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## MEMORANDUM

**DATE:** September 14, 2004

**TO:** Metropolitan King County Councilmembers

**FROM:** Cheryle A. Broom, County Auditor

**SUBJECT:** Performance Audit Roads Services Division (RSD)  
Capital Planning Program

The council requested this study as part of the auditor's 2004 Annual Work Program. The study reviewed the county's planning, prioritization, and management of road and road-related infrastructure capital improvement projects.

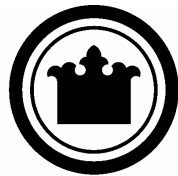
The audit assessed the extent to which the capital program is planned and carried out consistent with industry best practices. It also evaluated how existing information about RSD projects could be analyzed and reported to better support decision makers and strengthen accountability to citizens, and whether the RSD has a well-planned program to preserve the taxpayers' investment in road infrastructure. We addressed these areas by reviewing ongoing activities at the division and comparing those with industry best management practices. We also reviewed the division's current capital project data system and developed a framework for how existing data could be used to better communicate project performance to RSD managers, decision makers, and the public.

The report found that many division activities are consistent with best management practices. However, division practices fall short of best practices relating to thorough and consistent methods for program planning, economic analysis, and performance and accountability reporting. The RSD is equipped to address these areas and is moving in that direction. The audit makes several recommendations to strengthen analysis and documentation of proposed capital projects and road preservation activities, as well as to provide information that can be used by decision makers and the public to assess the performance of individual projects and RSD capital program-wide performance.

In his response to the study, the executive indicated that he generally agrees with the findings and concurs with the report's nine recommendations. We appreciate the cooperation received from management and staff at the Roads Services Division and the Office of Management and Budget.

# **PERFORMANCE AUDIT**

## **Roads Services Division Capital Planning**



**King County**

Presented to  
the Metropolitan King County Council  
Labor, Operations & Technology Committee  
by the  
County Auditor's Office

Cheryle A. Broom, King County Auditor  
Valerie Whitener, Principal Management Auditor  
Rob McGowan, Senior Management Auditor

Report No. 2004-03  
September 14, 2004

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## **Alternative Formats Available Upon Request**

# TABLE OF CONTENTS

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	<u>PAGE</u>
Executive Summary	ii
<b>Chapters</b>	
Chapter 1 Introduction	1
Chapter 2 Capital Improvement Planning and Management Practices	5
Chapter 3 Capital Project Management and Analysis	13
Chapter 4 Preserving Taxpayers' Investment in Transportation Facilities	27
<b>Exhibits</b>	
Exhibit A 2004 – 2009 Roads CIP Funding Sources	3
Exhibit B RSD's Compliance with Best Practices	8
Exhibit C Capital Project Management Best Practices and Activities	15
Exhibit D Sample Framework of Management and Performance Baseline Questions	18
Exhibit E Relationship of Pavement Deterioration to Repair Timing/Costs	29
Exhibit F Least Cost Lifecycle Summary	32
<b>Appendices</b>	
List of Recommendations & Implementation Schedule	37
Executive Response	39
Appendix 1 Roads Services Division Economic Analysis	41
<b>Abbreviations</b>	43

# EXECUTIVE SUMMARY

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## **Introduction**

This performance audit of the King County Roads Services Division (RSD) capital improvement program (CIP) assesses the extent to which the capital program is planned and carried out consistent with industry best practices. It also evaluated how existing information about RSD projects could be analyzed and reported to better support decision makers and strengthen accountability to citizens, and whether RSD has a well-planned program to preserve the taxpayers' investment in road infrastructure.

## **General Conclusions and Findings**

Overall, we found that RSD is making progress in improving management of its capital planning activities. However, there are some industry best practices that would lead to greater accountability and better information for decision makers and the public if implemented by the division. These practices relate to program planning, management, performance and accountability.

## **Planning/Demonstrating Program Accountability and Performance.**

- RSD is in the process of developing CIP performance measures, which should provide the tools to track achievement of the division's program goals.
- While RSD has clear, well-documented prioritization procedures for several project categories, other categories have no documented prioritization procedures. The absence of clear prioritization procedures for some types of projects undercuts the department's accountability to the public.

**Project Management and Analysis of Project Alternatives.**

- Many RSD project management and analysis practices are consistent with best practices. We found RSD practices for assessing project objectives, traffic effects, and natural and social environmental considerations associated with project development to be consistent with industry best management practices. These are crucial elements in a transportation capital planning process.
- RSD lacks an approach to ensure consistent methods are used for conducting economic analysis of potential projects. Important analytic assumptions can be omitted or left to the discretion of private consultants that conduct analysis on behalf of the county. Therefore, it is not possible to be confident that the estimated costs of pending projects are comparable program-wide, that they reflect the total lifecycle costs of projects to taxpayers, or that they are consistent with the county's overall transportation goals.

**Preserving taxpayers' investment in capital facilities.**

- RSD has developed a pavement preservation program that is designed to minimize the lifecycle cost of county roads. The Federal Highway Administration has documented savings of up to 6 to 1 when such programs are successfully implemented.
- RSD's overlay presentations to council include information about the benefits of the pavement preservation, in general terms. The presentations do not include sensitivity analyses describing the effect of different funding levels, nor do they include examples of the effects of deferring overlays on specific roads.
- RSD has not documented key steps in the overlay program prioritization process. Written procedures help ensure that the program is uniformly applied and consistent with the

department's mission. Documentation is also important for educating newer employees and maintaining the agency's institutional knowledge.

- Most of the overlay program's funding is subject to annual appropriations. In order to be successful, a pavement preventive maintenance program needs dedicated, predictable funding.

### **Scope and Objectives**

The audit focused on the means by which RSD capital projects are developed, programmed, and quality controlled. We reviewed industry literature and spoke with industry experts to develop best practices in CIP planning. We used a case study of an RSD capital project to identify how projects are planned and analyzed, then compared these practices with best practices. We also examined opportunities for tracking key project performance information. This was conducted with the intent of developing a sample framework for reporting performance information to decision makers. Finally, we examined the process for preserving the taxpayers' investment in road infrastructure through pavement preservation activities.

### **Summary of Recommendations**

The report makes nine recommendations to strengthen capital program management, analysis, and accountability:

- Complete development of program-wide performance measures and performance targets to track and report on achievement of program goals.
- Document prioritization processes for non-capacity projects and summarize the processes in the Transportation Needs Report (TNR).

- Provide guidelines for lifecycle cost analysis (LCCA) and benefit cost analysis (BCA), particularly for the assumptions used for key cost variables such as the discount rate, and designate an appropriate congestion delay cost methodology.
- Develop guidelines for how operations and maintenance costs should be included in analysis of design alternatives and communicate the total estimated lifecycle costs of proposed projects to decision makers and the public.
- Ensure that analysis of potential project alternatives includes documentation of the range of lifecycle costs of and qualitative benefits for each alternative.
- Provide sensitivity analysis and case studies to the council in order to illustrate the impact of different funding levels and deferred maintenance.
- Complete documentation of overlay project prioritization to promote consistency and accountability.

### **Summary of Executive Response**

The executive generally concurs with all of the recommendations in the report, and the RSD will continue its efforts to implement the recommendations in 2005. See the appendices section for the complete text of the executive response.



# 1 INTRODUCTION

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## **Interest in Roads Capital Program Delivery**

### **Audit Background**

In adopting the County Auditor's 2004 Work Program, the Metropolitan King County Council directed the auditor to conduct a performance audit of the county's planning and programming of road capital improvement projects. The council, which approves the road capital and operating budgets, and annual capital improvement program (CIP) funding reallocations, had expressed interest in obtaining more information about road capital projects and the Roads Services Division's (RSD) performance in delivering these projects.

## **RSD Activities Compared to Industry Best Practices**

The audit scope and objectives focused on identifying how road capital projects are developed and programmed, and how the taxpayers' investments in infrastructure are preserved. The division's data collection practices also were reviewed, with the intent of developing a summary reporting framework of capital project performance to decision makers and the public.

### **Roads Services in King County**

King County has responsibility for planning, designing, constructing, operating, and maintaining the public road system (excluding private roads and state highways) in unincorporated areas of the county. The county also participates in regional transportation initiatives to help create a "seamless" transportation system that serves a variety of users throughout the county.

RSD is responsible for the maintenance and operation of over 1,800 centerline miles<sup>1</sup> of roadway, approximately 200 bridges, and other transportation infrastructure throughout the county, including traffic signals, sidewalks, guardrail, and signs. When these facilities need improvements beyond simple maintenance, such as wider lanes or better drainage, RSD plans the project through the CIP process. The CIP is a planning and financial management process that identifies, prioritizes, and schedules capital improvements over a six-year period.

RSD's policy framework for the CIP is embodied in:

1. The Comprehensive Plan, required by the state's Growth Management Act, which provides guiding policy for all land use and development regulations in unincorporated King County;
2. The RSD's Strategic Plan, which sets broad transportation goals, strategies, and action steps to help implement the Comprehensive Plan;
3. The Executive's Proposed CIP, which provides an overview of the Roads CIP and contains details on each proposed project.

The six-year CIP is primarily financed by the county road fund generated as part of the property tax paid by citizens in King County, various state and federal transportation grants, and developer mitigation payments. The program is funded with 59% from the county road fund, 19% from federal and state grants, 13% from bond sales, 5% from developer mitigation payments (MPS), and 4% from other sources.

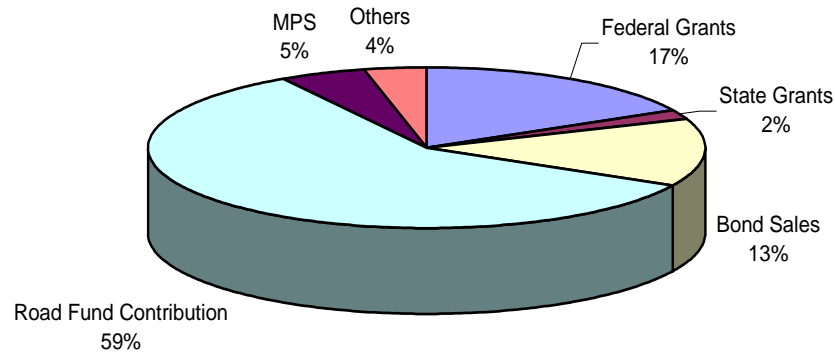
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<sup>1</sup> Highway agencies use two different methods to measure road miles. "Centerline miles" is the length of a road, measured down the road's center. Alternatively, "lane miles" is the product of centerline miles and the number of lanes. For example, a two mile long four-lane road has eight lane miles.

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**EXHIBIT A**  
**2004 – 2009 Roads CIP Funding Sources**

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**SOURCE:** King County DOT, Roads Services Division.

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**CIP Budget Revised in  
June 2004**

The 2004 amended budget for roads capital projects is \$37.8 million, reduced \$11.2 million from the adopted budget of \$49.06 million. The reduction was made in June 2004 in response to a State Supreme Court decision which upheld Initiative 776. The initiative, which passed in November 2002, eliminated the authority of local jurisdictions (including the county) to collect an optional vehicle license fee of \$15 for each license issued. Over the six years of the CIP, a revised total of \$318,308,000 is planned. This is a decrease from the six-year plan adopted by the council of \$45.86 million.

The RSD CIP program manages road investments in three major areas:

- Constructing Safety Improvements
- Preserving Transportation Infrastructure and Environmental Resources
- Constructing Projects to Increase Capacity and Reduce Congestion

Chapter 2 of this report reviews how the RSD capital program fulfills its responsibilities to identify and prioritize capital projects consistent with best practices. It documents strengths and weaknesses of current practices, as well as efforts currently underway to improve accountability of program goals and project prioritization activities. Chapter 3 reviews RSD capital project management and economic analysis activities for consistency with best practices. The chapter provides a sample framework for reporting project performance information and approaches to improve consistency of economic analysis. Chapter 4 compares RSD's road preservation activities to industry best practices and identifies actions that can be taken to improve RSD's road preservation program.

## 2 CAPITAL IMPROVEMENT PLANNING AND MANAGEMENT PRACTICES

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### Chapter Summary

This chapter describes how the Roads Services Division (RSD) plans and develops its capital improvement program (CIP). It identifies industry best practices for CIP programming and prioritization, RSD current practices, and how well RSD management activities align with best practices. Finally, the chapter provides recommendations to promote greater accountability for the division's capital program.

### Summary of Findings

**RSD Complies With Some Best Practices; Some CIP Planning and Prioritization Could Be Improved**

Overall, we found that the RSD is making progress in improving management of its capital planning activities. However, some RSD practices for CIP program planning and project prioritization fall short of industry best practice standards. The RSD has ongoing initiatives to address some of these shortcomings.

### Summary of Recommendations

Recommendations are made to improve program performance information and documentation of project prioritization processes.

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### Background - Best Practices for Capital Improvement Planning

Transportation agency officials are expected to explain and justify decisions concerning the expenditure of taxpayer dollars. The Government Accountability Office (GAO) identifies a variety of practices that leading organizations use to make capital investment decisions at the program-wide level and at the

individual project level.<sup>2</sup> Federal Highway Administration also provides guidelines to federal, state, and local agencies making transportation capital investment decisions. The following section provides a summary of best practices for capital improvement program-wide planning and prioritization. A review of how the practices should be applied at the individual project level will be discussed later in this report.

### **Best Practices – Capital Program Planning and Prioritization**

Effective capital programming uses long-range planning and a disciplined budget process as the basis for managing a portfolio of capital assets to achieve performance goals with the lowest lifecycle costs and least risk. The following are key best practices that have an effect on CIP performance:

#### **Policy Frameworks Include Goals, Objectives, Performance Measures, and Performance Targets**

**Planning Best Practice 1: A policy framework guides CIP development.** Policy frameworks consist of written expressions of a department's policy goals, objectives, performance measures, and performance targets. As the National Cooperative Highway Research Program's *Transportation Asset Management Guide* defines them:

**Goals** are statements that define the basic aim of a policy. Examples of goals are statements promoting better pavement performance and safety, respectively.

**Objectives** are specific aspects of goals to be attained. For example, the objective for pavement performance may be "to provide road users with a smoother ride," and for safety, "to reduce motor vehicle crashes."

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<sup>2</sup> US Government Accountability Office, *Creating Value Through World Class Financial Management*, GAO-00-134, April 2000; *Leading Practices in Capital Decision-Making*, GAO/AIMD-99-32, December 1998.

**Performance measures** are observable, quantifiable measures that align with objectives. They provide the way to track progress toward meeting the objectives. For example, measures of pavement ride quality or serviceability could be used to gauge smoothness of ride. A measure of crashes per 100 million vehicle miles could be used as the performance measure for the safety objective.

**Performance targets** are specific values of performance measures that provide the level of performance/service expected to be attained. It provides the bar against which actual performance data will be compared. For example,

- For pavement smoothness, the target may be to increase the percent of pavement network in good condition from 75 percent to 85 percent by the year 2005.
- For safety, the target may be to reduce the crash rate from 1.38 to 1.35 per 100 million vehicle miles by 2005.

**Performance  
Measurement Systems  
Help in Decision  
Making and  
Communicating Results**

A logical, concrete connection between goals, objectives, and performance measures and targets is critical to ensuring that the department's effort is focused on achieving goals and fulfilling its mission. Managers use performance measures to track progress toward achieving goals and objectives. Performance targets are set values against which accomplishments will be measured. The performance measurement system is needed to serve as a tool for decision making and communicating department-wide performance results.

**Planning Best Practice 2: Prioritization, both program-wide and within discrete transportation categories, is explicit and transparent.** Methods, formulas, and criteria to prioritize projects should reflect the policy framework's goals, objectives, performance measures, and performance targets. The policy framework should be specific enough to guide project prioritization.

**Documenting a  
Prioritization System  
Helps Ensure Uniform  
Application Consistent  
with Policy**

Prioritization systems should be clearly documented. Documentation formalizes the prioritization system and helps to ensure that the system is uniformly applied consistent with the department's policy framework.

**RSD Compliance with Key Best Practices**

The following exhibit summarizes RSD's compliance with best practices for programming and prioritization. A discussion follows.

<b>EXHIBIT B</b>	
<b>RSD's Compliance with Best Practices</b>	
<b>Best Practices</b>	<b>Roads CIP Practices</b>
<b>A policy framework guides CIP development.</b>	RSD's policy framework does identify goals and objectives that guide CIP development.  Although RSD has developed performance measures for the CIP in the county budget process, RSD is in the process of developing performance measures and targets that will be more useful in guiding the development of future CIPs.
<b>Prioritization, both program-wide and within discrete transportation categories, is explicit and transparent.</b>	RSD has recently changed its prioritization processes for CIP projects. However, while RSD provides a detailed description of its prioritization for capacity projects, it has not provided the same level of detail for the prioritization of various non-capacity projects.

**SOURCE:** King County Auditor's Office (KCAO).



*Policy Framework*

As outlined in Chapter 1, the RSD's policy framework for the CIP is embodied in three documents: the Comprehensive Plan, RSD's Draft Strategic Plan, and the Executive's Proposed CIP. Each of the documents is discussed in greater detail below.

**1. The Comprehensive Plan**

The Comprehensive Plan is the policy document for all land use and development regulations in unincorporated King County, and for regional services throughout the county. The plan sets four broad policy goals for transportation, including promoting connectivity, efficiency, affordable transportation options, and environmental stewardship. The most recent version was transmitted to the county council in March 2004.

**2. The Roads Services Division Strategic Plan**

According to its Executive Summary, the RSD Strategic Plan provides a bridge between the Comprehensive Plan's high-level policy guidance and the day-to-day practices, procedures, and decision making of the Roads Services Division. It highlights broad transportation goals, targeted strategies, and associated action steps, and will serve as an implementation guide for Comprehensive Plan transportation policies. The Strategic Plan was completed in March 2004.

**3. Executive's Proposed Roads CIP 2004**

The Executive's Proposed CIP includes all the projects proposed to be included in the six-year CIP. In addition to identifying all the project-specific information, the Executive's Proposed CIP articulates "core business goals," and one overarching program goal: "to construct new and enhance existing roadways to provide safe, efficient and environmentally sound transportation facilities for the

traveling public. The CIP is developed to provide safe roads and bridges, to be consistent with the county's land use policies and plans, and to meet identified transportation needs."

**RSD Is Developing  
Performance Measures  
to Guide CIP  
Development**

*Performance Measurement System*

RSD developed some CIP performance measures and targets for the annual business plan it submitted to the Office of Management and Budget.<sup>3</sup> However, the department stated that these measures and targets are not adequate for guiding the development of the CIP. For example, one performance measure is "Pavement overlay miles installed in unincorporated King County." RSD noted that this measure can fluctuate depending on the scope of overlay projects. If some overlay projects are wider roads, fewer road miles can be completed than if the overlaid roads were narrow. This distinction weakens the performance measure's usefulness in guiding the allocation of resources in future CIPs. RSD's effort to refine performance measures and targets has been put on hold for six months, due to a staff special assignment.

Chapter 3 provides a sample framework of measures that can be supported by RSD's existing data system. This framework could be used to manage and provide information about individual RSD capital projects and can be rolled-up, analyzed, and presented at the program level to provide a perspective on RSD capital program performance.

**The Transportation  
Needs Report  
Prioritizes Future CIP  
Projects**

*Program Prioritization*

RSD identifies the need for and prioritizes major projects through the Transportation Needs Report (TNR). The purpose of the report is to link land use and planning identified in the

<sup>3</sup> Executive agencies are required to submit business plans to the Office of Management and Budget as part of their budget request.

Comprehensive Plan with the projects in the CIP. RSD circulated the first draft of the new TNR for public comment in August 2004. The draft indicates a new prioritization process, separated into two categories:

- Capacity projects. These projects, which expand the capacity of existing transportation facilities, are identified and prioritized using a forecast system called “transportation demand modeling.” The draft TNR explains the model, and how it uses different traffic statistics to prioritize projects, in depth.
- Non-capacity projects. All other projects are grouped into different categories, such as bridges, overlays, and guardrail. The draft TNR contains an appendix with a list of project categories and the documents that explain their prioritization. Although many of these project categories have detailed prioritization procedures, the TNR does not summarize the procedures. During the course of this audit, RSD agreed that these prioritization procedures should be included in the TNR, and indicated that the next draft will include them.

**TNR Lacks  
Documentation for  
Non-Capacity Projects**

While TNR provides documentation of the prioritization process for capacity projects, documentation of other prioritization processes is lacking.

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**RECOMMENDATION 1**

Complete development of program-wide performance measures and performance targets to track and report on achievement of program goals.

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**RECOMMENDATION 2**

Document prioritization processes for non-capacity projects and summarize the processes in the TNR.

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# 3 CAPITAL PROJECT MANAGEMENT AND ANALYSIS

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## Chapter Summary

This chapter reviews how the King County RSD manages capital projects and the approaches RSD uses to analyze whether a particular project design alternative is worth undertaking. It identifies industry best practices and reviews the division's project management and analysis approach using a case study of a current RSD project. It concludes with recommendations to promote greater accountability of project performance, and improve consistency and rigor when analyzing capital project investments.

## Summary of Findings

### **Some Management Activities Fall Short of Best Practices ... Improvements Planned**

Overall, we found that the RSD is making progress in refining its capital project management. However, development of meaningful project performance information is lacking, and approaches to economic analysis of project alternatives are inconsistent, falling short of industry best practice standards. The RSD has ongoing and proposed initiatives to address some of these shortcomings.

## Summary of Recommendations

Recommendations are made to develop an approach to monitor and report on project performance, provide guidelines to improve the consistency and rigor of economic analysis, and ensure that analysis of potential project alternatives includes documentation of the range of costs of and qualitative benefits for proposed project alternatives.

**Support Decision  
Making with Proper  
Financial, Technical,  
and Risk Analyses**

**Identifying Best Practices – at the Project Level**

After a decision is made to pursue a capital investment to address a particular transportation need, there are a number of project management best practices intended to ensure that scarce resources are targeted to maximize benefits to the public. The best practice activities provide a decision-making framework that encourages the appropriate level of management review and approval, supported by the proper financial, technical and risk analyses. Exhibit C describes these practices and key activities associated with them:

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### EXHIBIT C

#### Capital Project Management Best Practices and Activities

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Track project cost, schedule, and technical performance goals:

- Scope (initial and changes)
- Schedule (avoidable/unavoidable)
- Budget (increases/decreases and the cause, avoidable/unavoidable)

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Provide good information to decision makers, scope, schedule and budget monitoring, understandable and relevant to:

- Internal decision makers
- External decision makers
- Public/taxpayers

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Identify and manage risks:

- Socioeconomic factors, e.g., environmental protection, public safety regulation, economic
- Organizational relationships, e.g., contractual relations, attitudes of participants, communication
- Technological problems, e.g., design assumptions, site conditions, construction procedures

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Evaluate results/incorporate lessons learned:

- Changes in policies and procedures
- Training/communication of changes
- Measuring results
- External feedback

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Systematic approach for economic evaluation:

- Establish objectives
- Identify constraints and specify assumptions
- Define base case and identify alternatives
- Set analysis period
- Define level of effort for screening alternatives
- Analyze traffic effects
- Estimate benefits and costs relative to base case
- Evaluate risk
- Compare net benefits and rank alternatives
- Make recommendations

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**SOURCES:** U.S. Government Accountability Office (USGAO) and U.S. Department of Transportation (USDOT)

As provided in the exhibit above, best practices at the project level call for adequate planning, analysis, monitoring, assessment, and reporting about delivery of the capital project. Monitoring and reporting information about a project's scope, schedule, and budget assists managers, decision makers and

taxpayers understand whether the project's goals have been met and that resources have been used efficiently and appropriately. Analyzing and using this performance data in day-to-day management and decision making enhances performance and results in improved information and accountability.

### **RSD Approach to Project Management, Monitoring, and Reporting and Consistency with Best Practices**

The King County Auditor's Office (KCAO) reviewed the project management system used by the RSD to plan, monitor, evaluate, analyze, and report on the delivery and performance of capital projects. We found that the RSD project management system created in 2000 and updated during the course of this audit is consistent with best practices in a number of areas:

#### **Many RSD Project Management Activities Consistent with Best Practices**

- RSD assembles multi-disciplinary teams from its staff to scope, plan, and manage projects.
- The RSD data system maintains scope schedule and budget change information.
- Project managers and supervisors are able to create monitoring reports from the RSD data system.
- Risk and change management policies are included in the project management system.
- RSD quarterly project review update meetings include project managers and supervisors who evaluate results and examine lessons learned.

#### **Analysis and Reporting of Project Performance Lacking**

We did find some gaps between RSD performance and industry best practices at the individual project management level, in particular:

- An absence of analysis and reporting of project performance to external stakeholders, and



- An absence of guidelines for appropriate monitoring of economic analysis of proposed projects.

A discussion of RSD efforts to address gaps in project performance reporting is provided below. Our review of economic analysis best practices and application of those practices by RSD at the project level will be discussed at the end of this chapter.

#### **RSD Activities Underway to Address Gaps in Project Performance Reporting**

##### **RSD Project Data Available... But Doesn't Demonstrate Performance**

RSD has been actively working to improve access to information about the performance of individual projects. During the course of this study, RSD updated its website to allow internet access to information about ongoing and planned King County road projects. This system will provide detailed scope, schedule, and budget information about individual King County road projects. This information will be useful to people with interest in specific geographic areas, projects, or project types. However, historical project information is not set in a context that describes overall project performance.

##### **Reporting Should Be Responsive to Needs of Managers, Decision Makers, and the Public**

Best practices identified during our review led to the development of the following framework of project performance questions. The Performance Baseline Questions below, are responsive to the scope, schedule, and budget performance interests typically expressed by elected officials and taxpayers and reflect key information. These types of measures could be rolled-up and reported to convey capital program-wide performance to decision makers.

<b>EXHIBIT D</b>	
<b>Sample Framework of Management and Performance Baseline Questions</b>	
<b>Performance Baseline Questions</b>	<b>Process Improvement Assessment</b>
Do RSD projects require substantive scope changes?	If so, why? If not, why?
Are scope changes avoidable/unavoidable?	What value added?
Are RSD projects being completed on time?	If so, why? If not, why?
How long are projects in the design phase?	Is this reasonable? If so, why? If not, why?
Are RSD projects completed within budget?	If so, why? If not, why? Avoidable/Unavoidable?
Was primary goal of project met? (e.g., capacity, safety, environmental—social or natural)	If so, how? (e.g., reduction in congestion delays or accidents, less environmental impact, positive economic impact)

**SOURCE:** KCAO

**Existing RSD Data  
System Could Provide  
Meaningful Project  
Performance  
Information**

Over the course of the study, we worked with the RSD and reviewed whether existing information is available to provide regular, meaningful reporting (in a context similar to the framework of sample measures provided above) to decision makers and taxpayers. The RSD does have data available to provide this information. However, providing reporting that is meaningful to external stakeholders such as decision makers and taxpayers would require the RSD to analyze its project data and provide a summary and context for project information.

**Best Practices Economic Analysis of Transportation Projects**

Our study scope included a review of how the RSD conducts economic analysis of potential road capital projects. Best practices provided above identify economic analysis as a critical

component that considers all key quantitative and qualitative impacts of a road investment. It allows transportation agencies to identify, quantify, and value the economic benefits and costs of road projects and programs of a multiyear timeframe. Economic analysis of road projects can help provide a number of benefits including cost-effective design and construction, best return on investment, understanding complex projects (the benefits and costs) and documentation of the decision process.

**Economic Analysis  
Should Provide  
Documentation of  
Decision Process**

The structure and documentation provided by economic analysis methods of lifecycle cost analysis (LCCA) and benefit cost analysis (BCA) allow the transportation agency to demonstrate its stewardship of the public's investment. LCCA is applied when an agency must undertake a project and is seeking to determine the lowest lifecycle cost (i.e., most cost-effective) means to accomplish the project's objectives. Unlike LCCA, BCA considers the benefits of an improvement as well as its costs and therefore can be used to compare projects that do not yield identical benefits, as well as to compare projects that accomplish different objectives (e.g., realignment of a road versus a widening project). Moreover, BCA can be used to determine whether the project's lifecycle benefits will exceed its lifecycle costs. The U.S. Department of Transportation (USDOT) identifies the following major steps in the BCA process:

Major steps in the BCA process:

- Establish objectives
- Identify constraints and specify assumptions
- Define base case and identify alternatives
- Set analysis period
- Define level of effort for screening alternatives
- Analyze traffic effects
- Estimate benefits and costs relative to base case

- Evaluate risk
- Compare net benefits and rank alternatives
- Make recommendations

#### **Recognizing Future Preservation and Maintenance Costs in Analysis**

#### **Analysis Should Recognize Costs Needed to Keep Investment Available to the Public in the Future**

Best practices also direct that future preservation, maintenance, and operational costs be included in the LCCA or BCA of potential project alternatives. The ability of a transportation asset to provide service over time is predicated on its being maintained appropriately by the transportation agency. Thus the investment decision should consider not only the initial activity that creates a public good, but also all future activities that will be required to keep that investment available to the public. Specific future rehabilitation and maintenance activities are in large part dictated by the design alternative selected. For example, a steel girder bridge will require periodic painting whereas a concrete girder bridge will not. However, a concrete girder bridge might not have the span-lengths that a steel bridge can have and may require construction of an additional column pier, with the additional construction and maintenance costs that would engender.<sup>4</sup> In practice, transportation agencies must rely on historical preservation, maintenance, and operational costs of similar projects and use this data to estimate future costs for varying alternatives.

#### **RSD Application of Economic Analysis Best Practices at the Project Level**

Using a case study approach, we reviewed the role economic analysis has in selection of project alternatives. KCAO selected the Carr Road Improvement Project in southeast King County as a case study because it was an example of a project that

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<sup>4</sup> USDOT, August 2002, 2003.

straddles potential annexation areas in Kent and Renton and potentially affects the county's ability to issue concurrency certificates<sup>5</sup> in the surrounding area, as required by the state's Growth Management Act. Both potential annexation and concurrency impacts are of significant policy and regulatory interest to the county. The project was at a stage of development suitable for review by this audit. As is typical for most RSD capital projects, the RSD project team contracted with a private engineering consultant to conduct the detailed economic analysis of project alternatives. RSD was then responsible to monitor and review the consultant's work.

We found that despite the absence of economic analysis guidelines within the RSD project management system, the analysis conducted for the Carr Road project was, for the most part, consistent with best practices. The process used in the case study ensured identification of project objectives and alternative solutions, analyzed traffic and other social and environmental effects, and was inclusive and attentive to the interests of most stakeholders.

#### **Absence of Economic Analysis Guidelines...**

However, there are some key areas where RSD activities diverge from best practices. The absence of economic analysis guidelines and policies reduces the likelihood that consistent methods and assumptions are used throughout the capital program when conducting benefit cost and lifecycle cost analyses of potential projects. The review of the project management system and case study led to the following conclusions:

#### **... Leads to Inconsistencies**

- Operations, maintenance, and preservation estimates are not typically included in the analysis of road project alternatives.

<sup>5</sup> Concurrency is a Washington State Growth Management Act requirement that infrastructure to support development must be planned and funded before that development can occur.

- The discount rate used to determine the time value of money is left to the consultant's discretion.
- The methodology to quantify the cost of vehicle wait times is left to the consultant and/or project team's discretion.
- The approach to weighting the significance of analysis variables such as transportation impacts, social and natural impacts, implementability (acceptability to the community, et al.), and other issues (which included the costs) is left to the discretion of the consultant and RSD project team.

**Lack of Guidelines  
Affects Reliability of  
Analysis ...**

The impact of allowing discretion for these important analytic variables on a project-by-project basis means that it is not possible to be confident that projected costs of pending projects are comparable program-wide, that they reflect the total lifecycle costs of projects to taxpayers, nor that they are consistent with the county's overall transportation goals.

In the example from the case study, the approach used to rank design alternatives provided that the project team and private engineering consultant screened the alternatives by reviewing and assigning weights to the following benefit cost analysis (BCA) variables:

- Social and natural environment impacts (25%)
- Transportation impacts (50%)
- Other impacts (25%)

The lifecycle cost of the project was one component of the "other impacts" category. Based on the weighting of the transportation impacts category, the alternative that posed the greatest transportation benefit was likely to emerge as the preferred alternative.

**...and Weighting****Analysis Results****Impacts Policy Goals**

As demonstrated in this example, application of weights to BCA variables impacts policy goals. Weighting is typically applied to analysis variables so BCA results support the selection of an alternative that achieves particular goals and objectives. In some jurisdictions policy makers set parameters or a range of weights for typical factors considered in transportation project BCA. The range allows for flexibility and collaboration among road engineering analysts and project stakeholders, while maintaining sufficient emphasis on key policy values.

**Need to Know Benefits  
and Costs of  
Alternatives**

The USDOT states that a “true” benefit cost analysis does not weight variables. When no weights are applied in the benefit cost analysis, the regulatory, environmental, social, and transportation benefits that vary among project alternatives can be partially measured and understood in relationship to varying costs of the project alternatives.

We applied this approach to the case study:

1. Ranked the net present values (NPV)<sup>6</sup> for the proposed alternatives from least expensive to most expensive.
2. Identified the difference between the lowest NPV and each proposed alternative’s NPV.
3. Analyzed the assessment of the qualitative factors for each alternative in terms of the difference between the NPV (cost) of the alternatives.

We found that 24 potential alternatives ranged in NPV from -\$9.75 million to \$11.65 million, a range of \$21.4 million. The RSD preferred alternative for the Carr Road project (\$2.55 million) ranked 16<sup>th</sup> in terms of NPV, thereby placing a value or opportunity cost of \$12.3 million on the qualitative benefits of the project. Identifying the differences in project alternatives using

<sup>6</sup> Net Present Value (NPV) compares the value of a dollar today versus the value of that same dollar in the future, after taking inflation and return into account.

this approach would provide accountability and be of particular value to elected officials and other decision makers when they decide among alternatives.

Appendix 1 provides more detail about our analysis of RSD performance in relationship to economic analysis best practices.

**RSD Addressing Some  
Gaps and OMB  
Discount Rate Policy  
Development Pending**

**Approaches to Address Economic Analysis Gaps**

The RSD acknowledges the gaps identified above and are planning to address some of the areas where there is a lack of clear policy and consistent practices in conducting economic analysis:

- RSD reportedly does include estimates of future operations and maintenance in the analysis of potential bridge capital projects but not other road projects. As mentioned earlier, in practice transportation entities use historical information from like projects in economic analysis. The RSD also indicates an interest in developing an approach to using historical information for estimating operations, maintenance, and preservation costs for major capital roads projects.
- RSD also reported that vehicle wait times published by the Washington State Department of Transportation are often used in RSD economic analyses and would be an appropriate existing standard to reference in their project management policies.

In response to an audit recommendation made by the KCAO in 2003, the King County Office of Management and Budget (OMB) is in the process of developing a countywide discount rate policy. OMB reports the policy will be released in September 2004.



<b>RECOMMENDATION 3</b>	Develop an approach to report capital project scope, schedule, and budget information in a format that is meaningful to decision makers and the public. That format should be consistent with the sample provided in this report.
<b>RECOMMENDATION 4</b>	Provide guidelines for LCCA and BCA, particularly for the assumptions used for key cost variables such as the discount rate and vehicle wait times.
<b>RECOMMENDATION 5</b>	Develop guidelines for how operations and maintenance costs should be included in analysis of major road project design alternatives.
<b>RECOMMENDATION 6</b>	Ensure that analysis of potential project alternatives includes documentation of the range of lifecycle costs of and qualitative benefits for each alternative.
<b>RECOMMENDATION 7</b>	Communicate the total estimated lifecycle costs of proposed projects to decision makers and the public.

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# 4 PRESERVING TAXPAYERS' INVESTMENT IN TRANSPORTATION FACILITIES

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## Chapter Summary

This chapter describes how the King County RSD manages its pavement preservation program. It identifies industry best practices, RSD current practices, and how well RSD's program aligns with best practices. Finally, the chapter provides recommendations to improve the pavement preservation program.

## Summary of Findings

**RSD's Overlay Program Meets Most Best Practices, But Some Improvements Can Be Made**

RSD's pavement preservation program meets some best practices, and is designed to minimize the lifecycle cost of county roads. Areas for improvement include enhancing communication with the council by analyzing the effects of varying levels of investment in the program and improving documentation of the preservation program prioritization processes to ensure greater consistency and accountability.

## Summary of Recommendations

Recommendations are made to improve the quality of information used to make infrastructure investment decisions, and to ensure the consistency and accountability of the overlay.

## Background – Pavement Preservation

The traditional approach highway agencies took to roadway maintenance was to leave a new road alone until it had sustained so much damage that the road's substructure had broken down. At that point, the road would be reconstructed or rehabilitated.<sup>7</sup> This traditional reactive approach is referred to as "worst first"

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<sup>7</sup> Reconstruction involves the complete replacement of the pavement and its substructure; rehabilitation involves enhancing the substructure and applying a new surface.

because the transportation department focuses its maintenance funding and attention first on those roads in the worst condition.

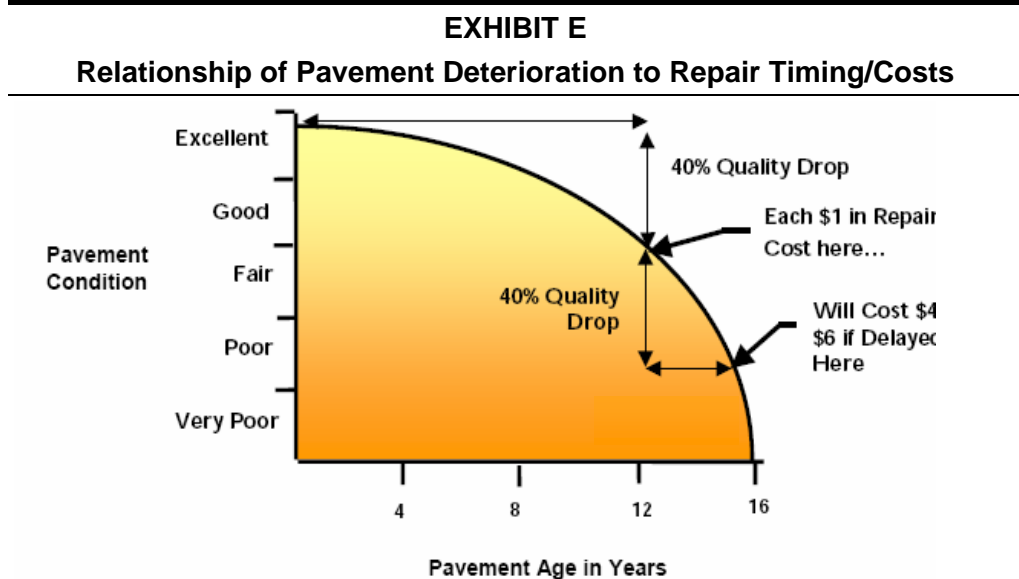
**Pavement Preservation  
Involves Treating  
Roads in Good  
Condition to Extend  
Their Usable Life**

In contrast to the reactive approach of “worst first,” pavement preservation programs are, by definition, proactive. Pavement preservation consists of applying a series of maintenance treatments that last only a few years to roads that are in relatively good condition. Considerable expertise is required to select the proper pavement thickness, the roadways most fit for preservation, and the appropriate time to treat the road. The American Association of State Highway and Transportation Officials (AASHTO) summarizes the key to pavement preservation as “applying the right treatment to the right pavement at the right time.”

The following are best practices for pavement preservation distilled from the industry literature.

**Pavement  
Preservation's Savings  
Have Been  
Documented at 6 To 1**

**Best Practice: Minimize lifecycle costs with a pavement preservation program.** The cost of repairing a road increases disproportionately as the condition of the pavement decreases over its life. When the pavement condition has decreased so substantially that structural damage occurs, the lower-cost treatments are no longer an option. The Federal Highway Administration has documented savings of 6 to 1 when a pavement preservation approach replaces a program in lieu of a “worst first” program. The following exhibit shows how, on average, performing \$1 in pavement preservation at the right point in the life of the pavement saves the department from spending \$4 to \$6 in rehabilitation or reconstruction later.



**SOURCE:** Kercher, Alan S., *Pavement Management: A Guide for Elected Officials*, Delaware Department of Transportation, October, 2000.

**Best Practice: Communication with the legislative branch.**

Successful implementation of a pavement preventive maintenance program requires that the department proactively educate elected officials of the long-term benefits of the program. This education needs to be ongoing because council members and executives change over time.

**Sensitivity Analysis Is an Important Tool in Demonstrating Different Levels of Pavement Preservation**

Two tools are helpful in conveying the message of pavement preservation to legislative bodies and the public: sensitivity analysis and examples from practice. Sensitivity analysis involves using the pavement management system (PMS) to show how different funding scenarios for the pavement preservation program result in different network condition levels. For example, the department might show the effect on network condition of funding the program at the requested level, at 10 percent less than the requested level, and at 25 percent less than the requested level. The sensitivity analysis should show not just the effect on the pavement network, but also the

anticipated additional costs to rehabilitate or rebuild roads that were not overlaid in time.

The second communication tool involves providing examples of real roads within the department's jurisdiction where a delayed overlay led (or could have led) to a road being reconstructed – at a higher cost. For example, the department could illustrate a case where the pavement preservation program proposed \$50,000 for an overlay of a particular street in 2005. If this overlay is not applied by 2007, the street will require a reconstruction project estimated to cost \$300,000.

**Written Guidelines  
Ensure Consistent  
Application of the  
Program**

**Best Practice: Written guidelines.** Written guidelines ensure that the pavement preservation program is consistent (that the department is “applying the right treatment to the right pavement at the right time”) and that decisions support the department's mission. Conversely, the absence of written guidelines increases the likelihood that the program could be inappropriately or inefficiently executed and it is difficult for the program to prove it is accountable to the public and the legislature.

**Best Practice: Dedicated funding for the program.** The results of pavement preservation programs are demonstrated over time. Several years of investment in the program are required to show improvement of the overall road network condition and reduction of reconstruction and rehabilitation costs. In order to implement such a program, pavement preservation programs require dedicated, predictable funding over time. However, maintenance activities usually do not receive consistent funding and are often a prime target for reductions in funding when budgets get tight.

### **RSD's Pavement Preservation Program**

The countywide overlay program within the CIP represents RSD's pavement preservation program. The program is comprised of three major stages:

- 1) All county roads are inspected and their condition rated on a 100-point scale.
- 2) RSD uses a computerized pavement management system (PMS) to prioritize the roads targeted for preservation. The primary factors the PMS uses in prioritizing road segments are:
  - Pavement condition,
  - Freight and transit traffic volume, and
  - Lifecycle cost.
- 3) RSD finalizes the overlay program by rearranging the computer-generated list to group projects in close proximity to one another in order to focus spending on laying asphalt, rather than hauling it.

### **RSD Compliance with Best Practices in Pavement Preservation**

RSD's compliance with each best practice area is discussed below.

#### **RSD's Pavement Preservation Program Is Designed to Minimize Lifecycle Costs**

#### *Minimizing Lifecycle Costs with a Pavement Preservation Program*

RSD has designed its pavement preservation program to minimize the lifecycle cost of the county's investment in pavement. The following exhibit, prepared by RSD using its PMS, estimates how performing an overlay on county arterials after 12 years (on average)<sup>8</sup> provides the least cost lifecycle.

<sup>8</sup> This is an average because some roads with high traffic volumes or other stress may need an overlay sooner, while some roads with less stress may need an overlay later. RSD is currently developing pavement curves for individual county roadways. Some of these curves will be much flatter (indicating a least cost lifecycle of more than 12 years), others will be much steeper (indicating a least cost lifecycle of less than 12 years).

<b>EXHIBIT F</b>			
<b>Least Cost Lifecycle Summary</b>			
<b>Lifecycle (years)</b>	<b>Average Arterial Network Pavement Condition Rating</b>	<b>Total 6-Year Program Arterial Costs</b>	<b>Annual Program Cost</b>
10	60	\$42,047,100	\$7,007,850
11	55	\$39,191,236	\$6,531,873
12	50	\$37,402,050	\$6,233,675
13	45	\$44,612,308	\$7,435,385
14	40	\$59,146,714	\$9,857,786
15	35	\$71,743,200	\$11,957,200
16	30	\$82,322,100	\$13,720,350

**SOURCE:** RSD

As the exhibit illustrates, the lowest lifecycle cost is achieved when roads are treated at a 12-year lifecycle. Increasing the cycle to 16 years would mean doubling the annual program cost.

#### **RSD Does Not Use Sensitivity Analysis or Examples of Specific Overlays**

##### *Communication with the Council*

In April 2003, RSD presented information to the council on its overlay program. The presentation explained how deferring overlays can increase repair costs significantly. At that time, RSD also noted that then-current funding was inadequate to maintain an optimal resurfacing cycle. However, RSD did not use sensitivity analysis or examples of specific overlays to describe the importance of preserving the county's investment in roads.

##### *Written Guidelines*

For the first stage of the pavement preservation program, RSD has developed thorough documentation of how to assign pavement condition ratings. This documentation is critical, as the successful use of the PMS (and the pavement preservation program by extension) depends on accurate, reliable, and consistent assignment of condition ratings.



In contrast, the other two stages of the overlay program have incomplete documentation. Documentation of the PMS explains how the system factors pavement condition and lifecycle cost into prioritization, but it does not explain how transit and truck volume is factored into the analysis. There is no documentation of the third stage: the process used to convert the initial computer-generated list to the final annual overlay program. This lack of documentation weakens accountability for the program, while also jeopardizing its consistency.

#### *Dedicated Funding*

Some of the funding for overlay is dedicated funding. A portion of the state's 45-cent gas tax is dedicated to overlay through the county arterial preservation program. This funding amounts to approximately \$600,000, or about 12 percent of the overlay budget.

The following are recommendations for the overlay program management area.

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**RECOMMENDATION 8**

Provide sensitivity analysis and case studies to the council in order to illustrate the impact of different funding levels and deferred maintenance.

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**RECOMMENDATION 9**

Complete documentation of overlay project prioritization to promote consistency and accountability.

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## **APPENDICES**

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## **LIST OF RECOMMENDATIONS & IMPLEMENTATION SCHEDULE**

### **Recommendation 1:**

Complete development of program-wide performance measures and performance targets to track and report on achievement of program goals

**Implementation Date:** June 1, 2005

#### **Estimate of Impact:**

Improves the department's ability to track its own performance and report that performance to taxpayers and the council.

### **Recommendation 2:**

Document prioritization processes for non-capacity projects and summarize the processes in the TNR

**Implementation Date:** December 31, 2005

#### **Estimate of Impact:**

Ensures that prioritization processes reflect the department's overall mission and goals, insulates the system from undue influence, and provides greater accountability to taxpayers.

### **Recommendation 3:**

Develop an approach to report capital project scope, schedule, and budget information in a format that is meaningful to decision makers and the public. That format should be consistent with the sample provided in this report.

**Implementation Date:** June 1, 2005

#### **Estimate of Impact:**

Greater compliance and accountability provided to council, council staff and tax payers.

### **Recommendation 4:**

Provide guidelines for LCCA and BCA, particularly for the assumptions used for key cost variables such as the discount rate and vehicle wait times

**Implementation Date:** January 1, 2005

#### **Estimate of Impact:**

Improved reliability and consistency of proposed project cost estimates. Greater compliance and accountability provided to council, council staff and tax payers.

## **LIST OF RECOMMENDATIONS & IMPLEMENTATION SCHEDULE (Continued)**

### **Recommendation 5:**

Develop guidelines for how operations and maintenance costs should be included in analysis of major road project design alternatives.

**Implementation Date:** September 1, 2005

#### **Estimate of Impact:**

Improved reliability and consistency of proposed project cost estimates. Greater compliance and accountability provided to council, council staff and tax payers.

### **Recommendation 6:**

Ensure that analysis of potential project alternatives includes documentation of the range of life cycle costs of and qualitative benefits for each alternative.

**Implementation Date:** September 1, 2005

#### **Estimate of Impact:**

Improved reliability and consistency of proposed project cost estimates. Greater compliance and accountability provided to council, council staff and tax payers.

### **Recommendation 7:**

Communicate the total estimated life cycle costs of proposed projects to decision makers and the public.

**Implementation Date:** September 1, 2005

#### **Estimate of Impact:**

Improved reliability and consistency of proposed project cost estimates. Greater compliance and accountability provided to council, council staff and tax payers.

### **Recommendation 8:**

Provide sensitivity analysis and case studies to the council in order to illustrate the impact of different funding levels and deferred maintenance

**Implementation Date:** June 1, 2005

#### **Estimate of Impact:**

Provides decision makers with more information about the impact of funding for pavement preservation.

### **Recommendation 9:**

Complete documentation of overlay project prioritization to promote consistency and accountability.

**Implementation Date:** April 1, 2005

#### **Estimate of Impact:**

Ensures that the processes are consistent and reflect the department's overall mission and goals, provides greater accountability to taxpayers.

## EXECUTIVE RESPONSE



King County

**Ron Sims**

King County Executive

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SEP 07 2004

KING COUNTY AUDITOR

September 7, 2004

Cheryl A. Broom  
King County Auditor  
Room 1020  
COURTHOUSE

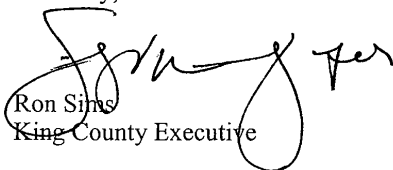
Dear Ms. Broom:

Thank you for the opportunity to respond to your proposed final report – Road Services Division Capital Planning, dated August 24, 2004. My staff and I appreciate the thoroughness and professionalism of the audit staff and look forward to the discussion of the final audit at the September 14, 2004, meeting of the Labor, Operations and Technology Committee. This letter and enclosure responds to the findings and recommendations discussed throughout the proposed final report.

I generally agree with the findings and concur with the recommendations. I appreciate the auditor's acknowledgement that the Road Services Division is improving its management of capital planning activities and has already implemented a number of industry best practices, such as assessing project objectives, traffic effects, and natural and social environmental considerations associated with project development. As noted in the attachment, the Road Services Division will continue its efforts to implement the recommendations in 2005.

For ease of presentation the recommendations contained in the auditor's proposed final report and our responses are attached in a spreadsheet. If you require additional information or have any further questions, please contact Division Director Linda Dougherty, Road Services Division, at 206-296-6590.

Sincerely,



Ron Sims  
King County Executive

Enclosure

cc: Maura Brueger, Deputy Chief of Staff, King County Executive Office  
Steve Call, Director, Office of Management and Budget  
Dave Lawson, Manager, Executive Audit Services  
Sheryl Whitney, Assistant County Executive  
Harold Taniguchi, Director, Department of Transportation (DOT)  
Linda Dougherty, Division Director, Road Services Division (RSD), DOT  
Jennifer Lindwall, Manager, CIP and Planning Section, RSD, DOT



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## EXECUTIVE RESPONSE (Continued)

Enclosure

Recommendation	Agency Position	Schedule for Implementation	Comments
1. Complete development of program-wide performance measures and performance targets to track and report on achievement of program goals.	Concur	The Division has completed its Strategic Plan and is preparing to design the initial performance measures and reporting cycles by June 1, 2005	
2. Document prioritization processes for non-capacity projects and summarize the processes in the TNR.	Concur	This information will be included in the final version of the TNR, which will be adopted by December 31, 2005.	
3. Develop an approach to report capital project scope, schedule, and budget information in a format that is meaningful to decision makers and the public. That format should be consistent with the sample provided in this report.	Concur	The Division will design a new format to use in presenting the 2006 Roads CIP Proposed Budget.	
4. Provide guidelines for Life Cycle Cost Analysis and Benefit Cost Analysis, particularly for the assumptions used for key cost variables such as the discount rate and vehicle wait times.	Concur	This is done informally on most large Road's capital projects. The Division will work with the Office of Management and Budget to establish universal rates for use in analysis.	
5. Develop guidelines for how operations and maintenance costs should be included in analysis of major road project design alternatives.	Concur	The Division will develop guidelines in the annual update of the RSD Project Management Manual. The next update will be Fall of 2005.	
6. Ensure that analysis of potential project alternatives includes documentation of the range of lifecycle costs of and qualitative benefits for each alternative.	Concur	The Division will develop guidelines in the annual update of the RSD Project Management Manual. The next update will be Fall of 2005.	
7. Communicate the total estimated lifecycle costs of proposed projects to decisionmakers and the public.	Concur	This is normally done during the Environmental Impact Statement (EIS) portion of a project. Road's will study ways to better communicate this information.	
8. Provide sensitivity analysis and case studies to the council in order to illustrate the impact of different funding levels and deferred maintenance	Concur	RSD will explore this potential in the 2006 Budget Process.	
9. Complete documentation of overlay project prioritization to promote consistency and accountability.	Concur	This currently underway and will be completed by Road Services Division first quarter of 2005.	



**APPENDIX 1**

**ROADS SERVICES DIVISION ECONOMIC ANALYSIS**

<b>Criteria (USDOT)</b>	<b>RSD Action</b>	<b>Consistent w/Best Practice Criteria</b>	<b>Auditor Comments</b>
Establish objectives	Identified congestion problems and need to address Growth Management Act (GMA) concurrency requirements.	YES	Objectives clearly stated and documented.
Identify constraints and specify assumptions	Environmental (natural and social), regulatory, economic, political and other constraints identified. Multi-jurisdictional impacts identified.	YES	Potential annexation issue identified. Technical Advisory Committee (TAC) established.  Public input process undertaken.  Impacts to sensitive land uses (natural and social identified).  Implementability – concurrency, mobility, transit/HOV, cost efficiency reviewed.
Define base case and identify alternatives	“No action” alternative included. Existing roadway, lane configuration, traffic conditions identified and reviewed.	YES	Consultation with TAC.
Set analysis period	Consistent with practice for 20 years	YES	--
Define level of effort for screening alternatives	Two tier approach. KC Roads Standards and WSDOT Design Manual.	YES	Scoring/weighting of criteria. <ul style="list-style-type: none"> <li>NOTE: Source/basis of weighting criteria variable by project at RSD.</li> </ul>
Analyze traffic effects	Traffic modeling.	YES	Evaluated level of service (LOS) projections of various alternatives.
Estimate benefits and costs relative to base case	Analysis performed on the alternatives to assess their cost effectiveness.	PARTIAL	Standard benefit cost analysis. <ul style="list-style-type: none"> <li>Operations and maintenance (including periodic repair and replacement) costs not included in analysis.</li> <li>Benefit of time savings (variable) source not defined.</li> <li>Basis of discount rate not defined.</li> </ul>

## APPENDIX 1 (Continued)

<b>Criteria (USDOT)</b>	<b>RSD Action</b>	<b>Consistent w/Best Practice Criteria</b>	<b>Auditor Comments</b>
Evaluate risk	Fatal flaws identified for options. Screening criteria comprehensive. Next steps and probable permit requirements identified.	YES	--
Compare net benefits and rank alternatives	Weighted variables. Criteria for weighting led by contractor and KC in consultation with project Technical Advisory Committee (TAC).	PARTIAL	<p>Source/basis of weighting criteria variable by project at RSD (no policies or guidelines, project-dependent).</p> <p>For Carr Road project, values assigned by contractor/RSD/and project TAC:</p> <ul style="list-style-type: none"> <li>• Social &amp; natural impacts 25%</li> <li>• Transportation impacts 50%</li> <li>• Implementability (cost included here) 25%</li> </ul> <p>NPV of project alternatives ranked by KCAO. 24 potential alternatives that range in NPV from -\$9.75 million to \$11.65 million, a range of \$21.4 million. The RSD preferred alternative ranked 16<sup>th</sup> in terms of NPV, thereby placing a value or opportunity cost of \$12.3 million on the qualitative benefits of the project.</p>
Make recommendations	Results of stage 1 and stage 2 evaluations described and recommendations substantiated with analysis findings.	YES	Process of making recommendation consistent with best practices.

## **ABBREVIATIONS**

AASHTO	American Association of State Highway and Transportation Officials
BCA	Benefit Cost Analysis
CIP	Capital Improvement Program
GAO	Government Accountability Office
LCCA	Life Cycle Cost Analysis
NPV	Net Present Values
PMS	Pavement Management System
RSD	King County Roads Services Division
TNR	Transportation Needs Report
USDOT	U.S. Department of Transportation

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