Appendix F

Technical Memoranda

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Consultants in Engineering, Architecture, Planning, Construction and the Environment

MEMO

TO: Washington State Department of Transportation DATE: July 11, 2008

FROM: Jacobs Carter Burgess Consulting Group

SUBJECT: SR 520, Seattle, Washington Memo #1
Identification of Toll Configuration Alternatives

DRAFT - WORK-IN-PROGRESS

Introduction

This memorandum describes toll configuration alternatives proposed for the SR 520 corridor. These configuration alternatives were developed by Jacobs Carter Burgess (JCB) and reviewed during Work Session #2 on March 5, 2008 with the Washington State Department of Transportation (WSDOT). The identification and definition of toll configuration alternatives is a necessary step in the process of implementing tolling on the SR 520 corridor as part of the Urban Partnership SR 520 Project.

General Assumptions

Following discussions with WSDOT, it was determined that any toll configuration proposed for the SR 520 corridor would take the form of multi-lane free flow (MLFF) tolling or all electronic toll collection (AETC); i.e., no traditional toll plazas. For this type of toll configuration, a tolling point typically consists of one or two overhead gantries on which electronic toll collection (ETC) readers and video cameras are mounted to read transponders and record the license plates of vehicles that do not have a transponder.

Proposed Toll Configuration Alternatives

The following table shows the ten toll configuration alternatives that were developed for the SR 520 corridor. They are listed in no particular order.

General Configuration	Description of Configuration	Alternative ID Number
Open Barrier System	Single mainline tolling point at or near Lake	(SR-520-1)
Open Barrier System	Two mainline tolling points, near I-5 and I-405	(SR-520-2)
Open Barrier System	Three mainline tolling points, at/near Lake, near I-5 and I-405	(SR-520-3)
Closed Barrier System	Seven mainline tolling points, one between each interchange between I-5 and I-405	(SR-520-4)

General Configuration	Description of Configuration	Alternative ID Number
Open Barrier System	Tolls on all on-ramps	(SR-520-5)
Open Barrier System	Tolls on all off-ramps	(SR-520-6)
Ticket System	All entries and exits to the SR 520 corridor between I-5 and I-405 are tolled	(SR-520-7)
Hybrid System	Toll gantries at most on-ramps and off-ramps, traditional "ticket" system for ETC only, single video tolling location at/near Lake, only trips across Lake Washington are tolled	(SR-520-8)
Hybrid System	Toll gantries at most on-ramps and off-ramps, traditional "ticket" system for ETC only, two video tolling locations near I-5 and I-405, only trips to/from I-5 and I-405 are tolled	(SR-520-9)
Hybrid System	Toll gantries at all on-ramps and off-ramps, traditional "ticket" system for ETC only, three video tolling locations at/near Lake, near I-5 and I-405. Only trips across Lake Washington, and/or to/from I-5 and I-405 are tolled	(SR-520-10)

Policy Analysis of Toll Configuration Alternatives

The major advantages and disadvantages of each of the proposed toll configuration alternatives were then examined, as well as how each configuration alternative relates to the following six general policy groups:

- Customer Service
- Operations
- Equity
- Administration
- Finance
- Technology/Construction

The policy analyses of the proposed configuration alternatives are presented in the following pages, along with a graphical representation of each proposed toll configuration.

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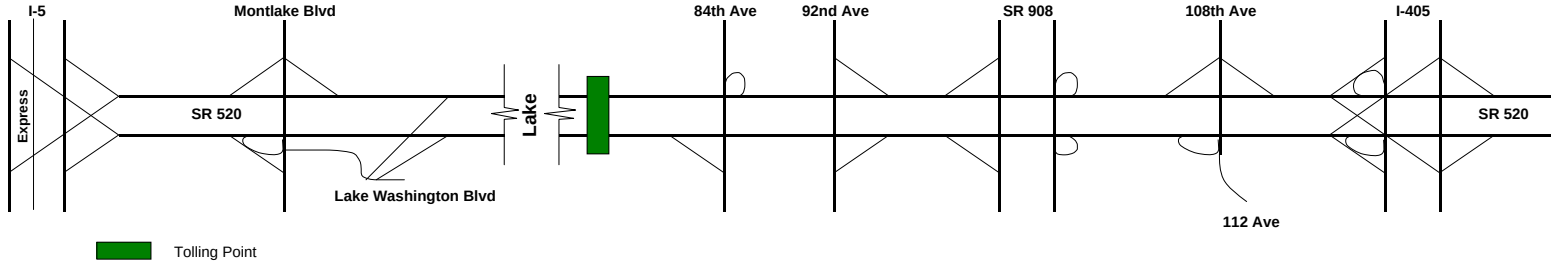
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-1



Description: One (1) mainline across-the-road toll gantry located at/near the bridge (to toll movements over Lake Washington), tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* one tolling location * one toll rate; simplicity * users of the bridge pay for the bridge * locals can travel for free for most of corridor
Major Disadvantages	* may be inequitable, as short trips travel for free * may still have congestion in the corridor * trips may begin or end after the decision points

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* one tolling location * easily identifiable tolling location *	* * *
Operational	* one transaction per trip * lowest number of transactions of all tolling concepts * less images to process	* * *
Equity	* *	* inequitable due to short trips that are free * short trips that travel over the bridge pay higher per-mile toll rates
Administrative	* easiest to process * lowest amount of toll points in which to violate	*
Financial	* least cost to operate * lowest capital costs * *	* highest risk of loss due to single toll collection point, potential loss of revenues if there are equipment failures * *
Technology / Construction	* one tolling location * plenty of space for gantry * least amount of equipment	* * *

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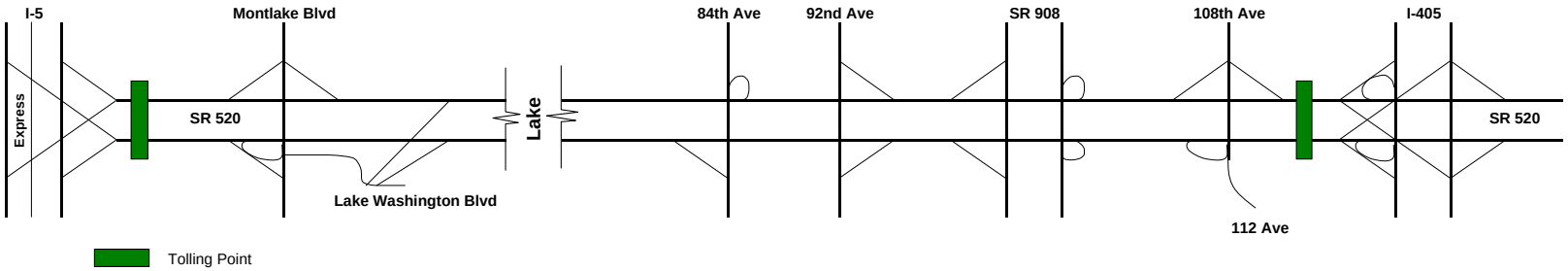
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-2



Description: Two (2) mainline across-the-road toll gantries (one located west of I-5 and one located east of I-405), tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* two tolling locations * two toll rates; relative simplicity * locals can travel for free for most of corridor
Major Disadvantages	* may be inequitable, as most short trips travel for free * users of the bridge do not pay for the bridge * easy to avoid the toll locations * may still have congestion in the corridor * trips may begin or end after the decision points

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* two tolling locations * easily identifiable tolling locations *	* * *
Operational	* up to two transactions per trip * second lowest number of transactions of all tolling concepts * less images to process	* more transactions to process than Concept A * *
Equity	* *	* inequitable due to short trips that are free *
Administrative	* easy to process * low amount of toll points in which to violate	*
Financial	* low cost to operate * low capital costs * with potential failure of one toll location, other still operable *	* * * *
Technology / Construction	* two tolling locations * plenty of space for gantries * low amount of equipment	* * *

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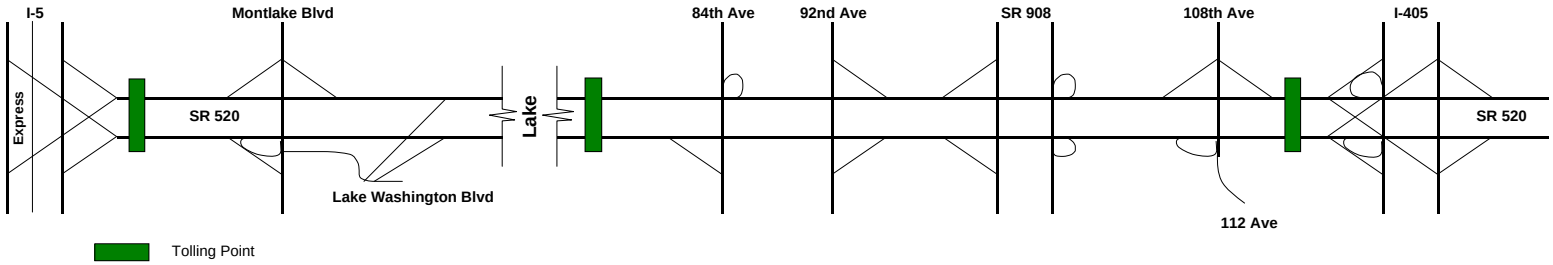
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-3



Description: Three (3) mainline across-the-road toll gantries (one located west of I-5, one located east of I-405, one located at/near Lake Washington), tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* three toll rates; relative simplicity * users of the bridge pay for the bridge * non-bridge users can travel for free for much of corridor
Major Disadvantages	* may be inequitable, as some short trips travel for free * three tolling locations * relatively easy to avoid the non-bridge toll locations * may still have congestion in the corridor * trips may begin or end after the decision points

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* easily identifiable tolling locations * *	* three tolling locations * hard to explain the toll rates at each tolling location *
Operational	* relatively easy to process * *	* more transactions to process than Concepts A or B * *
Equity	* *	* inequitable due to short trips that are free *
Administrative	* at most three transactions per trip * low amount of toll points in which to violate	*
Financial	* relatively low cost to operate * relatively low capital costs * with potential failure of one toll location, others still operable *	* * * *
Technology / Construction	* plenty of space for gantries * low amount of equipment	* three tolling locations * *

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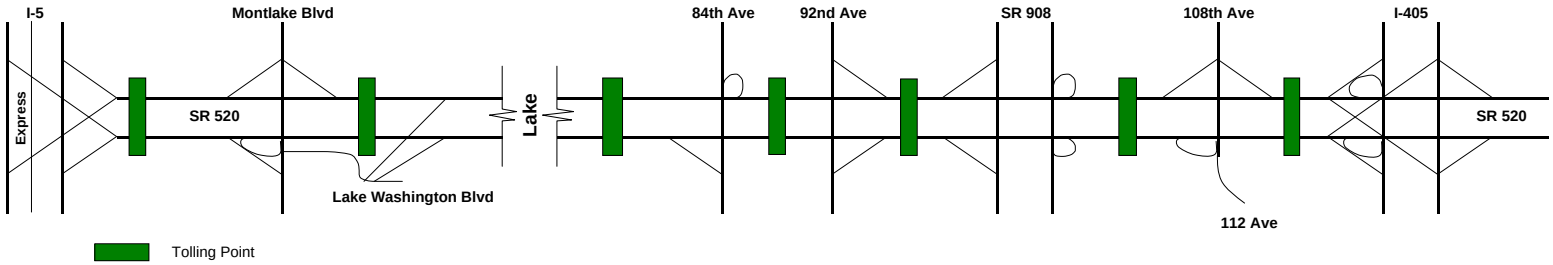
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-4



Description: Seven (7) mainline across-the-road toll gantries (one inbetween each major interchange between I-5 and I-405), tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* equitable as all users pay proportionate to their trip * * *
Major Disadvantages	* difficult to sign the toll rates * seven tolling locations * difficult to explain the tolling structure * seven toll rates; no simplicity

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* * *	* seven tolling locations * difficult to explain the tolling structure * largest back office needed
Operational	* manages congestion the best * *	* up to seven transactions per trip * difficult to sign the toll rates * expensive to maintain
Equity	* equitable, as all pay proportionate to their trip *	* *
Administrative	* *	* up to seven transactions per trip high amount of toll points in which to violate
Financial	* with potential failure of one toll location, others still operable * * *	* relative high cost to operate * high capital costs * *
Technology / Construction	* space for gantries *	* seven tolling locations * large amount of equipment needed * expensive to build

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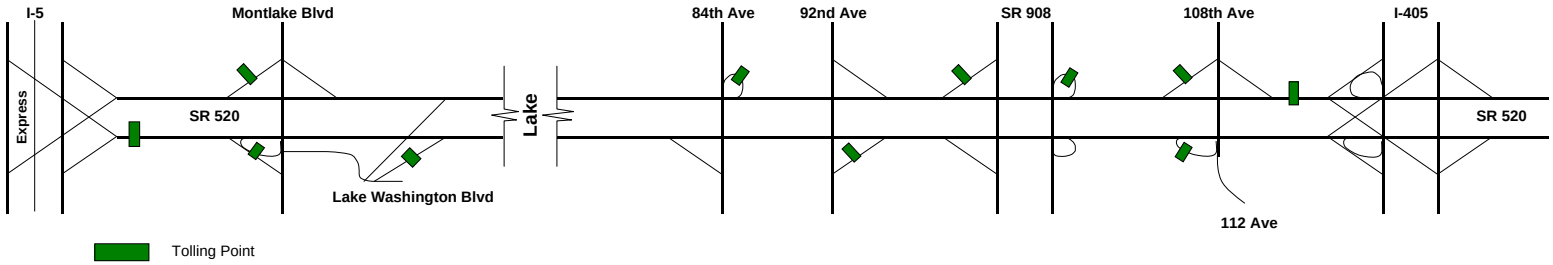
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-5



Description: All on-ramp toll gantries at each on-ramp, tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* equitable as all users pay proportionate to their trip * * *
Major Disadvantages	* difficult to sign the toll rates * eleven tolling locations * relatively difficult to explain the tolling structure * many toll rates; no simplicity

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* one toll payment point per trip * *	* eleven tolling locations * difficult to explain the tolling structure *
Operational	* manages congestion * one transaction per trip *	* difficult to sign the toll rates * expensive to maintain *
Equity	* equitable, as all pay proportionate to their trip *	* *
Administrative	* only one transaction per trip * easy to process	* high amount of toll points in which to violate *
Financial	* * * *	* relative high cost to operate * high capital costs * risk of loss due to single toll payment point per trip in event of equipment failure *
Technology / Construction	* space for gantries *	* eleven tolling locations * large amount of equipment needed * expensive to build

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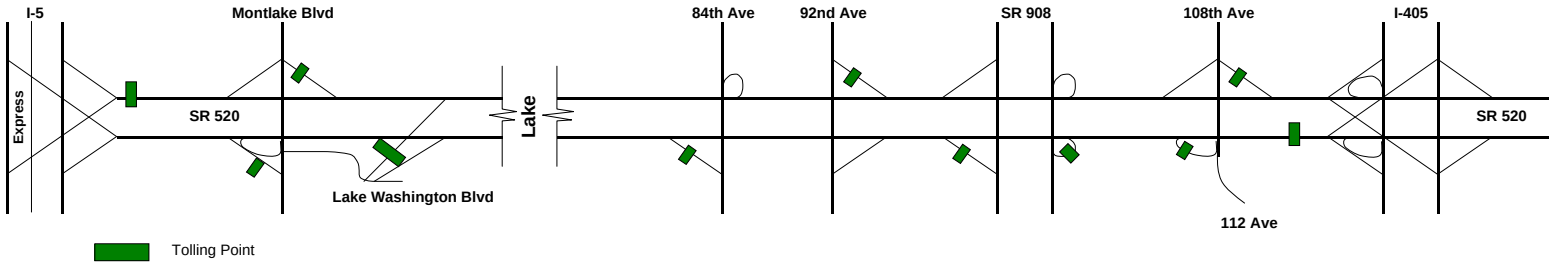
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-6



Description: All off-ramp toll gantries at each off-ramp, tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* equitable as all users pay proportionate to their trip * * *
Major Disadvantages	* difficult to sign the toll rates * eleven tolling locations * relatively difficult to explain the tolling structure * many toll rates; no simplicity

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* one toll payment point per trip * *	* eleven tolling locations * difficult to explain the tolling structure *
Operational	* manages congestion * one transaction per trip *	* difficult to sign the toll rates * expensive to maintain *
Equity	* equitable, as all pay proportionate to their trip *	* *
Administrative	* only one transaction per trip * easy to process	* high amount of toll points in which to violate *
Financial	* * * *	* relative high cost to operate * high capital costs * risk of loss due to single toll payment point per trip in event of equipment failure *
Technology / Construction	* space for gantries *	* eleven tolling locations * large amount of equipment needed * expensive to build

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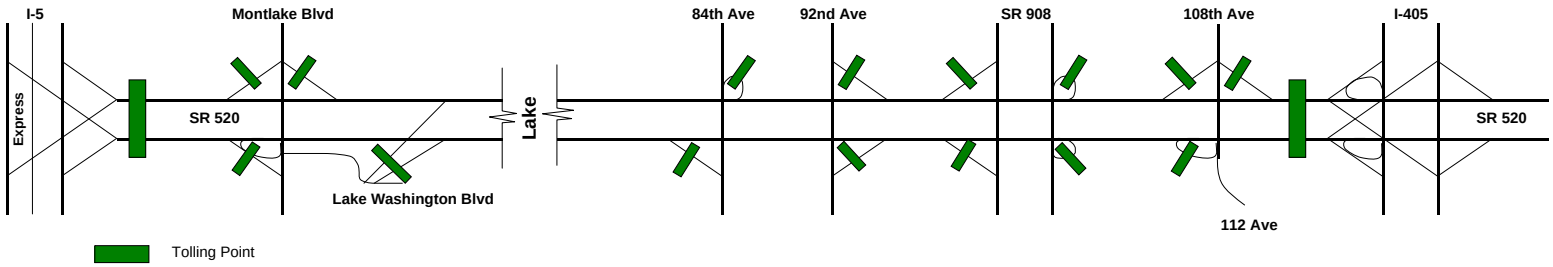
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-7



Description: Toll gantries at all ons and offs, with tag matching at each location, to toll by distance basis, esentially mimicking traditional "ticket" systems, tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* equitable as all pay proportionate to their trip * * *
Major Disadvantages	* relatively difficult to sign the toll rates * many tolling locations * relatively difficult to explain the tolling structure * many toll rates; no simplicity

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* pay tolls based on trip length * * *	* many tolling locations * difficult to explain the tolling structure * if trip is unmatched, need business rule policy to determine outcome * larger back office needed
Operational	* manages congestion the best * two transactions per trip *	* must match ons and offs * difficult to sign the toll rates * expensive to maintain
Equity	* equitable, as all pay proportionate to their trip *	* *
Administrative	* two transactions per trip *	* high amount of toll points in which to violate * harder to match video transactions
Financial	* * * *	* relative high cost to operate * high capital costs * *
Technology / Construction	* space for gantries *	* many tolling locations * large amount of equipment needed * expensive to build

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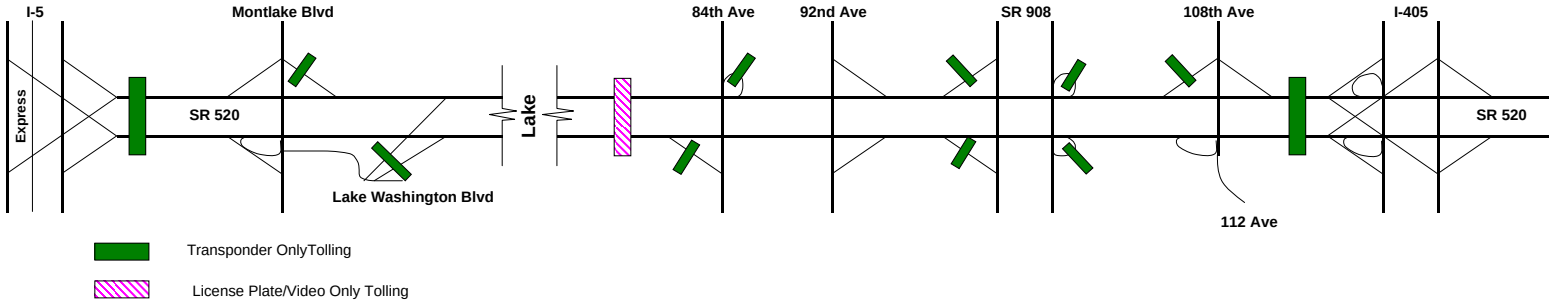
Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-8



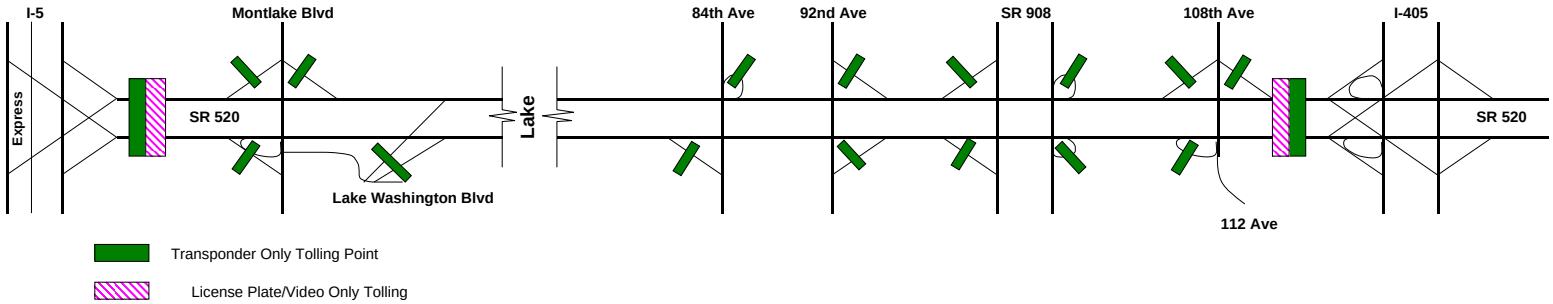
Description: Toll gantries at most ons and offs, with tag matching at each location, to toll by distance basis, esentially mimicking traditional "ticket" systems, for tags only, ; all others (license plates) tolled at one (1) across-the-road tolling gantry at/near the Lake, only toll movements over Lake Washington; tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* users of the bridge pay for the bridge * locals can travel for free for most of corridor * *
Major Disadvantages	* may be inequitable, as short trips travel for free * may still have congestion in the corridor * trips may begin or end after the decision points

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* pay only for the trip over the bridge * *	* many tolling locations * difficult to explain the tolling structure * if transponder trip is unmatched, need business rule policy to determine outcome * larger back office needed
Operational	* one toll transaction for video trip * *	* must match transponder ons and offs * difficult to sign the toll rates * expensive to maintain *
Equity	* *	* inequitable due to short trips that are free * short video trips that travel over the bridge pay higher per-mile toll rates
Administrative	* single video transaction per trip * encourages transponder use	*
Financial	* * * *	* relative high cost to operate * high capital costs * if video fails, all video revenues lost *
Technology / Construction	* space for gantries * *	* many tolling locations * large amount of equipment needed * expensive to build

DRAFT WORK-IN-PROGRESS

Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-9



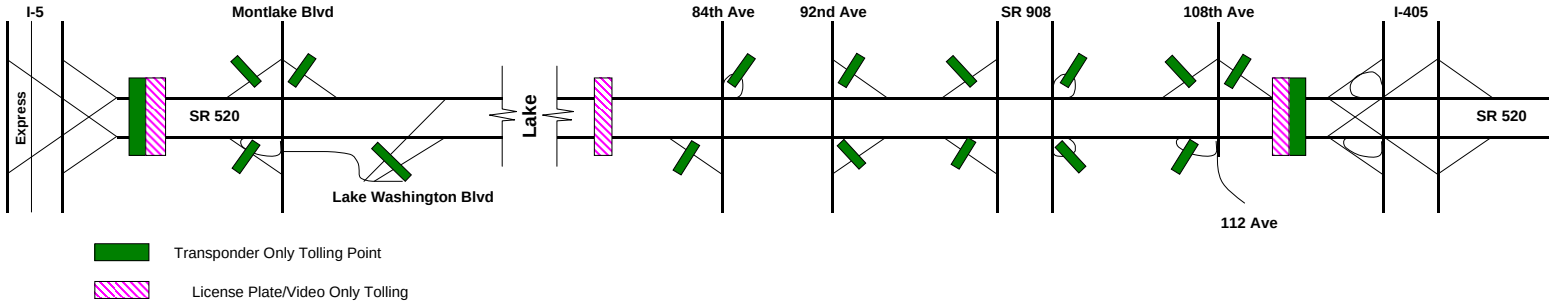
Description: Toll gantries at all ons and offs, with tag matching at each location, to toll by distance basis, esentially mimicing traditional "ticket" systems, for tags only; all others (license plates) tolled at across-the-road tolling gantries at two (2) locations (one located west of I-5 and one located east of I-405); only trips to/from I-5 and/or I-405 are tolled; tolling both directions.

Major Advantages/Disadvantages	
Major Advantages	* locals can travel for free for most of corridor * * *
Major Disadvantages	* may be inequitable, as most short trips travel for free * some users of the bridge do not pay for the bridge * may still have congestion in the corridor * trips may begin or end after the decision points

	Analysis of Toll Concept	
Toll Policy Group	**Advantages**	**Disadvantages**
Customer Service	* Pay only for trips to/from I-5 and/or I-405 * * *	* many tolling locations * difficult to explain the tolling structure * if transponder trip is unmatched, need business rule policy to determine outcome * larger back office needed
Operational	* * *	* must match transponder ons and offs * difficult to sign the toll rates * expensive to maintain
Equity	*	* inequitable due to short trips that are free * short trips that pass under only one video gantry will pay higher per-mile toll rates
Administrative	* encourages transponder use in that the toll would be more equitable for those customers using a transponder compared to those paying cash.	*
Financial	* * * *	* high cost to operate compared to other concepts * highcapital costs compared to other concepts * if video fails, all video revenues lost *
Technology / Construction	* plenty of space for gantries * *	* many tolling locations * large amount of equipment needed * expensive to build

DRAFT WORK-IN-PROGRESS

Urban Partnership, SR-520, Seattle, Washington
General Tolling Designs
Tolling Concept SR-520-10



Description: Toll gantries at all ons and offs, with tag matching at each location, to toll by distance basis, esentially mimicing traditional "ticket" systems, for tags only; all others (license plates) tolled at across-the-road tolling gantries at three (3) locations (one located west of I-5, one located east of I-405, one located at/near Lake Washington); transponder tolls collected only when vehicle passes a video tolling point; tolling both directions.

Major Advantages/Disadvantages

Major Advantages	* users of the bridge pay for the bridge * locals can travel for free for some of corridor * *
Major Disadvantages	* may be inequitable, as some short trips travel for free * may still have congestion in the corridor * trips may begin or end after the decision points

Analysis of Toll Concept

Toll Policy Group	Advantages	Disadvantages
Customer Service	* Pay only for trips across bridge and/or to/from I-5 and/or I-405 * * *	* many tolling locations * difficult to explain the tolling structure * if transponder trip is unmatched, need business rule policy to determine outcome * larger back office needed
Operational	* * *	* must match transponder ons and offs * difficult to sign the toll rates * expensive to maintain
Equity	*	* inequitable due to short trips that are free * short trips that pass under only one video gantry will pay higher per-mile toll rates
Administrative	*	* potentially the most violators of all concepts
Financial	* potentially highest amount of revenues compared to other concepts * * *	* high cost to operate compared to other concepts * high capital costs compared to other concepts * *
Technology / Construction	* plenty of space for gantries * *	* many tolling locations * large amount of equipment needed * expensive to build

Consultants in Engineering, Architecture,
Planning, Construction and the Environment

MEMO

TO: Washington State Department of Transportation DATE: July 11, 2008

FROM: Jacobs Carter Burgess Consulting Group

SUBJECT: SR 520, Seattle, Washington Memo #2
Screening Criteria for Toll Configuration and Pricing Alternatives

DRAFT - WORK-IN-PROGRESS

Introduction

This memorandum describes proposed screening criteria for evaluating various toll configuration alternatives and pricing alternatives proposed for the SR 520 corridor. These screening criteria were developed by Jacobs Carter Burgess (JCB) in conjunction with the Washington State Department of Transportation (WSDOT) during Work Session #2, March 5, 2008. The identification and definition of screening criteria is needed to perform a qualitative evaluation of tolling configuration and pricing alternatives, with the goal of identifying and selecting preferred alternatives. This is a necessary step in the process of implementing tolling on the SR 520 corridor as part of the Urban Partnership SR 520 Project.

Screening Criteria

The first level of screening criteria will address the purpose and need for the project, which is to implement tolling to reduce congestion on SR 520, by improving the movement of people and goods, increasing travel reliability and meeting the requirements of the Urban Partnership Agreement to initiate variable pricing on SR 520 by September 2009.

The following is a brief explanation of each of the screening criteria identified for the project and some examples of how it is applied to both toll configuration and pricing alternatives. The criteria are presented in order of importance to the project.

Purpose and Need Criterion related to Reducing SR-520 Congestion
Reducing congestion on SR-520 is the primary objective of this project. Congestion can be categorized into two types – recurring congestion and non-recurring congestion. Recurring congestion is the typical congestion that is experienced by travelers on a roadway where the traffic demand exceeds the roadway capacity and there are no unusual circumstances other than peak hour travel. Non-recurring congestion is congestion that is caused by specific incidents such as accidents, disabled vehicles, construction work zones, bad weather and special events. A 2003 study of recurring vs. non-recurring congestion in the Seattle area

estimated the percentage of delay on SR 520 due to non-recurring congestion to be about 60 percent in the westbound direction and about 35 percent in the eastbound direction.[1]

Tolling as a stand-alone alternative is much more effective in managing recurring congestion than non-recurring congestion simply because tolling (particularly higher peak hour tolls) would convince drivers to make their trip at a less congestion time, or on a different mode or on a less congested route, or not make the trip at all. A tolling alternative where all vehicles on SR-520 pay a toll for any usage of SR-520 would reduce congestion more than single toll point at the Lake (where only vehicles crossing the Lake pay the toll). A system with variable/dynamic or variable/static pricing – which has toll levels based on the level of congestion – will reduce SR-520 congestion more than a fixed toll rate all day. A flat rate for commuters would also be less likely to reduce congestion than other pricing strategies.

Tolling may mitigate some non-recurring congestion simply by lowering the number of vehicles in the corridor. However non-recurring congestion would be more effectively managed by other traffic and incident management programs such as intelligent transportation systems applications.

Purpose and Need Criterion related to Meeting the Implementation Schedule
Each alternative was evaluated on the likelihood that it will be implemented by September 2009, to satisfy the project schedule requirements of the Urban Partnership Agreement. This is related to the complexity of the alternative, and the more complex the alternative, the more factors there are that may put the project behind schedule. For example, a single mainline toll configuration is more likely to meet the schedule than a configuration with seven mainline toll points, or toll gantries on each ramp.

The pricing alternatives could all likely meet the schedule requirements, however, variable/dynamic pricing, which requires development of a toll rate algorithm and additional traffic monitoring equipment, and a resident discount program, which would likely require legislation, are the least likely of the alternatives to meet the implementation schedule. (Giving preferential treatment to someone based solely on location is not typically done in tolling without extenuating circumstances, and has in fact been called discriminatory. There are many places where tolls are reduced, but mainly it is due to frequency of usage, which technically is available to everyone. If indeed there is a program that allows for travel at lower tolls, it is usually available to everyone (though of course not everyone may know about it). At the Grand Island Bridges in upstate New York, for example, the residents get a large discount from the NY Thruway on tolls for crossing the Bridge, but that is the only way that they may access the Island; as such it is not discriminatory.)

Purpose and Need Criterion related to Meeting the UPA Requirements of Implementation by September 2009: Complexity of Back Office

[1] Table 1, Measurement of Recurring vs. Non-Recurring Congestion, Washington State Transportation Center (TRAC), University of Washington Final Report, Research Project T2695, Task 36, October 2003

What is the relative impact of the proposed alternative on the complexity of the back office/customer service center required for the project? For the toll configuration alternatives, the back-office complexity is related to the number of transactions as well as the general toll system configuration; a single mainline toll will have the fewest total transactions whereas a configuration with seven mainline tolls will have the largest number of toll transactions to be processed at the back office. In barrier toll systems, a toll is assessed every time the vehicle passes a tolling location; in ticket toll systems, the matching of an entry and exit transaction is required to assess the toll which is a more complex back office procedure.

For the pricing alternatives, back-office simplicity is based on the relative ability to audit the toll system: the more toll rates, the more difficult it is to resolve revenue assessed at the back office against transactions that occur in the lane. Fixed-price tolling has the most simplicity, while variable/dynamic pricing is most complex to audit.

Purpose and Need Criterion related to Meeting the Implementation Schedule: Simplicity of Tolling

It would be beneficial to potential customers to have a toll configuration and pricing mechanism that is relatively simple to explain. A single tolling point at the lake crossing would make the most sense to customers, while a hybrid toll system is relatively difficult to understand, since some customers pay rates based on distance while others (video customers) do not. A fixed toll rate for all customers is the simplest to understand, while variable/dynamic pricing, where the drivers do not know the rate until they drive up to the facility, is significantly more complex to communicate.

Local Diversion of Traffic

What is the impact of the proposed alternative on easing the local diversion of traffic from the corridor? Tolling only the Lake Washington crossing will not have much effect on local roads because there are no local roads that can carry traffic across the lake. Therefore, a single mainline toll would produce the least local diversion of traffic and thus the least social or environmental justice community impact related to traffic diversion. Alternatives that include multiple tolling points or a ticket system would produce the most diversion to the local street network.

Although local diversion depends mainly on the toll configuration and not the pricing alternative, some pricing alternatives will generally have more of an effect than others. For example, a flat rate commuter discount would encourage more traffic to use the toll facility than other pricing alternatives.

Facilitates HOV 3+ Management

What is the relative ease of enforcing an HOV 3+ requirement for the proposed alternative? Ease of HOV 3+ enforcement for toll configuration alternatives is based on the number of collection points; more collection points means more locations where vehicles must be monitored to ensure that they have three or more occupants.

HOV 3+ management has little to do with the pricing strategy; however, if HOV 3+ vehicles are allowed free or discounted travel, there would likely to be a system in place to identify these vehicles, such as special transponders.

Purpose and Need Criterion related to Ease of Public Acceptance
This criterion asks the question, "How likely will the alternative be generally accepted by the traveling public?" Acceptance has a lot to do with the simplicity of the system, fairness, and value. The simplicity of fixed-price tolling would appeal to potential customers, as could flat rate tolls, resident discounts, and the opportunity for free or reduced-price travel by carpooling. Additional fees or account charges are likely be negatively perceived.

In terms of toll collection concepts, having a single mainline toll would be the most appealing to potential customers, while having to pay many times within a relatively short distance – as with the seven mainline toll concept – would not be as well-accepted by the public.

Facilitates Phased Approach/Migration
This criterion asks, "Does the alternative facilitate a phased approach to implementing/migrating the new toll system?" While this does not apply to pricing alternatives, several toll configurations will work better than others in terms of phasing the toll system deployment in the corridor. Barrier toll system configurations that include a tolling point at the lake crossing work best as those with multiple mainline tolling points can be easily phased by deploying the single mainline toll at the lake first. Since a ticket toll system requires both an entry and exit transaction, all the tolling infrastructure has to be built at once before the system can be turned on; this type of toll system cannot be partially up and running during the migration period.

Ease of Enforcing Tolls
What is the ease of enforcing toll payment under the proposed alternative? This criterion was deemed not applicable to pricing alternatives since tolls are collected in the same manner (by transponder or video), regardless of pricing alternatives. Ease of enforcement for toll configuration alternatives is based on the number of collection points; more collection points means more locations where vehicles must be monitored to ensure that they have paid the toll and more vehicles to identify and locate.

Impact on Costs of Project
What is the relative impact of the proposed alternative on reducing the project costs? Fixed-price tolling, due to its simplicity, is the best candidate for a low-cost pricing alternative. Likewise, a single toll collection point would have the lowest construction cost compared to alternatives with multiple toll gantries. Variable pricing, especially variable/dynamic pricing which requires additional equipment to monitor traffic, will have the highest cost of the pricing alternatives. A system with many pay points would have the highest costs of the toll collection alternatives.

Purpose and Need Criterion related to Reducing I-90 Congestion
What is the likely impact of the proposed alternative on reducing congestion in the I-90 corridor? Obviously, the implementation of tolling on SR-520 would increase congestion on I-90, as that is its closest parallel route. Therefore all toll collection alternatives on SR-520 will divert some traffic to I-90. A flat toll rate on SR-520 would divert less traffic to I-90 than other pricing alternatives.

Purpose and Need Criterion related to Impact on Safety in Corridor
What is the relative impact of the proposed alternatives on improving safety in the corridor? Toll configuration alternatives with multiple tolling locations are more likely to divert traffic from SR

520 to local roads in the corridor, and thus are more likely to negatively impact safety in the corridor than the single toll collection point alternative.

Differential car/truck pricing could be used to discourage trucks from the corridor, improving safety more than other pricing alternatives. Variable/dynamic pricing may have a small detrimental effect on safety depending on the decision point to choose the tolled route, and whether or not it is easy to get on the toll route or free route without much weaving through traffic.

Impact on Environment
What is the relative impact of the proposed alternative on the environment? Since all toll collection alternatives under consideration are all-electronic, they require only overhead gantries and not conventional across-the road toll plazas with large rights-of-way; each is unlikely to have any discernable physical environmental impact to resources such as wetlands or water resources.

Flat rate tolling, since it does nothing to discourage peak usage, will have the least impact on reducing traffic congestion and air pollution than any other the other pricing alternatives. Variable pricing – both variable/dynamic and variable/static – would reduce air pollution in the corridor as the toll rate can be set to manage the level of congestion and keep traffic moving through the corridor. Low-emission vehicle discounts and free or discounted HOV vehicles are two other pricing strategies that are favorable to the environment as they would encourage behavior that would reduce air pollution levels.

Purpose and Need Criterion related to Improving Roadway Operations
What is the relative impact of the proposed alternative on improving roadway operations in the corridor? Variable pricing – both variable/dynamic and variable/static – is likely to improve operations on the facility more than the other pricing alternatives as it would be more effective at managing peak hour congestion. Flat rate tolling does not reduce traffic during peaks when compared to other pricing strategies; it can be said that this is the least effective in improving corridor operations.

The choice of toll configuration alternatives would not have an impact on roadway operations since none of the alternatives changes the physical attributes or geometry of the roadway.

Impact on Potential Revenues
What is the impact of the proposed alternatives on generating potential toll revenues? Some pricing and toll configuration alternatives are likely to generate more revenue than others. For example, variable pricing (both variable/dynamic and variable/static), which charges tolls based on recent or current congestion levels, have much more potential to generate higher revenues than an alternative where tolls do not change throughout the day. Flat rates, resident discounts, and discounts for low-emission vehicles will all reduce baseline revenues.

Toll configuration alternatives that are likely to generate the most revenues are those ones in which all vehicles in the corridor are tolled (such as a full ticket system or tolls at all on-ramps or all off-ramps), as opposed to a single mainline toll which does not capture all vehicles in the corridor.

JACOBS Carter Burgess
Consultants in Engineering, Architecture, Planning, Construction and the Environment

MEMO

TO: Washington State Department of Transportation DATE: July 11, 2008

FROM: Jacobs Carter Burgess Consulting Group

SUBJECT: SR 520, Seattle, Washington Memo #3
Qualitative Evaluation of Toll Configuration Alternatives

DRAFT - WORK-IN-PROGRESS

Summary

A single mainline tolling point on or near the Evergreen Point Floating Bridge was selected as the preferred toll configuration alternative for the SR 520 corridor. This preferred toll configuration alternative was chosen after performing a qualitative screening analysis of several configuration alternatives proposed for the project. The screening criteria were prioritized in order of importance of meeting the project constraints. This prioritization facilitated the short-listing of configuration alternatives and, consequently, the selection of the preferred toll configuration alternative.

Introduction

The goal of the Urban Partnership SR 520 Project is to reduce congestion on SR 520 between I-5 and I-405 through tolling. It is, therefore, necessary to determine the configuration of the toll collection system through which tolling would be implemented on the SR 520 corridor. This memorandum documents the qualitative evaluation of toll configuration alternatives proposed for the SR 520 corridor. This evaluation resulted in the identification of a preferred toll configuration alternative.

Methodology

A qualitative assessment was performed for the no-build alternative and ten proposed toll configuration alternatives, where each alternative was evaluated against selected screening criteria. A relatively simple assessment format was used, where criteria were judged to either be positive ("+"), neutral ("o"), negative ("-"), or not applicable (n/a) to the project.

A total of ten toll configuration alternatives were previously identified (see Memo #1) by Jacobs Carter Burgess (JCB) in consultation with the Washington State Department of Transportation (WSDOT). These alternatives are defined and documented in a separate technical memorandum. Screening criteria were developed for evaluating these alternatives and these criteria are also described in a separate technical memorandum. The screening criteria were prioritized in order of importance to meet the project constraints, the principal constraints being the reduction of congestion on SR520 and the implementation of tolling on SR 520 by September 2009, both of which to satisfy the requirements of the Seattle Urban Partnership Agreement with the U.S. Department of Transportation (USDOT).

Table 1 shows the evaluation matrix used for the assessment and the screening criteria prioritized in order of importance.

Table 1. Qualitative Evaluation Matrix

Tolling Concept	Tolling Concept Description	Reduces SR 520 Congestion	Meets Implementation Schedule	Complexity of Back Office	Simplicity of Tolling	Local Diversion of Traffic	Facilitates HOV 3+ Management	Ease of Public Acceptance	Facilitates Phased Approach/Migration	Ease of Enforcing Tolls	Impact on Costs of Project	Reduces I-90 Congestion	Impact on Safety in Corridor	Impact on Environment	Improves Roadway Operations	Impact on Potential Revenues
No Build																
NB-1	No change from existing															
SR-520 only	**Toll only SR-520 between I-5 and I-405**															
SR-520-1	Single Mainline Toll (at Lake)															
SR-520-2 *	Two Mainline Tolls (near I-5 and I-405)															
SR-520-3	Three Mainline Tolls (at Lake, I-5, I-405)															
SR-520-4	Seven Mainline Tolls (b/w interchanges)															
SR-520-5	On-ramp Tolls (all on ramps; all mvmts)															
SR-520-6	Off-ramp Tolls (all off ramps; all mvmts)															
SR-520-7	Closed "Ticket System;" (all mvmts)															
SR-520-8	Hybrid Ticket/Video 1, Single Video ML Toll at Lake															
SR-520-9	Hybrid Ticket/Video 2, Two Video ML Tolls at I-5 and I-405															
SR-520-10	Hybrid Ticket/Video 3, Three Video ML Tolls at Lake, I-5, I-405															

+	Improve/Easy/Increase
o	Same/Moderate/No Change
-	Degrade/Difficult/Decrease
n/a	Not Applicable

The screening criterion, “Reduces SR 520 Congestion” was considered to be the most important followed by “Meets Implementation Schedule”, “Complexity of Back Office,” “Simplicity of Tolling,” and so on.

Evaluation of Toll Configuration Alternatives

The alternative that called for a single mainline toll at the Lake was chosen as the preferred toll configuration alternative for the SR 520 corridor, as it best satisfied the screening criteria.

The short-listing of configuration alternatives was performed in the following way: each configuration alternative was evaluated against each screening criterion, and a rating was applied. Once the rating was completed, only those alternatives that were rated positive or neutral to the project (“+” or “o”) were short-listed, beginning with the most important screening criterion of “Meets Implementation Schedule.” This short list was narrowed down as each subsequent screening criterion was considered in order of importance.

Table 2 shows that all of alternatives rated positive to the project for the most important criteria of "Reduces SR 520 Congestion." Reducing congestion on SR-520 is the primary objective of this project. Congestion can be categorized into two types – recurring congestion and non-recurring congestion. Recurring congestion is the typical congestion that is experienced by travelers on a roadway where the traffic demand exceeds the roadway capacity and there are no unusual circumstances other than peak hour travel. Non-recurring congestion is congestion that is caused by specific incidents such as accidents, disabled vehicles, construction work zones, bad weather and special events.

Tolling as a stand-alone alternative is much more effective in managing recurring congestion than non-recurring congestion simply because tolling (particularly higher peak hour tolls) would convince drivers to make their trip at a less congestion time, or on a different mode or on a less congested route, or not make the trip at all. A tolling alternative where all vehicles on SR-520 pay a toll for any usage of SR-520 would reduce congestion more than single toll point at the Lake (where only vehicles crossing the Lake pay the toll). A system with variable/dynamic or variable/static pricing – which has toll levels based on the level of congestion – will reduce SR-520 congestion more than a fixed toll rate all day. A flat rate for commuters would also be less likely to reduce congestion than other pricing strategies.

Tolling may mitigate some non-recurring congestion simply by lowering the number of vehicles in the corridor. However non-recurring congestion would be more effectively managed by other traffic and incident management programs such as intelligent transportation systems applications.

After considering the second most important criteria of "Meets Implementation Schedule," six of the ten proposed alternatives were rated "+" or "o". Alternatives SR-520-3 through SR-520-7 were all eliminated from further consideration because they were judged to be relatively complicated to be implemented within the September 2009 timeframe (multiple tolling locations, full ticket system, etc).

Alternative SR-520-10 was then eliminated because it was judged to require more back office complexity than the other five alternatives. It includes a ticket system (which requires back office matching of entry and exit transactions) as well as three video tolling locations.

The "Simplicity of Tolling" criterion eliminates alternative SR-520-9 as it includes two video tolling locations in addition to a ticket system which only charges a toll if the vehicle passes the video tolling point. This alternative was rated worse than alternative SR-520-8, which only includes one video tolling location. The four alternatives that remain are SR-520-1 through SR-520-3 and SR-520-8.

Alternatives SR-520-2 and SR-520-8 are eliminated under the "Local Diversion of Traffic" criterion. Alternative SR-520-2 calls for two tolling locations near I-5 and I-405 and traffic wishing to bypass the tolls can easily take a local alternate route around the tolling points and access the corridor through a local interchange. Alternative SR-520-8 would have potential traffic diversions for those using video license plate tolling; those who would most likely take alternative local routings.

The "Facilitates HOV 3+ Management" criterion eliminates alternative SR-520-3 as it has three locations where the HOV 3+ occupancy would have to be enforced while the other remaining alternative (SR-520-1) only have one enforcement location.

Therefore the result of the screening analysis, short listing and elimination of alternatives resulted in alternative SR-520-1 (Single Mainline Toll at Lake) being selected as the preferred toll configuration alternative for the SR 520 corridor.

Table 2. Completed Evaluation Matrix

Tolling Concept	Tolling Concept Description	Reduces SR 520 Congestion	Meets Implementation Schedule	Complexity of Back Office	Simplicity of Tolling	Local Diversion of Traffic	Facilitates HOV 3+ Management	Ease of Public Acceptance	Facilitates Phased Approach/Migration	Ease of Enforcing Tolls	Impact on Costs of Project	Reduces I-90 Congestion	Impact on Safety in Corridor	Impact on Environment	Improves Roadway Operations	Impact on Potential Revenues
No Build																
NB-1	No change from existing	o	n/a	o	n/a	+	o	+	o	o	o	o	o	o	o	n/a
SR-520 only	**Toll only SR-520 between I-5 and I-405**															
SR-520-1	Single Mainline Toll (at Lake)	+	+	+	+	+	+	+	+	+	+	-	o	o	o	o
SR-520-2 *	Two Mainline Tolls (near I-5 and I-405)	+	+	o	o	-	o	o	o	o	o	-	o	o	o	o
SR-520-3	Three Mainline Tolls (at Lake, I-5, I-405)	+	+	o	o	o	-	o	+	o	o	-	o	o	o	+
SR-520-4	Seven Mainline Tolls (b/w interchanges)	+	-	-	-	-	-	-	+	-	-	-	-	o	o	+
SR-520-5	On-ramp Tolls (all on ramps; all mvmts)	+	-	+	o	-	-	o	-	-	-	-	o	o	o	+
SR-520-6	Off-ramp Tolls (all off ramps; all mvmts)	+	-	+	o	-	-	o	-	-	-	-	o	o	o	+
SR-520-7	Closed "Ticket System;" (all mvmts)	+	-	-	-	-	-	o	-	-	-	-	-	o	o	+
SR-520-8	Hybrid Ticket/Video 1, Single Video ML Toll at Lake	+	+	o	o	-	+	-	+	+	-	-	o	o	o	o
SR-520-9	Hybrid Ticket/Video 2, Two Video ML Tolls at I-5 and I-405	+	+	o	-	-	o	o	o	o	-	-	o	o	o	o
SR-520-10	Hybrid Ticket/Video 3, Three Video ML Tolls at Lake, I-5, I-405	+	+	-	-	o	-	-	+	o	-	-	o	o	o	+

+	Improve/Easy/Increase
o	Same/Moderate/No Change
-	Degrade/Difficult/Decrease
n/a	Not Applicable

* This Tolling Concept was removed from further analysis on 05 March 2008 at the WSDOT request.

Conclusion

The qualitative evaluation of the proposed configuration alternatives resulted in the selection of the single mainline toll at the Lake as the preferred toll configuration. This configuration was judged to be best configuration for meeting the overall project goal of implementing tolling on the SR 520 corridor by September 2009.

The next steps for the project are to develop a Concept of Operations plan for the preferred tolling alternative. Furthermore, toll pricing alternatives will be proposed for the SR 520 corridor and a preferred pricing alternative will be identified following a similar screening analysis.

Consultants in Engineering, Architecture,
Planning, Construction and the Environment

MEMO

TO: Washington State Department of Transportation DATE: July 11, 2008

FROM: Jacobs Carter Burgess Consulting Group

SUBJECT: SR 520, Seattle, Washington Memo #4
Identification and Evaluation of Pricing Alternatives

DRAFT - WORK-IN-PROGRESS

Summary

After evaluating various pricing strategies in this memorandum, it is recommended that variable/static pricing be the preferred alternative for the SR 520 corridor, with free or discounted HOV 3+ trips. Other discounting options are workable in conjunction with this, such as low-emission vehicle or resident discounts, and may be implemented at the discretion of WSDOT; however, each of these would require additional enforcement and have the effect of reducing revenue. Additional fees or account charges are an option that may be used to cover some of the costs of toll collection and processing.

Introduction

The purpose of this memorandum is to describe potential pricing alternatives for the SR 520 corridor. The primary objective of any pricing strategy is to influence driver behavior, whether it means shifting vehicles to a less-congested, less-expensive time period, or off of the toll facility to provide better service for remaining customers, or to promote usage of carpools and low-emission vehicles and therefore encourage environmental conservation.

This memo discusses ten alternative pricing strategies for the corridor: fixed-price tolling, peak period pricing, variable/static pricing, variable/dynamic pricing, differential pricing for cars and trucks, flat rate, resident discounts, free or discounted HOVs, low-emission vehicle discounts, and additional fees/account charges. These pricing alternatives may be used singly or in combination. Pricing strategies that are mutually exclusive are fixed-price tolling, peak period pricing, variable/static pricing and variable/dynamic pricing. All of the other pricing strategies can be applied in any combination with either one of these four main pricing alternatives. For example, WSDOT could deploy variable/static tolling as well as resident discounts, flat rate and free or discounted HOVs.

Each pricing alternative is first evaluated generically as it relates to the toll policy elements, and then evaluated in matrix format against screening criteria - identified and described in a separate memorandum - for the Urban Partnership SR 520 Project. The Urban Partnership Agreement specifically requires the facility will implement variable pricing (based on the level of demand) and discounted or free access for vehicles with 3+ occupants. As stated above, this document describes potential pricing alternatives that may influence driver's behavior distinct from the UPA. The fixed-priced tolling, differential pricing for cars and trucks, flat rate, resident discount, and low-emission vehicle discount alternatives do not meet either of the UPA pricing

requirements for this project. This memorandum concludes with the alternative chosen for the SR 520 corridor.

Generic Toll Pricing Alternatives

The following section describes each of the ten pricing alternatives, highlights their advantages and disadvantages, and relates each alternative to the following six policy elements:

- Customer Service
- Operations/Traffic Management
- Equity
- Administrative/Institutional/Legal
- Finance
- Technology/Construction

Fixed-Price Tolling

Description

Fixed-price tolling means that tolls would be the same all day, no matter what the speeds or level of congestion are on the toll facility. Most toll facilities throughout the U.S. operate with fixed pricing for each vehicle class.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Fixed-Price Tolling

Policy Elements	Advantages	Disadvantages
Customer Service	• Simplicity; the customer knows the toll rate	• Varied value of service (i.e., travel time savings vs. cost) during different times of day
Operations / Traffic Management	• Simplest in terms of toll collection and auditing	• Does not manage traffic as well as a value-priced system
Equity	• All vehicles of similar class pay the same rate all day long	• Customers are not receiving the same value (i.e., travel time savings vs. cost) during different times of day
Administration / Institutional / Legal	• Simplicity in auditing and account/trip management	• n/a
Finance	• Simplicity in auditing	• Potentially less revenue collected than with a variable pricing structure
Technology / Construction	• Does not require variable message signs displaying rates • Does not require algorithms or complex pricing schedules that would be required for variable pricing	• Not progressive

Peak Period Pricing

Description

Peak period pricing, a type of variable congestion pricing, is defined as a system with a fixed toll rate for the entire day with the exception of the peak period, which will have a higher toll rate. A higher peak period toll provides an incentive for vehicles to shift to another route during peak travel periods, and congestion relief to customers when it is needed most. It is also intended to shift vehicles from the peak period to less-expensive off peak travel.

It is common in many industries to charge higher prices during times of peak demand; for example, electrical usage and telephone rates are higher during peak periods.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Peak Period Pricing

Policy Elements	Advantages	Disadvantages
Customer Service	• Higher peak toll means improved travel time relative to fixed toll pricing • Relative simplicity; the typical customer is likely to know the peak and off-peak rates	• Peak period customers pay more
Operations / Traffic Management	• Improves travel times and reduces delays during peaks by providing an economic incentive for drivers to shift to another route or to off-peak travel • Relatively simple in terms of toll collection and auditing	• Does not manage traffic as well as an alternative where tolls vary by hour
Equity	• Higher peak tolls tend to improve congestion and create greater time savings. In turn, peak period customers may experience shorter travel times.	• Peak period customers incur a higher toll
Administration / Institutional / Legal	• Relative simplicity in auditing	• n/a
Finance	• Relative simplicity in auditing • More revenue collected than with fixed pricing	• Less revenue collected than with alternatives where tolls vary by hour

Technology / Construction	• May not require variable message signs displaying rates	• Not a progressive pricing method if the facility is all-electronic

Variable/Static Pricing

Description

Variable/static pricing is defined as having a set schedule of tolls that vary throughout the day, often in hourly increments, based on recent hourly traffic data. Like peak period pricing, it is meant to change driver behavior, controlling the amount of traffic on the facility and keep it moving more quickly by shifting vehicles to other time periods or off of the facility. However, it is a more refined methodology than simply peak/off peak tolling; it attempts to flatten out the peaks and valleys in demand throughout the day.

The 91 Express Lanes in Orange County, California is the premier example of a facility that operates with static variable pricing. This high Occupancy Toll (HOT) facility has a set schedule of tolls by direction, hour and day of the week. Their tolling policy defines when and how much each hourly toll should change based on monitoring traffic over time, with the goals of optimizing traffic throughput at free-flow speeds while providing sufficient revenue to sustain financial viability[1].

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Variable/Static Pricing

Policy Elements	Advantages	Disadvantages
Customer Service	• Customers experience relatively uncongested, high-speed conditions throughout the day • Low off-peak tolls	• High peak tolls • Customers may not be familiar with toll rate schedule
Operations / Traffic Management	• Improves operations during peaks by providing an economic incentive for drivers to shift to another route or change their travel schedule	• May be difficult to select a "decision point" where drivers can choose to use the facility or not (e.g. whether to take SR 520 or I-90)
Equity	• The toll rates directly correspond to the value of service the customer should expect.	• Customers pay different rates throughout the day; no continuity in tolling
Administration / Institutional / Legal	• n/a	• n/a
Finance	• More revenue likely to be collected than with fixed pricing or peak tolling	• n/a
Technology / Construction	• n/a	• May require variable message signs displaying rates

[1] 91 Express Lanes Toll Policy, July 14, 2003, http://www.91expresslanes.com/generalinfo/tollpolicy.asp

Variable/Dynamic Pricing

Description

Variable/dynamic pricing sets toll rates based on real-time traffic information. Tolls will vary, sometimes in increments as small as several minutes, to control traffic demand throughout the day. With this alternative, vehicle speeds, volumes, and/or density are monitored and toll rates set according to a pre-determined algorithm. Minnesota's I-394 Express Lanes and San Diego's I-15 Express lanes are two examples of facilities that utilize variable/dynamic pricing.

This type of system is considered technologically progressive, however, there are a few issues when it comes to the customers: they will not know the toll rate until they reach signage at the decision point; they may have a different toll rate listed at their decision point than at the facility when they use it, and they may negatively perceive a higher rate than usual as "price gouging."

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Variable/Dynamic Pricing

Policy Elements	Advantages	Disadvantages
Customer Service	• Priced to have relatively uncongested, high-speed conditions throughout the day • Low off-peak tolls	• High peak tolls • Customers will not know toll rate until they reach the "decision point" • May be negatively perceived as "price gouging"
Operations / Traffic Management	• Improves operations during peaks by providing an economic incentive for drivers to shift to another route or change their travel schedule	• Requires adequate space and distance for "decision points" where customers can choose to use the facility or not
Equity	• Toll rates vary according to the changing value of the service provided to the driver	• Customers pay different rates throughout the day
Administration / Institutional / Legal	• n/a	• More complicated to reconcile and may be more challenging to address disputed toll charges
Finance	• More revenue likely to be collected than with fixed pricing	• No discernible revenue difference between this and variable/static pricing • More complicated to reconcile

Technology / Construction	• Technologically progressive	• Will require variable message signs displaying rates • Requires equipment to constantly monitor traffic • Requires decision points to be determined

Differential Pricing for Cars and Trucks

Description

While nearly all toll facilities throughout the country have different toll rates for different vehicle classes, these are typically based on an *(n-1)* schedule, meaning, trucks pay *n-1* times the passenger car rate, with *n* representing the number of axles. There is the opportunity to reduce the proportion of trucks on a toll facility by introducing truck toll rates that are higher than usual. Trucks may be identified through axle counting or shape based classification. Another option may utilize a different transponder or account registered with axle count or vehicle shape/size.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Differential Pricing for Cars and Trucks

Policy Elements	Advantages	Disadvantages
Customer Service	• Fewer trucks means easier driving and less delays and congestion for passenger cars • Improved safety	• Truck drivers not happy being charged more than what is typical • Adds additional rates to the toll schedule
Operations / Traffic Management	• Fewer trucks means improved operations / traffic management	• Must post class/toll rate structure near toll point or decision point • Requires additional lane equipment to maintain
Equity	• May be considered equitable in that trucks do multiple times the damage to roadways as cars	• Truck owners and operators pay tolls higher than the proportion to car tolls to which they are accustomed
Administration / Institutional / Legal	• n/a	• n/a
Finance	• Will likely generate more revenue than a system with more typical truck tolls	• n/a
Technology / Construction	• Less damage to the roadway from fewer heavier vehicles	• Requires a classification system to recognize size/axle count of vehicle.

Flat Rate Tolling

Description

With this alternative, customers have the option of paying one price for unlimited trips over a given period of time, for example, a weekly or monthly pass. This will benefit frequent customers as it will cost them less per trip than infrequent customers, however, it will not effectively reduce travel among these frequent customers.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Flat Rate Tolling

Policy Elements	Advantages	Disadvantages
Customer Service	• Frequent customers happy to be paying less per trip	• Infrequent customers paying (potentially significantly) higher tolls than frequent customers
Operations / Traffic Management	• n/a	• Does not manage traffic well, as peak period traffic is likely to have the highest proportion of frequent customers, and therefore the lowest average toll rate • Encourages more frequent use; not good for the environment or traffic reduction
Equity	• n/a	• Frequent customers pay less per trip than others
Administration / Institutional / Legal	• n/a	• Additional account and system maintenance • May require kiosks or retail locations for pass distribution and account replenishment
Finance	• n/a	• May reduce revenue • More difficult to audit
Technology / Construction	• n/a	• Requires a means to identify a customer as a weekly/monthly pass holder • ROW / construction for kiosks

Resident Discount

Description

With this alternative, residents pay a lesser toll than non-residents. This is common in some island communities where the toll bridge is the only access to the mainland.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Resident Discount

Policy Elements	Advantages	Disadvantages
Customer Service	• Residents happy to be paying less	• n/a
Operations / Traffic Management	• n/a	• Does not manage traffic well, as peak period traffic is likely to have the highest proportion of residents, and therefore the lowest average toll rate
Equity	• n/a	• Residents pay less than other customers
Administration / Institutional / Legal	• n/a	• Requires federal legislation
Finance	• n/a	• Reduction in revenue
Technology / Construction	• n/a	• Requires a means to identify a customer as a resident

Free or Discounted HOVs

Description

Charging a lesser toll rate for high occupancy vehicles (HOV) - or allowing HOVs to use the facility for free - promotes carpooling, moving more people in fewer vehicles and thereby reducing traffic and air pollution. The Tappan Zee Bridge and the 91 Express Lanes are examples of toll facilities that allow HOV vehicles to travel for free or at a discounted rate. At the Tappan Zee Bridge the HOV discount is used in conjunction with a flat rate commuter plan, while on the 91 Express Lanes HOV vehicles have a form of peak period pricing: they travel for free during all times except outbound during the PM peak period, when they are charged half price tolls.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Free or Discounted HOVs

Policy Elements	Advantages	Disadvantages
Customer Service	• Carpoolers happy to be paying less	• Most people prefer not to carpool
Operations / Traffic Management	• Carpooling means fewer vehicles on the road	• n/a
Equity	• HOV vehicles pollute less when you consider pollution per passenger; those who pollute less pay less	• n/a
Administration / Institutional / Legal	• Carpooling is considered “green”; good for toll agency’s image	• n/a
Finance	• n/a	• Reduction in revenue if carpooling becomes more popular
Technology / Construction	• Progressive	• Requires a means to identify HOV vehicles, either through technology or directly in the field

Low-Emission Vehicle Discount

Description

In an effort to reduce air pollution and increase fuel efficiency, charging a lesser toll rate to low-emission vehicles has been a growing trend throughout the U.S. and Europe. Some examples of systems with these discounts are the New York State Thruway and the Port Authority of New York and New Jersey, both which currently offer a 10% discount for some hybrid vehicles; and Milan's and London's congesting charging zone, which allow clean-fuel vehicles free entry.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Low-Emission Vehicle Discount

Policy Elements	Advantages	Disadvantages
Customer Service	• Hybrid vehicle drivers happy to be paying less	• The only way to receive a discount – for most people – is to buy a new car
Operations / Traffic Management	• Improved air quality with potentially more efficient vehicles traveling the corridor	• Does nothing to manage traffic levels
Equity	• Vehicles that pollute less pay less, providing for a 'greener' toll facility and corridor	• Only drivers of low-emission vehicles receive a toll discount
Administration / Institutional / Legal	• "Going green" is good for toll agency's or DOT's image	• May require legislation
Finance	• n/a	• Reduction in revenue as hybrid vehicles become more popular
Technology / Construction	• Progressive	• Requires a means to identify and/or register low-emission vehicles

Fees and Account Charges

Description

Fees and account charges may be used to control the number of certain types of customers on a toll facility, or to pay additional processing costs related to that customer. For example, video (i.e., license plate) customers may be charged a fee to offset additional costs related to processing video license plate transactions, including visual identification, searching through license plate databases for an address, and mailing an invoice. This is opposed to a transponder transaction where the customer has an established account. Another example is charging tag holders a small monthly fee to keep their account open. This will discourage infrequent customers from keeping an account, saving money for the tolling authority.

Advantages and Disadvantages to the Six Policy Elements

Pricing Alternative – Fees and Account Charges

Policy Elements	Advantages	Disadvantages
Customer Service	• n/a	• Customers do not like additional fees on top of tolls
Operations / Traffic Management	• n/a	• Does nothing to manage traffic levels
Equity	• n/a	• Some customers pay more than others for the same trip and same time of day, due to potential fees to certain customers (e.g. license plate video surcharges)
Administration / Institutional / Legal	• Decreases overall account maintenance costs	• n/a
Finance	• May offset processing costs • May increase revenue	• n/a
Technology / Construction	• n/a	• Typically requires license plate identification, more personnel, and inter-agency cooperation

Evaluation of Pricing Alternatives

Methodology

A qualitative assessment was performed for the ten proposed pricing alternatives for the SR 520 corridor where each was evaluated against screening criteria. A relatively simple assessment format was used, where alternatives were judged to either be positive ("+"), neutral ("o"), negative ("-") or not applicable (n/a) to the project. The screening criteria developed for evaluating the alternatives are described in a separate technical memorandum.

Application to SR 520 Corridor

The matrix below evaluates each pricing alternative as it applies to the SR 520 corridor.

Qualitative Evaluation Matrix

Pricing Alternative	Reduces SR 520 Congestion	Meets Implementation Schedule	Complexity of Back Office	Simplicity of Tolling	Local Diversion of Traffic	Facilitates HOV 3+ Management	Ease of Public Acceptance	Facilitates Phased Approach/Migration	Ease of Enforcing Tolls	Impact on Costs of Project	Reduces I-90 Congestion	Impact on Safety in Corridor	Impact on Environment	Improves Roadway Operations	Impact on Potential Revenues
Fixed-price tolling	o	+	+	+	-	o	+	n/a	n/a	+	-	o	o	o	o
Peak period pricing	+	+	o	o	-	o	o	n/a	n/a	o	-	o	+	+	o
Variable/static pricing	+	+	o	-	-	o	o	n/a	n/a	-	-	o	+	+	+
Variable/dynamic pricing	+	-	-	-	-	o	o	n/a	n/a	-	-	-	+	+	+
Differential pricing for cars and trucks	+	+	o	+	-	o	o	n/a	n/a	o	-	+	+	+	+
Flat rate	o	+	o	o	-	o	+	n/a	n/a	o	-	o	-	-	-
Resident discount	-	+	o	o	o	o	+	n/a	n/a	o	o	o	o	o	-
Free or discounted HOVs	+	+	o	o	-	+	+	n/a	n/a	o	-	o	+	+	-
Low-emission vehicle discounts	o	+	o	o	-	o	o	n/a	n/a	o	o	o	+	o	-
Additional fees/account charges	o	+	-	o	-	o	-	n/a	n/a	o	-	o	o	o	+

+	Improve/Easy/Increase
o	Same/Moderate/No Change
-	Degrade/Difficult/Decrease
n/a	Not Applicable

While there are advantages and disadvantages to each alternative, it was necessary to focus on the requirements of the Urban Partnership Agreement (UPA). As an Urban Partner, WSDOT has responsibility to implement the tolling and technology elements of the UPA. The UPA pledges that variable pricing and free or discounted HOVs will be part of the selected pricing strategy.

Because variable pricing is the desired form of tolling in the UPA, fixed-price and peak period tolling, differential car and truck pricing, and flat rate alternatives have been removed from further analysis. The following sections compare static versus dynamic variable pricing for SR 520, and compares the various discount programs and fees that could be used in conjunction with variable pricing.

Static vs. Dynamic Variable Pricing on SR 520

Between the two variable pricing alternatives – static and dynamic – the main difference is that with static variable pricing the toll schedules are set in advance of the trip, and with dynamic variable pricing the tolls change directly in proportion to actual traffic at a given point in time. The potential customer under the dynamic pricing scenario will not know the toll rate until they reach the decision point (i.e., the point where a motorist must decide whether to take the toll route or an alternate route) In the case of SR 520, the static pricing has numerous advantages over the dynamic. Following is a comparison based on the screening criteria where the two alternatives received different ratings in the qualitative evaluation.

Criteria: Reduces SR 520 Congestion

Congestion can be categorized into two types – recurring congestion and non-recurring congestion. Recurring congestion is the typical congestion that is experienced by travelers on a roadway where the traffic demand exceeds the roadway capacity and there are no unusual circumstances other than peak hour travel. Non-recurring congestion is congestion that is caused by specific incidents such as accidents, disabled vehicles, construction work zones, bad weather and special events.

Tolling as a stand-alone alternative is much more effective in managing recurring congestion than non-recurring congestion simply because tolling (particularly higher peak hour tolls) would convince drivers to make their trip at a less congestion time, or on a different mode or on a less congested route, or not make the trip at all. A tolling alternative where all vehicles on SR-520 pay a toll for any usage of SR-520 would reduce congestion more than single toll point at the Lake (where only vehicles crossing the Lake pay the toll). A system with variable/dynamic or variable/static pricing – which has toll levels based on the level of congestion – will reduce SR-520 congestion more than a fixed toll rate all day. A flat rate for commuters would also be less likely to reduce congestion than other pricing strategies.

Tolling may mitigate some non-recurring congestion simply by lowering the number of vehicles in the corridor. However non-recurring congestion would be more effectively managed by other traffic and incident management programs such as intelligent transportation systems applications.

Criteria: Meets Implementation Schedule

Though dynamic pricing is regarded as being more technologically advanced, using real-time data rather than recent historical data, it requires a high level of accuracy, time and expense in developing pricing algorithms and implementing monitoring equipment. It would be difficult to accomplish this by September 2009.

Criteria: Complexity of Back Office

Financial audit of a static variable pricing alternative will be easier than a dynamic pricing alternative. It is simpler to keep track of revenue collection when toll rates are set, as opposed to changing every several minutes.

Criteria: Impact on Safety in Corridor

Dynamic pricing would have more safety issues than static variable pricing. When the pricing is not set, and the toll is unknown before the decision point, the decision whether or not to use SR 520 will be more difficult. Drivers may wait until the last minute to choose, possibly having to cross several lanes of traffic to exit.

Criteria: Improves Roadway Operations / Impact on Potential Revenues

While both variable pricing strategies received positive ratings for improving roadway operations and impact on potential revenues, it is important to mention that there is no substantial proof that dynamic variable pricing is better that static variable pricing in terms of keeping traffic moving or producing more revenue. A specific tolling policy could be developed for a static variable pricing strategy that would increase toll rates if hourly traffic levels and congestion were consistently higher than desired and/or if revenues were lower than expected.

Criteria: Other Considerations

While not covered under the qualitative evaluation matrix, it is important to point out that dynamic variable pricing may not work well for another reason: because the posted toll rates *at the customer's decision point* would not reflect real time traffic conditions throughout SR 520. Dynamically priced toll facilities have typically been managed lanes – such as Washington's 167 HOT Lanes, with tolled lanes adjacent to general purpose lanes - where the distance between the decision point and the toll collection point is very short, and a choice of toll vs. free lane use is provided to the customer. If this distance were long – say it were to take 20 minutes to get from this decision point to the facility entrance, and then another five minutes to reach the point where tolls are collected – it would defeat the purpose of dynamic pricing, because the traffic congestion data is already 25 minutes old, and conditions may have changed. For SR 520, since the adjacent free facility (I-90) is several miles away on often-congested highways, the decision points – where variable message signs display the toll rate - are far from the toll collection point, and the toll rate would not be based on real-time traffic conditions.

Comparisons of Discounts and Additional Fees/Charges

In addition to a variable pricing strategy, WSDOT may choose to discount certain vehicles and/or charge additional fees to particular vehicles. The three different discount programs evaluated (resident, HOV and low-emission vehicles) and additional fees/account charges are compared below in terms of the screening criteria for which they have received different ratings.

Criteria: Complexity of Back Office

Any of the discount programs are less likely to bring as much complexity to the back office than additional fees and account charges, which could require further measures to collect. For example, if license-plate transactions (video tolling) required an extra fee by the customer, it might be more difficult to collect.

Criteria: Local Diversion of Traffic

A resident discount would keep more vehicles on SR 520 than the other programs; therefore, it would cause less diversion to local roads.

Criteria: Facilitates HOV3+ Management

While providing an HOV3+ discount program or providing free travel for HOVs does not necessarily "facilitate" HOV management, it requires that the roadway, toll system, etc. are set up in such a way that HOVs are identified.

Criteria: Ease of Public Acceptance

Resident discounts and the opportunity for free or reduced-price travel by carpooling would likely appeal to potential customers of the corridor. Low-emission vehicle discounts would be well perceived by those who own them, but possibly unfair to those who do not. Additional fees or account charges are likely be negatively perceived.

Criteria: Reduces SR 520 Congestion

Of the discount programs, an HOV3+ discount would be the only one that may reduce traffic congestion on SR 520 by encouraging carpooling. A resident discount program would keep more traffic on SR 520 during peaks than other pricing alternatives, since residents are commuters and will travel mainly during peak periods.

Criteria: Reduces I-90 Congestion

While tolling SR 520 in general will divert traffic to I-90, resident or low-emission vehicle discounts will have less of a negative effect on I-90 because they encourage travel on SR 520 by these customers.

Criteria: Impact on Environment

Free or discounted HOVs and low-emission vehicle discounts are favorable to the environment as they would encourage carpooling behavior that would reduce air pollution levels.

Criteria: Improves Roadway Operations

An HOV discount program or free HOVs may improve roadway operations over other programs because it would encourage carpooling, which could reduce the amount of traffic on SR 520.

Criteria: Impact on Potential Revenues

Any of the three discount programs will reduce potential revenues, while additional fees/account charges would increase revenues by offsetting part of the costs of toll collection.

Criteria: Other Considerations

As stated previously, the UPA states that the Urban Partner will have discounted or free access for vehicles with 3+ occupants. Therefore, this will be part of the pricing strategy. WSDOT must consider how to identify and toll these vehicles; a transponder will be required if tolls are to be collected from them, but may not be necessary if these vehicles travel for free.

Conclusion

A static/variable pricing strategy with free or discounted HOV3+ vehicles is recommended for SR 520. A resident discount program is not recommended as this typically applies more to island communities, and it increases traffic during peak commute times more than other discount programs. Additional fees may be considered as a way to offset some toll collection costs, and low-emission vehicle discounting is popular for its environmental concern but will reduce revenues; these two pricing alternatives may also be considered by WSDOT according to its needs.

Cultural Resources Survey
Washington State Department of Transportation
SR 520 Urban Partnership Agreement Variable Tolling Project
Evergreen Point Bridge
Seattle, King County, Washington

Report No. 08-37

Cultural Resources Program
Connie Walker Gray, WSDOT Architectural Historian

December 22, 2008

Washington State
Department of Transportation
Urban Corridors Office
401 2nd Avenue South, Suite 560
Seattle, WA 98104

Executive Summary

The U.S. Department of Transportation's (USDOT) National Strategy to Reduce Congestion on America's Transportation Network, otherwise known as the Congestion Initiative, includes a component that calls for the Department to enter into Urban Partnership Agreements with model cities, pursuant to their commitment to, among other things, implementing "broad congestion pricing." Selected cities receive priority consideration for available Federal discretionary funds (about $1 billion).

In 2007, Washington State Department of Transportation (WSDOT), King County and the Puget Sound Regional Council submitted a successful application to join the Urban Partnership program. Known as the Lake Washington Urban Partnership Agreement, this cooperative effort will employ innovative traffic management tools for improving safety and traffic flow along State Route 520 and Interstate 90 between Seattle and the Eastside. It includes four key strategies, known as the four T's:

- Tolling
- Technology
- Transit
- Telecommuting

The SR 520 Urban Partnership Variable Tolling project is the tolling component of the Lake Washington Urban Partnership Agreement. This assessment evaluates the potential effects to historic properties as a result of variable tolling. Variable tolling can be defined as varying the price of tolls throughout the day to manage demand.

Because the USDOT is granting funds through the Federal Highway Administration (FHWA) to implement this project, Section 106 of the National Historic Preservation Act, as amended, applies. Section 106 requires that federal agencies evaluate the effects of their undertakings on historic properties. This report assists FHWA in fulfilling obligations under Section 106 and its implementing regulations, 36 CFR 800.

The Area of Potential Effects (APE) for this Variable Tolling Project is comprised of the SR 520 Bridge and approaches, as well as the portion of SR 520, just east of the bridge, where the control pads and cabinets will be located. The APE is entirely within the SR 520 right of way. The SR 520 Bridge, referred in this report as the Evergreen Point Bridge and also known as the Governor Albert D. Rosellini Bridge, is eligible for listing in the National Register of Historic Places. It is therefore considered a “historic property” as defined in 36 CFR 800.16(l)(1). However, as presently designed, the SR 520 Variable Tolling Project will have No Adverse Effect on the historic property. Provided the project description does not change, no further investigation is recommended for this project.

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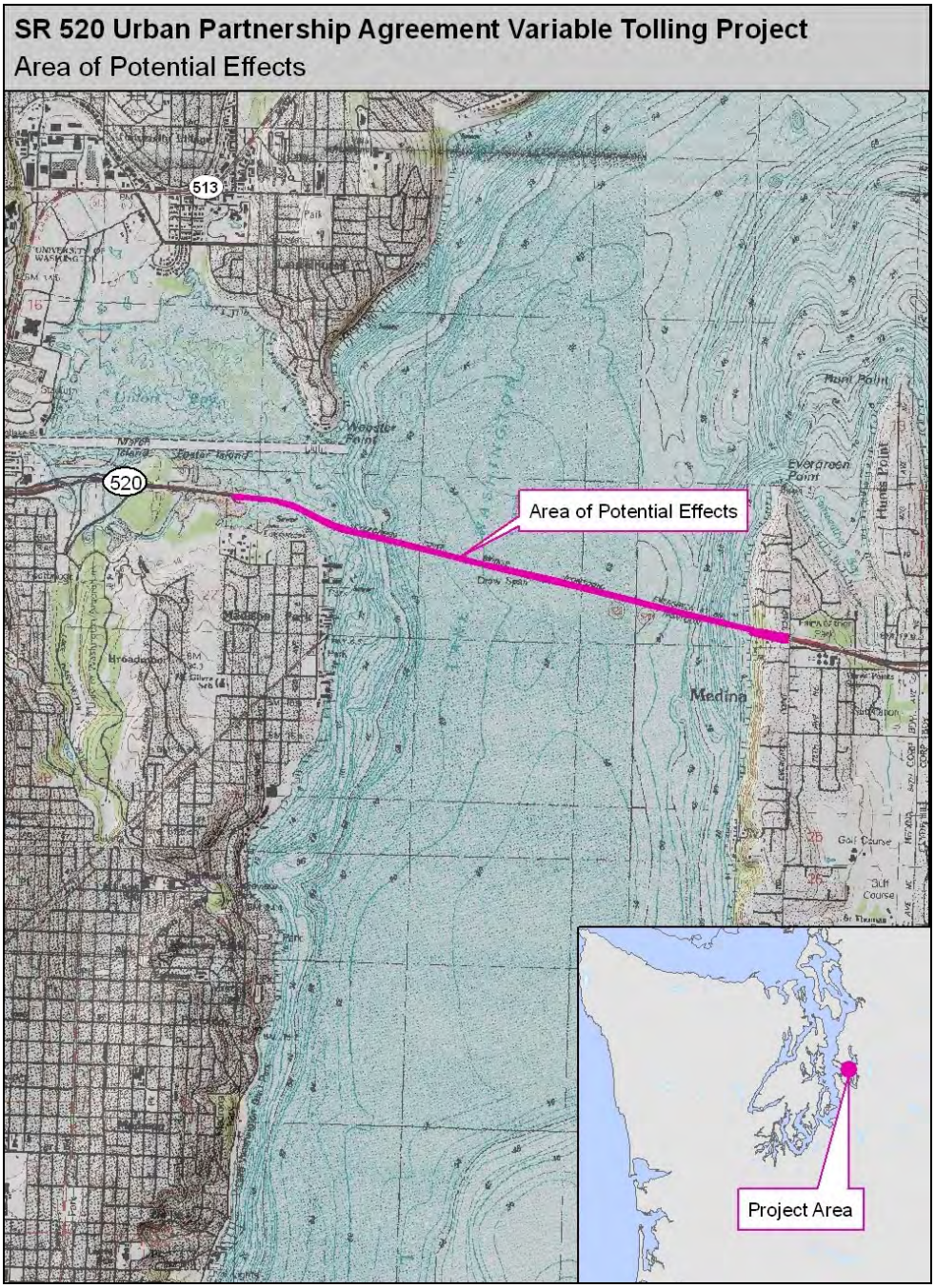
Area of Potential Effects (APE)

The Area of Potential Effects (APE) for this Variable Tolling Project is comprised of the SR 520 Bridge and approaches, as well as the portion of SR 520, just east of the bridge, where the control pads and cabinets will be located. The APE is entirely within the SR 520 right of way (Figure 1). It does not include any resources outside of the bridge footprint. This project has no potential to affect adjacent resources indirectly.

Figure 1. Area of Potential Effects



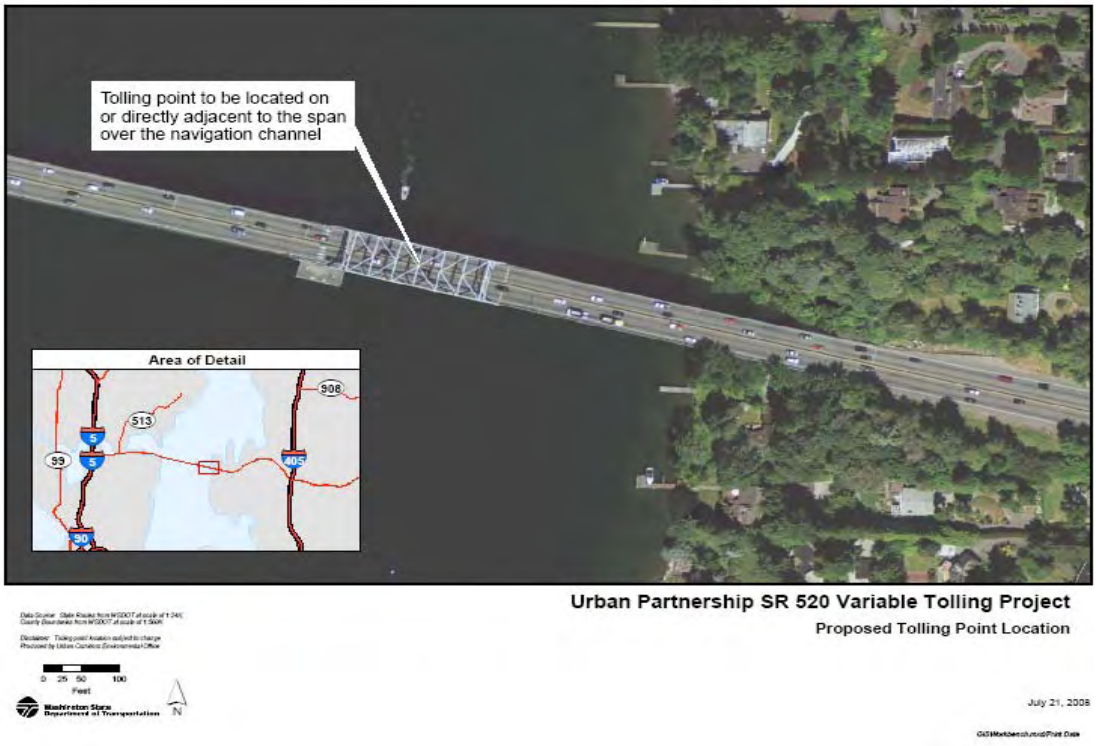
Project Description

This report outlines the potential effects to historic properties as a result of the SR 520 Urban Partnership Variable Tolling Project, the tolling component of the Lake Washington Urban Partnership Agreement. Variable tolling can be defined as varying the price of tolls throughout the day to manage demand.

Tolling Location

The tolling equipment will be located on the eastern end of the bridge either on the existing truss structure of the SR 520 Bridge, or on a separate set of gantries near the truss structure. This will ensure that only people crossing the bridge pay the toll and minimize diversion on local streets. Other locations were considered on land at either end of the bridge. Having the detection equipment and cameras on the bridge structure is preferable to a site located east or west of the bridge. Figure 2 shows the proposed location of the tolling equipment.

Figure 2. Proposed Location of the Tolling Equipment



Evaluation of Preferred Alternative against Other Alternatives

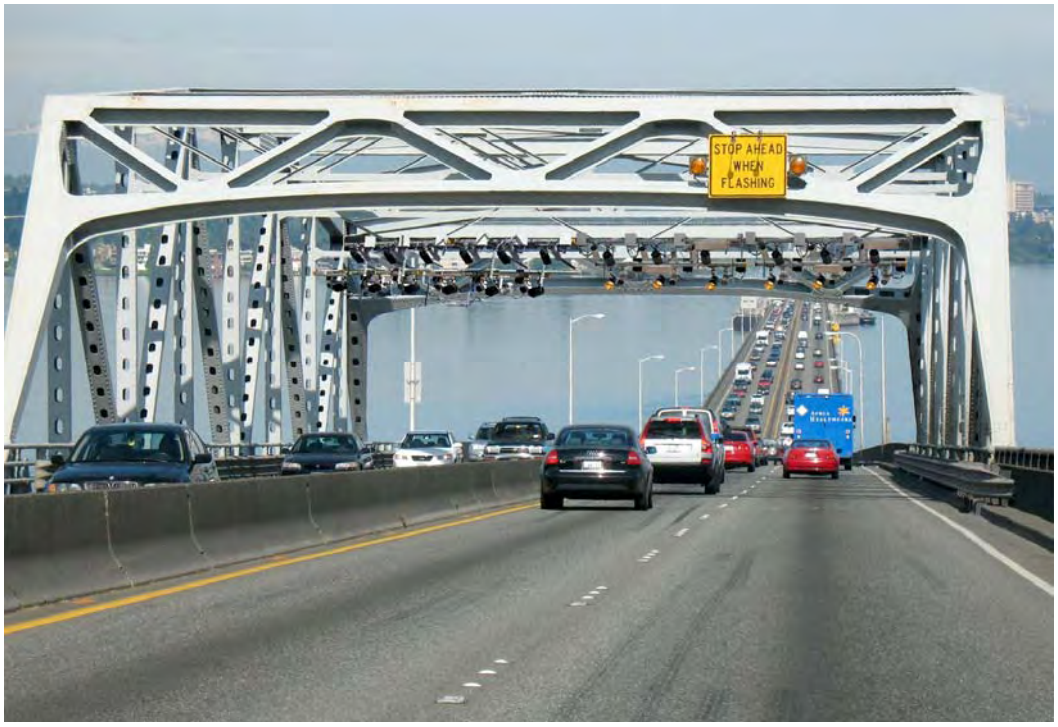
There is little room on the land at the west end of the bridge to build the structures required to hold the equipment, and the area is more environmentally sensitive than the east end. Land use at the east end of the bridge will not be preferable either because of the potential for conflicts with two other SR 520 projects, the Eastside Transit and HOV Project and the SR 520 Bridge Replacement and HOV Project. Both projects will include

construction just east of the bridge that will likely include lane shifts and require the relocation of any tolling equipment placed over those lanes. This is much less likely to occur if the bulk of the equipment is on the existing bridge structure itself.

Tolling Equipment

Tolling equipment will include overhead signs on the bridges for each direction of travel, an overhead automobile detection device, antennas and other equipment that will read in-vehicle transponders, video cameras over each lane to capture license plate images, and either visible or infrared lighting. In addition, roadside concrete pads with controller cabinets will be located on the east side of the lake just south of SR 520 in WSDOT right-of-way. A backup generator or simply a generator transfer switch for connection to a portable generator will be included in case of power outages. Figure 3 shows an illustration of tolling equipment on the SR 520 Bridge.

Figure 3. Illustration of Tolling Equipment on SR 520 Bridge



Tolling equipment will also include transponders to be placed in vehicle and linked to a prepaid *Good To Go!*^{TM} account. They will receive statements for their use of the bridge. This system is being used on both the Tacoma Narrows Bridge and the SR 167 HOT Lanes Pilot Project. Those without *Good To Go!*^{TM} accounts will automatically have their license plate photographed and a bill sent to the address of where the vehicle is registered. A surcharge will be added to the toll. These transactions will be managed through a Customer Service Center (CSC).

Proposed Schedule
Currently the proposed schedule includes developing procurement documents and advertising for contractors in 2009. The notice to proceed with construction will be given in mid-2009, and the project should be complete and opened in mid to late-2010. The project will be in place until the existing bridge is replaced in 2016.

Regulatory Environment

National Historic Preservation Act (NRHP)

The NRHP requires federal agencies to identify and consider the effects of federally assisted projects on historic properties. Historic properties generally must be at least 50 years old and meet at least one of four criteria of significance. According to the National Register Criteria for Evaluation:

> "The quality of significance in American history, architecture, archeology, engineering and culture is present in districts, sites, buildings structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and

A) That are associated with events that have made a significant contribution to the broad patterns of our history; or
B) That are associated with the lives of significant persons in our past; or
C) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D) That have yielded, or may be likely to yield, information important in history or prehistory (NRHP)."

Amendments to Section 101 of the NHPA in 1992 allowed inclusion of eligible properties of traditional cultural or religious importance to the National Register.

The Evergreen Point Bridge is partially located within the City of Seattle, which administers its own historic preservation program.

The City of Seattle Historic Preservation Program, part of the Department of Neighborhoods, oversees historic preservation. The Landmarks Preservation Board is appointed by the Mayor and confirmed by the City Council. It is governed by the Landmarks Preservation Ordinance, SMC 25.12. Its primary objectives are to encourage the rehabilitation and reuse of historic properties for public and private use; to promote the recognition, protection, and enhancement of landmark buildings, objects, and sites of historic, architectural, and cultural significance in Seattle; and to identify, protect, preserve, and perpetuate the cultural, economic, historical, and architectural qualities of historic landmarks and districts throughout the city.

According to the City of Seattle Department of Neighborhoods website, "the appearance and historical integrity of structures and public spaces within each district are regulated by a citizens board and/or the Landmarks Preservation Board in accordance with processes and criteria established by City ordinance" (http://www.seattle.gov /neighborhoods/preservation/ historic_districts.htm. Viewed 9/3/08.)

Designation as a City of Seattle landmark requires that the resource be at least 25 years old, that it retains sufficient integrity to convey its significance, and that it be significant under at least one of six criteria (SMC 25.12.350):

a. It is the location of, or is associated in a significant way with, a historic event that had a significant effect on the community, city, state, or nation; or
b. It is associated in a significant way with the life of a person important in the history of the city, state, or nation; or
c. It is associated in a significant way with a significant aspect of the cultural, political, or economic heritage of the community, city, state, or nation; or
d. It embodies the distinctive visible characteristics of an architectural style, or period, or method of construction; or
e. It is an outstanding work of a designer or builder; or
f. Because of its prominence of spatial location, contrasts of siting, age, or scale, it is an easily identifiable visual feature of the neighborhood or the city and contributes to the distinctive quality or identity of such neighborhood or the city.

Survey Results

Historic Significance of the Evergreen Point Bridge

The Evergreen Point (Albert D. Rosellini) Bridge was completed and placed in service in 1963, four miles north of the first floating bridge on Lake Washington - the I-90 Lacey V. Murrow Memorial Bridge. A second floating bridge was considered by local residents as early as 1946, but it wasn't until 1960 that work on the bridge actually began. In accordance with national trends, the population of the Puget Sound region expanded considerably in the period following World War II. Thanks to the I-90 Lacey V. Murrow Memorial Bridge, Lake Washington's east side was the fastest growing area in the region, as much as an 88 percent increase between 1950 and 1960. Citizens began calling for additional methods to cross Lake Washington (Holstine and Hobbs 2005).

After years of debate of where to locate the new floating bridge, the Washington State Toll Bridge Authority in 1957 determined that it would build two bridges: a new floating bridge at the current I-90/Lacey V. Murrow Bridge site and a new floating bridge connecting Seattle's Montlake community with Evergreen Point in Bellevue. Governor Albert Rosellini was a staunch advocate of the plan, and participated in the

groundbreaking ceremony by driving a bulldozer. In 1988, the bridge was named in Governor Rosellini's honor (Holstine and Hobbs 2005).

According to Craig Holstine and Richard Hobbs' comprehensive Washington State bridge book, *Spanning Washington*:

> More than two years (837 days) of construction brought the bridge to completion. At 1.4 miles in length, it was the largest floating span in the world. With a $25 million price tag (the floating section alone cost $10.9 million), it was also the most expensive. Located some four miles north of the first floating span, it was the central segment of a 5.8-mile project to connect two main north-south highways, Interstate 405 on the lake's east side and Seattle's Interstate 5 (Holstine and Hobbs 174)

The bridge was partially financed by a thirty-five cent toll, that helped pay for a forty year, $30 million bond. The bridge was far more widely used than the State Toll Bridge Authority expected: the bond was paid off 24 years early, in June 1979. The toll booths were removed that year (Holstine and Hobbs 2005).

When the original Lake Washington floating bridge sank in 1990, the Evergreen Point Bridge became Lake Washington's oldest floating bridge. When built, it was also the state's most expensive. It has been minimally altered. It now sees traffic congestion that could not have been anticipated by its engineers. Its intended maximum capacity was 65,000 cars per day; it currently sees as many as 115,000 vehicles per day.

Description of the Evergreen Point Bridge

The SR 520 Evergreen Point Bridge, the second span across Lake Washington, lies four miles to the north of the I-90 Lacey V. Murrow Memorial Bridge. The floating section of the four-lane bridge is 7,578 feet long and 43 feet wide, and includes a two-foot median and a three-foot walkway. A notable design characteristic was the "no bulge" lift-draw span that opens to 200 feet to allow passage of ships. The lift spans are raised seven feet, allowing retraction of the moveable pontoons. Large pleasure crafts are able to pass under the elevated fixed piers at the both ends of the floating section. The Evergreen Point Bridge floats on 35 pontoons. The largest pontoon weighs 6,700 tons, and measures 360 feet long and 60 feet wide, with a depth of 14.8 feet. The pontoons are connected to reinforced concrete anchors by two ¾-inch steel cables. There are 62 anchors in total, each weighing 77 tons (Holstine and Hobbs 2005).

Determination of NRHP Eligibility

Although the Evergreen Point Bridge was constructed in 1963, it is eligible for listing in the National Register of Historic Places. It is eligible under Criteria consideration G, "A property achieving significance within the past 50 years if it is of exceptional

importance" (NR Bulletin, *How to Apply the National Register Criteria for Evaluation*). The bridge will be 50 years old in 2013. A Washington State Historic Property Inventory (HPI) Form, prepared by Lori Durio of CH2M Hill, is included in Appendix A.

Determination of No Adverse Effect

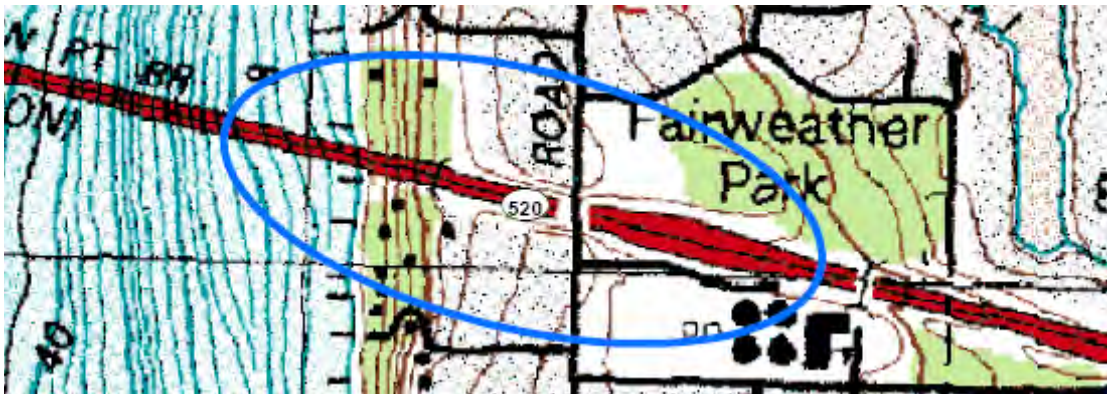
Installation of the tolling equipment on the truss structure will constitute no adverse effect to the historic property under 36 CFR part 800.5. The tolling equipment will not compromise the Evergreen Point Bridge's integrity of location, design, workmanship, materials, setting, feeling, or association. The tolling equipment will only be minimally noticeable from the bridge, and will be limited to some small equipment such as cameras and transponder readers over the roadway. There also may be overhead signs alerting motorists of lane changes or travel time. This signage and equipment are minor, and will not alter any of the characteristics of the Evergreen Point Bridge that form the basis of its eligibility for listing in the NRHP.

Electrical lines needed to power the tolling equipment will be placed within existing steel-pipe conduit on the bridge and within a newly installed buried conduit that terminates at electrical-supply cabinets at the old tolling plaza located approximately 900 feet east of the bridge. All ground disturbance associated with electrical supply will be confined entirely to the SR 520 right-of-way in areas previously disturbed by highway construction. UCO Archaeologist Ken Juell conducted a windshield survey of this area, along with a review of King County aerial photos and the USGS 7.5 min, topographic map on the WSDOT GIS, and a review of the LiDAR topographic map available online at the Puget Sound LiDAR Consortium website (December 19, 2008). The reconnaissance and research indicates that the power-supply corridor, the SR 520 roadway, and the old tolling plaza are located within a deeply excavated trough or road-cut (Figure 4). Such extensive excavation which would have removed or displaced the Holocene sedimentary sequence and any archaeological resource contained therein. Thus there is no potential to affect archaeological historic properties within the project area east of the bridge structure.

Conclusions

The SR 520 Urban Partnership Agreement Variable Tolling Project <u>will have no adverse effect</u> on the NRHP-eligible Evergreen Point Bridge. No further investigation is recommended for this project.

Figure 4. Eastside Approach to the Evergreen Point Bridge as shown on USGS 7.5 x 15 min. quad. Bellevue North, WA 1982 (above) and Puget Sound LiDAR Consortium image (below)



Note: The SR 520 Old Tolling Plaza is the widened roadway south of Fairweather Park. The SR 520 right-of-way traverses, and the Old Tolling Plaza lies within, a deeply excavated trough.

References Cited

Durio, Lori
2008 Washington State DAHP Historic Property Inventory Form, "Governor Albert D. Rossellini Bridge." On file at DAHP, Olympia.

Holstine, Craig and Richard Hobbs
2005 *Spanning Washington: Historic Highway Bridges of the Evergreen State.* Washington State University Press, Pullman.

Puget Sound LiDAR Consortium
2008 Topographic images. http://pugetsoundlidar.ess.washington.edu/lidardata/

Appendix A

Historic Property Inventory Form, Evergreen Point Bridge

Historic Property Inventory Report for *Governor Albert D. Rosellini Bridge* **at** *Lake Washington, vicinity of Seattle, WA*

LOCATION SECTION

Field Site No.: SR5 **OAHP No.:**

Historic Name: *Governor Albert D. Rosellini Bridge* **Common Name:** *Evergreen Point Bridge*

Property Address: Lake Washington, vicinity of Seattle, WA **Comments:** Bridge stretches from the Montlake area of Seattle, east across Lake Washington to Evergreen Point in Medina

County	Township/Range/EW	Section	1/4 Sec	1/4 1/4 Sec	Quadrangle
King					SEATTLE NORTH

UTM Reference
Zone: 10 **Spatial Type:** Point **Acquisition Code:** Other
Sequence: 1 **Easting:** 553897 **Northing:** 5277039
Sequence: 2 **Easting:** 556881 **Northing:** 5276342

Tax No./Parcel No. N/A **Plat/Block/Lot** N/A **Supplemental Map(s)** **Acreage**

IDENTIFICATION SECTION

Survey Name: SR 520 Bridge Replacement

Field Recorder: Lori Durio **Date Recorded:** 10/2/2008

Owner's Name:	Owner Address:	City/State/Zip:
State of Washington, Department of Transportation	310 Maple Park Avenue SE	Olympia, WA 98504

Classification: Structure **Resource Status** Survey/Inventory **Comments**

Within a District? No

Contributing?

National Register Nomination:

Local District:

National Register District/Thematic Nomination Name:

View of Looking east from Montlake area **taken** 3/7/2004

Photography Neg. No (Roll No./Frame No.): N/A

Comments:

DESCRIPTION SECTION

Historic Use: Transportation - Road-Related (vehicular)

Current Use: Transportation - Road-Related (vehicular)

Plan: Other **No. of Stories:** N/A

Structural System: Other

Changes to plan: Intact
Changes to original cladding:
Changes to windows:
Changes to interior:
Changes to other:
Other (specify): Replacement of dra

Style
Other

Form/Type
Other

Cladding
None

Foundation
Concrete - Poured
Other

Roof Material
None

Roof Type
None

NARRATIVE SECTION

Date Of Construction: 1960-63

Architect:

Builder: Guy Atkinson; General Construction Co; Manson Con.

Engineer: Charles E. Andrews, Ken Arkin, Mike Thomas, et al

Study Unit	Other
Transportation	
Community Planning/Development	
Science & Engineering	

Property appears to meet criteria for the National Register of Historic Places: Yes

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local):

Statement of Significance

The Evergreen Point Bridge, the second span across Lake Washington, lies 4 miles north of the first floating bridge, the Lacey V. Murrow Memorial Bridge. The Evergreen Point Bridge formed the center portion of the 5.8-mile project connecting the area's two main north-south highways, Interstate 405 on the lake's east side and Seattle's Interstate 5. (Hobbs and Holstine 2004). Construction on the Evergreen Point Bridge began in August 1960 and tock almost 3 years (837 days) to complete (Hobbs and Holstine 2004). Its opening ceremony was held August 28, 1963. Although still generally referred to as the Evergreen Point bridge, it was officially renamed the Governor Albert D. Rosellini Bridge in 1988 (Mauldin, n.d.).

The floating pontoon bridge design was originally conceived by engineer Homer Hadley and was first used on the Lacey V. Murrow bridge. Charles E. Andrew was chief consulting engineer on the Evergreen Point Bridge for the State Toll Bridge Authority. Ken Arkin was senior field engineer in charge of field engineering for the bridge, and Mike Thomas was design engineer for the structure. ("Bridge Offices..." 1954) The Project Engineer was Harold S. Sitzman, and the Resident Engineer was John C. Tucker. ("Evergreen Point Bridge" nd) The contractor for the floating portion was Guy F. Atkinson, and for the approach structures, the contractors were General Construction Company and Manson Construction and Engineering Company. ("Vital Statistics" n.d.)

At the time of its construction, the Evergreen Point Bridge was the largest floating span in the world at 1.4 miles long. It cost $24,972,000 (the floating section alone was $10.9 million), making it the most expensive floating bridge in the world (Hobbs and Holstine 2004). The State Toll Bridge Authority issued a $30 million bond for the bridge, with a 40-year retirement limit. The bridge had a 35-cent toll from 1963 to 1979. In June 1979, the bond was paid in full (20 years ahead of schedule) and the toll booths were removed. The bridge enabled the rapid growth of the north part of the Eastside, especially northern Bellevue, Redmond and Kirkland, leading to greatly increased development and with it, greatly increased commuter traffic.

Changes to the bridge over the years have mostly consisted of basic maintenance tasks, such as painting, cable replacement, repair/replacement of expansion joints, replacement and rehabilitation of guide rollers, repair of columns, and miscellaneous electrical and mechanical rehabilitation. More substantial work was done to increase the safety of the bridge, including the replacement of the draw span and the addition of an emergency stop bar in 1994, the addition of ladders and catwalks to selected pontoons, and the installation of a median barrier. None of these alterations are substantial and do not detract from the appearance, operation or significance of the bridge.

The bridge, having had few substantial alterations over its lifetime, appears today much as it did when completed in 1963. It continues to fulfill its original function, although it now must handle more than twice its intended capacity. The bridge is already over 40 years old, and will meet the 50 year mark for National Register eligibility in August 2013. Although it is not yet 50 years old, it qualifies for the NRHP under Criteria Consideration G for its exceptional importance. With the sinking of the original Lake Washington floating

bridge, the Evergreen Point Bridge became the oldest remaining floating bridge across Lake Washington, exemplifying an engineering feat of outstanding proportions. As noted above, it was also the longest and most expensive at its time of construction. It is eligible for the NRHP as a structure under criterion A for its significant impact on the development of the Seattle area, specifically on the communities on the east side of Lake Washington, and criterion C for its outstanding and innovative engineering design.

Description of Physical Appearance

The bridge stretches from the Montlake area of Seattle, across Lake Washington to Medina. The floating section of the bridge is 7,578 feet long (1.4 miles), with 33 floating sections and 62 anchors. A standard pontoon measures 360 feet long by 60 feet wide and 14'9" deep, and weighs 4,725 tons. ("Vital Statistics" n.d) The 62 reinforced-concrete anchors each weigh 77 tons and are connected to the pontoons by two ¾-inch steel cables. The roadway accommodates four lanes of traffic and is 54 feet wide. It has a 2-foot-wide median and 3-foot-wide walkway. The Evergreen Point Bridge was designed with a "no bulge" lift-draw span which opens to 200 feet to allow passage of ships. The lift spans are raised 7 feet, allowing retraction of the moveable pontoons. At each end of the floating section, elevated steel truss spans with fixed piers connect to the shore and provide enough vertical clearance to accommodate large pleasure craft (Hobbs and Holstine 2004).

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Mauldin, D. B. "Washington's Wondrous Highways That Float," newspaper clipping in DOT Environmental Affairs Office. n/d.

"Record of Contract Work (1972-2002)" n.d.

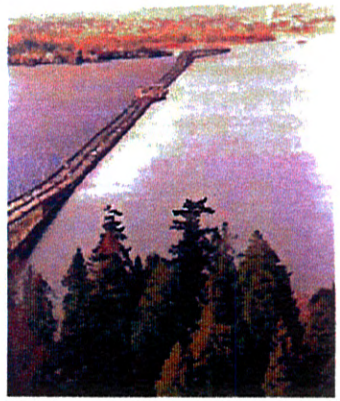
SR 520 Bridge Replacement & HOV Project. "Vital Statistics Our Bridge Today." n.d. http://www.wsdot.wa.gov/projects/SR520Bridge/faqs.htm Accessed on June 24, 2004.

Additional Photos for: *Governor Albert D. Rosellini Bridge* **at** *Lake Washington, vicinity of Seattle, WA*

View of aerial view of bridge, looking east **taken** 3/7/2004

Photography Neg. No (Roll No./Frame No.): N/A

Comments:



View of aerial view of bridge, looking west from Medina **taken** 3/7/2004

Photography Neg. No (Roll No./Frame No.):

Comments:

View of **taken**

Photography Neg. No (Roll No./Frame No.):

Comments:

View of **taken**

Photography Neg. No (Roll No./Frame No.):

Comments:

SR 520 Variable Tolling Project Ecosystems Technical Memo

What is the project?

The SR 520 Variable Tolling Project would consist of a single, two-way tolling location with variable pricing. The project would reduce peak period congestion on SR 520 by implementing a tolling system which would divert traffic to alternate routes, times, modes, and/or eliminate trips. The end result of the project will likely be a decrease in traffic during peak hours. Tolls would be collected using electronic tolling collection (ETC). Electronic tolls would be processed using equipment on overhead gantries to read the transponder and license plates of vehicles transiting across the bridge. Toll rates would vary throughout the day and would be set to manage traffic demand crossing Lake Washington on the SR 520 bridge and to maintain free flowing traffic conditions.

The current proposal for placement of tolling equipment is for it be located on the eastern end of the bridge either on the existing truss structure or on a separate set of gantries near the truss structure. Tolling equipment would include overhead signs on the bridge for each direction of travel, an overhead automobile detection device, antennas and other equipment that will read in-vehicle transponders, video cameras over each lane to capture license plate images, and either visible or infrared lighting.

In addition, roadside concrete pads with controller cabinets would be located on the east side of the lake just south of SR

520 in WSDOT right-of-way. In addition to the preferred tolling location (Option 1), a location in the center of the bridge for all tolling equipment is being considered (Option 2). Exhibit 1-1 shows the approximate locations of options 1 and 2. Option 2 would be used if further study concludes that there are technical problems associated with locating the equipment at the Option 1 location.

Exhibit 1-1
Tolling equipment locations

What is the setting for this project?

This project will occur in King County, Washington along the existing SR 520 roadway corridor across Lake Washington. Lake Washington is a major freshwater lake that lies between the city of Seattle and its eastern suburbs including Bellevue, Redmond, and Kirkland.

A variety of resident and anadromous (fish that migrate to the ocean) fish use the lake for part or all of their life-cycles. The construction of the Lake Washington Ship Canal, completed in 1917, dramatically altered the lake's function by lowering the lake's average elevation by 8.8 feet, creating a connection

between the lake and saltwater, and changing the Cedar River's terminus from the Black River to Lake Washington. Fish populations using the lake include the Endangered Species Act (ESA)-listed Chinook salmon, bull trout, and steelhead. Other species in the lake and their ecological role are noted in exhibit 1-1. The lake also is within the "usual and accustomed" fishing areas of federally recognized Indian Tribes, including the Muckleshoot Tribe.

1

Exhibit 1-2

Prevalent Lake Washington Fish Species and Their Ecological Roles

Species Name	Federal and State Status[a]	Native or Non-native Species	Ecological Role
River Lamprey	FCo, SC	Native	Salmonid predator observed in Lake Washington system.
Bull trout	FT, SC	Native	Overlapping habitat with other salmonids, but very low abundance or nonexistent in most of watershed. Major fish predator.
Cutthroat trout	None	Native	Young compete with other salmonids for prey. Adult cutthroat consume fish, including Chinook salmon and sockeye salmon.
Steelhead/Rainbow Trout	FT	Native	Overlapping habitat with other salmonids, consume similar prey.
Chinook salmon	FT, SC	Native	Wild and hatchery origin.
Coho salmon	FCo for Puget Sound	Native	Most abundant in north Lake Washington. Primarily hatchery origin.
Sockeye salmon/Kokanee	None	Native[b]	Pelagic in open water areas.
Largemouth bass	None	Non-native	Major fish predator that occupies shoreline habitat. Young compete with young salmonids for some prey.
Smallmouth bass	None	Non-native	Major fish predator that occupies salmonid fish habitat, resulting in some prey competition. Population size uncertain.
Brown bullhead	None	Native	Competitor with young salmonids for some of same prey.
Longfin smelt	None	Native	Pelagic in open water areas. Little likelihood of salmonids prey competition.
Northern pikeminnow	None	Native	Major fish predator that occupies salmonid fish habitat.
Peamouth chub	None	Native	Large numbers. Some occupy shallow benthic habitat, consume some of same prey as young salmonids.
Threespine stickleback	None	Native	Numerous, substrate-oriented, often near aquatic vegetation, provides prey for larger fish.
Pelagic sculpin	None	Native	Also known as coast range sculpin. Pelagic in open water areas. Some overlap in prey with young salmonids. Sculpins represent 72 percent of Lake Washington biomass.
Prickly sculpin	None	Native	Benthic habitat from shorelines to deep water. Prey competition with young salmonids. Sculpins represent 72 percent of Lake Washington biomass. Larger sculpins prey on small fish
Yellow perch	None	Non-native	Prey overlap with young salmonids. Abundant but substantially less than peamouth.

FCo=Federal Species of Concern, FT=Federally Threatened, SC=State Candidate Species, ESU=evolutionarily significant unit.

b Introduced stock, uncertain whether there was originally a native stock inhabiting this watershed.

The Lake Washington shorelines are developed with residential structures and uses along most of the shoreline length. Most of the shoreline length has been armored to protect upland areas from erosion and this development has led to the loss of shoreline vegetation. However, numerous roost and nesting trees remain near the shorelines and are used by migratory songbirds and raptors including bald eagles.

How could this project affect the natural environment?

There are three primary ways in which the project could affect the natural environment. These include 1) the installation and operation of powerlines, power boxes and monitoring equipment; 2) the installation and operation of gantries including transponder readers and video cameras; and 3) changes in traffic flow from successful implementation of this project.

Powerlines, power boxes and monitoring equipment are assumed to be run along existing WSDOT right-of-way and/or will be hung off of existing structures. Existing right-of-way is actively managed for support and maintenance of the SR 520 roadway and has few natural features and little wildlife value. Assuming that wetlands and native upland vegetation will not be disturbed for these construction activities, there are unlikely to be any permanent impacts to the natural environment from this component of the project. Temporary impacts are likely to be limited to effects from soil disturbance and construction noise which are typically managed to avoid impacts to the natural environment with erosion control best management practices (BMPs) and timing restrictions.

Effects of lighting to fish

The installation and operation of gantries, including transponder readers and video cameras will create a new over-water lighting source that will operate 24-hours a day (exhibit 1-2). The installation of this structure is presumed to minimally affect the bridge structure itself, apart from adding the gantry or attaching equipment to the existing truss structure. The video cameras require low level lighting to effectively read front and rear license plates of passing vehicles. Both options under evaluation will place the new lights over the roadway deck over deepwater habitats over Lake Washington. The preferred option is near the eastern shoreline of Lake Washington in an area where Sockeye spawning habitat has been documented while option 2 is in extremely deep water far from the shoreline of the lake. At the location of the preferred option the bridge deck is approximately 60 feet above the water's surface, while at option 2 the bridge deck is approximately 6 feet above the water's surface. Existing roadway lighting is currently immediately east and west of the truss structure (exhibit 1-3). Lighting from the video cameras is activated by passing vehicles and is at a low intensity to avoid startling or distracting drivers. While fish and wildlife do respond to lighting, these lights will be coincident with passing vehicle and the effects on ambient light levels will be indistinguishable from lights associated with passing vehicles. Since lights will be directed towards the road deck, it is anticipated that little light from the video cameras will reach the surrounding environment.

Exhibit 1-3
Transponder reader and video camera gantry

Several studies have evaluated effects of artificial lighting to salmonids and to predator-prey interactions of fishes (E.g. Marchesan et al. 2005; Mazur and Beauchamp 2003). Commercial fish rearing operations have long noted important relationships between light and salmon including that artificial lighting can promote early emergence from eggs and greater

activity from newly hatched fish (Dey and Damkaer 1990). High intensity artificial lighting is also used to promote rapid growth of sub-adult salmonids and to prevent physiological changes associated with changes in day-lengths for cultured fish (Porter et al 2003). Juvenile salmon are found in foraging locations throughout the day and night at temperatures above 10° C, however their feeding efficiency is much higher at day-time light levels (Metcalfe et al. 1999).

Responses to light are not universal for all species of fish – some species groups school and move towards light sources, while some predatory fish are adapted for hunting in low light intensities while others are attracted to higher light intensities (Machesan et al. 2005). High intensity strobe lights have been effectively used as a component of fish deterrent systems altering the behavior of fish by causing them to hide or avoid the lights (Richards et al. 2007). As light intensity decreases at dusk, predatory fish react to prey at rapidly declining reaction distances, a pattern that reverses at dawn (Beauchamp et al 1999). Thus light affects how well predators detect their prey and the search area these fish can efficiently exploit. Since the effects of this project are not expected to have a measurable affect on the ambient light conditions, no change in fish activity, predation or survival is expected to result from this project.

Exhibit 1-4
Locations of Existing Lighting East Approach

Overhead structure as wildlife habitat

The upper surface of a gantry may provide roosting or nesting opportunities for birds. Seagulls (Western and glaucus winged), Canada geese, swallows, and pigeons are known to use the SR 520 bridge for nesting or roosting behavior, and large raptors like bald eagles and osprey may occasionally land on the structure. Since the gantry will provide only limited areas of flat surface, and those areas will be exposed to wind and rain, bird use is likely to be limited to short-term roosting and resting behaviors.

Changes in traffic and stormwater

Changing traffic flow due to successful implementation of this project would be expected to reduce peak-travel period congestion on SR 520. Changing traffic may affect the accumulation of some stormwater pollutants. Of particular interest are metals which have the potential to impair the ability of salmon to detect predators, prey or natal streams with their sense of smell (e.g., Baldwin et al. 2003 and Sandahl et al. 2007). The primary sources of metals from vehicles are friction in engine and suspension systems, brake pad and tire wear, and rust and corrosion (Kearfott et al. 2005; Barrett et al. 1995; Lancaster 2005). Therefore, reduced congestion may reduce dissolved metal concentrations in stormwater runoff. However, evaluations of stormwater data have failed to find a relationship between traffic loads and dissolved metal loading in stormwater (Herrera 2007).

Summary of project effects to ecosystems

In summary, the implementation of the SR 520 Variable Tolling Project will change the operations of existing transportation infrastructure by installing tolling which is expected to reduce peak period congestion on the SR 520 bridge across Lake Washington. Effects to the natural environment as a result of this project are not likely to be detectable within the SR 520 corridor. Due to the speculative and uncertain nature of trip diversion, diversion of trips to alternate routes was not evaluated as a part of this analysis.

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