BEST VALUE APPROACH TO HIGHWAY PROJECTS: TRANSPARENCY AND INNOVATION

BY

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Submitted to the graduate degree program in Civil, Environmental and Architectural Engineering and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirement for the degree of Master of Science.

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ABSTRACT

Highway construction projects have historically been delivered using low bid procurement . Even though this method of contracting has fostered competition among the proposers, many industry stakeholders question whether it has achieved best value or not for the amount of dollars spent on the project. Best value procurement is one of several alternate procurement methods used by the highway industry to overcome the shortcomings of low bid procurement. Best value procurement requires the subjective evaluation of technical proposals, and combines the technical factors with price to select the proposer who offers best value to the owners. It is the subjective evaluation of these technical factors that causes transparency issues in the selection process. The aim of this thesis is to explore the use of best value and identify the best practices for developing transparent best value selection procedures in highway projects. This thesis utilized a survey, content analysis of best value Request for Qualification (RFQ)/ Request for Proposal (RFP) documents, interviews, and various case examples to fulfil the research objective. The thesis follows a two - paper format. The first paper focuses on identifying the current state of practice of best value procurement in the highway industry. The content analysis performed for this thesis helps identifies the most common evaluation criteria, award algorithms, and debriefing procedures that promote transparency in best value procurement. In the first paper seven case studies were compiled with the State Department of Transportations (DOT) that have most experience using the best value procurement in the first paper. These seven cases provide a clear description of the best value selection procedure and the steps taken to achieve transparency. The second paper focuses on the use of best value procurement on design-bid-build highway projects. The four case studies presented in the paper describe the best value procedure of the state agencies on their design-bid-build projects. The results of the second

paper show that best value procurement can be applied to design-bid-build projects successfully with minor adjustments to the selection process. The thesis results show that providing simple, clear, easy to understand, and project specific evaluation criteria increases the transparency of the best value selection process. This thesis also identifies the various award algorithms and debriefing procedures that increase the transparency of the selection process.

ACKNOWLEGDEMENTS

First, I would like to express my thankfulness to my advisor and committee chair, Dr. Daniel Tran, for his continuous support and guidance during the course of my thesis for its successful completion. He helped me in every possible way during these two years of my stay here and I will forever be grateful to him.

I would like to thank my committee members, Dr. Brian Lines and Dr. Alexandra Kondyli for their time, support and valuable suggestions they have offered me to complete this thesis.

I would like to thank the University of Kansas (KU), Civil, Environmental, and Architectural Engineering Department for providing me an opportunity to pursue my academics here.

I would like to thank my parents, Purna Chandra Reddy Kolli, Aruna Kumari Kolli and my sister Chandra Lekha Kolli for their support and encouragement throughout my studies.

Finally, I would like to thank my family members, friends, colleagues, and well wishers for their unconditional love and support in me.

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CHAPTER 1: INTRODUCTION

Construction projects in the public sector have been conducted for a long time by using the traditional contracting method – awarding the contract to the lowest bidder based on the design-bid-build delivery method. This contracting method increases competition among the proposers and helps the owners to choose the contractor who offers the lowest bid to complete the job (Chang 2004). This contracting method allows any contractor bid on the project if the contractor meets the bidding criteria and bonding requirements. Since the selection process is based solely on the price factor, the contract under the low bid procurement may fail to deliver the project on schedule which causes an increase in the frustration of the public sector (Hilger 2009). Moreover, the low bid procurement encourages contractors to implement cost cutting measures instead of quality increasing methods. The low bid contracting makes it less likely that contracts are awarded to the best performing contractor that will deliver the highest quality products (Abdelrahman et al. 2008). Even though the low bid procurement process is simple, easy to implement and is inherently transparent, this process can raise adversarial relationships among parties involved and restricts innovation. Low bid procurement may not provide the best-value to the owner for all project circumstances or types (Caltrans 2008).

Because of the above mentioned reasons, the highway industry has started to use alternate procurement methods. Best value procurement is one of several alternate procurement methods that has been used by highway agencies. State highway agencies have attempted to measure the relative success of best value procurement and are convinced that best value procurement provides better results than the low bid method of contracting (Abdelrahman et al. 2008). Best value procurement has also been adopted by many government agencies in the United States and

other countries because it helps owners to select the most advantageous contractor that can deliver a quality project (Yu and Wang 2012).

Best value procurement can be used in conjunction with a variety of project delivery methods. Achieving the optimum combination of price and technical solutions for the public is the main goal of best value selection. The use of best value procurement with the design - build (DB) project delivery method is the most commonly seen in the highway industry. The technical capability of the design builder is the most important factor along with cost in the DB method. The technical proposal and the price proposal are the two principal elements used in the evaluation for the best value selection in design build (Army Source Selection Guide, 2003; FAR part 15, 2001). The selection of appropriate projects and the amount of design to be included in the proposals are crucial for the success of DB best value projects (Molenaar and Johnson 2003). The use of best value procurement in design-bid-build projects is not as common as DB. Under DBB projects, since the design is already completed and there is less scope for innovation, owners have to rely more on the factors like past performance, past experience, safety records, and claims history to determine the best value contractor (Palaneeswaran et al. 2012).

The main objective of a government procurement office is to acquire goods and services and to carry out construction in a manner that improves access, contest and equality among proposers and results in best value to the public (Knight et al. 2012). The evaluation process of technical factors is subjective in nature in the best value procurement. As a result, there is a possibility of an unsuccessful proposer filing a protest that questions the transparency of the selection process (Shane et al. 2006). The state agencies need to be absolutely fair to all the proposers and should conduct the evaluation process with utmost transparency to prove that the contract is awarded without any bias (Shane et al. 2006). In public procurements, tax payers money is used to fund

the projects. So the public officials have to be answerable to the people supporting their decisions to award the project to a particular proposer. Parvin (2000) shows that without a transparent evaluation plan, owners may have difficulty defending the evaluation process. Parvin (2000) also states that clearly mentioning the evaluation criteria and the weights of each item in the Request for Qualifications (RFQ) or Request for Proposals (RFP) can help achieve transparency in the evaluation process. This helps to decrease the element of subjectivity that is inherent to the best value evaluation process (Scott et al. 2006).

1.1. Description of the Research

The section discusses the main goal and the objectives of this study. The research approach undertaken and the steps followed to achieve these objectives are also presented.

1.1.1. Goal

The primary goal of this research is to explore best practices that can help agency owners to achieve transparency in best value procedure for highway contracts. By identifying the evaluation criteria, selection methodologies, and debriefing procedures that can enhance the transparency in the selection process, recommendations are developed to assist the highway agencies in creating a transparent best value procedure.

1.1.2. Description of the Research

This goal is achieved by meeting the following research tasks:

1. *Content analysis of best value RFQ/RFP documents of highway projects.*

The RFQ/RFP documents of various best value highway projects from across the United States were gathered by performing a search on state Department of Transportation (DOT) websites. The documents gathered were analyzed to find the evaluation criteria, selection

methods and debriefing procedures used. This was achieved through a content analysis of the documents collected from the search.

2. *A national survey, structured interviews and case studies to identify the transparent best value procedures*

For the second part of the research, a survey questionnaire about the best value procurement was developed and sent to all state DOTs. After the analysis of survey results, agencies that have more experience with best value procurement were identified. To further investigate the research problem, interviews were conducted with those agencies to identify the opportunities and challenges of their best value procurement process. Finally, in depth case studies were compiled to explain how to reach transparency among parties involved in the best value procedure.

1.1.3. Relevance

Very few researchers have addressed the need for developing transparent best value selection procedures for highway construction projects. The conclusions and recommendations provided in this study benefit highway agencies that do not have much experience with best value procurement. The aim of these recommendations is to provide guidance to highway agencies that are willing to use best value for the first time or that have very little experience using best value. Providing these guidelines to owners will help them to develop a best value procurement procedure that is transparent and open to proposers. It also helps the owners to select the best qualified contractor to deliver the projects.

1.2. Thesis Organization

This thesis is divided into five chapters:

Chapter 1, Introduction, presents a short background on best value procurement and why transparency is an important factor in best value procurement. The description and the objectives of the research are also presented.

Chapter 2 summarizes the literature review of best value procurement. The literature discusses various procurement methods, best value procurement and its concepts, evaluation criteria, when to select the best value procurement, and advantages of best value procurement over the low bid system.

Chapter 3 documents the research conducted to identify the best value selection methods that help in achieving transparency in best value procurement for highway construction contracting. This chapter is presented in the form of a journal article. This article discusses the content analysis results of best value RFQ/RFPs, survey responses and presents case studies on the transparent best value selection procedures followed by state highway agencies.

Chapter 4 presents the research conducted on the use of best value procurement for the design-bid-build highway projects. This chapter is also presented in the form of an article format. This article discussed detailed case studies on the best value selection procedure for the design-bid-build projects. These case studies provide a better understanding of the use of best value in design-bid-build, which is currently used very little in the highway industry. This article was accepted for publication in the *Construction specialty conference, Vancouver, British Columbia.*

Chapter 5 presents the conclusions and the recommendations based on this research. The limitations of the study are also presented in this chapter.

The survey questionnaire, interview questionnaire, and references for the RFQ/RFP documents used in the content analysis are presented in the Appendix at the end of this thesis.

CHAPTER 2: LITERATURE REVIEW

The decision to use a particular form of project delivery calls for the commitment of design and construction services, labor, materials and the management to complete the project successfully. The steps taken by the owner to acquire the required services and commodities for successful completion refer to procurement (Beard et al. 2001).

2.1. Different Types of Procurement Methods

Selecting an appropriate procurement procedure has a significant impact on the project performance. Several factors should be considered during the selection process to make sure the project is finished successfully. Researchers indicated that risks associated with a given project can be minimized with the selection of an appropriate procurement method (El Wardani et al. 2006). The choice of procurement method should be adjusted according to the project delivery method and the type of contract format (Beard et al. 2001). There are a number of procurement procedures used in the construction industry. The typical procurement procedures include:

1. Sole source selection;
2. Qualifications based selection;
3. Negotiated source selection;
4. Fixed budget;
5. Low bid selection; and
6. Best value selection.

The following sections discuss briefly these procurement procedures.

Sole Source Selection

The sole source selection method involves the direct selection of the contractor based on selection factors like past performance, reputation, technical and managerial qualifications, and long-standing established relationships through previous projects. Price is not included as a competitive factor in this method, so it limits open competition, which is required for most of the public projects (Molenaar and Gransberg 2001). Public owners can use this method if there are no any potential bidders for the project (Beard et al. 2001).

Qualifications based Selection

Owners select contractors based on responses submitted by proposers to the Request for Qualifications (RFQs). A review of the proposals is performed on the basis of past performance, technical competence, reputation, and financial stability. The owners rank the firms, according to their qualifications during the review. Previous experience similar to the proposed project is crucial for ranking. Owners start negotiations with the top ranked proposer to reach a "fair and reasonable" price for the services required. In case of failed negotiations, the owner proceeds to the second ranked proposer (Beard et al. 2001).

Negotiated Source Selection

The negotiated source selection process involves bilateral discussion between the proposers and the owner (Beard et al. 2001). The owner requests proposals for the required services and evaluates the proposals just like any other procurement. This method permits bargaining and usually affords an opportunity for the proposers to revise their offers before the contract is awarded. Responsive proposals are held after the discussions, and best and final offers are

submitted for those competitive proposals. The contract is awarded to the best proposal (Beard et al. 2001).

Fixed Budget

The contract price is fixed by the owner and is stated in this procurement method. The proposers develop qualitative and technical proposals and compete against each other in terms of scope and quality as the project price is already fixed. The proposer that can provide the best value to the owner is awarded the project. The adoption of the fixed price method to procure integrated design and construction services is growing rapidly (Beard et al. 2001).

Low Bid

This is the oldest and most common procurement method. Price is the only attribute that determines the contract award. This method is commonly used with traditional project delivery methods, where the design is fully completed or nearly complete (Molenaar and Gransberg, 2001). The low bid method is used on projects where the scope is tight, and there is very little extent for innovation. This method is the simplest and easiest method to implement (Gransberg and Senadheera 1999). The low bid method is inherently transparent and will face the least opposition because of the fact that the project is awarded to the lowest bidder.

Best Value

In this type of procurement method, proposers submit a separate technical proposal and a price proposal for evaluation. The technical proposal is evaluated first on the basis of points determined by the owner. Price proposals are typically opened after the consideration of the technical proposals. The maximum points are allotted to the lowest bid and the points for all the

other bids are scaled inversely to that amount. The proposal with the highest combined points is awarded the project (Beard et al. 2001). Public clients are using best value procurements on their projects to achieve a maximum quality end product (Zhang 2006). The concept of best value was originated from the idea that one contractor offers a better quality service than others (Yu et al. 2013). The ideas and approaches that are used to procure products and services in the private sector were borrowed for the development of best-value procurement concepts in the public sector (Gransberg et al. 2006). The following section discusses the best value definition in more details.

2.2. Definition of Best Value

A procurement process where price and other key factors are considered in the evaluation and selection of a contractor to enhance the long-term performance and value of the construction is called bestvalue procurement (Gransberg and Ellicott 1996, 1997; Molenaar and Johnson 2003; Scott et al. 2006, Abdelrahman et al. 2008). These other factors include technical and managerial merit, financial merit, and past performance (Gransberg and Ellicott 1997). Obtaining the optimal combination of price and technical solution for the public is the main goal of best value. Best value procurements allow government contracting agencies to evaluate offers based on total procurement costs, technical solutions, and completion dates (Molenaar and Johnson 2003). Table 1 summarizes the various definitions of best value in the the literature.

Table 1. Definitions of best value

Source (Year)	Definition
U.S. Army materiel command (1994)	Best value is a process used in competitive negotiated contracting to select the most advantageous offer by evaluating and comparing factors in addition to price.
FAR 2.1001 Definions (2001)	Best value means the expected outcome of an acquisition that in the government's estimation, provides the greatest overall benefit in response to the requirement.
Molenaar and Johnson (2003)	Most advantageous to the government, price and other factors are considered.
Palaneeswaran and Kumaraswamy (2000)	The best value procurement is one that is structured to consider price and other relevant factors in making the bid selection to provide the greatest monetary value to the client.
Twomey (1989)	A selection process in which proposals contain both price and qualitative components and the award is based upon an evaluation of a combination of price and qualitative considerations.
Abdelrahman et al. (2008)	Best value aims at enhancing the long term performance through selecting the contractor with the offer most advantageous to the owner where price and other selection factors are considered.
Scott et al. (2006)	A procurement process where price and other key factors are considered in the evaluation and selection process to enhance long-term performance and value of construction.

2.3. Best Value Procurement Concepts

Scott et al. (2006) have categorized various concepts found in best value procurement with the help of a survey and case studies. Four primary concepts are used to describe the nature of the procurement process, including: best value parameters, evaluation criteria, evaluation systems, and award algorithms (Figure 1).

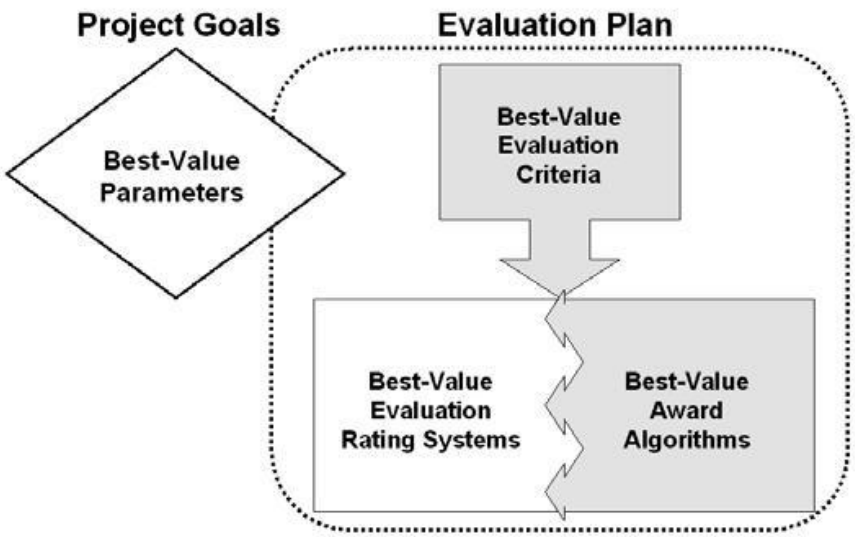

Figure 1. Best value procurement concepts (Scott et al. 2006)

2.3.1. Best Value Parameters

The identification of parameters that adds value to a project is very critical as the agencies should be able to defend their choices to the industry and public. Best value parameters are used to select relevant evaluation criteria. The cost parameter is always included in the final set of evaluation criteria. Scott et al. (2006) have performed several case studies and identified five important best value parameters. They are as follows:

1. Cost
2. Time
3. Qualifications
4. Quality
5. Design Alternates

Cost

Cost still plays an important role in best value contracting, but it takes into account other non-cost parameters as well. These non-cost parameters can be compared with the cost parameters to see whether an increase in the cost will increase the value brought by these non-cost parameters to the project. The objectivity of the cost parameter in the best value decision is its greatest advantage.

Time

Best value time parameters allow the contractor to establish a schedule that is appreciative to the plan for performing the construction (Scott et al. 2006). This parameter can reward the contractors who propose a reduced schedule with an increase in cost by making the best value award on a combination of price and time.

Qualifications

This parameter assists the state agency in selecting the most experienced and well-balanced team. Public agencies have generally used past performance and experience criteria to determine whether a contractor is qualified to bid or not. The ability to invite the contractors with a successful track record is the greatest advantage of this parameter. The possibility of accusations of favoritism is the main concern for this parameter. Owners should carefully develop qualifications based on project specific requirements in order minimize these concerns (Parvin 2000).

Quality

The main advantage of this parameter is the ability to review the proposer's quality management plans before the contract is awarded. Using this parameter provides contractors with an incentive to deliver a quality project because they will likely be judged on this performance in future projects (Scott et al. 2006).

Design Alternates

The use of design alternates in the proposal might bring innovation in solutions for design problems. The contractor who is aware of the latest developments in materials and technology will usually be able to turn a design alternate into a timely benefit for the public agency's project.

2.3.2. Best Value Evaluation Criteria

The next step after identifying the best value parameters is the determination of evaluation criteria from the pre-defined parameters. Identification of evaluation criteria that will be used to evaluate the ability of proposers to meet the needs and goals of the project is a key element in best value procurement. These criteria vary from project to project depending on the needs of the project and are generally developed by the owner. These factors may be evaluated on a pass/fail basis, in which proposers have to meet minimum requirements set by the owners to be responsive, or on a more objective best value basis, in which the proposals are evaluated against the technical factors mentioned in the RFQ/RFP. Each criterion should be defined in terms of standards against which responsiveness can be measured to be effective. Evaluation factors should be determined in a way to request information which can support meaningful comparison and minimize discrimination among proposals (Caltrans, 2008).

The best value evaluation criteria should be clear, and easy to understand for the proposers and the public. Owners should select the evaluation criteria that brings measurable value to the projects if they are not evaluated on a pass/fail basis (GDOT 2014). Several researchers have suggested various evaluation factors which are summarized in Table 2. Management, past experience, quality, safety, past performance, and financial ability are suggested by all the researchers.

Table 2. Suggested evaluation factors

Suggested evaluation factor	Potter & Sanvido (1995) and Russel (1996)	Bubshait (1996)	Alsugair (1999)	Palaneeswaran and Kumaraswamy (2000)	Scott et. al (2006)	Abdelrahman et. al (2008)	Molenaar and Tran (2015)
Management	√	√	√	√	√	√	√
Safety	√	√	√	√	√	√	√
Quality assurance and control	√	√	√	√	√	√	√
Location	√	√	√				
Past experience	√	√	√	√	√	√	√
Past performance	√	√	√	√	√	√	√
Workforce availability and resources	√	√		√			
Key Personnel				√	√	√	√
Financial stability	√	√	√	√	√	√	√
Failed performance/reputation	√	√	√				
Bonding	√	√			√	√	√
Capacity for assuming new projects	√						
Firm capacity	√			√			
Project specific requirements				√			
Scheduling and control		√			√		√

NCHRP report 561 provided the summary of best value evaluation criteria based on the research conducted and information gathered from case studies and literature reviews (Scott et al. 2006). Table 3 provides the list of evaluation criteria proposed by NCHRP report 561.

Table 3. Example best value evaluation criteria
Source: Scott et al. (2006).

Evaluation Criteria	Includes	Remarks
Initial Capital Cost	Construction, and procurement costs (also include design costs in a D-B project)	Sometimes called the "Bid" price
Schedule	Time to build the project (also include design time in a D-B project)	Sets contract performance period
Pre-qualification	Financial and corporate information as well as bonding requirements.	Typically a routine government form used for all contracting opportunities.
Past Project Performance	Project experience on past project that are similar to the project at hand. Also might include past history of claims and litigation	Preference is given to offerors with the most relevant experience.
Key Personnel Experience & Qualifications	Qualifications of key personnel	Licenses, registrations, and past project experience of individuals.
Subcontractor Information	Subcontracting plan, including small business utilization	Often requires that goals for participation by certain types of firms be met.
Project Management Plans	Plans for logistics, material management, equipment, traffic control, etc.	Often related to schedule constraints.
Safety Record and/or Plan	Corporate safety record and plans for specific safety hazards.	Often uses the Workmen's Compensation Insurance Modifier as a metric to measure safety record.
Quality Management Plans	Typical QA/QC program submitted prior to award.	May include design QC if bid alternates or D-B is used
Proposed Design Alternate	The owner allows the contractor to propose an alternate material or technology for a given feature of the work	Bid is submitted with and without alternates. The owner makes a decision which alternates will be accepted prior to award.
Technical Proposal Responsiveness	Proposals are considered responsive if they receive a minimum technical score.	Requires that a measurable standard be developed for each evaluation criteria.

Environmental Considerations	Plans to prevent and/or mitigate pollution during construction.	Many are required by law and/or regulation.

2.3.3. Best Value Evaluation Rating Systems

There are a wide variety of best value evaluation rating systems available for public owners. NCHRP report 561 has categorized the evaluation rating systems into four types. These are shown in Figure 2.

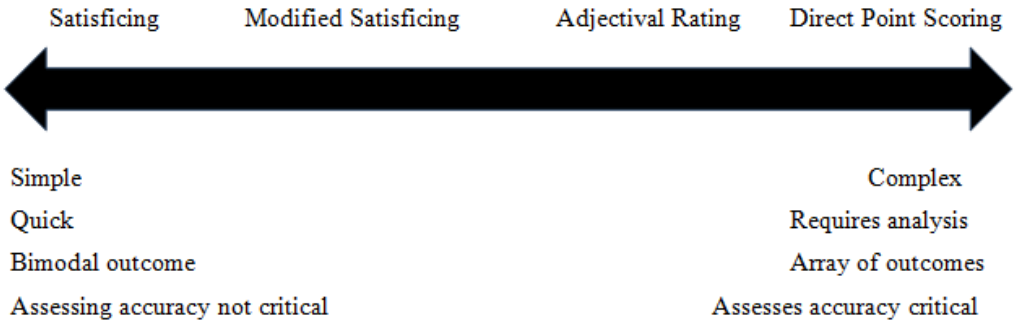

Figure 2. Best value evaluation rating systems (Source: Scott et al. 2006).

Satisficing

This evaluation rating system is the simplest and easy to use both for the evaluators and bidders. Minimum standards for every evaluation criterion are established. It is possible to change the minimum requirements to reduce the feasible set of alternatives. Satisficing can be used as an assessment technique because of its strong intuitive appeal. Industry often refers satisficing as "Go/No-Go." It is not critical to determine an accurate value from alternatives in satisficing.

Modified Satisficing

The degrees of responsiveness that may be present in the submittal can be represented by modified satisficing. This rating system allows the proposals which are nearly responsive with minor deficiencies to stay in competition and also rewards the proposals that exceed the published criteria. Red-Amber-Green systems are the simplest forms of modified satisficing. Green denotes that the proposal is fully responsive to evaluation criteria; Amber denotes minor deficiency in the proposal; and Red denotes a non-responsive proposal because of fatal deficiency.

Adjectival Rating

Adjectival rating systems are an extension of modified satisficing. Specific adjectives are used in this system to describe the conformance of evaluation criteria to the project requirements. There are three important elements of an adjectival rating system, including: definitions, performance indicators, and differentiators. High, moderate, and low ratings are given to the proposals and will be determined by the use of performance indicators. Differentiators further distinguish proposal grades.

Direct Point Scoring

This is the most complex scoring evaluation rating system. More detailed distinctions of proposals based on their merit can be obtained by this rating system because it includes more rating levels. The greatest advantage of this system is the flexibility of the scale on which each proposal is rated. However, this system may cause some issues related to fairness and objectiveness. It is difficult for owners to ensure that the evaluation system is both fair and uniformly applied to all proposals.

2.3.4. Best Value Award Algorithms

The best value algorithms involve a combination of best value parameters, evaluation rating systems, and evaluation criteria to put into final recommendations for awarding the contract. NCHRP report 561 describes seven most popular best value award algorithms (Scott et al. 2006). The summary of these award algorithms is presented in Table 4.

Table 4. Summary of best value award algorithms (Scott et al. 2006).

Best-Value Award Algorithm	Algorithm	Variables	Award Determination
Meets Technical Criteria-Low bid	If T > Tmin, Award to Pmin If T < Tmin, Non- Responsive	T= Technical Score P=Project Price	Lowest Price
Adjusted Bid	AB = P/T Award ABmin	AB = Adjusted Bid	Numerical analysis using point scoring, a mathematical combination of price and non-price factors, or a quantitative tradeoff analysis
Adjusted Score	AS = (T x EE)/P Award AS max	AS = Adjusted Score EE = Engineer's Estimate	
Weighted Criteria	TS = W1S1 + W2S2 + … + WiSi + W(i+1)PS Award TS max	TS = Total Score Wi = Weight of Factor i Si = Score of Factor i PS = Price Score	
Quantitative Cost-Technical Tradeoff	TIncrement = [(Tj/Ti) – 1] x 100% PIncrement = [(Pj/Pi) – 1] x 100% If TIncrement > PIncrement, Award Proposali If TIncrement < PIncrement, Retain Proposalj for possible award and repeat with Proposalj+1 Repeat Process until TIncrement > PIncrement	T = Technical score P = Project price	
Fixed Price-Best Proposal	Award T max, Fixed P	T = Technical Score P = Project Price	

Qualitative Cost-Technical Tradeoff	Similar to above, only no quantitative analysis of difference. Award to proposal that has best value in proposed scope.	Evaluation panel reaches consensus as to which proposal is the best	Qualitative tradeoff analysis of cost and technical factors

Meets technical criteria – Low bid

Price is the most important criterion in this award algorithm. The final decision on the award of the contract is based on price. Technical proposals are evaluated well before reviewing any cost proposals. The technical proposal is reviewed on a pass/fail basis typically. State DOT can also choose direct point scoring or adjectival ratings for the purpose of evaluation. In this case, RFP should mention the minimum score required for the proposal to be considered responsive (GDOT 2012). Technical proposals which meet the minimum proposed requirements are then taken forward and their price proposals are opened. The contract is then awarded to the proposer with the lowest price. This algorithm is preferred on projects where the scope is clearly defined and opportunities for innovation are limited.

Adjusted bid

Numerical scoring of the proposals is required for this algorithm. Technical proposals are scored first and then price proposals are opened. The proposal price is adjusted typically in the range from either 0-1 or 0-100 after the price proposal is opened. The project is awarded to the bidder with the lowest adjusted bid.

Adjusted Score

The adjusted score algorithm is very similar to the adjusted bid algorithm. Price proposals are opened after technical proposals are scored. The technical score of the proposal and the estimated total project price are multiplied and the result is divided by the price proposal submitted by the proposer to calculate the adjusted score. The project is awarded to the bidder with the highest adjusted score. When the owners' requirements and expectations can be clearly defined and a number of alternatives are present to fulfil those expectations, an adjusted score algorithm can be used (GDOT 2012).

Weighted Criteria

The weighted criteria algorithm can be more complex to implement and it allows greater flexibility in determining the relative importance of price against other evaluation criteria. Owners can control the relationship between the mathematical outcome and the project requirements (FHWA 2006). The weighted criteria algorithm allows the owner to allocate more weight to an element that is important to achieve project goals. The technical proposal and the price proposal are evaluated individually in this award algorithm. The technical evaluation factors and the price will be assigned weights depending on their importance. The total score of the proposal is calculated by the sum of these evaluations and the project is awarded to the proposal with the highest score.

Quantitative cost – technical tradeoff

Technical and price proposals are scored in increments and then the difference is observed. The project is awarded to the proposer with lowest price, unless justified that a high priced offer provides more technical value to the project. The justification is normally done by looking whether the increase in the price increases the technical score of the proposal.

Qualitative cost – technical tradeoff

Many federal agencies use the qualitative cost-technical tradeoff algorithm under the Federal Acquisition Regulation (FAR). This method relies on the judgment of the selection official to determine the relative advantages of the proposals. Evaluation, comparative analysis and tradeoff process are considered in the final decision. Ratings and scores are not the only considerations while conducting tradeoff analysis. The decision of awarding the contract must be based on the official's rational and independent judgment; comparative analysis of the proposal, and consistent with the solicitation, evaluation factors and sub factors.

Fixed price- best proposal

This award algorithm is based on the condition that the owner can establish either a maximum price or fixed price for the project. The proposers must submit an agreement to perform the work within the price constraints mentioned by the owner along with the technical proposal. The project is awarded based only on which is best among the technical proposals received. The evaluation process requires using either some form of weighted criteria without a price component or direct point scoring to determine the winning proposal. This algorithm can be used on budget sensitive projects.

2.4. Advantages and Disadvantages of Best Value Procurement

Best value provides agencies with the advantage of being able to modify the evaluation plan to meet the needs of the project. The main advantage of the best value procurement is its ability to use price as only one of the several evaluation criteria unlike low-bid procurement. Best value encourages the creativity and innovation from contractors in meeting the requirements of a project (Zhang 2006). Research performed by (Molenaar and Johnson 2003) showed that best

value procured projects deliver projects closer to the original budget and schedule. The best value method more often produces the projects that meet owner expectations (El Wardani et al. 2006). However, the complexity of the evaluation plan is the greatest disadvantage of the best value system. Because of the subjectivity in nature, the best value method is prone to greater risk than all the procurement methods (Gransberg and Senadheera, 1999).

Anderson and Russel (2001) describe the advantages and disadvantages of best value contracting in the NCHRP report 451 "Guidelines for warranty, multi-parameter, and best value contracting." This is based on the data received from survey questionnaires and interviews with state and federal agencies using best value contracting. The advantages of best value contracting include the following:

- The overall quality of the constructed product is improved when best value contracting is used t. This type of contracting allows only the contractors who have an accepted level of quality to bid on their projects.
- The overall completion time of the project is also reduced because of the evaluation of schedule in the proposals. More efficient schedules are prepared which leads to quick completion of the project.
- The agency shifts the risk to the contractor by asking him to submit the proposals for evaluation. The contractor uses lots of resources for developing proposals to be competitive in evaluation, but might not get the project. The risk of selecting the unqualified contractor is also removed from the agency.
- The best value system encourages contractor innovation in planning, which leads to successful project completion. Innovative ideas are required as a part of proposal in some best value RFPs.

The disadvantages of the best value system include:

- Compatibility with the low bid method is the main disadvantage of this system. Legislation must be enabled to achieve the best out of best value procurement.
- The number of proposers in this system is limited to a few when compared to traditional procurement because of the complexity of the project.
- The cost of delivering the project increases with the use of best value contracting. The best value method concentrates more on project quality rather than cost of the project.
- The main problem with the best value procurement is the ease of implementation. The process of developing proposals, evaluation criteria, and RFPs are quite complex than traditional low bid. Contractors need lots of time to develop the proposals and also should train their employees in developing the proposals.

2.5. Selection of Best Value Procurement Projects

The procurement method selected for the particular project impacts the performance of the project greatly (Wardani et al. 2006). Best value procurement is no exception. Best value should be selected when there is a need for completing the project quickly or addition of external factors, which is inherent to execute the project successfully (Gransberg and Senadheera 1999). Molenaar and Johnson (2003) state that owners should use best value on project elements that adds significant value to the project. The best value approach is better suited on projects where a low level of design description is achievable. There is a greater chance for innovation, and the contractor can take responsibility for quality and third party coordination (Caltrans, 2008). Many researchers have developed different evaluation methods to select the most advantageous contractor. However, none of them have answered why the procurement method should go with

best value rather than a low bid. To address this issue, Yu and Wang (2012) have developed a price elasticity of performance (PEP) index based on the heterogeneity of the market to help owners determine the most appropriate contracting method. It recommends that if the PEP is greater than 1, then the best value procurement should be selected.If the PEP value is less than one, it is advided to go with other procurement methods.

Owners should be able to communicate their goals and standards properly to the contractors, which is a key element for successful best value contracting (Abdelrahman et al. 2008). Determination of the key parameters, development of evaluation criteria, and performance requirements very early are required for successful implementation of best value. This upfront investment significantly saves total project cost, minimizes delays, and increases customer satisfaction (Gransberg and Ellicott 1997).

Anderson and Russel (2001) have developed a process for implementing best value selection which details the steps state highway agencies should follow to implement the best value contracting process. This process explains different steps starting from conceptual planning; program planning; bid, contract, award, and construction; evaluation of the pilot project; and evaluation of program phases of the project.

The process for selecting and implementing the best value contracting for a project involves several key decision steps. Scott et al. (2006) have developed a best value procurement process flow chart to help the agencies in implementing best value procurement which is shown in Figure 3. They have developed a screening tool which asks the agencies a few questions before making a decision to use best value for that project. The screening and selection process is the first step in implementing the best value project. If the addition of parameters to a procurement

process increases the value of the project, the owner should develop the evaluation plan from the framework of best value parameters and evaluation criteria.

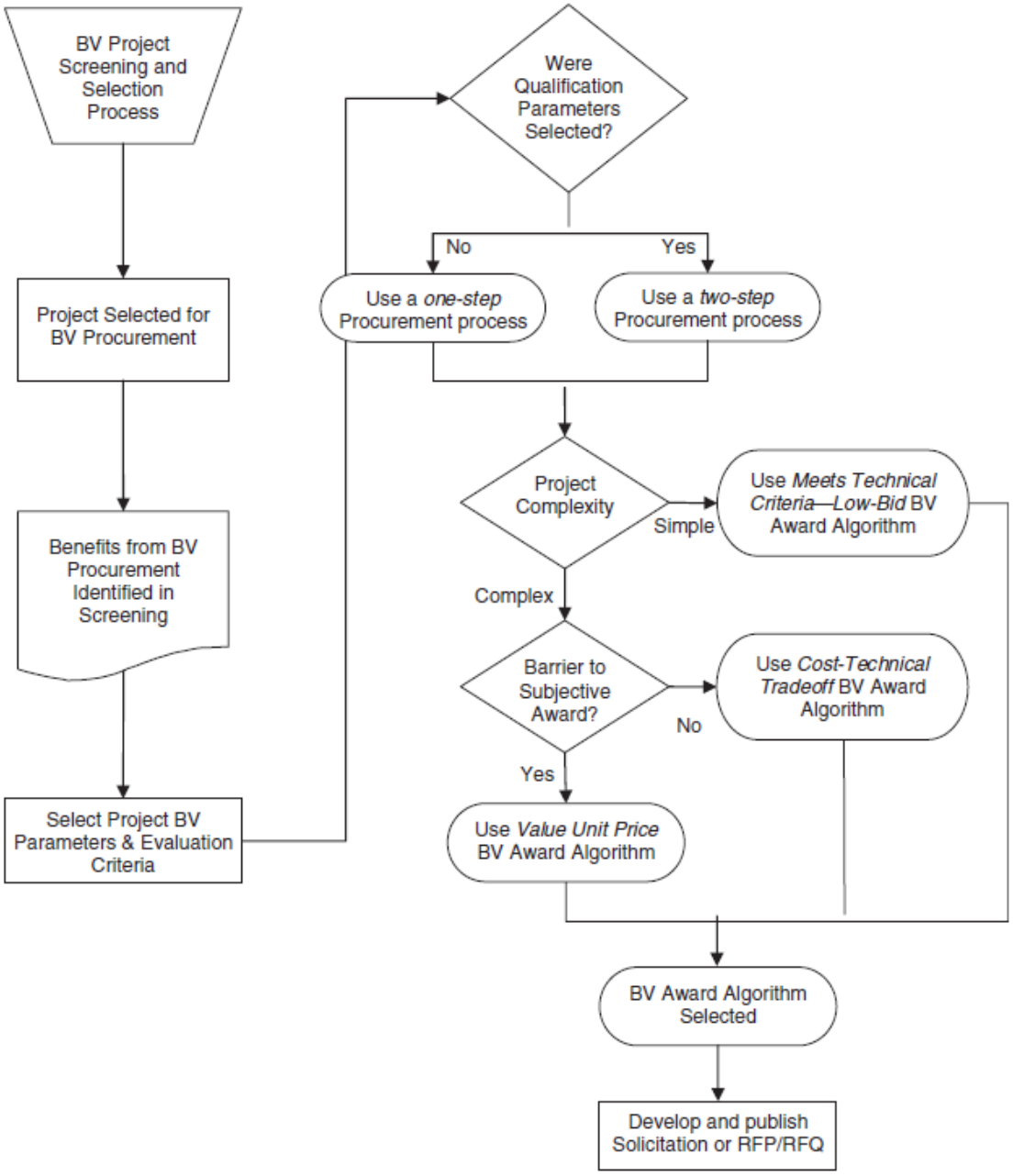

Figure 3. Best value procurement process flow chart (Source: Scott et al. 2006).

Figure 3 presents both one-step and two-step procedures for best value selection. One step method involves in the competitive evaluation of technical proposals in addition to price. The award decision is based on the best value determined by the state DOT. In the two step process, the qualifications of contractors are inquired early in the contract development process. The first step involves the pre-qualification of firms by issuing a RFQ. The technical committee reviews the RFQ's and shortlists most qualified proposers. Typically, there to five proposers are shortlisted in this step. The second step is a selection of the best value proposer based on the technical proposals received from the shortlisted proposers. The selection is based on the combined evaluation of both technical and price proposals (Molenaar and Johnson 2001). Researchers indicate that a project procured by using the two-step procedure is often delivered closer to actual budget and schedule than the one step method (El Wardani et al. 2006).

CHAPTER 3: TRANSPARENCY IN BEST VALUE SELECTION PROCEDURES FOR HIGHWAY CONTRACTS

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Abstract: Best value is one of several alternate procurement methods used by highway agencies to enhance innovation and bring more profits to the public. In best value procurement, the contract is awarded to the contractor who offers more advantages to the owner. This process is growing in popularity in the construction industry. This paper is intended to offer guidance to state highway agencies in developing transparent best value selection procedures. The evaluation process that includes the rating of non-price factors and combining them with the price proposal to select the best value contractor is the main reason for transparency issues. The authors conducted the literature review, surveys, a content analysis of 79 best value Request for Qualifications (RFQ) or Request for Proposals (RFP) documents, and case studies from seven states to identify the transparent best value selection procedures for state highway agencies. The results indicate that clear, comprehensive and well documented evaluation criteria, selection methods, and debriefing methods are critical to obtain transparency in the best value selection process. The findings from this paper contributes to the body of knowledge as the first study investigating transparency and objectiveness in the best value approach. The paper also provides guidance for state highway agencies to develop a fair and transparent best value selection process for their projects.

3.1. Introduction

Public service agencies strive to maximize overall 'value for money' for citizens. Consideration of issues like client satisfaction, the public interest, fair play, honesty, justice and equity are required to achieve maximum benefit for the public (Barrett, 2000; Korosec and Bartle, 2003). Value for money is the most important factor governing public procurement for many years. It is supported by the principles of efficiency and effectiveness, competition, accountability and transparency, ethics, and industry development (Commonwealth Procurement Guidelines, 2005). The contractor efficiency is a key element on public projects which accounts for a large portion of financial activity. Transparency in the procurement process affects the outcome of efficiency as it increases the competitiveness among the proposers (Ohashi 2009). Transparency in a procurement system has been an important success factor for many years and is still a sensitive issue in public projects (Hui et al. 2011).

The main objective of a procurement for public projects is to acquire goods and services and to carry out construction in a manner that improve access, contest, and equality among the proposers and results in best value to the public (Knight et al. 2012). In the best value procurement, due to subjective in nature of the best value evaluation process, there is always a possibility of an unsuccessful proposer filing a protest questioning the transparency of the selection process (Shane et al. 2006). The state agencies need to be fair to all the proposers and should conduct the evaluation process with utmost transparency to prove that the contract is awarded without any bias. Without a transparent evaluation plan, it is difficult for the owners to defend their decision (Parvin 2000). The main objective of this study is to identify the best value procedures that help to achieve transparency in the selection process.

3.2. Background

Low bid procurement is simple to implement and is also transparent because of the fact that the contract is awarded to the proposer with the lowest bid. However, it may not result in the best value to the agency for the amount of the money they spent on the project. This method of contracting allows any contractor to bid on the project if he meets the bidding criteria and bonding related requirements. Thus, there is a chance that the contractor can fail to deliver the contract on schedule with specified quality under the low bid procurement (Hilger 2009). State DOTs are increasingly using best value procurement to deliver their highway projects to improve the quality and performance (Molenaar and Tran 2015). However, the industry has expressed concern that the best value selection is subject to influence and favoritism. For best value projects, transparency in the selection process is a critical success factor to achieve a fair and objective selected contract. Hilger (2009) indicated that the use of an oversight committee, experienced personnel on the technical review committee, and legal guidance during the preparation and evaluation of proposals can help to achieve fairness in selection. Hui et al. (2011) emphasized that evaluation and selection of contractors in the procurement process need greater transparency to enhance fairness and objectivity of the decision. Criteria such as track record of contractors, their experience, and ability to complete the jobs on time should be taken into consideration in the evaluation and selection of contractors.

The selection of a best value contract is a complex process when both price and technical aspects are considered. The inclusion of non-price or technical factors increases the probability of achieving project goals. However, the evaluation of technical factors and the process of trading these non-price factors with price create transparency issues in public best value procurement (Molenaar and Tran 2015). The key to achieve success in best value contracting is

to have a transparent evaluation plan (Shane et al. 2006). Parvin (2000) suggested several steps to promote fairness in the evaluation process as following:

- Clearly state the evaluation criteria and weight given for each item and ensure the evaluation team uses them.
- Leave no doubt about the honesty and integrity of the public agency's evaluation team, made up of design and construction professionals.
- Clearly state the requirements of the RFP, including what will be considered to be a non-responsive proposal.
- Include the terms and conditions of the proposed design-build contract in RFP and make clear whether any terms are negotiable.

NCHRP synthesis 471, "Practices for developing transparent best value selection procedures" concluded that evaluation criteria, composition of the evaluation committee, evaluation comments, debriefing procedures, communication, and collaboration with industry affects transparency of the selection process. It also stated that transparency is increased by conveying the weights of evaluation criteria directly in the RFP. Further, researchers also found that specific and concise evaluation comments assist the evaluators to debrief the proposers and to achieve transparency (Molenaar and Tran 2015).

As mentioned previously, transparency is a key element that affects the success of the best value procurement. There is a lack of research that identifies evaluation criteria, and selection methodologies to support transparency in best value procurement. This paper attempts to close this research gap by investigating transparency issues in the best value process through surveys,

content analysis of RFQ/RFPs, interviews, and case studies. The following sections describe the research methodology and results in detail.

3.3. Research Methodology

The methods adopted for conducting this research include three main steps: (1) survey, (2) content analysis, and (3) case studies. In the first step, a survey was conducted to identify the current state of practice of best value procurement in the highway industry. Based on the results of the survey, a content analysis of best value documents was conducted to identify the best value procedures. The final step of this research was to perform the case studies. Based on the results of the survey and content analysis, seven state DOTs that have more experience with best value procurement are identified. These state DOTs were then selected for case studies to verify the findings from the survey and content analysis as well as further explore how they develop transparent best value procedure for their projects.

3.3.1. Survey Questionnaire

Through an exhaustive literature review, the opportunity, challenges, and strategies to overcome such challenges of the best value approach were recognized. Building upon these findings, the author designed a survey questionnaire to explore further the current state of practice of best value procurement by state DOTs. The questionnaire includes three main sections: (1) background, (2) overall best value approaches, and (3) transparency in best value selection. The detail of the survey questionnaire is presented in Appendix A. The questionnaire was piloted for appropriateness and comprehensiveness. The pilot testing results led to some minor changes to the questionnaire.

The survey questionnaire was distributed to the 50 state DOTs across the United States, the District of Columbia (D.C), and Puerto Rico using a webpage survey tool. During the survey administration, the authors kept track of the responses and sent two follow-up requests to the state DOT representatives who did not respond after three weeks of survey distribution. As a result, we received the responses from 46 state DOTs (88% response rate). Since best value is still relatively new to some DOTs, these 46 responses were mixed between the empirical data (project-based data) and the opinion-based data (based on their experience). To further explore the use of best value in highway projects and verify the survey result, the content analysis and case studies were conducted based on the preliminary survey result. The detailed survey results are presented later on.

3.3.2. Content Analysis

A formal content analysis of best value RFQ/RFP contract documents was conducted as the second step of the research to measure the current practice of best value contracting in the highway industry. The content analysis performed will create a source for identifying successful practices for best value contracting in the highway industry. "A content analysis is defined as a technique for making valid references by objectively and systematically identifying specified characteristics of a message, written or visual, using a set of procedures" (Holsti 1969; Neuendorf 2002). There are several ways to perform the content analysis. The investigator should decide the method of analysis based on his substantial problems (Weber 1990). The content analysis for this research was mainly focused on three areas: (1) evaluation criteria, (2) award algorithm, and (3) debriefing. The primary approach of this study is to develop a set of standard categories into which words that appear in the text of a written document can be placed. The content analysis method, then utilizes the frequency of their appearance as a means to

understand the content of the document (Weber 1990). This approach allowed a conclusion to be made regarding the highway agency approach to the best value contracting. When the final results of the analysis are accumulated for all the RFQ/RFPs, trends followed by the owners can be identified and reported.

The RFQ/RFPs issued by various state DOTs served as the source for this content analysis. The RFQ/RFPs were studied carefully to categorize the projects and to identify the major work scope of the project in that category. The projects are categorized into seven types which are further classified depending on the major work type as shown below.

1.New highway construction;

i) Highway Lanes: Laying of traffic lanes on the highway.

ii) Ramp: Construction of new ramps to enter or exit the highway.

2.Highway modifications;

i) Highway lanes: Relaying, striping of existing highway lanes.

ii) Ramps: Relaying or striping of existing ramps.

iii) Widening: Widening of the existing lanes and ramps.

iv) Interchange improvements: Modifications or upgrades to the interchanges.

v) Pavement signing and markings: Remarking of pavement signings.

3.New bridge construction;

i) Bridge structure: Construction of the new bridge.

4.Bridge modifications;

i) Modification of lanes: Replacing or stripping of existing highway lanes.

ii) Modification of structure: Strengthening or replacement of the existing bridge structure.

iii) Widening: Widening of bridge supports.

5.Low bid projects;

i) Highway replacement: Relaying, stripping of existing highway lanes.

ii) Highway construction: Laying of traffic lanes, ramps on the highway.

iii) Bridge modifications: Strengthening or replacement of the existing bridge structure.

6.Rail station projects;

i) Passenger railroad station design: Design for a railroad passenger station.

ii) Rail station construction: Construction of the rail station, platform, and rail track.

7.Other projects;

i) Parking Garage: Construction of a parking garage.

ii) Storm water drainage pipeline: Installing a storm water drainage pipeline.

iii) Development of master plan: Planning services for the preparation of transportation project plan.

These above seven categorized project's documents are carefully examined to identify the best value selection methodologies, evaluation criteria, award algorithms, and debriefing process. This study followed the following process to conduct the content analysis. First, the technical evaluation criteria determined by the agency are identified. Second, the description of what the agency is looking to receive from the proposers about that criteria are analyzed. Third, the importance or weights given to that particular criterion are noted. After that, the award algorithms and debriefing methods used by the agency for that project were identified from the RFPs.

3.3.3. Case Studies

The third and the final stage of this research was to perform the case study of best value selection procedures of the state DOTs that have more experience with the best value procurement. These state DOTs were selected based on the following criteria:

1. Years of experience using best value procurement;
2. Use of best value procurement with different project delivery methods, including Design Bid Build (D-B-B), Design Build (D-B), and Construction Manager/General Contractor (CM/GC);
3. The number of best value projects;
4. Comprehensiveness and availability of best value process documentation; and
5. Willingness of agency personnel to participate in the research as determined by the survey response.

Based on these criteria, we invited 11 DOTs by phone and e-mail to participate in the case example portion of this study. Participation required a structured interview, providing documents, and reviewing the final analysis for accuracy. Seven DOTs agreed to participate in this study. These seven DOTs are California, Florida, Michigan, Minnesota, New York, Oregon, and Utah.

An interview questionnaire was developed and sent to these 7 state DOTs prior to the interview date. Interviews are conducted with the officials of the state DOTs according to the previously agreed schedule and a strict interview protocol was followed. Each DOT was asked the same list of questions that were already sent to them through email. Appendix B provides the

complete list of the interview questions. The categories of questions that are of interest for this paper were:

1. Proposal evaluation criteria,
2. Selection methodologies,
3. Evaluation committee structure, and
4. Debriefing procedures.

The inputs from these seven DOT representatives and reviews of the documents provided were used in the analysis of the case studies.

3.4. Results and Analysis

3.4.1. Survey Results

Application of best value procurement in highway agencies

Out of 46 agency responses to the national survey, 30 agencies (65%) have or are currently implementing best value procurement; five agencies (11%) are considering best value procurement while 11 agencies (24%) have not used best value selection. Figure 4 illustrates the percentage of agencies currently implementing or considering best value procurement.

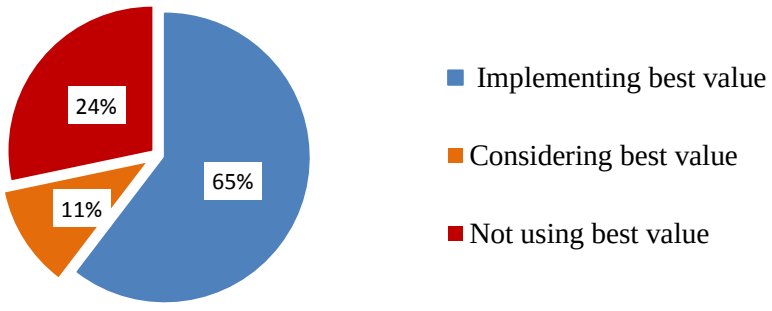

Figure 4. Current Practices of Best Value Procurement

Use of best value procurement with project delivery methods

Thirty-five agencies have provided responses for best value use with the various delivery methods. All 35 agencies (100%) use or can use best value with the D-B project delivery. Nineteen agencies (54%) use or can use best value for D-B-B project delivery. Nine agencies (26%) use or can use best value in conjunction with CM/GC project delivery. Twelve agencies (34%) use or can use best value with the job order contracting method. Figure 5 presents these findings. It is important to note that this question asks if agencies use or *are considering the use of* best value with each delivery method. For example, the reader should not interpret the data as 19 agencies are using best value with D-B-B.

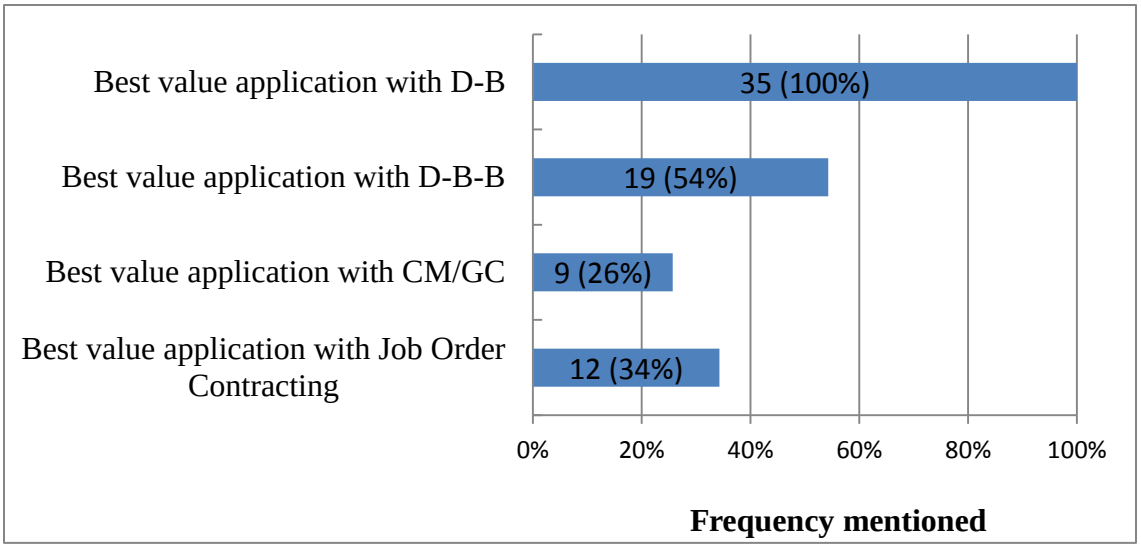

Figure 5. Best value procurement and project delivery methods (n=35)

Note: This question asks if agencies use or are considering the use of best value with each delivery method.

Evaluation criteria and transparency

Communication of evaluation criteria and their requirements to the proposers is essential for transparency. Figure 6 presents the methods agencies use to convey evaluation criteria and weights in the best value solicitation process.

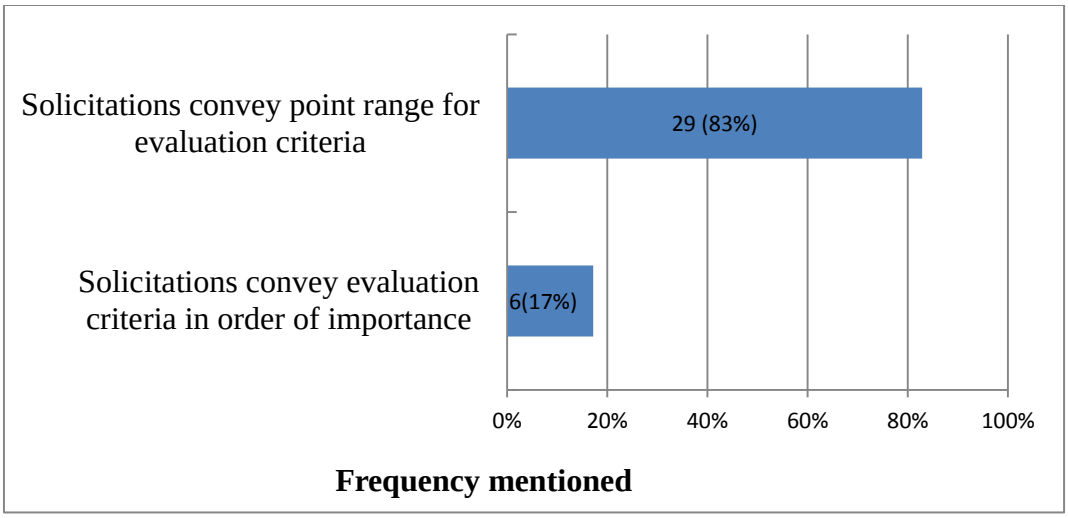

Figure 6. Evaluation criteria and weight in best value solicitations (n = 35)

Out of 35 responses, 29 agencies (83%) indicate that they use a point range to express the importance of the evaluation criteria in the solicitation process. Six agencies (17%) convey evaluation criteria by listing their order of importance. It is noted that four agencies from the aforementioned 29 agencies reported that they can also use the order of importance method in their solicitation process.

Debriefing

Subjectivity can exist in best value procurement, but debriefing promotes transparency (FHWA 2012). The primary purpose of debriefings is to provide feedback to unsuccessful proposers. State DOTs may conduct debriefings in person, with individual or group meetings, in writing, or over the phone.

The survey asked the respondents to specify how they conduct debriefings in the best value selection process. Figure 7 illustrates the results from the survey. Eleven agencies (31%) conduct debriefings in writing. Twenty-six agencies (74%) conduct debriefings orally; and two agencies (6%) note that best value proposers do not receive a debriefing. In addition, 16 agencies (46%)

indicated that they allow proposers to review the winning proposals. Five agencies (14%) have specific procedures to conduct best value debriefings.

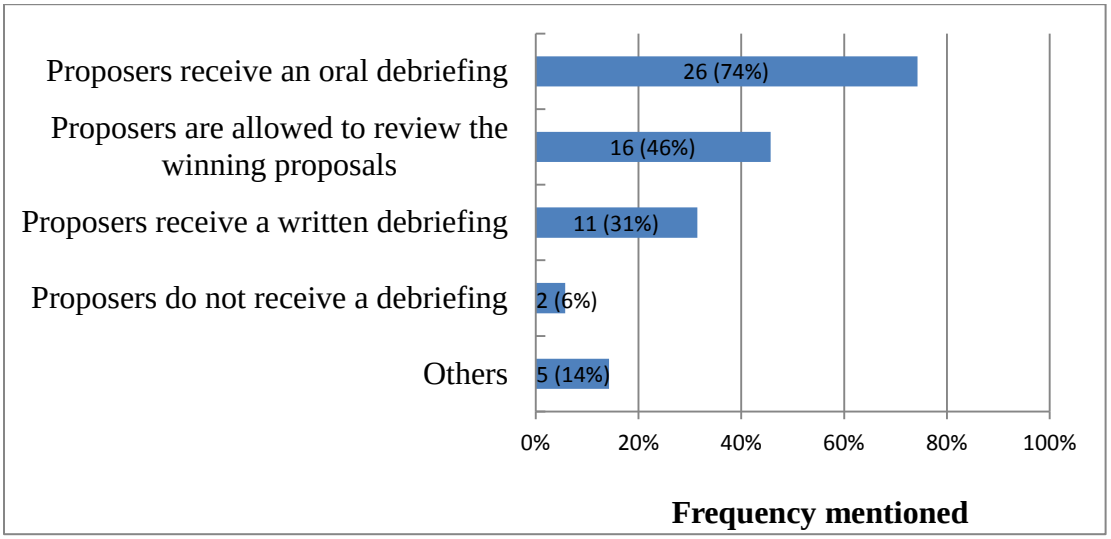

Figure 7. Debriefings in best value procurement procedures (n= 35)

3.4.2. Content Analysis Results

Table 5 contains the results of the content analysis of best value RFQ/RFP. The table is split into three major categories, including:

1. Evaluation criteria
2. Award Algorithms
3. Debriefing

.

Table 5. Best value RFP/RFQ content analysis

	Factors	Types of Projects	# of projects
Evaluation criteria	Experience and qualifications	1,2,3,4,5,6,7	50
	Project management	1,2,3,4,5,6,7	41
	Project understanding and approach	1,2,3,4,5,6,7	41
	Key personnel	1,2,3,4,5,6,7	39
	Past performance	1,2,3,4,5,6,7	33
	Legal and Financial	1,2,3,4,5,6	32
	Quality	1,2,3,4,7	30
	Schedule	1,2,3,5,6,7	25
	Safety	1,2,4,5,7	15
	Design	1,2,3,4	13
	DBE opportunities	4,6,7	12
	Traffic maintenance	1,2,4,5,6	11
	Environmental compliance	1,2,4	6
	Location	2,3	2
Award Algorithm	Weighted criteria	1,2,3,4,5,6	29
	Negotiated contracts	2,3,4,6,7	10
	Adjusted Bid	1,2,4	9
	Adjusted score	1,2,3	8
	Low bid	5	5
	Fixed price	1,2,5	3
	Composite score	2	1
	Not mentioned		11
Debrief	Oral debriefing	1,2,3,4,5,6	31
	Written debriefing	1	1
	No information		47

1 = New highway construction, 2 = Highway modifications, 3 = New bridge construction, 4 = Bridge modifications, 5 = Low bid projects, 6 = Rail station projects, 7 = Other projects

Table 5 was developed by conducting a content analysis of 79 best value RFQs/RFPs documents collected from 35 state DOTs. Seven types of projects are identified from the 79 RFQs/RFPs studied and are mentioned at the bottom of the table. The RFQs/RFPs that consider

the particular evaluation criteria, award algorithm, and method of debriefing are identified for each project type during the analysis. Various evaluation criteria used by the owners for that particular project type were identified and arranged in the table in the descending order according to their frequency. Award algorithms and debriefing were also arranged in the descending order of their frequency. The types of projects that consider the identified evaluation criteria, algorithms, and method of debriefing are observed and are mentioned in the second column of the table. The total number of RFQs/RFPs that consider the previously identified evaluation criterion or award algorithm are summed up and the total number is mentioned in the last column of the table. For example, if you consider experience and qualification factor, it is taken into account by the highway agencies on all types of projects. The total number of RFQs/RFPs that consider the experience and qualifications factor is 50. Likewise, the adjusted bid algorithm is considered on 9 RFQs/RFPs which include highway construction, highway modifications, and bridge modification projects.

Based on the results of the content analysis the following conclusions were drawn from each category.

Evaluation Criteria

- Table 5 shows that experience and qualifications, project management, and project understanding and approach, and key personnel are the most important evaluation criteria for the best value process. This is because a well-qualified construction team with highly experienced team members can probably sort out the post award technical issues, regardless of quality and clarity of technical requirements in the solicitation (Scott et al. 2006).

- Owners are also concerned about the past performance and schedule factors during the evaluation of best value proposals. For example, for projects that are schedule sensitive, the use of schedule evaluation factors helps the owner to select the contractor who can meet the schedule requirements.

Figure 8 depicts the most common evaluation criteria in best value procurement considered by the highway agencies.

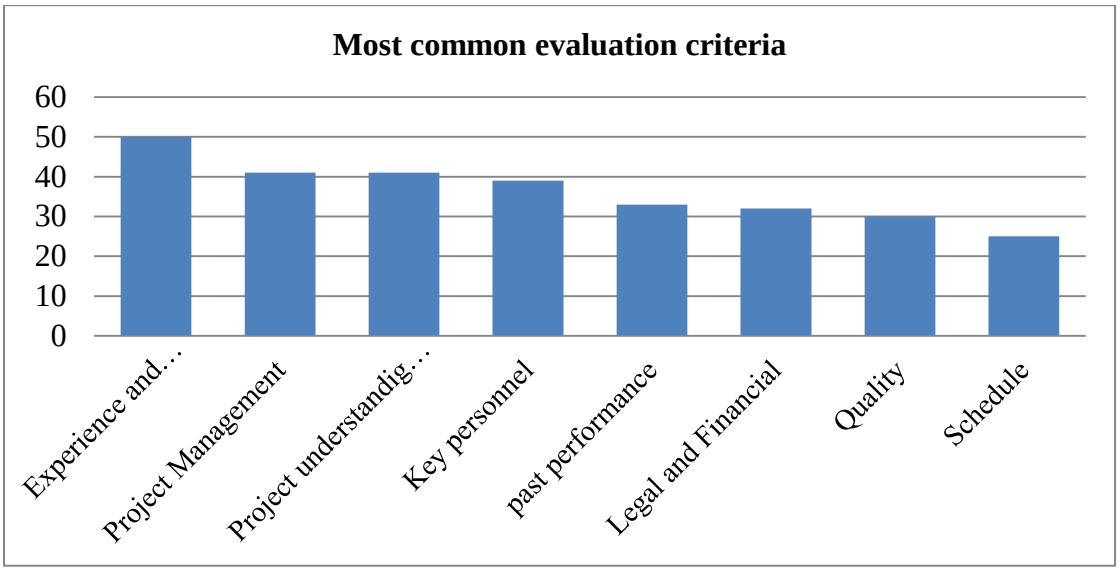

Figure 8. Most common important evaluation criteria (n=79)

The following sections describe these evaluation criteria in detail.

Experience and Qualifications

The qualifications and experience of the proposer's organization is a common evaluation factor in best value proposals. This evaluation factor varies depending on the type of project. The factors like roles and responsibilities of the individuals, minimum qualification requirements, and description of past experiences relevant to the nature, size, complexity, and composition of the proposed project are the major factors that are commonly considered in the evaluation

process. The ability to restrict competition to contractors with a record of successfully completing a project is the main advantage of this evaluation criterion. The public agencies can separate the unqualified contractors by using specific qualifications increasing the probability of successful completion of the project.

Project Management

Project management is a key factor that impact the success of the project. The complex nature of the best value projects demands highly efficient management to deliver the project successfully. The evaluation of project management factor is crucial for the best value approach. Owners often consider several factors such as structure of the team, design management, cost control, schedule, and coordination between design and construction teams, allocation of resources, safety management, approach to traffic management, and quality and risk management approach of the proposers during the evaluation of this criterion.

Project Understanding and Approach

Owners evaluate the proposer's understanding and approach to the project, capabilities and commitments of the proposer in delivering the final end product with regards to the project's goals and objectives. The proposers are required to submit information on their expertise and familiarity with the requirements of the project, along with their understanding. The proposers should list and describe the major tasks involved, opportunities for innovation, potential risks, and methods of addressing these risks. A work plan should be included in the project approach, mentioning the steps they take to meet or exceed the design, management, quality, and construction requirements for the successful completion of the project. Proposers conceptual

level of project understanding and approach for the successful completion of the project can be identified from the evaluation of this criterion.

Key Personnel

The qualifications and experience of the key personnel mentioned in the proposal are evaluated to see whether they are appropriate for the proposed project. The selection of key personnel often is one of the critical factors for the successful completion of the project. The best value projects often require highly qualified integrated teams with expertise and record of producing quality work. Proposers need to mention the licenses, qualifications, and experience of the key personnel who are going to be involved in the project. The proposers are required to keep them on the project for the total duration of the project. Any changes made to them must be reported to the agencies for their approval. Requesting information about key team members filling specific roles allows the proposers to demonstrate their teams' strengths and allows the owners to determine which teams is the most qualified for the project.

Legal and Financial

The legal and financial abilities of the proposers are evaluated in the selection process. Generally, these factors are evaluated on a pass/fail basis. The proposers need to show evidence that they have the legal ability to do business with the state. In case the proposer's organization is not formed yet, proposers need to provide a brief description of the legal structure or draft copies of agreements to achieve a pass rating. They also need to provide the bonds and acceptable guaranties required by the owner to achieve pass rating on the financial evaluation factor. The proposals that do not achieve the pass rating on this factor are not considered further in the evaluation process. This criterion up on evaluation also helps the owners to stay away from any

disputes and makes sure that the proposer who does not qualify to do business with the state is not awarded the project.

Past Performance

Proposers are asked to submit the records of their past performance on the projects that are similar to the scope and duration of the current project. Proposers need to provide details about their project completion schedule, quality, claims history, completion within the contract price, safety information, environmental compliance record, awards, references, and record of workforce diversity performance in detail for the purpose of evaluation. This criterion upon evaluation helps the owners in determining whether the contractor has completed the past projects successfully without any major problems.

Quality

By evaluating this factor, owner agencies seek for the proposer's commitment in delivering a high quality project. Agencies ask the proposers to provide the quality control plan addressing design and construction activities. The proposers are required to provide their quality management plans for both the design and construction sections respectively on a design-build project. Owners will review the contractor's QC/QA plan to see whether it meets the required guidelines and minimum requirements established. Further, owner agencies look for the procedure of communicating and coordinating with the department on issues that may affect the overall quality of the project.

Schedule

The proposer's schedule that integrates the design and construction activities of the project is evaluated. The start and completion dates for all the activities along with milestones should be

included and the critical path should be shown in the schedule. The owners also asks the proposers to submit a written description of the schedule which includes the description of milestones and critical path activities. Comprehensive and logical schedules that minimizes the contract duration were given more importance during evaluation.

Award Algorithm

Table 5 shows that the most used best value algorithm in selection of best value contractor is the weighted criteria followed by the adjusted bid algorithm. It is noted that the technical proposals are evaluated before opening the price proposals. Figure 9 illustrates the most important best value award algorithms found from the content analysis of 79 RFPs.

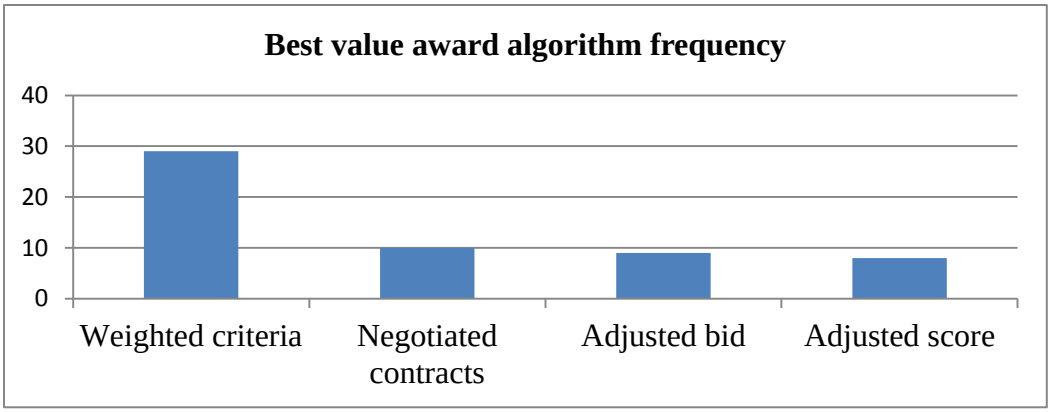

Figure 9. Most common best value award algorithms (n=79)

Weighted Criteria

In this algorithm, both the technical and price proposals are evaluated and scored separately. Each of them is awarded a particular weight depending on their importance. The scores of technical and price proposals are multiplied with the determined weight to obtain the final score for technical and price proposals. The sum of both of the proposal scores is the total score of the proposal. The proposal with the highest score is awarded the project. This approach can be

selected when there is a need for innovation, or when a particular factor is more important to the owner. The highway agencies mention the best value award algorithm and the formula they plan to use in the RFP issued to the proposers. The agencies also mentions the weights carried by both the proposals (technical and price) in the RFPs along with the evaluation criteria weights.

Adjusted Bid

The technical score of the proposal is converted into a dollar amount based on conversion factors mentioned in the RFP. The formulas used to convert the technical score are also mentioned in the RFPs by several highway agencies. The dollar value of technical proposals is either subtracted or added to the price proposal to achieve the total adjusted bid for the proposal. The proposal that has the lowest adjusted bid is awarded the project. The price proposals are opened only after the scoring of technical proposals is fully completed. This algorithm could work well when there are a number of alternatives which may provide the desired outcome.

Adjusted Score

In this algorithm, the price proposal is divided by the technical score of the proposal to achieve the adjusted score. The contract is awarded to the proposal with the lowest adjusted score. The price proposals are opened only after the scoring of technical proposals is fully completed. Adjusted score is calculated only for the responsive price proposals. This algorithm should be selected when price is an important factor.

Negotiated Contracts

Agencies, after evaluating all the technical proposals, rank the proposals in the descending order based on the technical scores. The bilateral discussions between the proposers and the owners starts and negotiations will then be conducted with the top ranked proposer for the contract price.

Owner bargains with the proposer to agree on a best price to complete the project. If the negotiations are not successful with the first proposer, the department proceeds to the next best proposer.

Debriefing

Since the best value evaluation process often involves subjectivity, questions about the evaluation process may arise. To obtain transparency in the best value selection process, agencies debrief the proposers to answer any questions they might have regarding proposal evaluation. In the debriefing, comments about the proposer's strengths and weakness are explained.

Selection methods for different types of projects

During the analysis of the content analysis results, it was observed that the evaluation criteria and award algorithms varied depending on the major work type of the project. Based on this observation, further research was performed to identify the evaluation criteria, and award algorithms selected for different types of projects with different work types involved. The most frequently used evaluation criteria and award algorithms identified previously are considered for this analysis.

Evaluation criteria

Table 6 provides a grouping of projects by major work types . The major work type involved in the particular project category are identified from the RFQs/RFPs and are mentioned in the second column of the table. The numbers in the category and major work type columns of the table indicate the number of highway construction projects mentioned in the RFQs/RFPs.. The

most common evaluation criteria identified from the table 5 are used in this table to see how many RFQ/RFPs are considering them on their projects with different work types. The total number of RFQs/RFPs that consider the above mentioned evaluation criterion are added up and the total number is mentioned in the table under their respective columns. For example, in the highway construction category that has constructing new highway lines as the major work type, 6 RFQs/RFPs are considering project understanding and approach out of 9 RFQs/RFPs. There are some RFQs/RFPs that do not consider a particular evaluation criterion and are marked as 0 in the table. The total number of RFQ/RFPs in the major work type is higher than the total number of projects under that project category because some RFQs/RFPs have more than one major work type involved. For example, if you consider bridge modifications category which has 23 RFQs/RFPs in total, the sum of all the RFQs/RFPs with different major work types involved is 38. This clearly shows that the RFQs/RFPs advertised by the state DOTs have more than one major work type involved.

Table 6. Evaluation criteria for different types of projects

Category	Major work type	Legal and Financial	Key Personnel	Experience and Qualifications	Past Performance	Project understanding and approach	Project management	Quality	Schedule
New highway construction (12)	Highway lanes (9)	5	5	5	3	6	5	2	5
	Ramp (3)	3	3	2	1	2	2	0	2
Highway modifications (18)	Highway lanes (6)	4	4	3	2	2	0	1	3
	Ramps (4)	4	4	4	2	4	3	1	2
	Widening (4)	4	3	2	2	4	4	2	2
	Interchange improvements (4)	1	2	3	2	3	1	1	2
	Pavement signings and markings (4)	2	2	2	2	2	1	0	1
New bridge construction (2)	Bridge structure (2)	1	1	1	1	1	1	1	1
Bridge modifications (23)	Modification of lanes (9)	5	4	6	5	7	4	0	3
	Modification of structure (25)	13	17	17	11	15	18	10	12
	Widening (4)	3	1	2	2	4	3	2	2
Low bid projects (3)	Highway replacement (1)	0	1	0	0	0	0	0	1
	Highway construction (1)	0	1	1	1	0	0	0	0
	Bridge replacement(1)	0	1	0	0	0	1	0	0
Rail station projects (7)	Passenger railroad station design (5)	1	1	4	3	3	1	0	0
	Rail station construction (2)	2	2	2	0	2	2	0	0
Other projects (3)	Parking garage (1)	0	1	0	0	0	0	0	1

Category	Major work type	Legal and Financial	Key Personnel	Experience and Qualifications	Past Performance	Project understanding and approach	Project management	Quality	Schedule
	Stormwater management (1)	0	0	1	1	1	0	0	0
	Development of master plan (1)	0	1	1	0	1	1	1	1

Note: The numbers in the table indicates the number of RFQ/RFPs that consider these evaluation criteria.

Table 6 shows thatthat the evaluation criteria were established depending on the major type of work. Experience and qualifications, legal and financial ability of the proposers, availability of key personnel, and project approach are the important factors that are mostly considered by the agencies during the evaluation of the proposals. Table 6 also indicates that project management and project understanding and approach are considered important in the construction of new highway lanes. For bridge modifications category, key personnel, project management, experience and qualifications of the team are considered more important than other criteria. Past performance and schedule factors are considered in approximately around 50% of the total Request for Proposals (RFP) studied irrespective of the project category. It should also be observed that schedule and quality factors are considered in almost 50% of the highway projects. Quality is considered in around 40%, while the schedule is at around 40% of the total Request for Proposals (RFP) studied in the case of the bridge projects.

Award Algorithms

The various best value award algorithms used by the agencies for different project categories are identified (Table 7). The numbers in the category and major work type columns of the table

indicates to the number of highway construction projects mentioned in the RFQ/RFPs. The award algorithms used by the state highway agencies for these projects are identified from the RFQ/RFPs. The total number of RFQ/RFPs that use the particular award algorithm are mentioned in the table. Some highway agencies have not mentioned about the award algorithms planned to use in the RFQ/RFPs. For example, under the highway construction category with major work type as constructing new highway lanes only 4 RFQ/RFPs have mentioned about the award algorithms out of 9.

Table 7. Award algorithms for different types of projects

Category	Major work type	Weighted criteria	Negotiated contracts	Adjusted bid
New highway construction (16)	Highway lanes (9)	0	0	4
	Ramp (3)	1	0	1
	Design (4)	0	2	0
Highway modifications (18)	Highway lanes (6)	1	0	0
	Ramps (4)	1	0	1
	Widening (4)	3	0	3
	Interchange improvements (4)	3	0	0
	Pavement signings and markings (4)	2	1	0
New bridge construction (2)	Bridge structure (2)	0	0	1
Bridge modifications (23)	Modification of lanes (9)	4	0	0
	Modification of structure (25)	13	2	1
	Widening (4)	3	0	1
Rail station projects (7)	Passenger rail road station design (5)	2	2	0
	Rail station	2	0	0

	construction (2)			
Other projects (3)	Parking garage (1)	1	0	0
	Storm water management (1)	0	1	0
	Development of master plan for DOT (1)	1	0	0

Note: The numbers in the table indicates the number of RFQ/RFPs that consider these award algorithms.

Table 7 shows that weighted criteria is the most favored algorithm by the owners to determine the best value contractor. Negotiated contracts are preferred on projects where the major work type is highway design and rail planning. The adjusted bid algorithm is mostly used in new highway construction and new bridge construction projects. It should be noted that the adjusted bid award algorithm is not preferred by agencies on bridge replacement projects.

Transparency in Best Value Procurement

As mentioned before, the best value selection process involves subjectivity and biases. Even though the owners are very careful in the evaluation process and remain fairness to all proposers, there is a possibility that proposers may file a protest questioning the best value evaluation system. Transparency in the evaluation plan is a key element to address these issues. Publishing transparent evaluation criteria and best value award algorithm in the RFP and following those criteria during evaluation play an important role in the best value approach. It is easier to defend against the protest because the transparent procedure reduces the subjectivity involved by clearly spelling this out in RFPs (Shane et al. 2006).

To this end, the author examined all aforementioned RFQ/RFPs to identify which criteria and award algorithms are help to obtain transparent best value evaluation. . Several RFQ/RFPs have

mentioned what they consider in the evaluation criteria and award algorithms used specifically along with their weights or importance.

Table 8 shows the grouping of the factors that affect the transparency of each evaluation criterion. The RFQ/RFPs that included a particular factor that contributes to the transparency of that criterion were cited. This process is followed for the rest of the transparency factors. A brief description of these criteria is also mentioned below the table. The major factors that contributes to the transparent evaluation of the evaluation criteria are identified from the RFQ/RFPs. These identified factors that contribute to the transparency are indicated against the evaluation factors in the table below. The RFQ/RFPs that mentioned about a particular factor are cited in the alst column of the table. The numbers in the last column represent the serial number in which the RFPs are arranged during the analysis. A few RFQ/RFPs that are irrelevant for the study are removed from the analysis because of which the total number of documents is reduced to 79 from 86. The references for all these 79 RFQ/RFP documents are included in the Appendix C at the end of this thesis.

Table 8. Factors that support transparency of evaluation criteria

Evaluation criteria	Transparency Factor	RFQ/RFP cited
Legal and Financial	Legal ability	18,31,42,45,49,66,46,50,51,68,69,70 74,77,78,79,80,81,82,83,84,85,86
	Bonds	18,31,42,45,49,66,46,50,51,54,68, 69,70,74,77,78,79,80,81,82,83,84,85,86
Key Personnel	Resume	7,9,27,45,49,66,46,69
	Experience	7,27,41,42,54,46,47,64,65,69,70,72, 74,77,78,79,80,81,82,83,84,85,86
Experience and Qualifications	Experience of the team	15,23,25,28,35,37,42,45,49,66,46,47, 51,54,64,65,68,69,74,80,81,82,83,84,85,86
	Qualifications of the team	13,15,35,37,46,54,65,68,80,81,82,83,84,85,86
	Roles and responsibilities	9,23,54,56,68,80
Past Performance	Related project performance	1,13,15,25,28,37,45,49,66,46,51,54, 63,80
	Experience in past 10 years	1,9,27,45,49,66,54,63,65,80
	References	1,13,15,37
Project Understanding and Approach	Approach plan	1,27,28,30,45,49,66,67,68,69,74,78, 79,80,81,82,83,84,85,86
	Understanding of project scope	9,12,13,25,27,30,42,45,49,66,46, 47,51,64,65,67,68,69,74,78,79,80
Project Management	Organization chart	4,8,37,45,49,66,46,47,67
	Project Management plan	10,11,14,18,31,42,45,49,66,46,47,56 ,63,64,67,69,72,77,78,79,81,82,83,84,85,86
	Identification and minimization of risks	10,11,14,23,45,49,66,56,64
	Quality control	4,45,49,66,63,69,72,77
	Coordination between various departments	4,8,23,30,37,45,49,66,56,64,67,77, 78,79,81,82,83,84,85,86
Quality	Quality management plan	7,8,9,10,11,14,23,27,30,41,45,49,66,53, 56,65
Schedule	CPM schedule	4,7,10,11,23,27,30,41,44,67
	Schedule for early completion	18,30,31,41,44,58,59,67

Legal and Financial

The legal and financial capacity of the proposers is evaluated on a pass/fail basis. The proposers are asked to provide complete copies of the organizational documents that allow the proposer to conduct business with the state DOT to achieve pass rating. Proposers are required to submit a letter from a surety or insurance company stating that the proposer is capable of obtaining a performance and payment bond covering the project for required amount set by the agency. State DOTs evaluate this factor to determine the legal and financial capacity of the proposer and also to make sure that they are not violating any state laws.

Key personnel

The proposers are required to provide information on all the key personnel that will be involved in the project. Proposers are also required to provide information on how much percentage of time the key personnel have committed to the present project along with their resumes. Evaluating the key personnel of the proposers allows the owners to identify the best possible crew for the project. Providing all this information in RFPs not only creates less confusion, but also increases the transparency in evaluation.

Experience and qualifications

The proposer submittals should include a statement of qualifications describing the relevant qualifications of the firm or firms included in the proposal. The factors evaluated by the owners are the qualifications of the proposer's staff, their experience, and roles and duties in the project. Providing information about the factors considerd in the evaluation process in the RFPs will make it easy to understand for all the proposers on what to submit for this criterion which

enhances the transparency. This factor upon evaluation provides guidance to owners on whether the proposer is qualified enough to deliver the project successfully or not.

Past Performance

Proposers need to mention their previous experience with the projects related to the size and scope of the present project. They need to provide dollar amounts of the project along with references for each project they have performed. Proposers also need to mention the project staff involved in each project. Some agencies also ask the proposers to submit information on projects completed in the past 5 or 10 years and references from those projects . Agencies want to know about the performance of the proposers in related projects and their ability and efficiency to complete the project on time and on budget.

Project understanding and approach

The proposers are asked to submit a narrative description of their understanding of the project goals and risks associated with the project. Asking the proposers to provide information about the risks associated with the projects and risk mitigations helps the owners to identify the proposers who provide the best answer to the risk associated with the project. The proposers also need to provide their approach to management, and technical aspects of the project for successful completion. Proposers are also encouraged to submit any innovative ideas that might benefit the project. Evaluators will use the understanding section to determine if the proposer fully understands the project to address the significant concerns and issues. By evaluating this factor, state DOTs can determine how well the proposer had understood the project goals and risks associated with the project and how can they address them. A detailed description of the

objectives and requirements for this evaluation factor increases the fairness of the evaluation process.

Project Management

The project management plan that integrates the design and construction plan, expertise and commitment to provide cost effective and high quality project, risk mitigation plan, and coordination plan are evaluated in this criteria. The proposers with clear management plans for completing the project effectively are identified upon the evaluation of this factor. Agencies will get to know about the proposer's qualifications and expertise in project management based on the evaluation of this criterion.

Quality

The proposers need to provide a quality assurance or quality control plan that addresses both design and construction activities. The quality plan should address staffing and resources planned to be included in the project, how errors are minimized, and what process is used to oversee the work. The proposers need to demonstrate their approach in implementing a quality management plan which is evaluated by the agency for its efficieny. State agencies by mentioning this in the RFPs makes sure that all the porposers understands what they need to submit to score maximum points for that evaluation criteria which improves the transparency. These factors will help the agencies to identify the proposer who provides maximum quality project.

Schedule

The evaluation of schedule factor is critical on schedule sensitive projects. A narrative description of a comprehensive and logical schedule which minimizes the contract duration should be provided by the proposers for the evaluation. The schedule provided should indicate the critical path, and proper attention should be provided for the critical path activities. The project schedule should include all the major anticipated milestones, phasing of activities, and coordination effects. The owners include everything that might have a material impact on the schedule in the solicitations given to the proposers.

In summary, the provision of detailed description of the technical evaluation factors, objectives and requirements of each evaluation factor, their relative weights and the information to be submitted to the agency in the RFQ/RFPs helps to increase the transparency in the evaluation process. The most important thing for the owners to increase the transparency is to focus on things that add value to the project and should tailor the criteria depending on the project needs. It is highly important that selection criteria is well defined in order to make the contract award most objective, fair, and competitive (MDT 2005).

Transparent Best Value Award Algorithms

As mentioned before, best value award algorithms are used to combine the price proposal and evaluation criteria, evaluation rating systems, and best value parameters after the technical evaluation of proposals to make a final recommendation for the section of best value contractor. The results from content analysis showed that weighted criteria, adjusted score, and adjusted bid algorithms are the most common award algorithms used to award the contracts. Negotiated contracts are also used by some agencies to award their best value projects. The award

algorithms were found to promote the transparency in the best value selection process. The following sections describe these award algorithms in detail.

Weighted criteria algorithm

The weighted criteria algorithm is the most frequent algorithm found in the analysis of 79 RFQs/RFPs. Both the technical and price proposals must be evaluated to use this algorithm. Owners must determine the relative weight of the technical proposal and the price proposal in the RFP to ensure the transparency of the selection process. The relative weights assigned to both the proposals vary from state to state. The total score of the proposals is the sum of the technical proposal score and the price proposal score. The proposal with the highest combined score is awarded the project. Weighted criteria algorithms used by various state DOTs are shown above in Table 9.

Table 9. Weighted criteria algorithm by state DOT

State DOT	Award algorithm formula
New Hampshire DOT	Total score = Price score(70)+technical score (30) Price score = (Lowest price value/proposers price value) *0.7 Technical score = Technical evaluation score*0.3
Idaho DOT	1000 total points Cost proposal = 250 points Technical proposal = 750 points
Montana DOT	Technical proposal points = (proposers technical score/total points) *0.75 Bid price proposal score = (lowest responsive total cost/proposal total cost)*0.25 Total score = technical score+price proposal score
Washington DOT	Technical proposal = 500 points Management proposal = 250 points Cos proposal = 150 points Best value = 100 points
Oregon DOT	Total score = (Quality weight*quality factor)+ (Price weight*price factor) Quality factor = Proposer quality score/highest proposal quality score Price factor = lowest proposal price/proposers price proposal Quality weight and price weight are determined by the agency
New York DOT	50% technical score 50% price proposal
Michigan DOT	Final score = (30%) *proposal price + (70%) *proposal price/(technical evaluation score* 0.01))
Ohio DOT	Total score = 100(0.2*(Proposers technical score/100)+0.10*(lowest schedule/proposers schedule)+(0.7*(lowest project price/proposers project price)
Georgia DOT	Total points = 1000. Split between technical score and price proposal in % Price proposal score = (lowest price proposal score/proposers price proposal)*max price proposal score Total proposal score = technical score*price proposal score

Missouri DOT	Total = 100 points Project schedule = 15 points Quality management plan = 10 points Complete bid proposal = 75 points 75 points for lowest price proposal For highest proposal prices points = (75 –(price submitted-lowest responsive price)/100000)

Table 9 shows that state DOTs use a similar formula to evaluate the proposals, but the allocation of weights to technical and price proposals varies from agency to agency. For example, New York DOT use equal weights while New Hampshire, Idaho, and Michigan DOTs use different weight for technical and price proposals. New Hampshire DOT gives 70% of weight to price proposal while Michigan DOT allots only 30% to the price proposal. Washington and Missouri DOTs add management plan in their weighted algorithm. Ohio DOT weighs 10% of schedule in the award algorithm.

Adjusted Score Algorithm

The technical proposals are evaluated by the owners before opening the price proposals publicly. The price proposals are checked for responsiveness immediately after opening them. Adjusted score is calculated only for the responsive price proposals. The price proposal is divided by the technical proposal score to determine the adjusted score for the proposal. The contract is awarded to the proposal with lowest adjusted score. Table 10 provides an example of adjusted score algorithms used by the state DOTs.

Table 10. Example of Adjusted Score Algorithms

State DOT	Award algorithm formula
Minnesota DOT, Florida DOT	Adjusted score = Price proposal/Technical proposal score
Colorado DOT	Adjusted score = (A+B) /Technical proposal score A = construction bid cost, B = T*road user cost T = design builder construction calendar days (schedule)

Table 10 shows that Colorado DOT uses a slightly different adjusted score formula than Minnesota and Florida. Colorado DOT multiplies the number of scheduled days with a road user cost and adds the result to the bid and divides the sum with the technical proposal score to attain the adjusted score for the proposal.

Adjusted Bid Algorithm

The results from the content analysis showed that California, Washington, Mississippi, and North Carolina DOTs use adjusted bid algorithms on their best value projects. The technical proposal score is converted into the dollar amount with the help of a predetermined formula by the owners. The proposer with the lowest adjusted bid is awarded gets the project. Table 11 summarizes the adjusted bid algorithms resulted from the content analysis.

Table 11. Adjusted bid algorithm by state DOT

State DOT	Award algorithm formula
California DOT	Total project value = Proposal price value+qualitative value Qualitative value = technical score value ($) * (300- technical score factor of proposer) Technical score value = lowest proposal price/700 Technical score factor of proposal = 300*(technical score of proposer/highest technical score)
Washington DOT	Adjusted bid = $Proposal price - $ sum of all technical credits earned
Mississippi DOT	Best value proposal = (Contract price proposal+ (number of calendar days*6000) – (17000000* (technical score/100)
North Carolina DOT	Adjusted bid = price proposal ($) – quality value ($) Quality value = quality credit*proposal price

Table 11 indicates that the adjusted bid algorithm varies slightly from state to state. For example, California DOT divided the technical score of the proposal by the highest technical proposal score and then multiply by 300 to achieve the technical score factor for the proposal. The lowest proposal price is divided by 700 to achieve technical score value for all the proposals. These two scores are used in calculating the qualitative value of the proposal. The total project value is the sum of price proposal value and qualitative value. The contract is awarded to the proposal with the lowest bid. Mississippi DOT includes schedule in their algorithm. North Carolina DOT converts the technical proposal score into quality credit using a specific guidance (table) to quantify the quality credit against the technical score. The table was mentioned in the RFP to obtain transparency in the evaluation process. Quality value in ($) is calculated by multiplying quality credit and proposal price. The project is awarded to the highest adjusted bid.

3.4.3. Case studies

Table 12 summarizes the key findings from seven case studies.These findings were documented based on the best value evaluation criteria, best value award algorithms, and structure of the evaluation committee. Various evaluation criteria used by these state DOTs are mentioned in the table under the evaluation criteria column. It should be noted that the evaluation criteria sometimes changes depending on the type of project being advertised. The best value award algorithm used and the structure of the evaluation committee are mentioned in the next columns of the table respectively.

Table 12. Case examples for best value selection procedure

No	State DOT	Evaluation criteria	Best value award algorithm	Structure of evaluation committee
1	California DOT (Caltrans)	1. Legal and Financial (P/F) 2. Management 3. Past performance 4. Experience 5. Environmental compliance plan 6. Transportation management plan 7. Responsiveness to RFP and Design concept	Adjusted bid Total project value = Proposal price value+qualitative value Qualitative value = technical score value ($) * (300-technical score factor of proposer) Technical score value = lowest proposal price/700 Technical score factor of proposal = 300* (technical score of proposer/highest technical score)	1. Technical review committee 2. Technical subcommittee 3. Process oversight committee
2	Florida DOT (FDOT)	1. Past performance 2. Experience 3. Project understanding 4. Environmental record 5. Design 6. Construction 7. Innovation 8. Value added	Adjusted score Adjusted score = $\frac{BPP + (PCT * TVC)}{TS}$, BPP = BPP = Bid Price Proposal PCT = Proposed Contract Time TVC = Time Value Costs ($_____ per day) TS = Technical Score	1. Technical review committee 2. Selection committee
3	Michigan DOT (MDOT)	1. Mobility 2. Schedule 3. Quality control 4. Project communications 5. Aesthetics	Final score = (30%) *proposal price + (70%) *proposal price/(technical evaluation score* 0.01))	1. Project manager 2. Construction engineer 3. Other project related personnel 4. Central selection review team (CSRT) member

No	State DOT	Evaluation criteria	Best value award algorithm	Structure of evaluation committee
4	Minnesota DOT (MnDOT)	1. Legal and Financial (P/F) 2. Experience 3. Key Personnel 4. Project Management 5. Project understanding	Adjusted score = Price proposal/Technical proposal score Max 100 points for the technical proposal	1. Process oversight committee 2. Technical advisors 3. Technical review committee 4. Technical subcommittee
5	New York DOT (NYSDOT)	1. Legal and Financial (P/F) 2. Experience 3. Past performance 4. Capacity 5. Project Understanding 6. Management approach 7. Technical solutions	50% technical score 50% price proposal Price component varies from project to project Price proposal weights up to 80% on budget sensitive projects.	1. Evaluation team 2. Selection team
6	Oregon DOT (ODOT)	1. Legal and Financial (P/F) 2. Experience 3. Past performance 4. Project understanding 5. Capacity 6. Management	Total score = (Quality weight*quality factor)+ (Price weight*price factor) Quality factor = Proposer quality score/highest proposal quality score Price factor = lowest proposal price/proposers price proposal	1. Facilitator 2. Technical evaluation support personnel 3. Scoring team 4. Selection official 5. Observers
7	Utah DOT (UDOT)	1. Legal and Financial (P/F) 2. Experience 3. Past performance 4. Key personnel 5. Project Management 6. Design	Price carries more weight in the selection process than any other factor. Proposals within 10% of the lowest proposal price are considered in best value selection	1. Technical analysis committee 2. Technical evaluation committee 3. Selection committee

Table 12 shows that the proposal evaluation criteria used by these seven state DOTs are not same. However, almost all the state DOTs believe that providing the detailed description, objectives, requirements, and relative weights of the evaluation factors in the RFPs increase the transparency of the evaluation process.

Similar to the evaluation criteria, each DOT has its own formula to determine the best value bidder. California DOT uses an adjusted bid algorithm on their projects, while Florida and Minnesota use adjusted score algorithms. New York and Oregon DOTs use a weighted criteria algorithm while Michigan DOT uses a composite score algorithm to award the project. Utah DOT considers a threshold value of price proposal. The price proposals that are within 10% of the least priced proposal are only considered for the best value selection.

The evaluation committee members are generally comprised of people from the state DOT, local representatives, and an FHWA member if federal funds are used in the projects. The technical committee members are generally responsible for the evaluation of the proposals. The selection committee/team is responsible for combining the technical evaluation and price proposal together to select the winning proposal. California, Minnesota, and Oregon DOTs use oversight committee/observers in the evaluation process to make sure that the evaluation is fair and transparent to all the proposers. The evaluation committee members of these agencies often conduct debriefing of the unsuccessful proposers. The following sections explain about each case study in detail.

3.4.3.1. California Department of Transportation

California DOT (Caltrans) uses a two-step procedure for their best value projects. Caltrans prequalifies the proposers in the first step, and in the second step technical proposals are

requested from the prequalified proposers. The project is awarded to the proposal that offers the best value among the received proposals. Caltrans uses both the pass/fail factors and technical evaluation factors during the evaluation. Legal and financial capacities of the proposers are evaluated on a pass or fail rating while the rest of the technical factors mentioned in the table are evaluated against the requirements mentioned in the RFP for each factor. Adjectival ratings are assigned to the factors which are finally converted into technical score based on conversion factors and weightings. The price proposals are opened after the technical evaluation is fully complete. The lowest price proposal is awarded the maximum points and the remaining proposals are assigned on a prorated basis using the lowest price. The adjusted bid price of the proposals is calculated with the help of the formula mentioned above in the Table 12. The contract is awarded to the proposal with the lowest adjusted bid.

The proposal evaluation is carried out by the technical review committee along with the technical subcommittee. The technical subcommittee provides comments on the strengths and weaknesses of the proposals to the review committee. The review committee then evaluates the strengths and weaknesses and the points are assigned to the proposals. California uses a process oversight committee that consists of a non-voting group of observers who oversee the evaluation process and make sure that the process is fair and transparent to all proposers. The evaluation committee members are also responsible for the debriefing of the unsuccessful proposers if a request is made by them. The members provide the comments on the strengths and weaknesses of the proposals based on the comments received from the evaluators during the evaluation. Caltrans requests the proposers to provide their feedback in the evaluation process so that they can improve the selection process to achieve more transparency.

California DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Provides detailed description of technical evaluation factors, objectives and requirements of each factor, and their relative weights in the RFP.
- The adjectival rating for each evaluation factor is determined by the consensus rating of the TRC members.
- The adjectival conversion factors are sealed until the evaluation of all the proposals is completed.
- Evaluation committee members are not allowed to contact proposers during the evaluation.
- Price is only considered after the RFP evaluation is completed.

3.4.3.2. Florida Department of Transportation

Florida DOT also uses a two-step procedure for selecting the best value contractor. FDOT uses a standard set of evaluation criteria for both the phases. In the phase1, the proposals are evaluated against the factors like: 1) past performance, 2) experience, 3) environmental record, and 4) project understanding. Florida prequalifies the proposers by evaluating these factors and a request is made to them to submit the technical proposals. The factors like design, construction, innovation and value added are evaluated in the second phase of the selection process. The maximum points available for the proposers are 100 points which includes 20 points obtained during the phase 1. The price proposals are opened after the technical evaluation is completed. The adjusted score of the proposals is calculated based on the best value award algorithm mentioned above in the Table 12. The contract is awarded to the proposal that has the lowest adjusted score.

The evaluation committee is divided into two groups by the Florida DOT. The first group is the technical review committee. They are responsible for the evaluation of the proposals using a direct point scoring and also ranking the proposals according to the scores. During the evaluation process, comments are provided by the review committee on the proposals which are used later in the debriefing process. The evaluation is done individually by the committee members. The second group is the selection committee. This committee is responsible for calculating the adjusted score of the proposals using the algorithm and identifies the proposal with lowest adjusted score. A non-voting member from the contracting unit is also included in this committee to observe the selection process which enhances the transparency. FDOT discusses the reasons for receiving that particular score for the factor with the unsuccessful proposers during the debriefing process. Due to the state law, FDOT also discusses about the competitors' proposals also unless something in the proposal is deemed private.

Florida DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Evaluates proposals based on the scoring criteria provided in the RFP.
- Provides comments to defend the scores given to the proposals.
- Evaluates the proposals individually.
- Conducts various procurement meetings to increase the transparency.

3.4.3.3. Michigan Department of Transportation

Michigan DOT uses both one step and two step procurement on their projects. The only difference between those two is that, in the one step procedure, there is no prequalification of the proposers. Michigan does not have a standard set of evaluation factors they use on every project.

Michigan indicated that they decide the evaluation criteria on a project by project basis. The selection team develops the evaluation criteria for the project. The authors considered M-21 over I-75 bridge project, to explain the best value procedure of Michigan. The evaluation criteria used on this project is mobility, schedule, quality, communications, and aesthetics. Mobility factor is given 50% of the weight in the technical evaluation, because minimizing the impacts to public movement is critical for this project. The project is awarded based on the composite score algorithm which is close to the weighted criteria algorithm. The project is awarded to the proposal with the highest score.

The evaluation committee for the MDOT includes the project manager, construction engineer, and other people related to the project. The members evaluate the proposals individually based on the requirements set for each factor in the RFP. Michigan also includes a member from the central selection review team on the committee to reduce any bias that may present during the evaluation process. This also helps in increasing the transparency of the selection process. Michigan conducts the debriefing to the proposers if a request is made within 60 days after the project is awarded. The information about the strengths and weaknesses of the proposals are provided in the debriefings.

Michigan DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Establishes a well-defined list of evaluation criteria, as it is one of their most important factors to achieve transparency.
- Includes the weight of the evaluation criteria in the RFPs.

- Only one point of contact for receiving clarifications and other communications about the project.

3.4.3.4. Minnesota Department of Transportation

Minnesota also uses a two-step best value procurement procedure to select the contractor. For the design build projects, in the first step, Minnesota evaluates the proposals based on both pass/fail and technical factors. Legal and financial abilities of the proposer are evaluated on a pass/fail basis, while the technical factors like experience, key personnel, project management, and project understanding are evaluated based on the requirements set forth in the RFQ. The contractors who did well in the evaluation process are qualified for the second phase of the selection procedure. The prequalified proposers then submit their technical proposals along with the price proposal for the evaluation process. The technical factors for the evaluation process varies according to the project in this step. The technical factors are evaluated against the requirements mentioned in the RFP and the adjectival ratings are given for each factor. The adjectival ratings are then converted into the proposal score by the selection committee. The total proposal score is 100 points, out of which 50 points are for responsive criteria and the other 50 are for technical merits. The price proposals are opened after the technical evaluation is completed. The adjusted score of the proposals is calculated by dividing the price proposal with the technical score. The contract is awarded to the proposal with the lowest adjusted score.

The structure of the evaluation committee has slight differences in design-bid-build and design build projects. For the DBB projects, the evaluation committee is comprised of the Technical Review Committee (TRC), process oversight committee, and technical advisors. For the design build projects, there is a subcommittee in addition to the already mentioned committees. The technical review committee is responsible for the evaluation of the proposals.

The evaluation process is done individually by all the committee members. Technical advisors, subcommittee members act as the advisors and provide input to the TRC members during the evaluation process. Process oversight committee members are non-voting group of observers who oversee the entire evaluation process and makes sure that the process is fair and transparent. MnDOT conducts the debriefing to the proposers if a request is made within 60 days after the project is awarded. The information about the strengths and weaknesses of the proposals are provided in the debriefings. MnDOT does not provide point by point comparisons with other proposals.

The Minnesota DOT uses the following strategies to increase the transparency and fairness in the selection process:

- All the technical proposals and cost proposals are filed and are open to public inspection.
- Be clear, defendable, and easy selection process for the proposers and public to understand.
- No overlap in the scoring criteria in RFQ and RFP.
- Focuses on items that bring value to the project.
- Provides detailed description, objectives, requirements, and relative weights of technical factors in the RFQ/RFP.
- The rating process during evaluation is documented on worksheets for each evaluation factor.
- Clearly documents the strengths and weaknesses of the proposals.
- Proposals are stored in electronic format so that they can be searched easily in the future for any information related to transparency in the evaluation process.

3.4.3.5. New York Department of Transportation

New York uses a best value procurement in both design-bid-build and design build projects. The DBB process is conducted in one step, but two parts are involved in that single step. Construction plans, bid items, and quantities are present in the first step, while technical evaluation is conducted in the second step. For the DB projects, the selection process is performed in two steps. The first step is the prequalification of the contractors with the help of SOQ evaluation. The second step involves the evaluation of technical and price proposals submitted by the prequalified contractors. The evaluation of the proposals is done by both pass/fail and technical factors. The evaluation factors used by New York DOT are mentioned in Table 12. The evaluation factors are evaluated against the requirements and are assigned adjectival ratings, which are later converted into technical scores. The price proposals are only considered after the technical evaluation process is fully completed. The price component may vary for some projects. On budget sensitive projects, price may weigh as high as 80% of total points available for the proposers. The total score of the proposals is calculated by adding the price proposal score and technical proposal score. The project is awarded to the proposal with the highest total score among the proposals.

The evaluation committee for the New York DOT is divided into two parts. The first part is the evaluation team. This team is responsible for the technical evaluation of the proposals. The proposals are evaluated individually by the members of the evaluation team. After the evaluation is completed, the team members meet and arrive at a consensus score, which will be the final score of the proposal. The second part of the evaluation committee is the selection team. This team provides a written narrative of the strengths and weaknesses of the proposals which supports the quality ratings assigned to the proposal. The selection team will open the price

proposals and calculates the total score of the proposal. The selection committee is responsible for awarding the contract to the best value contractor. NYSDOT also assigns nicknames to the proposals during the evaluation to remove the identities of the firms, which may create bias during the evaluation process. Debriefing the unsuccessful proposers is conducted upon their request. The procurement official familiar with the evaluation and selection process debriefs the proposers. Information is provided in the areas of proposals that have weaknesses. Any information related to competitors is not provided in these meetings.

New York DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Provides detailed description, objectives, requirements, and relative weights of technical factors in the RFQ/RFP.
- The results of individual rating factors are obtained through the consensus rating of all the members of the evaluation committee.
- The rating process during evaluation is documented on worksheets for each evaluation factor.
- Clearly documents the strengths and weaknesses of the proposals.
- Uses observers during the evaluation process.

3.4.3.6. Oregon Department of Transportation

Oregon DOT also uses a two-step procedure to select the best value contractor. In the first step, the agency shortlists three firms after the evaluation of the RFQs. In the second step, the proposals from the shortlisted firms are received and are evaluated to select the final proposal. The proposals are evaluated based on pass/fail, quality factors before opening the price proposal. The list of evaluation criteria used by Oregon is mentioned in Table 12. Direct point scoring is

used by the agency to evaluate the proposals. The proposals are evaluated against the requirements set forth in the SOQ/RFP. The price proposals are opened after the technical scores are developed and are immediately checked for responsiveness. The final score of the proposal is developed with the help of the best value selection formula developed by the agency officials. The quality and the price weights are determined by the project development team and are mentioned in the RFP issued to proposers. The contract is awarded to the proposer with the highest score.

The evaluation committee is often comprised of a facilitator, technical evaluation support personnel, scoring team, selection official, and observers. The facilitator controls and maintains the integrity of the evaluation and selection process according to the plan. He works under the guidance of the scoring team chairperson. The technical evaluation support personnel provides comments on the strengths and weaknesses of the proposals. These members do not score the proposals. The scoring team is responsible for scoring the technical proposal based on the evaluation criteria. The selection official reviews the results and recommendations made by the scoring team and approves the final scores of the proposals. Observers are included in the evaluation committee to make sure that the evaluation procedure is followed and the process is fair and transparent. Oregon conducts debriefing of the unsuccessful proposers upon their request within 20 days of awarding the contract. The agency allows the proposers to see the winning proposal and also the scoring results of the other proposers to enhance the transparency of the process.

The Oregon DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Provides detailed description, objectives, requirements, and relative weights of technical factors in the RFQ/RFP.
- The results of individual rating factors are obtained through the consensus rating of all the members of the evaluation committee.
- Clearly documents the strengths and weaknesses of the proposals.

3.4.3.7. Utah Department of Transportation

Utah DOT also uses a two-step procedure to procure their best value projects. The agency evaluates the pass/fail and technical factors listed in the SOQ in the first step and shortlists the proposers. Technical proposals submitted by shortlisted proposers are evaluated in the second step. The proposals are evaluated on pass/fail, technical factors listed in the RFP. The agency also mentions the relative importance of the technical factors in the RFPs issued to the proposers. The agency also uses some additional evaluation criteria depending on the type of project. The technical proposals are evaluated against the requirements mentioned in the RFP and are assigned adjectival ratings. The price proposals are opened only after the technical evaluation is completed. The price proposals are evaluated based on proposal price, price accuracy, completeness and reasonableness. The price proposal carries more weight in the selection process for Utah DOT. The proposals that exceed the 10% range of the lowest price proposal are not considered for the best value selection.

The best value evaluation committee for the Utah DOT is comprised of three committees. They are: 1) Analysis Committee; 2) Evaluation Committee; and 3) Selection Committee. The analysis committee analyzes and evaluates the proposals based on the facts, added values, risks, strengths and weakness of the proposals and identifies any deficiencies in the proposals. The evaluation committee evaluates the proposals, reviews the ratings and assigns blind aliases to the

proposals. The selection committee assigns overall technical ratings to the proposals with cost values. It also reviews the blinded technical information with the blinded price proposals and determines the best value bidder. Debriefing is conducted to the unsuccessful proposers upon their request. The procurement official familiar with the evaluation and selection process debriefs the proposers. Information is provided in the areas of proposals that have weaknesses.

The Utah DOT uses the following strategies to increase the transparency and fairness in the selection process:

- Provides detailed description, objectives, requirements, and relative weights of technical factors in the RFQ/RFP.
- Clearly documents the strengths and weaknesses of the proposals.
- Consultant services blinds the proposals and marks them with aliases before evaluation.
- Process witnesses are appointed to ensure that the evaluation process is fair and transparent.

3.5. Summary and Discussions

This paper provides information to the state highway agencies on developing the transparent best value selection procedure for their projects. The survey conducted for this study explains the current state of practice of the best value procurement in the highway industry. The evaluation criteria, award algorithms and debriefing procedures vary from project to project. The content analysis of 79 RFQs/RFPs showed that state DOTs use various evaluation criteria, award algorithms to obtain transparency for their best value projects. Finally, seven case studies were conducted with the state agencies that have more experience with best value procurement to describe their transparent best value procedure in more details.

The results of the research indicated that around 75% of the state agencies are using or considering the use of best value procurement.. The content analysis of the RFQ/RFPs revealed that the evaluation criteria used for the best value evaluation process vary from project to project. Some state DOTs use a standard set of evaluation criteria on their projects. The content analysis also identified the most common evaluation criteria and the award algorithms that contribute to the transparency in the best value evaluation process mentioned in RFPs.

Finally, the case studies presented in this paper explain the evaluation criteria, award algorithms that support transparent best value approach in detail. . The award algorithms used to select best value projects vary. Florida and Minnesota DOTs use an adjusted score algorithm on their projects. Florida DOT includes time value costs in their algorithm. Michigan, New York, and Oregon DOTs use weighted criteria algorithm which is slightly different in formula. New York DOT gives equal importance to both the price and technical proposals in the calculation of the best value score on projects that are not budget sensitive. Oregon DOT determines the best value score based on the quality weight and price weight according to the project requirements. The case studies also found that to enhance transparency in the selection process agencies often use non scoring persons in the evaluation committee to supervise the evaluation process.

3.6. Conclusions

This research investigates the best value approach to highway projects. The research indicates that that experience and qualifications, project management, project understanding and approach, and key personnel are the key evaluation criteria that are mostly used by the state highway agencies. . The results of this research show that providing clear, easily understandable and project specific evaluation criteria along with their requirements can promote transparency in the selection process. It was also observed that weighted criteria, adjusted bid, and adjusted score

algorithms are most commonly used by experienced state highway agencies. The inclusion of a non-voting person as an observer in the evaluation process helps to accomplish a fair and transparent evaluation process of the proposals. Providing comments about the strengths and weaknesses of the proposals during the evaluation process helps the evaluators during the debriefing process. The use of evaluation criteria that supports the project requirements, the transparent evaluation process supported by the most appropriate award algorithm is critical to accomplish successful best value contracting.

Even though this research provides guidance to state highway agencies for implementing a transparent best value selection procedure, it has some limitations. . First, some state agencies share the competitors' proposals with the unsuccessful proposers during the debriefing while some agencies do not. This is because of the legal system of that particular DOT. However, the impact of this sharing or not sharing process on the transparency of the overall selection process is unknown. Further research on this issue can promote the more competitive process. Second, the evaluation committee is responsible for attaining transparency in the selection process. The committee members are trained by the agencies before the evaluation process to make them familiar with the evaluation procedure. However, there is no previous research conducted on how the training is provided to the evaluation committee, and what the evaluation committee is taught to look in the proposals during the evaluation process which decides the outcome of the best value selection. Third, best value can be used on any project. The real benefits of the best value can only be achieved when it is used on the projects that absolutely require best value value for their successful completion. Future research on determining when to use the best value procurement and developing a framework for using best value on highway projects will significantly help the highway agencies.

3.7. References

Barrett, P. (2000). "Balancing accountability and efficiency in a more competitive public sector environment", *Australian Journal of Public Administration*, 59(3): 58-71.

Commonwealth Procurement Guidelines, 2005. [Online]. Available: www.dofa.gov.au/ctc/docs/commonwelath-procurement-guidelines

Hilger, P.A. (2009). "Best value Procurement: Lessons Learned, A review of best Practices in Minnesota: 2008-2009, 124pp

Hiroshi, O. (2009). "Effects of transparency in procurement practices on government expenditure: A case study on municipal public works", *Review of Industrial organization*, 34(3): 267-285

Holsti, O.R. (1969). *Content Analysis for the Social Sciences and Humanities*, Addison-Wesley publishing, Massachussets.

Hui, W., R. Othman, N.H. Omar, R.A. Rahman, and N.H. Haron. (2011). "Procurement issues in Malaysia", *International journal of public sector management*, 24(6): 567-593

Korosec, L.R., and Bartle, R.J. (2003). "A review of state procurement and contracting", *Journal of Public Procurement*, 3(2): 83-85.

Molenaar, K., D. Tran, NCHRP Synthesis 471: Practices *for Developing Transparent Best Value Selection procedures*, Transportation Research Board of the national Academics, Washington, D.C., 2015, 67 pp.

Montana Department of Transportation. (2005). *Defining Best Value,* MDT, 5pp. [Online]. Available: http://architecture.mt.gov/content/desigcoonstruction/docs/Best_Value_Definition.pdf

Nuendorf, K.A. (2002). *The Content Analysis Guie Book,* Sage Publications, Inc, California.

Parvin, C. (2000). "Design build: Evaluation and Award", *Roads and Bridges*, 38(12): 12 pp

Scott, S., K.R. Molenaar, D.D. Gransberg, and N.C. Smith, NCHRP Report 561: *Best Value Pocurement Methods for Highway Construction Projects,* Transportation Research Board of the national Academics, Washington, D.C., 2006, 213 pp.

Weber, R.P. (1990). *Basic Content Analysis*, 2nd Ed., Sage Publications, Inc, California.

CHAPTER 4: BEST VALUE PROCUREMENT FOR HIGHWAY DESIGN-BID-BUILD PROJECTS*

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* Accepted for publication in the *Construction specialty conference, Vancouver, British Columbia.*

Abstract: Best value procurement is the process in which factors additional to price are considered in the selection of a contractor. Time, operation and maintenance, technical and managerial merit, and past performance are the other key factors considered along with price in best value projects. Compared to the low-bid procurement, best value procurement offers several advantages, including opportunities to improve project quality, promote innovation, and enhance project performance. Best value procurement, while commonplace in highway design-build (D-B) projects, is limited in use for design-bid-build (D-B-B) projects. This paper explores the procedure and existing practices of D-B-B best value contracts for highway projects. Data were collected from a survey questionnaire, structured interviews, and case studies. The survey questionnaire was distributed nationwide to 52 state Departments of Transportation (DOTs) to identify the practices of using best value procurement in transportation projects. The seven structured interviews and four case studies were conducted in detail to investigate the opportunities and challenges of evaluation criteria, selection methodologies, and evaluation committee structure in D-B-B best value projects. The results indicate that evaluation criteria and selection methods are established on a project-by-project basis. The owner agency should

develop selection criteria and establish evaluation committees that are most beneficial to a given project. This paper provides some guidance for state DOTs to use best value procurement for their D-B-B projects.

4.1. Introduction

State departments of transportation (DOTs) have historically used a low bid approach to procure construction services. Under the low bid approach, price is a sole competitive factor. Non-price factors such as qualifications, experience, technical approaches, and innovative solutions are not considered. Typically, the DOT awards the contract based on the lowest responsive bid. Best-performing contractors who will deliver high quality projects are less likely awarded the contracts in this method of contracting (Abdelrahman et al. 2010). Researchers have identified several benefits of using low bid procurement including potential for monetary savings (Palaneeswaran et al. 2003), easy and simple implementation, reduced protests and disputes (Gransberg and Senadheera 1999), and a long-standing legal precedence, and enhanced competition (Scott et al. 2006). While the low bid approach offers several advantages and is inherently transparent, it does not always offer the best performance during and after construction. To improve project quality and performance, a number of DOTs are increasingly using best value procurement to deliver their transportation projects.

A review of literature indicated that a number of studies have investigated best value procurement for highway projects. However, most of them have focused on highway design-build (D-B) projects. Limited studies, if any have explored the use of best value procurement for traditional design-bid-build (D-B-B) projects. Building upon the relevant literature, the objective

of this study is to examine how to employ best value procurement in the D-B-B delivery method for highway projects.

4.2. Background

Best value is defined broadly in the literatre. Even in the highway industry, the best value definition may vary by state. This study used the best value definition based on the National Cooperative Highway Research Program (NCHRP) Report 561 as follows: best-value procurement is "a procurement process where price and other key factors are considered in the evaluation and selection process to minimize impacts and enhance the long-term performance and value of construction" (Scott et al. 2006). The report also indicated that best value procurement allows both objective and subjective elements to be considered in the selection process. The objective elements may include contractor experience, timeliness and accuracy of submittals, record of safety, or compliance with material and workmanship requirements. The subjective elements may include effective management, proactive measures to mitigate risk, training programs, customer satisfaction, and client relation.

Best value procurement is one of many procurement options. It is not ideal for every project, but it can provide benefits on appropriate projects. Project goals and project characteristics can determine if the use of best value will be advantageous. Goals that align well with best value procurement include shortening of the project duration, creating opportunities for innovation, and selecting the most qualified team. Appropriate project characteristics include opportunities for innovation, the amount of design required to develop a competitive industry proposal, agency experience with the process, and market capability. For example, researchers show that the best value method more often delivers projects that meet owner expectations (El Wardani et al. 2006).

The projects delivered using best value usually stay close to the original budget and schedule (Molenaar and Johnson 2003). Best value procurement is useful on those projects with unique objectives or challenges that may be difficult to meet using traditional low-bid procurement (MnDOT 2013).

State DOTs are increasingly using best value procurement for delivering their transportation projects. The 1996 version of the Federal Acquisitions Regulations (FAR) stated that best-value procurement should be selected when the project needs innovation and new technology or when a specific type of experience is required to obtain the desired outcome (FAR 1996). Considerations for best value procurements can include price, schedule, technical and managerial merit, financial health and past performance (Scott et al. 2006). Because the system provides a balance between price and qualitative considerations, it can optimize the benefits of fixed-price sealed bidding and sole source selection. The inclusion of key factors in evaluation criteria that match the specific needs of a particular project can raise the likelihood of meeting project performance goals (Abdelrahman et al. 2008). In fact, public clients use best value procurement when they aim to achieve the maximum outcome for their projects as opposed to the lowest price (Zhang 2006).

As mentioned above, although various studies have focused on the use of best value procurement on D-B highway projects, there is a very little research that explores how best value procurement can be used for highway D-B-B projects. This paper attempts to fill this knowledge gap by analyzing four case studies with state DOTs that have experience using best value procurement on their D-B-B projects. The following sections present briefly how these four case studies were selected.

4.3. Research methodology

The research methods employed in this study include three main steps: (1) a national survey, (2) structured interviews, and (3) case studies. The objective of step 1 is to preliminarily determine and identify the current state of practice on using best value with D-B-B projects. Based on the results of Step 1, the author conducted interviews with seven state DOTs who have the most experience with best value procurement. Finally, step 3 involved conducting four in depth case studies to explore how best value procurement can be applied to these four D-B-B projects.

4.3.1. Survey

Because of the lack of information about the best value D-B-B contracts, the authors developed a nationwide survey to collect preliminary data. The survey consisted of 18 questions related to the topic such as project delivery methods using the best value, experience of the agency, evaluation criteria, selection methods, evaluation committee, debriefing, legal, and protest information. The survey was sent to all 50 DOTs across the United States including the District of Columbia, and Puerto Rico. After two follow-up requests, the author received responses from 46 state DOTs. It is noted that the survey questionnaire asked the participants to describe not only their state of practice related to the best value D-B-B approach, but their perception regarding the use of best value procurement for D-B projects. The survey results indicated that 19 state DOTs are using or considering the use of best value procurement in their D-B-B projects. Based on these responses, the authors searched for relevant information on hese states D-B-B best value projects in their websites. Much information from state DOT websites

could not be found about the use of best value procurement with design-bid-build apart from the agencies like New York, Michigan, Minnesota, and Oregon.

4.3.2. Interviews

The responses from the survey were analyzed to determine which state DOTs have the most experience on best value projects. As a result, seven state DOTs were selected for interviews to further investigate the use of best value procurement with the D-B-B delivery method. The interview questions were divided into four sections, including 1) proposal evaluation criteria, 2) selection methodologies, 3) evaluation committee, and 4) debriefing procedures. The authors invited the DOT officials to participate in an interview by phone and email. The interview questions were sent in advance to the officials who had agreed to provide information on their best value projects. After the interviews, the author sent a request for potential case studies on best value D-B-B projects. In addition, the interviewees were requested to provide the documents most relevant to their best value procedures.

4.3.3. Case Studies

Due to the lack of data collected in the survey and interviews, the case study is a main research tool for this study. In this step, the authors analyzed documents collected from the survey and potential case studies provided by state DOTs in the interview process. As a result, four case studies were selected to conduct a detailed analysis. These four case studies were selected because of the completeness of the documented best value process. In each case study, the authors followed a rigorous case study protocol that included the following four primary criteria: (1) evaluation criteria; (2) selection methodology; (3) evaluation committee; and (4) debriefings. The following sections present the results of these four case projects.

4.4. Results and Analysis

Table 13 summarizes the key findings from evaluation criteria, best value award algorithm, and evaluation committee of the four case projects.

Table 13. Best value selection process for D-B-B projects

No	State DOT	Project Name	Evaluation Criteria	Best value Algorithm	Evaluation Committee
1	Michigan DOT	M-39 South field Freeway, Michigan	1. Air Quality (40 points) 2. Noise restriction(40 points) 3. Managing utilities to homes(40 points) 4. Construction traffic and mobility (40 points) 5. Avoiding damage to adjacent property from vibration (40 points) 6. Local Contractor and Workforce Participation Concerns (150 points) 7. Safety and Mobility (100 points) 8. Schedule concerns (50 points)	Contract awarded to proposer with the lowest composite score. Composite score = Bid price/technical score	Detroit Transportation service center (TSC) Manager TSC development manager TSC delivery engineer Metro region Engineer Metro region planning specialist Director of MDOT office of small business development Contract services division administrator
2	New York DOT	Patroon Island Rehabilitation Project, New York	1. Responsiveness to RFQ 2. Legal 3. Financial 4. Experience 5. Past Performance	The project is awarded to lowest cost responsible bid	A technical selection committee comprised of officials from NYSDOT.
3	Oregon DOT	Dennis L. Edwards Tunnel, Washington County	1. Construction and general tunnel experience (40 points) 2. Specific tunnel experience (24 points) 3. Traffic control and safety plan (16 points)	Price: 50% Technical qualifications: 40% Technical Approach: 10% Proposal with the highest score is awarded the project	Experts from ODOT bridge engineering section, region 1 technical center, project Manager, and representative from FHWA
4	Oregon DOT	I-84: Sandy River-Jordan Road, Bundle 210 project, Multnomah County	1. Qualifications and Experience (18 points) 2. Project Understanding and approach (21 points) 3. Key personnel (21 points) 4. In water work approach (16 points) 5. Steel Box girder approach8 (points) 6. Diversity (16 points)	Price: 70% Technical and qualification factor: 30% Proposal with the highest score is awarded the project	Individuals from ODOT, non-scoring members from outside ODOT

One can observe from Table 13, that the price component is an important factor in selecting the contractor for the D-B-B best value projects. For example, in the case study with NYDOT, it was observed that the contractor was selected based on the lowest responsible bid. The case studies with Oregon DOT revealed that the price factor accounted for 50% and 70% associated with Dennis Edwards Tunnel and I-84 Sandy River Jordan Road projects, respectively. However, the technical factors considered in the evaluation process were varied depending on the project type and characteristics. For example, Oregon DOT asked the proposers about their specific tunnel experience with regards to the Dennis L. Edwards tunnel project. Michigan DOT specified a list of detailed technical criteria such as air quality, noise restriction, safety and mobility on their M-39 Southfield project. New York DOT used standard evaluation criteria that are similar to D-B best value projects on their best value D-B-B Patroon Island Rehabilitation Project. These evaluation criteria include responsiveness to request for qualification (RFQ), legal, financial requirements, experience, and past performance. The following sections discuss each case study in detail.

4.4.1. Michigan DOT case study: M-39 South Field Freeway Project

M-39 Southfield freeway project involved the reconstruction of roadway from McNichols to M-10, roadway rehabilitation of 28 bridges, freeway lighting and signing, sanitary sewer, and screen wall replacement. Michigan DOT (MDOT) does not have a standard procedure for their best value projects. The selection process and evaluation criteria were determined depending on the type and location of the project. The eight evaluation criteria for this project include: 1) air quality, 2) noise restriction, 3) managing utilities to homes, 4) construction traffic, 5) avoiding damage to adjacent property due to vibration, 6) local contractor and workforce participation concerns, 7) safety and mobility, and 8) schedule concern. The maximum point available for

each factor is shown in Table 13. The maximum points available for the technical proposal are 500. The composite score of the proposals is calculated by dividing the bid price of the proposal by technical score. The proposal with the lowest composite score was awarded the contract.

The technical evaluation committee was comprised of the Detroit transportation service center (TSC) manager, development manager, delivery engineer, region engineer, region planning specialist, and director of MDOT office of small business development. The committee started with a baseline score and added points for innovative ideas. The final technical score of the proposals was the consensus rating of all the committee members. Price proposals were opened by the committee after evaluating the technical proposals. Finally, the project manager conducted debriefings to unsuccessful proposers after their request. Detailed comments about the strengths and weakness of the proposals were discussed in that meeting.

4.4.2. New York DOT case study: Patroon Island Rehabilitation Project

The Patroon Island bridge project involved the construction of ramps connecting the I-90 interchange with I-787, repairing the bridge decks and bearings, and painting the bridges. The project manager worked with the chief engineer to determine the evaluation criteria for the project. The evaluation factors for this project are responsiveness to RFQ, legal and financial information, experience, and past performance of the proposers. These evaluation criteria for D-B-B projects are similar to that of D-B projects. The proposals were evaluated against these factors by the evaluation committee on the pass or fail basis. After evaluating technical criteria, the evaluation committee evaluated the cost proposals. The proposer with the lowest cost bid was awarded the contract.

The evaluation committee, which included officials from the New York DOT, was responsible for the evaluation of the proposals and the selection of the best value contractor. The evaluation committee was prevented from seeing the cost proposals to avoid any potential bias during the evaluation process. The agency conducted debriefing to the unsuccessful proposers. A debriefing was conducted by a procurement official who is familiar with the selection and contract award process. Strengths and weaknesses of their proposals were explained to the proposers.

4.4.3. Oregon DOT Case Studies

Oregon DOT has employed best value procurement for several D-B-B projects. To identify the differences of using the best value approach with different type of projects, the authors conducted two case studies in Oregon DOT.

Dennis L. Edwards Tunnel Project

This project involved removing and replacing the existing lining, improving the wall drainage, and improving the lighting system of the tunnel along with the installation of a bike warning system. Oregon DOT (ODOT) used price plus technical qualifications plus technical approach best value process to select the contractor. The price factor accounted for 50% of the weight in evaluation process while the technical qualification and approach accounted for 40% and 10%, respectively.

The three evaluation criteria for this project included (1) construction and general tunnel experience, (2) specific tunnel experience, and (3) traffic control and safety plan. The evaluation committee was comprised of two technical experts (one from ODOT bridge engineering section and the other from regional technical center), the project manager, a representative from the

Federal Highway Administration (FHWA), and the engineering consultants who acted as facilitators and observers during evaluation process. The proposals were evaluated and scored separately by the members and the average of all the scores was the final technical score of the proposers. The project was awarded to the proposer whose combined score is the highest among all the proposers.

I-84 Sandy River – Jordan Road, Bundle 210 project

This project was a typical highway project that involved replacing and repairing the bridge. Different from the Dennis L. Edwards Tunnel project mentioned above, the price factor accounted for 70% of the weight in the selection process and the technical qualifications and approach factors accounted for 30%. The main reason for this was that the project is a typical highway project while the tunnel project was more complex. As a result, the technical factors of the tunnel project accounted for more weight in the evaluation process. In the tunnel project, the agency used specific tunnel experience factor to select the proposer who have more experience and offers the best value for the particular type of work involved. On the other hand, for the I-84 Sandy River project, which is a typical highway project, the agency preferred setting more weight on the price factor for their D-B-B projects. In addition, the evaluation committee of this project was simpler than that of the tunnel project. Technical experts, a member from FHWA, and consultant were not required for this project. Only officials from ODOT and a non-scoring member from outside ODOT were included in the evaluation committee.

4.5. Discussions

The case studies presented above illustrate the use of best value procurement in D-B-B projects. It is observed that Michigan and Oregon DOTs develop the evaluation criteria

depending on the nature of the project. New York DOT has employed a similar best value D-B project procedure for their best value D-B-B projects. In general, price accounts for the greatest weight in the best value evaluation process for D-B-B projects. Specifically, New York awards the project to the lowest bidder from the list of prequalified bidders while Michigan and Oregon assign more weight to the price while calculating the best value scores. Michigan selects the best value contract based on the least composite score, which is calculated by dividing price over the technical score. Oregon selects the best value contractor for their D-B-B projects based on the highest score that is combined between price and technical factors. Recently, Minnesota DOT has published a manual for best value procurement on D-B-B projects. This manual introduces a streamlined approach to best value procurement that can be applied to a variety of projects. The approach, which is intended for projects that requires advance design, suggests that the agency should develop pass-fail criteria to reflect the benefits of the project and select the low bid from the proposals meeting the criteria (MnDOT 2013).

Based on the four case studies, one can observe that the evaluation committees are often comprised of officials from state DOTs. In some cases officials from outside the agency (i.e., consultants, a representative from FHWA, or a non-scoring member) may also be included in the evaluation committee. Typically, after awarding the best value contract, state DOTs conduct debriefing sessions for the unsuccessful proposers. In these meetings, a member in the evaluation committee often explains the strengths and weaknesses of their proposals.

4.6. Conclusions

Transportation agencies are increasingly using best value selection procedures to deliver transportation projects. While low bid procurement processes are simple and transparent, they do

not allow agencies to evaluate additional factors that may add value to the agencies and stakeholders. Best value procurement is often used for D-B highway projects. This paper shows that best value approach can be applied to the traditional D-B-B projects. The case studies presented in this paper explained about the methods adopted by the state highway agencies the selection process of a best value contractor. The findings from this paper suggest that the use of best value for D-B-B projects in several state DOTs brings significant benefits to their agencies. Non-complex projects, in particular, have the potential for using streamlined best value processes. The evaluation criteria and award algorithms need not be as complex as those found on large D-B projects. In addition, the owner agency should develop the evaluation criteria and establish the selection committee based on a project-by-project basis.

Although the findings from this paper encourage the use of effective best value procurement on D-B-B delivery, the paper has several limitations. First, due to the lack of best value D-B-B project data, it is challenging to compare the project performance between best value and low bid procurement on D-B-B projects. Second, the sample size for this research is small. This study has not focused on some important factors like industry outreach, stipends, and training to evaluation committee which plays an important role in the selection of the best value contractor. A more substantial study with consideration of other factors and a large sample size should be performed to identify the best practices of using best value procurement on D-B-B delivery methods. In addition, future research could determine how to streamline best value procurement, allocate the risks equitably for the agency and contractors, and quantify the project performance between D-B-B low bid and best value projects.

4.7. References

Abdelrahman, M., T. Zayed, and A. Elyamany. 2008. "Best value Model Based on Project specific characteristics," *Journal of Construction Engineering and Management*, 134(3): 179-188.

El Wardani, Marwa A., John I. Messner, and Michael J. Horman. 2006. "Comparing Procurement Methods for Design-Build Projects." *Journal of Construction Engineering & Management*, 132(3): 230–38.

Elyamany, A., and M. Abdelrahman. 2010. "Contractor Performance Evaluation for the Best Value of Superpave Projects." *Journal of Construction Engineering and Management*, 136(5): 606–614.

Federal Acquisition Regulation (FAR). 1996. U.S. Government Printing Office, Washington, D.C.

Gransberg, D.D., and S. Senadheera. 1999. "Design-Build Contract Award Methods for Transportation Projects." *Journal of Transportation Engineering*, 125(6): 565–567.

Minnesota Department of Transportation (MnDOT), *Best Value Procurement manual*, MnDOT, St. Paul, 2013, 57 pp. [online]. Available: http://www.dot.state.mn.us/const/tools/docs/BestValueGuide-FinalMarch2013.pdf .

Molenaar, K.R., and D.E. Johnson. 2003. "Engineering the Procurement Phase to Achieve Best Value." *Leadership and Management in Engineering*, 3(3): 137–41.

Palaneeswaran, Ekambaram, Mohan Kumaraswamy, and Thomas Ng. 2003. "Targeting Optimum Value in Public Sector Projects through 'best Value'-Focused Contractor Selection." *Engineering, Construction and Architectural Management*, 10(6): 418–31.

Scott, S., K.R. Molenaar, D.D. Gransberg, and N.C. Smith, *NCHRP Report 561: Best Value Procurement Methods for Highway Construction Projects*, Transportation Research Board of the National Academies, Washington, D.C., 2006, 213 pp.

Zhang, X. 2006. "Public Clients' Best Value Perspectives of Public Private Partnerships in Infrastructure Development." *Journal of Construction Engineering and Management* 132(2): 107–14.

CHAPTER 5: SUMMARY AND CONCLUSIONS

The selection procedure of the best value contractor is key for the success of a project. Transparency issues are a concern with the best value procurement. It is necessary for the state DOT to adopt a transparent and fair selection process to achieve the desired outcome of a best value transaction. This study provides a groundwork for identifying best value selection procedures that promote transparency through a survey, content analysis, and case studies.

A national survey conducted as the first step of this research to identify the current state of practice of the best value procurement in the highway industry. The survey responses have indicated that 35 out of 46 agencies are using or currently using the best value procurement on their highway projects. The content analysis performed on the best value RFP/RFQ documents of the 35 state highway agencies concentrated mainly on the evaluation criteria, best value award algorithm, and the debriefing procedures. The state agencies that have most experience with the best value procurement were identified from the survey results. The interviews were conducted to gather the information required for compiling case studies on the best value selection procedure.

This thesis is based on a two- paper format. The first paper focuses on the content analysis of best value RFQ/RFPs, and case studies of best value selection procedures of seven highly experienced state DOTs identified from the survey. The seven case studies included in the paper examine the evaluation criteria, award algorithm, evaluation committee, and debriefing process that support transparent best value approach.

The results from the first paper indicates that clear, well documented evaluation criteria, and their relative weights in the RFPs is crucial for the success of the best value project. The analysis

of the results of content analysis reveals that experience and qualifications, project management, project understanding and approach, and key personnel are the most used evaluation criteria by these state highway agencies. There are several other evaluation criteria like legal and financial capacity, schedule, quality, and safety that are identified in the content analysis of the RFP documents that can be used by the agencies, depending on the type of project and the major work type involved in the project.

The analysis of these evaluation factors, the price proposals, and the process of combining these non-price related factors with the price proposal to select the best value bidder has raised concerns over the transparency of the selection process. The case studies discusses the methods adopted by the state highway agencies to increase the transparency in the selection process of a best value contractor. The results of these case study confirm that providing clear, easy to understand and project specific evaluation criteria along with their requirements can promote transparency in the selection process. It was also observed that weighted criteria, adjusted bid, and adjusted score algorithms are most commonly used by the experienced state highway agencies. The inclusion of a non-voting person as an observer in the evaluation process helps to achieve a fair and transparent evaluation. The practice of debriefing the unsuccessful proposers in a timely manner helps the proposers to understand their mistakes. Providing specific comments about the strengths and weaknesses of the proposals during the evaluation process helps the evaluators during the debriefing process. The use of evaluation criteria that supports the project requirements, and the selection process which includes a transparent evaluation supported by the most appropriate award algorithm are critical to accomplish successful best value contracting.

There is a very little existing research that investigated about the use of best value procurement in the design-bid-build method of project delivery. The second paper presented in this thesis focuses on the use of best value procurement in the design-bid-build project delivery method. Four case studies are conducted on the DOTs that use best value in design-bid-build delivery method. The findings from the second paper reveals that highway agencies can successfully use the best value procurement on their design-bid-build projects. The use of best value procurement on the non-complex design-bid-build projects can bring significant benefits to the highway agency. It was also observed that agencies follow the same procedures they follow on the design build best value projects to ensure the transparency of the selection process.

In summary, the findings from this research indicate the following results that enhances the transparency in the selection process:

1) Providing clear, easy to understand, and project specific evaluation criteria;
2) Clearly mentioning the weights, relative weights of the evaluation criteria in the RFQ/RFPs issued to the proposers;
3) Use appropriate evaluation criteria that meets the project requirements;
4) Using weighted criteria, adjusted bid, and adjusted score algorithms to provide a mechanism for promote transparency;
5) Use of non-voting observers or facilitators to oversee the evaluation process;
6) Providing detailed comments on the strengths and weaknesses of the proposals during the evaluation process;
7) Debriefing the unsuccessful proposers about their proposals.

5.1. LIMITATIONS AND FUTURE RESEARCH

. There are several research limitations in this study. This research has observed a few research gaps that can be filled with the help of some future research. They are:

1) The impacts of sharing or not sharing the competitor's best value proposals with the unsuccessful proposers during the debriefing on the transparency of the selection process.
2) The training given to the evaluation committee before the evaluation process on what to look in the proposals.
3) When to select the best value procurement and on what projects. Developing a framework for the selection of best value procurement for the highway projects
4) Comparison of project performance between best value and low bid procurements on DBB projects
5) Research determining how to streamline the best value procurement and allocate the risk equally for the contractors and the agency on design-bid-build projects.

REFERENCES

"The Best Value Approach; To Select a Contract Source," U.S. Army Materiel Command AMC Pamphlet 715-3 Volume 5, 1994.

Abdelrahman, M., Zayed, T., and Elyamany, A. (2008). "Best value Model Based on Project specific characteristics." *Journal of Construction Engineering and Management*, 134(3), 179-188.

Alsugair, A. M. (1999). "Framework for Evaluating Bids of Construction Contractors." *Journal of Management in Engineering*, 15(2), 72–78.

Anderson, S. D., and Russel, J. S. (2001). NCHRP Report 451: *Guidelines for Warranty, Multi-Parameter, and Best Value Contracting*, Transportation Research Board of the National Academies, Washington, D.C., 76pp.

Army Source Selection Guide. (2001). Army Corps of Engineers, Office of the Assistant Secretary of the Army, Acquisitions, Logistics and Technology, 2003.

Barrett, P. (2000). "Balancing accountability and efficiency in a more competitive public sector environment." *Australian Journal of Public Administration*, 59(3), 58-71.

Beard, J., Loukakis, M. C., and Wundram, E. C. (2001). *Design-build: Planning through development*, McGraw-Hill, New York., 543 pp.

Bubshait, A. A., and Al-Gobali, K. H. (1996). "Contractor Prequalification in Saudi Arabia." *Journal of Management in Engineering*, 12(2), 50–54.

California Department of Transportation (Caltrans), "*Alternative Procurement Guide.*", Caltrans, Sacramento, 2008, 296 pp. [online]. Available:

http://www.caltrans.ca.gov/hq/oppd/contracting/AlternativeProcurementGuide.pdf, (Feb. 27, 2015).

Chang, K. (2004). "Multiattribute Weighting Models for Best-Value selection in Public Sector Design-Build Projects." Ph.D. thesis, University of Colorado., Boulder, CO.

Commonwealth Procurement Guidelines, 2005. [Online]. Available: <www.dofa.gov.au/ctc/docs/commonwelath-procurement-guidelines> (Mar. 13, 2015).

El Wardani, M., Messner, J., and Horman, M., (2006). "Comparing Procurement Methods for Design-Build Projects." *Journal of Construction Engineering & Management*, 132(3), 230–238.

Elyamany, A., and Abdelrahman, M. (2010). "Contractor Performance Evaluation for the Best Value of Superpave Projects." *Journal of Construction Engineering and Management*, 136(5), 606–614.

Federal Acquisition Regulation (FAR). (2000). "Part 15 – Contracting By Negotiation," U.S. Government Printing Office, Washington, D.C.

Federal Acquisition Regulation (FAR). 1996. U.S. Government Printing Office, Washington, D.C.

Georgia Department of Transportation (GDOT), "*Design Build Guidebook*," GDOT, Atlanta, 2014, 94 pp. [online]. Available: http://www.dot.ga.gov/doingbusiness/PoliciesManuals/roads/DesignBuild/001-GDOT_Design-Build_Manual.pdf (Feb. 27, 2015).

Georgia Department of Transportation (GDOT), "*Recommended guide for next generation of transportation design build procurement and contracting in the state of Georgia.*", GDOT,

Atlanta, 2012, 263 pp. [online]. Available: http://www.dot.ga.gov/BuildSmart/research/Documents/10-23.pdf , (Feb. 27, 2015).

Gransberg, D. D., Ellicott, M. A. (1997). "Best-value contracting criteria." *Cost Engineering.*, 39(6), 31-34.

Gransberg, D. D., Molenaar, K. R., Scott, S., and Smith, N. C. (2006). "Implementing Best-Value Procurement in Highway Construction Projects." Alternative Project Delivery, Procurement, and Contracting Methods for Highways, 60-79.

Gransberg, D.D., and Ellicott, M. A. (1996). "Best-Value Contracting: Breaking the Low bid Paradigm," *AACE Transactions*.

Gransberg, D.D., and Senadheera, S. (1999). "Design-Build Contract Award Methods for Transportation Projects." *Journal of Transportation Engineering*, 125(6), 565–567.

Hilger, P.A. (2009). "Best value Procurement: Lessons Learned, A review of best Practices in Minnesota: 2008-2009, 124pp.

Hiroshi, O. (2009). "Effects of transparency in procurement practices on government expenditure: A case study on municipal public works.", *Review of Industrial organization*, 34(3), 267-285.

Holsti, O.R. (1969). *Content Analysis for the Social Sciences and Humanities*. Addison-Wesley publishing, Massachussets, 235 pp.

Hui, W., Othman, R., Omar, N. H., Rahman, R. A., and Haron, N. H. (2011). "Procurement issues in Malaysia." *International journal of public sector management*, 24(6), 567-593.

Knight, L., Harland, C., Telgan, J., Thai, K.V., Callender, G., and Mcken, K. (2012). *Public Procurement: International Cases and Commentary, Routledge, London, 400 pp.*

Korosec, L.R., and Bartle, R.J. (2003). "A review of state procurement and contracting.", *Journal of Public Procurement*, 3(2), 83-85.

Michigan Department of Transporation (MDOT), *Best Value Performance Based Contracting, M-39 (Southfield Freeway), Final Report*, MDOT, Lansing, 2012, 107pp.

Minnesota Department of Transportation (MnDOT), *Best Value Procurement manual*, MnDOT, St. Paul, 2013, 57 pp. [online]. Available: http://www.dot.state.mn.us/const/tools/docs/BestValueGuide-FinalMarch2013.pdf .

Molenaar, K. R., and Gransberg, D. D. (2001). "Design-builder selection for small highway projects." *Journal of Management in Engineering*, 17(4), 214-223.

Molenaar, K. R., and Songer, A. (1998). "Model for Public Sector Design-Build Project Selection." *Journal of Construction Engineering and Management*, 124(6), 467–479.

Molenaar, K. R., Tran, D. (2015). NCHRP Synthesis 471: Practices *for Developing Transparent Best Value Selection procedures*, Transportation Research Board of the national Academies, Washington, D.C., 67 pp.

Molenaar, K.R., and Johnson, D. E. (2003). "Engineering the Procurement Phase to Achieve Best Value." *Leadership and Management in Engineering*, 3(3), 137–141.

Montana Department of Transportation (MDT), "*Defining Best Value."*, MDT, Helena, 2005, 5 pp. [online]. Available: http://architecture.mt.gov/content/designconstruction/docs/Best_Value_Definition.pdf, (Feb. 27, 2015).

New York State Department of Transportation (NYSDOT), *Request to Qualify*, Patroon Island Bridge Project, NYSDOT, Buffalo, 2012, 22pp.

Nuendorf, K.A. (2002). *The Content Analysis Guie Book,* Sage Publications, Inc, California, 320 pp.

Oregon Department of Transportation (ODOT), *Post Construction Report on A+C+D contracting*, Dennis Edwards Tunnel, ODOT, Salem, 2011, 19pp.

Oregon Department of Transportation (ODOT), *Procurement Summary of I-84: Sandy River-Jordan Road, Bundle 210*, ODOT, Salem, 2009, 11pp.

Palaneeswaran, E., and Kumaraswamy, M. (2000). "Contractor Selection for Design-build Projects," *Journal of Construction Engineering and Management,* 126(5), 331- 339.

Palaneeswaran, E., Kumaraswamy, M., and Ng, T. (2003). "Targeting optimum value in public sector projects through 'best value'-focused contractor selection." *Engineering, Construction and Architectural Management*, 10(6), 418–431.

Palaneewaran, E., Kumaraswamy, M., and Zhang, X. Q. (2012). "Focusing on Best Value from a Source Selection Perspective." *Australasian Journal of Construction Economics and Building*, 4(1), 21–34.

Parvin, C. (2000). "Design build: Evaluation and Award.", *Roads and Bridges,* 38(12), 12 pp.

Potter, K. J., and Sanvido, V. (1995). "Implementing a Design/Build Prequalification System." *Journal of Management in Engineering*, 11(3), 30–34.

Russell, J.S. (1996). "Constructor Prequalification: Choosing the Best Constructor and Avoiding Constructor Failure." *American Society of Civil Engineers Press*, New York, N.Y., 193 pp.

Scott, S., Molenaar, K.R., Gransberg, D.D., and Smith, N.C. (2006). NCHRP Report 561: *Best Value Pocurement Methods for Highway Construction Projects*, Transportation Research Board of the National Academies, Washington, D.C., 213 pp.

Shane, J. S., Gransberg, D. D., Molenaar, K. R., Gladke, J. R. (2006). "Legal Challenge to a Best-Value Procurement System." *Leadership and Management in Engineering*, 6(1), 20-25.

Twomey, T. *Understanding the Legal Aspects of Design Build*, Means Co., 1989.

Weber, R.P. (1990). *Basic Content Analysis.*, 2nd Ed., Sage Publications, Inc, California, 96 pp.

Yu, W., and Wang, K. (2012). "Best Value or Lowest Bid? A Quantitative Perspective." *Journal of Construction Engineering and Management*, 138 (1), 128–134.

Yu, W., Wang, K., and Wang, m. (2013). "Pricing Strategy for Best Value Tender." *Journal of Construction Engineering and Management*, 139(6), 675-684.

Zhang, X. 2006. "Public Clients' Best Value Perspectives of Public Private Partnerships in Infrastructure Development." *Journal of Construction Engineering and Management*, 132(2), 107–114.

APPENDIX A – NATIONAL SURVEY QUESTIONNAIRE

1. Responding Agency Information

   Agency: .....

   Name: .....

   Title: .....

   Office/Bureau: .....

   Phone: .....

   e-mail: .....

2. Is your agency currently implementing or considering best value procurements?

   - ❑ Yes, currently implementing best value procurements
   - ❑ Yes, currently considering best value procurements
   - ❑ No, click here to complete the questionnaire

3. What group/section do you work in?

   - ❑ Design group/section
   - ❑ Construction group/section
   - ❑ Operations group/section
   - ❑ Alternative project delivery group/section
   - ❑ Contracts/procurement group/section
   - ❑ Other, please specify: ……

4. Is your agency currently implementing or considering best value selection on the following project delivery methods?

Delivery Method	Best Value Application
D-B-B	❑ Yes ❑ No
D-B	❑ Yes ❑ No ❑ D-B is not currently used by agency
CM/GC or CM-at-Risk	❑ Yes ❑ No ❑ CM/GC is not currently used by agency
Job Order Contracting	❑ Yes ❑ No ❑ Job order contracting is not currently used by agency

❑ Other relevant delivery methods, please specify: ……

5. If the answer to Question 4 is NO for any project delivery methods, complete the following table for each respective delivery method with a NO answer.

Delivery Method	Best Value Application
D-B-B	❑ Traditional procurement methods are adequate ❑ Legal or regulatory prohibitions against some methods ❑ Agency expertise not available ❑ Lack of staffing to oversee best value selection ❑ Not currently in use, but could be applied in the future ❑ Other, please specify:
D-B	❑ Traditional procurement methods are adequate ❑ Legal or regulatory prohibitions against some methods ❑ Agency expertise not available ❑ Lack of staffing to oversee best value selection ❑ Not currently in use, but could be applied in the future ❑ Other, please specify:
CM/GC or CM- at-Risk	❑ Traditional procurement methods are adequate ❑ Legal or regulatory prohibitions against some methods ❑ Agency expertise not available ❑ Lack of staffing to oversee best value selection ❑ Not currently in use, but could be applied in the future ❑ Other, please specify:

Job Order Contracting	❑ Traditional procurement methods are adequate ❑ Legal or Regulatory prohibitions against some methods ❑ Agency expertise not available ❑ Lack of staffing to oversee best value selection ❑ Not currently in use, but could be applied in the future ❑ Other, please specify:

6. In approximately what year did your agency begin using best value procurement?
7. Approximately what percentage of your average annual construction program, *in terms of number of projects*, is awarded using best value?
    - ❑ < 1%
    - ❑ 1% - 5%
    - ❑ 5%-10%
    - ❑ 10-20%
    - ❑ >20%
    - ❑ Other, please specify the number of best value projects your agency has awarded: …….
8. Which statement(s) best describe your industry outreach efforts with best value procurement?
    - ❑ Our agency did not solicit industry input into our best value procurement procedures.
    - ❑ Our agency worked with industry to develop our best value procurement procedures.

- ❑ Our agency regularly meets with industry representatives to evaluate our best value procurement procedures.
- ❑ Industry representatives participate in best value selection committees.
- ❑ Other, please specify: ……

9. Most commonly, how does your agency convey evaluation criteria and weight in solicitations?
    - ❑ Solicitations do not convey evaluation criteria weight
    - ❑ Solicitations convey evaluation criteria in order of importance
    - ❑ Solicitations convey point range for evaluation criteria
    - ❑ Other, please specify: ……
10. Does your agency interview proposers as part the selection process?
    - ❑ Interviews are always conducted
    - ❑ Interviews are included in selected best value procurements
    - ❑ Interviews are never conducted
    - ❑ Other, please specify: ……
11. Are stipends provided to unsuccessful proposers on best value procurements?
    - ❑ Stipends are provided on *all* best value procurements
    - ❑ Stipends are provided on *selected* best value procurements
    - ❑ Stipends are not provided
    - ❑ Other, please specify: ……
12. How does your agency conduct debriefing for unsuccessful proposers? (check all that apply)
    - ❑ Proposers receive a written debriefing

- ❑ Proposers receive an oral debriefing
- ❑ Proposers are allowed to review the winning proposals
- ❑ Proposers do not receive a debriefing
- ❑ Other, please specify: ……

13. Do your best value evaluation committees include personnel who are not agency employees?
    - ❑ Yes
    - ❑ No

    If YES, please describe the title and role of these personnel.
14. Does your agency provide training for evaluation committees on best value procurement selection?
    - ❑ General training is provided to agency personnel
    - ❑ Project-specific training for *every* project
    - ❑ Project-specific training for *some* project
    - ❑ Training is not provided by the agency
    - ❑ Other, please specify: ……
15. Does your agency have state legislation and regulation for best value procurements?
    - ❑ Yes
    - ❑ No

    If YES, can you provide a web link to the legislation?
16. Have you ever had a protest on a best value selection?
    - ❑ Yes
    - ❑ No

If YES, can you provide a brief description of the nature of the protest(s) and resolution?

17. Would you be willing to discuss your best value process with the research team in a structured interview?

    - ❑ Yes
    - ❑ No

    If NO, can you refer us to someone else in your agency?

    Contact name:

    Phone number:

    Email address:

18. Do you have any other information that you would like to share with the research team that might add value to this study?

    - ❑ Yes

      Please use this space to add information.

    - ❑ No

      Click here to complete the questionnaire

APPENDIX B – CASE EXAMPLE PROJECT QUESTIONNAIRE

A. Proposal Evaluation Criteria

1. When evaluating best value selection, what criteria do you use?
    a. *Does your agency have a standard set of criteria or a template with potential criteria?*
    b. *Please explain if/how each criterion contributes to transparency of the selection process?*
    c. *Please review this standard checklist if a written list is not available.*
        - *Price (initial capital cost)*
        - *Lifecycle*
        - *Technical Proposal Responsiveness*
        - *Project Schedule Evaluation*
        - *Past Project Performance*
        - *Key Personnel Experience and Qualification*
        - *Project Management Plan*
        - *Safety Record and/or Plan*
        - *Quality Management Plan*

- *Subcontractor's Information*
- *Environmental Considerations*

2. Does your agency evaluate alternative designs in best value selection?
    a. *If yes, what criteria are used?*
    b. *What processes are in place to ensure transparent selection?*
3. How does your agency share these evaluation criteria with the proposers?
    a. *Are the explicit or implicate in the RFP/RFQ?*
    b. *Are they provided with weights or an order of importance?*

B. Selection Methodologies

1. Does your agency have a manual or document that specifically describes the best value selection procedures?
    a. *Is there a standard procedures document?*
    b. *Is it adjusted for each project selection?*
2. Does your agency meet with proposing contractors during the procurement process?
    a. *Are these meetings mandatory?*
    b. *Are the meetings open to all proposers at once or individually?*
    c. *If they are individual meetings, how does the agency determine what is private and what is confidential?*
3. When scoring best value criteria, what methods do you use?
    a. *Direct point scoring?*
    b. *Adjectival scoring?*
    c. *Is the methods conveyed in the RFP?*

4. When awarding best value projects, what selection algorithms do you use? Please explain how this algorithm contributes to transparency of the selection process.
    a. Use the algorithms below as a checklist for review.
        - *Meets Technical Criteria-Low Bid*
        - *Fixed Price--Best Proposal*
        - *Adjusted Bid*
        - *Adjusted Score*
        - *Weighted Criteria*
        - *Quantitative Cost Technical Tradeoff*
        - *Qualitative Cost Technical Tradeoff*

C. Evaluation Committee Structure

1. How does your agency organize its best value selection committee to ensure transparent and objective selection?
    a. *Does your organization use a non-voting facilitator to clarify the proposal?*
    b. *Does your agency use a contractor representative?*
2. Does your agency require training for best value selection process?
    a. *Is the training formalized in your agency?*
    b. *Can you provide us with an example?*
3. Are evaluators isolated during the technical scoring process?
4. Does your organization have oversight committee to supervise entire best value process?

D. Debriefing Procedures

1. How does your agency conduct debriefing for unsuccessful proposers?
    a. *Is it done in person, over the phone, in writing?*

b. *Is it done with each individual proposer or as a group?*

c. *When is the review conducted?*

2. Do you have written procedures for what to share with unsuccessful proposers?

    a. *Can unsuccessful proposers see the proposals from other firms?*

    b. *Can you share any written guidance on what is confidential and when information can be shared?*

E. Industry Outreach Efforts

1. How does your agency work with industry to conduct best value procurements?

    a. *Did you work with industry to develop the initial procedures?*

    b. *Do you continue to work with industry to review/refine the procedures?*

2. How does your agency minimize the overall industry cost of developing proposal, but still maintain transparent and a fair best value approach?

F. Lessons Learned

1. What lessoned learned would you share with other agencies to help promote transparency in best value selection?

2. Has your agency ever been involved in a best value selection protest?

    a. *What was the outcome?*

    Is this public record and can we obtain a copy of the findings?

APPENDIX C – REFERENCES FOR RFQ/RFP DOCUMENTS USED IN CONTENT ANALYSIS

Alaska Department of Transportation & Public Facilities (DOT&PF), *Request for proposals package*, March 2014, 25 pp. [online]. Available: http://www.dot.alaska.gov/rfpdocs/02542033/02542033.pdf

Arkansas State Highway and Transportation Department (AHTD), *Request for proposals*, Innovative Financing Study for the Interstate 69 Corridor, July 30, 2010, 12pp. [online]. Available: http://www.arkansashighways.com/news/2010/RFP%20Full%20012100%20I69%20Innovative%20Financing%20final.pdf

California Department of Transportation (Caltrans 2012a), *Instructions to proposers*, I-15/I-215 Interchange Improvements (Devore) Design-Build Project, April 17, 2012, 102 pp. [online]. Available: http://www.dot.ca.gov/hq/oppd/designbuild/devore-index.html

California Department of Transportation (Caltrans), *Instructions to proposers*, Design and Construction on State Highway in Los Angeles County in the City of Baldwin park at route 10/605 Interchange, August 12, 2011, 100 pp. [online]. Available: http://www.dot.ca.gov/hq/oppd/designbuild/la10-605rfp/ITP/07-245204_ITP2.pdf

California Department of Transportation (Caltrans), *Instructions to proposers*, San Mateo 101 Ramp Metering Design-Build Project, 97 pp. [online]. Available: http://www.dot.ca.gov/hq/oppd/designbuild/sanmateo101rfp/ITP_04-2A7904.pdf

Colorado Department of Transportation (CDOT), *Request for Proposals*, US 6 over Garrsion Street Streamlined Design Build Project, July 31, 2014, 23 pp. [online]. Available: https://www.codot.gov/projects/us6overgarrison/final-rfp/itp/19478-sdb-final-instructions-to-proposers.pdf/view

Colorado Department of Transportation (CDOT), *Request for Proposals*, I-25 North Design Build Project, August 20, 2012, 22 pp. [online]. Available: https://www.codot.gov/projects/I25NorthCOSDB/i-25-north-design-build-draft-rfp/I-25%20ITP%20N%20Design%20Build.pdf/view

Colorado Department of Transportation (CDOT), *Request for Proposals*, Codevelopment, Multi-Modal, I-70 Mountain Corridor Project, July 6, 2012, 37 pp. [online]. Available: https://www.codot.gov/business/consultants/advertised-projects/2012/Interview/RFP%20Draft%20to%20Final

Colorado Department of Transportation (CDOT), *Request for Qualifications*, I-70 over Havana Street Design Build Project, April 2, 2013, 30 pp. [online]. Available: https://www.codot.gov/projects/i70overhavana/request-for-qualifications/final-i-70-over-havana-rfq.pdf

Connecticut Department of Transportation (ConnDOT), *Request for proposals for the transit oriented development of the Stamford parking Garage*, September 24, 2012, 139 pp. [online]. Available:

http://www.ct.gov/dot/lib/dot/documents/aec/Stamford_Transportation_Garage_RFP_07132012_FINAL_3_.pdf

Connecticut Department of Transportation (ConnDOT), *Request for Statement of Qualifications*, Rehabilitation of Bridges on Route, Bridgeport, April 24, 2014, 45 pp. [online]. Available: http://www.ct.gov/dot/lib/dot/RFQ.pdf

Delaware Department of Transportation (DelDOT), *Design Build Project for Indian River Inlet Bridge*, February 27, 2008, 30 pp. [online]. Available: http://www.deldot.gov/information/projects/indian_river_bridge/pdf/rfp/new_docs/DB2_ITP_Files/IRIB_DB2_ITP_Final.pdf?110708115336

Delaware Department of Transportation (DelDOT), Request for Proposal for Development of land, 43 pp. [online]. Available: http://www.riverfrontwilm.com/RFP-RDC.pdf

Florida Department of Transportation (DOT), *Design Build Maximum Price Request for Proposal*, CR 210 at US 1, St. Johns County, June 4, 2012, 70 pp. [online]. Available: http://www.dot.state.fl.us/contractsadministrationdistrict2/Design%20Build/2012/E2Q67%20CR%20210%20at%20US%201/210420-9_RFP_Draft_Ad_06-04-2012.pdf

Florida Department of Transportation (DOT), *Design Build Request for Proposal*, SR 50 over Econlockhatchee River Bridge Replacement Project, Orange County, Florida, January 14, 2014, 57 pp. [online]. Available: http://www.dot.state.fl.us/contractsadministrationdistrict5/Design%20Build/E5W31/E5W31%20RFP%20Draft%20for%20Ad.pdf

Georgia Department of Transportation (GDOT), *Request for Proposals for master developer*, Atlanta Downtown Multi-Modal Passenger Terminal (MMPT), February 4, 2011, 117 pp. [online]. Available: https://www.planning.org/uploads/consultants/requests/6293_10_09-24%20MMPT-Project-Information-Memo-FINAL.pdf

Georgia Department of Transportation (GDOT), *Request for Proposals*, Standard template for Instructions to the Proposers, 11 pp.

Idaho Transportation Department (ITD), *Request for Proposals*, I-15 & US-20 Corridor Controlled Fence Removal and Replacement, May 2, 2013, 64 pp. [online]. Available: http://itd.idaho.gov/AdminServices/NonHwyConstructionProjects/PDFS/F0000012FencingCorridorBestValueRFP(3).pdf

Idaho Transportation Department (ITD), *Request for Proposals*, Lewis Clark Valley Metropolitan Planning Organization LCVMPO), February 26, 2014, 14 pp.

Idaho Transportation Department (ITD), *Request for Proposals*, US-95, Little Salmon River Bridge #18270, Idaho/Adams County, April 24, 2014, 12 pp. [online]. Available: https://itd.idaho.gov/design/cau/solicitations/13388%20RFP.pdf

Indiana Department of Transportation (INDOT), *Request for Proposals*, Hoosier state intercity passenger rail service, April 9, 2014, 19 pp. [online]. Available: http://www.in.gov/indot/files/RFP_HoosierState.pdf

Kansas Department of Transportation (KDOT), *Request for Proposals*, Johnson County Gateway Phase 2 Project, June 28, 2013, 72 pp. [online]. Available: http://jocogateway.com/wp-content/uploads/2013/06/ITP-Instructions-to-Proposers.pdf

Maine Department of Transportation (Maine DOT), *Request for Proposals*, Falmouth-Portland Marti's Point Bridge Design-Build Project, March 2, 2012, 94pp.

Maine Department of Transportation (MaineDOT), *Request for proposal*, Design Report for Eastern Trail Old Orchard to Saco Project, 6 pp.

Michigan Department of Transportation (MDOT), *Best Value Performance Based Contracting*, M-39 (Southfield Freeway), Final Report, MDOT, Lansing, 2012, 107 pp.

Michigan Department of Transportation (MDOT), *Instructions to Proposers*, M-21 over I-75 Bridge Replacement Project, 2008, 32 pp.

Michigan Department of Transportation (MDOT), *Request for proposals*, Ann Arbor Station Environmental Review, 2013, 123 pp. [online]. Available: http://www.a2gov.org/departments/finance-admin services/purchasing/Documents/RFP%20866%20Final.pdf

Minnesota Department of Transportation (MnDOT), *Instructions to proposers*, I-35 E MnPass Desogn Build Project, 34 pp.

Minnesota Department of Transportation (MnDOT), *Instructions to proposers*, T.H. 52 Design Build Request for Proposals, May 2002, 42 pp.

Minnesota Department of Transportation (MnDOT), *Request for Qualifications*, T.H. 212 Design Build Project, March 26, 2004, 26 pp.

Minnesota Department of Transportation (MnDOT), *Request for Qualifications*, I-494 Design Build Project, September 2, 2003, 26 pp. [online]. Available: http://www.dot.state.mn.us/designbuild/i494/docs/rfq/final090203.pdf

Minnesota Department of Transportation (MnDOT), *Request for Qualifications*, I-35 W and 4th Street Ramp Design Build Project, November 22, 2011, 25 pp.

Minnesota Department of Transporttion (MnDOT), *Request for proposals*, TH2 Crookston Slope Stability Design Build Project, 31 pp.

Mississippi Department of Transportation (MDOT), *Request for Proposals*, Design and Construction of SR 304 / I-269 Project, Marshall County, Mississippi, January 21, 2013, 417 pp. [online]. Available: http://sp.mdot.ms.gov/Contract%20Administration/DesignBuild/MDOT%20Project%20NoDBSTP002903009%20%20102556304000%20Propos/RFP%20I-269.pdf

Mississippi Department of Transportation (MDOT), *Request for Proposals*, Bridge Widening Project, I-55 Lincoln County, Mississippi, April 21, 2010, 315 pp. [online]. Available: http://sp.mdot.ms.gov/Contract%20Administration/DesignBuild/Project%20No%20IM005501097105877301%20Bridge%20Widening%20Pr/RFP%20I-55%20District%207%20Design%20Build.pdf

Mississippi Department of Transportation (MDOT), *Request for Qualifications*, Improvements to Interstate 59 Pearl River, Forrest, & Lamar Counties, Mississippi, August 19, 2013, 15 pp. [online]. Available: http://sp.mdot.ms.gov/Contract%20Administration/DesignBuild/Proposed%20improvements%20to%20I59%20in%20Pearl%20River%20Lam2/RFQ%20I-59%20Final.pdf

Missouri Department of Transportation (MoDOT), *Request for Proposal*, Inspection and inventory of overhead sign structures, 11 pp. [online]. Available:

http://www.modot.org/business/consultant_resources/documents/overheadsigninspectionrfp.pdf

Missouri Department of Transportation (MoDOT), *Request for Proposal*, design of the city-arch-river project in downtown St. Louis, December 16, 2011, 9 pp. [online]. Available: http://modot.mo.gov/business/consultant_resources/documents/6I2413CityArchRiverDowntowStLouisRFP12.16.11.pdf

Missouri Department of Transportation (MoDOT), *Request for Proposals*, Merchants Bridge West Approach Replacement, St. Louis City, Missouri, September 19, 2014, 25 pp. [online]. Available: http://www.modot.org/business/consultant_resources/documents/0TRRAMerchantsWestApproachDBRFPPart109192014I.pdf

Montana Department of Transportation (MDT), *Design Build Request for Proposal*, I-90 Rockfall Mitigation-West of Drexel, Mineral County, May 31, 2013, 30pp. [online]. Available: ftp://ftp.mdt.mt.gov/contract/bidpackages/_PAST_LETTINGS/DESIGN_BUILDS/I-90_ROCKFALL_MITIGATION_W_DREXEL/RFP_AND_ATTACHMENTS/FINAL_RFP_053113.PDF

New Hampshire Department of Transportation (NHDOT), *Instructions to Proposers: Memorial Bridge Replacement Project Request for Proposals, Design Build Contract*, Portsmouth, NH – Kittery, Maine, April 27, 2011, 54 pp. [online]. Available: http://www.nh.gov/dot/projects/portsmouthkittery13678f/documents/itp_addendum_3_082311.pdf

New York State Department of Transportation (NYSDOT), Initial Report for SEP (Special Experimental Project) 14, February 26, 2012, 29 pp.

New York State Department of Transportation (NYSDOT), *Instructions to proposers*, Tappan Zee Hudson River Crossing Project, 2012, 231 pp. Available: http://www.newnybridge.com/documents/bidprocess/index.html

New York State Department of Transportation (NYSDOT), *Instructions to proposers*, Rochester Station Project, July 18, 2013, 187 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject/repository/NY-Rochester-Station-ITP_2014_02_28.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, Interstate 81 Bridges Over Route 80 Design-Build Project, August 25, 2014, 148 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject10/repository/ITP_Assembled_2014-08-25.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, I-190 and NY Route 265 Over the New York Power Authority Reservoir, July 18, 2013, 919 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject2/repository/E1D06622C6BA018AE0430A3DFC05018A

New York State Department of Transportation (NYSDOT), *Request for Proposals*, NY Route 347 Mount Pleasant Road To Terry Road, December 9, 2013, 172 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject4/repository/ITP-Genl-Instructions-DRAFT-20131209.pdf

New York State Department of Transportation (NYSDOT), *Request for Qualifications*, Route 146 Over The Mohawk River Design-Build Project, August 4, 2014, 87 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject13/repository/D900026_RFQ-20140804.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, Superstructure and Bridge Replacements in Regions 2 And 9, September 5, 2014, 186 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject9/repository/ITP-General_Instructions-20140905.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, Superstructure and Bridge Replacements at Various Locations in Regions 9, August 27, 2014, 208 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject8/repository/ITP_FINAL-20140827.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, SR 427 over Chemung River Design-Build Project, August 1, 2014, 171 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject7/repository/ITP-FINAL-20140801.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, I-390 Interchange Improvements, September 25, 2014, 186 pp. [online]. Available: https://www.dot.ny.gov/main/business-center/designbuildproject6/repository/ITP_FINAL-20140925.pdf

New York State Department of Transportation (NYSDOT), *Request for Proposals*, Kosciuszko Bridge over Newtown Creek, August 27, 2013, 203 pp. [online]. Available:

https://www.dot.ny.gov/portal/page/portal/content/delivery/region11/projects/X72977-Home/X72977-Repository/K-Bridge%20-%20ITP%20-%20General%20Instructions.pdf

North Carolina Department of Transportation (NCDOT), *Instructions to Proposers*, Garden Parkway-East Industry Draft Request for Proposals, February 23, 2012, 49 pp. [online]. Available: http://www.ncdot.gov/projects/gardenparkway/download/gardenpkwy_docs_eastindustrydraftitp.pdf

North Carolina Department of Transportation (NCDOT), *Request for proposals*, Monroe Connector/ Bypass, August 31, 2010, 45 pp. [online]. Available: http://www.ncdot.gov/projects/monroeconnector/download/monroe_procure_FinalITP.pdf

Ohio Department of Transportation (ODOT), Design-Build-Finance Instructions To Proposers, April 12, 2013, 110 pp. [online]. Available: http://www.dot.state.oh.us/Divisions/InnovativeDelivery/CCG2%20RFP/20130412-CCG2%20Final%20RFP%20-%20Instructions%20to%20Proposers.pdf

Oregon Department of Transportation (ODOT), *Post Construction Report on A+C+D Contracting*, Dennis Edwards Tunnel, ODOT, Salem, 2011, 19 pp.

Oregon Department of Transportation (ODOT), *Procurement summary of I-84: Sandy River-Jordan Road,Bundle 210*, ODOT, Salem, 20111, 9 pp.

Oregon Department of Transportation (ODOT), *Request for proposals*, Full-Service A&E Price Agreements for ODOT and Local Agency Transortation Projects, December 12, 2012, 25 pp.

Oregon Department of Transportation (ODOT), *Request for proposals*, Standard Instructions to Proposers, May 21, 2009, 28 pp.

Oregon Department of Transportation (ODOT), *Request for Qualifications*, Interstate 5-Mckenzie River to Goshen Grade Design Build Project, June 6, 2005, 37 pp.

Utah Department of Transportation (UDOT), *Request for proposals*, -15, Utah County Corridor Expansion, November 10, 2009, 98 pp.

Utah Department of Transportation (UDOT), *Request for proposals*, Standard Instructions for the Proposers Template, 44 pp.

Utah Department of Transportation (UDOT), *Request for Proposals*, UDOT I-15; S Payson Interchange to Spanish Fork River, Utah County, November 2012, 1778 pp. [online]. Available: http://www.udot.utah.gov/main/uconowner.gf?n=3002428169966226

Vermont Department of Transportation (VTrans), *Request for Proposals*, Operations Stormwater Management General Services Retainer, January 28, 2014, 7pp. [online]. Available: http://vtranscontracts.vermont.gov/sites/aot_contract_administration/files/admin/RFPStormwater_1.pdf

Vermont Department of Transportation (VTrans), *Request for Proposals for NY-VT Bi-State Intercity Passenger Rail Study*, September 9, 2010, 9 pp. [online]. Available: http://www.railvermont.org/documents/BenningtonRFP.pdf

Vermont Department of Transportation (VTrans), *Request for Proposal*, Montpelier in Motion – Bicycle and Pedestrian Master Plan, 23 pp. [online]. Available: http://www.montpelier-vt.org/upload/news/934/files/bike_master_plan_rfp_final.pdf

Virginia Department of Transportation (VDOT), *Request for Proposals*, I-495 Northern Section Shoulder Use Design-Build Project, February 6, 2014, 401 pp. [online]. Available: http://www.virginiadot.org/business/resources/rfp/I-495_Northern_Section_Shoulder_Use/105130_I-495_Shoulder_Use_RFP.pdf

Virginia Department of Transportation (VDOT), *Request For Proposals*, Route 29, Charlottesville Bypass Design Build Project, September 27, 2011, 179 pp. [online]. Available: http://www.virginiadot.org/business/resources/designbuild/29chv/Route_29_Bypass_RFP_9-27-2011.pdf

Washington State Department of Transportation (WsDOT), *Instructions to proposers*, I-405/NE 6th St to I-5 Widening and Express Toll Lanes Project, July 25, 2011, 67 pp. [online]. Available: http://www.wsdot.wa.gov/biz/contaa/DESIGNBUILDCONTRACTS/NE%206TH%20ST%20TO%20I-5/RFP%20ITP.pdf

Washington State Department of Transportation (WSDOT), *Request for proposals*, Othello to Royal City Rail Line, 40 pp. [online]. Available: http://www.wsdot.gov/NR/rdonlyres/5E278CBA-B64D-495F-BA1D-955BFEA1FDC5/0/RFP20140206ACQ.pdf