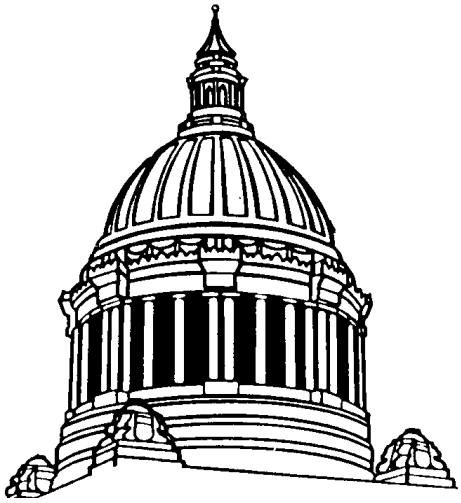

State of Washington
Joint Legislative Audit and Review Committee

Department of Transportation Highways and Rail Programs Performance Audit

Report 98-2

Prepared by Cambridge Systematics, Inc. for the Joint Legislative Audit and Review Committee

March 13, 1998

Upon request, this document is available in alternative formats for persons with disabilities.

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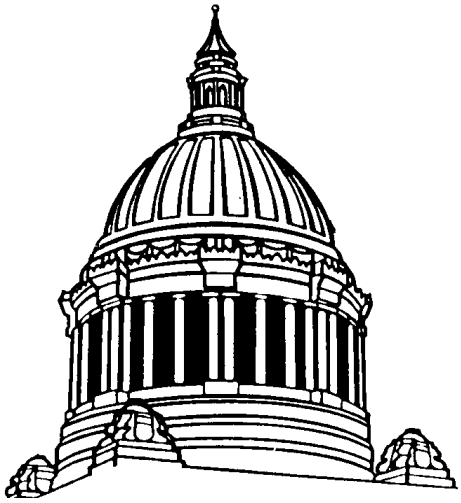

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TABLE OF CONTENTS

Chapter		Page
	Summary	**i**
	Summary of Recommendations	**xiii**
1	**Introduction**	**1-1**
	Background	1-1
	Scope	1-2
	Implementation of Findings	1-3
	Public Outreach	1-4
2	**Highway Construction Programs**	**2-1**
	Background	2-1
	Program Cost Comparisons	2-2
	Preservation Formulas	2-13
	Program Coordination with Maintenance	2-24
3	**Delivery of Highway Projects**	**3-1**
	Background	3-1
	WSDOT Control of Cost Overruns and Time Overruns	3-1
	Project Case Studies	3-15
	Allocation of Design Between Staff and Consultants	3-27
	Efficiency of Project Staging	3-30
	Work Zone Management and Review	3-42
4	**Highway Maintenance Program**	**4-1**
	Background	4-1
	Program Composition and Cost	4-1
	Maintenance Contracting	4-12

5	**Prevailing Wage Laws**	**5-1**
	Background	5-1
	Cost Impacts of Prevailing Wage Law	5-3
	Largest City Rule	5-6
6	**Environmental Compliance Costs**	**6-1**
	Background	6-1
	Costs of Compliance	6-3
	Status of Cost-Saving Proposals	6-15
7	**Rail Program**	**7-1**
	Overview	7-1
	Grain Train	7-1
	Statewide Passenger Rail Program	7-15
8	**Cross-cutting Issues and Recommendations**	**8-1**
	Overview	8-1
	WSDOT Knowledge of Its Costs	8-1
	WSDOT Approach to Its Mission and Business Area	8-5
	Regional Consistency vs. Autonomy	8-8

Appendices

1	Scope and Objectives	A1-1
2.	Agency Responses and Auditor's Comments	A2-1
3.	Data Supporting Analysis of Highway Design	A3-1
4.	State Statutes Relevant to Maintenance Contracting	A4-1
5.	Attorney General's Memorandum	A5-1
6.	Status of Environmental Cost-Saving Proposals	A6-1

WSDOT HIGHWAY AND RAIL PROGRAMS

Summary

This performance audit responds to legislation passed in 1997 (ESSB 6061) that called for performance audits of state transportation agencies. This report focuses on selected issues within the highways and rail programs of the Washington State Department of Transportation (WSDOT). A companion performance audit focuses on the Washington State Ferry System.

Altogether there were 15 performance audit questions identified by the legislature. Each of these questions falls within one of the following four areas:

- Highway construction and maintenance programs, including program cost comparisons, evaluations of program prioritization formulas, and an assessment of program coordination.
- Delivery of highway construction projects and maintenance work, including an evaluation of project cost and time overruns, and study of different methods of delivering these services, including outsourcing or managed competition.
- An evaluation of the impact of external factors that potentially could add to highway program costs: the state prevailing wage law, and compliance with environmental regulations.
- Assessments of the adequacy of information in two aspects of the rail program: the Grain Train Project, and passenger rail.

Findings in each of these areas are summarized below.

Fifteen questions were addressed in this performance audit.

HIGHWAY CONSTRUCTION AND MAINTENANCE PROGRAMS

During the 1995-1997 Biennium, WSDOT expended $2.471 billion, of which $2.004 billion was for capital, maintenance, and operating programs of the state-owned transportation

Washington's highway capital expenditures total $95,800 per system mile, ranking the state tenth in the country.

infrastructure. The major share of these dollars – $1.526 billion – was spent on highways.

Several audit questions dealt with the costs of the construction and maintenance programs and issues of management and coordination.

Program Cost Comparisons

WSDOT's costs of both highway capital construction and maintenance were compared with those of other states for calendar year 1995, the latest year for which data were available from the Federal Highway Administration (FHWA).

With a network of 7,035 miles, Washington's highway capital expenditures total $95,800 per system mile, ranking the state tenth in the country in this statistic, and 68 percent higher than the average of $57,000 for those states with networks of less than 10,000 miles. Several states that have dense, urbanized networks have costs comparable to, or higher than, Washington's.

While we could not determine from the available statistics the exact causes of Washington's higher-than-average costs, it is clear that major contributions to these costs came in the urban highway networks. A key factor is the composition of WSDOT's program itself, which in 1995 emphasized new construction and bridge construction at levels much higher than the national average in certain road classes. These projects are inherently more expensive than, for example, preservation projects that constituted a higher proportion of construction work in the other states. A supporting factor is a higher-than-average usage of urban highways that was also noted in the FHWA statistics. A third factor is that from 1987 through 1995, Washington experienced a rate of construction price inflation that was more than double the national average.

Washington's maintenance expenditures per system mile were 8 percent lower than the average for all states.

Highway maintenance costs in Washington were 22 percent lower in 1995 than the national average if considering just physical maintenance activities that exclude snow and ice control. If snow and ice control are included, Washington's maintenance expenditures per system mile were 8 percent lower than the average for all states. Washington's snow removal costs compare favorably with those of other northern tier states.

While the findings concerning construction costs do not, in and of themselves, demonstrate the existence of a problem, they at least suggest an area for potential further review and analysis by WSDOT. It is likely that factors relating to Washington's strong economy have influenced both the price of construction and the composition of Washington's program, particularly in urban areas.

Coordination Among Programs

Both the *preservation* and the *improvement* programs affect the demand for maintenance. Washington provides for coordination among these programs by a series of actions and decisions that occur within the regions and at the Olympia Service Center. We found that current coordination efforts are limited by existing budgeting practices, and that these practices result in an approach that is reactive in nature. Changes in maintenance budgets are based on decision packages submitted to and approved by the legislature. To the extent that resulting maintenance is less than requested, an overall less cost-effective application of funding to preserving or maintaining the highway system can result. Because this approach does not reflect a long-term view, there is less of an ability to achieve least-life-cycle-costs.

Coordination between programs is limited by existing budgeting practices, resulting in an approach that is reactive.

Other states plan and budget maintenance programs differently, and some states have begun to consider integrating the planning and budgeting of maintenance and capital preservation work on pavements and bridges. If such an approach were adopted for the maintenance program, a different, longer-term, and more proactive coordination mechanism could be accomplished. This could result in WSDOT being better able to ensure that the optimal mix of funding for improvement, preservation and maintenance projects, within funding limitations, is achieved.

Formulas for Highway Preservation

The audit reviewed the adequacy of existing formulas used in developing the highway preservation program, focusing on the major components of this program: Pavements and Bridges. The criterion applied to judge adequacy was the principle of least-life-cycle-cost.

Pavements

Pavement preservation programs are developed with the assistance of Washington State's Pavement Management System (PMS). Review of this system found that its logic and analytic routines identify least-life-cycle-costs. Nevertheless, the audit identified technical issues in the application, interpretation, and implementation of PMS results, and therefore includes recommendations for improvement.

Preservation formulas were judged on the basis of least-life-cycle-cost.

Bridges

Bridge preservation projects are now developed through an evaluation of bridge needs in several program areas. This evaluation is based upon bridge conditions established through biennial inspections, and evaluations based upon engineering knowledge, judgment, and ratings. The process does not now reflect a least-life-cycle-cost criterion. However, WSDOT is implementing a Bridge Management System (BMS) that does incorporate least-life-cycle-cost principles. Data describing all bridges have been input into the system, and the Department has outlined a plan to integrate the BMS into the programming process in the next two biennia. This will ultimately enhance WSDOT's ability to achieve least-life-cycle-costs.

DELIVERY OF SERVICES

This section considers several audit issues involving the delivery of design, construction, and maintenance services. The sections below summarize first the findings regarding WSDOT's delivery of highway construction, focusing specifically on extensions in project cost and time, and analyzing the various causes of change orders. A second issue is the legal environment surrounding the Department's ability either to contract for maintenance services or to deploy state forces more flexibly in maintenance. A third issue is the cost-effectiveness of the WSDOT's approach to design, comparing the use of state forces with design by engineering consultants. A fourth issue concerns project staging and WSDOT's management of highway work zones.

Highway Construction

Cost Overruns

To assess WSDOT's performance in managing time and cost overruns, the audit team analyzed construction histories of 865 highway projects built during the period 1990-1996.

Overall, the average cost overrun on these projects was 10 percent based upon project bid. This degree of overrun is comparable to that experienced by other state DOTs. However, the variation in the degree of overrun can be substantial in both directions (e.g., reflecting final cost that is 60 percent of original bid, or more than 200 percent of original bid, at the extremes observed in our analysis). Project characteristics influence the likelihood of a greater overrun, including project location, size, type of construction, and duration.

The average cost overrun on highway construction projects was 10 percent over project bid price.

Change Order Analysis

Although WSDOT's experience with cost overruns is similar to other states, there is still the question of whether the agency can take action to reduce costs associated with overruns. In order to address this question, the audit team analyzed more than 6,000 change orders to identify the causes of overruns, and to judge to what degree changes result in additional value to the project, and to what degree overruns may be avoidable. We also confirmed that the reasons cited for selected change orders recorded in the Department's construction cost database agree with the project situation described on the change order form.

We found that changes due to inadequate field investigation, specification ambiguity, plan error, design change, and construction engineer error total $35.4 million across the three biennia considered, or approximately $12 million per biennium. Our review of a sample number of change orders indicated approximately one-half of the dollar value related to work inefficiencies. Thus, it is reasonable to expect that up to $6 million per biennium can be saved through improved design and review procedures.

Target savings of $6 million per biennium might result from improved design and review procedures.

Time Overruns

A corresponding calculation was performed for time to completion, using the same set of projects as was evaluated for cost overruns. Overall, WSDOT projects overrun an average of

2.75 percent when gauged by chargeable working days (i.e., those days that count against a contractor's project performance time, accounting for factors such as weather). Washington's performance in this regard was comparable to that of other states. A clear trend emerged, indicating greater time overruns with longer project duration.

Three case studies were reviewed for insight into highway project delivery.

Case Study Projects

Three case studies were reviewed to provide more insight into opportunities to improve the delivery of highway projects. The audit team evaluated the DuPont South Interchange, the Sequim Bypass, and the Issaquah-Hobart Interchange, with the latter two projects compared to DuPont in terms of differences in project schedule.

The DuPont Interchange project was recently constructed on I-5 within a 26-month period, in lieu of an estimated time of four years using conventional design, right-of-way acquisition, and construction approaches. We analyzed this project to determine where time savings had been achieved, to what degree, and to what extent they could be replicated on other projects.

Our analysis indicated that a savings in total project time of 23.5 months was achieved by 1) starting project phases earlier than they would have been with a conventional approach, and 2) achieving shorter durations of phases. We further reviewed the factors that contributed to the success of the DuPont project from three perspectives:

Several lessons from the DuPont project can apply to other WSDOT design and construction work.

- Were factors unique to DuPont, and not likely to be replicated on other projects?
- Were factors matters of chance, which happened to run favorably at DuPont, but just as easily could run adversely on other projects?
- Were certain factors lessons that could be applied to other projects to achieve savings?

All three types of factors were observed in the DuPont project, but the degree to which they were interdependent makes it difficult to isolate any particular factor and attribute specific time savings. Nevertheless, several lessons have emerged from this project that can apply to other WSDOT design and construction work (e.g., early involvement of environmental and right-of-way considerations, improvements in the design and

review process, and innovations in the management of construction).

Highway Maintenance Program

This audit finds that the cost-effectiveness of highway maintenance can be substantially improved by ensuring that WSDOT management considers all the resources and methods of deployment available to it to deliver maintenance services. These resources should encompass state employees, private contractors and local government jurisdictions. A form of *managed competition* that would ensure a "level playing field" and adequate consideration of all cost-effective resource alternatives should be seriously considered.

Managed competition could result in cost savings of 8 to 10 percent and improve service levels in the highway maintenance program.

Toward this end, the audit report makes several recommendations, including changes to current law and the development of a pilot project to test the feasibility of the new approach. If fully implemented, a new approach to maintenance contracting could result in cost savings of 8 to 10 percent and at the same time promote improved service levels. If a pilot project were begun on the basis of a $60 million portion (approximately 25 percent) of the program, potential savings would be in the range of $5 to $6 million biennially. We believe this to be a realistic initial target. If these savings were realized, the project could be expanded to larger percentages of the program.

Allocation of Design between Staff and Consultants

Our analysis of whether in-house design staff or consultants achieve better performance was inconclusive. However, examination of this issue did reveal opportunities for WSDOT to improve its information systems in order to provide a better link between the design and construction phases. Such a better linkage will assist the agency in developing an overall strategy on the use of in-house staff and consultants.

Project Staging and Work Zone Management

The audit considered the long-term cost-effectiveness of staging project work in highway corridors over several biennia, rather than performing it all at once. The study found that staging is the economically preferred approach if there is modest or no congestion due to project work zones. If work zone congestion is

severe, it is more economical to perform the work as a single project in as short a period as feasible.

The study also found that WSDOT's practices in scheduling and managing work zones are comparable to those in other states, that it has tailored practices to the unique demands of the Puget Sound region, and that work zone safety performance is better in Washington than in many other states, based upon published data. WSDOT places a priority on highway safety in work zones, and has proactively achieved several improvements through the actions of its Work Zone Safety Task Force.

IMPACT OF STATE PREVAILING WAGE STATUTE

The state prevailing wage law increases highway program costs by less than one-half of one percent when analyzed against the federal wage law.

This audit evaluated two aspects of the prevailing wage statute:

- The impact of WSDOT's concurrent compliance with both state and federal (Davis-Bacon) prevailing wage laws on highway program costs.
- The impact of the "largest city rule," the current basis for determining state prevailing wages in a county, on highway program costs.

We found that the overall impact to highway program costs of having a state prevailing wage law in addition to the federal law is a cost increase of less than one-half of one percent. Assuming that labor accounts for 35 percent of construction costs, the impact of the state prevailing wage law on the $558 million portion of the construction program in which there was federal participation in the 1995-1997 Biennium would be approximately $0.86 million in the biennium.

In order to estimate the impact of the largest city rule, we compared it to two alternatives: a *county majority rule* and a *county average rule.* The results of our analysis suggest there is very little overall difference in cost by following any of the three alternatives. However, a change to a county majority rule would reduce data collection and reporting requirements, and likely would have a positive impact on both survey response rates and the accuracy of the data reported.

IMPACT OF ENVIRONMENTAL COMPLIANCE COSTS

WSDOT has taken proactive steps to mitigate the costs of environmental compliance.

Based on the experience reported in other states, environmental costs associated with the WSDOT construction program may be in the range of $75 to $95 million for the 1995-1997 Biennium. This is within total construction contract expenditures of $945 million.

Our general finding is that WSDOT has taken proactive steps to mitigate the costs of compliance. Factors that limit the agency's ability to reduce costs include federal regulations and WSDOT's adherence to local ordinances and regulations as required by the Growth Management Act.

A recommendation in the report calls for the legislature to consider funding for the Wetlands Bank, which has the potential to achieve cost savings as high as 50 percent of wetlands mitigation work. Additional recommendations address the need for WSDOT to speed efforts to implement an environmental costing system and to coordinate with other governmental units to work towards common definitions of environmental costs and benefits and a common database of such costs. These efforts should enhance WSDOT's ability to identify and control environmental costs.

RAIL PROGRAM INFORMATION

The audit reviewed existing information for the Grain Train Project and the Passenger Rail Program.

This section summarizes the review of existing information and analyses for the two rail initiatives: the Grain Train Project and the Passenger Rail Program. The objective for this part of the audit was to assess whether the information and analysis of these initiatives provided by WSDOT to the legislature and the Transportation Commission is adequate for policy and budget decision-making.

Grain Train Project

The audit found that the economic analysis provided to decision-makers is now outdated, was too limited in scope and was technically flawed in several respects. The effect of these problems was to overstate the overall value of the project. A comprehensive benefit-cost analysis should replace the current economic assessment of the Grain Train. Nevertheless, we

A comprehensive benefit-cost analysis of the Grain Train Project is needed.

found that the financial analysis and assumptions were credible. The actual flow of revenues and operating expenses suggest that the program is self-sustaining. However, car replacement and new car purchases cannot be accomplished until year 14 or 15 of the program instead of the nine-year period originally estimated.

Recommendations in the report focus on the need for periodic and more rigorous analysis of the program. Such analysis should assess the factors and conditions that may impact the choice of options in the future for operation of the Grain Train, including divestiture by the state of its ownership of the rolling stock, should policy-makers choose to consider this option.

Passenger Rail Program

The analysis on which the Passenger Rail Program is being implemented is consistent with industry standards and is being developed and updated through the use of improved analytical techniques on a periodic basis. Communication of material prepared for decision-makers is not, however, as adequate or effective as it could be. Specifically, it is not certain that the program is communicating effectively about changing market and other external conditions and uncertainties that may affect program implementation and performance.

The report recommends that WSDOT assess the need for and value of improved and updated summary materials for decision-makers and other key stakeholders.

CROSS-CUTTING ISSUES

The audit team addressed three cross-cutting issues.

The audit team addressed three issues that arose in two or more technical areas of the audit described above.

WSDOT's Knowledge of Its Costs

A knowledge of its costs will be critical to WSDOT's ability to manage its programs effectively, particularly if it considers new mechanisms of delivering projects and services in the future. The audit team recommended strengthening existing financial and management systems within the Department, as well as improving consistency and accuracy of data input.

WSDOT Approach to Mission and Business Area

While a complete review of WSDOT's approach to its mission and business area were not a part of this audit, issues in this area arose in considering different approaches to delivering maintenance and design services, and in improving delivery of construction projects. These issues will be particularly critical if WSDOT elects to engage in pilot efforts of managed competition, as recommended above for the maintenance program. A further recommendation in this section is that the evaluation of the pilot effort be performed within the context of an identified business approach.

The evaluation of the managed competition pilot effort should be performed within the context of an identified business approach.

Regional Consistency and Autonomy

This section concerns a very specific topic of procedural consistency among regions in matters such as contracting and reporting of management and cost information. While this issue does not cause problems now, it will take on greater importance as the Department moves to use cost information in different ways (e.g., to evaluate the relative costs and benefits of a managed competition pilot effort).

AGENCY RESPONSES

We have shared the report with the Office of Financial Management (OFM), the Department of Labor and Industries (L&I), and the Department of Transportation (DOT), and provided them an opportunity to submit written comments. OFM, L&I, and DOT have submitted written comments and those documents are attached as Appendix 2.

OFM, L&I, and WSDOT have submitted written comments, included in Appendix 2.

ACKNOWLEDGMENTS

We appreciate the extensive and courteous cooperation of the management and staff of the Washington State Department of Transportation. We also appreciate the many helpful comments and views expressed by private citizens and stakeholders during the course of the audit. In its preparations for contracting for this audit, JLARC received invaluable assistance from the Office of the State Auditor, the Office of Financial Management, the Senate Ways and Means Committee and the House Appropriations Committee.

This performance audit was conducted by Cambridge Systematics, Inc., under contract to JLARC.

AUDIT STANDARDS

This performance audit was conducted in conformance with generally accepted government auditing standards.

Cheryle A. Broom
Legislative Auditor

On March 13, 1998, this report was approved by the Joint Legislative Audit and Review Committee and its distribution authorized.

Representative Cathy McMorris
Chair

RECOMMENDATIONS

Summary

Recommendation 1

The Washington State Department of Transportation should continue to take positive steps to clarify its process for identifying and selecting pavement projects. The Department should not only approve proposals now under consideration, but also put in place an action plan that monitors compliance with, and progress toward, implementing and applying these steps.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	September 1998

Recommendation 2

The Washington State Department of Transportation should consider including pavement roughness, in addition to Pavement Structural Condition and rutting, in its candidate pavement project thresholds.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	April 1999

Recommendation 3

The Washington State Department of Transportation and the Legislature should discuss the nature of current highway program coordination and consider alternative approaches based upon forecasts of maintenance needs concurrently with forecasts of preservation and improvement needs for the coming biennium.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	April 1999

Recommendation 4

The Washington State Department of Transportation should develop, implement, and enforce clearer guidelines on the assignment of causes of change orders,

reducing the use of "Other" to those situations that literally are not covered by more definitive reasons, and promoting consistency among Regions on the interpretation and use of specific causes.

Legislation Required:	None
Fiscal Impact:	Can contribute to long-term cost effectiveness when coupled with actions under Recommendation 5; savings are indeterminate
Completion Date:	April 1999

Recommendation 5

The Washington State Department of Transportation should reduce its avoidable change orders that yield no added value to projects.

Legislation Required:	None
Fiscal Impact:	Cost savings of up to $6 million per biennium is a reasonable target
Completion Date:	Procedures by September 1998, with monitoring thereafter

Recommendation 6

The Washington State Department of Transportation should develop an action plan to achieve these cost savings, and report periodically to the Legislative Transportation Committee on the status of this effort, including statistics giving the breakdown of change orders by cause, frequency of occurrence, and dollar value over time.

Legislation Required:	None
Fiscal Impact:	See Recommendation 5
Completion Date:	Discuss reporting procedures and frequency with LTC to reach agreement by June 1998; reporting according to agreed-upon schedule thereafter

Recommendation 7

The Washington State Department of Transportation should continue its current steps to streamline project development procedures, collaborate with the private sector in unique design situations, and develop a more effective relationship between the Olympia Service Center and the regions.

Legislation Required:	None
Fiscal Impact:	Potential cost savings may be realized from these actions, together with improvements in service; dollar savings are indeterminate
Completion Date:	These steps are already underway; process should continue

Recommendation 8

The Washington State Department of Transportation should incorporate those lessons from DuPont that are replicable to other projects within its approach to design, environmental assessment, right-of-way acquisition, and construction, as appropriate for different types of projects.

Legislation Required:	None
Fiscal Impact:	Potential cost savings may be realized from these actions, together with improvements in service; dollar savings are indeterminate
Completion Date:	These steps are already underway; process should continue

Recommendation 9

The Washington State Department of Transportation should consider enhancing capabilities among its suite of management and financial accounting systems to provide a stronger capability to view project histories through all phases from design through construction completion.

Legislation Required:	None
Fiscal Impact:	$100,000 for review and conceptual design
Completion Date:	April 1999

Recommendation 10

Implement new legislation to encourage and facilitate expanded use of privatization where appropriate. Specifically, the legislation should provide the Washington State Department of Transportation management with the flexibility to evaluate and select the most cost-effective resources to perform highway maintenance. An environment that fairly and consistently considers the capabilities of both private sector contractors and state work forces should be key to the new legislation and guide the Washington State Department of Transportation implementation of maintenance contracting.

Legislation Required:	Yes (new state statute to define WSDOT's authority to apply state forces and contractors to normal highway maintenance)
Fiscal Impact:	See Recommendation 11 for potential for cost savings
Completion Date:	July 1999

Recommendation 11

If the implementing legislation is passed, the Washington State Department of Transportation should consider a pilot project to explore different ways of delivering maintenance services. Managed competition offers potential cost savings and places public and private sector providers on a level playing field to compete for maintenance work.

Legislation Required:	Yes (see Recommendation 6)
Fiscal Impact:	Initial cost savings of $5 to $6 million per biennium is a reasonable target; also see Recommendation 24
Completion Date:	December 2000

Recommendation 12

The Washington State Legislature should repeal the "largest city rule" in the Prevailing Wage Statutes (RCW 39.12), which mandates that the wage for each labor classification for each county will be based on the prevailing wage for the largest city in the county. A "county majority rule" should replace the existing "city majority rule."

Legislation Required:	Yes (amendment of RCW 39.12)
Fiscal Impact:	None
Completion Date:	July 2000

Recommendation 13

The Washington State Legislature should budget funds for the Wetlands Bank. This has considerable promise to significantly reduce environmental costs of transportation projects; greatly cut planning, regulatory and permit approval, and construction time requirements; and produce superior environmental protection.

Legislation Required:	Yes (inclusion in WSDOT budget)
Fiscal Impact:	Initial seed funding of Wetlands Bank; WSDOT has proposed $10 million, which is reasonable; projected 50 percent savings in costs of wetlands mitigation over long term
Completion Date:	July 1999

Recommendation 14

The Washington State Department of Transportation should speed efforts to implement an environmental costing system consistent with the intentions of SB 5572. It should develop a comprehensive environmental decision model that:

- Recognizes environmental benefits, as well as environmental costs.
- Attempts to comprehensively recognize all significant costs and benefits, including those that are not generally expressed in financial terms, such as quality of life, biodiversity, public health and safety, and delay of achievement of benefits due to regulatory compliance requirements.
- Where possible and practical, costs and benefits should be expressed in monetary terms; where monetarization is not possible, costs and benefits should be quantified in non-monetary terms; and where when quantification is not possible, costs and benefits should be identified and measured in qualitative terms.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	Begin conceptual design immediately, for completion by April 1999

Recommendation 15

The Washington State Department of Transportation should work with the federal government; other state and local governmental units, particularly within the state of Washington; professional societies such as the Transportation Research Board, the American Association of State Highway and Transportation Officials, the Government Finance Officers Association; and with academic institutions to work towards a common definition of environmental costs and benefits and a common database of such costs to be available to the Department of Transportation and other users and interested parties.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	April 1999

Recommendation 16

Continued periodic review and analysis of the Grain Train Project should be undertaken in a benefit/cost framework to monitor both changes in the economic impacts of the project as evaluated in the original 1996 report, as well as changes in the conditions affecting the performance of the project vis-a-vis state, program, and project goals and policy objectives.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	December 1998

Recommendation 17

Analytical techniques relating to the Grain Train Project should be reviewed and updated to assure consistency with state-of-the-practice techniques and data, and that documentation be provided in instances where alternative approaches are used.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	December 1998

Recommendation 18

More rigorous market analysis relating to the Grain Train should be considered to assess the impact of the project on preservation of light-density rail lines over which

existing cars are now being operated, and other potential lines where similar conditions exist and where similar initiatives might be considered.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 1999

Recommendation 19

Continued economic analysis should be undertaken to assess the factors and conditions that may impact the choice of options in the future for operation of the Grain Train, including divestiture by the state of its ownership of the rolling stock, should policy-makers choose this option.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 1999

Recommendation 20

The Washington State Department of Transportation should assess the need for improved summary materials on the passenger rail program, which would consistently and regularly address a broader range of program elements and contexts for use by decision-makers and other key stakeholders. These materials would be in addition to the intermittent updates on selected program milestones currently being provided.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	December 1998

Recommendation 21

The Washington State Department of Transportation's current management systems should be enhanced to provide easier and more reliable mechanisms to track costs of projects and key activities, based upon Activity-Based-Costing concepts. These enhancements should enable the Department to understand better its current cost structure, the factors that influence highway project and program costs, and the corresponding costs of alternative ways to accomplish work.

Legislation Required:	None
Fiscal Impact:	$100,000 for review and conceptual design; coordinate with Recommendation 9
Completion Date:	April 1999

Recommendation 22

Guidelines for the input of data to management and financial systems should be clarified by examples to indicate correct and consistent assignment of codes from

the Chart of Accounts, so that these data support an accurate picture of activity-based costs within the Department. Enforcement of these guidelines should be considered by the Washington State Department of Transportation internal audit function.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	December 1998

Recommendation 23

Develop the principles, strategies and goals necessary to guide the Washington State Department of Transportation's management of the evaluation of its business. Pilot efforts that are undertaken by the Department in outsourcing or managed competition should be designed based upon the Department's and its stakeholders' thinking on its strategic business approach.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 1999

Recommendation 24

Provide training to the Washington State Department of Transportation employees to assist them in reengineering their work approaches and empowering them to be competitive within the pilot efforts that are undertaken.

Legislation Required:	None
Fiscal Impact:	$250,000 to $500,000 to apply the ABC cost approach to selected WSDOT functions, provide assistance to employees in reengineering their work process, assist in bid review for managed competition, and provide training to employees on the managed competition environment. Cost savings associated with this effort are identified in Recommendation 11.
Completion Date:	July 2000; coordinate with Recommendation 11

Recommendation 25

The evaluation of the pilot effort should be made within the context of the proposed business approach, and should compare the relative costs, cost savings and risks of the piloted approach versus current practice.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 2000; coordinate with Recommendation 11

Recommendation 26

Guidelines on implementing new ways of delivering departmental services, and on tracking and reporting the performance and costs of current and new delivery mechanisms, should be issued, interpreted, implemented, and managed consistently across the Washington State Department of Transportation Regions. The focus should be on ensuring that department-wide needs for consistency and standards are addressed without jeopardizing the regional need for flexibility in meeting local service requirements.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 1999

INTRODUCTION

Chapter One

BACKGROUND

Background

The Washington State Department of Transportation (WSDOT) plans, designs, builds, maintains, and operates the transportation systems for which the state has responsibility and jurisdiction. These systems include highways, state ferries, and state-owned airports. WSDOT planning also encompasses other transportation modes in which there is a state interest: public transportation (including various forms of transit and non-motorized modes), local roads, freight rail, intercity passenger rail, marine ports and navigation, and aviation. During the 1995-1997 Biennium, WSDOT expended $2.471 billion, of which $2.013 billion was for capital, maintenance, and operating programs of the state-owned transportation infrastructure. The major share of these dollars ($1.523 billion) was spent on highways. WSDOT also spent $315 million on those modes defined to hold state interest, with the major share (over $260 million) conveyed to local governments via TransAid Programs. To accomplish its work throughout the 1995-1997 Biennium, the department expended 6,477 full-time-equivalents (FTE) of employee labor.

This audit is the result of a legislative process.

In the 1997 Legislative Session, WSDOT sought an increase in the fuel tax to fund increasing needs in its transportation program. This revenue proposal was narrowly defeated. Following this vote, however, legislators expressed a desire for a better understanding of WSDOT's Highway Program costs and the factors that affect these costs, and an impartial assessment of several questions regarding transportation program costs. This performance audit, and a concurrent audit of Washington State Ferries, are the result of that legislative process.

This performance audit comes at a time of significant institutional change in surface transportation that affects state DOTs across the country. A recent (1997) survey of member departments of the American Association of State Highway and

Transportation Officials (AASHTO) cites multiple forces and concepts now driving change within DOTs, including revisions in corporate strategy, an emphasis on quality of work, and a focus on both the "policy" and the "production and delivery" aspects of a DOT's operations. However, wide variations in the impacts of these trends and how they are dealt with are observed among member departments.

The audit focuses on selected issues in WSDOT highways and rail programs.

SCOPE

The performance audit documented in this report by no means addresses the full range of the WSDOT's transportation programs. It has focused, rather, on selected issues in the department's highway programs. It has also responded to a question on the adequacy of information for two components of WSDOT's Rail Program. Cambridge Systematics, Inc., has performed this audit of WSDOT's Highways and Rail Programs under contract to the Joint Legislative Audit and Review Committee (JLARC). The corresponding audit of the WSDOT's Ferry Program has been conducted concurrently by Booz-Allen Hamilton, Inc., for JLARC.

The specific questions that were posed for this audit are listed in Appendix 1. While these 15 questions cover a diverse set of highway and rail issues, they are interrelated in several respects. It will be easier to draw connections and comparisons among the findings of these tasks if they are collected within groups. We have therefore organized the report in the following way:

Audit questions have been organized within groups.

- Chapter 2 covers several questions dealing with the highway construction programs, including audit issues A through C.
- Chapter 3 considers WSDOT's performance in delivering highway projects, covering cost overruns and schedule delays (audit issue D), allocation of highway design between in-house staff and design consultants (audit issue E), and project staging and workzone safety in highway corridors (audit issues F and G).
- Chapter 4 addresses issues specific to the maintenance program, encompassing audit issues L through N.
- Chapter 5 responds to the two questions on the state prevailing wage law, audit issues H and I.

- Chapter 6 deals with the impact of environmental compliance on highway program costs, audit issues J and K.
- Chapter 7 responds to questions on the adequacy of information regarding two initiatives of WSDOT's Rail Program: the Grain Train and Passenger Rail.
- Chapter 8 presents findings and recommendations on general or cross-cutting themes relating to two or more of the audit areas above .

IMPLEMENTATION OF FINDINGS

The audit questions in Appendix 1 represent a broad spectrum of issues not only in their subject matter, but also in the types of analyses that they call upon, and the nature of the findings that have resulted from their analysis. While all of the audit questions relate to transportation program costs in some way, the ability of WSDOT to achieve cost reductions, to influence those factors that affect highway program costs, or simply to take independent actions to respond to the audit findings, will vary across the several components of this audit:

The ability of WSDOT to reduce costs will vary across audit questions.

- WSDOT has considerable management control to respond to recommendations regarding management and delivery of the highway construction programs (i.e., the issues discussed in Chapters 2 and 3) and the related, but more general, recommendations in Chapter 8.
- WSDOT can also take steps to improve the management of its maintenance program, following upon the results described in Chapter 4. However, for the department specifically to increase its contracting for maintenance services, or to have greater flexibility in deploying state forces for maintenance work (as in emergencies), will require legislative action.
- Prevailing wage requirements and compliance with environmental regulations affect highway costs as described in Chapters 5 and 6. These topics, however, are governed by both federal and state statutes with which WSDOT must comply, and legislative action would be needed to effect fundamental changes in statutory requirements. Previous studies have identified cost-reduction measures in environmental compliance procedures that the department could take. Chapter 6 describes WSDOT's progress to date in addressing these recommendations.

- An evaluation of the information and analyses that WSDOT has provided with respect to rail programs is provided in Chapter 7. The scope of this audit task was limited to the adequacy of this information for planning and budget decisions. Audit findings do not address the broader policy issue of WSDOT's role and degree of involvement in rail programs, which must be addressed by the Transportation Commission, the department, and the legislature as a separate matter.

PUBLIC OUTREACH

The audit has been accompanied by public outreach efforts.

This audit has been accompanied by several public outreach efforts that have been undertaken by JLARC:

- A telephone survey of highway users was conducted to assess public perceptions of WSDOT's performance. Results have been compiled in a separate report.
- A series of focus group meetings was conducted to obtain the opinions of Washington State residents regarding WSDOT performance and the topics of the audit.
- This audit has received press coverage through references in public statements by state legislators and executives. Many items of correspondence have been received by JLARC from stakeholders, concerned groups, and interested citizens, expressing their thoughts on audit questions, and suggesting topics for review.

A proactive public awareness effort to this extent is unique in JLARC's conduct of performance audits. This innovation influenced the audit positively in several ways:

Public outreach influenced the audit positively in several ways.

- Many of the letters provided useful insight into public perceptions of WSDOT performance and transportation problems germane to this audit, helping to frame the investigation of each question.
- The diversity of views reflected in the letters also served as a steady reminder that perceptions of transportation issues and programs can vary widely across the state, and that a general finding (e.g., regarding the costs or benefits of a program) may mask considerable variation in the program's impact from one region to another.

- Letters also contributed several useful leads in addressing particular questions (e.g., suggestions of relevant state statutes).
- Survey and focus group results provided a useful counterpoint to the data and assessments obtained from the department, and contributed a valuable "customer perspective" to the audit.

Specific contributions of these public perceptions to the audit are noted in respective chapters. All data and analyses cited in the report, however, are the work of the audit team.

HIGHWAY CONSTRUCTION PROGRAMS

Chapter Two

BACKGROUND

WSDOT's Highway Construction Program comprises two major programs of work, consistent with the provisions of RCW 47.05:

1. The **preservation** program includes all investments to "preserve the existing state highway system and to restore existing safety features, giving consideration to lowest life-cycle costing."

2. The **improvement** program includes all investments that address deficiencies on the state highway system, and that in so doing "improve mobility, safety, support for the economy, and protection of the environment."

Two WSDOT highway capital programs

The preservation program and the improvement program encompass all capital projects built by WSDOT on its highway system. A third program, maintenance, funds work to keep the system in an operable condition and to accomplish non-capital repairs. All of these programs entail significant expenditures, both in absolute dollars and as a percentage of the WSDOT's biennial budget. In the 1995-1997 Biennium, outlays by the WSDOT for these programs were as follows:

- Improvement: $794.9 million;
- Preservation: $432.5 million; and
- Maintenance: $266.0 million.

Several issues regarding these highway programs were posed in the scope of work for this audit. This chapter responds to three specific questions addressing the capital construction programs and their coordination with maintenance. Additional topics related to the delivery of construction projects and the maintenance program specifically are addressed in Chapters 3 and 4, respectively. The questions dealt with in this chapter are as follows:

This chapter responds to three specific questions.

- How do Washington's highway construction costs for preservation and improvement compare with those in other states?
- With respect to the preservation program: Are the formulas used to schedule and budget highway preservation work on pavements and bridges adequate, in terms of least life-cycle cost principles?
- Are planning and budgeting for the preservation, improvement, and maintenance programs adequately integrated and coordinated?

WSDOT's costs were compared to those of other states.

The following sections address each of these questions in turn.

PROGRAM COST COMPARISONS

Methodology

WSDOT's costs of highway construction were compared to those of other states by using data on highway expenditures and system mileage for each state as published annually in the U.S. Department of Transportation's *Highway Statistics*. Because the data in *Highway Statistics* are reported on a calendar-year basis, the numbers cited below differ from biennial expenditure data used elsewhere in this report. Nonetheless, adopting this convention places WSDOT's construction expenditure data in the same timeframe with expenditure data from other states.

All comparisons were performed for calendar year 1995.

All comparisons were performed for calendar year 1995, the most recent year for which *Highway Statistics* data were available at the time the audit was performed. As will be discussed below, 1995 also represents the most recent year in a trend marked by steadily increasing expenditure levels in the WSDOT capital construction programs, and therefore represents an historical peak in highway expenditures. This characteristic will be noted below. Apart from this, we have no reason to believe that 1995 represents anomaly in the pattern of recent WSDOT expenditures for highway projects.

System mileage data were obtained from Table HM-80 in *Highway Statistics*. Capital expenditure data were obtained from Tables SF-12 and SF-12A. However, because these data include capital expenditures for toll facilities and ferry systems as well as state highways, costs of ferry and toll facilities were deducted from total expenditure data. For Washington State,

this deduction was accomplished by functional class[1] and improvement type, using information on Forms 534[2] that were submitted by WSDOT to the Federal Highway Administration (FHWA) for 1995. For the other states, this deduction was made using information in Table SF-4B; however, these data are available only on a total system basis.[3] Therefore, comparisons below by functional class or by improvement type are adjusted for ferry and toll facilities in Washington's case, but not in the case of other states. Nevertheless, these comparisons have been included because they are still instructive regarding differences between the distribution of expenditures in Washington compared to those nationwide.[4] Comparisons of **total** highway capital costs between Washington and other states are based upon adjusted figures throughout. Apart from these adjustments, reviews of WSDOT submittals, and verification with FHWA staff on methodology for the adjustments, no independent audit of the *Highway Statistics* data have been performed.

Highway capital costs were computed in terms of expenditures per system mile.

Using the adjusted *Highway Statistics* data, highway capital costs were computed for each state in terms of expenditures per

[1] Functional classification denotes the role that a particular highway or road plays in serving trips through a highway network. The functional systems include rural and urban arterials, which handle generally long or through trips; collectors, which collect and disperse traffic between arterials and lower level roads and streets; and local roads and streets, which provide access to individual homes, businesses, and so forth. Interstate highways are a subdivision of the arterial classification. Functional classes are also subdivided by rural and urban areas. The "Local" functional class is not included in any of the comparisons in this chapter, since WSDOT's highway network does not include these.

[2] Forms 534 are the worksheets used for input of state DOT data to *Highway Statistics*. These forms were also used to verify WSDOT's entries in *Highway Statistics*.

[3] A corresponding adjustment was not made to the mileage data. We confirmed with the FHWA that mileage data in Table HM-80 pertain solely to state highway facilities.

[4] Capital expenditures for ferry and toll facilities nationwide in 1995 are almost $2 billion of total system capital expenditures of $31.6 billion, or about 6 percent. Therefore, while this inconsistency in data treatment between Washington and all states may introduce some error in comparisons by functional class or improvement type, the error is expected to be small, and should not affect the basic patterns observed or conclusions derived. Note that for Washington State, however, capital costs attributable to ferry facilities are $94.5 million of total system capital expenditures of $768.3 million, or 12.3 percent of the total. Deducting the ferry expenditures from Washington's capital expenditure total has a greater effect proportionately than the nationwide adjustment.

system mile, where capital expenditures are in 1995 dollars, and system miles equate to highway centerline miles. Capital expenditure data include costs of engineering, right-of-way acquisition, and construction. For Washington State, this analysis encompasses the preservation (P) and the improvement (I) programs. Maintenance expenditures are analyzed in Chapter 4.

Comparisons of Expenditures

Washington's capital expenditures total $95,800 per system mile – 10th in the country.

Highway capital expenditures per system mile nationwide range from about $15,000 to $402,000, with a 50-state weighted mean of $44,300.[5] However, this value of weighted mean is influenced strongly by below-average expenditures in seven states with large networks of more than 20,000 system miles. A more representative mean value is about $57,000 per system mile, which applies to the group of state DOTs with networks less than 10,000 miles in length as well as the group of DOTs with networks of between 10,000 and 20,000 system miles.

With a network of 7,035 miles, Washington's highway capital expenditures total $95,800 per system mile, ranking the state tenth in the country in this statistic, and 68 percent higher than the average of $57,000 for those states with networks of less than 10,000 miles. To understand the implications of this comparison and factors that could explain WSDOT's expenditures, we developed the comparison by functional class shown in Exhibit 2.1.

[5] The weighted mean expenditure per system mile is computed using state system miles as the weight. For example, assume that State A has 10,000 system miles and an expenditure of $100,000 per system mile; State B has 20,000 system miles and an expenditure of $60,000 per system mile. The weighted mean would be computed as follows: [(10,000 x $100,000) + (20,000 x $60,000)] / [10,000 + 20,000], or $73,333. By comparison, a simple mean would be computed as $80,000. Since State B has double the system miles of State A, it exerts a stronger influence in determining the value of the weighted mean.

Exhibit 2.1

Capital Expenditures per System Mile by Functional Class

Highway Functional Class	Washington State	National Average
Rural Interstate	$44,607	$95,565
Urban Interstate	$756,355	$535,573
Total Interstate	$289,008	$223,737
Rural Arterial	$49,483	$33,796
Urban Arterial	$316,717	$128,128
Total Arterial	$95,301	$56,252
Rural Collector	$10,051	$8,532
Urban Collector	$49,054	$33,821
Total Collector	$10,894	$9,583
Rural Highways	$37,986	$24,612
Urban Highways	$414,110	$173,367
Total Highways	$95,781	$44,294

For interstate highway capital expenditures, Washington is 29 percent higher overall than the nationwide mean, but this pattern diverges between rural and urban areas. WSDOT's expenditures per system mile are less than 50 percent of the national average for rural Interstate highways, but more than 40 percent higher for urban interstate highways. The fact that Washington's urban interstate mileage is about half of its rural interstate mileage indicates that these data are strongly influenced by major urban interstate projects.

Washington devotes higher-than-average expenditures to urban highways.

The influence of urban projects is shown even more strongly in the statistics for other arterial highways: For the urban arterial class, Washington's expenditures per system mile are the fourth highest in the country. More will be said about this and about rural arterial projects shortly.

Expenditures for collectors are 13 percent higher than average in total, driven mainly by highways in rural areas.

An analogous pattern is shown if the costs are computed on the basis of expenditures per system lane mile. In this case, data on the state highway systems nationwide are available only for interstate highways, so only that class was analyzed. The results are as follows:

	Washington State *Dollars per Lane Mile*	National Average *Dollars per Lane Mile*
Rural Interstate	$10,094	$22,743
Urban Interstate	$129,435	$96,827
All Interstate	$58,882	$48,753

States with the highest costs as a group are small states with dense, urbanized networks.

Characteristics of States

A review of these several cost comparisons by individual state showed the following:

- States with the highest costs as a group are small states, located primarily in the Northeast or Middle Atlantic regions, having dense, urbanized networks: Massachusetts, New Jersey, Rhode Island, Connecticut, District of Columbia, and Maryland. Hawaii also falls into this group.
- The highest intensity of expenditures–more than $402,000 per system mile–corresponds to Massachusetts. In addition to the effect of a small, urbanized state, this rate of expenditure is influenced by the multibillion dollar Central Artery Project, illustrating how program composition can affect the construction expenditure statistic in a given state.
- Washington falls within a second group of states that also exhibit higher-than-average costs. These states include Florida, California, New York, Illinois, Michigan, and Arizona. Three of these states exceed Washington's costs: Florida ($147,153 per system mile), California ($135,831 per system mile), and New York ($117,325 per system mile).

Washington falls within a second group of states with higher-than-average costs.

- Many states with networks of length less than 10,000 miles have costs in the range of $15,000 to $40,000 per system mile, including Nebraska, Colorado, Utah, New Hampshire, and Maine.

Thus, Washington's 1995 construction expenditures are not out of range of other states. Similar costs are exhibited by several states with large land areas and major urban centers. Nevertheless, the fact that Washington's costs exceed the expenditures per system mile in many other states with comparably sized networks prompts further inquiry as to the causes for these higher expenditures.

Details of Comparisons

Highway Program Composition

Exhibit 2.2 provides a breakdown of highway capital expenditures by type of improvement and functional class, comparing WSDOT to all other state DOTs. These comparisons show patterns in which WSDOT diverges from the composite nationwide.

One explanation of the higher WSDOT expenditures is the different composition of highway work accomplished in Washington, as compared to the national composite.[6] For example, new construction of urban interstate highways accounted for almost 40 percent of WSDOT's 1995 interstate expenditures, as compared to 15 percent of total interstate expenditures for this type of work in the national composite statistics.

One explanation for higher WSDOT expenditures is the different composition of highway work in Washington.

A second unique characteristic in WSDOT's program composition occurs with arterial highways. From Exhibit 2.1, Washington's expenditures per system mile on rural arterials are 46 percent higher than that nationally, and for urban arterials, WSDOT's expenditures per system mile are almost two-and-a-half times the national average. From Exhibit 2.2, Rural Arterial construction is characterized by higher ratios of reconstruction and safety work compared to the national average, and less to rehabilitation. The Urban Arterial Construction Program is characterized by almost 35 percent of expenditures devoted to bridge work compared to almost 20 percent nationally, and correspondingly less rehabilitation work.

[6] When construction statistics are broken down by type of highway improvement, data for Washington are excluded from the national statistics (i.e., the statistics for 49 other states plus District of Columbia) to avoid distorting the national composite distribution.

Exhibit 2.2

1995 Highway Capital Expenditures by Improvement Type:
Data from Highway Statistics, 1995, Table SF-12A
(Expenditures in Thousands of Dollars)

Interstate Highways	ROW and Engineering	New Construction	Reconstruction	Major Widening	3R	Bridge Work	Safety, Other	Total
WSDOT								
Rural Interstate	$6,819	$0	$0	$0	$10,006	$2,253	$3,270	$22,348
Percent Distribution	30.5%	0.0%	0.0%	0.0%	44.8%	10.1%	14.6%	100.0%
Urban Interstate	$51,912	$86,343	$23,230	$167	$12,716	$6,323	$17,474	$198,165
Percent Distribution	26.2%	43.6%	11.7%	0.1%	6.4%	3.2%	8.8%	100.0%
All Interstate	$58,731	$86,343	$23,230	$167	$22,722	$8,576	$20,744	$220,514
Percent Distribution	26.6%	39.2%	10.5%	0.1%	10.3%	3.9%	9.4%	100.0%
Total for Other States								
Rural Interstate	$417,184	$296,545	$352,335	$200,924	$1,201,704	$353,004	$192,178	$2,991,526
Percent Distribution	13.9%	9.9%	11.8%	6.7%	40.2%	11.8%	6.4%	100.0%
Urban Interstate	$1,582,113	$1,091,965	$666,600	$362,419	$1,081,547	$1,201,033	$728,797	$6,516,309
Percent Distribution	24.3%	16.8%	10.2%	5.6%	16.6%	18.4%	11.2%	100.0%
All Interstate	$1,999,297	$1,388,510	$1,018,935	$563,343	$2,283,251	$1,554,037	$920,975	$9,507,835
Percent Distribution	21.0%	14.6%	10.7%	5.9%	24.0%	16.3%	9.7%	100.0%
Other Arterials	**ROW and Engineering**	**New Construction**	**Reconstruction**	**Major Widening**	**3R**	**Bridge Work**	**Safety, Other**	**Total**
WSDOT								
Rural Other Arterial	$60,748	$6,543	$26,881	$22,130	$38,268	$7,979	$24,862	$187,411
Percent Distribution	32.4%	3.5%	14.3%	11.8%	20.4%	4.3%	13.3%	100.0%
Urban Other Arterial	$54,012	$35,027	$23,956	$17	$17,032	$85,587	$31,597	$247,228
Percent Distribution	21.8%	14.2%	9.7%	0.0%	6.9%	34.6%	12.8%	100.0%
All Other Arterial	$114,760	$41,570	$50,837	$22,147	$55,300	$93,566	$56,459	$434,639
Percent Distribution	26.4%	9.6%	11.7%	5.1%	12.7%	21.5%	13.0%	100.0%
Total for All Other States								
Rural Other Arterial	$1,735,420	$1,230,484	$654,090	$566,252	$1,823,613	$799,755	$373,038	$6,946,973
Percent Distribution	25.0%	17.7%	9.4%	8.2%	26.3%	11.5%	5.4%	100.0%
Urban Other Arterial	$2,213,613	$1,129,157	$1,050,266	$548,320	$1,287,671	$1,581,744	$670,806	$8,188,664
Percent Distribution	27.0%	13.8%	12.8%	6.7%	15.7%	19.3%	8.2%	100.0%
All Other Arterial	$3,949,033	$2,359,641	$1,704,356	$1,114,572	$3,111,284	$2,381,499	$1,043,844	$15,135,638
Percent Distribution	26.1%	15.6%	11.3%	7.4%	20.6%	15.7%	6.9%	100.0%

These characteristics of interstate and arterial highway construction imply essentially a more expensive composition of highway program for Washington State than that experienced nationally. For example, whereas rehabilitation projects (3R) generally range from $100,000 per mile to about $10 million per mile depending upon highway functional class, terrain, extent of rehabilitation work (e.g., whether or not drainage improvements are included), design standards, and other factors, new construction can range to hundreds of million dollars per mile or higher, especially in urban areas. These types of improvement projects drive up the cost per system mile statistic. Likewise, because bridge projects occur at specific locations and may involve specialized work, their costs also drive up cost per mile statistics. Thus, program composition offers one explanation for the higher construction costs computed for Washington State.

Seattle and Tacoma both have higher road usage than the national average.

Road Usage and Other Characteristics

Other possible explanatory factors concern the road network itself (e.g., design characteristics, usage, terrain traversed, pavement condition, and so forth). Reliable statistics and descriptions are harder to come by for national comparisons of these factors, and what comparisons can be done are very coarse. Nevertheless, we investigated sets of statistics that could be consistently compared to see if other explanations existed for the construction expenditure patterns noted above.

Road usage is expressed in vehicle-miles-traveled (VMT).[7] Washington's VMT per system mile for rural interstate highways is close to the national composite. However, its urban VMT per system mile is about 34.57 million, compared to a national composite value of 26.46 million for urban interstates. Corresponding data are not available for other functional classes.[8] The daily vehicle-miles-traveled per capita that is computed in *Highway Statistics* for urban areas greater than 500,000 population shows both Seattle and Tacoma higher than the composite national value (24.5 and 21.8, versus a composite value of 21.4). It is reasonable to believe that this heavier usage translates into higher capital expenditures, but a direct calculation of this relationship is not easily obtainable.

Heavier usage may translate into higher capital expenditures.

[7] For example, ten vehicles each traveling five miles on a road would account for 50 VMT.

[8] VMT data are available for other functional classes, but do not distinguish those highways that are the responsibility of the state DOT or state highway agency, as opposed to other jurisdictions.

It is likely that other factors affect Washington's highway construction costs relative to other states (e.g., geometric design standards, economic development initiatives, variations in terrain and climate, number of river crossings, and so forth). However, data are not readily available to perform a statistical comparison of these factors among states. We reviewed the distribution of pavement condition in Washington in comparison with the national composite distribution of pavement condition, but this exercise did not explain the higher capital expenditures by WSDOT. The cost implications of environmental compliance are discussed in Chapter 6.

Construction Price Inflation

Washington experienced construction price inflation more than twice the national average.

Washington's expenditures for highway construction have increased by 57 percent in current dollars in the 12-year period between the 1983-85 Biennium and the 1995-97 Biennium. This increase results from a doubling of preservation expenditures and a 40 percent increase in highway improvements, both again in current dollars. However, the Federal Highway Administration's Construction Cost Index tracks an increase in the price of construction **in Washington State** of 46 percent from 1987 to 1995,[9] compared to a nationwide composite increase of 22 percent.

The implication is that there has been an increase in the real expenditures on WSDOT's highway Capital Construction Program of about 8 percent, and an increase in the unit price of construction bid items of 46 percent, in this five-biennium period. While one cannot use construction price indexes to compare actual differences in **costs** between states or between a state and the national average, one can say the following: If the price of construction in Washington State equaled the national average price in 1987 (assuming the same composition of the market basket), the difference in the price trends in this ten-year period would imply a growth in the price of construction in Washington State more than double the national average. While this cannot be claimed to be an exact figure, it suggests a

[9] This increase was likely driven by almost a doubling in the price of structural concrete used in Washington State during this period, but we do not know the composition of the market basket (therefore, the weights) by which the index is computed. Other construction items in the Washington index tracked national trends, with the exception of common excavation, which declined in Washington State by almost 30 percent in the face of a 13 percent increase nationally.

contribution to the higher capital expenditures per system mile observed for Washington State in 1995.

No clear trends in index values could be discerned to explain construction expenditure results.

A check was made of the R.S. Means Construction Index for major U.S. cities,[10] to determine if there were any unusual patterns that might affect relative construction costs in Washington State. The index suggests that cities in Washington have materials costs 10 to 25 percent higher than the 30-cities composite that serves as the base, but labor and equipment costs 0 to 10 percent lower than the base. By comparison, Oregon has similarly higher-than-base materials costs, and but its labor costs are also higher than the base by about 5 percent. Wisconsin and Arizona have index values lower than Washington's (i.e., construction costs are cheaper, by about 20 percent), but California's values are higher. No clear trends in these index values could be discerned between Washington and other states to explain the construction expenditure results earlier. Moreover, since the Means index is oriented more toward building construction rather than highway construction, greater reliability is placed upon the analysis using the FHWA Construction Cost Index for highways described in the previous item.

Other Potential Statistics

Statistics other than expenditures per system mile were considered.

All of the dollar comparisons in this section have been based upon a statistic of expenditures per system mile. Consideration was given to an alternate statistic, cost per mile of project constructed. However, past surveys of highway project costs have exhibited variations of an order of magnitude (i.e., by a factor of ten) or more for highway projects involving nominally the same type of construction, with no apparent explanation for the variation.[11] It is logical to assume that these variations

[10] *Means Heavy Construction Cost Data*, R.S. Means Company, Inc., Kingston, MA, 1996.

[11] A recent study by the audit team solicited documented costs of projects to build a four-lane freeway through rolling terrain in non-urban areas. All states contacted were in the same region of the country, and costs were adjusted to treat project components (design, right-of-way acquisition, etc.) in a comparable fashion. The resulting costs varied from $5 million to about $35 million per mile, with one project exceeding $80 million per mile. Variations in costs existed within states as well as among states (although the state in which the project was located appeared to have some effect on the range of costs). Moreover, these variations masked the effect that was being sought (a baseline for judging the impact of particular environmental regulations).

derive from differences in design standards, terrain and soil type, materials used, contract type, bid climate, and other factors. Resolving the impact of these factors on the unit costs observed would require a detailed examination of project-specific data that are not easily obtained.

FINDINGS

Washington's expenditures for highway construction are 68 percent higher than the average for states with less than 10,000 system miles.

1. *Washington's expenditures for highway construction are within the range established by other states, but they are 68 percent higher than the average expenditure per system mile by states with less than 10,000 system miles.*

2. *This higher intensity of expenditure is due in part to the composition of WSDOT's Construction Program compared to the national composite, focusing much more on new construction for urban interstate highways, and on urban arterial bridge projects. Higher-than-average usage of urban interstate freeways may also help explain these higher expenditures.*

3. *Another explanation derives from an increase in the price of construction in Washington State that was more than double the composite increase nationwide by 20 percent in the years 1987-1995.*

4. *WSDOT's Highway Capital Construction Programs grew in current dollar terms by 57 percent between the 1985-87 and the 1995-97 Biennia. However, given the construction price increase noted above, the growth in construction program volume in real terms is estimated at 8 percent during this period.*

5. *Other factors, such as design standard, terrain, climate, economic development, and environmental regulations, also contribute to the expenditures that have been observed. The effect of environmental compliance costs is discussed in Chapter 6. Estimating the impacts of the other factors listed above would require engineering, site, demographic, and project data that are not readily available.*

6. *Nothing in the analysis indicates that, for a particular project, the costs of **project** construction in Washington State diverge widely from those in other states. For example, among the functional classes shown in Exhibits 2.1 and 2.2, and with the exceptions cited earlier, the distributions of WSDOT costs among types of improvements and phases of work (right-of-way acquisition and engineering) are similar to the national composite. The results do show that Washington's **system** construction costs are higher than average.*

The costs of project construction in Washington do not diverge widely from those in other states.

We will return to the subject of construction costs in Chapter 3, to analyze specifically the impact of cost changes during construction, and in Chapter 6, to deal with environmental influences on costs.

PRESERVATION FORMULAS

A second aspect of this program review deals with the adequacy of the formulas used to schedule and select (i.e., prioritize) preservation projects. The objectives of the preservation program listed in RCW 47.05 are as follows:

- To extend the service life of the existing highway system;
- To ensure the structural ability to carry loads imposed upon pavements and bridges; and
- To minimize the life-cycle costs of the highway facility.

Formulas will be reviewed in light of their contribution to these preservation objectives, as well as to the needs of capital program prioritization.

Are preservation formulas adequate?

The major highway elements involved in preservation work are pavements and bridges. Formulas for each are embodied in computerized management systems referred to, respectively, as a Pavement Management System (PMS) and a Bridge Management System (BMS). While much of the discussions below will focus on the analytic procedures of these systems, it should be understood that these systems are tools that are applied by managers, and that the procedures to apply and to update the preservation formulas involve human judgment as well as automated computations.

Pavements

Approach to Pavement Prioritization

The following review is based upon interviews with WSDOT staff, studies of documents including research papers and descriptions of the PMS, and demonstration of the PMS.

WSDOT identifies candidate roadway preservation projects in a pavement array.

WSDOT identifies candidate roadway preservation projects in a pavement array (now maintained in the Priority Array Tracking System, or PATS), which lists highway segments projected to have deficient pavement conditions. The pavement array is built using the PMS, which organizes information on the structure and condition of each section of pavement and applies analytic models (which yield performance curves) to predict the future pavement condition of each section.

Pavement condition and performance for purposes of identifying candidate pavement projects are gauged in terms of the following measures:

- The Pavement Structural Condition (PSC), which has values ranging from 100 (excellent pavement condition) to zero (completely deteriorated pavement).
- The depth of rutting (i.e., channel-shaped depressions in the wheelpaths of the pavement), which is measured in millimeters.

After a roadway is built, its condition begins to deteriorate over time, due to traffic usage and environmental stresses. While routine maintenance can lessen the rate of deterioration, it cannot forestall it forever. Eventually the pavement requires rehabilitation; the condition at which rehabilitation should be performed is denoted by a threshold value of PSC or of rutting. Both are tracked in the PMS, and either threshold can trigger the pavement section as a candidate for a rehabilitation project. (Roughness is also tracked in the PMS, but it is felt by WSDOT staff that the PSC or the rut depth will signal the need for rehabilitation before roughness reaches the point of requiring corrective action.)

WSDOT has given careful consideration to the formulation and interpretation of the PSC itself, and the value of the PSC threshold, in terms of how pavement rehabilitation projects in Washington should be programmed. Cost analyses performed by WSDOT (using an earlier, but analogous, measure of

pavement condition, the Pavement Condition Rating or PCR) show that unit costs of rehabilitation increase by a factor of three to four for projects programmed at a PCR of zero compared to projects programmed at a PCR of 40 to 50. Also, given Washington's climate, it is felt to be more efficient to rehabilitate pavements early (i.e., when the first stages of cracking have appeared), rather than later after the damage has progressed. As the result of this thinking, WSDOT has recommended as a general guideline a PSC threshold of 50 to provide the least life-cycle cost approach to pavement preservation.[12] The rutting threshold of 10 mm is likewise based upon considered judgment.

With information on current pavement condition (obtained from annual or biennial surveys), pavement performance curves (developed from WSDOT research on in-service pavements of different types), and a specified PSC threshold value of 50 and a rut depth threshold of 10 mm, the PMS can forecast the expected time to the next rehabilitation for each pavement section. The next rehabilitation for a pavement section is predicted to occur when its performance curve reaches either the PSC threshold (i.e., the pavement PSC = 50), or the rut depth threshold of 10 mm. Each candidate pavement project is assigned to a priority group according to its predicted "due date:" for example, if the rehabilitation is forecast to occur in 1999, then the project is "due" in 1999.[13]

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[12] These pavement analyses are described in the following sources: Nelson, T.L. and LeClerc, R.V., **Development and Implementation of Washington State's Pavement Management System**, WSDOT Report WA-RD 50.1, February 1983. *Washington State Pavement Management System*, **An Advanced Course in Pavement Management Systems,** Section 2.0, developed through joint sponsorship of the Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO), and Transportation Research Board (TRB), undated. Pierce, Linda M., "Determination of Effective PCR," draft working paper, March 1992.

[13] This is a simplified description, since the concept of a "due" pavement applies to a biennium, and WSDOT therefore defines a "window" within which a pavement is considered "due." Recently the department has decided to revise the definition of when a pavement is "due" to increase the length of the window from 24 to 36 months, and to provide an overlap between successive windows. These changes accommodate uncertainties in the model predictions of due pavements, allow managers to adjust for variations in pavement condition in the field, and permit some flexibility in scheduling a project for a biennium.

Projects due before the first construction season in the biennium being programmed (i.e., the first biennium of the investment program) are assigned to a priority group indicating that they are "past due" or part of a backlog, and are beyond the point at which the lowest life-cycle cost solution can be applied. At the other end of the spectrum, projects due later than the third biennium in the future are all assigned to a single priority group that indicates they are beyond the six-year investment program period. Priority groups are defined by individual year only for those six years that are encompassed by the investment program. These priority groups, taken collectively, form the priority array of pavement preservation needs.

PMS results are structured to show lane miles of rehabilitation required annually to preserve the network at lowest life-cycle cost.

Predictions of "due" pavements by the PMS are reviewed by staff in the Olympia Service Center Pavement Office and by regional staff. Site visits are made to verify the accuracy of the PMS prediction and its underlying pavement condition data, to assess causes of the observed defects, and to gather other information (e.g., on the condition of adjacent sections) that will assist in scoping a project, and reveal any special considerations that need to be taken into account in setting priorities.

The *Statewide Highway System Plan* applies the assumption that each highway functional class within each WSDOT region identifies a road network, and that prioritization and programming will be done individually for each network. Therefore, the PMS results are structured to show the number of lane miles of pavement rehabilitation by region, functional class, and pavement type that are required annually to preserve the network at the lowest life-cycle cost. These annual mileage figures are referred to as the target lane miles, which can be used (together with costs) to monitor the delivery of the Roadway Preservation Subprogram. Once these rehabilitation needs are identified, projects can be defined by improvement type, according to the type of existing pavement addressed by each project. Pavement types include Bituminous Surface Treatment (BST), Asphalt Concrete Pavement (ACP), and Portland Cement Concrete Pavement (PCCP).

WSDOT is currently proposing to formalize the categorization of the lane miles of pavements in each region with regard to specific pavement type, and to ensure that pavements of a particular type receive repair or rehabilitation treatments that are appropriate to that type, and no others. At the time the audit was conducted, this proposal had not yet been formally

adopted. We regard this proposal as a positive step to eliminate confusion and uncertainty that has occurred in the past among regions regarding the types of treatments, associated mileage accomplished, and pavement program costs that were actually accomplished in the field as compared to original program estimates at the beginning of a biennium.

PMS Analytic Capabilities

The PMS has the analytic capabilities to serve the priority programming function described in the preceding section, and to do so on a least-life-cycle basis. These features include the following:

- An inventory of the pavement network, including pavement type, materials characteristics, and condition expressed in several measures appropriate to the pavement type.
- Pavement performance or deterioration models that are calibrated to pavement conditions in the field every year (for interstate highways) or every two years for other highways.
- Thresholds describing when work should be performed. The threshold has been established at a PSC of 50 and a rut depth of 10 mm based upon an analysis of life-cycle agency costs, as noted earlier.
- Costs to perform different pavement activities.

These capabilities are suitable to forecast pavement condition and need for repair, and to do so on the basis of least life-cycle cost. The life-cycle criterion is based upon minimization of agency costs alone. User costs or benefits are reflected at best indirectly through the specification of a PSC threshold and the rut depth criterion that will trigger the need for repair prior to extensive surface damage and user discomfort. Moreover, the way in which pavement condition is inspected and computed makes it amenable to considering the effects of routine maintenance as well as capital projects. This capability exists because field inspectors distinguish the amount of sealed cracks (in addition to noting the unsealed cracking) and patched pavement surface as part of their inspection.[14]

WSDOT's life-cycle cost criterion is based upon agency costs alone.

[14] Items such as sealed cracks and patched pavement surface are considered "deductions" in value in the rating of pavements, but these deductions are less than those assigned to unrepaired defects: e.g., unsealed cracks. The notion is that repairs such as cracking and patching indicate prior damage to the pavement surface that cannot totally be repaired or restored through

There are issues with how PMS results are conveyed.

While the PMS has the analytic capabilities to help prioritize pavement projects, there are issues with how PMS applications and results are communicated. There is also a need for greater recognition of customer perceptions of pavement condition, as noted in the findings below.

Findings

1. *The WSDOT PMS assists in the development of the Pavement Capital Preservation Program. It satisfies least life-cycle cost principles in its operation, and forecasts times when pavements are due for rehabilitation. WSDOT managers and staff review these predictions and verify them through site visits, which also provide additional information needed to develop and prioritize projects. The department's PMS has been applied to capital programming for several years, and in our judgment the development of the priority array in this way is a reasonable approach. Nevertheless, some technical issues should be addressed by the department, as noted below.*

There is at least some public dissatisfaction with pavement surface condition.

2. *While trends in pavement condition according to PMS results are improving over time, the highway user survey conducted by JLARC in conjunction with this audit indicates at least some public dissatisfaction with pavement surface condition. Among five specific highway elements posed to survey respondents, road surface had the highest negative ratings, with 15 percent of respondents indicating an inadequate rating. Fourteen percent of respondents claimed that Washington's highways are either not as good as, or much worse than, other states' highways. While 57 percent rated state highways better than local roads and streets, 34 percent claimed they were about the same, and 8 percent felt they are not quite as good, or much worse, than local roads and streets.*

maintenance, a concept that is recognized in pavement literature. The differential in scoring that WSDOT applies to repaired versus unrepaired defects permits an estimate of pavement life extension due to ordinary maintenance, and an analysis performed by WSDOT at our request showed this extension to be on the order of one to three years, a value that agrees with research by others. This capability can be applied in the future to analyze the benefits of ordinary pavement maintenance and to perform capital-maintenance tradeoffs. Full development of this capability will require, however, further development of maintenance management system capabilities, and integration of maintenance and pavement data.

3. *One reason for this difference in perception may be that the PSC, which is used by WSDOT as a key indicator of condition and need for future repair, is based upon cracking, whereas highway users are more sensitive to surface measures like roughness and rutting.*[15] *The PMS tracks roughness and rutting. With respect to roughness specifically:*

   - *Past research has shown that roughness is highly correlated with user perception of serviceability;*
   - *Ratings in the PMS (and data reported by Washington to Highway Statistics) show that that the state's pavements overall are only fair with respect to roughness; and*
   - *Roughness is the one measure that is not used as a threshold in the PMS for triggering consideration of a corrective project.*

The PSC is based on cracking, but highway users are more sensitive to roughness and rutting.

4. *In reviewing data on the PMS and the pavement network, we noted a persistent set of approximately 1,000-2,000 lane miles (of 18,000 total) in Poor condition. Whereas, the percentage of Very Poor pavements has been reduced from more than 3,000 lane miles in 1973 to almost none now, the population of Poor pavements has persisted since 1969 (i.e., these are not necessarily the same pavement sections, but rather a changing population whose quantity continues at a level between 1,500 and 2,000 lane miles). There is no evidence to believe that these result from a defect in the PMS; rather, their existence appears to be the result of management decisions on which pavements will be rehabilitated in a biennium, and the department must balance the reduction in this inventory of Poor pavements against the least-life-cycle-cost strategy applied to other pavements as they become due for rehabilitation. WSDOT staff indicate that the reduction in this backlog has been planned through a 12-year period, and progress in meeting this reduction can be monitored using the PMS.*

WSDOT must balance the reduction in inventory of poor pavements against the least-life-cycle-cost strategy for other pavements.

[15] This finding derives from the AASHO Road Test in 1960 and subsequent research by state DOTs, which relates pavement serviceability, as perceived by users, to various measures of pavement condition. Serviceability is highly correlated with roughness and, to some extent, with rutting. Cracking exhibits the least correlation. Since only 2 percent of Washington's state highway network exhibits poor rutting, but these sections are in part on I-5, rutting may or may not be a key factor in this user perception of the state's highways.

Recommendations

1. *The Washington State Department of Transportation should continue to take positive steps to clarify its process for identifying and selecting pavement projects. The Department should not only approve proposals now under consideration, but also put in place an action plan that monitors compliance with, and progress toward, implementing and applying these steps. Specific examples are cited in the text below.*

2. *The Washington State Department of Transportation should consider including pavement roughness, in addition to Pavement Structural Condition and rutting, in its candidate pavement project thresholds.*

Examples of the clarification steps the department can take to better communicate how it selects candidate pavement projects are the following:

WSDOT should consider including pavement roughness in its candidate project thresholds.

- WSDOT has proposed identifying pavement sections by specific pavement type and allowing only those corrective actions that are appropriate to that pavement type. This proposal should be approved, adopted, and monitored explicitly for compliance and follow-through by regions.
- WSDOT has proposed changes to the window in which pavement sections are due. This change should be revisited periodically in discussion with regions and the legislature to assess whether a more stable and easily communicated pavement program has indeed resulted from this change.
- While WSDOT now assumes a 15-year life in its pavement rehabilitation actions for asphalt concrete, field data show that actual lives now being achieved are less than 15 years in four of the regions and less than 15 years overall statewide. This current situation can be explained by the transition in 1993 from a “worst first” approach to a “least life-cycle cost approach,” coincident with the implementation of a changed capital programming process mandated by revisions to RCW 47.05. The recommendation here is to continue monitoring the distribution of pavement lives by region and statewide to ensure that observed pavement lives are indeed moving toward the 15-year assumption.

Bridges

Current Programming Approach

The Bridge Preservation Program includes the following components:

Components of the Bridge Preservation Program

- **Bridge replacement**, consisting of total replacement of a structurally inadequate or functionally obsolete bridge with a new structure built to current geometric standards.
- **Bridge rehabilitation**, which extends the useful life of deteriorated bridges, corrects geometric or structural deficiencies, replaces a deteriorated deck, or prevents abnormal damage to the structure.
- **Bridge deck restoration**, which entails the application of modified concrete and thin polymer overlays on existing bridge decks.
- **Major, special, and movable bridge repair**, which includes "heavy maintenance" such as pier strengthening, anchor cable replacement, pier fender rehabilitation, raising cross frames and portals, upgrading operating systems of movable bridges, and upgrading railings when required for structural reasons.
- **Seismic retrofit of bridges,** which addresses the vulnerabilities of existing bridges to earthquakes.
- **Painting** of steel bridges on the state highway system.
- **Miscellaneous structures repair**, which includes work required to restore the structural integrity of tunnels and retaining walls, and restore or replace sign bridges and high-mast luminaires.

- **Bridge engineering support**, which includes the inspection, evaluation, rating, and inventory of highway system bridges.

The prioritization of these projects is done by the Bridge and Structures Office.

Currently, the prioritization of these projects is done by the Bridge and Structures Office, considering each type of work above individually to produce the various bridge arrays listing prioritized projects. For example, restoration and replacement projects are ranked statewide based on a rating factor that considers both structural and functional adequacy, an assessment of the importance of the facility to the highway system, and urgency of the project need. Bridge deck restoration projects are prioritized according to condition and traffic levels. Other major bridge repair priorities are established in meetings between the regions and the Bridge and Structures Office based on urgency, condition, and scheduling considerations. Bridge painting priorities are based on historical experience regarding the frequency of painting as influenced by bridge type and environment (correlated with location east or west of the Cascades).

Bridge replacement and rehabilitation priorities are identified in the bridge priority array maintained by the PATS system. Construction and preliminary work in progress are assigned the highest priority. Planned bridge replacement and rehabilitation projects are prioritized according to the relative deficiencies of each candidate bridge, organized within the program subgroups noted above. The time span of projected work varies within each of these program subgroups. For example, for bridge decks the projections look ten years into the future; for special repairs and bridge painting, the horizon is three years.

WSDOT is currently engaged in the implementation of a bridge management system.

The current program is thus based upon structural engineering judgment that is informed by inspection data on each structure, which is obtained at least every two years, and on a special basis when warranted. The Bridge Preservation Program is driven by the priority array that results from this process. While the process is not based on a least-life-cycle-cost criterion, it is typical of the procedures used throughout the country prior to major BMS development that began in the late 1980s. WSDOT is currently engaged in the implementation of its bridge management system, as described below.

WSDOT Implementation of BMS

Although the mandates by ISTEA for BMS development and implementation are no longer a legal requirement, WSDOT has already satisfied the intended target date of 1998 to complete data input for the entire bridge network. The BRIDGIT BMS conforms to least-life-cycle-cost principles in identifying preservation needs and recommending projects within a budget constraint. WSDOT has already begun using the BMS database to assist in project identification and selection. However, the Bridge and Structures Office does not feel that there is yet sufficient information on the deterioration of bridge elements, user costs, and costs of feasible preservation actions to make rigorous use of the BMS in budgeting and to use the built-in optimization techniques to critique the cost-effectiveness of project selections.

In a response to a question from the audit team, WSDOT Bridge and Structures feels that sufficient information will be available by 2001 to enable the BMS to be implemented fully, with partial implementation beginning in 1999 to assist in the development of the 2001-2003 bridge priority arrays. These BMS outputs are expected to be of primary use in prioritizing major repairs, deck rehabilitation, steel bridge painting, bridge rehabilitation, and bridge replacement. Several programs will continue to be stand-alone and not addressed through the BMS (e.g., Bridge Seismic Retrofit, Bridge Scour, and Movable Bridge Program).

Sufficient information will be available by 2001 to enable the BMS to be implemented fully, with partial implementation beginning in 1999.

Findings

1. *The current process for identifying and selecting bridge projects is not based upon least-life-cycle-cost principles. It is based upon considered engineering judgment, informed by specific information on the structural condition of each bridge. The process is typical of procedures used by DOTs prior to the advent of bridge management systems in the late 1980s.*

2. *WSDOT is now implementing a BMS and has compiled and loaded descriptive and inspection data for each structure ahead of the schedule that had been set by the FHWA. The BMS satisfies a least-life-cycle-cost criterion in its analytic capabilities. WSDOT now refers to these data in the consideration of program needs. However, sufficient historical data have not been compiled to calibrate the BMS analytic routines so that they could be applied reliably now.*

WSDOT has indicated a schedule toward BMS implementation that will bring it on line between 1999 and 2001 to assist in program development, as the pavement system does now.

PROGRAM COORDINATION WITH MAINTENANCE

One of the audit questions in highway programs deals with the interaction and coordination between the two capital programs and the maintenance program, particularly regarding planning and budgeting. We address this question of program coordination here. The maintenance program itself will be considered in Chapter 4.

Current Program Coordination

The maintenance program coordinates with both the preservation and the improvement programs.

The maintenance program coordinates with both the preservation and the improvement programs. Coordination with the improvement program is needed because this program adds to the highway inventory (through the construction of new pavement, bridges, highway features, etc.). Coordination with the preservation program is needed because approximately 30 percent of maintenance program expenditures relate to a preservation function: i.e., correction of defects in pavements and bridges, and work on the highway drainage system.

Program coordination occurs at different levels. For example, at an operational level coordination between respective work needs is addressed by the department at the regional or area offices to ensure that surface maintenance is not performed on a pavement section that is due for capital preservation work. Similarly, need for work zones is coordinated, particularly in high-traffic-impact areas.

At a budget level coordination is also exercised between programs to ensure that work needs are met, highway levels of service are maintained, and the maintenance program responds to changes in the highway inventory that result from capital programs. The nature of this coordination results from the way in which the maintenance program is budgeted. Maintenance budgets for a given biennium are derived primarily from the prior biennial budget, adjusted for inflation and for changes resulting from legislative decision packages that have been approved. When situations arise that require further

coordination between capital programs and maintenance, this coordination is likewise accomplished through formal decision requests that respond to changes in the highway system that may arise in several ways:

Coordination is accomplished through formal decision requests that respond to changes in the highway system.

- A typical example of coordination between maintenance and preservation occurs when needed preservation projects are not funded, or are deferred. For example, a reduction in the level of funding for preservation work below anticipated System Plan levels would translate into a deferral of work on certain pavement sections. WSDOT then will file a decision request to maintain essential requirements, by specifying maintenance actions (e.g., chip seals) for these sections of pavement.
- A typical example of coordination between maintenance and improvement occurs when projects add to the inventory of highway features. A decision package is then filed, quantifying specific additions to inventory and listing additional maintenance labor, equipment, and material needed to perform work on this added inventory to maintain service levels at their desired value.
- Decision packages are also filed to enable increased maintenance effort on highways that have experienced traffic growth, and therefore require a higher maintenance effort to maintain service levels. While many factors account for increased highway usage, this type of request reflects a long-term, indirect coordination between maintenance and improvement.

The common characteristic of these examples is that the timeframe in which the coordination is considered is limited to a biennium. Moreover, if preservation projects are unexpectedly deferred, the coordination is reactive, rather than proactive. If the approved maintenance funding is less than requested, an overall less cost-effective approach to preserving or maintaining the highway system can result. Because this approach does not reflect a long-term view, there is less of an ability to achieve least life-cycle costs.

The common characteristic of these examples is that the timeframe in which the coordination is considered is limited to a biennium.

Other states plan and budget maintenance programs differently, and some states have begun to consider integrating the planning and budgeting of maintenance and capital preservation work on pavements and bridges. If such an approach were adopted for the maintenance program, a different, longer-term, and more proactive coordination mechanism could be accomplished. This

Other states plan and budget maintenance programs differently.

could result in WSDOT being better able to ensure that the optimal mix of funding for improvement, preservation, and maintenance projects, within funding limitations, is achieved.

However, with the recent implementation of levels of service for maintenance activities, a firmer basis exists for defining the required coordination (i.e., level of effort and costs of needed work) by maintenance with both the improvement and the preservation programs.

Findings

1. *Coordination between the maintenance and the capital programs is accomplished through decision packages that are submitted for formal legislative approval when changes in the highway inventory or in projects affecting level of highway service occur. These changes are documented explicitly and relate to conditions as they are reflected in the current biennium. The process does not look forward beyond the current biennium.*

2. *While the nature of this coordination appears to have evolved in the situation where changes in maintenance budgets are accomplished through legislative decision packages, the use of decision packages as a tool for maintenance budgeting is itself different from how other state DOTs approach maintenance budgeting, in the audit team's experience.*

A more pro-active interaction between maintenance and capital programs is possible.

3. *Other DOT's program and budget maintenance needs, in much the same manner as capital needs, are programmed and submitted for legislative approval in Washington State: by identifying anticipated needs, prioritizing them, and submitting to the legislature for review. This approach allows proactive consideration of the interactions between maintenance and capital programs in maintaining highway levels of service.*

4. *Washington has taken a step toward having a capability to do this through the establishment of explicit maintenance levels of service. Another step in this direction would be the development of a highway features inventory for maintenance, and a maintenance management system. Other states that have adopted this approach are now considering or pursuing a closer integration among their pavement, bridge, and maintenance management*

capabilities. This latter approach defines another basis on which to coordinate highway programs, which Washington may wish to consider.

Recommendation

1. *The Washington State Department of Transportation and the Legislature should discuss the nature of current highway program coordination, and consider alternative approaches based upon forecasts of maintenance needs concurrently with forecasts of preservation and improvement needs for the coming biennium.*

WSDOT should consider alternative approaches to highway program coordination.

DELIVERY OF HIGHWAY PROJECTS

Chapter Three

BACKGROUND

This chapter addresses several issues associated with the delivery of highway construction projects:

- WSDOT's handling of overruns and delays.
- A case study of a recent project, the DuPont South Interchange, which introduced unique, innovative practices in design and construction delivery, and a comparison with two other project cases: the Sequim Bypass, and the Issaquah-Hobart Interchange.
- An analysis of in-house versus outsourced design services.

Other analyses associated with delivery, such as looking at work zone safety and project staging, and additional case studies of the Sequim Bypass and the Issaquah-Hobart Interchange, will be included in the final report.

WSDOT CONTROL OF COST OVERRUNS AND TIME OVERRUNS

Objective and Data Source

This section of the report deals with cost overruns and time overruns on WSDOT highway projects. The objective is to document WSDOT's performance in managing both cost and time to completion for its construction programs, encompassing both preservation (Program P) and improvement (Program I) projects. The terms "cost overrun" and "time overrun" will be used in this chapter to refer to the comparisons between final

The objective is to document WSDOT's performance in managing both cost and time to completion.

In most cases, there are valid causes for adjustments to time and cost of construction.

cost and original bid cost, and working time to substantial completion versus original contract schedule, respectively.[1]

The terms "cost overrun" and "time overrun" refer only to the computational results of these cost and time comparisons, and convey no judgment one way or the other as to the validity of the reasons behind the overruns themselves. The question of validity will be taken up in a separate section of this chapter, dealing with Causes of Contract Overruns. It will be seen that, in most cases, there are indeed valid causes for adjustments to time and cost, based upon contract provisions (e.g., governing estimated quantities) and change orders for additional work, changed field conditions, and so forth. The subset of overruns that we conclude are avoidable and that provide no added value to a project will be the subject of recommendations for improved WSDOT performance and cost savings.

The CCIS dataset used in this analysis contained information on 865 construction contracts.

The information for this analysis was obtained from WSDOT's Construction Contracts Information System (CCIS). We imposed criteria on the projects selected from this system to ensure that both start date and end data were encompassed by the data reflected therein, ensuring that a complete historical record would be available for each project. A check was also run to eliminate projects with obviously bad data (e.g., zero time or cost). The resulting CCIS dataset used in this analysis contained information on 865 construction contracts that reached physical completion between October 24, 1990, and June 30, 1997, and represented approximately $1.2 billion of construction value in-place. Other than for the filters and checks described above, no other audit of the validity of the information in CCIS was performed.

Audit Approach

The audit identified the final cost of each project and compared it to the original winning bid value. Overrun is gauged by the ratio of final project cost to original bid value, which is easily

[1] These comparisons reflect standard practice and relate most closely to data obtained from other states. Unless otherwise noted, all exhibits and results cited in this chapter refer to these comparisons. Other comparisons were also performed as part of this audit: i.e., comparing final cost to engineer's estimate (rather than original bid value), and considering time to physical completion rather than time to substantial completion to gauge delays. Results of these additional analyses will be referred to for comparative purposes later in the chapter.

convertible to a percentage.[2] A ratio greater than one, or a percentage greater than zero, denotes an overrun that increased project cost. A ratio less than one, or a percentage less than zero, denotes an underrun that resulted in a final project cost lower than the initial bid. These computations were performed regardless of the cause of the overrun or its justification. Causes of overruns are dealt with separately later in this chapter.

Once the overrun had been computed for each project, program-level statistics were developed by computing a weighted average overrun. The weighting factor applied to each project was its bid value.

Construction Contract Cost Overruns

The average overrun across all 865 projects was 10 percent. Underruns by as much as 40 percent and overruns exceeding 200 percent were observed. To eliminate the small number of projects at these extremes, so as to focus on the larger set of projects typifying WSDOT performance, we excluded 5 percent of the projects at each of the extremes within each grouping of projects studied. The findings below pertain to the remaining 90 percent of the projects in the dataset, 779 in all.

The average overrun across all 865 projects was 10 percent.

Exhibit 3.1 presents program-level statistics on the weighted average, high, and low cost overruns for each region. The extreme values range from an underrun of 15.3 percent in the Olympic Region to an overrun of 45.3 percent in the Northwest Region. The region with the lowest weighted average – 2.6 percent – and the narrowest distribution – an underrun of 8.1 percent to 18.1 percent – is North Central. This result is likely due to the lesser number of projects and the type of projects encountered in this region, emphasizing more preservation rather than improvement, both occurring in a rural setting. The three regions with the highest weighted averages – Northwest, Olympic and Southwest – have weighted average overruns of 14.0 percent, 6.5 percent, and 7.9 percent, respectively. These regions deal with greater numbers of projects and construction more urban in nature, and on the west side of the Cascades

[2] For example, an overrun of 1.25 is equivalent to a percentage increase of 25 percent. An underrun of 0.60 is equivalent to a percentage reduction of (40 percent). Equivalent percentage is computed as [ratio-1] x 100. Ratios and percentages can be used interchangeably, but for consistency the text uses percentages.

Large and complex bridge projects experienced the greatest overruns.

(which involve higher traffic volumes), a greater mix of environmental issues, more chances for utility conflicts, and wetter soils in general. It is likely that regional results are displaying, at least in part, overrun profiles that depend upon type of construction project and factors influencing construction uncertainty. Based upon a review of specific project histories, large and complex bridge projects experienced the greatest overruns.

Exhibit 3.1

Construction Cost Overruns by Region

Region	Number of Projects	Average Winning Bid	**Average Cost Overrun/ (Underrun), %**	**Maximum Cost Overrun/ (Underrun), %**	**Minimum Cost Overrun/ (Underrun), %**
Northwest	269	$1,424,422	14.0%	45.3%	(14.8%)
North Central	75	$1,041,577	2.6%	18.1%	(8.1%)
Olympic	180	$1,089,480	6.5%	30.8%	(15.3%)
Southwest	93	$1,144,357	7.9%	38.6%	(13.3%)
South Central	89	$1,116,983	4.1%	34.9%	(8.5%)
Eastern	73	$2,047,846	3.4%	18.8%	(11.8%)
Overall	**779**	**$1,300,030**	**8.5%**	**45.3%**	**(15.3%)**

Exhibit 3.2 illustrates the ranges and weighted average overruns by the value of the winning bid. While there is no trend with regard to the high-to-low range as a function of project size, the weighted average overrun increases with project size, from 2.8 percent for projects less than $250,000 to 10.3 percent for projects greater than $1,500,000 in value.

The weighted average overrun increases with project size.

Exhibit 3.3 illustrates overrun data by the year in which the contract was advertised. Although it appears that the average overrun declines over time, in fact this result is due to a different effect. Since all projects in the dataset have been completed by June 1997, those projects that have been bid more recently are likely to have been smaller in scale and of shorter duration. Project duration exercises a strong effect on the likelihood of overrun, as noted in the next discussion.

Exhibit 3.2

Construction Cost Overruns by Project Size

Size of Winning Bid, $	Number of Projects	Average Winning Bid	Average Cost Overrun/ (Underrun), %	Maximum Cost Overrun/ (Underrun), %	Minimum Cost Overrun/ (Underrun), %
< 250K	220	$139,564	2.8%	43.7%	(15.6%)
250K-500K	146	$360,109	3.7%	37.6%	(15.3%)
500K-750K	103	$625,386	5.8%	34.6%	(12.7%)
750K-1M	56	$869,215	4.2%	33.7%	(10.5%)
1M-1.5M	90	$1,244,918	5.1%	28.8%	(10.1%)
> 1.5M	164	$4,218,133	10.3%	38.2%	(8.5%)
Overall	**779**	**$1,283,938**	**8.6%**	**43.7%**	**(15.6%)**

Exhibit 3.3

Construction Cost Overruns by Year of Advertisement

Year of Contract Ad	Number of Projects	Average Winning Bid	Average Cost Overrun/ (Underrun), %	Maximum Cost Overrun/ (Underrun), %	Minimum Cost Overrun/ (Underrun), %
90/91	175	$1,942,787	11.8%	35.6%	(13.3%)
92	144	$1,158,720	9.9%	45.4%	(10.1%)
93	175	$1,463,391	9.1%	39.8%	(10.5%)
94	120	$1,091,221	3.7%	27.4%	(13.6%)
95	105	$850,164	0.5%	22.2%	(15.0%)
96/97	60	$539,685	(0.5%)	35.2%	(19.4%)
Overall	**779**	**$1,421,778**	**8.4%**	**45.4%**	**(19.4%)**

Exhibit 3.4 illustrates the ranges and weighted average overruns by project duration (calculated as the difference between the date of substantial completion and time start date). Once again, although the ranges appear to be fairly consistent, there is a definite trend in the weighted averages; the longer the project the greater the overrun.

Exhibit 3.4

Construction Cost Overruns by Project Duration

Duration of Project (Calendar Days)	Number of Projects	Average Winning Bid	Average Cost Overrun/ (Underrun), %	Maximum Cost Overrun/ (Underrun), %	Minimum Cost Overrun/ (Underrun), %
< 50	127	$210,206	(0.4%)	35.2%	(24.8%)
50-99	161	$518,848	1.5%	28.3%	(15.5%)
100-149	113	$787,506	4.8%	35.6%	(12.0%)
150-199	79	$1,091,063	2.6%	37.6%	(13.3%)
200-299	110	$1,146,259	6.6%	34.1%	(8.2%)
> 299	189	$3,233,201	11.9%	44.8%	(10.4%)
Overall	**779**	**$1,312,678**	**8.7%**	**44.8%**	**(24.8%)**

A parallel analysis was also conducted using engineer's estimate, rather than winning bid, as the baseline for computing overruns. The composite behavior across all WSDOT projects is for the winning bid to come in at almost 8 percent below engineer's estimate. Once project construction begins, costs rise (for reasons discussed in the next section) to the point where final costs are 1.5 percent above engineer's estimate, but 10 percent above winning bid. The results using the winning bid as the baseline will be those that are quoted in the findings and recommendations to this section.

Causes of Contract Overruns

Analysis of Change Orders

Of the 865 separate construction contracts, 752 had one or more change orders.

Of the 865 separate construction contracts, 752 had one or more change orders. There were a total of 6,413 change orders to these 752 contracts, with an estimated value of almost $94 million, accounting for 86 percent of the total aggregate overrun of $109 million. The remaining $15 million (or 14 percent) of cost overruns is due to "estimated quantity" provisions in contracts, by which the amounts paid for material quantities actually used in the field may differ from the cost submitted for estimated quantities specified in the original bid. The dollar values of these changes, however, are below the threshold that requires a formal change order, and are therefore not reflected in the change order data.

CCIS provides details about each change order, including a brief description of the situation, its estimated dollar value, and up to six reasons for the change. The assignment of a reason for a change order is not always straightforward. More than one reason may underlie a project change, and the selection and order of the cited reasons are open to individual interpretation. For example, a **design change** might be required after construction has begun because of **changed conditions** that might otherwise have been discovered if a more extensive **site investigation** had been performed earlier. WSDOT's CCIS would allow the entry of any or all of these three reasons. Moreover, the order in which they are entered would depend on individual judgment, and in certain circumstances there might be no obvious precedence. Nonetheless, it was determined from interviews with Olympia Service Center and Regional WSDOT staff that it would be logical to take the first reason as the primary cause of the change. Exhibit 3.5 provides a breakdown of all project changes, grouped by the **first** reason that was specified in the change order record.

The assignment of a reason for a change order is not always straightforward.

The group of change orders having the greatest dollar value has reason 1 listed either as "Other," or has no value in that field. A reading of the detailed change order forms for these changes indicated that in most cases the second listed reason provided the cause of the change. Therefore, Exhibit 3.5 was altered, reassigning those change orders with reason 1 listed as "Other" to the group identified under reason 2, resulting in Exhibit 3.6.

Reasons for Contract Changes

In considering the nature of the causes of project overruns there are two criteria that should be considered.

Two criteria were applied to evaluate contract changes.

Added Value/No Added Value: Whether or not the change provides any additional value: e.g., the repaving of a portion of a city's road (at the city's request and expense) when a WSDOT project abuts this particular road.

Avoidable/Unavoidable: Whether or not the change could have been avoided by WSDOT: e.g., the omission of a critical item in the plans and specifications on which the successful contractor based its bid.

Exhibit 3.5

Primary Reasons for Change Orders

Primary Reason for Change Order	Total Value
Added Work	$2,008,207
Administration	$7,841,503
Third Party Request	$4,029,608
Unavoidable Change	$545,626
Major Item Over/Under	$585,385
Hazardous Material	$672,759
Changed Conditions	$8,127,202
Inadequate Field Investigation	$2,240
Spec Ambiguity	$610,705
Plan Error	$18,725,738
Design Change	$15,020,632
Construction Engineer Error	$735,206
Claim Settlement	$44,810
Delays	$621,748
Other or No Primary Reason Given	$36,666,997
DRB Decision	$246,594
Work Method Change	$169,729
Specification Change	$14,749
Deleted Work	($272,821)
Cost Reduction Incentive Proposal	($1,605,258)
Contractor Error	$35,634
COA Revision	($467,870)
Budget Constraints	($40,084)
Non-Spec Material	($279,041)
Material Substitution	($160,878)
Interim Maintenance Problem	$0
Impacts Unchanged Work	$0
Grand Total	**$93,879,121**

Exhibit 3.6

Adjusted Primary Reasons for Change Orders

Adjusted Primary Reason for Change Order	Total Value
Added Work	13,630,286
Administration	7,917,143
Third Party Request	4,053,068
Unavoidable Change	1,352,328
Major Item Over/Under	3,188,150
Hazardous Material	672,759
Changed Conditions	8,258,448
Inadequate Field Investigation	169,461
Spec Ambiguity	610,940
Plan Error	18,767,646
Design Change	15,086,443
Construction Engineer Error	735,206
Claim Settlement	6,327,849
Delays	2,890,704
Other/No Primary Reason	13,518,371
DRB Decision	246,594
Work Method Change	151,196
Specification Change	14,749
Deleted Work	(1,157,611)
Cost Reduction Incentive Proposal	(1,605,258)
Contractor Error	35,634
COA Revision	(553,613)
Budget Constraints	(40,084)
Non-Spec Material	(279,041)
Material Substitution	(164,648)
Interim Maintenance Problem	45,040
Impacts Unchanged Wk	7,360
Grand Total	**93,879,121**

A review of change orders was conducted according to these criteria. Almost 38 percent of the change order value, or change orders totaling $35.4 million, were judged to be avoidable and adding no value to projects. These changes had the following reasons: Inadequate Field Investigation, Specification Ambiguity, Plan Error, Design Change, and Construction Engineer Error. A reduction in these change orders would present an opportunity for savings by WSDOT.

Almost 38 percent of the change order value were judged to be avoidable and adding no value to projects.

An analysis was conducted of the sample of avoidable, no-added-value change orders for which a detailed reading had been made of the change order forms themselves (so that there was some understanding of project context and the rationale for the change). From this reading, we determined that this subset of change orders addressed two basic types of problems in WSDOT's management of the respective contracts:

Two types of avoidable, no-added-value change orders were identified.

- They corrected **critical omissions** in the information regarding the project: e.g., items that had erroneously not been included in the plans and specifications, or conditions that had not been accurately or completely portrayed. Additional payments to the contractor were authorized to cover work on these omitted items.
- They resolved, through additional payments to the contractor, **work inefficiencies** due to defects in the plans and specifications, or errors in construction engineering, by WSDOT. Examples of these inefficiencies included rework on items to correct previous work that had been done according to the erroneous information, or unnecessary work or purchases of materials and supplies that, again, had been undertaken according to the erroneous information, but now were determined to be no longer needed.

Implications for Cost Savings

These two types of problems have different implications for potential cost savings.

Change orders that correct critical omissions bring the plans and specifications to the point where they more accurately reflect actual field conditions or project situations. Had the plans and specifications reflected this information accurately from the start, the construction costs attributable to this information would still need to be borne. Eliminating change orders that address critical omissions therefore does not necessarily result in a cost savings. In fact, to the extent that critical omissions relate to site evaluation, the costs of site exploration necessary to provide more complete information from the outset may actually increase project costs.

Eliminating change orders that address critical omissions does not necessarily result in a cost savings.

One way in which the reduction of critical omissions errors may result in net cost savings is as follows: If the omissions are due to human error, and therefore can be corrected at little additional cost to WSDOT through more careful plan review or improved procedures and information, the affected construction items would benefit from inclusion in a competitive bid process, rather than being subject to negotiation during a change order process. This competitive effect may result in a reduced construction cost that offsets the cost of WSDOT's improvement in the design process. This effect is difficult to analyze directly given the hypothetical situation posed and the many other factors that affect bid prices.

In contrast, change orders that correct work inefficiencies can result in direct savings that can be estimated from the change order record. Reductions in these change orders would essentially follow the ethic of "getting it right the first time," and eliminate work or purchases that occurred unnecessarily or needed to be redone the correct way. Therefore, the focus of our analysis was to determine the percent of avoidable, no-added-value change orders that related to work inefficiency problems.

The sample of these change orders for which we had conducted a reading of the change forms themselves totaled 178 in number, with a combined dollar value of $2.9 million. Our evaluation of this sample indicated that 30 of these change orders, totaling $1.5 million, related to work inefficiencies. This analysis suggests a target of 50 percent reduction in the dollar value of avoidable, no-added-value change orders that WSDOT can translate into direct cost savings. These savings would be achieved through improved design and construction engineering procedures to reduce error. The savings estimate is conservative, since these improved procedures would also serve to reduce the error rate of critical omissions, thereby gaining the posited benefit of competitive pricing of affected construction items.

We identify potential savings of $6 million per biennium through reduction in avoidable change orders.

The $35.4 million value of change orders was accrued over three biennia covered in the CCIS dataset, or approximately $12 million per biennium. We therefore identify potential savings of $6 million per biennium through reduction in these change orders.

Construction Contract Time Overruns

A corresponding analysis was performed of construction time overruns. The overall average time overrun to the point of substantial completion is 2.75 percent. As with cost overruns, there was a significant range of values, from underruns of 80 percent to overruns of 600 percent. Exhibit 3.7 illustrates the variation among regions.

Exhibit 3.7

Construction Time Overruns by Region

Region	Number of Project Phases	Total Winning Bids	Original Contract Days	Actual Working Days to Complete	Overrun (Working Days)	Overrun %
Northwest	274	$323,120,998	23338	23533	195	0.84%
North Central	83	$87,529,385	5614	5868	254	4.52%
Olympic	195	$191,919,754	13461	14016	555	4.12%
Southwest	101	$109,336,427	7651	7791	140	1.83%
South Central	96	$100,448,827	6843	7329	486	7.10%
Eastern	79	$154,425,941	6311	6422	111	1.76%
Grand Total	**828**	**$966,781,332**	**63218**	**64959**	**1741**	**2.75%**

The longer the project duration, the greater the potential for time overrun.

Exhibit 3.8 illustrates the variation in overruns based upon project size. Smaller projects tend to be completed in less than the time allowed by the contract. Once project costs exceed $0.5M the average overrun of contract time is approximately 5 or 6 percent, although it does not appear to increase above this level as the cost exceeds $1.5 million. Corresponding trends were noted in analyses of project duration – the longer the project, the greater the potential for time overrun.

Exhibit 3.8

Construction Time Overruns by Project Size

Contract Size	Number of Project Phases	Total Winning Bids	Original Contract Days	Actual Working Days to Complete	Overrun (Working Days)	Overrun %
> $250K	221	$30,040,929	7589	6820	(769)	-10.13%
$250K-$500K	156	$55,632,118	8224	8119	(105)	-1.28%
$500K-$750K	112	$68,966,208	7183	7630	447	6.22%
$750K-$1M	57	$48,952,421	4211	4461	250	5.94%
$1M-$1.5M	100	$117,542,170	8091	8587	496	6.13%
> $1.5M	182	$645,647,486	27920	29342	1422	5.09%
Grand Total	**828**	**$966,781,332**	**63218**	**64959**	**1741**	**2.75%**

Comparisons with Other States

Cost Overruns

WSDOT's cost overruns of 10 percent computed earlier compares with other states as follows:

- Oregon DOT estimates its overruns as 3 percent.
- Minnesota DOT estimates its overruns in the range of 9 to 10 percent, and has calculated a value of 8.8 percent for calendar year 1996.
- Florida DOT has calculated overruns of 9 percent for the period 1980-1995 and 15 percent for 1994-1995.
- Wisconsin had established a goal for FY 1995-1996 to keep construction costs within 12 percent of original contract amount, and met this goal with an actual overrun of 7 percent.

Comparisons with other states

WSDOT History of Cost Overruns

The average value of 10 percent calculated in this audit is approximately double that calculated in the two earlier studies by WSDOT for the Legislative Transportation Committee (LTC) and the Washington State Transportation Commission (WSTC) of 5.4 percent and 5.8 percent, respectively. The overrun calculated in this audit is based upon an analysis of 865 projects, as opposed to 132 projects in the LTC study and 432 projects in the WSTC study.

The average value of 10 percent calculated in this audit is approximately double that calculated in two earlier studies by WSDOT.

The overrun reported in the WSTC study is an arithmetic unweighted average percentage, and therefore does not compensate for the more significant cost implication of overruns on projects of larger dollar value. Based upon the breakdown of average overruns by project size included in the WSTC report, and a calculation on our part, we estimate that the weighted value of the overrun represented in the WSTC report would be approximately 7.5 percent.

In the LTC report, the average winning bid value of the projects reviewed is $950,000, or 75 percent of the $1.259 million average contract value reviewed in this audit. Since this audit indicates a greater tendency for larger projects to exhibit greater overruns, a lower overall percentage overrun in the LTC report (5.4 percent) is not unexpected. In fact, Exhibit 3.2 indicates

that projects with a value from $750,000 to $1 million in the sample we used have a weighted average cost overrun of 4.2 percent.

Contract Time Overruns

In terms of contract time overruns, WSDOT's value of 2.75 percent to substantial completion (in terms of working days) compares favorably to the values cited by Florida DOT, 22 percent and 32 percent for the 1991-92 and 1994-95 periods, respectively. Oregon DOT does not utilize working-day type contracts, but reports that its rate of contract time overrun has been running at about 1.2 percent, based upon total calendar time. Minnesota DOT could not provide the degree to which its projects overrun on average, but stated that approximately 10 percent of its contracts run beyond their allotted contract period.

Oregon DOT estimates the proportion of overruns that were avoidable as between 35 percent and 40 percent, as compared to 38 percent we have calculated for WSDOT.

Avoidable Cost Overruns

Oregon DOT estimates the proportion of overruns that were avoidable as between 35 percent and 40 percent, as compared to 38 percent we have calculated for WSDOT. Florida DOT states that upon review of 132 contracts (1993-95) that exhibited particularly high overruns, approximately 62 percent of the overruns were attributable to design error (the major component of the "avoidable" overruns cited for WSDOT as well).

Cost Overruns Providing Additional Value

The analysis of WSDOT overruns indicates that approximately 14 percent of contract overruns provide some additional value. Oregon DOT estimates that approximately 10 percent of their overruns provide added value.

Unavoidable Cost Overruns

The analysis of WSDOT overruns indicates that approximately 14 percent of the overruns were unavoidable, while the corresponding estimate by Oregon DOT is 50 percent.

Findings

1. *Overall, the average cost overrun on WSDOT projects has been 10 percent, with an overall time overrun of 2.75 percent to substantial completion.*

2. *The variation in cost overrun statistics can be considerable, ranging from 60 percent of original bid to more than 200 percent of original bid.*

3. *WSDOT's experience in overruns is comparable to that of other states.*

4. *Almost 38 percent of the change order value, or change orders totaling $35.4 million, were judged to be avoidable and adding no value to projects. The $35.4 million value of change orders over three biennia correspond to $12 million per biennium. A realistic target for savings is to reduce this volume of avoidable change orders by one-half. We therefore identify potential savings of $6 million per biennium through reduction in these change orders.*

WSDOT's experience in overruns is comparable to that of other states.

Recommendations

1. *The Washington State Department of Transportation should develop, implement, and enforce clearer guidelines on the assignment of causes of change orders, reducing the use of "Other" to those situations that literally are not covered by more definitive reasons, and promoting consistency among Regions on the interpretation and use of specific causes.*

2. *The Washington State Department of Transportation should reduce its avoidable change orders that yield no added value to projects. A target reduction of $6 million per biennium should be set.*

3. *The Washington State Department of Transportation should develop an action plan to achieve these cost savings, and report periodically to the Legislative Transportation Committee on the status of this effort, including statistics giving the breakdown of change orders by cause, frequency of occurrence, and dollar value over time.*

A realistic target for savings is to reduce avoidable change orders by $6 million per biennium.

PROJECT CASE STUDIES

Project case studies were developed to obtain specific practical information on factors that influence highway project time to completion. The major thrust of the discussion will focus on the DuPont South Interchange. Comparisons in schedule will then be made with two other projects: the Sequim Bypass, and the Issaquah-Hobart Interchange on SR 18. The review will

conclude with a discussion of the successful aspects of these projects that can be replicated by WSDOT on other projects in its construction programs.

South DuPont Interchange

Project Overview

The South DuPont Interchange on Interstate 5 was completed in only 26 months (versus 48 months as originally estimated by the department).

The completion of the South DuPont Interchange on Interstate 5 in only 26 months (versus 48 months as originally estimated by the department) resulted from a combination of unique characteristics and circumstances regarding this project itself, favorable site conditions, and innovative approaches to design and construction undertaken by WSDOT. Exhibit 3.9 illustrates the areas in which time savings were achieved. The diagram was developed based upon comparative schedule information for South DuPont and other projects that is included in WSDOT's review of this project.[3] For the purposes of this discussion, many discrete activities have been reduced into six larger umbrella activities, and the two simplified schedule diagrams are the result. The upper diagram illustrates the timing and duration of the activities that occurred in the case of the South DuPont Interchange ("DuPont"), and the second is what is described in WSDOT's review as the "Nominal Process."

Exhibit 3.10 was generated from these two schedules and indicates the amount by which the completion of each phase was brought forward, and how this earlier completion was achieved. The two ways in which phase completion could be brought forward are: 1) by commencing the activity ahead of the time indicated by the nominal process, or 2) by compressing the phase itself (i.e., performing the same activity in a reduced amount of time).

[3] Interstate 5 South DuPont – Interchange Design Process Report, WSDOT, 1997.

Exhibit 3.9

Comparison of DuPont and Nominal Schedules

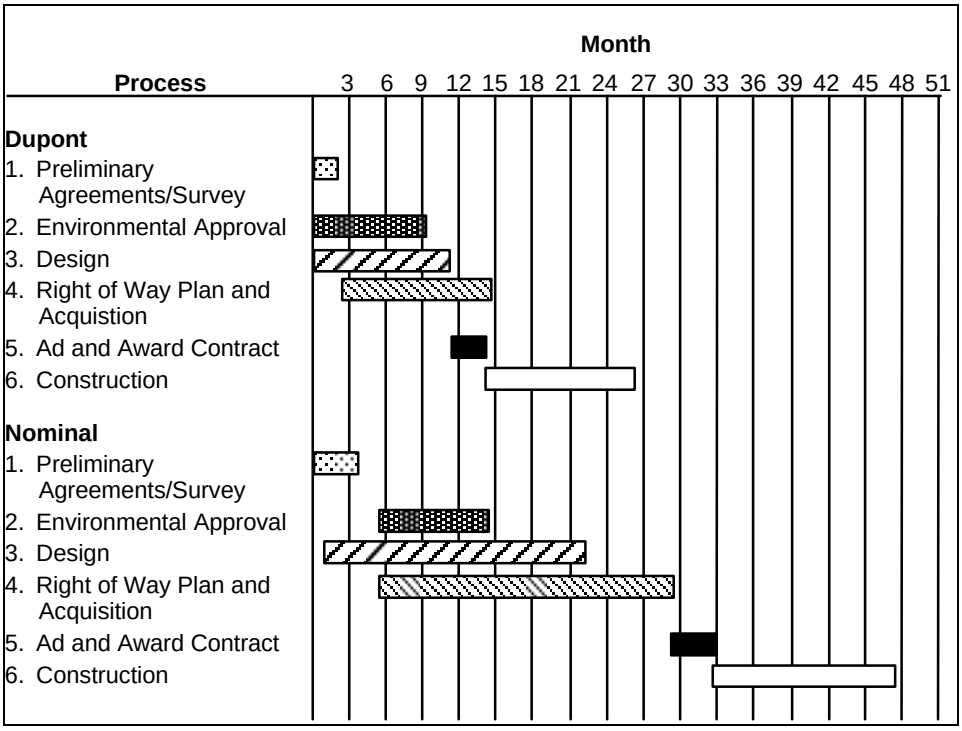


Exhibit 3.10

Compression and Acceleration of Project Phases at DuPont

Project Phase	Relative Phase Start Time (months)	Relative Phase Duration (months)	Relative Phase Completion (months)
Preliminary Agreements/Survey	0.0	-2.0	-2.0
Environmental Approval	-5.5	0.0	-5.5
Design	-1.0	-10.5	-11.5
Right-of-Way Plan and Acquisition	-3.0	-11.5	-14.5
Contract Ad and Award	-17.5	0.0	-17.5
Construction	-17.5	-6.0	-23.5

Contributing Factors

Many factors contributed to the time savings documented in Exhibit 3.10. Since these items are discussed in some detail in WSDOT's project review, they are summarized below, and are not exhaustive. It is also important to understand that many of

these factors interacted with one another in achieving the time savings noted, rather than acting independently of other factors.

The time savings at DuPont were due to the following factors, organized by major project phase as identified in Exhibit 3.10:

The time savings at DuPont were due to many factors.

- Preliminary Agreements and Survey
  - Early work on the concept of a South DuPont Interchange beginning in the 1970s, prior to the formal inception of the project itself.
  - Early identification of South DuPont Interchange as part of the traffic congestion mitigation plan for the adjacent Northwest Landing property developed by Weyerhaeuser Real Estate Company, the source of private funding for this project.
- Environmental Approval
  - Commencement of this activity as soon as the project began.
  - Early work on environmental mitigation accomplished in the preceding phase.
  - WSDOT's success in gaining regulatory approval that the project site came under the authority of the Model Toxics Control Act, resulting in the State Department of Ecology being the lead environmental regulatory agency for the project rather than federal EPA.
  - WSDOT's success in gaining approval for a NEPA Documented Categorical Exclusion (DCE) to satisfy environmental requirements, rather than a full NEPA Environmental Impact Statement (EIS).
- Design
  - Selection of a dedicated "Top Gun" design team.
  - Streamlined design review, involving a high degree of communication and coordination, elimination of redundant reviews, and performance of reviews in parallel rather than in sequence as normally practiced.
  - Use of staged submittals, in which design work proceeded based upon engineering estimates of increasing precision rather than waiting for complete information before beginning.
  - Commencement of bridge design prior to interchange plan approval.

- Right-of-Way Plan and Acquisition
  - Only three land owners to deal with (other than WSDOT itself).
  - Process improvements (e.g., using existing right-of-way drawings, employing a Hearing Waiver and Notice of Opportunity process).
  - Commencement of land acquisition prior to completion of design and receipt of environmental approval.
- Advertisement and Award
  - Advertisement and award conducted prior to completion of right-of-way permitting activities.
- Construction
  - Favorable project layout, allowing simultaneous work on structures with minimal impact to traffic.
  - Inclusion of utility work as part of construction contract, reducing potential third-party delays.
  - Inclusion of shoring plans and retaining wall alternatives directly in contract documents, rather than requiring contractor submittal and WSDOT approval.
  - Uniformly favorable site conditions.
  - Availability of suitable construction materials close to the site.

The DuPont project schedule will be compared to those of two other projects.

We will return to an assessment of these factors and their replicability to other projects, following a comparison of DuPont with two other projects.

Sequim Bypass

Project Overview

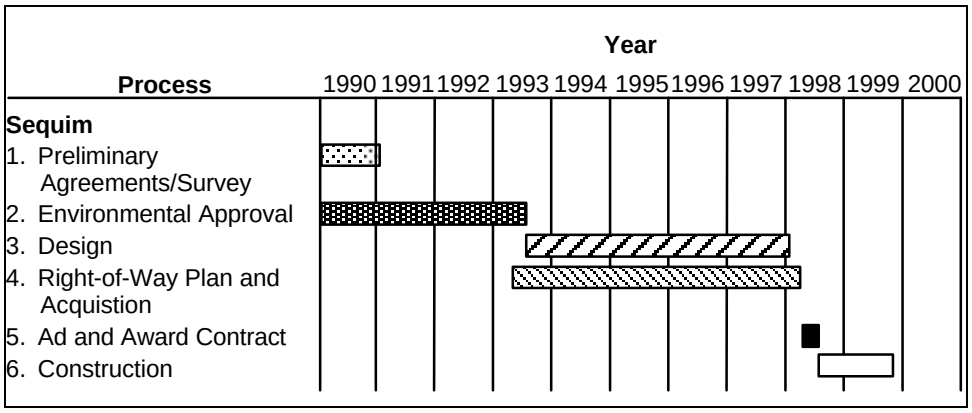
The Sequim Bypass project was originally programmed in July 1990, and involves the realignment of approximately five miles of State Highway 101 around the southern perimeter of Sequim. The project's anticipated cost is approximately $40 million, and is currently scheduled to be completed during the latter part of 1999, five years later than originally scheduled.

The Sequim Bypass project is scheduled to be completed five years later than originally scheduled.

The simplified time line in Exhibit 3.11 has been developed from discussions with WSDOT staff involved with the project, and illustrates at a high level the manner in which the project has developed.

Exhibit 3.11

Current Schedule for Sequim Bypass



There are a number of differences between the schedules for Sequim and for DuPont.

Contributing Factors

There are a number of differences between the schedule for Sequim in Exhibit 3.11 and the schedule for DuPont in Exhibit 3.9, summarized as follows:

- Environmental Approval
  - Little overlap between environmental review and final design (some coordination did occur in provision of general design information to assist in EIS preparation).
  - Delays in reviews of environmental documentation and issuance of permits.
  - Amended EIS to reflect highway realignment to avoid wetlands.
- Right-of-Way Plan and Acquisition
  - Appraisal and acquisition of approximately 165 parcels of land of varied function, much larger number than at DuPont.
  - Local opposition to the project.
  - Discovery of an archaeological site of interest within the right-of-way (although other right-of-way acquisition proceeded concurrently during the archaeological investigation).
  - Reassessment and renegotiation of right-of-way parcels in the area of realignment of the highway design to avoid wetlands.

- Design
  - Later start in comparison to environmental review as compared to DuPont.
  - Redesign of highway mainline and interchange in area of realignment to avoid wetlands.
  - Additional permits required as compared to DuPont, including a Coastal Zone Management Consistency Certification and a Shoreline Substantial Development Permit.
- Ad and Award
  - The contract was advertised as planned on January 26, 1998.
  - Award and start of construction are anticipated within two to three months of ad, occurring after the conclusion of this audit.

Issaquah-Hobart Interchange

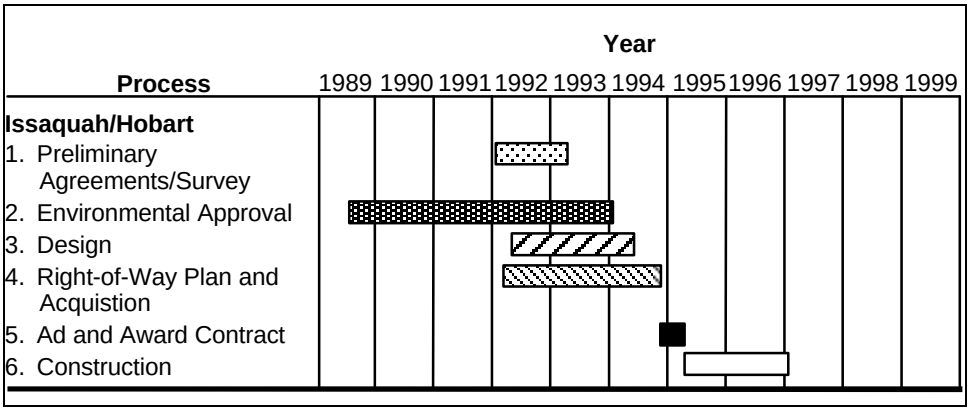
Overview

The Issaquah-Hobart Interchange is located on State Route 18 near three salmon-bearing streams and adjacent wetlands in terrain that varies from rolling to mountainous. The simplified project schedule illustrated in Exhibit 3.12 has been developed from discussions with WSDOT staff involved with the project, and illustrates at a high level the manner in which the project progressed to completion.

The Issaquah-Hobart Interchange is located near three salmon-bearing streams and adjacent wetlands.

Exhibit 3.12

Schedule for Issaquah-Hobart Interchange



Contributing Factors

New environmental regulations came into effect in King County during the development of the Issaquah-Hobart project.

New environmental regulations in the form of a Sensitive Areas Ordinance (SAO) came into effect in King County during the development of the Issaquah-Hobart project, and had a significant impact on its completion date. The result of the new permitting requirement on the project was to force significant redesign, delaying the ad date and subsequent construction by approximately one year. The engineering consultant who had substantially completed original design in early 1993 needed to continue work through the remainder of the year to incorporate necessary revisions.

As a result of the SAO a new permit, the King County Public Agency and Utility Exception, was created. This permit was additional to other required permits from the Corps of Engineers, Department of Ecology, U.S. Fish and Wildlife Service, Washington State Fish and Wildlife, and the Muckleshoot Native American Tribe. When WSDOT met in early 1993 with the various permitting agencies to discuss the project, it was determined that the planned wetlands impact and new stream crossings would be unacceptable based upon the SAO. As a result WSDOT redesigned the project, realigning an access road across several large parcels, routing it over an existing structure, and relocating an on-off ramp to the highway further away from SR 18 on Issaquah-Hobart Road to minimize impacts to the wetlands. In addition, the department modified several other aspects of the project to avoid bodies of water, to remove impediments to their flow, to replace a deteriorated structure for which WSDOT would assume ownership as the result of the ramp relocation mentioned above, and to allow for detention and treatment of surface runoff from both newly proposed and existing impervious surfaces. (Normally, WSDOT designs address only the additional runoff created by a project.)

Only some of the factors contributing to the success of DuPont can realistically be transferred to other projects.

Assessment of Case Studies

Exhibit 3.13 combines the schedules of the three project case studies and the nominal schedule developed by WSDOT within a single graphic. The time savings achieved at DuPont as compared to the other projects and the nominal case are readily apparent. From our review of these cases, however, it is equally apparent that only some of the factors contributing to the success of DuPont could realistically be transferred to other projects. We reviewed the contributing factors at DuPont in

light of the other case studies to organize the factors into three groups:

- Those that were unique to DuPont and therefore unlikely to be replicated on other projects.
- Those that were the product of chance, and happened to result favorably at DuPont, but can just as easily occur adversely at other project sites.
- Those that are replicable to other projects, and can therefore be applied as lessons learned.

Three groups of factors in the success of DuPont

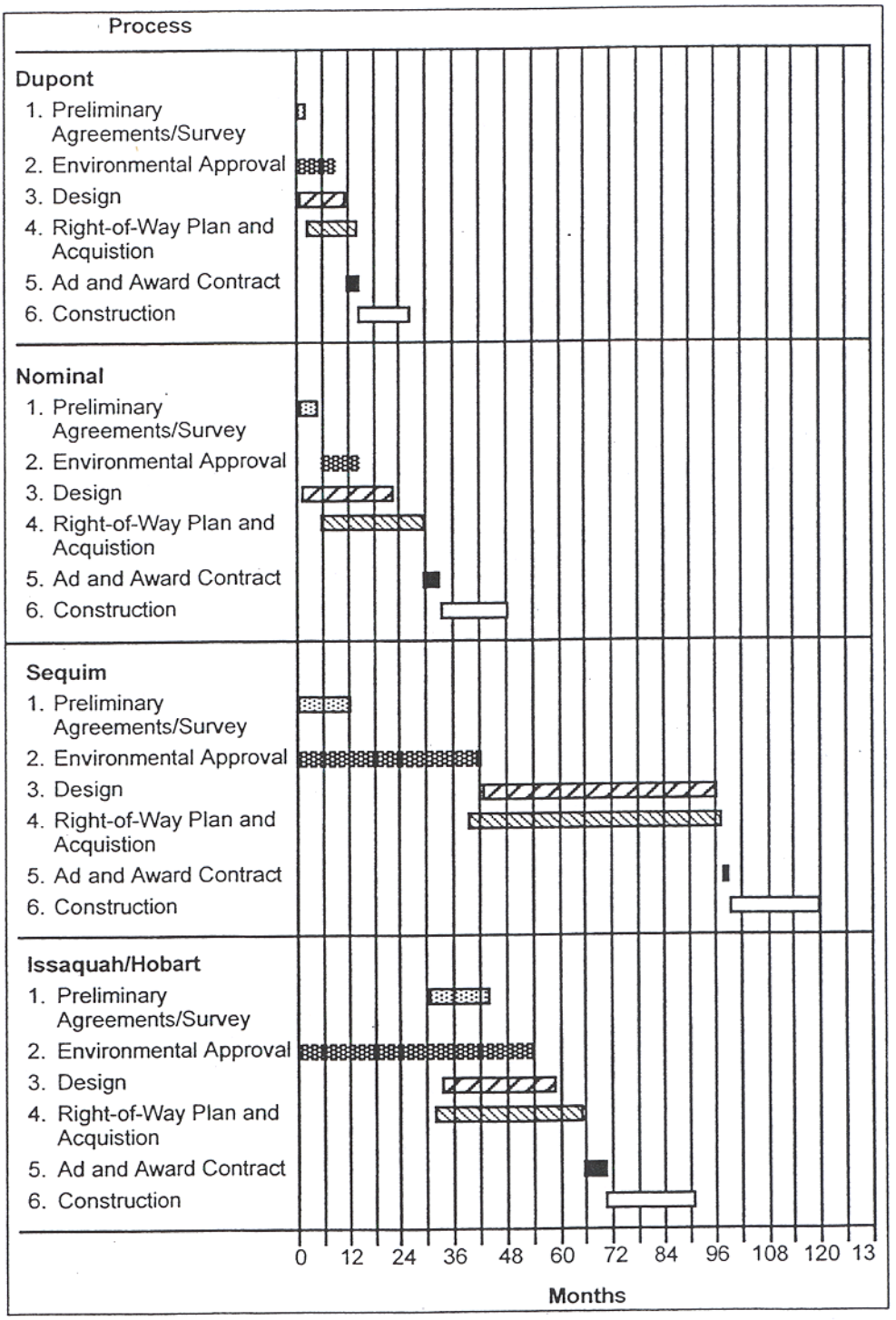
Characteristics Unique to DuPont

The key characteristics determined to be unique to DuPont are as follows:

- The availability of private sector funding for the project, which enabled the department to balance cost savings (i.e., the time-value of money) versus risk in a manner much different from its historical approach to projects funded through traditional public sector mechanisms. For example, prudent risks were able to be taken in advertising the project and commencing construction prior to obtaining all permits, an approach generally not followed on more typical projects.

Exhibit 3.13

Comparison of Project Schedules



- WSDOT's ability to obtain favorable approvals of the environmental assessment process that would need to be followed.
- Relative simplicity of the right-of-way acquisition process due to the small number of land owners involved.

Factors Involving Chance

Examples of factors that were determined to involve chance outcomes at DuPont are as follows:

- Site conditions that were favorable to design and construction by their uniformity and excellent engineering characteristics (e.g., soil characteristics, layout minimizing interference with traffic).
- Availability of suitable construction materials within close proximity to the site.

Factors Replicable on Other Projects

Factors that were determined to be replicable to other projects, and which therefore could help achieve savings in construction time, are as follows:

- The advantages of beginning environmental review early in the project, and of coordinating environmental considerations and design development as both proceed.
- The advantages of a more efficient design process, including the several items described in the DuPont case study.
- The advantages of including utility work as part of the construction contract.
- The potential advantages of including details or options as part of the plans and specifications package, in lieu of requiring contractor submittal.

These points have been discussed as advantages because they may be appropriate on some or many projects but not all, and therefore should be considered on a case-by-case basis. Nevertheless, to the extent that the department can incorporate the advantages above within revised processes for design, construction, and environmental assessment, it can reap the benefits of what proved at DuPont to be a more efficient approach. Our interviews with department staff indicate that these types of improvements are indeed recognized and

Factors that were determined to be replicable to other projects, and which therefore could help achieve savings in construction time

beginning to be implemented: e.g., in more streamlined and decentralized decision-making regarding design, ad, and award; new types of design team approaches that involve partnering with the private sector on certain projects; and evolution of the Olympia Service Center into a source of technical expertise available to the regions.

Findings

Success factors at DuPont are recognized by WSDOT and beginning to be implemented.

1. *The DuPont South Interchange was designed and built in one-half the time that would typically have been estimated for a project of this type. These savings were achieved both by starting certain project phases earlier and compressing the time needed for particular phases.*

2. *The savings at DuPont were possible because of the confluence of three sets of factors: very favorable circumstances that were unique to the DuPont project; chance factors that happened to develop favorably at DuPont, but could just as easily have occurred adversely; and design and construction innovations introduced by WSDOT.*

3. *Some of the innovations that contributed to the successful outcome at DuPont can be applied to other projects, particularly by improvements in the processes surrounding design, environmental assessment, right-of-way acquisition, and construction.*

Recommendations

1. *The Washington State Department of Transportation should continue its current steps to streamline project development procedures, collaborate with the private sector in unique design situations, and develop a more effective relationship between the Olympia Service Center and the regions.*

2. *The Washington State Department of Transportation should incorporate those lessons from DuPont that are replicable to other projects within its approach to design, environmental assessment, right-of-way acquisition, and construction, as appropriate for different types of projects.*

ALLOCATION OF DESIGN BETWEEN STAFF AND CONSULTANTS

Introduction

This section responds to the following audit question:

> "*Does WSDOT follow a cost-effective approach in allocating highway design work between departmental staff and consultants?*"

Our objectives were twofold:

- To review the cost breakdown of each of the design work orders associated with the 865 construction contracts previously considered in the analysis of cost overruns and delays, as a means of comparing design costs.
- To review the construction histories of the projects in terms of numbers and types of change orders, and to compare histories of projects designed by WSDOT staff versus those in which some engineering consultant involvement occurred, accounting for the degree of consultant involvement.

WSDOT's CCIS includes a design work order number[4] for each construction contract. We requested cost breakdowns for each of these work orders. However, the analysis of costs indicated problems involving incomplete or inaccurate data that are likely due to the difficulty of linking design and construction phases in the WSDOT management systems. For example, Exhibit 3.14 shows design cost as a percentage of construction volume. Since design cost is typically 5 to 15 percent of construction value on WSDOT projects, the data in Exhibit 3.14 imply that not all construction projects that pertain to the designs have been identified.

The analysis of project costs indicated incomplete or inaccurate data.

[4] Job Number field in the contracts table.

Exhibit 3.14

Analysis of Design Costs by Consultant Participation

Design Participants	# of Design Work Orders	Design Work Order Cost	Design $ as % of Construction $
WSDOT Only	106	$17,697,751	17.0%
WSDOT + Consultant	133	$95,618,594	33.1%
Total	**239**	**$113,483,305**	**28.9%**

No conclusion could be drawn from these data regarding the relative costs and effectiveness of engineering consultants.

While Exhibit 3.14 indicates a higher cost for designs with consultant involvement, we could not infer any conclusion from this statistic:

- The indication that design cost is 33.1 percent of construction value is unrealistic, as noted above, and is likely due to missing data rather than to a real difference in design cost itself.
- Even if the cost results were realistic, the higher cost with consultant involvement could be attributable to a number of reasons due to WSDOT, the engineering consultants, the characteristics of projects on which consultants typically work, and so forth.

No conclusion could be drawn from these data regarding the relative costs and effectiveness of engineering consultants on WSDOT highway design. Interviews with WSDOT managers indicate that the department is undertaking new initiatives with engineering consultants: e.g., partnering arrangements in which consultants and WSDOT engineers work side by side on projects. Our experience indicates, however, that WSDOT's ability to track the performance of these types of arrangements, and to compare them with current methods of doing business, are severely limited by the difficulty of obtaining information from current management and financial systems that cannot successfully and reliably link the design and the construction phases of projects.

Comparisons of costs between WSDOT and the private sector should include a full-cost estimate for WSDOT.

If consideration is given in the future to greater use of engineering consultants for highway design, comparisons of costs between WSDOT and the private sector should include a full-cost estimate for WSDOT to obtain a long-term view of the relative economies of the two approaches. Our estimate of WSDOT design function overhead on the basis of a full-cost perspective is at least 117 percent of direct labor costs, including

an allocation of the costs of departmental administration, management, and support; a share of the biennial costs of WSDOT-owned facilities that are used by design; fringe benefits for design labor; and a percentage of labor cost to cover time spent on indirect activities. The corresponding rates for private sector firms as estimated by WSDOT based upon several contracts range from 142 percent to 171 percent.

Other State's DOT Experience

The audit team used design cost and performance information from three states.

The audit team sought design cost and performance information from three states: Minnesota (MnDOT), Oregon (ODOT) and Wisconsin. ODOT's data were in the form of estimates. We also reviewed audit reports dealing with cost overruns and delays in the states of Florida (FDOT) and Wisconsin, and two previous reports on WSDOT cost overruns prepared by WSDOT for the Legislative Transportation Committee (LTC) and the Washington State Transportation Commission (WSTC), respectively.

For those design work orders that WSDOT were able to provide object cost information, the percentage of the total design work order costs that was expended on consultants was 6 percent.[5] This figure is significantly lower than the 15 percent firmly identified by ODOT over last five years, and 35 percent firmly identified by Wisconsin DOT. MnDOT stated that consultants are normally only involved in the pre-construction phase, although it could not cite an approximate percent of the total design value.

Findings

1. *Findings regarding the WSDOT's use of in-house staff versus engineering consultants for highway design are inconclusive. The process to extract and link WSDOT financial and management system information on the design and construction phases of projects was difficult and unreliable. Cost results were unrealistic. No inferences should be drawn from the results presented on the use of engineering consultants in design.*

[5] This figure would apply to approximately a six-year period 1990-96. Data on the 1995-97 Biennium indicate consultant involvement on design at 10 percent for architectural and engineering services only (i.e., excluding surveying and other preliminary engineering activities).

WSDOT should consider enhancing capabilities among its accounting systems to view project histories through all phases.

Recommendation

1. *The Washington State Department of Transportation should consider enhancing capabilities among its suite of management and financial accounting systems to provide a stronger capability to view project histories through all phases from design through construction completion.*

EFFICIENCY OF PROJECT STAGING

Overview

Work within a highway corridor may be divided into separate projects that are built sequentially over a period of several biennia. An audit question asked about the relative efficiency of this approach, in terms of minimizing life-cycle costs, as compared to the alternative of constructing the entire scope of work all at once. This section responds to this question, considering both the costs to WSDOT of designing and building the projects and the costs to highway users of congestion and delays due to the imposition of construction work zones.

WSDOT's stated reason for staging projects is the limited funding available each biennium.

Example Projects

WSDOT Northwest Region provided examples of two project situations in which highway corridor improvements have been or are being addressed in stages. These highway corridors are State Route (SR) 18 from Black Diamond Road to Interstate 90, and SR 522 from SR 9 to SR 2. WSDOT's stated reason for staging projects is the limited funding available each biennium.

The improvements in the SR 18 and SR 522 corridors encompass road widening, interchanges, revegetation, and environmental mitigation. Key characteristics of these projects with respect to the proposed analysis are described on the following page.

Characteristic	SR 18	SR 522
Length of corridor	24 miles	10.6 miles
Number of individual projects	19	5
Value of work in current dollars	$372 million	$123 million
Number of biennia with project work in current schedule	10	3 + future[6]

The current schedules provided by WSDOT for each corridor show the sequence of design, right-of-way, and construction activities for each project in the corridor. Across projects, the work is staged so that in any given biennium there is a mix of design, right-of-way, and construction work. The staging of the projects is done in such a manner that results in construction being programmed at one or more locations in the SR 18 corridor in nine of the ten biennia in WSDOT's schedule, and in all three of the biennia programmed in the current schedule for SR 522, with remaining construction to be completed in unspecified future biennia.

To obtain one estimate of the schedule compression that might occur if projects were conducted concurrently rather than in sequence, we adjusted the schedule to accelerate all projects to begin work in the first biennium shown in the current schedule, while maintaining the relationship in timing among the design, right-of-way, and construction phases within each project. Based on this series of adjustments, and assuming for the sake of the analysis: 1) no limitations in funding, 2) no limitations in the availability of WSDOT construction staff, and 3) no problems due to interactions among projects at different locations in the corridor, the schedule for SR 18 is reduced from ten biennia to five; and the schedule for SR 18, from an assumed six biennia (allowing for three "future" biennia) to four. Further reductions in schedule might be achieved by streamlining design and accelerating project phases, particularly if funding limitations are removed as a constraint.

State highway corridor examples are useful in understanding the practical aspects of project staging.

These corridor examples are useful in understanding some of the practical aspects of the project staging question. However, the two example corridors differ in key respects, as indicated above, and data are not readily available in other corridors throughout the state to characterize a "typical" corridor situation.

[6] Work in SR 522 has to date been programmed only for the next three biennia in the construction program. Remaining work is designated for "future" biennia.

We have approached the analysis by posing an idealized situation that draws upon the data in the two examples above.

Therefore, we have approached the analysis by posing an idealized situation that draws upon the data in the two examples above, but allows flexibility in the assumptions and parameter values that are applied in the agency cost and user cost calculations. The advantages of this approach are as follows:

- It focuses the analysis at the corridor level to which the audit question is addressed, rather than at the level of specific projects.
- It provides a standard basis for comparison by which the sensitivity of results to different parameter values and to different assumptions may be investigated.
- It allows for the relaxation of constraints (as in funding or in availability of design and construction engineering staff) that may influence how corridor improvements are now performed, and that could inhibit exploration of alternative staging options.
- As the result of all of these characteristics, it focuses on the essential behavior of the solution and the critical factors that most strongly influence the solution.

The analysis and its results are described below.

Analysis

Corridor and Case Descriptions

To analyze the impact of different staging options, five cases are considered.

The project staging analysis is based upon a hypothetical 20-mile-long corridor that is programmed for improvement along its entire length. To analyze the impact of different staging options, five cases are considered, with each case entailing variations in the following characteristics of the improvement: 1) the number of construction project stages active at a given time in the corridor, 2) the length of corridor under construction at a given time (which equals the length of the construction work zone), and 3) the number of biennia required to complete construction of the entire corridor. It is assumed that each project stage - i.e., the accomplishment of work within each work zone - takes two biennia to complete, regardless of work zone length. Thus, the intensity of work, and the resulting expenditure per biennium in which work occurs, also vary across the five cases. The five cases are summarized in Exhibit 3.15.

Exhibit 3.15
Project Staging Cases Analyzed

Case Number	Biennia to Complete Construction	Number of Project Stages	Length of Work Zone for Each Project, Miles	Expenditures Per Biennium
1	10	5	4	$20 million
2	8	4	5	$25 million
3	6	3	6.67	$33.3 million
4	4	2	10	$50 million
5	2	1	20	$100 million

The following conditions are assumed to simplify the analysis and to focus on the essential behavior of the solution. These assumptions could be relaxed and adjustments made in applying the results to particular corridors. However, the basic thrust of the solution and the findings of this analysis would remain valid. The assumptions are as follows:

Simplifying assumptions

- None of the cases is affected by constraints in funding, project constructability, or availability of necessary WSDOT staff.
- Highway and traffic characteristics are uniform along the corridor length.
- The costs of traffic management and the efficiency of construction operations do not vary significantly among cases.
- A portion of the design and right-of-way acquisition has already been completed, allowing construction to begin in the first biennium of the analysis period in each case, and to continue through each biennium required for project stage completion as noted in Exhibit 3.15. This assumption mirrors the situation in the current schedules of both the SR 18 and the SR 522 corridor improvements. The design or right-of-way phases are already in progress as of the beginning of the current schedule, and are sequenced to allow construction to continue through the remainder of the schedule.

Cost Estimation Methodology

The analysis of costs addresses both the agency capital expenditures to design and build the projects, and the additional costs to highway users that are due to imposition of a construction work zone, with attendant delays in travel time and changes in vehicle operating costs.[7] Agency costs and user

[7] The analysis did not consider accident costs explicitly. However, the methodology used would easily allow the inclusion of the costs of additional

Agency costs and user costs are discounted and summed through a 20-year analysis period.

costs will be discounted and summed through the 20-year analysis period in each case, using a discount rate of 7 percent. The result will be a total discounted cost for each of the five cases in Exhibit 3.15, which will then be compared to identify the economic implications of different project staging options. The methodologies for analyzing discounted cost streams that are applicable to the agency cost and the user cost components, respectively, are explained below.

Agency Costs

Agency costs have been estimated in constant dollars at $5 million per biennium for each mile of highway with a project underway, or $10 million per completed mile (since each project is assumed to require two biennia to complete). The unit cost of $10 million per completed mile approximates the unit costs of both the SR 18 and SR 522 projects when projected expenditures are converted to constant dollars. The total cost of the entire corridor improvement in this analysis is therefore $200 million in constant dollars, irrespective of the case being analyzed.

The distribution of agency costs by project and over time will vary by case as implied in Exhibit 3.15, leading to differences in the total discounted agency cost for the corridor, as follows:

Case	Total Discounted Agency Cost
1	$109.5 million
2	$122.1 million
3	$136.9 million
4	$154.3 million
5	$175.1 million

The discounted agency costs are the lowest in Case 1 because projected expenditures are distributed uniformly throughout the 20-year analysis period. Conversely, Case 5, which requires only one project stage and two biennia for completion, has the maximum value of discounted agency cost, because the expenditure of $200 million for the corridor improvement is concentrated in the first two biennia of the analysis period (Exhibit 3.15).

accidents due to the presence of the work zone. Again, the essential behavior of the solution and the findings of this analysis would remain the same.

The discount factor represents an opportunity cost of the use of the available capital funds on a particular project. By spending dollars in a given biennium on this corridor improvement, WSDOT is precluded from applying these dollars to other projects in the program. In this light, Case 1 conserves the most capital for use on other projects by deferring expenditures on this corridor improvement to later biennia. Case 1 also has the lowest discounted agency cost. Conversely, Case 5 requires the greatest amount of capital for immediate use in this corridor improvement. It has the highest discounted agency cost, indicative of the opportunity cost of forgoing the option for immediate investment in competing projects. This "opportunity cost" effect provides an economic interpretation of the rationale for project staging from an agency cost perspective. It should be understood, however, this is strictly an agency cost perspective on the project staging issue, and does not account for the relative **benefits** of the available investment options, whether in this corridor or elsewhere. To arrive at the benefits side of the calculation requires the consideration of the impacts of project staging on the costs borne by highway users.

Case 1 defers the most expenditures to later biennia.

Case 5 applies the greatest amount of capital immediately.

Highway User Costs

The highway user costs attributable to a work zone[8] have been analyzed using a methodology to estimate vehicle operating and travel time costs developed for the Federal Highway Administration (FHWA).[9] This methodology considers two periods of the day on a highway:

[8] For brevity in the following section, references to "user costs" will mean "additional costs that are experienced by highway users as the result of a work zone." Highway users also experience a base level cost of travel time and vehicle operation during normal highway situations when no work zone is present, but these are excluded from this analysis because they are the same for all cases. This approach is consistent with the methodology described in the following paragraphs.

[9] E.N. Burns, C.L. Dudek, and O.J. Pendleton, *Construction Costs and Safety Impacts of Work Zone Traffic Control Strategies*, vols. 1 and 2, FHWA-RD-89-209 and 210, December 1989.

The FHWA methodology allows one to simplify actual variations in traffic flow.

- The peak period, during which flow through a work zone may or may not result in congested conditions.[10]
- The off-peak period, during which traffic flow through the work zone is assumed to be uncongested, but nevertheless at a reduced speed as compared to the normal highway situation without the work zone.

The FHWA methodology allows simplification of the actual traffic flow variations during a 24-hour day into two periods of idealized, uniform flows representing peak and off-peak conditions, respectively. We took advantage of this approach to define a hypothetical 4-hour peak period and a 12-hour off-peak period. In lieu of specifying a daily traffic volume directly, we selected a single value of work zone capacity for illustration (1,800 vehicles per hour), and expressed demand volume as a percentage of this work zone capacity. Initially a range of values of this percentage was tested; however, in later stages of the analysis, we focused on a single value of traffic volume of 90 percent of work zone capacity for reasons described below.

We addressed congestion effects by testing different values of the hourly excess of vehicles contributing to congestion during the peak period.

We addressed congestion effects by testing different values of the hourly excess of vehicles contributing to congestion during the peak period. These values are in reality a function of several factors including the number of lanes of the existing highway, the hourly traffic flows in the peak period (during which buildup of congestion will occur) and in the hours following the peak period (during which dissipation of congestion will be completed), the composition of traffic in terms of the percentage of trucks, and the capacity of the work zone. Thus, the use of this hourly excess parameter serves as a surrogate for what would be in fact many characteristics of highway, traffic, and work zone configuration that would need to be accounted for in the analysis of a specific project.

To understand the results of this user cost analysis, it is important to understand the differences in the treatment of uncongested and congested conditions in the FHWA methodology.

- Uncongested conditions reflect the situation in which the primary effect of the work zone is to reduce the speed of the

[10] "Congested conditions" are those in which the traffic demand at the entrance to the work zone exceeds the available capacity of the work zone, causing a queue to build on the upstream end of the work zone, entailing additional delays beyond those experienced in the work zone.

vehicles passing through it, as compared to normal highway operations when the work zone is not present. This speed reduction is reflected by an increase in user costs that varies with **the length of the work zone and the number of hours in which traffic flows through it uncongested.**

- Congested conditions reflect the situation in which the primary effect of the work zone occurs at its upstream end, in terms of the buildup of a queue waiting to enter the work zone. This delay in the queue is reflected by an increase in user costs that varies with **the average queue length, which itself is a function of the hourly flows of traffic during the peak period, the work zone capacity, and the number of highway lanes upstream of the work zone.**

The important point is that user costs during uncongested conditions **are sensitive to the length of the work zone**, whereas **user costs during congested conditions are not**. In the congested situation, the congestion effects upstream of the work zone are assumed in the methodology to dominate the work zone effects, so work zone length does not enter into a calculation involving congested traffic, even though the traffic must still travel through the work zone. Both congested and uncongested user costs are sensitive, however, to the duration of the work zone, in that these costs persist in each biennium in which the work zone is present, and both go to zero when the work zone is removed. Since the five cases of project staging in Exhibit 3.15 affect both the length and the duration of work zones, they have implications for user costs that will differ depending upon whether conditions are congested or uncongested.

User costs during uncongested conditions are sensitive to the length of the work zone, whereas user costs during congested conditions are not.

Results

Uncongested Conditions

When uncongested conditions are assumed throughout the analysis, the results indicate increasing costs from Case 1 to Case 5 in all categories of discounted costs:

Case	Discounted Agency Costs	Discounted User Costs	Discounted Total Costs
1	$109.5 million	$36.8 million	$146.3 million
2	$122.1 million	$41.1 million	$163.2 million
3	$136.9 million	$46.0 million	$182.9 million
4	$154.3 million	$51.9 million	$206.2 million
5	$175.1 million	$58.9 million	$234.0 million

Explanations follow:

- Agency costs increase for the reasons described earlier.
- User costs increase from Case 1 to Case 5 for the following reasons:
  - The reduction in time that the highway is under construction is offset by the longer work zone through which traffic must flow. As a result, total **undiscounted** user costs are the same regardless of the case under consideration.
  - Total **discounted** costs increase from Case 1 to Case 5 because of the opportunity cost effect, similar to the behavior observed for agency costs.
  - There are no congestion effects present to derive the benefit of a shorter duration of work zone.

When uncongested conditions prevail, trends in both highway agency costs and highway user costs favor a greater degree of project staging.

In addition to the effects of the different cases of project staging, we also analyzed the impacts of different traffic levels for a given staging option. User costs increase nonlinearly (at an accelerating rate) with increasing traffic, because traffic flow in the work zone itself is impeded by increasing numbers of vehicles. This situation is analogous to nonlinear reductions in speed (and corresponding increases in travel time) on mainline highways with increasing traffic volumes, as represented by speed-flow curves in references such as the *Highway Capacity Manual*.[11]

As a general rule, therefore, when uncongested conditions prevail at a project work zone, trends in both highway agency costs and highway user costs favor a **greater degree of project staging.** In other words, the economically preferred approach in this situation is to spread work over time and by location, analogous to Case 1 in Exhibit 3.15. The net effect of project staging in this situation is to defer a portion of both agency costs and user costs to future years, reducing their discounted total. The greater the traffic volume, the greater the

[11] *Highway Capacity Manual*, Special Report 209, Transportation Research Board, 1994.

economic incentive to stage project work in this way, as long as there is no congestion.

Congested Conditions

The analysis was repeated for situations in which congestion is present. Since congestion results from an excess of traffic demand over highway capacity, we did not explore the effect of different traffic volumes as in the preceding analysis. Rather, the analysis presumed a relatively heavy travel demand that would be expected to result in congestion during peak periods. The focus of the analysis was therefore on the variation in peak period hourly volumes and their impacts on queue length in the formation of congested flow, which influences congestion-related costs. Off-peak volumes were uniformly assumed to be equal to 90 percent of work zone capacity.

If the work zone results in significant congestion, the preferred strategy is to perform as much work as early as possible in a single project.

The evaluation of Cases 1 through 5 indicates that:

- Discounted agency costs **increase** from Case 1 to Case 5, for the same reasons as those cited in the uncongested analysis.
- Discounted user costs must be evaluated separately for off-peak (uncongested) and peak period (congested) behavior:
  - Discounted off-peak user costs reflect work zone effects, and **increase** from Case 1 to Case 5 for the same reasons as those cited in the uncongested analysis.
  - Discounted peak-period user costs reflect congestion effects and **decrease** from Case 1 to Case 5. These costs are sensitive to the duration of highway work zones, but not to their length. Thus, these discounted costs are minimized when project work is accomplished as quickly as possible, regardless of work zone length. In terms of the cases listed in Exhibit 3.15, these conditions for cost minimization are satisfied most closely by Case 5.

This situation governing the overall solution is thus one of opposing cost trends between (1) the combination of agency costs and uncongested user costs, and (2) congested user costs. The economically preferred approach to project staging depends upon which set of costs dominates a particular analysis. If congestion exists but is not sufficient to offset the combination of agency cost and uncongested user cost, then the preferred staging approach would lean in the direction of case 1. If congestion is significant to the point of offsetting the combined effect of

The situation governing the overall solution is thus one of opposing cost trends.

agency cost and uncongested user cost, then the preferred staging approach would lean in the direction of Case 5.[12]

We performed a series of analyses to determine the break point between these two opposing solutions. For the particular values and assumptions in our hypothetical corridor, the break point occurs where congested user costs total $30 million per biennium. According to the FHWA methodology, this would translate in our idealized corridor to an average queue length during the peak period of about 1.7 miles. Congestion worse than this value would justify performing work as quickly as possible, in the manner suggested by Case 5. Congestion not as severe as this value, or the absence of congestion at the entrance to work zones, would justify staging the work over several projects and biennia in the manner leaning toward Case 1.

The economically preferred approach to project staging depends upon the degree of congestion at the work zone.

Practical Considerations

This analysis has been built upon an idealized, hypothetical problem situation for reasons cited at the beginning of the discussion of this audit issue. It is recognized that actual projects do not fit this idealized mold, and that adjustments for specific technical inputs representing highway, traffic, construction, and work zone characteristics may be needed. Nevertheless, the nature of the FHWA methodology implies that the basic factors identified in this analysis are critical to determining which project staging approach is preferred based upon an economic efficiency criterion.

It is also acknowledged that other criteria besides economic efficiency will influence WSDOT decisions on project staging. Among the other key considerations are availability of funds, availability of WSDOT design and construction staff, projects of competing priority in other corridors and locations, the efficiency of the construction operations themselves as influenced by work zone configuration, and external constraints on scheduling (such as required environmental reviews of particular locations in the corridor in question). The results of this analysis nevertheless provide economic guidelines that can contribute to the overall decision of how projects are staged within a highway corridor.

[12] The reportedly successful weekend closure of Interstate 405 to complete project work could be viewed as an extension of this logic.

WSDOT Application

WSDOT may wish to consider the implications of this analysis in its decisions on project staging in situations where project work zones are likely to result in significant congestion and queues. While it may not always be possible to consolidate all anticipated work in the corridor within a single project, in general the analysis indicates that whatever reduction in highway occupancy time and whatever degree of work consolidation within a single work zone (i.e., causing only one congestion choke point) that are possible, serve to reduce user costs. In effect, the department has already recognized and applied this principle in its recent, successful weekend closure of Interstate 405. This analysis may help to identify other situations where adjustments in project staging are desirable. The FHWA methodology to analyze user costs is readily available, if the department wishes to conduct more detailed or specialized analyses of particular situations.

WSDOT has already recognized and applied this principle in its recent, successful weekend closure of Interstate 405.

Findings

1. *Project staging strategies that minimize total life-cycle costs in a highway corridor depend upon the traffic situation that will result from imposition of a work zone.*

   - *If the work zone does not result in significant congestion, the preferred strategy based upon an economic criterion is to defer some of the project stages to later biennia.*

   - *If the work zone does result in significant congestion, the preferred strategy based upon an economic criterion is to perform as much work as early as possible in a single project.*

2. *The above guidelines are based upon an economic analysis of an idealized case. Other considerations also affect the staging of projects in a highway corridor, including availability of funding and necessary WSDOT staff, competing needs in other corridors and locations, and site- or construction-related factors that affect work zone configuration.*

WORK ZONE MANAGEMENT AND REVIEW

Work zone performance has attracted nationwide attention for several

A separate audit issue addressed the department's management of projects as they affect traffic slowdowns and highway worker safety. This issue deals essentially with the design, management, and scheduling of work zones for highway projects. The following paragraphs explore this issue.

Reasons for Importance

The performance of work zones for highway projects has attracted nationwide attention for several years. One reason has been the increasing volume of highway rehabilitation work, which requires the occupancy of the highway while maintaining traffic operations safely. Work zone impacts on speed and congestion are particularly acute on heavily used urban highways. A second reason are the safety implications of work zones, both for motorists and for highway workers in the work zone itself.

WSDOT Practices

WSDOT has adopted a number of practices to promote greater safety and efficiency of work zones.

Work Zone Guidelines

Traffic control plans are comparable to those by other transportation agencies.

It has developed work zone traffic control guidelines[13] to promote greater safety and ease of movement through work zones. These guidelines present traffic control plans for different highway situations which describe the geometric layout of each type of work zone, the recommended length and layout of the taper at the entrance to the work zone, and the recommended placement and use of signs, flaggers, cones or other traffic channelization devices, and buffer vehicles. The guidelines also provide information on clothing and equipment that highway workers should employ in work zones, their recommended applications, and, for truck-mounted attenuators, their priorities for use. These guidelines are comparable to traffic control plans by other transportation agencies.

[13] *Work Zone Traffic Control Guidelines*, WSDOT Field Operations, M 54-44, July 1994.

Work Zone Safety Task Force

Responding to a fatal accident involving a WSDOT project inspector in a work zone in Seattle in 1993, the department established a Work Zone Safety Task Force to examine the then current work zone safety accident trends and develop recommendations to reduce vehicle intrusions into highway work zones. The Task Force is multidisciplinary in its composition and includes representatives of labor, industry, and the Washington State Patrol in addition to WSDOT staff. Recommendations were developed in several areas relating to departmental practice and procedures, public awareness, worker training and reporting, and supporting legislation and funding. Although the final report of the Task Force was issued in January 1994, the Task Force continues to meet at intervals to review progress and to conduct follow-up studies as needed. For example, a recent study reviewed the procedures used by Regions to conduct work zone traffic control reviews.[14] Recommendations focused on Regions taking a lead role and a proactive approach to conducting these reviews and to ensuring that a specific office or individual is designated for traffic control issues.

WSDOT's Work Zone Safety Task Force continues to review progress and conduct follow-up studies.

Specific actions and results of the Task Force to date as reported by WSDOT include the following:

- Measures to increase worker safety and knowledge including improved high-visibility clothing, institution of training directed specifically to traffic control and flagging, use of training videos at employee safety meetings, requirement that a certified Traffic Control Supervisor be present on all construction contracts, and independent field reviews of work zone traffic control as well as formal guidance on how to conduct reviews.
- Testing and using new products to improve work zone safety including innovative types of barriers, work zone intrusion alarms, and truck-mounted impact attenuators.
- Institutional reinforcement of the importance of work zone safety including a WSDOT Executive Order and legislation to double fines for work zone violations and reckless endangerment of highway workers.

[14] *Highway Work Zone Reviews,* WSDOT Work Zone Safety Task Force, March 1997.

- Public outreach and awareness efforts including revisions to the Driver's License Manual to emphasize work zones, development of a video for use in driver education courses, and a public information campaign in various media outlets.
- Increased use of Washington State Patrol troopers in work zones.

High Impact Situations in Urban Areas

The importance of traffic control is heightened in urban areas.

The importance of traffic control is heightened in urban areas, where the combination of major highway infrastructure, heavy traffic demand, dense development abutting the highway perimeter, and lack of free space complicate the scheduling of highway project work and the logistics of work zone placement. Special organizational units and procedures have been established in WSDOT Northwest Region to deal with these issues.

The Construction Traffic Coordinating Office in Northwest Region oversees highway construction projects in terms of scheduling and managing work zones. With the high traffic volumes on highways in the Puget Sound area, about 80 percent of construction work is conducted at night. Responsibilities of the Construction Traffic Coordinating Office include the following:

With the high traffic volumes on highways in the Puget Sound area, about 80 percent of construction work is conducted at night.

- Assign the allowable work hours to be included in the construction contract.
- Review all Traffic Control plans submitted by the contractor.
- Exercise control over all oversize or overweight vehicles passing through construction work zones.
- Review work zone traffic control operations through site visits.
- Maintain a Web site with information on daily closures, and perform other public information functions.

The Northwest Region also has an Urban Construction Task Force to consider the issues surrounding construction projects that have high impacts on traffic. This Task Force reviews high-impact projects, such as those occurring on a bridge or those that require the taking of lanes on heavily traveled routes, to consider various approaches that might minimize traffic impact. Examples of the type of recommendations that this Task Force would make include the following:

- Providing incentives to contractors to speed completion of work.
- Reducing the number of days required for highway occupancy by, for example, lengthening the number of hours that the contractor may work each day: e.g., so that preparatory work can be finished with sufficient time left for actual project accomplishment.
- Considering when lanes can be taken away without undue adverse effects on traffic flow.

Regarding the first item on contractor incentives, the department has looked into mechanisms such as lane rental, in which a contractor effectively "pays" for occupancy of the highway after a stated period of time. In the opinion of WSDOT staff, lane rental would work best on simple, straightforward projects about which there is little uncertainty regarding duration and work performance from either WSDOT's or the contractor's perspective. There is also a concern that lane rental might not achieve its desired effect of minimizing project time, since it affords the contractor some flexibility in the project schedule, albeit at a monetary price.

Comparative Accident Experience

Several studies have been performed at the state and national levels to determine the impact of work zones on the rates of highway accidents. Accident rates generally increase in the presence of work zones when compared to the rate prior to construction.[15] The amount of increase is variable, depending upon the functional class of highway and whether it is in an urban or a rural area, traffic volume, the type of work zone and number of lanes closed, and the location of work.

Accident rates generally increase in the presence of work zones.

When viewed at a broad level such as by functional class, rates of increase may range from 15 to 75 percent.[16] When specific highway and work zone configurations are taken into account, however, the percentage increase is more highly variable,

[15] Decreases in accident rates have been observed when the location of work is off the traveled way: e.g., on shoulders or roadsides.

[16] See J.W. Hall and V.M. Lorenz, *Characteristics of Construction Zone Accidents*, Annual Meeting of the Transportation Research Board, January 1989; and *Procedure for Determining Work Zone Speed Limit*s, National Cooperative Highway Research Program, Research Results Digest No. 192, September 1996.

Work zone safety is better in Washington than in many other states.

ranging from 5 to 150 percent.[17] This variability is also reflected in reviews of data from different states, from 7 percent to 120 percent in the increase in accident rates reported by 12 states.[18] Washington State is included in the latter study, with a reported increase of 6.8 percent. This value would place Washington at the low end of the range of values reported in the literature, indicating a small adverse impact of work zones on highway safety as compared to other states.

We attempted to verify the accident experience in work zones in Washington over the past five biennia. However, data on the frequency of accidents and the daily traffic volume, both of which are necessary to compute the accident rate, could not be readily reconciled. The accident frequency data appear as shown in Exhibit 3.16 for all categories of accidents, and Exhibit 3.17 for fatal accidents. Two points to note regarding these exhibits:

- The graphs represent number of accidents, not accident rate. An increase in the number of accidents may not signal an increase in the rate of occurrence if the accidents occurred on high-volume highways.
- Recent time periods by which the data are organized are not equal in length. Rather, they range from one to three years in duration.

[17] J.L. Graham, R.J. Paulson, and J.C. Glennon, *Accident and Speed Studies in Construction Zones,* report by Midwest Research Institute to the Federal Highway Administration, FHWA-RD-77-80, June 1977.

[18] T-J Ha and Z.A. Nemeth, *Detailed Study of Accident Experience in Construction and Maintenance Zones, Transportation Research Record 1509,* Transportation Research Board, Washington, D.C., 1995.

Exhibit 3.16

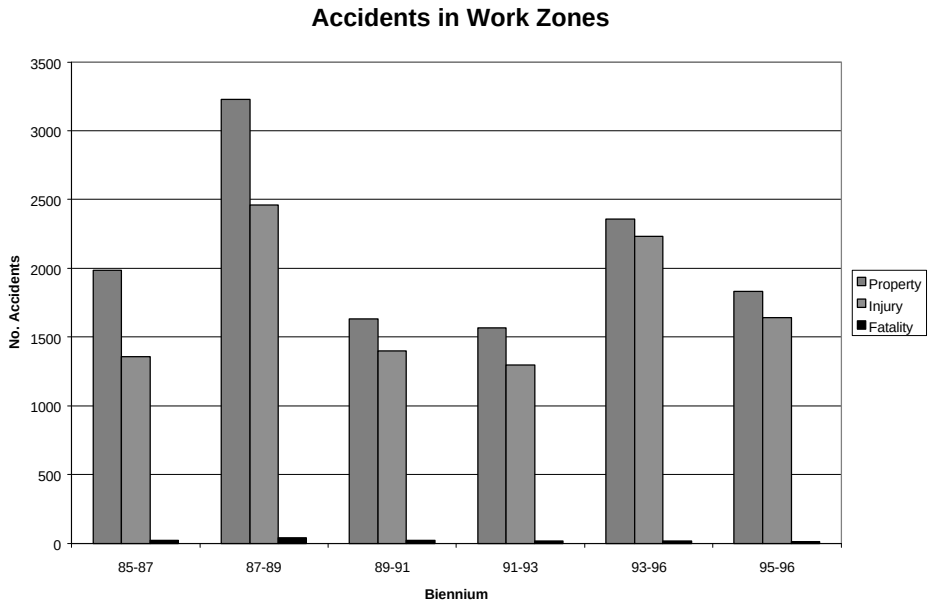
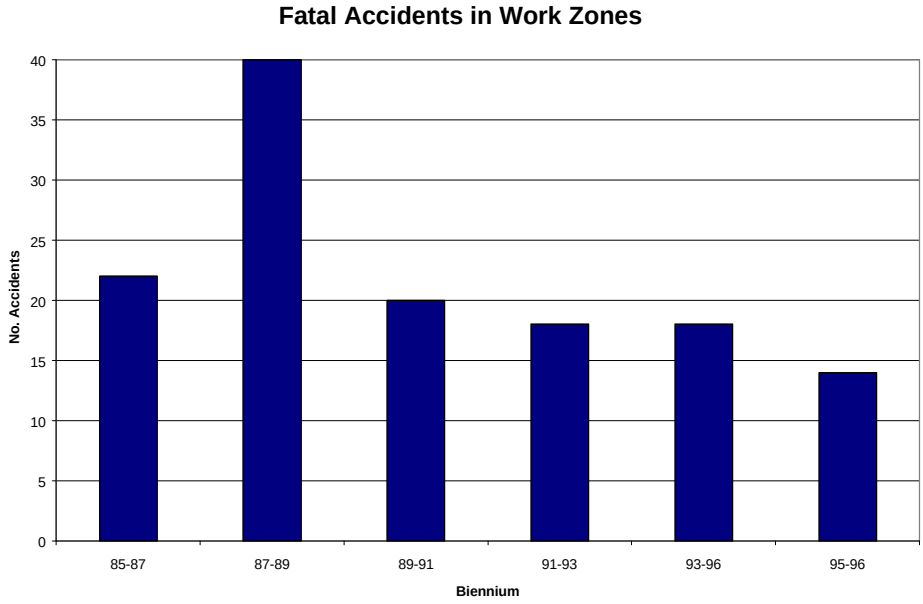


Exhibit 3.17



Findings

1. *Washington's practices in scheduling and managing highway work zones are comparable to those in other states, and are tailored to the special demands of high-impact work*

zones such as those in the Puget Sound region. Based upon published studies, Washington's accident experience in highway work zones is considerably better than that reported for other states.

HIGHWAY MAINTENANCE PROGRAM

Chapter Four

BACKGROUND

Background

Aspects of WSDOT's Highway Maintenance Program were discussed in Chapter 2, particularly regarding coordination between maintenance and the preservation and improvement programs. This chapter focuses on the maintenance program specifically, and reviews it in two respects:

- What are the composition and costs of the maintenance program, and how do they compare with those in other states?
- What are the issues surrounding the department's ability to outsource maintenance services, and what has been the experience by other DOTs in contracting for such services with either the public or the private sectors?

An analysis is now being completed, to be included in the final report, concerning the department's use of appropriate equipment and technology for maintenance.

These issues are discussed in the major chapter sections that follow.

PROGRAM COMPOSITION AND COST

Types of Ordinary Maintenance

WSDOT's Highway Maintenance Program was funded at $266 million in the 1995-97 Biennium, of which $246 million was allocated for direct work on the state highway system. The program encompasses a range of actions needed to keep a highway facility or feature in a condition that substantially retains its originally intended use and function. These actions, collectively referred to as "ordinary maintenance" in the context of state statutory authority for DOT operations, are performed in two different contexts:

- **Normal** maintenance covers all budgeted ordinary maintenance work that is performed routinely on a scheduled basis. Normal maintenance is not eligible for federal reimbursement, and it is funded from WSDOT's M2 maintenance subprogram.[1]
- **Emergency** maintenance includes the same types of activities as normal maintenance, but their performance may be greater in scope and magnitude depending upon the demands posed by the emergency. Emergency maintenance is not budgeted or scheduled on a routine basis, but it is eligible for federal reimbursement beyond a $5,000 threshold. Emergency maintenance also includes work on highway features that have been damaged by third parties.

Normal maintenance constitutes the major part of WSDOT's program and is the focus of maintenance planning and budgeting.

The analysis of maintenance work below will deal mainly with normal maintenance, since this work constitutes the major part of the department's program and is the focus of maintenance planning and budgeting. Emergency maintenance will be discussed in the context of WSDOT's contracting for outside maintenance services.

Activity Structure

WSDOT's maintenance program encompasses a spectrum of diverse activities that include work on roadway surfaces (pavements and shoulders), bridges and other structures, roadsides, drainage systems, rest areas, traffic features and control (e.g., lane striping, signs, signals, roadway lighting), snow and ice control, and supervision. Following a recent study of the management and administration of its maintenance program[2], WSDOT reorganized the descriptions of its maintenance work into a simplified structure referred to as the Maintenance Accountability Process, or MAP.

[1] The M2 subprogram covers expenditures for maintenance accomplishment in the field, including labor, equipment, materials and supplies, contracted services, and certain support items that will be discussed in more detail later. Departmental administration, buildings and other facilities to store maintenance equipment and materials, and utilities and other operating expenses associated with these maintenance sites are in other subprograms, not in M2.

[2] *Maintenance Management and Administration Evaluation*, prepared for WSDOT by Dye Management Group, Inc., June 1996.

The MAP activity structure organizes the maintenance program within nine groups. Each group encompasses work elements that describe key functions of the maintenance organization. WSDOT has also specified a crosswalk between this MAP activity structure and the detailed work operation numbers by which expenditures are currently tracked in the department's accounting system (TRAINS). Both the MAP structure and the breakdown of the maintenance program by work operation numbers have been used in the analyses that follow.

The MAP activity structure organizes the maintenance program within nine groups.

While state DOTs employ different numbers and definitions of maintenance activities, at a higher level highway maintenance programs nationwide are comparable in their organization around major categories of work, analogous to the MAP structure adopted by Washington. This comparability makes it possible to do high-level comparisons of programs.

Distribution of Expenditures by Activity

The distribution of WSDOT subprogram M2[3] expenditures among MAP activities is given below. These expenditures totaled $246 million in the 1995-97 Biennium. Also shown for comparison are the corresponding breakdowns for the Colorado DOT and the Virginia DOT maintenance programs[4] and the results of an analysis of maintenance budgets of six states that was performed in a separate study.[5] There are several reasons for the ranges in values in this latter study, including differences among states in how they define, categorize, and report specific maintenance activities and different compositions of program work. For example, the percentage distribution of maintenance expenditures among categories of activities is influenced strongly by the magnitude of snow and ice control, if any. Nevertheless, the comparison suggests that WSDOT's distribution of biennial maintenance expenditures is comparable to that in other states reviewed, with the one exception of roadway surface maintenance, for which WSDOT expenditures

WSDOT's distribution of biennial maintenance expenditures is comparable to that in other states.

[3] Subprogram M2 addresses the direct maintenance of the state highway system. Other maintenance subprograms are M1, maintenance management and support, and M5, inventory and stores administration.

[4] Recent data on maintenance program expenditures were readily available for Colorado DOT and for Virginia DOT.

[5] M.J. Markow, *Development of Quality Standards and Impact Models for Highway Maintenance*, Working Paper No. 1, unpublished technical paper prepared under DOT-RC-92016 for the U.S. Department of Transportation, February 1980.

are less on a percentage basis than that observed in the other states.

Category of Work (Coincides with WSDOT MAP Activity)	WSDOT	Colorado DOT	Virginia DOT	Six Other States
Roadway surface	16.4%	30%	20.8%	20 to 60%
Drainage	6.6%	7%	11.1%	1 to 9%
Roadside, vegetation control	6.7%	9%	14.0%	6 to 14%
Structures	6.5%	3%	2.0%	1 to 9%
Snow and ice	18.6%	22%	16.7%	0 to 30%
Traffic services	13.7%	15%	10.1%	0 to 17%
Rest areas	2.9%	8%[6]	9.6%	0 to 10%
Supervision	10.5%	4%	15.7%	0 to 12%
Emergency	18.0%	2%	n/a	n/a
TOTAL	100.0%	100%	100.0%	

Comparison of Expenditures with Other States

Highway Statistics data permit a 50-state comparison of maintenance expenditures.

A comparison of maintenance expenditures with those of other states was performed using data in *Highway Statistics* for calendar year 1995. These data are expressed in maintenance dollars per system mile for the state highway network, analogous to the statistics used in the comparison of construction expenditures in Chapter 2. These data have the advantage of permitting a 50-state comparison (and are the only such data known to the audit team), and they have been applied in a performance audit in Wisconsin.[7] As the Wisconsin audit points out, however, these statistics must be used with caution,

[6] Also includes indirect items such as maintenance buildings and yards, stockpile management, etc. These items are not included in the data shown in this MAP activity for WSDOT.

[7] An Evaluation: Management of the Highway Program, Department of Transportation, Wisconsin Legislative Audit Bureau, Report 97-4, March 1997.

since they are not audited and may involve duplication resulting from intergovernmental relationships, and because costs may not be categorized consistently from state to state.

Certain characteristics of the manner in which *Highway Statistics* data on maintenance are reported need to be taken into account:

- Data on physical maintenance (i.e., maintenance activities except for snow and ice control) are reported by functional class, in a manner similar to the capital construction expenditure data cited in Chapter 2. Comparisons of WSDOT's expenditures for physical maintenance to national averages will be structured by functional class, excluding the Local functional classification since WSDOT does not manage any facilities of this type. Physical maintenance data are in Table SF-12 of *Highway Statistics.*
- Data on snow and ice control are reported by state as an aggregate total, with no further detail. Expenditures for snow and ice control will be added to the physical maintenance results above for the entire state and the national highway networks, and a new comparison will be made. Snow and ice data are in Table SF-4C of *Highway Statistics.*
- Maintenance expenditure data in *Highway Statistics* encompass ferry system maintenance in Washington State, and maintenance expenditures for toll facilities and ferry facilities nationwide. Adjustments were made to exclude ferry facility and toll facility expenditures from highway system data, in the same way as described in Chapter 2 for capital expenditures.

The comparison of physical maintenance expenditures shows that Washington's costs are $7,487 per system mile, while the nationwide average of 50 states' costs is $9,597 per system mile. WSDOT is 22 percent below the average expenditure per system mile nationwide. This trend indicating Washington to be lower than average cost holds for almost all functional classes.[8]

Washington's costs are $7,487 per system mile, while the nationwide average is $9,597 per system mile.

[8] Even though 50-state data adjusted for ferry and toll facilities are not available by functional class, the degree to which Washington's adjusted cost data are below the nationwide unadjusted data when compared by functional class make it very likely that Washington's maintenance costs are indeed lower than the nationwide average across all functional classes with the possible exception of Rural Collectors.

With snow removal included, WSDOT's maintenance expenditures are almost 8 percent lower than the average for all states.

If the cost of snow removal is added to physical maintenance, the comparison is as follows:

- WSDOT: $10,295 per system mile, physical maintenance plus snow and ice removal.
- All states: $11,149 per system mile, physical maintenance plus snow and ice removal.

With snow removal included, WSDOT's maintenance expenditures are almost 8 percent lower than the average for all states. This narrowing of the gap between WSDOT and the nationwide average when snow and ice removal are introduced is not surprising, since the cost per system mile statistic computed for these winter operations includes many states across the central belt and southern tier of the country that have less intensive winter operations. When compared solely to states across the northern tier of the country and to a mountainous state such as Colorado, WSDOT's snow and ice removal costs of $2,808 per system mile compare favorably with costs in these other states:

State	Snow and Ice Removal Costs Dollars per System Mile
Alaska	$3,966
Colorado	$2,625
Idaho	$3,398
Maine	$2,532
Massachusetts	$7,394
Michigan	$3,765
Minnesota	$3,346
Montana	$855
New Hampshire	$4,837
Ohio	$1,973
Pennsylvania	$4,541
Vermont	$8,067
Washington	$2,808
Wisconsin	$2,428

Distribution of Costs by Object

An analysis was made of the 1995-97 Biennium expenditures in subprogram M2 to examine the costs by object or maintenance resource. A standard way of expressing DOT maintenance expenditures is by a breakdown of labor, equipment, material, contract, and other expenses. To accomplish this we analyzed the M2 program in terms of object codes, supplemented with cross-tabulations by work operation number in cases where additional detail was needed. The result was compared to data from Colorado DOT, as follows:

An analysis was made of the 1995-97 Biennium expenditures in subprogram M2.

Resource or Object	WSDOT	Colorado DOT
Labor	42.4%	46.9%
Equipment	22.8%	17.9%
Materials and Supplies	17.5%	35.2%
Contracts for Normal Maint.	2.8%	n/a
Contracts for Emergency Maint.	8.7%	n/a
Highway Assessments	1.0%	n/a

Expenditures for labor and materials are lower for WSDOT than for CDOT in the comparison above. This effect is due in part to the inclusion of contracts and assessments for Washington, with no comparable data for Colorado. Beyond this, we cannot explain the difference in materials costs. Equipment costs are higher for WSDOT in part because in our analysis we included not only the costs of equipment usage at the job site, but also purchases of equipment that occurred outside the Transportation Equipment Fund (TEF). These purchases are reflected as expenditures in subprogram M2, with no adjustment or amortization.

Contract costs for normal maintenance were 2.8 percent of the maintenance program, an amount higher than the 1.9 percent cited in the 1996 Dye Management Associates report. The reason for the difference is that, in addition to including expenditures listed under the "contracts" object codes, we included expenditures for the "equipment rental with driver" object, which represents a form of outsourcing.

Contract costs for emergency maintenance totaled 8.7 percent in the 1995-97 Biennium.

Contract costs for emergency maintenance totaled 8.7 percent in the 1995-97 Biennium, or more than $20 million of the $44 million spent for work on emergencies and third-party damage. This amount was regarded by WSDOT staff as greater than normal, due to heavy rains, flood damage, and slope failures on

highways. Of the $44 million total, $33 million was reimbursed by the federal government.

Highway assessments are payments by WSDOT to local utility districts for services such as fire protection (e.g., for rest areas), stormwater runoff, and electricity for highway lighting and signals. These costs are related to highways explicitly, rather than to maintenance yards and facilities, and are therefore included as a direct cost in subprogram M2 rather than in the maintenance indirect cost subprograms.

Although subprogram M2 is nominally for direct maintenance costs on the state system, several cost items appear to be indirect in nature.

Although subprogram M2 is nominally for direct maintenance costs on the state system, we noted several cost items that we regarded as indirect in nature. These items totaled $5.8 million, or 2.4 percent of program expenditures, and included the following:

- Expenditures for employee tests, training, or benefits (e.g., commute incentive allowances).
- Equipment that did not appear to be directly related to maintenance work in the field: e.g., office furniture.
- Data processing expenses for hardware, software, MIS support, and computer maintenance.
- Other expenses: e.g., out-of-state travel, and meeting expenses.
- Required Program Administration Fee (PAF).

Program M2 also includes the following items that were considered as indirect in the overhead rate calculation described later:

- Nonlabor items in the 6000 series of work operation numbers related to Supervision. These items totaled $18.2 million, and when added to the items above, bring the indirect percentage in subprogram M2 to 7.4 percent.
- Labor charged to the 6000 series of work operation numbers, totaling $13.4 million. Inclusion of this labor as an indirect charge would bring the total indirect amount in subprogram M2 to 12.9 percent.[9]

[9] We recognize that a portion of this maintenance supervision occurs at the work site, and could therefore be arguably considered as a direct cost. However, since no allowance has been taken for labor "down time" during the day, there is likely a compensating effect. A more precise estimate, using

We looked at equipment specifically, as requested in an audit question. The Department's costs of use of equipment are comparable to those in other states. Moreover, based upon published papers and members' service on committees that are nationally recognized, the Department is a leader in areas of technology germane to its maintenance operations, particularly in environmental and winter maintenance (e.g., anti-icing) topics.

WSDOT is a leader in areas of technology germane to its maintenance operations.

Variations by Region and Area

Maintenance expenditures were analyzed by region and by maintenance areas within regions to investigate geographical differences in costs and likely explanations. Areas are organizational units within regions, corresponding to locations of maintenance crews at yards serving subdivisions of the regional network. Regions have between four and five maintenance areas, with 25 areas total statewide.

Within each region and area, maintenance expenditures were compared to road network characteristics (system miles, lane miles, vehicle miles traveled), terrain, and functional class. While areas were investigated to test the value of looking at geographic divisions finer than regions, in fact the resulting statistics for areas were distorted by too fine a breakdown. Consequently, the results presented below are at the regional level.

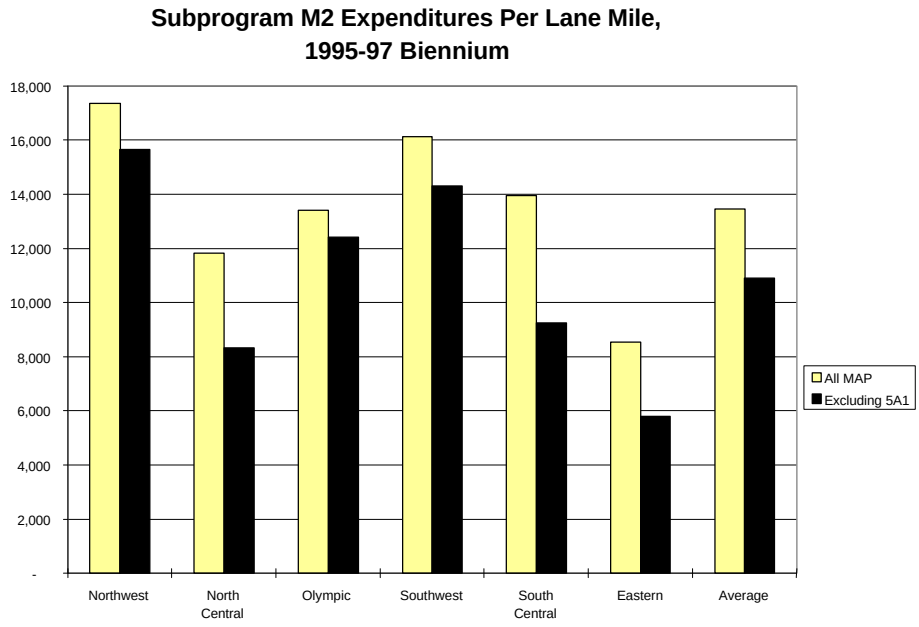
Exhibit 4.1 shows the variation in maintenance expenditures per lane-mile by region. Exhibit 4.2 provides a corresponding breakdown of expenditures by vehicle miles traveled (VMT) to capture the effect of highway usage. Two maintenance expenditure totals are computed for each region: one encompassing all MAP activities, the second excluding activity 5A1, snow and ice control, to provide a better comparison of physical maintenance activities. In the discussion below, we have identified factors that are likely to be correlated with the levels of expenditure shown. Establishing definitive relationships between maintenance costs and these factors or variables would require a modeling exercise that goes beyond the scope of the audit. The correlations that are discussed seek to establish whether the observed variations among regions

Maintenance expenditure totals were computed with and without snow and ice control.

activity-based costing techniques that identify on what activities time is actually spent, would address this issue.

could have a logical explanation that would need to be explored further.

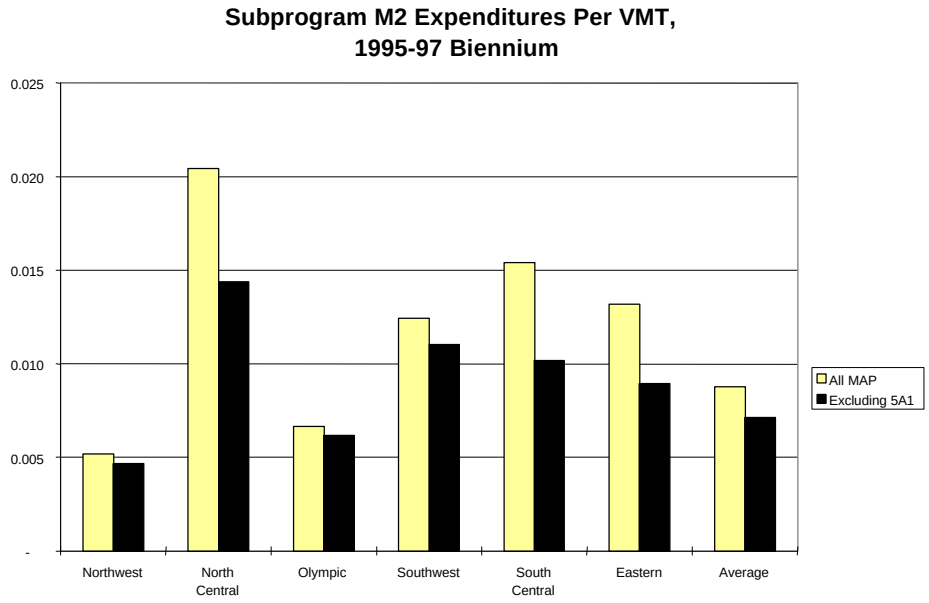
Exhibit 4.1



The three higher-cost regions are those that are more urbanized.

Considering Exhibit 4.1 first, the three higher-cost regions, Northwest, Southwest, and Olympic, are those that are more urbanized. Physical maintenance costs vary between $12,000 and $16,000 per lane mile per biennium. Highways in these regions are used more intensively, the roads would have more maintainable features (signs, luminaires, appurtenances, overpasses, etc.), greater constraints on locating work zones, and greater need for traffic control. Snow and ice control are not major factors in these regions.

Exhibit 4.2



North Central and South Central Regions have moderate levels of physical maintenance costs, between $8,000 and $9,000 per lane mile per biennium. These are regions with 86 to 95 percent of highways classified as rural. However, they also encompass the highest percentages of roads through mountainous terrain, about 15 percent as compared to about 4 percent in the other regions. Snow and ice control play a more significant role in these regions, adding $4,000 to $5,000 per lane mile to the costs of physical maintenance.

The Eastern Region has the lowest costs, about $6,000 per lane mile for physical maintenance and about $2,700 per lane mile additional for snow and ice control. This region is characterized by over 90 percent of highways classified as rural, and a predominantly rolling terrain.

Urbanized regions exhibit lower expenditures per VMT.

The comparison on the basis of vehicle miles traveled in Exhibit 4.2 views the situation from the perspective of highway usage. Urbanized regions tend to exhibit lower costs using this statistic (in direct contrast to the statistic based upon expenditures per lane mile), and the opposite is true for the rural regions. The situation regarding the Southwest Region invites attention, because its unit maintenance costs are relatively high in both Exhibits 4.1 and 4.2. A closer examination of its characteristics reveals that it has the smallest network, in terms of lane-miles, of all six regions, and

The composition of WSDOT's maintenance program is consistent with that observed in other states.

82 percent of this network is classified as rural. On the other hand, it has almost 50 percent higher VMT than the average of the three rural regions. Thus, Southwest Region straddles the urban and the rural designations, and this characteristic affects its comparative maintenance expenditures.

Findings

1. *WSDOT's highway maintenance expenditures per system mile are 22 percent below the national average for maintenance excluding snow and ice control and 8 percent below the national average when snow and ice control are included.*

2. *The composition of WSDOT's maintenance program was studied in several ways. In each comparison, the composition is consistent with that observed in other states. The one exception concerns roadway surface maintenance, which accounts for 16.4 percent of maintenance expenditures in the 1995-97 Biennium. The range observed in other states for this type of activity is between 20 and 60 percent. There may be a correlation between this finding and the relatively low expenditure for Interstate maintenance noted above, but this could not be demonstrated.*

There is a long history of debate as to whether the public or private sector can deliver highway maintenance work more efficiently and effectively.

MAINTENANCE CONTRACTING

Background

There is a long history of debate – in Washington State, nationally, and overseas – as to whether the public or the private sector can deliver highway maintenance work more efficiently and effectively. Within Washington State, highway maintenance contracting decisions have been significantly directed or influenced by existing state statutes and by court decisions related to the state's civil service laws. As a result of this legal environment, WSDOT has felt constrained in its ability to deploy maintenance resources as needed, whether by pursuing increased levels of maintenance contracting, or in making greater, more effective use of state forces where desirable. In the 1995-97 Biennium, WSDOT contracted 2.8 percent of maintenance program expenditures for normal maintenance services.

The primary maintenance contracting issues, for purposes of this audit, are summarized below:

- Does WSDOT have the authority, under current law, to engage in substantially greater maintenance contracting?
- Do current WSDOT interpretations of maintenance staffing and contracting policies comply with what is specified in existing statutes?
- Are there opportunities for greater efficiencies in the highway maintenance program through increased contracting with the private sector, under current or new state statutes?

Primary maintenance contracting issues, for purposes of this audit

These issues will be addressed in the following subsections:

- The existing legal environment relating to maintenance contracting.
- Current WSDOT maintenance staffing and contracting practices.
- Contracting practices of peer organizations.
- Recommended course for privatizing maintenance.
- Steps to implement the audit recommendations.

For purposes of this chapter, the term "contracting" is interpreted to mean "outsourcing" in a general sense, allowing for consideration of both public (e.g., counties) and private sector entities to deliver maintenance services for WSDOT.

Existing Legal Environment

Relevant Statutes and Case Law

The Revised Code of Washington (RCW) statutes 47.28.030 and .035 (see Appendix 4) establish a $30,000 threshold above which highway work **must** be contracted to the private sector and below which WSDOT **may** use state employees. In cases of emergencies, the threshold is increased to $50,000. On the other hand, WSDOT maintenance program contracting has also been influenced, and thereby constrained, by a series of Washington appellate court decisions interpreting the state civil service law. The resulting general rule in Washington, as we understand from the State Attorney General (see Appendix 5), is "that in the absence of legislative authority to do so a state agency may not contract with a private contractor for work traditionally performed by state employees."

There is a $30,000 threshold above which highway work **must** be contracted to the private sector and below which WSDOT **may** use state

A far-reaching and frequently cited legal case

A far reaching and frequently quoted case is Washington Federation of State Employees v. Spokane Community College (1978). In that case, the college entered into a contract with a private organization to perform custodial services at a new administration building which had never been serviced by state employees. No existing employees were to be laid off or otherwise adversely affected in their employment by this contract. The college expected a cost savings from the contract as compared to using civil service janitors. The union objected on the grounds that custodial services historically had been provided by civil service employees. The Supreme Court agreed, holding that:

> *"[A]s a matter of law, the college has no authority to enter into a contract for new services of a type which have regularly and historically been provided, and could continue to be provided, by civil service staff employees..."*

The Court's analysis was based on the policy and language of the civil service law. It held that contracting for services that are ordinarily and regularly provided by classified civil servants, although not specifically prohibited by the civil service law, directly contravenes its basic policy and purpose.

In response to the Spokane Community College decision, the legislature enacted RCW 41.06.380, authorizing state agencies to purchase services by contract if: (1) such services were regularly purchased pursuant to a valid contract prior to April 23, 1979; and (2) the contract does not have the effect of terminating classified employees or eliminating classified employee positions existing at the time of the execution or renewal of the contract. Thus, the legislature protected contracting out which was in place prior to the Spokane decision while leaving the decision in the Spokane case intact with respect to contracting out for new services.

Audit Team Consultation with Attorney General

We met with Washington State Attorney General (AG) legal staff to explore the intent, authority and restrictions inherent in the current statutes and case law regarding contracting for highway maintenance. We subsequently drafted a series of questions for the AG staff regarding the current legal environment affecting WSDOT's authority to use private

contractors and state employees on highway maintenance and design activities. We also posed questions regarding what would be required to provide WSDOT authority to expand its use of either private contractors or state forces beyond current levels. A memorandum (an informal legal opinion) from an Assistant Attorney General responding to our audit questions is provided in Appendix 5.

The memorandum discusses in detail the many issues inherent in current statute and case law that affect WSDOT's ability to privatize maintenance activities or to make greater use of state forces. For example, a major issue is that the terminology (e.g., the definitions of "ordinary maintenance" and "repair," or of "project" and "work") used in several of the key statutes has contributed to confusion by many parties regarding WSDOT's authority to contract for maintenance services.

The terminology used in several key statutes has contributed to confusion regarding WSDOT's authority to contract for maintenance services.

For example, the word "repair" is used in RCW 47.28, but it was not clear to what activities it might apply. If the term "repair" were construed to encompass certain types of "maintenance," RCW 47.28.030 would arguably provide WSDOT with authority to contract for these maintenance services, although the provisions of civil service law would still need to be reckoned with. We therefore posed the following question to AG staff (see Attorney General Memorandum, Appendix 5, p. 11-12, section III.3):

> *Did the legislature intend that RCW 47.28.030 should address some or all of the DOT's highway maintenance activities?"*

The response is provided below in its entirety:

> *This question has no easy answer. As your question points out, it is possible to characterize at least some traditional maintenance activities as "repairs," and, as discussed above, the distinction between what is a "repair" and "maintenance" can be problematic in some circumstances. However, there is now a fairly well-established history of the types of work performed by maintenance forces, and, absent legislative amendment, this history would support both an administrative interpretation of the definition of "maintenance" and an argument that such work cannot be contracted out. Again, with appropriate legislative amendment, the department*

could be empowered to contract some or all maintenance work, including that which is arguably "repair."

Whether that was the original legislative intent behind RCW 47.28.030 is difficult to determine, given that the statute was enacted in 1937. However, the intervening sixty years of practice would weaken any argument that the specific items of work mentioned in your questions, generally considered maintenance and performed by WSDOT maintenance forces, were intended to be considered as "repairs" and contracted out.

Finally, it has generally been our office's practice, in advising the department, to read RCW 39.04 and 47.28.030 together (see discussion above, page 6, especially n.5). Again, if it is the legislature's desire to clarify the relationship between these two statutes, it can do so with appropriate amendatory language.

Specific legislative authority will be needed to increase the amount of work contracted out for highway maintenance.

These and other legal issues are reviewed in the memorandum. Key points made by the AG are the lack of clarity in existing legislation regarding maintenance specifically, a number of definitional issues in relating RCW 47.28.030 and 39.04 to typical maintenance situations, and even a question as to whether RCW 47.28 applies to highway maintenance at all (although WSDOT documents make it clear that the Department has regarded the $30,000 and $50,000 limits on use of state forces in RCW 47.28 as applying to maintenance).

In summary, our review of current statutes, case law, and our discussions with AG staff lead us to believe that specific legislative authority will be necessary if the state wishes to increase the amount of work contracted out in highway maintenance. Specific legislative authority will also be necessary if the state wishes to allow expanded use of state employees on projects of greater than $30,000 cost, or $50,000 for emergency projects.

Maintenance Staffing and Contracting Practices

The second issue we explored was whether WSDOT's maintenance staffing and contracting practices are in

compliance with the existing legal framework governing these functions. To conduct this element of the audit we:

- Reviewed published WSDOT policies, directives, and procedures.
- Interviewed WSDOT maintenance staff in the Olympia Service Center and in regions.
- Reviewed sample maintenance contracts.
- Reviewed WSDOT financial data related to maintenance activities.
- Reviewed the final report on the Maintenance Management and Administration Evaluation (June 30, 1996) prepared by Dye Management Group, Inc.
- Reviewed labor grievance data related to maintenance contracting.

WSDOT staffing and contracting practices reflect the legal environment discussed in the preceding section.

WSDOT maintenance staffing and contracting policies and practices generally reflect the legal requirements discussed in the preceding section. Less than 2 percent of routine maintenance is contracted to the private sector and to local government agencies. Most of the routine maintenance contracts are for activities such as roadway sweeping, landscaping, state highway and bridge maintenance activities within certain cities, and for certain equipment maintenance. Contracts for these activities are executed on a case-by-case basis by the regions and are not statewide.

Most of these contracts are allowed because they existed prior to April 23, 1979 (see RCW 41.06.380), or are new bodies of work not traditionally performed by state employees. Nevertheless, the labor union has filed grievances a number of times on WSDOT's contracting of maintenance activities. These contracts are let at the regional level. Maintenance activities that may be contracted within one region or for a specific highway facility may be performed by state employees elsewhere. In addition, there is some variability among regions as to whether certain activities are treated as routine maintenance performed by state employees or are organized as a major maintenance project to be contracted.

Regional contracting practices can vary.

Chip seal treatments[10] of roadway surfaces are a prime example of regional variability. Eastern Washington WSDOT regions have traditionally "bundled" chip seal work (excluding roadway striping) into a regionwide contract performed every two years by private contractors, although state forces have also been used for this work if the "bundling" is accomplished at sufficiently dispersed locations to meet the requirements of RCW 47.28. Western Washington WSDOT regions have traditionally performed chip seal work with state employees.

Eastern Washington regions, while contracting the chip seal work, traditionally used state forces to perform the roadway striping following the chip seal, instead of using the private contractor to perform this activity as part of the chip seal contract. As the result of recent work force and workload constraints, a decision was made to contract for striping services as a part of the chip seal project. This resulted in a labor grievance in the Eastern Region, which is still pending.

The cases discussed above point out the need for more statewide consistency and enforcement governing the use of state employees and private contractors for routine maintenance.

Nearly all state and Canadian provincial transportation agencies contract for some portion of their highway maintenance work.

However, we believe WSDOT maintenance management polices and practices are generally in compliance with existing legal requirements. While we firmly believe that there is a need for greater statewide direction governing the use of maintenance employees and contractors, we believe the WSDOT has been making a good faith effort to comply with current state law. As discussed in the memorandum from the State Attorney General's office (Appendix 5), the current legal framework governing these activities is complex and sometimes difficult to interpret.

Maintenance Contracting by Other Agencies

Nearly all state and Canadian provincial highway and transportation agencies, as well as many counties and cities, contract for some portion of their highway maintenance work, although practices vary widely. The amount contracted ranges

[10] A chip seal is a form of preservation of the pavement surface, in which liquid asphalt and stone chips are spread on the surface to rejuvenate it and seal existing cracks.

from none in Puerto Rico to 100 percent in Wisconsin and British Columbia.

Basic types of highway maintenance contracting

There are three basic types of highway maintenance contracting currently used by transportation agencies.

- *Outsourcing* – Most agencies use private sector contractors to varying degrees to provide highway maintenance services. British Columbia uses the private sector for 100 percent of its routine highway maintenance. Other agencies contract on a project-by-project basis, regional or geographic basis, by specific highway or by maintenance activity. Texas has mandated that 50 percent of all maintenance activities be contracted with the private sector. Florida has determined that approximately 75 percent of its maintenance activities can be contracted.
- *Intergovernmental Contractors* – A number of states contract with cities and counties to perform highway maintenance activities. For example, Wisconsin contracts all maintenance on state highways to the counties. Michigan contracts with over 150 cities and 62 counties for maintenance of state highways.
- *Managed Competition* – An increasing number of governmental agencies have created an environment that injects market dynamics into government services in an attempt to achieve quality at the lowest cost. Private sector bids are solicited for a service, such as highway maintenance, and are then compared to a bid prepared by the agency work forces currently performing the service. Management then selects the service provider who brings the best value. Iowa and Massachusetts are examples of states that use managed competition for highway maintenance activities. The cities of Phoenix and Indianapolis have pioneered the use of managed competition for municipal services including street maintenance.

Because of the legal constraints on highway maintenance contracting, the state of Washington has had only limited experience with any of the above forms of privatization. The Maintenance Management and Administration Evaluation[11] included a review of WSDOT's maintenance contracting activities as well as a survey of other states to obtain

[11] Maintenance Management and Administration Evaluation, Dye Management Group, Inc., June 30, 1996.

Highway maintenance services are one of the principal targets for improvement by agencies.

benchmarking data for maintenance contracting. The final report on the study noted that "Washington contracts approximately 1.9 percent[12] of routine maintenance." The percentage of routine maintenance contracted in states as noted in the Dye Report based upon 1993 data is listed in Exhibit 4.3.

The trend throughout the pubic sector in this country, and indeed throughout the world, is to seek innovative ways to deliver governmental services more cost-effectively. Highway maintenance services are one of the principal service areas targeted for improvement by a wide variety of governmental agencies. Privatization of maintenance services, in some form, has been evaluated and reportedly implemented with success by a number of public agencies. In the following paragraphs we have summarized the experiences, lessons learned and results of a number of public agencies, who have recently privatized highway maintenance activities.

Exhibit 4.3

Maintenance Contracting by State DOTs

State	Percent Contracted
California	0.8%
Colorado	2.0-3.0%
Idaho	5.0-10.0%
Indiana	21.7%
Minnesota	0.0%
Montana	50.0%
Ohio	10.0%
Pennsylvania	20.0%
Texas	33.0%
Virginia	33.0%
Washington	1.9%

[12] It was discussed earlier that our analyses have revised this estimate to 2.8 percent for normal maintenance.

Texas

The Texas State Department of Highways and Public Transportation (TDHPT, now the Texas DOT) was required by legislative statute in 1989 to contract with the private sector for a minimum of 25 percent of maintenance work. The statute further mandated that these contracts achieve a savings of at least 10 percent. TDHPT estimated that over $10 million in savings were achieved through maintenance contracting in fiscal year 1990, the first year of the program. For fiscal year 1990, privatized routine highway maintenance represented 27.2 percent or almost $112 million of maintenance work. Contract amounts averaged $65,743 and ranged from $2,096 to $1,035,900.

Texas SDHPT: Over $10 million saved through maintenance contracting.

A number of procedures were developed to reach the mandated contracting level and savings. TDHPT has developed a methodology to evaluate the costs of maintenance functions. A contractability rating for a function is calculated by assigning different weights to factors such as cost-effectiveness, time sensitivity and availability of contractors.

Texas subsequently raised the percentage of maintenance required to be contracted to 30 percent in 1992 with 5 percent increases until a 50 percent contracting level was reached in 1996. Forecasted additional savings of the new program increment (i.e., beyond those obtained at the 25 percent program level) for 1996 were estimated at approximately $12 million.

Massachusetts

The Massachusetts Highway Department (Mass Highway) has jurisdiction over 12,517 lane-miles of highways and more than 3,000 bridges.

A pilot program of competitive contracting in 1992 in Essex County, Mass.

Mass Highway had been experiencing a number of significant management problems related to its maintenance program. A pilot program of competitive contracting was initiated in 1992 in Essex County as an attempt to deal with these problems. All routine maintenance functions except snow and ice removal (85 percent of which was already contracted) and emergency work would become the responsibility of a single private contractor. A drastically reduced state work force would remain to address emergency responses and contract monitoring.

Mass Highway concluded that the contract would provide nearly $2 million in additional services beyond current service levels.

Mass Highway determined that all routine highway maintenance tasks would be included in the contract for Essex County, encompassing roadway and roadside activities, bridge maintenance, pavement markings, maintenance of traffic control equipment and signs, and drawbridge operations. The contract was quantity- and performance-based–the contractor was to be paid for actual work performed according to specifications. Mass Highway concluded that the contract proposed for Essex County would provide nearly $2 million in additional services beyond current service levels. The results for the first year of the Essex County pilot include approximately $2 million in direct operating costs, $1 million in reallocated equipment and $1.5 million savings by reallocating employees.

A 1993 report by Harvard's Kennedy School of Government documented examples of the increases in service levels that had been achieved to date:[13]

- With just half of the year-long contract period completed, almost 11,600 of the 12,100 catch basins in the county had been cleaned, compared to 11,725 cleaned in the entire previous year prior to the contract.
- Five complete grass cuttings were being performed per year by contract, as compared to two per year prior to the contract.
- Significant roadside cleaning had been accomplished in areas that had been overgrown for years.

The contractor had been able to meet or exceed service levels from the same time period in the previous

- Overall, a review of records indicated that the contractor had been able to meet or exceed service levels from the same time period in the previous year prior to the contract.
- Market value of additional services achieved was estimated at over $3 million - $1.7 million in Essex County itself, and more than $1.3 million in the rest of the state resulting from former Essex County maintenance employees who had filled vacant positions in other locations.
- Cost savings due to contracting and the value of additional services received were sufficient to offset the cost of retaining former Essex County maintenance workers who took

[13] David Gow, Catherine Jovicich, Margaret Laws et al., *Highway Maintenance Services in Essex County*, excerpted from *From Public to Private: The Massachusetts Experience 1991-1993*, John F. Kennedy School of Government, Harvard University, Cambridge, MA, April 1993.

employment in other districts. The net benefit statewide was computed as $1.27 million.

An independent review of the cost savings attributable to the Essex County competitive contracting was conducted by Coopers and Lybrand in 1996.[14] This review found that whereas pre-privatization direct costs of maintenance had been $7.1 million in FY 1992, post-privatization costs in FY 1993 were $4.7 million, a net savings of $2.5 million or 35 percent. These savings exceeded both the estimated cost savings that had been projected by Massachusetts and the result of an analysis by the State Auditor that the program would cost more than prior maintenance performance by state employees.[15] The net cost savings determined by C&L were attributable to the following:

- Labor cost reductions: $4.0 million
- Reduced vehicle depreciation: $0.1 million
- Closure of an office building: $0.5 million
- Reduced vehicle maintenance and administration: $0.1 million
- Increased cost due to the contract: a reduction in the above savings of $2.2 million

Based upon the success of the Essex County trial, in 1993 Mass Highway initiated another pilot program of managed competition, in which private companies competed with public employees on maintenance work in two districts. Seven individual contract areas were created within the two districts. Each of the seven contracts covered work through one year, and expanded the scope of work beyond that of the Essex County contract to include rest area maintenance and fence repair. The state developed a structure for monitoring contractors' performance. Contract Specialist positions were created to be responsible for directing and monitoring the contractors in a

Based upon the success of the Essex County trial, in 1993 Mass Highway initiated another pilot program of managed competition.

[14] *Independent Assessment of Massachusetts Highway Maintenance Privatization Program*, Coopers and Lybrand L.L.P., prepared for the Massachusetts Executive Office of Transportation and Construction, June 1996.

[15] Major differences between the Coopers & Lybrand findings and those by the State Auditor were determined to be errors by the State Auditor in failing to account for the costs of certain pre-privatization activities that were counted in post-privatization, and the fact that whereas the State Auditor used the estimated value of the contract of $3.7 million (at a point before actual costs were known), C&L was able to use the actual cost of the outsourcing contract, $2.6 million.

quality assurance role. In September 1993, four contracts were awarded to private contractors and three were awarded to Mass Highway employees.

Iowa

IDOT began two pilot projects to introduce competition into the delivery of government services.

In May 1996, the Iowa Department of Transportation (IDOT) initiated two pilot projects as part of a larger state government initiative to introduce competition into the process of delivering government services. Competition was defined to mean evaluating private sector bids against bids prepared by state employees traditionally responsible for performing the work.

Guidelines were established for the competition initiative. Principal features of these guidelines include:

- The Request for Proposal process is used to solicit maintenance service and cost proposals from private sector providers. The state work unit currently providing the service also submits a reengineering plan of work and cost proposals.
- Technical assistance for the state work unit (and secondarily, the department) is provided in activity-based costing reengineering, and proposal preparation.
- For comparative purposes, the in-house proposal includes all direct and indirect costs which would be avoided if the function were contracted out.
- Assistance is provided for any state employee(s) displaced by competition in the form of consideration for other positions in the department and elsewhere in state government, and placement services.
- Management and union receptivity to reengineering ideas and incentives proposed by work unit employees.
- A 5 percent preference for the in-house proposal, to compensate the department for disruption and risk associated with the activity being outsourced.

The two areas selected for the pilot by IDOT included:

- *Paint Striping* – Painting the center, no passing zone, edge lines and special markings on the 10,000 miles interstate and state highway system. The budget for this activity includes

$2 million per year and 24 full-time-equivalent (FTE) employees.

- *Sign Manufacture/Graphics Display Work* – Sign manufacture for the road system and the sign shop's part of IDOT's graphics display work. The budget includes $1.1 million per year and 6.5 FTEs.

In December 1996, proposals were obtained and evaluated. IDOT employee proposals were the lowest bid for paint striping and sign manufacture. A private sector firm was awarded the work for graphic display work. Because the sign shop had already reengineered operations, opportunities for further efficiencies were limited to filling excess capacity. The paint areas reduced their costs and enhanced their bid by cutting supervisor positions and adopting a self-directed work team, adopting best practices, dissolving regional boundaries and streamlining fleet and equipment inventories. Annual benefits to IDOT from these changes exceed $300,000 per year or 15 percent of the affected budget.

Annual benefits to IDOT from these changes exceed $300,000 per year or 15 percent of the affected budget.

KPMG Peat Marwick was engaged to assist the departmental units in calculating activity-based costs (ABC) for the activities on which they were bidding: reengineering their work processes; and preparing their proposals. KPMG produced pre- and post-reengineering ABC figures and made additional suggestions for improved operations.[16]

Virginia

The Virginia Department of Transportation (VDOT) has undertaken the nation's first major roadway all-inclusive routine maintenance outsourcing. VDOT has negotiated a five-year renewable fixed-price contract for maintenance of 250 miles of interstate (I-95, I-77 and I-88). This pilot project will provide turn-key maintenance services ranging from routine maintenance and operations to major rehabilitation or restoration work. Once the vendor demonstrates satisfactory capability and capacity to perform snow removal, it will assume that responsibility as well.

The Virginia DOT has undertaken the nation's first major outsourcing of fenceline-to-fenceline maintenance.

The vendor is taking full risk and must achieve at least current performance standards based upon annual evaluations. The vendor is making extensive use of subcontractors, low inventory

[16] Excerpted from the Managed Competition Pilot Project Report, Iowa Department of Transportation, November 1997.

levels and management flexibility, and is guaranteeing $22 million in savings over estimated state costs.

City of Indianapolis

Indianapolis took the position that competition in the marketplace, rather than privatization per se, produces the most value for the

The city of Indianapolis has implemented managed competition for a wide range of government services. Indianapolis took the position that competition in the marketplace, rather than privatization per se, produces the most value for the taxpayer. Employees were trained and encouraged to prepare bids in competition with private sector contractors.

Street maintenance was an area targeted by city management for improvement. Through outsourcing and managed competition, the city realized the following results in its transportation function:

- Estimated $700,000 in cost savings (30 percent improvement) between 1992 and 1996.
- Pothole crew daily productivity increased by 68 percent.
- 200 percent annual average increase in lane-miles repaired between 1993 and 1996.

COMPARATIVE COSTS FOR MANAGED COMPETITION

State DOTs to date have used two approaches to determining costs within a managed competition setting.

As stated in a recent GAO report on privatization, "reliable and complete cost data on government activities are needed to ensure a sound competitive process and to assess overall performance. Reliable and complete data... simplify privatization decisions and make these decisions easier to implement and justify to potential critics."[17] State DOTs to date have used two approaches to determining these costs within a managed competition setting:

- A full-cost approach, in which all departmental costs relevant to an activity, including indirect costs, are estimated in a manner analogous to estimates of full costs by private sector firms.

[17] *PRIVATIZATION: Lessons Learned by State and Local Governments,* Report to the Chairman, House Republican Task Force on Privatization, U.S. General Accounting Office, GAO/GGD-97-48, March 1997.

- An avoided or "go-away" approach, in which indirect costs associated with an activity are based upon the costs that would be avoided if the activity were to be eliminated or contracted out.

We believe that the full-cost approach is better suited to identifying long-term opportunities to save money and to establish policy directions in terms of how the Department can accomplish its work most economically, and who should perform that work. Nevertheless, some of the state and local governments engaged in privatization have preferred to apply the avoided-cost approach, likely because it relates to immediate savings that will result from outsourcing. Regardless of the approach that WSDOT may employ if it elects to try managed competition, we believe that a full-cost calculation should be done at the outset and periodically thereafter to provide and maintain a long-term perspective on comparative costs and to inform policy decisions regarding business approach and competitive ways to accomplish its mission.

We believe that the full-cost approach is better suited to identifying long-term opportuni-ties to save

We have estimated a full-cost maintenance overhead rate of at least 141 percent for the Department's maintenance function. This calculation has been based upon an allocation of a share of the costs of Department administration, management, and support; the costs of the portion of WSDOT-owned buildings used by maintenance; fringe benefits on maintenance labor; the portion of maintenance labor costs spent on supervision; and items in the M2 maintenance program that are indirect in nature. It is not intended to be an exact calculation, but defines a point of departure for a more precise calculation that should be performed if the managed competition pilot moves ahead. Several state DOTs that engage in managed competition or that desire a cost comparison with the private sector update their calculation of effective overhead rate annually or biennially as consistent with their financial cycle.

Recommendation

Based upon our review of the WSDOT's highway maintenance function, the current legal environment governing contracting and the use of state forces, and trends in maintenance privatization in other transportation agencies, we recommend the following:

Legislation should provide WSDOT flexibility to use the most cost-effective delivery of highway maintenance.

1. *Implement new legislation to encourage and facilitate expanded use of privatization where appropriate. Specifically, the legislation should provide the Washington State Department of Transportation management with the flexibility to evaluate and select the most cost-effective resources to perform highway maintenance. An environment that fairly and consistently considers the capabilities of both private sector contractors and state work forces should be key to the new legislation and guide the Washington State Department of Transportation implementation of maintenance contracting.*

The current legal environment, as stated earlier, imposes specific barriers to the use of private sector contractors on work traditionally performed by state employees. Current statutes also restrict WSDOT's abilities to use state employees on "projects" that exceed $30,000 ($50,000 for emergencies) in value. These legal requirements have had the effect of limiting the amount of maintenance performed by contractors from WSDOT to 2.8 percent of the maintenance budget for the 1995-1997 Biennium. As a result, there is very little definitive information available from WSDOT to determine whether the private or public sector is more cost-effective in performing the wide range of highway maintenance activities. Some information on the **potential** savings from maintenance contracting in Washington State was developed, however, in a recent study described in the following section.

PCEM Study of Maintenance and Construction Costs

A study was commissioned in 1985 by the Washington Legislative Transportation Committee in an attempt to settle the ongoing debate between the private and public sectors as to which entity can accomplish highway construction or maintenance work at better or lowest costs. The initial study objectives were:

PCEM study objectives

- Review existing roadway accounting and cost practices.
- Develop a new methodology to compare public and private contractor costs on a project-by-project basis.
- Make recommendations for changes to laws and regulations.

Deloitte & Touche was selected to conduct the original study and oversee a pilot project to evaluate the costs and capabilities of private contractors versus public agencies as it relates to their ability to perform roadway maintenance and construction projects. The Project Cost Evaluation Methodology (PCEM) was developed as a process that organized cost-estimating data, put projects out for private and public sector bids, documented award decisions, captured actual costs for comparison and reported results so that comparisons could be made on a project-by-project basis.

WSDOT districts participated in the PCEM pilot only in a "shadow" approach.

WSDOT participated in a three-year test of the methodology in which both construction and maintenance projects were put through the PCEM process. Apparently, in response to labor concerns and the state's current contracting legal restrictions, WSDOT districts were to participate in the pilot only on a "shadow" approach. This allowed WSDOT to identify projects, prepare in-house bids, call for bids from contractors, track agency costs for completing the projects and then compare the results. However, no projects could actually be awarded to private contractors. A number of cities and counties also participated in the pilot and were allowed to award contracts to private contractors.

The results of the PCEM project were presented in a paper by several WSDOT managers.[18] The authors of this Transportation Research Board (TRB) paper concluded the following:

> *The results of the maintenance element of the study have demonstrated that there is more potential for change within WSDOT if more flexibility was available. The bid limit of $30,000 and state law and union agreements represent artificial restraints to the most efficient way of managing the maintenance program. The savings identified from the maintenance projects are consistent with the expected 8 to 10 percent identified by the consultant team and is a realistic expectation should artificial constraints be removed.*

[18] John F. Conrad, Paul Nelson, and Kelly Jones, "The PCEM Approach to Privatization in the Washington State Department of Transportation," paper 93-0763, presented at the Annual Meeting of the Transportation Research Board, January 1993.

The paper went on to recommend the following course of action for WSDOT:

> *. . . full implementation of the PCEM concept within WSDOT is not recommended. Rather, a limited project-by-project approach should be undertaken. Projects proposed for possible change from current practice (beyond $30,000 with state forces or contracting work currently done with state forces) should be subject to a PCEM or similar economic analysis. In many instances a full detailed PCEM approach would not be justified in order to accomplish projects at the lowest cost for the taxpayer. Such items as detailed contract plans or project inspection may not be necessary on every project.*

Counties and cities in Washington contracted for maintenance services in PCEM and reported 8 to 10 percent savings.

The PCEM pilot encountered a number of problems and was inconclusive about the cost-effectiveness of maintenance contracting by WSDOT. WSDOT has not implemented the PCEM methodology or a similar methodology, because of the legal constraints cited earlier. However, counties and cities in Washington did contract for maintenance services as part of the PCEM effort, and reported achieving savings in the 8 to 10 percent range.

Maintenance Management and Administrative Evaluation Study

A Maintenance Management and Administrative Evaluation was conducted by the Dye Management Group, Inc., in 1996 to assess WSDOT's highway maintenance function. In that study the following conclusions and recommendations were made regarding WSDOT maintenance contracting:

1. There is strong evidence from national research and specific states contacted in this study that there are significant benefits to private sector contracting of maintenance.
2. Washington currently contracts 1.9[19] percent of routine maintenance. Current state law prevents WSDOT from increasing this amount.

[19] The analysis in this audit has estimated 2.8 percent of normal maintenance is contracted.

3. Given that the benefits of maintenance contracting have been validated elsewhere, it would seem prudent for Washington to have this capability.
4. Washington State law requires that WSDOT contract any project work with a cost of $30,000 or greater.
5. The WSDOT should explore introducing competition between state forces and private sector on project work, at least on an experimental basis.
6. If the WSDOT pursues more extensive maintenance contracting in the future, it should do so on a request for proposal basis, not strictly by low bid.

Implementation will require authorizing legislation.

These recommendations regarding maintenance contracting in the Dye Management report have not been implemented to date. Once again, the audit finding is that implementation will require authorizing legislation.

Recommended Implementation Steps

The cost-effectiveness of highway maintenance can be substantially improved by ensuring that WSDOT management can and does consider all the resources and methods of deployment available to it to deliver maintenance services. These resources should encompass state employees, private contractors and local government jurisdictions. A form of *managed competition* that will ensure a "level playing field" and adequate consideration of all cost-effective resource alternatives should be seriously considered.

We suggest that the state of Washington consider the following implementation steps:

Suggested implementation steps

- *Develop a highway maintenance business strategy* that reflects the objectives of the state's various highway stakeholders including Washington State citizens, executive and legislative leadership, WSDOT management, labor and private industry. The state's goals, objectives and approach to contracting should be defined as input to the drafting of the enabling legislation.
- *Propose and implement authorizing legislation* that ensures that all resources are available to WSDOT and that they be considered fairly and equitably. The legislation should mandate that the business goals of the new process be defined

such as cost-effectiveness, safety and responsiveness to the citizens of Washington.

- *Implement reliable cost accounting systems* to enable adequate tracking and comparison of maintenance costs. A number of government agencies are implementing Activity Based Costing (ABC) to better manage and understand the costs of government services. A system such as ABC accounting will be critical to ensure a level playing field when comparing contractor and public sector costs.
- *Develop WSDOT transition strategies and resources* to assist both WSDOT management and labor to adopt more cost-effective business practices. If the state elects to introduce a form of managed competition it will be critical that WSDOT employees at all levels receive training and tools that will enable them to effectively compete with private contractors. Statewide as well as regional policies and procedures will need to be developed to ensure consistent application of the new contracting methodology.
- *Establish performance monitoring and oversight* that ensures that the new contracting processes result in the expected outcomes. This will be necessary to help ensure that the government's interests are protected and that accountability of both WSDOT and private contractors is maintained. Performance monitoring should take the form of not only contract auditing, but also quality control or performance monitoring to ensure the required contract outcomes are attained. The state should also consider ongoing independent oversight to provide a more objective and unbiased evaluation of the maintenance contracting activities than is possible by line- or program-level managers.
- *Develop and implement a pilot project* to test the feasibility of the new approach. A mix of WSDOT regions and maintenance activities should be included in the pilot. The pilot should be conducted for a one- to two-year period to adequately test all conditions. The results of the pilot should be used to fine-tune the approach prior to rolling out the new contracting methodology on a statewide basis.

A new approach to maintenance contracting could result in cost savings of 10 percent or more and improve maintenance service levels.

As stated earlier, there is little comparative data available in Washington to precisely calculate the savings which will be gained by encouraging more cost-effective decisions by allowing greater flexibility in using private sector as well as WSDOT

employees and other government jurisdictions to perform highway maintenance. However, based upon the demonstrated experiences of other states, and the findings in Washington gained through the PCEM project, we believe that when fully implemented, a new approach to maintenance contracting could result in real cost savings of 10 percent or more over current expenditures and at the same time have the potential to improve maintenance service levels.

Managed competition offers potential cost savings and a level playing field for competition.

Recommendation

1. *If the implementing legislation is passed, the Washington State Department of Transportation should consider a pilot project to explore different ways of delivering maintenance services. Managed competition offers potential cost savings and places public and private sector providers on a level playing field to compete for maintenance work.*

The pilot could be structured to address a portion of the maintenance program initially to develop better information on relative costs and savings, and to permit public sector employees to transition to this new environment. If the program were begun on the basis of a $60 million portion (approximately 25 percent) of the program, and if savings were in the range of 8 to 10 percent as discussed above, the potential savings would be $5 to $6 million net. Savings targets could be incorporated as part of the bid process. If these savings were realized, the program could be expanded at intervals of, for example, five years, from 25 percent of the program to 50 percent, with further reviews and consideration of expansion thereafter.

PREVAILING WAGE LAWS

Chapter Five

BACKGROUND

In this chapter, two aspects of the prevailing wage program are investigated.

The state's prevailing wage law has been perceived by some as contributing to higher costs of WSDOT's highway programs. In this chapter, two aspects of the prevailing wage program are investigated:

- The impact of WSDOT's concurrent compliance with both state and federal (Davis-Bacon) prevailing wage laws on highway program costs, as compared to the case where only the federal Davis-Bacon prevailing wage would apply.
- The impact of the "largest city rule," the current basis for determining state prevailing wages in a county, on highway program costs.

State and Federal Law

All construction contractors working for state and local governmental units in the state of Washington, including state government departments, cities, counties, and special districts, are subject to the Washington State Public Works Act,[1] also known as the prevailing wage law. Originally enacted in 1945, the law requires that workers be paid "prevailing wages" when employed on public works projects.

The stated purpose of the prevailing wage law is described as follows:

> *The Public Works Act is modeled after the federal Davis-Bacon Act, which was enacted to protect the employees of contractors performing public works construction from substandard earnings, and to preserve local wage standards. The employees, not the contractor or its assignee, are the beneficiaries of*

[1] RCW 39.12.

The audit focuses on the impacts of the state prevailing wage law that are beyond those of the federal Davis-Bacon Act.

> *the Act. It is remedial and should be liberally construed. In other words, the Washington State Department of Labor and Industries is directed to apply the law in ways that carry out its intent, which is to protect workers.*

The WSDOT is consistently one of the largest construction agencies in the state of Washington. In the 1995-1997 Biennium it let construction contracts totaling $945 million. We estimate that 20 to 35 percent of the costs of such construction contracts, or approximately $190-330 million in the 1995-1997 Biennium, are for wages and benefits for workers covered by the prevailing wage act. All WSDOT construction contracts (and any maintenance work that is accomplished by contract) are subject to the state prevailing wage law.

Projects that receive federal funds are also subject to the federal prevailing wage requirements established in the Davis-Bacon Act. In the 1995-1997 Biennium, project work totaling 58 percent of construction program expenditures, or $558 million, was subject to both state and federal prevailing wage requirements. In these cases where both laws apply, the contractor is required to pay the higher of the state prevailing wage or Davis-Bacon wage.[2] It is this "federal participation" portion of the highway program that will be the focus of this analysis: i.e., we will compare highway program costs when the program is subject to both the federal Davis-Bacon Law and the state prevailing wage law, to the case where only the federal Davis-Bacon law is assumed to apply. In this manner, the impact of the state prevailing wage law can be determined.

Application

All public sector construction contracts are required to include a provision that prevailing wage rates shall be paid.[3] Contractors are required to post notices to this effect in the workplace.[4]

Before any payment can be made by a governmental agency on a contract subject to the prevailing wage law, the contractor must file a "Statement of Intent" with the Industrial Statistician[5] and

[2] WAC 296-127-025.
[3] RCW 39.030.
[4] RCW 39.12.020.
[5] The Industrial Statistician is the legislatively enacted party in the Department of Labor and Industries (L&I) that makes determinations of

have the Statement of Intent approved. Before the final (retainage) payment can be made, the contractor must file, and have approved, an "Affidavit of Wages Paid."[6] These forms show the labor classifications and the wages proposed to be paid or actually paid.

Contractors are required to include with each billing a statement that prevailing wages were paid.

Contractors are also required to include with each billing a statement that prevailing wages were paid. The fee for filing Intent and Affidavit forms is $25 per form.[7] An amount equal to 30 percent of the fees is currently allocated to the state General Fund, and the remaining 70 percent is intended to make the administration of the Prevailing Wage Program self-supporting. In recent years, the collections for program administration have been approximately $1 million per year, and the fund balance at the end of the most recent biennium was slightly over $775,000. This balance is available for use in improving service to the contractors who are paying the fees and the governmental units that rely on prompt processing of the forms.

COST IMPACTS OF PREVAILING WAGE LAW

To assess the impacts of the state prevailing wage law on highway construction program costs, we compared the labor rates established by the federal Davis-Bacon Act and the state of Washington prevailing wage law for a sample of construction trades.

Audit Procedure

Sample selection and analysis procedure

The sample selection and analysis procedure was as follows:

- Ten labor classifications were identified that are highly utilized in WSDOT construction projects and that are common to both the federal and state labor classification systems in all 39 counties in the state. The selection of classifications was made in consultation with WSDOT staff and L&I personnel who administer the prevailing wage and Davis-Bacon process.

prevailing wage rates (RCW 39.12.015) and administers the other aspects of the prevailing wage law.

[6] Both submittals are required by RCW 39.12.040(1).

[7] There is only one fee for each form filed, regardless of the number of times it must be reprocessed by L&I.

- The difference, if any, between the federal and state wage rates for each labor classification in each county was computed. Only those differences in which the state prevailing wage exceeded the federal prevailing wage were germane to the analysis.
- Any difference between the state and the federal wage rates was weighted by the relative amount of WSDOT construction work in that county.[8] This weighting calculation reflects the contribution of each county to the increased costs of the highway program that are due to the state prevailing wages in that county.
- These results were then summed by labor classification, by county, and by WSDOT region.

The labor classifications used in this analysis were as follows:

Labor classifications used in this analysis

- Carpenters
- Cement Masons
- Flaggers
- Laborers/Asphalt Rakers
- Laborers/Grade Checkers
- Power Equipment Operator/Chain Saw Operator and Faller
- Power Equipment Operator/Loader-Overhead – Front End (six to eight cubic yards)
- Power Equipment Operator/Oiler
- Truck Driver/Dump Truck (10 cubic yards)
- Truck Driver/Transit Mixer (10 cubic yards)

[8] For example, slightly over 40 percent of all WSDOT construction work for the 1995-1997 Biennium was performed in King County, so the King County labor classification pairs were given 40 percent weighting.

Analysis of Wage Surveys[9]

While there are a large number of differences in both the procedures and timing of the surveys performed by the L&I for the state prevailing wage law and by the U.S. Department of Labor for Davis-Bacon purposes, there was a fair degree of compliance between the results of the two surveys. Generally, there were far more federal-state wage pairs where the Davis-Bacon rate was higher than where the state prevailing wage rate was higher; where differences existed between the two prevailing wages, they were far larger where the Davis-Bacon rate was higher. Specifically:

Generally, there were far more federal-state wage pairs where the Davis-Bacon rate was higher than where the state prevailing wage rate was higher.

- Of the total of 390 wage pairs:[10]
  - In 211 pairs, or 54 percent of the total, the two wage rates either equaled each other or were within $0.05 of each other.
  - In 52 pairs, or 13 percent of the total, the state value was more than $0.05 higher than the federal value.
  - In 127 pairs, or 33 percent of the total, the federal value was more than $0.05 higher than the state value.
- Of the 52 pairs where the state value was higher than the federal rate, the average difference was $0.88. The largest difference between the two elements of a pair when the state rate was higher was $2.86.
- Of the 127 pairs where the federal value was more than $0.05 higher than the state rate, the average difference was $9.25. The largest difference between the two elements of a pair when the federal rate was higher was $19.08.

[9] In reviewing the specific wage rates for labor classifications, certain factors should be kept in mind: 1) the hourly "wage" rates shown include the costs of employee benefits provided at the cost of the employer, 2) due to weather and other factors, most construction employment is highly variable–there are almost no workers in the Davis-Bacon or state prevailing wage surveys that have "traditional" 40-hour week, 52-weeks-a-year employment understandings with their employers, and 3) many construction workers are at a far higher risk of job loss, due to factors such as industrial injury and variable employment patterns, than non-construction workers.

[10] The number of wage pairs, 390, comes from 10 labor classification pairs (i.e., a state labor classification and a comparable federal classification) whose wages are compared in each of 39 counties in the state.

The overall impact to highway program costs of the state prevailing wage law is 0.44 percent.

Findings

1. *The overall impact to highway program costs of the state prevailing wage law is 0.44 percent. If we assume that labor accounts for 35 percent of construction costs, then the impact of the 0.44 percent increase due to the prevailing wage law on a construction program of $558 million (the portion of the 1995-97 Biennial program involving federal participation) would be $0.86 million in the biennium.*

2. *This result derives from a combination of two basic effects:*

   - *There are not many situations where state prevailing wages exceed the federal rate. (State rates were higher in only 13 percent of the sample pairs, as noted above).*

   - *Those counties in which state prevailing wages are higher do not, as a rule, experience large volumes of state highway construction.*

3. *Administrative costs of the state prevailing wage law are nil to WSDOT. Fees are paid by contractors directly to L&I prior to and at the completion of project work, and there are no compliance reports or audits of compliance as with federal enforcement of Davis-Bacon.*

The "largest city rule" was reviewed because it is the basis of establishing the prevailing wage in a county.

LARGEST CITY RULE

The "largest city rule" was reviewed because it is the basis of establishing the prevailing wage in a county.[11] The rule is embodied in the prevailing wage law, which states:

> *(1) The "prevailing rate of wages," for the intents and purposes of this chapter, shall be the rate of hourly wage, usual benefits, and overtime paid in the locality, as hereinafter defined, to the majority workers, laborers, or mechanics, in the same trade or occupation. In the event that there is not a majority in the same trade or occupation paid at the same rate, then the average rate of hourly wage and overtime paid to such laborers, workers, or mechanics in the*

[11] RCW 39.12.010 defines the largest city in the county as the "locality" for purposes of determining prevailing wage. Our work is therefore premised on the largest city, not the "county seat" as described in the scope and objectives in Appendix 1.

> *same trade or occupation shall be the prevailing rate. If the wage paid by any contractor or subcontractor to laborers, workers, or mechanics on any public work is based on some period of time other than an hour, the hourly wage for the purposes of this chapter shall be mathematically determined by the number of hours worked in such period of time.*
>
> *(2) The "locality" for the purposes of this chapter shall be the largest city in the county wherein the physical work is being performed.*

The actual logic applied by the L&I Industrial Statistician to make prevailing wage rate determinations is as follows:[12]

- If more than one-half of all hours reported in the largest city of a county are worked at one wage package, then that majority wage package becomes the prevailing wage for the whole county.
- If there is no majority wage package, then a weighted average wage is computed utilizing data from the largest city, where the weight attached to each wage is the total number of hours reported to be worked at that wage.
- If no hours are reported in a county's largest city, then a weighted average wage is computed using county-wide data.
- If no data is reported for the whole county, then the county's old prevailing wage is retained as the new prevailing wage.

To test the impact of the "largest city rule" on the calculation of county prevailing wage rates by L&I, we studied four surveys compiled in 1996 and 1997. Since the L&I procedure for wage surveys has been changing in recent years, we tested the validity of the *current* procedure, and excluded older surveys. The classifications tested were:

The "largest city rule" analysis is based on four surveys compiled in 1996 and 1997.

[12] Memo from Dr. Michael W. Johnson, Research Analyst for Prevailing Wage, to All Interested Parties, re: "The Current Prevailing Wage Survey Methodology."

- Commercial Bricklayer (1996)
- Commercial Cement Mason (1996)
- Commercial Roofer (1997)
- Commercial Sheet Metal Worker (1997)

Ideally, the labor classifications tested would have related more closely to highway construction trades. However, of the ten highway construction classifications tested in the wage analysis earlier, only commercial cement masons have been surveyed recently enough to include in this largest city rule analysis. The other highway trades were last surveyed from three to eleven years ago, and could not be used in this analysis. Therefore, we selected the other construction classifications listed above, all of which have been surveyed recently. Since the results reported below do not show a large disparity among the different wage determination methods tested, this selection of labor classifications should not be of concern.

Two alternative rules to replace the current legal requirement: "county majority" and "county average"

To provide a comparative basis for testing the impact of the largest city rule, we applied two alternative rules to each labor classification to replace the current legal requirement:

- First, we shifted from the current "largest city majority" rule to a "county majority" rule. In other words, if there is a "wage package" (wage plus cost of benefits) that encompassed the majority of all work performed in the county, that would be the prevailing wage. If there was no "county majority," then we calculated the average rate for the county.
- Second, we shifted to a "county average"–the weighted average of all wage rates reported in a county.

The "majority" wage rule is highly utilized in prevailing wage type calculations. Since the "majority" rule is both common in such calculations and has been codified in state law for decades, we first assumed that, if the "city majority" rule were to be repealed, then a "county majority" rule would be a possibility for the new requirement.

Adopting either alternative rule would have almost no impact.

From the phrasing of the audit question that led to this investigation, there may have been an expectation that the existing "city majority" rule has had the effect of increasing prevailing wage labor rates. However, in applying the two alternative rules to the data from the four surveys, we found that adopting either alternative rule would have almost no impact. The results shown in Exhibit 5.1 are in terms of 156

survey points tested: four labor classifications in each of 39 counties.

Exhibit 5.1

Repeal of City Majority Rule Would Have This Result

New Rule to be Applied	No Difference	Raise Wages	Lower Wages
County Majority	134	13	9
County Average	68	27	61

A change from City Majority Rule to County Majority Rule would increase weighted average wage rates by 0.07 percent. A change from City Majority Rule to County Average Rule would decrease wage rates by 1.45 percent.

Absolute differences between the current city majority wage rate and wage rates based on other rules are small.

First we discuss the results as obtained county by county for each of the four labor classifications. In almost all cases, there were small absolute differences between the current city majority wage rate and the other wage rate being compared (either the county majority or the county average). In most cases, the results for individual pairs are identical–85 percent of the pairs are identical between the city majority and the county majority rule. Even between the city majority rule and the county average rule pairs, where the logic of the rules tends to generate more differences, 44 percent of the pairs were identical, and where the two data elements in a pair were not identical, the differences were generally small.

The largest difference in terms of absolute wage rates in a given county, was $8.85,[13] with only 13 differences (out of a total of 312 pairs) over $2.00. Compared to the differences in the earlier analysis of the state prevailing wage and the federal Davis-Bacon rates, where 16 percent of the differences were over $10.00, with the largest at $19.08, there is comparatively little difference between the results produced by these three survey methodologies. More importantly, when the wage rate differences are weighted by the percent of total state highway construction dollars within each county, the overall impact of these wage rate differences is small on a total program basis.

[13] The largest difference occurred for commercial cement masons in Whatcom County.

If the statute were changed to require reporting by county, then data collection would be eased for reporting contractors.

Now we consider the weighted average results across the state for the four labor classifications, comparing the largest city rule to the alternative rules. Roofers and cement masons exhibited a higher weighted average wage rate under the largest city rule as compared to either of the other rules, while bricklayers had a lower weighted average wage rate under the largest city rule. Results for sheet metal workers were mixed: lower weighted average wage rates under the largest city rule as compared to the county majority, but higher weighted average wage rates as compared to the county average. More importantly, the magnitude of the difference between weighted average wage rates determined by the largest city rule as compared to rates under the alternative rules was small throughout the analysis. In all cases but one these differences were less than 2 percent, with the exception being a difference less than 4 percent. This result provides some confidence that the cost impact on the highway program of changing the largest city rule would be small for other labor classifications, particularly those more prevalent in highway construction.

Although there does not appear to be any significant monetary impact from a change in the statutory city majority rule under our survey methodology, there is a good reason to consider a change. The reason is that the current rule requires each contractor reporting to prevailing wage surveys to collect data into two "buckets" for each county–one "bucket" for work performed in the largest city and another "bucket" for all other work (assuming that the contractor has done work both in and outside of the largest city in the county). If the statute were changed to require only reporting by county, then data collection would be eased for reporting contractors, which is likely to have a positive impact on both survey response rates and the accuracy of data reported. It would also make the survey data collection and data entry process simpler for L&I.

Adoption of the county majority rule rather than the county average rule might be preferred.

If the state were to consider a change in the city majority rule, the adoption of the county majority rule rather than the county average rule might be preferred for the following reason. If there is a valid "county majority," then it is likely to represent a negotiated wage rate in most counties, especially the larger ones. A linkage between the prevailing wage set by L&I and a negotiated wage rate is advantageous, as has been demonstrated by the experience with the current city majority rule. When there has been a rate change due to a labor contract under a city majority determination, L&I has incorporated the

change in their prevailing wage updates. This is the only way that changes in the prevailing wage can be made between full surveys. With current surveys as much as 10 years apart, this capability to update under a county majority rule could be an important consideration.

The capability to update under a county majority rule may be an important consideration.

Recommendation

1. *The Washington State Legislature should repeal the "largest city rule" in the Prevailing Wage Statutes (RCW 39.12), which mandates that the wage for each labor classification for each county will be based on the prevailing wage for the largest city in the county. A "county majority rule" should replace the existing "city majority rule."*

ENVIRONMENTAL COMPLIANCE COSTS

Chapter Six

BACKGROUND

Environmental regulations encompass a number of areas affecting highway costs (e.g., mitigation of impacts on wetlands, control and treatment of water runoff, limiting the effects of air pollution and traffic noise, controlling the contamination of groundwater from highway sources, and conducting work operations to limit the spread of toxic chemicals, to name but a few). This chapter responds to two audit issues related to the environment:

This chapter responds to two audit issues related to the environment.

- To identify the impact of environmental compliance on highway program costs; and
- To review the status of WSDOT's implementation of cost-saving proposals dealing with the effect of environmental regulations, and to assess the likelihood that implementation of those recommendations will yield significant and quantifiable savings.

The analysis of the costs of environmental compliance in highway programs is complicated by several factors:

The analysis of environmental compliance costs in highway programs is complicated.

1. Costs due strictly to environmental compliance may be difficult to isolate from other costs of highway construction or maintenance. For example, the costs of handling water runoff may have an environmental component (e.g., to retain, divert, or treat runoff), but these items are incorporated within a drainage system that serves other engineering, safety, and road-use functions in highway design and performance.
2. During highway design, the direct costs of many environmental activities can be identified (e.g., to obtain permits, prepare a wetlands mitigation plan, or hold public hearings), but other costs cannot be obtained from WSDOT's current management and accounting systems (e.g., the costs

to shippers and customers of not having a project completed for a period of time).

3. Similarly, the incremental highway construction costs due to environmental factors are often incorporated as part of the expenditures for standard highway features. For example, adjustments in highway location and in the slopes of embankments to avoid wetlands, and corresponding costs of guardrail (e.g., to accommodate the steeper slopes), are handled as part of the overall costs of highway earthwork and appurtenances. The cost of conforming with environmental regulations is rarely singled out in these cases.

Identification of environmental costs alone ignores the other side of the ledger, that of the benefits attached to such activities.

Identification of environmental costs alone ignores the other side of the ledger, that of the benefits attached to such activities. While environmental costs can be expressed in dollar terms once they are identified, environmental benefits are more difficult to monetarize. While it may be possible, albeit difficult, to assign dollar values to certain benefits of environmental protection costs–for example, the revenues from commercial fishing–others are more difficult to express monetarily (e.g., the benefit of preserving an area of wetland, or species of plant or animal).

As a general statement on its design, WSDOT's current accounting system does not identify environmental compliance costs. (Environmental costs that are identified and tracked are discussed in the following section.) Adding this capability to identify "environmental" costs will require careful planning of methodology, training of personnel in the requirements and use of the new procedures, and constant awareness on the part of many individuals to ensure that the required costs are identified and properly classified. Collecting environmental costs is particularly challenging because they can be numerous, diverse, pervasive, and very different on each project.

While cost accounting is not an exact science—and these environmental issues reveal its deficiencies—it is nevertheless valuable to include cost accounting concepts as part of the larger environmental decision model, and in so doing produce more meaningful, more precise, and more timely data than presently available. For example, it may not be possible to place a value on an acre of wetlands. However, if project alternative A will preserve wetlands at a cost of $10,000 per acre, while alternative B will do so at $20,000 per acre, then these data can be useful in setting priorities between A and B.

COSTS OF COMPLIANCE

Until a comprehensive environmental costing system or model is available, most of the available data on WSDOT costs to comply with environmental regulations must be obtained on a project- or activity-specific basis. Even in cases where such data are available, they must be used with care because of the many complicating factors or special situations involved. The examples below apply primarily to the 1995-1997 Biennium. In some cases additional information is cited from an earlier biennium (e.g., the six cost study pilot projects), the 1997-1999 Budget, and longer-range plans, where environmentally-related costs have been broken out in greater detail.

Costs Identified in Financial Reports

While the WSDOT budget and financial reporting systems do not identify all environmental costs, they do list certain items that are unambiguously related to compliance with environmental regulation, as described in the following sections.

While the WSDOT budget and financial reporting systems do not explicitly identify all environ-mental costs, they do list certain

Environmental Office and Regional Functions

One item is the organizational cost of the Environmental Affairs Office and the Hydraulics Section in the Olympia Service Center and the environmental functions in the regions. In the 1995-1997 Biennium these costs totaled $18.8 million.

Environmental Retrofit Work

Environmental retrofit is addressed in the following ways in the WSDOT highway program:

- The WSDOT Highway Capital Construction Program includes a specific "environmental" subprogram within its improvements program: I4, Environmental Retrofit. For the 1995-1997 Biennium, total expenditures were $3.4 million, primarily for fish passages.
- There is also $5.5 million in stormwater retrofit work included in Programs I (Improvements) and M (Maintenance). While there is a significant environmental element in these expenditures, it is not possible at this time to determine the specific percentage.

The growing significance of environmental retrofit work may be seen from projections of future costs in this area.

The growing significance of environmental retrofit work may be seen from projections of future costs in this area. For the 1997-1999 Biennium, the total budget for environmental retrofit work is $4.7 million, with $2.3 million of this for fish passage barrier removal. Costs for retrofitting stormwater discharge facilities for the five-year period ending in Fiscal Year 2003 are estimated to be $29.5 million. For the 20-year period 1997-2016, WSDOT estimates that it needs to spend $790 million (1997 dollars) to retrofit state highway facilities to reduce existing environmental impacts in the following areas:

- Construct noise walls to reduce unacceptable noise levels;
- Remove fish barriers along state highways;
- Reconstruct existing stormwater discharge facilities to meet new state and federal requirements;
- Monitor air quality and implement projects as needed;
- Construct all system improvements with no net loss of wetlands.

Site Cleanup

The WSDOT expends $1.5 million per biennium to perform site cleanups at its facilities (e.g., maintenance yards, storage areas), and to address environmental compliance issues at its capital facilities sites and buildings. For example, removal of heating oil tanks is covered by this expenditure, funded through Subprogram D4.

The wetlands protection requirement has led to significant changes in the design and cost of certain bridges.

Costs Not Explicit in Financial Reports

Costs to comply with environmental regulations may be incurred by WSDOT, but there may be no way to identify easily these additional expenses through budgets and financial reports. Following are examples in which this situation may arise.

Wetlands Protection

The wetlands protection requirement has led to significant changes in the design and cost of certain bridges. According to discussions with WSDOT engineers, a recently completed design illustrates the regulatory impacts that can occur.

The S.E. 256th Street Bridge project in King County involves the replacement of an existing two-lane bridge with a four-lane

bridge. The area traversed by the bridge is wetlands, with Jenkins Creek flowing through it. To meet hydraulic requirements only, it would have been possible to replace the existing bridge with a similar, but wider, 50-foot span over the creek, with fill trucked in to widen the existing approaches built on embankments through the wetlands on either side of the creek bed. However, wetlands preservation changes the design requirements to a 256-foot span over both the creek and the abutting wetlands, with only a single pier support in the center of the structure. WSDOT Bridge and Structures estimates the cost of the 50-foot, non-compliant bridge (including widening the approaches) at $0.35 million, while the 256-foot bridge is projected to cost $1.15 million—an increase of $0.80 million, or approximately 230 percent. The cost of the longer bridge includes removing the approaches to the old bridge.

According to WSDOT, this magnitude of cost increase is unique to bridge projects where wetlands restrictions are involved, and cannot be extrapolated to other situations. Generally, where changes to bridge design are required for wetlands protection, WSDOT Bridge and Structures estimates that such costs are not more than 25 percent of the project cost.

Fish Window Requirements

The Washington State Department of Fish and Wildlife has established periods where stream beds utilized by fish may not be disturbed by construction and related activities. For protected streams in each county, there are “fish windows” established to permit construction to proceed outside of the times required for spawning fish to migrate upstream and for the fry to travel downstream. As a result, all construction activities involving such waterways must be compressed into short time periods, reducing the usual construction seasons to periods as short as two months and generally less than three-and-one-half months. Work that cannot be completed within this window must be delayed for another season.

At our request, Bridge and Structures personnel reviewed all bridge designs during the period from January 1996 to August 1997, with the following results:

For the 15 bridges affected, the cost increase was $1.3 million, or approximately 5 percent.

- A total of 95 bridges were designed.
- The total estimated construction cost of these 95 bridges is approximately $185 million.
- Of these 95 projects, 15 bridges, or 16 percent of the projects, are affected by the fish window requirement.
- The construction costs for the 15 affected bridges are estimated as:
  - $26.0 million to meet the fish window requirement; but
  - $24.7 million if the fish window requirement did not exist.
- Therefore, the impact of the fish window requirement on the bridges designed during this period was:
  - For the 15 bridges affected, the cost increase was $1.3 million, or approximately 5 percent.
  - Based upon total costs for all 95 bridges, the increase of $1.3 million amounted to a 0.7 percent change.

Bridge Painting

Within the last decade, compliance with two regulations has been given as the dominant reason for significant increases in the costs of bridge painting.

Within the last decade, compliance with two regulations has been given as the dominant reason for very significant increases in the costs of bridge painting. One of the two regulations is primarily environmental, requiring WSDOT to ensure that no prohibited materials, such as old or new paint and materials used to remove old paint, are allowed to enter waterways. The other regulation requires workers to be protected against exposure to materials used in bridge painting and paint removal, chiefly lead-based paints. While the second regulation may be viewed as a worker health and welfare provision, it is related closely to environmental factors. It would be difficult to segregate the effects of the second regulation from those of the first. Therefore, as a practical matter, we consider the implications of both regulations for bridge painting costs.

WSDOT uses “cost per ton” as its primary indicator of bridge painting cost trends. This index is computed by dividing the painting contract value by the tons of steel in the bridge being painted. These WSDOT data have been used to construct annual index values by calculating weighted averages for all bridges painted in each year from 1990 to 1997. The Federal Highway Administration (FHWA) Construction Cost Index (CCI) has been applied to adjust for inflation. The data show that:

- The "raw" (unadjusted) weighted average cost of painting a ton of bridge rose from $133.92 in 1990 to $816.12 in 1997, an increase of 509 percent in seven years
- The CCI-adjusted cost rose from $133.92 in 1990 to $715.51 in 1997, an increase of 434 percent.

These data point to a significant increase in bridge painting costs since 1990. If it is conservatively assumed that the increase is 300 percent, then it now costs WSDOT four times as much, inflation-adjusted, to paint bridges than it did in 1990. WSDOT staff claim that the two regulations discussed above, taken together, are responsible for most of the increase in bridge painting costs, but we were unable to confirm this. Translated to a program basis, total bridge painting expenditures have increased as follows since 1991:

1991-93 Biennium	$3.1 million
1993-95 Biennium	8.5 million
1995-97 Biennium	9.3 million
1997-99 Biennium	14.0 million

While part of this increase is attributable to the number and size of bridges requiring painting, the increase since 1990 in the unit cost of painting, cited above, accounts for a major part of this increase. If the cost increase over this period was conservatively estimated at 300 percent, this would account for $12.4 million of the $14.0 million estimated for the 1997-99 Biennium.

The impact of environmental regulations may also be seen by considering examples of project development in which environmental compliance was a major consideration.

Project Case Examples

The impact of environmental regulations may also be seen by considering examples of project development in which environmental compliance was a major consideration. While the individual projects below are not typical of the majority of highway projects (and some may represent extreme cases of increased costs, delayed schedules, and other impacts), collectively they indicate the range of consequences that compliance with environmental regulation may entail. They also illustrate the interaction among federal, state, and local environmental regulations in influencing the progress on a highway project.

The examples below respond to the audit question to identify costs of complying with environmental regulations; they do not address the presumed benefits of compliance. Also, by their nature these projects have been contentious and elicited different points of view from WSDOT and environmental constituencies. The comments below have been confined to simply stating the effect on project schedule and cost of meeting the environmental process.

The comments below have been confined to simply stating the effect on project schedule and cost of meeting the environmental process.

SR 101 Sequim Bypass

Phase I of this project is to construct a bypass of the City of Sequim on a new alignment for State Route 101 that is approximately 3.5 miles long. Throughout its history the project has faced a series of challenges on environmental grounds, including the following:

- To obtain the necessary Corps of Engineers permit, a complete redesign of the east end of the alignment was required at a cost of almost $1 million. The permit was applied for in May 1996, but has not yet been issued as of January 1998.
- A segment of the project, approximately 100 feet long at the extreme west end of the new alignment, is subject to the Shoreline Management Act (SMA) Substantial Development permit process. Project opponents appealed WSDOT's permit, delaying the project an additional six months.
- This was the first project subject to the newly enacted Sequim Critical Areas Ordinance. The permit process took 11 months.

SR 167 North Sumner Interchange

This project entails building a new limited-access interchange. In a redesign of the project, the location of the interchange was moved to minimize effects on wetlands as a requirement for the Corps of Engineers permit. The city of Sumner has done major work to provide for SMA environmental clearance. Although the corps has indicated that the wetlands impacts of the interchange itself will be acceptable at the new location, it is considering possible secondary wetland and flood-plain effects from potential future development close to the interchange. The cost of the redesign to WSDOT was approximately $1 million and the project has been delayed at least one year.

SR 167, SR 512 to SR 509

This project is a multilane, limited-access connector in the Puyallup River Valley between Puyallup and Tacoma. The FHWA originally supported a streamlined NEPA/ISTEA[1] tiered EIS process, but is now rethinking their approval. The original Tier I EIS is now being treated more like a complete Tier II EIS, and FHWA and EPA are reluctant to approve the EIS. EPA is bringing up new issues—environmental issues and biodiversity—that were not commented on in the DEIS process and which WSDOT staff do not believe have relevance. Schedule delays are approaching two years.

Schedule delays are approaching two years.

SR 101 Ruby Beach Realignment

This project realigns the highway to improve severe curves on approximately one mile of roadway in the area near Olympic National Park. The marbled murrelet is protected by the Endangered Species Act. One of only four murrelet nests on the West Coast was discovered in Olympia National Park close to the project. The highway realignment will be abandoned and the project will be redesigned, with a delay of one year. The new project will work to make improvements within the existing alignment. WSDOT staff believe these improvements will serve primarily to reduce the **severity** of accidents caused by vehicles leaving the road, but will be far less effective than the original proposal in reducing the **number** of accidents. Over the past 20 years, this mile of road has had an accident rate of 4.14 occurrences per million vehicle miles traveled, or almost three times the statewide average.

The highway realignment will be abandoned and the project will be redesigned, with a delay of one year.

SR 112, Milepost 19.5 to 20.5 Realignment

This project realigns a curve in a one-mile stretch of roadway to improve safety. The accident rate on this section has been 8.7 per million vehicle miles traveled, or approximately six times the statewide average. Since there was a report of a spotted owl sighting in the project area within the last five years, WSDOT is undertaking a six-month process to determine if there are spotted owls, which is necessary to obtain federal approval to

[1] NEPA refers to the National Environmental Protection Act; ISTEA refers to the Intermodal Surface Transportation Efficiency Act. Explanations of other acronyms are as follows: EIS, Environmental Impact Statement; EPA, Environmental Protection Agency; DEIS, Draft Environmental Impact Statement.

remove trees. If spotted owls are found, then trees cannot be removed and the project cannot be completed as proposed.

SR 706 Safety Project

This project involved shoulder widening and slope flattening for safety improvement. Although WSDOT had obtained a Corps of Engineers permit for the wetland impacts, Pierce County implemented a Critical Areas Ordinance to protect the same wetlands. The project was delayed a year to obtain the necessary local permit.

Pilot Projects for Environmental Cost Tracking

Six highway projects were tracked as a pilot project in monitoring environmental compliance costs.

In 1993, the legislature passed Senate Bill 5572 to establish an Environmental Cost Study. The objective of this study was to identify a process for accessing, budgeting, and accounting for environmental costs of transportation projects. With these cost data, one could determine if the environmental costs exceeded the transportation benefits of a project. WSDOT set up the Environmental Cost Tracking Study to meet the requirements of this mandate. Six highway projects were tracked as a pilot project in monitoring environmental compliance costs.

Exhibit 6.1 summarizes the findings in the latest WSDOT status report to the legislature. The first four projects are completed and closed out. The last is completed, but subject to final close-out cost adjustments. The fifth project, I-5 HOV lanes, is a long-term project that will not be completed for several years. The environmental costs for the I-5 HOV project are likely higher, on a percentage basis, during this initial phase than they are likely to be when the project is completed, for reasons given on the following page.

As with the other project cases cited in this chapter, these projects cannot be considered indicative of the overall WSDOT construction program.

As with the other project cases cited in this chapter, these projects cannot be considered indicative of the overall WSDOT construction program. For example, the I-5 project includes almost $1.4 million for sound walls, an initial cost that constitutes almost all of the compliance costs of that project to date. The SR-18 project includes extensive water quality construction costs. Nevertheless, the strong environmental content of these projects enables them to serve the objectives of the Environmental Cost Tracking Study and provides another indication of the potential range of environmental compliance costs in selected projects.

Exhibit 6.1

Status of Environmental Cost Study Projects

Project	Description	Project Cost, $	Environmental Cost, $	Environmental Percent
SR-97	Resurfacing, restoration, and rehabilitation including earthwork, guardrail, drainage, safety improvements, and asphalt overlay on 15.8 miles of roadway	4,200,000	117,200	2.8
SR-395	Resurfacing, restoration, and rehabilitation, including drainage, frost heave, and shoulder repairs, intersection realignment, slope flattening, and asphalt overlay of 4.8 miles of highway	2,978,500	68,233	2.3
SR-14	Resurfacing, restoration, and rehabilitation including intersection realignment and channelization	197,100	18,670	9.5
SR-18	Road widening from two to four lanes, bridge and interchange construction for 1.2 miles of highway	40,140,000	7,167,364	17.9
I-5	Addition of HOV lanes including road widening, bridge reconstruction, and shoulder improvements	5,300,000	1,452,000	27.4
Edmonds Ferry Terminal	Pier enlargement, boat slip and overhead passenger loading construction, dredging, intersection realignment, railroad grade separation	15,600,000	143,530	0.9
	TOTALS	68,415,600	8,966,997	13.1

Impact of Local Ordinances and Regulations

Growth Management Act Provisions

Several of the examples in the preceding section highlighted the need by WSDOT to comply with local environmental protection ordinances. The authority for this intergovernmental compact is the state's Growth Management Act (RCW 36.70A.103), which states the following:

> *State agencies shall comply with the local comprehensive plans and development regulations and amendments thereto adopted pursuant to this chapter.*

Washington has committed itself to the policy objectives and goals of both environmental protection and intergovernmental coordination.

By the passage of this provision of the Growth Management Act, the state has committed itself to the policy objectives and goals of both environmental protection and intergovernmental coordination. The higher project costs and longer completion times needed to comply with the laws and regulations of local governments are one aspect of the price the state has declared itself willing to pay to achieve these broader societal objectives. Another example of the implications of conformity with local regulations is given in the following section.

King County "Zero Water Rise" Requirement

King County has enacted a local ordinance that prohibits construction projects from impeding water flow. Regarding bridge projects specifically, the post-construction backwater level (i.e., upstream from the bridge) is not allowed to rise above the pre-construction level. WSDOT has generally complied with this local ordinance in its construction activities, although in two cases noted below, exceptions were granted by the county.

WSDOT staff have prepared an analysis of 11 bridges located in King County that were designed since 1990, identified in Exhibit 6.2. The analysis identifies the costs of complying with this ordinance. The first six bridges below are King County projects; the remaining five are WSDOT projects.

Exhibit 6.2

Construction Cost Impact of King County Zero Water Rise Requirement

Bridge	Basic Cost of Bridge, $ Millions	Cost to Comply with Zero Water Rise, $ Millions	Total Cost of Bridge, $ Millions	Percent Increase Due to Zero Water Rise
Avondale Road	0.5	0.1	0.6	15
Eliott	2.9	2.5	5.4	85
Green River	1.1	0.2	1.3	20
Raging River	1.4	0.1	1.5	5
Rock Creek	0.7	0.0	0.7	0
124th Street/ Sammamish River	0.55	0.05	0.6	10
TOTALS - KING COUNTY BRIDGES	**7.15**	**2.95**	**10.1**	**41**
SR 405, Bridge 405/18, E&W Replacement	7.3	1.1	8.4	15
SR 520, Lake Sammamish Parkway	1.8	0.1	1.9	5
SR 169, 196th Ave SE	0.9	Note 1	0.9	n/a
SR 18, Bridge 18/34 Replacement	0.6	0.0	0.6	0
SR 18, Green River	1.4	Note 2	1.4	n/a
TOTALS - WSDOT BRIDGES MEETING ZERO WATER RISE	**9.7**	**1.2**	**10.9**	**12**

NOTES:

1. Zero Water Rise requirement waived through executive action. Cost to build a bridge that would meet the requirement would have been $3.4 million, an increase in cost of about 280 percent.
2. Zero Water Rise requirement waived through executive action. Cost to build a bridge that would meet this requirement would have been $2.1 million, an increase in cost of approximately 50 percent.

Review of Costs of Compliance

Many examples of different environmental impacts have been cited to this point. A recapitulation follows:

Environmental costs explicitly identified in WSDOT's current financial reports total $29.2 million in the 1995-97 Biennium.

- Environmental costs explicitly identified in WSDOT's current financial reporting total $29.2 million in the 1995-97 Biennium. These costs are for the Environmental Affairs Office in the Olympia Service Center, environmental staff in the regions, and specific environmental components of the highway programs, such as stormwater retrofit and site cleanup.
- The project examples show considerable variation in the effect of environmental regulations. Cost impacts due to environmental regulation in the examples reviewed range from zero to hundreds of percent, depending upon the specific factors affecting each project. Of these projects, however, for which explicit analyses of costs with and without environmental regulation have been performed, the additional cost due to environmental impacts is, in many cases, less than 30 percent.

Extrapolating these costs to the overall highway program is difficult.

Extrapolating these costs to the overall highway program is difficult, since project characteristics regarding the influence of environmental regulation vary. Very few of other state DOTs have data regarding their environmental costs, and those that have such data do not use consistent definitions of such costs.[2] A recent research paper reports a survey of the 50 state DOTs (of which 19 responded), finding that "of those states reporting that they kept records on the staff time and added costs of [environmental] compliance, the added compliance costs were reported to be under 10 percent in each category of expense."[3] The authors also cite discussions with Wisconsin DOT on an analysis of environmental compliance costs in DOT construction that was completed in 1993. Based upon these data, the authors conclude that, "Based upon the responding states, compliance costs range from nearly 8 to 10 percent of construction and repair expenditures for Federal Aid highway projects."

If this percentage is applied to WSDOT highway construction program, considering construction contract expenditures of $945

[2] U.S. Government Accounting Office, *Wetlands Protection: Progress Has Been Made Towards Implementing Some GAO Recommendations, But Further Action Is Needed*, GAO/RCED-93-26, April 1994.

[3] V. Kerry Smith, Roger Von Haefen and Wei Zhu, *Environmental Compliance Costs Where the Rubber Meets the Road*, presented at the conference *Transportation and the Environment: Can Economic Analysis Inform the Policy Process?*, North Carolina State University Center for Transportation and the Environment and the Duke University Center for Environmental and Resource Economics, December 1997.

million in the 1995-97 Biennium, the result would imply an environmental expenditure of approximately $75 million to $95 million. This estimate recognizes that, while only about 60 percent of WSDOT's highway program expenditures are subject to federal aid (and therefore federal environmental regulation), the existence of state and local environmental regulations in Washington make it logical to apply the percentage estimate to the entire state highway program. Furthermore, this estimate is consistent with the environmental compliance percentages developed in the specific project examples.

Estimated program environmental expenditure of approximately $75 million to $95 million

STATUS OF COST-SAVING PROPOSALS

One of the environmental audit tasks in Appendix 1 poses the following questions:

> *What is the status of WSDOT's work to implement recommendations from past studies designed to reduce the cost impact of complying with environmental regulations, and what is the likelihood that implementation of those recommendations will achieve significant and quantifiable savings?*

To address this task, we considered the recommendations in the two most significant studies of WSDOT environmental activities in recent years:

- *Environmental Cost Savings and Permit Coordination Study*, by Ficklin Environmental Services, Inc., Berk & Associates, Inc., David Evans & Associates, Inc., and Preston Gates & Ellis for the Legislative Transportation Committee, December 1994.
- *Environmental Organization Report – Washington State Department of Transportation*, State of Washington Transportation Commission, January 1994.

Since these reports were prepared three and four years ago, respectively, WSDOT has had a reasonable period to take steps toward implementing these recommendations. It is, therefore, an appropriate time to assess progress to date.

We considered the implementation of the 16 "lead" and "shared" recommendations to be relevant to this task.

Environmental Cost Savings and Permit Coordination Study

There are a total of 36 recommendations in this study. Of these, our assessment is that WSDOT has the lead responsibility for implementation in 12, it shares responsibility with another agency in 4, and it has a limited or supporting role in the other 20. We considered the implementation of the 16 "lead" and "shared" recommendations to be relevant to this task. The status of these 16 recommendations is summarized in Exhibit 6.3.

Exhibit 6.3

Status of Recommendations from Environmental Cost Savings and Permit Coordination Study

Status	Number of Recommendations	Recommendation Numbers
WSDOT has fully implemented the recommendation or is effectively participating in the recommended ongoing activities	9	1, 3, 6, 7, 18, 22, 25, 26, 32
WSDOT has undertaken alternative activities that are accomplishing the intent of the recommendation	4	5, 10, 16, 31
WSDOT has made some progress toward implementation	2	15, 27
Little or no progress has been made by WSDOT	0	
Activities outside of WSDOT's control show limited progress	1	13

Additional details for each of the 16 recommendations are given in Appendix 6.

Environmental Organization Report

There are a total of 46 recommendations in the detail portion of this study (not including 26 sub-recommendations). After excluding recommendations dealing with training, personnel, and actions not under the control of WSDOT, there are 16 remaining that are commented on below. These are given initial letter codes representing the sections of the report that they apply to: **O** – Organization and Administration, **A** – Administration, **I** – Intra-Departmental Coordination, and **E** – External Relations. Our evaluation of the current status of implementation of these 16 recommendations is summarized below:

Exhibit 6.4

Status of Recommendations from Environmental Organizational Report

Status	Number of Recommendations	Recommendation Numbers
WSDOT has fully implemented the recommendation or is effectively participating in the recommended ongoing activities	11	O4, A4, A8, I1, E1, E2, E3, E6, E7, E8, E9
WSDOT has undertaken alternative activities that are accomplishing the intent of the recommendation	2	E4, E5
WSDOT has made some progress toward implementation	1	A5
Little or no progress has been made by WSDOT	2	A10, A11

Additional details for each of the 16 evaluated recommendations are given in Appendix 6.

Potential for Cost Savings

There are several initiatives now underway that we believe will lead to significant and quantifiable savings if properly implemented. In the items below, the parenthetical codes refer to the recommendations discussed in the preceding sections and listed in detail in Appendix 6.

There are several initiatives now underway that we believe will lead to significant and quantifiable savings if properly implemented.

Wetlands Banking and Regional Mitigation

(See **R13** in Appendix 6.)

WSDOT has sought to improve the handling of wetlands issues. Wetlands banking and regional mitigation are two such efforts, as described below, based upon interviews with and opinions of WSDOT staff.

Under procedures used formerly, wetlands issues were project-specific (i.e., if the implementation of a project led to wetlands impacts, then that project had to provide for preservation, restoration, replacement, or mitigation). This project-specific approach was time-consuming to gain approvals, expensive to

perform mitigations or replacements in the immediate proximity of the project, and often had little net positive impact on the larger ecosystem because issues outside of the immediate area of the project could be ignored.

The new approach is based on a view of the entire ecosystem. In many circumstances, not only can a "big picture" approach do more to preserve and enhance the environment, but it can be far more cost-effective and faster to implement. By taking a regional, rather than a project-specific, approach to wetland mitigation, it is often possible to develop a larger, more comprehensive, and interconnected wetland system that offers more benefits than a patchwork of small, piecemeal wetlands tracts with no overall design connectivity.

Wetland banking can offer significant benefits, especially when used as part of a regional mitigation approach.

Wetland banking can offer significant benefits, especially when used as part of a regional mitigation approach. Under piecemeal, project-specific wetland mitigation, projects can be delayed for months or years while an acceptable approach is planned, approved, and permitted. By doing wetland projects in advance and "banking" credits towards later transportation projects, the project-specific wetland mitigation delays can be all but totally eliminated. This not only allows the transportation projects to be started and completed faster, but the wetlands as well. Also, the banking approach allows the selection of more regionally significant and/or more cost-effective wetlands projects.

Real estate costs can range from nothing (where the land is already owned by the state) to as high as $1 million per acre in urbanized areas.

Last year, the legislature established the wetlands bank.[4] However, the value of the bank will be limited unless there is funding that will allow WSDOT and other interested parties to plan for and implement advance mitigation projects. WSDOT is now trying to apply advance mitigation techniques for several construction projects, but to date none has progressed to the point of approval, let alone implementation. While there are several issues that must be resolved for each wetlands project, the costs of rehabilitating or creating wetlands – often $50,000 to $150,000 per acre, excluding acquisition of real estate – is ordinarily the greatest problem. Real estate costs can range from nothing (where the land is already owned by the state) to as high as $1 million per acre in urbanized areas.

[4] RCW 47.12.330.

By focusing wetlands mitigation efforts on locations that are less costly and more environmentally productive, the department can achieve costs savings for mitigation work (apart from land acquisition) as high as 50 percent on specific projects, and higher than 50 percent for certain land acquisition costs. This range of savings is inferred from data presented in the previously cited work by Smith et al., in which 23 states reported average, minimum, and maximum costs per acre to perform wetlands mitigation on a total of 176 projects. The divergence among average costs per acre is high, ranging from less than $1,000 per acre to over $1 million per acre. Furthermore, even within individual states, the ratio of maximum to minimum costs is in most cases between 2 and 70, with 6 values between 15 and 75 and with 3 states having respective ratios of 250, 650, and 1,550 in their highest to lowest mitigation cost per acre.

The approach that wetlands banking would allow WSDOT to take to achieve cost savings is to minimize or avoid completely the requirement for extremely high cost projects. For the cost to mitigate one acre at $600,000, 30 acres of wetlands can be produced at $20,000 per acre. Two of the factors that influence high costs of wetlands mitigation are:

- Site-specific project requirements that force mitigation acres to be close to the "old" wetlands that are taken for highway projects. In urban areas, for example, this requirement would increase costs of land acquisition and complicate the process and cost of producing the desired "new" wetlands effect.
- Delays in finalizing site-specific wetlands projects.

The variation in the ratios of maximum to minimum costs among states cited above suggests that not all responding states were using the same cost definitions. Nevertheless, a clear pattern emerges that demonstrates that the high-cost mitigation projects are many times more expensive than the lower-cost projects, with multiples from 2 to 70 and higher. On the basis of this pattern, we have conservatively put forth the prospect of a 50 percent savings by substituting a wetlands banking approach for what would otherwise be high-cost projects. This estimate corresponds to a ratio of with-banking to without-banking of 2, which is at the very lowest, most conservative, end of the scale identified in the survey cited by Smith et al.

For the cost to mitigate one acre at $600,000, 30 acres of wetlands can be produced at $20,000 per acre.

Wetlands banking implies advance mitigation work, by at least two years. The greatest savings will be on those projects with the largest and most expensive wetlands mitigation projects, implying a situation of "spending money to save money," with a long-term view required. Therefore, it would be logical to think of an initial investment of several million dollars for this bank.

Wetlands banking implies advance mitigation work, by at least two years.

Streamlining the Transportation Decision-Making Process

(See **R1**, **E3**, **E8**, and **E9** in Appendix 6.)

WSDOT, FHWA, and the Puget Sound Regional Council have been developing a national pilot project to improve and accelerate the project development process by moving community development to sooner in the workflow. The expected benefits include:

- Significant savings of elapsed time and staff/consultant effort through a single planning process.
- Ability to address significant issues once, minimizing the potential that changes to satisfy one regulatory, permitting, or funding agency's concerns will cause problems with another.
- By allowing earlier input by resource agencies and communities into project plans and designs, it is anticipated that later reworks can be minimized.
- Planning, the National Environmental Policy Act (NEPA), the State Environmental Policy Act (SEPA), and transportation decision-making will be merged into a single integrated process, creating more certainty, savings costs, and speeding project design and permitting.
- The linkage will better coordinate state, local, and federal decision-making to provide the public with a single, more understandable decision-making process.

WSDOT is engaging in a number of activities to improve interagency cooperation.

Interagency Cooperation

(See **R1**, **E1**, **E3**, **E4**, **E5**, and **E8** in Appendix 6.)

WSDOT is engaging in a number of activities to improve interagency cooperation, including:

- Wetland Monitoring – WSDOT has developed partnerships with universities where students monitor wetland sites to

assure that performance standards are met. The students receive class credit. For 1997, this saved $23,400, and it is hoped that this early exposure to WSDOT's environmental activities (including, in some cases, classes taught by WSDOT staff) will have other long-term benefits.

- Ecology Permit Streamlining – WSDOT and the Department of Ecology have agreed upon a blanket, rather than a project-specific, permitting process for activities such as culvert repair. This saves WSDOT staff effort to apply for individual permits, Ecology effort to process the permit applications, and can save considerable time in getting the work started. In one 1996 flood event, the Southwest Region saved $4,080 in application costs.
- Fish and Wildlife Permit Streamlining – WSDOT and the Department of Fish and Wildlife have also developed a blanket permitting process for activities such as removal of debris from DOT structures such as bridge piers and culverts. In 1997 the South Central Region saved an estimated $24,000 in staff resources.
- Off-Site Wetland Mitigation Partnering – WSDOT and State Parks and Recreation partnered in a recent wetland mitigation project in the Southwest Region. Rather than buy land to create two acres of wetlands to mitigate unavoidable impacts on a project, WSDOT instead constructed a two-acre wetland at Maryhill State Park. WSDOT paid for the design and construction on land provided by Parks and Recreation, saving $20,000 in capital costs. There are also savings to the WSDOT on the continuing maintenance of the new wetland, which is incorporated as part of overall park maintenance within the Parks and Recreation budget.

Environmental Decision Model

Environmental decisions are among the most difficult facing public-sector decision-makers because of the complexity of the technical matters involved, the large number of interested parties (often with very different viewpoints and priorities), the diversity of impacts, and the scarcity and lack of precision of data regarding important items. Such decisions can be aided by a multifaceted environmental decision model. Such a model can provide useful information for project decisions on environmental matters, and thereby support more cost-beneficial expenditures of funds.

Environmental decisions can be aided by a multifaceted environmental decision model.

Now that the six pilot projects are largely completed, WSDOT is moving on to the next phase.

Status of WSDOT Environmental Costing System

The WSDOT efforts to develop an environmental costing system are rooted in the passage of SB 5572 in 1993, which is discussed earlier in the context of the six pilot projects. The process to determine the environmental cost of these projects has provided WSDOT with valuable "real world" experience in the requirements and problems associated with environmental costing of transportation projects.

Now that the six pilot projects are largely completed, WSDOT is moving on to the next phase. It is currently recruiting to fill an Environmental Cost Specialist position, which will be responsible for the formalization of the system requirements and specific implementation recommendations. WSDOT believes it will promulgate this document during the current biennium.

Future Steps Toward System Development

Focusing our discussion of the model for purposes of this audit to monetary and certain other quantifiable impacts, we recommend that the following steps be followed by WSDOT and other state agencies as appropriate:

The objective would be to produce a series of models, based on past performance, that can be applied to fu-

- Formulate environmental decisions, to the extent practical, based on quantitative data that is relevant, accurate, and timely, and make efforts to improve the quality of data used for these purposes.
- Express impacts – both costs and benefits – in monetary terms, where it is technically possible to obtain data that meet the above tests in a cost-effective manner, supported by non-monetary quantitative measures or qualitative measures, as appropriate.
- Specific models and decision methodologies should continue to be developed for common and recurring environmental impact issues, such as wetland preservation, species protection, roadway noise, etc. For these common issues, the major impacts should be identified, specific methodologies for measuring impacts developed and agreed upon for statewide use, and representative cost and other quantitative factors computed. The objective would be to produce a series of models, based on past performance, that can be applied to future projects to estimate costs and benefits with a useful degree of accuracy.

Findings

1. *It is not currently possible to precisely calculate the total amount of WSDOT environmental costs. It is possible to identify certain WSDOT environmental costs on organizational, work operations, and project bases, and these total almost $30 million. Of the selected projects reviewed, environmental compliance has increased costs by zero to hundreds of percent, illustrating the variability that can occur. Research by others, however, suggests that on a program basis, compliance costs are 8 to 10 percent of highway expenditures, but this figure must be interpreted as an approximate guide, not a firmly determined number.*

2. *WSDOT is making progress towards a comprehensive system for identification and reporting of environmental costs. SB 5572 was passed in 1993, with the intent of establishing such a system. WSDOT has largely completed an important pilot project, studying six construction projects, and is now ready to commence design of a comprehensive system.*

3. *The Growth Management Act provision that subjects state agencies to the ordinances and regulations of local governments imposes additional environmental costs on WSDOT projects that vary by location. As a result, WSDOT's highway costs may be higher than those in other states that do not have locally imposed environmental regulations applicable to state highway projects.*

4. *WSDOT has implemented most of the recommendations of past reports designed to reduce the cost impact of complying with environmental regulations, or has programs underway to work towards implementation. While not all recommendations have been fully implemented, WSDOT appears to have given priority to the implementation of the more important recommendations.*

5. *There is a high likelihood that significant and quantifiable savings can be achieved from the full implementation of recommendations of past studies to reduce environmental compliance costs. However, for full implementation to be achieved, further actions are required, including some that are outside of WSDOT's direct control. Also, the WSDOT*

WSDOT has implemented most of the recommendations of past reports designed to reduce the cost impact of complying with environmental regulations.

environmental costing system should continue to be developed in order to properly quantify such savings.

Recommendations

1. *The Washington State Legislature should budget funds for the Wetlands Bank. This has considerable promise to significantly reduce environmental costs of transportation projects; greatly cut planning, regulatory and permit approval, and construction time requirements; and produce superior environmental protection.*

WSDOT should speed efforts to implement an environmental costing system.

2. *The Washington State Department of Transportation should speed efforts to implement an environmental costing system consistent with the intentions of SB 5572. It should develop a comprehensive environmental decision model that:*

   - *Recognizes environmental benefits, as well as environmental costs.*
   - *Attempts to comprehensively recognize all significant costs and benefits, including those that are not generally expressed in financial terms, such as quality of life, biodiversity, public health and safety, and delay of achievement of benefits due to regulatory compliance requirements.*
   - *Where possible and practical, costs and benefits should be expressed in monetary terms; where monetarization is not possible, costs and benefits should be quantified in non-monetary terms; and where quantification is not possible, costs and benefits should be identified and measured in qualitative terms.*

3. *The Washington State Department of Transportation should work with the federal government; other state and local governmental units, particularly within the state of Washington; professional societies such as the Transportation Research Board, the American Association of State Highway and Transportation Officials, the Government Finance Officers Association; and with academic institutions to work towards a common definition of environmental costs and benefits and a common database of such costs to be available to the Department of Transportation and other users and interested parties.*

RAIL PROGRAM

Chapter Seven

OVERVIEW

With respect to the Rail Program, the objective of this audit is to assess whether the information and analysis provided by WSDOT to the Legislature and the Transportation Commission is adequate for policy and budget decision-making. Two specific components of the Rail Program are addressed: (1) the Grain Train Project, and (2) Passenger Rail. Our analyses, findings, and recommendations regarding each of these initiatives are presented in separate sections below.

Two specific components of the Rail Program are addressed.

GRAIN TRAIN

Background

The Grain Train Project is one component of the WSDOT Freight Rail Program. It was initiated in 1995 as a pilot project designed to serve freight rail Service Objective 2 from *Washington's Transportation Plan*, "to preserve and enhance service on branch lines, promote continued service on light density lines, and preserve essential lines threatened with abandonment." The project is a partnership among WSDOT, the Port of Walla Walla, the Blue Mountain Railroad and four grain cooperatives in the Palouse Region of Eastern Washington operating under the name of the Palouse Blue Mountain Shippers Association. The partnership is governed by a formal "Grain Car Operating Agreement," number RR-175 executed in June 1994, and amended in November 1994.

The goals of the Grain Train Project are to:

- Preserve rail service as part of a statewide multimodal transportation system;
- Provide rail car capacity to alleviate shortages;

- Reduce road maintenance costs and congestion, and increase road safety;
- Redistribute energy rebate funds to affected parties while saving energy; and
- Keep Washington grain competitive in world and domestic markets.

The project was initiated with the purchase and rehabilitation by WSDOT of 29 used grain cars. The $754,031 spent for purchase of the cars was granted to WSDOT by the State Energy Office, applying funds made available to the state on a one-time basis from a Stripper Oil Rebate Fund. This fund was established as part of a settlement of a federal suit alleging overcharges to the agricultural community by the oil industry. The cars were purchased to ship grain from the four grain cooperatives over light-density lines operated by the Blue Mountain Railroad. The Port of Walla Walla acts as the fiscal agent for the project, collecting payments for car use and disbursing funds for their maintenance and eventual replacement.

During the time that the Grain Train Project has been in operation, it has prompted considerable discussion and debate.

During the time that the Grain Train Project has been in operation, it has prompted considerable discussion and debate.

Advocates of the project point to: (1) the value to the agricultural community in the Palouse Region of an alternative form of transportation; (2) the value to the state as a whole from maintaining service on light density lines operated in the region; and (3) the positive cash flow to the project resulting from the project.

Several concerns have been raised about the project, including: (1) the scope of the benefits to the state as a whole; (2) perceived inequities based on the fact that neither the same state-supported opportunity nor the existing state-funded grain cars are available for use by shippers in other parts of the state; (3) the process by which the Stripper Well Rebate funds were made available to WSDOT for the project; and (4) the overall efficacy of state ownership of rail equipment to support private business.

RCW 47.76 calls for a comprehensive review of the Freight Rail Program every six years. In February 1997, this Program Review was completed for the WSDOT by Wilbur Smith

Associates.[1] The section of the review describing the Grain Train Project references an earlier economic evaluation of the project by Professors Casavant and Mack.[2] These two documents, the review and the economic evaluation, provide the most current and detailed references available to the audit team to address our task.

Issues and Audit Scope

The policy framework within which the Grain Train Project was initiated reflects a wide range of factors, goals, and objectives. The audit has identified two levels of issues related to the adequacy of information and analysis for policy and budget decision-making on the Grain Train Project.

Two levels of issues relate to the adequacy of information for policy and budget decisions on the Grain Train Project.

- The first set of issues deals with the results of analyses of specific economic costs and benefits associated with the Grain Train Project, including the analytic techniques used, their validity, and their import and usefulness in informing policy and budget decision-making about the Grain Train or similar activities.
- The second set of issues deals with a broader set of program objectives and information on the degree to which those objectives are being met.

Technical Analysis of Specific-Cost Savings

The most comprehensive analysis to date of the Grain Train Project is the economic evaluation carried out for WSDOT by Professors Casavant and Mack, published in the February 1996 report cited above. The evaluation was carried out at the direction of the State Transportation Commission to assess the status of the project after its first year of operation. The specific objectives of the analysis were to:

[1] Wilbur Smith Associates, *Review of the WSDOT Freight Rail Program*, prepared for the Washington State Department of Transportation, February 1997.

[2] Casavant, Dr. Kenneth L. and Mack, Dr. Richard, *An Economic Evaluation of the Performance of the Washington State Department of Transportation Grain Train Project*, February 1996.

- Evaluate the average loads of grain transported by car;
- Evaluate whether the program assists in fulfilling WSDOT's mission as a provider of multimodal freight transportation options;
- Evaluate car income and expenses;
- Determine the amount of energy saved through the use of the cars;
- Evaluate grain car inventory control;
- Evaluate capital and operating costs of the grain car program;
- Evaluate cost savings from road impacts; and
- Evaluate the impact of the project on preserving rail service and consequent benefits to shippers and taxpayers.

Without the Grain Train, truck traffic on the region's state and county roadways would increase with an attendant increase in damage to highways and roads.

In our review of the economic evaluation, several questions arose regarding the absolute level of specific costs and benefits that the analysts were directed to evaluate. These include highway damage savings, changes in safety and accident experience, cost savings to growers, and energy savings. Each of these questions is highlighted below, indicating the significance for policy and budget decision-making.

Estimates of Highway Damage Savings

Without the Grain Train, truck traffic on the region's state and county roadways would increase with an attendant increase in damage to highways and roads. The economic evaluation recognizes this effect and the authors were, in fact, specifically requested to assess the amount of avoided highway damage due to the Grain Train in dollar terms. Developing such estimates is a complicated process involving variability in truck size, weight, and configuration (e.g., number of axles), as well as the design characteristics of the different pavements over which trucks would travel, climate, and topography. Sophisticated research has resulted in the development of pavement damage "coefficients," or unit costs, expressed in terms of dollars (or cents) per truck-mile or ton-mile.

Our review of the Grain Train economic analysis suggests that the road damage coefficients used in the benefits calculation are higher, possibly by an order of magnitude (i.e., a factor of ten), than levels typically used today for such analyses in other parts of the country or for analyses of national transportation issues.

The effect is to exaggerate road damage from shipping grain by truck in the absence of the Grain Train, or to attribute too high a value to savings in road damage resulting from the availability of the Grain Train.

Road damage from shipping grain by truck is overstated in the Grain Train analysis.

Specifically, road damage in cost per ton-mile carried was estimated in the Grain Train study at $0.071 on state highways and $0.1065 on county roads. On a truck-mile basis, these figures translate to approximately $2.86 and $4.26 per truck-mile, respectively. Recent work on a national scale indicates that damage per truck-mile typically ranges from $0.05 to $0.34 for an 80,000-pound truck,[3] varying with pavement strength.[4] As a result, the road damage savings attributed to the Grain Train may be nearer $19,000-20,000 annually (based on 1995 shipping estimates) rather than the $188,000 noted in the 1996 economic evaluation report. Discussions with Professors Casavant and Mack on the derivation and application of road damage coefficients elicited the following points:

- The data and procedure by which the road damage coefficients were developed was considered by the authors to be the best available for local use at the time the economic evaluation was performed in 1995.
- The authors suspected that these coefficients were too high and incorporated into the economic evaluation a sensitivity analysis to assess the effects of a 50 percent reduction in the damage estimates.
- Subsequent research now being completed by Professors Casavant and Mack on 60 roadway segments indicates values of road damage coefficients far lower than those assumed in their 1996 evaluation. Work on 30-35 of these road segments is complete. Results indicate average costs of $0.02 per ton-mile on state roads ($0.80 per truck mile) and $0.05 per ton-mile on county roads ($2.00 per truck mile). While these values are, respectively, one-third and one-half as large as those applied in the 1996 report, they still

[3] Professor Casavant indicates that trucks with 100,000 gross vehicle weight (GVW) are also used for grain haulage. These trucks would have different cost coefficients from those for 80,000-lb. GVW. However, since the analysis in the 1996 report considered only 80,000-lb. GVW trucks, our comparison has been limited to these vehicles as well.

[4] Unpublished analysis conducted for the 1997 Federal Highway Cost Allocation Study, U.S. Department of Transportation, by Cambridge Systematics, Inc., 1997.

exceed the values used in national studies that were cited earlier.

- County and secondary roads may have been designed and built to such minimal standards that road damage coefficients would be expected to be greater on these roads than those typically used in national transportation studies. However, road damage on higher-design facilities (e.g., interstate highways) would be minimal.

Road damage savings could be as low as $18,800 annually, rather than the $188,000 figure noted in the 1996 report.

In sum, Professors Casavant and Mack acknowledge that information on pavement damage emerging from their own current research, and from other sources not used in the 1995 analysis, would result in estimates of road damage from shipping grain by truck (or, conversely, the savings in road damage resulting from availability of the Grain Train) that are lower than those noted in the 1996 report. Our estimates using coefficients developed for the 1997 Federal Highway Cost Allocation Study indicate that road damage savings could be as low as $18,800 annually, rather than the $188,000 figure noted in the 1996 report.

The long-term cost of road damage could be reduced if pavements were redesigned and rebuilt to higher standards.

The authors also acknowledge that the long-term cost of road damage could be reduced if those pavements that are expected to experience increases in truck traffic (in the absence of the Grain Train) were redesigned and rebuilt to higher standards. With this strategy, the rebuilt roads would be capable of sustaining increased truck traffic without failure or major annual maintenance and repair costs as originally estimated.

Rebuilding existing roads, however, would require a large capital investment up front in order to defray continued annual repair costs of the magnitude originally estimated. Professors Casavant and Mack acknowledge that this scenario was not included in the analysis as an alternative to mitigating the full costs of road damage as estimated. It is also recognized that the commitment of funding in a one- or two-year period to reconstruct small segments of roads in a given locale represents a sizable draw on limited funds and that such a commitment might lack political support during budget review.

Valuation of Safety Benefits

An evaluation of safety benefits of the Grain Train Project was also directed to be a part of the 1995 analysis. The safety impacts of various transportation investments are typically

estimated by calculating the frequency of crashes and their severity and applying a dollar cost factor recognized as a reasonable estimate of the economic cost of various types of accidents. The economic consequences of fatalities, personal injury, and property damage can then be summed to indicate the economic consequences of crashes and the savings or benefit from crash avoidance.

The annual safety savings attributed to the Grain Train in the 1996 economic evaluation are small – $8,263 – because the use of truck-mile data and Washington State accident frequency data for non-interstate roads indicated that a single accident would be expected over a five-year period. A set of dollar values for the severity of accidents and the frequency of each type (fatal, personal injury, and property damage only) were applied to estimate savings from accident avoidance attributable to the Grain Train. The dollar values used in the 1996 report are questionable because we were not able to determine the source of these values. The differences between values used in the 1996 economic evaluation and current estimates used by the Federal Highway Administration (FHWA) in its Highway Economics Requirements Model (HERS) are shown below:

The annual safety savings attributed to the Grain Train in the 1996 economic evaluation are small – $8,263.

Accident Category	1996 Economic Evaluation Report	1997 FHWA HERS
Fatality	$700,000	$2.7 million
Personal Injury	57,000	25,400
Property Damage	5,300	7,680

The use of current FHWA HERS cost factors would increase the 1996 estimate of safety cost savings to approximately $11,000 annually, or approximately one-third greater than estimates in the 1996 economic evaluation, assuming that accident frequency and severity data from the 1996 report are accurate. Economic values associated with various types of accidents, however, can vary across agencies, programs, and among analysts. Those taken from HERS for comparative purposes reflect one set of values in use by the FHWA.

Summarizing Estimated Cost Savings

The authors of the 1996 report were explicitly requested to assess the economic impact or savings attributable to the Grain Train in terms of reduced road damage, improved safety, reduced fuel consumption, and cost savings to grain shippers.

Each of these impacts was estimated independently. Notwithstanding the estimation issues noted in previous sections, the effort to summarize, "roll up," or add all these independently derived estimates also contributes to a likely overstatement of the economic benefits of the Grain Train because of double-counting the estimated savings from the impacts that were analyzed.

There are several areas in which double-counting is likely to have occurred. First, reduced fuel consumption is a common public policy objective and a key factor in the State Energy Office's assessment of funding proposals for Stripper Well Rebate funds. While the operation of the Grain Train is likely to contribute to reduced fuel use at levels estimated in the 1996 report, the reduced cost of fuel is expected to be reflected in the shipping rate that is paid by growers: i.e., a "transportation cost savings to growers," as noted in the report. Adding the full economic value for fuel savings to the transportation cost savings to growers effectively results in double-counting this benefit in economic terms.

The same is true with respect to the independent calculations of "safety savings" and "transportation cost savings to the growers." To the extent that the insurance costs borne by carriers are passed on to the growers through pricing and, therefore, included, in part, in the estimate of savings to the growers, they should not be fully included in an independent estimate of "safety savings," as was done in the 1996 analysis. In effect, the estimated transportation cost savings to growers already includes some portion of the estimated safety savings. It is difficult, however, to accurately estimate what portion of the safety savings should be added independently of transportation cost savings to the growers.

Finally, to the extent that road damage costs are recovered from carriers through taxes and these costs are included in the price that growers pay for shipping, there is double-counting between estimates of "road damage avoidance" and "transportation cost savings to growers."

In our discussions with the authors of the 1996 study on this point, they acknowledge that to sum directly the estimates of savings that were derived independently for each of the four factors analyzed, and to provide a single cumulative dollar figure without adjustment or annotation, led to an

overstatement of benefits. However, the authors claim that the independent estimates for each component of benefit were required by the specific charge given to them. The authors agreed that an appropriate solution would have been to acknowledge the fact of some level of double-counting: e.g., through the inclusion of a footnote in the summary table of the report.

The analysis contained in the 1996 economic evaluation does not constitute a comprehensive benefit/ cost analysis.

It is important to note that with respect to the estimates of dollar cost savings, the economic evaluation of the Grain Train Project has focused explicitly on four impacts – road damage savings, cost savings to growers, safety savings, and energy savings. While these factors are important in policy and budget decision-making, the analysis contained in the 1996 economic evaluation does not constitute a comprehensive benefit/cost analysis that should be applied in the evaluation of a project such as the Grain Train.[5] The analysis is therefore judged to be inadequate for budget and policy decision-making.

Analysis of Other Aspects of Grain Train Performance

The 1996 economic evaluation analyzed a number of other aspects of the Grain Train Project in addition to the monetized cost savings of selected impacts, as described above.

Physical Utilization of the Grain Train Cars

The analysis indicates that WSDOT target carloads per month (1.5) was expected to be exceeded in 1995. No data beyond that used in the 1996 report were available to the audit team to assess utilization. Interviews with WSDOT staff, however, indicated that grain car shortages persist and utilization at or above target levels has not been achieved, but is expected in the short-term.

Financial Performance

The 1996 economic evaluation contains a financial analysis of the Grain Train Project using assumptions and a simple forecasting procedure designed to determine whether or not:

[5] A comprehensive benefit-cost analysis would include several elements not present in the current analysis: e.g., projections of both costs and benefits through an appropriate analysis period, correct summation of benefits, application of a discount rate to the cost and the benefit streams, and comparison of discounted benefits to discounted costs.

- There will be sufficient net cash-flow to offset depreciation of the cars and replacement of the fleet; and
- Funds will be available beyond depreciation to purchase additional cars.

While the assumptions used in the cash-flow analysis are reasonable, significant variations are now evident between the 1996 revenue and expense estimates for Year 2, as forecast in the 1996 report, and the actual 1996 flow of revenues and expenses as reported in monthly statements for calendar year 1996. Estimates from the 1996 economic evaluation and the 1996 monthly reports are summarized below.

	Year 2 Estimates	1996 Actuals	Difference	Percent
Revenue	$172,067	$123,180	-$48,087	-28%
Expenses	20,736	8,905	-11,831	-57%
Profit	151,331	115,075	-36,256	-24%
Cumulative Profit	305,023	268,767	-36,256	-12%

Both revenue and expenses for Year 2 are substantially below forecasts.

The pattern illustrated above indicates that both revenue and expenses for Year 2 are substantially below forecasts. The factors contributing to this discrepancy were not analyzed by the audit team but are likely to be associated with market-related conditions or other factors since the escalation factors and other assumptions built into the cash-flow model used in the 1996 analysis are reasonable.

Should the actual cash-flow characteristics of 1996 be used as the base for future revenue and expense estimates (rather than the Year 1 figures in the economic evaluation), smaller year-to-year profits will result and reserves needed to replace the current fleet and buy additional cars will build more slowly. Using the 1996 cash-flow data as a base and the cost escalation factors used in the 1996 report, our estimates indicate that the point at which accumulated profits will be adequate to replace the current fleet and begin buying additional cars will slip from Year 9 to Year 14, a 5-year lag.

This delay in replacement does not appear to affect the integrity of the project on a cash-flow basis. The difference in actual versus estimated revenue and cost does point up the uncertainties associated with the overall market and the difficulties inherent in attempting to forecast performance and cash-flow.

This delay in replacement does not appear to affect the integrity of the project on a cash-flow basis.

While the timeframe for car replacement and the addition of new cars may be extended, it is reasonable to assume that the Grain Train can continue to produce revenues significantly greater than operating costs, assuming no major change in external market forces. From the standpoint of budget and policy decision-making, however, a more thorough market analysis would provide a better basis for performance and cash-flow projections than simple straight-line factoring of current data.

Project Management and Administration

The 1996 economic evaluation contains observations indicating that the management and administration of the Grain Train Project have proceeded effectively. While these conclusions do not appear to be the result of in-depth analysis, based on materials available to the audit team, there is no evidence to support a contrary finding. Among the materials reviewed was the November 1997 Draft Executive Summary of Examination of the Washington State Grain Train. The report generally supports this observation in a number of its concluding statements, including:

> *"The State's investment in assets such as the Grain Train cars is consistent with established policy objectives and with the views of most knowledgeable and interested persons at both the state level and locally in the communities affected. The Grain Train has been a program acquired through the expenditure of minimal state resources. This program has proven to be successful in meeting its objectives, it is financially self-sufficient, and it enjoys widespread support of grain growing and shipping stakeholders, even many of those who do not benefit from it directly." (p. iv)*

Included in this same report, however, are concerns about the basic equity of the Grain Train Project that were echoed in

comments made to the review team by WSDOT staff and authors of the 1996 economic evaluation. There was no detailed information or data available to the audit team to evaluate the incidence of project benefits and costs on various constituencies and stakeholders, a feature which would be addressed more effectively in a comprehensive benefit/cost analysis.

Overall, available information on project management and administration indicates that, despite the apparent success of the project in its current form, the future of the Grain Train and the role of the state in ownership of freight rail rolling stock remains an open policy question.

Rail Service Preservation

In addition to the estimates of dollar savings from operations of the Grain Train noted in the prior section, the 1996 economic evaluation contains positive observations about the value of the project in preserving light density rail lines. Anecdotal information provided to the authors of the 1996 report indicates that this objective has been served and that the potential for further rail line abandonment may be increased without the availability of the Grain Train fleet. This conclusion was reached without detailed market analysis. The audit team has no additional evidence that either supports or contradicts this assessment.

Findings

Primary Findings

1. *Information and analysis of the Grain Train Project contains elements and findings that are critical in making policy and budget decisions related to the project.*

2. *The analysis is now outdated, was too limited in scope, and was technically flawed in several respects:*

    a. *The analysis carried out to date has been done in a piecemeal fashion utilizing independent estimates of project impacts and consequences covering a limited number of factors.*

b. The absence of a comprehensive benefit/cost framework for analysis suggests that the charge given to the analysts was too limited in scope.

c. A related matter is the lack of a rigorous approach to questions surrounding the impact of the project on broader state policy objectives.

d. The effort to estimate cost savings in several key areas showed data and methodological shortcomings, as well as inappropriate roll-ups of estimated cost-savings.

3. *Improvements can be made in the technical analysis of benefits and costs that would reduce the annual savings that were estimated for 1995 (approximately $300,000) by as much as two-thirds. However, even with these reductions in the estimates of benefits, the current analysis indicates that future savings due to the Grain Train will continue to be positive.*

Even with reductions in the estimates of benefits, future savings due to the Grain Train will continue to

4. *Financial analysis and assumptions are credible and flow of funds to the project continues to be positive. Adjustments are necessary to reconcile the actual flow of revenues and operating expenses with projections. The effect using updated straight line factoring is to extend from 10 to 14-15 years the period before car replacement and new car purchases can be supported. This need notwithstanding, the finding that the project is self-sustaining and capable of being enlarged is credible. More rigorous market analysis would provide a better basis for subsequent projections.*

5. *The conditions that gave rise to the Grain Train Project will not remain constant, however, and the impact of the project in economic and broad policy terms may change. Regular examination of key factors is necessary, including changes in the availability of grain cars and associated pricing, changes in the pricing and retention of revenues by the railroads, variation in other commodity flows that might alter the dynamics of grain shipping and pricing, etc. These are circumstances that might be examined in subsequent analyses to better frame the inherent risk of the project in broader, long-range terms and clarify the potential for expanding the project through any of a variety of mechanisms, with or without a direct state role.*

The impact of the project in economic and broad policy terms may change.

The relative weight to be given to quantitative economic analysis versus broader policy concerns represents a fundamental policy decision in itself.

6. *In considering the information and analysis that is currently available on the Grain Train Project, the relative weight to be given to quantitative economic analysis versus broader policy concerns represents a fundamental policy decision in itself. Although the scope of the economic benefits calculated to date may change with revisions in analytical procedures (or even become negative in the future), progress toward other declared goals and objectives may be considered an acceptable tradeoff.*

Other Findings

In addition to the major findings above, there are several issues in the nature of technical corrections that were revealed by this audit. Each would have an impact on the absolute and relative estimates of costs, savings and benefits that have been developed in the 1996 report.

1. *There are corrections that should be considered in the assumptions regarding truck vehicle weight. The weight of an empty tractor-trailer is assumed to be 13,400 pounds. This, however, is the typical weight of the tractor alone; a grain trailer weighs on the order of 10,000 pounds. Fully loaded to 80,000 pounds, the typical tractor-trailer is carrying only 28 tons rather than the 33 tons noted in the 1996 report. The effect of this difference means that damage estimates (as related to truck weight) will be slightly higher since reduced payload implies increased numbers of truck trips.*

2. *A widely used relationship holds that road damage increases with the fourth power of axle weight. Damage from empty vehicles is, therefore, far lower than the 13/40ths of the damage caused by loaded trucks as assumed in the study.*

3. *The Grain Train analyses to date do not indicate differences in the circuitry of routing among the three modes of interest - truck, barge, and train. These differences may cancel each other out or be small enough to be inconsequential. There is likely to be reasonably accessible data in the future, however, to include a more precise look at the circuity factor in subsequent analyses.*

Recommendations

1. *Continued periodic review and analysis of the Grain Train Project should be undertaken in a benefit/cost framework to monitor both changes in the economic impacts of the project as evaluated in the original 1996 report, as well as changes in the conditions affecting the performance of the project vis-a-vis state, program, and project goals and policy objectives.*

2. *Analytical techniques relating to the Grain Train Project should be reviewed and updated to assure consistency with state-of-the-practice techniques and data, and that documentation be provided in instances where alternative approaches are used.*

3. *More rigorous market analysis relating to the Grain Train should be considered to assess the impact of the project on preservation of light-density rail lines over which existing cars are now being operated, and other potential lines where similar conditions exist and where similar initiatives might be considered.*

4. *Continued economic analysis be undertaken to assess the factors and conditions that may impact the choice of options in the future for operation of the Grain Train, including divestiture by the state of its ownership of the rolling stock, should policy-makers choose this option.*

Continued periodic review and analysis of the Grain Train Project should be undertaken within a benefit/cost framework.

STATEWIDE PASSENGER RAIL PROGRAM

Background

In 1991, the legislature directed the preparation of a comprehensive assessment of the feasibility of high-speed ground transportation and established the Washington High Speed Ground Transportation Study Steering Committee to guide the effort. Following designation of the Pacific Northwest Rail Corridor by the U.S. DOT as one of five corridors for development of high-speed rail passenger service, the legislature directed WSDOT, under RCW 47.79, "to develop high-quality intercity rail passenger service through an upgrading of existing service."

Two principal service objectives guide the passenger rail effort.

Two principal service objectives drawn from the Washington Transportation Plan guide this effort and the current Passenger Rail Program:[6]

- Preserve and maintain existing service statewide, and;
- Improve the speed, frequency, reliability, and intermodal access of rail passenger service in the Pacific Northwest Rail Corridor and improve the quality of service in other corridors statewide.

Although earlier rail passenger planning has included preliminary analysis of high-speed service in the east-west corridor from Seattle to Moses Lake to Spokane, the Intercity Rail Passenger Program is now focused on service improvements in the 466-mile Pacific Northwest Rail Corridor (PNWRC) from Eugene, OR, to Vancouver, BC. At the present time, a 20-year Corridor Intercity Rail Passenger Plan is nearing completion and a Corridor Environmental Impact Statement (EIS) is in the alternative review stage and will clear the way for a five-year program of infrastructure improvements.

The Passenger Rail Program and the services now in operation have been the focus of continual planning and investment throughout the decade.

The PNWRC planning effort is being carried out under the guidance of the Pacific Northwest Rail Corridor Technical Oversight Committee with representation by the Washington State Department of Transportation, the Oregon Department of Transportation, the Province of British Columbia, as well as Amtrak, the Burlington Northern Santa Fe (BNSF) Railroad and Southern Pacific Lines. Additional partners have been fully engaged in the corridor planning effort as well, including the Union Pacific Railroad, the Central Puget Sound Regional Transit Authority and local jurisdictions along the corridor.

Issues and Audit Scope

The Passenger Rail Program and the services now in operation have been the focus of continual planning and investment throughout the decade. The program is an integral part of a multi-state and provincial effort in the corridor, and the corridor is one of five designated by the Federal Railway Administration (FRA) for high-speed service. This audit focuses on the adequacy of technical planning for budgetary and policy-making

[6] *WSDOT's Rail Office Information Packet on Program and Budget Policy*, WSDOT, February 1997.

purposes and the nature of the information being made available to decision-makers.

Current Services

Current state-supported services operated by Amtrak include a daily round trip on the *Mount Baker International* between Seattle and Vancouver, and a daily round trip between Seattle and Portland on the *Mount Adams.* Amtrak runs additional services in the Seattle-Portland-Eugene portion of the corridor. All service is provided over BNSF lines. WSDOT reports that annual ridership in the corridor exceeds 400,000 and has nearly doubled since 1993. The two state-sponsored trains each carry over 80,000 passengers annually and passenger-generated revenues have increased to cover 65 percent of operating costs on the *Mount Baker International* and 55 percent on the *Mount Adams* without increases in service frequency or running times. Both ridership and revenue continue to exceed forecasts. Recent WSDOT analyses indicate that service and infrastructure improvements and the addition of Spanish Talgo train sets now being constructed offer the prospect of travel time improvements under current track conditions sufficient to allow an additional midday Seattle-Portland round trip by 1999 without the purchase of new equipment.

Both ridership and revenue continue to exceed forecasts.

The ongoing Rail Passenger Program is broad-based and includes continuing investment in operations, capital, and planning. Partnership funding arrangements are in place for current services and improvement programs, further leveraging state investment, and future funding partnership arrangements have been framed in broad terms.

The work of the Oversight Committee and its consultants, particularly the report on *Options for Passenger Rail in the Northwest Rail Corridor,* published in 1995, and the periodic *Program Update* documents prepared by WSDOT, provide the most current and detailed references available to the team in support of its effort to carry out a review of the Rail Passenger Program under this audit. While a revised *20-year Corridor Intercity Rail Plan* for the Vancouver-to-Portland portion of the corridor is nearing completion and a *Corridor Environmental Impact Statement* is underway, neither document was available at the time the audit review was conducted.

The corridor planning effort draws on and synthesizes three years of technical analysis.

The corridor planning effort draws on and synthesizes three years of technical analysis that has been somewhat more advanced in Washington State and Oregon than in British Columbia. This work has focused on development of a practical, incremental program of improvements in safety, reliability, frequency, travel times, and connections to other modes that are designed to meet the legislative mandate to carry out a cost-effective incremental program to advance long-range goals, including:

- Operation of hourly service between Seattle and Portland with a travel time of two hours, thirty minutes;
- Two-hour service between Seattle and Vancouver, BC, with a travel time of three hours;
- Improved local transportation connections; and
- Improved service quality in other corridors.

The Rail Passenger Program is proceeding through a three-part strategy outlined in the *Options* report.

The Rail Passenger Program is proceeding through a three-part strategy outlined in the *Options* report that provides: (1) priority to low-cost improvements to relieve bottlenecks and increases train speeds in the most restricted settings; (2) priority to increases in capacity through improvements to existing facilities and infrastructure; and, (3) priority to larger, high-cost projects with more significant impacts and longer lead times. Attention has been given to establishing "functional priority" for proposed actions and investments and packaging associated projects to maximize timeliness and impact on services. A four-phased staging plan has been used covering 5- to 6-year increments.

Technical Analysis

The 1995 *Options* report provides a comprehensive synthesis of recent (1992-1994) technical analysis of service levels, ridership, revenues, capital costs, and operating costs. The report also addresses critical issues related to governance, management, and finance. Included in the documentation are observations about experiences and plans being implemented in other areas of the country, including two corridors in California.

Based on conversations with WSDOT Rail Program staff, the audit team has carried out its review on the assumption that current planning and investment strategies now being implemented are based on:

- The findings and recommendations that have emerged from the Options report;
- The use of improved analytical techniques applied since the completion of the Options report, including techniques used by the U.S. DOT Volpe Center to assess commercial feasibility of intercity rail services for the FRA, cost-estimating procedures used by Amtrak, and state-of-the-art rail capacity modeling used by WSDOT consultants; and
- The directive by the legislature to pursue an incremental approach to corridor investment that allows the state to take maximum advantage of each increment of improvement.

While the *Options* report presents a comprehensive, well-developed, and well-presented synthesis of prior detailed studies and analyses, there are several important instances in which caveats are noted regarding analytical approaches and results. With respect to ridership estimates, the *Options* report relies on forecasts done earlier, noting that resources were not available in preparation of the 1995 report to engage in updated technical forecasting and modeling. As the report notes, the ridership estimates are, therefore, derived from observed experiences that relate rider response to changes in service levels. While this approach is effective in the short run and represents a conservative approach consistent with budgetary and other constraints that exist, it is important to also conduct more rigorous forecasting and modeling analyses that reflect the broader travel market and factors that are likely to influence mode choice and travel behavior other than changes in rail services. WSDOT staff have indicated that more sophisticated ridership forecasting has been undertaken since the publication of the *Options* report using analytical techniques from the commercial feasibility methodology used by the FRA. Documentation and results of these analyses had not yet been completed in final form and were thus not available to the audit team. WSDOT staff has indicated, however, that these more recent analyses and additional market research data have confirmed the validity of overall ridership estimates from prior analyses, though ridership projections for various sections of the corridor have changed somewhat, increasing on some sections but decreasing on others.

It is important to conduct more rigorous forecasting and modeling analyses.

The Rail Passenger Program necessarily involves considerable depth and complexity.

With respect to cost analysis, the *Options* report references a three-tiered Amtrak cost methodology, but notes that only costs associated with direct train operations are included in the report, leaving out costs for route or system elements and activities as well as administrative costs that would typically be allocated to these services to arrive at an estimate of full costs. The report does note that direct operating costs can be increased by a factor of 37 percent to account for these costs, but this increment is not included in the operating cost figures used in the 1995 report. Since the publication of the *Options* report, WSDOT staff have indicated that the three-tiered Amtrak methodology has been enhanced and the full methodology has been used in preparation of the new operations report now nearing completion.

Information for Decision-Makers

Additional attention should be given to the preparation of comprehensive, periodic summary documents for legislators and others.

The Rail Passenger Program necessarily involves considerable depth and complexity with regard to the issues being analyzed, the analytical techniques being used, and the results and conclusions being formulated. Under these conditions, there is always some difficulty in assembling and presenting appropriate information for the many audiences and stakeholders that must be kept informed and given credible bases for action.

Material available to the audit team afforded a glimpse of the technical detail and findings in the form of a synthesis of technical planning and analysis, along with material prepared to satisfy basic public information needs on selected projects and aspects of the overall program. In addition, periodic program updates prepared by WSDOT were made available which highlight major milestones for key elements of the program and are presumably an important element in the effort to monitor and inform decision-makers. Other critical, detailed documents, including the update of the 20-year corridor plan and the corridor EIS, are in progress or nearing completion and thus were not available for review. Based on material available to the team, additional attention should be given to the preparation of comprehensive, periodic summary documents for legislators and others that address key aspects of the program in a consistent way.

This point is raised because it was not evident from documents available to the audit team that there are materials available

that fill the gap between extensive, detailed analytical documentation and broad, descriptive public information.

Tracking Uncertainties

The Rail Passenger Program has been launched and is being carried out using an incremental approach to improvement and investment as well as assumptions that have proven to be prudently conservative in many cases. Over the past two to three years and certainly into the future, circumstances are likely to arise that warrant careful analysis with respect to their impact on the Rail Passenger Program and the assumptions on which it is based. Increasing amounts of information and reporting on a wide range of topics indicate the breadth of concerns and the varied and complex questions that will arise for both program managers and decision-makers. Under these circumstances, consideration should be given to some form of routine assessment and interpretation of many of the conditions and circumstances that are certain to be in flux.

While many of these uncertainties and related assumptions have been noted in the documents and materials that were available for review, they may be of sufficient importance to be assessed and reported on a regular basis, specifically citing their potential impact on the Rail Passenger Program. Among the most significant of these are the following:

- Uncertainties in Amtrak plans, funding, and operations in view of potential federal reductions in Amtrak's operating budget;
- Developments in federal high-speed rail policy and funding;
- Progress in reauthorization of federal highway and transit programs;
- Milestones in other state rail passenger programs;
- State budget and funding decisions and policies, given constitutional prohibitions on the use of gas tax revenues and the competition for increased transportation investment;
- Policy and program decisions pending in FRA;
- Changes in cost drivers and other factors that may affect corridor operations plans; and
- Changes in development and other factors affecting travel demands and travel patterns in the Northwest.

Analysis of the Rail Passenger Program appears consistent with industry standards.

Undoubtedly, these and many more issues of interest are being tracked and reported by WSDOT and others. Increased focus might be placed on routinely providing specific interpretations relevant to the Rail Passenger Program and the possible value of such an effort in a decision-making context.

Findings

1. *Analysis on which the Rail Passenger Program is being implemented appears consistent with industry standards and is being developed and updated through the use of improved analytical techniques on a periodic basis. The result appears to be timely progress in carrying out major capital improvements in partnership with major corridor stakeholders, ridership, and revenue increases in excess of projections, agreements in principle on future funding partnerships, and imminent decisions that will foster additional service improvements consistent with state policy and legislative objectives.*

2. *Based on the material available to the audit team, the scope and format of information and analytical results routinely prepared for use by decision-makers is not as adequate or effective as it could be. Similarly, it is not certain that the program is communicating effectively about changing market and other external conditions and uncertainties that may affect program implementation and performance.*

WSDOT should provide improved summary information on the passenger rail program.

Recommendation

1. *The Washington State Department of Transportation should assess the need for improved summary materials on the passenger rail program, which would consistently and regularly address a broader range of program elements and contexts for use by decision-makers and other key stakeholders. These materials would be in addition to the intermittent updates on selected program milestones currently being provided.*

CROSS-CUTTING ISSUES AND RECOMMENDATIONS

Chapter Eight

OVERVIEW

Certain fundamental, cross-cutting themes have emerged from the audit.

To this point each chapter has developed specific findings and recommendations by individual topic area of the audit. When the discussions, findings, and recommendations across the entire audit are considered collectively, however, certain fundamental, cross-cutting themes emerge that encompass issues in multiple topic areas. This chapter addresses these cross-cutting themes, and develops "big picture" recommendations that complement, reinforce, and bring together several recommendations cited in earlier chapters. The cross-cutting themes are as follows:

- WSDOT's knowledge of the costs of its operations.
- WSDOT's approach to its business and its mission.
- Balancing consistency and autonomy across regions.

WSDOT KNOWLEDGE OF ITS COSTS

Synthesis

Knowing and understanding the costs of its operations is important to WSDOT in several ways:

- A good understanding of its cost structure would enable WSDOT to compare its operations to benchmarks in the public and private sectors, to track changes in performance over time, and to understand variations in its operations across regions. (Refer to highway program and project cost comparisons in Chapters 2 through 4.)

Knowing and understanding the costs of its operations are important to WSDOT in several ways.

- An awareness of the factors affecting its costs and their combined impact on the highway programs would enable WSDOT to:
  - Identify factors and trends that affect the costs of its highway capital construction and maintenance programs;
  - Communicate the implications of these trends effectively in support of its highway programs and future funding needs; and
  - Respond to or anticipate critical situations, whether by working with public and private sector parties to control those factors that increase costs, or to seek more cost-effective avenues to achieve transportation objectives and broader public policy goals.

  (Refer to the discussion of factors affecting WSDOT's construction costs in Chapter 2, particularly the impact of construction inflation at a rate more than double the national average, and to the cost impact of environmental compliance in Chapter 6.)

- Improved knowledge of the costs of performing specific activities within the department is critical to evaluating new ways of doing business, and to understanding the cost implications of institutional, organizational, and procedural changes in how work gets done and who performs it. (Refer to the discussions of managed competition in Chapter 4, and of the potential use of additional private sector design services in Chapter 3.)

Role of Financial and Management Systems

The audit has indicated useful enhancements in WSDOT's financial and management systems.

WSDOT now employs and maintains several financial and management systems to compile and report data on program estimates, project cost performance, and financial expenditures. The analyses conducted as part of this audit have relied heavily on output from these systems, including TRAINS, CPMS, and CCIS, as described in previous chapters. Our work on several audit questions has indicated directions in which enhancements in the systems themselves and related procedures would be useful:

- To provide a more comprehensive picture of the cost and the relative performance of delivery mechanisms used in project design and construction. This would facilitate better life-cycle analyses from design phases through final construction.

- To provide clearer cost information on different business approaches to accomplishing a task—e.g., use of WSDOT staff versus other public or private sector forces, as for highway project design or for normal maintenance – based upon Activity-Based Cost (ABC) concepts that encompass the total costs of performing an activity or function.
- To employ more definitive procedures in assigning and classifying costs by the various codes in the WSDOT Chart of Accounts, and to do so consistently across organizational units, so that reporting of items such as contracted work is unambiguous.

The department has considerable hardware, software, and human investment in its current financial and management systems. Therefore, the thrust of the recommendations below is not toward substitution of existing systems with completely new systems, but rather toward enhancements of existing systems to enable them to support departmental functions in the ways described above. There are different approaches by which system enhancements might be accomplished, and the suggestions below are intended as examples rather than as firm guidelines for system development.

The thrust of the recommendations below is not toward substitution of existing systems, but rather toward enhancements of existing systems.

One approach would be to create flags or linkage variables to track costs of interest: e.g., cost items related to environmental regulation (which would need to be defined); or, design, construction, and right-of-way costs associated with a particular project, contract, or work order. Rule-based approaches may also be automated to provide more precise estimates where needed: e.g., to identify specific types of contracts, or to account for complicated project histories involving splitting, combination, or termination of project phases.

Another approach would be to create a complementary system, best illustrated by the WSDOT's current Transportation Executive Information System (TEIS), which reads information from existing databases to compose a new, integral database. The system would also resolve the logical, definitional, and data structure and linkage issues implied in the preceding paragraph so that data can be analyzed and displayed meaningfully and correctly. Such a system could embody relevant queries and analyses behind an easily applied user interface, much as TEIS does now.

Data gathering for several questions in this audit indicated problems that are avoidable and easily clarified.

An accurate understanding of one's cost structure requires that cost information be recorded and reported correctly according to the codes in WSDOT's Chart of Accounts. While the large number of these codes makes some degree of human error unavoidable, data gathering for several questions in this audit indicated problems that are avoidable and easily clarified. For example, there is ambiguity across the department about –

- Which codes to apply for particular cost items (e.g., utility district assessments paid through subprogram M2);
- The meaning of particular codes (e.g., whether referenced equipment is office- or field-related); and
- Which codes to assemble to address a particular question (e.g., what work is now contracted?).

Moreover, when data were cross-tabbed between two sets of codes (such as object codes and work operation numbers), inconsistencies appeared in how data are reported. If these issues are approached from the perspective of an activity-based cost structure – where the intended use of cost information is clearly defined – it should be possible to develop specific guidelines that clarify by example how the various codes in the Chart of Accounts should be applied, and that define consistency rules where needed: e.g., between work operation numbers and object codes pertaining to contracted services.

Data input should be clarified by examples to indicate correct and consistent assignment of codes from the Chart of Accounts.

Recommendations

1. *The Washington State Department of Transportation's current management systems should be enhanced to provide easier and more reliable mechanisms to track costs of projects and key activities, based upon Activity-Based-Cost concepts. These enhancements should enable the department to understand better its current cost structure, the factors that influence highway project and program costs, and the corresponding costs of alternative ways to accomplish work.*

2. *Guidelines for the input of data to management and financial systems should be clarified by examples to indicate correct and consistent assignment of codes from the Chart of Accounts, so that these data support an accurate picture of activity-based costs within the department. Enforcement of*

these guidelines should be considered by the Washington State Department of Transportation internal audit function.

WSDOT APPROACH TO ITS MISSION AND BUSINESS AREA

Synthesis

The audit issues dealing with the delivery of design, construction, and maintenance services in Chapters 2 through 4 touched upon more fundamental matters of how WSDOT views its mission; what approach does it follow to accomplish its work; and what are the human and financial resources, organizational roles and responsibilities, and institutional relationships necessary to meet its objectives. Relevant issues are as follows:

Delivery of design, construction, and maintenance services touch upon more fundamental matters of how WSDOT views its mission.

- The mix of public and private sector resources that WSDOT employs to deliver its services, and the relationships between WSDOT staff and outside labor.
- Respective roles and responsibilities of the Olympia Service Center and regions.
- The degree to which the department performs work with its own forces, as opposed to managing and reviewing work by others.
- Alternative perceptions of cost-effectiveness and risk, as demonstrated by the DuPont South Interchange project discussed in Chapter 3.

The audit was not tasked with a review of WSDOT's mission and business approach, although we became aware of the department's past efforts in these areas in interviews regarding current responsibilities and potential opportunities for outsourcing. Moreover, whereas the audit considered recommendations such as outsourcing on the basis of comparative costs and projected savings, the mission and business approach of the department also involve consideration of other factors in maintaining a core capability to deliver services using department forces. This rationale for a core capability is recognized by WSDOT managers, has been discussed in audits of DOTs completed in other states, and includes several points:

Core capabilities to be maintained.

- The need for WSDOT managers and staff to maintain competence and institutional memory in their technical knowledge and skills. This core capability:
  - Is the first line of defense of, and accountability for, the public interest and safety in the transportation program; and
  - Enables WSDOT staff to pursue effectively the introduction and evaluation of innovative design, construction, and maintenance approaches within the department's practice.
- The need for WSDOT managers to be at the forefront of current practice so that they may effectively manage other public or private sector entities performing services for WSDOT.
- The need to respond to emergencies quickly and effectively.
- The need to exert a competitive control on the price of services charged by others.

A pilot effort in managed competition has been recommended for maintenance in Chapter 4, and a corresponding pilot effort can be considered for outsourcing project design.

Recognizing the importance of these issues, WSDOT is now taking steps in several areas (e.g., decentralization of project responsibilities from Service Center to regions; innovative partnering with private sector project design staff) to redefine the department's business approach to its mission. However, a definitive, comprehensive statement of the department's business approach, core staffing levels, and relationship with other public and private sector entities has not yet been developed.

Relationship to Managed Competition Pilot

A pilot effort in managed competition has been recommended for maintenance in Chapter 4, and a corresponding pilot effort (e.g., in increased outsourcing) can be considered for project design.[1] These pilot efforts could benefit from, as well as contribute to, a better understanding of WSDOT's business approach to achieving its mission. The pilot efforts would benefit from this understanding in that they would focus on specific activities that the department has explicitly identified as candidates for

[1] The federal Brooke Act requires that procurement of engineering services consider professional qualifications and capabilities, and cannot be accomplished through a low-bid competition. It is our understanding that WSDOT follows this practice now in its outsourcing for engineering services on state- as well as federal-funded projects, and it is assumed that this practice would continue in any pilot for increased outsourcing.

managed competition or outsourcing. Furthermore, WSDOT managers and staff would better understand the emerging roles they need to play in undertaking new business approaches. The pilot efforts would contribute to this understanding in that they would test the relative cost and non-monetary considerations underlying the involvement of non-WSDOT staff in delivering services, and thereby help shape the next stage of these initiatives. An important aspect of the pilot should include training WSDOT employees in how to reengineer their activities and empower them to be competitive with outside resources.

Thus, while the audit has not explicitly considered matters of the WSDOT mission or its evolving strategic business approach, these broader considerations play an important role in how the pilot efforts that have been recommended in this report are perceived and conducted. Ideally, the definition of WSDOT's overall business strategy and the conduct of pilot projects in managed competition or outsourcing would proceed concurrently, to mutual benefit. Moreover, the findings of previous chapters and experience with managed competition in other states suggest the following premises:

These broader considerations play an important role in how the pilot efforts are perceived and conducted.

- WSDOT cannot undertake new approaches to doing business on its own. Undertaking managed competition in highway maintenance, for example, will require enabling legislation. More generally, new business approaches will require the participation and cooperation of the department's employees, the construction industry, and vendors and suppliers. The Transportation Commission, Legislature, and Executive Branch will need to agree with these new approaches and their implications: e.g., in changed perceptions of cost and risk.
- Changes in the business process cannot happen overnight. For example, if the department proceeds with managed competition, WSDOT employees will require a transition period to adjust to the new competitive environment. Evaluation of the pilot may suggest revisions before the next step in the business process is taken.
- To evaluate the costs and benefits of a pilot accurately, the department must first know the full costs of its current method of doing business. The discussion and recommendations of the preceding section pertain.

Recommendations

1. *Develop the principles, strategies and goals necessary to guide the Washington State Department of Transportation's management of the evaluation of its business. Pilot efforts that are undertaken by the department in outsourcing or managed competition should be designed based upon the department's and its stakeholders' thinking on its strategic business approach.*

2. *Provide training to the Washington State Department of Transportation employees to assist them in reengineering their work approaches and empowering them to be competitive within the pilot efforts that are undertaken.*

3. *The evaluation of the pilot effort should be made within the context of the proposed business approach, and should compare the relative costs, cost savings and risks of the piloted approach versus current practice.*

REGIONAL CONSISTENCY VS. AUTONOMY

Synthesis

Issues of regional consistency or autonomy in the context of this audit refer to specific procedures.

Issues of regional consistency or autonomy in the context of this audit refer neither to basic organizational responsibilities and relationships nor to matters of geography, but rather to specific procedures as practiced throughout WSDOT. The major example occurs in maintenance contracting. As discussed in Chapter 4, Regions differ in their ability to contract for pavement chip seals and striping and the scope of these contracts, a result of local historical precedent, current state law, and managerial decisions. This, in effect, has resulted in Regional precedents being established which can impact the department's relationship with the union. Other examples may arise as the result of recommendations of this audit: e.g., consistency in reporting cost information as discussed earlier, and in documenting causes of change orders more precisely as recommended in Chapter 3.

The thrust of this discussion is that managerial objectives and decisions will be facilitated by greater consistency in all of these areas. With respect to maintenance contracting, achieving this

consistency will require legislative remedy to enable the WSDOT to address disparate historical precedents that have developed. With respect to the other examples, WSDOT will need to promote and enforce guidelines to ensure that key information on the costs and performance of business processes are reported accurately and according to the same definitions and conventions. Nothing in this discussion should be interpreted as contradicting or ignoring the actual and significant differences that exist among Regions as the result of geography, population, terrain, road functional classes, traffic levels, or relationships with local jurisdictions and organizations. We are speaking solely of internal procedures and their implementation across regions.

Department-wide needs for consistency should be addressed without jeopardizing the regional need for flexibility in meeting local service requirements.

Recommendation

1. *Guidelines on implementing new ways of delivering departmental services, and on tracking and reporting the performance and costs of current and new delivery mechanisms, should be issued, interpreted, implemented, and managed consistently across the Washington State Department of Transportation Regions. The focus should be on ensuring that department-wide needs for consistency and standards are addressed without jeopardizing the regional need for flexibility in meeting local service requirements.*

SCOPE AND OBJECTIVES

Appendix 1

SCOPE OF WORK

The Firm shall conduct an objective performance audit of the highways maintenance, preservation, and improvement programs; and an independent evaluation of the information and analysis concerning freight and passenger rail programs provided by WSDOT to the legislature and the Transportation Commission for decision-making purposes.

SERVICES TO BE PROVIDED

The Firm shall use judgment, experience, and creativity in conducting this performance audit. The performance audit shall identify those activities and programs that should be strengthened, those that should be abandoned, and those that need to be redirected or other alternatives explored.

The Firm shall consider and appropriately respond to public comments solicited and received by JLARC regarding this performance audit. A public comment survey report will be completed by JLARC and will be made available to the Firm on or about September 11, 1997.

The Firm may be required to attend public meetings and will be required to provide oral briefings and written reports to members and staff of JLARC. In addition, the Firm must meet with representatives of WSDOT and with various stakeholders as needed.

Specific Performance Audit Issues Identified by the Temporary Advisory Committee and JLARC

At a minimum, the performance audit shall address the following, specific issues. Potential measurements (or audit criteria) and approaches are listed under each issue. See V-4 Section 3: Technical Proposal for instructions concerning these potential measurements and approaches.

Highways

A. As measured over an appropriate timeframe, is planning and budgeting for the highways maintenance, preservation, and improvement programs adequately integrated and coordinated?

Potential measurement and approach: Analysis of whether maintenance associated with planned preservation and improvement projects are adequately accounted for in the planned maintenance program; and whether planned maintenance activities are adequately accounted for in the preservation program. Comparison of respective plans versus documented need.

B. As measured over an appropriate timeframe, are the formulas by which highway preservation work is scheduled and budgeted adequate?

Potential measurement and approach: Analysis of whether the Pavement Management System model and the Bridge Management System model, and their use by WSDOT, lead to the identification of the lowest life-cycle costs for preservation projects (using industry standards for assumptions for life-cycle cost analysis and conducting sensitivity analysis as appropriate).

C. How do the costs of Washington's maintenance, preservation and improvement projects compare with other states, and among regions within the state?

Potential measurement and approach: Comparison of Washington's costs to other states and identification of appropriate public or private sector benchmarks for measuring Washington's cost-effectiveness. Comparison of costs by region within the state and identification of appropriate internal benchmarks. Utilization of recognized industry standard cost ratios for comparing costs. Analysis of full costs by cost component and identification of percentages of full costs that are attributable to overhead. Identification of any differences within the statutory and regulatory environment, or differences due to regional location, that should be controlled for and addressed in making the comparisons.

D. What is the WSDOT's performance in controlling cost-overruns and delays?

Potential measurement and approach: Determination of the extent of cost overruns and delays in WSDOT preservation and improvement projects. Analysis of the factors that contribute to cost overruns and delays and identification of actions WSDOT can take to minimize cost overruns and delays:

Development of a representative sample of completed projects; identification of avoidable and unavoidable overruns and delays, and overruns and delays that add value and those that do not. Examination of the reasons for overruns and delays, and an evaluation of whether WSDOT's processes to avoid overruns and delays, and to recover costs, are adequate and meet industry standards. Analysis of change orders and an evaluation of WSDOT's processes for mitigating the number and cost of change orders, and comparison to industry best practices.

Development of a case-study approach for improvement projects, which will include the DuPont interchange and other selected projects.

Assessment of the relationships that exist between WSDOT's estimates of construction costs, the bids received from contractors, and final construction costs by analyzing a representative sample of completed projects.

E. Does WSDOT follow a cost-effective approach in allocating highway design work between department staff and consultants?

Potential measurement and approach: Comparison of the costs and quality of highway design services provided by department staff to those services furnished by industry engineering consulting firms. Comparison of WSDOT practices to industry standards and/or best practices.

F. As measured over an appropriate timeframe, does the manner in which WSDOT schedules and sets priorities for improvement projects minimize life-cycle costs?

Potential measurement and approach: Review of a representative sample of highway capacity improvement projects over the same roadways and bridges over time to determine if the sequencing of work results in the lowest possible life-cycle costs (using industry standards for assumptions for life-cycle cost analysis and conducting sensitivity analysis, as appropriate).

G. How are improvement projects designed, managed, and scheduled so as to minimize traffic slowdowns during construction and to minimize risks to workers and the public? How does the WSDOT's performance in this area compare to industry standards?

Potential measurement and approach: Review of a representative sample of projects and WSDOT policy, procedures, and processes in scheduling improvement projects. Identification and evaluation of the methods and criteria used for weighing the advantages and disadvantages of alternatives. Comparison of WSDOT's practices to industry standards.

H. What is the cost impact of the current policy of requiring contractors to comply with both federal and state prevailing wage laws and to use the greater of the federal or state prevailing wage?

Potential measurement and approach: Identification or estimation of the proportion of highway construction projects that receive federal funding and are required to comply with the Davis-Bacon Act. For a sample of projects that is representative in terms of cost and geographical dispersion, identification of what the difference in contract cost would have been if only federal wage rates had been used.

Identification and quantification of the reporting and other administrative costs for both the department and its contractors in meeting the requirements of the state prevailing wage law. Analysis of the differences in federal and state wage rates by job class, geographic area, and other appropriate criteria.

I. Does the state policy of using the prevailing wage of the largest county seat for the prevailing wage of the county in which construction occurs, result in urban wages being used for a material number of rural projects, and does this policy result in the payment of higher wages?

Potential measurement and approach: Estimation of the number or proportion of highway construction projects that take place in rural areas. Identification of prevailing wages for each project. Identification of the number of employees per job class for each project. Identification of the difference in contract cost paid by the state if federal rural wage rates were used instead of state wages in rural areas.

J. What is the overall cost impact on Washington's highways programs of having to comply with environmental requirements and regulations, and how does that compare to similar costs in other states?

Potential measurement and approach: Review of past and current efforts by WSDOT to assess cost impact and assess accuracy of such efforts. Comparison of results to available information from other states, with an explanation for differences. To the extent possible, a determination within Washington State of which entity's regulations/requirements have the greatest cost impact–local, state, or federal.

K. What is the status of WSDOT's work to implement recommendations from past studies designed to reduce the cost impact of complying with environmental regulations, and what is the likelihood that implementation of those recommendations will achieve significant and quantifiable savings?

Potential measurement and approach: Review of past studies and a determination of implementation status based on interviews with agency personnel and review of relevant documentation. Analysis of likelihood that implementation of individual recommendations will result in cost savings and identification of the extent of any such savings.

L. What is the array of state highway maintenance activities, and when, where, why, and by whom are these services provided? What are the costs and quality of services? What are the experiences of other states in contracting out comparable services?

Potential measurement and approach: Comparison of Washington's costs and quality of maintenance services with comparable maintenance services in other states that have contracted out. Use of recognized industry standards for assessment of maintenance quality and cost. Analysis of full direct and indirect costs by cost component. Identification of any differences due to the statutory and regulatory environment, or differences due to regional location, that should be controlled for and addressed in making the comparison. Determination of whether there are potential cost and/or efficiency savings that could be achieved by contracting some or a portion of maintenance services. Identification of the optimal mix of contracted/non-contracted services for Washington's highway maintenance services.

M. Review the department's and regional offices' interpretations of the current statute (RCW 47.28.030 and 035) with regard to maintenance activities.

Potential measurement and approach: Analysis of how "projects" are defined by the department in its policies or directives and review implementation of that definition at the regional level. Identification of whether there are opportunities to engage in more contracting of the maintenance services than is currently done using a different definition of "projects" and alternative interpretation of the term "portions thereof" by the department. Identification of potential cost savings or efficiencies that might be implemented with utilization of contracted work under the above existing statutes and under different definitions.

N. Evaluate Washington's use of appropriate equipment and technologies for maintenance activities.

Potential measurement and approach: Comparison of Washington's use of equipment and technologies in maintenance areas to those of other states performing similar maintenance activities. Use of recognized industry standard cost ratios for comparing costs. Identification of any differences within the statutory and regulatory environment, or differences due to regional location, that should be controlled for and addressed in making the comparison. Identification of equipment and technology alternatives, their costs, and projected savings for performing maintenance activities.

Rail Programs

O. Is the information and analysis provided to the legislature and the Transportation Commission by WSDOT for policy and budget decision-making adequate for this purpose?

Potential measurement and approach: Review of the completeness and accuracy of the information used in WSDOT's analysis of the Grain Train Project, focusing on all of the economic costs and benefits to local and state citizens and taxpayers. An update of the Grain Train analysis using actual expenditures and revenues to date. A sensitivity analysis on major assumptions. Identification of the risks associated with the investment and a determination of the feasibility of privatizing the project. Review of the completeness and accuracy of information used in WSDOT studies that support the current passenger rail program, focusing on all of the economic costs and benefits to local and state citizens and taxpayers. Note: These would be reviews, not original analyses. The end point would be a determination of whether the Grain Train and passenger train economic analyses meet industry standards for such analyses and whether the presentations of the results of the analyses are accurate, unbiased, and are presented in a manner that facilitates use by decision-makers (e.g., clearly conveyed, with assumptions made clear and alternatives presented).

AGENCY RESPONSES AND AUDITOR'S COMMENTS

Appendix Two

- **Office of Financial Management**
- **Department of Labor and Industries**
- **Department of Transportation**

To link to this appendix, click here.

Department of Transportation

Response to Joint Legislative Audit and Review Committee's Preliminary Report of the DOT Highways and Rail Programs Performance Audit

The Department of Transportation welcomed the thorough review mandated by the 1997 Legislature and the professional conduct of this audit. Furthermore, the Department concurs with the recommendations made in this report and has or will implement the proposed changes as part of its continuous improvement journey. Where implementation of the recommendations requires concurrence or actions by the Legislature and/or other stakeholders, the Department will continue to advocate for the recommended changes and cooperate fully with all interested parties.

The detailed responses follow:

Recommendation 1

The Washington State Department of Transportation should continue to take positive steps to clarify its process for identifying and selecting pavement projects. The Department should not only approve proposals now under consideration, but also put in place an action plan that monitors compliance with, and progress toward, implementing and applying these steps.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	September 1998

Agency Response: Concur

These changes have already been implemented in 1997 as the Department continues to moves towards a lowest life-cycle cost approach to pavements.

Recommendation 2

The Washington State Department of Transportation should consider including pavement roughness, in addition to Pavement Structural Condition and rutting, in its candidate pavement project thresholds.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	April 1999

Agency Response: Concur.

The Department already considers roughness in its rehabilitation of concrete pavements. The recent "dowel bar retrofit" on the Interstate system is an example. Asphalt and chip seal pavements crack before roughness becomes an issue.

Recommendation 3

The Washington State Department of Transportation and the Legislature should discuss the nature of current highway program coordination and consider alternative approaches based upon forecasts of maintenance needs concurrently with forecasts of preservation and improvement needs for the coming biennium.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	April 1999

Agency Response: Concur with the recommendation.

To fully implement this recommendation requires system changes and enhancements. All available current information technology resources are dedicated to the Year 2000 effort. The Department will include this recommendation as part of its 1999-01 biennial budget request to the Transportation Commission, the Governor and the Legislature. However, the completion date will depend on legislative and gubernatorial authorizations.

Recommendation 4

The Washington State Department of Transportation should develop, implement, and enforce clearer guidelines on the assignment of causes of change orders, reducing the use of "Other" to those situations that literally are not covered by more definitive reasons, and promoting consistency among Regions on the interpretation and use of specific causes.

Legislation Required:	None
Fiscal Impact:	Can contribute to long-term cost effectiveness when coupled with actions under Recommendation 5; savings are indeterminate
Completion Date:	April 1999

Agency Response: Concur.

The Department has recognized this need and will continue to work on clarifying guidelines and regional consistency.

Recommendation 5

The Washington State Department of Transportation should reduce its avoidable change orders that yield no added value to projects.

Legislation Required:	None
Fiscal Impact:	Cost savings of up to $6 million per biennium is a reasonable target

Completion Date: Procedures by September 1998, with monitoring thereafter
Agency Response: Concur.

Efforts to improve the processes are already underway. A new constructability review process has been developed on pilot projects. Once the results of the pilot projects are fully available and analyzed, the new procedures will be fully implemented for projects advertised after July 1, 1999.

Recommendation 6

The Washington State Department of Transportation should develop an action plan to achieve these cost savings, and report periodically to the Legislative Transportation Committee on the status of this effort, including statistics giving the breakdown of change orders by cause, frequency of occurrence, and dollar value over time.

Legislation Required:	None
Fiscal Impact:	See Recommendation 5
Completion Date:	Discuss reporting procedures and frequency with LTC to reach agreement by June 1998; reporting according to agreed-upon schedule thereafter

Agency Response: Concur.

However, once the new processes are implemented, attributable cost savings may be better defined as "cost avoidance."

Recommendation 7

The Washington State Department of Transportation should continue its current steps to streamline project development procedures, collaborate with the private sector in unique design situations, and develop a more effective relationship between the Olympia Service Center and the regions.

Legislation Required:	None
Fiscal Impact:	Potential cost savings may be realized from these actions, together with improvements in service; dollar savings are indeterminate
Completion Date:	These steps are already underway; process should continue

Agency Response: Concur.

These efforts are part of the Department's emphasis on continuous improvement.

Recommendation 8

The Washington State Department of Transportation should incorporate those lessons from DuPont that are replicable to other projects within its approach to design, environmental assessment, right-of-way acquisition, and construction, as appropriate for different types of projects.

Legislation Required:	None
Fiscal Impact:	Potential cost savings may be realized from these actions, together with improvements in service; dollar savings are indeterminate
Completion Date:	These steps are already underway; process should continue

Agency Response: Concur.

See comments on Recommendation 7 above.

Recommendation 9

The Washington State Department of Transportation should consider enhancing capabilities among its suite of management and financial accounting systems to provide a stronger capability to view project histories through all phases from design through construction completion.

Legislation Required:	None
Fiscal Impact:	$100,000 for review and conceptual design
Completion Date:	April 1999

Agency Response: Concur with the recommendation, but not with the estimated cost and completion date.

Given the current effort on Year 2000, the Department has no available resources to devote to this effort. The Department will include the recommended enhancements in its 1999-01 budget submittal to the Transportation Commission, the Governor and the Legislature.

Recommendation 10

Implement new legislation to encourage and facilitate expanded use of privatization where appropriate. Specifically, the legislation should provide the Washington State Department of Transportation management with the flexibility to evaluate and select the most cost-effective resources to perform highway maintenance. An environment that fairly and consistently considers the capabilities of both private sector contractors and state work forces should be key to the new legislation and guide the Washington State Department of Transportation implementation of maintenance contracting.

Legislation Required:	Yes (new state statute to define WSDOT's authority to apply state forces and contractors to normal highway maintenance)
Fiscal Impact:	See Recommendation 11 for potential for cost savings
Completion Date:	July 1999

Agency Response: Concur.

The completion date is subject to legislative and gubernatorial actions and eventual savings will depend on the outsourced components of the maintenance program.

Recommendation 11

If the implementing legislation is passed, the Washington State Department of Transportation should consider a pilot project to explore different ways of delivering maintenance services. Managed competition offers potential cost savings and places public and private sector providers on a level playing field to compete for maintenance work.

Legislation Required:	Yes (see Recommendation 6)
Fiscal Impact:	Initial cost savings of $5 to $6 million per biennium is a reasonable target; also see Recommendation 24
Completion Date:	December 2000

Agency Response: Concur.

See comment on Recommendation 10 above.

Recommendation 12

The Washington State Legislature should repeal the "largest city rule" in the Prevailing Wage Statutes (RCW 39.12), which mandates that the wage for each labor classification for each county will be based on the prevailing wage for the largest city in the county. A "county majority rule" should replace the existing "city majority rule."

Legislation Required:	Yes (amendment of RCW 39.12)
Fiscal Impact:	None
Completion Date:	July 2000

Agency Response: Concur.

The completion date will depend on the Legislature's willingness to change RCW 39.12.

Recommendation 13

The Washington State Legislature should budget funds for the Wetlands Bank. This has considerable promise to significantly reduce environmental costs of transportation projects; greatly cut planning, regulatory and permit approval, and construction time requirements; and produce superior environmental protection.

Legislation Required:	Yes (inclusion in WSDOT budget)
Fiscal Impact:	Initial seed funding of Wetlands Bank; WSDOT has proposed $10 million, which is reasonable; projected 50 percent savings in costs of wetlands mitigation over long term
Completion Date:	July 1999

Agency Response: Concur.

The funding level will depend on legislative and gubernatorial actions. Realistic estimates of savings will depend on work that is currently underway but not yet completed.

Recommendation 14

The Washington State Department of Transportation should speed efforts to implement an environmental costing system consistent with the intentions of SB 5572. It should develop a comprehensive environmental decision model that:

- Recognizes environmental benefits, as well as environmental costs.
- Attempts to comprehensively recognize all significant costs and benefits, including those that are not generally expressed in financial terms, such as quality of life, biodiversity, public health and safety, and delay of achievement of benefits due to regulatory compliance requirements.
- Where possible and practical, costs and benefits should be expressed in monetary terms; where monetarization is not possible, costs and benefits should be quantified in non-monetary terms; and where when quantification is not possible, costs and benefits should be identified and measured in qualitative terms.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	Begin conceptual design immediately, for completion by April 1999

Agency Response: Concur with the recommendation.

However, the Department does expect fiscal impacts: Models and modeling techniques will have to be either established or purchased and systems will have to be changed to implement and track the newly developed techniques. As stated before, all current information technology resources are devoted to accomplishing the Year 2000 effort, placing the completion date in all likelihood beyond April 1999.

Recommendation 15

The Washington State Department of Transportation should work with the federal government; other state and local governmental units, particularly within the state of Washington; professional societies such as the Transportation Research Board, the American Association of State Highway and Transportation Officials, the Government Finance Officers Association; and with academic institutions to work towards a common definition of environmental costs and benefits and a common database of such costs to be available to the Department of Transportation and other users and interested parties.

Legislation Required:	None
Fiscal Impact:	None

Completion Date: April 1999

Agency Response: Concur with the recommendation.

The completion date may not be accomplished since current efforts are still in their infancy. The Department expects to be ready with a proposal in time for the 2001-03 biennial budget submittal.

Recommendation 16

Continued periodic review and analysis of the Grain Train Project should be undertaken in a benefit/cost framework to monitor both changes in the economic impacts of the project as evaluated in the original 1996 report, as well as changes in the conditions affecting the performance of the project vis-a-vis state, program, and project goals and policy objectives.

Legislation Required: None
Fiscal Impact: None
Completion Date: December 1998

Agency Response: Concur.

A new analytical model using Federal Railroad Administration and Federal Highway Administration guidelines was developed and completed in August 1997. A new analysis is underway and expected to be completed Prior to the recommended completion date.

Recommendation 17

Analytical techniques relating to the Grain Train Project should be reviewed and updated to assure consistency with state-of-the-practice techniques and data, and that documentation be provided in instances where alternative approaches are used.

Legislation Required: None
Fiscal Impact: None
Completion Date: December 1998

Agency Response: Concur.

See comments on Recommendation 12.

Recommendation 18

More rigorous market analysis relating to the Grain Train should be considered to assess the impact of the project on preservation of light-density rail lines over which existing cars are now being operated, and other potential lines where similar conditions exist and where similar initiatives might be considered.

Legislation Required: None
Fiscal Impact: None

Completion Date: July 1999

Agency Response: Concur.

See comments on Recommendation 12.

Recommendation 19

Continued economic analysis should be undertaken to assess the factors and conditions that may impact the choice of options in the future for operation of the Grain Train, including divestiture by the state of its ownership of the rolling stock, should policy-makers choose this option.

Legislation Required: None
Fiscal Impact: None
Completion Date: July 1999

Agency Response: Concur.

An independent analysis was presented to the Legislature in December 1997. Continuing, ongoing economic analyses will require additional resources.

Recommendation 20

The Washington State Department of Transportation should assess the need for improved summary materials on the passenger rail program, which would consistently and regularly address a broader range of program elements and contexts for use by decision-makers and other key stakeholders. These materials would be in addition to the intermittent updates on selected program milestones currently being provided.

Legislation Required: None
Fiscal Impact: None
Completion Date: December 1998

Agency Response: Concur.

An updated twenty year plan was recently completed and the Department has committed to summarize progress in semi-annual reports to the legislature. In addition, efforts are currently underway to establish, use and report consistent performance measures.

Recommendation 21

The Washington State Department of Transportation's current management systems should be enhanced to provide easier and more reliable mechanisms to track costs of projects and key activities, based upon Activity-Based-Costing concepts. These enhancements should enable the Department to understand better its current cost structure, the factors that influence highway project and program costs, and the corresponding costs of alternative ways to accomplish work.

Legislation Required: None
Fiscal Impact: $100,000 for review and conceptual design; coordinate with Recommendation 9
Completion Date: April 1999

Agency Response: Concur with the recommendation, but not with the cost or completion date.

The Department anticipates major data architecture and system enhancement efforts to implement this recommendation. These efforts will depend on the availability of information technology resources, currently devoted to the Year 2000 effort, and on future budget decisions by the Transportation Commission, the Legislature and the Governor.

Recommendation 22

Guidelines for the input of data to management and financial systems should be clarified by examples to indicate correct and consistent assignment of codes from the Chart of Accounts, so that these data support an accurate picture of activity-based costs within the Department. Enforcement of these guidelines should be considered by the Washington State Department of Transportation internal audit function.

Legislation Required: None
Fiscal Impact: None
Completion Date: December 1998

Agency Response: Concur.

The Chart of Accounts clarifications will be included in the upcoming revision and supported by additional training efforts.

Recommendation 23

Develop the principles, strategies and goals necessary to guide the Washington State Department of Transportation's management of the evaluation of its business. Pilot efforts that are undertaken by the Department in outsourcing or managed competition should be designed based upon the Department's and its stakeholders' thinking on its strategic business approach.

Legislation Required: None
Fiscal Impact: None
Completion Date: July 1999

Agency Response: Concur.

The Department is currently engaged in refining and updating the agency strategic plan and is committed to establishing and reporting performance measurements and indicators for all its programs, products and services. The Department is also engaged in developing the principles and strategies necessary to successfully undertake outsourcing and managed competition. The eventual pilot efforts will depend on legislative and gubernatorial authorization and concurrence.

Recommendation 24

Provide training to the Washington State Department of Transportation employees to assist them in reengineering their work approaches and empowering them to be competitive within the pilot efforts that are undertaken.

Legislation Required:	None
Fiscal Impact:	$250,000 to $500,000 to apply the ABC cost approach to selected WSDOT functions, provide assistance to employees in reengineering their work process, assist in bid review for managed competition, and provide training to employees on the managed competition environment. Cost savings associated with this effort are identified in Recommendation 11.
Completion Date:	July 2000; coordinate with Recommendation 11

Agency Response: Concur with the recommendation.

The fiscal impact will depend on the level of effort required. The resource requirement can only be defined once the Department's approach has been established and approved by the Washington State Transportation Commission, external decision makers and stakeholders. The completion date is subject to legislative and gubernatorial actions.

Recommendation 25

The evaluation of the pilot effort should be made within the context of the proposed business approach, and should compare the relative costs, cost savings and risks of the piloted approach versus current practice.

Legislation Required:	None
Fiscal Impact:	None
Completion Date:	July 2000; coordinate with Recommendation 11

Agency Response: Concur.

See comments to Recommendation 20 above.

Recommendation 26

Guidelines on implementing new ways of delivering departmental services, and on tracking and reporting the performance and costs of current and new delivery mechanisms, should be issued, interpreted, implemented, and managed consistently across the Washington State Department of Transportation Regions. The focus should be on ensuring that department-wide needs for consistency and standards are addressed without jeopardizing the regional need for flexibility in meeting local service requirements.

Legislation Required:	None
Fiscal Impact:	None

Completion Date: July 1999

Agency Response: Concur with the recommendation.

This effort will be supported by the continuing emphasis on the use of quality tools and principles throughout the Department as well as the current work on performance based budgeting and reporting. System enhancements to allow ready visibility of these measurements will depend on the completion of the Year 2000 effort and resource decisions on future budget submittals. The July 1999 deadline does not seem to be realistic

DATA SUPPORTING ANALYSIS OF HIGHWAY DESIGN

Appendix 3

Exhibit No. 3.1
Design Costs Broken Down By Region

WSDOT Region	No. Of Design Work Orders	Design Work Order Cost	Anticipated Construction Cost	Design $ as % of Construction $
Northwest				
WSDOT Only	24	$ 4,978,843	$ 39,006,449	12.8%
Average W/O Cost		*$ 207,452*	*$ 1,625,269*	
WSDOT + Consultant	40	$ 38,054,450	$ 165,220,277	23.0%
Average W/O Cost		*$ 951,361*	*$ 4,130,507*	
Northwest Total	**64**	**$ 43,033,293**	**$ 204,226,726**	**21.1%**
North Central				
WSDOT Only	18	$ 2,987,098	$ 13,747,403	21.7%
Average W/O Cost		*$ 165,950*	*$ 763,745*	
WSDOT + Consultant	16	$ 3,991,561	$ 13,698,684	29.1%
Average W/O Cost		*$ 249,473*	*$ 856,168*	
North Central Total	**34**	**$ 6,978,659**	**$ 27,446,088**	**25.4%**
Olympic				
WSDOT Only	30	$ 5,616,613	$ 22,206,525	25.3%
Average W/O Cost		*$ 187,220*	*$ 740,218*	
WSDOT + Consultant	29	$ 37,972,897	$ 38,354,317	99.0%
Average W/O Cost		*$ 1,309,410*	*$ 1,322,563*	
Olympic Total	**59**	**$ 43,589,510**	**$ 60,560,842**	**72.0%**
Southwest				
WSDOT Only	11	$ 1,670,756	$ 11,743,591	14.2%
Average W/O Cost		*$ 151,887*	*$ 1,067,599*	
WSDOT + Consultant	19	$ 6,409,515	$ 38,250,606	16.8%
Average W/O Cost		*$ 337,343*	*$ 2,013,190*	
Southwest Total	**30**	**$ 8,080,271**	**$ 49,994,197**	**16.2%**
South Central				
WSDOT Only	10	$ 1,066,682	$ 10,283,898	10.4%
Average W/O Cost		*$ 106,668*	*$ 1,028,390*	
WSDOT + Consultant	13	$ 3,390,970	$ 12,676,242	26.8%
Average W/O Cost		*$ 260,844*	*$ 975,096*	
South Central Total	**23**	**$ 4,457,652**	**$ 22,960,139**	**19.4%**
Eastern				
WSDOT Only	13	$ 1,377,759	$ 6,989,832	19.7%
Average W/O Cost		*$ 105,981*	*$ 537,679*	
WSDOT + Consultant	16	$ 5,799,201	$ 20,369,224	28.5%
Average W/O Cost		*$ 362,450*	*$ 1,273,076*	
Eastern Total	**29**	**$ 7,176,960**	**$ 27,359,055**	**26.2%**
Grand Total	**239**	**$113,316,345**	**$392,547,047**	**28.9%**

Exhibit No. 3.2

Change Order Reasons

CCIS Change Order Reason No. 1 Adjusted	Some Consultant Design		WSDOT Only Design		865 Projects Dataset	
	Total Reason Value	% of All CO's	Total Reason Value	% of All CO's	Total Reason Value	% of All CO's
Added work	$ 1,167,563	8.6%	$1,120,773	21.2%	$13,630,286	14.5%
Administration	$ 335,259	2.5%	$ 181,427	3.4%	$ 7,917,143	8.4%
Third party request	$ 2,605,885	19.2%	$ 832,395	15.8%	$ 4,053,068	4.3%
Unavoidable change	$ 306,979	2.3%	$ 123,231	2.3%	$ 1,352,328	1.4%
Major item over/und	$ 252,632	1.9%	$ 579,456	11.0%	$ 3,188,150	3.4%
Hazardous materials	$ 145,764	1.1%	$ 0	0.0%	$ 672,759	0.7%
Changed conditions	$ 2,109,126	15.5%	$ 812,158	15.4%	$ 8,258,448	8.8%
Inadequate field investigation	$ 8,870	0.1%	$ 28,358	0.5%	$ 169,461	0.2%
Spec ambiguity err	$ 96,441	0.7%	$ 350,734	6.6%	$ 610,940	0.7%
Plan error	$ 3,030,601	22.3%	$ 953,100	18.1%	$18,767,646	20.0%
Design change	$ 2,562,997	18.8%	$ 464,129	8.8%	$15,086,443	16.1%
Const eng error	$ 108,953	0.8%	$ 42,005	0.8%	$ 735,206	0.8%
Claim settlement	$ 0	0.0%	$ 2,023	0.0%	$ 6,327,849	6.7%
Delays	$ 631,894	4.6%	$ 112,748	2.1%	$ 2,890,704	3.1%
Other	$ 727,145	5.3%	$ 207,080	3.9%	$13,518,371	14.4%
DRB decision	$ 0	0.0%	$ 0	0.0%	$ 246,594	0.3%
Work method change	$ 934,444	6.9%	$ 93,653	1.8%	$ 151,196	0.2%
Spec change	$ 34,940	0.3%	$ 137,886	2.6%	$ 14,749	0.0%
Deleted work	($258,054)	-1.9%	($93,503)	-1.8%	($1,157,611)	-1.2%
Cost reduction incentive proposal	($1,015,858)	-7.5%	($3,921)	-0.1%	($1,605,258)	-1.7%
Contractor error	($40,696)	-0.3%	($434)	0.0%	$ 35,634	0.0%
COA revision	($15,426)	-0.1%	($204,067)	-3.9%	($553,613)	-0.6%
Budget constraints	$ 0	0.0%	$ 0	0.0%	($40,084)	0.0%
Non-spec material	($75,062)	-0.6%	($12,279)	-0.2%	($279,041)	-0.3%
Material subst	($60,668)	-0.4%	($459,239)	-8.7%	($164,648)	-0.2%
Interim maintenance problem	$ 0	0.0%	$ 12,039	0.2%	$ 45,040	0.0%
Impacts unchanged wk	$ 7,360	0.1%	$ 0	0.0%	$ 7,360	0.0%
Grand total	**$13,601,090**		**$5,279,751**		$**93,879,121**	

Exhibit No. 3.3

Design Costs Broken Down By Construction Project Winning Bid

Construction Project Winning Bid	No. Of Design Work Orders	Design Work Order Cost	Anticipated Construction Cost	Design $ as % of Construction $
< 250K				
WSDOT Only	36	$ 2,930,124	$ 5,720,698	51.2%
Average W/O Cost		*$ 81,392*	*$ 158,908*	
WSDOT + Consultant	38	$ 4,900,621	$ 6,335,576	77.4%
Average W/O Cost		*$ 128,964*	*$ 166,726*	
< 250K Total	**74**	**$ 7,830,744**	**$ 12,056,274**	**65.0%**
250K - 500K				
WSDOT Only	19	$ 2,963,099	$ 6,819,616	43.4%
Average W/O Cost		*$ 155,953*	*$ 358,927*	
WSDOT + Consultant	26	$ 6,713,907	$ 9,504,350	70.6%
Average W/O Cost		*$ 258,227*	*$ 365,552*	
250K - 500K Total	**45**	**$ 9,677,005**	**$ 16,323,966**	**59.3%**
500K - 750K				
WSDOT Only	17	$ 2,990,451	$ 11,740,323	25.5%
Average W/O Cost		*$ 175,909*	*$ 690,607*	
WSDOT + Consultant	16	$ 4,852,418	$ 10,521,982	46.1%
Average W/O Cost		*$ 303,276*	*$ 657,624*	
500K - 750K Total	**33**	**$ 7,842,869**	**$ 22,262,305**	**35.2%**
750K - 1M				
WSDOT Only	9	$ 1,439,703	$ 8,746,573	16.5%
Average W/O Cost		*$ 159,967*	*$ 971,841*	
WSDOT + Consultant	13	$ 6,544,923	$ 12,345,066	53.0%
Average W/O Cost		*$ 503,456*	*$ 949,620*	
750K - 1M Total	**22**	**$ 7,984,627**	**$ 21,091,639**	**37.9%**
1M - 1.5M				
WSDOT Only	9	$ 1,699,880	$ 11,081,677	15.3%
Average W/O Cost		*$ 188,876*	*$ 1,231,297*	
WSDOT + Consultant	10	$ 13,236,084	$ 10,623,775	124.6%
Average W/O Cost		*$ 1,323,608*	*$ 1,062,377*	
1M - 1.5M Total	**19**	**$ 14,935,964**	**$ 21,705,452**	**68.8%**
> 1.5 M				
WSDOT Only	16	$ 5,674,494	$ 59,868,811	9.5%
Average W/O Cost		*$ 354,656*	*$ 3,741,801*	
WSDOT + Consultant	30	$ 59,370,642	$239,238,600	24.8%
Average W/O Cost		*$ 1,979,021*	*$ 7,974,620*	
> 1.5M Total	**46**	**$ 65,045,136**	**$299,107,411**	**21.7%**
Grand Total	**239**	**$113,316,345**	**$392,547,047**	**28.9%**

STATE STATUTES RELEVANT TO MAINTENANCE CONTRACTING

Appendix 4

REVISED CODE OF WASHINGTON (RCW) STATUES
RELEVANT TO MAINTENANCE CONTRACTING

RCW 41.06.380

RCW 41.06.380 Purchasing services by contract not prohibited--Limitations.

Nothing contained in this chapter shall prohibit any department, as defined in RCW 41.06.020, from purchasing services by contract with individuals or business entities if such services were regularly purchased by valid contract by such department prior to April 23, 1979: PROVIDED, That no such contract may be executed or renewed if it would have the effect of terminating classified employees or classified employee
positions existing at the time of the execution or renewal of the contract. [1979 ex.s. c 46 § 2.]

RCW 47.28.030

RCW 47.28.030 Contracts--State forces--Monetary limits--Small businesses, minority, and women contractors--Rules.

A state highway shall be constructed, altered, repaired, or improved, and improvements located on property acquired for right of way purposes may be repaired or renovated pending the use of such right of way for highway purposes, by contract or state forces. The work or portions thereof may be done by state forces when the estimated costs thereof is less than thirty thousand dollars: PROVIDED, That when delay of performance of such work would jeopardize a state highway or constitute a danger to the traveling public, the work may be done by state forces when the estimated cost thereof is less than fifty thousand dollars. When the department of transportation determines to do the work by state forces, it shall enter a statement upon its records to that effect, stating the reasons therefor. To enable a larger number of small businesses, and minority, and women contractors to effectively compete for highway department contracts, the department may adopt rules providing for bids and award of contracts for the performance of work, or furnishing equipment, materials, supplies, or operating services whenever any work is to be performed and the engineer's estimate indicates the cost of the work would not exceed fifty thousand dollars. The rules adopted under this section:

(1) Shall provide for competitive bids to the extent that competitive sources are available except when delay of performance would jeopardize life or property or inconvenience the traveling public; and

(2) Need not require the furnishing of a bid deposit nor a performance bond, but if a performance bond is not required then progress payments to the contractor may be required to be made based on submittal of paid invoices to substantiate proof that disbursements have been made to laborers, materialmen, mechanics, and subcontractors from the previous partial payment; and

(3) May establish prequalification standards and procedures as an alternative to those set forth in RCW 47.28.070, but the prequalification standards and procedures under RCW 47.28.070 shall always be sufficient.

The department of transportation shall comply with such goals and rules as may be adopted by the office of minority and women's business enterprises to implement chapter 39.19 RCW with respect to contracts entered into under this chapter. The department may adopt such rules as may be necessary to comply with the rules adopted by the office of minority and women's business enterprises under chapter 39.19 RCW. [1984 c 194 § 1; 1983 c 120 § 15; 1977 ex.s. c 225 § 3; 1973 c 116 § 1; 1971 ex.s. c 78 § 1; 1969 ex.s. c 180 § 2; 1967 ex.s. c 145 § 40; 1961 c 233 § 1; 1961 c 13 § 47.28.030 . Prior: 1953 c 29 § 1; 1949 c 70 § 1, part; 1943 c 132 § 1, part; 1937 c 53 § 41, part; Rem. Supp. 1949 § 6400-41, part.]

NOTES:

Effective date--Applicability--Severability--Conflict with federal requirements--1983 c 120: See RCW 39.19.910 , 39.19.920.

Office of minority and women's business enterprises: Chapter 39.19 RCW.

RCW 47.28.035

RCW 47.28.035 Cost of project, defined.

The cost of any project for the purposes of RCW 47.28.030 shall be the aggregate of all amounts to be paid for labor, material, and equipment on one continuous or interrelated project where work is to be performed simultaneously. The department shall not permit the construction of any project by state forces by dividing a project into units of work or classes of work to give the appearance of compliance with RCW 47.28.030. [1984 c 194 § 2.]

ATTORNEY GENERAL'S MEMORANDUM

Appendix 5

Christine O. Gregoire
ATTORNEY GENERAL OF WASHINGTON
Transportation & Public Construction Division
PO Box 40113 • Olympia WA 98504-0113 • (360) 753-6126

M E M O R A N D U M

December 10, 1997

TO: Timothy C. Easton
Pacific Consulting Group

FROM: William L. Williams
Sr. Assistant Attorney General

SUBJECT: Legal Issues Relating to Performance Audit of the Department of Transportation

This memorandum follows up on our meeting of November 7, 1997, regarding legal issues associated with the performance audit of the Department of Transportation that is currently being conducted by the Joint Legislative Audit and Review Committee (JLARC). It is my understanding that you have been employed to assist in part of that audit. In that capacity, following our meeting, you forwarded a list of questions about possible legal issues relating to privatizing certain aspects of the Department's activities, particularly highway design and maintenance, and other issues arising during the performance audit.[1]

As we discussed, the answers to some of your questions are fairly clear, while answers to others are less so. Moreover, while you pose -- and I attempt to answer -- questions in the abstract, application of the principles discussed in this memorandum to a particular situation will depend very much on the specific facts of that situation.

In general, your questions request identification of "constitutional, statutory or collective bargaining" issues relating to privatization of highway maintenance and design activities. I begin with a general discussion of the various elements you have requested that I address. This discussion is designed to provide a framework from which to proceed to answer your questions.

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[1] Ordinarily the Attorney General's Office provides legal advice only to state agencies and officers and their employees. Since you have been retained for the purpose of participating in the legislatively-mandated performance audit, it is appropriate that I provide this memorandum to assist you in that process. I must caution you, however, that, like any informal opinion from an assistant attorney general, this memorandum reflects only the views of the author and does not necessarily represent the opinion of the Attorney General's Office.

I. EMPLOYMENT LAW ISSUES[2]

A. CONTRACTING OUT

The general rule in the state of Washington is that in the absence of legislative authority to do so a state agency may not contract with an outside provider for work traditionally performed by state employees. This rule is based upon a series of Washington appellate court decisions, most of which involved an interpretation of the higher education civil service law. Even though that law has since been repealed, the case law interpreting it would still apply because the current state civil service law is nearly identical in terms of its policy and pertinent language.

The first case was Cunningham v. Community College Dist. No. 3, 79 Wn.2d 793, 489 P.2d 891 (1971), in which the Supreme Court held that civil service food workers could not be laid off in order to contract food service to a private company. The next case in the series was Washington Fed'n of State Employees v. Spokane Comm'ty College, 90 Wn.2d 698, 585 P.2d 474 (1978). In that case, the college entered into a contract with a private organization to perform custodial services at a new administration building which had never been serviced by state employees. No existing employees were to be laid off or otherwise adversely affected in their employment by this contract. The college expected a cost savings over using civil service janitors as a result of the contract. The union objected on the grounds that custodial services historically had been provided by civil service employees. The Supreme Court agreed, holding that:

> as a matter of law, the College has no authority to enter into a contract for new services of a type which have regularly and historically been provided, and could continue to be provided, by civil service staff employees, . . .

79 Wn.2d at 100.

The court's analysis was based on the policy and language of the civil service law. It held that the procurement of services ordinarily and regularly provided by classified civil servants through independent contracts, although not specifically prohibited by the civil service law, directly contravenes its basic policy and purpose. Spokane Comm'ty College, 90 Wn.2d at 702-03.

In response to the Spokane Comm'ty College decision, the legislature enacted RCW 41.06.380 authorizing state agencies to purchase services by contract if (1) such services were regularly purchased pursuant to a valid contract prior to April 23, 1979; and (2) the contract does not have the effect of terminating classified employees or eliminating classified employee positions existing at the time of the execution or renewal of the contract. Thus, the legislature protected

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[2] This discussion draws largely on a memorandum authored by Senior Assistant Attorney General Richard A. Heath in connection with a 1995 study performed by the JLARC relating to privatization of prisons. Although the context of the two studies -- highway design and maintenance and prison operation -- are different, the legal principles governing state employees are essentially the same.

contracting out which was in place prior to the Spokane decision while leaving the decision in the Spokane case intact with respect to contracting out for new services.

The next case involved the layoff of state employee bakers as a result of a decision to buy bakery products from a private source. The court upheld the contract, concluding that the Spokane decision was limited to services and did not preclude an agency from laying off classified employees who had previously been used to produce products. Keeton v. Department of Social & Health Servs., 34 Wn. App. 353, 661 P. 2d 982 (1983). Subsequent cases have consistently followed the rationale of these three decisions.

It is important to note that these discussions are based on the court's interpretation of statutes; thus, it is possible for the legislature to alter or completely change the law as it relates to contracting out by enacting appropriate legislation. However, the legislative language should be clear and unambiguous to be assured that the desired purpose can be accomplished.

Specific legislative authority will be necessary if the state wishes to privatize highway maintenance without using state civil service employees.[3] Enacting a statute authorizing the department to contract out for maintenance of state highways would be consistent with the holding in the Spokane decision. The court stated in that case that before an agency will be allowed to contract out for services which have been historically provided by civil service employees, it must be authorized by "clear legislative expression to that effect." Spokane, 90 Wn.2d at 704-05. In order to avoid arguments over whether the legislature intended to authorize contracting out, the safest way to provide such authority would be in the form of an explicit direction in the statute to contract out the services involved.

A recent Court of Appeals decision is illustrative of the importance of clarity in drafting. In Washington Fed'n of State Employees v. Joint Ctr. For Higher Education, 86 Wn. App. 1, 933 P.2d 1080 (1997), the Joint Center for Higher Education's (JCHE) reliance on a general statute for authority to contract out for janitorial services was successfully challenged. The rationale used by the court in striking down the contract was that legislative exceptions to the prohibitions on contracting out will be narrowly construed to preserve the general rule. Initially, the statute in question in that case contained a provision stating, "The board shall contract for financial and personnel services." Six years later, the statute was amended authorizing the board to:

> . . . contract services as deemed appropriate to carry out its functions. Such services shall include, but not be limited to, facilities and project management, grants and contract development and monitoring, personnel services, and accounting.

RCW 28B.25.050 (emphasis added).

[3] Privatizing design is currently authorized, at least to some extent, as discussed more fully below at pp. 10-11.

The Washington Federation of State Employees brought a declaratory judgment action to enjoin JCHE from contracting out for janitorial services. It contended that the "include, but not be limited to" language of the amendment was not a blanket authorization to contract out, but instead, merely authorized contracting out in two additional professional employment areas -- facilities and project management and grants and contract development monitoring. The Court of Appeals affirmed the trial court order enjoining the contract, concluding that janitorial functions were not included in the authorization of contracting out because they were not management-type functions.

A related question is whether RCW 41.06.380 needs to be amended or repealed to accomplish contracting out. Repeal of RCW 41.06.380 is neither necessary nor appropriate if the legislature wishes to authorize privatization of highway maintenance and preserve contracting out that is currently in place. RCW 41.06.380 does not prohibit contracting out, except as to a subcategory of contracts it would otherwise authorize (*i.e.,* those having the effect of terminating employees or terminating classified positions). However, it does protect other state agencies from challenges to contracts which they currently have which meet the requirements of that statute. A recent Personnel Appeals Board (PAB) decision interpreting RCW 41.06.380 is illustrative. In Rinehart v. Department of Ecology and Dept. of General Admin., PAB No. V93-074 (1995), the PAB upheld the contracting for janitorial services at the new Department of Ecology headquarters building because janitorial services for the Department of Ecology had historically been provided by contract since before April 23, 1979, and no civil service employees were laid off because of the contract. This decision was appealed to the Thurston County Superior Court which affirmed the PAB, but was not appealed further, so there is no published appellate decision. Therefore, if there is a desire to deal with RCW 41.06.380 and to preserve existing authorization for contracts, any amendment or replacement should be drafted in a way that would preserve that authority.

B. COLLECTIVE BARGAINING

The enactment of a statute which authorizes contracting out would be consistent with the Spokane decision. However, doing so would not necessarily resolve all legal issues involved with the ability to contract out. A statute giving WSDOT discretion to contract out highway maintenance activities with nothing more, would still leave the issue as one that could be limited through the collective bargaining process. RCW 41.06.150(13) directs the Personnel Resources Board to adopt rules, consistent with the purposes of the civil service law, to provide procedures for:

> Agreements between agencies and certified exclusive bargaining representatives providing for grievance procedures and collective negotiations on all personnel matters over which the appointing authority of the appropriate bargaining unit of such agency may lawfully exercise discretion;

(Emphasis added.) Within that grant of rulemaking authority, the Board adopted WAC 356-42-050(1), which states in relevant part:

> (1) Written agreements may contain provisions covering all personnel matters over which the appointing authority of the appropriate bargaining unit of such agency may lawfully exercise discretion.

The statute and rules as currently written require an agency to bargain over personnel matters over which management can lawfully exercise discretion. If WSDOT is given discretion to contract out highway maintenance, then it could be faced with an argument that contracting out is a personnel matter that must be bargained with the designated bargaining agent. To avoid this, the legislature could either place statutory limits on WSDOT's discretion, or amend RCW 41.06.150(13) to eliminate WSDOT's discretionary decision to contract out highway maintenance as a bargainable item.

One final point: currently, WSDOT is a party to separate collective bargaining agreements governing its maintenance and design employees. It is my understanding that neither of these contracts includes a clause prohibiting contracting out of services, although the agreement covering professional engineers does require certain advance notice of contracting out of design services. If my understanding is incorrect, or if such clauses should be included in a future collective bargaining agreement before any legislative amendments are enacted, such amendments could be viewed as an impairment of those contracts. *See for example* Fed'n of Employees v. State, 127 Wn.2d 544, 563-64, 901 P.2d 1028 (1995) (holding that Initiative 134 which, *inter alia*, repealed the statute allowing state employee unions to bargain for deduction of membership dues from employees' salaries, could not be constitutionally applied to contracts containing such a provision in effect at the time the initiative passed). A more detailed analysis of this issue is included in Mr. Heath's memorandum referred to above, page 2, n. 2.

II. CURRENT WSDOT CONTRACTING STATUTES AND PRACTICES

By statute, WSDOT is directed to provide for "designing, constructing, improving, repairing, operating and maintaining state highways." RCW 47.01.260. There is no specific statutory direction as to how the design and maintenance activities are to be accomplished; however, by extrapolating from statutes governing the other functions the department is to perform, it is possible to identify legislatively imposed limitations on how the design and maintenance functions can be accomplished. I address each in turn.

A. MAINTENANCE ACTIVITIES

RCW 47.28.030 provides, in relevant part:

> A state highway shall be constructed, altered, repaired, or improved, and improvements located on property acquired for right of way purposes may be repaired or renovated pending the use of such right of way for highway purposes, by contact or state forces. The work or portions thereof may be done by state forces when the estimated costs thereof is [sic] less than thirty thousand dollars: PROVIDED, That when delay of performance of such work would jeopardize a state highway or constitute a danger to the traveling public, the work may be done by state forces when the estimated cost thereof is less than fifty thousand dollars. . . .

This statute does not speak directly to maintenance activities. However, it must be read in conjunction with the general public works law applicable to all state and local agencies, RCW 39.04, which defines a public work as including "all work, construction, alteration, repair, or improvement other than ordinary maintenance." RCW 39.04.010, emphasis added.[4]

Reading these two statutes together, the legislature has identified "work" on state highway systems as being divided into one of five categories: (1) construction, (2) alteration, (3) improvement, (4) repair, and (5) maintenance.[5]

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[4] It is arguable that RCW 39.04 has no application to highway construction activities since they are covered by the more specific RCW 47.28.030. *See*, Ronken v. County Commissioners, 89 Wn.2d 304, 313, 572 P.2d 1 (1977) (holding that the more recent and more specific RCW 36.77.070 relating to county road construction prevails over RCW 39.04); and Contractors v. Ellensburg School Dist., 96 Wn.2d 806, 810-11, 638 P.2d 1220 (1982) (holding that exemption of "ordinary maintenance" from the definition of public work and bidding or notice requirements of RCW 39.04 was "inapplicable" to the school district, which was subject to requirements under RCW 28A.58.135 [since recodified as RCW 28A.335.190] to competitively bid, *inter alia*, "improvements, or repairs, or other work.")

[5] One could argue that the reference to "ordinary maintenance" in RCW 39.04 suggests the existence of a sixth category, *i.e.*, "extraordinary maintenance," and in fact the Department of Labor and Industries, for purposes of implementing the prevailing wage law, RCW 39.12, has differentiated "maintenance" from "ordinary maintenance." *Cf.* WAC 296-127-010(7)(a)(iv) defining maintenance as "keeping existing facilities in good usable, operational condition" and WAC 296-127-010(7)(b)(iii) defining "ordinary maintenance" as "work . . . performed on a regularly scheduled basis (e.g., daily, monthly, seasonally, semiannually, but not less frequently than once per year), to service, check, or replace items that are not broken; or work not performed by contract that is not regularly scheduled but is required to maintain the asset so that repair does not become necessary." This distinction has no direct implication for the interpretation of RCW 47.28.030, since, by its terms, the Labor and Industries definition applies only to work actually contracted out. However, as will be discussed more fully below, issues involving interpretation of these statutes are difficult and complex. In my opinion, any attempt to distinguish between maintenance that is "extraordinary" but not "construction, alteration, improvement or repair" and "ordinary maintenance" would simply add to the complexity. Moreover, the concept of "extraordinary maintenance" becomes easily confused with the phrase "heavy maintenance" used in federal standards for emergency relief funding under 23 CFR § 668.101, *et seq.*. The federal emergency reimbursement system focuses on the magnitude of the maintenance effort required (*i.e.*, beyond that which WSDOT could reasonably have been expected to plan for), rather than on the nature of the maintenance activities generally, while analysis of the requirements of RCW 47.28.030 focuses primarily on the nature of the activity. Since any activity that might be considered "extraordinary maintenance" would of necessity also constitute either "construction, alteration, improvement or repair," most likely the latter, I find it less confusing

Having said that, the next question becomes which of the five categories a particular activity constitutes. In general, it is relatively easy to differentiate activity constituting "construction, alteration or improvement" from maintenance. And there is a fairly well-recognized group of activities that most would agree fall clearly into the category of maintenance. This would include snow removal, cleaning out ditches and culverts, repainting faded lane markers, just to name a few.

There are some instances, however, where a particular activity could arguably be considered either "maintenance" or "repair." Consider, for example, filling and patching a pot hole -- is this "maintenance" or "repair"? The legislature has provided little guidance in answering this and similar questions because it has not defined either of these terms. Two rules of construction are used by the courts in construing statutory language that has not been statutorily defined. One is to assume that the legislature intended the term not statutorily defined to be understood in its common, ordinary sense, as reflected in a dictionary definition. *See for example* State ex rel. Olympia v. Olympia Light & Power Co., 91 Wash. 519, 532, 158 P. 85 (1916) (relying on Webster's Dictionary to define "maintain," albeit in a different context); *see also* Garrison v. State Nursing Bd., 87 Wn.2d 195, 196-97, 550 P.2d 7 (1976) (Supreme Court relied on dictionary definition of word "distribute" in overturning licensing disciplinary action against registered nurse who used drugs, but did not "distribute" them to others).

An alternative approach used by the courts has been to rely on the interpretation of the statute by the agency charged with its administration. *See for example* Hart v. Peoples Nat'l Bank, 91 Wn.2d 197, 201, 588 P.2d 204 (1978) (adopting Supervisor of Banking's established interpretation of the word "town" as used in bank branching statute).

As you will see, neither of these approaches to determine whether a particular activity is categorized as "maintenance" or "repair" provides a completely satisfactory means of determining whether a particular activity is "maintenance" or "repair." The dictionary defines "maintain" as follows:

> to keep in a certain condition or position, especially of efficiency, good repair, etc.; to preserve; as, the state *maintains* the roads.

Webster's New Twentieth Century Dictionary of the English Language, Unabridged, (2d Ed. 1962) (emphasis in original).[6]

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to use the term "maintenance." Accordingly, in my opinion, these two statutes should be read as categorizing state highway work into one of the five categories identified above.

[6] The definition of "maintain" referred to by the Supreme Court in the Olympia Light & Power Co. case referred to above is similar:

> "The word 'maintain' . . . means to keep up, to keep from change; to preserve; to hold or keep in any particular state or condition. . . ." 91 Wash. at 532.

The same dictionary defines "repair" as follows:

> to restore to a sound or good state after decay, injury, dilapidation, or partial destruction; to mend; as, to *repair* a house, a wall, or a ship; to *repair* roads and bridges.

Id.

Using these definitions, one could argue that a particular activity, *e.g.*, filling and patching a pothole, is either "repair" (*i.e.*, restoring the road surface to a sound or good state), or "maintenance" (*i.e.*, keeping the roadway in a passable condition and preserving it by preventing the pothole from becoming larger, as would likely happen were the patch and fill not undertaken).

Similarly, relying on the WSDOT's past practices in administering the statute is likewise not entirely satisfactory. While these practices have been documented to some extent in the WSDOT Maintenance Manual, there is at least anecdotal suggestions from WSDOT staff that implementation of the statute has not been entirely consistent either from region to region, or over time. To further confuse the issue, WSDOT activities are classified as maintenance or construction for other purposes, *i.e.* funding, in a wholly different context using different criteria. Thus, some activities (*e.g.*, replacement of a deteriorating bridge structure with no enhancement of the bridge's capacity) might be considered as "maintenance" for funding purposes, and "construction" or "repair" for purposes of RCW 47.28.030. In the final analysis, the determination of whether a particular activity constitutes "repair" or "maintenance" involves a judgment based on the specific facts of the particular activity, the commonly understood definition of the terms, and the history of WSDOT's implementation of the statute.

Were the statutory requirement to contract out all "repair" work absolute, this distinction between maintenance and other activity would be more critical, and less of an academic exercise. However, the statutory requirement is not absolute. Rather, the statute provides that even work that is clearly not maintenance "may be done by state forces when the estimated costs thereof is [sic] less than thirty thousand dollars: . . ."[7]

While this provision does not address the differentiation between "repair" and "maintenance" activities, it does mitigate the significance of that distinction, since even if

[7] A higher limit of $50,000 is authorized "when delay of performance of such work would jeopardize a state highway or constitute a danger to the traveling public, . . ." RCW 47.28.030. Application of that standard to particular patterns can also be challenging. However, since your questions do not address emergency issues, I have not done so either, but the differentiation between maintenance and non-maintenance activities is the same regardless of which statutory limit is involved.

"repair" work is mischaracterized as "maintenance" and performed by state forces, the statute is not violated as long as the estimated cost of state forces is less than the statutory amount.

Unfortunately, that in turn raises additional questions, specifically two: (1) what elements of the work are included when calculating the amount of non-maintenance work that may be completed with state forces; and (2) which activities, or groups of activities, should be included in determining whether the statutory limit has been violated?

The first question has been specifically answered by the legislature: RCW 47.28.035 provides that the "cost of any project for the purposes of RCW 47.28.30 shall be the aggregate of all amounts to be paid for labor, material, and equipment . . . ." Thus, any department-owned materials or equipment, as well as the labor costs of using state forces, are included.

The same statute attempts, somewhat less successfully, to answer the second question. Costs are to be determined by "project," or "one continuous or interrelated project where work is to be performed simultaneously." RCW 47.28.035. On its face, this statutory language is problematic in at least two respects. First, it in effect defines "project" in its own terms, *i.e.*, a project is a continuous or interrelated project. Second, the last phrase -- "where work is to be performed <u>simultaneously</u>" (emphasis added) -- is, if read literally, nonsensical. Highway work can virtually never be performed "simultaneously;" rather, it is performed in a logical sequence over a period of time. For example, construction of a new section of highway requires excavation, construction of road bed, paving, striping, and, if appropriate, installation of guardrail, signage, or other auxiliary items. These activities must be performed in sequence; it is not possible to perform them "simultaneously." Similarly, repaving an existing highway will take place sequentially in segments, over a length of time, not "simultaneously."

To address this seemingly improbable result, I have used a broader definition of "simultaneously" in advising the department. In general, it is my opinion that activities carried out in a logical and chronological sequence to produce a desired end result are considered to be done "simultaneously" for purposes of RCW 47.28.035.

I should also point out that whether work being performed is "continuous or interrelated" can also be susceptible to different interpretations, depending on the facts and circumstances. Take, for example, the pothole fill and patch work I referred to above. Generally, most small potholes can be filled and patched for far less than the thirty thousand dollar limit for state force work set forth in the statutes. Thus, whether the work is "maintenance" or "repair" is largely academic. However, where there are a number of potholes in close-enough proximity so that the patch and fill work is "continuous or interrelated," the distinction becomes more meaningful. If the work is "maintenance," the statutory limit doesn't apply. If, on the other hand, it is "repair," then a determination must be made as to whether it is one or more "projects" to determine statutory compliance.

In summary, determination of compliance with the requirements of RCW 47.28.030 involve sometimes difficult judgments about whether particular activities constitute "maintenance" or "repair," and whether, if the latter, they are "continuous or interrelated" and performed "simultaneously" so as to constitute one project, the costs of which are included in determining whether the statutory limits for use of state forces have been exceeded. These judgments are intensely fact-specific, often subject to debate or disagreement, but reflect, in my opinion, the best good faith attempt that can be made to comply with the general legislative guidance that has been given to date.

B. HIGHWAY DESIGN.

The only explicit legislative direction relating to highway design is found in RCW 47.01.260 which, as noted above, directs WSDOT to provide for "designing . . . state highways," and RCW 43.27.040 which requires such design work to be accomplished "[b]efore entering into any contract" under RCW 47.28.030.

And, in fact, WSDOT has a long history of employing a sufficient engineering and other staff to accomplish much of the design work that has been required over the years. Thus, for the most part, design of state highways is work that has been "regularly and historically provided . . . by civil service staff employees" in the terms used by the Supreme Court in the Spokane case.

However, it is my understanding that the quantity and nature of design work needed has varied over time, and that WSDOT also has a history of contracting out design work when the volume was such that agency staff were insufficient to accomplish the work in a timely manner or when there was a need for a particular kind of expertise that was not available in-house. This falls within the category of contracting out that the legislature approved by the enactment of RCW 41.06.380, *i.e.*, the services were provided regularly by contract prior to April 23, 1979, and the practice of continuing to contract out as needed does not result in termination of state employees or elimination of civil service positions.[8]

That being the case, no further legislative action is required to allow design work to continue to be contracted out consistent with this historical practice. On the other hand, if there is a desire to authorize or require contracting out of design work beyond that which has historically been provided, the comments above relating to contracting out highway maintenance pertain as well. Such legislation should be clear, should address collective bargaining issues, and should specify any desired changes in the manner in which contracts are awarded.[9]

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[8] The passage of time since the enactment of RCW 41.06.380 has created the possibility that it may become increasingly difficult for one party or another to prove or disprove whether particular services were or were not in fact "regularly purchased by valid contract . . . prior to April 23, 1979," should it be necessary to do so.

[9] Under current law, since design services involve engineering expertise, they are contracted as personal services subject to RCW 39.80.

One final point before addressing your specific questions: I have, in this general discussion, focused on the law as it exists today. It is largely drawn from the specific statutes and the interpretation given to these statutes by the courts. Any of the policies reflected in these statutes can be changed via legislation, although as noted above, care must be taken in drafting legislation so the legislative intent is clear and incontestable. If, as a result of conducting the performance audit, JLARC determines to recommend legislation, our office would welcome the opportunity to assist in the drafting and/or review specific proposals.

III. SPECIFIC QUESTIONS

Now to the specific questions you have posed, which, for ease of reference, I repeat as each is addressed.

1. ***What are the specific legal restraints to privatizing highway maintenance services beyond the current levels?***

The only current legal restraint is state statute, as interpreted by the courts. To accomplish the outcome expressed in the question, legislation would be required to give the department clear, unambiguous authority to contract out maintenance work that is currently being performed by state employees. If the intent is that the department could have the discretion to either use state forces or contract out the work, and that the department could not bargain away its discretion, then legislation would have to be enacted to eliminate contracting out as a bargainable issue.

2. ***What are the specific legal restraints to increasing the bid limit thresholds to allow greater flexibility in the use of state forces beyond the current $30,000 level?***

Again, the only restraint is the current state statute which can be amended. To some extent, the department's flexibility under the current law is also limited by the practical problems in applying the law. If there is a desire to amend RCW 47.28.030 and .035, the legislature may wish to consider clarifying some of the issues discussed above in applying the existing language as well.

3. ***RCW 47.28.030 refers to a "state highway [that is] constructed, altered, repaired or improved…". Our highway program experience suggests that "repaired" could be interpreted to include those activities in the maintenance program that deal with the preservation of road surfaces, bridges, and other structures, features, and appurtenances (e.g., pavement patching, sealing, and crack filling; guard rail repairs; drainage cleaning; bridge deck repairs; reopening of a highway blocked by a slope failure). Did the legislature intend that RCW 47.28.030 should address some or all of the DOT's highway maintenance activities? Please explain. Also, does the scope of a***

"public work" as defined in RCW 39.04 influence the interpretation of what "project work" is addressed by RCW 47.28.030?

This question has no easy answer. As your question points out, it is possible to characterize at least some traditional maintenance activities as "repairs," and, as discussed above, the distinction between what is a "repair" and "maintenance" can be problematic in some circumstances. However, there is now a fairly well-established history of the types of work performed by maintenance forces, and, absent legislative amendment, this history would support both an administrative interpretation of the definition of "maintenance" and an argument that such work cannot be contracted out. Again, with appropriate legislative amendment, the department could be empowered to contract some or all maintenance work, including that which is arguably "repair."

Whether that was the original legislative intent behind RCW 47.28.030 is difficult to determine, given that the statute was enacted in 1937. However, the intervening sixty years of practice would weaken any argument that the specific items of work mentioned in your questions, generally considered maintenance and performed by WSDOT maintenance forces, were intended to be considered as "repairs" and contracted out.

Finally, it has generally been our office's practice, in advising the department, to read RCW 39.04 and 47.28.030 together (*see* discussion above, page 6, especially n. 5). Again, if it is the legislature's desire to clarify the relationship between these two statutes, it can do so with appropriate amendatory language.

4. ***Does RCW 47.28.030 provide the WSDOT the authority to contract for maintenance services with small businesses, and with women- and minority-owned businesses, below the $50,000 threshold? If so, how does this authority relate to or conflict with the prohibition to contracting for work historically performed by state forces as found in the Civil Service Law and subsequent court decisions? What is the precedence between the Civil Service Law and statutes such as RCW 47.28.030?***

There is nothing in RCW 47.28.030 that allows contracting out of maintenance services. The language to which you refer establishes an alternative method for bidding out "construction, alteration, improvement or repair" projects where the estimated cost will not exceed fifty thousand dollars.

In general, as discussed above, if it is desired to reverse the Supreme Court's interpretation of the civil service law as prohibiting contracting out work historically performed by state employees, the legislature would have to enact clear and unambiguous language authorizing the department to do so.

5. ***What was the legislative intent of RCW 47.28.035? Was it intended to cover construction projects only, or any work that "constructs, alters, repairs, or improves" a highway, including maintenance work that "repairs" a roadway?***

Since RCW 47.28.035 specifically refers to RCW 47.28.030, it appears that the intent of the former is to clarify the latter, by specifying which costs were to be included and attempting to delineate which work was to be considered in calculating the statutory limit. RCW 47.28.030 applies to "construction, alteration, improvement and repair." As discussed above, it may be arguable that certain work traditionally performed by maintenance workers is truly "repairs." RCW 47.28.035 doesn't help answer that question, unfortunately. Moreover, for activities that are correctly determined to be "maintenance," RCW 47.28.035 has no application, since the limits on the use of state forces do not apply to "maintenance" activities.

6. **According to RCW 47.28.030, "…work or portions thereof may be done by state forces when the estimated costs thereof are less than $30,000." What are the legal issues surrounding the definition of "work or portions thereof" when considering work eligible to be contracted? RCW 47.28.035 attempts to deal with this issue in part by defining the "cost of any project for purposes of RCW 47.28.030… (as)… the aggregate of all amounts to be paid… on one continuous or interrelated project where work is to be performed simultaneously." However, this seems to shift the definitional issue to what is "one continuous or interrelated project where work is to be performed simultaneously." From a legal standpoint, what is an appropriate method of resolving such definitional issues? Could the provisions of RCW 47.28.030 and 035 be construed to apply to a maintenance work zone?**

The "work or portions thereof" language refers to that part of work on a project that is performed using WSDOT employees, equipment and materials. Consider, for example, an effort to repair an embankment using WSDOT employees, equipment and materials. Assuming, arguendo, that this is a "repair" and not "maintenance," the statute applies, and the state forces must not be used if the estimated cost of all three combined exceeds the statutory limit. On other hand, if the equipment is rented from a private contractor, and materials contracted for delivery from a private supplier, state employee labor could be used if that labor "portion" of the project was estimated to be below the statutory limit.

The balance of your question and the discussion above (pp. 5-10) illustrate some of the difficulties encountered in applying the current law. As pointed out previously, the "appropriate method of resolving such definitional issues" is through legislation which could, for example, include the establishment of "maintenance work zones." The policy choice is one for the legislature; my only caution is that the choice be spelled out in language that will be clear to the department and to the courts.

7. ***How do the definitions of "work" in RCW 47.28.030 and "project" in RCW 47.28.035 compare with one another? What is "ordinary maintenance" in RCW 39.04? What***

implications do these definitions have for interpreting what services are eligible for contracting?

Under current law, these terms define what must be bid -- *i.e.,* construction, repair, alteration and improvement -- and what need not be bid and in fact has historically been performed by state employees -- *i.e.,* maintenance. "Work" includes all categories that must be contracted out -- "construction, alteration, improvement or repair." A "project" is those elements or units of work that are to be included in determining the compliance with statutory limits on use of state forces.

See above (p. 6, esp. n. 5), for cases suggesting that the term "ordinary maintenance" does not apply to RCW 47.28.030, and for reference to the definition of "ordinary maintenance" established by the Department of Labor and Industries for purposes of the prevailing wage law. As expressed more fully there, in my opinion, the term "ordinary maintenance" is not applicable to RCW 47.28.030.

8. ***How do the legal issues differ, if at all, if the WSDOT desired to contract for maintenance services with a local government agency instead of a private sector business?***

In general, state and local agencies are authorized to contract with each other to perform services for each other that either could perform. *See generally* RCW 39.34, the Interlocal Cooperation Act. However, this statute does not give a state agency authority to contract with a city or county to perform work traditionally performed by state employees. *See* WWU v. Fed'n of State Employees, 58 Wn. App. 433, 439-40, 793 P.2d 989 (1990) (action by university to lay off campus police officers and contract with city for campus security violated applicable civil service laws). Thus, absent legislative amendment, the result is the same whether the proposal is to contract with a private sector or public sector service provider.

9. ***Please consider the following potential future scenario:***

The WSDOT elects to develop a new "Major Maintenance" Program that "bundles" certain activities from the current Maintenance Program and puts these "contracts" out for bid for performance by the private sector. What legal steps would be necessary or recommended to implement this scenario? Would the legal issues and steps differ if WSDOT elected to contract for "roadway preservation" maintenance activities (e.g., bridge deck repair, pavement crack sealing, repair of damaged or aging guardrail, etc.) versus "customer service" maintenance activities (e.g., rest area cleaning, towing, snow plowing, grass mowing, etc.)?

The primary step necessary to authorize contracting of maintenance would be to enact legislation clearly giving the department authority to contract out maintenance. The amendments

should also address whether contracting is mandatory or discretionary, and if the latter, whether the right to contract out is subject to collective bargaining. (*See* comments above at pp. 2-5). If there is a desire to require that prospective bidders meet pre-qualification or other standards, as is the case with construction contracts under RCW 47.28.070, the amendments should address that issue as well.

Under current law, most purchased services contracts for most state agencies are awarded through competitive bidding by the Department of General Administration under RCW 43.19.190, *et seq.* If it is desired that maintenance contracts be awarded through some other mechanism, the amendments should specify how and by which agency the contracts are to be awarded. Finally, the legislation should address whether some or all of the contracted services will be subject to the prevailing wage law, RCW 39.12.

Finally, if the desire is to differentiate among various services, such as the examples in your letter, this differentiation should be spelled out as clearly as possible in the legislative amendments as well.

10. ***What are the legal steps necessary to overcome the constraints on use of state forces beyond the current bid limits in RCW 47.28.030?***

A legislative amendment would be necessary to change, or "overcome," the limitation on the use of state forces set forth in RCW 47.28.030.

OTHER QUESTIONS

1. ***What was the intent of Article 18 of the Washington state constitution? In the context of this Article, what are the legal issues surrounding the imposition of a sales tax on WSDOT highway construction projects? What is the specific authority that makes this tax constitutional?***

The gravamen of these questions appears to be whether there are any constitutional infirmities in the statutory imposition of a general fund sales tax on state highway construction projects which are partially funded by highway fund taxes in view of the state constitutional provision that such taxes are "to be used exclusively for highway purposes." Wash. Const., art. II, § 40, as amended by amendment 18.

It is conceivable that one could frame an argument that, to the extent that sales tax actually has been paid from funds subject to amendment 18, such payment violates the

constitutional restriction.[10] In the twenty-six years since the sales tax statute was amended to make state highway construction subject to the sales tax this issue has not been litigated, and therefore there is no definitive resolution. However, in my opinion, it is unlikely that any such argument, if raised, could prevail in court, for several reasons.

First, the person raising the challenge would have to establish that sales tax was in fact paid from highway fund taxes rather than from some other source, such as federal participation or other state taxes (*e.g.* the motor vehicle excise tax) that have been used to pay for highway construction over the years but are not subject to the restrictions of amendment 18.

Second, it appears that the sales tax has been identified as a source of state revenue because it is tied to economic activity, *i.e.*, the sale and purchases of goods and services. I believe that the legislature, by including construction of highway projects as subject to the tax, simply recognized such projects as one more indication of economic activity and determined that the tax should be included as a cost of conducting that activity on the same basis as other economic activity.

Finally, even if it could be established that sales tax has been paid from motor vehicles funds, and that this violates the constitutional restriction, I would argue that any such tax paid to the general fund should be offset by general fund taxes (again citing the motor vehicle excise tax as an example) that have from time to time been devoted to highway purposes. My expectation is that the amount of such non-amendment 18 funds that have been used for highway purposes over the years exceeds any sales taxes that may have been collected from amendment 18 funds, and thus any alleged constitutional violation, if it exists, has not in fact undercut the purpose of the 18th amendment.

In my opinion these arguments, individually and collectively, would defeat any attempt to have the current sales tax statute as it applies to state highway construction activity declared to be a violation of amendment 18.

2. *What would be the legal impediments to having WSDOT exempt from the state's prevailing wage law?*

If the legislature wishes to do so, it may exempt WSDOT projects from the state prevailing wage law (RCW 39.12) by enacting an amendment to the statute. It should be recognized that highway projects supported by federal funds would continue to be subject to the federal equivalent, the Davis-Bacon Act (40 U.S.C.A. § 276a), made applicable to federally-funded highway construction projects by the Federal Aid Highway Act, 23 U.S.C. § 113(a).

[10] Such an argument would perforce apply not only to sales tax imposed on highway construction, but also to other activities paid for with motor vehicle fund monies, such as State Patrol automobiles, Department of Licensing computers, etc.

There may also be a constitutional argument raised if such legislation were enacted. Generally, the Equal Protection Clause of the Fourteenth Amendment and the privileges and immunities clause of article 1, section 12, of the state constitution require that the state treat equally those who are situated similarly unless there is a rational basis justifying differential treatment. If an amendment were enacted exempting WSDOT highway projects from the prevailing wage laws, it could be argued that contractors who were similarly situated (*i.e.* contractors performing public works in Washington) were being treated differently, in that those working on WSDOT state-funded projects were exempt from the prevailing wage law, and those working on all other public works (including WSDOT projects funded from federal or other sources) were not.[11] To help defend against an argument that such differential treatment deprived the latter group equal protection of the law, any amendatory legislation should clearly spell out a rational basis for the differentiation.

3. ***What was the legal intent of the state's prevailing wage law beyond the already existing federal Davis-Bacon Act?***

The federal Davis-Bacon Act applies by its terms to projects "to which the United States or the District of Columbia is a party." Under the Federal-Aid Highway Act, 23 U.S.C. § 113(a), the provisions of the Davis-Bacon Act are extended to all highway projects funded at least in part by federal funds. The effect, and presumed intent, of the state prevailing wage law was to extend similar requirements to <u>all</u> public works projects, not just those constructed or funded by the federal government.

CONCLUSION

I know that the foregoing does not give the sort of clear and unambiguous answers you would have liked -- unfortunately, such answers simply don't exist for reasons which I have attempted to identify in this discussion. Notwithstanding this lack of clarity, I hope that the foregoing will be of assistance to you. Please do not hesitate to contact me if you would like to discuss these issues further.

WLW:am

cc: Bob Thomas, JLARC Staff
Elaine Rose, Assistant Attorney General
Sid Morrison, Secretary, Department of Transportation

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[11] The argument could also be made by workers in reverse, *i.e.*, that those working on WSDOT projects funded from federal or other sources would enjoy the benefit of the prevailing wage law, while those workers employed on state-funded projects would not.

STATUS OF ENVIRONMENTAL COST-SAVING PROPOSALS

Appendix 6

ENVIRONMENTAL COST SAVINGS AND PERMIT COORDINATION STUDY

The bold R number and the text in normal font identifies the original recommendation; the succeeding paragraph in italics describes the current status of implementation.

R1 – The Department of Transportation should establish an outreach program designed to improve interagency understanding of mandates and constraints under which state and local transportation and resource agencies must operate.

WSDOT has participated in a number of such projects, including the Governor's Task Force on Regulatory Reform, Statewide Wetland Integration Strategy (SWIS), Study of the Relationship Between State-Owned or Operated Transportation Facilities and Local Comprehensive Plans (LOS Study), Senate Bill 5572 Environmental Cost Study, Watershed Coordinating Council, Model Toxics Control Act (MTCA), and the Interagency Working Agreement to Integrate Special Aquatic Resources (404) Permit Requirements into the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA).

R3 – The Department of Transportation should evaluate options for inter-agency cross-training of environmental personnel with the Departments of Ecology, Fish and Wildlife, and Natural Resources.

WSDOT has several courses with open invitations for participation by outside agency personnel, including, for example, a course in sediment and erosion control. Cross-training with regional managers of Fish and Wildlife will commence shortly.

R5 – In cooperation with the Office of Financial Management, the Departments of Transportation and Ecology should develop a pilot Alternative Dispute Resolution process. The process should be applied, as needed, to disputes involving Transportation and Ecology for a 12-month period, after which time Transportation and Ecology would evaluate the success of the process and make any necessary revisions. The Department

of Transportation should then develop similar alternative dispute resolution processes with the Department of Fish and Wildlife and The Department of Natural Resources.

An alternative dispute resolution process has not been developed. WSDOT has funded a position at Ecology for the past three-and-one-half years which, among other tasks, provides dispute resolution services. A similar procedure is used with Fish and Wildlife.

R6 – The Department of Transportation should evaluate its current rating system for determining which projects are funded as research projects. Environmental issues that have a significant adverse effect on the delivery of the Transportation Program would be rated higher in the evaluation process, based on the magnitude of the negative impacts.

WSDOT has one full-time position for environmental research oversight. The Environmental Strategy Team's (EST) research policy gives top priority to issues of environmental and regulatory significance and the EST helps guide decision-making on the selection of research projects.

R7 – The Department of Transportation should actively pursue joint interagency funding of environmental research projects, such as those related to eelgrass beds, that affect transportation improvement projects.

WSDOT has received external funding toward several objectives: e.g., Department of Health funds for a wellhead protection database, FHWA funds to develop a cultural resources geographic information system (GIS) layer, and EPA funds for a groundwater GIS layer, among other projects. It is pursuing other opportunities.

R10 – As a demonstration project, the Legislative Transportation Committee should select one Regional Transportation Planning Organization (RTPO) to establish and evaluate the effectiveness of an environmental review on its transportation plan. The selected RTPO should use its best efforts to involve state and local regulatory agencies in the planning phase of its regional transportation plan, and efforts to facilitate identification of multi-jurisdictional project opportunities among its member jurisdictions and/or with the Department of Transportation.

The Department was successful in its recent efforts to secure approval from the Federal Highway Administration of funding for a pilot study of WSDOT's corridor planning process and environmental coordination of NEPA requirements. This NEPA Re-invention Pilot will link RTPO decision making to WSDOT's transportation system plans and, ultimately, to environmental decision making.

R13 – The Department of Transportation should construct a demonstration wetlands bank to provide compensatory mitigation for projected unavoidable adverse wetland impacts associated with a specific project or set of projects, in accordance with the provisions of the Washington State Department of Transportation: Wetland Compensation Bank Program, Memorandum of Agreement of September 15, 1994.

WSDOT has been very active in pursing wetland banking opportunities. The legislature has recently established a revolving account for such activities, but the requested $10 million to advance-fund the program was not approved.

R15 – The Department of Transportation should develop a model shared-use agreement for reducing and allocating liabilities between parties participating in joint stormwater management facilities, including vactor waste treatment and disposal systems.

While a model has not yet been developed, WSDOT has developed joint vactor waste treatment and disposal systems with various partners.

R16 – The Department of Transportation should form an interagency task force of regional, state and local transportation agencies, the Departments of Ecology, Fish and Wildlife, and Natural Resources, and the Federal Highway Administration to develop a common definition of the terms mitigation, retrofit, and enhancement.

While a formal task force has not been appointed, there has been extensive activity between the parties in other forums and progress is being made for consistent definitions of mitigation, retrofit, and enhancement.

R18 – The Department of Transportation, in cooperation with the Departments of Ecology, Fish and Wildlife, and Natural Resources, should establish an interagency management team to determine where available retrofit and enhancement funds would provide the most benefit to the environment based on regional resource management plans.

WSDOT has implemented this as a key element in its overall watershed approach to environmental mitigation and in coordinating agency expenditures in accordance with the requirements of the 1997–1999 Capital Program Budget (SB 6063).

R22 – The Department of Transportation, in cooperation with city and county public works agencies, should form a committee to identify existing rules that should receive priority in any review or appeal process enacted as a result of the Task Force (on Regulatory Reform) recommendations.

WSDOT is an active member of the Land Use Study Commission, working with city and county officials on implementing recommendations of the Task Force and has worked with other state agencies in developing model ordinances for use by local governmental units.

R25 – For one or more projects requiring formation of an Interdisciplinary Team (IDT), WSDOT should create an IDT consisting of a core team that includes at least one representative from the planning, environmental, design, construction, and operations divisions, and a project manager familiar with each area. The IDT would be expanded to include additional members from within WSDOT and state permitting agencies during appropriate stages of the project development process, such as during the development of project alternatives or design options to avoid or minimize adverse environmental impacts.

WSDOT has several IDTs with planning, environmental, and design representatives. The new NEPA decision-making process will include an interdisciplinary team with representatives from all these groups. The team will have management responsibility for the environmental process. The new process will be pilot-tested beginning in 1998.

R26 – WSDOT should prepare a report, based in part on the findings resulting from the requirements of SB 5572, to the Transportation Commission that addresses issues associated with the preparation of preliminary design and environmental review fund appropriations from construction fund appropriations.

Included in the report should be recommendations for modifying the priority array statutes, Chapter 47.05 RCW, that address the requirements of SB 5572, and provisions that would allow WSDOT additional flexibility to take advantage of unanticipated opportunities for private development participation in compensatory environmental mitigation projects that may occur subsequent to approval of the two-year construction program.

This report should be completed prior to December 1, 1995, to allow the drafting of any required legislation that may be appropriate.

WSDOT has reported annually to the legislature on these items.

R27 – A new environmental review demonstration program to track expenditures on selected projects should be created within the Department of Transportation's budgeting and cost accounting system.

WSDOT is working on the development of a new financial system that will provide the ability to identify environmental costs within transportation project costs.

R31 – The Departments of Transportation and Ecology should revise the summary of the milestones in the collaborative process presented in Chapter 8 of this Environmental Cost Savings and Permit Coordination Study to incorporate important steps resulting from the final version of the NEPA/404 Integration Agreement.

WSDOT and all seven signatory agencies review the NEPA/SEPA/404 merger process on an annual basis. It is from these meetings that the need to advance a pilot project, NEPA Re-invention, was formulated.

R32 – The Departments of Transportation and Ecology should conduct training for local governments on the NEPA/404 Integration Agreement once it is completed to encourage local agencies to participate in the process as joint lead or cooperating agencies.

WSDOT has conducted such training and continues to do as necessary.

ENVIRONMENTAL ORGANIZATION REPORT

The bold **O/A/I/E** number and the text in normal font identifies the original recommendation; the succeeding paragraph in italics describes the current status of implementation.

O4 – The environmental staff in headquarters and environmental staff in each district [now region] should provide services to other functional areas of the Department as needed. Interaction should include close and continuous communications and exchange of information. The staff should be a resource available for all functional areas of the Department. For example, environmental staff should assist maintenance staff in securing permits and in environmental documentation.

The environmental staff have expanded their roles to serve other WSDOT activities as indicated.

A4 – A pre-bid meeting should be held for environmentally sensitive projects and should be mandatory for all bidders. These projects could include, but are not limited to, those located in critical areas, as defined by local governmental ordinance, or those located in shoreline areas.

Pre-bid meetings are held for this purpose.

A5 – Methods for improved and more timely estimating, budgeting, and accounting of environmental protection costs should be developed. The department should call upon resource and regulatory agencies to assist, when possible, in defining environmental values in an economic context so that the full costs and benefits of dealing with environmental protection can be better calculated. The costs and other impacts of non-compliance to the Department and other agencies should be addressed.

WSDOT has projects underway to better estimate, budget, and account for environmental costs. It is cooperating with other agencies to better define environmental values and benefits. It is currently recruiting for an Environmental Cost Specialist to lead the development of such methods.

A8 – Implementation of the Department's environmental research findings should be emphasized. Parties assisting the Department in research activities should understand the necessity of providing recommendations for action rather than just continuing study. Research findings should be broadly disseminated to local governments and the private sector so they can be used to improve environmental protection activities and stimulate technology transfers.

WSDOT environmental research is focused on implementable, problem-solving activities that have been of use to the state, including eelgrass mitigation and improved wetland mitigation. WSDOT has been successful in obtaining external funds for research activities.

A10 – The Department should develop an "Environmental Award" program. Criteria should include innovation, creativity, impact avoidance and minimization, and application of new technology.

This has not been done.

A11 – The Policy Team should develop a tracking system and performance measurements to ensure implementation and success of environmental commitments. Districts [i.e., regions] should use the system developed by the team.

This has not been done.

I1 – A system for screening environmental issues should be created and used as an integral part of system and route development plans. Environmental staff should be involved in this process.

This was implemented with the 1998 Washington Transportation Plan.

E1 – The Department should encourage and participate in current and future efforts to minimize duplication and overlap of environmental regulations of regulatory agencies.

*WSDOT is participating in such activities. See response to **R22** above.*

E2 – The Department should improve its efforts to enhance coordination and cooperation with Indian tribes.

WSDOT has been successful in gaining Indian tribes' participation in public forums and in working with tribes on fish passage and wetland matters.

E3 – The Department should continue to explore ways to enable earlier involvement by state and federal resource and regulatory agencies, local governments, Indian tribes, and the public in developing an improved project planning and design process that is more integrated (as mentioned in the Intra-Departmental section). An improved process will allow earlier identification and resolution of issues and would enable permitting decisions on a more timely and effective basis for both departmental and regulatory agencies.

*WSDOT participates in many such activities. See response to **R1** above.*

E4 – The Department should explore, with all relevant parties, the development and adoption of environmental standards commensurate with appropriate levels of environmental protection. An example of this approach is the development of a Department runoff manual based on the Department of Ecology's manual.

*WSDOT engages in on-going dialog with many parties on these and similar matters. See response to **R15** and **R16** above and **E5** below.*

E5 – Current departmental efforts to deal with interagency issues should be continued, and the Department should implement recommendations from these efforts, to the extent practical.

The Interagency Task Force (mentioned in the detail of the recommendation) has been disbanded, but WSDOT is involved in several alternative procedures.

E6 – The Secretary of Transportation should work with resource and regulatory agency directors to foster better understanding among their respective agencies.

The WSDOT Secretary participates in several such activities, including the Governor's Joint Natural Resources Council with the heads of several state resource and other agencies and a working group on management of liability for sediment lands with the State Attorney General and the heads of the Natural Resources and Ecology Departments.

E7 – The Transportation Commission should develop a working relationship with the environmental committees of the legislature, to advocate Commission policies regarding transportation and environmental issues.

The Transportation Commission directly participates in all WSDOT policy, legislative, and budgetary initiatives. Under its direction, WSDOT staff communicate with the Legislature to represent the priorities of the commission and WSDOT. Commissioners frequently lead efforts to form policy, including two commissioners who served as co-chairs of the task force that lead to the recommendations in this environmental report.

E8 – The Department should work more closely with local governments as they carry out their increasing environmental protection responsibilities under growth management legislation. This is particularly important in the development of local comprehensive plans and implementing ordinances.

WSDOT is active in many intergovernmental task forces, such as the State Land Use Study Commission, which works to formulate better local-regional-state interface on land use and environmental process. An example of the one-on-one work of WSDOT on these matters is its work with Snohomish County to tailor the administration of its Critical Areas Ordinance to make wetlands banking possible.

E9 – The Department should provide specific staff contacts for resource and regulatory agency use for discussion of policy, as well as project environmental impact and permitting issues.

WSDOT has added a Permit Liaison position and an Environmental Policy Manager as a result of this recommendation.