



Central Link  
Initial Segment and Airport Link  
Before & After Study

Final Report

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February 2014

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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 154<sup>th</sup> 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.

### Before and After Study Requirement and Purposes

Federal transit law requires FFGA project sponsors to conduct a **Before and After Study** (B&A Study). The study reports on five characteristics of the project at major milestones – three during project planning and development, 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.

### Project Characteristics

Federal transit law identifies 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. Entry to Preliminary Engineering (PE)
2. Entry to Final Design (FD)
3. Signing of the Full Funding Grant Agreement (FFGA)
4. Before service opening
5. Two years after service opening

Table 0-1 shows the dates for each milestone and how each milestone is used in the study's two types of comparisons: before versus after, and predictions versus actual.

**Table 0-1: Project Milestones**

Entry to Preliminary Engineering	Entry to Final Design	FFGA	Amended FFGA	Before Service Opening	Actual / After Service Opening
Winter 1999	Spring 2002	Fall 2002	Summer 2008	Fall 2008	Fall 2011

Predictions vs. Actual

Before vs. After

### 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 noted, 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 the Report

First, this report explains the planning history for Central Link. Then, the five characteristics are discussed for the project as constructed, beginning with the physical scope of the project and continuing with capital cost, transit service levels, operation and maintenance cost, and then concluding with ridership and revenues. For each characteristic, actual outcomes are discussed followed by comparisons to predictions made at the project milestones. For some characteristics a comparison is made between the “before” and “after” milestones. At the end of the report, a series of appendices include a list of economic indicators, ridership and trip characteristics tabulations, and data about the bus network that was in place in the project corridor both before and after Central Link opened for service. This report concludes the B&A Study.

## History of Project Planning and Development

Sound Transit completed a Major Investment Study (MIS) for the Central Link project in March 1997<sup>1</sup>. The Draft Environmental Impact Statement (Draft EIS) was completed in December 1998. Based on information in the Draft EIS, the Sound Transit Board identified the Locally Preferred Alternative (LPA) with Motion M99-14 on February 25,

<sup>1</sup> Completion of a MIS was consistent with FTA policy at the time. The MIS requirement was later reverted back the Alternatives Analysis (AA) requirement.

1999. As shown in Figure 0-1, The LPA was a 20-mile light rail line with 21 stations beginning at NE 45<sup>th</sup> Street in the University District in Seattle, connecting to Capitol Hill, First Hill, downtown Seattle, Rainier Valley, Tukwila, Seattle-Tacoma International Airport, and ending at South 200th Street in the City of SeaTac. The Downtown Seattle Transit Tunnel (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 operating and maintenance facility (OMF) was not identified.

The Final Environmental Impact Statement (Final EIS) was published in November 1999. Based on the Final EIS, 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 the Draft EIS, 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.

#### MOS-1

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 45<sup>th</sup> 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 together constituted the project that FTA approved into final design. In 2000, Sound Transit sought an FFGA for 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.

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.

#### FFGA – the Initial Segment Project

As a result of the Inspector General's recommendations, 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 light rail vehicles (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 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 154<sup>th</sup> 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.

#### Amended FFGA – the Airport Link Project

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.



Figure 0-1: Central Link Project Scope History



## Characteristic 1 - Project Scope

The project as 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 and Table 1-1.

The system operates in a mix of tunnels, elevated structures, and surface segments. Surface segments include both exclusive and semi-exclusive rights-of-way. In the SODO industrial area, one semi-exclusive surface segment runs parallel to the SODO Busway and receives full priority at signalized crossings with arterial streets. These intersections include railroad crossing gates, lights and bells. The other semi-exclusive segment is a five-mile segment in a raised median of Martin Luther King Jr. Way S. Along this stretch, a signal progression was designed to allow trains to proceed without stopping in both directions. Fully exclusive surface segments include short stretches of guideway adjacent to highways SR 599 and I-5 and a segment running in the median of the Airport Expressway. All elevated segments are fully exclusive and include substantial stretches of guideway through Tukwila and shorter stretches through Seattle and SeaTac.

The project includes four underground stations in the Downtown Seattle Transit Tunnel (DSTT). The 1.3-mile DSTT was originally opened in 1990 for dual-powered diesel/electric trolley buses. The tunnel was also designed to accommodate light rail trains, and embedded rails were installed during the original construction. However, in order to accommodate the modern low-floor LRVs for Central Link, the tunnel needed substantial changes including lowering the tracks at station platforms to allow for level boarding, installing new insulated rails, replacing the overhead catenary power supply and installing new interconnected signaling and communications systems for both buses and trains. Sound Transit closed the DSTT in 2005 for two years to complete these changes. The DSTT now operates with both diesel/electric hybrid buses and Central Link trains together using the same right-of-way and station platforms. A cut-and-cover tunnel extension to the DSTT was also built underneath Pine Street for two blocks in downtown Seattle to provide tail tracks at the end of the line for switching ends.

The Beacon Hill Tunnel includes new fully exclusive twin one-mile tunnels and a subway station about 160 feet below ground. The twin tunnels were mined using a boring machine. The station lies approximately midway along the tunnels and was constructed using sequential excavation mining. A large shaft was excavated from the surface above the station for use during construction, and the shaft is now used for vertical circulation, ventilation and other station functions.

The project also includes a fleet of 35 low floor 95-foot double-articulated LRVs and a 25-acre Operations and Maintenance Facility (OMF) in the SODO industrial area. The OMF 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.

One park-and-ride lot was built at Tukwila International Blvd. Station with about 600 surface parking stalls. No other long-term parking facilities were built, although many stations have short-term parking spaces designed for passenger pick-up. All stations have adjacent bus loading zones, mostly on-street. Tukwila International Blvd. Station includes off-street bus loading and layover facilities directly underneath the station platforms.

Five stations are underground, three are elevated and five are at-grade. All stations include platforms that are 380 feet long to accommodate 4-car trains. They are fully ADA compliant including these features:

- Boarding platforms are level with the LRV floors.
- The horizontal gap between the platform and LRV floor is less than the maximum allowable distance specified in the Code of Federal Regulations Title 49 Part 38. (49 CFR Part 38).
- Required signage complies with 49 CFR Part 38.
- Ticket vending machines comply with 49 CFR Part 38.

**Figure 1-1: Scope of the Project as Constructed**



**Table 1-1: Physical Scope of Project**

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Guideway					
Fill / At-Grade	6.4	5.4	6.4	6.4	6.4
Elevated	7.0	6.8	7.0	7.0	7.0
Tunnel	2.3	2.3	2.3	2.3	2.3
Total Guideway	15.6	14.5	15.6	15.6	15.6
Stations	13	14	12	12	13
DSTT Operation	joint bus/rail	rail only	joint bus/rail	joint bus/rail	joint bus/rail
Vehicles	35	35	35	35	35

The anticipated scope of the project during planning and project development was mostly consistent with the project as constructed. There were five key differences at Entry to PE:

1. The alignment was slightly shorter in the SODO area than the actual project, running along South Lander Street instead of South Forest Street. This segment along South Lander Street was also planned to be a surface and retained fill alignment instead of the elevated South Lander Street alignment that was built.
2. The route through Tukwila in the median of Tukwila International Blvd. was 1.1 miles shorter than the Tukwila Freeway Route that was actually built.
3. Two additional stations were planned – Boeing Access Road and South 144<sup>th</sup> Street that were not built.
4. The Beacon Hill Station was not included at this stage of the project. It was identified as a potential station.
5. The DSTT was planned to operate with only light rail trains, instead of the joint bus and light rail operation that was actually implemented.

As the project moved to Entry to FD, there were four changes that brought the scope closer to the project that was built:

1. The elevated alignment along South Lander Street was selected.
2. The Tukwila Freeway Route was selected.
3. Beacon Hill Station was added.
4. The DSTT was planned to operate jointly with buses and light rail trains, adding a signaling and communications system to the scope of the project in order to allow buses and trains to safely operate using the same right-of-way and stations.

Also at Entry to FD, Stadium Station was deferred.

Moving from Entry to FD to the FFGA milestone, there were no changes to the scope of the project. At the Amended FFGA milestone, Stadium Station was included and the scope of the project was the same as constructed.

## Characteristic 2 - Capital Cost

As shown in Table 2-1, the cost of the project was \$2.558 billion in year-of-expenditure (YOE) dollars. Physical elements of the project accounted for most of the cost (60%), including guideway and trackwork (27%), systems (12%), stations and ventilation (7%), utilities and roadway (7%), vehicles (6%) and other specialty items (1%). 20% was spent on services and administration. 9% was spent for right-of-way and 2% for other capital costs. The remaining 9% was spent on other project costs including expenditures from the project reserve (1%), financing (7%) and debt service payments on the original DSTT construction (1%).

**Table 2-1: Project Costs in Year-of-Expenditure \$**

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Year of Opening / Year of Prediction	2009	1999	2002	2002	2008
Actual / Planned Year of Opening		2006	2009	2009	2009
<b>Total Cost (millions)</b>	<b>\$ 2,558.0</b>	<b>\$ 1,858.0</b>	<b>\$ 2,650.7</b>	<b>\$ 2,679.9</b>	<b>\$ 2,690.9</b>
Difference from Actual	-	\$ (700.0)	\$ 92.7	\$ 121.9	\$ 132.9
Difference from Actual (%)	-	-27%	4%	5%	5%

Table 2-2 shows the costs in constant 2009 dollars. Comparisons in constant 2009 dollars allow for the isolation of cost impacts due to changes in scope and errors in unit costs used at the milestones, whereas comparisons in YOE dollars allow for the isolation of cost impacts due to schedule changes and unanticipated inflation.

**Table 2-2: Project Costs in 2009 \$**

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Year of Opening / Year of Prediction	2009	1999	2002	2002	2008
Actual / Planned Year of Opening		2006	2009	2009	2009
Ratio of Construction Cost Index - Seattle BCI: 2009 / Year of Prediction	1.00	1.40	1.30	1.30	1.03
<b>Capital Costs (millions)</b>					
Guideway	619	468	673	657	652
Utilities and Roadway	200	222	215	213	213
Trackwork	100	75	102	105	105
Stations and Ventilation	185	219	196	192	216
Systems	322	278	320	332	331
Specialty Items	35	0	38	38	38
Vehicles	153	156	170	168	167
Design and Engineering	206	173	183	208	201
Construction Management	123	90	87	99	103
Right-of-Way	198	174	341	356	348
Admin and Operations	205	248	265	271	269
Other Capital*	65	0	80	83	82
<b>Total Capital Costs</b>	<b>\$ 2,411</b>	<b>\$ 2,103</b>	<b>\$ 2,670</b>	<b>\$ 2,722</b>	<b>\$ 2,725</b>
<b>Other Project Costs (millions)</b>					
Project Reserve	34	0	131	131	131
Financing	187	0	230	230	230
Transit Art	8	0	13	13	13
DSTT Debt Service	25	0	31	26	26
<b>Total Other Project Costs</b>	<b>\$ 254</b>	<b>\$ 0</b>	<b>\$ 405</b>	<b>\$ 400</b>	<b>\$ 400</b>
<b>Total Cost</b>	<b>\$ 2,665</b>	<b>\$ 2,103</b>	<b>\$ 3,075</b>	<b>\$ 3,122</b>	<b>\$ 3,125</b>
Difference from Actual	-	\$ (562)	\$ 410	\$ 457	\$ 460
Difference from Actual (%)	-	-21%	15%	17%	17%

\*Other Capital items include third party agreements, the B&A Study, direct labor for PE, pole procurement and site preparation.

At the Entry to PE milestone, the cost estimate significantly underestimated the actual cost, due to:

- Differences in project scope:
  - Guideway - The route along Tukwila International Blvd was about 1.1 miles shorter than the Tukwila Freeway Route that was built.
  - Systems – The DSTT was assumed to operate exclusively with rail and did not include the additional cost for an integrated signaling and communications system for joint bus and rail operations.
- Other project costs, like the project reserve, financing and DSTT debt service, were not included in the cost estimate for the project at this milestone.
- The actual year of opening was 2009 instead of 2006, increasing exposure to inflation during those three years. Construction cost inflation from the year of the forecast (1999) to the actual year of opening (2009) was 40%.

At the Entry to FD, FFGA and Amended FFGA milestones, the cost was overestimated, mostly because:

- Right-of-way costs were overestimated. In 2002 the real estate market in the Seattle area was starting to escalate, and as a result higher contingencies were assumed. Additionally, the actual cost of construction easements was less than planned at these milestones.
- A conservative cost estimating approach was used. Sound Transit worked closely with the Project Management Oversight Consultant (PMOC) and FTA staff in the development of the project's costs in the wake of cost estimating problems the agency encountered relative to the MOS-1 project. The FTA was also concerned about the potential risk associated with the Beacon Hill tunnel.
- The FTA required Sound Transit to add a project reserve to cover unanticipated costs. A large portion of the project reserve was not used.

## Characteristic 3 – Transit Service Levels

Central Link provides twenty hours of service per day on weekdays and Saturdays from 5 a.m. to 1 a.m., and eighteen hours of service on Sundays and holidays from 6 a.m. to midnight. 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. On weekdays, trains run every 7.5 minutes in the peak periods, every 10 minutes during midday and evening hours, and every 15 minutes during early morning and late night hours. On weekends trains run every 10 minutes except during early morning and late night when they run every 15 minutes. The system runs with two-car trains. The average speed from Westlake Station to SeaTac/Airport Station is 24 mph, and the one-way running time is 38 minutes. Central Link service levels are shown in Table 3-1.

Buses in the project corridor are operated by King County Metro (Metro). Outside of downtown Seattle, the project corridor is comprised mainly of two areas:

- Southeast Seattle, including the Beacon Hill and Rainier Valley neighborhoods, and
- Southwestern King County near Sea-Tac International Airport

Southeast Seattle is comprised of areas of single-family homes with areas of multi-family and mixed-use buildings including subsidized housing. Commercial areas lie along the major arterials, especially Rainier Ave S and MLK Jr Way S. The population is diverse, generally lower and lower-middle income, and includes many different languages. Bus services are generally operated with 10- to 30-minute headways, with a few hourly routes. Since this population is more transit-dependent than other areas of the city, these neighborhoods are served by some of Metro's most frequent and most productive bus routes. A few of these routes provide all day north-south connections to downtown Seattle with 10-minute headways or better. There are also a few limited-stop express routes on north-south arterials that provide commuter connections to downtown Seattle in the peak periods in the peak direction only.

These bus services were largely left in place after Link opened for service. Some routes in the area were deviated to make a connection with a light rail station. Some routes were truncated in order to terminate at a station, but the deleted portions of these routes were replaced by the extension or restructuring of other bus routes. Some of the express routes were either reduced or eliminated. Other services in the corridor were upgraded, like an improvement to 15-minute bus headways along MLK Jr. Way S throughout most of the day.

Southwest King County is also comprised of both single-family and multi-family homes, with commercial areas concentrated along Tukwila International Blvd. in the city of Tukwila and International Blvd in the city of SeaTac. The population here is also diverse, including many immigrant, non-English speaking and lower-middle income families. Most bus routes in this area operate with 30-minute headways throughout most of the day. The most frequent routes operate with 10- to 15- minute headways along the major arterials and connect regional destinations like Westfield Southcenter mall, Sea-Tac Airport and Burien Transit Center. The RapidRide A Line opened in 2010 and operates with 10- and 15-minute headways along International Blvd and connects to Central Link at two stations. The least frequent routes penetrate more into the single-family neighborhoods.

Prior to Central Link opening, Metro operated an express bus between downtown Seattle and the airport with 15-minute headways throughout much of the day. Another bus operated locally along Tukwila International Blvd., providing a connection between downtown and the airport when the express bus was not operating. A few other routes provided peak period, peak direction commuter-oriented connections with downtown Seattle.

After Central Link opened for service, Metro eliminated some express routes to downtown Seattle, including the downtown-airport express route, and it also eliminated other direct connections to downtown Seattle. The A Line opened resulting in increased service levels along International Blvd. Several local routes were restructured to connect at stations. Metro gained operating efficiency by removing all of its services from the airport's terminal loop drive and relocating its services to International Blvd, taking advantage of a pedestrian bridge over International Blvd that Sound Transit built for access to SeaTac/Airport Station. This bridge connection allows local buses to connect directly with Central Link, and it also allows bus passengers to access the airport terminal from International Blvd.

The overall effect on bus service levels in the project corridor was a small net increase in service hours between 2008 and 2011, as shown in Table 3-2.

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

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Daily hours of service					
Weekdays	20	20	20	20	20
Saturdays	20	20	20	20	20
Sundays	18	20	18	18	18
Headways (minutes)					
Peak Periods	7.5	6	6	6	6
Midday / evening	10	10	10	10	10
Early morning / late night	15	15	15	15	15
Cars per train					
Peak periods	2	2	2	2	2
Off-peak periods	2	2	2	2	2
Run Time, Westlake – SeaTac/Airport (minutes)	38	34	37	37	38
Number of Stations	13	14	12	12	13
Average speed (mph)	24	25	25	25	24

The service levels predicted for the project are effectively the same as the service levels that were actually implemented, with the exception of the peak period headway. Throughout project planning, Sound Transit predicted that Central Link would operate with 6-minute peak period headways. However after testing joint rail/bus operations in the DSTT, it was determined that 7.5-minute headways would be operated initially, and this headway has been sufficient to meet passenger demand in the first years of operation.

At the Entry to PE milestone, the one-way running time was predicted to be 34 minutes, or four minutes less than the actual running time. The shorter running time was due to the shorter alignment along Tukwila International Blvd. that was assumed to take nearly three minutes less than the Tukwila Freeway route that was built. Also, the Beacon Hill Station was not included at this milestone, reducing the running time prediction at this milestone.

At the remaining milestones, the service levels are nearly the same as actually implemented. At the Entry to FD and FFGA milestones, the running time is slightly shorter and the speed is slightly faster because Stadium Station was deferred at those milestones.



**Table 3-2: Revenue Service Hours for Corridor Buses**

	Before	After	Change
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%

After Central Link was implemented, a similar level of bus service hours remained in the project corridor. Resources from truncated or eliminated routes were generally reinvested in the corridor, resulting in a similar amount of service hours.

During project planning, it was assumed that bus resources would be reinvested in the corridor by eliminating or truncating some routes and reinvesting those hours into existing or modified routes with connections at stations. In southeast Seattle, some routes with direct connections to downtown were assumed to be eliminated (7 Express, 42 and northern part of 106). These routes were not eliminated (although the service levels for 7 Express and 42 were reduced). By eliminating these routes, it was assumed the service hours would have been reinvested in new or modified services providing connections to Link stations. Even though these routes were not eliminated, the amount of service in the project corridor was not significantly different than assumed because the routes continued to operate in the corridor as before.

In south King County, the bus network changes were generally the same as assumed at project milestones. The express bus between downtown and the airport was eliminated, and other direct connections to downtown were eliminated. Service hours were reinvested in new routes with connections to stations, and the level of service was improved for other existing routes in the project corridor, like upgrading International Blvd to the RapidRide level of service.

Bus network changes are still being implemented in the project corridor, like the elimination of route 42 in February 2013, providing evidence that the implementation of bus network changes is slower than predicted, especially in southeast Seattle.

## Characteristic 4 – Operation and Maintenance Costs

The operation and maintenance (O&M) cost for Central Link in 2011 was \$47.7 million, as shown in Table 4-1. Labor costs accounted for 44% of the total cost. 24% was spent on services. Services include contracts, such as maintenance contracts with third party vendors or other governmental agencies. For Central Link, the biggest individual item for services was the contract for private security, including fare collection, and with the King County Sheriff for commissioned officer services. These costs alone totaled \$8 million. Other elements are costs for maintenance of the ticket vending machines and costs for the regional ORCA fare payment system, marketing creative services (creating ads), facilities maintenance expenses including environmental monitoring, insurance brokerage services, and a maintenance contract for radios.



**Table 4-1: Operation & Maintenance Costs in 2011 \$**

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Labor	20.83	20.51	19.04	20.85	23.41
Services	11.28	8.93	8.28	6.35	7.13
DSTT	5.57	-	-	-	-
Material	2.31	3.58	3.32	3.63	4.08
Fuel	0.00	0.06	0.06	0.04	0.05
Insurance	1.34	1.03	0.95	1.04	1.17
Tax	0.43	0.05	0.05	0.04	0.04
Utilities	2.02	2.74	2.55	2.79	3.13
General & Administrative	3.66	4.41	4.09	4.48	5.03
Miscellaneous	0.26	0.48	0.44	0.34	0.38
<b>Total Costs (millions)</b>	<b>\$ 47.70</b>	<b>\$ 41.78</b>	<b>\$ 38.77</b>	<b>\$ 39.56</b>	<b>\$ 44.42</b>

Table 4-1 also shows a comparison of each milestone's prediction for O&M cost versus the actual cost in 2011. At each milestone, the cost for services was underestimated. This was mainly due to the cost to provide security, which was more than planned due to new requirements from the U.S. Department of Homeland Security and local police and fire departments.

Additionally, the cost for the DSTT was not included during project planning. Due to accounting methods adopted by Sound Transit, these costs were included in the actual O&M cost. Costs for the DSTT result from an agreement with King County (which owns the DSTT) through which Sound Transit contributes to the costs to operate and maintain the DSTT. These are generally pass-through expenses that are allocated based on a negotiated percentage share with Metro. These expenses include utilities, service contracts for elevators and escalators, as well as the costs for King County staff time. Additionally, Sound Transit contributes a share of the debt service that was originally used to construct the DSTT. After 2011, these debt service expenses began to be treated as a lease expense (approximately \$2.5 million).

Table 4-2 shows the annualized O&M cost for buses that operated in the project corridor before and after Link opened for service. The cost is shown in constant 2011 dollars.

**Table 4-2: Operation and Maintenance Cost for Corridor Buses in 2011 \$**

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

The overall cost to operate buses in the project corridor was essentially the same after Link opened for service. Bus platform hours were slightly reduced in the project corridor, in spite of a slight increase in revenue service hours. Metro made an effort to gain more efficiency out of its bus network in the midst of a major economic recession that put pressure on financial resources. Even though platform hours were reduced slightly, the cost to operate the buses remained the same because the unit cost to operate an hour of bus service increased faster than inflation. The unit cost to provide bus service increased up to 10% between 2008 and 2011, as shown in Table A7-1 in Appendix 7.

## Characteristic 5 – Ridership and Revenues

In fall 2011, there were about 23,400 average weekday boardings on Central Link. There were 7.8 million boardings for the year 2011, resulting in an annualization factor of 333 ( $= 7.8 \text{ M} / 23,400$ ). Ridership on Central Link experiences a seasonal pattern that peaks during the summer months when more sports events and community events are hosted in downtown Seattle, and the tourist and cruise ship season draws more riders between downtown and the airport. Total ridership in the third quarter of 2011 (2.22M for July through September) was about 13% higher than ridership in fourth quarter of 2011 (1.96M for October through December). Typically the region sees the highest transit ridership in the fall months when universities and colleges are in session, so ridership on Central Link has shown a different seasonal effect than the rest of the transit services in the region.

Transit travel increased in the corridor as a result of the project. By comparing linked transit trips in the project corridor in both fall 2008 and fall 2011, conclusions can be drawn about how the project affected transit travel in the corridor. The project corridor serves three primary sub-areas: 1) downtown Seattle, 2) Rainier which includes the SODO, Beacon Hill and Rainier Valley neighborhoods, and 3) SeaTac which includes portions of southwest King County served by the project. In the project corridor there were about 7,000 more linked transit trips during fall weekdays after Central Link opened for service, indicating that the project attracted new transit riders to the corridor.

The increase in trips was especially noticeable for downtown Seattle. Transit travel to and from downtown increased from the other two sub-areas within the project corridor, and also between downtown Seattle and areas outside the corridor. Travel to and from downtown increased by about 6,500 transit trips, indicating that Link generated more transit riders who were attracted to downtown Seattle jobs and activities. Transit commuting in the project corridor increased by about 2,000 daily trips between fall 2008 and fall 2011, in spite of an economic recession that significantly depressed employment during this period.

Transit travel increased between downtown and the SeaTac sub-area by about 1,500 daily trips, indicating that the project attracted more riders to the airport – the primary destination in this sub-area. Airport passengers are less transit dependent due to higher incomes and more car availability, so the project attracted new riders who have choices when they travel.

There is only one park-and-ride lot included in the project – at Tukwila International Blvd. Station. Therefore, most passengers who used Central Link began their transit trips by walking to their first transit vehicle. 73% of Central Link passengers began their trips by walking, reflecting the project's emphasis on walk access and transit transfers. This compares to 84% walk access for the project corridor overall. About 19% of Central Link passengers began their trip using an auto (drive alone, carpool and drop-off) as compared to 10% for the project corridor overall. Central Link passengers use auto access more than other passengers in the corridor due to the availability of the park-and-ride lot at Tukwila International Blvd. Station. For bus passengers there are no park-and-ride lots in the Rainier sub-area, and the park-and-ride lots in the SeaTac sub-area are primarily served by buses with limited service only in the peak period and peak direction.

Table 5-1 shows how ridership on Central Link in 2011 compares with predictions made during project planning.

**Table 5-1: 2011 Central Link Ridership**

Milestone	Actual	Entry to PE	Entry to FD	FFGA	Amended FFGA
Average fall weekday boardings	23,400	34,900	37,800	37,800	37,800
Annual boardings	7.8 M	10.6 M	11.5 M	11.5 M	11.5 M
Difference from actual	-	36%	47%	47%	47%
Annualization factor (annual / average fall weekday)	333	305	305	304.6	304.6

The 2011 ridership estimates developed for the project milestones were overestimated. At Entry to PE, the estimate was 36% higher than the actual ridership in 2011. Beginning with Entry to FD, the ridership estimate was 47% higher than actual. Actual ridership in 2011 was affected by employment in downtown Seattle that was less than predicted by about 80,000 jobs. The employment overforecast was due in part to the economic recession that began in 2008 and lasted through 2011, depressing employment in downtown Seattle, especially in the banking and government sectors. To understand more about the local economic conditions, it is helpful to consider the economic indicators that are documented in Appendix 1.

The employment overforecast was also due in part to an optimistic growth forecast for downtown Seattle developed by the metropolitan planning organization (MPO) with input from the city of Seattle. Sound Transit uses economic growth forecasts provided by the MPO. The employment overforecast accounts for about 11,000 weekday trips on the project, or about 76% of the fall 2011 weekday ridership overforecast that was first developed at the Entry to FD milestone.

The annualization factor is used to estimate annual ridership, and it usually indicates that ridership on weekends and holidays is less than weekdays. A factor of 365 would indicate the average daily ridership on weekends and holidays is the same as weekdays. A factor less than 365 would indicate there is a drop in ridership on weekends and holidays. For project planning, Sound Transit estimated the annualization factor to be about 305. The factor was developed using historical ridership data from Metro buses operating throughout King County, including commuter services that only operate on weekdays. The actual annualization factor of 333 is a result of the high levels of service provided by Central Link on weekends as compared to the Metro bus network, which is reduced on weekends. Additionally, the higher factor reflects a preference by weekend and holiday riders for the service qualities provided by Central Link – more hours of service, better headways, visibility, learnability and reliability.

As of first quarter 2013, ridership on Central Link has continued to grow by at least 10% year-over-year in every quarter since service opening, indicating that ridership is continuing a maturity phase lasting beyond two years after opening. This growth is coinciding with a gradual economic recovery in the Puget Sound region, with economic growth occurring in downtown Seattle in particular.

The longer ridership growth period is also affected by factors that influence how fast people adopt the new Central Link service:

- language barriers and lower income levels in the project corridor
- a new and unfamiliar ORCA electronic fare payment system that is not compatible with paper transfers provided to Metro riders who pay using cash
- bus network changes that are being implemented more slowly than predicted in southeast Seattle neighborhoods

Other project assumptions had a lesser effect on ridership forecasts developed during project planning:

- Travel time reliability in the DSTT is adversely affected by joint bus/rail operations. This was not assumed in the forecasts.
- 7.5-minute peak headways are operated. The forecasts assumed 6-minute peak headways.
- From project opening until fall 2012, fares were charged for Central Link trips within the DSTT while buses remained free. The forecasts assumed both would be free. (Since fall 2012, fares are now required for both buses and Central Link in the DSTT.) As a result of fares being charged in the DSTT as well as the distance-based fare policy adopted for Link, the average fare per boarding (AFB) in 2011 was \$1.53, 43% higher than the \$1.08 AFB prediction for 2011. Assuming a transit fare elasticity of -0.3 on ridership, the higher fare would reduce anticipated Central Link ridership by 13%.

Riders on Central Link have higher incomes and more car availability than riders in the project corridor overall. Central Link riders have a median household income of \$54,800 as compared to \$33,900 for the corridor overall. 80% of Central Link riders have driver licenses, compared to 66% for the corridor, and they have 1.8 vehicles per household as compared to 1.5 for the corridor. This indicates that Central Link is attracting riders who have more mode choices when traveling, especially airport travelers. Rider and trip characteristics tabulations are shown in Appendix 2.

Buses in the project corridor experienced a drop in ridership between 2008 and 2011. Table 5-2 compares how ridership changed on buses that operate in the corridor between fall 2008 and fall 2011.

**Table 5-2: Ridership on Corridor Buses**

	<b>Before</b>	<b>After</b>	<b>Change</b>
Weekdays	84,287	70,807	- 16%
Saturdays	47,628	42,411	- 11%
Sundays	32,503	27,382	- 16%

The drop in corridor bus ridership was due to a combination of factors:

- The economic recession depressed ridership systemwide for Metro by about 8% from 2008 to 2010; ridership recovered about 3% from 2010 to 2011.
- Some bus trips were replaced by trips on Central Link, especially trips on the express bus between downtown and the airport that was eliminated. Some other direct bus connections to downtown from southwest King County were also eliminated.
- Metro implemented three fare increases resulting in a total increase of 43% to 50% for adult fares from 2008 to 2011.

Fare revenue for Central Link was \$12.03 million in 2011. Table 5-3 shows how actual 2011 fare revenue for Central Link compares to the prediction made at the FFGA milestone.

**Table 5-3: Annual Fare Revenues for Central Link in 2011 \$**

<b>Milestone</b>	<b>FFGA</b>	<b>Actual</b>	<b>Difference</b>
Annual fare revenue in 2011 (millions)	\$9.04	\$12.03	+33%

The actual fare revenues were more than predicted, in spite of ridership shortfall in 2011. This is due to differences in assumptions used for the prediction. Sound Transit adopted a distance-based fare policy for Central Link. The result was a higher fare per boarding amount (\$1.53) than assumed for the prediction (\$1.08). Also, fares are required for riders who take trips within the DSTT, whereas for the prediction it was assumed that fares would be free.

The annualized fare revenue on buses was \$22.42 million for buses that were operating in the project corridor in fall 2011. Table 5-4 shows how fare revenues changed for buses in the project corridor between 2008 and 2011.

**Table 5-4: Annualized Fare Revenues for Corridor Buses in 2011 \$**

	<b>Before</b>	<b>After</b>	<b>Change</b>
Annualized fare revenue in 2011 (millions)	\$22.42	\$24.20	+ 8%

Bus fare revenue increased from 2008 to 2011 in spite of a reduction in ridership for buses in the corridor. This is due to fare increases implemented by Metro during this period that increased the systemwide average fare per boarding from \$0.87 to \$1.11 in 2011\$.

## Appendix 1 – Local Economic Conditions

The 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
- fall 2011, two years after the project opened for service

A set of local economic indicators is reported in Table A1-1 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 footnotes.

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.

Employment in downtown Seattle was lower than the employment forecast used at the time the Initial Segment Project was baselined for the FFGA 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 about 80,000 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 in mid-2013. The actual employment as compared to the employment forecast played a significant role in the B&A Study results.

**Table A1-1: Economic Conditions**

	<b>Fall 2002 FFGA (2002\$)</b>	<b>Fall 2008 Before (2008\$)</b>	<b>Fall 2011 After (2011\$)</b>
<b>Employment in Seattle-Bellevue-Everett Area (September) <sup>2 3</sup></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
<b>Consumer Price Index <sup>4</sup></b>			
CPI-U for Seattle-Tacoma-Bremerton (Annual)	189.3	224.7	232.8

<sup>2</sup> 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

<sup>3</sup> 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

<sup>4</sup> 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](http://www.bls.gov/eag/eag.wa_seattle_msa.htm), obtained March 2012

	Fall 2002 FFGA (2002\$)	Fall 2008 Before (2008\$)	Fall 2011 After (2011\$)
<b>Housing</b> <sup>5 6 7 8</sup>			
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
<b>Transportation</b>			
Seattle-Tacoma International Airport passengers (September) <sup>9 10 11</sup>	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 <sup>12 13</sup>	214,000	200,000	195,000
Seattle-Everett area mobility report measures <sup>14</sup>			(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
<b>Net Migration</b> <sup>15 16 17</sup>			
Washington State (incoming minus outgoing residents)	31,100	58,000	4,800
<b>Gasoline Prices</b> <sup>18 19</sup>			
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
<b>Parking Price and Availability in Downtown Seattle</b> <sup>20 21</sup>			
	(2002)	(2006)	(2010)
	(2002\$)	(2006\$)	(2010\$)
Parking stalls	58,538	51,342	45,535
Occupancy Rate	63.2%	65.4%	62.8%
Average Price			

<sup>5</sup> Northwest Multiple Listing Service, News release and table, October 2002

<sup>6</sup> Seattle Bubble, NWMLS: *Flat is Still the New Up*. Trust Us.; Seattle area real estate summary blog entry; October 5, 2011

<sup>7</sup> Seattle Bubble, NWMLS: *Supply, Demand, and Prices All Sinking Together*, Seattle area real estate summary blog entry; November 3, 2011

<sup>8</sup> Seattle Bubble, NWMLS: *Median Price Still Down Double Digits from 2010*, Seattle area real estate summary blog entry; December 5, 2011

<sup>9</sup> Port of Seattle, Sea-Tac International Airport Traffic and Operations Summary, September 2002

<sup>10</sup> Port of Seattle, Sea-Tac International Airport, *2008 Seattle-Tacoma International Airport Activity Report*, p 1

<sup>11</sup> Port of Seattle, Sea-Tac International Airport 2011 Passenger, Cargo and Operations summary table; obtained March 2012

<sup>12</sup> Washington State Department of Transportation, *2002 Annual Traffic Report*, p 14.

<sup>13</sup> Washington State Department of Transportation, *2011 Annual Traffic Report*, p 71

<sup>14</sup> Texas Transportation Institute *2011 Annual Urban Mobility Report*, Performance Measure Summary – Seattle, WA

<sup>15</sup> Washington State Office of Financial Management, *2002 Population Trends*, p 1

<sup>16</sup> Washington State Office of Financial Management, *2009 Population Trends*, p 1

<sup>17</sup> Washington State Office of Financial Management, *2011 Population Trends*, p 1

<sup>18</sup> AAA Washington, *AAA News, Fuel Price Update*, Labor Day 2002

<sup>19</sup> Energy Information Administration, *Weekly Seattle, WA All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon)*, obtained March 2011

<sup>20</sup> Puget Sound Regional Council, *2002 parking Inventory for the Central Puget Sound Region*, January 2003

<sup>21</sup> Puget Sound Regional Council, *Puget Sound Trends: Parking Trends in the Central Puget Sound Region, 2006-2010*, April 2011

		Fall 2002 FFGA (2002\$)	Fall 2008 Before (2008\$)	Fall 2011 After (2011\$)
	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		
<b>Economy</b>				
Washington Index Leading Indicators <sup>22 23</sup>				
	September	95.9	110.3	111.7
	October	95.7	107.2	111.6
	November	n/a	104.1	112.7

<sup>22</sup> Washington State Economic and Revenue Forecast Council, *Washington Economic and Revenue Forecast*, November 2002, p 28

<sup>23</sup> Washington State Economic and Revenue Forecast Council, *Washington Economic and Revenue Forecast*, February 2012, p 106

## Appendix 2 – Ridership and Trip Characteristics Tabulations

**Table A2-1: 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 (Linked)	50,900			52,800	+ 1,900
Access Mode at Start of Trip					
Walk	88%	89%	73%	84%	- 5%
Drive or Ride	8%	8%	19%	10%	+25%
Fare Payment <sup>24</sup>					
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%

**Table A2-2: Total Trips in the Corridor**

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

**Table A2-3: Origin Location 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%

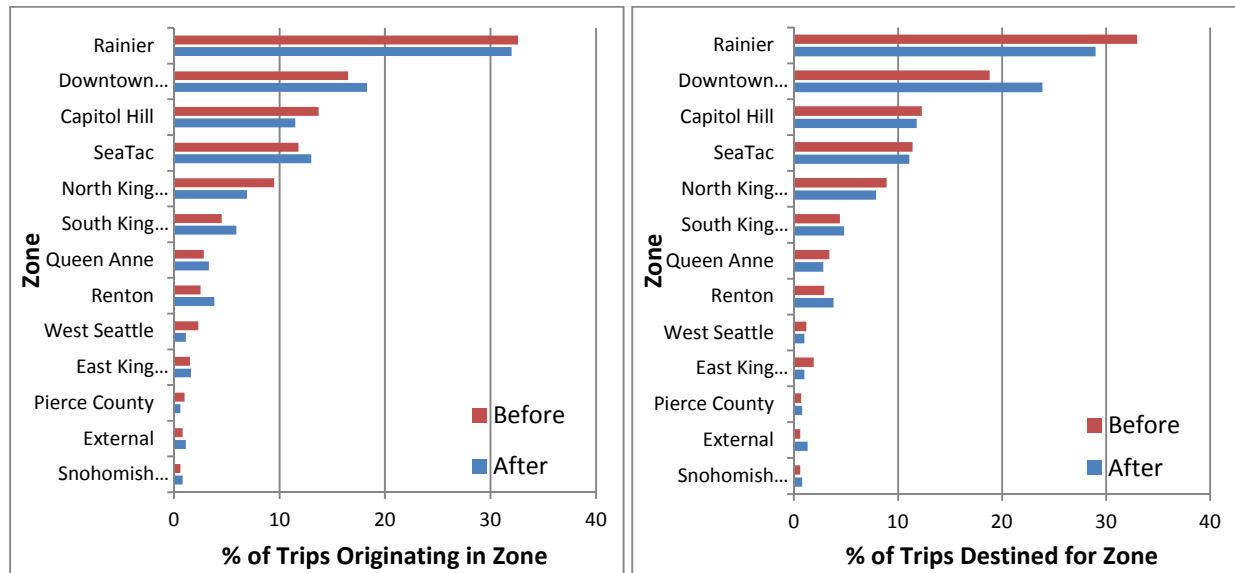
**Table A2-4: Destination Location for Linked Trips in the Corridor**

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

<sup>24</sup> Columns do not add to 100% because multiple responses are allowed for each trip.



**Figure A2-1: Origin and Destination Zones for Linked Trips in the Corridor**



**Table A2-5: Origin / Destination Zone Pairs for Linked Trips in the Corridor**

Origin	Destination →	Downtown Seattle		Rainier		SeaTac		Other Zones		Total	
		#	%	#	%	#	%	#	%	#	%
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	

## Appendix 3 – Summary of King County Metro Bus Service Changes

Press Release: May 18, 2009 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 Rainier 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 Rainier 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 Rainier Beach Link Station from the Skyway and Rainier View neighborhoods and replace Route 42 coverage.
- 124 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 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."

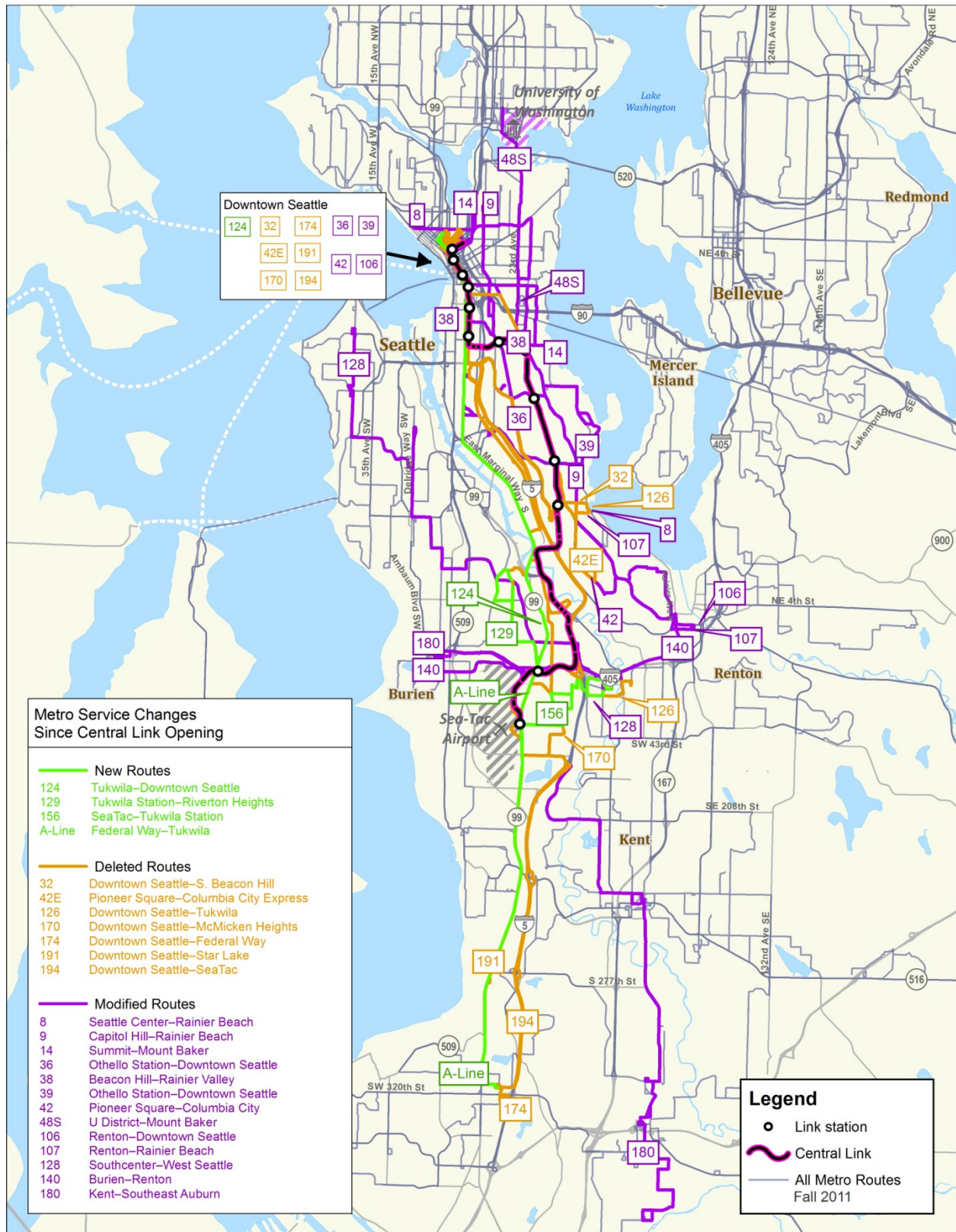
The extension of light rail to Sea-Tac Airport in December will also impact Metro's service along the Tukwila-SeaTac-Federal Way corridor. Duplicate service along Route 194 to SeaTac Airport will be eliminated in February 2010. Route 174, one of Metro's longest routes, will be split; new Route 124 will 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.

Figure A3-1: Map of Metro Bus Service Changes



## Appendix 4 – Summary of Bus Service Changes Compared to Prediction at FFGA Milestone

**Table A4-1: Bus Service Changes Compared to Prediction at FFGA Milestone**

Route	FFGA Prediction	Actual	Notes
<b>Deleted Routes</b>			
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
<b>New Routes</b>			
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

Route	FPGA Prediction	Actual	Notes
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 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
<b>Modified Routes</b>			
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 5 – Bus Routes in the Before & After Study

**Table A5-1: Bus Routes in the Before & After Study**

Route	2008	2011	Corridor	SODO Busway <sup>25</sup>	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

<sup>25</sup> 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 6 – Bus Service Levels, Ridership and Revenues

**Table A6-1: 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
	Sat	7	127	6,578	8,147	423,662	\$355,876	\$368,687

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\$)
		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
<b>Total Sat</b>			<b>956</b>	<b>49,700</b>	<b>47,628</b>	<b>2,476,673</b>	<b>\$2,080,406</b>	<b>\$2,155,300</b>
	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
		174	108	6,284	5,348	310,184	\$260,555	\$269,935
		194	57	3,321	2,653	153,874	\$129,254	\$133,907

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\$)
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
		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

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\$)
Total Other DSTT Buses			1,243	184,391	66,165	10,874,697	\$10,229,404	\$10,597,662

**Table A6-2: 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
		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

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011\$)
	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
	<b>Total Sat</b>		<b>974</b>	<b>50,635</b>	<b>42,411</b>	<b>2,205,366</b>	<b>\$2,447,956</b>
	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
		A Line	103	5,981	4,794	278,042	\$308,627
	<b>Total Su/H</b>		<b>750</b>	<b>43,506</b>	<b>27,382</b>	<b>1,588,124</b>	<b>\$1,762,818</b>

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011\$)
<b>Total Corridor Buses</b>			<b>3,249</b>	<b>482,036</b>	<b>140,599</b>	<b>21,805,967</b>	<b>\$24,204,623</b>
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
<b>Total M-F</b>			<b>695</b>	<b>176,669</b>	<b>41,744</b>	<b>10,601,399</b>	<b>\$13,207,985</b>
	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
<b>Total Sat</b>			<b>365</b>	<b>18,974</b>	<b>20,635</b>	<b>1,073,010</b>	<b>\$1,343,456</b>
	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
		255	55	3,207	1,213	70,333	\$78,070
		550	37	2,133	1,899	110,169	\$209,322

Fall 2011	Day	Route (loc & exp)	Daily Rev Hours	Annualized Rev Hours	Daily Riders (excluding RFA)	Annualized Riders (excluding RFA)	Annualized Revenues (2011\$)
	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 7 – Bus Operation & Maintenance Costs

**Table A7-1: 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 A7-2: 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
	145								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



Fall 2008	Route (local & express)	Annualized Platform Hours by Bus Type											Total
		11	23	26	28	31	32	36	41	42	68	96	
	39		10,261		255		1,135	8,084					19,734
	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
<b>Total Corridor Buses</b>		<b>5,762</b>	<b>134,781</b>	<b>151,507</b>	<b>22,147</b>	<b>281</b>	<b>71,742</b>	<b>81,529</b>	<b>45,856</b>	<b>75,317</b>	<b>89,226</b>		<b>678,147</b>
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

Fall 2008	Route (local & express)	Annualized Platform Hours by Bus Type											Total
		11	23	26	28	31	32	36	41	42	68	96	
	550											52,808	52,808
Total Other DSTT Buses				238,923			1,102					52,808	292,832

**Table A7-3: 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

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		
	190		\$554,368	\$113,323			\$61,588						\$729,278	\$755,532
	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
<b>Total Corridor Buses</b>		<b>\$665,261</b>	<b>\$18,331,555</b>	<b>\$19,329,248</b>	<b>\$3,012,250</b>	<b>\$33,043</b>	<b>\$8,451,213</b>	<b>\$9,604,104</b>	<b>\$5,539,417</b>	<b>\$9,979,522</b>	<b>\$11,383,430</b>		<b>\$86,329,044</b>	<b>\$89,436,889</b>
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
<b>Total Other DSTT Buses</b>				<b>\$30,481,743</b>			<b>\$129,812</b>					<b>\$6,120,393</b>	<b>\$36,731,948</b>	<b>\$38,054,298</b>

**Table A7-4: 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

Fall 2011	Route (local & express)	Annualized Platform Hours by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	38	2,302												2,302
	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
<b>Total Corridor Buses</b>		<b>2,302</b>	<b>120,611</b>	<b>28,246</b>	<b>13,623</b>	<b>69,238</b>	<b>41,253</b>	<b>79,975</b>	<b>86,680</b>	<b>62,513</b>	<b>151,861</b>	<b>634</b>		<b>656,938</b>
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

Fall 2011	Route (local & express)	Annualized Platform Hours by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	255			37,377							26,150			63,528
	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 A7-5: 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

Fall 2011	Route (lo & ex)	Annualized Cost by Bus Type												Total
		11	23	26	28	32	36	41	42	60	68	70	96	
	150										\$8,182,779			\$8,182,779
	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
<b>Total Corridor Buses</b>		<b>\$284,702</b>	<b>\$17,494,613</b>	<b>\$3,968,598</b>	<b>\$1,976,060</b>	<b>\$8,729,586</b>	<b>\$5,201,227</b>	<b>\$9,892,069</b>	<b>\$12,032,938</b>	<b>\$8,786,195</b>	<b>\$21,344,085</b>	<b>\$79,931</b>		<b>\$89,790,003</b>
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
<b>Total Other DSTT Buses</b>				<b>\$34,063,319</b>							<b>\$3,722,010</b>		<b>\$7,014,244</b>	<b>\$44,799,573</b>