance-based or end-result specifications)

In the light of above-mentioned factors, the following section presents a brief overview of the TxDOT pavement design system.

TxDOT Pavement Design Systems

TxDOT pavement design procedures include design systems for both flexible and rigid pavements. TxDOT engineers design flexible pavements using the computer-based Flexible Pavement System (FPS). The rigid pavements are designed using the AASHTO method. This research project is limited to flexible pavements and therefore, this section discusses only the FPS.

In January 1995, TxDOT implemented new technical analysis criteria for its FPS (TxDOT Pavements Section 1995). The new FPS, labeled FPS-19, continued to be based on the pavement serviceability concept similar to the AASHTO design system (Scrivner and Michalak 1969). However, it included the following changes from its predecessor FPS-11:

1. Use of pavement deflections obtained from the Falling Weight Deflectometer (FOOD) instead of the DYNAFLECT
2. Pavement layer backcalculation using the MODULUS backcalculation program instead of the STIFF2 computer program
3. Use of pavement layer moduli instead of layer stiffness coefficients

FPS-19 is recommended for the design of flexible pavements with flexible bases, asphalt stabilized bases and lightly stabilized (less than 3 percent stabilizing agent) bases. It is also recommended for the design of overlays. However, it is not recommended for pavements with layers comprised of Portland cement concrete or heavily stabilized materials and for overlays on cement treated or concrete bases.

FPS-19 can be used for new pavement design, overlay design for existing flexible pavements, and for pavement rehabilitation design. The design system provides a summary of best design strategies together with the following information:

1. Layer configuration (layer materials and thicknesses)
2. Initial construction cost
3. Overlay construction cost
4. Routine maintenance cost
5. Total life-cycle cost

Depending on whether the project is a new design or a rehabilitation, the designer has to provide data for the design system. Data required for a new design include the following:

1. Values for depth to bedrock and subgrade modulus, obtained from backcalculating adjacent pavements,
2. District generated moduli values for layer materials,
3. Traffic (current ADT future ADT and cumulative 18-kip estimates),
4. Length of analysis period (pavement design life),
5. Confidence level for design data - There are existing TxDOT guidelines to select a confidence level for design data based on the type of highway and its importance.

For a pavement rehabilitation design the design procedures are different from the above because of the necessity to evaluate the existing pavement structure. Such an evaluation is referred to as a remaining life analysis and it is based on deflection testing using the FWD. Based on this evaluation, rehabilitation strategies are recommended.

Fig. D-l illustrates the current TxDOT approach on pavement rehabilitation design and Table D-l outlines the data requirements for pavement design at various stages of the process. One of the key aspects of pavement rehabilitation design for design-build contracts is whether to share the pavement monitoring information collected by TxDOT with the prospective designbuild contractors.

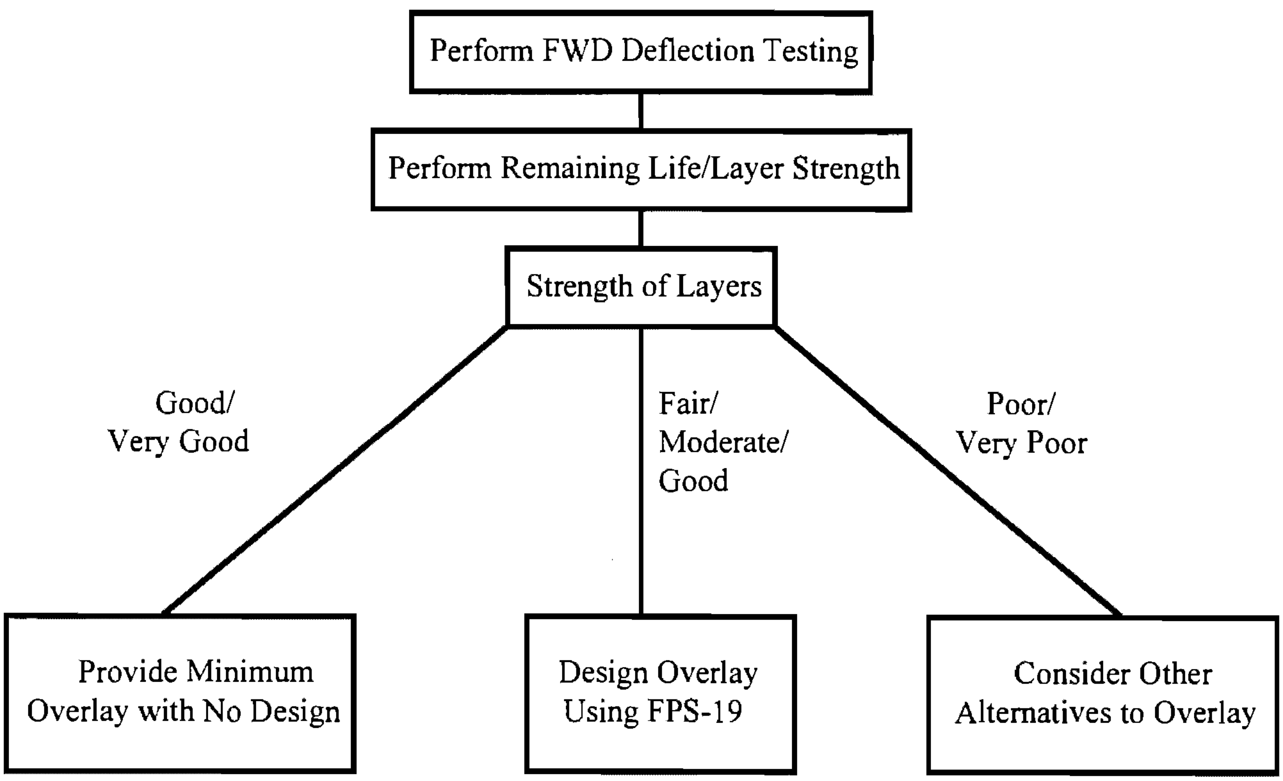

FIG. D-l. Schematic Diagram of TxDOT Pavement Rehabilitation Design Process

TABLE D-1. Data Requirements for Pavement Rehabilitation Design

Design Segment	Data Description
MODULUS backcalculation	Existing layer material types
	Existing layer thicknesses
	FWD deflection data
MODULUS remaining life analysis	Cumulative 20-year, 18-km ESAL
	Percent alligator cracking
	Average rut depth
Design program (FPS-19)	Current and Future ADT
	Cumulative 20-year, 18-km ESAL
	Beginning and ending PSI
Design strategy selection	Construction/maintenance history
	Type and date of last resurfacing
	Data from forensic studies
	Area engineer's recommendation for rehabilitation
	District recommendation for rehabilitation

APPENDIX E: Design Build Best Practice Survey

The study team prepared and issued two surveys to various state and federal agencies to identify existing "Best Practices" in this important area. The first survey was a preliminary survey whose purpose was to identify those states with current DB experience and obtain the name of the person who had the most comprehensive knowledge in each agency. This approach had been used successfully by the team in a previous TxDOT research project. The second survey involved a detailed questionnaire and was sent directly to the point of contact named in the preliminary survey. At this writing, the responses to the second survey are not complete. Therefore, only emerging data is available for discussion in this report. Additionally, a copy of a nationwide survey on DB conducted by the Design-Build Institute of America (DBIA) was obtained (DBIA, 1996). This study helps put the results of the survey of DOTs in perspective. Before the details of our surveys are presented, it will be helpful to discuss the DBIA survey and allow it to establish the national context in which we must analyze the data we obtained.

In 1996, DBIA surveyed the Offices of the Attorneys General of all 50 states and the District of Columbia. The overall purpose of the study was to "benchmark the acceptance and use of alternative and innovative contracting methods permitted by state governments (DBIA, 1996)." There were 27 states which reported that DB was a permissible procurement mechanism. Only 9 states had laws which expressly forbade DB. Interestingly, Texas was not among those nine. Of the states which did not permit DB, four reported that it was possible to use a DB subcontractor, and surprisingly, Texas was one of those. 45 states reported that they are required to select architect/engineer services on a qualifications-bases process, and 48 stated that they were required to award construction contracts which do not include design by competitive bids. Finally, 29 states reported that they employ contracting methods other than Design-Bid-Build (DBB) to procure projects. Texas was not among that group. It is also interesting to note that the information reported by the Texas Attorney General's Office appears to conflict with that found by the TxDOT General Counsel's Office (Appendix B). We attribute this discrepancy to a less than accurate response by the Attorney General's Office. Additionally, the TxDOT response was a documented brief rather than a questionnaire response, and therefore, the writer was directly focused on the specific application of DB in the Department rather than a broad, all-encompassing Yes/No response to the use of DB throughout the state in both private and public projects.

When this information is taken along with information collected by the FHWA, an interesting picture emerges. Only thirteen out of fifty state DOTs are currently using Design-Build to procure highway and highway related projects, and the FHWA has approved DB projects in the following thirteen states: Alaska, Arizona, California, Colorado, Florida, Maine, Michigan, Minnesota, New Jersey, North Carolina, Ohio, South Carolina, and Utah (FHWA, 1996). The geographic dispersion of the states who have adopted DB covers virtualy the entire country. No specific region seems to either espouse or reject DB. The experience of the Federal government is also cogent to this discussion. The Department of the Navy reported a 15% savings in DB project cost and a 12% reduction in facility delivery time over DBB projects. The Department of Defense Nonappropriated Fund projects showed savings of 18% in costs and 14% in time (DBIA, 1996). Obviously, some state DOTs are seeking to accrue benefits similar to those realized by federal engineering agencies. Now let us take a look at the use of DB in state DOTs as measured by this study's survey.

Table E-1: Results of Design-Build Preliminary Survey

State	Question 1	Question 2	Question 3	Question 4	Question 5	Additional Information
Alabama	Yes	2 projects	No		Yes	Useful on unusual or extremely fast-track projects
Alaska	Yes	< 1%	Yes	Loren Rosmusson	Maybe	(907) 465-6958
Arizona	Yes	0%	N/A	Ron Williams	Yes	(602) 255-7707 Working on two pilot projects
Arkansas	No	N/A	N/A	Robert Walters	No	(5 01)569-2000
California						
Colorado	Yes	2 projects	Yes	Ken Mauro	Yes	
Connecticut	Yes	None	No	Earle Munroe, PE	No	(860)594 31 S0
Delaware	No	N/A	N/A		No	
Florida	Yes	Yes		Greg Xanders	Yes	(904)48 8-6721
Hawaii	No	N/A	N/A	Francis Nishioka	No	
Idaho	No	N/A	N/A	James D. Porter	Maybe	(208)334-8495 Just received permission to utilize DB
Iowa	Yes	None	N/A	David Little	No	(515)239-1402 IaDOT did one project in 1982
Kansas	No	N/A	N/A	David Comstock PP.	No	(913)296-1568 Would like a copy of final report
Kentucky	No	N/A	N/A	J M Yowcll, PP	No	*Would like copy of final report
Louisiana	No	None	No	William Hickey	No	(504)167-9108
Maine						
Michigan						
Mississippi	No	N/A	N/A		No	
Montana	No	N/A	N/A		No	
Nebraska	No	N/A	N/A	Claude Oie	No	(402)479-4532
Nevada	No	None	N/A	Susan Martinovich	No	(702)888-7440 'Would like ~ copy of report
New Jersey						
New York	No	N/A	N/A		No	Currently seeking legislation to allow maintenance paving
North Carolina	Yes	I project	Yes	Robert Canales, PP.	Yes	(919) 250-415 I
North Dakota	No	N/A	N/A		No	
Ohio						
Oklahoma	No	None	No		No	Not interested in D/B
Pennsylvania	Yes	8	Limited	MG. Patel, PK.	Yes	
South Carolina						
South Dakota	No	None	N/A	Tim Bjorneberg, John Cole, or Lawrence Weiss	No	(605)773-3174 Possible attempt at future projects.
Utah	No	N/A	N/A	PK Mohanty, PP.	Yes	(801)9654000 Awarding first DIB project in March
Virginia	No	N/A	N/A	Robert Edwards	No	*Would like copy of final report
Wyoming	No	N/A	N/A	Gary Carver	No	*Would like copy of final report

Questions

1. Has your department ever used design-build for any of its construction work?

2. If so, approximately what percentage of projects were contracted using design-build over the past 5 years?

3. In your opinion, was the design-build method beneficial to your construction projects?

4. Who is the point of contact for design-build in your department?

Note

Any state that has no entries are either non responsive or have not submitted there response.

BEST PRACTICE SURVEY

In order for us to determine what the state of design-build contracting is in the United States, we have done a survey to find out more information. Two surveys were conducted. The purpose of the first survey was to find out which states were using the D-B method of contracting. The second survey was conducted for those states that were using the D-B method of contracting. In addition to this we have learned that The Design Build Institute of America has recently concluded a survey of all 50 states.

The first survey was sent out in late Fall 1997. A copy of this survey can be found in Tab 1. This survey was general in nature and was mainly conducted to determine which states use the D-B method of contracting. Then we could send a more detailed survey to those states that do use D-B contracting.

- Of the 50 states, 33 responded to the questionnaire.
- Of the 33 respondents, nine responded that they had used D-B on some projects - Alabama, Alaska, Arizona, Colorado, Connecticut, Florida, Iowa, North Carolina, and Pennsylvania.
- Out of those nine states, five said they thought the method was beneficial to their construction projects - Alaska, Colorado, Florida, North Carolina, and Pennsylvania.
- Five states requested a copy of our report when it is completed - Kansas, Kentucky, Nevada, Virginia, and Wyoming.

The second survey was sent out in February. A copy of this questionnaire can be found in Tab 2. As of this date not all the surveys have been responded to. The survey was sent to - Alabama, Alaska, Arizona, Colorado, Connecticut, Florida, Iowa, North Carolina, and Pennsylvania. The four states that have responded are: Arizona, Colorado, Pennsylvania, and Utah. The results of the survey can be found in Tab 3.

Emerging results of questionnaire #2 are as follows:

1. The majority of respondents have done less than 5 D-B projects. Arizona, Colorado and Utah. Pennsylvania have done the most projects, 5-20.
2. Arizona and Colorado have been using D-B for 3-5 years
   Pennsylvania has been doing D-B projects for more than 5 years.
   Utah has just awarded their first D-B project and is currently working on another D-B project.
3. The value of the projects ranged from \$300,000 - \$1.33 billion with an average value of \$336,625,000.
   Colorado has the lowest value at \$300,000 and Utah has the highest value at \$1.33 billion.
4. Arizona uses a statement of qualifications and technical proposal as their format for request for proposal (RFP) .
   Pennsylvania uses 20-30% preparation of plans and permit approval as a basis for RFP.
   Information on RFP for Colorado and Utah was unavailable.
5. The majority of states require a technical proposal for proposal submission.

6. All states have a formal proposal evaluation plan evaluated mainly on: Milestones (proposed schedule),Contractual experience, Design approach, Cost, Quality Control, Financial data of company, and Safety and Traffic Control
7. The majority of states pre-qualify proposals. Companies are pre-qualified based on experience, qualifications, and bonding capacity.
8. Two states award final D-B contracts without negotiations, Arizona and Colorado. Pennsylvania awards contract on low bid basis. Utah negotiates to receive best and final offers.
9. The majority of states listed the main factors in selecting D-B contracts over D-B-B contracts as:
   Need to fast track to achieve fixed delivery date Reduced project delivery period
   Constructability considerations will drive design concept
   Constructability considerations will drive design details
   100% design not required to permit high quality product
   Risk and costs can be shared to reduce overall cost.
10. Pennsylvania and Utah list reduced cost as the major advantage of D-B contacts. While Arizona and Colorado list project completion time as the main advantage.
11. Arizona lists less control of final design as the major disadvantage of D-B. Colorado lists increased risks as the major disadvantage and the other two states were non-responsive.
12. In comparing D-B vs. D-B-B all states agree that D-B is faster and most agree that it generates value engineering.
13. Three out of the four states use D-B on major rehabilitation and bridge projects. While two states use D-B on new highway projects.
14. Two states have limited use of D-B in regards to their laws and one state has unlimited use.
15. Three out of four states have a standard set of clauses for D-B projects.
16. Three states have had the contractor organized as the general contractor with a design subcontractor. Utah has had the contractor organized as a joint venture between general contractor and the Architect/Engineer.
17. In administering D-B contracts all departments of transportation approve final design, submittals, pay estimates & quantities and quality control test results.

Tab 1: Original Questionnaire

1. Has your department ever used design-build for any of its construction work?

2. If so, approximately what percentage of projects were contracted using design-build over the past 5 years?

3. In your opinion, was the design-build method beneficial to your construction projects?

4. Who is the point of contact for design-build in your department?

Tab 2: Questionnaire #2

1. How many projects, to date, have used design/build as the method of contract?

None   Less than 5   5-20   greater than 20

2. How many years has your state used design/build as a method to contract highway projects?

1-2 years   3-5 years   more than 5 years

3. What is the dollar value of the projects that have used design/build?

Smallest___________   Largest___________   Average ______________ ______

4. What is your format for design/build request for proposal?
   Would you please send us a copy of a typical RFP?

5. What format do you require for proposal submission?

6. Do you prepare a formal proposal evaluation plan? If so, please send us a copy of a typical plan.

Yes   No

If so, what areas do you typically evaluate?

____Milestones (proposed schedule)
____Contractual experience
____Design approach
____Cost
____Quality Control
____Financial data of company
____Safety
____Environmental Protection Plan
____Traffic Control
____Other (specify)_______________.

7. Do you pre-qualify proposals?   Yes   No

8. How are companies pre-qualified?

____Experience
____Qualification
____Bonding Capacity
____Other (specify)__________________.

9. How are the final design/build contracts negotiated?

____Award without negotiations
____Negotiate and receive best and final offers

____Other (specify)____________________.

10. What factors would cause you to select design/build as the contracting instrument rather than design-bid-build for given project? Mark all that apply.

____Need to fast track to achieve fixed delivery date
____Reduced project delivery period
____Constructability considerations will drive design concept
____Constructability considerations will drive design details
____100% design not required to permit high quality product
____Risk and costs can be shared to reduce overall cost.
____A single point of responsibility is required for the life of the project
____Owner/designer must rely on builder to supply best technology/lowest cost matrix
____Unique factors about project location require special knowledge or experience to produce least cost design.
____Other (Specify)____.

I 1. What is the principle advantage and disadvantage, from your point of view, of using design/build contracts?

Advantages: (mark one only)
____Project completion time
____Reduce cost
____Single point of responsibility
____Other____________________________________.

Disadvantages: (mark one only)
____Less control on final design
____Legal situation less clear
____More front-end contract preparation work
____Higher potential for award protest
____Other____________________________________.

12. Would you give a comparison of design/build vs. Design-bid build contracts. (check all that apply)

____D/B is faster ____D/B has less claims
____D/B is less expensive ____D/B generates value engineering

3. On what types of projects do you use design/build? (check all that apply)

____new highway ____major rehab projects
____maintenance ____bridge
____buildings ____traffic signals/devices

4. What are the state laws regarding design/build contracting for public works projects?

____prohibit ____allow limited ____unlimited

15. Do you have a standard set of contract clauses for design/build projects? (If yes, would you send us a copy) Yes No

16. What is the average project delivery time from authorization of funding to substantial completion of actual project.

Design/build project ______________ months.

Design-bid-build project ___________ months.

17. In past design/build projects, how has the contractor been organized?

____General contractor with design subcontractor
____Joint venture between general contractor and Architect/Engineer
____Architect/engineer as prime with builder as subcontractor
____General contractor with in house design capability.
____Other_____________________________________.

18. In administering design/build contracts who approves;

Final design	____DOT	____Designer
Submittals	____DOT	____Designer
Pay estimates & quantities	____DOT	____Designer
Quality control test results	____DOT	____Designer

Tab 3: Emerging Results of Questionnaire #2

Arizona

1. How many projects, to date, have used design/build as the method of contract?
   Less than 5

2. How many years has your state used design/build as a method to contract highway projects?
   3-5 years

3. What is the dollar value of the projects that have used design/build?
   Smallest 1.8 Million Largest 3 Million Average 3-4 Million

4. What is your format for design/build request for proposal?
   Statement of Qualifications(SOQ) and Technical proposal

5. What format do you require for proposal submission?
   SOQ and Technical proposal

6. Do you prepare a formal proposal evaluation plan?
   Yes

   If so, what areas do you typically evaluate?

Milestones (proposed schedule)	Financial data of company
Contractual experience	Safety
Design approach	Traffic Control
Quality Control	Cost

7. Do you pre-qualify proposals?
   Yes

8. How are companies pre-qualified?
   Experience, Qualification, and Bonding Capacity

9. How are the final design/build contracts negotiated?
   Award without negotiations

10. What factors would cause you to select design/build as the contracting instrument rather than design-bid-build for given project?
    Need to fast track to achieve fixed delivery date
    Reduced project delivery period
    100% design not required to permit high quality product
    Risk and costs can be shared to reduce overall cost.
    Use of innovative (private) financing

11. What is the principle advantage and disadvantage, from your point of view, of using design/build contracts?

Advantages: Project completion time
Disadvantages: Less control on final design

12. Would you give a comparison of design/build vs. Design-bid-build contracts.
    D/B is faster

13. On what types of projects do you use design/build?
    new highway, major rehab projects, and bridges

14. What are the state laws regarding design/build contracting for public works projects?
    allow limited

15. Do you have a standard set of contract clauses for design/build projects?
    Yes

16. What is the average project delivery time from authorization of funding to substantial completion of actual project?
    Design/build project 15 months
    Design-bid-build project 18 months

17. In past design/build projects, how has the contractor been organized?
    General contractor with design subcontractor

18. In administering design/build contracts who approves?
    DOT approves all:
    Final design.
    Submittals.
    Pay estimates & quantities. and
    Quality control test results.

Colorado

1. How many projects, to date, have used design/build as the method of contract?
   Less than 5 2.

2. How many years has your state used design/build as a method to contract highway projects?
   3-5 years

3. What is the dollar value of the projects that have used design/build?
   Smallest <u>$300~000</u> Largest <u>$30 Million</u> Average <u>over $10 Million</u>

4. What is your format for design/build request for proposal?

5. What format do you require for proposal submission?
   Low bid and Technical proposal

6. Do you prepare a formal proposal evaluation plan?

Yes. we use a committee to evaluate proposals to assure they meet minimum contract requirements.

If so, what areas do you typically evaluate?

no response

7. Do you pre-qualify proposals?

Yes

8. How are companies pre-qualified?

Experience,
Qualifications,
Bonding Capacity, and
Standard state list for DOT

9. How are the final design/build contracts negotiated?

Award without negotiations - lump sum bid

10. What factors would cause you to select design/build as the contracting instrument rather than design-bid-build for given project?

Need to fast track to achieve fixed delivery date
Reduced project delivery period
Constructability considerations will drive design concept
Constructability considerations will drive design details
100% design not required to permit high quality product

11. What is the principle advantage and disadvantage, from your point of view, of using design/build contracts?

Advantages: Project completion time
Disadvantages: Legal situation less clear - more risk

12. Would you give a comparison of design/build vs. Design-bid build contracts.

D/B is faster and generates value engineering

13. On what types of projects do you use design/build?

major rehab projects and bridges

14. What are the state laws regarding design/build contracting for public works projects?

allow limited

15. Do you have a standard set of contract clauses for design/build projects?

Yes

16. What is the average project delivery time from authorization of funding to substantial completion of actual project.

Response: Varies

17. In past design/build projects, how has the contractor been organized?
    General contractor with design subcontractor

18. In administering design/build contracts who approves?
    DOT approves all
    - Final design
    - Submittals
    - Pay estimates & quantities
    - Quality control test results

Pennsylvania

1. How many projects, to date, have used design/build as the method of contract?
   5 - 20

2. How many years has your state used design/build as a method to contract highway projects?
   more than 5 years
3. What is the dollar value of the projects that have used design/build?
   Smallest $500,000 Largest $5 Million Average $1 Million

4. What is your format for design/build request for proposal?
   Prepared 20-30% of plans, secured all permits, and cleared R/W

5. What format do you require for proposal submission?
   Same as above

6. Do you prepare a formal proposal evaluation plan?
   Yes

7. Do you pre-qualify proposals?
   No

8. How are companies pre-qualified?
   Experience, Qualifications, and Bonding Capacity

9. How are the final design/build contracts negotiated?
   Low bid

10. What factors would cause you to select design/build as the contracting instrument rather than design-bid-build for given project?
    Low bid

11. What is the principle advantage and disadvantage, from your point of view, of using design/build contracts?
    Advantages: Project completion time, Reduce cost, and Single point of responsibility

Disadvantages: If design can be completed while securing permits and clearing R/W, then D-B has no advantage.

12. Would you give a comparison of design/build vs. Design-bid-build contracts.
    N/A

13. On what types of projects do you use design/build?
    Bridges

14. What are the state laws regarding design/build contracting for public works projects?
    We had to be extremely careful in meeting the state law requirement which indicates that the department is responsible for providing plans and specs in sufficient detail to ensure that a common base for bidding is established.

15. Do you have a standard set of contract clauses for design/build projects?
    Yes

16. What is the average project delivery time from authorization of funding to substantial completion of actual project.
    Varied

17. In past design/build projects, how has the contractor been organized?
    General contractor with design subcontractor

18. In administering design/build contracts who approves?
    DOT approved all
    - Final design
    - Submittals
    - Pay estimates & quantities
    - Quality control test results

Utah

*note - We are just about to award our first design/build contract (major rehab). We are currently in the planning stages on a second project (new highway).

1. How many projects, to date, have used design/build as the method of contract?
   less than 5

2. How many years has your state used design/build as a method to contract highway projects?
   1-2 years

3. What is the dollar value of the projects that have used design/build?
   $1.33 Billion

4. What is your format for design/build request for proposal?
    A copy (on CD) was provided to TxDOT - a set can be purchased by contacting Scott Palmer at (801)288-3231

5. What format do you require for proposal submission?
    N/A

6. Do you prepare a formal proposal evaluation plan?
    Yes

If so, what areas do you typically evaluate?

Milestones (proposed schedule)
Contractual experience
Design approach
Cost
Quality Control

7. Do you pre-qualify proposals?
    Yes

8. How are companies pre-qualified?
    Experience, Qualifications, and Bonding Capacity

9. How are the final design/build contracts negotiated?
    Negotiate and receive best and final offers

10. What factors would cause you to select design/build as the contracting instrument rather than design -bid-build for given project?

Need to fast track to achieve fixed delivery date
Reduced project delivery period
Constructability considerations will drive design concept
Constructability considerations will drive design details
100% design not required to permit high quality product
Risk and costs can be shared to reduce overall cost.
A single point of responsibility is required for the life of the project
Owner/designer must rely on builder to supply best technology/lowest cost matrix
Unique factors about project location require special knowledge or experience to produce least cost design.

11. What is the principle advantage and disadvantage, from your point of view, of using design/build contracts?

Advantages: Reduce cost
Disadvantages: N/A

12. Would you give a comparison of design/build vs. Design-bid-build contracts?

D/B is faster, has less claims, is less expensive, and generates value engineering

13. On what types of projects do you use design/build?
    new highway and major rehab projects

14. What are the state laws regarding design/build contracting for public works projects?
    Unlimited

15. Do you have a standard set of contract clauses for design/build projects?
    No

16. What is the average project delivery time from authorization of funding to substantial completion of actual project?
    Expect 41/2 years on current project

17. In past design/build projects, how has the contractor been organized?
    Joint venture between general contractor and Architect/Engineer

18. In administering design/build contracts who approves?
    DOT approves all

    Final design
    Submittals
    Pay estimates & quantities
    Quality

APPENDIX F: Design-Build Evaluation Model

To reconcile D-B contracting with government procurement regulations, a public agency must devise a "fair and equitable system" of evaluating offerors' proposals (Procedures, 1990). To do this, an objective methodology for individually comparing each proposal must be developed and its contents published in the RFP (FAR, 1996). There have been many solutions to this problem in the past ten years. Some are relatively simple and parallel the existing evaluation systems for Architect/Engineer design service contracts. Others are very complex (Napier,1989) and require computer based expert systems and special technical knowledge to understand. One such system was developed by Construction Engineering Research Laboratory and uses fuzzy logic and a myriad of input to identify the optimal condition (Paek et al, 1992). This type of system is probably justified for use on complex projects with a large number of competitors. However, its effectiveness is probably reduced when applied to routine facility procurement. To achieve wide spread acceptance, an evaluation methodology must be simple enough to be understood by both engineers and procurement professionals and flexible enough to be applied to the full gamut of possible project types without the help of outside expertise (Barrie, 1984; Fisk 1992; Tenah and Guevara, 1985).

D-B Utility Theory

Utility theory is an uncomplicated, flexible means to take a common sense approach to quantifying qualitative data (Riggs and West, 1986). D-B inherently requires the evaluation of qualitative information. Such things as professional competence or past experience are difficult to describe in quantitative terms. To compare these qualities in a manner which is both fair and objective requires the evaluator to rank the qualities of each offeror in each category of requested information. This ranking can then be the basis for assigning a relative value to each piece of data, and the sum of the relative values in each category for each offeror becomes the quantified value of each proposal when compared to all other proposals.

The Federal Government has the greatest experience with the use of DB in public projects; therefore it was determined to use the federal model as the basis for developing a model to the Department. In light of this use, it should be noted that for federal procurement each proposal must be rated against a standard, not compared with each other (ER 1180-1-9, 1994). Thus the simplest form of utility theory (i.e. rank ordering each proposal) would be prohibited by federal regulation. Additionally, the FAR also requires that cost be rated separately (FAR, 1996) and not combined with the other evaluation criteria ratings until best and final offers are made (ER 1180-1-9, 1994). This constraint is often cited as an unnecessary limitation to the development of an innovative evaluation plan tailored to the direct needs of a specific project. (Ellicott, 1994).

However, this does not prevent the State of Texas from being able to incorporate the cost and technical evaluations into a single model. In fact, by using FPS-19 as the standard for technical evaluation of the design, this model must be able to rate both cost and technical quality simultaneously. This is particularly appropriate for pavement design where a small increase in the construction cost can hugely reduce long term maintenance costs and thereby decrease overall life cycle cost. This means of optimizing the design with respect to life cycle cost is precisely what is needed to successfully procure highway projects and reap the long range benefits of using this innovative contracting technique. Other categories of requested information such as price or calendar days to complete the contract are already in quantitative form. Thus, the rank ordering of each proposal in these categories takes care of itself. When the relative values of both quantitative and qualitative categories are added up, an overall value can be assigned to each proposal and the proposals can then be compared to one another. To make the methodology more responsive to the owner's concerns and desires, a relative weight can be assigned to each category. The product of the category weight and its relative value becomes the category value and the sum of the "weighted category values" becomes the overall value for a given proposal.

The evaluation system should consider establishing minimum standards for each category which would disqualify a proposal if not met. For example, the RFP would state that the project delivery date shall be no later than a given date. Thus proposals which promise delivery after that date are disqualified. On the other hand, proposals that purport to deliver the project before the deadline would be given a higher relative value than those which promise delivery on the milestone.

Most solicitations require contractors to submit the following categories of information in their proposals (Ellicott, 1994):

- Technical Approach
- Management Capability
- Financial Capability
- Personnel Qualifications
- Prior Experience
- Past Performance
- Projected Performance Milestones
- Project Pricing Information

Methodology

The system of evaluation can take many precise forms depending on the complexity of the project and the needs and regulations of the Department, but the basic methodology will remain the same as described above. The simplest form, called weighted ranking, can best be described by example.

Assume that TxDOT has decided to request each offeror to submit information on the eight topics shown in the previous section. Three proposals are received. The Department then assembles an interdisciplinary team of experts to evaluate the various proposals. Several types of design engineers are required to evaluate the various technical aspects of the Technical Approach category. A design engineer will be needed to evaluate the proposed design concept and interpret

FPS- 19 output. A business management consultant may be retained to evaluate the Management Capability category, and an accountant may be needed to check Financial Capability. The District will want the construction engineer to evaluate the proposal's Past Performance and Projected Performance Milestones, and a cost engineer to evaluate Project Pricing Information. All the members of the team will probably evaluate the Prior Experience and Personnel Qualifications categories. The Department may even want to have an attorney assess the various levels of contractual risk associated with the different proposals and make input to the process for determining the weighting of each category.

The process will be kept to its simplest form by asking the interdisciplinary evaluation team to merely rank each proposal from least responsive to most responsive with the least responsive proposal getting a score of one point and the most responsive receiving a score of three points. Each of the eight categories has a weight based on its individual importance to the Department and its overall contribution to the successful outcome of the project. The sum of the weights equals 1.00. Therefore, if a given proposal was rated the best in all categories, it would received a weighted total score of 3.00, the theoretical perfect score. Figure F- 1 is the conceptual diagram of the model, Figure F-2 is a hypothetical contractor design proposal, and Table F- 1 illustrates the mechanics of this particular application to this example.

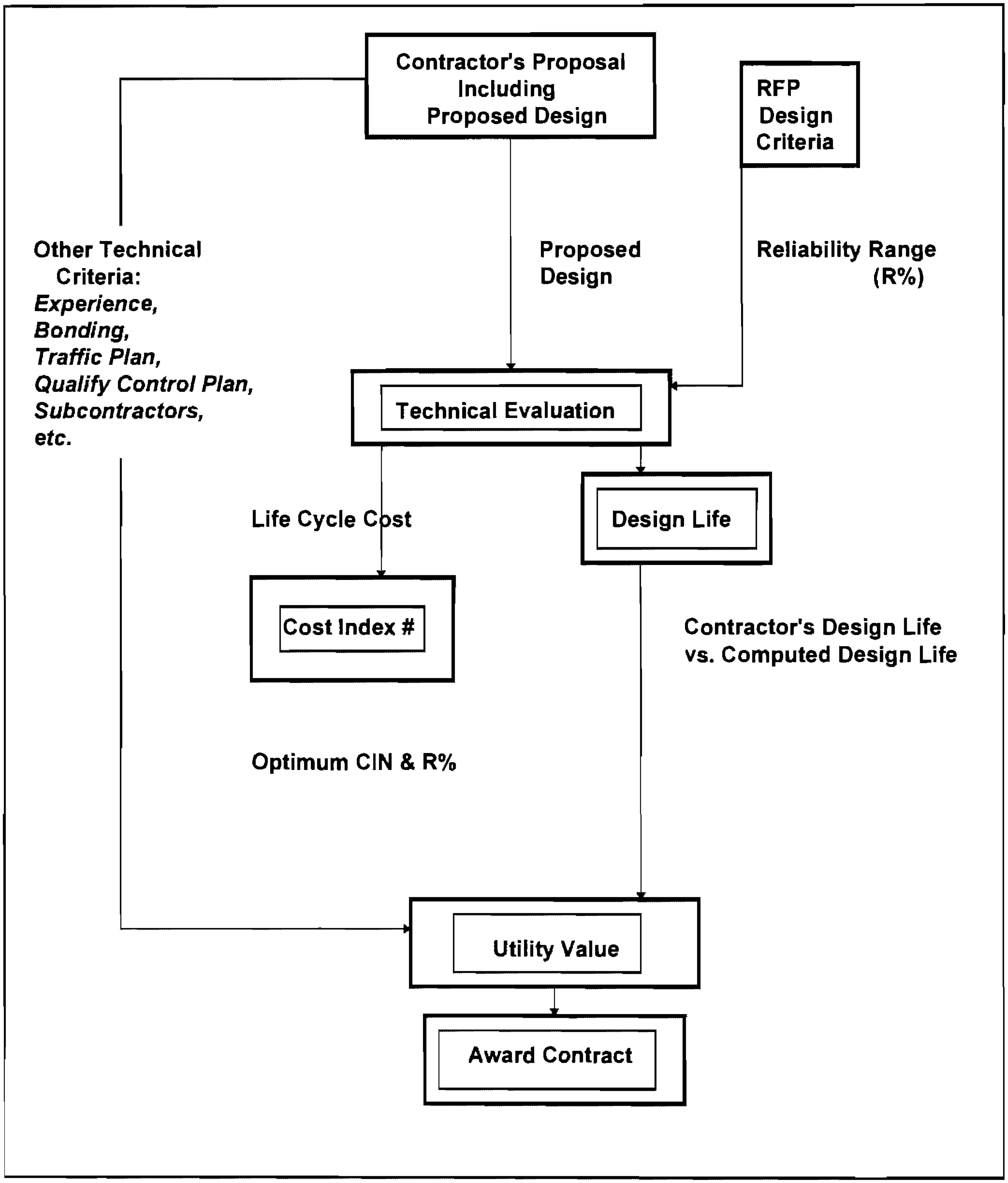

Figure F-1: Design-Build Evaluation Model.

	Design Option #1	Design Option #2	Design Option #3
HMAC	2 inch HMAC	2 inch HMAC	2 inch HMAC
Base	14 inch Flex Base	14 inch Flex Base	14 inch Flex Base
Analysis Period (years)	10	15	20
Number of Overlays	--	1	1
Overlay Time (year)	--	10	10
Overlay Thickness *in.)	--	1.5	2.0
Total Cost/yd2 ($)	2.22	2.90	3.25
Total Cost/Year of Life($)	0.222	0.193	0.163

Input Data for FPS-19 Design Program

Reliability of Overall Design = 80%
Initial Average Daily Traffic (ADT) = 1000
ADT at the End of 20 Years = 2000

Figure F-2: Hypothetical Contractor Design Proposals for Evaluation Model Example

Table F-1: Example of Hypothetical Evaluation of Three Proposals Using the Design-Build Evaluation Model. Rank: Best =3, Next = 2, and Last =1; or Yes = 3 and No = 0. Based on this example analysis, Contractor number 2 would be awarded the contract.

FACTOR		Wt	Prop #1 Rank	Rank	Score	Prop #2 Rank	Rank	Score	Prop #3 Rank	Rank	Score
Experience		0.10									
Contractor	#TxDOT Projects	0.05	25	2	0.10	38	3	0.15	5	1	0.05
Designer	#TxDOT Projects	0.05	12	3	0 15	3	1	0 05	7	2	0.10
Bonding		0.05									
	Total Capacity	0.02	10M	2	0.04	13M	3	0.06	6M	1	0.02
	%Available	0.03	15	1	0.03	20	2	0.06	80	3	0.09
Traffic Plan		0.10									
	Meets Code	0.05	Y	3	0.15	Y	3	0.15	Y	3	0.15
	Estimated Delay	0.02	4min	3	0.06	10 min	2	0.04	12 min	1	0.02
	Days Disruption	0.03	124	2	0.06	112	3	0.09	140	1	0.03
Quality Control		0.20									
Personnel	Design Tm PE	0.05	Y	3	0.15	Y	3	0.15	Y	3	015
	QC PE	0 05	Y	3	0.15	Y	3	0.15	N	0	0
Testing											
	Aggregates	0.04	Y	3	0.12	Y	3	0.12	Y	3	0.12
	Hot Mix	0.04	Y	3	0.12	Y	3	0.12	Y	3	0.12
	Concrete	0.02	Y	3	0.06	Y	3	0.06	N	0	0
Subcontractors		0.10									
	Qualified	0 05	Y	3	0.05	Y	3	0.15	Y	3	0.05
	TxDOT Exper	0 03		3	0.09	N	0	0.00	Y	3	0 09
	%Subcontracted	0.O2	30	3	0.06	60	2	0.04	80	1	0.02
Design Approach		0.10									
	Past success	0.05	Y	3	0.15	Y	3	0.15	Y	3	0.15
	Design life	0.03	12	1	0.03	20	2.5	0.08	20	2.5	0.075
	Reliability	0.02	80	2	0.04	80	2	0.04	80	2	0.04
Technical		0.35									
Evaluation	Cost/yr.	0.20	0.222	1	0.20	0.193	2	0.40	0.163	3	0.6
vs. FPS-19 Oupu	Reliabilty	0.05	80	2	0.10	80	2	0.10	80	2	0.1
	Design life	0.03	10	1	0.03	15	2	0.06	20	3	0.09
	# Overlays	0.02	0	3	0 06	2.5		0.05		2.5	0.05
	TOTALS	1.00			2.1 0			2.27			2.22
	Final Rank			3			1			2	

From table F- I it can be seen that the lowest and best proposal is Contractor 2. Even though the proposed cost is somewhat higher than Contractor 3, Contractor 2's extensive experience, better traffic plan and reduced delays to users makes his proposal the best. It should be noted that the technical evaluation against FPS-19 standards validated Contractor 2's claimed reliability and reduced his claimed design life while allowing for the proposed single overlay. Finally, it must be remembered that this is merely a hypothetical example developed to demonstrate the mechanics of applying Utility Theory to this problem. The final plan will undoubtedly modify what is presented here to some extent. At this writing, we have not discussed or evaluated the idea of prequalification of proposers and developing a shortlist which are asked to submit a full proposal. Additionally, the question of reimbursing proposal preparation costs for unsuccessful shortlisted proposers must also be explored.

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