



**Washington State
Department of Transportation**

ADMINISTRATIVE MANUAL

Cost Estimating Manual for WSDOT Projects

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Environmental and Engineering Programs
Strategic Analysis and Estimating Office

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Each project is unique. To accurately develop an estimate of the construction costs for a project, an Estimator must be capable of mentally constructing the project and then accounting for all the activities necessary to complete it. Many of the best cost estimators are knowledgeable in both transportation design and construction.

Estimators should be shielded from pressures to keep estimates within programmed or desired amounts based on funding availability. Estimators should be free to establish what they consider to be a reasonable estimate based on the scope and schedule of the project and the bidding conditions (i.e., local and global market conditions) that are anticipated.

This guidance has been developed by the Strategic Assessment and Estimating Office (SAEO) in alignment with the goals of the Statewide Program Management Group (SPMG).

We would like to thank the dozens of key Washington State Department of Transportation (WSDOT) people who participated in the review process for these guidelines.

Contents

	<i>Page</i>
Foreword	iii
Purpose	1
Definitions	2
Cost Estimating Process	5
Determine Estimate Basis	5
Prepare Base Estimate	5
Review Base Estimate	6
Determine Risks and Set Contingency	6
Determine Estimate Communication Approach	7
Conduct Independent Review and Obtain Management Endorsement	7
Cost Estimating Methodology	9
Cost Estimating and Project Development Level	12
Planning	12
Scoping	13
Design	14
PS&E	15
Cost Estimate Training	18
Documentation/Basis of Estimate	19
Techniques	19
Basis of Estimate (BOE)	19
Level of Detail in the Basis of Estimate	25
Cost Estimating Data	27
Specialty Groups	28
Bridges, Nonstandard Retaining Walls, and Structures	28
Right of Way	28
Environmental	29
Utilities	29
Preliminary Engineering Costs	30

	Page
Important Factors	32
Geographic Considerations	32
Quantity Considerations	33
Item Availability	33
Scheduling/Lead Time	33
Difficult Construction/Site Constraints	34
Estimating Lump Sum Items	34
Force Account	35
Timing of Advertisement	36
Expected Competition/Contractor Availability	36
Other Contracts	36
Specialty Work	37
Standard Items vs. Nonstandard Items	38
First Time Used	38
Soil Conditions	38
Permit Conditions	39
Allowances	39
Construction Contingencies	39
Other Funding Sources/Agreement Work for Others	39
<hr/>	
Independent Estimate/Estimate Review	40
Inclusion of Risk: CRA, CEVP, and SMSS	41
Internal Project Team	41
Peer Review	41
Region/Headquarters Review	42
External	42
<hr/>	
Resources	44
<hr/>	
Basis of Estimate Template	45
Risks	47
<hr/>	
List of Assumptions	49

Purpose

This document provides a consistent approach to cost estimating policies and procedures including estimate quantification, estimating pricing, estimate review, estimate documentation, estimate communication, and management of estimate data. At the same time, it provides guidance on how to treat the common and recurring challenges encountered in the estimating process. The underlying estimate assumptions noted in this document are intended to apply to projects typical to WSDOT experience.

Assumptions should be adjusted as needed, utilizing sound professional judgment, in the case of unique projects or if project-specific conditions warrant.

Larger, more complex projects should go through an alternative more extensive analysis commensurate with risk during the scoping phase to obtain a preferred alternative so that a more accurate cost estimate can be developed.

Definitions

Estimate – A quantitative assessment of the likely amount or outcome. Usually applied to project costs, resources, effort, and durations and is usually preceded by a modifier (i.e., preliminary, conceptual, order-of-magnitude, etc.). It should always include some indication of accuracy (e.g., \pm x percent). (Source: PMBOK Third Edition)

Cost Estimate – A prediction of quantities, cost, and/or price of resources required by the scope of an asset investment option, activity, or project. As a prediction, an estimate must address risks and uncertainties. Estimates are used primarily as inputs for budgeting, cost or value analysis, decision making in business, asset and project planning, or for project cost and schedule control processes. Cost estimates are determined using experience and calculating and forecasting the future cost of resources, methods, and management within a scheduled time frame. (Source: Copyright 2007, AACE International, Inc., AACE International Recommended Practices, Number 10S-90)

Base Cost Estimate – The base cost represents the cost that can reasonably be expected if the project materializes as planned. Typically a variance is associated with the base cost. (Source: WSDOT working definition)

Note: Base Cost Estimates are to be prepared by the project estimator in current year dollars and will exclude future cost escalation. The Statewide Programming Office escalates project estimates using WSDOT inflation tables (CCI, RWCI, and PECE).

Cost-Based Estimate – A method to estimate the bid cost for items of work based on estimating the cost of each component (labor, materials, equipment, including contractor and subcontractor markups) to complete the work and then adding a reasonable amount for a contractor's overhead and profit. (Source: WSDOT working definition)

Historical Bid-Based Estimate – This type of estimate tends to be a straightforward count or measure of units of items multiplied by unit costs. These unit costs are developed from historical WSDOT project bids and may be modified to reflect project specific conditions. This is the most common type of estimating at WSDOT. (Source: WSDOT working definition)

Parametric Estimate – A method to estimate the cost of a project or a part of a project based on one or more project parameter. Historical bid data is used to define the cost of a typical transportation facility segment, such as cost per lane mile, cost per interchange or cost per square foot. Historical percentages can be used to estimate project segments based on major project parameters. These methods are often used in early estimating, such as planning and scoping estimates. (Source: WSDOT working definition)

Risk-Based Estimate – Involves simple or complex modeling based on inferred and probabilistic relationships among cost, schedule, and events related to the project. It uses the historical data and/or cost based estimating techniques and the expert’s best judgment to develop a Base Cost or the cost of the project if the project proceeds as planned. Risk elements (opportunities or threats) are then defined and applied to the Base Cost through modeling to provide a probable range for both project cost and schedule. (Source: WSDOT working definition)

Engineer’s Estimate – Typically the final estimate prior to bid opening. This estimate is loaded into EBASE and locked prior to Ad. The project should have an accurate, complete Engineers Estimate PRIOR to going to advertisement. Revising an Engineers Estimate during the Ad period should be the exception, not the rule. However, bid period addenda that change the scope or cost of the work may require a revised Engineers Estimate or reconciliation of the changed value to serve as part of the justification for award. (Source: WSDOT working definition)

Construction Engineering (CE) – The project management effort (budget/cost) of taking a project from contract execution through construction and project completion. Refer to the [Plans Preparation Manual](#) 830.03 for guidance on estimating the CE cost.

Construction Contingency – A markup applied to the base cost to account for uncertainties in quantities, unit costs, and minor risk events related to quantities, work elements, or other project requirements during construction. See the [Plans Preparation Manual](#) 830.03 for guidance on estimating construction contingency.

Allowance – Additional resources included in an estimate to cover the cost of known but undefined requirements for an activity or work item. Allowances are part of the base cost.

Preliminary Engineering (PE) – The effort (budget/cost) of taking a project through planning, scoping, and design phases. Planning and scoping typically have separate budgets but are encompassed under Design or Preliminary Engineering (PE). The terms “Design” or “Design Phase” are sometimes used interchangeably with PE.

Risk – The combination of the probability of an uncertain event and its consequences. A positive consequence presents an opportunity; a negative consequence poses a threat.

Mobilization – Calculated as a percentage of the total of the construction cost estimate, mobilization is included in a project estimate to cover a contractor’s preconstruction expenses and the cost of preparatory work and operations (such as moving equipment on site and staging). See [Plans Preparation Manual](#) 830.02 for guidance on selecting a mobilization percentage.

Sales Tax – The contractor’s liability to pay state sales tax for all items of work on a project, and WSDOT’s responsibility to reimburse the contractor for state sales tax for work performed on state-owned or private land, must be taking into account and included in all project cost estimates. Refer to the Standard Specifications Section 1-07.2 for information on whether to include sales tax as a markup on individual bid item costs or as an adjustment applied to the construction total (including mobilization) of a project estimate, or a combination of both.

For additional definitions, refer to the CREM Glossary at:

www.wsdot.wa.gov/NR/ronlyres/D10B9B96-9C03-479C-8B52-17FF7BFF9A0F/0/GlossaryOfTerms.doc

Cost Estimating Process

All projects benefit from following a thoughtful and deliberate process in developing project cost estimates. The process presented in [Figure 1](#) describes the way WSDOT develops its project cost estimates. It is applied to all levels of project delivery, starting with the planning level estimate and ending with the project design and plan, specification, and estimate (PS&E) level. Each level of estimate may require different estimating inputs, methods, techniques and tools.

The task of cost estimating, by its very nature, requires the application of prudent judgment to the completion of the task.

A short description of each step in the cost estimating process is presented below. More details are available on the Web site at:

www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Process/

Determine Estimate Basis

This activity focuses on obtaining project information, including all previously developed project scope and schedule details and data, from which a project cost estimate can be prepared. The level of scope detail varies depending on the project phase, project type, and project complexity, but would include the design matrix and criteria, all assumptions and pertinent scope details. The estimate basis should be clearly documented and forms the beginning of the estimate file that should be prepared for each estimate. Each of the following steps will add information to this file, with the end result being a complete traceable history for each estimate. This documentation is covered in detail under the Documentation/Basis of Estimate section, later in this manual.

Prepare Base Estimate

This activity covers the development of estimated costs for all components of a project, excluding future escalation. These components may be estimated using different techniques depending on the level of scope definition and the size and complexity of the project. The number and detail of components estimated may vary depending on the project development phase. For example, in the scoping phase the cost estimate covers preliminary engineering, Right of Way (ROW), and construction. As the design progresses and more details are known, pieces of the estimate become more detailed. Key inputs to this activity include project scope details, Historical Databases and other cost databases, knowledge of Market Conditions, and use of Inflation Rates. WSDOT has internal specialty groups that should be used to provide estimate information when preparing base estimates.

A required component of the base estimate step is the preparation of a Basis of Estimate document that describes the project in words and includes underlying assumptions, cautionary notes, and exclusions. The base estimate should also be based upon, and include as an attachment for reference, the associated schedule for all remaining project activities. For conceptual level base estimates the schedule will be cursory and very broad in its coverage. However, as a minimum it should include the major milestones that WSDOT uses to measure performance and progress on projects. The conceptual level schedule may only include a few activities, but should begin with the development of the project, and include ROW, design, and construction phases.

Review Base Estimate

This activity is necessary to ensure that (1) assumptions and basis are appropriate for the project; (2) the base cost estimate is an accurate reflection of the project's scope of work; (3) scope, schedule, and cost items are calculated properly and required components are not missing or double counted; and (4) historical data, the cost based estimate data, or other data that was used reasonably reflects project scope and site conditions. Internal specialty groups and/or Subject Matter Experts (SMEs) must participate in reviewing the Base Estimate.

Determine Risks and Set Contingency

This activity is part of developing a risk management plan for a project, and is an integral component of project management planning – see the Project Management Online Guide. Risk management is an active and ongoing process of maximizing the probability and consequences of positive risk events (opportunities) and minimizing the probability and consequences of negative risk events (threats) to the project objectives. In the context of cost estimating, the cost impact of project risks (favorable or unfavorable) must be included to derive a total project cost.

If necessary, internal and/or external specialists are involved in a workshop format to validate the Base Estimate, provide input on specific issues such as construction staging, and elicit risks for modeling purposes. Formal risk assessment at WSDOT typically occurs in workshops such as Cost Risk Assessment (CRA) and Cost Estimate Validation Process (CEVP) workshops. Formal or informal risk assessment techniques are a valuable and valid tool and should be applied to all estimates. WSDOT's project risk management policy is found in Secretary's [Executive Order E 1053.00](#).

Determine Estimate Communication Approach

Cost estimate data is communicated to both internal and external constituencies. The communication approach determines what estimate information should be communicated, who should receive this information, how the information should be communicated, and when the information should be communicated. Cost estimate information should be included when the communication plan is developed as part of the project management process. Often the words are as important as the numbers. The Basis of Estimate document can be used effectively as a communication tool to convey key information about the project to others.

Conduct Independent Review and Obtain Management Endorsement

Estimates are key products of the project management process and are fundamental documents upon which key management decisions are based. Given their importance, all estimates should receive an independent review and then be reconciled and revised as needed to respond to independent reviewer comments. Once independent review comments have been satisfactorily incorporated, estimates should be presented to management staff for approval.

Management approval of estimates developed for initial budgeting or baseline definition is a defined step in the project management process. Revised estimates, typically developed if project requirements change, or as design is developed, should also be reviewed by management staff, revised as necessary to reflect management comments, and then approved. Each revised estimates shall then be incorporated into project cost baselines through the established project change management process.

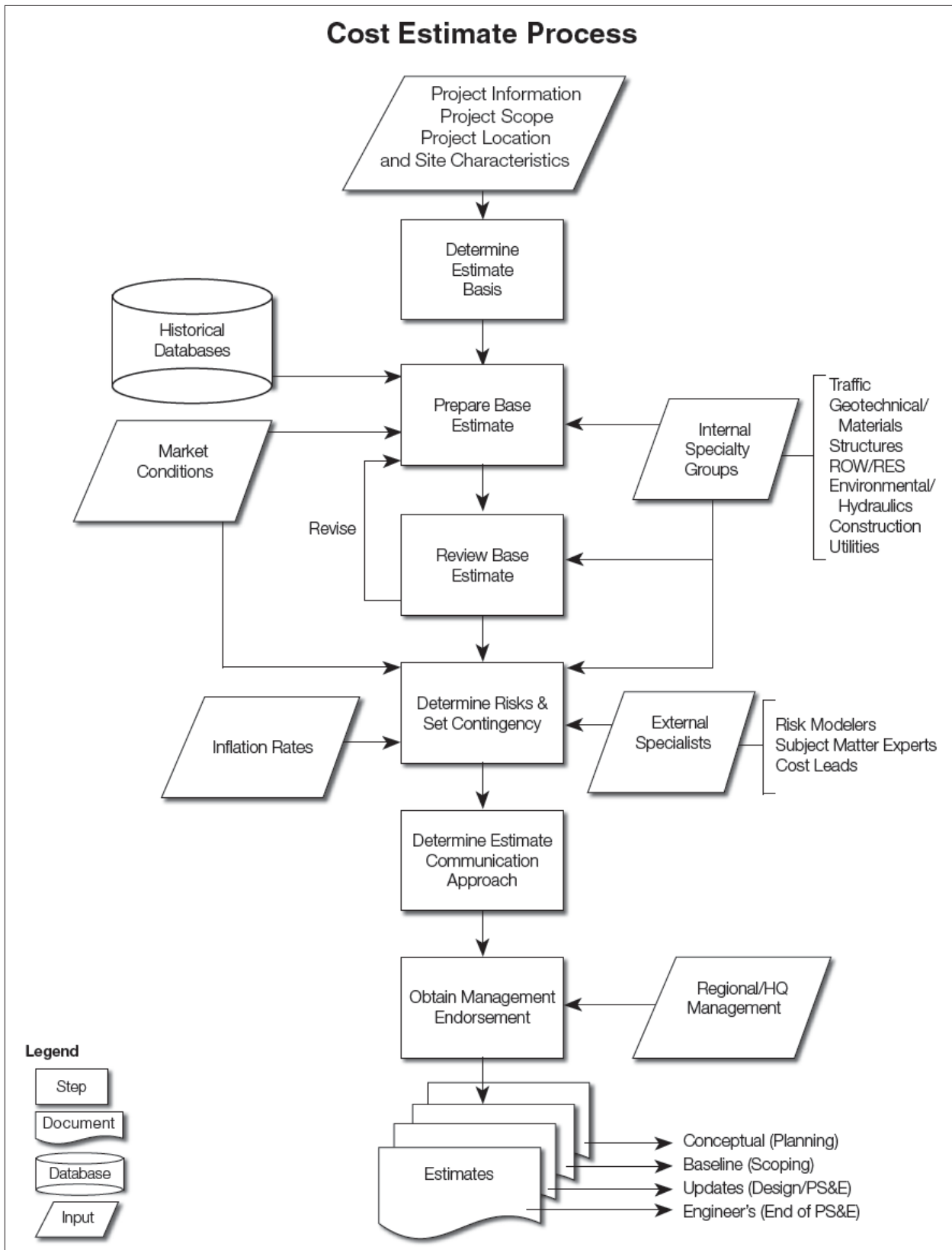


Figure 1: Cost Estimating Process

Cost Estimating Methodology

Estimating methodologies fall into one of four categories: parametric, historical bid-based, cost based and risk-based. These categories encompass scores of individual techniques/tools to aid the Estimator in preparing cost estimates. It is important to realize that any combination of the methods may be found in any given estimate. Two specialty items, bridges and nonstandard retaining walls, are both estimated by the HQ Bridge and Structures Office. These two items as well as other specialty items such as Traffic, Right of Way acquisition, Environmental and Utilities are covered under the **Specialty Groups** section.

Parametric methods are applied to projects in the planning, scoping, or early design stage, and involve techniques that use historical data to define the cost of typical transportation facility segments, such as cost per lane mile, cost per interchange, cost per square foot, and cost per intersection. Typically the historical bid prices used to develop the estimate come from previous projects awarded by WSDOT out of databases such as EBASE or BidTabs Professional. Two techniques that are commonly used in parametric estimating are (1) analogous (similar) projects and (2) historical percentages. WSDOT has other commercial estimating software available that can support parametric estimating for projects for which WSDOT does not have relevant historical data. Two tools that employ parametric methods include:

- **Mobility Project Prioritization Process (MP3)**, which is an Excel workbook, www.wsdot.wa.gov/mapsdata/tdo/mobility.htm
- **Planning Level Project Cost Estimating (PLCE)**, which is an Access database. Contact Murshed Delwar at delwarm@wsdot.wa.gov for more information on this tool.

Historical bid-based methods are commonly used to develop WSDOT Engineer's Estimates, and are appropriate when design definition has advanced to the point where quantification of units of work is possible. These methods apply historical unit costs to counts or measures of work items to determine a total cost for the item or project. The unit cost data used is typically received by WSDOT in bid documents from prior projects and should be modified or adjusted to reflect current prices (inflated to current time) and project specific conditions such as geographic location, quantity of item needed, and the scheduled timing of project advertisement (see the **Important Factors** section for more information). Techniques such as historical bid pricing, historical percentage, and cost based estimating are also used to determine unit prices. Historical cost data sources include:

- E-base.
- BidTabs Professional.

- Unit Bid Analysis.
- RS Means, when WSDOT-specific unit costs are not available (this tool can be used for both historic bid based and cost based methods).

Cost-based estimate methods do not rely on historical WSDOT bid data, but rather are based on determining, for an item or set of items, the contractor's cost for labor, equipment, materials and specialty subcontractor effort (if appropriate) needed to complete the work. A reasonable amount for contractor overhead and profit is then added. This method is preferable on unique projects or where geographical influences, market factors and volatility of material prices can cause the use of historical bid-based methods to be unreliable. Also, since contractors generally utilize a cost-based estimating approach to prepare bids, this method can provide more accurate and defensible costs to support the decision for contract award/rejection and to support any future price negotiations with the contractor after contract award.

Cost-based estimates require significant effort, time, and estimator experience to prepare. They should be limited to those items that comprise the largest dollar value of the project, typically that 20 percent of items of work that account for 80 percent of project cost. The cost of the remainder of estimate line items can be determined using Historical Bid-Based Estimate methods. This approach provides for a more efficient use of estimating resources and reduces the total time and cost of preparing Cost-Based Estimates. Cost based estimating is also a good way to check a few large items of work in a historical bid based estimate to ensure that the historical prices are still valid.

Risk-based estimate methods involve simple or complex analysis based on inferred and probabilistic relationships between cost, schedule, and events related to the project. It uses a variety of techniques, including historical data, cost based estimating, and the best judgment of subject matter experts for given types of work, to develop the Base Cost (the cost of the project if all goes as planned). Risk elements (opportunities or threats) are then defined and applied to the Base Cost through modeling (Monte Carlo Simulation) to provide a probable range for both project cost and schedule.

Depending on the project's magnitude, complexity, and controversy, the following tools are available to develop a risk based estimate:

1. Cost Estimating and Validation Process (CEVP) workshops which includes external subject matter experts
www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/
2. Cost Risk Assessment (CRA) workshops, typically held internally.
3. Small internal workshops using the Self-Modeling Excel workbook
www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm

WSDOT's risk based estimating policy can be found at:
www.wsdot.wa.gov/publications/fulltext/cevp/1053policy.pdf

Current risk based estimating policy is summarized as follows:

It is the policy of the Washington State Department of Transportation (WSDOT) to perform Project Risk Management on all projects. It is the policy of the WSDOT to conduct risk based estimating workshops for all projects over \$10 Million. This policy reaffirms the requirement that a **risk management plan** is a component of every project management plan, as required under [Executive Order E 1032.00](#) Project Management. This policy statement advances the effort to identify, share, and manage risks across all organizations and functions as directed under [Executive Order 1038.00](#) Enterprise Risk Management.

Levels of risk based estimating, in support of risk management:

Project Size (\$)	Required Process (project managers can use a higher level process if desired)
Less than \$10 M	Qualitative Spreadsheet in the Project Management Online Guide
\$10 M to \$25 M	Self-Modeling Spreadsheet
\$25 M to \$100 M	Cost Risk Assessment (CRA) Workshop
Greater than \$100 M	Cost Estimate Validation Process (CEVP®) Workshop

Cost Estimating and Project Development Level

There are four main phases or levels of project development:

1. Planning
2. Scoping
3. Design
4. Plans, Specifications, and Estimate (PS&E)

The estimate for each level of project development has a specific purpose, methodology, and expected level of accuracy. [Table 1](#) summarizes the relationship that exists between project development levels, purpose of the estimate, estimating methods, and the estimate's expected level of accuracy. Note the inverse relationship between the project development level and the expected accuracy range. Some of the typical causes of project cost uncertainty are lack of scope definition, multiple alternatives, and lack of information about factors outside the roadway prism (ROW, community, cultural, and environmental). As the project progresses, more data is available and the expected accuracy range narrows.

Planning

The planning level estimate is used to estimate funding needs for long range planning and to prioritize needs for the Highway System Plan. These estimates are typically prepared with little detail to the project definition.

Techniques

Parametric estimating techniques are often used for planning estimates. Lane mile and square foot are two types of parametric estimating techniques. **Historical bid prices** and **historical percentages** can be used to generate costs for these parameters. **Analogous project** estimating is another approach that can be used. Commercial estimating programs are available to assist in parametric estimating, especially for projects that have little or no historical data available in WSDOT databases.

WSDOT has developed two tools that employ parametric methods to prepare planning level estimates:

- **Mobility Project Prioritization Process (MP3)**, which is an Excel workbook. This program evaluates both costs and benefits to arrive at a benefit/cost ration for use in planning level analysis and selection.
www.wsdot.wa.gov/mapsdata/tdo/mobility.htm

- **Planning Level Project Cost Estimating (PLCE)**, which is an Access database. This tool is primarily a planning level cost estimating tool, most suited for urban environments. Contact Murshed Delwar at delwarm@wsdot.wa.gov for more information on this tool.

Concerns

When using analogous project estimating, the chosen historical project must be truly analogous. Finding an appropriate project or projects and determining the similarities and differences between the historical projects and the current project can take significant time and effort. Project data from older projects is less reliable due to variations in prices, standards, construction technology, and work methods. The analogous method is best used as a tool to determine broad price ranges for simple, straight forward projects or as a check to verify estimates prepared using another method.

- Due to the lack of scope definition or preliminary design, care should be taken to properly communicate with project stakeholders regarding the range of possible cost and schedule changes as the project becomes more defined.
- Given the large-scale assumptions inherent in Parametric Estimating methods, the estimator must document all assumptions clearly.
- Provide an adequate range of costs that reflects the unknowns in the project (see [Table 2](#)). This can be accomplished through allowances in the estimate for those items not yet defined or quantified.
- Keep the estimate current as the project waits to move on to scoping.

Scoping

A scoping level estimate is used to set the baseline cost for the project and to program the project. A project is programmed when it is entered into the Capital Improvement and Preservation Program (CIPP) and the Biennial Transportation Program. The scoping estimate is important because it is the baseline used by the Legislature to set the budget and all future estimates will be compared against it. Clearly document assumptions and scope definitions in the Basis of Estimate document so that all future changes can be accurately compared to this estimate.

Techniques

Historical Bid-Based, Cost-Based, Parametric, and Risk-Based:

The estimator will be able to determine approximate quantities for items such as asphalt, concrete pavement, structures, and roadway excavation. For such quantifiable items, Historical Bid-Based or Cost-Based estimating methodologies should be used for pricing. Other items not yet quantified

may be estimated parametrically or through the use of historical percentages. Risks should be identified, and a Risk Management Plan developed to be included in the estimate notebook for future reference.

Concerns

- **Create/Update Basis of Estimate.** All changes, assumptions, and data origins should be clearly documented. This is particularly important because any future estimates will be compared with this one to justify changes in the cost of the project.
- Estimators should guard against false precision; that is assuming a level of precision that is not inherent to this level of estimate. Although a properly developed estimate will include well documented assumptions, many of the details that impact project cost are not defined at the time a scoping level estimate is done. Miscellaneous item allowance in design at this level of design definition typically ranges from 20 to 30 percent, and ranges even higher on nonstandard projects (see [Table 2](#)). This includes rounding costs (and quantities) to an appropriate significant figure.
- It is important to choose the correct unit costs for major items and then correctly inflate those costs to current dollars.
- Use sound risk identification and quantification practices to ensure that major risks to the project are identified and documented.

Design

Estimates prepared at the various design levels, including Geometric Review, General Plans Review and Preliminary Contract Review are used to track changes in the estimated cost to complete the project in relation to the current budget (CIPP or “Book” amount). Each time the estimate is updated the Cost Estimate Process detailed in [Figure 1](#) should be followed. The current project cost budget and schedule should be compared to the new estimate. Clearly document each of these updates in relation to the previous estimate and include the documentation in the estimate file. If the budget or scope of the project needs to be updated, fill out and submit a Project Change Request Form. The final Engineers Estimate, along with supporting documents, is required to be filed in the Design Documentation Summary (DDS).

Design approval is an important stage of design for estimating purposes. At design approval the configuration of the project is known. This will solidify many items in the scope such as Right of Way needs, likely permit conditions, environmental mitigation, quantities of major items and outside stakeholders. As scope definition improves, the accuracy of the estimate will likewise improve. The work effort required to prepare, document and review the estimate also increases.

Techniques

Historical Bid-based, Cost-based, and/or Risk-based. As design definition advances, design engineers and estimators are better able to determine project work items and their associated quantities and unit prices. Historical Bid-based methodologies are typically used for items of work for which historical data is available. Cost-based estimating methodologies can be used for those items with little or no WSDOT bid history, or for major items of work that are project “cost drivers.” Key resources are suppliers and other individuals knowledgeable about current prices for the subject items, typical construction methodology and production rates, and equipment used. The estimator should contact these resources to develop basic cost data for materials, labor and equipment. Review risks identified earlier in the project development process and update the Risk Management Plan to reflect the current design level and risks.

Concerns

As with the Scoping Level Estimate mentioned above, estimators should guard against false precision—thinking they know more about a project than they do. Significant project definition continues to be developed until the project is ready for advertisement. Use appropriate item allowances and ranges for estimates (see [Table 2](#)).

If cost based estimating techniques are used, pay special attention to documenting all of the assumptions that are made in the development of unit prices such as the crew size, crew make up, production rates, equipment mix and type. The costs assumed for contractor overhead and profit as well as for subcontractor work should also be clearly documented. It is important to remember that these decisions may not reflect the decisions of the individual contractors that will bid the job, thus introducing elements of risk into the estimate.

PS&E

The Engineer’s Estimate is prepared for the Final Contract Review in preparation for advertisement and is used to obligate construction funds and to evaluate contractor’s bids.

Techniques

Historical bid-based, Cost-based, and Risk-based. The project has matured to a point that design engineers and estimators are able to specify all items of work that will be required for the project and accurately estimate quantities and unit prices. This level of project estimate has the advantage of detailed understanding of project scope and conditions. If the estimators are from outside the project team, they should take special care to understand the details of the project, including performing a detailed review of the plans

and specifications. All quantities and unit prices should reflect current knowledge at the time of the estimate. Clearly document the development of and adjustments to line item quantities and prices. This is critical for both the review of the estimate and the review of bids prior to award. This data should be clearly defined and identified in the estimate file. Historical Bid-based methodologies should be used for most items of work where historical data is available. Cost-based estimating methodologies can be used for those items with little or no WSDOT bid history, or to check major items of work that significantly impact on the total project cost. Review the risks again and update the Risk Management Plan.

Concerns

Reviews of these types of estimates should be extensive and detailed and should include final independent QA/QC checks of calculations, prices and assumptions. The Basis of Estimate and overall estimate documentation package should be carefully reviewed to make sure they are complete, accurate and easily understood, and that all figures, from detailed backup to summary levels, are traceable.

- Major quantities and cost drivers should be carefully checked to assure that they have been properly calculated (proper conversion factors have been used and allowances applied to neat line quantities if applicable).
- Specialty group estimates should be reviewed for both scope and cost.
- Contract Special Provisions should be carefully reviewed and cost and schedule impacts incorporated into the Engineer's Estimate.

Project Development Level	Project Maturity (% of design completed)	Purpose of Estimate	Methodology	Estimate Range
Planning Washington Transportation Plan	0% to 2%	Screening or Feasibility WTP/HSP (20 Year Plan) WTP – Washington Transportation Plan HSP – Highway Systems Plan	Risk-based or Judgment Historical % Similar Projects Parametric MP3 PLCE	-50% to +200%
Highway System Plan Design Studies Route Dev. Plans	1% to 15%	Concept Study or Feasibility Implementation Plan (10 Yr. Plan)	Parametric MP3, PLCE Analogous Projects Historical % Risk-based CEVP CRA Self-Modeling	-40% to 100%
Scoping Project Summary (PD, DDS, ERS)	10% to 30%	Budget Authorization or Control Capital Improvement & Preservation Plan (CIPP)	Parametric MP3, PLCE Analogous Projects Historical bid-based (UBA, BidTabs Pro) Risk-based CEVP, CRA Self-Modeling	-30% to +50%
Design Design Documentation I/S Plans for Approval Design Approval	30% to 90%	Design Estimates (Project Control of Scope Schedule Budget)	Historical bid-based (UBA, BidTabs Pro, EBASE) Cost-based Risk-based CEVP CRA Self-Modeling	-10% to +25%
PS&E Plans, Specs, Estimate (R/W Plans approved)	90% to 100%	Engineer's Estimate (prior to bid)	Historical bid-based (UBA, BidTabs Pro, EBASE) Cost-based Risk-based Self-Modeling	-5% to +10%

Table 1: Cost Estimating Matrix

Cost Estimate Training

Several classes are offered by WSDOT that specifically address cost estimate preparation. Most are available in ATMS. These include:

- CZV: Introduction to Cost Estimating
- A4J: Contract Plans and Estimate Preparation
- CZ2: Risk-Based Transportation Cost and Schedule Estimating
- NHI: Risk Management Class (not in ATMS)

Resources from the Strategic Analysis and Estimating Office are also available to assist with specific questions about estimate preparation and the use of individual techniques or tools described in this document.

Documentation/Basis of Estimate

Documentation is a key element in good estimating practice. The estimate file should be a well organized, easy to follow history from the first estimate at the beginning of the planning phase through preparation of the final estimate. The Basis of Estimate document, described in this section, contains recommended organization, topics and format. Each estimate should track changes from the previous estimate, updating the scope, assumptions, quantity and price calculations, and risks from the previous estimate. At each update the differences between the previous estimate and the current estimate should be highlighted. This contributes to transparency and accountability in estimating and promotes the consistency between estimates.

Clear documentation is particularly important as the project passes from one group to another, or as team member's change. The project estimate file should follow the project through the various stages so that each new estimate can be easily tied to the previous one.

Techniques

Several techniques can be employed to ensure clear documentation. It is recommended that estimating be specifically scheduled in the project management plan for each phase of the project. This ensures that adequate time and resources are allotted for performing the estimate. A specific schedule should be developed for each estimate that includes the steps in [Figure 1](#). As part of the estimate review process, someone external to the project team should perform a review of the estimate file. This external review will help ensure that the estimator has clearly recorded the assumptions and decisions made in the estimating process.

Basis of Estimate (BOE)

The BOE is characterized as *the one deliverable that defines the scope of the project*, and ultimately becomes *the basis for change management*. When the BOE is prepared correctly, our customers can use it to understand and assess the estimate, independent of any other supporting documentation. A well-written BOE achieves these goals by clearly and concisely stating the purpose of the prepared estimate (i.e., cost study, project options, benefit/cost study, funding, etc.), the project scope, pricing basis, allowances, assumptions, exclusions, cost risks and opportunities, and any deviations from standard practices. The BOE is a documented record of pertinent communications that have occurred and agreements that have been made between the estimator and other project stakeholders.

A template to help project estimators develop a Basis of Estimate document is included at the end of this manual.

A well prepared Basis of Estimate will:

- Document the overall project scope.
- Document the items that are excluded from the project scope.
- Document the key project assumptions.
- Communicate the estimator's knowledge of the project by demonstrating an understanding of scope and schedule as it relates to cost.
- Alert the project team to potential cost risks and opportunities.
- Provide a record of key communications made during estimate preparation.
- Provide a record of all documents used to prepare the estimate.
- Act as a source of support during dispute resolutions and for bid analysis.
- Establish the initial baseline for scope, quantities and cost for use in cost trend evaluation throughout the project.
- Provide the historical relationships between estimates throughout the project lifecycle.
- Facilitate the review and validation of the cost estimate.

The primary intent of this document is to provide a guideline for the topics and contents to be included in typical BOE. Points of significance when preparing a BOE include:

- Factually complete, yet concise.
- Ability to support your facts and findings.
- Identify estimating team members and their roles (including specialty groups).
- Describe the tools, techniques, estimating methodology, and data used to develop the cost estimate.
- Identify other projects that were referenced or benchmarked during estimate preparation.
- Develop and update the cost estimate and the BOE concurrently.
- The BOE establishes the context of the estimate, and supports review and validation.
- Qualify any rates or factors that are referenced either in the estimate or BOE; e.g., productivity can be expressed as either units/time (linear feet/hour) or time/units (hours/linear foot).

The following sections should be included in the Basis of Estimate document:

Project Purpose

This initial section of the BOE provides a brief and concise description of the project. The type of project should be identified; (e.g., Maintenance Program (M), Operations Program (Q), Preservation Program (P), Improvement Program (I)), as well as the location of the project, and the overall timing of the project. This section should also include the phase of the project; planning, scope, 30%, 60%, 90% design, etc.

Project Scope Description

This section of the BOE should be organized to correspond with the project's work breakdown structure (i.e., roadway, bridge, structure, marine; terminal or boat, etc.). A semi-detailed description of the scope of work should be provided for each major segment of the project. Identify major items of work. Be as thorough as necessary, without being overly descriptive, so as to adequately explain the scope of work being estimated.

Estimate Methodology

This section describes the primary estimating methodology used to prepare the cost estimate. This should include documentation of the use of cost resources, historical data and project benchmarking. Documenting the level of effort (i.e., man-hours and resource allocation) used in preparation of the estimate may also be helpful. The schedule for the estimate can be listed here.

Design Basis

In this section of the BOE, the estimator will identify the types and status of engineering and design deliverables that were provided to prepare the estimate including any design basis assumptions. WSDOT Design standards and guidelines will typically specify the technical and project information required for the classification of the estimate that is being prepared. Two attachments to the estimate basis should be referenced:

1. An estimate deliverables checklist that is aligned with the project schedule.
2. A listing of all engineering drawings (including revision number and date), as well as other design information, such as specifications, equipment lists, units of measure, planning, scoping, etc.

In addition it may be useful for certain projects to document specific quantity metrics, such as excavation and backfill quantities, concrete volumes, piping quantities, etc. These may be organized by the work breakdown structure of the major items of work.

Planning Basis

This section of the BOE documents the project management, engineering, design, procurement, fabrication, and construction approaches to the project. The contracting and resource strategies should be identified, as well as any assumptions that were made with regard to the workweek schedule (hours worked per day, days worked per week, shifts worked per day, work windows, night/day work, phasing, etc.) and planned use of overtime. Any assumptions made regarding constructability, modularization, use of specialized construction equipment should also be noted here. The project schedule and key milestones should be identified.

Cost Basis

This section of the BOE describes the methods and sources used to determine the cost for each listed item.

Identify the following pricing sources used: (WSDOT Historical, Cost Based, etc.)

- Pricing source and methodology for all Contracting Agency costs (project management, engineering, design, etc.).
- Mobilization costs and percentage used.
- Identify tax rates as applicable.
- Escalation indices used, and the method of calculation (including duration). (*Note:* This is to bring historical prices to current dollars. It is not for estimating or predicting future prices.)
- Allowance development and basis.
- Location factors used and the basis for these factors.
- Influence of local market conditions.
- Portions of the estimate provided by the Bridge and Structures Office.
- ROW cost and pricing source (including acquisition and relocation costs, if applicable).
- Any other pricing factors or external influences that may have a significant impact on project cost should be identified.

Allowances

This section of the BOE should describe any other costs that have not been detailed in the body of the estimate, such as lump sum allowances for specific areas of the scope or any other factored costs not described elsewhere in the estimate basis.

Allowance funds are typically meant to cover a variety of possible events and problems that have been identified but not specifically quantified. They can also be used to account for a lack of project definitions during the preparation of planning estimates. Misuse and failure to define what cost allowance amounts cover can lead to estimate problems. It is a mistake to use an allowance amount to cover added scope as the allowance is then not available to cover the project risks it was originally intended for.

Assumptions

Any other assumptions made by the estimator but not documented elsewhere in the estimate basis should be included in this section. This may include such assumptions as raw materials costs such as asphalt oil, cement, steel, etc. This should also include the effect of job site conditions on labor rates and productivity, and material/equipment costs; crew/equipment compositions for major items of work that are considered “cost drivers” to the overall estimate and how these composition assumptions translate into unit rates; sequence-of-work assumptions that may not be obvious in the accompanying project schedule; traffic management assumptions; and work calendar assumptions, to include whether certain work must be performed at night or on weekends and why this is the case. Small assumptions can change into major assumptions throughout the life of a project. Therefore, it is best to document all assumptions.

Exclusions

In this section, the estimator should document all potential items of cost that a reviewer might associate with the project, but for which no costs have been included in the estimate. Wetland mitigation, removal of hazardous wastes, creosote pilings, RW acquisition, etc., are examples of potential items that may need to be identified. Where WSDOT or a third party is providing materials or other scope items to the contractor this should be noted.

Exceptions

In this section the estimator should identify any anomalies or variances to the Contracting Agency’s standard estimating practices. The estimator should document any significant deviations from the project and/or engineering deliverables normally required for the applicable level of estimate. Use the checklist as an attachment to the BOE that will document any exceptions that are identified.

Threats and Opportunities

In this section any areas of the estimate containing significant risks (threats or opportunities) should be identified. If a formal risk analysis study (CRA or CEVP) has been prepared then it should be included. In particular, this section should identify those cost elements that have been identified with high or very

high risk (threat or opportunity) values. The risk analysis report (or summary) should be provided as an attachment to the BOE. This information should be added as the estimate is prepared. This is a great time to identify risks.

Estimate Quality Assurance

Since estimate reviews are the means for testing the quality of the estimate, this section of the BOE should identify all estimate reviews that have taken place to date and any additional reviews that are scheduled to take place. All review comments or analysis should be included as an attachment to the BOE. For guidance on estimate reviews, see the Independent Estimate/ Estimate Review section of this manual.

Reconciliation

This section should provide an overview of the major differences between the current estimate and the last published estimate prepared for this project. Identify the cost impacts due to scope changes, pricing updates, labor productivity adjustments, estimate refinement, etc. Also provide a reconciliation of all reviews performed and how they were incorporated into the estimate. A more detailed reconciliation or cost trending report can be provided as an additional attachment if necessary.

Benchmarking

This section should document any comparisons of overall estimate metrics, ratios, and factors with similar projects, historical data, and industry data. Projects used in the benchmark comparisons should be similar in process type and overall value. If significant variations of the estimated project costs versus the benchmarks exist, those inconsistencies should be identified and commented upon. A more detailed benchmark analysis report may be included as an attachment to the BOE.

Estimating Team

In this final section, all members of the estimating team should be identified and their roles and responsibilities defined.

Attachments

Several supporting documents will generally be included with the Basis of Estimate.

Attachment A: Estimate Deliverables Checklist

This checklist should be provided to support preparation of the estimate in accordance with its associated estimate classification, and to document whether certain deliverable were in fact available during preparation of the estimate.

Attachment B: Reference Documents

Document the drawings, manuals, texts, notes, specifications, and other references used in developing the estimate. Identify the revisions and date of issue for key documents. All documents used as references or resources upon which the estimate was based should be listed in a way similar to the formality of a bibliography, including revision numbers and document dates.

Attachment C: Schedule Documents

Document the project design and construction schedule, including working days, shift assumptions, key milestones and critical path activities.

Additional Attachments

Include any other attachments that may be necessary or required (reconciliation report, benchmarking report, risk analysis report, escalation calculations, etc.).

Level of Detail in the Basis of Estimate

It is often not a simple matter to determine just how much detail should be provided in a BOE. Several factors may come into play during the preparation of the cost estimate that will help determine the answer. It is the estimator's best judgment that will ultimately decide the appropriate level of detail in the BOE.

Level of Project Definition

Estimates are prepared at various stages of a project. While a more detailed estimate will generally require a more detailed BOE; this is not always the case. A conceptual estimate will probably be based on a limited amount of scope definition but it may require a more detailed basis of estimate. It's not uncommon for a BOE for a conceptual estimate to be more thorough than one prepared for a more detailed estimate because there are often more assumptions made at the conceptual stage of a project that require greater documentation. Conversely, there may be times when the project definition is so complete or simplistic that a BOE does not require a great amount of detail. In the later case, a three or four page document may be sufficient to convey the BOE.

Cost Value of the Project

A more expensive project will typically require a more detailed BOE. However, projects of lesser cost may also require an extensive BOE to fully communicate major assumptions that constrain or reduce the cost.

Type of Project

- | The type of project can also affect the level of detail in a BOE. For example, the BOE for a direct purchase (e.g., single piece of large equipment such as a ferry) may be less detailed than for a construction project

Other Factors

- | Other factors that may effect the level of detail in a BOE are the projects work breakdown structure (WBS), consideration for new technologies, contracting strategy, etc. The BOE should contain a concise level of detail to fully support the review of the estimate by those that have not been a part of the preparation of the estimate. The BOE provides a definition of the scope of the project as estimated, and should establish the basis for change management subsequent to publication of the estimate.

Cost Estimating Data

An estimator calculates the cost of work items, then applies markups such as mobilization, sales tax, preliminary engineering (PE), Miscellaneous Item Allowance in Design (only for historical bid-based, cost-based, and risk-based methods), and construction engineering (CE). [Table 1](#) presents a summary of recommended values for various elements.

Cost Estimating Elements	Planning	Scoping	Design	PS&E
Identification of Work Items	> \$50,000	> \$10,000	All Items	All Items
Mobilization	Per Plans Preparation Manual , 830.02			
Sales Tax	Site-specific, based on Control Section. Data can be found in TRIPS or EBASE. Specific direction is found in Standard Specification 1-07.2.			
Preliminary Engineering	See Table 3		PM's Workplan + Actuals to Date	Actual
Miscellaneous Item Allowance in Design ³	30% to 50%	20% to 30%	10% to 20%	0% (all items should be defined)
Contingency	Applies to parametric, historical bid-based and cost-based estimates only. Per Plans Preparation Manual , 830.03			
Construction Engineering	Per Plans Preparation Manual , 830.03			

Table 2: Markups Summary

Notes:

1. Round final cost estimate to the nearest appropriate significant digit, usually third or fourth from left for scoping through design. For example, \$196,526,918.00 could be rounded to \$197 million.
2. Report cost estimates in current dollars to program management. The Construction Cost Index (CCI) will be used to inflate the estimate to midpoint of construction by program management.
3. Miscellaneous Item Allowance in Design accounts for lack of scope definition and those items too small to be identified at that stage of the project. This allowance is eliminated entirely in PS&E estimates as the scope will then be fixed and all estimate items should be identified.

Specialty Groups

It is important to recognize that there are several specialty groups at WSDOT that provide cost estimates for parts of the work.

Bridges, Nonstandard Retaining Walls, and Structures

The costs to construct bridges and nonstandard retaining walls and various other structures are estimated by the Headquarters (HQ) Bridge and Structures Office.

The HQ Bridge and Structures Office maintains a database of historical structure costs and bid information. The HQ Bridge and Structures Office database is more current than information available through the Unit Bid Analysis database or other published WSDOT sources. Since bridges and structures are in their field of design and construction responsibility, the HQ Bridge and Structures Office is in a strategic position to interpret and establish structure costs for a project at any point during project development, from initial planning through PS&E completion.

For planning and scoping level estimates, contact the Bridge Projects Unit in the HQ Bridge and Structures Office. They will help prepare the estimate using historical bid based methods and take into account type of structure, site conditions, project location and the most current market conditions and prices for the specific bridge and structure types that meet project specific conditions. For Design and PS&E level estimates the Bridge Projects Unit in the HQ Bridge and Structures Office will provide a detailed cost based estimate for the projects structures. Estimators should take care to understand what is included and what is not included in estimates from specialty groups. Request documentation supporting specialty groups estimate to include in the project's estimate file.

Right of Way

Right of Way (ROW) costs vary widely throughout Washington State. Region Real Estate Services or the HQ Real Estate group should be involved early to help determine appropriate costs for the project. It is important that all specialty groups detail what is included and what is not included in their estimate. Factors that should be considered in the ROW estimate include administration, relocation, clean up costs and allowances for condemnation.

Real estate markets are best characterized by those familiar with the geographic area. In consideration of this fact, subject matter experts (SMEs) such as region Real Estate Services and region right of way staff should be asked to provide this estimate. These SMEs can provide input regarding

the cost of right of way and the uncertainty associated with the real estate market in the geographic area of the project. Other issues to consider include zoning changes, speculation, and growth management plans and pending comprehensive plan changes.

Environmental

Project environmental staff needs to be involved in the process early. The costs of complying with environmental impact analysis, mitigation, permit, and public involvement requirements in environmental laws and regulations and interagency agreements need to be included in the project estimate.

Utilities

The Utilities Office should also be involved early in the process. Sub-surface and overhead utilities are located on a majority of projects sites and conflicts with these utilities can increase a projects cost dramatically. When a utility is located on an easement and WSDOT acquires the property through ROW acquisitions, WSDOT must pay all relocation costs in addition to providing the affected utility with a new easement. Also note that city owned utilities that are impacted within the city's limits can cause similar costs to a project.

Another risk that may affect project costs is triggered when utilities that are not identified during the design phase (due to insufficient engineering investigation or inaccuracy in utility as-builts) are discovered while the project is under construction. Utility conflicts not identified until the construction phase can result in costly change orders and project delays.

Preliminary Engineering Costs

Preliminary Engineering (PE) percentages can be used at early stages (planning and scoping) to estimate the cost of design for a project. These percentages will vary by project type and total dollar amount of the project. On average, PE costs for WSDOT designed projects are approximately 15 percent of project cost. This should be used as a starting point, then adjusted according to [Table 3](#) for the specific project type and cost range. As the project moves through design, the PE cost should reflect actual costs to date plus the anticipated costs from the work plan. There is a reasonable minimum cost for PE, including the cost of the Ad, Bid and Award process, which even a very small project will incur. If the project cost is under \$200,000, it might be more efficient to combine it with another project due to the minimum cost of the PE process.

For projects that include consultant design, PE costs can be significantly different than for projects designed by WSDOT. The cost of design by consultant is almost always more than the typical WSDOT design costs due to several factors. PE cost estimates should be increased by up to 2.8 times the estimated WSDOT design cost, depending on the size of the project and the number of consultants involved in the design effort.

Improvement Program PE as % of CN	I1 Mobility				I2 Safety				I3 Economic Initiative				I4 Environmental Retrofit	
	IA	IB	IC	IQ	ID	IE	IF	IG	IH	II	IK	IL		
	Urban	Rural	Urban Bike Conne- ction	HOV Lane	Collision Reduction	Collision Prevention	All Weather Highway	Trunk System Completion	New Safety Rest Area	Bridge Restriction	Storm water Runoff	Fish Barrier Removal		
\$0	ND	ND	ND	ND	40%	20%	ND	ND	ND	ND	40%	40%		
\$250,000	ND	ND	15%	ND	30%	20%	ND	ND	ND	ND	25%	30%		
\$500,000	ND	ND	ND	ND	22%	20%	ND	ND	ND	ND	20%	20%		
\$1,000,000	15%	20%	12%	ND	20%	20%	ND	ND	ND	ND	20%	15%		
\$2,000,000	15%	20%	12%	ND	20%	15%	10%	ND	ND	ND	ND	15%		
\$5,000,000	15%	ND	ND	10%	12%	15%	10%	ND	ND	ND	ND	ND		
\$10,000,000	15%	10%	ND	10%	12%	15%	10%	14%	ND	ND	ND	ND		
-														

Preservation Program PE as % of CN	P1 Roadway			P2 Structures			P3 Other Facilities					
	PA	PB	PC	PD	PE	PF	PG	PH				
	Paving Safety Restoration	Structure Preservation	Catastrophic Reduction	Rest Area	Unstable Slope	Weigh Station	Program Support	Major Drain Electrical				
\$0	15%	20%	40%	20%	30%	ND	ND	30%				
\$250,000	12%	15%	30%	20%	20%	ND	ND	20%				
\$500,000	12%	13%	20%	20%	15%	ND	ND	20%				
\$1,000,000	10%	12%	13%	ND	10%	ND	ND	20%				
\$2,000,000	8%	12%	13%	ND	10%	ND	ND	20%				
\$5,000,000	6%	12%	13%	ND	10%	ND	ND	ND				
\$10,000,000	6%	11%	13%	ND	ND	ND	ND	ND				
-												

Notes:

1. The percentages in this table are based on actual WSDOT project costs state wide from July 2001 through March 2007.
2. ND indicates that there is no data for this cell.
3. Yellow highlighted cells indicate that there is limited data for that cell.
4. For project type definitions see below and *Plans Preparation Manual* section 830.03.
5. A factor must be applied to the PE amount for consultant work. Typical factors for the consultant portion of the work range between 1.8 and 2.8, depending on the type and scope of consultant involvement.

Table 3: Preliminary Engineering Percentage

Important Factors

Many factors influence a project estimate. Several key factors are described in the sections below. More information is available at:

www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Process/

Geographic Considerations

Geographic considerations can have a profound affect on the selection of unit bid prices. The project's location, whether it is in an urban, suburban, or rural setting should be considered in establishing bid prices. Dependent on the restrictions of Standard Specification 1-90.7, some of the cost considerations relating to a project's location may be accounted for in the mobilization bid item.

A project in an urban setting generally has to contend with construction operations occurring in more confined work spaces, with greater volumes of traffic, and limited hours of operations, night time work, etc. Some of these factors may be offset by availability of local contractors, materials, equipment and personnel.

Projects located in rural settings have factors that affect the establishment of unit bid prices contrary to projects located in urban settings. Construction operations may have less restricted work areas, less traffic to contend with, and additional hours to complete the work; all factors that increase productivity. On the other hand, materials, equipment and personnel may have to be brought in from out of the area which may increase costs related to transportation, support, wages, per diem, etc.

On projects that utilize large quantities of aggregate, whether for base, surfacing, or earthwork, the location of material sources and disposal sites may have a large impact on costs. Nearby material sources or disposal sites reduce hauling costs. On rural projects, the cost of bringing in a concrete batch plant, hot mix asphalt plant, or similar facility, may increase unit bid prices. Again, dependent on the restriction of Standard Specification 1-09.7, those costs may be directly attributed to and reflected in the mobilization bid item.

Terrain may also be a consideration in establishing an items cost. Mountainous terrain and steep grades cause production rates to fall, whereas level terrain and straight roadways generally have the opposite effect.

Groundwater conditions can vary greatly and need to be investigated to determine the extent of dewatering required for foundations and other structures such as storm water retention ponds. Varying geotechnical conditions are covered under soil conditions.

Quantity Considerations

The quantity of a given material on a project impacts the unit cost of constructing and/or supplying that item. This is not simply a supply and demand issue, but also one of production efficiency and economy of scale. Generally speaking, the unit price for larger quantities of a given material will be less than smaller quantities. Suppliers offer discounts for larger quantity orders. Mobilization, overhead and profit are all spread out over a larger quantity, thus reducing their affect on each unit. Waste is also spread over a larger quantity thereby having a smaller impact on each unit. Larger quantities also give rise to efficiency by gained experience and expertise of the contractor's personnel in completing the work.

Projects with very large quantities of certain materials may actually cause an increase to the unit bid price. For example, a project with numerous or large structures may affect the market for a particular type of steel, the availability of cement, or even tie up a region's labor resources.

Small quantities of items of work are less cost effective to construct and hence lead to higher unit prices. Not only do suppliers charge more for smaller purchases, but in some instances the minimum amount that has to be purchased is greater than the needed quantity. Small quantities do not generally allow for high production rates or other efficiencies and thus cause higher unit costs. Smaller quantity items are also frequently subcontracted out. This practice increases a contractor's overhead and usually results in a markup being applied to those items.

Item Availability

Materials that are readily available, or ones that are commonly used, are generally less expensive to purchase and install/construct. Materials that are in short supply are more expensive. This should be considered in establishing the unit price.

Large quantities of materials required in a short period of time may result in a temporary shortfall in product availability and potential cost increase or delay to a project.

Scheduling/Lead Time

To be efficient, a contractor needs to optimize the scheduling of his resources including labor, equipment and materials. When a contractor can plan for and maximize his resources, he can become more competitive in his bidding. However, the lead time needs to be considered in the estimating process by estimating the project based upon when it is expected to be built. For example a project that is two seasons long may have the majority of its paving in either the first or the second year.

Difficult Construction/Site Constraints

Difficult construction and site constraints will increase the cost of construction for a contractor. Placing piles under water, working near active railroads, nearby historical buildings (possibly fragile), construction on or near culturally important or environmentally hazardous sites, and limited room to construct an item are all examples of constraints that should be considered.

Estimating Lump Sum Items

From an estimating standpoint, lump sum bid items are often more difficult to price. Lump sum items can reduce administrative costs in contract administration, as well as allowing a contractor a variety of work means and methods, and thus do make sense in some instances. They also transfer the risk of performance and quantities to the contractor. If the work to be performed can be quantified, then a payment method that includes a quantity should be used. However, lump sum bid items are often used when an item of work can only be defined in general terms, such as when the finished product can be defined but not all the components or details can be easily determined. This can make estimating lump sum items difficult for the estimator. The more information and breakdown of a lump sum item that an estimator has available, the greater the likelihood that an accurate lump sum estimate can be developed. An estimator should define a lump sum item in terms of its simplest, most basic components and should consider other factors that may not be easily estimated. By breaking out a lump sum item into smaller items of work which have historical data, and then applying reasonable estimated prices to those sub units, the estimator can accurately establish a price for the overall lump sum item.

Using lump sum items typically transfers risk to a contractor, and the contractor may adjust his price upward to take on this risk. Contractors cannot necessarily rely on overruns to cover work that they did not foresee.

Lump sum items are typically bid at higher costs than component costs due to the transfer of risk from the owner to the contractor. Therefore, the use of lump sum items should be used with great care. In some situations, as may be the case for a time-based lump sum bid item such as *Project Temporary Traffic Control*, the lump sum payment may provide the basis as an incentive to perform the work more quickly. In such a situation, hourly pay items offer no incentive, and may even cause the contractor to stay in the work zone as long as possible. However, in most situations using lump sum bid items will lead to higher contractor bids, therefore lump sum items should only be used when the following conditions apply:

- A. The lump sum item is a standard item with no appropriate alternative non-lump sum standard item available for use.

- B. The work is not easily defined. In other words, the final product is known, but the construction techniques or other components are difficult to determine.
- C. Complex items with many components (although the designer is encouraged to break down constituent items if possible).
- D. The lump sum payment may be justified as an incentive to complete the work in a more timely or efficient manner than if other units of measure were used.
- E. The lump sum item may be justified as less expensive than a force account item (see below) or where the risk assumed by the contractor is low.

The use of a lump sum item must be justified and the work breakdowns documented in the estimate file. The use of earned value techniques will aid in determining performance of the contractor on lump sum bid items.

Force Account

Force account is a method of payment that pays the contractor his actual expenses for all labor, materials and equipment to complete the work. Markups for material costs, labor surcharges, overhead and profit may be added to this figure. The force account method of payment is used primarily for “extra work” (i.e., work that is unforeseen at the time a project is let or advertised and is discovered during construction) or for items of work that are poorly defined and may or may not be used during construction. This second case is the one most frequently encountered by the estimator. Since the contractor does not usually bid on this work, there is little incentive for him to reduce costs or prosecute the work diligently. Because of this, the force account method of payment should only be used when necessary.

When a reasonable cost estimate for a force account item is required, the estimator should try to establish the scope of work to be accomplished. Once the scope is developed, it can be compared to historical bid price data for similar items of work. If no comparable history exists, the force account item should be broken out into its anticipated core components. The estimator can then rely on historical bid data for those items and the given limitations to come up with a reasonable force account estimate. If no such data exists for even the smaller core items of work, the estimator may need to estimate the amount and costs of labor, materials and equipment to execute the work (i.e., use the cost based method of estimating).

Force account may also be considered a tool for transferring risk from the contractor to the owner. If the work is properly directed by the project inspector, force account may actually cost less than an equivalent lump sum item.

Use of force account items and their estimated cost must be documented and justified in the project estimate file.

Timing of Advertisement

When a project is advertised and subsequently bid has a major influence on the bid prices. Contractors typically have a time of year that is busier than others. This is typically when contractors prefer to do the majority of their work. This is normally directly correlated with the weather and occurs when the conditions are the most conducive for construction activities (such as asphalt paving). Appropriate timing of advertisement can also be affected by other items like fish and HMA paving windows or other outside constraints. Peak season for most highway projects is from April through October. Peak season for marine work is November through March. The best time to advertise a project is several months before the work season for that type of work to allow time for contract execution and for the contractor to mobilize their resources in time to take full advantage of the work season.

If a contractor has fully allocated his resources for the season then they are less likely to bid on a project and, if they do bid, it is in a less competitive environment. For this reason there is a benefit to WSDOT to advertise a project as soon as possible prior to the peak season, to allow the contractor time to plan, schedule and seek as many opportunities as possible to find efficiencies in their work plan. This also creates a more competitive bid climate and lower bid prices.

The estimator preparing the final engineer's estimate needs to be aware of the timing of the advertisement and account for any expected fluctuations in bid prices due to the season such as lower production during temperature extremes, additional protections for weather sensitive materials, and so forth.

Expected Competition/Contractor Availability

Projects that are advertised for bids late in the season or after contractors have scheduled their work for the year, can expect higher bid prices. This is due to the lack of competition or contractor availability. Projects that are bid during a period of time when a large number of contractors are available are bid more competitively. Contractors know that they must bid the lowest possible price to be able to get the contract. See the Other Contracts that follows for a reasonable range of cost increases to account for this factor.

Other Contracts

Multiple projects being advertised at the same time can influence bid prices in much the same way as lack of competition and availability. The contractors only have so many resources available to develop bids for projects. In the case of large projects, a contractor may not have the resources to develop bids for more than one project at a time. The most prudent course of action

in this case is to manage the program of projects to ensure that this does not become an influencing factor on the bids. If this cannot be prevented, then the estimate needs to reflect that multiple bids will be developed at the same time. Typically with four or more bidders the effect on the bid amount is negligible. The estimator should consider to what extent the reduction below the normal number of bidders will influence the bid amount. A reasonable range of impact is a 0 to 8 percent increase over the engineer's estimate for construction. The probability of the occurrence of this risk should be evaluated by the estimator. Common mitigation strategies include timing of the Ad and work packaging.

Another factor to consider in a multiple contract environment is the resources required for the projects and if multiple active projects will create conflicts in an area. For example, multiple large-scale bridge projects in a given area may create a shortage in structural steel or skilled labor. In these cases the estimator must be aware of the ability of the market to support multiple projects.

Having multiple contracts in an area may create conflicts between the projects. These could include traffic control, labor issues, direct coordination issues, and similar issues. These conflicts need to be considered in the calculation of production rates and subsequent bid item prices. Project managers should be aware of adjoining projects and nearby work (even from other regions or local agencies). There may be opportunities for collaboration and coordination that will result in more competitive bids and better maintenance of traffic.

Specialty Work

Specialty items are not necessarily new items or new construction methods, but are items that are somehow different than the majority of the work on a given project. For example, on a pavement rehabilitation project the signal work may be classified as specialty work, although it would not be classified as such on a project that was predominately signal and lighting work. Projects that include specialty work or are comprised totally of specialty work items need to be characterized correctly when estimating. Estimating the cost of specialty work requires a thorough understanding of the work involved and the resources required to accomplish the work.

When estimating specialty work seek the advice of experts in the area of concern. When estimating specialty items utilizing historical bid data, the similarities and differences between the historical project(s) and the project at hand must be fully accounted for in the development of the estimate.

Another factor to consider is the number of qualified contractors capable of doing the project or elements of work. Other examples of specialty work may be landscaping, guideposts, fencing or mechanical rehabilitation of moveable bridge components. Specialty work should be reviewed by staff that is familiar with that particular type of work.

Standard Items vs. Nonstandard Items

Standard items, as listed on the WSDOT Standard Item Table, are familiar to both WSDOT and the contractors. These items of work typically represent a known quantity and quality to both WSDOT and the contractor, and bid history tends to reflect that. When an item is changed in some way to become a nonstandard item then uncertainty is introduced. This uncertainty typically results in an increased price for the item, especially the first time that contractors see it in a contract. Typical practice should be to use standard items whenever possible. When a standard item is changed and becomes a nonstandard item, the estimator should recognize that the price may differ from the historical prices.

First Time Used

On occasion, items of work are included in a project that WSDOT has little or no historical data to use to establish unit prices. In these instances, similar items may provide some guidance, but additional investigative work may be necessary. If the item is thought to be of minor significance, there may be little benefit in spending much time in determining a reasonable bid price. If the item is considered major or is likely to be significant to the overall project bid, research should be conducted to establish a cost. Contacting others who are familiar in the use of the item can usually help in determining a cost. Suppliers, other state departments of transportation, the Strategic Assessment and Estimating Office (SAEO) at WSDOT HQ, Regional Transportation Commissions, Port Authorities, Consultant Letting, R.S. Means Publications, and even contractors can be valuable resources in establishing costs. Be wary of relying on estimates from a single contractor or source. Multiple sources should be utilized in developing an estimate for first time used items.

If the item in question is unique in some manner (innovative, new or experimental) or it is considered a specialty item, costs may need to be adjusted to account for the contractor's lack of experience with it and the potential increased risk in construction. If the work is likely to be subcontracted out then the prime contractor may also add a markup to the subcontractor's price.

Soil Conditions

General assumptions about soil conditions may be made early in the estimating process, but they may turn out to be wrong. As the estimate progresses, geotechnical data may help improve the information and prevent costly change orders and claims. In the early estimates the assumptions regarding soil conditions and the potential effects of unknown soil conditions should be clearly documented. A common estimate omission is an improper allowance for shrink and swell of material. The region materials engineer should be consulted to determine the appropriate shrink or swell factor to use. Soil conditions can be a significant cost risk to a project. Risk based

estimating techniques should be utilized to quantify geotechnical risks if they pose a significant threat or opportunity.

Permit Conditions

Throughout the stages of planning, scoping, and design, various projections of permit conditions for construction can be obtained from region or HQ Environmental Offices. Engaging these groups early may help identify specific permits or conditions that can drive up construction costs and identify opportunities to avoid costly environmental conflicts. Considerable costs may be required due to storm water collection and treatment, wetland protection and mitigation, hazardous material testing, containment and treatment, and removal and disposal of underground fuel tanks, creosote timbers, and contaminated soils.

Allowances

Please refer to the definition of contingency provided in the Definitions section of this document. Allowances are typically meant to cover a variety of possible events and problems that are not specifically identified or quantified. They are also used to account for a lack of project definition during the preparation of planning estimates. Misuse and failure to define what specific allowances amounts cover can lead to estimate problems. It is a mistake to use allowances or contingency funds to cover added scope as the contingency is then not available to cover the risk item(s) for which it was originally intended.

In WSDOT estimates, allowances should be shown separate from the base cost. Allowance amounts should be identified with specific unknowns so they can be managed appropriately as the design progresses. This will assist in review of the estimate and help designers and project managers manage the risk. Contingency amount guidance during construction can be found in the [Plans Preparation Manual](#) 830.03.

Construction Contingencies

Construction contingencies are typically meant to cover a variety of possible risks or events that are not specifically identified or quantified such as uncertainties in quantities and minor risk events related to quantities, work elements, or other project requirements during construction. See [Plans Preparation Manual](#) 830.03 for guidance on estimating construction contingencies.

Other Funding Sources/Agreement Work for Others

Whether or not a project is expected to receive contributions from outside funding sources should also be documented in the Basis of Estimate. Federal funding, participation from local agencies (e.g., participation in intersection improvements), or funding from public/private partnerships should all be documented.

Independent Estimate/Estimate Review

Each estimate should have some level of review, as indicated on the flow chart provided in [Figure 1](#), Cost Estimating Process. Project complexity is the most important driver of the level of estimate review. The level of review should be carefully chosen by the project manager.

Estimates are key outputs of the project management process and are fundamental documents upon which key management decisions are based. It is recommended, and may become policy at the region's discretion, that all cost estimates will be independently reviewed by estimating staff specialists, subject matter experts, and others as appropriate. The estimate will then be reconciled and revised as needed to respond to independent reviewer comments. In the event of a significant difference of opinion, an estimate reconciliation meeting will be held and the results documented. The final results of the independent review and reconciliation meeting must receive management endorsement before any project is advertised.

Independent reviews (check estimates) should be made by experienced estimators who are familiar with the type of work inherent in the project, and who have had no involvement in the development of the project estimate to date. The independent estimator consults with other independent sources such as design engineers, construction managers, or other estimators as needed on specialty items of work. Checks performed by independent estimators will include but not be limited to:

- Reviewing the estimate file and Basis of Estimate document for completeness and readability.
- Ensuring that the name(s) of estimator(s) involved in preparing the estimate are shown.
- Ensuring that the estimating methodologies are noted by individual item of work.
- Reviewing the overall estimate documentation to ensure that it is clear and that figures are traceable from detailed back-up to summary levels.
- Conducting a detailed check of the estimate to include:
 - Checking the development of unit rates and quantities of those items that drive the majority of the bottom-line cost (the 20 percent of the items that comprise 80 percent of the estimated project cost).
 - Making note of comments on unit rates and quantities.
 - Checking for mathematical errors.

Inclusion of Risk: CRA, CEVP, and SMSS

WSDOT policy requires a CRA for projects over \$25 million and a CEVP for projects over \$100 million. These processes both include an estimate review. For projects more than \$10 million the Self-Modeling Spreadsheet is required. It is recommended that all projects undergo at least an internal project team review for each estimate update. A peer review or region review should be considered for each estimate that is complex or includes significant changes to scope or design development. A region/headquarters or external estimate review should be considered for all projects over \$10 million or for projects that are complex during the design phase. Each estimate review should be thoroughly documented and any changes made to the estimate as a result of the review clearly shown. The WSDOT policy for Risk Base Estimating is available at: www.wsdot.wa.gov/publications/fulltext/cevp/1053policy.pdf.

Internal Project Team

This type of review is the first level of estimate review and is recommended for all estimates. The internal project team review should include a quality control check of quantities and prices as well as a quality assurance check that the proper procedures were followed, the documents are complete and clearly understandable and the final costs and schedule is deemed reasonable for the project scope, size, location and complexity. The advantages of the internal project team review are that the project team's schedule is easier to coordinate than outside resources and the reviewers have a base knowledge of the project. A disadvantage is that internal reviews tend to be conducted with the same vision, framework, and assumptions as the project teams. This can lead to a review that does not objectively assess all the parameters that affect the estimate.

One useful double check for project teams includes preparing estimates in two different ways and then comparing. For example, if a project team utilizes historical bid-based methods for preparing the project cost estimate then consider selecting the top 5 to 10 items in terms of cost and estimate them using a cost-based approach (materials, equipment and labor). The comparison of the two estimates may be enlightening.

Peer Review

This type of review is similar to the internal project team review but uses another project team or office to conduct the review. Offices can often perform reviews for each other in this way. The advantage to this type of review over the internal review is that the project gets a review with a fresh perspective on the estimate. This can provide an increased level of confidence in the estimate. This is also a good way to share lessons learned and information between project offices and serves to efficiently utilize fixed engineering resources within the department.

Region/Headquarters Review

This type of review at the region and headquarters level is typically more formal. One advantage to this type of review is that the reviewers are external to the project team and thus can provide a truly independent perspective on the project. However, the biggest advantage is that the reviewers typically have significantly more experience in performing this type of independent review. Region reviews can be coordinated with region staff. HQ reviews should be coordinated with SAEO staff. Their contact information can be found on the CRA or CEVP Web sites.

External

In this type of review external experts are brought in to review either specific pieces of the estimate or the entire estimate. This type of review can be combined with any of the other types of reviews to supplement knowledge of a specific item of work or to provide an outside perspective. This type of review has a wide range of costs but can provide significant confidence in the estimate that might not be otherwise attainable from internal WSDOT resources.

[Table 4](#) is a matrix that identifies which position has responsibility for reviewing and endorsing each type of WSDOT estimate.

Changes Including Scope Changes, Schedule Changes, Budget Requests	PE/PM Through Region PDE or EM Must Process Control Change Form Through the Project Control and Reporting Office
Planning Level	Region Planning Manager
Scoping Level, including: Design Documentation Package (DDP)	Region Plans Office and Programming
Design Approval Design Report Alternative Analysis	PE/PM, PDE/EM, and Region Plans Office
Determine Contingencies	PE/PM, PDE/EM
PS&E Level Estimates	Estimator, Designer, and PE/PM
Documentation, including: Assumptions Quantities and adjustments Prices and adjustments	Estimator, Designer, and PE/PM
Review Estimates	Region Plans Office and Peer Review Team
Check Estimates and Calculations	Region Plans Office
Prepare Engineer's Estimate	Estimator, Designer, and PE/PM
Independent Estimate	To be determined

Table 4: Activity/Responsibility Matrix

ASDE – Assistant State Design Engineer EM – Engineering Manager PC&R – Project Control and Reporting	PE – Project Engineer PM – Project Manager PDE – Project Development Engineer
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Note:

The Region Project Engineer, Project Manager, Project Development Engineer, and Engineering Manager should be informed of changes and updates to project scope, schedule, and cost estimates. This table is based on the *Project Control and Reporting Manual* (M 3026) January 2006 revision.

Resources

CPMS CCI Tables:

wwwi.wsdot.wa.gov/ppsc/pgmmgt/cpms/fields/cci.txt

CPMS RWCI Tables:

wwwi.wsdot.wa.gov/ppsc/pgmmgt/cpms/fields/RW.INFL.TXT

CPMS PECI Tables:

wwwi.wsdot.wa.gov/ppsc/pgmmgt/cpms/fields/PE.INFL.TXT

Bridge Design Manual (Chapter 12, Appendix 12-A):

www.wsdot.wa.gov/publications/manuals/M23-50.htm

EBASE (Estimates and Bid Analysis System):

www.wsdot.wa.gov/EESC/Design/projectdev/AdReady/EBASE.htm

Oman Systems BidTabs Professional (see your IT to setup):

www.wsdot.wa.gov/eesc/design/projectdev/adready/bidtabsproprogram.htm

WSDOT Project Bid Results and Contract Awards:

www.wsdot.wa.gov/biz/contaa/BIDSTATS/

Cost Estimate Process:

www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Process/

CEVP Guidelines and Glossary:

www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/workshop.htm

Estimating Tips and Watch-outs:

www.wsdot.wa.gov/NR/rdonlyres/76111703-D435-4CB7-A965-1297F7F00599/30323/ESTIMATINGTIPSWATCHOUTS.doc

Instructional Letter: Inflation and Market Conditions Applied to Base Estimate:

wwwi.wsdot.wa.gov/docs/OperatingRulesProcedures/4071.pdf

Online Project Management Guide:

wwwi.wsdot.wa.gov/OneDOT/News/2005/07/05_0627ProjectOnlineGuide.htm

Self-Modeling Excel worksheet:

www.wsdot.wa.gov/publications/fulltext/CEVP/Self-Modeling-RMP.xls

RS Means:

www.rsmeans.com/

Basis of Estimate Template

This Basis of Estimate questionnaire prompts project teams to think about their projects and costs. It is also a tool used in the CRA/CEVP process. It can be used as a template to develop the Basis of Estimate document for a project.

#	Question	Include?			Comments
		Yes	No	N/A	
1	Has NEPA/SEPA process begun?	Yes	No	N/A	
2	Has a preferred design alternative been selected?	Yes	No	N/A	
3	Have any environmental mitigation measures been defined and included in the estimate?	Yes	No	N/A	
4	Has an alignment been established?	Yes	No	N/A	
5	Has a grade been established?	Yes	No	N/A	
6	Have right of way requirements been researched and priced?	Yes	No	N/A	
7	Has a typical roadway section been established?	Yes	No	N/A	
8	Have the geotechnical site conditions been researched?	Yes	No	N/A	
9	Have potential geotechnical cost issues been factored into the estimate?	Yes	No	N/A	
10	Has a drainage report and concept plan been prepared?	Yes	No	N/A	
11	Has a noise analysis been performed?	Yes	No	N/A	
12	Are sound walls included in the estimate?	Yes	No	N/A	
13	Have retaining wall types been defined?	Yes	No	N/A	
14	Has a traffic analysis (modeling, HCM, LOS, etc.) been performed?	Yes	No	N/A	
15	Have pavement design reports been reviewed?	Yes	No	N/A	
16	Has a pavement life cycle cost analysis been performed?	Yes	No	N/A	
17	Has a preliminary construction phasing strategy been developed to help estimate traffic control, detours, temporary structures, temporary construction easements, lanes, etc.?	Yes	No	N/A	
18	Were potential detours evaluated for traffic volumes and vehicle classifications?	Yes	No	N/A	
19	Have any investigations been done in regards to potential major utility impacts?	Yes	No	N/A	
20	Has a conceptual landscaping and aesthetics plan been developed?	Yes	No	N/A	
21	Are there any design deviations that are or expected to be of concern?	Yes	No	N/A	
22	Were other projects used as metrics of comparison for the estimate? If so, please list projects.	Yes	No	N/A	
23	Has funding been identified for: Design/PS&E?	Yes	No	N/A	
24	Has funding been identified for: Right of Way?	Yes	No	N/A	
25	Has funding been identified for: Construction?	Yes	No	N/A	

The following information is to be provided by the project team. Some sample responses are provided in blue font.

Project

Sponsor (Lead Agency):	WSDOT
Responsible Person:	Name/Title/Tel Number
Design Organization (Sponsor or Consultant):	Name and Contact Info
Estimator:	Name and Contact Info
Estimator's Organization:	Name
Project Location (County):	COUNTY
Date of Report:	Month and Year
Start of Construction:	Month and Year
Estimating Processing Software:	Excel or ?
Estimate available in Excel format:	Yes (desirable for estimates to be available in Excel)
Work Breakdown Structure (WBS):	Very Basic (describe)
WIN/PIN/Project No.	#####
Database for cost estimate:	Sources
Method of Measurement:	Scaling and CAD/In-Roads

Purpose

Describe the project, its purpose, timing and location.

Scope

Mission/Design:	Improve safety and congestion at ####/## I/C
Estimate Type:	Parametric, Deterministic or Stochastic
Project Type (Greenfield vs. Upgrade):	Upgrade existing facility
New structures required:	Yes
Existing Structures which need to be modified:	Assumed structure is replaced
Demolition:	Bridge and buildings
Hazardous Materials:	Anticipated
Wetlands Issues:	Yes
Archeological Impacts:	Not anticipated, based on database research
Native American (Tribal) Issues:	Not anticipated, based on contacts made to date
Storm water regulation update:	Estimate based on updated WSDOT runoff manual and retrofitting
Noise walls:	Anticipated

Describe in paragraph form the basic scope of the project.

Methodology

Describe the primary estimating methodology used for the cost estimate. Several different methodologies may be used in one estimate. Also list the schedule or timeline for the estimating process.

Design Basis

Describe the types and status of engineering and design deliverables used to prepare the estimate, including any design assumptions.

Schedule/Planning Basis

Describe the project management, engineering, design, and construction approaches used to prepare the estimate. This should include proposed or assumed working schedule, construction sequence, etc. List project milestones and project schedule.

Cost Basis

Describe methods and sources for determining listed item pricing. Provide detailed backup and the date in the attachments.

Allowances

Describe allowances in the cost estimate. Include their purpose and how the allowance amount was determined.

Assumptions

Discuss all assumptions not covered in other areas of the Basis of Estimate.

Exclusions

List those items NOT INCLUDED in the cost estimate. Include those things that an outside person might think are included but are not.

Exceptions

Describe any item that does not follow WSDOT standards for cost estimating.

Risks

Describe all threats and opportunities that surface during the preparation of the cost estimate. This can become the basis for a risk management plan, as required on all WSDOT projects.

Estimate Quality Assurance

Describe the quality assurance plan for the estimate. What reviews or benchmarking has been done on this estimate?

Reconciliation

How were review comments incorporated into the estimate? How does this estimate compare to the previous one performed for this project? What are the differences and how are they explained?

Estimating Team

List all parties involved in preparing the estimate. Phone and e-mail records should be kept of all the people that had input into the estimate.

Lead:	Name and Contact Info
Quantity Survey:	Name and Contact Info
Unit Cost Development:	WSDOT bid items
Summarization and Presentation:	Name and Contact Info
Estimate Review and QA/QC:	Name and Contact Info

Attachments

Attachment A: Estimate Deliverables Checklist

Attachment B: Reference Drawings

Attachment C: Schedule Documents

Attachment D: Additional Attachments (as necessary)

List of Assumptions

Construction funding all at once.

Will need to replace bridge SR###/Bridge No.

Stormwater retrofit of #####.

The applicable environmental regulations do not change.

Today's dollars, unknown inflation rate and energy cost.

Mid point of construction could change.

Undeveloped properties remain undeveloped. At this time there are no known proposed developments on the properties, although some of the properties are for sale.

There are good soils.

Captured major bid items.

Traffic control cost based on past experience and region philosophy does not change.

Right of Way is not needed to relocate the gas line.

The project is in the process of selecting a preferred alternative for analysis in an EA. At this time there are two alternatives, a preferred alternative should be selected by MONTH AND YEAR. The estimate is based on alternative ##### with the thought that it may be the more expensive of the two options.

Civil	
Structural	
Environmental	
Other	

Additional Information relevant to the "Basis of Estimate" for this project:

Management Review and Endorsement Documents

