State of Washington
Joint Legislative Audit & Review Committee (JLARC)

Washington State Department of Transportation's Scoping and Cost Estimating for Highway Construction Projects

Report 10-3

January 5, 2010

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The statutory authority for JLARC, established in Chapter 44.28 RCW, requires the Legislative Auditor to ensure that JLARC studies are conducted in accordance with Generally Accepted Government Auditing Standards, as applicable to the scope of the audit. This study was conducted in accordance with those applicable standards. Those standards require auditors to plan and perform audits to obtain sufficient, appropriate evidence to provide a reasonable basis for findings and conclusions based on the audit objectives. The evidence obtained for this JLARC report provides a reasonable basis for the enclosed findings and conclusions, and any exceptions to the application of audit standards have been explicitly disclosed in the body of this report.

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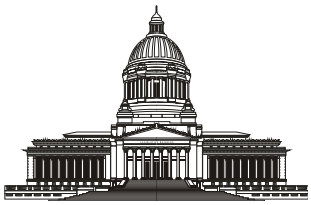
Committee Approval

On January 5, 2010, this report was approved for distribution by the Joint Legislative Audit and Review Committee.

WSDOT's Scoping and Cost Estimating for Highway Construction Projects

Report 10-3

January 5, 2010



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REPORT SUMMARY

The 2009-11 Transportation Budget directed JLARC to review how the Washington State Department of Transportation (WSDOT) develops highway construction project scope and cost estimates. Focusing on projects funded from the increased revenues provided in 2003 and 2005, JLARC compared WSDOT policies and procedures to industry guidelines and looked at actual practices used in WSDOT regions through analysis of eight case studies. Recognizing that many policies and procedures used in 2003 and 2005 have changed, or are changing, JLARC also looked at how the state is currently positioned to produce cost estimates for new highway projects.

Highway Project Cost Estimates Change

Within the Transportation Budget, the Legislature appropriates funds for specific highway projects. A highway project may not be completed for ten or more years, so the Legislature chooses whether, and at what level, to include appropriations for the same project in a series of transportation budgets.

In 2003 and 2005, the Legislature approved increases in the state fuel tax that provide additional funding for projects to preserve and improve the state's highways. JLARC estimates that 1,088 budget changes have been made to 336 preservation and improvement projects funded by these increased revenues since the Legislature approved the original project budgets, with just over three-quarters (76 percent) of project budgets changing each year.

A change in the cost estimate for a project requires legislative analysis and approval to ensure that the Transportation Budget remains balanced. One project may have its funding reduced or eliminated to pay for a cost increase in another project.

WSDOT Highway Project Scoping and Cost Estimating Align with Industry Guidelines

A substantial body of literature addresses cost overruns and cost estimating in construction projects. The National Academy of Sciences, through the Transportation Research Board and the National Cooperative Highway Research Program (NCHRP), developed detailed cost estimating guidelines aimed at the specific procedures needed to improve the accuracy of cost estimating for highway projects. JLARC used the NCHRP guidelines and other sources to evaluate whether WSDOT policies and procedures align with these industry guidelines.

WSDOT policies and procedures for cost estimating currently align with industry guidelines. In addition, for the eight case study projects, WSDOT practices in the field align with its policies and procedures.

Once WSDOT has developed the cost estimate, it may become an agency budget request. The literature JLARC reviewed recognizes the need to protect cost estimates from outside pressures. One way of evaluating that is to see if there is an easy-to-follow trail between the dollar amounts developed by the cost estimating process and the dollar amounts requested in the budget. WSDOT's current procedures, polices, and forms do not create such a trail between a cost estimate and the amount of a budget request.

JLARC recommends that WSDOT should adapt its current procedures and forms so that an easy-to-follow trail is established between the cost estimate developed by the cost estimating process and the request for funding submitted to the Legislature.

The State is Better Prepared Now to Accurately Estimate Highway Project Costs Than It Was in 2003 and 2005

Changes Made by WSDOT in Scoping and Cost Estimating Since 2003 and 2005

WSDOT has made changes in its scoping and cost estimating policies and procedures since 2003 and 2005, with some changes in process as JLARC conducted this analysis. Evidence of these changes contributed to JLARC's conclusion that WSDOT is currently following industry guidelines to increase estimate accuracy. Based on this conclusion, the state is better prepared now to accurately estimate highway construction costs than in 2003 and 2005.

For example, WSDOT has created a formal cost estimation manual; the agency now has four different tools available for estimating costs and project risks, with the complexity of the project dictating which tool to use; and WSDOT is developing distinct scoping processes for different program areas.

WSDOT is also formalizing the use of *risk reserves*. WSDOT defines risk as the probability of an uncertain event and its consequences; risk analysis creates estimates of the costs if those events occur. WSDOT is formalizing in policy the use of risk reserves to pay for risks realized during the course of delivering the project. The agency plans to include these risk reserves in project budget requests for projects $10 million or greater. The use of risk reserves is consistent with industry guidelines in how project risk can be managed.

Other Issues to Consider to Make Cost Estimates More Accurate

In the course of synthesizing the literature, reviewing WSDOT policies and procedures, and observing practices on the ground, JLARC identified three issues to bring to the attention of policymakers as they consider the accuracy of highway project cost estimates.

Time When a transportation agency is given the time to fully understand a project's needs and risks, there is greater chance for more accuracy in a project's cost estimate.

Resources Investing more money into the scoping process may result in more accurate initial project cost estimates.

Communication Clear communication about project cost estimate uncertainty and the *reasons why an estimate has changed* is critical to maintaining stakeholder trust and building confidence in an estimate. There can be mutual confusion among legislators, legislative staff, and WSDOT about terminology such as what constitutes a "scope change." A more productive avenue may be to ask what has happened that has resulted in a change to a project cost estimate; for instance, has the project now reached a critical milestone?

Highway Project Cost Estimates Will Always Have a Level of Uncertainty

The literature provides expectations for how accurate cost estimates should be at various points in a project: the more that is known about a project and its risks, the more accurate an estimate should be. In addition, there are industry guidelines for making estimates more accurate, with WSDOT's policies and procedures following those guidelines. Nevertheless, the literature also indicates that estimates will always have a level of uncertainty. There may be an inherent tension between a more accurate cost-estimating process that takes more time and resources and includes risk reserves, and a budget process that calls for quick cost estimates for highway construction projects. Regardless of how much you know about a project and its design, estimates are always just estimates.

REPORT

Part One: Highway Construction Budget Estimates Span Many Years and Change

Legislature Directed JLARC to Review Scoping and Cost Estimating of Highway Projects

The 2009-11 Transportation Budget directed JLARC to review how WSDOT develops highway construction project scope and cost estimates, with a focus on future highway preservation and improvement construction projects. Projects to include in the review are those funded by the Transportation 2003 Account (Nickel Account) or the 2005 Transportation Partnership Account (TPA), excluding "mega projects" such as the Alaskan Way viaduct replacement.

Scoping is a process during which a project's objectives, purpose and need, preliminary cost estimate, and preliminary schedule are initially developed. A *cost estimate* is the probable amount of money required for a project. A cost estimate consists of normal costs for project materials and services (such as design, concrete, asphalt, steel, right-of-way, etc.), contingencies, and may include reserves for costs associated with project risks. Inflation is applied to the cost estimate to arrive at an expected future cost for a project.

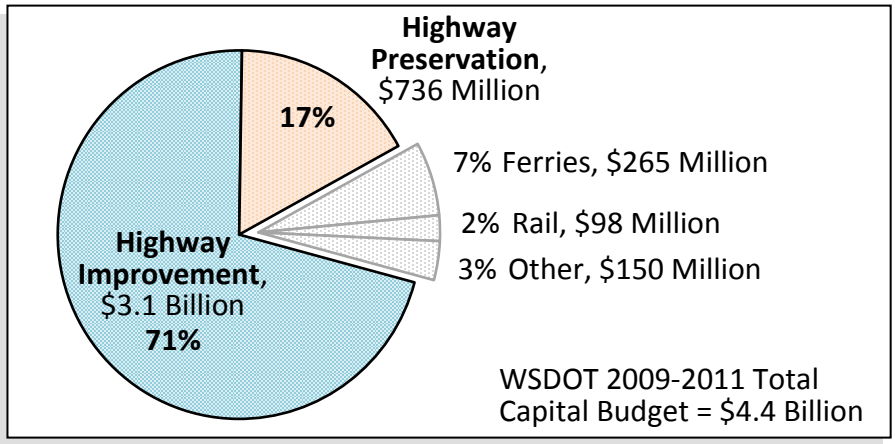
The Legislature directed the review to examine whether the scoping and cost estimate guidelines used by WSDOT are consistent with general construction industry practices and other appropriate standards. The review included an analysis of the scope and cost estimates for select future projects.

WSDOT's scoping and cost estimating policies and procedures align with industry guidelines. Based on this conclusion, the State is better prepared now to accurately estimate highway project construction costs than it was in 2003 and 2005.

Highway Project Construction Budgets

The Washington State Department of Transportation's (WSDOT) construction budget for the 2009-11 Biennium is $4.4 billion dollars. Exhibit 1 on the following page illustrates that 88 percent of this budget goes to two areas: highway preservation projects and highway improvement projects. *Preservation* projects focus on keeping existing roads and bridges in good condition, while *improvement* projects focus on increasing safety and mobility, such as widening roads.

Exhibit 1 – Improving and Preserving the State's Highways Account for 88% of WSDOT Construction Spending for 2009-2011



Source: Legislative Evaluation and Accountability Program (LEAP) budget reports.

When the Legislature makes funding decisions for highway preservation and improvement projects funded from Nickel or TPA revenues, it does so at a detailed project level. While the Improvement Program shows a total of $3.1 billion in expected expenditures for this biennium, this is the sum of a number of individual appropriations to individual projects. In order to develop its budgets, the Legislature requires WSDOT to provide information about individual projects.

In addition, since the budgeting process for improvement and preservation projects is based on a 16-year funding plan, the Legislature is establishing an expectation for funding often well in advance of a project actually being constructed. The current biennium's budget is the current two-year expenditure authorization within a longer range plan, with expected expenditures established into future years. Exhibit 2 provides examples of two projects included in the 2009-2011 Transportation Budget.

Exhibit 2 – A Single Project May Take Many Years to Complete, with an Appropriation for the Current Period and Expenditure Estimates for Future Years

	I-5/ Add Lanes	US 12 Interchange
Prior Expenditures	$14,550,000	$1,280,000
2009-11 Appropriation	$56,178,000	$90,000
2011-13 Expected Expenditure	$79,702,000	$10,000
2013-15 Expected Expenditure	$60,000,000	$0
2015-17 Expected Expenditure	$3,903,000	$0
2017-19 Expected Expenditure	$0	$0
2019+	$0	$37,084,000
Project Planned Total	**$214,333,000**	**$38,464,000**

Source: LEAP Transportation Document 2009-1 as developed April 24, 2009.

The Legislature is likely to see a budget estimate for a given project again and again as years pass. In addition, those estimates may change. For example, in the 2011-2013 Biennium, the Legislature may see a different estimate for these projects than they saw in 2009-2011. As a result, the budget for that project may change in legislative appropriations.

In 2003, the Legislature approved a five-cent increase in fuel taxes; projects funded from this source are called "Nickel Projects." Another increase was approved in 2005, with projects funded from this increase called "TPA Projects," for the Transportation Partnership Account.

JLARC estimates that 1,088 budget changes have been made to 336 preservation and improvement projects funded by these increased revenues since the Legislature approved the original project budgets beginning in 2003 and 2005. On average, over three-quarters (76 percent) of project budgets have changed each year. Exhibit 3 provides additional detail on the frequency of these changes.

Exhibit 3 – Estimates for Preservation or Improvement Projects Funded by Nickel or TPA Revenues Have Changed 1,088 Times Since Their Initial Budgets Were Established in 2003 or 2005

Projects With:	Number of Projects	Total Budget Changes
No Changes	23	0
One Change	31	31
Two Changes	41	82
Three Changes	83	249
Four Changes	95	380
Five Changes	32	160
Six Changes	31	186
Total	**336**	**1,088**

Source: JLARC analysis of WSDOT data provided in the "Section 304 Report." For purposes of this analysis, "change" means a change of $1,000 or more; a change can mean that a project's funding is eliminated or merged with another project. A limited number of projects had their initial funding in years other than 2003 or 2005.

A cost estimate forms the basis of a budget request. When WSDOT presents to the Legislature a change in the estimated cost for a project, budget approval of such changes requires legislative action. Increases in one project's budget may require a decrease in another project's budget. The frequency of project cost estimate changes impacts the complexity of maintaining a balanced Transportation Budget: more changes mean more moving parts.

Part Two: WSDOT Highway Project Scoping and Cost Estimating Align With Industry Guidelines

This section of the report explains JLARC's review of whether WSDOT's current policies and procedures for highway construction project scoping and cost estimating align with industry guidelines. This is followed by analysis of whether WSDOT practices in the field align with the agency's policies and procedures.

Industry Has Guidelines for Highway Project Scoping and Cost Estimating

There is a substantial body of literature on both scoping and cost estimating, with a primary focus on cost estimating. JLARC conducted an extensive literature review to determine whether there are industry guidelines for *highway project* scoping and cost estimating, which there are. Appendix 3 provides additional detail on the literature JLARC reviewed to determine industry guidelines.

Recognizing the complexity of highway construction projects, the literature focuses on techniques and guidelines for increasing the accuracy of cost estimates. One particular report, *National Highway Cooperative Research Program* (*NHCRP) 574 Guidance for Cost Estimation and Management for Highway Projects During Planning, Programming and Preconstruction (Anderson, et al.*), is a comprehensive manual on highway cost estimating. This manual summarizes salient points from the literature and provides eight strategies to increase the accuracy and consistency of highway project cost estimates. These strategies lay the groundwork for the five guidelines we synthesized from the literature.[1]

Another well-recognized source is the Association for Advancement of Cost Estimating International (AACE). AACE recognizes estimates have an expected range of accuracy depending on how far the project has progressed and also sets guidelines for cost estimating practices.[2]

Determining that Current WSDOT Policies and Practices Align with Industry Guidelines

JLARC synthesized the literature into five key questions that were then used to determine if current WSDOT policies and procedures are in alignment with industry guidelines. With assistance from a consulting engineer, JLARC developed 46 detailed criteria for determining WSDOT alignment with the five key questions. JLARC examined WSDOT policies and procedures documentation including manuals, online information, and databases to determine if WSDOT met the criteria.

Exhibit 4 illustrates WSDOT's alignment with these five key questions that support the conclusion that WSDOT is in alignment with industry guidelines.

[1] The author of the NCHRP 574 report, Dr. Stuart Anderson of the Texas Transportation Institute at Texas A&M University, spent a year (2005-2006) working at WSDOT and advising the agency on its cost estimating practices.
[2] AACE International (1997). Cost Estimate Classification System. AACE International Recommended Practice No. 17R-97. TCM Framework: 7.3 – Cost Estimating and Budgeting.

Exhibit 4 – WSDOT Highway Project Cost Estimating Policies and Procedures are in Alignment with Industry Guidelines

Five Key Alignment Questions	Scored Yes on Criteria	Is WSDOT in Alignment?
Does WSDOT have a systematic, documented process for defining scope, ensuring the scope reflects the project's purpose, cost, and schedule, and controlling changes in scope and schedule?	6 out of 7	YES
Does WSDOT actively manage the cost estimation process and fully document each stage and all changes in cost estimates?	11 out of 11	YES
Does WSDOT inform the public and other stakeholders on project scope, estimates, changes, and other project status issues?	4 out of 5	YES
Does WSDOT have a systematic method for reviewing, quantifying, and mitigating risks?	9 out of 10	YES
Does WSDOT have "checks and balances" and institutional support to ensure that scope, estimates, and risks are reviewed and checked for accuracy, and that estimates are not unduly impacted by outside pressures?	12 out of 13	YES

Source: JLARC analysis of WSDOT policies and procedures.

Details on the 46 criteria used for this analysis are contained in Appendix 4 of this report. WSDOT met 91 percent of the criteria, which led JLARC to conclude that WSDOT aligns with industry guidelines.

It is important to note that WSDOT had different policies and procedures in place at the time of the original cost estimates for the Nickel and TPA–funded projects. More information about changes in policies and procedures to improve cost estimating accuracy are explained in Part 3 of this report.

For Eight Case Study Projects, WSDOT Field Practices Align with Agency Policies and Procedures

To evaluate practices in the field, JLARC again focused on the five key questions synthesized from the literature. For each of the five key questions JLARC again identified criteria for determining WSDOT alignment. However, this time alignment was determined by comparing field practices to WSDOT policies and procedures in eight case study projects. JLARC chose case study projects that:

- Are categorized as improvement projects;
- Used different cost estimating techniques;
- Were not in the construction phase or not far advanced in the construction phase; and
- Were located in various WSDOT regions across the state.

For the eight case study projects, WSDOT field practices are in alignment with the agency's policies and procedures, which are in turn in alignment with industry guidelines. It is important to note that the eight case study projects may not be representative of all highway projects at WSDOT and

should be seen only as illustrations of practices in the field. Appendix 5 provides more detail on criteria used to determine that WSDOT field practices are in alignment.

While there is alignment, some of the projects reviewed did not document the original cost estimate, which makes it difficult to follow changes in the estimate. In addition, some project cost estimates may be provided to the Legislature before WSDOT considers scoping complete. In one case, very little scoping had taken place and only 1 percent of design had been completed when the initial estimate was provided to the Legislature. Incomplete scoping means there is less information available about the project on which to base the cost estimate, which increases the likelihood of an inaccurate estimate.

Once the Cost Estimate is Developed, is that the Number WSDOT Includes in a Budget Request?

The cost estimating literature JLARC reviewed recognizes the need to protect cost estimates from outside pressures. The history of construction cost estimating has many examples of underestimating project costs to get a project approved by decision makers. This is part of what the literature refers to as "optimism bias"—to secure funding a project may be "sold" as being less expensive than what the cost estimation process may indicate.

One way of evaluating whether cost estimates are protected from such pressures is to see if any differences between cost estimate figures and budget request figures are identified and the reason for the differences are clearly documented.

JLARC looked at the project records in the eight case studies and reviewed current policies, procedures, and forms to see if there is an easy-to-follow trail between the cost estimate developed by the cost estimating process and the request for project funding submitted to the Legislature. No such trail exists.

JLARC is not suggesting that any evidence points to manipulation of estimates. Rather, the project record needs to contain an easy-to-follow trail between the estimating process and the budget request. Such trails may help protect the cost estimating process from outside pressures that are a cause of such things as optimism bias in project budgets.

Recommendation: WSDOT should adapt its current procedures and forms so that an easy-to-follow trail is established between the cost estimate developed by the cost estimating process and the request for funding submitted to the Legislature.

Part Three: The State is Better Prepared Now to Accurately Estimate Highway Construction Costs Than it Was in 2003 and 2005

A number of WSDOT's scoping and cost estimating policies and procedures are relatively new or have changed from what was in place in 2003 and 2005. Some were being updated and amended as JLARC conducted this analysis. Evidence of these changes contributed to JLARC's conclusion that WSDOT is currently following industry guidelines to increase estimate accuracy. Based on this conclusion, the state is better prepared to accurately estimate highway project construction costs than in 2003 and 2005.

The examples below illustrate changes WSDOT has undertaken to improve the accuracy of its highway project cost estimates. This is followed by a discussion of three issues identified in the course of JLARC's analysis related to more accurate highway project cost estimates. This section—and the report—concludes with a reminder that, while the literature provides expectations for how accurate cost estimates should be at various points in a project, estimates will always have a level of uncertainty.

Examples of Changes WSDOT has Made or is Making

Scoping:

Guidelines on highway project cost estimating suggest that thorough scoping enhances the quality of a cost estimate. To provide consistency in scoping, WSDOT is developing specific scoping processes for different project types. For instance, in the Improvement Program, there is a specific scoping process for environmental retrofit of fish barriers. In the Preservation Program, there is a specific scoping process for bridge replacement. These defined processes were not in place in 2003 or 2005. However, even with processes in place, adequate time and resources are required in order for effective scoping to take place.

Cost Estimating:

Guidelines on highway project cost estimating point to formal cost estimation manuals as a means of ensuring consistent estimation practices across an agency. WSDOT developed its cost estimation manual in 2007. According to WSDOT, the purpose of the manual is to provide a consistent approach to cost estimating, including estimate quantification, estimating pricing, estimate review, estimate documentation, estimate communication, and management of estimate data.[3]

Risk Analysis Tools:

WSDOT began developing its current risk analysis tools in 2002 and now has three risk analysis techniques for projects over $10 million, with a policy to conduct risk-based estimating workshops on all such projects. Projects likely receive their initial funding before these techniques are used. WSDOT uses the size of project cost to guide which technique to use. The three techniques are:

- **C**ost **E**stimate **V**alidation **P**rocess (CEVP): For projects $100 million or more. Applying statistical and quantitative techniques in a workshop setting using external subject matter experts, CEVP is designed as a systematic means of identifying, describing, and quantifying the risks to a project's cost and schedule. WSDOT estimates workshops last three to five days, with an average cost of $60,000.

[3] "Cost Estimating Manual for WSDOT Projects," Washington State Department of Transportation. November 2008.

- **C**ost **R**isk **A**ssessment (CRA): For projects ranging from $25 million up to $100 million, WSDOT has a simplified CEVP process. This technique also uses quantitative and statistical techniques and internal or external subject area experts, with workshops lasting one to two days, at an average cost of $24,000.
- Self-Modeling Quantitative Spreadsheet: For projects from $10 million up to $25 million, a self-modeling quantitative spreadsheet is used by project managers. This technique does not require participation from those outside of the project team. Risks are identified as are the potential costs.

For projects under $10 million, WSDOT has what it calls a qualitative spreadsheet, used as a tool to identify project risks. Unlike the self-modeling quantitative spreadsheet, the qualitative spreadsheet does not calculate the probable costs associated with those risks.

The case study projects JLARC reviewed used these tools. In one project, multiple CEVP workshops were held because the project manager believed that more knowledge on risks was required.

Risk Reserve:
A risk reserve is a portion of funds budgeted for a project that is held in reserve to cover the potential cost of anticipated risks identified in a risk-based estimating process. A risk reserve is a component of a broader *risk strategy* in cost estimating. A risk strategy is the process of identifying risks, quantifying their potential impact on cost, and taking actions to mitigate the impacts of risks.

WSDOT is currently formalizing the use of risk reserves in policies and procedures as a way of incorporating an estimate of the cost of those risks into WSDOT transportation project budgets. A project's base cost and the risk reserve are to be separately identified in WSDOT's project tracking systems. According to WSDOT, the risk reserve is not directly available to a project manager without regional management approval. WSDOT plans to present the Legislature with a cost estimate that includes the risk reserve for projects estimated to cost $10 million or more.

Part Four: Other Issues to Consider to Make Highway Project Cost Estimates More Accurate: Time, Resources, and Communication

In the course of synthesizing the literature, reviewing WSDOT policies and procedures, and observing WSDOT practices on the ground, JLARC identified three issues to bring to the attention of policymakers as they consider the accuracy of highway project cost estimates.

Issue One: With More Time, Cost Estimates Can Become More Accurate

The literature recognizes that giving a transportation agency time to fully understand a project's needs and risks may increase the accuracy of a project's cost estimate. The Association for Advancement of Cost Estimating International (AACE) has published expected ranges of accuracy as a project progresses, with the range becoming smaller as a project moves through different phases.[4]

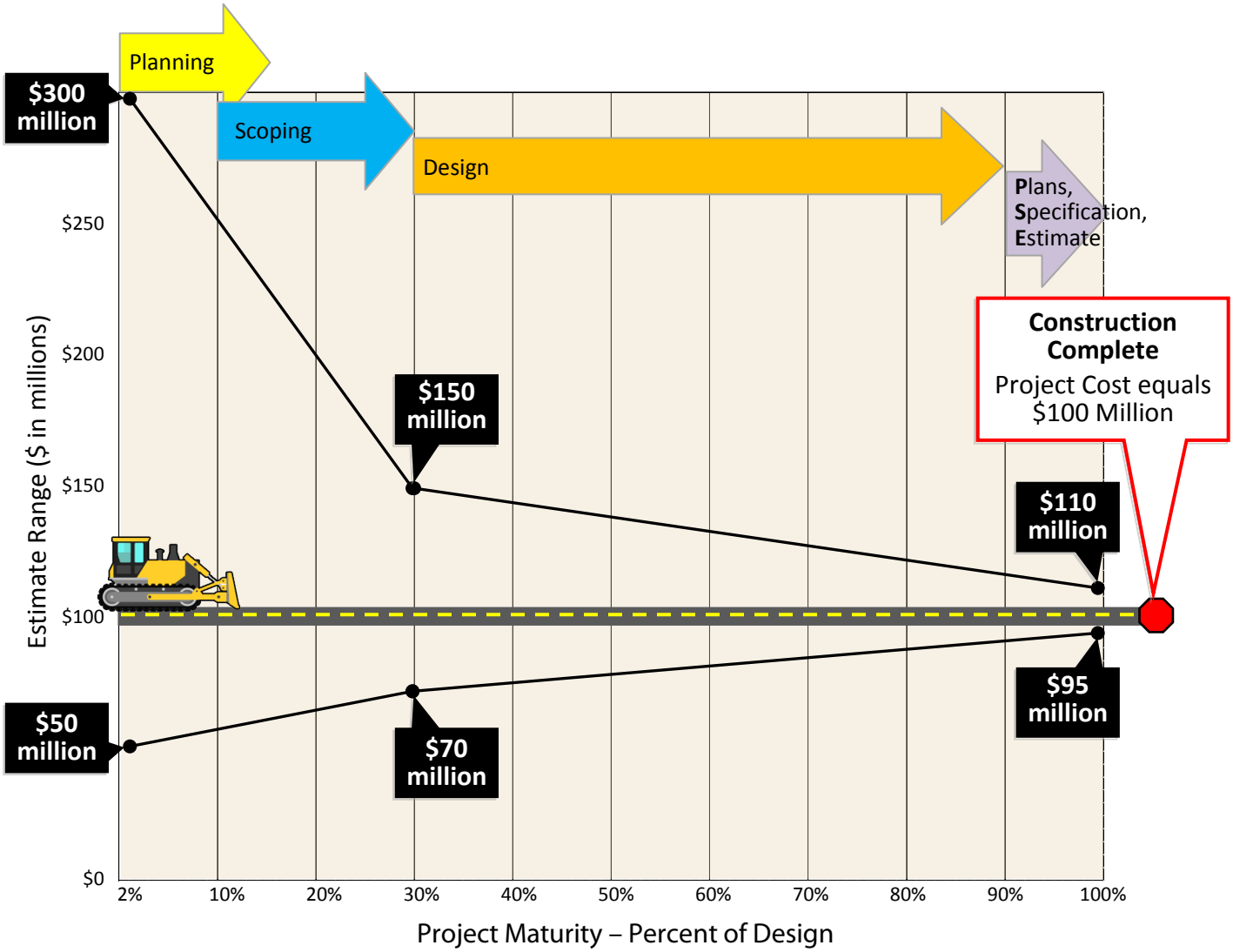
WSDOT has applied AACE guidelines to highway projects and established accuracy ranges based on how far the project has progressed. Exhibit 5 illustrates these ranges for a $100 million project.

[4] AACE International (1997). Cost Estimate Classification System. AACE International Recommended Practice No. 17R-97. TCM Framework: 7.3 – Cost Estimating and Budgeting.

The exhibit shows that there are much wider ranges of expected cost estimate accuracy at 2 percent design than at 100 percent design, with 100 percent design representing the point where a project is sent out for construction bids.

For example, looking at a project that eventually costs $100 million, at 2 percent design, an "accurate" estimate is between $50 million and $300 million. At 30 percent design, when scoping would generally be complete for even the most complex projects, the accuracy range is $70 million to $150 million. At 100 percent design, when a project is sent out for bid, the accuracy range is much narrower: $95 million to $110 million, for the $100 million project.

Exhibit 5 – Expectations for Accuracy Change as More is Known about a Project



Source: JLARC analysis of Association for Advancement of Cost Estimating International (AACE) and WSDOT guidelines and manuals.

According to WSDOT, for complex projects scoping is often considered complete by 30 percent design. When scoping is complete, critical information is documented about environmental issues, right of way, and design decisions. However, WSDOT is frequently asked to provide an estimate for a project when little is known about a project's design. JLARC estimates that **almost three quarters (74 percent) of 336 Nickel and TPA projects were initially funded when only 3 percent or less of design was complete.**

For example, in a $212 million case study project to widen I-5 in Southwest Washington WSDOT provided an estimate on widening I-5 to the Legislature when scoping had just begun—design was 1 percent complete. The project cost estimate increased considerably as more information about geotechnical issues, right of way, and design alternatives became available.

Issue Two: More Resources into Scoping May Produce More Accurate Cost Estimates

Scoping is a process during which a project's objectives, purpose and need, preliminary cost estimate, and preliminary schedule are developed. The WSDOT scoping process includes developing a design decisions summary and an environmental review summary. Using WSDOT's terms, a scope presents a strategy to rectify a deficiency.

Similar to providing more time, the literature indicates that providing the necessary resources to fully perform the scoping process may result in more accurate cost estimates. This can be divided into two areas. First, putting additional resources into scoping may result in a more in-depth and complete scoping process, which translates into more information on which to base the estimate. Second, more resources into scoping may result in the hiring of experts who may more clearly define the risks and parameters of the project.

Issue Three: Clear Communication About Why a Project Estimate Changes Can Maintain Stakeholder Trust and Increase Confidence in the Cost Estimate

The literature indicates that clear communication about project cost estimate uncertainty and the reasons for estimate changes is critical to maintaining stakeholder trust and building confidence in the estimate.

For example, there can be mutual confusion among legislators, legislative staff, and WSDOT about terminology such as what constitutes a project "scope change." For WSDOT engineers, design decisions may result in a change to the estimate but no change in scope. Legislators and legislative staff, however, might see changes that increase the cost estimate substantially as a scope change.

An example of potential communication challenges about scope change can be found in one of the case study projects. WSDOT identified two design alternatives for an interchange, one of which included a round-about. If the round-about alternative were chosen, would this constitute a scope change? WSDOT engineers indicated that from their perspective it would not be a scope change because it is an alternative solution for the same traffic flow problem. Rather than debating whether this was, or was not, a scope change, it may be more beneficial for all parties involved to have a clear understanding of the reasons for any change in the project cost estimate.

Final Reminder: Highway Project Cost Estimates Will Always Have a Level of Uncertainty

Even with more time, additional resources for project scoping, and clear communication about the estimate, project cost estimates will always have a level of uncertainty.

The literature suggests that one way to account for this uncertainty is to use ranges when expressing the project cost estimate. A single point (one number) cost estimate may provide a false sense of accuracy and create confusion for stakeholders when the number changes. Ranges remind a decision maker that there is uncertainty in a cost estimate. There may be an inherent tension between a more accurate cost-estimating process that takes more time and resources and that communicates cost estimates in ranges, and a budget process that calls for quick, single-number cost estimates for highway projects.

Regardless of how much is known about a project and its design, cost estimates are always just estimates.

Recommendation: Establish an Easy-to-Follow Trail Between a Cost Estimate and a Budget Request

The Washington State Department of Transportation should adapt its current procedures and forms so that an easy-to-follow trail is established between the cost estimate developed by the cost estimating process and the request for funding submitted to the Legislature.

The total estimated cost for a project may change for valid reasons. For example, if a project will be delayed to a later date in the budget, inflation assumptions will need to be changed. Or additional information may be gained over time about project risks, changing the estimated cost of the project.

JLARC concluded that WSDOT's estimating policies and procedures align with industry standards. Nevertheless, it is not possible to systematically link the project cost estimate developed by that process and the amount that is eventually included in a budget request or the approved budget.

The project record needs to contain an easy-to-follow trail between the estimating process and the budget request. Such trails may help protect the cost estimating process from outside pressures that are a cause of such things as optimism bias in project budgets. This may be particularly important for projects that span many years, as information on the basis of a cost estimate and the project's budget may get lost over time.

WSDOT currently has a form that may be adapted to establish a trail from project cost estimates to budget requests. The Basis of Estimate form serves as a checklist to document what factors were used to develop the base cost of a project. The form is currently not widely used, but a draft instructional letter shared with JLARC outlines a policy requiring regions to use the Basis of Estimate form.

Legislation Required:	None
Fiscal Impact:	JLARC assumes this can be completed within existing resources.
Implementation Date:	September 30, 2010

APPENDIX 1 – SCOPE AND OBJECTIVES

SCOPING AND COST ESTIMATING FOR HIGHWAY PROJECTS

SCOPE AND OBJECTIVES

JULY 22, 2009

STATE OF WASHINGTON

JOINT LEGISLATIVE AUDIT AND REVIEW COMMITTEE

STUDY TEAM

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Joint Legislative Audit & Review Committee
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Why a JLARC Study of Scoping and Cost Estimating for Highway Projects?

The 2009-11 Transportation Budget directs the Joint Legislative Audit and Review Committee (JLARC) to review the Washington State Department of Transportation's (WSDOT) scoping and cost estimating practices. JLARC is to analyze how WSDOT is developing scope and cost estimates for future highway construction projects.

The review is to focus on highway preservation and improvement projects funded by the Transportation Partnership Account or the Transportation 2003 Account. Five "mega-projects" are *excluded* from the review: the Alaskan Way Viaduct, the North Spokane Corridor, the 520 Bridge, the I-5 Tacoma HOV, and I-405.

WSDOT Preservation and Improvement Programs

WSDOT's combined operating and capital budget for 2009-11 is $5.8 billion. Of this total, $3.9 billion, or 67 percent, goes to two highway capital program areas: preservation and improvement. *Preservation* projects focus on keeping existing roads and bridges in good condition, while *improvement* projects focus on increasing safety and mobility, such as widening roads. Other program areas in WSDOT include ferries, rail, aviation, and public transportation.

In 2003 and 2005, the Legislature approved fuel tax increases to fund transportation projects. Between them, these two increases will provide $2.5 billion in funding for the preservation and improvements programs in 2009-11. These two fund sources (2003 Nickel Account and the 2005 Transportation Partnership Account) and the preservation and improvement programs are the focus of this JLARC audit of WSDOT's scoping and cost estimating practices.

Project Scoping and Cost Estimating

Scoping is a process during which a project's objectives, purpose and need, cost estimate, and schedule are initially developed. Scoping generally happens after some amount of project planning has already taken place. A *cost estimate* is the probable amount of money required for a project. A cost estimate consists of normal costs for project materials and services (such as concrete, asphalt, steel, right-of-way, etc.), contingencies, and may include reserves for costs associated with scope changes and unforeseen events. Estimates may change depending on the phase of a project and can be expressed as either a range or as a single value.

Study Scope

As directed, JLARC will review how project scope and cost estimates are developed by WSDOT for future transportation highway preservation and improvement construction projects. Projects that will be reviewed are those Funded in whole, or in part, by the Transportation Partnership Account or the Transportation 2003 Account (Nickel Account), excluding specific "mega-projects."

The review will examine whether the scoping and cost estimate guidelines used by the WSDOT are consistent with general construction industry practices and other appropriate standards. The review will include an analysis of the scope and cost estimates for select future projects.

Study Objectives

JLARC's analysis will focus on answering six key questions related to WSDOT's highway project scoping and cost estimating.

1) What guidance, such as industry standards or defined business practices, exists for transportation scoping and cost estimating practices?
2) Does WSDOT have defined scoping and cost estimating practices?
3) To what extent do WSDOT's practices align with industry standards or defined business practices?
4) For a set of case study projects (not yet in a construction phase), what actual processes were used by WSDOT for developing project scope and cost estimates, and did these actual processes align with WSDOT guidelines and industry standards?
5) For the case study projects, how do the scoping and cost estimates compare to the budget request information supplied to the Legislature?
6) For projects that may be planned far into the future, what processes are in place to keep these projects' cost estimates up-to-date?

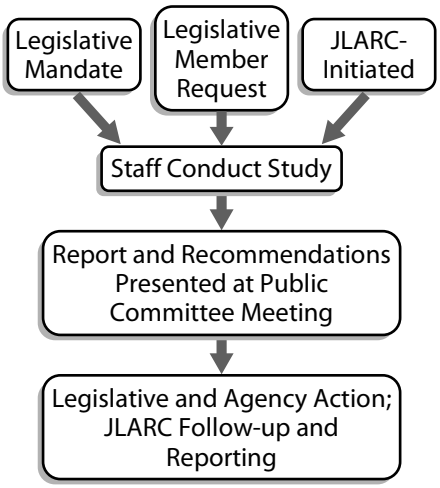
Timeframe for the Study

Staff will present its preliminary and final reports at the JLARC meetings in December 2009 and January 2010.

JLARC Staff Contact for the Study

John Woolley (360) 786-5184 woolley.john@leg.wa.gov

JLARC Study Process



Criteria for Establishing JLARC Work Program Priorities

- Is study consistent with JLARC mission? Is it mandated?
- Is this an area of significant fiscal or program impact, a major policy issue facing the state, or otherwise of compelling public interest?
- Will there likely be substantive findings and recommendations?
- Is this the best use of JLARC resources? For example:
  - Is JLARC the most appropriate agency to perform the work?
  - Would the study be nonduplicating?
  - Would this study be cost-effective compared to other projects (e.g., larger, more substantive studies take longer and cost more, but might also yield more useful results)?
- Is funding available to carry out the project?

APPENDIX 2 – AGENCY RESPONSES

- Washington State Department of Transportation
- Office of Financial Management

Washington State Department of Transportation
Paula J. Hammond, P.E.
Secretary of Transportation

Transportation Building
310 Maple Park Avenue S.E.
P.O. Box 47300
Olympia, WA 98504-7300

360-705-7000
TTY: 1-800-833-6388
www.wsdot.wa.gov

December 8, 2009

Ruta Fanning, Legislative Auditor
Joint Legislative Audit &Review Committee
PO Box 40910
Olympia, WA 98504

RECEIVED
DEC - 9 2009
JLARC

Dear Ms. Fanning:

Thank you for the opportunity to respond to the Joint Legislative Audit and Review Committee's (JLARC) Preliminary Report on *Washington State Department of Transportation's Scoping and Cost Estimating for Highway Construction Projects*. We reviewed the report and our formal response is included in this letter.

We are pleased that this audit found that the Washington State Department of Transportation (WSDOT) policies and procedures for cost estimating currently align with industry guidelines, and that WSDOT practices in the field align with WSDOT policies and procedures.

We are also pleased that JLARC noted that WSDOT has continued to make improvements in scoping and cost estimating. These improvements have prepared the agency to more accurately estimate the cost of highway construction projects. WSDOT's development of the Cost Estimate Validation Process (CEVP) was a beginning to that improvement process. In addition, CEVP and other WSDOT estimating tools more recently developed are held out as models in many major publications, including *Guidance for Cost Estimation and Management for Highway Projects During Planning, Programming and Preconstruction*, published by the Transportation Research Board, and *Project Cost Estimating, A Synthesis Of Highway Practice,* published by the American Association of State Highway and Transportation Officials (AASHTO).

WSDOT has built our processes recognizing that adequate time, money, and communication will result in better project scoping and estimating. It is reassuring to see that JLARC agrees on this point. We further recognize the challenges that exist in the timing and relationships between the scoping and estimating process with the budget development process. We are open and willing to continue discussions with the Office of Financial Management (OFM) and the Legislature, to enhance how the information flows to and relates to the budget process.

It is important to point out that the dramatic and surprising construction cost increases from 2005 through 2007, followed by an economic recession driving down transportation revenues, were the primary reasons for changes to WSDOT's project cost estimates during the audit period. Most of the construction industry worldwide was also challenged by these circumstances.

Finally, we would like to express our appreciation to the JLARC staff. We appreciate their professionalism and flexibility in working with us during a time in which WSDOT was busy in delivering our largest construction season ever and also preparing for the 2010 Legislative session and accompanying supplemental budget.

Sincerely,

Paula J. Hammond, P.E.
Secretary of Transportation

PJH:jaa
Enclosure

cc: David Dye, WSDOT
Steve Reinmuth, WSDOT
Jerry Lenzi, WSDOT
Amy Arnis, WSDOT
Dillon Auyoung, WSDOT
Lloyd Brown, WSDOT
Jay Alexander, WSDOT
Rick Smith, WSDOT
Pasco Bakotich, WSDOT
Steve McKerney, WSDOT
John Woolley, JLARC

Ruta Fanning, Legislative Auditor
December 8, 2009
Page 3 of 3

Official Agency Response to the JLARC Preliminary Report on:

Washington State Department of Transportation's Scoping and Cost Estimating for Highway Construction Projects

Recommendation:

The Washington State Department of Transportation should adapt its current procedures and forms so that an easy-to-follow trail is established between the cost estimate developed by the cost estimating process and the request for funding submitted to the Legislature.

Agency Position:

The Agency concurs with the recommendation.

Comments:

To establish the documentation recommended, the following action steps are already underway.

WSDOT Action Steps:

- Require use of a standard estimate form for new and updated project cost estimates, **submitted after December 31, 2009**
- Require clear, easy to follow comments in WSDOT's Capital Project Management System (CPMS) for all changes to base (uninflated) cost estimates, **submitted after December 31, 2009**

STATE OF WASHINGTON
OFFICE OF FINANCIAL MANAGEMENT
Insurance Building, PO Box 43113 • Olympia, Washington 98504-3113 • (360) 902-0555

December 16, 2009

TO: Ruta Fanning, Legislative Auditor
Joint Legislative Audit and Review Committee

FROM: Victor A. Moore
Director

SUBJECT: **PRELIMINARY REPORT – WASHINGTON STATE DEPARTMENT OF TRANSPORTATION'S SCOPING AND ESTIMATING FOR HIGHWAY PROJECTS**

Thank you for the opportunity to review JLARC's preliminary report on Washington State Department of Transportation's Scoping and Estimating for Highway Projects. Here is our response to the recommendation in the report.

Recommendation	Agency Position	Comments
1. The Washington State Department of Transportation should adapt its current procedures and forms so that an easy-to-follow trail is established between the cost estimate developed by the cost estimating process and the request for funding submitted to the Legislature.	Concur	We agree that WSDOT must continue to adapt its procedures and processes to make it easier for policymakers and the public to better understand its assumptions in estimating project costs.

We look forward to your final report. If you have any questions, please call Clint McCarthy at (360) 902-0419.

cc: Robin Rettew, Senior Budget Assistant, Office of Financial Management
Clint McCarthy, Budget Assistant, Office of Financial Management
Teresa Berntsen, Executive Policy Advisor, Office of the Governor

APPENDIX 3 – PROJECT REFERENCE MATERIAL

JLARC conducted an extensive review of the literature regarding scoping and cost estimating, with the literature's primary focus on cost estimating. This literature is referenced in this appendix.

While all the literature informed our analysis, in establishing our detailed criteria, we rely mainly on a document published by the National Academy of Sciences, through the Transportation Research Board and the National Cooperative Highway Research Program (NCHRP): *National Highway Cooperative Research Program* (*NHCRP) 574 Guidance for Cost Estimation and Management for Highway Projects During Planning*. Also listed below are documents, guidance letters, and forms used by the Washington State Department of Transportation.

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APPENDIX 4 – DETAILED CRITERIA USED TO EVALUATE ALIGNMENT WITH INDUSTRY GUIDELINES

This appendix highlights the criteria and evidence used to determine if WSDOT policies and procedures align with industry guidelines. JLARC developed five key questions and corresponding criteria through a literature review and discussions with a consultant. Evidence was collected by reviewing WSDOT documentation including forms, manuals, policies, online information, and databases. JLARC found that WSDOT policies and procedures align with industry guidelines. Detail on the results of the alignment review are captured in the tables that follow.

Summary of Findings

JLARC used 46 criteria to determine if WSDOT policies and procedures are in alignment with industry guidelines. WSDOT is in alignment with 42 out of 46 of the criteria. In 3 out of the 46 criteria WSDOT partially aligns with industry standards. In 1 out of 46 criteria WSDOT does not align with industry standards.

Testing whether WSDOT policies and procedures are in alignment with industry guidelines:

1. Does WSDOT have a systematic, documented process for defining scope, ensuring the scope reflects the project's purpose, cost, and schedule and controlling changes in scope and schedule?		
	Does WSDOT Align? (Yes/No)	**Primary Data Sources for Documenting Answer**
1. Is there a systematic approach to scoping as evidenced by a scope primer, manual, checklist or other documentation?	Yes	• Introduction to Project Development CF4, Training Module 2 Scoping, Design Manual 330.06, pages 21-32 • Project Summary defines the scope of work, Design Manual 150.04(3), 330.03, 330.06 • Project Definition identifies scope and design elements and includes the needs and purpose of the project, program categories, and project phasing, Design Manual 330.03, 330.06. • Deliverable Expectation Matrix identifies Project Definition and Summary as documentation of project purpose, type, strategy, phase durations, budget, and recommended add date. • See 130-6 to 130-9 and Chapter 330 in the Design Manual • See 2009-2011 Scoping and Programming Guidance Office of Systems Analysis & Program Development • See Cost Estimating Manual, pg 12
2. Are there standard forms and templates?	Yes	• There are multiple forms, templates, and schematics, for examples go here: http://fmapps.wsdot.wa.gov/forms/findresults.php
3. Is there staff and money dedicated to scoping?	Yes	• Three people are dedicated to scoping in the Head Office of Systems Analysis and Priority Programming. • Each region has specific staff identified as leading scoping efforts. • Eight million dedicated to scoping in 07-09 per email conversation between JLARC staff and WSDOT dated 7/20/09. • WSDOT Project Scoping Cost document
4. Are changes in scope and schedule documented along with their impact on the cost estimate?	Yes	• Change Management Plan • Project Change Request Form and Instructions • Project Cost Estimate Creation, Update, Review and Approval Procedures • Cost Estimating Manual includes description of scoping level estimate, page 11.
5. Is there an evaluation of how well the scope performed?	No	• There is no documentation that an evaluation of scope is performed. However, WSDOT indicates this process takes place informally as they work through the process outlined in process flow charts and other scoping material.

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	Does WSDOT Align? (Yes/No)	**Primary Data Sources for Documenting Answer**
6. Are alternative designs considered?	Yes	• See RCW 47.05.010 • Introduction to Project Management CF4 Training Module, page 21 • Highway System Plan
7. Are prior geotechnical information/data used when scoping projects?	Yes, when available.	• The Design Manual, Chapter 610, outlines the duties of the Regional Material Offices and HQ Geotechnical services.

2. Does WSDOT actively manage the cost estimation process and fully document each stage and all changes in cost estimates?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
1. Is there a manual that documents cost estimation procedures and outlines documentation requirements?	Yes	• Cost Estimation Manual • Web based resources: http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Process/ and http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm
2. Are there standard forms and templates?	Yes	• There are four different risk analysis processes each with their own forms and templates (CVEP, CRA, Self-modeling, qualitative spreadsheet). For example: http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/default.htm; \\Jefferson\lbcdisk\Transportation 2009 Scoping-Estimating\Documents from WSDOT\wsdot self-modeling spreadshet.xls; http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Tools/PC_Tools_Inventory.htm; • See also web resource http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm.
3. Is there a project checklist for standard project elements?	Yes	• Each step on the Online Guideline has a series of specific guidance. http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Phase_Guides/Pre-Construction/Pre-Construction_files/slide0001.htm • Design Manual, page 330-8, 330-9 • Ebase can serve as a checklist http://www.wsdot.wa.gov/Design/ProjectDev/EngineeringApplications/ • Master Deliverables List

2. Does WSDOT actively manage the cost estimation process and fully document each stage and all changes in cost estimates?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
4. Do project staff receive on-going training on WSDOT cost estimation procedures?	Yes	• Primary responsibilities of the Strategic Analysis and Estimating Office http://www.wsdot.wa.gov/Design/SAEO/ • Workshops for CEVP and CRA risk assessments http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/default.htm • WSDOT offers a class in cost estimating: http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm
5. Is there staff and money dedicated to estimating?	Yes	• Although there are no people in the field titled "cost estimators," the Strategic Analysis and Estimating Office has staff dedicated to training, policy development, and limited review of estimates. http://www.wsdot.wa.gov/Design/SAEO/ • List of staff dedicated to cost estimating and risk analysis http://www.wsdot.wa.gov/Design/SAEO/Contacts.htm
6. Are personnel qualified to produce estimates?	Yes	• Engineers have minimum qualifications posted on the Department of Personnel website. • WSDOT offers a class in cost estimating: http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Information.htm
7. Is technology up to date and uniform across users?	Yes	• Extensive access of internet based tools (see above) • Access to WSDOT Intranet based tools • Available tools includes BidTab Pro, Unit Bid Analysis, PertMaster
8. Are there milestones where management approval is required before proceeding to the next step?	Yes	• Design Manual, page 810-4 and section 300. • Project Control and Reporting http://www.wsdot.wa.gov/projects/PCR • Design Documentation Checklist
9. Is the budget updated as changes to the estimate occur?	Yes	• The budget is updated regularly in Capital Project Management System. See the Project Control and Reporting Manual and the Capital Project Management System User's Guide.
10. Is inflation accounted for when schedule changes?	Yes	• This is how WSDOT accounts for inflation: http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/Process/Inputs_Document_Descriptions.htm#Inflation

2. Does WSDOT actively manage the cost estimation process and fully document each stage and all changes in cost estimates?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
11. Does value engineering take place?	Yes	• Value engineering webpage http://www.wsdot.wa.gov/Design/ValueEngineering • According to WSDOT all projects with a total estimated cost (construction, right of way, preliminary engineering, utilities, etc.) over $25 million and any bridge project over $20 million will need to have a value engineering study. • WSDOT Policy on value engineering • WSDOT Design Manual, Chapter 310

3. Does WSDOT inform the public and other stakeholders on project scope, estimates, changes, and other project status issues?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
1. Is there a communication protocol?	Yes	• The Public Involvement and Hearings, Chapter 210 from the Design Manual • The Communications Manual • Writing a Public Involvement Plan • Communications Office http://www.wsdot.wa.gov/communications/
2. Are outside groups interested in project identified early in the process?	Yes	• Pre-construction project management online guide http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Phase_Guides/Pre-Construction/Pre-Construction_files/slide0001.htm • Communication plan template • Master Deliverables List PE-S-01.03.06
3. Do they convey the uncertainty of the estimate to stakeholders?	Yes	• See variance on project definition form
4. Do they keep all parties informed of changes in scope and estimate?	Yes	• Project Control Manual, Chapter 4, pages 4-1 and 4-2 • The Gray Book addresses project changes and reporting
5. Are ranges used to convey the estimate to stakeholders?	Yes – public No - Legislature	• WSDOT uses a one-pager that specifies the ranges in a graph to update the community. • Ranges are developed when a CRA ,CVEP, or self-modeling spreadsheet is used (see Q4, #2 for links to CRA and CVEP. • Ranges are not used when the qualitative worksheet is completed. • The number that is given to the Legislature is a single point estimate for budgetary reasons. See Capital Project Management System User's guide.

4. Does WSDOT have a systematic method for reviewing, quantifying, and mitigating risks?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
1. Is there a manual or other guiding documents that standardize the ways that risks are analyzed?	Yes	• Risk analysis web page http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/ • Cost Estimating Manual
2. Are their tools for analyzing risk, such as software?	Yes	• CEVP for over 100 million – workshop http://www.wsdot.wa.gov/NR/rdonlyres/77C3E627-FE25-40B6-BB4A-CC79BD06825B/0/CRACEVPFlowchart20060110rev.pdf • CRA for 25 to 100 million – workshop http://www.wsdot.wa.gov/NR/rdonlyres/77C3E627-FE25-40B6-BB4A-CC79BD06825B/0/CRACEVPFlowchart20060110rev.pdf • Self-modeling worksheet for 10 to 25 million • Qualitative worksheet for less than 10 million
3. Are risk identified early in the project?	Yes	Occurs early in the pre-construction process, at the "Plan the Work" phase: http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Phase_Guides/Pre-Construction/Pre-Construction_files/slide0001.htm
4. Do estimate ranges reflect risk?	Yes	• Cost Estimating Manual, pages 2, 5 • Project Definition Form (see instructions) • See quantitative analysis in the self modeling spreadsheet • See Alaska Way Viaduct Risk Register
5. Does the risk analysis account for project complexity?	Yes	• WSDOT uses cost as a proxy for complexity in the Cost Estimating Manual, page 9 (CVEP, CRA, Self Modeling Spreadsheet, Qualitative Spreadsheet).
6. Is there mitigation of risk?	Yes	• Project Cost Estimate Creation, Update, Review, and Approval Procedures • Project Risk Management Guide and Risk Management Spreadsheet
7. Is contingency clearly defined?	Yes	• See "reserve" in the Project Management Glossary • See also "construction contingency" in the Cost Estimating Manual • See workpaper defining contingency for detailed discussion of the meaning of contingency
8. Is there a consistent application of contingency?	Yes – Construction Contingency No – Reserve	For Construction • Process Activity – Determine Risk and Set Contingency http://www.wsdot.wa.gov/NR/rdonlyres/45B85BFF-6813-439C-B82B-3AE50544A023/23821/DetermineRiskandSetContingency.pdf • Plans Preparation Manual, page 8-3

4. Does WSDOT have a systematic method for reviewing, quantifying, and mitigating risks?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
9. Is there an end-of-project review that looks at whether appropriate risks were left out of the cost estimation process?	Yes	• Lessons Learned Database Description http://www.wsdot.wa.gov/Projects/delivery/LessonsLearned/Default.htm • Deliverables Expectation Matrix – Project Close Out and Archiving
10. Is there a specific group or staff assigned to performing tasks related to risk management?	Yes	• Strategic Analysis and Estimating Office http://www.wsdot.wa.gov/Design/SAEO/ • Regional Coordinators for the Strategic Analysis and Estimating Office http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/contacts.htm

5. Does WSDOT have "checks and balances" and institutional support to ensure that scope, estimates and risks are reviewed and checked for accuracy, and, that estimates are not unduly impacted by outside pressures?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
1. Is there a documented process for estimate quality control?	Yes	• Review Base Estimate Protocol • Cost Estimating Manual
2. Are estimates produced by an interdisciplinary team with expertise in areas such as right of way and constructability?	Yes	Team Identification from the Online Guide http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Phase_Guides/Pre-Construction/PC_Initiate_Align/PC_Team_Identify.htm
3. Are there periodic reviews of estimates throughout the project?	Yes	Online guide to project management – Develop Project Performance Baseline http://www.wsdot.wa.gov/Projects/ProjectMgmt/OnLine_Guide/Phase_Guides/Construction/CN_Plan_the_Work/CN_Plan_Baseline.htm
4. Do the reviews check the basis of the estimate?	Yes	• Review Base Estimate Protocol • See Basis of Estimate in the Estimating Manual
5. Do reviews check that the estimate matches the scope of the project?	Yes	• Change management process

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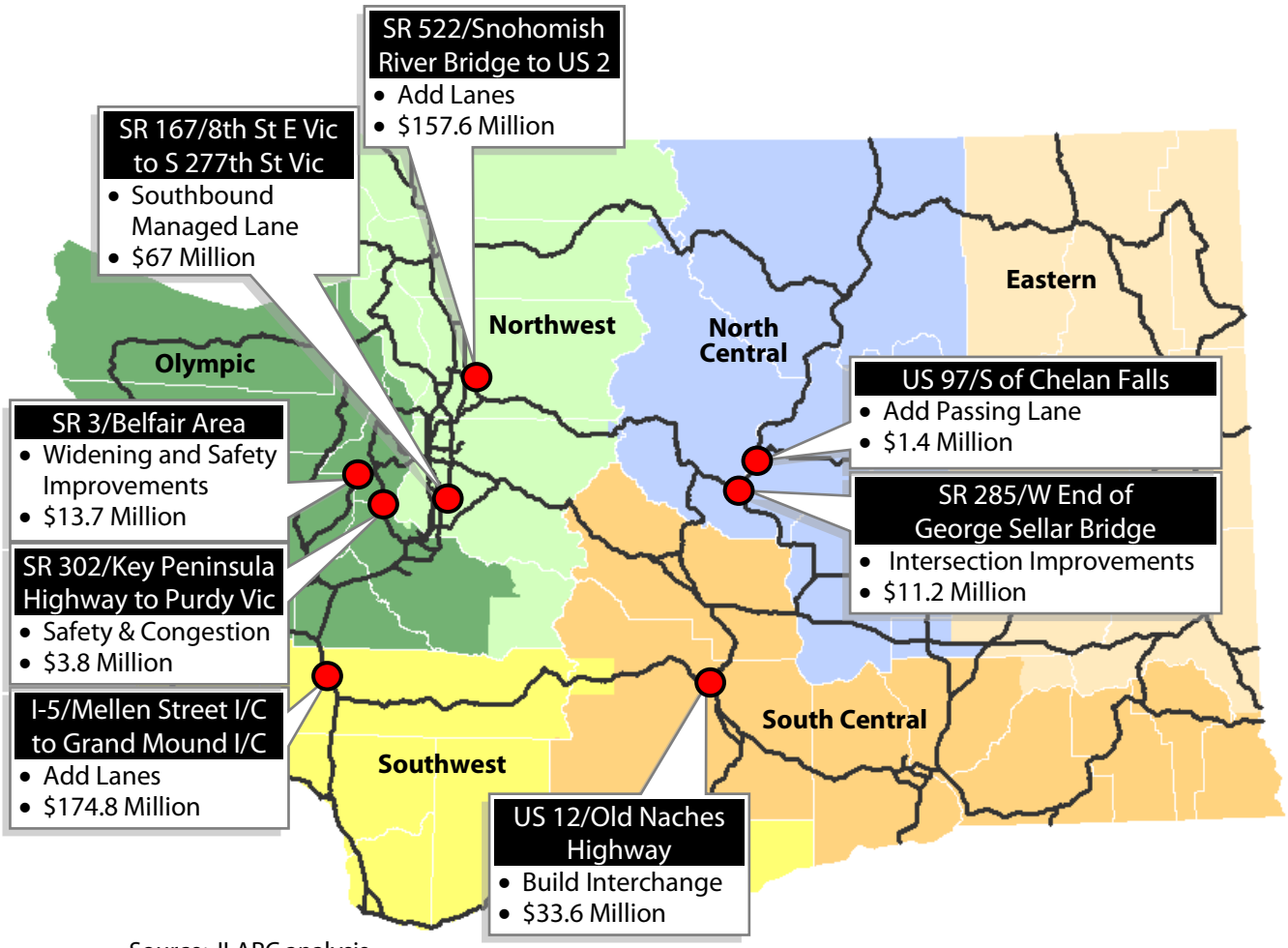
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
6. Do reviews check against bias, discrepancies, errors, and omissions?	Yes	• Cost Estimating Manual, page 32
7. For complex projects, are knowledgeable and experienced individuals independent of the project team used to conduct reviews of the estimate and estimate updates?	Yes	• External reviews are from independent experts according to the Process Activity – Review Base Estimate. http://www.wsdot.wa.gov/NR/rdonlyres/45B85BFF-6813-439C-B82B-3AE50544A023/23820/ReviewBaseEstimate.pdf • Cost Estimating Manual, page 32
8. Are costs developed by region and based on local market factors?	Yes	• The Cost estimating manual describes estimating duties of experts in the regions and discusses geographic considerations on page 25. • Regional Coordinators for the Strategic Analysis and Estimating Office http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/contacts.htm are assisted by the Cost Risk Estimating Management Unit http://www.wsdot.wa.gov/Design/SAEO/ • Plans, Preparation Manual, page 8-2
9. Is historic data collected, developed, maintained and used?	Yes	• The Cost Estimating Manual refers to historical data, databases, and percentages. • See Strategic Analysis and Estimating Office website for databases on historic cost information available to project managers. http://www.wsdot.wa.gov/Design/SAEO/
10. Are estimates in year of expenditure?	Yes	• Estimates are put into Inflation – Deflation tables. • The Capital Project Management System Users Guide on Dollar Inflation provides instruction and indicates that the estimate is for the midpoint date of the construction phase.
11. Do they have a statement of purpose or other indication that they require accuracy in estimating and schedule?	Yes	• The Cost Estimating Manual talks about ensuring and increasing the accuracy of estimates, page iii. • On time and on budget is a performance measure. http://www.wsdot.wa.gov/publications/folio/ProjectDeliveryFolio.pdf • Project Control Manual, page 4-2 • Secretaries Executive Orders E1053.00 • Project Management Principles web page http://www.wsdot.wa.gov/accountability/mgmtprinciples.htm

5. Does WSDOT have "checks and balances" and institutional support to ensure that scope, estimates and risks are reviewed and checked for accuracy, and, that estimates are not unduly impacted by outside pressures?		
	Does WSDOT Align? (Yes/No)	**Primary Data Source for Documenting Answer**
12. Do they have procedures to protect the estimate from political and public pressure?	Partial	• Although WSDOT has no procedures specifically in place to protect the estimate from political and public pressure, WSDOT does use uniform software to develop the estimates, which can help protect the estimate from outside influences.
13. Do contracts reflect an expectation of estimate and schedule accuracy?	Yes	• See Standard Specifications, 2008, page 1-03.4

APPENDIX 5 – DETAILED CRITERIA USED TO ANALYZE FIELD PRACTICES

This appendix highlights the criteria used to assess whether the eight case study projects JLARC examined illustrate alignment between WSDOT field practices and WSDOT policies and procedures. The eight case study sites were chosen from different regions across the state, as shown in the map below:

Exhibit 6 – Eight Sites Included in the Study



Source: JLARC analysis.

Below, five key questions are followed by criteria that were developed through a literature review and discussions with our consultant. Through site visits and interviews with regional staff, the criteria were used to develop qualitative impressions of field practices. As noted in the body of this report, JLARC found that WSDOT field practices are in alignment with its policies and procedures. Note that case studies are not randomly selected and are not a statistically representative sample of all WSDOT highway projects. Rather, they serve as illustrations of regional practices. The following shows the criteria used to test alignment in each key question.

Question 1: How does this case study illustrate if there is a systematic process for scoping?	
	Comments/Explanation
1. Is there a project definition document that summarizes the need and purpose of this project?	**Yes:** The case study projects contained a project definition form.
2. If the scope changes, is there a change request form?	**Yes:** Project change request forms were located in projects where a scope change had taken place.
3. Can details on the scope and scope changes be found in electronic form so that all members of the team have access?	**Yes:** Details on the scope and project change request forms are kept electronically and are readily available to team members.
4. If the scope changes, is the budget and schedule revised?	**Yes:** In cases where there was a scope change, the project change request form reflects the revised budget and schedule.
5. Are prior geotechnical information/data used when scoping this project?	**Yes:** Prior geotechnical information/data are often used when scoping a project.

Question 2: How does this case study illustrate if WSDOT systematically and actively manages the cost estimation process?	
	Comments/Explanation
1. Is data on estimates kept in electronic form so that it may be accessed by management and by the project team?	**Yes:** Most of the case study projects contain an EBASE report. EBASE is an easy to use, flexible system for developing project estimates. Some projects have a Project Management Plan which has data on the estimate and is kept electronically.
2. Is there a project checklist for standard project elements?	**Yes:** If the case study project had progressed far enough it has a project checklist in the form of EBASE or the Master Deliverables Checklist.
3. Is the estimate documentation in a form that can be easily understood, checked, verified, and corrected?	**Yes:** Most case study projects documented an estimate in EBASE.
4. Is the initial baseline estimate documented?	**No:** The initial baseline estimate was only documented in a few of the case study projects.
5. Are estimates presented in ranges?	**Yes:** Output from a risk analysis is presented in a range and the project definition estimate includes a variance.

Question 3: How does this case study illustrate if WSDOT keeps stakeholders informed?*

	Comments/Explanation
1. Was the estimate presented to the Legislature after scoping was complete (at about 30% design)?	**No:** In some cases WSDOT did not complete scoping before the estimate was presented to the Legislature. In one case the scoping was completed by a locality instead of WSDOT.
2. Is the estimate that was developed in this case study projects the same as the estimate presented to the Legislature?	Unable to determine.

*JLARC determined through our interviews that regional staff keep the stakeholders informed through public meetings, involvement with stakeholder groups, and updated online information about the projects.

Question 4: How does this case study illustrate if WSDOT reviews and quantifies risks?

	Comments/Explanation
1. Is there a risk charter or another type of document that identifies, quantifies, and mitigates risk?	**Yes:** In the case study projects that have progressed far enough for a risk analysis, there is a risk charter and/or details about risk from a risk analysis. (CEVP, CRA, Self-modeling spreadsheet, qualitative spreadsheet)
2. Is there an estimate range that reflects the risks?	**Yes:** There is an estimate range that reflects risk if a risk analysis has been completed.
3. Are the appropriate tools, given the project's cost, used to evaluate risk? (CEVP,CRA, Self-Modeling Spreadsheet, Qualitative Spreadsheet)	**Yes:** Most of the case study projects used the appropriate tool to evaluate risk.

Question 5: How do the case study projects illustrate if WSDOT provides checks and balances and ensures institutional support?

	Comments/Explanation
1. Is there an internal review of the estimate and updates to the estimate?	**Yes:** In most cases there is an internal review of the estimate.
2. If this project requires a CEVP, is there an external review by experts outside of WSDOT?	**Yes:** In most cases there is an outside review of the estimate by experts. This often takes place at the CEVP workshops.
3. Is there a milestone checklist?	**Yes:** The case study projects have a milestone checklist which is usually part of an electronic schedule.