Central Link - Initial Segment
Before & After Study

Final Report (Draft)

July 2012

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Introduction

On July 18, 2009 Sound Transit began operating the Central Puget Sound region's first light rail service. The first Central Link light rail transit project, called the Initial Segment, extends from downtown Seattle to S 154th St in the City of Tukwila. An extension to the City of SeaTac and Seattle-Tacoma International Airport, called Airport Link, was added to the project and opened December 19, 2009. Central Link represents a brand new transit alternative and provides service to some of the most diverse and transit-dependent populations in the region. The $2.7 billion project was funded in part by the Federal Transit Administration (FTA) with a $500 million Full Funding Grant Agreement (FFGA). The Initial Segment FFGA was awarded on October 24, 2003 and was amended in 2008 to include the Airport Link project.

FTA Before and After Study Requirement

The FTA requires FFGA project sponsors to conduct a ***Before and After Study*** (B&A Study). The study is meant to report on five characteristics of the project at major milestones – three during project planning and decision making, one immediately before project opening and one two years after project opening. The B&A Study has two distinct and important purposes:

1. Expand insights into the costs and impacts of major transit investments.
2. Improve the technical methods and procedures used in the planning and development of those investments.

One of the First Before and After Studies

Sound Transit was among the first agencies in the nation to undertake a B&A Study. Sound Transit developed a plan that outlines the data collection and reporting responsibilities for the study. This plan was initially submitted in September 2002 and approved by FTA. The plan was later revised and re-approved by FTA in September 2003 based on additional guidance from FTA.

Project Characteristics

FTA has identified the following five project characteristics to be documented in the B&A Study:

1. physical scope
2. capital costs
3. transit service levels
4. operation and maintenance (O&M) costs
5. ridership and revenues

Milestones

Data for each project characteristic are collected at five project milestones:

1. Conclusion of alternatives analysis[1]
2. Conclusion of preliminary engineering
3. Signing of the Full Funding Grant Agreement (FFGA)
4. Before service opening
5. Two years after service opening

[1] Consistent with FTA policy at that time, Sound Transit completed a Major Investment Study (MIS) for the Central Link project in March 1997. The MIS requirement was later replaced with the Alternatives Analysis (AA) requirement. For this B&A Study, the first milestone includes data collected in February 1999, just after the publishing of the *Draft Environmental Impact Statement* (DEIS) for the Central Link Light Rail Transit Project. In this report the milestone will continue to be referred to as "Conclusion of AA" even though a MIS was done for this project.

The fifth milestone (two years after service opening) assumes the new project has become mature enough to collect data for comparison to predictions about the project characteristics. In the case of Central Link, there is evidence that some project characteristics will not become mature until well after two years of service. Ridership, for example, continues to experience significant growth even after nearly three years of service. This provides strong evidence that fall 2011 is premature to collect data for some project characteristics.

In September 2004 Sound Transit submitted the *New Starts Before-and-After Actual-and-Predicted Study* for the Initial Segment. The report documented the project characteristics and predictions available at the first three project milestones. The third milestone (Signing of the FFGA) occurred in October 2003; however, the data for that milestone was collected in fall 2002 to correspond with the 2002 baseline of the project scope and schedule that was submitted with the FFGA application. The following table shows a schedule of milestones and the project characteristics that are gathered at each milestone.

Schedule of Study Milestones

			Milestones				
			End of Alternatives Analysis	End of Preliminary Engineering	FFGA	Before Service Opening	After Service Opening
			Winter 1999	Fall 1999	Fall 2002	Fall 2008	Fall 2011
			Predictions Report Completed September 2004 ▼	▼	▼	Completed Feb. 2010 ▼	Current Report ▼
Project Characteristics	1	Project Scope	✓	✓	✓	Not applicable	✓
	2	Capital Costs	✓	✓	✓		✓
	3	Transit Service Levels	✓	✓	✓	✓	✓
	4	Operation & Maintenance Costs	✓	✓	✓	✓	✓
	5	Ridership & Revenues	✓	✓	✓	✓	✓

Predictions vs. Actual

Before vs. After

This report completes the B&A Study. It compares predictions about the project characteristics made during project planning against actual conditions about two years after the project opened for service. For some characteristics, it also compares the conditions before the opening of the project against conditions after the project has been operating for about two years.

Data Collection in the Fall

Data for transit service levels, O&M costs, and ridership are collected in the fall. Two factors suggest that fall is the most appropriate time to collect data:

- First, major ridership surveys are typically conducted in the spring or fall quarter while universities and colleges are in session, people are less likely to be on vacation and winter weather is not disrupting travel patterns. Thus, fall and spring are the times of year when a survey done on any particular day or days is most likely to accurately capture normal weekday ridership patterns. It should be note, however, that summer is consistently the highest ridership period for Central Link due to the cruise ship and tourist season, and also due to stadium events.

- Second, data collected for the conditions before service opening (fourth milestone) and the conditions after service opening (fifth milestone) should occur in the same season. The Initial Segment and Airport Link opened for service in July 2009 and December 2009, respectively. Therefore Central Link will have operated for two years in fall 2011. Fall 2011 will be the best time to collect data in order to capture normal ridership patterns. For conditions before service opening, data was collected in fall 2008, almost one year prior to service.

Organization of this Report

This report includes background information on local economic and transportation conditions. The report follows with a presentation of data collected for all five project characteristics.

Local Economic Conditions

The approved B&A Study plan included the collection of local economic conditions to track changes to the region that could affect the regional transit system and the implementation of light rail service. Sound Transit collected a summary of local economic conditions at three project milestones:

- fall 2002, when the project was baselined for the FFGA
- fall 2008, before the project opened for service in July 2009 to Tukwila and December 2009 to SeaTac
- fall 2011, two years after the project opened for service

A set of local economic indicators is reported below and indicates trends in the local economy. These indicators provide an important context within which to evaluate Link's performance and its impacts on other transit services in the corridor. These economic conditions are used to help explain contributing factors for characteristic 5 (Ridership and Revenues). Sources for data are shown in the endnotes.

Between 2002 and 2008, the local economy showed significant growth, including gains in employment, airport passengers and people migrating into the state. In fall 2008, the Seattle metropolitan area was entering a recession that the rest of the country had already begun to experience. Real estate prices were falling while homes stayed on the market much longer. In fall 2011 the region was still suffering effects of the recession, including much higher unemployment in 2011 than 2008, real estate prices continuing to fall, and much slower migration of people into the region. Inflation for the entire three-year period from 2008 to 2011 was 3.6%, according to the local consumer price index.

Also, employment in downtown Seattle is lower than the employment forecast used at the time the Initial Segment Project was baselined in 2002. The Puget Sound Regional Council's (PSRC) small area employment forecast was used for the 2011 and 2020 Central Link ridership forecasts. In 2010 there were 79,000 fewer jobs in downtown Seattle than forecasted by PSRC at the FFGA milestone. The downtown forecast was 210,000 jobs for 2010 and 225,000 for 2020. These were updated in 2006 to 202,000 and 226,000 respectively. For the same geographic area, the dataset released by PSRC in May 2012 for the local review process shows 131,000 for 2010 and 187,000 for 2020. These new estimates are scheduled be revised and finalized by the end of 2012. The actual employment as compared to the employment forecast played a significant role in the B&A Study results.

Table 0-1: Economic Conditions

	Fall 2002 FFGA (2002$)	Fall 2008 Before (2008$)	Fall 2011 After (2011$)
Employment in Seattle-Bellevue-Everett Area (September) [a b]			
Total nonfarm employment	1,339,400	1,485,300	1,417,300
Aerospace manufacturing jobs	70,300	81,400	84,800
Information (software & telecom) jobs	72,600	86,600	86,700
Unemployment rate	6.5%	4.9%	8.2%
Total unemployment	85,100	71,580	123,400
Consumer Price Index [c]			
CPI-U for Seattle-Tacoma-Bremerton (Annual)	189.3	224.7	232.8
Housing [d e f g]			
Median Price for Single Family Home – King County			
September	$259,000	$415,000	$350,000
October	n/a	$392,000	$320,000
November	n/a	$395,000	$322,000
Months of Supply - King County			
September	n/a	6.6	3.7
October	n/a	8.3	3.3
November	n/a	8.7	3.4
Transportation			
Seattle-Tacoma International Airport passengers (September) [h i j]	2,193,910	2,667,645	2,843,171
King County Metro Systemwide Ridership (millions annual riders)	94.5	118.8	112.8
Traffic on I-5 at Boeing Access Rd – Daily Volume [k l]	214,000	200,000	195,000
Seattle-Everett area mobility report measures [m]			(2010)
Travel time index (peak travel time / free-flow travel time)	1.32	1.26	1.27
Annual hours of delay per peak auto commuter	46	47	44
Annual hours of delay per peak auto commuter saved by transit	n/a	10	9
Net Migration [n o p]			
Washington State (incoming minus outgoing residents)	31,100	58,000	4,800
Gasoline Prices [q r]			
Per gallon regular for Seattle			
September	$1.49	$3.88	$3.92
October	n/a	$3.58	$3.88
November	n/a	$2.58	$3.84
Parking Price and Availability in Downtown Seattle [s t]	**(2002)** (2002$)	**(2006)** (2006$)	**(2010)** (2010$)
Parking stalls	58,538	51,342	45,535
Occupancy Rate	63.2%	65.4%	62.8%
Average Price			
One Hour	$3.60*	$7.74	$9.63
Daily	$14.52	$16.47	$21.62
Monthly	$200.29	$197.79	$225.16
	*derived from reported 2002 2-hour rate of $7.20		
Economy			
Washington Index Leading Indicators [u v]			
September	95.9	110.3	111.7
October	95.7	107.2	111.6
November	n/a	104.1	112.7

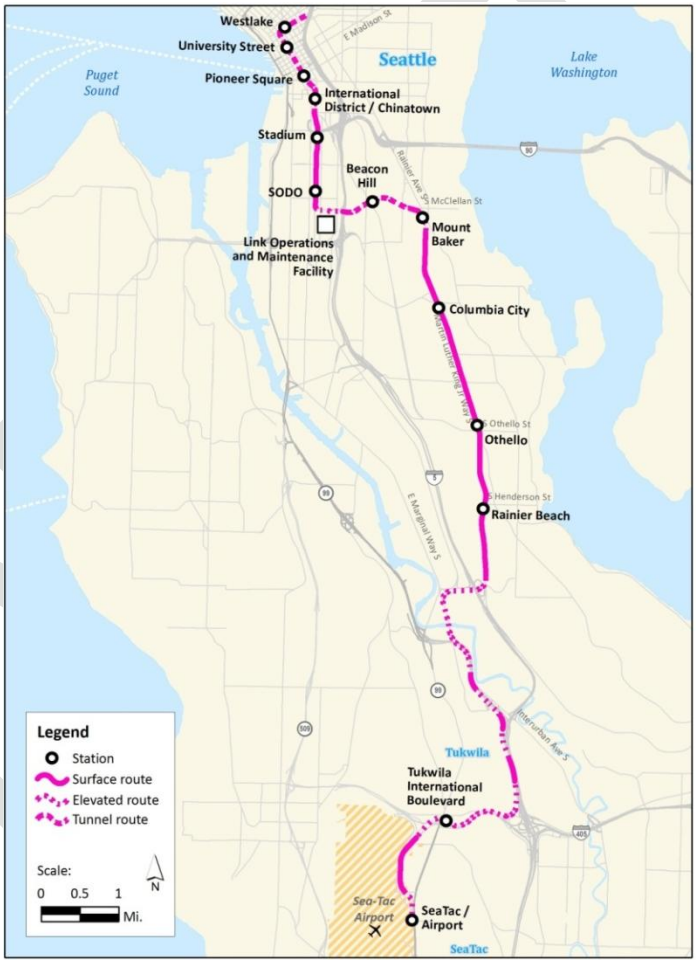
Characteristic 1 - Project Scope

The Project Scope characteristic explains the physical components of the project. The project as constructed is shown in Figure 1-1, and the project scope evolution through the project milestones is illustrated in Figure 1-2 and summarized in Table 1-1.

Project as Constructed

The project that was constructed includes the Initial Segment and Airport Link extension projects, which together are a 15.6 mile double-tracked light rail line with thirteen stations extending from downtown Seattle to Seattle-Tacoma International Airport, as shown in Figure 1-1.

Figure 1-1: Scope of the Project as Constructed



The system operates in a mix of tunnels, elevated structures, and surface segments. Surface segments include both exclusive and semi-exclusive rights-of-way. The semi-exclusive segments include grade crossings with full priority signals or signal progression that allow trains to proceed without stopping. In the Downtown Seattle Transit Tunnel (DSTT), light rail trains operate jointly with buses in the same right-of-way using the same station platforms. The project also includes a fleet of 35 low floor articulated light rail vehicles (LRVs) and a 25-acre Operations and Maintenance Facility (OMF) in the SODO industrial area that was expanded in 2008 to accommodate up to 104 LRVs, as part of the University Link extension project that is scheduled to open in 2016.

All stations include platforms that are 400 feet long to accommodate 4-car trains. Five stations are underground, three are elevated and five are at-grade.

Project Development through AA and PE

The project that was constructed is very similar to the project as defined at the FFGA milestone. However the project has changed dramatically from the earlier milestones, as illustrated in Figure 1-2. At the conclusion of Alternative Analysis (AA), based on information in the Draft Environmental Impact Statement (DEIS), the Sound Transit Board identified the Locally Preferred Alternative (LPA) with Motion M99-14 on February 25, 1999.

The LPA was a 20-mile light rail line with 21 stations beginning at NE 45th Street in the University District in Seattle, connecting to Capitol Hill, First Hill, downtown Seattle, Rainier Valley, Tukwila, Sea-Tac International Airport, and ending at South 200th Street in the City of SeaTac. The DSTT was to be converted to exclusive use for light rail vehicles, and tunnel buses would be relocated to city streets. In southeast Seattle's Rainier Valley neighborhood, a surface alignment would run in the median of Martin Luther King, Jr. Way S with up to 14 signalized intersections and up to 12 additional signalized pedestrian crossings. The street was to be completely rebuilt and widened to 93 feet, and bicycle access would be provided parallel to the corridor. The surface alignment through Tukwila would run in the median of Tukwila International Blvd. and also include the reconstruction of the street. The location of a new OMF was not identified.

At the conclusion of Preliminary Engineering (PE), based on the Final Environmental Impact Statement (November 1999), the Sound Transit Board selected the Final LPA with Resolution R99-34 on November 18, 1999 and the FTA issued a Record of Decision in January 2000. The Final LPA was similar to the LPA identified after AA (DEIS), but three stations were deferred: Royal Brougham (Stadium), Beacon Hill and Graham Street. The at-grade MLK segment was also modified to include 19 signalized intersections and 9 signalized pedestrian crossings. The Forest Street location in the SODO area was selected for the OMF.

The Final LPA selected by the Board also included the Minimum Operable Segment (MOS)-1, a portion of the Final LPA that could be constructed with federal funds, providing fully operational transit service. MOS-1 was defined as a 7-mile line with 9 stations from NE 45th Street in the University District to S Forest Street and Airport Way S including the OMF at the Forest Street site in SODO. The Final LPA and MOS-1 is the project that advanced to final design after FTA issued authority to enter final design. In 2000, Sound Transit submitted a FFGA application to build MOS-1.

Further work unveiled engineering and cost challenges to build the project, including unstable soils beneath Portage Bay and in the vicinity of a number of proposed underground stations, increased right-of-way costs and increased construction costs. As a result, the Sound Transit Board increased the budget to build the project and extended the revenue service date from 2006 to 2009. The cost and schedule changes were reflected in an amended MOS-1, which became the scope of an FFGA approved by FTA in January 2001.

Figure 1-2: Physical Scope through Project Milestones

FFGA

In April 2001 the U.S. Department of Transportation Inspector General recommended that federal funding for fiscal years 2001 and 2002 be held in abeyance and recommended these actions:

- Sound Transit should identify all issues that could impact project cost, schedule and scope.
- FTA and its Project Management Oversight Contractor (PMOC) should validate the project estimated cost to complete.
- FTA and its Financial Management Oversight Contractor (FMOC) should validate sufficient funding sources to complete the project and assess impacts on the project beyond MOS-1.
- Congress would have 60 days to review the project's grant agreement after these issues have been satisfactorily addressed.

As a result, Sound Transit re-examined the project and decided not to proceed with MOS-1. On September 27, 2001, the Sound Transit Board identified its preference for an Initial Segment Project that would provide light rail service with a 14-mile alignment between downtown Seattle and South 154th Street in Tukwila and 31 LRVs. The Initial Segment was developed to allow more time to study the complex design issues to the north and to consider more cost-effective ways to build the northern portion of the project. On November 29, 2001, the Sound Transit Board selected the Initial Segment to be constructed and operated by 2009. Sound Transit prepared an Environmental Assessment for the Initial Segment (February 5, 2002) and FTA issued an Amended Record of Decision for the Initial Segment May 8, 2002. The Initial Segment ultimately constituted a revised MOS for federal funding purposes. The FFGA for the Initial Segment Project was executed on October 24, 2003.

The FFGA Initial Segment project also had these new project features:

- Both buses and trains would operate together in the DSTT, rather than rail exclusive operation.
- Beacon Hill Station (previously deferred) was included.
- Boeing Access Road Station was deferred.
- An elevated Tukwila Freeway Route was chosen instead of a surface alignment on Tukwila International Blvd.
- A shuttle bus service was planned to connect passengers between S 154th Street and Sea-Tac International Airport.

In January 2005 Sound Transit received a Documented Categorical Exclusion (DCE) from FTA to add Stadium Station, which was previously a deferred station, bringing the total number of stations to twelve.

Also in 2005, after the Initial Segment was already under construction, Sound Transit prepared an Environmental Assessment (May 26, 2005) and approved the Airport Link Project, a 1.7-mile extension to Sea-Tac International Airport with one additional elevated station that was to begin operations by the end of 2009. FTA issued a Record of Decision for Airport Link September 13, 2005. The project included the purchase of four additional LRVs.

The Airport Link project was not included in the original scope of the FFGA. However, the Initial Segment Project was under budget as it neared completion of construction, and it became clear Sound Transit would not be able to receive its entire grant due to spending and the match ratio as defined in the FFGA. As a result, the FFGA was amended in 2008 to include the Airport Link Project. By adding the additional scope to the FFGA, Sound Transit was able to receive its entire $500 million grant.

Table 1-1: Project Scope Summary by Milestone

	Description	Milestone Date	Alignment Summary	Planned Revenue Service
Project as Constructed	Initial Segment + Airport Link	Fall 2009	15.6 miles 13 stations Downtown Seattle to Sea-Tac International Airport (S 176th Street)	2009 (actual)
Conclusion of AA	Preliminary Locally Preferred Alternative	February 1999	20 miles 21 stations University District to S 200th Street	2006
Conclusion of PE	Locally Preferred Alternative	November 1999	20 miles 18 stations University District to S 200th Street	2006
	Minimum Operable Segment (MOS-1) of the LPA	November 1999	7 miles 9 stations University District to S Forest Street	2006
FFGA	Initial Segment (Revised MOS)	Fall 2002	13.9 miles 11 stations Downtown Seattle to S 154th Street	2009
	Stadium Station added	August 2005	13.9 miles 12 stations Downtown Seattle to S 154th Street	2009
FFGA Amended	Airport Link extension added	August 2008	15.6 miles 13 stations Downtown Seattle to Sea-Tac International Airport (S 176th Street)	2009

Characteristic 2 - Capital Cost

The total project cost for the Initial Segment and Airport Link projects were lower than the FFGA baseline cost estimates. Table 2-1 shows that the Initial Segment and Airport Link projects were $117 million and $7.5 million under the FFGA baseline cost estimate, respectively, for a total project savings of $124.5 million.

Table 2-1: Total Project Costs vs. Cost Estimate - Initial Segment and Airport Link (Millions YOE$)

Project	FFGA Baseline Cost Estimate	Total Cost of Project as Constructed	Difference
Initial Segment	2,436.9	2,319.9	- 117.0
Airport Link	269.1	261.6	- 7.5
Total	2,706.0	2,581.5	- 124.5

Total project costs include the project reserve, financing, transit art and DSTT debt service. These other project costs are not included in capital costs, and they also were not estimated at the conclusion of AA. A comparison of the estimated final capital cost versus the FFGA baseline cost estimates for the Initial Segment and Airport Link projects is shown in Tables 2-2 and 2-3. The estimated final capital cost for the Initial Segment includes the cost to build Stadium Station and is slightly above the FFGA baseline cost estimate. Some elements of the capital costs were less than estimated, including vehicles, right-of-way and administration. Other elements were higher than estimated, including final design, construction and construction management. For the Initial Segment, about 60% of the cost was in construction, and about 10% was in right-of-way costs.

The estimated final cost for the Airport Link project is less than the FFGA baseline cost estimate in nearly all cost areas.

Table 2-2: Final Capital Costs vs. Cost Estimate – Initial Segment (Millions YOE$)

Cost Item	FFGA Baseline Cost Estimate	Estimated Final Cost	Difference
Preliminary Engineering	29.9	28.9	- 1.0
Environmental Analysis	5.1	4.4	- 0.7
Final Design	123.0	144.1	21.1
Construction Management	82.5	102.7	20.3
Construction	1,166.7	1,228.4	61.6
Light Rail Vehicles	138.3	131.8	- 6.5
Third Party Agreements	58.8	61.5	2.7
Right-of-Way	233.0	206.5	- 26.5
Before and After Study	0.6	0.8	0.3
Direct Labor for PE	2.0	2.0	0.0
Pole Procurement	0.5	0.3	- 0.1
Site Preparation	5.4	4.6	- 0.8
Admin and Operations	224.2	183.0	- 41.2
Total	**2,070.0**	**2,099.0***	**29.0**

* The estimated final cost includes about $2.5 million for above ground work at Stadium Station, and about $3.3 million for the cost of removing hazardous materials which had not been considered in determining the appraised values of properties, for a total of $5.8 million that was not included in the FFGA Baseline Cost Estimate.

Table 2-3: Final Capital Costs vs. Cost Estimate – Airport Link (Millions YOE$)

Cost Item	FFGA Baseline Cost Estimate	Estimated Final Cost	Difference
Preliminary Engineering	2.8	3.1	0.3
Environmental Analysis	0.5	0.5	0.0
Final Design	16.1	15.8	- 0.3
Construction Management	15.4	15.4	0.0
Construction	191.1	188.3	- 2.8
Light Rail Vehicles	14.6	14.6	0.0
Third Parties	2.0	1.4	- 0.7
Right-of-Way	12.8	12.5	- 0.3
Administration	12.2	10.0	- 2.2
Project Contingency	1.5	0.0	- 1.5
Total	**269.1**	**261.6**	**- 7.5**

The capital and total project costs are shown for each project milestone in Table 2-4. For comparison purposes, costs are shown in both 1995$ and in year-of-expenditure (YOE$), where available.

Table 2-4: Capital and Total Project Cost by Milestone

	Description	Milestone Date	Capital Cost (millions 1995$)	Capital Cost (millions YOE$)	Total Project Cost (millions YOE$)
Project as Constructed (Estimated Final Cost)	Initial Segment	Summer 2009	-	$2,099	$2,320
	Airport Link	Fall 2009	-	$262	$262
	Initial Segment + Airport Link	Fall 2009	-	$2,361	$2,568
Conclusion of AA	Preliminary LPA	Feb 1999	$2,066	-	-
Conclusion of PE	LPA	Nov 1999	$1,924	$2,480	-
	LPA amended	Jan 2001	$2,599	$3,600	-
	MOS-1	Nov 1999	$1,104	$1,421	-
	MOS-1 amended	Jan 2001	$1,638	$2,250	$2,603
FFGA	Initial Segment (Revised MOS)	Fall 2002	$1,511	$2,070	$2,437
FFGA Amended	Airport Link extension added	August 2008	-	+ $269	+ $269

Cost estimates were greatly affected by the changes in project scope and project schedule through the milestones. At the conclusion of AA, the scope included a 20-mile project with 21 stations, including four new underground stations (and four existing underground stations), opening for service in 2006 with a capital cost of $2.066 billion in 1995$. Costs were not estimated in YOE$ at this milestone.

At the conclusion of PE, MOS-1 was developed for federal funding, and this project included a 7-mile line, mostly underground with nine stations connecting the University District with downtown Seattle and the Forest Street OMF with a capital cost of $1.104 billion in 1995$ and $1.421 billion in YOE$. After further engineering and environmental work, the capital cost for MOS-1 was amended to reflect more challenging tunneling conditions, and the projected revenue service date was extended to 2009. These changes resulted in a higher capital cost estimate for MOS-1 of $1.638 billion in 1995$ and $2.250 billion in YOE$, a significant increase over the previous estimates. The total project cost for MOS-1 was estimated at $2.603 billion in YOE$. An FFGA was awarded for MOS-1 in 2001.

Due to the significant increase in cost and schedule delay for MOS-1, federal grant funding was held in abeyance and Sound Transit re-examined the project. The MOS was revised to include a 13.9 mile line with eleven stations connecting downtown Seattle to 154th Street in Tukwila, opening in 2009 with a shuttle bus service to the airport. An FFGA was awarded for this revised MOS with a baseline capital cost estimate of $2.070 billion and a total project cost of $2.437 billion in YOE$.

In summer 2008, the Airport Link extension was added to the project, and the FFGA was amended to include the project for an additional $269 million.

Characteristic 3 – Transit Service Levels

Light Rail

Central Link provides all-day frequent transit service. Trains operate 20 hours per day weekdays and Saturdays from 5 a.m. to 1 a.m., and 18 hours per day Sundays from 6 a.m. to 12:00 a.m. There is also a special early morning trip Mondays through Saturdays leaving Stadium Station at 4:40 a.m. to help airport employees reach the airport in the early morning hours. Headways are 7.5 minutes in the peak periods, 10 minutes in the midday, evenings and weekends, and 15 minutes in the early morning and late night periods.

Two-car trains are operated except on weekday evenings after 7 p.m. and on some weekend days, when ridership is expected to be lower. Two-car trains are always operated when special events are expected to increase passenger demand. Also, extra trains are placed in service when needed to accommodate unusually high passenger volumes, especially after stadium events. Table 3-1 shows how service levels compare to the predictions made during project planning.

Table 3-1: Central Link Levels of Service through Project Milestones

	Conclusion of AA	Conclusion of PE	FFGA	Actual
Scope of Light Rail System	20 miles NE 45th to S 200th		13.9 miles Downtown to S 154th	15.6 miles Downtown to Airport
Daily hours of service				
Weekdays	20	20	20	20
Saturdays	20	20	20	20
Sundays	20	20	18	18
Headways (minutes)				
Peak Periods	4 (trunk)	4 (trunk)	6	7.5
Midday / evening	7.5	8	10	10
Early morning / late night	10	10	15	15
Cars per train				
Peak periods	4	4	2	2
Off-peak periods	2	2	2	1-2
Shuttle Bus - S 154th to airport	No	No	Yes	No
Annual revenue car miles[2]	n/a	n/a	2.61 M	2.45 M
Annual revenue car hours[2]	n/a	n/a	123,988	130,175
Average speed (mph)	28	28	24	24

From AA to PE, the operating plan remained similar. At the FFGA milestone, the scope of the project changed significantly, and the operating plan was also revised. Trains were planned to operate less frequently since the ridership demand in the Initial Segment corridor was less than the higher ridership demand expected in the University District – Downtown corridor. The estimated average speed was reduced since several miles of grade-separated alignment (University District – Downtown) were removed from the project.

At the time of the FFGA milestone, a shuttle bus was predicted to operate between S 154th St and Sea-Tac International Airport in order to connect light rail passengers to the airport. When the Initial Segment Project opened for service, this shuttle bus was operated for approximately five months before the light rail extension was

[2] Revenue car miles and hours include security sweeps at Westlake Station, travel into and out of tail tracks, switching ends and layover time.

opened to the airport. The shuttle bus operation was discontinued in December 2009 when the airport extension opened for service.

When comparing the actual revenue car miles and hours against the FFGA predictions, there are four important factors to consider:

- The actual project includes 1.7 miles of additional grade-separated track (Airport Link) that was not included at the FFGA milestone.
- 7.5-minute headways were operated in the peak periods instead of the predicted 6-minute headways.
- One-car trains were operated during periods of low ridership, whereas for the FFGA milestone 2-car trains were assumed to operate at all times.
- Trains were operated with longer turnaround and layover time than what was assumed at the FFGA milestone. This longer time included a security sweep of every northbound train at Westlake Station.

The Airport Link Project, with its extra length, increased revenue car miles and hours compared to the predictions at the FFGA milestone. The 7.5-minute headways and the operation of one-car trains reduced the car miles and hours compared to predictions at the FFGA milestone. However, more turnaround and layover time increased the car hours compared to the FFGA prediction. When considering all these factors together, car miles were slightly lower than the FFGA prediction, but the car hours were higher than the FFGA prediction.

Corridor Buses

Buses in the Corridor are operated by King County Metro (Metro) and provide a mix of services including all-day frequent local routes and peak period express routes for commuters. Corridor bus routes include routes that operate in the project area and serve similar transit markets as Central Link, including routes operating in the SODO Busway and the DSTT. Routes operating in the DSTT are affected by the joint operation of buses and trains in the tunnel. Most of these routes operate in corridors outside the Central Link corridor. Therefore, these routes are reported separately in this study.

Bus services in the corridor were modified in September 2009 (two months after the Initial Segment opened) and in February 2010 (two months after Airport Link opened). Services were modified again in October 2010 when the A Line opened for service – Metro's first RapidRide line with improved service along SR-99/International Blvd with connections to Central Link at SeaTac/Airport and Tukwila International Blvd Stations. Figure 3-1 illustrates the bus network modifications implemented between fall 2009 and fall 2011.

Revenue service hours for buses in the corridor were measured in fall 2008 and fall 2011. Tables 3-2 and 3-3 show the comparison of the bus revenue service hours before and after Central Link opened for service. Table A3-1 in Appendix 3 lists the buses included in this study for both fall 2008 and fall 2011. Tables A4-1 and A4-2 in Appendix 4 show daily and annualized service hours by route for fall 2008 and fall 2011, respectively.

Table 3-2: Revenue Service Hours for Corridor Buses

	Before	After	Change
Daily Revenue Service Hours			
Weekdays	1,480	1,525	+ 3%
Saturdays	956	974	+ 2%
Sundays	725	750	+ 3%
Annualized Revenue Service Hours			
Weekdays	375,486	387,895	+ 3%
Saturdays	49,700	50,635	+ 2%
Sundays	42,060	43,506	+ 3%
Total	467,245	482,036	+ 3%

Table 3-3: Revenue Service Hours for Other Buses Operating in DSTT

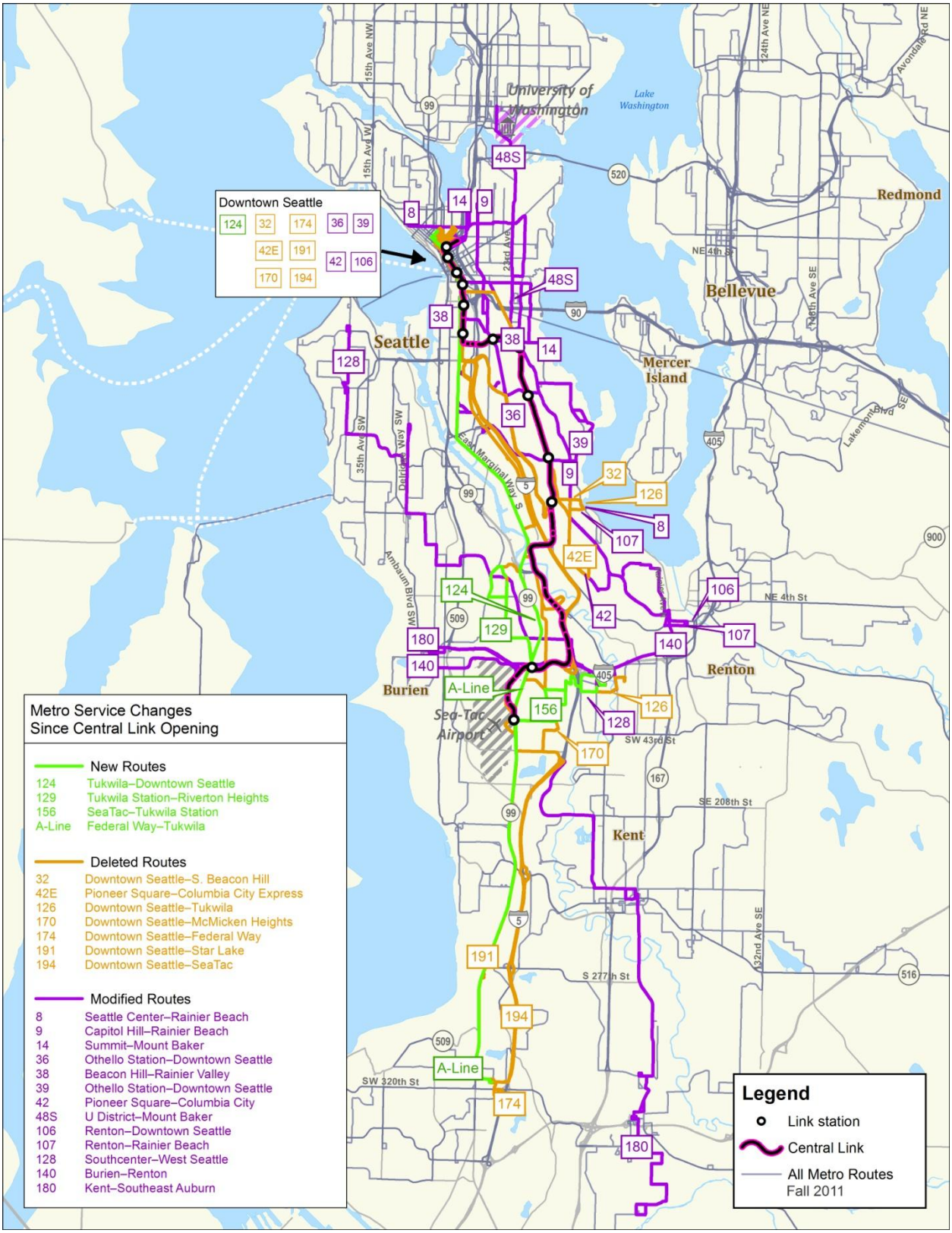
	Before	After	Change
Daily Revenue Service Hours			
Weekdays	583	695	+19%
Saturdays	373	365	- 2%
Sundays	287	251	- 13%
Annualized Revenue Service Hours			
Weekdays	148,342	176,669	+ 19%
Saturdays	19,376	18,974	- 2%
Sundays	16,672	14,575	- 13%
Total	184,391	210,219	+ 14%

Revenue service hours provided by buses in the corridor were similar between fall 2008 and fall 2011, showing that service hours from discontinued routes were reallocated into other routes in the corridor. If services were lost due to route discontinuation or truncation, those services were generally replaced with new routes or revised routes with similar levels of service. In south King County, route 174, a local route connecting downtown Seattle with Tukwila, Sea-Tac Airport and Federal Way, was discontinued. This route was replaced with local route 124 between Seattle and Tukwila, and with the new bus rapid transit (BRT) A Line between Tukwila and Federal Way. The A Line provides 10 to 15 minute service throughout most of the day, an improvement over route 174. Route 194, an express service between downtown Seattle and Sea-Tac Airport with some trips extending to Federal Way, was discontinued. The express services from Federal Way to Sea-Tac Airport and between Federal Way and downtown Seattle were replaced by additional service on Sound Transit Express routes 574 and 577/578, although these routes do not operate in the Central Link corridor and are not included in service level calculations.

In Rainier Valley, routes 32 and 42 Express, which provided limited commuter services, were discontinued. Route 48 was shortened to terminate at Mount Baker Station, and the resulting loss of local bus service along Martin Luther King Jr. Way S was replaced by extending and increasing service on route 8. Route 36 was modified to terminate at Othello Station, and the resulting loss of service on Beacon Ave S was replaced by modifying route 106. Route 14 was modified to provide a connection at Mount Baker Station.

In the DSTT, some routes were discontinued or removed from the tunnel, but others were also added to the tunnel, resulting in a net increase of service hours for buses serving the DSTT. Many of the routes added to the tunnel operate in the peak period only, which explains why service hours were increased on weekdays, but reduced on weekends.

Figure 3-1: Metro Service Changes from Fall 2009 to Fall 2011



Average speed for buses in the corridor was also measured in fall 2008 and fall 2011. Table 3-4 shows PM peak period average speed for corridor buses before and after Central Link opened for service, and how the actual speed in fall 2011 compares to predictions made at the FFGA milestone. Tables A5-1 and A5-2 in Appendix 5 show PM Peak speed by route for fall 2008 and fall 2011, respectively.

Table 3-4: PM Peak Revenue Speed for Corridor Buses (including DSTT buses)

	Before	After / Actual	Change	FFGA	Difference: Actual - FFGA
Inbound (mph)	14.5	13.8	- 5%	13.5	+ 2%
Outbound (mph)	16.0	15.6	- 3%	14.4	+ 8%

Average speed in the PM peak period was slightly reduced for buses in the corridor after Central Link opened for service. Some freeway-running bus services were discontinued, like route 194 from downtown Seattle to the airport and Federal Way. Also, buses took longer to travel through the DSTT after joint bus and rail operation was implemented in the tunnel.

When comparing the actual PM Peak revenue speed for corridor buses against the prediction made at the FFGA milestone, actual speeds were slightly faster than predicted. In the outbound direction the average actual speed for buses in the corridor was about 8% faster than predicted.

Other Transit in the Corridor

Sound Transit operates a peak period commuter rail service called Sounder. There are two Sounder lines:

- Everett – Seattle
- Tacoma – Seattle

The Everett – Seattle line serves four commuter rail stations, and the Tacoma – Seattle line serves seven commuter rail stations. Both lines terminate and connect to Central Link at King Street Station in downtown Seattle, with a short walking transfer to International District / Chinatown Station. Table 3-5 shows the level of service for each line for fall 2008 (Before) and fall 2011 (After). The table also compares the fall 2011 (Actual) service to predictions made during the FFGA milestone.

Table 3-5: Sounder Commuter Rail Service Levels – Number of Trains

		Before		After / Actual		Change		FFGA		Difference: Actual - FFGA	
Inbound / Outbound		**IB**	**OB**	**IB**	**OB**	**IB**	**OB**	**IB**	**OB**	**IB**	**OB**
Everett – Seattle	AM	4	0	4	0	-	-	4	0	-	-
	PM	0	4	0	4	-	-	0	4	-	-
Tacoma – Seattle	AM	6	2	7	2	+ 1	-	6	3	+1	-1
	PM	2	6	2	7	-	+ 1	3	6	+1	-1

At the FFGA milestone, Sound Transit also predicted the Tacoma Line would be extended to Lakewood with two additional stations by fall 2011. However, this seven mile extension will not be open for service until fall 2012.

Characteristic 4 – Operation and Maintenance Costs

Light Rail

O&M costs for Central Link were greater than predicted at the FFGA milestone. Security costs were escalated in the post 9/11 environment, especially for the DSTT which operates underneath downtown Seattle. Sound Transit accommodated greater security requirements set forth by the U.S. Department of Homeland Security, the Seattle Police Department and Seattle Fire Department. Security is provided using two contracts – one with the King County Sheriff and another with a private security company.

Under an agreement with King County, Sound Transit is responsible for paying off a share of the debt used to build the DSTT. The cost allocated to light rail is based on formulas related to service levels for buses and light rail trains in the DSTT. At the time of the FFGA milestone, this cost was assumed to be allocated as an agency cost, and therefore it was not included as a Central Link O&M costs. Due to accounting methods adopted by Sound Transit, this cost has subsequently been included as an operating cost for Central Link. Also, Central Link served two additional stations (SeaTac/Airport and Stadium) in fall 2011, and the costs to operate these stations were not predicted at the FFGA milestone.

Security and DSTT debt costs account for the bulk of the difference between the actual and predicted costs:

- Security costs $6.67 M more than predicted
- DSTT Debt Payments $2.58 M more than predicted

If you do not include these two amounts, the O&M cost for 2011 would be $41.57 million, or 5% more than predicted at the FFGA milestone ($39.56 million).

Table 4-1 shows how actual O&M costs compare to the prediction at the FFGA milestone. At the conclusion of AA and PE milestones, costs were calculated for a system running from the University District to S 200th St.

Table 4-1: Operation and Maintenance Costs for Central Link

	Conclusion of AA (2011$)	Conclusion of PE (2011$)	FFGA (2011$)	Actual (2011$)	Difference: Actual - FFGA
O&M Cost for Central Link – 2011	$53.80 M	$64.19 M	$39.56 M	$50.82 M	+ 28%

Corridor Buses

Metro supplied data to calculate O&M costs for buses in the corridor. The number of annualized platform hours for each route was given by bus type (based on fall 2008 and fall 2011 service). Metro also provided the estimated hourly cost to operate each bus type. Annualized costs were calculated by multiplying the annualized platform hours for each bus type by the hourly cost for each bus type. Tables 4-2 and 4-3 show the total platform hours and total annualized O&M costs for corridor buses and other buses operating in the DSTT. The hourly cost for each bus type is shown in Table A5-1 in Appendix A. Tables A6-2 through A6-5 in Appendix 6 show annualized platform hours and annualized platform cost by route and bus type for fall 2008 and fall 2011.

Table 4-2: Operation and Maintenance Costs for Corridor Buses

	Before (2011$)	After (2011$)	Change
Annualized Platform Hours	678,147	656,938	- 3%
Annualized Cost	$89.44 M	$89.79 M	0%

Table 4-3: Operation and Maintenance Costs for Other Buses Operating in DSTT

	Before (2011$)	After (2011$)	Change
Annualized Platform Hours	292,832	318,831	+ 9%
Annualized Cost	$38.05 M	$44.02 M	+ 16%

The cost to operate buses in the corridor remained the same after the introduction of Central Link. The slight reduction in platform hours was offset by rising O&M costs for buses. The cost to operate one platform hour of service increased by up to 10% from 2008 to 2011 for Metro buses, which was higher than inflation (3.6% over the same period). For buses in the DSTT, the annual O&M cost increased due to both additional service and rising bus O&M costs from 2008 to 2011.

Characteristic 5 – Ridership and Revenues

Light Rail

Ridership for Central Link has not yet reached a mature level. After three years of operation, ridership totals and averages are still showing significant growth. Both the totals and the average weekday ridership for the 2nd quarter of 2012 were ten percent above those for the 2nd quarter of 2011, indicating that ridership is still maturing.

There is a combination of possible factors why ridership has not yet reached maturity. It is assumed these factors will be corrected over time, allowing ridership on the system to reach its full maturity.

Table 5-1: Factors Affecting Central Link Ridership

	Estimated Period to Reach Maturity
Impacts from Economic Recession. The Puget Sound region, along with national and global economies, experienced a major economic recession starting in 2008 and was still recovering in 2011. The recession affected transit ridership. In King County, Metro experienced an 8% decline in ridership between 2008 and 2010 before ridership increased about 3% from 2010 to 2011. Higher unemployment affected large economic sectors in downtown Seattle, like government and banking. It is anticipated the local economy will continue its recovery and return to a healthy growth level between 2012 and 2014.	2012 - 2014
PSRC Employment Forecasts in Downtown Seattle. Sound Transit's ridership model uses economic forecast information provided by PSRC, including employment forecasts. In 2010 there were an estimated 79,000 fewer jobs in downtown Seattle than forecasted by the PSRC. At the FFGA milestone, the employment forecast for downtown Seattle in 2010 was 210,000 jobs. In May 2012 PSRC published an updated total for 2010 employment in downtown Seattle of 131,000 jobs.	n/a
Slow Adoption of New Transit Service in Rainier Valley Corridor. Major transit-dependent populations in the Rainier Valley have not yet fully adopted Link as a transit option. Outreach efforts have shown reluctance by many low income and non-English speaking populations in the Beacon Hill and Rainier Valley neighborhoods to change long-established travel patterns of using local bus routes. Customer service and outreach staff continue working on educational efforts to engage these communities and encourage Link usage as a faster travel option.	2009 - 2017
ORCA Card Adoption. The region's transit agencies, including Sound Transit, launched a new electronic fare payment system in June 2009, one month before Central Link opened for service. Sound Transit also adopted a policy that requires an ORCA card in order to transfer between buses and trains without having to pay twice. However, Metro adopted a policy to continue distributing free paper transfers for cash-paying riders, which may have reduced the use of ORCA cards for some ridership groups like low income and non-English speaking riders. Riders without an ORCA card face a stiff fare penalty when transferring between local buses and Central Link, because they must pay the full cash fare for each service.	2009 - 2018
Transit Integration. Transit network changes feeding the light rail stations have been implemented incrementally. Some competing transit services were left in place after Central Link opened for service. Route 7 Express, for example, still operates between Rainier Valley and downtown Seattle, and Route 106 continues to operate to downtown Seattle via Rainier Beach. There is a lack of frequent feeder bus routes that connect neighborhoods to light rail stations, especially at Mount Baker, Columbia City and Rainier Beach Stations. New feeder routes are still being implemented and will continue to change over time. For example, Metro	2009 - 2020

	Estimated Period to Reach Maturity
has recently adopted a new route 50 to begin service in fall 2012, with higher service levels connecting nearby neighborhoods to Columbia City and Othello Stations. The estimated length of time it will take to fully modify the route network to support the 2020 ridership forecast could be about 10 years.	
Travel Time Reliability in DSTT. The ridership model did not account for potential travel delays in the DSTT. Due to joint bus and rail operations in the DSTT, passengers sometimes experience slower travel times, especially in the peak periods which may impact ridership. It is expected the DSTT will have rail-only operations by 2021, which will decrease impacts to rail service to and from the DSTT.	2021
Headways. Sound Transit started service with 7.5-minute peak headways instead of the originally planned 6-minute peak headways. Headways are planned to be reduced to 6 minutes with the opening of the University Link extension in 2016.	2016
DSTT Fares. In the DSTT buses are free until 7 p.m., while trains require a fare, resulting in a fare disincentive for Central Link. Sound Transit adopted a fare policy that requires all riders to pay a fare for Central Link, including those riders in the DSTT. Buses in the DSTT, however, are part of the downtown Ride Free Area (RFA). Therefore bus riders do not pay a fare to ride buses in the DSTT until 7 p.m. During project planning it was assumed both buses and trains would be part of the RFA in the DSTT. The RFA is planned to be discontinued in September 2012, and all bus and light rail riders will then be required to pay a fare in the DSTT.	2012

Because Central Link was introduced to the region as an entirely new mode of transit, in combination with the introduction of a new fare payment method and a supporting transit network that is still evolving, riders are still adjusting their travel patterns in the corridor. With these factors together with the economic recession, ridership on Central Link did yet reached a level of full maturity in fall 2011. Because the FFGA prediction for fall 2011 assumed ridership would be fully mature, actual fall 2011 ridership is lower than predicted.

Table 5-2 shows how Central Link's average weekday and annual ridership compares to predictions from project planning milestones. In fall 2011 average weekday ridership was 23,900 compared to the FFGA prediction of 35,200, or about 32% lower than predicted. For all of 2011, Central Link carried 7.8 million passengers compared to the FFGA prediction of 10.7 million, or about 27% lower than predicted. Average weekend and holiday ridership performed better than expected, resulting in a higher annualization factor (annual ridership / average weekday ridership). The annualization factor for 2011 was 330.8 compared to the prediction of 304.6. It should also be noted that Central Link experiences the most ridership during the summer months, due to an increase of airport travelers during the cruise ship / tourist season, and due to events in downtown and at the stadiums.

Table 5-2: Central Link Ridership - Actual vs. Predictions

Milestone	Conclusion of AA	Conclusion of PE	FFGA	Actual	Difference: Actual - FFGA
Scope of System	20 miles NE 45th to S 200th		13.9 miles Downtown to S 154th	15.6 miles Downtown to Airport	1.7 miles S 154th to Airport
Number of Stations	21	18	11	13	+ 2
2020 – annual boardings[3]	-	-	12.9 M	-	-
2011 – average fall weekday boardings	105,000 (2010)	102,600 (2010)	35,200	23,900[4]	- 32%
2011 – annual boardings	32.0 M (2010)	31.3 M (2010)	10.7 M	7.8 M	- 27%
2011 – average weekday boardings	-	-	-	23,600[5]	-
Annualization factor	305	305	304.6	330.8	+ 26.2

The predictions for AA and PE include a 20-mile system extending from the University District to S 200th St connecting high ridership areas including downtown Seattle, Capitol Hill and the University of Washington. The FFGA forecast for fall 2011 included the Initial Segment Project extending from downtown to S 154th St.

Corridor Buses

There was a drop in ridership on corridor buses from 2008 to 2011. This is likely due to a combination of factors:

1. The major economic recession depressed ridership systemwide for Metro about 8% from 2008 to 2010; ridership recovered about 3% from 2010 to 2011.
2. Some riders shifted from buses to light rail.
3. Metro implemented three fare increases of $0.25 in February 2009, January 2010 and January 2011, raising a one- zone peak fare from $1.75 to $2.50 and an off-peak fare from $1.50 to $2.25. Increases of 43% to 50% were much higher than inflation, which was 0.6% in 2009, 0.3% in 2010 and 2.7% in 2011.

Ridership increased by 14% on buses operating in the DSTT. This is likely due to the 14% increase in revenue service hours on DSTT buses from fall 2008 to fall 2011.

Data was collected from Metro's Automatic Passenger Counting (APC) system, which sampled each route throughout the fall 2008 and fall 2011 service periods. In order to calculate annualized ridership, fall 2008 and fall 2011 daily ridership was multiplied by the number of days operated in one year. Tables 5-3 and 5-4 show fall 2008 and fall 2011 ridership on corridor buses and other buses operating in the DSTT. Tables A4-1 and A4-2 in Appendix 4 show daily and annualized bus ridership by route for fall 2008 and fall 2011, respectively.

Ridership information does not include free rides in the RFA of downtown Seattle. In fall 2008 Metro did not report ridership information in the RFA. In fall 2011, Metro did collect ridership information in the RFA, but these rides were estimated and subtracted from the fall 2011 ridership data in order to be consistent with data from fall 2008.

[3] 2020 ridership was used to develop New Starts cost effectiveness ratings.

[4] Average of October, November and December 2011. The average for the entire fall 2011 service period (Oct 1 2011 – Feb 17 2012) was 23,400.

[5] Average for all of 2011, used to calculate actual annualization factor

Table 5-3: Ridership on Corridor Buses

	Before	After	Change
Daily			
Weekdays	84,287	70,807	- 16%
Saturdays	47,628	42,411	- 11%
Sundays	32,503	27,382	- 16%
Annualized			
Weekdays	21.40 M	18.01 M	- 16%
Saturdays	2.48 M	2.21 M	- 11%
Sundays	1.89 M	1.59 M	- 16%
Total	25.76 M	21.81 M	- 15%

Table 5-4: Ridership on Other Buses Operating in DSTT

	Before	After	Change
Daily			
Weekdays	36,411	41,744	+ 15%
Saturdays	17,547	20,635	+ 18%
Sundays	12,208	13,271	+ 9%
Annualized			
Weekdays	9.25 M	10.60 M	+ 15%
Saturdays	0.91 M	1.07 M	+ 18%
Sundays	0.71 M	0.77 M	+ 9%
Total	10.88 M	12.44 M	+ 14%

Rider Characteristics in the Corridor

Sound Transit conducted on-board passenger surveys in fall 2008 and fall 2011 to collect information about passengers and their trips in the project corridor. Surveys were conducted on corridor buses in fall 2008, and on both corridor buses and Central Link in fall 2011. Table 5-5 shows some information collected from these passenger surveys, including demographic information, access mode to transit and fare payment methods.

Table 5-5: Ridership Characteristics

	Before	After			Change
	Total Corridor (Buses)	Corridor Buses	Central Link	Total Corridor	Total Corridor
Median Household Income (2011$)	$36,100	$29,100	$54,800	$33,900	- $2,200
Has Driver License	63%	60%	80%	66%	+ 5%
Number of Household Vehicles	1.5	1.5	1.8	1.5	0
Commute Trips	74%	72%	64%	70%	- 5%
Access Mode at Start of Trip					
Walk	88%	89%	73%	84%	- 5%
Drive or Ride	8%	8%	19%	10%	+25%
Fare Payment[6]					
Pass	52%	55%	56%	55%	+ 6%
Cash / Ticket	33%	34%	25%	32%	- 3%
ORCA E-Purse	-	9%	18%	12%	n/a
Transfer Slip	12%	13%	1%	9%	- 25%

[6] Columns do not add to 100% because multiple responses are allowed for each trip.

Central Link carries a greater share of non-commute passengers than buses, indicating Link passengers are more likely making discretionary trips than bus passengers. Passengers on Central Link had higher household incomes, were more likely to have driver licenses, and they had more vehicles available in the household. This indicates that Central Link attracted more transit riders in the corridor who have a choice on how to travel – riders who may have been more reluctant to take transit before Central Link opened.

For the corridor overall, household incomes went down between 2008 and 2011, most likely due to higher unemployment. More passengers in the corridor had driver licenses in 2011 than in 2008, and there were also slightly more vehicles at home. Therefore, there is evidence that Central Link attracted more "choice" transit riders – people who had a choice of how to travel in the project corridor. It also attracted more non-commute trips in the corridor, such as trips to and from the airport.

Walking remained the most common way to access transit. However automobile access was increased from 8% to 10% from 2008 to 2011, reflecting the new 600 stall park-and-ride lot at Tukwila International Blvd. Station. The majority of passengers used passes to pay for transit trips in the corridor, both before and after Central Link opened for service. Beginning in 2009, passes were loaded onto ORCA cards, the new electronic fare payment method that was introduced in 2009. Another ORCA payment option is "E-Purse", or loading a prepaid balance onto the card similar to a debit card, and the fare is paid by electronically deducting the balance from the card. ORCA card fare payments include a 2-hour transfer credit that allows passengers to transfer between vehicles without paying twice. E-Purse is a more popular payment option for Central Link riders than for bus riders, whereas bus riders are more likely to use cash and transfer slips. These fare payment preferences reflect the different fare payment policies adopted by Sound Transit and Metro.

Corridor Trips

Average weekday ridership data on Central Link and corridor bus routes was acquired from Sound Transit and Metro. This ridership data was used to expand the 2008 and 2011 survey data to the weekday transit rider population in the corridor. Total trips, shown in Table 5-6, were calculated for both unlinked trips and linked trips. Unlinked trips represent all boardings on weekdays in the corridor for both Central Link and buses. Linked trips account for transferring among buses in the corridor and Central Link. If a passenger uses a corridor bus and Central Link in the same trip, for example, that trip is counted as only one trip, not two.

From 2008 to 2011, there was an increase in the number of transit trips in the corridor. After Central Link opened there were 7,200 more linked trips in the corridor on weekdays, in spite of an economic recession and a reduction in transit traveling throughout the region. This indicates that Central Link attracted new transit riders into the corridor.

Table 5-6: Total Trips in the Corridor

	Before	After	Change
Unlinked Trips	73,000	83,300	+ 10,300
Linked Trips	68,500	75,700	+ 7,200

Origins and Destinations

During the surveys in 2008 and 2011, Sound Transit asked passengers where they started their trips, and where they would end their trips. Tables 5-7 and 5-8 show a summary of survey responses.

After Central Link opened for service, a slightly greater share of riders in the corridor began their trips at home, while slightly fewer trips began at work or school. This is consistent with the reduction in commute trips shown in Table 5-5. Riders in the corridor were less likely to end their trips at home after Central Link opened, and more trips were destined for school.

Table 5-7: Origins for Linked Trips in the Corridor

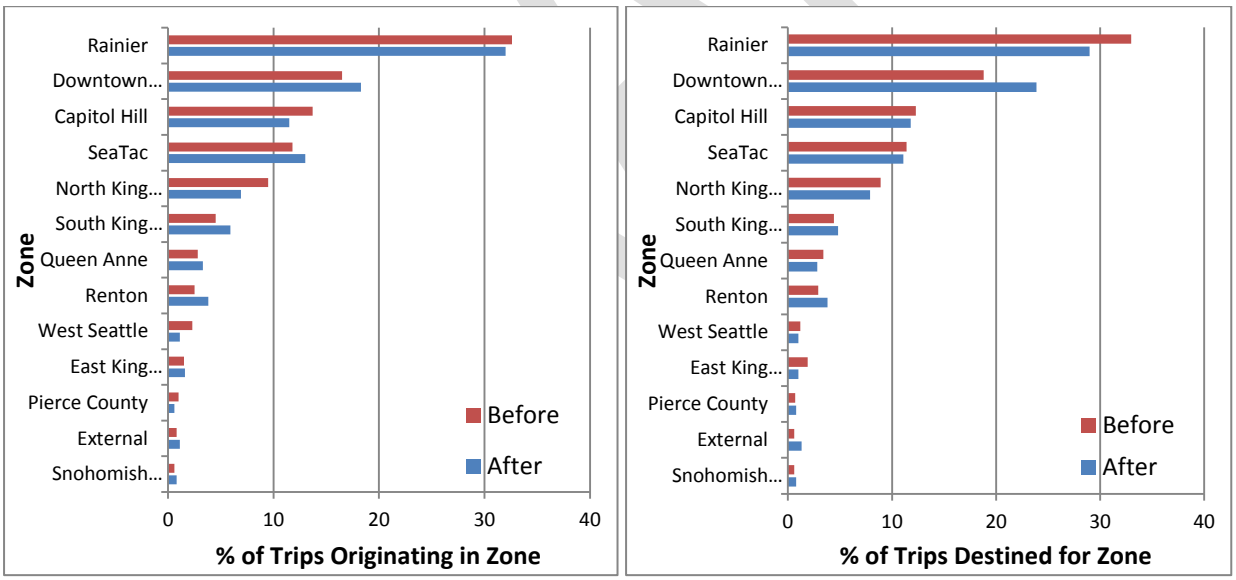
Trip began at:	Before	After	Change
Home	49%	52%	+ 6%
Work	26%	25%	- 4%
School	13%	12%	- 8%
Other	12%	12%	0%

Table 5-8: Destinations for Linked Trips in the Corridor

Trip ended at:	Before	After	Change
Home	40%	32%	- 20%
Work	31%	32%	- 3%
School	11%	15%	+ 36%
Other	19%	21%	+ 11%

Riders were also asked to provide the geographic locations where they started and ended their trips, and these locations were translated into coordinates for analysis. Each trip was assigned to an origin and destination zone based on these coordinates. Figure 5-1 illustrates the zones in which corridor trips started and ended.

Figure 5-1: Origin and Destination Zones for Linked Trips in the Corridor



Travel patterns in the corridor remained similar from 2008 to 2011. The Rainier zone was the most common zone for both origins and destinations in both 2008 and 2011. However, there was a shift in the share of trip destinations from Rainier to downtown Seattle between 2008 and 2011.

Travel patterns in the corridor can also be investigated by looking at origin / destination zone pairs. There are three origin and destination zones served by Central Link stations – downtown Seattle, Rainer and SeaTac. These zone pairs can be used to determine if Central Link impacted travel patterns for trips taken wholly within the

project corridor. Table 5-9 shows the number and share of corridor trips that were traveled within the nine zone pairs covering the downtown Seattle, Rainier and SeaTac zones. Trips to and from other zones are also shown.

Table 5-9: Origin / Destination Zone Pairs for Linked Trips in the Corridor

	Destination →	Downtown Seattle		Rainier		SeaTac		Other Zones		Total	
Origin		#	%	#	%	#	%	#	%	#	%
Downtown Seattle	Before	630	0.9	5,850	8.5	1,690	2.5	3,100	4.5	11,280	16.5
	After	1,940	2.6	6,200	8.2	2,160	2.9	3,530	4.7	13,830	18.3
	Change	+ 1,310		+ 350		+ 470		+ 420		+ 2,550	
Rainier	Before	6,810	9.9	6,460	9.4	900	1.3	8,120	11.8	22,290	32.6
	After	8,240	10.9	7,200	9.5	1,010	1.3	7,780	10.3	24,230	32.0
	Change	+ 1,430		+ 740		+ 110		- 340		+ 1,950	
SeaTac	Before	2,190	3.2	980	1.4	2,420	3.5	2.510	3.7	8.090	11.8
	After	3,140	4.1	1,170	1.5	1,730	2.3	3,800	5.0	9,840	13.0
	Change	+ 960		+ 190		- 690		+ 1,290		+ 1,750	
Other Zones	Before	3,250	4.7	9,280	13.6	2,780	4.1	11,500	16.8	26,810	39.2
	After	4,780	6.3	7,390	9.8	3,510	4.6	12,110	16.0	27,790	36.7
	Change	+ 1,540		- 1,890		+ 730		+ 610		+ 980	
Total	Before	12,880	18.8	22,570	33.0	7,790	11.4	25,230	36.9	68,460	100.0
	After	18,100	23.9	21,970	29.0	8,410	11.1	27,210	35.9	75,690	100.0
	Change	+ 5,230		- 610		+ 630		+ 1,980		+ 7,230	

Travel increased among and within these three zones after Central Link opened, with the exception of travel within the SeaTac zone. Downtown Seattle became a more popular destination from zones within the project area as well as from other zones, reflecting the frequent all-day downtown connection and reliability provided by the introduction of Central Link. There was an increase in travel between downtown and SeaTac, reflecting more airport passengers using Central Link. The reduction in travel within SeaTac could be explained by the economic recession and unemployment which hit King County's southern communities especially hard. Although Central Link contributed more Rainier trips to and from zones within the project area, travel between Rainier and other zones outside the project area was reduced. This could be explained by more riders in the Rainier zone shifting to make trips within in the project area since Central Link provides high levels of service to all station areas.

The increase in trips within downtown Seattle is a result of passengers using Central Link within downtown. Although Central Link is not included in the RFA, buses do provide free rides in the RFA, and those bus passengers were not included in the 2008 or 2011 surveys. These passengers were not included do to the unique nature of the RFA in which riders often take the first available bus and do not pay attention to the route being used. There are over one hundred bus routes traveling through downtown Seattle, most of which do not serve the project corridor beyond downtown Seattle.

Sounder Transfer Rate at King Street Station

As described for Characteristic 3, King Street Station is the terminus in Seattle for all Sounder commuter rail trains. Sounder passengers have many choices for transferring to and from other transit services at King Street Station, including a short walking transfer to Central Link and other buses in the DSTT. Sound Transit conducted a passenger survey in fall 2008 and fall 2011 to determine the transfer activity of Sounder passengers at King Street Station. The results are shown in Table 5-10.

Table 5-10: Sounder Transfer Rate at King Street Station
(includes transfers to and from both buses and Central Link)

	Before	After / Actual	Change	FFGA	Difference: Actual - FFGA
Transfer Rate	50%	50%	0%	86%	- 42%
Number of Transfers in the PM Peak Period	2,220	2,180	- 2%	3,525	- 38%

The transfer rate at King Street Station remained the same from 2008 to 2011. This is mainly because, in both years, there were many transit choices for people to transfer, including buses in the DSTT. The introduction of Central Link did not significantly change the frequency of available transit connections for Sounder passengers working in downtown Seattle. The number of transfers declined slightly between 2008 and 2011 because Sounder ridership decreased by 2% from fall 2008 to fall 2011. The number of PM peak transfers (from both buses and Central Link to Sounder) in 2011 was 38% below the prediction developed at the FFGA milestone, due to the ridership model overpredicting the transfer rate of passengers at King Street Station. Passengers who work within about six blocks (about 1/3 mile) of the station often prefer to walk, due to the reliability of walking.

Farebox Revenues

Light Rail

Table 5.11 shows how actual Central Link fare revenues compare to a prediction from the FFGA milestone. Actual fare revenues are much higher than predicted at the FFGA milestone. This is mainly due to a distance-based fare policy adopted by Sound Transit and the decision to charge fares in the DSTT, resulting in the actual average fare per boarding in 2011 of $1.53. For the revenue prediction at the FFGA milestone, the average fare per boarding for light rail was assumed to be $1.08 in 2011. This resulted in more fare revenue than predicted at the FFGA milestone.

Table 5-11: Annual Farebox Revenues for Central Link

	FFGA (2011$)	Actual (2011$)	Difference
Annual farebox revenue in 2011	$8.52 M	$12.03 M	+ 41%

Corridor Buses

For buses in the corridor, annual farebox revenues were calculated by multiplying the annualized ridership (based on fall 2008 and fall 2011 ridership) for each bus route by the average fare per boarding for Metro and Sound Transit bus services:

	2008 (2008$)	2008 (2011$)	2011 (2011$)
• Metro Bus	$0.84	$0.87	$1.11
• Sound Transit Bus (used in this report for route 550 only, a route that operates in the DSTT)	$1.47	$1.52	$1.90

For Sound Transit bus routes, average fares are higher due to the long distance express bus routes operated by Sound Transit. The annualized revenues for each route were then added together to obtain the revenues for all corridor buses. Tables 5-12 and 5-13 show the corridor bus revenues annualized for both 2008 and 2011. Tables A4-1 and A4-2 in Appendix 4 show annualized bus revenues by route for fall 2008 and fall 2011, respectively.

Table 5-12: Annualized Farebox Revenues for Corridor Buses

	Before (2011$)	After (2011$)	Change
Annualized farebox revenue	$22.42 M	$24.20 M	+ 8%

Table 5-13: Annualized Farebox Revenues for Other Buses Operating in DSTT

	Before (2011$)	After (2011$)	Change
Annualized farebox revenue	$10.60 M	$15.49 M	+ 46%

In spite of a reduction of riders on corridor buses, there was an increase in fare revenues. This is due to fare increases implemented by Metro between 2008 and 2011 which increased the systemwide average fare per boarding on Metro from $0.87 to $1.11 in 2011$. Revenues on buses operating in the DSTT increased due to both ridership increases and fare increases

Endnotes

[a] Washington State Employment Security Department, Nonagricultural Wage and Salary Employment in the Seattle-Bellevue-Everett Metropolitan Division (King and Snohomish Counties), historical data worksheet, obtained March 2012
[b] Washington State Employment Security Department, Resident Civilian Labor Force and Employment in Seattle-Bellevue-Everett MD (King & Snohomish Counties), historical data worksheet, obtained March 2012
[c] United States Department of Labor, Bureau of Labor Statistics, Economy at a Glance, Seattle-Bellevue-Everett, WA; Consumer Price Index - All Urban Consumers; http://www.bls.gov/eag/eag.wa_seattle_msa.htm, obtained March 2012
[d] Northwest Multiple Listing Service, News release and table, October 2002
[e] Seattle Bubble, *NWMLS: Flat is Still the New Up. Trust Us.*; Seattle area real estate summary blog entry; October 5, 2011
[f] Seattle Bubble, *NWMLS: Supply, Demand, and Prices All Sinking Together*, Seattle area real estate summary blog entry; November 3, 2011
[g] Seattle Bubble, *NWMLS: Median Price Still Down Double Digits from 2010*, Seattle area real estate summary blog entry; December 5, 2011
[h] Port of Seattle, Sea-Tac International Airport Traffic and Operations Summary, September 2002
[i] Port of Seattle, Sea-Tac International Airport, *2008 Seattle-Tacoma International Airport Activity Report* , p 1
[j] Port of Seattle, Sea-Tac International Airport 2011 Passenger, Cargo and Operations summary table; obtained March 2012
[k] Washington State Department of Transportation, *2002 Annual Traffic Report*, p 14.
[l] Washington State Department of Transportation, *2011 Annual Traffic Report*, p 71
[m] Texas Transportation Institute *2011 Annual Urban Mobility Report*, Performance Measure Summary – Seattle, WA
[n] Washington State Office of Financial Management , 2002 *Population Trends*, p 1
[o] Washington State Office of Financial Management , 2009 *Population Trends*, p 1
[p] Washington State Office of Financial Management, *2011 Population Trends*, p 1
[q] AAA Washington, *AAA News, Fuel Price Update*, Labor Day 2002
[r] Energy Information Administration, *Weekly Seattle, WA All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon)*, obtained March 2011
[s] Puget Sound Regional Council, *2002 parking Inventory for the Central Puget Sound Region,* January 2003
[t] Puget Sound Regional Council, Puget Sound Trends: Parking Trends in the Central Puget Sound Region, 2006-2010, April 2011
[u] Washington State Economic and Revenue Forecast Council, *Washington Economic and Revenue Forecast*, November 2002, p 28
[v] Washington State Economic and Revenue Forecast Council, *Washington Economic and Revenue Forecast*, February 2012, p 106

Appendix 1 – Summary of Bus Service Changes from King County Council

May 18, 2009 Press Release from King County Council

County Council integrates Metro bus service around new Link light rail system
"Partial retention of Route 42 in the Rainier Valley among service revisions in SE Seattle and SW King County"

Bus riders will be able to take advantage of the new Link light rail system that arrives in July under service changes adopted unanimously today by the Metropolitan King County Council that will feed buses into the new system and improve bus service within neighborhoods and between communities.

"These service changes reflect the input of hundreds of Metro riders," said Council Vice Chair Jane Hague, chair of the Physical Environment Committee. "We are happy to work with Sound Transit to provide the best coverage possible."

The service changes will take place in September 2009 or February 2010. The service changes include new routes, the discontinuation of several bus routes to avoid duplication of transit services, and changes to others. In tandem with Link light rail, the changes provide many new opportunities to use transit for trips in Southeast Seattle and Southwest King County and provide new connections between communities:

Routes	Service change
32, 126, 170	Eliminated to avoid duplication of light rail service between Westlake Station and Tukwila International Boulevard Station.
7 Express	With many riders expected to switch to Link light rail, this service reduced from eight morning northbound trips and nine afternoon southbound trips to five northbound morning trips and five afternoon southbound trips, increasing the productivity of this route.
8	This route now provides service from Seattle Center and Capitol Hill to the intersection of Rainier Avenue S. and Martin Luther King Jr. Way S. It will be extended south to serve local bus stops on Martin Luther King Jr. Way S. down to S. Henderson St.
9 Express	This route will now provide a connection between Rainier Ave. S. and the Rainer Beach Link Station. In February 2010, midday service will be improved to every 30 minutes.
36	Trolley service will be extended to the Othello Link Station, providing frequent connections from Beacon Hill. Trips during evening hours and on Sunday will serve the VA Medical Center from Beacon Ave. S.
39	Service will serve and terminate at the Othello Link Station. The 39 will continue to serve the VA Medical Center main entrance.
42	Metro proposed eliminating this route. The Council adopted a partial retention with hourly service from 8:00 a.m. to 6:00 p.m. between Pioneer Square, the International District and Columbia City.
48	Service will end at the Mount Baker Link Station and Transit Center to improve schedule reliability. Through a "Transit Now" partnership with the City of Seattle, weekday evening service will be improved to every 15 minutes until 10:30 p.m. and weekday midday trips will be added to serve high school students.
60	Additional trips beginning in Feb. 2010 to help relieve standing passenger loads.
106	Will begin serving south Beacon Hill and make stops along Airport Way S., Beacon Ave. S., Carkeek Dr., and S. Henderson St. Service will increase to every 15 minutes northbound in the morning and southbound in the afternoon. This revised routing will provide connections to Rainier Beach Link Station from the Skyway, south Beacon Hill, and Georgetown neighborhoods.

107	Will connect parts of Skyway and Rainer View to the Rainier Beach Link Station. Service will increase every to 15-30 minutes from 3:00 p.m. to 6:00 p.m. This revised routing will provide connections to Rainer Beach Link Station from the Skyway and Rainier View neighborhoods and replace Route 42 coverage.
124 (New Route)	Will replace Route 174 between Tukwila International Boulevard Station and downtown Seattle. This replacement service will provide connection to SODO from downtown Seattle and Tukwila International Blvd. Station.
129 (New Route)	Will replace part of Route 170 with a peak connection between Riverton Heights and the Tukwila International Blvd Station. This new route will provide five morning and five afternoon peak trips instead of three morning and three afternoon trips on the existing Route 170.
140	Revised, more direct routing between Burien, Tukwila/Southcenter and Renton, and east-west connections to the Tukwila International Blvd. Link Station.
156	Will replace portions of Route 140 and 170 and connect McMicken Heights with the SeaTac/Airport Link Station and Southcenter. This route will provide new service seven days a week along South 176th Street in SeaTac.
174	Route 174 will continue to operate between Tukwila International Blvd. Station and Federal Way and peak service frequency will be improved to 15-minutes compared to the current 20-30 minutes. Revised routing will provide connection to the Tukwila International Blvd. Station and the SeaTac/Airport Link Station from Federal Way and the SR 99 South corridor.
191	Will be eliminated. Replacement service in September 2009-June 2010 will be on Route 174 connecting with Link.
194	To be eliminated in February, 2010, to avoid duplication of light rail service between downtown Seattle and SeaTac / Airport station when Link opens in Dec. 2009. Service between Federal Way and downtown Seattle will be replaced by direct Sound Transit Regional Express service saving riders 10 to 15 minutes.

Testimony heard at a joint meeting of the Council's Physical Environment Committee and Budget and Fiscal Management Committee on April 28 played a key role in the partial retention of some Route 42 service, which Metro proposed to eliminate because its route duplicates light rail service through the Rainier Valley. Concerns raised by the Asian American community about the loss of direct service into the International District led Councilmembers Larry Gossett, Dow Constantine and Larry Phillips to propose an amendment adopted by the Council to retain the portion of Route 42 that runs from the International District to the Columbia City Light Rail Station. Service will operate hourly from 8:00 a.m. to 6:00 p.m.

"After hearing the concerns of the community, I worked with Metro and my colleagues to find a solution to the proposed elimination of route 42," said Councilmember Gossett, who represents the Rainier Valley and was prime sponsor of the amendment. "While the new route does not address all of the issues raised, I hope it will allow members of the community to retain some of the transportation services they have come to depend on."

"In an effort to address the concerns by Asian Counseling and Referral Services and many neighborhood residents, I worked with Councilmember Gossett to find hours to partially restore the Route 42 by deferring some needed improvements to the Route 60 in our districts," said amendment co-sponsor Constantine, whose district includes the International District. "We will continue to monitor this route and ask Metro to provide direct counseling to educate riders on their options."

"These bus service changes are a bonus on top of the increased speed and reliability residents will gain with light rail, combining to create a better transit network with more options than ever before," said Councilmember Phillips, co-sponsor of the amendment. "We balanced these changes with sensitivity towards our most vulnerable riders—the elderly, disabled, and non-English speaking—by retaining existing bus connections on which they rely."

The extension of light rail to Sea-Tac Airport in December will also impact Metro's service along the Tukwila-SeaTac-Federal Way corridor. Duplicate service along Route 194 to SeaTac Airport will be eliminated in February

2010. Route 174, one of Metro's longest routes, will be split; new Route 124 will run from downtown Seattle to Tukwila International Boulevard Station, and Route 174 will run from Tukwila International Boulevard Station to Federal Way with more service along the southern portion of the route.

"The Metro service changes include the implementation of our new Rapid Ride bus lines, which result in the most frequent bus service in south King County in history," said Councilmember Julia Patterson, who represents the cities of Tukwila and SeaTac. "Riders from Tukwila to Federal Way will have access to buses that run along Highway 99 every 15 minutes.

"Sound Transit and King County Metro are working together to make this a positive change, so riders have a user-friendly and efficient service," said Councilmember Pete von Reichbauer.

The service changes are based on six months of community outreach conducted by Metro. Metro revised its initial proposals based on rider comments from open house meetings and surveys, and made a major effort to reach out to riders with limited English proficiency. Two community advisory groups worked with the agency over the six-month period to help Metro evaluate all public input. Metro also worked closely with Sound Transit to coordinate changes to service in the I-5 South Corridor between Federal Way and downtown Seattle and in the City of SeaTac.

Appendix 2 – Summary of Bus Service Changes Compared to Prediction at FFGA Milestone

Table A2-1: Bus Service Changes Compared to Prediction at FFGA Milestone

Route	FFGA Prediction	Actual	Notes
Deleted Routes			
7E	Deleted	Not Deleted	express between Rainier Beach and downtown Seattle was predicted to be discontinued; service was reduced to five trips in the AM and PM, and then reduced again to four trips on the AM and PM
9	Deleted	Modified	express between Rainier Beach and Capitol Hill was predicted to be discontinued; was modified and rerouted to terminate at Rainier Beach Station instead of Seward Park Ave S / S Henderson St
39E	Deleted	Not Deleted	express between Rainier Beach and downtown Seattle via Seward park was predicted to be discontinued; currently operating as route 34
42	Deleted	Modified	local service between Rainier View and downtown Seattle was predicted to be discontinued; coverage and service levels were reduced; now provides service between Columbia City Station and Pioneer Square
42E	Deleted	Deleted	discontinued
32	No Change	Deleted	express between Rainier Beach and downtown Seattle via Beacon Hill was discontinued; coverage in south Beacon Hill was replaced by modified route 106
170	Modified	Deleted	limited peak period service between Riverton Heights (City of SeaTac) and downtown Seattle replaced by new route 129 with connection to downtown via Link at Tukwila Int'l Blvd Station; provides limited peak period service only
174	No Change	Deleted	local service between Federal Way and downtown Seattle was split into routes 174 and 124, connecting at Tukwila Int'l Blvd Station; route 174 was then replaced by RapidRide A Line
191	No Change	Deleted	park and ride service between Redondo Heights P&R and downtown Seattle; replaced by route 174 (and then A Line) connecting to Link at SeaTac/Airport Station
194	No Change	Deleted	express between Federal Way and downtown Seattle via Sea-Tac airport was replaced by Link extension to SeaTac/Airport Station; service between Federal Way and airport replaced by additional services on Sound Transit Express routes 574; service between Federal Way and downtown Seattle replaced by additional services on ST Express routes 577/578
New Routes			
34	New	Not implemented	would have provided neighborhood connection from Prentice St to Rainier Beach Station. (Note - The existing route 34 is a replacement for the old route 39 Express and is not related to the concept of this predicted new route.)
47	New	Not implemented	would have provided a connection from Skyway to Link via Renton Ave, S Bangor St, 51st Ave S; similar coverage provided by modified route 106 and modified route 107
49	New	Not implemented	would have provided service between Rainier Beach and downtown Seattle via west Beacon Hill and SODO; similar coverage provided by modified route 106 and route 60 (note - The current route 49 operates as the former northern part of route 7 between downtown Seattle and the University District via Capitol Hill, and is not related to the concept of this predicted new route.)
126	New	Deleted	service between Tukwila and Rainier Beach; was implemented years prior to the opening of Link, but then was discontinued in Feb 2010; connection between Tukwila and Rainier Beach replaced by Link
161 (180)	New	New	service between Auburn and Burien via Kent and Sea-Tac airport was implemented in 2006
184	New	Not implemented	service between Star Lake and Tukwila Int'l Blvd Station via Des Moines and McMicken Heights
199 (A Line)	New	New	BRT service between Federal Way and Southcenter via Pacific Hwy/International Blvd; service provided by RapidRide A Line between Federal Way TC - Tukwila Int'l Blvd Station; modified route 140 serves Tukwila Int'l Blvd Station - Southcenter; route 140 is planned to be converted to RapidRide F Line in 2013
124	n/a	New	replacement for northern portion of discontinued route 174 between Tukwila Int'l Blvd Station and downtown Seattle
129	n/a	New	replacement for discontinued route 170; provides connection between Riverton Heights (City of SeaTac) and downtown Seattle via Tukwila Int'l Blvd

Route	FFGA Prediction	Actual	Notes
			Station with limited peak only service
156	n/a	New	replaced coverage from modified 140 between Southcenter and airport, and replaced coverage for southern portion of discontinued route 170 in McMicken Heights; connects to SeaTac/Airport Station
Modified Routes			
7	Modified	Not modified	was predicted to be modified to provide service between downtown Seattle and Rainier Beach Station, via Rainier Ave S and S Henderson St., terminating at Rainier Beach Station
8	Modified	Modified but not as predicted	was predicted to be modified to be terminated at Mount Baker Station, providing service between Seattle Center and Mount Baker Station via Capital Hill; was actually modified to be extended along MLK Jr. Way S, providing service between Seattle Center and Rainier Beach via Capitol Hill and MLK; replacement for local service from modified route 48
9	Deleted	Modified	express between Rainier Beach and Capitol Hill; was rerouted to terminate at Rainier Beach Station instead of Seward Park Ave S / S Henderson St
14	Modified	Modified but not as predicted	was predicted to be modified to terminate at Mount Baker Station, providing service between downtown Seattle and Mount Baker Station via Mount Baker; was actually modified and rerouted to connect to Mount Baker Station, but was not terminated there (service to S Hanford St was left in place)
27	Modified	Not Modified	was predicted to be rerouted and extended to terminate at Mount Baker Station
36	Modified	Modified but not as predicted	was predicted to be rerouted to Othello Station, providing service between downtown Seattle and Rainier Beach via Beacon Hill, Othello St and Rainier Ave; was actually modified to terminate at Othello Station, providing service between downtown Seattle and Othello Station via Beacon Hill.
38	Modified	Modified but not as predicted	was predicted to provide service between SODO and Rainier Valley with an extension to serve Columbia City, Seward Park and terminate at Othello Station; was actually modified to provide service between Beacon Hill Station and Mount Baker Station via S McLellan St
39	Modified	Modified but not as predicted	was predicted to provide service between SODO Station and Columbia City Station via VA Medical Center; was actually modified to terminate at Othello Station, providing service between downtown Seattle and Othello Station via VA Medical Center and Seward Park
42	Deleted	Modified	coverage and service levels were reduced; now provides service between Columbia City Station and Pioneer Square
106	Modified	Modified but not as predicted	was predicted to provide service between Renton and Othello Station via Skyway and Rainier Beach Station; was actually modified to serve south Beacon Hill, providing service between Renton and downtown Seattle via Rainier Beach Station and south Beacon Hill; replacement for service from discontinued route 32 and modified route 36
107	Modified	Modified but not as predicted	was predicted to provide service between Renton and Othello Station via West Hill, Rainier Ave and Rainier Beach Station; was actually modified to provide service between Renton and Rainier Beach Station via Rainier View; replacement for deleted portion of modified route 42 in Rainier View
170	Modified	Deleted	was predicted to provide all-day service between Riverton Heights and Star Lake via McMicken Heights and Tukwila Int'l Blvd Station; was actually deleted, and coverage in Riverton Heights was replaced by new limited peak-only route 129 with connection at Tukwila Int'l Blvd Station; McMicken Heights, Des Moines and Federal Way are covered all day by new routes 156, route 180 and A Line connecting to SeaTac/Airport Station.
48S	No Change	Modified	was modified to delete service between Mount Baker Station and Rainier Beach; service replaced by modified route 8
128	No Change	Modified	was rerouted to connect to Tukwila Int'l Blvd Station
140	No Change	Modified	was rerouted to connect to Tukwila Int'l Blvd Station and discontinue serving the airport
180	No Change	Modified	was rerouted to discontinue serving the airport terminal building to instead serve SeaTac/Airport Station

Appendix 3 – Bus Routes in the Before & After Study

Table A3-1: Bus Routes in the Before & After Study

Route	2008	2011	Corridor	SODO Busway[7]	DSTT
7	X	X	X		
7 Express	X	X	X		
8	X	X	X		
9	X	X	X		
14S	X	X	X		
27	X	X	X		
32	X	-	X		
34	X	X	X		
36	X	X	X		
38	X	X	X	2008 only	
39	X	X	X	X	
42	X	X	X		
42 Express	X	-	X		
48S	X	X	X		
101	X	X	X	X	X
106	X	X	X	X	X
121	X	X	X		
122	X	X	X		
123	X	X	X		
124	-	X	X		
131	X	X	X		
132	X	X	X		
134	X	X	X		
150	X	X	X	X	
170	X	-	X	X	
174	X	-	X	X	X
177	X	X	X	X	
190	X	X	X	X	
194	X	-	X	X	X
196	X	X	X	X	
A Line	-	X	X		
41	X	X			X
71	X	X			X
71 Express	X	X			X
72	X	X			X
72 Express	X	X			X
73	X	X			X
73 Express	X	X			X
74 Express	X	X			X
76	-	X			X
77	-	X			X
212	X	X			X
216	-	X			X
217	X	X			X
218	-	X			X
225	X	-			X
229	X	-			X
255	X	X			X
256	X	-			X
301	X	X			X
316	-	X			X
550	X	X			X

[7] Buses that operate in the SODO Busway are considered to operate in the project corridor because there are two Central Link stations adjacent to the SODO Busway. Passengers taking inbound trips from the SODO Busway can choose to take a bus or light rail. Similarly, passengers taking outbound trips with a destination along the SODO Busway can choose to take a bus or light rail. However, several of these bus routes do not operate in the project corridor beyond the SODO Busway. For these routes, passenger surveys were conducted only along the SODO Busway for passengers boarding inbound buses, and for passengers alighting outbound buses. These routes include 101, 150, 177, 190 and 196.

Appendix 4 – Bus Service Levels, Ridership and Revenues

Table A4-1: Fall 2008 Bus Service Levels, Ridership and Revenues

Fall 2008	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2008$)	Annualized Revenues (2011$)
Corridor Buses	M-F	7	192	48,308	11,345	2,871,273	$2,411,869	$2,498,697
		8	51	12,916	3,441	877,455	$737,062	$763,596
		9	26	6,488	1,816	448,552	$376,784	$390,348
		14S	47	11,959	3,288	836,048	$702,280	$727,562
		27	27	6,983	1,407	358,885	$301,464	$312,316
		32	7	1,787	394	97,318	$81,747	$84,690
		34	6	1,494	261	64,467	$54,152	$56,102
		36	144	36,747	9,720	2,477,104	$2,080,767	$2,155,675
		38	11	2,877	392	99,960	$83,966	$86,989
		39	45	11,552	1,831	464,487	$390,169	$404,215
		42	67	16,955	3,772	956,008	$803,047	$831,956
		48S	103	26,147	9,122	2,306,285	$1,937,279	$2,007,021
		101	83	21,128	5,037	1,280,515	$1,075,633	$1,114,355
		106	69	17,514	4,407	1,123,785	$943,979	$977,963
		121	27	6,877	1,187	302,685	$254,255	$263,409
		122	13	3,349	675	172,125	$144,585	$149,790
		123	9	2,323	293	73,851	$62,035	$64,268
		131	45	11,505	1,560	397,800	$334,152	$346,181
		132	62	15,827	2,391	609,705	$512,152	$530,590
		134	11	2,763	349	88,739	$74,541	$77,224
		150	127	32,287	5,652	1,436,868	$1,206,969	$1,250,420
		170	5	1,346	160	39,520	$33,197	$34,392
		174	146	37,297	8,806	2,244,554	$1,885,425	$1,953,301
		177	29	7,395	1,231	309,585	$260,051	$269,413
		190	11	2,694	390	98,314	$82,584	$85,557
		194	98	24,840	4,854	1,235,674	$1,037,966	$1,075,333
		196	17	4,129	505	124,839	$104,865	$108,640
Total M-F			**1,480**	**375,486**	**84,287**	**21,396,402**	**$17,972,977**	**$18,620,005**

Fall 2008	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2008$)	Annualized Revenues (2011$)
	Sat	7	127	6,578	8,147	423,662	$355,876	$368,687
		8	19	1,001	1,448	75,313	$63,263	$65,540
		14S	32	1,648	2,315	120,380	$101,119	$104,759
		27	25	1,295	817	42,484	$35,687	$36,971
		36	91	4,724	5,693	296,060	$248,690	$257,643
		38	10	541	229	11,908	$10,003	$10,363
		39	34	1,742	876	45,552	$38,264	$39,641
		42	49	2,570	2,525	131,300	$110,292	$114,263
		48S	72	3,744	4,051	210,652	$176,948	$183,318
		101	47	2,428	2,091	108,743	$91,344	$94,632
		106	61	3,182	2,843	147,836	$124,182	$128,653
		131	43	2,257	1,575	81,900	$68,796	$71,273
		132	44	2,272	1,455	75,660	$63,554	$65,842
		150	119	6,172	3,997	207,844	$174,589	$180,874
		174	116	6,013	6,240	324,480	$272,563	$282,375
		194	68	3,533	3,325	172,900	$145,236	$150,464
	Total Sat		**956**	**49,700**	**47,628**	**2,476,673**	**$2,080,406**	**$2,155,300**
	Sun / Hol	7	90	5,219	4,807	278,786	$234,180	$242,611
		8	16	911	1,075	62,350	$52,374	$54,259
		14S	29	1,710	1,697	98,426	$82,678	$85,654
		27	14	815	387	22,474	$18,878	$19,558
		36	80	4,655	4,301	249,458	$209,545	$217,088
		38	10	580	162	9,396	$7,893	$8,177
		39	11	665	239	13,862	$11,644	$12,063
		42	48	2,800	2,165	125,570	$105,479	$109,276
		48S	32	1,860	1,864	108,112	$90,814	$94,083
		101	34	1,960	1,342	77,836	$65,382	$67,736
		106	51	2,985	2,102	121,916	$102,409	$106,096
		131	41	2,369	1,100	63,800	$53,592	$55,521
		132	42	2,459	1,095	63,510	$53,348	$55,269
		150	60	3,466	2,166	125,628	$105,528	$109,327

Fall 2008	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2008$)	Annualized Revenues (2011$)
		174	108	6,284	5,348	310,184	$260,555	$269,935
		194	57	3,321	2,653	153,874	$129,254	$133,907
	Total Su/H		**725**	**42,060**	**32,503**	**1,885,182**	**$1,583,553**	**$1,640,561**
Total Corridor Buses			**3,161**	**467,245**	**164,418**	**25,758,257**	**$21,636,936**	**$22,415,865**
Other DSTT Buses	M-F	41	120	30,331	7,952	2,011,733	$1,689,856	$1,750,690
		71	64	16,397	3,976	1,013,880	$851,659	$882,319
		72	57	14,629	4,142	1,056,210	$887,216	$919,156
		73	71	17,982	4,994	1,273,470	$1,069,715	$1,108,225
		74	12	3,069	1,063	271,065	$227,695	$235,892
		212	18	4,511	1,766	443,226	$372,310	$385,713
		217	5	1,326	214	52,858	$44,401	$45,999
		225	5	1,326	312	79,560	$66,830	$69,236
		229	7	1,675	481	122,655	$103,030	$106,739
		255	88	22,506	3,643	925,429	$777,360	$805,345
		256	9	2,174	276	68,172	$57,264	$59,326
		301	28	7,106	1,595	406,725	$341,649	$353,948
		550	99	25,313	5,997	1,529,235	$2,247,975	$2,328,903
	Total M-F		**583**	**148,342**	**36,411**	**9,254,218**	**$8,736,961**	**$9,051,492**
	Sat	41	87	4,513	3,962	206,024	$173,060	$179,290
		71	66	3,408	3,151	163,852	$137,636	$142,591
		72	55	2,865	3,181	165,412	$138,946	$143,948
		73	56	2,913	3,210	166,920	$140,213	$145,260
		255	62	3,221	1,870	97,240	$81,682	$84,622
		550	47	2,457	2,173	112,973	$166,070	$172,048
	Total Sat		**373**	**19,376**	**17,547**	**912,421**	**$837,606**	**$867,760**
	Sun / Hol	41	49	2,866	2,272	131,776	$110,692	$114,677
		71	65	3,784	3,139	182,062	$152,932	$158,438
		72	35	2,010	1,984	115,072	$96,660	$100,140
		73	34	1,967	1,861	107,938	$90,668	$93,932
		255	58	3,371	1,308	75,864	$63,726	$66,020

Fall 2008	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2008$)	Annualized Revenues (2011$)
		550	46	2,675	1,644	95,346	$140,159	$145,204
	Total Su/H		**287**	**16,672**	**12,208**	**708,058**	**$654,837**	**$678,411**
Total Other DSTT Buses			**1,243**	**184,391**	**66,165**	**10,874,697**	**$10,229,404**	**$10,597,662**

Table A4-2: Fall 2011 Bus Service Levels, Ridership and Revenues

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011$)
Corridor Buses	M-F	7	201	51,030	9,905	2,521,942	$2,799,356
		8	158	40,265	8,003	2,040,817	$2,265,307
		9	41	10,266	2,523	628,247	$697,354
		14S	53	13,484	1,735	440,381	$488,823
		27	24	6,175	1,084	276,324	$306,720
		34	4	1,099	162	39,898	$44,286
		36	149	37,916	7,991	2,031,601	$2,255,077
		38	5	1,235	101	25,004	$27,754
		39	42	10,588	916	233,130	$258,774
		42	6	1,428	63	16,139	$17,914
		48S	91	23,134	5,992	1,526,637	$1,694,567
		101	72	18,411	4,017	1,022,223	$1,134,667
		102	16	4,073	726	183,786	$204,002
		106	100	25,538	4,125	1,051,781	$1,167,477
		121	31	7,875	927	236,359	$262,359
		122	15	3,727	458	116,739	$129,580
		123	9	2,145	190	47,758	$53,011
		124	72	18,403	3,268	833,463	$925,144
		131	49	12,555	1,038	264,591	$293,696
		132	66	16,766	1,805	460,220	$510,844
		134	10	2,424	188	47,360	$52,570
		150	139	35,345	5,723	1,458,212	$1,618,616
		177	25	6,276	982	247,417	$274,633
		190	9	2,357	342	85,881	$95,328
		196	11	2,750	307	75,805	$84,143

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011$)
		A Line	128	32,627	8,238	2,100,763	$2,331,847
	Total M-F		**1,525**	**387,895**	**70,807**	**18,012,477**	**$19,993,849**
	SAT	7	136	7,050	7,440	386,869	$429,425
		8	114	5,945	5,213	271,093	$300,913
		14S	34	1,781	1,294	67,303	$74,707
		27	21	1,093	492	25,586	$28,400
		36	116	6,019	5,275	274,292	$304,464
		38	5	260	57	2,956	$3,281
		39	22	1,130	340	17,681	$19,626
		48S	60	3,137	2,510	130,502	$144,857
		101	41	2,149	2,249	116,931	$129,794
		106	67	3,476	2,385	124,026	$137,669
		124	54	2,791	1,986	103,257	$114,615
		131	44	2,286	995	51,752	$57,444
		132	44	2,272	1,175	61,120	$67,844
		150	110	5,718	4,870	253,218	$281,072
		A Line	106	5,528	6,130	318,779	$353,845
	Total Sat		**974**	**50,635**	**42,411**	**2,205,366**	**$2,447,956**
	Sun / Hol	7	110	6,401	4,229	245,286	$272,267
		8	66	3,845	3,075	178,320	$197,935
		14S	32	1,840	819	47,490	$52,713
		27	19	1,079	353	20,494	$22,748
		36	86	4,974	3,519	204,118	$226,571
		39	21	1,231	259	15,014	$16,666
		48S	32	1,866	1,374	79,688	$88,454
		101	31	1,787	1,455	84,373	$93,654
		106	58	3,346	1,707	98,995	$109,885
		124	50	2,871	1,680	97,458	$108,179
		131	44	2,529	687	39,832	$44,214
		132	42	2,464	847	49,126	$54,530
		150	57	3,293	2,584	149,888	$166,376

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011$)
		A Line	103	5,981	4,794	278,042	$308,627
	Total Su/H		**750**	**43,506**	**27,382**	**1,588,124**	**$1,762,818**
Total Corridor Buses			**3,249**	**482,036**	**140,599**	**21,805,967**	**$24,204,623**
Other DSTT Buses	M-F	41	114	28,951	8,067	2,047,871	$2,273,137
		71	65	16,469	3,894	992,847	$1,102,060
		72	60	15,211	3,806	970,641	$1,077,412
		73	71	18,211	4,605	1,174,374	$1,303,555
		74	13	3,290	951	242,589	$269,274
		76	12	2,931	835	206,170	$228,849
		77	13	3,088	700	172,889	$191,906
		212	23	5,870	1,950	489,760	$543,633
		216	14	3,564	598	150,814	$167,404
		217	5	1,258	197	50,191	$55,712
		218	16	3,989	1,677	422,895	$469,413
		255	150	38,082	5,260	1,339,076	$1,486,374
		301	26	6,626	1,312	334,438	$371,226
		316	11	2,836	743	183,512	$203,699
		550	103	26,295	7,150	1,823,332	$3,464,330
	Total M-F		**695**	**176,669**	**41,744**	**10,601,399**	**$13,207,985**
	Sat	41	81	4,218	4,586	238,493	$264,727
		71	57	2,975	3,533	183,718	$203,927
		72	48	2,500	3,242	168,595	$187,140
		73	50	2,603	3,368	175,114	$194,377
		255	60	3,132	2,195	114,160	$126,717
		550	68	3,545	3,710	192,930	$366,567
	Total Sat		**365**	**18,974**	**20,635**	**1,073,010**	**$1,343,456**
	Sun / Hol	41	44	2,541	3,134	181,747	$201,739
		71	52	3,027	2,983	173,022	$192,054
		72	32	1,834	2,093	121,394	$134,747
		73	32	1,833	1,949	113,072	$125,510

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011$)
		255	55	3,207	1,213	70,333	$78,070
		550	37	2,133	1,899	110,169	$209,322
	Total Su/H		**251**	**14,575**	**13,271**	**769,737**	**$941,442**
Total Other DSTT Buses			**1,311**	**210,219**	**75,650**	**12,444,146**	**$15,492,882**

Appendix 5 – PM Peak Bus Speed

Table A5-1: Fall 2008 PM Peak Bus Speed

Fall 2008	Route (local & express)	Annualized Revenue Miles (PM Peak)	Annualized Revenue Hours (PM Peak)	Revenue Speed MPH (PM Peak)
Inbound	7	32,933.3	3,425.5	9.6
	8	15,134.3	1,602.3	9.4
	9	9,867.7	864.5	11.4
	14S	10,291.9	1,117.3	9.2
	27	5,214.8	505.8	10.3
	36	40,509.8	3,672.8	11.0
	38	3,531.8	272.0	13.0
	39	16,998.3	1,262.3	13.5
	41	34,501.5	2,252.5	15.3
	42	11,436.8	998.8	11.5
	48S	33,793.5	2,863.1	11.8
	71	13,323.8	1,100.8	12.1
	72	13,846.5	1,113.5	12.4
	73	23,434.5	1,921.0	12.2
	101	29,980.4	1,445.0	20.7
	106	17,459.9	1,185.8	14.7
	121	14,445.8	624.8	23.1
	131	16,164.5	1,075.3	15.0
	132	22,210.5	1,551.3	14.3
	150	50,642.0	2,707.2	18.7
	174	49,092.6	3,383.0	14.5
	194	65,895.2	2,617.3	25.2
	212	8,682.8	493.0	17.6
	255	26,010.0	1,504.5	17.3
	256	14,829.9	938.6	15.8
	301	7,491.9	391.0	19.2
	550	34,310.3	1,921.0	17.9
Total Inbound		**622,033.6**	**42,809.6**	**14.5**
Outbound	7	63,959.1	6,629.2	9.6
	8	12,362.4	1,292.0	9.6
	9	13,234.3	1,132.1	11.7
	14S	12,654.1	1,532.3	8.3
	27	10,085.3	1,126.3	9.0
	32	9,277.3	798.6	11.6
	34	9,554.0	815.1	11.7
	36	45,941.2	4,739.8	9.7
	38	3,503.7	306.0	11.5
	39	15,912.0	1,253.8	12.7
	41	85,861.8	4,716.0	18.2
	42	29,866.3	2,495.1	12.0
	48S	37,361.4	3,245.3	11.5
	71	15,269.4	1,198.5	12.7

Fall 2008	Route (local & express)	Annualized Revenue Miles (PM Peak)	Annualized Revenue Hours (PM Peak)	Revenue Speed MPH (PM Peak)
	72	15,957.9	1,219.8	13.1
	73	17,365.5	1,279.3	13.6
	74	16,190.0	1,215.5	13.3
	101	88,513.9	4,692.2	18.9
	106	31,729.7	2,210.0	14.4
	121	38,663.1	2,006.0	19.3
	122	20,869.2	1,173.0	17.8
	123	19,401.2	1,233.8	15.7
	131	6,992.1	527.0	13.3
	132	18,168.8	1,241.0	14.6
	134	10,075.1	760.8	13.2
	150	55,380.6	2,916.3	19.0
	170	12,011.6	757.5	15.9
	174	54,916.8	3,897.3	14.1
	177	83,577.1	3,097.7	27.0
	190	31,657.7	1,341.2	23.6
	194	44,298.6	1,780.8	24.9
	196	50,052.1	2,008.9	24.9
	212	33,654.1	1,154.6	29.1
	217	4,243.5	251.1	16.9
	225	14,305.5	675.8	21.2
	229	13,532.9	650.3	20.8
	255	62,773.2	3,639.0	17.3
	301	46,246.8	2,171.8	21.3
	550	65,935.4	3,217.3	20.5
Total Outbound		**1,221,354.2**	**76,397.4**	**16.0**

Table A5-2 Fall 2011 PM Peak Bus Speed

Fall 2011	Route (local & express)	Annualized Revenue Miles (PM Peak)	Annualized Revenue Hours (PM Peak)	Revenue Speed MPH (PM Peak)
Inbound	7	32,936.6	3,922.8	8.4
	8	38,627.3	4,135.3	9.3
	9	12,663.9	1,142.3	11.1
	14S	10,143.7	1,277.8	11.2
	27	4,175.8	403.8	10.3
	36	39,864.6	3,469.8	12.4
	38	726.7	86.5	8.4
	39	12,736.0	988.1	12.9
	41	34,489.3	2,341.8	14.7
	42	2,362.3	187.0	12.6
	48S	29,788.7	2,825.3	10.5
	71	13,324.9	1,164.5	11.4
	72	13,848.4	1,207.0	11.5
	73	23,430.9	1,967.8	11.8
	101	29,843.9	1,672.2	17.8
	106	18,855.5	1,555.5	12.1
	121	11,368.4	548.3	20.6

Fall 2011	Route (local & express)	Annualized Revenue Miles (PM Peak)	Annualized Revenue Hours (PM Peak)	Revenue Speed MPH (PM Peak)
	124	22,860.5	1,653.3	13.8
	131	18,259.2	1,143.3	16.0
	132	22,174.7	1,649.0	13.4
	150	51,055.9	2,996.3	17.0
	212	8,737.9	425.0	20.6
	255	61,425.5	3,508.4	17.5
	301	7,513.8	399.5	18.8
	A Line	51,875.3	3,472.3	14.9
Total Inbound		**573,089.5**	**44,142.3**	**13.8**
Outbound	7	48,534.4	5,462.3	9.4
	8	33,318.7	3,625.3	9.2
	9	16,736.5	1,501.8	11.1
	14S	14,713.6	2,185.0	6.7
	27	8,787.3	964.8	9.0
	34	7,077.8	638.1	11.1
	36	49,162.9	5,151.0	9.7
	38	719.6	98.8	7.3
	39	15,442.4	1,272.5	12.1
	41	86,610.3	5,107.8	16.6
	42	2,158.8	170.0	12.7
	48S	27,175.8	2,876.2	9.4
	71	15,276.2	1,377.0	11.1
	72	15,960.6	1,334.5	12.0
	73	17,369.7	1,300.5	13.4
	74	16,187.9	1,326.0	12.2
	76	17,598.9	1,346.2	13.0
	77	20,470.6	1,375.0	14.6
	101	51,822.3	3,058.6	16.9
	102	40,302.3	2,127.1	18.9
	106	45,490.9	3,599.8	12.5
	121	48,788.6	2,932.5	16.5
	122	20,847.4	1,304.8	16.0
	123	19,558.0	1,233.8	15.9
	124	23,829.4	1,746.8	13.7
	131	9,099.6	620.5	14.7
	132	23,938.6	1,734.0	14.7
	134	13,216.2	887.0	14.9
	150	61,659.5	3,646.1	18.0
	177	71,675.1	2,482.8	28.9
	190	26,307.5	1,103.4	23.8
	196	31,280.5	1,136.2	27.5
	212	50,469.6	1,807.2	27.9
	216	36,279.6	1,532.3	23.7
	217	8,875.8	433.5	20.5
	218	57,564.8	1,619.2	35.6
	255	87,180.1	5,133.8	17.2

Fall 2011	Route (local & express)	Annualized Revenue Miles (PM Peak)	Annualized Revenue Hours (PM Peak)	Revenue Speed MPH (PM Peak)
	301	47,441.4	2,401.3	20.0
	316	18,483.4	1,251.5	14.6
	A Line	53,669.3	3,557.3	15.0
Total Outbound		**1,261,082.0**	**82,461.6**	**15.6**

Appendix 6 – Bus Operation & Maintenance Costs

Table A6-1: Bus Cost per Platform Hour by Bus Type

Bus Type	Bus Description	2008 Cost per Platform Hour (2008$)	2008 Cost per Platform Hour (2011$)	2011 Cost per Platform Hour (2011$)
11	30 foot diesel	$115.46	$119.62	$123.66
23	60 foot diesel	$136.01	$140.91	$145.05
26	60 foot low-floor hybrid electric / diesel	$127.58	$132.17	$140.50
28	60 foot low-floor diesel	$136.01	$140.91	$145.05
31	40 foot diesel	$117.80	$122.04	-
32	40 foot diesel	$117.80	$122.04	$126.08
36	40 foot low-floor diesel	$117.80	$122.04	$126.08
41	40 foot electric trolley	$120.80	$125.15	$123.69
42	60 foot electric trolley	$132.50	$137.27	$138.82
60	60 foot low-floor hybrid electric / diesel	-	-	$140.55
68	60 foot low-floor hybrid electric / diesel	$127.58	$132.17	$140.55
70	40 foot low-floor hybrid electric / diesel	-	-	$126.08
96	60 foot low-floor hybrid electric / diesel - Sound Transit (contract rate per platform hour for operation by King County Metro)	$115.90	$120.07	$124.83

Table A6-2: Fall 2008 Bus Platform Hours by Route and Bus Type

Fall 2008	Route (local & express)	Annualized Platform Hours by Bus Type											Total
		11	23	26	28	31	32	36	41	42	68	96	
Corridor Buses	7		4,695	1,281			942	469	620	75,317			83,325
	8		3,681		871		727	19,406					24,684
	9		6,035				1,873	2,581					10,489
	14S								21,152				21,152
	27							15,399					15,399
	32		515				1,354	848					2,717
	34		1,169				1,177	531					2,878
	36		28,979	1,449		281	6,194	5,636	24,084				66,622
	38	5,762											5,762
	39		10,261		255		1,135	8,084					19,734

Fall 2008	Route (local & express)	Annualized Platform Hours by Bus Type											Total
		11	23	26	28	31	32	36	41	42	68	96	
	42		13,473		531		1,955	13,953					29,912
	48S		10,994		19,474		525	12,120					43,112
	101			14,565							27,861		42,426
	106			30,213			5,801						36,014
	121		6,277		255		2,588	854					9,975
	122		3,060				1,874						4,934
	123		2,805				281	332					3,417
	131		5,603				15,089	239					20,930
	132		7,192				19,021	459					26,673
	134		468		761		2,577	619					4,424
	150		1,645	3,147							56,462		61,253
	170			235			2,054						2,289
	174		19,160	46,971							1,802		67,933
	177		3,706	8,788							845		13,339
	190		4,076	888			523						5,487
	194			42,571							2,257		44,827
	196		988	1,400			6,052						8,439
Total Corridor Buses		**5,762**	**134,781**	**151,507**	**22,147**	**281**	**71,742**	**81,529**	**45,856**	**75,317**	**89,226**		**678,147**
Other DSTT Buses	41			62,069									62,069
	71			34,270									34,270
	72			28,058									28,058
	73			33,483									33,483
	74			5,202									5,202
	212			11,450									11,450
	217			1,223			1,029						2,252
	225			2,210									2,210
	229			3,149									3,149
	255			42,558			73						42,630
	256			3,474									3,474
	301			11,777									11,777
	550											52,808	52,808

Fall 2008	Route (local & express)	Annualized Platform Hours by Bus Type											Total
		11	23	26	28	31	32	36	41	42	68	96	
Total Other DSTT Buses				238,923			1,102					52,808	292,832

Table A6-3: Fall 2008 Bus O&M Cost by Route and Bus Type

Fall 2008	Route (lo & ex)	Annualized Cost by Bus Type											Total Cost (2008$)	Total Cost (2011$)
		11	23	26	28	31	32	36	41	42	68	96		
Corridor Buses	7		$638,590	$163,447			$110,989	$55,284	$74,866	$9,979,522			$11,022,698	$11,419,515
	8		$500,585		$118,499		$85,611	$2,285,970					$2,990,665	$3,098,328
	9		$820,825				$220,649	$304,059					$1,345,534	$1,393,973
	14S								$2,555,212				$2,555,212	$2,647,200
	27							$1,814,020					$1,814,020	$1,879,325
	32		$69,988				$159,546	$99,898					$329,433	$341,293
	34		$159,014				$138,694	$62,558					$360,265	$373,235
	36		$3,941,429	$184,895		$33,043	$729,653	$663,862	$2,909,339				$8,462,222	$8,766,862
	38	$665,261											$665,261	$689,211
	39		$1,395,612		$34,683		$133,674	$952,250					$2,516,218	$2,606,802
	42		$1,832,479		$72,255		$230,299	$1,643,640					$3,778,673	$3,914,705
	48S		$1,495,269		$2,648,661		$61,794	$1,427,732					$5,633,456	$5,836,260
	101			$1,858,198							$3,554,447		$5,412,645	$5,607,501
	106			$3,854,530			$683,389						$4,537,919	$4,701,284
	121		$853,769		$34,683		$304,896	$100,631					$1,293,978	$1,340,561
	122		$416,191				$220,787						$636,977	$659,908
	123		$381,540				$33,043	$39,051					$453,633	$469,964
	131		$762,005				$1,777,484	$28,131					$2,567,620	$2,660,054
	132		$978,227				$2,240,703	$54,070					$3,273,000	$3,390,828
	134		$63,585		$103,470		$303,561	$72,950					$543,565	$563,133
	150		$223,702	$401,430							$7,203,358		$7,828,491	$8,110,317
	170			$29,937			$241,987						$271,923	$281,713
	174		$2,605,949	$5,992,560							$229,899		$8,828,409	$9,146,231
	177		$504,051	$1,121,196							$107,809		$1,733,057	$1,795,447
	190		$554,368	$113,323			$61,588						$729,278	$755,532

Fall 2008	Route (lo & ex)	Annualized Cost by Bus Type											Total Cost (2008$)	Total Cost (2011$)
		11	23	26	28	31	32	36	41	42	68	96		
	194			$5,431,161							$287,916		$5,719,078	$5,924,964
	196		$134,378	$178,569			$712,867						$1,025,814	$1,062,743
Total Corridor Buses		**$665,261**	**$18,331,555**	**$19,329,248**	**$3,012,250**	**$33,043**	**$8,451,213**	**$9,604,104**	**$5,539,417**	**$9,979,522**	**$11,383,430**		**$86,329,044**	**$89,436,889**
Other DSTT Buses	41			$7,918,797									$7,918,797	$8,203,874
	71			$4,372,143									$4,372,143	$4,529,540
	72			$3,579,597									$3,579,597	$3,708,463
	73			$4,271,706									$4,271,706	$4,425,487
	74			$663,671									$663,671	$687,563
	212			$1,460,853									$1,460,853	$1,513,443
	217			$155,986			$121,236						$277,222	$287,201
	225			$281,952									$281,952	$292,102
	229			$401,781									$401,781	$416,245
	255			$5,429,507			$8,576						$5,438,083	$5,633,854
	256			$443,272									$443,272	$459,230
	301			$1,502,478									$1,502,478	$1,556,567
	550											$6,120,393	$6,120,393	$6,340,727
Total Other DSTT Buses				**$30,481,743**			**$129,812**					**$6,120,393**	**$36,731,948**	**$38,054,298**

Table A6-4: Fall 2011 Bus Platform Hours by Route and Bus Type

Fall 2011	Route (local & express)	Annualized Platform Hours by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
Corridor Buses	7		1,478	754		1,687			79,060					82,979
	8		45,360		1,666	723	16,699							64,448
	9		10,833			880	3,747							15,460
	14S							22,110						22,110
	27		735	89		12,831								13,656
	34		819		231		955							2,005
	36			1,149				57,865	7,620					66,633
	38	2,302												2,302

Fall 2011	Route (local & express)	Annualized Platform Hours by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	39		6,375		289	1,713	7,930							16,306
	42					2,104								2,104
	48S		18,530		11,438		7,103							37,071
	101										32,693			32,693
	102										6,202			6,202
	106										43,472			43,472
	121		8,075			2,975	570							11,620
	122		4,135			1,284								5,419
	123		1,672			931	862							3,465
	124		2,304	26,255		4,223								32,782
	131		9,459			12,601								22,061
	132		10,070			14,240	2,163							26,473
	134		765			1,860	1,226							3,851
	150										58,220			58,220
	177					4,234					8,182			12,415
	190					3,476					1,330			4,806
	196					3,479					1,762	634		5,874
	A Line									62,513				62,513
Total Corridor Buses		**2,302**	**120,611**	**28,246**	**13,623**	**69,238**	**41,253**	**79,975**	**86,680**	**62,513**	**151,861**	**634**		**656,938**
Other DSTT Buses	41			55,566										55,566
	71			30,323										30,323
	72			25,444										25,444
	73			31,178										31,178
	74			5,440										5,440
	76			5,455										5,455
	77			5,829										5,829
	212			12,852										12,852
	216			6,289										6,289
	217			2,159										2,159
	218			10,208							332			10,540
	255			37,377							26,150			63,528

Fall 2011	Route (local & express)	Annualized Platform Hours by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	301			10,277										10,277
	316			4,047										4,047
	550												49,906	49,906
Total Other DSTT Buses				**242,444**							**26,482**		**49,906**	**318,831**

Table A6-5: Fall 2011 Bus O&M Cost by Route and Bus Type

Fall 2011	Route (lo & ex)	Annualized Cost by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
Corridor Buses	7		$214,367	$105,897		$212,689			$10,975,155					$11,508,108
	8		$6,579,504		$241,653	$91,093	$2,105,412							$9,017,662
	9		$1,571,358			$110,919	$472,365							$2,154,642
	14S							$2,734,809						$2,734,809
	27		$106,648	$12,540		$1,617,758								$1,736,945
	34		$118,827		$33,439		$120,415							$272,681
	36			$161,371				$7,157,260	$1,057,783					$8,376,414
	38	$284,702												$284,702
	39		$924,694		$41,919	$215,944	$999,781							$2,182,337
	42					$265,241								$265,241
	48S		$2,687,786		$1,659,048		$895,540							$5,242,374
	101										$4,595,015			$4,595,015
	102										$871,693			$871,693
	106										$6,110,032			$6,110,032
	121		$1,171,279			$375,088	$71,803							$1,618,169
	122		$599,818			$161,824								$761,642
	123		$242,579			$117,349	$108,652							$468,580
	124		$334,123	$3,688,790		$532,476								$4,555,388
	131		$1,372,062			$1,588,770								$2,960,832
	132		$1,460,605			$1,795,362	$272,743							$3,528,710
	134		$110,963			$234,517	$154,517							$499,998
	150										$8,182,779			$8,182,779

Fall 2011	Route (lo & ex)	Annualized Cost by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	177					$533,762					$1,149,959			$1,683,721
	190					$438,216					$186,967			$625,183
	196					$438,580					$247,640	$79,931		$766,150
	A Line									$8,786,195				$8,786,195
Total Corridor Buses		**$284,702**	**$17,494,613**	**$3,968,598**	**$1,976,060**	**$8,729,586**	**$5,201,227**	**$9,892,069**	**$12,032,938**	**$8,786,195**	**$21,344,085**	**$79,931**		**$89,790,003**
Other DSTT Buses	41			$7,806,953										$7,806,953
	71			$4,260,346										$4,260,346
	72			$3,574,875										$3,574,875
	73			$4,380,537										$4,380,537
	74			$764,320										$764,320
	76			$766,369										$766,369
	77			$819,003										$819,003
	212			$1,805,748										$1,805,748
	216			$883,654										$883,654
	217			$303,340										$303,340
	218			$1,434,236							$46,592			$1,480,828
	255			$5,251,532							$3,675,418			$8,926,949
	301			$1,443,848										$1,443,848
	316			$568,559										$568,559
	550												$7,014,244	$7,014,244
Total Other DSTT Buses				**$34,063,319**							**$3,722,010**		**$7,014,244**	**$44,799,573**