City of Bellevue

Post Office Box 90012 ▪ Bellevue, Washington ▪ 98009 9012

Date: January 6, 2011

To: Sound Transit

From: City of Bellevue Transportation Department

RE: Downtown Bellevue Traffic Modeling Attachments

Attached to this memo, as part of the City of Bellevue's comments on the Sound Transit East Link Supplemental Draft Environmental Impact Statement, please find the following:

BKR Documentation Report

The Bellevue/Kirkland/Redmond (BKR) Documentation report was prepared for the Sound Transit Light Rail Peer Review Panel to document the components and assumptions for the 2008 "base year" traffic model and the 2030 forecast year model results. This traffic demand modeling was the basis for the development of the micro-simulation traffic analysis of the East Link light rail alternatives for Downtown Bellevue.

VISSIM Documentation Report

The VISSIM micro-simulation traffic analysis was conducted jointly by the City of Bellevue and Sound Transit and its consultants, whose work and results are contained in this report. This analysis provided information used to compare light rail alternatives in Downtown Bellevue, specifically measuring effects on the downtown transportation system. Multiple iterations of the VISSIM model were run until each agency was reasonably satisfied of its accuracy in predicting 2030 traffic impacts.

The results of this work were documented in this report and summarized in the *Downtown Bellevue Light Rail Alternatives Concept Design Report* released jointly by Sound Transit and the City of Bellevue in February 2010. The version of the VISSIM results used in the Concept Design Report was referred to by Bellevue staff as Version 1.0. Subsequently, Bellevue staff refined the VISSIM traffic analysis (Versions 1.1 and 1.2) based on staff's desire to attain a higher confidence level in the results and address specific questions about the work from City Council members and other community stakeholders. The refined VISSIM results (V 1.2) were presented to the Sound Transit Peer Review Panel and Sound Transit staff on February 22, 2010 and to the Bellevue City Council on March 15, 2010. It should be noted that some of the work that was presented to City Council in March, such as the detailed travel time route comparisons, were a direct result of recommendations made by the Peer Review Panel.

VISSIM Analysis of intersection delay, level of service and travel time

This spreadsheet is Version 1.2 of the VISSIM micro-simulation traffic analysis, built upon the joint Bellevue/Sound Transit effort, and developed by the City of Bellevue for traffic analysis of the light rail alternatives for Downtown Bellevue. As noted in the spreadsheet, the findings

from Version 1.2 show a greater difference overall (both for the Downtown area as a whole and the smaller southeast subarea of Downtown where surface light rail alternatives were being considered) between the C9T/C14E alternatives and the C9A and C11A alternatives in terms of average vehicle delay at intersections.

Bellevue City Council Presentation March 15, 2020

This attachment is a copy of a staff presentation to the Bellevue City Council of the VISSIM Version 1.2 traffic modeling analysis of the light rail alternatives for Downtown Bellevue. This more detailed analysis was done based on questions raised by the City Council about specific intersection results, which were not reported in the *Downtown Bellevue Light Rail Alternatives Concept Design Report*. This analysis includes travel delay data for specific intersections that are shown to operate at Level of Service E or F in 2030 and the amount of vehicle delay at these intersections. Charts in the presentation also show the differences in delay at specific intersections between the C9T/C14E alternatives and the C9A and C11A alternatives, which is quite significant in certain places.

East Link:
Downtown Bellevue Alignments

Bellevue City Council

March 15, 2010

Tonight's Agenda

- Council's 2/2009 downtown alignment preference
- Development and evaluation of new alternatives
- C9T performance
- C9T funding strategy
- Next Steps

Downtown Bellevue City Council Preference (2/09)

Policy and plan consistency:

- "Light rail is critical to reinforcing Bellevue's development as a metropolitan center…"
- …tunnel through downtown Bellevue best meets the needs of the city and region"
- "Build it right the first time"
- Hospital station serves Wilburton redevelopment

High Performance:

- Downtown, hospital district, and Wilburton well served
- High ridership

Low Permanent Impact:

- Minimal street and environmental impacts

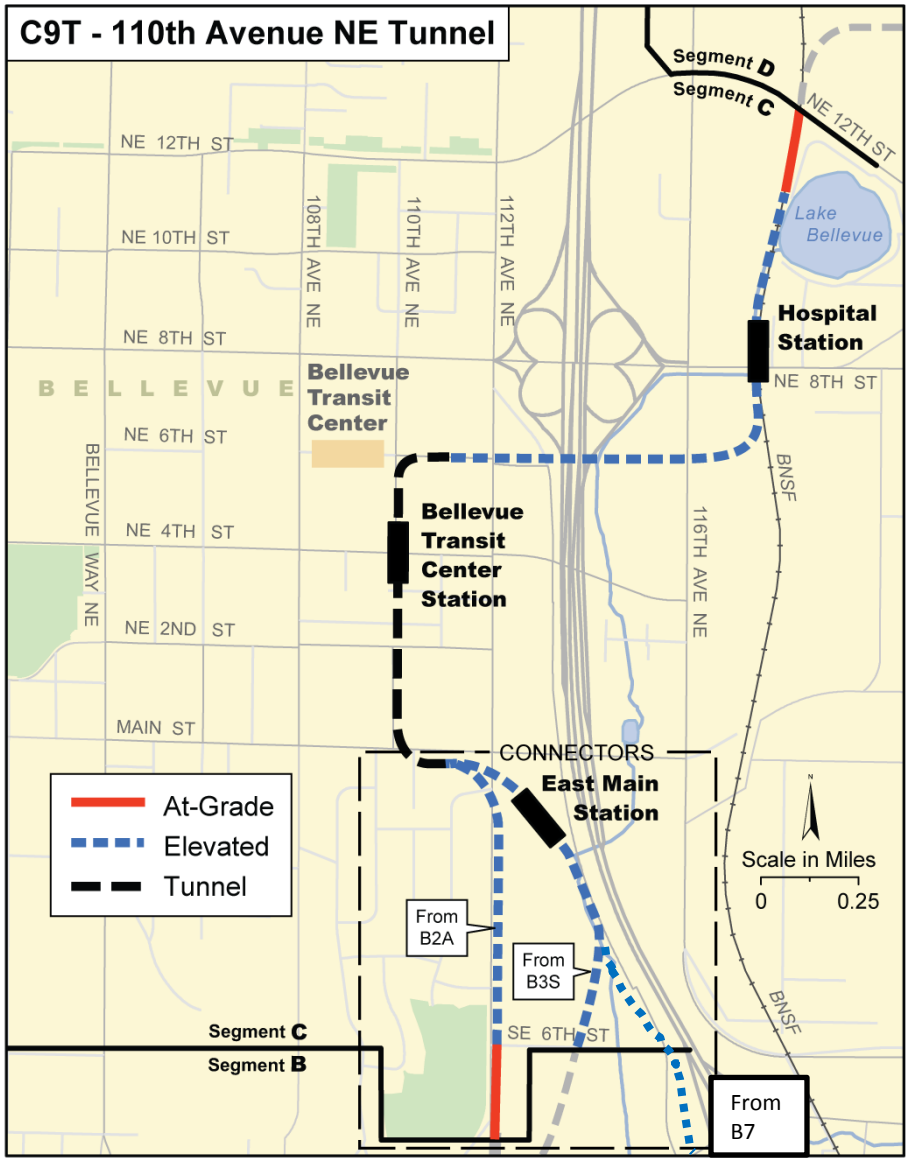
"…best combination of performance and community value, making it the best investment for the next 100 years based on a regional, as well as local, evaluation process."

Alignment Alternatives Development

- Peer Review and Value Analysis result in three new alternatives
- Bellevue City Council requested study of C14E
- Public workshop and stakeholder briefings in November and December 2009
- Sound Transit with Bellevue staff developed new alternatives to conceptual engineering level of design

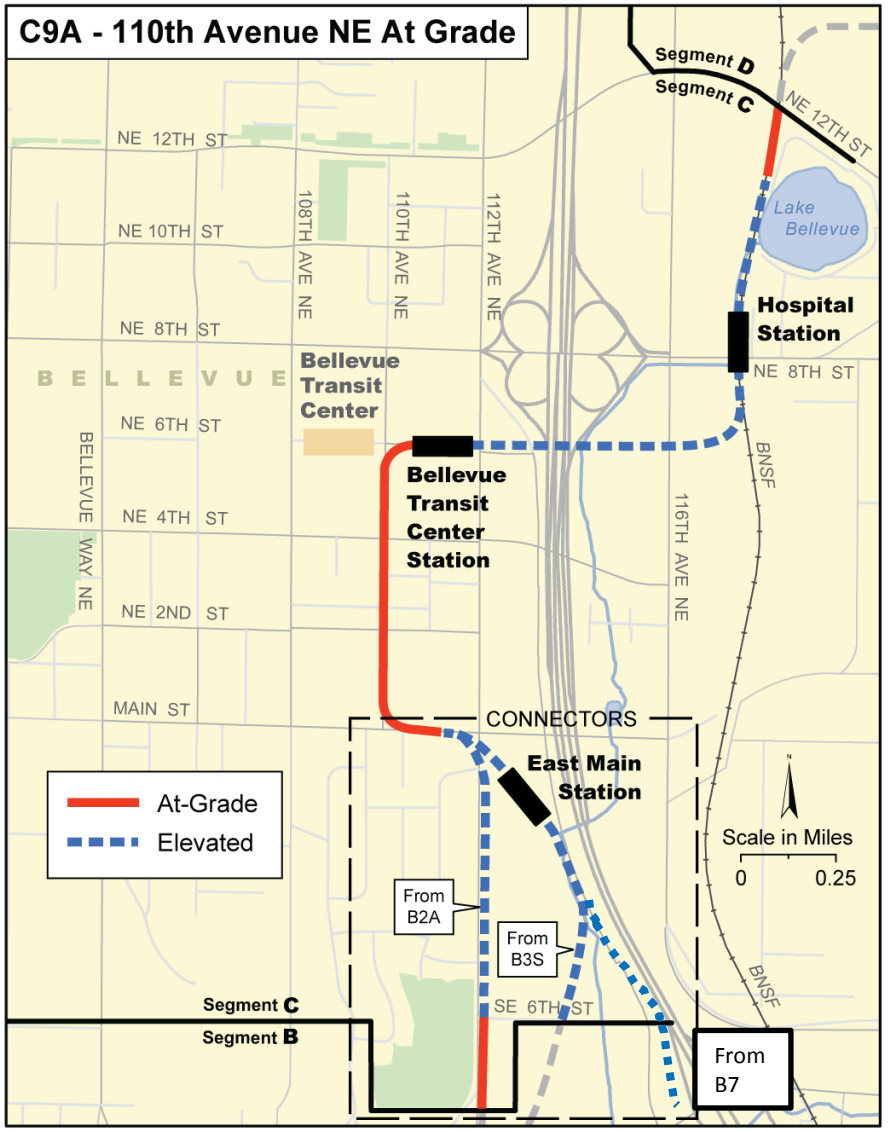
C9T: 110th NE Tunnel

- Tunnel under 110th
- Three stations:
  - East Main: elevated
  - BTC: underground
  - Hospital: elevated



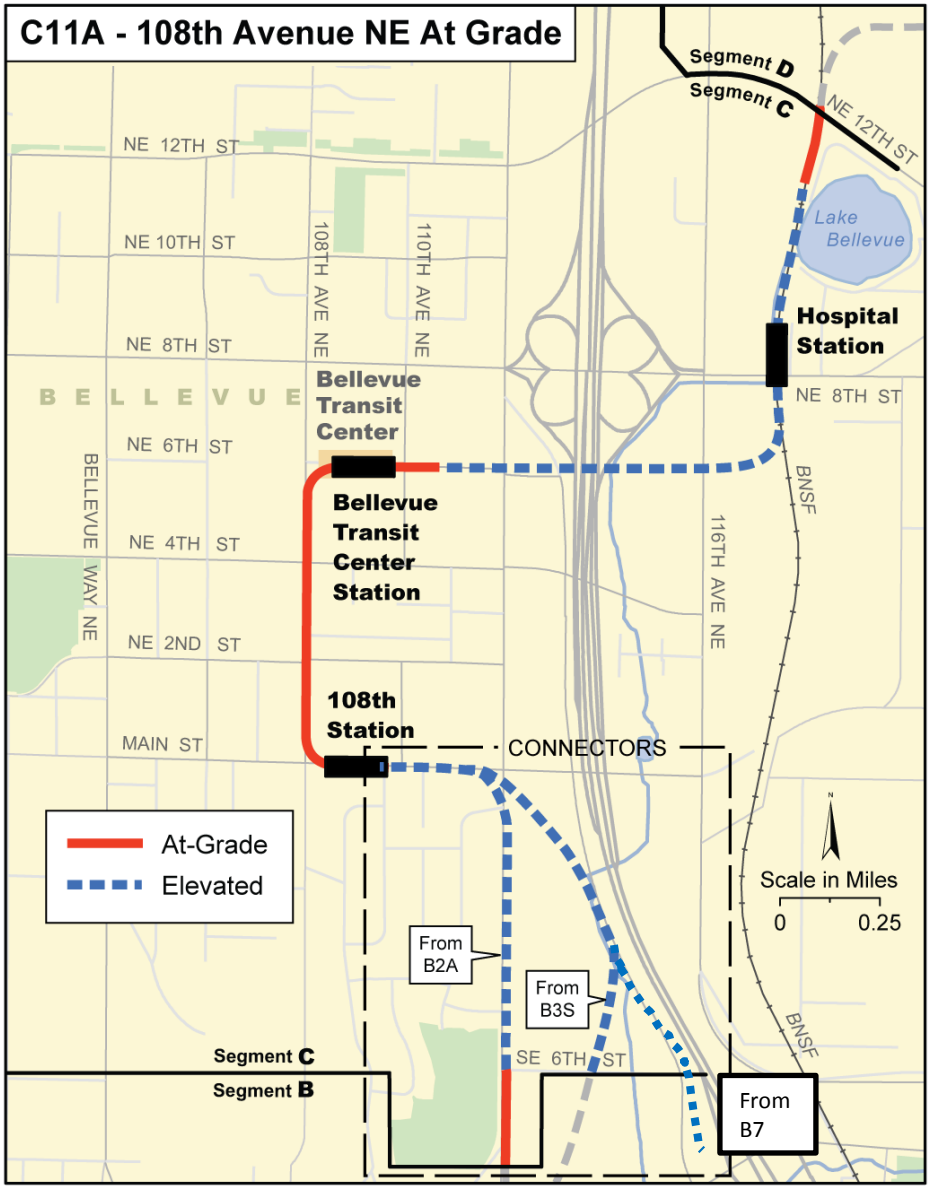
C9A: 110th NE At-Grade

- At-grade, center running on 110th
- Three stations:
  - East Main: Elevated
  - BTC: Elevated
  - Hospital: Elevated



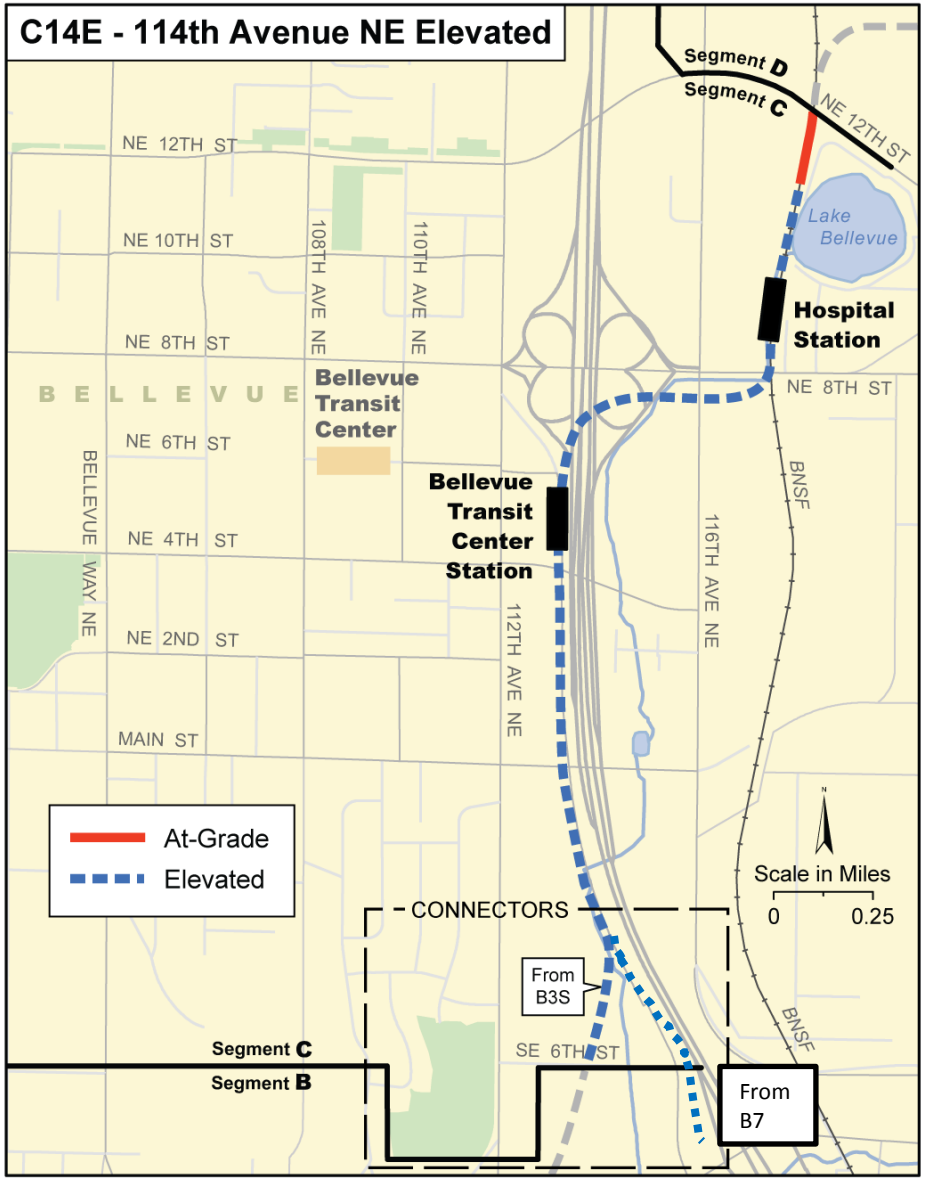
C11A: 108th NE At-Grade

- At-grade running on 108th
- Three stations:
  - 108th: At-grade
  - BTC: At-grade
  - Hospital: Elevated

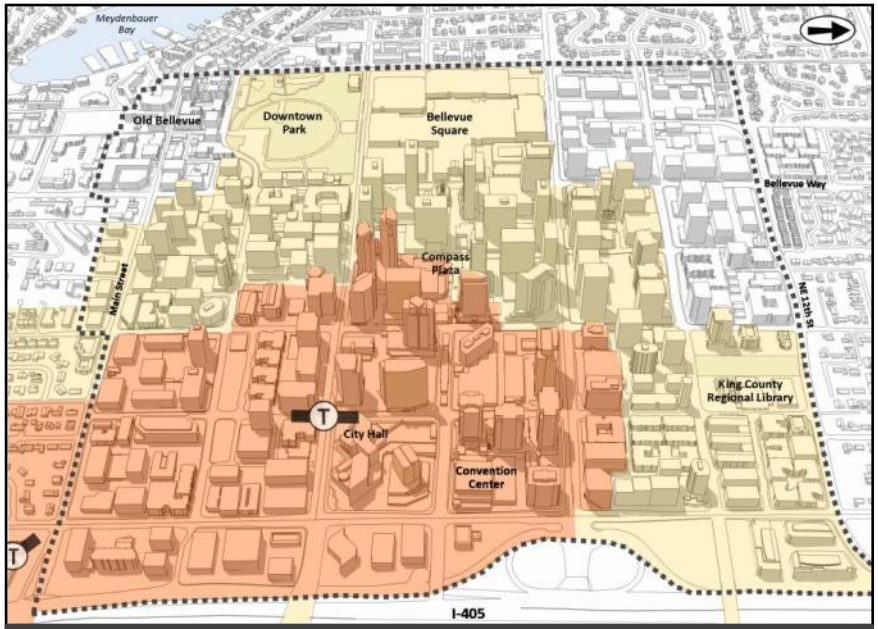


C14E: 114th NE Elevated

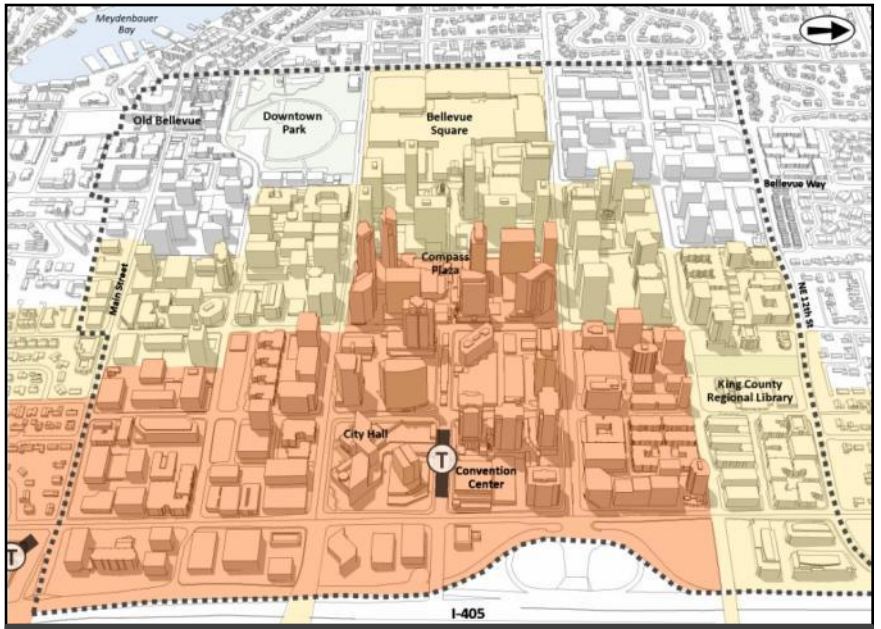
- Elevated on 114th
- Two stations:
  - BTC: Elevated
  - Hospital: Elevated
- Other elements:
  - Moving sidewalk
  - Pedestrian bridge to Meydenbauer Center
- Possible additions:
  - 200-space park-and-ride
  - Circulator bus



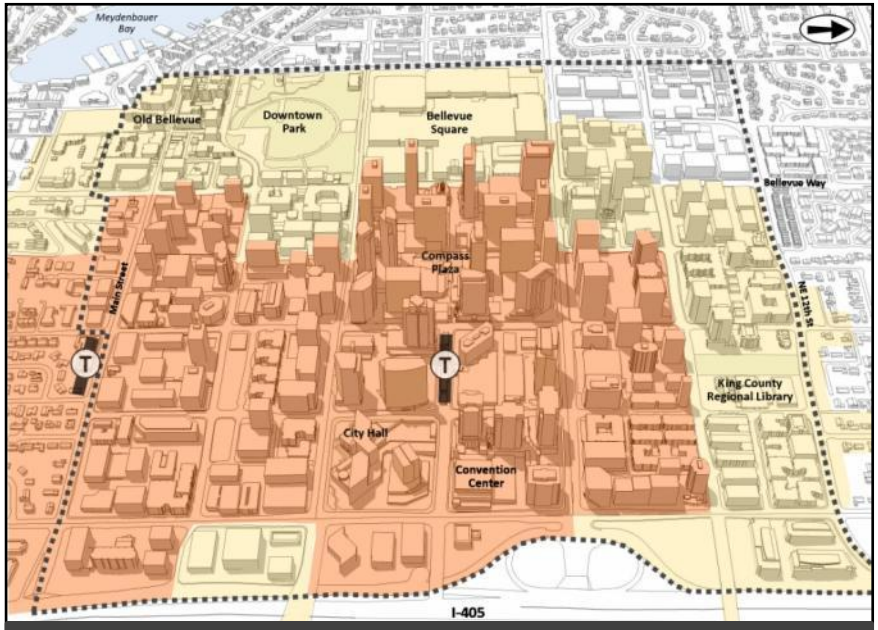
Downtown: 2030 Depiction of Where Growth Might Occur



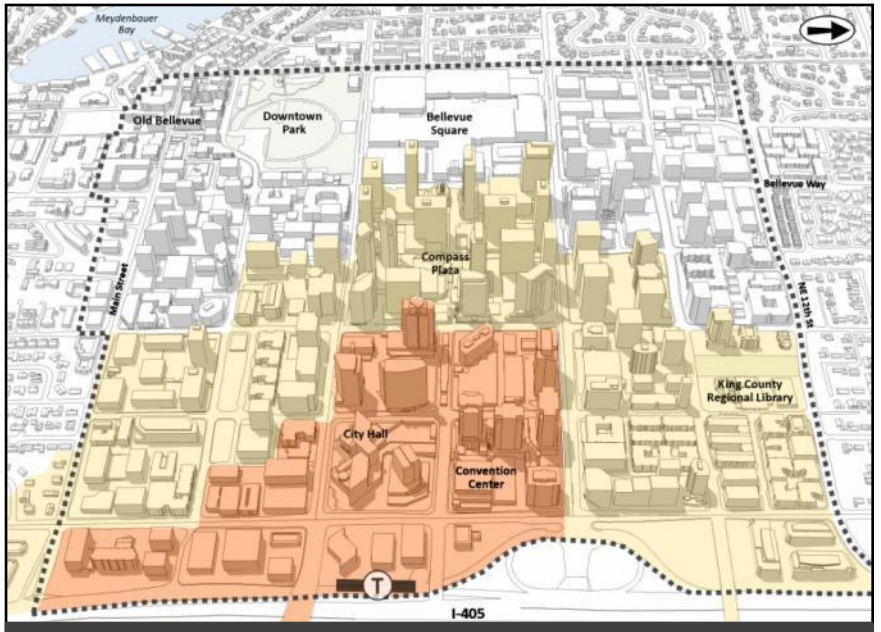
C9T: 5 and 10-minute Walk



C9A: 5 and 10-minute Walk



C11A: 5 and 10-minute Walk



C14E: 5 and 10-minute Walk

Walk Distance to Stations

	2030 Downtown Jobs		2030 Downtown Residents	
Downtown Subarea Forecast	79,000		19,000	
Walk Distance	5-min. walk	10-min. walk	5-min. walk	10-min. walk
C9A Alignment: 110th NE At-Grade				
Downtown Land Use within Walk Distance	**39,938**	**75,298**	**5,221**	**11,826**
Percent of 2030 Downtown Subarea Total	**51%**	**96%**	**28%**	**63%**
C9T Alignment: 110th NE Tunnel				
Downtown Land Use within Walk Distance	**34,755**	**75,908**	**3,940**	**12,345**
Percent of 2030 Downtown Subarea Total	**44%**	**97%**	**21%**	**66%**
C11A Alignment: 108th NE At-Grade				
Downtown Land Use within Walk Distance	**60,059**	**77,824**	**9,929**	**17,157**
Percent of 2030 Downtown Subarea Total	**76%**	**99%**	**53%**	**92%**
C14E Alignment: 114th NE Elevated				
Downtown Land Use within Walk Distance	**21,249**	**62,023**	**1,258**	**8,628**
Percent of 2030 Downtown Subarea Total	**27%**	**79%**	**7%**	**46%**

Evaluation Summary: Ridership and Travel Time

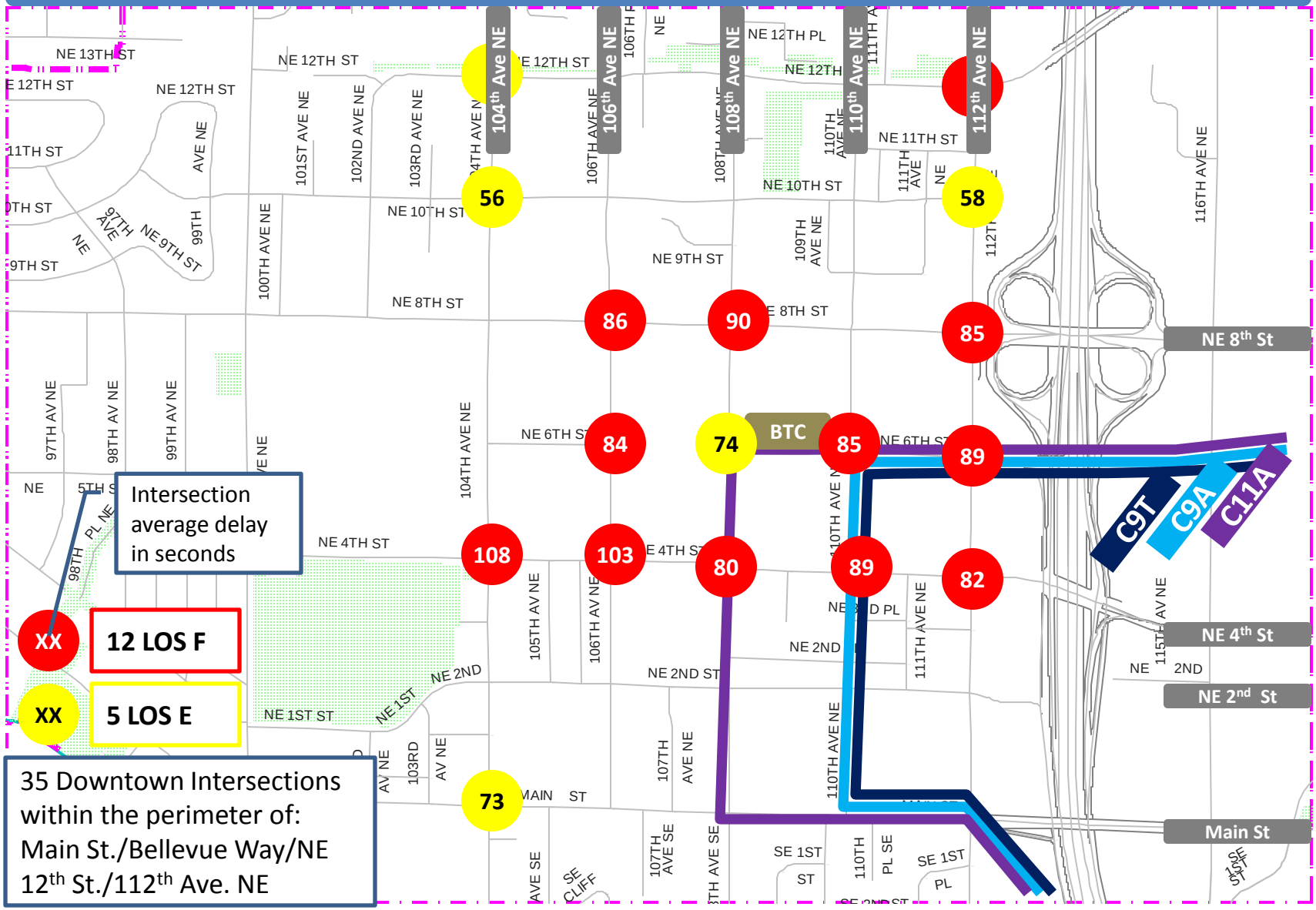
Criteria	C9T 110th Tunnel	C9A 110th At-Grade	C11A 108th At-Grade	C14E 114th Elevated
Segment C daily boardings	8,000	7,500	8,000	6,000
East Link daily ridership	51,000	48,500	49,000	48,500*
Segment C light rail travel time (minutes)	6	9	9	4

* Inclusion of a 200 space park-and-ride garage and circulator bus but does not significantly increase segment ridership.

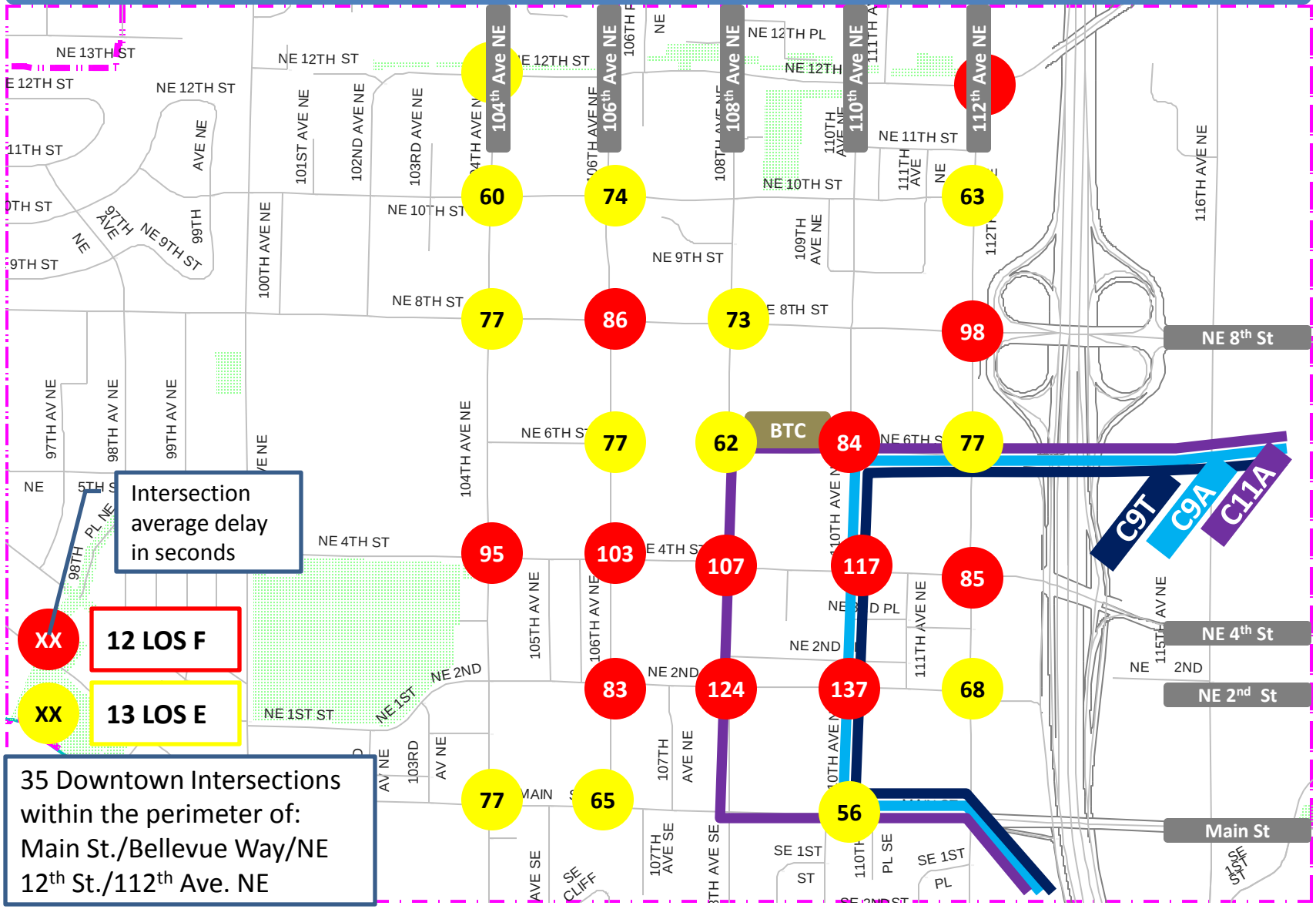
Evaluation Summary: Traffic Operations (Updated)

Criteria	C9T 110th Tunnel	C9A 110th At-Grade	C11A 108th At-Grade	C14E 114th Elevated
Southbound vehicle travel time (minutes)	7.1	8.0	8.0	7.1
Northbound vehicle travel time (minutes)	5.3	5.6	5.7	5.3
Eastbound vehicle travel time (minutes)	4.7	4.6	5.6	4.7
Westbound vehicle travel time (minutes)	4.4	5.2	5.1	4.4
Percent of vehicle demand into and out of downtown served	82%	80%	80%	82%
Average downtown intersection vehicle delay (seconds)	**61**	**71**	**68**	**61**
Average vehicle delay at key affected intersections (seconds)	**68**	**82**	**82**	**68**

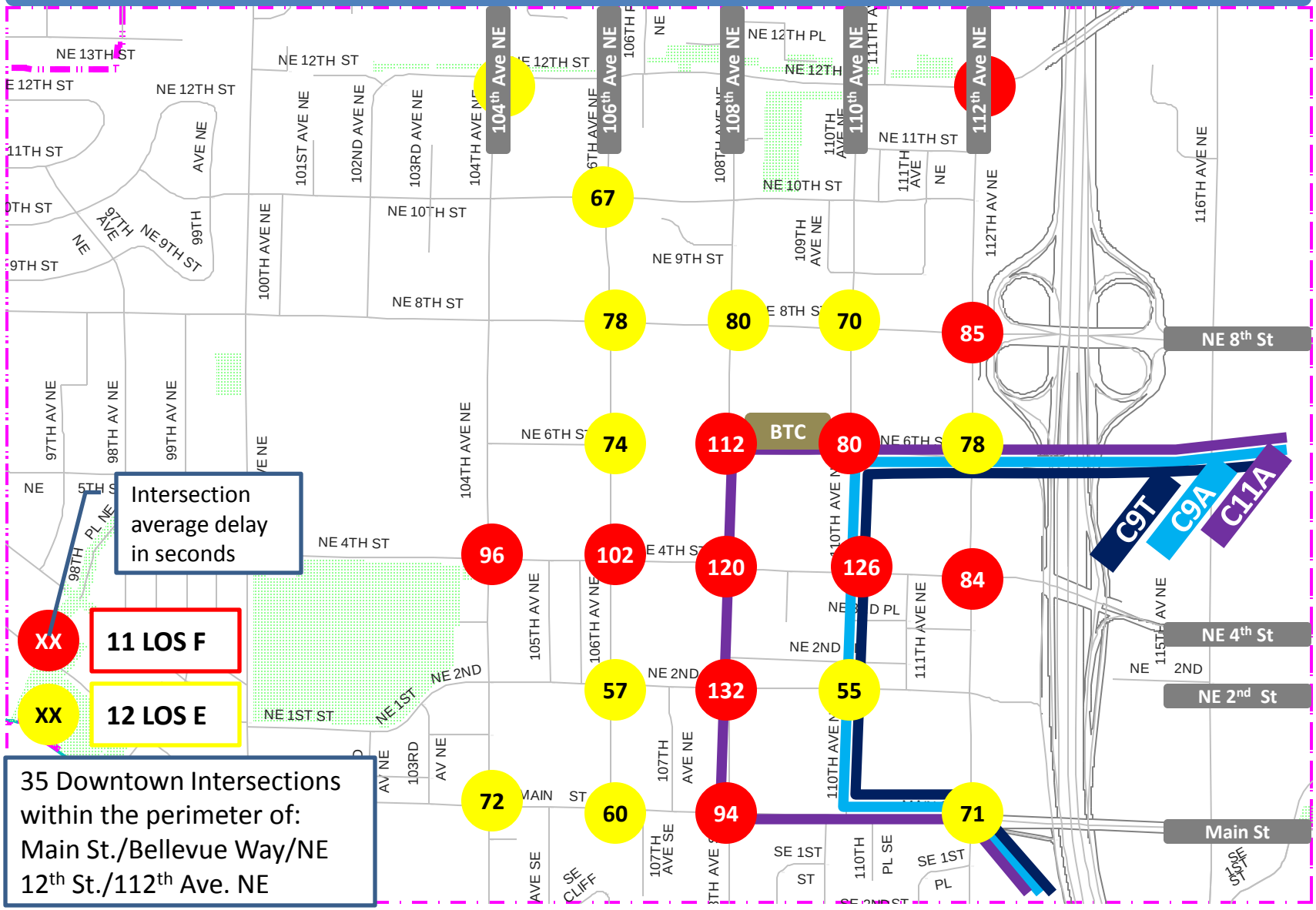
Intersection LOS E and F in LRT Alternatives C9T and C14E V1.2



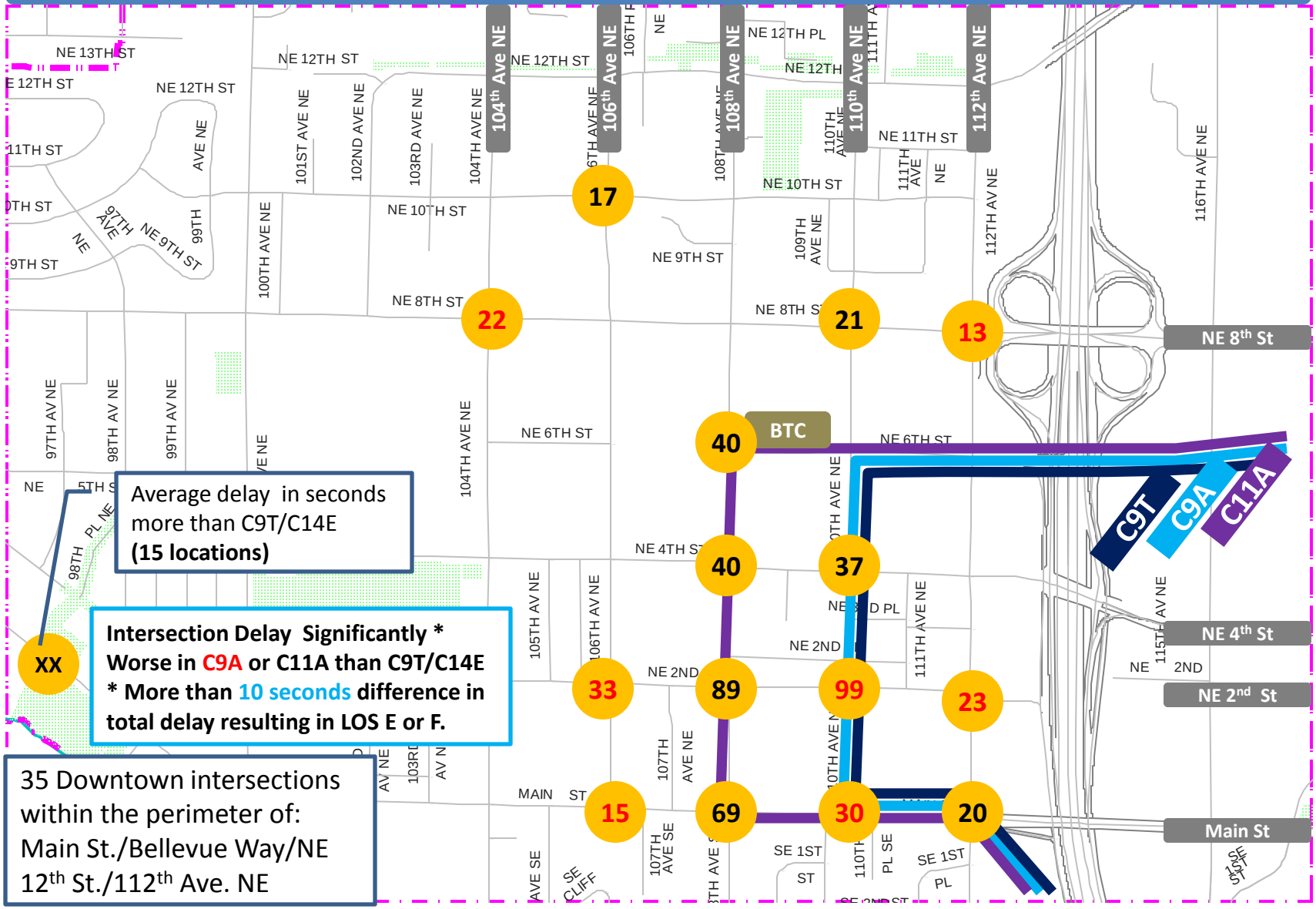
Intersection LOS E and F in LRT Alternative C9A V1.2



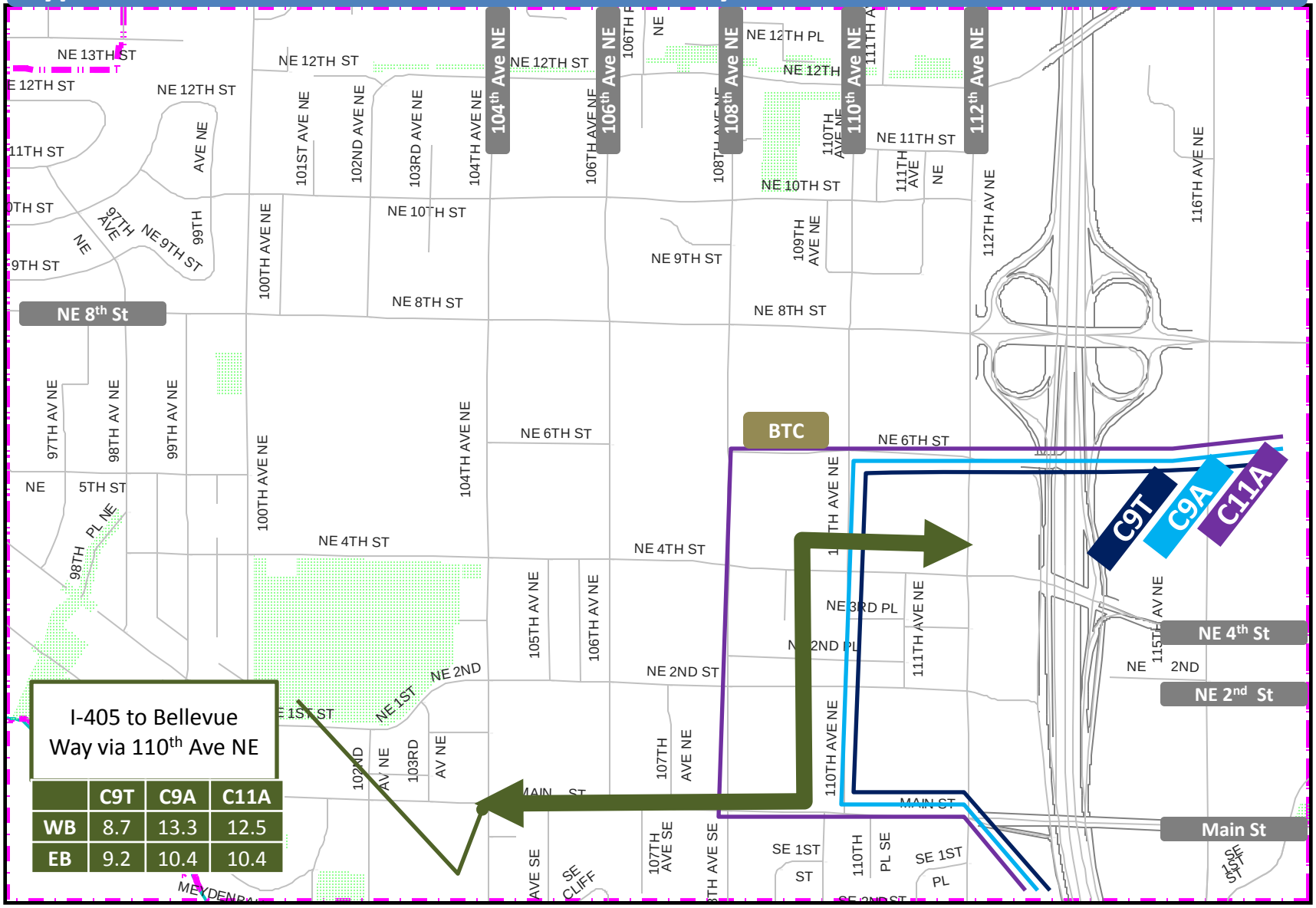
Intersection LOS E and F in LRT Alternative C11A V1.2



Intersection Delay Significantly * Worse in C9A or C11A than in C9T/C14E V1.2



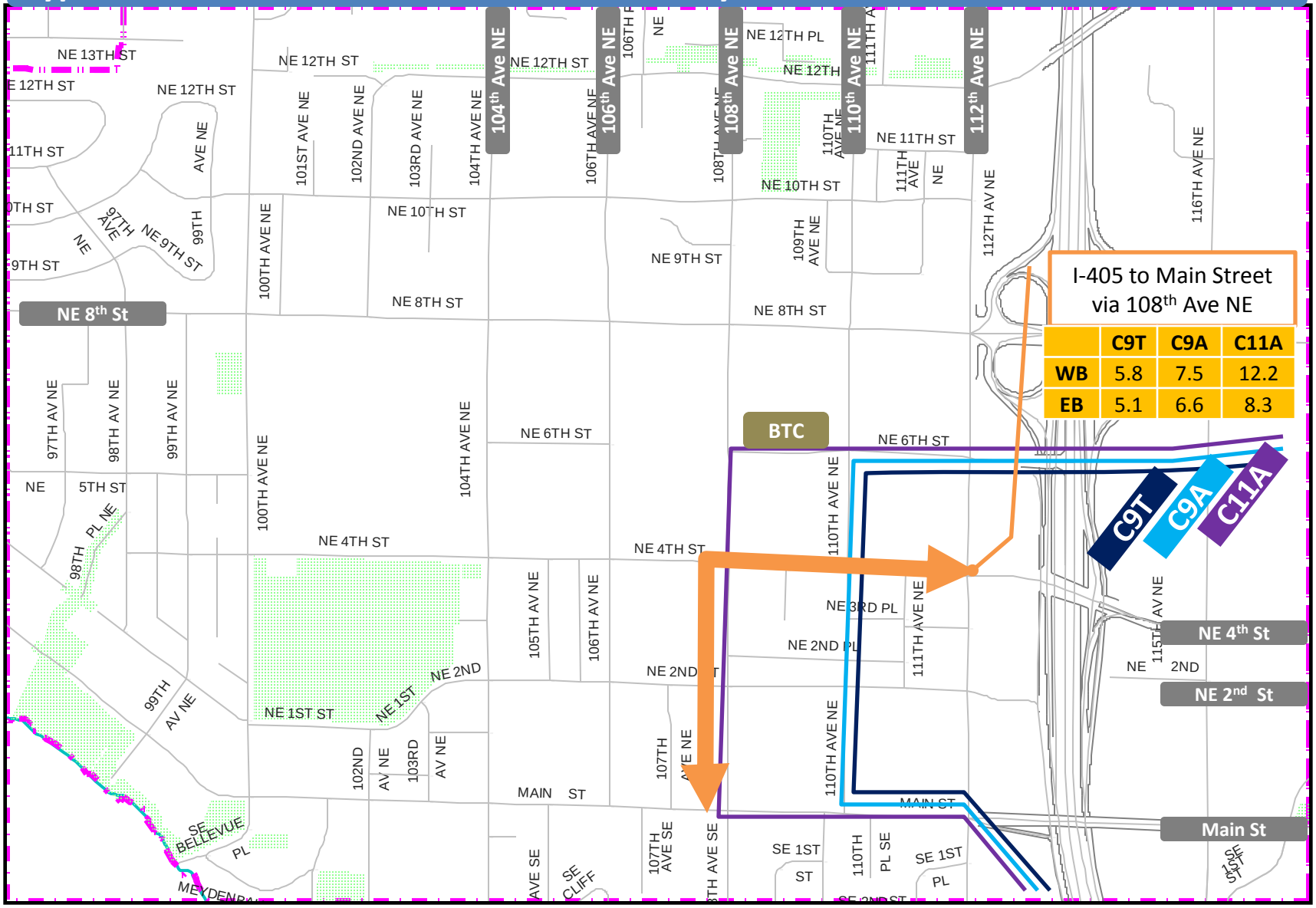
Typical Downtown Routes - Travel Time Analysis V1.2



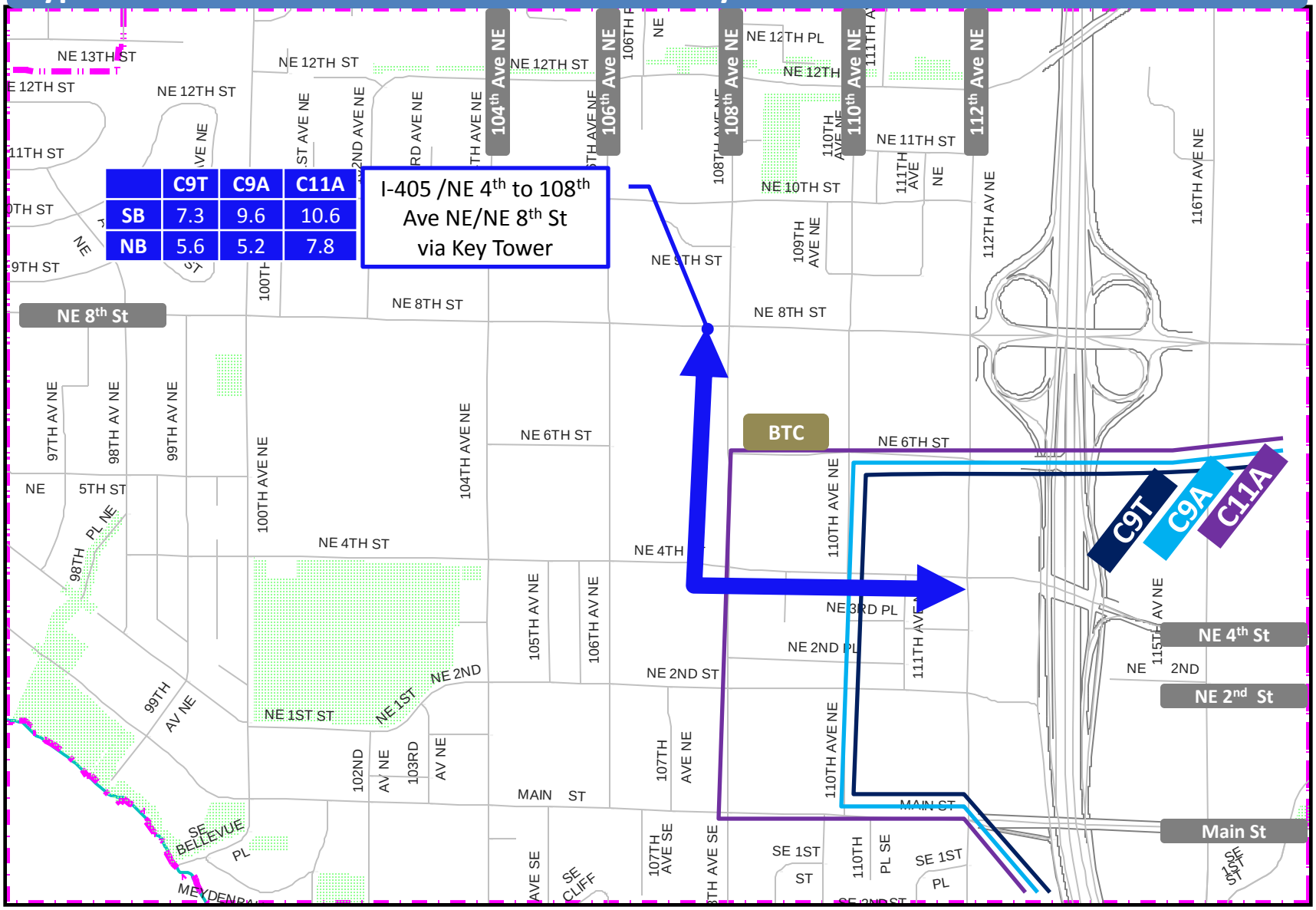
I-405 to Bellevue Way via 110th Ave NE

	C9T	C9A	C11A
WB	8.7	13.3	12.5
EB	9.2	10.4	10.4

Typical Downtown Routes - Travel Time Analysis V1.2



Typical Downtown Routes - Travel Time Analysis V1.2



	C9T	C9A	C11A
SB	7.3	9.6	10.6
NB	5.6	5.2	7.8

Downtown Traffic Analysis

Implications in 2030

- Traffic analysis shows that, based on assumptions in the model for land use growth and the assumed transportation network, Downtown will be very congested in 2030
- At-grade light rail alternatives will make congestion worse
  - Additional congestion for the Downtown as a whole
  - More severe congestion in southeast portion of Downtown
  - Severe congestion/delay at specific intersections
- Congestion also results in increased travel times for light rail in at-grade options
- LRT at-grade more susceptible to service disruptions than grade-separated

Downtown Traffic Analysis

Implications Beyond 2030

- Downtown Bellevue's status as a regional growth center (in Vision 2040) means that Downtown will be a local and regional focus for growth beyond 2030
- Traffic analysis shows larger numbers of LOS E intersections in at-grade alternatives— shows increased congestion in the longer term
- Transportation system constrained and prone to operational disruptions.

Conclusion

110th Avenue Northeast Tunnel (C9T) most consistent with 2/09 Council preferences

- Serves core of downtown and is fully grade separated
- Eliminates street impacts, allowing for system growth and flexibility beyond 2030
- Downtown and Hospital/Wilburton stations (NE 6th St. I-405 crossing)
- High ridership
- Minimal adverse environmental impacts

Funding shortfall an issue ($285 million), yet far less than previously:

- C2T: $1.3 billion ($600 million over ST2 budget)
- C3T: $1.2 billion ($500 million over ST2 budget)

	C9T					C9A					C11A				
Intersection	LOS	Delay	Model Throughput	Vehicle Demand	Percent Served	LOS	Delay	Model Throughput	Vehicle Demand	Percent Served	LOS	Delay	Model Throughput	Vehicle Demand	Percent Served
Bellevue Way/Main Street	E	72.6	4138	4728	87%	E	77.0	3920	4730	83%	E	72.1	3823	4764	80%
Bellevue Way/2nd Street	C	21.3	3275	3713	88%	C	23.9	3110	3737	83%	C	25.1	3067	3803	81%
Bellevue Way/4th Street	F	107.7	3720	4504	82%	F	94.8	3613	4624	78%	F	95.7	3520	4678	75%
Bellevue Way/6th Street	B	16.3	2486	2803	88%	C	32.6	2384	2925	81%	B	16.1	2311	2882	80%
Bellevue Way/8th Street	D	54.3	4364	4962	86%	E	76.6	4176	5093	82%	D	48.7	4290	5084	84%
Bellevue Way/10th Street	E	55.8	3784	4205	88%	E	60.0	3652	4286	85%	D	51.0	3821	4289	89%
Bellevue Way/12th Street	E	57.3	4010	4521	86%	E	55.6	3894	4533	86%	E	57.2	4086	4535	90%
106th Avenue/Main Street	D	50.5	2746	3264	83%	E	65.2	2513	3263	77%	E	59.5	2540	3314	77%
106th Avenue/2nd Street	D	49.6	3042	3597	83%	F	82.5	2659	3620	73%	E	57.2	2745	3670	75%
106th Avenue/4th Street	F	103.3	3573	4379	81%	F	103.4	3460	4635	75%	F	102.1	3447	4766	72%
106th Avenue/6th Street	F	84.4	2083	2899	71%	E	76.5	2185	2977	73%	E	73.9	2176	3032	72%
106th Avenue/8th Street	F	86.4	4255	5425	77%	F	85.5	4195	5646	74%	E	78.1	4243	5534	77%
106th Avenue/10th Street	D	49.7	2755	3519	77%	E	74.0	2625	3507	75%	E	66.7	2626	3410	77%
106th Avenue/12th Street	C	32.7	2609	3189	81%	D	36.7	2538	3134	81%	C	33.8	2600	3121	83%
108th Avenue/Main Street	C	25.3	2673	3176	84%	D	50.5	2501	3213	78%	F	94.1	2522	3148	80%
108th Avenue/2nd Street	D	42.7	2112	2598	79%	F	123.6	1983	2832	70%	F	132.0	1773	2385	74%
108th Avenue/4th Street	E	79.9	3110	4086	76%	F	106.8	3188	4514	71%	F	120.0	2731	4264	64%
108th Avenue/6th Street	E	73.6	1129	1497	75%	E	61.7	1190	1543	77%	F	111.5	937	1221	77%
108th Avenue/8th Street	F	89.5	3875	5125	75%	E	72.8	3814	5142	74%	E	80.0	3724	4951	75%
108th Avenue/10th Street	C	34.8	2151	2829	75%	D	35.5	2100	2766	76%	D	35.7	2110	2683	79%
108th Avenue/12th Street	C	25.2	2963	3568	83%	C	24.9	2931	3563	82%	C	25.4	3002	3567	84%
110th Avenue/Main Street	C	26.0	2562	3098	82%	E	55.5	2285	2949	77%	D	53.5	2394	3160	76%
110th Avenue/2nd Street	D	41.0	2287	2919	76%	F	137.3	1884	2990	63%	E	55.2	2001	2978	67%
110th Avenue/4th Street	F	89.0	3704	4943	74%	F	117.3	3399	4808	71%	F	125.6	3269	5339	61%
110th Avenue/6th Street	F	85.0	1604	2200	72%	F	83.9	1479	1769	84%	F	80.2	1831	2449	75%
110th Avenue/8th Street	D	49.5	4705	5882	79%	D	51.7	4528	5667	80%	E	70.1	4593	5851	78%
110th Avenue/10th Street	D	38.5	2913	3557	81%	D	37.4	2865	3425	84%	D	41.4	2766	3338	83%
110th Avenue/12th Street	C	30.4	2943	3583	82%	C	27.1	2943	3572	82%	C	28.4	2996	3559	84%
112th Avenue/Main Street	D	51.0	4384	5247	83%	D	52.6	4168	5380	77%	E	70.6	4128	5347	77%
112th Avenue/2nd Street	D	44.6	3160	3995	78%	E	68.0	2892	4288	67%	D	49.2	2976	4122	72%
112th Avenue/4th Street	F	82.1	4619	6419	72%	F	84.6	4619	6848	67%	F	83.5	4307	6550	66%
112th Avenue/6th Street	F	89.1	3151	4376	72%	E	77.4	3157	4464	71%	E	77.6	3175	4412	72%
112th Avenue/8th Street	F	85.0	5934	7728	77%	F	98.0	5715	7630	75%	F	85.4	5789	7589	76%
112th Avenue/10th Street	E	58.1	3369	4210	80%	E	62.9	3231	4264	76%	D	53.8	3201	4188	76%
112th Avenue/12th Street	F	82.2	4148	5180	81%	F	86.0	4073	5156	79%	F	82.0	4210	5174	81%
116th Avenue/Main Street	C	32.0	3072	3596	86%	C	34.3	2904	3583	81%	C	29.1	2885	3562	81%
116th Avenue/4th Street	E	57.4	3660	4420	84%	E	59.7	3425	4461	77%	D	48.5	3321	4404	75%
116th Avenue/8th Street	D	54.0	5847	6769	87%	E	74.2	5568	6896	81%	D	41.6	5566	6912	81%
116th Avenue/11th	C	32.1	2297	2738	85%	D	35.9	2255	2759	82%	B	16.0	2394	2759	87%
116th Avenue/12th Street	E	63.1	4792	5819	84%	E	57.5	4797	5786	83%	D	53.3	4957	5779	86%
120th Avenue/8th Street	E	73.2	4912	5354	92%	E	77.5	4767	4961	96%	E	74.2	4821	4988	97%
102th /8th Street	B	14.9	2178	2367	91%	C	22.0	2099	2396	88%	B	13.7	2085	2345	89%
Mall/8th Street	A	7.2	2094	2255	92%	B	15.6	2021	2266	89%	A	6.3	2008	2233	90%
100th Avenue/8th Street	C	24.5	2574	2696	95%	C	30.0	2503	2697	93%	C	22.9	2501	2657	94%
100th Avenue/5th	B	11.5	1725	1844	93%	B	12.7	1703	1853	92%	B	11.2	1694	1820	93%
100th Avenue/4th Street	B	12.9	1436	1746	82%	B	11.3	1426	1753	81%	A	9.8	1400	1725	81%
102nd Street/4th Street	E	64.7	1247	1589	77%	C	34.2	1298	1595	81%	C	27.1	1277	1593	80%
Bellevue Way/7th Street	D	36.5	2887	3345	86%	D	51.5	221	3464	6%	C	30.3	2756	3423	80%
Network Weighted LOS/Delay	E	61.4	114336	141924	80%	E	71.1	109865	143493	77%	E	68.4	109729	143157	77%
Subarea Weighted LOS/Delay	E	68	64709	82853	77%	F	82.2	61813	84178	73%	F	81.7	61300	84082	73%
Network Entering Demand/Throughput			14872	17448	85%			14606	17459	84%			14918	17804	84%
Network Departing Demand/Throughput			16825	21136	79%			16812	21968	77%			16877	22046	77%
Total Delay Hours in Downtown		1952					2169					2085			

North-South Travel Time

	C9T	C9A	C11A
Bellevue Way SB	5.7	5.4	5.2
Bellevue Way NB	3.0	3.5	3.9
106th SB	8.3	8.7	8.4
106th NB	5.8	7.1	6.2
108th SB	7.3	8.7	14.2
108th NB	8.3	7.5	11.6
110th SB	5.3	8.7	10.9
110th NB	8.4	9.1	8.0
112th SB	8.2	10.2	9.1
112th NB	6.6	6.0	5.7

East-West Travel Time

	C9T	C9A	C11A
Main EB	3.3	3.1	5.4
Main WB	3.2	5.2	5.0
4th EB	7.5	8.1	7.1
4th WB	6.6	5.4	7.7
8th EB	3.6	2.9	4.3
8th WB	4.0	5.2	3.9

Weighted Travel Time

	C9T	C9A	C11A
SB Weighted	7.1	8.0	8.0
NB Weighted	5.3	5.6	5.7
EB Weighted	4.7	4.6	5.6
WB Weighted	4.4	5.2	5.1