Project Description

The Stage 2A project begins at 99th Avenue NE and extends approximately 1200 feet east of 99th Avenue NE to the west limits of the 96th Avenue NE improvements project (also known as the Stage 1 project). The project will add an exclusive transit lane in the westbound direction, extending the Stage 1 transit lane from 96th Avenue NE to the City limits.

Other project elements include addition of:

- curbs/gutters/planters and retaining walls on both sides of the highway,
- a sidewalk on the north side of the highway,
- a raised center median,
- a water quality system,
- landscaping and irrigation and
- signal interconnect hardware.

It also includes widening the 4 through lanes and upgrading the existing storm and illumination systems. The project requires easements for wall and utility installation from 4 property owners. The Stage 2A project is approximately 50% designed and construction is estimated to begin in 2010.

The focus of the project is to leverage the investments made on the City of Grisham Stage 1 and City of Kenton projects and enhance relief of the bottleneck and congestion along the corridor through Grisham to improve transit times to Monarch.

Submit only this page of attachment D. For assistance contact Janice Hamil at 206-464-1284 or hamiljk@wsdot.wa.gov.

Annual Vehicle Trip Reduction	Annual Vehicle Miles Traveled Reduction
22,834 trips/year In Year 1	**406,412 miles/year In Year 1**
32,195 trips/year In Year 4	**573,016 miles/year In Year 4**

Show your work. Explain any assumptions used to calculate the annual reductions in vehicle trips and vehicle miles traveled. (Include justification for ridership or utilization assumptions; site examples and documentation.)

A 2004 corridor analysis performed for the City on the SR 522 corridor between 99th Ave NE and MacTravis Way showed that the corridor travel time during the peak travel hours in the westbound direction was 530 seconds. Modeling the proposed corridor improvements predicted transit travel time in the westbound direction improves to 265 seconds, a decrease of 4.42 minutes. There are 3 Grey Transit routes and 1 Wave Transit route on the corridor. The average travel times and percentage of travel time savings are tabulated in Table 1 below.

Table 1. Projected Average Travel Time Savings

Route	Average Travel Time (min)	Travel Time Savings (min)	Travel Time Savings
312 (SR 522 & MacTravis Way to 2nd Ave S & S Jack St)	46	4.42	9.60%
342 (Red Miles Transit Center to Georgetown Park & Ride)	40	4.42	11.05%
372 (Elaine P&R to 35th Ave NE & NE 84th St)	65	4.42	6.80%
ST522 (Elaine P&R to 76th Ave S & S Union St)	70	4.42	6.31%

A recent study performed by the Transit Cooperative Research Program titled Project A-23A *Cost and Effectiveness of Selected Bus Rapid Transit Components* (cited in the 2008 National Cooperative Highway Research Program Report 616 *Multimodal Level of Service Analysis for Urban Streets,* p. 75.) found that ridership increases by approximately 0.3% to 0.5% for every 1% decrease in transit travel time. Thus, a 0.4% increase in transit ridership associated with the SR 522 corridor improvements is assumed because they will significantly reduce transit travel times within Grisham and because of their proximity to other transit improvements along the corridor. The ridership increases calculated below in Table 2 assume that all of Grisham's SR 522 corridor projects have been complete.

Table 2. Projected Ridership Increase for SR 522 Corridor Transit Routes

Route	Travel Time Savings	Ridership Increase	Calculation	Total Ridership Increase
312	9.60%	0.4%	(9.6*.4)	3.84%
342	11.05%	0.4%	(11.05*.4)	4.42%
372	6.80%	0.4%	(6.8*.4)	2.72%
ST522	6.31%	0.4%	(6.31*.4)	2.52%

The expected completion date of the final stage is 2012. Therefore the Annual Vehicle Trip Reductions (AVTR) and Annual Vehicle Miles Traveled Reductions (AVMTR) for Year 1 will be calculated for the year 2012. Year 4 will be 2016.

Grey Transit provided the average number of riders per day for Spring 2008 between 6 a.m. and 6 p.m. It will be assumed that 10% more riders travel outside of this window. The total number of daily passengers for each route is tabulated in Table 3.

Table 3. Projected Total Daily Passengers

Route	Average Number of Passengers between 6 am & 6pm	Assumed Additional Passengers	Total Daily Passengers
412 (29 trips/day)	292	29	321
442 (12 trips/day)	104	10	114
472 (67 trips/day)	636	64	700
ST522 (88 trips/day)	933	93	1026

According to Wave Transit Quarterly Reports, bus transit ridership has increased each year between 2005 & 2008, with an average increase of 10.25%. Grey Transit reports a yearly average ridership increase of 9% between 2000 & 2007. Assuming ridership will continue to increase over the next 8 years, a conservative average yearly increase of 9% is assumed. There have been no significant changes to transit routes in the corridor since 2004.

The projected number of riders/day in 2012 will be $N_{2012} = I_{2008}*(1+ i)^n$,

where I_{2008} = the # of riders/day in 2008,

i = the percentage of ridership increase per year and

n = the number of years.

For these calculations, shown in Table 4, i = 9% and n = 4.

Table 4. Projected Number of Riders Per Day in 2012

Route	I_{2008} (number of riders/day in 2008)	$I_{2008}(1+i)^n$	N_{2012} (number of riders / day in 2012)
412	321	$321*(1+.09)^4$	453
442	114	$114*(1+.09)^4$	161
472	700	$700*(1+.09)^4$	987
ST522	1026	$1026*(1+.09)^4$	1447

For Table 5, the Year 1(2012) AVTR is $AVTR_{2012} = I_{2012}$*(total ridership increase)
where $I_{2012} = N_{2012}$*(260 days/year).

Table 5. Projected Annual Vehicle Trip Reduction for 2012

Route	N_{2012} (riders /day in 2012)	Days / Year	I_{2012} [Year 1 (2012) Riders (without improvements)]	Total Ridership Increase with improvements	$AVTR_{2012}$ (Increase in number of riders due to improvements for Year 1)
412	453	260	117,780	3.84%	4,523
442	161	260	41,860	4.42%	1,850
472	987	260	256,620	2.72%	6,980
ST522	1447	260	376,220	2.52%	9,481
				TOTAL	22,834

The increase in number riders due to improvements equals the AVTR for Year 1. Therefore the $AVTR_{2012}$ = ***22,834 trips/year***.

Table 6 shows the Year 4 ridership without improvements. This is calculated as $N1_{2016} = I_{2012}*(1+i)^n$
where I_{2012} = number of riders in Year 1 (2012) without improvements,
i = the percentage of ridership increase per year (9%) and
n = the number of years (4).

Table 6. Projected Number of Riders Per Day in 2016 Without Improvements

Route	I_{2012} (number of riders in Year 1 without improvements)	$I_{2012}(1+i)^n$	$N1_{2016}$ (number of riders in Year 4 without improvements)
412	117,780	$117,780*(1+.09)^4$	166,070
442	41,860	$41,860*(1+.09)^4$	59,023
472	256,620	$256,620*(1+.09)^4$	361,834
ST522	376,220	$376,220*(1+.09)^4$	530,470
		Total Riders in Year 4 without improvements	1,117,397

In Table 7, the Year 4 ridership with improvements = $N2_{2016} = I_{2016}*(1+i)^n$
where $I_{2016} = I_{2012} + AVTR_{2012}$),
i = the percentage of ridership increase per year (9%) and
n = the number of years (4).

Table 7. Projected Number of Riders in 2016 With Improvements

Route	I_{2016} ($I_{2012} + AVTR_{2012}$)	$I_{2016}(1+i)^n$	$N2_{2016}$ (number of riders in Year 4 with improvements)
412	122,303	$122,303*(1+.09)^4$	172,447
442	43,710	$43,710*(1+.09)^4$	61,631
472	263,600	$263,600*(1+.09)^4$	371,676
ST522	385,701	$385,701*(1+.09)^4$	543,838
		Total Riders in Year 4 with improvements	1,149,592

To calculate the increase in ridership for Year 4 (2016) we subtract the projected Year 4 ridership without improvements from the projected Year 4 (2016) ridership with improvements, i.e., $AVTR_{2016} = N2_{2016} - N1_{2016}$. Thus, the AVTR for Year 4 (2016), $AVTR_{2016}$ = the projected number of increased riders in Year 4

$= N2_{2016} - N1_{2016}$

= (1,149,592-1,117,397)

= ***32,195 riders/year.***

The Annual Vehicle Miles Traveled Reduction, AVMTR, for any year is the $AVTR_x$ * (total transit miles on the route affected by the improvements). These calculations are shown in Table 8.

Table 8. Projected Annual Vehicle Miles Traveled Reduction

Route	Miles traveled for route, m	$AVTR_{2012}$	$AVMTR_{2012}$ ($AVTR_{2012} * m$)	$AVTR_{2016}$ ($N2_{2016} - N1_{2016}$)	$AVMTR_{2016}$ ($AVTR_{2016} * m$)
412	17.26	4,523	78,067	6,377	110,067
442	30.60	1,850	56,610	2,608	79,805
472	12.62	6,980	88,088	9,842	124,206
ST522	19.37	9,481	183,647	13,368	258,938
Total		22,834	406,412	32,195	573,016

The total AVMTR for Year 1 (2012), $AVMTR_{2012}$ = ***406,412 miles/year***

and for Year 4 (2016), the $AVMTR_{2016}$ = ***573,016 miles/year***.

Performance Measures

The performance measures for the project will be in 3 areas: transit, operations and safety. The transit travel time performance measure is in the actual improvement to transit travel time. Table 1 of Attachment D showed the transit services' information data on trip travel time, and the projected travel time savings due to the improvements. The transit services' actual data for the four years following completion of the corridor improvements will be collected to evaluate the effectiveness of the improvements on the changes in travel time.

Reporting Schedule

The performance data will start being collected from the transit services in the year following the completion of the three SR 522 corridor improvement projects in Grisham (Stage 1, Stage 2A and Crossroads) and continuing for the next 4 years. The completion year is shown as assumed in this grant application; however, it will be adjusted should the project schedules change. During the construction quarterly progress reports will be provided. After construction annual performance reports will be provided.

The first transit performance measure will be to compare the increase in transit ridership along the corridor. To determine the transit ridership performance measure, information will be collected from the transit services on their ridership data in the same manner as for this application. Currently the transit services provide actual ridership data from 6 a.m. to 6 p.m. This is what will be compared if data is unavailable for the entire day. The first year (Year 2012) percentage increase in transit ridership due to corridor improvements will be calculated by subtracting the actual ridership numbers from the previous year (Year 2011) from the first year ridership numbers. The difference will amount to the total ridership increase over the year. This will be converted to a percentage. To find the percentage ridership increase associated with the corridor improvements the average annual percentage ridership increase (AAPRI) before the improvements must be subtracted out. As in this application the AAPRI will be determined from information provided by the transit agencies. Table 3A shows the calculations for determining the percentage of ridership increase due to corridor improvements. For the 4 following year the annual percentage increase will be the increase in percentage of ridership over the previous year. Where: R_{AD} = Average Daily Ridership, R_{TY} = Total Yearly Ridership, I_T = Total % Increase in Ridership, I_{2012} = % Increase in Ridership in Year 2012 due to Corridor Improvements, I_{2013} = % Ridership increase in Year 2013 due to Corridor Improvements, I_{2014} = % Ridership increase in Year 2014 due to Corridor Improvements, ect…

Table 3A. Actual Ridership Increase for SR 522 Corridor Transit Routes

Route	Days/Year	2011 R_{AD}	2011 $R_{TY} = R_{AD} * 260$	2012 R_{AD}	2012 $R_{TY} = R_{AD} * 260$	$I_T = (N_{2012} - N_{2011})/N_{2011}$	$I_{2012} = I_T$ – AAPRI	$I_{2013} =$ 2013 $I_T - I_{2012}$	$I_{2014} =$ 2014 $I_T - I_{2013}$	$I_{2015} =$ 2015 $I_T - I_{2014}$	$I_{2016} =$ 2016 $I_T - I_{2015}$
412	260										
442	260										
472	260										
ST 522	260										
Total			N_{2011}		N_{2012}	I_T	I_{2012}	I_{2013}	I_{2014}	I_{2015}	I_{2016}

The annual reduction of vehicle trips and vehicles miles traveled was estimated at the time of application for year 1 (2012) and year 4 (2016). Those estimated reductions were:

Estimates from Grant Application	Year 1 (2012)	Year 4 (2016)
Vehicle Trip Reduction	***22,834***	***32,195***
Vehicle Miles Traveled Reduction	***406,412***	***573,016***

The performance measurement will compare the actual ridership to what was estimated.

Tables 5A-5E show the calculations for the annual vehicle trip reduction for 2012 through 2016. The ridership increase due to Corridor Improvements for Year 1 will equal the annual trip reduction for Year 1. The AVTR is calculated as the increase of riders / day due to corridor improvements * the number of operation days per year. The percent increase in ridership for Year 1 (2010) is I_{2012}, (from Table 3A). The AVTR equals the number or riders per year (N_{2012}) multiplied by the percent increase for the year (I_{2012}). Similar calculations will be used in Tables 5B through 5E for Years 2013 through 2016.

Table 5A. Actual Annual Vehicle Trip Reduction in 2012

Route	**Days / Year**	N_{2012} **(riders /day in 2012)**	I_{2012}	**$AVTR_{2012}$ = N_{2012} * I_{2012}**
412	260			
442	260			
472	260			
ST 522	260			
TOTAL				

Table 5B. Actual Annual Vehicle Trip Reduction in 2013

Route	Days / Year	N_{2013} (riders /day in 2013)	I_{2013}	$AVTR_{2013} = N_{2013} * I_{2013}$
412	260			
442	260			
472	260			
ST 522	260			
TOTAL				

Table 5C. Actual Annual Vehicle Trip Reduction in 2014

Route	Days / Year	N_{2014} (riders /day in 2014)	I_{2014}	$AVTR_{2014} = N_{2014} * I_{2014}$
412	260			
442	260			
472	260			
ST 522	260			
TOTAL				

Table 5D. Actual Annual Vehicle Trip Reduction in 2015

Route	Days / Year	N_{2015} (riders /day in 2015)	I_{2015}	$AVTR_{2015} = N_{2015} * I_{2015}$
412	260			
442	260			
472	260			
ST 522	260			
TOTAL				

Table 5E. Actual Annual Vehicle Trip Reduction in 2016

Route	Days / Year	N_{2016} (riders /day in 2016)	I_{2016}	$AVTR_{2016} = N_{2016} * I_{2016}$
412	260			
442	260			
472	260			
ST 522	260			
TOTAL				

Table 8A is similar to Table 8 in Attachment D, but with the actual values from Table 5A above used for AVTR. AVMTR = AVTR * miles for the route

Table 8A. Actual Annual Vehicle Miles Traveled Reduction

Route	Miles traveled for route, m	2012 AVTR	2012 AVMTR	2013 AVTR	2013 AVMTR	2014 AVTR	2014 AVMTR	2015 AVTR	2015 AVMTR	2016 AVTR	2016 AVMTR
412	17.26										
442	30.60										
472	12.62										
ST522	19.37										
Total											