

MEMORANDUM

Date: February 24, 2020 **TG:** 1.17239.00

To: Jeff Wilkens, CDTC

From: Brent Turley, Transpo Group

Subject: CDTC Travel Demand Model: INFRA Grant Analysis Documentation

The purpose of this memorandum is to provide the documentation on how the Chelan-Douglas Transportation Council (CDTC) Travel Demand Model was used in the Benefit-Cost Analysis (BCA) for the 2020 INFRA Grant Application.

Background

The CDTC Model was developed to provide a solid technical basis for evaluating transportation system needs in coordination with long-term planning for Wenatchee, East Wenatchee, and nearby urban areas. The CDTC Model was built using Visum software (Version 18.02) and is consistent with local and regional growth plans within the region. The scope of the model is the Wenatchee Valley areas of Chelan and Douglas Counties, from Monitor to the west and Rock Island to the east (approximately 15 miles wide and 15 miles tall). The boundaries are based on U.S. Census geography in the area.

The CDTC Model has a base year of 2016 and a forecast horizon year of 2045. The 2016 year is based on the year of the latest available land use for the area at time of model development. The model trip assignment represents the PM peak hour period (one-hour volume) between 4 p.m. and 6 p.m. on a typical weekday. The model has a total of 237 Transportation Analysis Zones (TAZs). The 2016 CDTC Model has 521 lane miles coded that represent expressways, arterials, collectors, and local streets. Trip generation is based on population and employment inputs, which are converted to daily trips, then converted to peak hour trips by time-of-day factors. The model network includes both link capacities and intersection movement capacities to evaluate delays and congested travel times. Auto, truck, and transit modes are represented in the trip assignments.

For purposes of the INFRA grant application, it is worth noting that the rate of population growth built into the travel demand model of approximately 1 percent, while based on official city and county growth estimates established in 2016, are well below the actual current rate of annual population increase since that time. According to Washington State Office of Financial Management the actual rate of population growth from 2015-2019 has averaged 1.4 percent per year. As a result, it is likely that the travel demand model represents a conservative forecast of future traffic volumes and corridor travel times, potentially under-estimating the travel delay benefits of the project.

2016 Existing Model

The CDTC 2016 Existing Model represents the base year model that was used for calibration. This model represents one bookend of how the model changes over time, with the other bookend being the Baseline 2045 Model.

2045 Baseline Model

The CDTC 2045 Baseline Model includes added land use growth and external trip growth as compared to the 2016 Existing Model, consistent with *Transportation 2040*, the long-range transportation plan for the region. In addition, several funded and committed network improvements projects are assumed in the 2045 Baseline Model (compared to the 2016 Model), including:

- Add signal to McKittrick Street/ Wenatchee Avenue intersection
- Add roundabout to Springwater Avenue/ Western Avenue intersection
- Add roundabout to Red Apple Road/ Miller Street intersection
- Add signal to 9th Street NE/ Valley Mall Parkway intersection
- Add 35th Street NW Extension, between NW Cascade Avenue and NW Empire Avenue

In addition, the 2045 Baseline land use in the area was conservatively adjusted to reflect 50 percent of build out of the Wenatchi Landing Development Plan. This provides a common land use for comparison between all the 2045 scenarios.

2028 Baseline Model

To assist in the INFRA BCA analysis, a 2028 interim horizon year baseline model was created to represent year of opening of the planned projects. This 2028 Baseline Model is the same as the 2045 Baseline model except land use growth and external zone traffic volumes were adjusted to reflect 2028 conditions. The 2028 Baseline Model network structure is coded the same as the 2045 Baseline Model network.

INFRA Model Analysis Scenarios

The following five model scenarios were developed as part of the INFRA Grant BCA analysis. Each scenario, representing project segments of the Apple Capital Loop project, was evaluated for two horizon years, 2028 and 2045.

North Wenatchee Avenue Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the North Wenatchee Avenue project. In the model, this includes increased roadway and intersection movement capacities to reflect better access management, signal improvements, and “Phase 1” frontage road at Maiden Lane and Horse Lake Road.

Confluence Parkway Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the Confluence Parkway project. In the model this included network changes as documented in the *Confluence Parkway Transportation Discipline Report*, (October 2019).

Wenatchi Landing Interchange Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the proposed network design for Wenatchi Landing Development Plan. The most prominent network elements of

this plan is a new half interchange at US 2, and removed direct intersection access at Cascade Avenue. A new roundabout at SR 28/35th Street NW is also included in this scenario.

Sunset Highway Scenario

This scenario is the same as the Baseline Model scenario, but revised to include the widening of Sunset Highway (SR 28) between 9th Street NE and 23rd Street NE to four lanes with median and left-turn pockets.

Full Build Scenario

This scenario is the same as the Baseline Model scenario, but revised to reflect all of the above scenarios combined.

Scenario Metrics

The following metrics were compiled for 2016 Existing, 2028 Baseline, 2045 Baseline, and all analysis scenarios as described above.

Travel Time Corridors and Delay

The following corridors were used to evaluate travel time benefits. Travel times were compiled for each direction of travel, for the PM peak hour time period. Maps of the segments are shown in Attachment 1.

1. **Between Wenatchee Avenue/Miller Street and US 2/Easy Street intersections.** This is meant to capture travel time changes relative to the North Wenatchee Avenue project.
2. **Shortest Route: Wenatchee Avenue/Miller Street to US 2 EB Ramp intersection at Euclid Ave.** This is meant to capture travel time changes relative to the Confluence Parkway project. The shortest route was used, meaning for some scenarios it may be using the North Wenatchee Avenue corridor and other scenarios it may be Confluence Parkway corridor.
3. **US 2/ Easy Street intersection to SR 28/ 19th Street NE intersection.** This is meant to capture travel time changes relative to the Wenatchi Landing project.
4. **SR28 Sunset Highway: US2 to Valley Mall Parkway.** This is meant to capture travel time changes relative to the Sunset Highway Widening project.

Traffic Volumes

Traffic volume forecasts were developed to understand the number of users that would benefit from the planned improvements. The forecasts were post-processed using the difference method, which is calculating the trip growth between existing and future year model outputs and adding that to existing counts. Post-processing volumes is an industry best practice.

The following locations were forecasted:

- North Wenatchee Avenue at the Wenatchee River Bridge
- Confluence Parkway at the Wenatchee River Bridge
- US 2, west of the future Wenatchi Landing Interchange
- US 2, east of the future Wenatchi Landing Interchange
- SR 28, south of 19th Street NE

Scenario Results

The summary of scenario results are shown in Tables 1 and 2, for 2028 and 2045 conditions, respectively.

Travel time corridor delay and volume metrics were derived from the CDTC Regional Model for all scenarios, including the 2028 horizon year (first full year of operation after project opening) and the 2045 horizon year (official forecast year for long-range CDTC planning). For each of the scenarios, the total corridor delay was compared to the Baseline (No Build) scenario to capture the benefit of the project in terms of reduced minutes of travel time delay. These figures were then translated into total hours of reduced delay over the full year.

The PM peak one-hour delay results (representing one day) were converted into annual delay impacts in two steps. First, the one-hour delay was multiplied by 365 to reflect annual delay based on one-hour congestion per day. While at first glance this may appear incorrect to include weekends in this calculation, this is actually a proxy for the many hours of congestion on weekends during peak summer recreational and fall fruit harvest periods. Second, the one-hour peak period was expanded to include an additional 5 hours where observed traffic volume currently operates at 80 percent of the peak hour or greater. To reflect the non-linear relationship between traffic volume and travel delay, a factor was applied to the non-peak hours that indexed 80 percent of peak traffic volume as equivalent to 50 percent of the amount of delay in the peak hour. With these factors applied, the 6 actual hours were factored down to an equivalent of 4.5 hours per day experiencing delay. Figure 1 represents average daily traffic on North Wenatchee Avenue where WSDOT has a permanent traffic recorder that provides an accurate daily distribution of volumes.

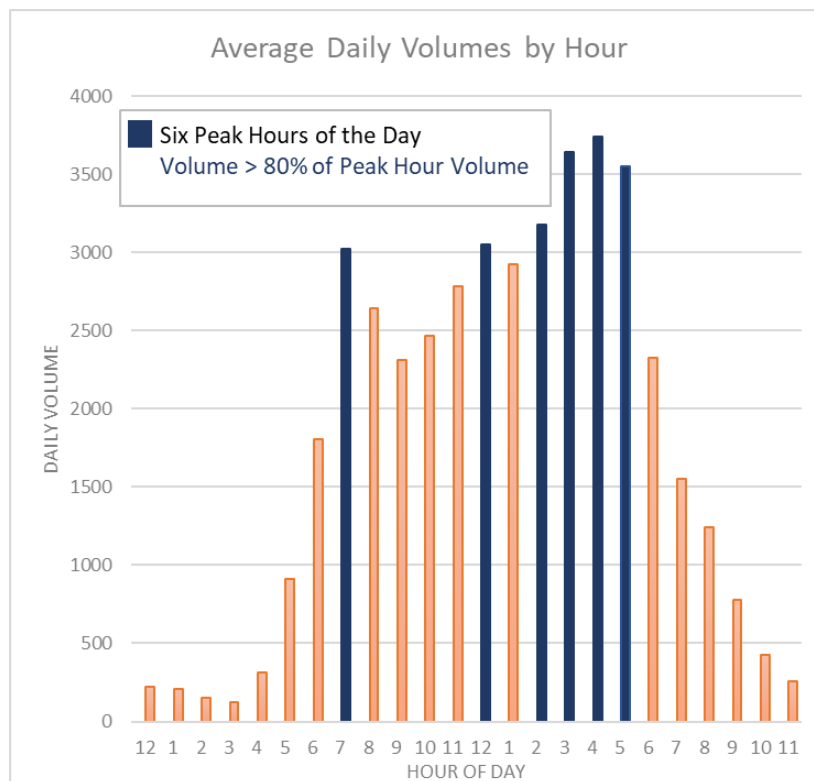


Figure 1 – Hourly Volumes at North Wenatchee Avenue

The results shown in Tables 1 and 2 were used in the calculating BCA metrics on a year-by-year basis. Using the total number for Hours of Reduced Delay produced by the travel demand model for year 2028 and year 2045, the resulting growth rate curve is 3.12 percent per year, which was used to interpolate the per-year Hours of Reduced Delay between 2028 and 2045, and then to extrapolate the model results out to year 2048 for a full 20 year total of Hours of Reduced Delay for the full project and each project segment.

Due to constrained corridors the year-by-year growth in traffic delays is higher than travel volume growth. The calibrated CDTC Model identifies a 1.0 percent annual traffic volume growth rate when measured from the 2016 Model Calibration year out to 2045. The relatively low growth rate in the model (lower than the rate of population growth) is due to reaching the capacity of the study corridors and no alternate or parallel corridors to accommodate additional trips. The model is forced to truncate trip lengths and therefore paints a picture of forecasted travel demand that is lower than what actually exists. Using the traffic model's low 1.0 percent rate of volume growth (1.7 percent volume growth used in previous INFRA applications), the resulting increase in travel delay on the highly capacity-constrained project corridors is higher at a straight-line 3.12 percent per year (the delay growth rate would probably be better represented as a curve instead of a straight line, lower in the early years and higher in the latter years, but without proper data the BCA calculation assumes a straight-line growth rate in order to keep the results directly tied to the travel demand model output).

Full BCA calculations are not included in this memorandum.

Table 1. Travel Time Metrics: 2028 Model Scenarios

Travel Time Corridor	2016 Existing	2028 Model Scenarios					
		Baseline	N Wen. Ave	Conf. Pkwy	Wenatchi Land. IC	Sunset Hwy	Full Build
<i>Wenatchee Ave, Miller Street to US 2/Easy St</i>							
SB Travel Time (minutes)	7.1	9.5	8.8	6.4	9.7	9.1	6
NB Travel Time (minutes)	7.0	8.6	7.8	6.1	8.6	8.3	5.7
Combined Travel Time (minutes)	14.1	18.1	16.6	12.5	18.3	17.4	11.7
Minutes Saved vs Baseline			1.5	5.6	-0.2	0.7	6.4
Volume @ Wenatchee River Bridge			4,305	3,165	4,255	4,160	3,295
Hours Reduced Congestion (1 day)			108	295	-14	49	351
Peak Hour			39,283	107,821	-5,177	17,715	128,285
Peak Hour + 80% Shoulder Hours ¹			176,774	485,195	-23,296	79,716	577,284
<i>Shortest Route, Wenatchee Ave/Miller St to Euclid Ave/US 2 EB Ramp</i>							
SB Travel Time (minutes)	8.4	10.8	10.0	6.2	11.0	10.3	6.0
NB Travel Time (minutes)	7.9	9.5	8.6	6.2	9.5	9.2	5.9
Combined Travel Time (minutes)	16.3	20.3	18.6	12.4	20.5	19.5	11.9
Minutes Saved vs Baseline			1.7	7.9	-0.2	0.8	8.4
Combined Volume @ Wenatchee River Bridges			4,305	4,720	4,255	4,160	4,770
Hours Reduced Congestion (1 day)			122	621	-14	55	207
Peak Hour			44,521	226,835	-5,177	20,245	75,373
Peak Hour + 80% Shoulder Hours ¹			200,344	1,020,759	-23,296	91,104	339,176
<i>US 2/Easy St to SR 28/19th St NE</i>							
SB Travel Time (minutes)	7.1	7.7	7.7	7.8	8.2	8.2	8.6
NB Travel Time (minutes)	7.3	8.3	8.3	8.5	8.1	8.5	8.3
Combined Travel Time (minutes)	14.4	16.0	16.0	16.3	16.3	16.7	16.9
Minutes Saved vs Baseline			0	-0.3	-0.3	-0.7	-0.9
Average Volume @ US 2 near Wenatchi IC			1,728	1,838	1,423	1,720	1,510
Hours Reduced Congestion (1 day)			0	-9	-7	-20	-23
Peak Hour			0	-3,353	-2,596	-7,324	-8,267
Peak Hour + 80% Shoulder Hours ¹			0	-15,090	-11,682	-32,960	-37,203
<i>Sunset Hwy, US 2 to Valley Mall Pkwy</i>							
SB Travel Time (minutes)	7.4	9.0	9.0	8.7	9.3	7.3	7.6
NB Travel Time (minutes)	7.1	8.5	8.3	8.3	8.7	7.1	7.3
Combined Travel Time (minutes)	14.5	17.5	17.3	17.0	18.0	14.4	14.9
Minutes Saved vs Baseline			0.2	0.5	-0.5	3.1	2.6
Volume @ SR 28 south of 19th Street			1,860	1,835	1,850	2,905	2,685
Hours Reduced Congestion (1 day)			6	15	-15	150	116
Peak Hour			2,263	5,581	-5,627	54,783	42,468
Peak Hour + 80% Shoulder Hours ¹			10,184	25,117	-25,322	246,526	191,105

1. Measured as the peak traffic hour plus additional hours that operate at 80% of peak hour volume or greater; delay at 80% is represented as 50% of peak hour delay.

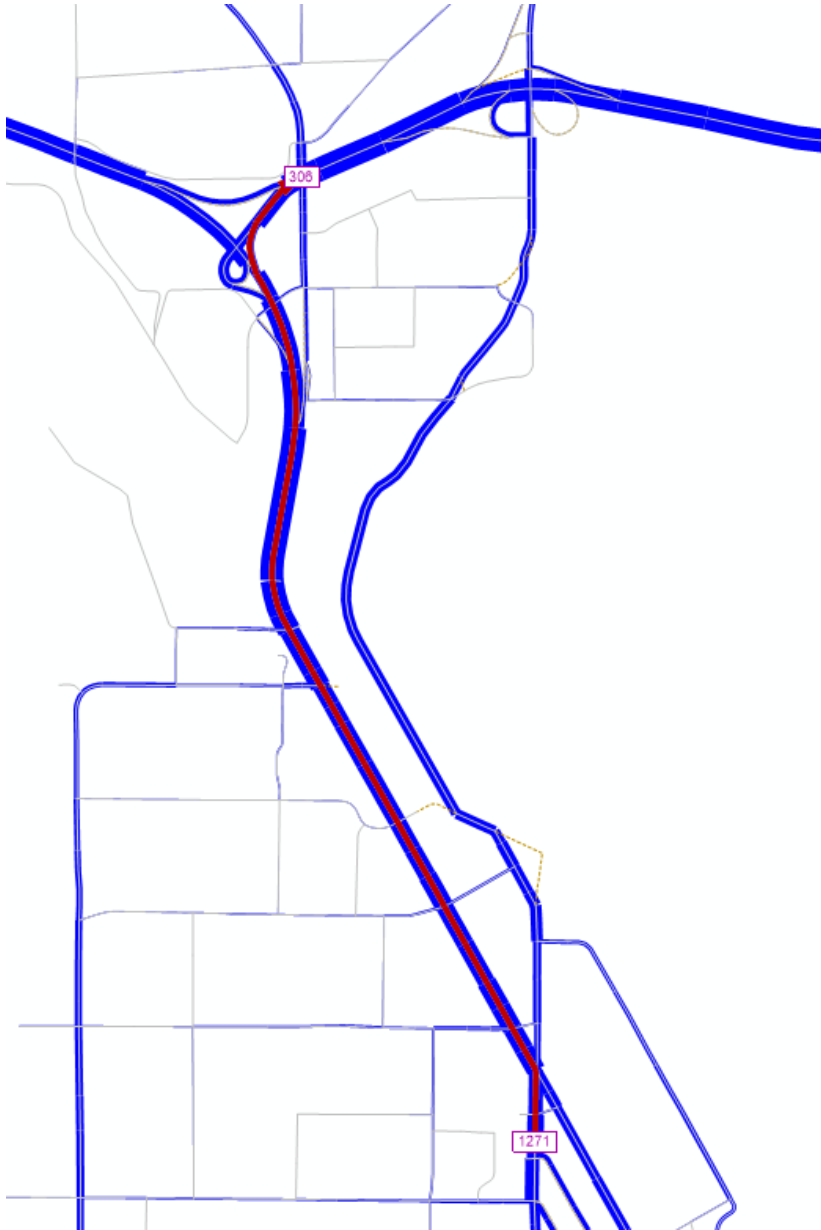
Table 2. Travel Time Metrics: 2045 Model Scenarios

Travel Time Corridor	2016 Existing	2045 Model Scenarios					
		Baseline	N Wen. Ave	Conf. Pkwy	Wenatchi Land. IC	Sunset Hwy	Full Build
<i>Wenatchee Ave, Miller Street to US 2/Easy St</i>							
SB Travel Time (minutes)	7.1	12.8	11.9	8.0	13.1	12.0	7.4
NB Travel Time (minutes)	7.0	11.0	9.9	7.4	11.1	10.6	6.7
Combined Travel Time (minutes)	14.1	23.8	21.8	15.4	24.2	22.6	14.1
Minutes Saved vs Baseline			2.0	8.4	-0.4	1.2	9.7
Volume @ Wenatchee River Bridge			4,895	3,730	4,845	4,725	3,865
Hours Reduced Congestion (1 day)			163	522	-32	94	625
Peak Hour			59,556	190,603	-11,790	34,493	228,067
Peak Hour + 80% Shoulder Hours ¹			268,001	857,714	-53,053	155,216	1,026,302
<i>Shortest Route, Wenatchee Ave/Miller St to Euclid Ave/US 2 EB Ramp</i>							
SB Travel Time (minutes)	8.4	14.0	13.2	7.8	14.3	13.3	7.4
NB Travel Time (minutes)	7.9	12.0	10.8	7.5	12.1	11.6	6.9
Combined Travel Time (minutes)	16.3	26.0	24.0	15.3	26.4	24.9	14.3
Minutes Saved vs Baseline			2.0	10.7	-0.4	1.1	11.7
Combined Volume @ Wenatchee River Bridges			4,895	5,530	4,845	4,725	5,605
Hours Reduced Congestion (1 day)			163	986	-32	87	1,093
Peak Hour			59,556	359,957	-11,790	31,618	398,936
Peak Hour + 80% Shoulder Hours ¹			268,001	1,619,806	-53,053	142,282	1,795,211
<i>US 2/Easy St to SR 28/19th St NE</i>							
SB Travel Time (minutes)	7.1	9.4	9.5	9.9	9.6	10.0	10.5
NB Travel Time (minutes)	7.3	9.8	9.8	10.3	9.1	10.1	9.6
Combined Travel Time (minutes)	14.4	19.2	19.3	20.2	18.7	20.1	20.1
Minutes Saved vs Baseline			-0.1	-1.0	0.5	-0.9	-0.9
Average Volume @ US 2 near Wenatchi IC			2,135	2,265	1,775	2,113	1,909
Hours Reduced Congestion (1 day)			-4	-38	15	-32	-29
Peak Hour			-1,299	-13,779	5,399	-11,566	-10,450
Peak Hour + 80% Shoulder Hours ¹			-5,845	-62,004	24,295	-52,047	-47,027
<i>Sunset Hwy, US 2 to Valley Mall Pkwy</i>							
SB Travel Time (minutes)	7.4	10.8	10.7	10.2	11.0	8.3	8.4
NB Travel Time (minutes)	7.1	10.3	10.1	10.1	10.3	8.4	8.4
Combined Travel Time (minutes)	14.5	21.1	20.8	20.3	21.3	16.7	16.8
Minutes Saved vs Baseline			0.3	0.8	-0.2	4.4	4.3
Volume @ SR 28 south of 19th Street			1,960	1,930	1,955	3,260	3,065
Hours Reduced Congestion (1 day)			10	26	-7	239	220
Peak Hour			3,577	9,393	-2,379	87,259	80,175
Peak Hour + 80% Shoulder Hours ¹			16,097	42,267	-10,704	392,667	360,789

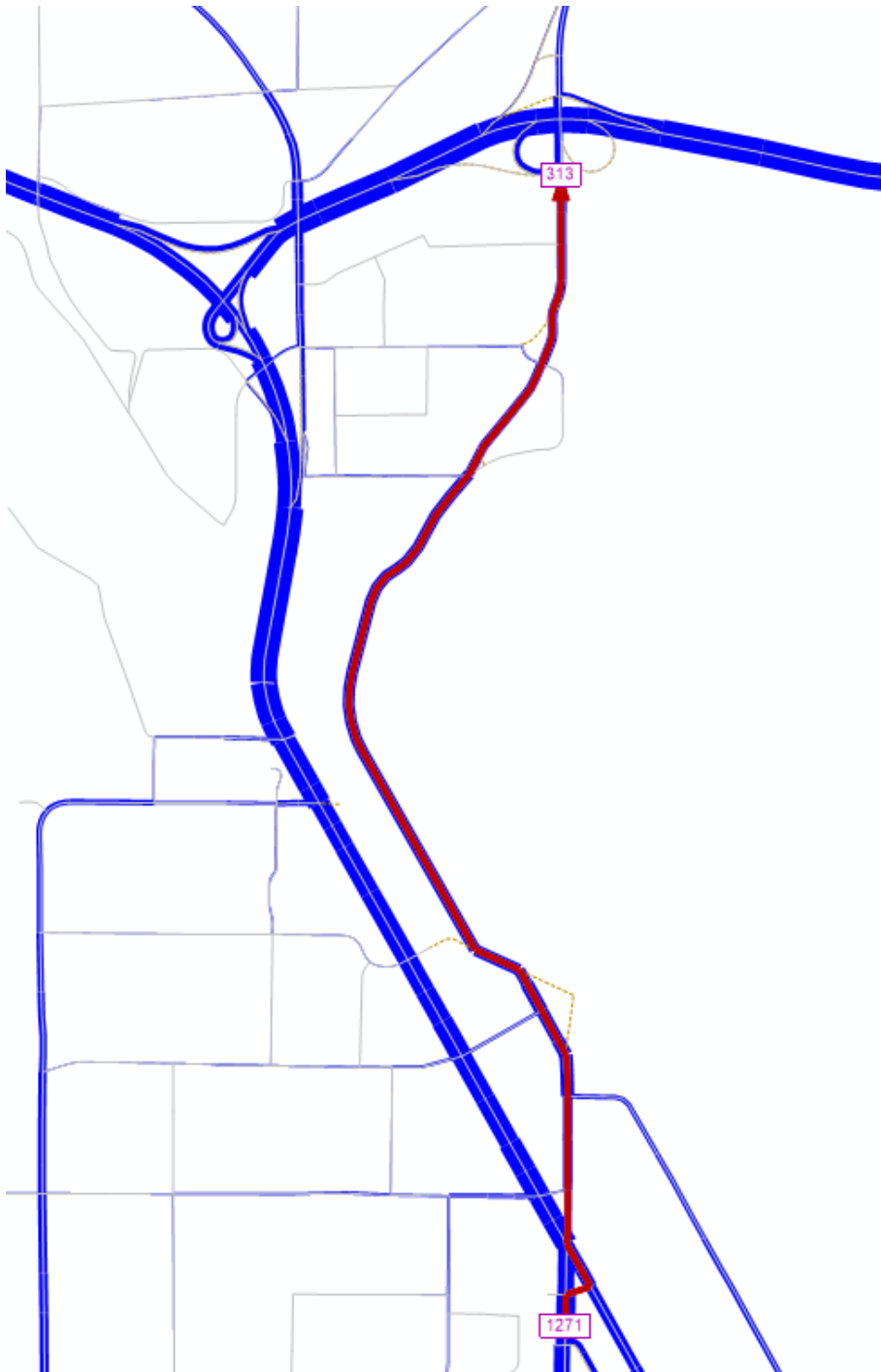
1. Measured as the peak traffic hour plus additional hours that operate at 80% of peak hour volume or greater; delay at 80% is represented as 50% of peak hour delay.

Attachment 1: Travel Time Segments

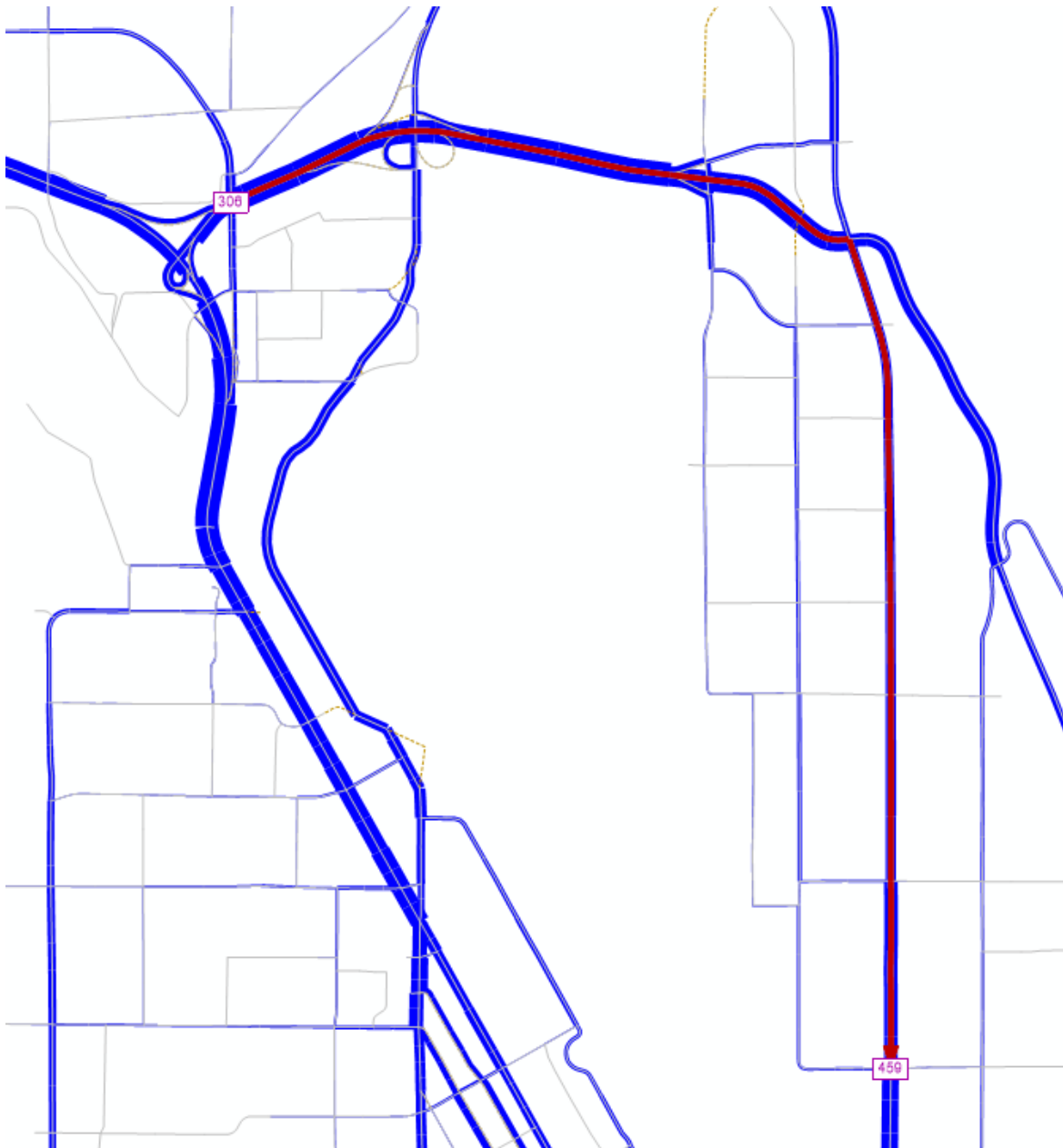
Between Wenatchee Avenue/Miller Street and US 2/Easy Street intersections.



Shortest Route: Wenatchee Avenue/Miller Street to US 2 EB Ramp intersection at Euclid Ave.



US 2/ Easy Street intersection to SR 28/ 19th Street NE intersection.



SR28 Sunset Highway: US2 to Valley Mall Parkway

