The Alaskan Way Viaduct and SR 520 Bridge Projects

Report of the Expert Review Panel

Revision 1

September 1, 2006








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The enclosed report conveys the findings of the Expert Review Panel constituted under the provisions of ESHB 2871 to assess the finance and implementation plans for replacing the Alaskan Way Viaduct and the State Route 520 Bridge.

For the reasons we explain in our report, we strongly believe the plans are fundamentally sound and achievable. This does not mean they are flawless—but the concerns that we identify do not pose insurmountable obstacles to successful completion of the projects. Our report provides recommendations in several areas for moving forward with project planning and into construction in the most effective manner.

We are grateful to the Washington State Department of Transportation for its responsiveness and support throughout our review. We were consistently impressed with the skill and experience that the WSDOT staff brought to this process. We also commend the Governor and the Washington State Legislature for their clear commitment to improving the state's transportation systems, and especially for passing funding packages in 2003 and 2005, at a time when few state legislatures were taking similar action. Without their leadership, rebuilding these key public assets would be impossible.

With the conclusion of this review, we believe that now is the appropriate time for decisions. The Washington State Legislature, the Puget Sound region, and the people of Washington State have explored—diligently and faithfully—the various possibilities for these much-needed projects. The public thoughtfulness that has characterized them for the past several years is admirable.

But additional deliberation of the merits of various options would be counterproductive. If the decision-making process is extended much further, inflation will diminish the purchasing power of the funds that have already been committed. Meanwhile, the existing viaduct and bridge will continue to deteriorate and inch closer to catastrophic failure. The time has come to move forward with these vital public works projects.

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Executive Summary

In June 2006, the Washington State Governor and Legislature created an expert review panel to evaluate the finance and implementation plans for the proposed projects to replace the Alaskan Way Viaduct and the State Route 520 bridge. They charged the panel with three tasks:

- Review the finance plan for each project to ensure that it clearly identifies secured and anticipated funding sources and is feasible and sufficient.
- Review the project implementation plans covering all state and local permitting and mitigation approvals, to ensure that they offer the most expeditious and cost-effective delivery of the projects.
- Report its findings and recommendations to the Governor, the Joint Transportation Committee, and the Office of Financial Management by September 1, 2006.

GENERAL FINDINGS

We conclude that the Washington State Department of Transportation (WSDOT) has done an admirable job overall. It has adopted state-of-the-art systems to evaluate the financing and implementation of its large projects. In particular, we applaud its use of probabilistic methods for evaluating the risks that can affect cost estimates and schedules. We encourage WSDOT to continue using these systems.

Beyond WSDOT's handling of these projects, we wish to emphasize the need for all parties to move more quickly in building the projects and eliminating the risk to public health and safety posed by the existing structures. Sufficient time has passed to allow WSDOT, other agencies, and the public to discuss the reasonable alternatives available. It is now time to make decisions and build the projects.

FINANCE PLANS

We assessed the two main components of the finance plans: cost estimates and funding plans.

The bases of the cost estimates for both projects are generally sound, in view of each project's level of design maturity. Moreover, WSDOT's quantitative risk analysis approach, the Cost Evaluation Validation Process (CEVP), is a valid methodology for evaluating the variability of cost and schedule predictions due to risks and opportunities.

However, we did identify three major concerns. The first, based on spot checks of cost estimating documentation for both projects, is that some of the estimates appear overly optimistic. Our second concern is that the ranges of expected costs for both projects are unreasonably narrow, for what would be expected at this stage in the projects' design life. Thus, we are concerned that the cost ranges may be underestimated. Our third, and perhaps most significant, concern involves the treatment of price escalation (inflation). The validation process uses an average annual rate of inflation of 2.4 percent, which accurately reflects construction-related historical price escalation. However, we believe those historical averages understate the price escalation rates that will occur in the future, considering the unexpected demands for, and limited supply of, critical construction commodities such as steel. Current projections expect construction-related inflation of 6 to 10 percent.

None of these concerns constitutes a fatal flaw in the cost estimate. Indeed, WSDOT is fully aware of our concerns and is actively addressing them.

The viaduct project premised its finance plan on $2.4 billion of secured funding and a maximum of $1.8 billion to $2.6 billion in anticipated funding for the elevated and tunnel alternatives, respectively. We find that premise reasonable, even if optimistic for a few of the funding sources. This optimism surfaces in assumptions that federal funding from routine reauthorizations will be forthcoming, and that the project will receive revenues from the state sales tax. Nonetheless, we accept the project's funding assumptions as reasonable.

Moreover, we find that the viaduct's overall finance plan provides a reasonable framework for funding the core project for either of the reviewed alternatives.

The SR 520 project premised its finance plan on $573 million of secured funding and over $3.6 billion of anticipated funding. We think that premise is overly optimistic. Overall, we find it unreasonable to assume the project will realize sufficient funding from secured and anticipated funding sources. We doubt that an anticipated $153 million in sales tax revenue will be transferred to the project. We have assumed that only the six-lane alternative, if selected, will receive Regional Transportation Improvement District (RTID) ballot measure funding of $800 million. Moreover, we find no basis to believe that any of the second

increment of the RTID funding target of $1.4 billion will be available to the project.

Consequently, we find that the funding sources identified in the SR 520 finance plan fall far short in secured and anticipated funding categories. This shortfall is of particular concern, given the impacts to regional circulation if the structure should fail. The lack of alternative routes makes it essential to fully fund the solution chosen for SR 520 bridge alternative.

IMPLEMENTATION PLANS

We assessed three components of both projects' implementation plans: project management, permitting, and design and construction.

Both projects have project management plans that conform to federal guidance. The viaduct's plan is somewhat more developed than the SR 520 plan, because the former is farther along in the planning phase. Both project management plans are in the draft stage and are expected to be living documents that will evolve and expand as the projects progress. Overall, we find both project management plans to be comprehensive and sufficient for their level of design development.

We found that the strategy for environmental permits and regulatory approvals in both projects is sound overall, as are the related approaches for environmental mitigation planning and management. The draft Environmental Impact Statements for both projects provide useful initial sets of mitigation strategies and associated assumptions. We expect as the EIS process continues, the projects will identify other mitigation strategies. WSDOT's Environmental Permits and Approvals Guide is a good planning document and provides an excellent overview of the environmental permits and regulatory approvals that will likely be required. All of the major permits and regulatory approvals have been identified.

Both project teams appear to be following a number of best practices, including the formation of a permits strategy team, and assigning and locating WSDOT staff in the offices of environmental regulatory agencies to coordinate and manage the permits required. We encourage WSDOT to continue this type of interagency coordination, and to extend it to higher levels of management at each agency and with the Native American Tribes.

However, although all permits have been identified, WSDOT's permit schedule contains some optimistic assumptions. In many cases agency practice requires sequential permitting. We recommend that these linkages be confirmed within the overall schedules. Some linkages are described in the approvals guide as interrelated, but the risk of associated schedule delay seems underestimated. In addition, some permits, if appealed, may not take effect until the appeal is fully adjudicated. WSDOT's timeline correctly estimates when a particular permit will be issued, but in some cases the risk management assessments underestimate the time frame for appeals. For example, Risk "U28—Appeals to project permits"

(Alaskan Way Viaduct and Seawall Replacement Major Risk Events) factors in a 3-month project delay for the appeals process, which is a relatively short time compared with other projects of this size and scope.

We generally agree that WSDOT's base schedule should be reasonably optimistic, since WSDOT should proactively manage these vital projects toward the earliest completion dates that can be justified. But we recommend that, in some cases, longer delays be included as risks during the CEVP review process. Large projects like these can encounter longer than usual delays, so WSDOT should fully evaluate these risks and prepare for the potential impacts.

With respect to the implementation plans for design and construction approvals, we found that the design approvals process is mature for the viaduct project. The design team has developed its concept and logic for design approvals, including proposed changes to the upcoming WSDOT Design Manual. The viaduct project team is also considering risk issues, such as taking steps to reduce schedule risks by obtaining early design decisions.

As with the other components in its project implementation planning, SR 520's project design and construction plans are still in the preliminary stages. We did find, however, many of the same key elements in the SR 520 plans that we found in the viaduct project.

FINDINGS AND RECOMMENDATIONS

We summarize our main conclusions and recommendations for both projects' finance plan and implementation plan below.

Finance Plans

With respect to the cost estimates:

- The basis of WSDOT's cost estimates is generally sound for this stage of the project.
- The Cost Estimate Validation Process is a good tool for evaluating cost and risk. However, we have recommendations for improvement as WSDOT moves forward in designing these projects. None of our concerns constitutes a fatal flaw.
- The cost estimate is appropriate for selecting alternatives, but not for establishing a final project budget. It is unnecessary to do further cost estimating to select a preferred alternative.
- Cost impacts due to inflation can be mitigated by accelerating project implementation with early action items.

With respect to the funding plans:

- Assumptions about the sources of funding for the viaduct are reasonable for the core project, although anticipated sums may be optimistic in some categories.
- The amount of funding from anticipated sources for the SR 520 project fall short.
- For both projects, the state should aggressively pursue other sources of funding, such as regional tolling and public-private partnerships, particularly for SR 520.
- The current CEVP cost estimates are adequate for developing the funding framework. Once WSDOT completes its revised CEVP estimates, it should consider a less conservative budgeting level criterion, for example something less than the 90 percent confidence level.
- We believe that, for both projects, there are shared cost responsibilities:
  - The state is responsible for rebuilding current capacity.
  - The region is responsible for increased capacity.
  - The city and other beneficiaries are responsible for local improvements.
- We recommend that stakeholders identify—early in the process—how increases to the cost of the project will be handled.

Implementation Plans

With respect to the project management plans:

- The draft project management plans are comprehensive and represent the level of detail necessary at this stage. We have a few suggested improvements:
  - WSDOT should develop a quality management plan and implement it at an earlier stage in the planning and design process than may be typical.
  - The plans for public involvement should be incorporated into the project management plan (PMP).

- It is important to clarify roles and responsibilities with respect to decision making and any subsequent liability.

- The membership of the Executive Oversight Committee should be expanded to include external members who are experienced in construction and implementation of transportation mega-projects.

With respect to environmental permitting:

- Overall, the environmental process and permitting strategy is sound. However, we suggest the following:

  - WSDOT should involve higher levels of management from each agency and the Native American Tribes in the existing interagency coordination committees.

  - WSDOT should also identify schedule linkages between permits, and include risks associated with possible permitting delays in the CEVP process.

  - Legislative changes should be considered, to speed up the permitting process.

With respect to design and construction:

- We recommend that the state establish a separate team to review constructibility and pricing. Between now and July 2007, WSDOT should do the following for each project:

  - Select the preferred alternative.

  - Complete 15–20 percent design.

  - Perform a constructability review.

  - Develop a preliminary finance plan, based on the 15 percent design.

- Any chosen alternative for the Alaskan Way Viaduct needs to keep the waterfront accessible to both pedestrians and traffic during construction. The panel is confident that there are construction techniques for either alternative that will accomplish this.

- It is important to take advantage of schedule flexibility, to minimize delays during construction. This approach should include the consideration of supporting legislation.

- We urge WSDOT to evaluate design standards with an eye for reducing construction costs and impacts.
- We recommend seeking legislation to reduce performance bonding requirements, in order to expand competition.

CONCLUDING COMMENTS

We commend all parties for creating the funding and implementation mechanisms to move the projects to this point. However, we are concerned about the political fragmentation that seems to characterize these projects today. It is not evident that either political will or public support has coalesced around these projects. We see strongly held opinions and positions by political leaders and stakeholders, but no process for reaching a conclusion. We see a great need for strong political leadership now, to move these vital public-works projects forward.

The biggest risk these projects face—more severe than financial and logistical hazards—is that of indecision and vacillation by political and civic leaders. If these projects are to succeed, the people in positions of elected and appointed authority must make decisions that stick, so the projects can be completed. We believe there are risks in both projects; the engineering and constructibility risks are generally identified, but the political risks of delay have not been accounted for and could have a significant impact.

The safe, speedy rebuilding of these roadways and infrastructure is critical, both to the Puget Sound Region and the entire statewide transportation system—not only to relieve congested highways, but also to prevent catastrophic damage in the event of an earthquake or major storm.

A great deal of time and consideration has already gone into the viaduct and SR 520 bridge projects. For this, the state's legislators and public servants deserve praise; the thoughtful, thorough deliberation they have given these projects is admirable and appropriate.

We urge political leaders and stakeholders to decide the best path forward—and then proceed on that path, swiftly. We are confident that the information needed is in hand to make a decision and to move these public works projects forward. The data have been crunched; the risks have been assessed; the designs have been scrutinized many times. Now, they must be implemented, without further delay.

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Chapter 1
Introduction

Washington State is currently considering two transportation projects of great importance: the replacement of the Alaskan Way Viaduct and Seawall, and the rebuilding of the State Route (SR) 520 bridge.

Both projects are crucial to the city of Seattle and the state of Washington. Today, neither the viaduct nor the SR 520 bridge is as secure as it should be against earthquakes and storms. This fact has been made clear by the 2001 Nisqually earthquake, which caused the viaduct significant damage, and by the continuous damage done to the bridge by winter storms. As time passes, these assets become increasingly vulnerable to the threat of natural disasters. Postponing improvements to a later date is no longer reasonable.

As with any large-scale public works projects, replacing the viaduct and the SR 520 bridge will be immensely complicated undertakings. These two efforts will involve three counties and five local jurisdictions. They will impact local businesses, have a significant effect on local transportation, and require a large investment of public funds. As a further complication, many advocacy groups are understandably interested in getting involved with these projects, to shape how they proceed.

The people of Washington and their political leaders are rightly concerned with choosing the best design and setting the most appropriate budget and timetable. To ensure that the financial, organizational, and logistical processes for the projects are sound, the Governor and the Washington State Legislature appointed an Expert Review Panel in June 2006 to perform an independent review of the plans.[1] The panel examined the key assumptions forming the foundation of these projects, to evaluate how reasonable and comprehensive they are.

SCOPE OF PANEL REVIEW

The Governor and the Washington State Legislature charged the panel with two key missions:

- **Review the finance plan** for each project, to ensure that the plans clearly identify both secured and anticipated sources of funding and set a budget that is both feasible and sufficient. The panel also reviewed the process for developing the project scope, estimating the project costs, assessing the

[1] State of Washington's Engrossed Substitute House Bill 2871, 59th Legislature, 2006 Regular Session, June 7, 2006.

cost risks, and developing the cash flow requirements, in order to better determine the sufficiency of the funding plan.

The purpose of this review was for the panel to independently assess the soundness of the process for developing the scope, costs, and financial plans. The review did not include "value engineering" or a comparative analysis of costs and alternative financial plans for the projects.

- **Review the project implementation plan** to ensure the most expeditious and cost-effective delivery of the project. This included reviewing all strategies for obtaining the necessary environmental and design permits, as well as any other necessary approvals or legislative or electoral support from the various federal, state, and local agencies and jurisdictions involved in each project.

  The panel assessed the soundness and comprehensiveness of each project's implementation plan, paying particular attention to the scope and timetable, and to whatever provisions were made to address potential risks or setbacks.

The Governor and the Legislature directed the panel to report its finding and recommendations to the Governor, the Joint Transportation Committee, and the Office of Financial Management by September 1, 2006.

GUIDING FRAMEWORK: CHARACTERISTICS OF A SUCCESSFUL MEGA-PROJECT

Managing a mega-project in the public sector is an extraordinary undertaking. It requires transportation agencies to effectively and efficiently conceive, plan, design, build, and operate projects of immense size and complexity. As demands on transportation systems increase—especially in heavily populated areas—and as infrastructure ages and engineering techniques advance, the call for mega-projects is certain to increase. Managing these projects successfully requires a set of skills and competencies—for both the organizations and individuals involved—that differ from those required on more traditional, smaller projects. There is a far greater environmental consciousness, a concern for natural ecosystems, and an awareness of real limits on traditional energy supplies. Today's successful transportation projects must fulfill a broad range of responsibilities. While being cost-effective in their creation, they must contribute to the economic health of a city and its region for generations.

Perhaps the single most important aspect of successfully completing a mega-project is maintaining public trust and confidence in the project, and especially in the transportation agency's ability to invest valuable resources wisely. Without the public's trust, the resources that a mega-project requires are not likely to be made available. To maintain the public's trust and confidence, a transportation

agency must excel in one area in particular: managing expectations. By communicating optimistically but honestly with the public about the amount of time and money a mega-project will require, a transportation agency can ensure that the public will not have a too-rosy view of the mega-project, which could lead to disappointment—or a too-gloomy view, which could prevent the project from getting the public support it needs to succeed.

Striking this balance and achieving the public's trust is not a simple matter. It requires work in three key areas, all of which are crucial to a project's success: finances and schedule; technical and management issues; and political support. If a transportation agency fails to manage expectations and build trust in any one of these areas, the project is far less likely to succeed. This is the "three-legged stool" model of management: all three legs need to be strong and stable for the stool to stay standing. To successfully carry through a mega-project, its three legs—finances, management, and politics—must each receive careful consideration. The following discussion highlights significant features of those components that we assessed in our review, and that help identify whether a mega-project is likely to succeed.

Finance Plan

One of the most important aspects of completing a mega-project is identifying viable funding streams from multiple sources. These are expensive, time-consuming projects, and when decision makers don't plan for the necessary funding over the entire course of the project, it is considerably more difficult to initiate realistic project design and construction activities.

That much is nearly self-evident. But there is a second reason for lining up all the necessary funding—including contingency costs—as early as possible in the process: failure to do so can rapidly undermine public confidence.

Getting the right initial estimates of how much a project will cost and how long it will take to complete—including time and money to deal with potential risks and setbacks—is critically important to successfully completing a mega-project. Cost escalation and schedule delays are highly visible, and they can rapidly change the public's perception of how a project is proceeding. Once an estimate is anchored in the public mind, changing it—no matter how correct to do so—is very difficult without losing public support.

The public has learned from experience that initial estimates of costs for mega-projects are to be met with skepticism. Today, the average cost overrun for a bridge or tunnel mega-project is more than one-third of the estimated project cost.[2] Given the size of the investment, securing the additional funding often requires significant time and resources—which in turn leads to longer schedule

[2] Bent Flyvbjerg, "Policy and Planning for Large Infrastructure Projects: Problems, Causes, Cures," World Bank Policy Research Working Paper 3781, WPS3781, December 2005.

delays, higher project costs, and reduced revenues. It is imperative that the initial estimate—the one that becomes fixed in the public memory—is accurate and incorporates the risks commonly found in delivering mega-projects. As some agencies have found out the hard way, approving and publicizing an overly optimistic estimate of project costs—or "low-balling" the estimate to obtain initial project approval—becomes a significant liability as the project matures and the cost and schedule grows.

Technical and Management Solutions

Mega-projects are, by definition, very large and technologically complex. They often require complicated and creative technical and environmental planning, to meet the challenges of building in congested urban areas with aging infrastructure. Managing mega-projects is also a subjective, dynamic process, requiring input from many people and groups—often with differing opinions of how the project should proceed. So in addition to developing innovative technical solutions, the transportation agency must also have a highly effective and competent management approach in place to deal with the multitude of stakeholders and interested parties involved.

Mega-projects typically start with a long front-end phase, often taking more than 5 years to complete. This phase is crucial to the project's viability. During this phase, successful projects implement a robust framework for developing and evaluating various proposals and alternatives. Since every mega-project involves some degree of uncertainty, successful managers put strong institutional methods in place from the beginning to deal with uncertainties and the challenges that inevitably develop.

For example, when a state transportation capital improvement program has a mature and robust approach to identifying, evaluating, and selecting transportation projects—a process that includes considering various alternatives, resolving technical questions, engaging stakeholders, and obtaining commitments—that agency tends to be more capable of dealing with uncertainties as they emerge throughout the life of the project.

The agency in charge of a mega-project must be equipped to work in an environment of changing information, with multiple decision makers and locations. It must be able to assess the numerous interactions of scope, cost, time, quality, and risk that the project involves. It must be nimble and disciplined, capable of creating a strong plan of action and changing tactics when the need arises. The organizational structure—including internal policies and procedures, technologies, and systems—must be designed with these qualities in mind.

An iterative process to help shape the project at the outset is found in many successful large projects. This process consists of formulating, testing, challenging, and reformulating the project during the front-end project phase. This is particularly useful as the project proceeds, and unforeseen risks and other issues arise

that may require quick attention. For instance, a change in political leadership or public opinion may force an analysis of different alternatives and their solutions, thereby adding cost and time to the project. It is useful if the management team has already considered many alternatives and variations on their plan from the start.

Another key to the successful completion of a mega-project is the development and implementation of an integrated project management plan (PMP)—the road-map for the entire project. A properly designed PMP is essential to planning a project well and keeping it on track throughout its lifetime. The PMP lays out the project in great detail, addressing all the important aspects of a successful mega-project: funding, risk identification and mitigation, schedule, contingencies, cost control, environmental management, quality, safety, and communications. The PMP should be a living document—as the project progresses and matures, the PMP should mature, becoming more complete and more detailed. Each project is unique and includes unique challenges, so each PMP must be unique. It cannot be cribbed from a similar mega-project.

Political Support

All levels of government—federal, state, and municipal—will be involved with a mega-project to some degree, and each government group will bring its own concerns and regulations to the table. In particular, the public sector puts near-constant pressure on project managers to minimize or eliminate—both during and after construction—disruption to the local and regional economy, environment, and quality of life.

A mega-project's success is predicated on having a strong project sponsor. Without a local champion, a mega-project is unlikely to succeed. The right project sponsor will have the ability to integrate the business, technical, and political aspects of the project; competency in coalition-building; the ability to evaluate complex systems from multiple perspectives; the ability to marshal resources to support the long development and execution phases of the project; and the will to cancel a seriously flawed project.

A change in the political landscape can greatly influence the performance of a mega-project. Support for it—or an alternative—can waver as political leaders and trends change. To protect against this, the managers of the mega-project must be abundantly willing to build consensus among the key decision makers wherever possible—whether on bolstering economic viability, maintaining mobility, increasing public safety, or achieving environmental sustainability. The goal must always be to proceed with the mega-project by reconciling any differences in opinion.

Scrutiny of mega-projects by the public sector should be intensive. An effective sponsor can help create transparency in the costs, schedules, and other data and information related to the project. This scrutiny and transparency goes a long way

toward ensuring that the project will meet the public's—and key stakeholders'—expectations. Bringing stakeholders with diverse perspectives into the scrutiny and review process can also help accomplish this. Independent external reviews have been used successfully by transportation agencies to strengthen and validate a project's performance.

Lastly, a key discriminator of successful mega-projects is the development of coalitions within a network of the various stakeholders. Every project involves a large body of stakeholders and allied groups—each with their own perspectives and interests—which can and will influence performance and outcomes. In most mega-projects, there will be federal, state, and local governmental bodies, special interest groups, industry groups, and the general public—all eager to be involved in development and execution. Some individuals will belong to multiple stakeholder groups. Some of the groups and individuals will be associated with the project through formal channels of communication, while others will be connected through an ad hoc or informal association. The mega-project community is a dynamic, vital social network, and its importance to the success of the project cannot be overstated. It can help shape the success of the mega-project, and it can bring it crashing down. Effectively developing relationships with the stakeholders—by managing their expectations and addressing their concerns throughout the duration—is key to the mega-project's success.

REVIEW METHODOLOGY

Our approach was to evaluate the viaduct and SR 520 projects against the characteristics set forth above. To do that, we convened periodically over the course of 3 months, from June through August 2006, to evaluate the project proposals from the Washington State Department of Transportation (WSDOT). At each convening, panel members attended open hearings to receive information from the staff of WSDOT and other stakeholders, including local elected officials, interest groups, and private citizens. In addition, we met with and received documentation from members of the Washington State Legislature, including the Speaker of the House and some members of the Puget Sound delegation. We also held numerous working group sessions to review and analyze specific study-related issues. As required, panel members received advice and evaluation of technical matters from technical advisors assigned to the panel.

We concentrated our review on the finance plans and the implementation plans for obtaining state and local permits and mitigation approvals for the primary alternatives for each project. For the viaduct project, the primary alternatives are a new, elevated structure and the tunnel. For the SR 520 bridge project, the primary alternatives are the four-lane and six-lane designs. (See Appendix A for an overview of the viaduct project and Appendix B for an overview of the SR 520 project.)

REPORT ORGANIZATION

The remaining chapters of this report contain the heart of our assessment. Chapter 2 contains our review of the finance plans. Chapter 3 examines the implementation plans. Chapter 4 presents our overall conclusions. The appendixes contain background information.

Chapter 2
Finance Plan

One of our two major requirements was to assess the soundness of the finance plans for the viaduct and SR 520 projects. To meet this requirement, we reviewed the cost estimates and examined the assumptions underlying those estimates. We then reviewed the funding projections and the assumptions underlying them.

COST ESTIMATES

We reviewed cost estimates prepared in 2005 for both projects.[1] In our assessment of the underlying assumptions of those cost estimates, we examined two factors: the basis of the cost estimates and the treatment of the uncertainty associated with them. We reviewed the basis of the cost estimates in terms of the sources, relevance, and quality of the data used by the cost estimators. We reviewed the treatment of the uncertainty in terms of the soundness of the methodology and modeling used by the risk analysts.

Viaduct Project

The estimated total project cost ranges for the viaduct project alternatives are displayed in Table 2-1.[2] For the elevated structure alternative, the estimated costs range from $2 billion to $2.4 billion for the "core" project; and $2.6 billion to $3.1 billion for the full project.[3] For the tunnel alternative, the estimated costs range from $3.0 billion to $3.6 billion for the core project; and $3.7 billion to $4.5 billion for the full project.

Table 2-1. Viaduct Project Cost Estimate Range ($ billions)

Alternatives	Core project	Full project
Elevated structure	2.0-2.4	2.6-3.1
Tunnel	3.0-3.6	3.7-4.5

Source: October 2005 Cost Evaluation Validation Process (CEVP) estimate.

[1] We did preview the preliminary results of the 2006 Cost Evaluation Validation Process update. However, those results were not finalized and released to the public by the time we published this report.

[2] The range represents the 80 percent confidence interval for each estimate. In other words, the estimators are confident that there is only a 10 percent likelihood that the true cost will be less than the lower bound value, and a 90 percent likelihood that the true cost will be no greater than the upper bound value.

[3] See Appendix A for a description of the viaduct alternatives.

SR 520 Project

The estimated total project cost ranges for the SR 520 project alternatives are displayed in Table 2-2.[4] For the four-lane base alternative, the estimated costs range from $1.7 billion to $2 billion. For the six-lane alternative, the estimated costs range from $2.3 billion to $2.8 billion.

Table 2-2. SR 520 Bridge Project Cost Estimate Range ($ billions)

Alternatives	Base project
Four-lane	1.7-2.0
Six-lane	2.3-2.8

Source: October 2005 CEVP estimate.

Assessment

We found the bases of the cost estimates generally sound, in view of each project's level of design maturity. The cost estimators for both projects based their estimates primarily on unit cost factors (such as the cost per linear foot of guardrail) derived from relevant historical data and applied professional judgment. Moreover, the estimators developed the uncertainty distributions associated with those cost estimates through WSDOT's Cost Evaluation Validation Process (CEVP). This process is a quantitative risk analysis technique that uses Monte Carlo simulation as a means of incorporating uncertainty in the estimating process.

We accept the premise that CEVP, if properly applied, provides a valid methodology for evaluating the variability of cost and schedule predictions due to risks and opportunities. Moreover, we recognize that results are dependent on the underlying assumptions. Thus, if each risk or opportunity factor is entered in the model using a realistic probability (or uncertainty) distribution of all possible occurrences, the CEVP results should reasonably represent the range of probable outcomes.

We also recognize that the mere identification of risks is a useful side benefit of CEVP. This side benefit has allowed the project teams to begin developing their rather comprehensive and useful risk management plans in the earliest stages of the projects' development. Consequently, we commend WSDOT for adopting this relatively sophisticated technique and integrating it into the cost estimating process.

[4] See Appendix B for a description of the SR 520 alternatives.

While we believe that the process that has been used to develop the cost estimates is valid and appropriate, we identified three concerns. The first, based on our spot checks of both projects' cost estimating documentation, is that some of the estimates appear overly optimistic. In some cases, we thought the estimates for additional costs and schedule impacts for some of the identified "risks" were not great enough. Similarly, we thought that the estimates for cost savings from some of the identified "opportunities" were too great.

A second concern involves the ranges of costs derived from the CEVP models for both projects. Those ranges are unreasonably small—in other words, overly precise—for what would be expected for this stage in the project's design life. Industry guidelines,[5] supported by practical experience, lead us to expect the ranges to be no more precise than about plus or minus 25 percent about the mean—and, perhaps, closer to plus or minus 35 percent. Thus, we are concerned that the cost ranges may be underestimated.

We identified several possible reasons for the narrowness of the range. One possible reason involves the apparently optimistic estimates of some of the opportunities and risks. Another possible reason involves the modeling of the opportunities and risks. WSDOT has done a good job developing the CEVP process for evaluating opportunities and risks, but some of the models are not accounting fully for the interrelationships between the risk (or opportunity) factors and the associated base cost factors. We understand that WSDOT is aware of this problem and is working to refine its models to more accurately reflect these real-world relationships.

A third area of concern—and one that is perhaps more significant—involves the treatment of price escalation (inflation). The CEVP process applies an average annual inflation rate of 2.4 percent, as prescribed by WSDOT for all projects statewide. This rate, as we understand it, is based on historical averages. We appreciate the underlying premise for the WSDOT policy of prescribing a fixed price escalation rate for cost estimating purposes. Many other agencies and companies do the same thing, and it has generally worked in prior years when inflation was more stable. Yet a fixed rate, based on historical norms, very likely will not reflect today's reality. Our conversations with economists and senior staff at the Association for General Contractors and the American Association of State Highway Transportation Officers suggest that this practice is becoming a nationwide problem that typically leads to an underestimation of costs.

We have also learned from those same conversations and from recent research performed by our technical advisors that in response to this problem, many agencies and private firms have abandoned their practice of assuming a fixed rate based on historical norms. Instead, they are using quantitative risk techniques similar to WSDOT's CEVP to consider the uncertainty associated with forecasting construction inflation rates. Moreover, those forecasts are ranging in the 6 to

[5] American National Standards Institute (ANSI) Standard Z94.0 and Association for the Advancement of Cost Engineer (AACE) International Classification Standards.

10 percent range. WSDOT is also aware of the inflation issue, and we understand that it is considering changes in its estimates to address these realities.

None of our concerns constitutes a fatal flaw in the cost estimate. Indeed, WSDOT is fully aware of our concerns and is actively addressing them.

Observations and Recommendations

While it was not within our charge to review the base cost estimate, we did review the process used to develop it. Based on that review we offer the following comments that are relevant to both projects.

- It is important to keep in mind that a cost estimate is an opinion about probable costs. At the early stage of design in a construction project, such as the current stage of both the viaduct and SR 520 projects, one would expect a cost estimate to have a relatively broad range—given that many of the details of the design have yet to be developed. Consequently, cost estimates derived at this stage are useful primarily for evaluating competing alternatives, but not for budgeting and funding purposes. In the case of these projects, we believe that the cost estimates are appropriate for selecting an alternative, provided they properly represent the full range of risk results.

- We recommend that a team of individuals with relevant construction and cost engineering experience validate the constructability of the design and reasonableness of the base cost estimate. We also recommend that the proposed review team perform a separate assessment of unit price and cost variability on the base cost estimate. It then should use the CEVP process (or an equivalent quantitative risk analysis methodology) to incorporate uncertainty and escalation. WSDOT should consider performing this review at the 15–20 percent project design stage.

FUNDING PLANS

We assessed the reasonableness of the assumptions underlying each project's funding plans. To do that, we relied not only on our collective judgment, but also on judgments of current and former senior government officials and staff familiar with federal budgeting, and others with relevant expertise in state and local public finance.

In the following subsections, we first summarize each project's funding projections. We then assess each funding component of those projections: secured; anticipated; and other.

Viaduct Project Funding Projections

Table 2-3 summarizes funding sources and amounts identified in the Viaduct's finance plan. The secured funding amounts appear as single values, while anticipated funding amounts (and sums of secured and anticipated amounts) appear as ranges from minimum to maximum. The funding differs for the two alternatives because of the different amounts of tax rebate funds that are potentially available for the each alternative.

Table 2-3. Summary of Secured and Anticipated Funding for the Viaduct Project ($ millions)

Categories of funding considered in the finance plan	Amount for the elevated structure alternative	Amount for the tunnel alternative
Secured	2,416	2,416
Anticipated (minimum-maximum)	32-1,805	32-2,617
Total funding available to cover the estimated core cost (minimum-maximum)	2,448-4,221	2,448-5,033

We discuss each of the funding sources below.

SECURED FUNDING

Table 2-4 shows the secured funding sources.

Table 2-4. Secured Funding Sources and Amounts for the Viaduct Project ($ millions)

	Source	Amount
Federal	TEA-21 earmarks and formula funding	19
	U.S. Army Corps of Engineers (Water Resources Development Act)	0.5
	SAFETEA-LU earmarks	198
State	Pre-2003 funding	4
	2003 Nickel Package	177
	2005 Transportation Partnership Account	2,000
Regional	Puget Sound Regional Council STP grant	1
Local	City of Seattle	16
Total secured funding		2,416

In the secured funding category, the finance plan identified a total of $2,416 million. The three federal sources of earmarks and formula funding comprise just over $200 million. We find it is reasonable for the project to count on these sources.

Three state sources from previous state legislation supply a total of nearly $2.2 billion. The largest of these is the 2005 Transportation Partnership Account (TPA) package: $2 billion, which accounts for 84 percent of total secured funding. This source is not "firmly" secured; in November 2006, voters may have the opportunity to consider repealing the weight fees and other transportation taxes also included in the TPA package.

However, even if the repeal is successful and a portion of the TPA funding is denied, it is likely that there would still be enough funding in the TPA package to finance the $2 billion target amount. Thus, we find the assumed ranges of state secured funding reasonable for this stage of the project's maturity.

The regional and local sources are the Puget Sound Regional Council and the city of Seattle. The finance plan identified about $17 million from these two sources. We find it reasonable to assume those funds will be available for the project.

ANTICIPATED FUNDING

Table 2-5 shows the anticipated funding sources, and recognizes that some revenue sources will be available only for the tunnel alternative.

Table 2-5. Anticipated Funding Sources for the Viaduct Project ($ millions)

Source		Maximum funding for the elevated structure	Maximum funding for the tunnel
Federal	Future transportation funding reauthorizations	280	280
	Emergency relief funding	60	60
	U.S. Army Corps of Engineers: Water Resources Development Act	200	200
Regional	RTID[a] ballot measure	800	800
	Tolling	150	150
	Sales tax rebate	115	177

Table 2-5. Anticipated Funding Sources for the Viaduct Project ($ millions)

Source		Maximum funding for the elevated structure	Maximum funding for the tunnel
Local (City of Seattle and Port of Seattle)	Open space and other funding	0	80
	Transportation funding	0	20
	Public utilities	0	400
	Local improvement district	0	250
	Capital improvement plan	200	200
Total anticipated funding		1,805	2,617

[a] Regional Transportation Improvement District.

Federal Sources

The funding plan identifies three anticipated federal sources: future reauthorizations with a maximum amount of $280 million; emergency relief funding with a maximum amount of $60 million; and funding under the Water Resources Development Act with a maximum amount of $200 million.

Given the current political climate in Washington, DC, to reduce the deficit and finance the war in Iraq, plus the increased scrutiny of congressional budget earmarks, we expect an overall reduction in transportation funding. This expectation is based not just on intuition, but also on discussion with former and current senior federal officials and recent testimony by senior officials of the Department of Transportation, Department of Treasury, and the Congressional Budget Office. Those officials presented a consistent forecast: a reduction in the Highway Trust Fund of $2.3 billion by 2009 for projects nationwide.

While it is likely Congress will take some actions with respect to the Trust Fund, we recognize that it is very hard to predict those actions. Nonetheless, we find it unreasonable to plan on receiving the maximum amounts from the three anticipated federal sources. In our judgment, it would be more reasonable to expect no more than about $100 million from future reauthorizations; no more than $60 million in emergency funding, depending on current testing under way; and no more than $150 million in funding under the Water Resources Development Act.

Regional Sources

The regional sources account for the largest share (50.5 percent) of the anticipated funding category. There are three anticipated sources: the Regional Transportation Improvement District (RTID), tolling, and sales tax rebates. The RTID funding is targeted at up to $800 million and is subject to voter approval in November 2007.

We confirmed with RTID staff that the $800 million target is in the January 2006 RTID plan, *The Blueprint for Progress*.

The anticipated revenue from tolling is as much as $150 million dollars. This amount is about $60 million more than the amount projected in an earlier WSDOT tolling study. WSDOT explains this difference by noting that the tolling study was focusing on traffic control, not revenue generation. Moreover, the traffic models used in the $150 million estimate took a more comprehensive view of the tolling potential than did the models used in the earlier tolling study. We find the project team's rationale reasonable.

The sales tax rebate is targeted at as much as $177 million for the tunnel alternative and $115 million for the elevated structure alternative. We are skeptical that this is a viable source for the project, given that the sales tax revenue is directed into the state's general fund, and it is unclear whether the language incorporated into the RTID legislation will be interpreted as broadly as the finance plan assumes.

We recognize that it is unlikely that all of the anticipated funding will be realized. Yet, we do find it reasonable for the project to assume that the maximum RTID target of $800 million is feasible, and that the maximum revenues from tolling could be as much as $150 million.

Local Sources

Essentially, there are three anticipated local sources. One is the city of Seattle. The city pledged, in an open hearing with this panel, $500 million for the tunnel alternative, but not for the elevated structure alternative. Thus, we believe it is reasonable to assume the viaduct project would receive up to $500 million from the city, should it choose to pursue the tunnel alternative.

Another source, again only for the tunnel alternative, is the envisioned local improvement district that Seattle would intend to create in the vicinity of the tunnel. The maximum anticipated amount is $250 million. Property owners in this local improvement district would in essence finance this amount via assessments to the increased value to their properties resulting from the construction of the tunnel. We find this a reasonable assumption.

A third source is the Port of Seattle. The anticipated amount is a maximum of $200 million, which is earmarked for either alternative, tunnel or elevated structure. Given the added value the viaduct project will yield the port, we find it reasonable to assume $200 million from the port.

Other Funding Sources

The finance plan identified three potential "other funding" sources, but did not quantify a dollar amount or range available from them:

- Public-private partnerships—state level
- City of Seattle—general fund (tunnel only)—local level
- Tax increment financing—local level.

The finance plan noted that "the likelihood of attracting a private partner to bring additional equity investment (capital funding) to the project is currently very low." While this assessment may have been true in the past, there is a growing national interest in this area. We believe that WSDOT should aggressively pursue this option.

The second potential funding source identified in this category is Seattle's general fund (available for tunnel alternative only). For the tunnel alternative, there is a possibility to share the Seattle general fund's annual allocation of more than $650 million with many other competing uses, such as arts, culture and recreation, and health and human services. While this would force the city to make difficult choices, it is at least possible to use this source of funds to make up shortfalls from other sources.

The third potential funding source identified in this category is tax increment financing. This is a technique used in some other states for capturing a portion of rising property tax receipts to help fund redevelopment and community improvement projects. Currently, tax increment financing is generally not an option in Washington due to constitutional restrictions. However, the finance plan noted that, even if the tax increment financing becomes a viable option, "tax increment financing does not appear to be especially beneficial compared to other value capture alternatives such as a local improvement district," which was already included in the anticipated funding category.

Overall, we find it reasonable to identify these three sources as potential "other" funding sources. We urge WSDOT to continue pursuing them aggressively in case additional funding is needed.

Summary of Observations on Funding Plan for Viaduct Project

The viaduct project premised its finance plan on $2.4 billion of secured funding and a maximum of $1.8 billion to $2.6 billion anticipated funding for the elevated and tunnel alternatives, respectively. We find that premise reasonable, even if somewhat optimistic for a few of the funding sources. This optimism lies in the assumptions that federal funding from routine reauthorizations will be forthcoming and that the project will receive the transfer of state sales tax. Nonetheless, we accept the project's funding assumptions as reasonable.

Our estimates of the reasonable maximum funding levels for each major source category are shown in Table 2-6.

Table 2-6. Panel's Estimates of Reasonable Maximum Funding Sources and Amounts for the Viaduct Project ($ millions)

Source		Maximum funding for the elevated structure	Maximum funding for the tunnel
Secured			
	TEA-21 earmarks and formula funding	19	19
Federal	U.S. Army Corps of Engineers (Water Resources Development Act)	0.5	0.5
	SAFETEA-LU earmarks	198	198
	Pre-2003 funding	4	4
State	2003 Nickel Package	177	177
	2005 Transportation Partnership Account	2,000	2,000
Regional	Puget Sound Regional Council STP grant	1	1
Local	City of Seattle	16	16
Total secured funding		2,416	2,416
Anticipated			
Federal	Future transportation funding reauthorizations	100	100
	Emergency relief funding	60	60
	U.S. Army Corps of Engineers: Water Resources Development Act	150	150
Regional	RTID ballot measure	800	800
	Tolling	150	150
	Sales tax rebate	0	0
Local (City of Seattle and Port of Seattle)	Open space and other funding	0	80
	Transportation funding	0	20
	Public utilities	400	400
	Local improvement district	0	250
	Port of Seattle Capital improvement plan	200	200
Total anticipated funding		1,860	2,210
Total potentially available funding		4,276	4,626

While the panel finds it reasonable to assume that the maximum RTID funding and the tolling revenues could be realized, we do not think the project should

count as "firm" any funds from a sales tax rebate. In addition, it is important to note that the RTID funding is critical to the funding plan for the project.

SR 520 Project Funding Projections

Table 2-7 summarizes the funding sources and amounts identified in the SR 520 project finance plan. We discuss each of the funding sources below. The funding differs for the two alternatives because of the different amounts of tax rebate funds potentially available for each alternative.

Table 2-7. Summary of Secured and Anticipated Funding for the SR 520 Bridge Project ($ millions)

Categories of funding considered in the finance plan	Amount for the four-lane alternative	Amount for the six-lane alternative
Secured	573	573
Anticipated (minimum-maximum)	710-3,039	710–3,093
Total funding available to cover the estimated project cost (minimum-maximum)	1,283–3,612	1,283–3,666

SECURED FUNDING

Table 2-8 summarizes the secured funding sources.

Table 2-8. Secured Funding Sources and Amounts for the SR 520 Bridge Project ($ millions)

Source		Amount
Federal	TEA-21 Formula Funding	6
State	Pre-2003 funding	12.5
	2003 Nickel Package	52
	2005 Transportation Partnership Account	500
Regional	RTA Sound Transit	1.5
	Puget Sound Regional Council STP grant	1
Local	City of Seattle	0.25
Total secured funding		573

In the secured funding category, the finance plan identified a total of $573 million. The federal funding source of formula funding totals just over $6 million. We are satisfied that it is reasonable for the project to count on this sum.

There are three state sources from previous state legislation providing a total of about $565 million. Of these, the largest is the state's 2005 TPA package ($500 million, which accounted for 91 percent of total secured funding). This source is not "firmly" secured; in November 2006, voters may have the opportunity to consider repealing the weight fees and other transportation taxes also included in the TPA package.

However, even if the repeal is successful and a portion of the TPA funding is denied, it is likely that there would still be enough funding in the TPA package to finance the $500 million target amount. Thus, we find the assumed ranges of state secured funding reasonable for this stage of the project's maturity.

The local source is the city of Seattle. It pledged $250,000, which has already been applied to the project.

ANTICIPATED FUNDING

Table 2-9 provides a summary of the anticipated funding sources.

Table 2-9. Anticipated Funding Sources for the SR 520 Bridge Project ($ millions)

Source		Maximum funding
Federal	Future transportation funding reauthorizations	40
State	6.5% Washington State sales tax transfer (four lane–six lane)[a]	99-153
Regional	RTID ballot measure (Jan. 2006 RTID plan proposed allocation)	800
	RTID ballot measure (ESHB 2871 funding proposal)	1,400
	SR 520 tolling	700
Total anticipated funding		3,039-3,093

[a] Sales tax will be different for the four-lane and six-lane options, since project costs are different for the two alternatives.

In the anticipated funding category, the finance plan identified a maximum of $3,093 million in potential funding from federal, state, and local sources.

Federal Sources

The funding plan anticipates as much as $40 million in funding from future federal legislation authorizations. Given the political climate in Washington, DC, and the overall reduction of the Highway Trust Fund, this number may be optimistic. However, it is reasonable to view the $40 million as a maximum potential amount.

State Sources

The funding plan anticipates nearly $153 million from a transfer of the state's sales tax revenue to the project. We are skeptical that this source is viable, given that sales tax revenue is typically earmarked for the state's general fund.

Regional Sources

The bulk of the anticipated funding is envisioned to come from RTID funding and tolling revenues. The RTID funding comprises two anticipated allocations. One is for up to $800 million for the six-lane alternative. The RTID itself identified this sum as its target allocation for the SR 520 project.[6]

The other anticipated RTID allocation is for as much as $1.4 billion. We are skeptical about the viability of this funding source, given that—unlike the $800 million target just mentioned—the RTID has not allocated or earmarked this sum for the SR 520 project. On the contrary, the RTID has allocated that $1.4 billion to other regional projects in the three-county area.

The RTID funding, whatever the final amount proposed for the project, is subject to voter approval in November 2007.

The finance plan anticipates that the state will look to establish tolling to raise the $700 million in revenue from tolling the SR 520 bridge. The 2004 *SR 520 Toll Feasibility Study* tends to support the potential for attaining the $700 million target. We find it reasonable to count on as much as $700 million in tolling revenue.

OTHER FUNDING SOURCES

The finance plan identified three potential funding sources, but did not quantify a dollar amount or range available from any of them. According to the plan, "the reasons why dollar ranges have not been assigned to the "other" funding sources include low probability of funding, insufficient information available, and/or limited applicability to the project."

[6] In its January 2006 plan, "The Blueprint for Progress", the RTID proposes to allocate $800 million to the SR 520 project. This proposed allocation was confirmed by RTID staff during a July 19, 2006, meeting with the Panel.

The three potential funding sources presented in the "other" funding category are:

- I-90 toll revenue—state level
- Public-private partnerships—state level
- Sound Transit 2—regional level.

The first candidate for potential funding source in this category is I-90 tolling. However, the finance plan indicated that no I-90 toll funding is assumed at this time.

The second candidate for potential funding in this category is public-private partnerships. As we found with the viaduct project, more study is needed in this area, and we suggest that WSDOT aggressively pursue this potential funding source for this project because of its relatively high revenue potential.

The third candidate for potential funding in this category is the Sound Transit 2 investment plan. The finance plan contends that Sound Transit 2 may contribute a modest investment in the SR 520 project. However, its investment plan has not yet been finalized, and any such contribution would be subject to passage of the 2007 ballot measure.

Overall, we find it reasonable to identify these three sources as potential "other" funding sources. We urge WSDOT to continue pursuing them aggressively.

Summary of Observations on Funding Plan for SR 520 Project

Overall, we find it unreasonable for the SR 520 bridge project to assume that it will realize sufficient funding from secured and anticipated funding sources. We doubt that the $153 million in anticipated sales tax revenue will be transferred to the project. We have assumed that only the six-lane alternative, if selected, will receive RTID ballot measure funding of $800 million, because it is the only alternative that provides for increased traffic capacity. Moreover, we find no basis to believe that any of the second increment of RTID $1.4 billion funding target will be available to the project.

Our estimates of the reasonable maximum funding levels for each major source category are shown in Table 2-10.

Table 2-10. Panel's Estimates of Reasonable Maximum Funding Sources and Amounts for the SR 520 Bridge Project ($ million)

Source		Maximum Funding	
		Four-lane	Six-lane
Secured			
Federal	TEA-21 Formula Funding	6	6
	Pre-2003 funding	12.5	12.5
State	2003 Nickel Package	52	52
	2005 Transportation Partnership Account	500	500
Regional	RTA Sound Transit	1.5	1.5
	Puget Sound Regional Council STP grant	1	1
Local	City of Seattle	0.25	0.25
Subtotal		573	573
Expended		–21	–21
Total secured funding remaining		552	552
Anticipated			
Federal	Future transportation funding reauthorizations	40	40
State	6.5% Washington Sales Tax Transfer	0	0
Regional	RTID ballot measure June 2006 Plan	0	800
	RTID ballot measure ESHB Funding Proposal	0	0
	Tolling	700	700
	Total anticipated funding	740	1,540
Total potentially available funding		1,292	2,092

SUMMARY OF OBSERVATIONS ON FINANCE PLANS

We commend *all* parties for their contributions of energy and thoughtfulness toward funding these two critical transportation problems in the Puget Sound region. The existing viaduct and SR 520 bridge are vulnerable to seismic destruction and storm damage. The speedy replacement of these facilities is therefore critical to the statewide transportation network and the Puget Sound region. Up until now, a wide range of concerns, and sometimes mutually exclusive opinions, have been expressed by parties seeking the best possible solutions.

However, it is now time for decisions, common purpose, and action. That's because the consequence of delaying decisions and not taking action is that inflation

could rapidly cause project costs to increase to an unaffordable level. A conservative estimate of the impacts of inflation for both the viaduct and SR 520 projects is that delay could easily cost $30 million per month. Thus, in a relatively short time the additional costs of inflation would dwarf the current difference between each project's alternatives.

In the case of the viaduct project, we believe that the funding sources identified by the state and the city are reasonable. The anticipated sums may be optimistic in some categories, but overall the finance plan provides a reasonable framework for funding the core project for either of the reviewed alternatives.

In the case of the SR 520 bridge project, we believe that the identified funding sources, both secured and anticipated, fall far short. This shortfall is of particular concern, given the impacts to regional circulation if the structure should fail. The lack of alternative routes makes it essential to fully fund the solution chosen for SR 520 bridge alternative.

In order to meet the goal of developing a financially viable package for both of these projects, we have recommendations related to costs, funding responsibilities, and funding sources.

Recommendations related to costs:

- As previously noted, we understand that WSDOT is reviewing its cost estimating and risk evaluation processes for both the viaduct and the SR 520 projects. We expect that the resulting refinements will produce a set of cost estimates and a range of uncertainties that are sufficient for making decisions on project alternatives. We caution the decision makers not to expect the range of estimates developed at this stage to accurately represent the final project cost. In order to reach such numbers for these types of projects, where so much of the cost depends upon the development of a construction approach, a more detailed "construction-type" cost estimate should be prepared, which should be done after an alternative has been selected. We do not believe that further cost estimating is needed in order to select a preferred alternative.

- In the implementation section (Chapter 3) we have identified several early action items that are appropriate to pursue while decisions on preferred alternatives are being made (such as seawall replacement and utilities relocation). These actions will speed up the successful completion of both projects, reduce costs related to inflation, and reduce the risk of a natural calamity.

Recommendations related to funding responsibilities:

- We understand that in order to coalesce stakeholder opinion on the relative cost of these projects vis-à-vis other demands for public funds, it is necessary to identify the probable costs and realistic funding sources that could be used to finance these projects.

  Notwithstanding the concerns we expressed earlier regarding the impacts of inflation and the narrow range of the current CEVP analysis, we believe that there is adequate funding identified to fund either viaduct option at the mean (50 percent probable) cost, but *not* the 90 percent probable cost. As WSDOT and the city select an alternative and move through preliminary design, we suggest that they continue to reduce project costs by aggressively managing project risks and by seeking appropriate revisions in design guidelines. At this stage of the design process, the panel believes that the financing framework should use a target cost that is dependent upon the robustness of the CEVP evaluation and the nature of its inflation estimates. We recognize that this might not be the 90 percent confidence level.

  After selecting each project's design alternative, we recommend that the design team advance the design to a level of approximately 15–20 percent, at which time it would be appropriate to conduct a detailed constructability review to identify construction methods, traffic handling, and mitigation. Budgets can then be established in accordance with our above recommendations on the financing framework.

- Once WSDOT selects a project's preferred alternative, it should begin value engineering.

- As each project's design moves forward to around 15 to 20 percent complete, WSDOT should begin developing the project's preliminary finance plan. We acknowledge that the development of a preliminary finance plan at the 15 to 20 percent design development stage is earlier than those types of plans are normally developed. Yet, because of the magnitude and complexity of each project, we think that it is a prudent time to begin preliminary plan development.

- The costs to improve the viaduct and SR 520 so that they can be relied upon to safely serve the public at their current capacity should be the responsibility of the state. In addition to basic project costs, this includes upgrades for traffic and seismic safety, Battery Street Tunnel improvements, and appropriate mitigation for both construction and operational impacts to the community. If this amount exceeds the current state authorization, the Legislature should act to provide additional funding.

- The costs resulting from design features incorporated into the viaduct project that improve the Seattle waterfront should be the responsibility of the city and other beneficiaries. This includes the costs for any alternative (for example, a tunnel) that exceed the full cost required to replace the current facility.

- The costs for increased traffic capacity should be the responsibility of the region, which would include RTID, the port, or others. For the viaduct project, this includes improvements at the south end, such as new bridges over the railroad tracks and a new aerial interchange near the stadiums at South Atlantic Street and South Royal Brougham Way. For the SR 520 project, this includes the additional cost of a six-lane alternative—which provides high-occupancy vehicle (HOV) capability—over that of a four-lane replacement alternative, the Pacific Street Interchange, expanded capacity of the existing Montlake Interchange, and a second bascule bridge over the Montlake Cut.

- The cost of replacing the seawall on the viaduct project should be the responsibility of the state, the Port of Seattle, and the city, subject to contribution from the U.S. Army Corps of Engineers (USACE).

- The costs necessary to relocate public and private utilities should be handled consistent with existing policy by the state and the utility (ratepayers), irrespective of the design alternative selected.

Recommendations related to funding sources:

- The state responsibility may be funded from federal highway funds (TEA-21, and SAFETEA-LU), the 2003 Nickel Package, the 2005 TPA, sales tax rebates, or any supplemental authorizations necessary to meet the total amount required.

- The regional responsibility may be funded from Port of Seattle contributions, Sound Transit, the Puget Sound Regional Council (PSRC), and funds resulting from RTID ballot measures.
- The city responsibility may be funded by city-owned utilities, a local improvement district, the general fund, tax increment financing, or any other source available to local government.
- Any funds resulting from the use of public-private partnerships should be attributed to the jurisdiction that creates the revenue stream used to fund the public-private partnership.

As the design progresses—and as cost estimates are updated with more realistic estimates of the impact of inflation—it would be wise to consider what to do if additional funds are not available to cover the anticipated shortfall:

- Because cost estimates for such projects are not guaranteed, changes may occur during construction. In order to ensure adequate funding for project completion, we recommend that all the stakeholders reach agreement on how such cost increases should be allocated.

- For both projects we suggest that cost savings are possible, and can be achieved through a continued effort by all parties to refine the project scope and design guidelines using good judgment.

- The finance plan noted that "the likelihood of attracting a private partner to bring additional equity investment (capital funding) to the project is currently very low." This assessment may be correct, but there is considerable national interest in this area, and we believe that WSDOT should aggressively pursue this possible source.

  As stated by Mary Peters, former director of the Arizona Department of Transportation and former administrator of the Federal Highway Administration, in her keynote address at a recent transportation conference:

  > America's transportation infrastructure offers attractive long-term investment opportunity, especially for patient investors, such as pension funds. There is significant untapped investment opportunity in the transportation asset class, and that fact is apparent not only to Spanish and Australian firms like Cintra and Macquarie. Credit Suisse/GE, Carlyle Group, JP Morgan, Goldman Sachs, Merrill Lynch, Citigroup, Morgan Stanley, and UBS have either announced interest in or have established infrastructure investment asset portfolios. These firms recognize the potential to monetize the economic value of infrastructure and obtain a steady cash flow from revenue producing assets. While these tools will not be the right solution for every infrastructure project, diversifying the funding base through public private partnerships can lessen the dependence on current fiscal circumstances.

  Moreover, the Wall Street Journal recently observed that our nation will see much more private investment in roads, water systems, and airports in the future.

  The crucial element for a public-private partnership is a revenue stream. Tolls are one obvious candidate, but there are also other possibilities. For example, right of way often represents a significant portion of the cost. If the new alignment frees up existing roadway right of way, however, landowners may be willing to swap or donate property.

Chapter 3
Implementation Plan

Our second major requirement was to assess the implementation plans covering state and local permitting, design, and mitigation approvals. To meet this requirement, we focused on assessing the soundness and comprehensiveness of the implementation plan scope, schedule, and provisions for managing risk. We also reviewed the strategies for obtaining environmental, design, and other approvals from the various agencies and jurisdictions.

We present our observations and findings in three broad categories: project management, permitting, and design and construction.

PROJECT MANAGEMENT

We began by assessing each project team's ability to successfully execute its implementation plans. The first step was to review the PMPs for both projects and evaluate the completeness and strength of the project management processes, from planning through implementation.

Overview

Both project management plans conform to federal guidance for major highway projects.[1] The Alaska Way Viaduct plan is somewhat more developed than the SR 520 plan, because the project is farther along in the planning phase. Both PMPs are in the draft stage and are expected to be living documents that will evolve and expand as the projects progress from planning through design, construction, and commissioning.

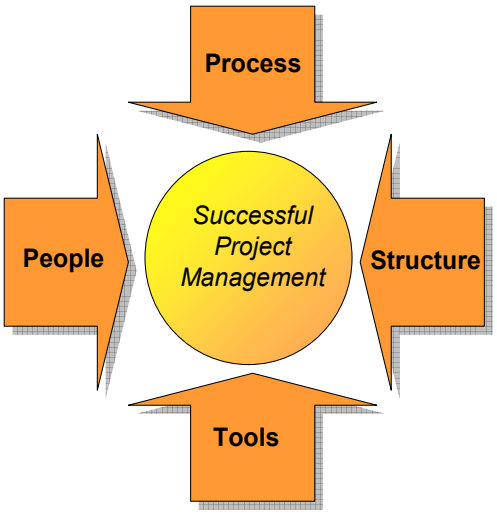
Overall, we find both PMPs to be comprehensive and represent the level of detail necessary for projects of this scale. At the same time, we have some suggestions that we present in the following discussion.

WSDOT manages its projects through a macro-level, five-step process called MPD (Managing Project Delivery). This process is similar to the Project Management Institute's five-step process, which is successfully used across a variety of industries and organizations. We find MPD an appropriate way to manage projects like these. The success of the process depends on experienced staff members who consistently apply a variety of subprocesses and management tools through a defined project organization. As shown in Figure 3-1 below, these building blocks

[1] U.S. Department of Transportation, Federal Highway Administration, *Interim FHWA Major Project Guidance,* January 27, 2006; online at http://www.fhwa.dot.gov/programadmin/mega/012706.cfm#guidance.

are people, process, structure, and tools. We, therefore, evaluated WSDOT's project management approach with respect to these four building blocks. (See Appendix C for our evaluation worksheets for both projects.)

Figure 3-1. Primary Components of Successful Project Management



We highlight below our key observations and findings for each of the building blocks.

People

WSDOT has surveyed other agencies to better understand their best practices and to avoid their pitfalls. One consistent theme has been that successful delivery depends on keeping an experienced agency staff member in the lead on a project—having a "strong owner," rather than assigning delivery responsibility solely to a consultant. To its credit, WSDOT has consistently adhered to this principle.

It is our opinion that both projects have been staffed with experienced people, with the expertise and knowledge to complete these projects. We were consistently impressed with the skill and experience the project team brought to this process. In addition, to support these complex projects, WSDOT is supplemented with engineering consultants who provide additional specific expertise and staff as necessary. All key personnel assigned to the projects, both WSDOT staff and consultants, are co-located to facilitate communication and problem solving.

Process

WSDOT's overall project development process includes a number of subprocesses such as CEVP, design management, and change management. Two processes that are named in the PMPs but not fully developed are quality management and public involvement. Both PMPs note that individual plans will be developed

for quality management and public involvement. Given the magnitude and visibility of both projects, we encourage WSDOT to expeditiously develop and formally implement a quality management plan and a public involvement communications plan for the remaining environmental phase of both projects.

WSDOT's conventional practice may be to reserve a full quality assurance/quality control program for construction, and to limit quality assurance/quality control during the design phase to formal design reviews, but we encourage WSDOT to immediately implement a formal quality management plan for both projects now. We further recommend that the quality management plan have a quality assurance section explaining the overall approach, responsibilities, and quality processes. It should also include a quality control section that details the specific practices and testing to ensure quality standards. If WSDOT has attained ISO 9001 certification in other areas of its business, those practices could be the foundation for developing a quality management plan for the viaduct and bridge projects.

In developing the communications plans, we suggest that both projects adopt two draft components from the communications management section (Section 9) of the SR 520 PMP. These components are a set of metrics for successful public involvement and a set of targeted messages for external communications.

We are impressed with another process outlined in the SR 520 PMP, configuration management. It includes managing, documenting, and gaining approval for changes made to the initial highway configuration and other features related to the highway. We suggest that configuration management become part of the project management approach for both projects.

Earned value management is currently cited in both PMPs. Earned value management provides a rigorous method for determining the cost and schedule status of a project. It appears that both projects intend to manage earned value once they enter the design phase. Considering the magnitude of the expenditures necessary to successfully complete the environmental phase, we suggest that earned value management be implemented now.

In view of the size and complexity of both projects, we recommend performing thorough constructability reviews, by an independent team of construction experts, and value engineering to refine the estimated costs and traffic disruption plans. The level of review we recommend is more rigorous than would normally be expected at this stage in a simpler project, but it is critical to making more informed decisions about the various alternatives here. This review can be part of a sequence of the following events that WSDOT should consider performing between now and July 2007:

- Select the preferred alternative.
- Complete 15–20 percent design.

- Perform a constructability review.
- Develop a preliminary finance plan, based on the 15 percent design.

The CEVP process for risk management is a robust, proven process. As we noted in Chapter 2, we are concerned about optimistic estimates for some risk factors, the unexpected narrowness of the cost estimate range, and the use of a historically based fixed escalation rate to account for construction inflation. Yet, as we also mentioned there, none of our cost estimate concerns rise to the level of a fatal flaw. Moreover, WSDOT is aware of our concerns and is actively addressing them.

Structure

The viaduct project has a well defined organizational structure that includes an active partnership with the city of Seattle and the consulting team. Although the key leaders of the SR 520 team are identified, the staffing levels required for various project phases are yet to be defined in the PMP. For both projects WSDOT is using fully integrated teams, which have great benefits but carry some risks. These partnerships are working well, but roles, responsibilities, and liabilities for each party must be clearly defined and reviewed at every stage of project development.

The draft PMPs begin to define roles and responsibilities. As the matrices of roles and responsibilities are completed, approval authorities for all key decisions must be defined. We also note that the matrices of roles and responsibilities do not go to the level of defining the legal liabilities of each party. Clarity about liability issues needs to be determined up front. One of the lessons learned from other mega-projects is that if roles become unclear over time, a consultant's professional liability can be difficult to assess.

The organizational structure of each project has an Executive Oversight Committee, which includes executive-level leaders from WSDOT and the city of Seattle. Its charge is to provide insight, help resolve issues, recommend solutions, and approve funding decisions. Given the potential construction-related issues that exist for both projects, we recommend that committee membership be expanded to include individuals with extensive experience in managing the construction of transportation mega-projects.

Tools

The foremost management tool available for both projects is a comprehensive and updated PMP. We have already expressed our recommendations for completing the draft PMPs. In addition, WSDOT has sought to provide the management teams for the viaduct and SR 520 projects with "best of breed" project management tools, such as Primavera 5.0 for project scheduling and Expedition for

document control. We agree that these are the appropriate tools to effectively manage these projects.

PERMITTING

In this section we evaluate permitting, both for environmental work and for design and construction.

Environmental

We reviewed the environmental permits likely required for both projects, as well as their associated mitigation strategies, focusing primarily on federal and state regulatory requirements.

Overall, the strategy for obtaining environmental permits and regulatory approvals, and the related approaches to environmental mitigation planning and management, are sound. The draft Environmental Impact Statements for both projects identify useful mitigation strategies and meaningful assumptions. WSDOT's Environmental Permits and Approvals Guide is a good planning document and provides an excellent overview of the environmental permits and regulatory approvals that will likely be required for the project. All of the major permits and regulatory approvals have been identified.

Both project teams appear to be following a number of best practices, including the formation of a Permits Strategy Team, and assigning (and locating) WSDOT staff in the offices of the major applicable environmental regulatory agencies (such as the U.S. Army Corps of Engineers) to coordinate and manage all facets of the permits required. We encourage WSDOT to continue this type of interagency coordination, and to extend it to higher levels of management at each agency and to the Native American Tribes.

However, while all permits have been identified, in many cases agency practice requires sequential permitting. We recommend that these schedule linkages be confirmed within the overall schedule for the project. Some linkages are described in the permits guide as interrelated. For example, some federal permits—especially for Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act—will not be approved until the state Department of Ecology issues the Clean Water Act Section 401 certification. The latter is a critical state certification to obtain, because other necessary permits depend on its approval. Moreover, the complete Section 401 certification process can typically take much longer than the 1 year the Department of Ecology has to officially issue certification once it receives a permit request. These key permits, and a strategy to obtain them in a timely fashion, must be identified early on. Likewise, WSDOT should give special attention to the Department of Transportation Act Section 4(f) review, considering the sensitive nature of the historic and park resources being affected.

In addition, some permits, if appealed, may not take effect until the appeal is fully adjudicated. WSDOT's time line correctly estimates when a particular permit will be issued, although in some cases the risk management assessments underestimate the time frame for appeals. Risk "U28—Appeals to project permits" (Alaskan Way Viaduct and Seawall Replacement Major Risk Events) factors in a 3-month project delay for the appeals process, which may be a relatively short time compared with other projects of this size and scope.

We generally agree that WSDOT's base schedule should be reasonably optimistic, since WSDOT should proactively manage these vital projects toward the earliest completion dates that can be justified. But we recommend that, in some cases, longer delays be included as risks during the CEVP review process. Large projects like these can encounter longer than usual delays, so WSDOT should fully evaluate this risk and prepare for the potential impacts.

We considered whether WSDOT might be able to minimize the risk of permitting delays by seeking legislative changes to the permit and appeal laws. Many government agencies across the country have attempted to streamline this process to expedite important projects, without exempting them from any environmental protections. These efforts have not always been successful, so we are reluctant to recommend any specific changes. Nevertheless, we suggest that WSDOT consider some limited ways to speed up the process:

- Create a consolidated permit process for Seattle's review of the huge number of design and building plans needed for these projects.
- Seek to expand the existing state law (Chapter 43.21L RCW) that consolidates the appeals of certain state permits.
- Seek to revive the amendment to the state Shoreline Management Act (Chapter 90.58 RCW) used to allow the construction of I-90 to proceed while any appeals were pending.

We reviewed the environmental process used for the "special construction site," which will be used to build pontoons for SR 520 and other projects. We agree with WSDOT's process for conducting separate permitting for these two projects, and we concur with the assumption that permitting the special construction site ought to fit within the SR 520 schedule.

To minimize the risk of any delays, however, WSDOT might consider preparing a focused Environmental Impact Statement (EIS) for the special construction site, rather than starting with an Environmental Assessment (EA), because an unfavorable outcome on the Finding of No Significant Impact would require an EIS anyway. In our experience, the level of effort required for an EA on a large project is often similar to that for an EIS. Where this is the case, it can sometimes be less risky to complete an EIS, rather than an EA. We urge WSDOT to consider this approach, if the schedule has sufficient time for EIS reviews. If WSDOT decides

that an Environmental Assessment makes more sense, we urge WSDOT to consider doing one that resembles as closely as possible the functional equivalent of an EIS. This might have the same benefits without the complications.

Although we were not asked to review how WSDOT evaluated individual alternatives, we did review the overall screening process. We are confident that the processes used for both projects were satisfactory. A broad range of alternatives was developed, and the range was reviewed by other agencies and the public. WSDOT then evaluated the alternatives by applying a comprehensive set of factors to each.

Appendix D provides a summary of the potential federal and state environmental permits and environmental laws, project team assumptions, and our specific assessments and comments on those assumptions.

Design and Construction

To evaluate the implementation plans for design and construction approvals, we assessed the approvals process and schedule. Our primary criterion is whether a process is in place to ensure that permit conditions required during project development are incorporated into the project design, contract plans, and specifications, and finally carried out in construction.

We recognize that design and construction permitting and approvals for the viaduct are critical elements to project success. Delays and cost increases resulting from permitting and approval issues—for example, legal challenges to permits and approvals, or disputes over the information required by permitting agencies—may affect project success (in terms of cost, schedule, and expectations).

We determined that the design approvals process is mature for the viaduct project. The design team has developed its concept and logic for design approvals, including proposed changes to the upcoming WSDOT Design Manual. The viaduct project team is also considering risk issues, such as taking steps to reduce schedule risks by obtaining early design decisions.

As with the other components in its project implementation planning, the SR 520 project design and construction plans are still preliminary. We did find, however, many of the same key elements in those plans as we found in the viaduct project.

We were also impressed that both projects are using a permit strategy team. This appears to be an excellent approach for identifying the permits needed, and developing strategies to obtain the required permits and approvals. Moreover, the Viaduct Permits and Approvals Guide appears to be a comprehensive list of potential permits needed throughout the design and construction process. We encourage the SR 520 project to use this guide, too.

We applaud both projects for relying upon the Signatory Agency Committee (SAC)—comprising key federal, state, and local agencies—to create (or help

create) a clear, consistent, and efficient permitting process with a predictable timeline. Having this type of coordinating body for the two project teams is an excellent mechanism for improving communication among key stakeholders and adjudicating issues among the team partners. If managed properly, the SAC should highlight risk issues early in the process and help facilitate expeditious solutions to prevent unnecessary schedule delays and cost increases. For the committee to be effective, each agency will need to commit executive management throughout the life of the projects.

For this stage, we find the planning assumptions adopted by both projects reasonable for obtaining design and construction approvals and permits.

OTHER DESIGN AND CONSTRUCTION ISSUES

In addition to reviewing the implementation plans, we offer the following observations, comments, and recommendations to WSDOT on design and construction issues.

- Construction impacts are unavoidable, but a successful project requires a comprehensive plan to mitigate impacts on business, traffic, noise levels, and so on. We understand that the project team is currently pursuing detailed mitigation plans for traffic, and applaud those efforts. Nonetheless, because the anticipated construction period is so lengthy, the design details must recognize the ongoing requirements of residents, commercial establishments, and industry during construction, and make appropriate provisions for minimizing impacts.

  Using an example from the viaduct project, access to the waterfront is essential for the survival of local business and for the regional economy. Any chosen alternative will need to keep the waterfront accessible to both pedestrians and vehicles during all stages of construction. Rather than waiting until final design, we recommend that WSDOT develop methods during preliminary engineering to maintain access during construction. We are confident that there are construction approaches that would allow continued access to the waterfront.

- Both projects will require schedule flexibility for construction work, in order to minimize project delays and to take advantage of non-rush-hour periods. Examples might include the use of rolling four 10-hour shifts to avoid unnecessary costs for premium time. (The state may need to pass special legislation to allow this approach.)

- In order to reduce construction impact and construction duration, a number of early actions not related to overall construction could be moved ahead. An example would be to build the seawall reinforcement in a manner that will accommodate all alternatives under consideration, as this needs to be done regardless of the alternative chosen. Performing this

work in conjunction with utility relocation could reduce the schedule and thus seismic vulnerability. Once completed it would also improve accessibility to the waterfront for emergency services and the public.

- We believe that when an alternative is selected and the projects advance to preliminary engineering, some design standards and guidelines should be challenged in order to reduce construction costs and impacts.

With respect to the institutional contracting capacity and capability available for both projects, the panel makes the following observations:

- In view of the urgency of these two projects, WSDOT should consider its overall agency resources and the contracting capacity of the region in timing construction of other projects. A confluence of large projects could have significant impacts on bid prices, quality control, and the range of choices in decision making.

- Considering that several individual contracts are expected to be greater than $300 million, in order to promote the greatest competition during the bid process, the state should consider legislation allowing contractors to provide less than 100 percent performance bonding.

- To minimize potential delays due to labor unrest, we recommend that WSDOT implement a project labor agreement for both projects. This approach would also benefit the projects by coalescing support from organized labor.

Chapter 4
Conclusion

We began this report by describing how successful mega-projects are often organized with a focus on three key areas: finance and schedule, project management, and political support. We called this model the "three-legged stool" approach to management, to emphasize the equal importance of all three areas: without a balanced approach, the project could stall and collapse.

Now that we have reviewed WSDOT's plans for rebuilding the Alaskan Way Viaduct and the SR 520 bridge, it is useful to ask: how do these plans measure up to this model?

Given the early stage of the project, WSDOT has made strong progress toward ensuring that all three components are strong, particularly in the area of project management. We have made recommendations for improving the process, including improvements to the cost estimating process, determining cost sharing responsibilities, strengthening the environmental implementation process.

We are concerned about the political fragmentation that seems to characterize these projects today. It is not evident that either political will or public support has coalesced around these projects. We see strongly held opinions and positions by political leaders and stakeholders, but no process for reaching a conclusion. We see a great need for strong political leadership now, to move these vital public works projects forward. Thus, we suggest the following steps for both projects:

- Select the preferred alternative.
- Complete 15–20 percent design.
- Perform a constructability review.
- Develop a preliminary finance plan, based on the 15 percent design.

The biggest risk these projects face—more severe than financial and logistical hazards—is that of indecision and vacillation by political and civic leaders. If these projects are to succeed, the people in positions of elected and appointed authority must make decisions that stick, so the projects can be completed. We believe there are risks in both alternatives for the Alaskan Way Viaduct; the engineering and constructibility risks are generally identified, but the political risks of delay have not been accounted for and could have a significant impact.

The safe, speedy rebuilding of these roadways and infrastructure is critical, both to the city of Seattle and the entire statewide transportation system—not only to

relieve congested highways, but also to prevent catastrophic damage in the event of an earthquake or major storm.

A great deal of time and consideration has already gone into the viaduct and SR 520 bridge projects. For this, the state's legislators and public servants deserve praise; the thoughtful, thorough deliberation they have given these projects is admirable and appropriate.

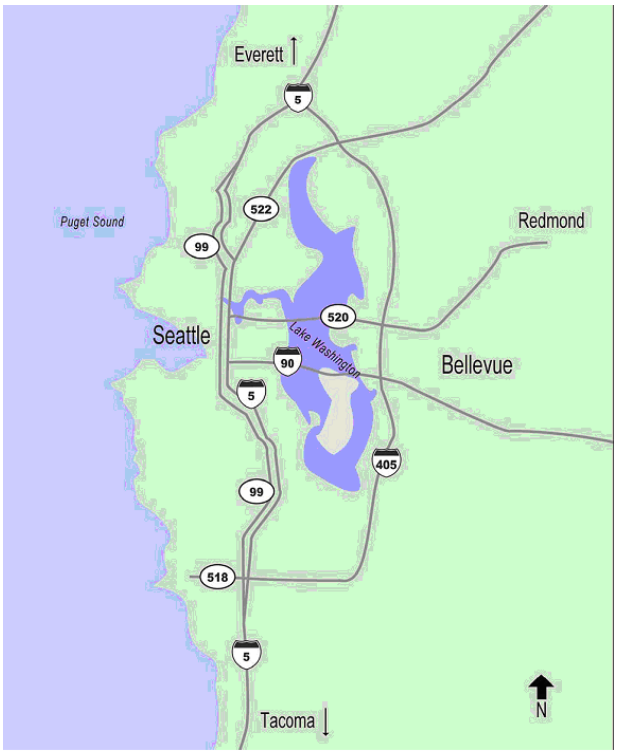
We urge political leaders and stakeholders to decide the best path forward—and then proceed on that path, with swiftness. We are confident that the information needed is in hand to make a decision and to move these public works projects forward. The data have been crunched; the risks have been assessed; the designs have been scrutinized many times. Now, they must be implemented, without further delay.

Appendix A
Overview of Viaduct Project

Washington State Route 99 (SR 99) is a highway in King County, which is located on Puget Sound and encompasses Seattle. It is one of only three north-south corridors through the region (along with Interstates 5 and 405).

An elevated segment of SR 99 known as the Alaskan Way Viaduct runs along Seattle's Elliott Bay waterfront and through downtown Seattle. The viaduct takes its name from Alaskan Way, a surface street that runs next to it for a distance. The viaduct can carry 110,000 vehicles per day into and through downtown Seattle, and it provides downtown access for neighborhoods to the west of SR 99. Figure A-1 is a map of the Puget Sound Area transportation system.

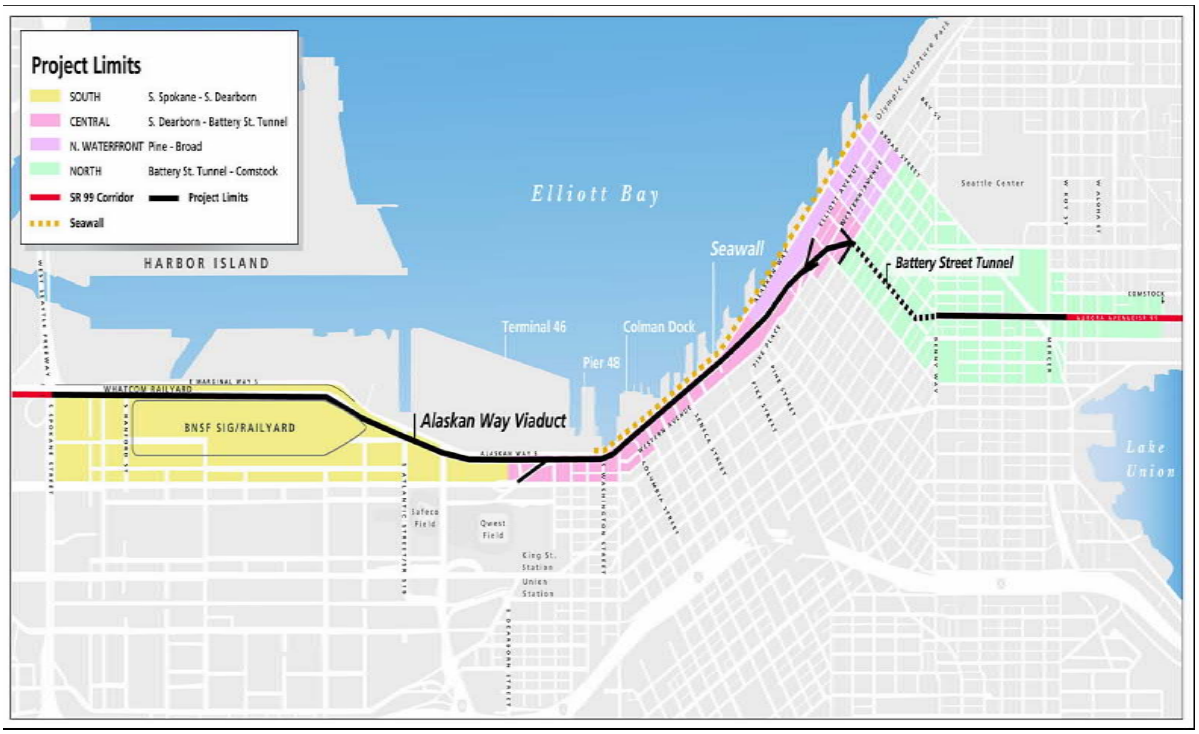
Figure A-1. Puget Sound Area Highway System



The Alaskan Way Seawall holds soils along an extensive portion of the waterfront and immediately adjacent to the viaduct, and stabilizes the Alaskan Way surface street, railroad tracks, and utilities. The fills retained by the wall provide lateral support for some of the foundations of the viaduct.

The viaduct project area is 4 miles long, extending from approximately South Spokane Street in the south to Roy Street in the north. The Alaskan Way Seawall is within these boundaries, extending from South Washington Street to Broad Street. Figure A-2 illustrates the location of the viaduct and seawall.

Figure A-2. Alaskan Way Viaduct Project Corridor



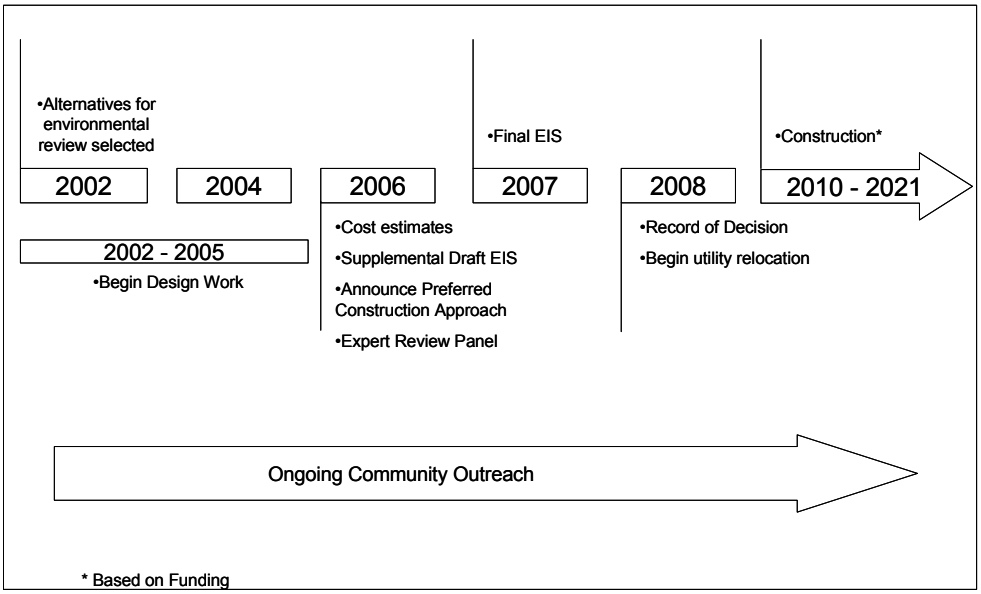
SR 99 through downtown Seattle consists of a surface roadway from South Spokane Street to approximately Holgate Street, an elevated double-deck structure from Holgate Street to the Battery Street Tunnel, and a surface roadway north of the Battery Street Tunnel until it reaches the Aurora Bridge over the Ship Canal.

The viaduct and seawall are crucial to the continued viability of SR 99 as a primary commuter, transit, and freight route in and through Seattle. Both, however, are at some risk. The viaduct structure is 53 years old, built to 1950s design standards, and vulnerable to earthquakes because of its age, design, and location. In 2001, the 6.8 magnitude Nisqually earthquake shook the Puget Sound region. A team of structural design and seismic experts examined the viaduct and determined that the earthquake had damaged joints and support columns, and portions of the structure have moved and settled five times since. The team of experts concluded that it was not cost-effective to fully retrofit most of the viaduct. They recommended the viaduct be rebuilt or replaced. The seawall is also seismically vulnerable.

PROJECT SCHEDULE

Figure A-3 gives a summary view of the viaduct project schedule, with high-level milestones.

Figure A-3. Viaduct Project Schedule



PROJECT ALTERNATIVES

The viaduct project's 2004 draft EIS evaluated five alternatives in addition to the "no build" alternative. In late 2004, the alternatives were narrowed to two: a new elevated structure, and a tunnel. Both alternatives would be built to withstand a 2,500-year earthquake without collapse, as seismic safety is one of the main concerns with the current structure. Either alternative would also add shoulders, increase lane widths, and improve on- and off-ramps in accordance with current design standards.

Elevated Structure

The elevated structure alternative would replace the viaduct in its existing location with a structure similar to the current one, including ramps into downtown at Seneca and Columbia Streets. It would be 50 percent wider than today, allowing for shoulders and lanes that meet modern highway standards. In the south, the viaduct would be replaced with an at-grade roadway and an interchange connecting to South Atlantic Street and South Royal Brougham Way. The Battery Street Tunnel would have the same fire and life safety upgrades as the tunnel alternative, similar improvements north of the Battery Street Tunnel, and the same north seawall replacement option.

Tunnel

The tunnel alternative would replace the viaduct structure with a "cut-and-cover" tunnel along the central waterfront, with three lanes in each direction. It would also have emergency exits, a fire suppression system, and a ventilation system. The outer wall of the tunnel would become the new seawall through the central section. Ramps into downtown would be provided at South King Street.

Core Projects and Full Projects

To address questions about funding availability for either alternative, the Washington State Department of Transportation and the city of Seattle identified a "core project" for both alternatives. The core project would build the most critical elements of the project first. For both alternatives, these would include improvements in the south, along the central waterfront, up to the Battery Street Tunnel, and upgrades to the Battery Street Tunnel itself. As elements of the "full" project, the north seawall replacement and improvements north of the Battery Street Tunnel would be built once additional funding became available.

Appendix B
Overview of SR 520 Project

State Route 520 (SR 520) and Interstate 90 (I-90) are the two east-west corridors that cross Lake Washington. SR 520 crosses between Seattle's Montlake and University neighborhoods and Eastside cities and towns (Medina, Hunts Point, Yarrow Point, Clyde Hill, Bellevue, Kirkland, and Redmond). I-90 crosses the lake across Mercer Island between Seattle's Mt. Baker neighborhood and South Bellevue. SR 520 accommodates 115,000 daily vehicle trips across the lake, and is a link in the region's bus system. Figure B-1 shows the SR 520 project vicinity.

Figure B-1. SR 520 Project Vicinity

SR 520 is a four-lane facility (two general-purpose lanes in each direction) that connects Interstate 5 (I-5) in the west to Redmond in the east. Some westbound segments include a HOV lane. The freeway includes two bridges: the Portage Bay Bridge and the Evergreen Point Bridge, the world's longest floating bridge. Figure B-2 illustrates the SR 520 project corridor in greater detail.

Figure B-2. SR 520 Project Corridor

The two bridges that make up SR 520 were built in the early 1960s with an effective design life to last until 2020. Over the years, design standards have become more stringent, effectively reducing the useful design life of the bridges in the corridor. Recent studies by the WSDOT revealed that the aging spans of the Portage Bay Bridge and the fixed approach sections of the Evergreen Point Bridge are highly vulnerable to earthquakes. Studies also show that the floating portion of the Evergreen Point Bridge is vulnerable to windstorms.

Traffic congestion is a major issue in the SR 520 corridor. Factors such as population, employment growth, and bridge capacity limitations have contributed to traffic problems on SR 520. The new Lake Washington crossing enables more people to live in Eastside cities and towns and work in Seattle, resulting in a surge of vehicles traveling westbound across the Evergreen Point Bridge in the morning and eastbound in the evening. Today, seven times more vehicles cross SR 520 each day than when the bridge first opened in 1963.

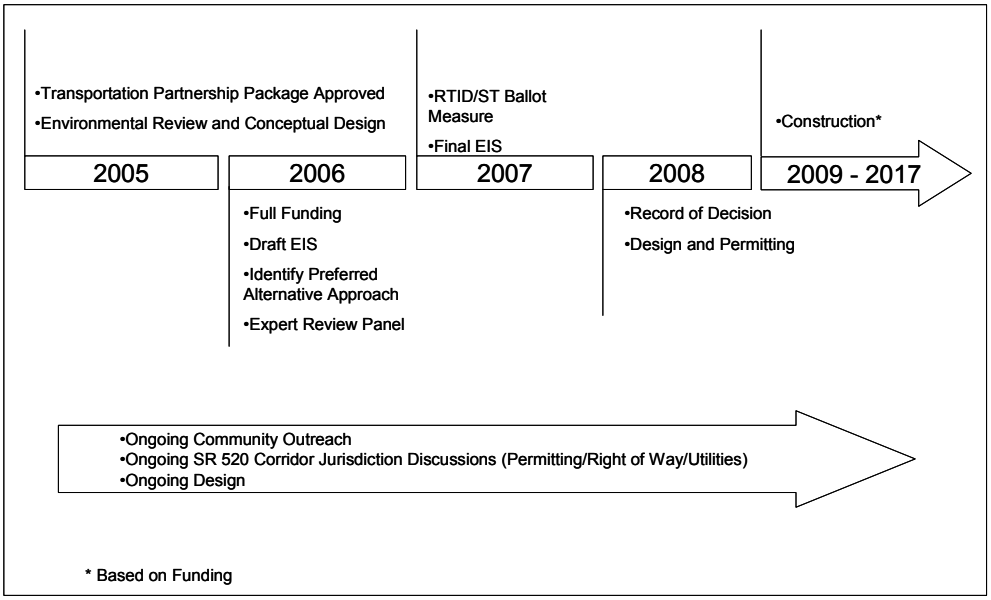
Another factor contributing to the congestion is the narrow design of the Evergreen Point Bridge, especially since it lacks shoulders. When a vehicle breaks down, an entire lane becomes unusable, the remaining lane slows as vehicles merge into it, and emergency vehicles have difficulty rendering aid. Another congestion-causing factor is the termination of the westbound HOV lane, just east of the bridge. The lack of a continuous HOV lane significantly reduces transit and HOV reliability.

PROJECT SCHEDULE

The SR 520 project team is working to identify a preferred alternative by the end of 2006. The final EIS is expected in mid-2007, with the Record of Decision in early 2008. Assuming full funding, construction would start in 2009–2010. To meet that construction schedule, which calls for 55 concrete pontoons, WSDOT is evaluating offsite construction sites. The offsite process for pontoon construction

is planned to be complete to support a 2009 construction start. The SR 520 project schedule is shown in Figure B-3 below.

Figure B-3. SR 520 Project Schedule



PROJECT ALTERNATIVES

WSDOT began the EIS process with three build alternatives for the entire SR 520 corridor. Besides the no-build alternative, the draft EIS assesses four-lane and six-lane alternatives, with several design options that are currently being evaluated.

All alternatives would meet updated design and seismic standards, and would have full shoulders for disabled vehicles and emergency aid. The existing movable draw span would be eliminated, and boats would be able to travel under an elevated east high rise. Removing the draw span will significantly reduce windstorm vulnerability. Wider lanes, shoulders, sound walls, and a bicycle/pedestrian path are also a part of each alternative.

Four Lanes

The four-lane alternative includes two general-purpose lanes in each direction, similar to the existing configuration. This alternative would include facility improvements such as full shoulders, a bicycle/pedestrian path, storm water treatment facilities, and sound walls. The four-lane alternative would rebuild SR 520, from I-5 to Bellevue Way, with two 12-foot general-purpose lanes in each direction, the same number as today. The existing westbound HOV lane on the Eastside, between Bellevue Way and the Evergreen Point Bridge, would also be rebuilt under this alternative. However, the HOV lane would not be carried across the bridge.

WSDOT would replace both the Evergreen Point and Portage Bay bridges and rebuild all the bridges that carry local streets over SR 520. Pontoons to support the Evergreen Point Bridge would be sized to carry future high-capacity transit. Roadway shoulders would meet current design standards, which for a four-lane roadway requires a 4-foot-wide inside shoulder and a 10-foot-wide outside shoulder. Freeway transit stops would be reconstructed on the outside of the highway at Montlake Boulevard, Evergreen Point Road, and 92nd Avenue Northeast.

The following are transportation components of the four-lane alternative:

- **I-5/SR 520 interchange.** The four-lane alternative would connect SR 520 to I-5 in almost the same way as it does today. A new HOV-only ramp would connect SR 520 westbound to the I-5 southbound express lanes.

- **Seattle bridges over SR 520.** WSDOT would rebuild four bridges in Seattle that carry local streets over SR 520 in order to widen the highway. All but Montlake Boulevard would have the same width and lane configuration as the existing structures. The Montlake Boulevard Bridge would be slightly wider and reconfigured in locations to improve operation of the interchange.

- **Portage Bay Bridge.** The Portage Bay Bridge would be widened to the north in order to avoid shoreline impacts to the south. The slope of this bridge would be more gradual than it is today, with portions of it 20 feet higher than the existing bridge. The distance between support columns would average 250 feet, compared with the existing bridge's 100-foot average column spacing.

  The Portage Bay Bridge would have seven lanes: four general-purpose lanes; a lane each way for buses to accelerate out of, or decelerate into, the Montlake transit stop; and a westbound auxiliary lane from the Montlake interchange to I-5 northbound. This auxiliary lane is required because the distance between the existing Montlake and I-5 interchanges is less than current design standards require, and without it, dangerous weaving patterns could result as vehicles merge into traffic.

- **Montlake interchange.** The new Montlake interchange would be similar to today's. The following modifications have been proposed to improve operations and safety along Montlake Boulevard:

  - Signalize the westbound off-ramp as a full-access intersection.

  - Add another lane of left-turn access to the westbound on-ramp.

  - Add new westbound on-ramp capacity to serve as a transit and HOV-bypass lane.

  - Increase the turning movement capacity at the eastbound off-ramp.

- **Lake Washington Boulevard ramps.** A new westbound off-ramp to Lake Washington Boulevard and a new eastbound on-ramp from the boulevard would pass over the WSDOT-owned peninsula, west of the Arboretum, instead of over the water, as the existing ramps do.

- **Evergreen Point Bridge.** The floating portion of the bridge would be constructed up to 200 feet north of the existing bridge. The bridge would have two 12-foot general-purpose lanes in each direction, 4-foot-wide inside shoulders, and 10-foot-wide outside shoulders. A 14-foot-wide bicycle/pedestrian path would be located on the north side of the bridge. Under the four-lane alternative, pontoons supporting the bridge would be sized to accommodate future high-capacity transit. Two parallel rows of 60-foot-wide pontoons would support the structure. The new bridge would not have a draw span under either alternative. Instead, the new west approach would be higher and less steep than the current high rise. The west approach would provide a navigational clearance of 25 feet, 19 feet less than the existing structure. The new east approach structure would provide 70 feet of navigational clearance, 13 feet more than the existing high rise.

- **Eastside bridges over SR 520.** Three bridges carrying local streets over SR 520 east of the Evergreen Point Bridge would be rebuilt under both alternatives.

- **Bellevue Way interchange.** Only minor changes would be made to the Bellevue Way interchange. A new lane would be added to Lake Washington Boulevard Northeast between Northup Way and the westbound on-ramp. The SR 520 eastbound off-ramp to Bellevue Way Northeast would be rebuilt as a single general-purpose lane ramp.

Six Lanes

The draft EIS evaluates the six-lane alternative and several design options. This alternative includes two general-purpose lanes plus one HOV lane in each direction, along with the same improvements listed for the four-lane alternative. In addition, the new six-lane facility would include five 500-foot-long lids reconnecting neighborhoods separated by the original construction of SR 520. Two of the lids would be in Seattle: one connecting Roanoke Park with North Capitol Hill, and the other connecting the Montlake neighborhood across SR 520. On the Eastside, there would be three lids: at Evergreen Point Road, 84th Avenue Northeast, and 92nd Avenue Northeast bridge crossings.

The following are the transportation components of the six-lane alternative:

- **I-5/SR 520 interchange.** The connection of SR 520 to I-5 would be similar to the four-lane alternative, but would include a new ramp over I-5 with a reversible HOV lane to connect the SR 520 HOV lanes to the I-5 express lanes. The connection of I-5 to SR 520 eastbound would also be

similar to the four-lane alternative, with a few exceptions (sections of the tunnel will be wider).

- **Seattle bridges over SR 520.** Similar to the four-lane alternative, four bridges over SR 520 would be rebuilt to provide room to widen the highway.

- **Portage Bay Bridge.** The section from I-5 to the Montlake Boulevard interchange, including the Portage Bay Bridge, would be nine lanes wide under the six-lane alternative: four general-purpose lanes, two HOV lanes, one transit-only lane, and two auxiliary lanes (westbound and eastbound).

- **Montlake interchange.** The Montlake interchange would function similarly to the four-lane alternative, with added HOV direct access ramps.

- **Lake Washington Boulevard ramps.** Similar to the four-lane alternative, the existing Lake Washington Boulevard ramps and the ramps from the never-completed R.H. Thompson Expressway would be removed, and the Lake Washington Boulevard Interchange would be reconstructed.

- **Evergreen Point Bridge.** Similar to the four-lane alternative, the floating portion of the bridge would lie up to 200 feet north of the existing bridge. Under the six-lane alternative, the bridge would have two 12-foot general-purpose lanes in each direction, one inside HOV lane in each direction, and 10-foot-wide inside and outside shoulders. All other improvements are similar to the four-lane alternative.

- **Eastside bridges over SR 520.** The Evergreen Point Road overpass would be rebuilt as part of a new lid (about 500 feet long) that would also include Evergreen Point Road. Transit stops and center HOV lanes would be located in the center of SR 520 east of the Evergreen Point Bridge. The 84th Avenue Northeast Interchange and the 92nd Avenue Northeast Interchange would be configured similarly to the four-lane alternative. However, under the six-lane alternative, these interchanges would have 500-foot-long lids.

- **Bellevue Way interchange.** The Bellevue Way interchange would be similar to the interchange that exists today.

- **108th Avenue NE interchange.** The 108th Avenue NE interchange westbound on-ramp would be rebuilt to accommodate an HOV bypass lane.

- **East of I-405.** An eastbound auxiliary lane would be added from I-405 to the 124th Avenue Northeast exit from SR 520. The SR 520 bridge that crosses over Northup Way would be widened to accommodate the new lane.

Design Options for Six Lanes

After developing the six-lane alternative, WSDOT identified several optional designs in response to community and agency input. The design options were developed to reduce the width of the six-lane alternative, provide more direct transit opportunities in the corridor, and address community concerns. Seven design options were ultimately developed, and analyzed in the draft EIS. Three of these are in Seattle, and four are on the Eastside.

SEATTLE OPTIONS

- **Pacific Street interchange.** The Pacific Street interchange option removes the existing Montlake transit stop and consolidates the Montlake and Lake Washington Boulevard interchanges into a single interchange. The new interchange would include exclusive transit/HOV direct access ramps for the westbound off-ramp and eastbound on-ramp.

  From SR 520, there would be new general-purpose connections to the north via a new bridge over Union Bay, and south to Lake Washington Boulevard. The new bridge to the north would essentially extend Pacific Street, passing through what is now the University of Washington's Husky Stadium parking lot. The Pacific Street bridge over Union Bay would be four lanes wide and would include a 14-foot-wide bicycle path.

- **No Montlake Freeway transit stop.** This option eliminates the Montlake Freeway transit stop, which could narrow the footprint of the six-lane alternative through Montlake by approximately 40 feet.

- **Second Montlake Bridge.** The second Montlake Bridge option is the same as the previous one (no transit stop) but also includes a second drawbridge across the Montlake Cut, parallel to the existing Montlake Bridge.

EASTSIDE OPTIONS

- **No Evergreen Point Freeway transit stop.** This option eliminates the transit stop at Evergreen Point Road, narrowing the footprint of SR 520.

- **South Kirkland park-and-ride transit access**

  - *108th Avenue Northeast.* This option allows buses more direct access from eastbound SR 520 to the South Kirkland park-and-ride lot and from there to westbound SR 520. It adds two new ramps for transit and HOVs to 108th Avenue Northeast—one eastbound off-ramp and one westbound on-ramp.

  - *Bellevue Way*. This option provides the same improved bus access as the 108th Avenue Northeast option, but using a different approach. It adds a new HOV/transit lane to the eastbound Lake Washington Boulevard off-ramp and relocates the westbound Bellevue Way on-ramp to Northup Way.

- **Bicycle/Pedestrian Path to the North.** The bicycle/pedestrian path would be located on the north side of SR 520 as it extends east from the SR 520 east approach and would not cross to the south side as originally planned.

Appendix C
Project Management Assessment Worksheet

The two tables in this appendix detail the areas of the Expert Review Panel's evaluation of project management for the Alaskan Way Viaduct and SR 520 bridge projects. Where elements are observed to exist and are consistently applied, our response is a "Y" (Yes). Where the elements were not observed, our response is an "N" (not observed).

Table C-1. Project Management Assessment—Viaduct

Building block component	Subcomponent	Exists for project?	Consistently applied on this project?
People	Strong owner	Y	Y
Structure	Organizational structure	Y	Y
	Job description	N	N
	Roles/responsibility matrix	Y	Y
Process	Standardized project delivery process	Y	Y
	Transportation facility planning	Y	Y
	Selection methodology for alternatives	Y	Y
	Public involvement	Y	Y
	Environmental analysis	Y	Y
	Financial analysis and planning	Y	Y
	Cost estimating	Y	Y
	Context-sensitive evaluation/urban design	Y	Y
	Utility relocation/design	Y	Y
	Constructability evaluation	N	N
	Traffic management during construction	Y	Y
	Evaluation of operation and maintenance costs	Y	Y
	Risk management	Y	Y
	Quality management	N	N
Tools	Standardized work breakdown structure	Y	Y
	Scheduling tools	Y	Y
	Risk evaluation tools	Y	Y
	Cost estimating tools	Y	Y
	Standardized project plan template	Y	Y

Table C-2. Project Management Assessment—SR 520 Bridge

Building block component	Subcomponent	Exists for project?	Consistently applied on this project?
People	Strong owner	Y	Y
Structure	Organizational structure	Y	Y
	Job description	N	N
	Roles/responsibility matrix	N	N
Process	Standardized project delivery process	Y	Y
	Transportation facility planning	Y	Y
	Selection methodology for alternatives	Y	Y
	Public involvement	Y	Y
	Environmental analysis	Y	Y
	Financial analysis and planning	Y	Y
	Cost estimating	Y	Y
	Context-sensitive evaluation/urban design	Y	Y
	Utility relocation/design	Y	Y
	Constructability evaluation	N	N
	Traffic management during construction	Y	Y
	Evaluation of operation and maintenance costs	N	N
	Risk management	Y	Y
	Quality management	N	N
Tools	Standardized work breakdown structure	Y	Y
	Scheduling tools	Y	Y
	Risk evaluation tools	Y	Y
	Cost estimating tools	Y	Y
	Standardized project plan template	Y	Y

Appendix D
Assessment of Key Permit and Approval Assumptions

The tables in this appendix summarize the panel's assessment of key project assumptions regarding environmental permits, as well as design and construction approvals. Table D-1 deals with environmental permits, Table D-2 with design approvals and construction permits. Each table lists potential requirements, describes the project team's assumptions, and gives the panel's specific assessments and comments on those assumptions.

It is important to note that the plans for the viaduct project are further along than those for the SR 520 project, and as a result, these tables more accurately reflect the necessary permits and approvals that have been identified for the viaduct. Nevertheless, the permitting and approval for the SR 520 project will likely be very similar to the viaduct project.

Table D-1. Assessment of Key Assumptions—Environmental Permits and Laws

Potential federal/state permits and environmental laws/lead agency	Key project team assumptions	Panel analysis and assessments
National Environmental Policy Act (NEPA)/Federal Highway Administration (FHWA)	Project will comply with NEPA requirements.	Reasonable.
Transportation Act, Section 4(f)/FHWA	Section 4(f) analysis and documentation is being performed as part of the NEPA EIS for the project.	Reasonable.
Clean Water Act Section 401 Water Quality Certification/Washington Department of Ecology (Ecology)	None noted.	Ecology will likely certify the project with conditions (e.g., provide and maintain adequate sediment and erosion control measures), which will be binding on the project. Section 401 certification process, however, can take a prolonged time. While Ecology officially has a 1-year deadline to issue certification, this typically can take much longer than 1 year.
Clean Water Act Section 404/USACE	Permit timeline assumes USACE review of Joint Aquatic Resources permit application will take 180 days.	Section 404 approval contingent on approval of Clean Water Act Section 401. Assumption appears to be optimistic, given size and complexity of project.
	Permit timeline assumes citizens will not appeal to federal court.	Assumption appears to be optimistic, given the number of citizens/groups that oppose the project.

Table D-1. Assessment of Key Assumptions—Environmental Permits and Laws

Potential federal/state permits and environmental laws/lead agency	Key project team assumptions	Panel analysis and assessments
U.S. Rivers and Harbors Act Section 10 Permit/USACE	Permit timeline assumes USACE review of Joint Aquatic Resources permit application will take 180 days.	Section 10 approval contingent on approval of Clean Water Act Section 401. Assumption appears to be optimistic, given size and complexity of project.
	Permit timeline assumes citizens will not appeal to federal court.	Assumption appears to be optimistic, given the number of citizens/groups that oppose the project.
Endangered Species Act-Section 7 Consultation/U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS)	Project will likely affect listed endangered species, and "formal consultation" will be required.	Reasonable.
	Entire consultation process typically will take 135–195 days.	Reasonable.
Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)/NMFS	MSFCMA consultation will occur concurrently with the ESA consultation.	Reasonable.
	Entire consultation process typically will take 135–195 days.	Reasonable.
Marine Mammal Protection Act/USFWS and NMFS	It is not anticipated that a Letter of Authorization will be required.	Reasonable.
	An Incidental Harassment Authorization (IHA) will be required and likely take 2–6 months to obtain.	If an IHA is likely to be required, it will probably take 2–6 months to obtain. Add some level of risk for up to 6 months to obtain this approval.
Clean Air Act, Air Act Conformity/FHWA	The proposed project will not adversely impact the National Ambient Air Quality Standards established in the State Implementation Plan for the Central Puget Sound region.	Reasonable.
National Historic Preservation Act, Section 106/FHWA	Section 106 consultation for the project will be performed by FHWA and WSDOT in coordination with the Washington Department of Archaeology and Historic Preservation (DAHP).	Advisory Council on Historic Preservation could become involved, given the complexity and citizen interest in the project. Review/approval process can take well over a year on controversial disputes.
Clean Water Act Section 401 Water Quality Certification/Ecology	None noted.	Ecology will likely certify the project with conditions (e.g., provide and maintain adequate sediment and erosion control measures), which will be binding on the project.

Table D-1. Assessment of Key Assumptions—Environmental Permits and Laws

Potential federal/state permits and environmental laws/lead agency	Key project team assumptions	Panel analysis and assessments
Shoreline Substantial Development Permit/Shoreline Hearings Board	None noted.	Appeal to the Shoreline Hearings Board is supposed to be expedited so that it concludes within 180 days. Permit is supposed to include condition that construction cannot start until 21 days after permit is issued or "all review proceedings are terminated"; therefore, factor in a 201-day delay. WSDOT should seek a legislative amendment to start construction soon after permit issuance, even if appeals are filed (similar to the I-90 project near Lake Washington).
Coastal Zone Management Act (CZMA) Consistency Certification/Ecology	The CZMA consistency approval will be required and likely take 225 days to obtain.	Reasonable.
National Pollutant Discharge Elimination System (NPDES), a.k.a. Construction Storm Water Individual Permit/Ecology	Individual (site-specific) permit will be required.	Reasonable.
	Permit will be obtained within 60 days.	Permit acquisition timeline appears to be optimistic, given the complexity of the project.
NPDES Individual Wastewater Discharge Permit/State Waste Discharge Permit/Ecology	The viaduct project will need to comply with existing NPDES permits for existing combined sewer outfalls, stormwater outfalls, and sewage treatment plant outfall, but will not require a separate "project-specific" permit. SR 520, on the other hand, will likely need a new permit for operation after construction. This is a notable difference between the two projects.	Reasonable.
Removal of underground storage tanks/Ecology	The project will remove or abandon in place (if appropriate) any inactive underground storage tanks encountered during construction.	Reasonable.
Hydraulic Project Approval (HPA)/Washington Department of Fish and Wildlife (WDFW)	This permit will be required because of the need to reconstruct the seawall, place fill for the tunnel, etc.	Reasonable. Permit will likely include mitigation requirements to achieve "no net loss" of productive capacity of fish and shellfish habitat.
Aquatic Lands Use Lease Approval/Washington Department of Natural Resources (WDNR)	WDNR approval to use state-owned land likely needed to remove Pier 48.	Reasonable.
	Timeline indicates 157 days to obtain approval.	Timeline appears optimistic, given the complexity of the project; recommend that 1 year be assumed.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Design Approvals	The design team has developed its concept and logic for design approvals, including proposed changes to the upcoming WSDOT Design Manual (for instance, see Section 6.3 of the Viaduct PMP, Viaduct Design Program Logic diagram, and Aligning Viaduct Project Delivery documents). The viaduct project team is also considering risk issues, such as taking steps to reduce schedule risks by obtaining early design decisions. For the SR 520 project, there is some reference to design review procedures (on p. 68 of Tab 3 in the Expert Panel Review Notebook) with specific mention of the WSDOT Design Manual and the FHWA Stewardship Agreement.	The design approvals process is mature for the viaduct project. Based on information provided, it appears that the design approvals process for the SR 520 project is not as far along as that of the viaduct project. The SR 520 team should develop detailed processes and procedures to use in the design review and approval process, ensure that they are adequately linked to the project schedule, and assess risk areas in case of review delays or other problems. The SR 520 team needs to proactively address design review and approval approach, processes, roles and responsibilities, and cost/schedule risk issues (as related to design review/approval).
Permit Strategy Team	Project partners established this team in 2004 for the viaduct (Tab 2, p. 44). Required permits for both the viaduct and SR 520 have been identified. Key stakeholders identified in Signatory Agency Committee agreement of September 2002 are in place to help streamline regulatory compliance. The permit strategy is under development (see p. 1 of Viaduct Permits and Approvals Guide). Two SAC agencies have requested issue resolution on the SR 520 project with respect to concurrence point 2, “range of project alternatives” for draft EIS.	Establishment of Permit Strategy Team is an excellent idea for these two complex projects. The Permit Strategy Team needs to develop a plan to address key stakeholders or powerful special interest groups if there is a problem/dispute with permits and approvals. Key problem areas, with respect to permitting and approvals, need to be identified in advance and mitigation approaches developed. The SAC and Permit Strategy Team must also develop a strategy for issue resolution for concurrence point 2 for SR 520. This will have an impact on schedule and cost, which should be accounted for and mitigation strategies developed.
Master Permitting Agreement	“Potentially a Master Permitting Agreement will need to be executed” (see Viaduct PMP, para. 1.5.2., p. 8).	The Master Permitting Agreement is an excellent idea, and while it is being created, input and support from all relevant stakeholders is key.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Permitting Management Procedures	Viaduct: Environmental Permits and Approvals Guide is in place; team will identify specific permits and approvals for viaduct, as well as "provide permit information such as: the project activities that will trigger the need for a permit; regulatory requirements that must be met; permit processes, timelines and durations; and approval criteria, so that there is a common frame of understanding regarding permits for the Viaduct." (p. 1 Permits/Approval Guide). Per the viaduct PMP, procedures for coordinating and obtaining permits from permitting agencies, utility companies, and railroad companies will be developed. This should include procedures for ensuring that all permitting, utility, and railroad requirements are incorporated into the design of the project; and procedures for coordinating submittals and agency reviews such that the overall project schedule is not delayed (see viaduct PMP, para. 5.2 Design Quality Control, p. 33). Procedures for the SR 520 permitting process are not addressed in the UCO Mini Business Plan.	This is a critical element of the success of the viaduct and SR 520 projects. Delays and cost increases resulting from permitting and approvals issues, such as legal challenges to permits and approvals and disputes over the information required by permitting agencies, may impact project success (in terms of cost, schedule, and expectations). Some permits, if appealed, may not take effect until the appeal is fully adjudicated. WSDOT's permit timeline correctly estimates when a particular permit will be issued, though the risk management assessments underestimate the time frame for the appeals process. Risk "U28—Appeals to project permits" (Alaskan Way Viaduct and Seawall Replacement Major Risk Events) factors in a 3-month project delay for the appeals process, which is a very short time compared with other projects of this size and scope. Critical and/or high-risk permits for the viaduct and the SR 520 need to be identified by the Permit Strategy Team. 401 Certification, for example, is a key federal certification to obtain because other necessary permits are dependent on its approval. These key permits must be identified early on. Risk mitigation strategies need to be developed in case of project delay or cost increase due to permitting problems. The viaduct requirements for permitting procedures will likely also apply to the SR 520 project, though there will be notable differences between the projects. While the SR 520 team should use the viaduct processes and permit plans as a baseline, input needs to be given to what unique needs SR 520 will have. For example, while the viaduct will likely not need a new NPDES/state waste discharge permit for its operation, SR 520 probably will.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Permit Interdependencies	Interrelationships between permits are shown in the Viaduct Summary Permit Timeline (Viaduct Permits and Approvals Guide, Appendix B, p. B-1).	The guide shows individual permitting timelines. There is no linkage (i.e., no evidence of interdependence shown) between the permits. Some are described in the guide as interrelated. For example, some of the federal permits (especially the 404 and Section 10 permits) will not be issued until Ecology issues the 401 certification. These issues must be addressed as part of the overall permit strategy.
Project Delivery Method	Viaduct—Design-bid-build. SR 520—Design-bid-build (p. 35, Tab 3).	These are reasonable assumptions at this stage of planning. Changes would likely be needed if portions of the work were delivered in a different matter, such as by design-build. This could affect roles and responsibilities, schedules, etc., and mitigation plans should be in place in the event this happens.
Required Approvals Before Start of Permitting	Viaduct and SR 520: Record of Decision for project needed. FONSI for Special Projects Construction Site in SR 520 needed.	These are reasonable assumptions.
Permit Design Basis	Viaduct and SR 520: Use 30 percent design plans. Permitting of Special Projects Construction Site is concurrent with SR 520.	This appears reasonable. There should be a process for updating permits and approvals if/when design changes. For example, if a tunnel is built, it seems likely that contamination will be encountered, and that WSDOT will have to work through the Washington Model Toxics Control Act. If design changes, the permitting team needs to identify possible changes to the permitting strategy.
Permit Fees	None noted.	Permit fees should be included in the project cost estimate.
Review Steps and Timeline	Viaduct: Typical processes described, but they are complex. If permit needs design review or triggers City Council process, steps/timelines could change (p.46 Permits/Approval Guide). SR 520: Permitting scheduled for Q1 2008 through Q3 2011 (total of 3.5 years). SPCS permitting scheduled for Q1 2007 through Q2 2008 (1.5 years).	Identified permit timelines appear to reflect best-case duration for the viaduct project. Need to integrate permit requirements into project design and construction schedule; need to assess high-risk permits with critical elements in schedule and develop mitigation strategy. The permit schedule should be integrated with the overall project schedule for both projects.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Master Use Permit (MUP)—For any land use development with city of Seattle	Applications for Master Use Permits (MUPs) are reviewed for consistency with the use and development standards of the Land Use Code. Environmental review and conditioning pursuant to SEPA are performed during this process. Projects may also undergo design review by the Seattle Design Commission, and landmarks and historic district preservation review (e.g., Pike Place Market Historic District Commission and Pioneer Square Preservation Board). Projects located in Environmentally Critical areas are also subject to DPD review, and although not classified as MUPs, approvals for development in these areas use the same procedures as those applicable to MUPs. City will take about 9 months to complete review of the MUP (this includes estimated time for additional information). Each type of MUP application triggers somewhat different notice, comment, and appeal.	Additional reviews will impact the schedule and should be accounted for. Permitting/approval interdependencies for the viaduct project need to be identified. The impact of the city considering different MUP applications on 9-month duration should be taken into account. As discussed previously, prolonged delays in the permitting process are likely, and should be factored into the project plan.
Demolition Permit—Required for demolition of structures	Demolition of the viaduct SRP would be reviewed for compliance with applicable regulations, including Section 106 of the National Historic Preservation Act, the Seattle Building Code, landmarks and historic district regulations, and environmental regulations. Prior to performing any demolition work, an asbestos and lead-based paint survey must be performed per the regulations of the Puget Sound Clean Air Agency (PSCAA) and Washington Department of Labor and Industries. Permit review and approval duration is estimated at 8.5 months.	Make sure required surveys are completed. Compliance with permit needs to be managed by the permit and design and construction teams.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Building Permit—Construction of new buildings or structures	Building permits are required for all new buildings and freestanding structures, and would apply to the structures associated with the viaduct SRP. If a MUP was issued prior to the building permit (for example, obtaining MUP approval and completing SEPA review before applying for the building permit), conformance is required with conditions of the MUP existing before issuance of any building permit—parking info, building code analysis and documentation, means of exiting (egress) plans, floor plans, elevation views, building sections, construction details, and landscape plans. Building permits are generally valid for 18 months and may be renewed. Permits for major construction projects may be issued for the period of time necessary for the construction up to 3 years and may be renewed. Permit review and approval duration is estimated at 8.5 months.	Size and complexity of the project may increase the 8.5 month duration. Interaction between building permit and MUP/SEPA reviews should be coordinated.
Noise Variance—Construction noise that exceeds city noise standards	Viaduct SRP will need a technical variance from the noise standards, since the noise standards will be exceeded for a period longer than 14 days. The process requires a public hearing, so it may take up to 30 days to set up and hold the meeting, consider public comments, and issue or deny the variance.	At this point in the project, this appears reasonable.
Over the Counter (OTC) Permits—New mechanical equipment, electric work, new or altered signs, fire alarms, and new elevators	SRP may require OTC permits for mechanical, electrical, sign, elevator (if tunnel alternative is selected), or fire alarms. Processing of the OTC permit applications has been streamlined.	Appears reasonable.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Street Use Permit—Any work within the public right of way (includes street and utility improvements, landscaping, and lighting)	Seattle Department of Transportation (SDOT) issues over 60 different types of street use permits. The majority for the viaduct SRP will be street improvement permits (e.g., shoring and excavation, utilities, street use, driveways, and sidewalk repairs). SCL, SPU, and King County utilities will need to be relocated prior to construction of the viaduct SRP work taking place. In addition, many privately owned utilities will need to be moved. One of the critical aspects of the utility work will be to coordinate the relocation of the multitude of public and private utilities prior to and following construction. Duration of a street improvement permit will be for the life of the project in coordination with the building permit. Additionally each permit will have a certain "shelf life" between approval of the permit package and beginning of construction. The permitting process may take 8.5 months to complete.	Appears reasonable, at this point of the project. But as design progresses and more information is known about the project, the Permit Strategy Team and project design/execution teams will need to monitor these permits closely.
Side Sewer Permit—Temporary construction dewatering and discharge of dewatering to the sanitary sewer system	DPD typically will identify the requirements for a side sewer permit as part of the building permit review. The side sewer permit would be triggered for the viaduct SRP by the depth of excavation, amount of land disturbance, and the quantity of water that would be encountered during excavation. A permit may require SEPA review, if SEPA thresholds are triggered. Permit review and approval duration is estimated at 8.5 months.	The estimated duration of this permit needs to factor in change as a result of the alternative selected—more duration for the tunneling alternative versus replacement of the viaduct.
Construction Traffic Approvals—Detour routing, travel in downtown traffic control zone, concrete truck use, and removal of required parking	Several permits/approvals related to construction would be required from the city. These include detour routing approval, permits for construction-related traffic traveling through the downtown traffic control zone, and concrete truck approval. It is likely that SDOT will also require a traffic control plan for the viaduct SRP construction-related traffic.	Durations are not explicitly defined in the Permitting Guide. Traffic control plan will need to be completed prior to submitting these approval requests.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Pioneer Square Historic District—Alterations to historic structures or new structures within the district Pike Place Market Historic District—Alterations to historic structures or new structures within the district Landmark Building Approval—Alterations to designated landmarks	Reviews are made of any proposed new buildings and structures, or changes to buildings/structures within the historic districts. Any new structure must be approved by the commissions and Director of Neighborhoods before any other permit is issued by the city. A certificate of approval is required for any work that results in changes to the exterior of any historic district structure.	Appears to be completed in conjunction with Seattle building permitting process, with duration of 120 for Council review. Depending on the nature of work, this may need to be extended. The project schedule should factor in this possible extension.
Clearance Permit—Utility relocation, substation modification, transmission outage request, and feeder clearance permit	Permit required from Seattle City Light for temporary shutdown of transmission lines. Seattle City Light recommends 12 months' advance application in all cases. The distribution feeder clearance approval is controlled internally by SCL's system operations center. This approval is required to maintain safety and proper operational characteristics of the distribution feeder system. Typically, it is necessary to make distribution clearance requests well in advance of the planned work. Generally, SCL recommends a 6- to 9-month advance application for distribution feeder clearances. For a major project such as the viaduct SRP with complex tunnel/highway and utility construction factors, a 12-month advance application for feeder clearances is advisable.	Appears reasonable.
Discharge of Construction Dewatering—Discharge of construction dewatering to the sanitary sewer system	Discharges would be required to demonstrate compliance with the standards and limitations set by Seattle and King County and the conditions of the NPDES permit. They may also require self-monitoring for specified substances, and place limits or prohibit certain materials (e.g., sand, grass, and gravel). Discharges of construction dewatering may also be limited or prohibited during the wetter winter months because there is less capacity. Also required is an explanation of why discharges of 25,000 gallons or greater cannot be discharged to surface water along with proof of denial of an NPDES permit by Ecology. King County stipulates a 90-day period. The viaduct SRP team shows a 21-day review and approval period.	Appears reasonable.

Table D-2. Assessment of Key Assumptions—Design Approvals and Construction Permitting

Analysis element	Key assumptions of project teams	Panel analysis and assessments
Railroad Right-of-Way Use Approval—Burlington Northern and Santa Fe	Several portions of the viaduct SRP improvements would need to use or affect the Burlington Northern and Santa Fe Railroad right of way, such as the utility relocation. Construction activities would need to be coordinated with the train operations. In addition, if there are improvements within the right-of-way that require ongoing maintenance, an agreement is necessary with Burlington Northern and Santa Fe that describes who would be responsible for this maintenance.	Duration is not addressed in the Permit Guide. The approval process activities need to be defined and addressed in the project plan and schedule.

Appendix E
Biographies of Panel Members and Support Team

EXPERT REVIEW PANEL

JANE GARVEY, CHAIR
AREAS OF EXPERTISE: PROGRAM AND AGENCY MANAGEMENT, FINANCE

Ms. Garvey has almost 20 years of experience in the aviation and highway management industry. She was the commissioner of the Massachusetts Department of Public Works (now Massachusetts Highway Department) and director of Boston's Logan International Airport, and she served as acting administrator and deputy administrator for the Federal Highway Administration. At the Federal Highway Administration, Ms. Garvey conceived and developed the Innovative Financing Initiative, enabling states to use federal highway funds more effectively. Currently, she is an executive vice president and chairman of APCO Worldwide's transportation practice, and a lecturer and research scientist at the Massachusetts Institute of Technology's Center for Transportation and Logistics. Ms. Garvey holds a bachelor's degree from Mount Saint Mary College and a master's degree from Mount Holyoke College.

LEROY E. BAKER, P.E.
AREAS OF EXPERTISE: ENGINEERING AND MANAGEMENT

Mr. Baker has over 35 years of experience in the design of major civil and structural transportation and public works projects and programs throughout the United States. He has a master of science degree with dual majors in structures and hydraulics from the University of Illinois and a bachelor of science degree in civil engineering with distinction from the University of Nebraska. Mr. Baker led the risk identification and risk management task force for the 20-mile effluent and influent tunnels to the Brightwater Wastewater Treatment Plant in King County, Washington. He also helped the Utah Department of Transportation develop a process for "best value" selection of design-build contractors. Mr. Baker is currently a senior vice president for special projects at HDR, Inc.

RODNEY L. BROWN, JR., J.D.
AREA OF EXPERTISE: ENVIRONMENTAL

Mr. Brown is a lawyer with over 20 years of experience practicing environmental law in Washington state. With a juris doctor degree from the University of Texas,

Mr. Brown represents clients on issues related to environmental impact statements and permits; pollution control and waste management regulations; Endangered Species Act requirements; and environmental liabilities. He was on the Blue Ribbon Commission for Transportation, is a member of the Washington Department of Ecology's Regulatory Performance Advisory Group, and serves on the board of the Washington Environmental Council. Mr. Brown has also been listed among the eight best environmental lawyers by Seattle Business Monthly and named a "Best Lawyer" by Seattle magazine. He is currently a partner at the Cascadia Law Group.

WILLIAM EDGERTON, P.E.
AREAS OF EXPERTISE: TUNNEL DESIGN AND CONSTRUCTION

Mr. Edgerton has 35 years of experience in management, design and construction, contracting, construction management, and claims and dispute resolution for infrastructure and tunnel projects. He has a master of business administration degree in procurement and contracting from George Washington University and a bachelor of science degree in civil engineering from Tufts University. Until recently, Mr. Edgerton was the project manager for the final design of King County's Brightwater Conveyance System, a 13-mile system of effluent and influent tunnels. He also serves as the chairman for the American Underground Association's steering committee, which is revising its "Better Contracting in Underground Construction" manual. He is currently a principal at Jacobs Associates.

DONALD E. FORBES, P.E.
AREAS OF EXPERTISE: PROJECT IMPLEMENTATION, RISK

Mr. Forbes is a former director of the Oregon Department of Transportation. During his 8-year tenure at ODOT, he was responsible for managing the state's highways, bridges, and airports. Since then he has been involved with the Caltrans Toll Bridge Seismic Retrofit Program, including construction of the $1.4 billion San Francisco-Oakland Bay Bridge; the Caltrans Devil's Slide Tunnels Project risk management (oversight and technical assistance); and the Illinois Tollway Reconstruction Program. As program manager of this $5.3 billion, 10-year reconstruction program, his responsibilities have included overall strategy for design and construction, consistent with the quality management program conforming to FHWA quality guidelines.

KENNETH E. KRUCKEMEYER, AIA, ASCE
AREAS OF EXPERTISE: PLANNING, URBAN DESIGN, AND TRAFFIC

Mr. Kruckemeyer has nearly 4 decades of experience integrating the design and engineering of projects of public significance with the communities they serve. With a bachelor of arts degree from Princeton University and a bachelor of architecture degree from the Massachusetts Institute of Technology, Mr. Kruckemeyer was responsible for the engineering, architecture, and design of the

Southwest Corridor transit, rail, arterial, and urban development project in Boston. This $750 million project received a Presidential Design Award and was named the Outstanding Engineering Achievement of 1998 by the American Society of Civil Engineers. He was then an associate commissioner of the Massachusetts Highway Department, where he implemented better urban design processes and made significant improvements to bridge design engineering and aesthetics. He is a recent research associate at the Center for Transportation and Logistics and lecturer in the Departments of Civil and Environmental Engineering and Urban Studies and Planning at the Massachusetts Institute of Technology.

DAVID L. MCCRACKEN, P.E.
AREAS OF EXPERTISE: CONSTRUCTION AND COST ESTIMATING

Mr. McCracken has 40 years of experience in the heavy construction industry. He has been responsible for engineering and management for many highway projects, as well as canal and irrigation projects and airport runway construction. Mr. McCracken has a bachelor's degree in civil engineering from the University of Maine. He worked on the $1 billion Central Arizona Project canal system, which required excavation and heavy concrete structure work. He has been responsible for the contractor's selection of projects to bid, bid review, equipment selection, overview of project operations, cost control, and preparation and negotiations of construction claims. Mr. McCracken is currently self-employed as a construction consultant specializing in construction management and dispute resolution.

CAROLYN (LYN) WYLDER, P.E.
AREAS OF EXPERTISE: PROJECT MANAGEMENT, ENGINEERING

Ms. Wylder has over 30 years of experience ranging from conceptual engineering through construction and has had direct responsibility for the development and delivery of major transportation projects. She is currently the project manager for the Federal Transit Administration's project management oversight of transit and highway construction projects in lower Manhattan, worth $1.5 billion, which is reconstructing infrastructure damaged in the attacks of September 11, 2001. Previously as chief engineer and then vice president for operations and development with MARTA in Atlanta, she was responsible for design, construction, schedule, cost adherence, and overall quality for a $700 million transit line extension. This project included 3,000- and 4,000-foot cut-and-cover tunnels and was completed early and under budget. Ms. Wylder has master of science and bachelor of engineering degrees in civil engineering from the Georgia Institute of Technology. She is currently a vice president at David Evans and Associates.

ANALYTICAL AND ADMINISTRATIVE SUPPORT TEAM

DAVID R. GALLAY, D.SC., P.E.

Dr. Gallay has more than 30 years of experience as an engineer manager and operations researcher in the private sector and in the Army. His specialty areas are engineering economics, finance, and cost engineering. Currently, as the program director of Facilities and Engineering Management at LMI, he leads a multidisciplinary group of engineers and analysts in providing research and consulting services to public-sector clients in areas involving public works policy and management. Dr. Gallay is also is an adjunct faculty member at George Washington University, where he teaches various courses in finance and engineering economics. Before joining LMI, he was a career Army officer who served in military engineer and operations research positions. Dr. Gallay is a registered professional engineer and a certified cost engineer. He holds a bachelor of science degree in engineering from the U.S. Military Academy, a master of science in civil engineering from Purdue University, a master of science in systems management from the University of Southern California, and a doctorate in engineering management from George Washington University.

AMITA SINGH

Ms. Singh is a research fellow at LMI focusing on issues involving engineering economic studies and financial analysis. Her areas of expertise are statistical modeling, asset and portfolio valuation, and risk assessment and management. Prior to joining LMI, Ms. Singh was with Caminus Corporation's strategic consulting team in New York, where she advised clients on business opportunities and risk management practices in the North American electricity markets. Before joining Caminus, she worked with the wholesale power group at ICF Consulting, where she assisted with developing electricity price forecasting models and performed asset valuations and market assessments of electric power markets. Her project experience involved working with energy companies and investment banks in the United States and Canada, developing portfolio optimization strategies and regional market assessments of the electric power, natural gas, and air emissions markets. Ms. Singh earned her bachelor's degree in mathematics from the University of Delhi and her master's degree in operations research from George Washington University. Currently, she is a doctoral candidate at George Washington University, and expects to earn her doctorate in engineering management and systems engineering later this year.

BARBARA GILLILAND

Ms. Gilliland is a transportation planner with over 20 years of experience in high-capacity transit planning, and multimodal transportation program and project management. She brings both roadway and transit experience, with over 10 years at the senior management level. While at Sound Transit she held many positions

spanning planning, construction and operations, including Deputy Director of Transportation Services, responsible for facilities and services for Sound Transit's bus, commuter rail and light rail programs. Barbara has an extensive background in program development, project management, environmental documentation, alternatives analysis and technical review, policy development and community outreach working with community leaders and advocates, the public and elected officials at all levels of government. Barbara has a master's degree in Intermodal Transportation Management from the University of Denver and a bachelor's degree in Urban and Regional Planning. She currently leads the Bellevue, WA, transportation practice for Parametrix.