

**Central Link Light Rail
Transit Project**

**FINAL
ENVIRONMENTAL
IMPACT
STATEMENT**

**Transit Ridership
Forecasting
Technical Report**

October 1999



SOUNDTRANSIT

**Central Puget Sound
Regional Transit Authority**



**U.S. Department of Transportation
Federal Transit Administration**

4.2 TRANSIT RIDERSHIP FORECASTS

Ridership forecasts produced from the ST model for each Segment Alternative are summarized below. Segment Alternatives (A through F) are defined in Chapter 2 of the “Central Link Light Rail Project – Environmental Impact Statement.” In addition, ridership forecasts were produced for the Locally Preferred Alternative (LPA), Minimum Operating Segment (MOS) Alternative, and Staff Preferred Alternative with and without the Beacon Hill station. Interpretation of the ridership forecasting results is discussed in Chapter 3 of the Environmental Impact Statement.

In order to test the individual effects of each EIS Segment Alternative, ridership forecasts varied only one segment in each forecast. The segments held constant when testing alternative routes in other segments were A1.1, B1, C2.3, D3.2.1, E1.1, and F3. These are referred to as the “ridership forecasting common segments.” Had ridership for every combination of segment alternatives been forecasted, over 4,800 permutations of forecasts would have had to be analyzed.

Within a segment, ridership differences can be considered significant if the forecast variation between route alternatives meets or exceeds 2,000 daily boardings, or approximately 500 in the peak and approximately 1,500 in the off-peak. Ridership differences of less than 2,000 daily boardings are not considered to be significantly different.

For a number of 2020 alternatives where differences in 2010 and 2020 service levels for each segment were insignificant or similar, the ST model was not used to produce 2020 ridership forecasts. Instead, 2020 ridership forecasts were produced based on factoring Stage 3 2010 ridership forecasts produced for these alternatives, according to implied growth estimated from Stage 3 2010 and 2020 ridership forecasts produced from another segment alternative with similar service levels. For example, Stage 3 2010 ridership forecasts were produced for both Segment Alternatives A1.1 and A2.1, whereas Stage 3 2020 ridership forecasts were produced for Segment Alternative A1.1 only. For Segment Alternative A2.1, 2020 boardings for each station were estimated as follows:

- 2020 Station Boardings for Alternative A2.1 = 2010 Station Boardings for Alternative A2.1 x (2020 Station Boardings for Alternative A1.1 / 2010 Station Boardings for Alternative A1.1)
- The above method was used to produce 2020 ridership forecasts for Alternatives: A2.1, B2.2, C3, D1.1, D1.3, D3.3, D3.4, E1.2, F1, F1.2, F2.2, and F3.1.

Daily transit boardings are reported here for all EIS segment alternative forecasts. In addition, daily transit trip production and origin-destination matrices are reported for the ridership forecasting common segments, the LPA, and three alternatives (B2.1, E2, and E3) which serve significantly different corridors than the ridership forecasting common segments or the LPA.

4.2.1 2010 Transit Ridership Forecasts

Systemwide and station daily boardings for the EIS alternatives are shown in Table 4.2a, 4.2b and Table 4.2c.

Daily 1992 and 2010 transit trips produced in each district are shown in Table 4.2d for the Baseline, E2, E3, B2.1, and LPA Alternatives. Daily transit trip summaries at 26x26 and 10x10 district levels are shown in Tables B1 through B12 in Appendix B for 1992, ridership forecasting common segments, E2, E3, B2.1, and LPA Alternatives.

4.2.2 2020 Transit Ridership Forecasts

Segment Alternative daily systemwide and station boardings are shown in Tables 4.2e, 4.2f, and 4.2g. Systemwide and station daily boardings for the LPA and MOS are shown in Table 4.2e and for the Staff-Recommended Alternative in Table 4.2g. Daily 1992 and 2020 transit trips produced in each

district are shown in Table 4.2d for the ridership forecasting common segments, E2, E3, B2.1, and LPA Alternatives. Daily transit trip summaries at 26x26 and 10x10 district levels are shown in Tables B13 through B22 in Appendix B for the Baseline, E2, E3, B2.1, and LPA Alternatives.

4.2.3 Transit Travel Time Analysis

Comparative analysis of transit travel times was performed for various alternatives. Weighted average PM peak transit travel times to the designated neighborhood clusters for 2010 and 2020 are shown in Tables 4.2h and 4.2i, respectively (please see pages 103 and 104). Interpretation of the travel time analysis results is discussed in the Environmental Impact Statement.

**Table 4.2d
Comparative Analysis of Year 1992, 2010 and 2020 Total Daily Transit Trips
(Trips Origins by 26 Districts)**

District Name	1992	2010					2020				
		Baseline	Alternative E2	Alternative E3	Alternative B2.1	LPA	Baseline	Alternative E2	Alternative E3	Alternative B2.1	LPA
North Everett	4,884	9,261	9,260	9,261	9,252	9,275	11,048	11,048	11,048	11,040	11,035
South Everett	4,206	7,038	7,037	7,037	7,029	7,041	8,732	8,732	8,732	8,723	8,667
Lynnwood	5,180	8,950	8,952	8,952	8,925	8,973	12,053	12,056	12,056	12,032	12,002
North Creek	2,080	4,437	4,438	4,438	4,428	4,443	5,590	5,593	5,593	5,582	5,595
Shorelin	3,668	4,518	4,521	4,524	4,452	4,507	4,890	4,899	4,901	4,812	4,817
Ballard	16,175	21,754	21,724	21,757	21,223	21,535	23,056	23,309	23,335	22,548	22,883
North Seattle	11,721	18,833	18,812	18,826	18,096	17,730	21,878	21,861	21,876	21,163	20,546
University District	19,824	30,583	30,562	30,600	28,623	31,219	34,605	34,624	34,661	32,499	35,015
Queen Anne	13,040	15,529	15,519	15,531	16,406	15,554	20,866	20,877	20,895	21,929	20,908
Capitol Hill	25,071	35,440	35,398	35,495	31,525	35,130	40,515	40,537	40,611	36,140	40,404
Seattle CBD	74,320	97,531	97,215	97,472	95,975	97,586	131,189	131,228	131,770	129,502	131,294
W Seattle	9,499	12,234	12,215	12,248	12,073	12,317	14,585	14,573	14,605	14,441	14,686
Rainier	14,667	20,879	20,756	20,774	20,573	21,988	22,794	22,874	22,906	22,494	23,684
Sea-Tac	5,638	8,561	8,309	8,451	8,480	8,080	9,694	9,502	9,703	9,631	9,608
Renton	5,969	9,584	9,977	10,210	9,503	9,382	11,867	12,250	12,826	11,814	11,751
Federal Way	3,040	5,164	5,091	5,152	5,136	5,052	6,445	6,415	6,487	6,421	6,451
Kent	3,913	6,416	6,614	6,659	6,385	6,334	7,448	7,677	7,777	7,413	7,429
Kirkland	3,923	5,898	5,889	5,892	5,882	5,911	6,389	6,384	6,387	6,377	6,396
Redmond	2,199	4,623	4,622	4,621	4,604	4,629	4,805	4,807	4,807	4,789	4,795
West Bellevue	3,139	6,931	6,921	6,926	6,848	6,901	8,790	8,789	8,794	8,715	8,758
Bellevue	4,120	5,470	5,468	5,470	5,434	5,433	5,829	5,831	5,837	5,802	5,803
Issaquah	893	1,620	1,618	1,618	1,611	1,618	2,042	2,042	2,042	2,035	2,036
North Tacoma	10,355	14,549	14,532	14,539	14,550	14,537	16,161	16,157	16,159	16,161	16,166
South Tacoma	5,631	7,965	7,957	7,965	7,965	7,959	8,631	8,628	8,632	8,630	8,631
Lakewood	3,512	6,292	6,299	6,299	6,293	6,290	6,809	6,810	6,811	6,810	6,811
Puyallup	1,349	4,313	4,309	4,311	4,309	4,311	4,304	4,300	4,302	4,302	4,303
Total	258,012	374,371	374,015	375,028	365,580	373,734	451,015	451,802	453,551	441,802	450,492

TABLE 4.2i
Comparative Analysis of Year 2020 Average Door-to-Door PM Peak Travel
Times for Riders Residing in Each Cluster (Work-Place to Home)

Cluster Number	Neighborhood	Segment	Total Travel Time To Cluster (minutes)							
			No-Build	Baseline	LPA	E3	Alt C1	MOS-1	Rainier Tunnel	MOS-2
1	Northgate	A	48	37	42	37	37	42	37	42
	(Travel Time Savings Relative to No-Build in min)			11	6	11	11	6	11	6
2	Roosevelt	A	49	36	39	36	36	40	36	45
	(Travel Time Savings Relative to No-Build in min)			13	9	13	12	8	12	3
3	University District	B	46	36	37	37	37	38	36	43
	(Travel Time Savings Relative to No-Build in min)			9	9	9	9	8	9	3
4	Capitol Hill / First Hill	B	40	31	31	31	31	32	31	35
	(Travel Time Savings Relative to No-Build in min)			9	9	9	9	8	9	6
5	Downtown/PS	C	41	36	36	36	36	37	36	38
	(Travel Time Savings Relative to No-Build in min)			5	5	5	5	4	5	3
6	International District/Royal Brougham/Lander Street	C	54	48	46	47	46	47	48	49
	(Travel Time Savings Relative to No-Build in min)			6	7	6	8	7	6	5
7	Beacon Hill / McClellan	C	50	40	33	39	39	34	39	35
	(Travel Time Savings Relative to No-Build in min)			11	17	11	11	17	11	15
8	Rainier Valley (Edmunds/Graham/Othello/Henderson)	D	58	40	40	39	40	48	39	42
	(Travel Time Savings Relative to No-Build in min)			18	18	19	18	11	19	16
9	Boeing Access	E	66	59	60	61	60	63	58	64
	(Travel Time Savings Relative to No-Build in min)			6	6	5	6	3	8	2
10	South 144th Street	E	66	60	61	62	61	64	59	64
	(Travel Time Savings Relative to No-Build in min)			5	5	4	5	2	7	2
11	South 154th street/Airport	F	70	61	62	61	62	68	60	68
	(Travel Time Savings Relative to No-Build in min)			9	8	8	8	2	10	2
12	South 200th street	F	61	54	55	55	54	58	53	60
	(Travel Time Savings Relative to No-Build in min)			7	6	6	7	3	8	1

- Notes :**
- The travel times presented here have been weighted by the 2020 No-Build (No LRT) PM Peak trips to the cluster, for all the alternatives.
 - The No-Build alternative does not include light rail but includes the regional express routes and commuter rail.
 - Alternative C1 includes the Royal Brougham and Lander street alignment and does not include a station at Beacon Hill.
 - MOS-1 (Minimum Operating Segment) alternative includes the light rail line operating between NE 45th street to McClellan via Beacon Hill.
 - MOS-2 (Minimum Operating Segment) alternative includes the light rail line operating between Capitol Hill and Henderson Street.

4.1.4 Transit Service

Bus service changes defined under the Link Light Rail Alternative were based on the work performed to define integration of bus services with Link light rail, Sounder commuter rail, and ST Express bus services under Sound Transit's adopted Sound Move ten-year plan. This plan provides for implementation of high-capacity transit in the three-county region of King, Snohomish, and Pierce counties²⁴. The networks identify conceptual routings and headways for the feeder bus system providing access to the Link light rail system at stations. In addition to the feeder bus system, the networks include regional and local bus services operated by King County Metro, Community Transit, Everett Transit, and Pierce Transit. The services operated by these agencies were considered part of the background bus system, and updated to reflect agency plans for service expansion and bus service revisions recently implemented by the transit agencies.

A Transportation System Management (TSM) alternative was prepared by modifying the Link baseline network. The TSM alternative provides a service network similar to that which would be achieved with light rail, by restoring key trunk bus routes and using the proposed LRT feeder network to feed those trunk bus routes. This network retains the Sounder commuter rail and ST Express bus services provided in *Sound Move*.

The light rail speeds used in the Central Link ridership forecasts are based on operational simulations prepared for Sound Transit engineering staff by Puget Sound Transit Consultants (PSTC). These run times are calibrated to observations of the Los Angeles Blue Line and account for track grade, curvature, and at-grade speed restrictions²⁵.

For 2010 forecasts, light rail headways were based on an operating plan with peak period turnbacks at the International District Station. From the International District, the plan provided 4-minute peak service north to the University District or Northgate and 8-minute peak service south to SeaTac. During the off-peak period, the plan provided 8-minute headways the full length of the LRT line²⁶.

Analysis of the 2010 ridership forecasts led to the conclusion that a more efficient rail operating plan would involve turnback trains at Henderson Street. From Henderson Street trains would operate on 5-minute peak/7.5-minute off-peak headways north to the University District or Northgate and 10-minute peak/15-minute off-peak headways south to SeaTac.²⁷ This new operating plan was used for the 2020 EIS forecasts.

The bus and rail services defined were coded using the network coding conventions presented in Section 2.8.2. Bus speeds were adjusted for each forecasting year to reflect average roadway speed degradation. This was based on analysis of actual travel times experienced by buses, as discussed in Section 2.8.2. Stage 3 2010 and 2020 ridership forecasts for each EIS Alternative were produced accordingly.

4.1.5 Manual Adjustment of Ridership Forecasts for SeaTac Stations

Use of the ST Transit Model has resulted in forecasts of 1,200 to 2000 daily boardings for the proposed rail station at the SeaTac Airport. Planning models like the ST Transit Model consider a rail line to be the same as a bus line, ignoring any improvements in reliability, visibility, and simplicity (see Section 1.2.5). These factors are probably more important for airport stations than for other

²⁴ "Service Integration Plan for Link Light Rail Alternatives – Final Report," Prepared for Sound Transit by Parsons Brinckerhoff, Inc. in Association with Nelson Nygaard Consulting Associates, July 22, 1998.

²⁵ "Central Puget Sound Regional Transit Authority: Central Line Operation Plans Memorandum" – Prepared by David Donatelli, Puget Sound Transit Consultants, September 4, 1998

²⁶ Ibid

²⁷ Ibid