

PERFORMANCE AUDIT OF TRANSIT

TECHNICAL REPORT A: FINANCIAL & CAPITAL PLANNING



King County

Presented to
the Metropolitan King County Council
Government Accountability and Oversight Committee
by the
County Auditor's Office

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EXECUTIVE SUMMARY

Introduction

While Transit employs some core elements of financial and capital planning, there are opportunities to manage costs, increase revenues, and enhance their use of analysis to produce the most cost-effective decisions. The Regional Transit Committee and King County Council will also play a role in implementation of the recommendations included in this report as some of the recommendations involve changes to financial or fare policies. Other recommendations, for example, using economic replacement analysis to determine when vehicles should be replaced, can be implemented by Transit itself. There are a number of recommendations in chapter 2 that are repeated from past audits because they have not been fully resolved.

1 INTRODUCTION

We Evaluated the Effectiveness of Transit's Financial Plan, Model, and Analytic Methods

Summary

This chapter provides background on Transit's financial and capital planning including options for replacement of Transit's trolleys and fare strategies. We describe the objectives and methodology used in analyzing these areas and conclude with a summary of the findings and recommendations and an accounting of the estimated savings that could result from implementation of these recommendations.

Objectives and Methodology

The entire Transit audit spanned multiple areas of work, including Transit's service design practices, financial and capital planning, technology and information management, vehicle maintenance, operator and transit police staffing, and paratransit. The objectives of this portion of the Transit audit were to determine if Transit's financial plan and model were effective and serving their intended purposes and if they effectively plan for replacing their fleets. We also evaluated the effectiveness of Transit's capital budget planning, but limited our review to following up on and reassessing capital planning recommendations from prior audits. We also evaluated the costs and benefits of replacement alternatives for the existing trolley fleet and developed a lifecycle cost analysis as an economic basis for making the decision. Finally, we evaluated the effectiveness of Transit's fare policy, fare policy goals, fare structure and the downtown free ride area reimbursement formula.

To achieve these objectives, the office and its consultants:

- Interviewed Transit leadership, management, and line staff
- Surveyed relevant industry literature and best practices
- Reviewed Transit documents and agreements
- Developed a lifecycle cost model comparing trolleys, hybrid diesel-electric, hydrogen battery, and fuel cell buses
- Utilized Booz Allen Hamilton's fare modeling tool
- Performed analysis of Transit data including data from
 - Transit's financial analysis model
 - Fleet and vehicle maintenance data systems
 - Capital project information systems
 - Transit's diesel-hybrid cost model

Transit Employs Core Elements of Financial and Capital Planning, but Opportunities Exist

Summary of Findings

While Transit employs some core elements of financial and capital planning, there are opportunities to manage costs, increase revenues, and enhance their use of analysis to ensure the most cost-effective decisions. The Regional Transit Committee and King County Council will also play a role in implementation of the recommendations included in this report.

Transit's financial planning and financial model are thorough and prudent. However, its financial model is overly complex and lacks transparency, making it difficult for outsiders to understand or test the assumptions upon which Transit's financial plan is based. We also found that some of Transit's financial policies are outdated. Transit's financial plan holds more money in reserve than is needed in the Revenue Fleet Replacement Fund; \$105 million could be transferred out of that fund and used for other purposes.

Transit has made some progress in implementing earlier audit recommendations to support its capital decision-making with

standard economic analysis techniques; however, there is still room for improvement. For example, Transit does not base its fleet replacement decisions on economic replacement analysis. Given that Transit spends almost \$200 million per year to purchase and maintain its bus fleets, even a small reduction in these costs could amount to millions of savings per year.

Fuel cell and battery-powered buses are not viable candidates for replacing the trolley fleet; however, Transit could save \$8.7 million per year by replacing the trolley buses with hybrid diesel/electric buses, through cost and scheduling efficiencies. The trade-offs for this potential savings would include increased noise and diesel exhaust emissions in the neighborhoods currently being served by the trolleys.

Transit's fare policies are not guided by goals that are tied to organization-wide strategy. There are a variety of options for raising revenue by increasing fares or making strategic fare policy decisions. Finally, Transit was unable to fully document or provide support for the formula it uses as the basis for payments by the City of Seattle in support of the downtown ride free area.

Summary of Recommendations

To resolve the issues identified in the analysis of Transit's financial and capital planning, Transit should undertake a number of activities and planning processes. In some cases the recommendations made are policy choices that involve the review and approval of the Regional Transportation Committee and/or the King County Council and are noted in the text of the recommendation. Transit should:

Chapter 2

- Create an updated version of the financial model that facilitates sensitivity analysis and has complete documentation and explicitly identified assumptions. This

model should be made available to external parties such as the Office of Management and Budget (OMB) and council staff.

- Propose updated financial policies, particularly those related to sales tax distribution and cost growth to the Regional Transit Committee and council.
- Revise its assumptions to improve the accuracy of projections for capital expenditures and capital grant revenue.
- Develop a plan for reducing the size of the Revenue Fleet Replacement Fund balance and submit the plan for council approval.

Chapter 3

- Address technical issues with its economic analysis model.
- Use economic replacement analysis to inform its vehicle replacement decisions, starting with a model for the Revenue Fleet.
- Complete a review of Fleet Administration's operations and maintenance data if they wish to continue to use Fleet Administration's replacement criteria for its Non Revenue Vehicle (NRV) Fleet.
- Complete its comprehensive Asset Management Guidebook, including all asset management efforts currently underway within the division.
- Implement a Facilities Condition Index and systemwide targets for condition ratings for the Transit Facilities Condition Report.
- Ensure that all elements of facility master planning are incorporated as part of its 2010 update to the Comprehensive Plan.

Chapter 4

- Consider, with the council, all relevant factors, including costs, when determining an appropriate fleet replacement for the trolley buses.

Chapter 5

- Develop and propose policy goals as part of the update to the strategic plan to the Regional Transportation Committee and Council. These should include elements fully discussed in Chapter 5, and should be used to guide future fare policy decisions.
- Update and fully document the formula used to assess the City of Seattle's payment for the Downtown Seattle ride free area to reflect current ridership and operating conditions including trips that would be attracted by virtue of free fares. Transit and council should then consider revising the agreement with the City of Seattle.

EXHIBIT A**Estimated Savings / Revenue From Recommendations**

	Annual Cost Savings	Opportunities for Increased Annual Revenue	One-Time Fund Balance Available for Other Uses
Financial Planning			\$105 million
Trolley Replacement	\$8.7 million		
Fare Strategies		\$0 to \$51 million	

SOURCE: King County Auditor's Office

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2 FINANCIAL PLANNING

Transit's Financial Planning Is Thorough but Model Is Not Transparent to Decision-Makers

\$105 Million Could Come Out of the Fleet Replacement Reserve Fund

Chapter Summary

This chapter assesses Transit's financial planning, financial policies, and the analytical model Transit uses to conduct financial planning. We found that Transit's financial planning is thorough and its financial planning model includes all the elements recommended by the Federal Transit Administration (FTA). However, the financial model is overly complex, lacks transparency, and does not facilitate sensitivity analysis by policy-makers. We also found that Transit's financial plans have been relatively accurate in projecting operating revenues and costs, but less accurate in projecting capital grant revenues and capital expenditures. Also, some of Transit's financial policies are outdated. Finally, we found that more money is being held in the Revenue Fleet Replacement Fund balance than is necessary to fund future fleet replacement requirements. We calculated that \$105 million could be transferred out of the Revenue Fleet Replacement Fund while still maintaining a sufficient fund balance to fund all projected fleet replacement needs between 2009 and 2025.

Transit's Financial Plan and Model

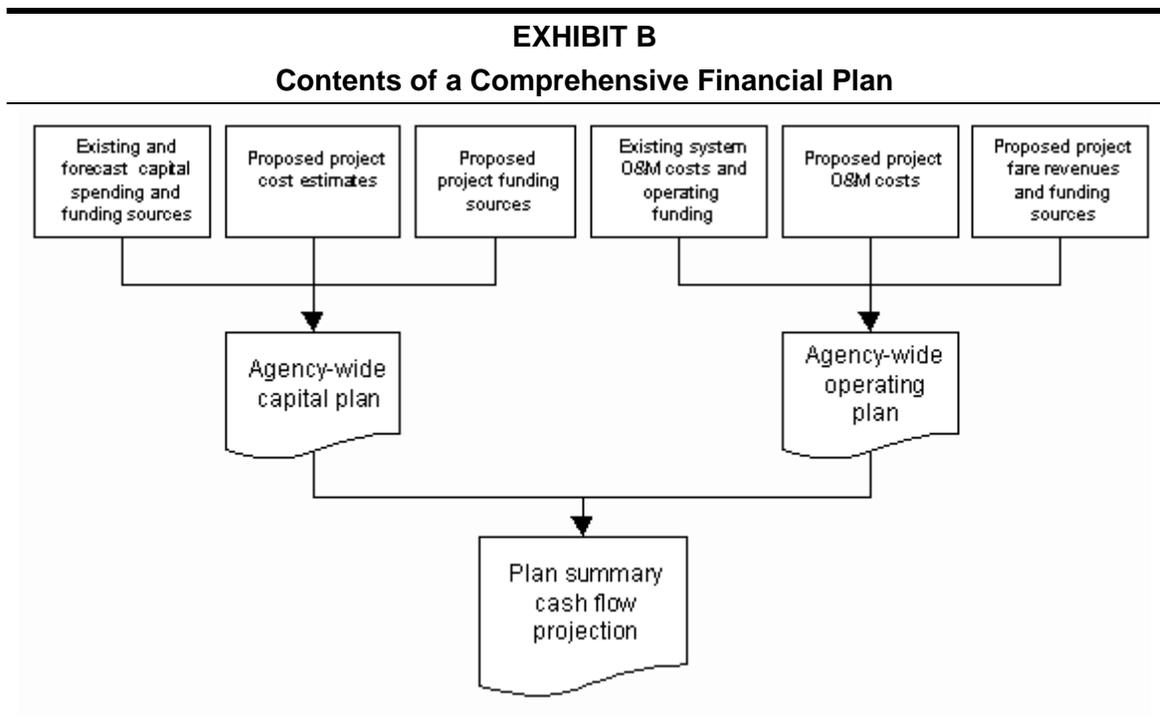
A financial plan summarizes recent and forecasted revenues and expenditures. It is therefore a key document for analyzing Transit's financial condition and informing crucial decisions about future service enhancements and capital improvements.

According to the FTA:

A solid financial plan facilitates the selection and implementation of new services and projects and the ongoing operation and maintenance of the

transit system. The financial plan presents the recent financial history of the transit agency, describes its current financial health, documents projected costs and revenues into the future, and demonstrates the reasonableness of key assumptions underlying these projections.

In the exhibit below, the FTA illustrates how financial plans bring together in one document an agency’s capital and operating plans.



SOURCE: *Financial Planning for Transit*, Federal Transit Administration.

In order to prepare a financial plan, Transit employs a financial model, an analytical tool that allows the agency to test assumptions and model different financial strategies for meeting the agency’s goals.

Principles of Sound Financial Planning and Modeling

The following principles of financial planning and modeling have been adapted from the American Institute of Certified Public Accountants (as cited by the Federal Highway Administration in *Financial Plans Guidance*) and the Federal Transit Administration's *Financial Planning for Transit*.

- Forecasts should be well documented and compared regularly with attained results.
- Key financial plan assumptions should be appropriate, explicitly identified, and well documented.
- The model should enable sensitivity analysis.
- The information used in preparing financial forecasts should be consistent with the organization's policies and strategic plans.
- Financial models should be accessible to multiple users.

Evaluation of Transit's Financial Model

**Transit's
Comprehensive
Financial Model Could
Be Improved**

Transit's financial model is an Excel workbook with several linked spreadsheets. The model provides detailed information about revenue and expenditure forecasts. The model does not include instructions. Transit prepares a separate document explaining key assumptions and forecasts for council.

We found that Transit's financial model includes all of the elements of a comprehensive financial plan as identified by the FTA (shown above in Exhibit A). It includes forecasts for both operating and capital revenues by source of revenue, operating and capital expenditures, and projected cash flows for the operating, capital, and revenue fleet replacement funds.

In general, we found Transit's financial model to be comprehensive, thorough, and conservative. It provides a comprehensive tool for agency managers to plan for the future.

However, there are some elements of the model that could be improved.

- In some instances, Transit's model does not include documentation for its forecasts.
- The model lacks documentation for forecasts performed outside of Transit's finance group, including forecasts related to capital expenditures, capital grants, sales tax, and ridership projections.
- Since many crucial assumptions are hard-coded into the model, the model is not set up to facilitate sensitivity analysis.
- The model's complexity, lack of documentation, and the frequency of hard-coded variables (numbers without the formulas from which they were derived) make it difficult to use.

RECOMMENDATION A1

Transit should create an updated version of the financial model that facilitates sensitivity analysis and has complete documentation and explicitly identified assumptions. This model should be made available to external parties such as the Office of Management and Budget (OMB) and council committee staff.

Transit Financial Policies

Transit has adopted Transit Program Financial Policies which are annually submitted to the Regional Transit Committee for review and approval. The policies cover broad areas of fund structure and reserves, resource allocation, capital funding and debt, fares and costs, and financial policies and development.

Findings Relating to Financial Policies

Some financial policies do not reflect the current operating environment. For example, the policy related to the distribution of sales tax revenue (75 percent operating, 25 percent capital) was

**Financial Policies Do
Not Reflect Current
Fiscal Environment**

set prior to the 2000 loss of the Motor Vehicle Excise Tax (MVET) and the subsequent sales tax increases. When Transit received the MVET, 100 percent of revenue from that source went for operations while the sales tax was distributed between operations and capital. After the loss of the MVET, the sales tax was increased to partially offset the loss. More recently, the sales tax was raised again to support the Transit Now initiative. Additionally, capital grant revenue has increased significantly recently. The combined effect of these changes has resulted in a higher proportion of Transit's revenue dedicated to the capital program than was the case when the policy for distributing sales tax revenue between operations and capital was set. While previously, operating revenues were used to support the capital program, now capital revenues support the operating program. In light of the above and additional findings (discussed below) relating to the size of the Revenue Fleet Replacement Fund balance, a change in the allocation of revenue between the capital and operating programs is warranted.

Transit appears to be out of compliance with Section IV of the Transit Program Financial Policies that requires that Transit keep cost/hour growth within inflation or provide explanation to council during budget planning and propose a plan to bring hourly costs back to the targeted level. Not only has cost/hour growth exceeded inflation, but the Transit financial model assumes that this trend will continue indefinitely in the future. Transit does not routinely present to the council the explanations or budget options required by the financial policy.

RECOMMENDATION A2 Transit should propose updated financial policies particularly those related to sales tax distribution and cost growth for consideration by the Regional Transit Committee and the King County Council.

Historical Accuracy of Financial Plan Projections

One-year revenue and expenditure projections

We analyzed six years of Transit financial plans (2003-2008) to assess the accuracy of each year's revenue and expenditure projections for the subsequent year. Over this period, Transit's forecasts of overall revenues and operating expenditures for the following year have been good: revenue projections have been within four percent of actuals in the last three years. Forecasts of operating expenditures have been around one percent or less of actuals. However, this analysis yielded two areas of particular concern:

Projections for Capital Expenditures and Grant Revenues Have Been Inaccurate

Capital Expenditures were overestimated in five of the six years evaluated.¹ In the last three years of the analysis, Transit spent 51, 51, and 41 percent less on capital than they had budgeted. This echoes findings from the 1999 Transit Management Audit, which noted underspending by 53, 53, and 50 percent on the capital program from 1996-1998.

Capital Grants. Over six years, Transit forecasted receiving 17 percent (or \$75 million) more grants than it received. While Transit's forecast underestimated grants for 2004 and 2006 by 28 and 23 percent, these underestimates did not offset overestimates in 2003, 2005, 2007 and 2008 of 30, 34, 35, and 10 percent.

¹ Transit has responded to this concern by pointing out its accuracy in projecting final expenses for the following year during the budget cycle. (E.g., Transit's forecasts for 2009 are produced in June 2008. Its projection for 2009 is produced in April/May of 2009.) While the difference in Transit's estimate is reduced to fewer than 10 percent when looking at the forecasts mid-year, it is still troubling that the long-term forecasting has remained inaccurate over the decade since the auditor's office published the Transit Management Audit report conducted by Doolittle and Associates, consultants, in 1999.

Estimation of Grant Revenue Ranged From \$5 Million Over Actual in 2002 to \$143 Million Under Actual in 2005

Multi-year projections of capital expenditures and capital grant revenue

Concerns generated by our analysis of Transit's one-year forecasts of capital expenditures and capital grant revenue led us to examine the accuracy of Transit's multi-year forecasts of capital expenditures and capital grant revenue. We compared the multi-year projections of capital grant revenue as stated in the Transit Enterprise Fund financial plan provided with each budget between 2002 and 2005 with the amount of capital grant revenue received in the multi-year projection period of each financial plan (e.g., the 2002 financial plan projects revenues and expenditures for 2002, 2003, and 2004). Three of the four financial plans underestimated the amount of capital grant revenue received during the projection period. The amount of the multi-year underestimation of capital grant revenue ranged from a \$5 million overestimation in 2002 to a \$145 million underestimation in 2003. All four of the financial plans overestimated the amount of capital expenditures for the multi-year projection period.

Combined effect of previous capital revenue and capital expenditure projections

As discussed above, Transit has consistently overestimated capital expenditures and underestimated capital grant revenue. The following exhibit shows the combined effects of the difference between the projected and actual amounts of capital grant revenue and capital expenditures for the projections provided in the financial plans submitted with the 2002-2005 budgets. In each instance, there were significantly fewer resources required for the capital program (because capital expenses were overestimated, capital grant revenues were underestimated, or both) than was projected in the financial plan.

EXHIBIT C			
Overestimation of Expenditures and Underestimation of Grant Revenues			
Year	# Years Projected	Combined Effect of Overestimating Expenditures or Underestimating Revenue (Total Additional Money That Was Available in the Financial Plan)	Average Annual Additional Money That Was Available in the Financial Plan
2002	3	\$127,644,183	\$42,548,061
2003	5	\$228,277,511	\$38,046,252
2004	3	\$183,505,511	\$61,168,504
2005	3	\$160,037,236	\$53,345,745

SOURCE: King County Auditor's Office

The last two columns of the table indicate the multi-year overestimate of the amount of resources needed for the capital program and the average yearly amount of additional money that was available for other uses in comparison to the projections made in the financial plan.

Forward-looking capital grant revenue projections

The preceding paragraphs discuss how Transit's *previous* projections of capital expenditures and capital grant revenue have overstated the amount of resources needed for the capital program due to a combination of overestimating capital expenditures and underestimating capital grant revenue. Based on our review of the projections in Transit's *current* financial plan, we suspect the current financial plan may also overstate the amount of resources needed for the capital program. Projected grant revenue in the future is significantly less than the amount of grant revenue currently being received. For example:

- The amount of capital grant revenue from competitive grants for 2009 in the adopted budget is \$53.6 million, whereas the projected formula capital grant revenue for 2014 and thereafter is \$0. Grants Administration staff did not indicate any reason why capital grant revenues would be expected to decrease in the future. In fact, they indicated that capital grant revenue has been increasing over time. Transit

Transit's Projection of \$0 in Grants for 2014 Is an Unlikely Scenario

financial staff have suggested that the types of projects in the future CIP, which are primarily oriented towards maintaining existing assets rather than acquiring new assets, will not fare well in the competitive process. The assumption that Transit will get no money from competitive grants after 2013 is not reasonable.

- Projections for ongoing sources of grant revenue that are awarded based on formulas rather than on competition (e.g., the \$50 million annual preventative maintenance grant and the \$12 million annual fleet replacement grant) are flat at current levels and do not reflect any growth for inflation, increasing fleet size, or increased funding levels from the FTA. While the formulas for awarding these grants may not directly recognize inflation or growth in fleet size as award criteria, revenue from these sources has increased in the past. Transit has offered no explanation why they would not continue to do so in the future.

RECOMMENDATION A3

Transit should revise its assumptions to improve the accuracy of projections for capital expenditures and capital grant revenue.

Revenue Fleet Replacement Fund Balance

The Revenue Fleet Replacement Fund (RFRF) provides a reserve for projected fleet expansion and for replacing old fleet vehicles. Based on vehicle acquisition schedules and projected costs, it identifies an annual amount of money that should be set aside in anticipation of future fleet acquisition expenditures. The current fund balance in the RFRF is nearly \$200 million.

The RFRF was created during a time when Transit's financial structure was significantly different than the current structure. Transit no longer receives the MVET, but receives higher sales tax revenue to offset the loss of the MVET. Financial policies

dictate that 25 percent of sales tax revenue be directed to capital (and the RFRF is the first priority for capital revenue after debt service). The effect of these changes to Transit's financial structure is that capital revenue has benefited to a greater degree than operating revenue. This is illustrated by the fact that prior to the loss of the MVET, the operating fund would transfer excess revenue to the capital fund. Now the capital fund transfers excess revenue to the operating fund.

**\$105 Million Could Be
Used From Revenue
Fleet Replacement
Fund While Still
Funding All Planned
Fleet Replacements**

The relative richness of capital revenue brings into question whether the RFRF needs to maintain such a large fund balance. In almost every year, the amount of revenue dedicated to the RFRF (sales tax and preventive maintenance grant) is more than sufficient to cover that year's fleet acquisition expense. Between 2009 and 2020, excepting two years, each year's revenue to the RFRF exceeds what is needed to cover that year's fleet replacement expense. Thus, the financial plan shows that between 2009 and 2020, approximately \$500 million will be transferred out of the RFRF into the capital fund *while still increasing the fund balance from about \$200 million at the beginning of 2009 to almost \$300 million by 2020.*

While it is prudent to maintain a reserve for future fleet acquisition expenses, the size of the current reserve reflects Transit's old financial structure in which operating revenue had to support capital expenditures. Given the current financial structure in which dedicated annual capital revenues provide an excess of funds for fleet replacement, there is currently no need to maintain such a large balance in the RFRF. For example, Transit's financial model shows \$693 million in excess revenue being transferred out of the RFRF between 2009 and 2025, while still building the fund balance from approximately \$200 million to \$300 million. Using Transit's financial model, we calculated that in addition to the amount of transfers out of the fund balance

projected by Transit in the financial plan, another \$105 million could be transferred out of the RFRF while still maintaining sufficient fund balance to fund all fleet replacements identified in the financial plan. Also, spending down the fund balance amounts to a one-time source of revenue, so we caution against using the entire amount in one year if these funds are to be used to support ongoing operating expenditures. This source of revenue will not be available again once it is spent. It would be more prudent to use these funds more gradually.

RECOMMENDATION A4 Transit should develop a plan for reducing the size of the Revenue Fleet Replacement Fund balance and submit the plan for council approval.

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3 CAPITAL PLANNING AND FLEET REPLACEMENT

Optimizing Fleet Replacement Decisions Could Save Millions Per Year

Chapter Summary

This chapter reviews Transit's progress in implementing the recommendations of previous audits relating to its capital planning and includes an evaluation of the economic analysis supporting its vehicle replacement decisions. We found that Transit has made progress in implementing previous recommendations to use economic analysis to support capital decision-making, but further improvements are needed. We also found that Transit does not use economic replacement analysis to determine when its bus fleets should be replaced. Given that Transit spends almost \$200 million per year to purchase and maintain its vehicles, even small reductions in these costs resulting from optimizing fleet replacement decisions could save millions per year.

Background

The 2008-2013 Transit capital improvement program includes \$1.27 billion in projects to replace existing Transit infrastructure and build new infrastructure to support current Transit service and planned expansion.

The plan is split into 13 different programs. Exhibit D shows the programs and their 2007 actual expenditures. 2008 figures were not available at the time of audit analysis.

EXHIBIT D	
Transit CIP Programs	
Program	2007 Expenditures
Asset Maintenance	\$15,498,015
Passenger Facilities	\$11,978,735
Transit Systems	\$11,318,887
Miscellaneous and 1 % for Art	\$9,619,842
Operating Facilities	\$7,014,329
Reimbursable Program & Leases	\$3,749,060
Vanpool	\$3,243,383
Fleet	\$1,848,671
Trolley	\$1,554,534
Speed & Reliability	\$1,510,442
Rapid Ride	\$1,118,540
ADA/Paratransit	\$64,093
Business Systems	\$0
Total:	\$68,518,531

SOURCE: King County Auditor's Office

Previous Capital Planning Audits

In the past 10 years, the King County Auditor's Office has examined Transit capital planning in four different audit projects: the 1999 Transit Management Audit, the 2005 Performance Audit of Transit Capital Planning and Management, the 2006 Follow-up on Economic Analysis of Capital Projects, and the 2007 Follow-up on the 2005 Performance Audit. Previous audit recommendations have focused on the need for:

- Economic analysis, including lifecycle cost analysis for fleet replacement decisions,
- Asset management, and
- Facility master planning.

We have assessed the status of Transit's implementation of the recommendations of these previous audits and will discuss the current status of these recommendation areas below.

Economic Analysis

Economic analysis refers to the processes used to compare the benefits and costs of potential project alternatives based on standardized economic assumptions within an appropriate analytical framework.

**Progress Made in
Economic Analysis but
Further Improvement
Is Needed**

In our 2005 audit, we found that Transit lacked guidelines for economic analysis and was inconsistent in identifying, quantifying, and analyzing the cost impacts of alternatives for major capital investments. We reviewed four case studies of major Transit CIP decisions, and we found that Transit did not apply the appropriate analytical tools when evaluating the costs of proposed projects. We also found that Transit did not have policies, procedures, or guidelines that would help ensure economic analyses were sound and consistently applied. Instead, Transit's analyses were applied on an ad hoc basis, sometimes relying primarily upon professional judgment. We concluded that the absence of policies, procedures, and guidelines for economic analysis, and for applying best practices in such analyses, made it difficult for Transit to be held accountable for its decisions and for the County Council to provide effective oversight. Alternately, if Transit provided the council with its analysis of a thorough array of alternatives, it could enrich the council's deliberations and support its decision-making process. We recommended that Transit develop and apply guidelines and models for economic analysis.

Transit finalized their guidelines as well as an economic analysis model in August 2007. For this audit, we evaluated three case studies of Transit economic analysis to test Transit's application of its new guidelines. We found that Transit has made progress in implementing previous audit recommendation related to economic analysis, but technical issues with their use of economic analysis remain.

Although each of the case studies had individual issues, two matters were consistently problematic. First, Transit did not apply accurate annual equivalent values or appropriate discount rates. Annual equivalent values are the cost per year of owning and operating an asset over its entire lifespan. When considering alternative options for spending Transit's money, using accurate annual equivalents would be more likely to result in apples to apples comparison of the choices, allowing Transit to make the most cost-effective decision. Second, Transit has used an improper discount rate throughout all the case studies. Discount rates are used to relate present and future dollars by eliminating the effects of expected inflation. Ensuring that accurate discount rates are used would equalize Transit's varying streams of costs and benefits, so that different alternatives could be accurately compared, allowing Transit to make the most cost-effective choices.

RECOMMENDATION A5

Transit should address technical issues with its economic analysis model and provide it to the auditor's office to confirm its accuracy.

Transit Spends \$96 Million Annually on Buying Vehicles and \$94 Million Annually on Maintenance

One specific area we selected to review Transit's economic analysis is for fleet replacement decisions. Transit operates almost 3,679 vehicles, among five distinct fleets. Each fleet has separate fleet replacement practices. Determining when to replace vehicles is important in minimizing the costs of owning and operating vehicles. Economic replacement analysis identifies the point in a vehicle's lifecycle that owning and operating costs are minimized, and identifies the optimal time to replace vehicles. Transit spends approximately \$94 million per year on vehicle maintenance, and \$96 million per year on vehicle procurement. Given the magnitude of these costs, it is crucial that Transit

minimize ownership and maintenance costs by conducting economic replacement analysis in order to determine the most economic time to replace its vehicles.

Vehicle Replacement Criteria

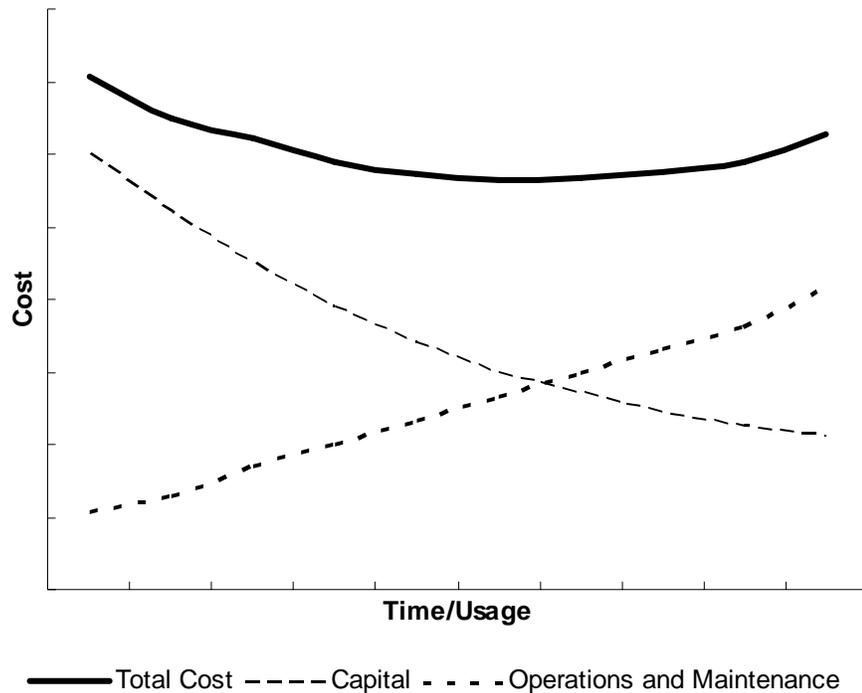
Vehicle replacement criteria are guidelines for when to remove vehicles from the fleet and buy new equipment to take its place. Choosing the right vehicle replacement criteria is critical to minimizing costs over the lifecycle of the vehicle.

Transit Should Use Economic Vehicle Replacement Analysis

There are two valid approaches to establishing replacement criteria: performing a detailed economic replacement analysis or adopting criteria from an agency that has performed an economic replacement analysis for a similar fleet. The method chosen depends partially on the analytical capabilities of the fleet management agency and the quality and breadth of the data available for analysis.

Using economic replacement analysis, the fleet management agency calculates the most economically advantageous time to dispose of its vehicles and replace them with new vehicles. Finding the optimal replacement point in the lifetime of a vehicle requires taking into account the total ownership costs of a vehicle. For example, over time, while fleet capital costs tend to decrease, operating costs tend to increase. Exhibit E shows a theoretical example of how these two types of costs determine the optimal vehicle replacement point.

EXHIBIT E
Optimum Vehicle Replacement Point



SOURCE: King County Auditor's Office

The optimum time to replace vehicles is at the lowest point of the total cost line, before increased operations and maintenance costs force the total cost line to rise again. Well designed vehicle replacement programs take into account:

- Initial purchase costs
- Operations and maintenance costs
- Downtime
- Salvage value
- The time value of money

An alternative to performing economic replacement analysis is using the replacement criteria from other organizations with comparable fleets which do conduct appropriate lifecycle cost analysis. Agencies choosing this approach need to ensure that both their fleet (size, mix, procurement cost, and approach) and

experience (usage, weather, operations, and maintenance) are similar to the agency from which they are adopting their criteria.

Transit's Vehicle Replacement Criteria

Transit manages five different vehicle fleets with five separate replacement criteria, as indicated in Exhibit F. None of the five vehicle fleets' replacement criteria is based on economic replacement analysis.

EXHIBIT F			
Replacement Criteria for Transit Fleets			
Fleet Type	Total Vehicles	Replacement Criteria	Criteria Basis
Revenue Fleet, buses, vans, and trolleys	1,336	Baseline of 7 years for vans, 12 years for buses, and 15 years for trolleys	FTA funding guidelines Ad hoc analysis of extending timeframe
Non-Revenue Fleet, light trucks, police vehicles, and vans	448	4 – 10 years	King County Fleet Administration criteria
Access Fleet, small buses and vans	367	8 - 10 years	Professional judgment
Vanpool, vans	1,478	7 years	Professional judgment
DART Fleet, buses and vans	50	N/A. 5-year service contract covers both provision and operation of new vehicles.	Contract length based on professional judgment
Total Fleet:	3,679		

SOURCE: King County Auditor's Office

The following sections will explain the fleets and replacement criteria in more detail.

Revenue Fleet

The largest components of the fleet include 410 forty-foot Gillig diesel buses, 272 sixty-foot New Flyer diesel buses, and 234 sixty-foot New Flyer hybrid buses.

**Transit Does Not
Conduct Economic
Replacement Cost
Analysis to Determine
When to Replace Buses**

Bus replacement is somewhat constrained by federal funding. The Federal Transit Administration has set standards for bus replacement (12 years for a diesel bus and 15 years for an electronic trolley, for example). If a transit agency chooses to replace a bus sooner than that standard, the agency must reimburse a prorated portion of the federal grant used to purchase the bus. Therefore, Transit considers the FTA standards to be a baseline from which to consider the replacement criteria for buses and uses professional judgment in extending beyond this minimum. Each major category of vehicle has its own unique lifecycle costs, so in order to ensure that the total cost of owning and operating a vehicle is minimized, the replacement criteria for each category of vehicles should be based on a separate economic replacement analysis for that vehicle category.

Revenue Fleet Replacement Criteria

Transit does not conduct economic replacement cost analysis in order to determine the replacement criteria for the revenue vehicle fleet. In interviews, Transit indicated that its replacement criteria are based on the requirements of the FTA. For the large (40-foot and larger) bus categories, the FTA's minimum service requirement is 12 years or 500,000 miles, whichever comes first. Thus when Transit states that their replacement criteria is based on FTA requirements, this means that they plan to keep a bus at least 12 years before it is replaced.

Transit stated that they analyze whether to keep buses a few years beyond the 12-year minimum. Transit staff indicated this analysis involved assessing the condition of the buses and the prior year's operating and maintenance costs. However, Transit was unable to provide documentation of this analysis. Further, an analysis that considers only one year of operating and maintenance costs, and does not consider the annual cost of

owning the bus does not substitute for an economic replacement analysis that considers all costs over the life of the bus and determines the most economic time to replace the bus.

Transit has recently begun using a tactical replacement model that is included in their vehicle maintenance information system. This tactical replacement model prioritizes which vehicles should be replaced first after a strategic replacement decision (i.e., when to begin to replace a group of vehicles) has been made. While the tactical replacement model provides information useful for prioritizing, it does not substitute for using economic replacement analysis as the proper tool for making the strategic replacement decision.

Conclusion

The Cost of Owning and Maintaining Transit's Buses Is Likely Higher than Necessary

Transit does not conduct economic replacement analysis to identify the economic replacement point for its revenue vehicles, so it is likely that the cost of owning and operating its revenue vehicle fleet is higher than necessary. Given that Transit spends nearly \$200 million a year to acquire and maintain buses, even a small reduction in these costs resulting from optimizing the vehicle replacement decision could save millions of dollars per year.

Non-Revenue Fleet

Transit's non-revenue vehicle fleet includes light-duty vehicles used for supervisors, cleaning crews, and Transit police. The 448 total non-revenue vehicles include 138 light trucks, 132 passenger vehicles, 111 vans, and 67 police vehicles.

As part of our 2006 County Vehicle Replacement performance audit, we looked at the non-revenue vehicle fleet. We found that in lieu of developing a lifecycle cost model, Transit has chosen the alternative method of establishing criteria – it has adopted its

replacement criteria from Fleet Administration. As noted above, this is a valid approach for comparable fleets. Transit's fleet is similar to Fleet Administration's fleet in that it is subject to the same weather, the cars are acquired from the same vendor, and the vehicles are used on the same roads. However, Transit has noted that many of its vehicles have unique uses. For example, Transit has pickup trucks with pressure washers that spend much of the time idling while cleaning bus stops, rather than driving and accumulating miles. In addition, Transit employees, not Fleet Administration employees, provide maintenance for the Transit fleet. Both its unique uses and differences in the way Transit employees maintain their fleet could lead to operations and maintenance costs that are different from those experienced by Fleet Administration vehicles. Therefore, it is unclear whether the replacement criteria used by Fleet Administration based on the cost patterns of Fleet Administration vehicles is valid for Transit vehicles.

In 2006 we recommended that Transit review a full year of operations and maintenance data for vehicles in the non-revenue fleet to assess whether its costs are comparable to Fleet Administration's. If Transit found that its data differed significantly from Fleet Administration's data, we recommended that Transit develop its own fleet replacement criteria for the non-revenue vehicles. Transit concurred with our recommendation and committed to implementing it in the 2009 budget submittal.

Transit received Fleet Administration's data in June 2009 and has not yet finished its analysis, but reports that analysis will be complete by late August 2009.

Access Fleet

Access is Transit's Americans with Disabilities Act (ADA) Paratransit service. Riders are pre-screened for eligibility and may request a ride 1-3 days in advance. The Access fleet consists of 367 vehicles: 264 fourteen- to fifteen- passenger buses, 67 ten- to twelve-passenger buses and 36 modified four-passenger minivans.

Access Fleet Replacement Analysis Does Not Consider All Important Variables

Transit does not use economic replacement analysis to determine the economic replacement point for its Access fleet. Rather, Transit reports it uses professional judgment weighing operational costs, current demand, service requirements and vehicle condition based on detailed inspection of the vehicle's interior, exterior, chassis, understructure and drive train. According to Transit, this data is then combined with vehicle age, mileage accumulation, historical repair and maintenance hours, road calls, and vehicle down-times. This approach is inadequate because it is not an economic replacement analysis which considers all vehicle costs including purchase price, and the time value of money.

Vanpool Fleet

Transit's Vanpool program aims to reduce single-occupant vehicle trips by providing vans to groups of 5 to 15 commuters. The vanpool groups establish their own routes and schedules. They pay fares based on the vanpool group's round trip mileage, the number of riders that share the van, and weekly work schedule. Individual vanpoolers, except the drivers, pay their share of the total fixed monthly fares. The larger the van and the more participants, the lower the fare for everyone in the group. The cost to participants may be further reduced by subsidies provided by employers. Vanpool has a total of 1,478 vans in the fleet. The majority of these vans are 8-passenger vans, 7-passenger vans, and 12-passenger vans.

Transit does not use economic replacement analysis to determine the economic replacement point for its VanPool fleet. Rather, they use professional judgment when determining when to replace vehicles.

DART Fleet

Demand-Responsive Transit Service (DART) provides flexible routes in 12 general service areas. With DART service, riders can call ahead and make arrangements for vans to pick up and drop off at locations off regular routes. DART service is contracted out to private vendors, and the DART vehicles are owned by the private vendors. The contract payments are based on the owning and operating costs of the vehicles. The length of the contract is based on Transit staff's professional judgment of the useful life of the vehicles. Thus, while Transit does not own the DART vehicles, its contractual payment amount is based, in part, on Transit staff's judgment of the useful life of the vehicles.

Transit does not conduct an economic replacement analysis to determine the economic replacement point of DART vehicles.

RECOMMENDATION A6 Transit should create economic replacement analysis model to inform its vehicle replacement decisions, starting with a model for the revenue fleet.

RECOMMENDATION A7 If Transit wishes to continue to use Fleet Administration's replacement criteria for its Non-Revenue Vehicle fleet, it should complete its review of Fleet Administration's operations and maintenance data. If Transit chooses not to use Fleet Administration's replacement criteria, economic replacement analysis should be used for non-revenue vehicles. Note: This recommendation is comparable to the 2006 County Vehicle Replacement performance audit recommendation.

Asset Management

According to the Federal Transit Administration, asset management involves a strategy for cost-effectively allocating resources and managing infrastructure. That strategy requires maintaining an inventory of assets, monitoring the assets' condition over time, and planning for the maintenance and replacement of assets over their useful life. The ultimate goal of asset management is to minimize lifecycle costs of managing transportation assets.

Transit's asset management plan

State Requires Asset Management

Asset management has received a higher profile in Washington state since the Blue Ribbon Commission on Transportation emphasized its importance in its final report in November 2000. The commission recommended that transit agencies invest in maintenance and preservation of their systems, and that funding for such activities be linked to best practices. In response, in 2003, the Washington State Legislature required all transit agencies within the state to submit an asset management plan to the Washington State Department of Transportation (WSDOT).

Transit submitted its first asset management plan to WSDOT in May 2005. Our 2005 audit recommended that Transit consider using the state-mandated asset management plan to document

and communicate its asset management approach both internally and externally. Transit concurred with the recommendation, and stated its intent to discuss this option with the state before its next submittal, which would be due in 2007.

When we followed up with Transit in January 2007, Transit noted that it had decided to develop a more comprehensive asset management guidebook that satisfies both state and federal requirements, but had not set a schedule for developing the document. Our follow-up recommendation was for Transit to identify a new timeline for implementing a comprehensive asset management guidebook that satisfies both state and federal mandates.

**Progress Made Toward
Asset Management
Plan; Updates Needed**

Transit developed Asset Management Guidelines in July 2008. This document provides an overview of state, federal, and county requirements for asset management, as well as a description of Transit's replacement processes for different asset types. It is not the comprehensive guidebook on asset management envisioned in Transit's 2007 response. According to Transit, the division has not worked on the document in over a year.

Our original recommendation in 2005 was intended to help Transit assimilate and communicate its approach to asset management, using an existing process (the state requirements). In order to implement the recommendation, Transit's guidebook needs to be comprehensive, including the elements of the state requirements, as well as other germane asset management efforts within the division. This means the document should include:

- A mission statement,
- A complete inventory of assets,
- A preservation plan,

- An explanation of Transit's lifecycle cost analysis approach, and
- Detailed program narratives.

Much of this information is already included in Transit's 2005 submission to WSDOT. However, Transit has since created economic analysis guidelines and has made other changes that require the document to be updated to fully reflect Transit's current approach.

RECOMMENDATION A8

In 2005 we recommended that Transit complete its comprehensive Asset Management Guidebook, including all asset management efforts currently underway within the division. We continue to recommend that the comprehensive Asset Management Guidebook be completed.

The Transit asset management program and Transit Facilities Condition Report

The Transit Asset Management Program (TAMP) is a program designed to preserve and replace Transit's facilities and equipment. TAMP represents a significant portion of Transit's CIP. TAMP was the largest program in Transit's 2007 CIP, at over \$15 million (TAMP totaled \$12 million and other asset maintenance projects added \$3 million).

Transit Has Many Elements of Strong Asset Management In Place

The Transit Facilities Condition Report (TFCR) supports the TAMP by identifying the capital projects necessary to preserve Transit assets in the near term. The report organizes projects into four categories – architecture, civil, electrical, and mechanical. Each category has separate, more specific programs (for example, the mechanical projects category has elevators and escalators, lifts, HVAC, and miscellaneous mechanical programs), and each program within the four

categories has a detailed program summary. The most recent TFCR, for 2007-2014, identifies \$92 million in asset preservation projects. This amount does not include costs associated with equipment replacement, trolley infrastructure, administration, or shelter refurbishment.

TAMP and the TFCR embody many elements of strong asset management and facility planning. Industry best practices include compiling a comprehensive inventory, regularly performing condition assessments and updating the inventory with such information, and articulating program goals and objectives. Transit's program and report adhere to these best practices. Transit noted that they are moving to a new work order system in the coming year, which will allow more real-time updates to facility condition.

**Targets and Tracking
Would Monitor Facility
Conditions**

The success of an asset management program is reflected by how well it is preserving capital assets. While Transit tracks and maintains information on individual facility components, it does not set targets for or track systemwide condition. A facilities condition index (FCI) can be used to track and monitor facility condition relative to targets.² Programwide facility condition ratings can be summarized to provide the percentage of buildings in excellent, good, fair, or poor condition, and targets can be set for how much of the system should be in particular conditions. If, for example, a goal is to maintain 75 percent or more of an agency's facilities in good condition, the FCI can show progress toward that goal.

² The FCI is expressed as the ratio of required repairs to the replacement value of the building. One example of the use of FCI is the Washington State Community College System, which provides a biennial report on the condition of its facilities systemwide.

RECOMMENDATION A9 Transit should implement a Facilities Condition Index and systemwide targets for condition ratings for the Transit Facilities Condition Report.

Facility Master Planning

**Auditors First
Recommended a
Facility Master Plan in
2005**

In our 2005 audit, we noted that capital projects should be guided by a comprehensive facility master plan. Facility master planning is the practice of examining the current and projected facility needs of an organization and the capacity and condition of existing facilities in order to determine the best facility investments in the future. The product of the facility master planning process is a report that plans facility development for the long range – usually 10 to 15 years.

A facility master plan supports the CIP by articulating the relationship between the department's strategic goals and its physical plant. A facility master plan also helps to clarify facility needs and priorities for CIP investments by providing comprehensive information on current facilities, their condition, and building standards to which the department adheres. Finally, a facility master plan identifies a rough level of investment needed to satisfy building needs, compared to current funding levels.

Although Transit did not have a facility master plan in 2005, we noted that the Transit Facilities Condition Report (mentioned above) includes many of the components necessary to create a facility master plan. We recommended that Transit develop a facility master plan and designate a schedule for periodically updating the plan. Transit concurred with the recommendation and committed to developing a facility master plan by the fourth quarter of 2006.

In our 2007 follow-up audit, Transit noted that it had postponed work on a facility master plan until it finished development of an operational master plan. Through a 2006 budget proviso, council required Transit to update its long-range policy framework in preparation for an operational master plan. An October 2006 council motion provided schedules for updating the operating and capital policy framework and developing a work plan and scope for an operational master plan. The work plan was expected to be transmitted in the third quarter of 2007, and the scope of the operational master plan was expected in the first quarter of 2008.

In 2007, Transit and council staff agreed upon an alternative planning structure that would include the elements of an Operational Master Plan and Facility Master Plan in the update of the Transit Comprehensive Plan for Public Transportation and the Ten-Year Transit Strategic Plan for Public Transportation.

**Plan Needed to
Determine Best Facility
Investments**

The Transit Division continued to work with the Regional Transit Committee during 2008 towards development and adoption of a wide-ranging update of both the Transit Comprehensive Plan for Public Transportation and the Ten-Year Transit Strategic Plan for Public Transportation that would include operational and facility master plan elements. That process was tabled until the Transit Division's current financial picture is clear and actions related to revenue shortfalls are identified and reviewed by policy-makers.

When the planning efforts resume later in 2009 or in early 2010, the updated Comprehensive Plan is intended to establish the planning framework, including mission, goals, objectives and policies to guide the transit system. The update to the Strategic Plan will establish operating and capital program strategies sufficiently comprehensive to address service and capital master plan elements.

**RECOMMENDATION
A10**

In its 2010 update to the Transit Comprehensive Plan, Transit should ensure that it fully incorporates all elements of facility master planning. This is comparable to a recommendation made in 2005.

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4 ALTERNATIVES TO TROLLEY BUSES

Transit Scheduled to Replace Trolleys in 2014

Chapter Summary

Electric trolley buses (trolleys) are used on some routes within the City of Seattle as an alternative to diesel buses. Because trolleys are quieter and do not generate tailpipe emissions, they have environmental advantages in densely populated urban areas; however, trolleys are expensive to purchase and operate. Transit's trolley fleet is aging and is scheduled to be replaced in 2014. This chapter evaluates whether there are viable alternative technologies to the trolleys that provide similar benefits at a comparable or lower cost than the trolleys that could be considered during the replacement process.

Of the alternative technologies considered; hybrid diesel/electric buses (hybrids), battery powered buses, and hydrogen fuel cell powered buses; only hybrids are a viable alternative to the trolleys. Battery and fuel cell powered bus technologies are not sufficiently advanced to be a viable alternative to the trolleys for the 2014 replacement timeline. Replacing the trolleys with hybrids could save approximately \$8.7 million in vehicle purchasing and maintenance costs with commensurate reductions in operational costs. Replacing the trolleys with hybrids would result in some added tailpipe emissions and noise in the neighborhoods currently being served by the trolleys.

Background

In adopting the 2007 Energy Plan, the King County Council defined the following key sustainability and climate control initiatives for the county. Two goals explicitly call out Transit, but all of them potentially impact Transit and its vehicle replacement decisions:

- Reduce greenhouse gas emissions 80 percent below current levels by 2050
- Increase amount of biodiesel used in all county diesel vehicles to 20 percent renewable energy:
 - Ensure at least 35 percent of transit energy use come from efficiencies and renewable energy sources by year 2015
 - Ensure at least 50 percent of transit energy use come from efficiencies and renewable energy sources by year 2020

Hybrids, Hydrogen Fuel Cell, and All Battery Buses May Be Alternatives to Trolleys

Four technologies were evaluated for this report: trolleys, hybrids, hydrogen fuel cell buses, and all-battery buses. No other alternate fuels technologies were identified in the Federal Transit Administration's current *Multi-Year Research Program Plan*.

Trolleys

A trolley is an electric bus that draws its electricity from overhead wires using spring-loaded trolley poles. Trolleys are a mature technology that is currently employed by several transit systems. Other agencies' use of trolleys and the future of trolley funding and manufacturing are discussed later in this chapter.

Hybrid Buses

A hybrid bus is a form of bus that uses hybrid electric and diesel technology for propulsion instead of a conventional diesel engine. Transit currently operates and maintains a fleet of hybrid buses. At this time hybrid buses are the most viable alternative to trolleys due to availability and reliability of the technology.

Hydrogen Fuel Cell Powered Buses

A fuel cell bus is a bus that uses a hydrogen fuel cell as its power source for electrically driven wheels. Based on the Federal Transit Administration's March 2009 *Report on Worldwide*

Hydrogen Bus Demonstrations, fuel cell buses still have technical and commercial challenges that make it unlikely that they will be a viable alternative by 2014, when Transit's trolleys are scheduled to be replaced. Key challenges identified in the report include:

- Fuel cell buses can only travel 150 miles before refueling as compared to diesel and hybrid buses that can operate for a range of about 400 miles without refueling.
- It takes between 10 and 30 minutes to charge a hydrogen fuel cell as compared to 2.5 to 10 minutes to refuel a diesel bus.
- Fuel cell test buses were only available to operate their routes 85 percent of the time because of issues with energy storage and lack of a mature supply chain industry.
- Infrastructure for the production of hydrogen is not fully developed and hydrogen is not readily available for purchase.

**All Battery Buses Are
Not A Viable
Alternative to Trolleys
in 2014**

All Battery Buses

An all battery bus uses chemical energy stored in rechargeable battery packs and uses an electric motor instead of an internal combustion engines for propulsion. While the all battery bus may be capable of supplementing an electric trolley bus fleet, all battery buses also have technical, cost, and range limitations that make it an unlikely viable alternative to trolleys in 2014. King County Transit, participating in a consortium of four transit agencies, has applied for grant funding under the Federal Transit Administration's Transit Investments for Greenhouse Gas and Energy Reduction (TIGGER) program, to demonstrate the feasibility of an all battery powered bus as a means to complement the existing trolley bus fleet and expand the carbon free footprint of the transit system. Award of grants will be announced later in 2009.

Exhibit G below shows the status of trolleys at other transit agencies in North America.

Because trolleys are only used by five other transit agencies in North America, there are some questions about the ongoing viability of the technology and the availability of future federal grant funding. San Francisco, Vancouver, Boston and Philadelphia have purchased new trolleys within the last 10 years. San Francisco plans to purchase new 60-foot trolleys in 2012. There are no immediate plans for trolley purchases at other transit agencies; however they continue to maintain and support their trolley systems.

EXHIBIT G		
Key Characteristics and Status of Electric Trolley Buses in North America		
Transit Agency	Fleet Plans	Trolley Fleet Size
San Francisco	Will purchase new 60-ft trolleys for 2014. Operating 88 hybrids and will purchase more. Will undergo mid- life overhaul of the ETI/Skoda trolleys.	333
Vancouver	Will not purchase more trolleys unless adding new lines.	262
Dayton	Sustaining system	39
Philadelphia	Receiving 400 hybrids from New Flyer. Currently operating 32. Recently re-opened 3 trolley lines.	38
Boston	Sustaining System	28 32 Dual

SOURCE: Booz Allen Hamilton

The existing North American trolley systems will be in operation for the next cycle of trolley purchases, creating a market for trolleys. Parts for repairs and overhauls will still be available and worldwide operation of trolleys remains steadfast. There is concern over whether there will be more than one bus builder for the United States trolley market in 2014 when Transit's trolleys are scheduled for replacement. Since existing hybrid propulsion technology is adaptable to trolleys, there may be more manufacturers capable of and interested in building trolleys.

The risk in having only one manufacturer is that lack of competition could drive up costs and/or impact the long-term availability of parts. The only bus manufacturer that is currently capable and committed to building a trolley is New Flyer. The other manufacturers either went bankrupt, are not interested, or are interested but currently not capable of manufacturing an trolley without an infusion of capital or development money to make a trolley bus body.

**Lifecycle Cost Analysis
Determined the Annual
Per-Bus Cost of
Alternatives**

Lifecycle Cost Analysis

Lifecycle cost analysis evaluates both the owning and operating costs of a vehicle through its entire life and takes into account the time value of money by discounting future costs (and cost savings, if applicable) to their present value. It is a standard financial technique for comparing options with different procurement costs, operating and maintenance costs, and useful lives. For this section, the projected lifecycle costs of trolley buses, hybrids, hydrogen fuel cell, and battery-powered buses were estimated using data from various sources. For example, since Transit is already operating fleets of trolleys and hybrids, the source of information (e.g., vehicle purchase price, vehicle maintenance costs) was largely based on Transit's actual experiences with trolleys and hybrids. For the technologies that are not currently being used by Transit and are also not widely in service anywhere else (e.g., hydrogen fuel cell and battery-powered buses), the source of data for cost projections is largely based on other research and/or assumptions made by the consultants.

The lifecycle cost analysis determined the annual per-bus costs for each of the four technologies:

Annual Per-Bus Cost	Estimated Useful Life
Hybrid bus: \$141,878	16 years
Trolley: \$177,318	18 years
All battery: \$204,234	14 years
Fuel cell: \$397,154	14 years

**Trolleys Cost \$8.7
Million per Year More
Than Hybrid Buses**

Based on these results, the annual lifecycle cost per vehicle is lowest for the hybrid, followed by the trolley, the all battery bus and last, the hydrogen fuel cell bus. Extrapolating the annual cost to a fleet of 159 buses, replacing the trolley fleet with hybrids would save \$5.6 million per year in comparison to replacing the current trolley fleet with new trolleys. Replacing the trolley fleet with either fuel cell or battery-powered buses would be substantially more expensive than the current trolley fleet, while also suffering from the operational limitations noted above.

The lifecycle cost analysis did not attempt to place a value on the social or environmental impacts of the trolley replacement options. Some of the considerations might include the reduced noise of the trolleys or the improved visual impact of removing overhead wires. In addition, there may be some benefit of reduced carbon emissions resulting from the use of trolleys. While trolleys generate no tailpipe emissions, the generation of the electricity used to power the trolleys does generate emissions to the extent that fossil fuels may be used in the generation of electricity. Given this region's substantial use of hydroelectric power in the generation of electricity, the reductions in carbon emissions from using trolleys compared to hybrid buses is likely to be substantial. However, hydroelectric plants may cause their own environmental problems (e.g., damage to fish runs). The lifecycle cost analysis did not attempt to place a value on the cost of such environmental impacts of electricity generated by hydroelectric plants.

Efficiencies and Trade-offs Between Hybrids and Trolleys

In addition to the savings noted above, there are other cost savings that would be likely if the trolley fleet were replaced with hybrids. The Service Development Technical Report found that the most inefficiently scheduled routes were the trolley routes. Characteristics unique to trolleys make these routes difficult to schedule efficiently; for example, trolleys can only travel in limited areas that are under overhead wire, one trolley cannot pass another, and detours to other streets are impossible without wiring. Replacing the trolley buses with hybrids would remove the scheduling constraints inherent in buses operating on fixed overhead wires, and improve scheduling efficiency. The audit team estimates that if the trolleys were replaced with hybrids, \$3.1 million per year could be saved by improved scheduling efficiency. Adding the \$3.1 million of annual savings from improved scheduling efficiency to the \$5.6 million annual savings from lower owning and operating costs, we estimate that replacing the trolley fleet with hybrids would save \$8.7 million per year.

Many Other Factors Besides Cost Need to Be Considered in Replacing Trolleys

While replacing the trolley fleet with hybrids would save an estimated \$8.7 million per year, there are also trade-offs associated with such a decision. For example, while hybrids are quieter than diesel buses, they are not as quiet as trolley buses. Also, unlike diesel or hybrids, the trolleys generate no tailpipe emissions. Any emissions from the generation of electricity to power the trolleys are at the power plant, which in many cases are hydroelectric, and not in the neighborhoods in which the trolley operates.

The availability of federal funding for trolley bus procurements is another consideration. The standard federal match for bus purchases is 80% using Section 5307 or fixed guideway funds. The federal match increases to 83% for transit agencies

purchasing 'clean' vehicles, such as electric trolley buses. In addition, a separate federal program, the Clean Fuels Program, will fund most of the cost for vehicles that use clean fuels. Electric trolleys also qualify for this program.

RECOMMENDATION
A11

Transit and the council should consider all relevant factors, including costs, when determining an appropriate fleet replacement for the trolley buses.

5 FARE STRATEGIES

Chapter Summary

This chapter addresses four issues related to Transit fares:

- Transit's use of goals in guiding fare decisions,
- The impact of fare decisions on revenue and ridership,
- Seattle's free ride area, and
- Discounted fares.

Opportunities Exist to Increase Revenue and Achieve Other Fare Objectives

Multiple opportunities exist to increase revenues and achieve other fare objectives through changes to Transit's fare policies; however, Transit has not defined goals for its fare policies, making it difficult to tie fare changes to Transit's overall goals and objectives. As a result, there are gaps between Transit's fare policy and its underlying fare structure and prices. These gaps could be addressed with fare policy goals relating to optimizing market-based pricing strategies, developing partnerships, generating revenue, and leveraging smart card capabilities. Fare policies related to Access paratransit are addressed in *Technical Report D: Paratransit*.

Transit can neither fully explain nor provide backup documentation for the operating cost savings that offset the fare revenues in the calculation of the annual charges to the City of Seattle for the city's ride free area. We also found that in comparison to peers, Transit's discounted fares for seniors, persons with disabilities, and youth are unusually generous. Finally, Transit has made changes in its fare structure to encourage the use of the ORCA regional smart card program and is considering other changes.

Background

A transit agency's fare policy goals establish the principles that guide the agency's strategy for its fare policies and underlie the agency's fare structure and pricing decisions, and represent one way of pursuing the agency's overall goals. Best practices in the transit industry suggest that agencies' fare policies and goals should be linked to their overall organizational goals and objectives.

Fare structure is a broad term that includes the fare prices, fare products, and fare media offered by a transit agency and the relationships among them. Transit has multiple fare types and options as of February 1, 2009.

EXHIBIT H		
Transit Fare Products		
Fare Type	Cash Fare Per Trip	Monthly Pass Price³
One- and two-zone off-peak	\$1.75	\$63.00
One-zone peak	\$2.00	\$72.00
Two-zone peak	\$2.50	\$90.00
Youth fare (age 6-17)	\$.75	\$27.00
Senior/Disabled fare	\$.50	\$9.00

SOURCE: Booz Allen Hamilton

Examples of Transit fare products include monthly passes, ticket books, and the weekend day pass. Fare media are the physical vehicle through which customers pay their fares. Examples of fare media include Transit's monthly PugetPasses on magnetic fare cards, paper transfer tickets, and pre-loaded stored value cards.

³ All monthly passes are PugetPass except Senior/Disabled, which is a Transit-only monthly pass.

**Fare Policy Decisions
Would Benefit From
Greater Linkage to
Division Goals and
Objectives**

Transit's Fare Policy Goals

Transit does not have adopted goals to guide fare policy decisions. These goals would steer the development of fare recommendations presented to policy-makers and link fare decisions to Transit's overall business strategy. In discussions of fare policies, such as Transit's February 2009 report to the council on transit fare policies and discounted fares, Transit has reviewed adopted fare policies and related them to common fare policy goals, in part to explain how fare policy goals can influence fare decisions.

Since 1998 Transit's fare structure has been changed four times, a new regional fare collection system (ORCA) has been implemented, land use and travel patterns have shifted, and new transit modes are or will soon be operating in the region (light rail, commuter rail, RapidRide). In addition, both the Comprehensive Plan and the Strategic Plan were adopted in the last two years. All of these factors suggest the need for fare policy goals to define a predictable strategy and guidance for fare policy decisions.

**RECOMMENDATION
A12a**

Transit should develop and propose fare policy goals to the Regional Transit Committee and King County Council that are clearly tied to Transit's strategic plan and are representative of Transit's agencywide goals and objectives. These goals should be used as a basis for making fare policy decisions.

**Ratios for Farebox Recovery and Operating Revenue to
Operating Expense**

Farebox recovery and operating revenue to operating expense (OR/OE) ratios are often used interchangeably, but have important differences. Farebox recovery is the proportion of the cost of operating the bus service that is "recovered" through bus

Transit's Calculation Showing Operating Costs Recovered at the Farebox Includes Non-Fare Revenue

fares. In some cases, fares are "paid" not just at the farebox, but via fees paid in exchange for operating a specific route or service or by someone other than the rider (e.g., an employer or university) and are not typically included in the farebox recovery calculation but may make sense to include. OR/OE is similar, but includes revenues that are not related to fare payment, such as advertising. It is also important to understand which transit services are included in the ratio. Many transit entities operate rail, ferry, paratransit, and vanpool as well as bus service, and including these in their ratios can make the ratios not directly comparable to one another across transit entities. In this discussion, we address both the OR/OE and farebox recovery approaches, and we are looking at bus service only and not including other transit services.

Transit's Financial Policies, Comprehensive Plan and Strategic Plan currently specify the target for the OR/OE of at least 25 percent. Fares and fare-related revenue generate 93 percent of operating revenue, and miscellaneous revenue (primarily advertising) generates the other 7 percent. Because the OR/OE ratio includes non-fare related revenue, the OR/OE ratio is higher than the farebox recovery ratio, which is the percentage of operating expenses that are recovered by fares. For example, in 2006 Transit's OR/OE ratio was 21.8 percent while its farebox recovery ratio was 19.6 percent. In the same year, the average bus-only farebox recovery for transit systems nationwide was 28 percent.

Over the last five years, Transit's OR/OE ratio has not exceeded 24.6 percent and the amended farebox recovery ratio that the auditors recommend has not exceeded 22.9 percent, as shown in Exhibit I.

EXHIBIT I					
Operating Revenue/Operating Expense and the Recommended⁴ Farebox Recovery Ratios					
	2004 Actuals	2005 Actuals	2006 Actuals	2007 Actuals	2008 Actuals
OR/OE Ratio	22.7%	22.5%	21.8%	21.5%	24.6%
Recommended Farebox Recovery Ratio	21.5%	21.0%	20.0%	19.5%	22.9%

SOURCE: Modified from Public Transportation Fund Cash Flow, July 2009.

Transit Should Define and Monitor a Target Farebox Recovery Ratio

Although Transit has not achieved its OR/OE target over the last five years, with the fare increase in 2008, the OR/OE indicator improved markedly, from 21.5 percent in 2007 to 24.6 percent in 2008 and has continued to move closer to the target of 25 percent through 2009. Another fare increase will be implemented in 2010. With the exception of some unique adjustments for reduced fares, all three fare changes have provided \$0.25 across-the-board increases and have impacted about 46 percent of riders. The 54 percent of riders who were not directly impacted by this fare increase include:

- Seniors, riders with disabilities, and youth who ride at a significant discount, as discussed later in this report;
- Ride Free area route riders for whom revenue is captured from other sources and under other provisions, as discussed later in this report; and
- Flex-pass and U-pass riders whose rates are negotiated separately from the fare change, based on actual use.

In some jurisdictions, transit agencies are mandated to achieve specific farebox recovery targets.⁵ For example, in California, transit agencies that do not maintain a 20 percent farebox recovery may be subject to a loss of state funds. In Los Angeles,

⁴ Recommended ratio includes fare revenue + fare-related revenue (i.e., Seattle Ride Free Area payment, School Service fee, U-Pass Service, Home Free Guarantee, Husky Stadium Supplemental Service, Seahawks Service, Mariner Service). It excludes advertising and miscellaneous revenue.

⁵ Farebox recovery targets are different from Transit's OR/OE ratio. Farebox recovery ratios include only fare revenues; they do not include other operating revenues.

a higher standard (39 percent) has been established under the county's transit funding program. In some cases, the targets are mandates with associated penalties; in other cases they are board-adopted targets to enable the agency to maintain and possibly improve service. Transit agencies have also pegged fare increases to increases in the cost of living. Other transit agencies experiencing challenges similar to Transit's have adopted multi-year fare change policies, like the one adopted by King County in 2007.

**RECOMMENDATION
A12b**

As part of adopting fare policy goals, Transit should define and monitor a target farebox recovery ratio. This ratio should include only bus fares and bus fare related revenues divided by only bus operating expenses.

Revenue-Generating Fare Policy

Fares are a flexible and powerful tool to generate revenue for Transit that may assist in avoiding or lessening service cuts. We evaluated six distinct fare policy options designed to increase fare revenue. They are shown here as illustrations of opportunities for Transit and policy-makers to consider as they weigh revenue options and examine fare policies. The options shown in Exhibit J below could result in millions of dollars annually in additional revenues, although each would impact ridership.⁶

⁶ When fares change, the number of people willing to pay the new fare changes as well. Typically, when fares increase fewer riders are willing to pay the fare. This phenomenon is called "elasticity" and must be considered when evaluating fare changes.

EXHIBIT J
Policy Options to Increase Fare Revenue

Opportunity to Increase Fare Revenue	Annual Estimate of Revenue Generated	Potential Reduction in Ridership
Increase the PugetPass/ORCA monthly pass breakeven point to 40 trips. ⁷ The current regional fare agreement provides that riders would need to board 36 times in a month to breakeven if they were paying cash fare for each boarding.	\$6.6 million	0.3%
Increase the base and peak fares another \$0.25 (beyond the \$0.25 planned in 2010).	\$10.8 million	1.1%
Eliminate fare zones and increase the corresponding base and peak fares by \$0.25 (beyond the \$0.25 planned in 2010). Note: this results in a \$0.25 decrease for riders who currently pay a 2-zone peak fare.	\$7.4 million	1%
Eliminate discounts for riding during off-peak times, while retaining the 2-zone fare structure.	\$6.2 million	1.1%
Eliminate free transfer tickets while retaining the rest of the peak/off-peak and zoned fare structure.	\$16.5 million	3.8 % ⁸
Eliminating free transfer tickets and introduce the option of purchasing a day pass (priced at 3 times the base fare) and retain the peak/off-peak and zoned fare structure. ⁹	\$9.3 million	2.3% ¹⁰

SOURCE: Booz Allen Hamilton

These scenarios are accurate individually, but if more than one were implemented the revenue generation and ridership change values would change. For illustrative purposes, a scenario was modeled that combined multiple fare policy changes together: increase adult peak period fares by \$0.25, retain zonal fares, eliminate the off-peak discount, increase the PugetPass multiple from 36 to 40, eliminate transfers with no Day Pass, eliminate the youth discount, reduce the senior/disabled discount to 50% with

⁷ Changing PugetPass breakeven points would require agreement from all participating ORCA entities.

⁸ This is based on an estimated average transfer rate (unlinked boardings made per linked trip) of about 1.5, although the true transfer rate is not known. If the average transfer rate is 1.3, then eliminating transfers is estimated to generate \$10.9 million (8.7 percent) with a loss of 3.0 million boardings (2.7 percent).

⁹ A day pass would be valid on King County Transit only and not valid for travel on Sound Transit or other regional transit providers.

¹⁰ This is based on an average transfer rate of about 1.5. Using an average transfer rate of 1.3, the revenue generated is estimated at \$5.8 million (4.7 percent) with a loss of 1.7 million boardings (1.5 percent).

peak/off-peak pricing, and eliminate the Metro monthly pass for senior/disabled patrons.

The cumulative effect of combining these multiple fare policy changes together is greater than the sum of the fare changes individually, because the changes build off each other particularly for youth and senior/disabled patrons. This used Transit's assumptions regarding elasticity and is shown in Exhibit K.

EXHIBIT K				
Fare Levels for Combined Fare Policy Modeling Run				
Rider Group	Fare Type	\$ Adopted 2010 Fare	\$ Modeled 2010 Fare (Multiple Change Scenario)	% Increase
Adult	Cash, Peak 1-Zone	2.25	2.50	11
	Per Boarding with One Transfer	1.13		122
Adult	Cash, Peak 2-Zone	2.75	3.00	9
	Per Boarding with One Transfer	1.38	3.00	118
Adult	Cash, Off-Peak	2.00	2.50	25
	Per Boarding with One Transfer	1.00	2.50	150
Youth	Cash	.75	2.50 or 3.00	233 or 300
	Per Boarding with One Transfer	.38	2.50 or 3.00	567 or 700
Senior	Cash	.75	1.25 or 1.50	67 or 100
	Per Boarding with One Transfer	.38	1.25 or 1.50	233 or 300
Adult	PugetPass, Peak 1-Zone	81.00	100.00	23
Adult	PugetPass, Peak 2-Zone	99.00	120.00	21
Adult	PugetPass, Off-Peak	72.00	100.00	39
Youth	PugetPass	27.00	100.00 or 120.00	270 or 344
Senior	PugetPass	27.00	50.00 or 60.00	85 or 122
Senior	Sticker	18.00	50.00 or 60.00	178 or 233
Fare Program	U-Pass	Per trip cost determined by formula		31
Fare Program	FlexPass	Per trip cost determined by formula		23
RFA/Free Routes	Free	Free	Free	0
Under 6	Free	Free	Free	0
Total - Average Fare per Boarding		1.11	1.87	68

SOURCE: Booz Allen Hamilton

The combined fare policy modeling run is estimated to generate \$64.3 million in the year 2010, with a ridership loss of 10.1 percent. Using the American Public Transportation Association's (APTA) elasticity¹¹ instead, this model estimates generating \$51.0 million with a ridership loss of 15.6 percent.

Fare Changes Could Yield up to \$51 Million per Year...

...But With Significant Ridership Loss

Transit fares were increased in 2008 and 2009 and will be increased again in 2010 to assist in addressing Transit's budget deficits. While those fare changes resulted primarily in across-the-board fare increases, the alternatives noted here would result in changes to Transit's fare structure (e.g., by eliminating zones and increasing base and peak fares, eliminating off-peak discounts, eliminating free/discounted transfers). Market-based fare strategies, which consider the market characteristics of Transit's ridership and the entire fare structure, can be used to restructure fares to better meet the needs of riders, shifting them to other fare products and minimizing ridership losses while increasing fare revenues.

RECOMMENDATION A12c

Transit and policy-makers should consider further utilizing fare policy changes to generate additional revenues to assist in funding Transit operations.

Changes in Fare Policy to Leverage ORCA

Transit is participating in the regional smart card fare payment system called ORCA. This system began roll-out in April 2009, and by the end of 2009, nearly all Transit passes will be available for purchase only on an ORCA card. The new smart card fare payment technology offers fare policy opportunities that were neither feasible nor easy to implement with the use of more

¹¹ When fares change the number of people willing to pay the new fare changes as well. Typically, when fares increase fewer riders are willing to pay the fare. This phenomenon is called "elasticity" and must be considered when evaluating fare changes.

conventional fare payment options like cash, tickets, and magnetically-encoded passes.

**Transit Has Begun
Implementing Policies
Afforded by ORCA**

With the introduction of ORCA, Transit has implemented several small policy changes and plans to monitor and measure the effects of the current policies as implemented on ORCA before defining future policy strategies. Fare policy changes include: addressing the amount of money a customer can store on their card; response to lost/stolen/damaged ORCA cards; balance protection and reloading processes; and changes in the value of inter-agency transfers. These new policies and procedures will facilitate ORCA implementation and are expected to encourage riders to migrate to ORCA from other fare media.

Transit plans to propose and/or implement additional fare policies to leverage the capabilities of the ORCA system. To encourage cash riders to switch to ORCA, Transit has proposed and received approval to allow discounts for intersystem travel. Another possibility would be to offer discounts on weekends and holidays for riders who pay cash fares using ORCA. Transit would also like consistent youth age ranges with their regional partners. While there currently is no charge for obtaining an ORCA card, in the future, the ORCA Interlocal Agreement establishes a \$5.00 fee to purchase a card, at least in part as an incentive to encourage riders to retain and reuse their cards.

There are two general approaches that Transit could implement through policy to increase the return on the investment in the ORCA project; policies with revenue as a goal and those with a savings goal. Some engineering and development costs would be associated with some of these options. The strategies that capitalize on opportunities to increase fare revenue include:

- Introduce a day pass in lieu of the current bus-to-bus transfer policy. Transit staff notes that the day pass has not been

ORCA Offers Additional Opportunities to Generate Revenue

agreed to by regional ORCA participants and would be King County Transit-only, precluding the benefit of regional travel. Transfers were eliminated and a day pass was implemented by Orange County Transit Authority in 1999. After the change, revenue collected at the farebox increased by 13 percent and total fare revenue (including sales of prepaid passes) grew by nearly 17 percent. Monthly pass revenue rose by 19 percent. Similar results have been experienced on Lynx, in Orlando, Florida and on Omnitrans, in San Bernardino, California.

- Implement distance-based fares instead of zoned fares leveraging ORCA and Automatic Vehicle Location (AVL) technology, like those that have been implemented on Link and Sounder.
- Replace monthly passes with a “Frequent Commuter” program similar to the program introduced by Houston METRO. This policy maintains the convenience of a pass, encourages ridership by offering an incentive, and may generate an incremental increase in revenue. This policy was considered and rejected by ORCA participants during the design process due to concerns about revenue allocation among the six ORCA transit agencies.

Policies that induce riders to use ORCA more frequently increase the cost savings inherent in the program by reducing fare media costs (ORCA is more durable than magnetic fare cards and can last up to five years) and enabling a faster fare payment process that reduces the time buses wait while riders board. Policy options for increasing ORCA usage include:

- Limiting fare products like transfers or monthly passes or day passes to the ORCA card. Similar policies have been implemented in numerous smart card programs and plans to

- limit passes to ORCA are currently being implemented at Transit.
- Offering a discount for fares paid with ORCA that is not available on other fare products or media.
- Delaying fare increases for ORCA card holders, to induce riders to shift to ORCA to avoid a fare increase for a brief time. A similar approach is used for the FastTrak automatic toll payment system in the San Francisco Bay Area.

We support Transit in their implementation of policies and processes that will encourage the use of and leverage the capabilities of the ORCA smart card system.

Analysis of Senior, Disabled, and Youth Fare Discounts

Transit Exceeds Federal and Policy Requirements for Fare Discounts

The Federal Transit Administration (FTA) requires its grantees to allow seniors, persons with disabilities, and Medicare cardholders to ride fixed route services during the off-peak hours for a fare not to exceed 50 percent of the base fare charged full-fare riders during the peak hours. Although there are no requirements for providing youth discounts, most transit agencies provide some level of discount, at least on local services. Transit's adopted fare policies for seniors, persons with disabilities, and youths include:

- The cash fare for seniors and persons with disabilities will be provided at a discount of at least 50 percent of the regular adult one-zone peak fare. Attendants and assistive animals ride free.
- There will be discounts for youths from ages five through seventeen and persons over seventeen years of age who attend regular sessions of junior or senior high school.
- Up to four children less than five years of age may ride free with a fare-paying adult. Up to four children/youths may ride free with a fare-paying adult on Sundays and holidays.

Under the adopted fare structure, Transit's senior/disabled and youth discounts exceed the FTA requirement for both peak and off-peak travel. With the recent three-step fare increases (2008-2010), senior/disabled and youth discount rates are changing, but in 2010 there will be a 63-percent discount from the adult base fare for seniors, persons with disabilities, and youths:

EXHIBIT L							
Transit Senior, Disabled (S/D) and Youth Fare Pricing and Discounts							
	2004	2005	2006	2007	2008	2009	2010
Adult Base Fare	\$1.25	\$1.25	\$1.25	\$1.25	\$1.50	\$1.75	\$2.00
S/D Fare	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$0.50	\$0.75
Discount	60%	60%	60%	60%	67%	71%	63%
Youth Fare	\$0.50	\$0.50	\$0.50	\$0.50	\$0.75	\$0.75	\$0.75
Discount	60%	60%	60%	60%	50%	57%	63%

SOURCE: Booz Allen Hamilton

Because Transit's reduced fares are priced at a flat fare, its discounts are greater on zoned, peak period services that have higher fares.

EXHIBIT M					
Transit Senior, Disabled (S/D) and Youth Fare Discounts by Service Level					
	Adult	S/D	Discount	Youth	Discount
Metro					
Off-peak	\$1.75	\$0.50	71%	\$0.75	57%
Peak 1-zone	\$2.00	\$0.50	75%	\$0.75	63%
Peak 2-zone	\$2.50	\$0.50	80%	\$0.75	70%

SOURCE: Booz Allen Hamilton

Almost universally, Transit's regional and national peers do not offer discount fares as much for seniors, disabled persons, and youth. The following table shows current fare structures and levels for national and local peers:

EXHIBIT N					
Transit Senior, Disabled (S/D), and Youth Fare Discounts Compared to Peers					
Peer Agencies	Adult	S/D	Discount	Youth	Discount
Baltimore MTA					
Local	\$1.60	\$0.55	66%	\$1.10	31%
Shuttle	\$1.00	\$0.50	50%	\$1.00	0%
Express	\$2.00	\$0.95	53%	\$2.00	0%
Houston METRO					
Local	\$1.25	\$0.60	52%	\$0.60	52%
P&R Zone 1	\$2.00	\$1.00	50%	\$1.00	50%
P&R Zone 2	\$3.25	\$1.60	51%	\$1.60	51%
P&R Zone 3	\$3.75	\$1.85	51%	\$1.85	51%
P&R Zone 4	\$4.50	\$2.25	50%	\$2.25	50%
Oakland – AC Transit					
Local	\$2.00	\$1.00	50%	\$1.00	50%
TransBay	\$4.00	\$2.00	50%	\$2.00	50%
Community Transit					
Local	\$1.50	\$0.50	67%	\$1.00	33%
Commuter/S	\$3.50	\$1.50	57%	\$2.75	21%
Commuter/N, E	\$4.50	\$1.75	61%	\$3.75	17%
Pierce Transit					
Local	\$1.75	\$0.75	57%	\$0.75	57%
Express	\$2.50	\$1.25	50%	\$2.50	0%
Express 1-Zone	\$1.50	\$0.50	67%	\$1.00	33%
Express 2-Zone	\$2.50	\$1.25	50%	\$1.75	30%
Express 3-Zone	\$3.00	\$1.50	50%	\$2.50	17%
Sound Transit					
1-Zone	\$1.50	\$0.50	67%	\$1.00	33%
2-Zone	\$2.50	\$1.25	50%	\$1.75	30%
3-Zone	\$3.00	\$1.50	50%	\$2.50	17%
King County Metro					
Off-Peak	\$1.75	\$0.50	71%	\$0.75	57%
Peak 1-Zone	\$2.00	\$0.50	75%	\$0.75	63%
Peak 2-Zone	\$2.50	\$0.50	80%	\$0.75	70%

SOURCE: Booz Allen Hamilton

Transit's current 71-percent senior/disabled discount is more generous than the discounts (50-67 percent) offered by any of the peers. Transit's 75-percent and 80-percent senior/disabled discounts on peak, zoned services also exceed any of the senior/disabled discounts offered by peers (50-67 percent). Transit's 57-percent off-peak youth discount is more generous than all but one peer. For services with higher fares, Transit's 63-percent and 70-percent discounts are far more generous than those offered by peers, which range between 0-51 percent.

**Transit's Senior,
Disabled, and Youth
Fare Discounts Are
More Generous than
Peers**

In addition to the cash fare discounts, Transit offers a senior/disabled monthly pass for \$9.00. Relative to the \$0.50 cash fare, the break-even point of this pass is 18 boardings. This compares to a break-even of 36 boardings for the PugetPass, providing a further 50-percent discount from the \$18 PugetPass that corresponds to the already discounted \$0.50 senior/disabled cash fare.

Transit's current fare structure exceeds the discounts specified in its policies and what is required by federal regulations: discounts exceed 50 percent, they are offered 24 hours per day / 7 days per week instead of being limited to off-peak periods, and extend to pass prices as well as cash fares. Transit prices other fares in relation to cash fares but that practice does extend to reduced fares beyond a Transit-only senior/disabled pass. Transit has recommended this policy change in the past. Because Transit's reduced fares are set at flat rates that apply across all services and times of day, fares are easier to understand and enforce, but discounts are higher relative to zoned, peak period fares.

Transit's reduced fare policies generate ridership, but at a cost. If Transit were to bring discounted fares more in line with federal requirements and its peers, there could be additional revenue

generated, with some corresponding reduction in ridership, as illustrated below in Exhibit O.

EXHIBIT O		
Potential Impacts of Policy Options to Increase Fare Revenue		
Option to Increase Fare Revenue	Annual Estimate of Revenue Generated	Potential Reduction in Ridership & Among Senior/Disabled/ Youth Patrons
Hold senior/disabled discounts at 50 percent and offer them 24/7	\$470,000 to \$500,000 ¹²	0.2% all 2.1 to 2.2% S/D
Reduce youth discounts to 50 percent and offer the discount 24/7	\$1.6 to \$1.8 million ¹³	1.2% to 1.3% all 9.8% to 10.4% youth
Eliminate youth discounts	\$8.2 million annually	3.7 % all 29.5% youth

SOURCE: Booz Allen Hamilton

Transit proposed changes in fare policy in February 2009 that would make discounts more in line with peers and would peg discounted fares to the base fares by specifying the percentage discount, the change was not accepted by policy-makers at that time.

RECOMMENDATION A12d

Transit should reintroduce senior/disabled/youth fare discounts in line with peers and peg discounted fares to base fares by specifying a percentage discount.

Evaluation of Seattle Downtown Ride Free Area Payment Methodology

Ride free areas or routes have been implemented in a number of cities, particularly in central business districts. Free fares attract ridership and speed boardings, thereby reducing congestion and

¹² The range depends on whether peak/off-peak pricing also applies to senior/disabled patrons (peak/off-peak pricing results in higher revenue gain and greater ridership loss).

¹³ The range is associated with whether peak/off-peak pricing applies to youth patrons.

the length of time that buses pause at stops in more congested parts of a city.

**Cost of Ride Free Area
Reimbursement Should
Be Based on Sound,
Transparent
Methodology**

In King County, Ride Free Areas are permitted by King County Code, and Transit's strategic plan identifies Ride Free Areas as a means of enhancing circulation in busy downtown areas, with the stipulation that existing fare revenues should not be reduced and financial partnerships should be encouraged to cover any additional expenses. Currently, Transit is reimbursed by partner cities (Issaquah, Kent) for lost fare revenue on ride-free routes and by the City of Seattle for lost fare revenue minus any reduced operating costs that result from free boardings in the downtown Seattle Ride Free Area.

Transit can neither fully explain nor provide backup documentation for the operating cost savings that offset the fare revenues in the calculation of the annual charges to the City of Seattle for the city's Ride Free Area. Transit is reimbursed by the City of Seattle based on a formula that has been described by Transit staff as including:

- The fare revenue lost for trips that would have been taken within the ride free area if rides were not free; and
- Operational savings resulting from reduced time buses rest at stops as a consequence of not requiring fare payment and enabling boardings through all doors.

We evaluated the material that Transit provided to support the payment amount and found that the methodology has not been updated to reflect changing conditions,¹⁴ some of the assumptions in the methodology used to calculate lost fare revenue were questionable, and Transit could not document or validate the calculation of operational savings.

¹⁴ Since the formula was developed in 1998, Transit's fare structure has changed, ORCA has been implemented, land use and travel patterns have shifted, and new transit modes are or will soon be operating in the region.

**RECOMMENDATION
A13**

Transit should update and fully document the formula used to assess the City of Seattle's payment for the downtown Seattle Ride Free Area to reflect current ridership and operating conditions including trips that are attracted by virtue of free fares. Transit and the council should then consider revising the agreement with the City of Seattle.

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