Tom Rasmussen
Seattle City Councilmember

Date: April 16, 2015

To: Monica M. Simmons, City Clerk

From: Councilmember Tom Rasmussen, Chair, Transportation Committee

Subject: Adaptive Signal Control Proviso Lift – 2015 Green Sheet 108-1-A-3

In adopting the 2015 Budget, the City Council imposed the following proviso on capital improvement funding for Adaptive Signal Control Implementation (2015 Green Sheet 108-1-A-3):

> "None of the money appropriated in the 2015 budget for the Seattle Department of Transportation's Mobility--Capital BCL may be spent for the Adaptive Signal Control Implementation CIP project until the chair of the City Council Transportation Committee files with the City Clerk his certification that the Seattle Department of Transportation has submitted a report to the Transportation Committee on how the money will be spent on this project or whether it will instead be used for other transportation priorities."

On March 24, 2015, the Seattle Department of Transportation (SDOT) submitted a report to the members of the Transportation Committee on how SDOT intends to spend the $200,000 appropriated in 2015 to the Adaptive Signal Control Implementation CIP. The funds will not be used for other transportation priorities. The Department's response was satisfactory, and explains the benefits of adaptive signal control and the schedule for implementation.

This memo serves as my certification that the proviso in 2015 Green Sheet 108-1-A-3 is satisfied. SDOT is now permitted to spend the funds appropriated for the Adaptive Signal Control Implementation CIP.

Attachments: 1) March 24, 2015 SDOT Response to Proviso
2) 2015 Green Sheet 108-1-A-3

cc: Seattle City Councilmembers
Scott Kubly, Director, SDOT
Ben Noble, Director, City Budget Office
Calvin Chow, Council Central Staff

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Scott Kubly, Director, SDOT
Ben Noble, Director, City Budget Office
Calvin Chow, Council Central Staff

MEMORANDUM

DATE: March 24, 2015

TO: Councilmember Tom Rasmussen, Chair of Transportation Committee
Councilmember Mike O'Brien,
Councilmember Jean Godden,
Seattle City Council

FROM: Scott Kubly, Director
Seattle Department of Transportation

SUBJECT: Adaptive Signal Control Proviso – Green Sheet 108-1-A-3

Purpose

1. Request that the proviso on the Adaptive Signal Control (ASC) CIP put into place by Green Sheet 108-1-A-3 of the 2015 Adopted Budget be lifted, based on the schedule and expenditure plan outlined below under "Response to Proviso."

2. Provide additional context on the functioning and phasing for Adaptive Signal Control in two appendices:
    - Appendix A - *Benefits of ASC, comparison to current state of signal control within the City*
    - Appendix B - *Full phasing for ASC implementation and estimated costs*

Background

Green Sheet 108-1-A-3 created a new project in SDOT's 2015-2020 Capital Improvement Program, and added $200,000 in 2015 and $800,000 in 2016 for deploying an Adaptive Signal Control (ASC) system along the Mercer Corridor.

The effort is intended to take advantage of the ASC-compatible signal detection, controller and communication equipment being installed as part of the Mercer Corridor project, by implementing the computer systems required to manage signal timing dynamically, based on real-time traffic data. To implement ASC in the Mercer Corridor, SDOT is proposing the following steps:

- Complete construction of the West Mercer project (anticipated December 2015),
- Gather baseline traffic data (Q2-Q3 2015),
- Select an ASC vendor through an RFP process (2H 2015), and
- Develop the traffic system model with an ASC vendor to program the signals (2016).

With this funding, ASC on the Mercer Corridor is expected to be operational by the end of 2016. The $1 million included in this green sheet for ASC on the Mercer Corridor represents Phase 1 of SDOT's total $10.5 million ASC proposal for the Seattle Center and South Lake Union area.

The Green Sheet additionally imposed the following proviso:

"None of the money appropriated in the 2015 budget for the Seattle Department of Transportation's Mobility--Capital BCL may be spent for the Adaptive Signal Control Implementation CIP project until the chair of the City Council Transportation Committee files with the City Clerk his certification that the Seattle Department of Transportation has submitted a report to the Transportation Committee on how the money will be spent on this project or whether it will instead be used for other transportation priorities."

Response to Proviso

Phase 1 implements ASC on 31 intersections on Mercer, Valley and Roy from I-5 to 3rd Ave W. The entire signal infrastructure to support ASC at these intersections has been built as part of the Mercer project. Therefore, phase 1 requires $1 million in funding to procure an ASC vendor, build the signals system model to operate ASC, and build the back office infrastructure to house ASC in the Transportation Operations Center.

As described in the Green Sheet, the $200,000 added to the new CIP project in 2015 was intended to fund the following activities:

- Selection of the adaptive signal control system, through an RFP process
- Data collection to support implementation

The below table further details SDOT's schedule and spending plan for the $200,000 2015 appropriation.

Preliminary Mercer Adaptive Signal System Budget and Schedule

Activity	Budget	2015										
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Oct	Nov	Dec
Data Collection	$100,000											
Consultant Selection from Consultant Roster	-											
RFP Preparation to Select Adaptive System Vendor	$ 20,000											
RFP Publishing and Selection	-											
Adaptive Simulation Modeling	$ 40,000											
SDOT Staff Project Management and QA/QC Process	$ 40,000											

A schedule for spending the $800,000 2016 appropriation will be developed after the ASC system has been selected, in the fourth quarter of 2015.

In order to deliver this project by the end of 2016, SDOT requests the proviso on 2015 funds be lifted as soon as possible.

Thank you,

Scott Kubly

Cc: Calvin Chow, Council Central Staff
Karen Melanson, Department of Transportation
Chris Ruffini, Department of Transportation
Mary Rutherford, Department of Transportation
Saroja Reddy, City Budget Office
Doug Palmer, City Budget Office

Appendix A
Benefits of Adaptive Signal Control; Comparison to Current State

Current State

The current signal system includes time-of-day, vehicle actuated, and responsive traffic corridor pre-set timing plans. Pre-set timing plans are programmed based on historical data measuring normal traffic conditions per time of day (peak, inter-peak, and off peak). In their current state, the traffic control systems operated by SDOT do not provide adaptive control, nor system-generated notification of abnormal traffic conditions (manual identification is possible via video detection), and limited functionality to influence traffic automatically when an abnormal event occurs. Another major downside in the current state is the inability to adjust many signals in a coordinated manner as traffic volumes change.

The following is an overview of the various signal timing systems currently in use:

Time-of-day Signals: The signal system automatically switches from one plan to another based on the time of day, requiring frequent adjustments by traffic engineers as traffic flows and patterns change. Signals in close proximity, or along major corridors, are programmed with coordinated plans to maximize traffic throughput.

Vehicle Actuated Signals: Intelligent Transportation Systems (ITS) devices such as video detection, induction loops, and magnometer detectors are used to detect the presence of a vehicle. Detection inputs override the current time-of-day plan to switch signals more quickly, or slowly, where feasible.

Traffic Responsive Corridors: The same ITS devices mentioned above can also monitor traffic demand along a corridor, and switch the signals from one pre-set plan to another based on preset triggers. Responses to changing traffic conditions are limited to pre-set signal plans, and lack the ability to adapt beyond the assumptions in those plans. Six traffic responsive corridors are currently in operation; Aurora – Winona to 145th; E Marginal; 15th Ave NW (Market to Holman/85th); 1st Ave S; 4th Ave S; Elliot/15th Ave W).

Signal timing plans are developed and updated based on traditional traffic counting methods. New traffic counts are collected on a rolling schedule, input into a simulation model, and timing adjustments are made if necessary. Unfortunately, timing plans lose effectiveness as travel patterns and conditions change. This is particularly true when major construction projects disrupt traffic patterns, or unexpected events such as collisions and stalls happen. Due to the time intensive process of data collection, analysis, and implementing timing updates, pre-set timing plans lag in their responsiveness to current traffic patterns.

Adaptive Signal Control

Adaptive signal control technology (ASC) is a major change in signal timing practices. ASC adjusts signal timing based on current traffic conditions by feeding data to a central system that develops custom timing plans in real-time . ASC improves upon the current best practice, Traffic Responsive Corridors, by adapting the signal timing to current conditions *without relying on a pre-set plan*; timing adjustments are customized to the specific traffic pattern occurring.

The main benefits of adaptive signal control technology over conventional signal systems are that it can:

- Continuously distribute green light time equitably for all traffic movements
- Improve travel time reliability by progressively moving vehicles through green lights
- Reduce congestion by creating smoother flow

- Minimize traditional timing and re-timing efforts

ASC is made up of the following physical components:

- ITS Devices - collect data in real time.
- Signal Controllers - communicate conditions to a central server and receive instructions from the server on how to respond.
- Connectivity (Fiber, WiFi) - enables communication between controllers and the server.
- Central Server System - evaluates conditions and instructs controllers on how to best adapt.
- Front End Operator Station - allows human monitoring and adjustment as needed.

Source: "Task 3: ASC Corridor Implementation, Next Generation ITS" report prepared for SDOT by TranspoGroup, 2014

Appendix B
Full Phasing of Adaptive Signal Control Implementation

A robust adaptive signal control (ASC) implementation in the Seattle Center and South Lake Union area will improve traffic flow from Queen Anne, Westlake, Seattle Center and South Lake Union. It will also improve traffic operations at the SR-99 north tunnel access when the tunnel is completed and support integrated corridor management on Denny Way and Mercer. Implementation of this network would take place over a 5-year period in 3 phases, at a cost of $10.5 million in total. The estimated costs are detailed in the table below. Each phase provides additional benefits to the corridor. The Federal Highway Administration (FHWA) indicates that, in general, these systems improve travel time efficiency by five to ten percent, during peak hours. (Note, the FHWA analysis is not specific to the Mercer corridor but is a general statement about these systems effectiveness.) Other benefits include the ability to better manage changing traffic patterns caused by events, collisions and stalls, and improve for pedestrian travel in off peak periods.

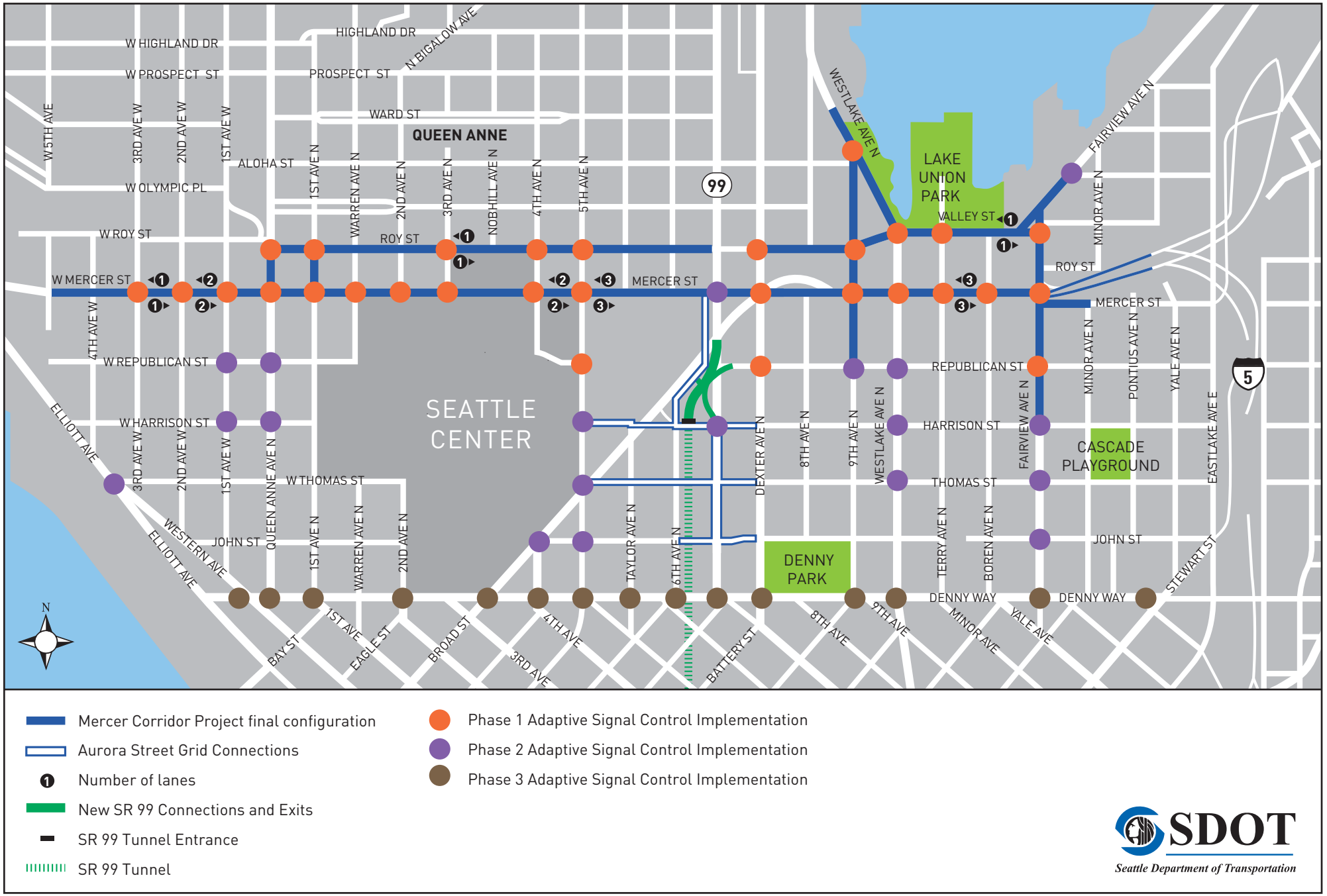
- **Phase 1** includes configuring 31 intersections to operate ASC on Mercer, Valley and Roy from I-5 to 3rd Ave W. As the infrastructure necessary to support ASC has been built as part of the Mercer project, Phase 1 requires $1 million in funding to procure an ASC vendor, build the signals system model to operate ASC, and build the back office infrastructure to house ASC in the Traffic Operations Center.

- **Phase 2** implements ASC on 17 intersections on Denny Way. Phase 2 requires $4.66 million to design and construct the signals at these intersections and implement ASC. SDOT has identified $510,000 of funding for design of the Denny Way infrastructure through an anticipated Puget Sound Regional Council (PSRC) grant and resources in SDOT's ITS program.

- **Phase 3** implements ASC on 21 intersections on "connector streets" between Mercer and Denny Way, including select locations on Elliott Ave, Queen Anne Ave N, Broad St, Dexter Ave N, Westlake Ave N, Fairview Ave N and 1st, 5th and 9th Ave N. Phase 3 requires $4.85 million to design and construct the signals at these intersections and implement ASC. These "connector street" intersections will allow for more robust use of ASC on the Mercer and Denny Way Corridors.

Phase and Task	2015	2016	Funding and Schedule TBD	Total Estimated Costs ($1,000)
Phase 1 – Mercer ASC Implementation				**$1,000**
Select adaptive signal control system through RFP process and complete data collection to support implementation	$200[1]			$200[1]
Implement ASC on Mercer, Valley and Roy		$800		$800
Phase 2 – Denny Way ASC Implementation				**$4,660**
Design infrastructure for Denny Way	$510[2]			$510[2]
Construct Denny Way infrastructure			$3,800	$3,800
Implement ASC on Denny Way			$350	$350
Phase 3 – Connector Street ASC Implementation				**$4,850**
Design infrastructure on "connector streets"			$650	$650
Construct infrastructure on "connector streets"			$3,600	$3,600
Implement ASC on "connector streets" completing ASC network for Seattle Center/SLU			$600	$600
Total ASC Project	**$710**	**$800**	**$9,000**	**$10,510**

At this time, these are preliminary planning level cost estimates. The type of detection and the cost of configuration per intersection vary considerably depending on the ASC system selected. For example, installation of detection only and configuration of an intersection can range from $30,000 to $75,000 depending on the platform selected.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EAGLE ST
BROAD ST
BATTERY ST
1ST AVE
3RD AVE
4TH AVE
8TH AVE
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MINOR AVE
YALE AVE
N
Mercer Corridor Project final configuration
Aurora Street Grid Connections
Number of lanes
New SR 99 Connections and Exits
SR 99 Tunnel Entrance
SR 99 Tunnel
Phase 1 Adaptive Signal Control Implementation
Phase 2 Adaptive Signal Control Implementation
Phase 3 Adaptive Signal Control Implementation
SDOT
Seattle Department of Transportation

2015 - 2016 Seattle City Council Green Sheet

Approved

Tab	Action	Option	Version
108	1	A	3

Budget Action Title: Create a new CIP project, add $200,000 in 2015 and $800,000 in 2016 for Adaptive Signal Control deployment in the Mercer Corridor, and add a proviso

Has CIP Amendment: Yes Has Budget Proviso: Yes

Councilmembers: Budget Committee

Staff Analyst: Calvin Chow

Council Bill or Resolution:

Budget Committee Vote:

Date	Result	SB	BH	SC	TR	NL	TB	JG	MO	KS
11/24/2014	**Pass 9-**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**

Summary of Dollar Effect

See the following pages for detailed technical information

	2015 Increase (Decrease)	***2016 Increase (Decrease)***
General Subfund		
General Subfund Revenues	*$0*	*$0*
General Subfund Expenditures	*$0*	*$0*
Net Balance Effect	***$0***	***$0***
Other Funds		
Transportation Operating Fund (10310)		
Revenues	*$0*	*$0*
Expenditures	*$200,000*	*$800,000*
Net Balance Effect	***($200,000)***	***($800,000)***
Total Budget Balance Effect	***($200,000)***	***($800,000)***

* Note: This action rescinds 108-1-A-2

Tab	Action	Option	Version
108	1	A	3

Budget Action description:

This version of green sheet 108-1-A-3 rescinds 108-1-A-2. This new version revises proviso language and removes unnecessary project description language on the CIP project page.

This green sheet creates a new CIP project in the 2015-2020 CIP, and adds $200,000 in 2015 and $800,000 in 2016, for the deployment of an Adaptive Signal Control (ASC) system along the Mercer Corridor. This effort takes advantage of the ASC-compatible signal detection, controller and communication equipment being installed as part of the Mercer Corridor project.

To implement ASC in the Mercer Corridor, SDOT will have to complete construction of the West Mercer project (expected to be complete by the end of 2015), gather firm baseline traffic data after normal traffic activity returns to the area (estimated 3 months), and develop the traffic system model with an ASC vendor to program the signals (estimated 9 months). With this funding, ASC on the Mercer Corridor is expected to be operational by the end of 2016. The $1 million included in this green sheet for ASC on the Mercer Corridor represents Phase 1 of SDOT's total $10.5 million ASC proposal for the Seattle Center and South Lake Union area.

This green sheet amends the 2015-2020 CIP to include the Adaptive Signal Control CIP project page as shown in Attachment A.

This green sheet would impose the following budget proviso:

"None of the money appropriated in the 2015 budget for the Seattle Department of Transportation's Mobility-Capital BCL may be spent for the Adaptive Signal Control Implementation CIP project until the chair of the City Council Transportation Committee files with the City Clerk his certification that the Seattle Department of Transportation has submitted a report to the Transportation Committee on how the money will be spent on this project or whether it will instead be used for other transportation priorities."

<u>Background</u>

SDOT proposes to deploy ASC in the Seattle Center and South Lake Union area to improve traffic flow from Queen Anne, Westlake, Seattle Center and South Lake Union; improve traffic operations at the SR-99 north tunnel access when the tunnel is open and support integrated corridor management on Denny Way and Mercer. Implementation of this network could take place over a 5-year period in 3 phases. Each phase provides additional benefits to the corridor. The Federal Highway Administration (FHWA) indicates that, in general, these systems improve efficiency by five to ten percent. (Note, the FHWA analysis is not specific to the Mercer corridor but is a blanket statement about these systems in general.) SDOT believes that ASC projects are very competitive for grants and that grant funding could potentially cover up to 2/3's of the total project costs.

SDOT proposes the following three phases of implementation:

- **Phase 1** implements ASC on 31 intersections on Mercer, Valley and Roy from I-5 to 3rd Ave W. All of the signal infrastructure to support ASC at these intersections has been built as part of the Mercer

project. Phase 1 requires $1 million in funding to procure an ASC vendor, build the signals system model to operate ASC, and build the back office infrastructure to house ASC in the Traffic Management Center.

- **Phase 2** implements ASC on 17 intersections on Denny Way. Phase 2 requires $4.66 million to design and construct the signals at these intersections and implement ASC. SDOT has identified $510,000 of funding for design of the Denny Way infrastructure through an anticipated Puget Sound Regional Council (PSRC) grant and resources in SDOT's ITS program.

- **Phase 3** implements ASC on 21 intersections on "connector streets" between Mercer and Denny Way, including select locations on Elliott Ave, Queen Anne Ave N, Broad St, Dexter Ave N, Westlake Ave N, Fairview Ave N and 1st, 5th and 9th Ave N. Phase 3 requires $4.85 million to design and construct the signals at these intersections and implement ASC. These "connector street" intersections will allow for more robust use of ASC on the Mercer and Denny Way Corridors.

The table below shows tasks, timelines and preliminary budgets to complete this work. These are very preliminary cost estimates. The type of detection and the cost of configuration per intersection varies considerably depending on the ASC system selected. For example, installation of detection only and configuration of an intersection can range from $30,000 to $75,000 depending on the platform selected.

Phase and Task	2015	2016	Funding and Schedule TBD	Total Estimated Costs ($1,000)
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Implement ASC on "connector streets" completing ASC network for Seattle Center/SLU			$600	$600
Total ASC Project	**$710**	**$800**	**$9,000**	**$10,510**

Notes:

[1] Approximately $50,000 to $75,000 will be used to purchase servers, workstations and miscellaneous operating equipment that will be housed in the TMC to operate ASC on all corridors in the city

[2] SDOT has identified $510,000 of funding for design of the Denny Way infrastructure through an anticipated Puget Sound Regional Council (PSRC) grant and resources in SDOT's ITS program.

Tab	Action	Option	Version
108	1	A	3

Budget Action Transactions

Budget Action Title: Create a new CIP project, add $200,000 in 2015 and $800,000 in 2016 for Adaptive Signal Control deployment in the Mercer Corridor, and add a proviso

#	Transaction Description	Position Title	Number of Positions	FTE	Dept	BCL or Revenue Source	Summit Code	Fund	Year	Revenue Amount	Expenditure Amount
1	Increase use of 2015 Fund Balance by $200,000 for the Adaptive Signal Control CIP project				SDOT	USE OF FUND BALANCE	379100	10310	2015	$200,000	
2	Increase use of 2016 Fund Balance by $800,000 for the Adaptive Signal Control CIP project				SDOT	USE OF FUND BALANCE	379100	10310	2016	$800,000	
3	Add $200,000 of 2015 appropriations to Mobility-Capital BCL for the Adaptive Signal Control CIP project				SDOT	Mobility-Capital	19003	10310	2015		$200,000
4	Add $800,000 of 2016 appropriations to the Mobility-Capital BCL for the Adaptive Signal Control CIP project				SDOT	Mobility-Capital	19003	10310	2016		$800,000

Seattle Department of Transportation

Adaptive Signal Control Implementation

BCL/Program Name:	Mobility-Capital	**BCL/Program Code:**	19003
Project Type:	New Facility	**Start Date:**	Q1/2015
Project ID:	TC367650	**End Date:**	Q4/2019
Location:			
Neighborhood Plan:	Not in a Neighborhood Plan	**Council District:**	7
Neighborhood District:	In more than one District	**Urban Village:**	In more than one Urban Village

This project implements adaptive signal control (ASC) in the Seattle Center and South Lake Union area, and supports integrated corridor management on Denny Way, Mercer, and SR-99 north tunnel access. Phase 1 begins operation of 31 intersections on Mercer, Valley, and Roy that have been built as part of the Mercer project. Phase 2 includes 17 intersections along the Denny Way corridor. Phase 3 includes several connector streets between Mercer and Denny Way, including Elliott Ave, Queen Anne Ave N, Broad St, Dexter Ave N, Westlake Ave N, Fairview Ave N, 1st Ave N, 5th Ave N, and 9th Ave N. Phase 1 funding is proposed for 2015 and 2016.

	LTD Actuals	2014 Rev	2015	2016	2017	2018	2019	2020	Total
Revenue Sources									
Commercial Parking Tax	0	0	200	800	0	0	0	0	1,000
To be determined	0	0	0	0	4,800	3,600	600	0	9,000
Total:	0	0	200	800	4,800	3,600	600	0	10,000
Fund Appropriations/Allocations									
Transportation Operating Fund	0	0	200	800	0	0	0	0	1,000
Total*:	0	0	200	800	0	0	0	0	1,000
O & M Costs (Savings)			0	0	0	0	0	0	0

**This detail is for information only. Funds are appropriated in the budget at the Budget Control Level. Amounts are in thousands of dollars.*