DRAFT TECHNICAL MEMORANDUM

Shaw Road Traffic Analysis: 12th Avenue SE to 23rd Avenue SE

1.0 Introduction

This technical memorandum presents the findings of a Traffic Study completed to assess improvement alternatives along Shaw Road between 12th Avenue SE and 23rd Avenue SE. To capture the upstream and downstream impacts, the traffic model included Shaw Road between E Pioneer and 39th Avenue SE.

2.0 Study Methodology

2.1 Time Periods

The traffic study involved analysis of the weekday 7 to 9 AM and 4 to 6 PM peak periods because these time periods generally have the highest traffic volumes (worst-case conditions). A detailed micro-simulation analysis was performed for both the AM and PM peak hours.

2.2 Alternatives Analyzed

The analysis evaluated the following alternatives:

- 2020 Existing Conditions
- 2040 No-Build Conditions
- Build 1: 2040 Build Conditions with three lanes on Shaw Road: 1 southbound (SB) lane, 1 northbound (NB) lane, and a two-way left turn lane (TWLTL)
    - Build 1A: All the improvements in Build 1 PLUS 2 SB through lanes at Shaw Road/23rd Avenue SE intersection (2nd SB lane starts 500 feet upstream and is truncated 320 feet downstream) and 2 NB through lanes at Shaw Road/23rd Avenue SE intersection (2nd NB lane starts 165 feet upstream and is truncated 500 feet downstream)
- Build 2: 2040 Build Conditions with four lanes on Shaw Road: 2 SB lanes, 1 NB lane, and a TWLTL
    - Build 2A: All the improvements in Build 2 PLUS 2 SB through lanes at Shaw Road/23rd Avenue SE intersection (2nd SB lane is truncated 320 feet downstream) and 2 NB through lanes at Shaw Road/23rd Avenue SE intersection (2nd NB lane starts 165 feet upstream and is truncated 500 feet downstream)
- Build 3: 2040 Build Conditions with five lanes on Shaw Road: 2 SB lanes, 21 NB lanes, and a TWLTL
    - Build 3A: All the improvements in Build 3 PLUS 2 SB through lanes at Shaw Road/23rd Avenue SE intersection (2nd SB lane is truncated 320 feet downstream) and 2 NB through lanes at Shaw Road/23rd Avenue SE intersection (2nd NB lane starts 165 feet upstream and is truncated 500 feet downstream)
- **Build 4 (Preferred Alternative)**: 2040 Build Conditions with four lanes on Shaw Road (2 SB lanes, 1 NB lane, and a TWLTL) between 23rd Avenue SE and Highlands Boulevard. North of Highlands Boulevard, Shaw will have 5 lanes (2 SB lanes, 2 NB lanes, and a TWLTL) with the 2nd NB lane starting as an WB right add lane at the Highlands Boulevard intersection. This alternative has 2 SB through lanes at Shaw Road/23rd Avenue SE intersection (2nd SB lane is truncated 320 feet downstream).

Study Intersections

The following study intersections were analyzed and are shown on **Figure 1**:

1. Shaw Road/E Pioneer
2. Shaw Road/Pioneer Crossing
3. Shaw Road/ 12th Avenue SE
4. Shaw Road/Highlands Boulevard
5. Shaw Road/15th Avenue SE
6. Shaw Road/16th Avenue SE
7. Shaw Road/23rd Avenue SE
8. Shaw Road/39th Avenue SE

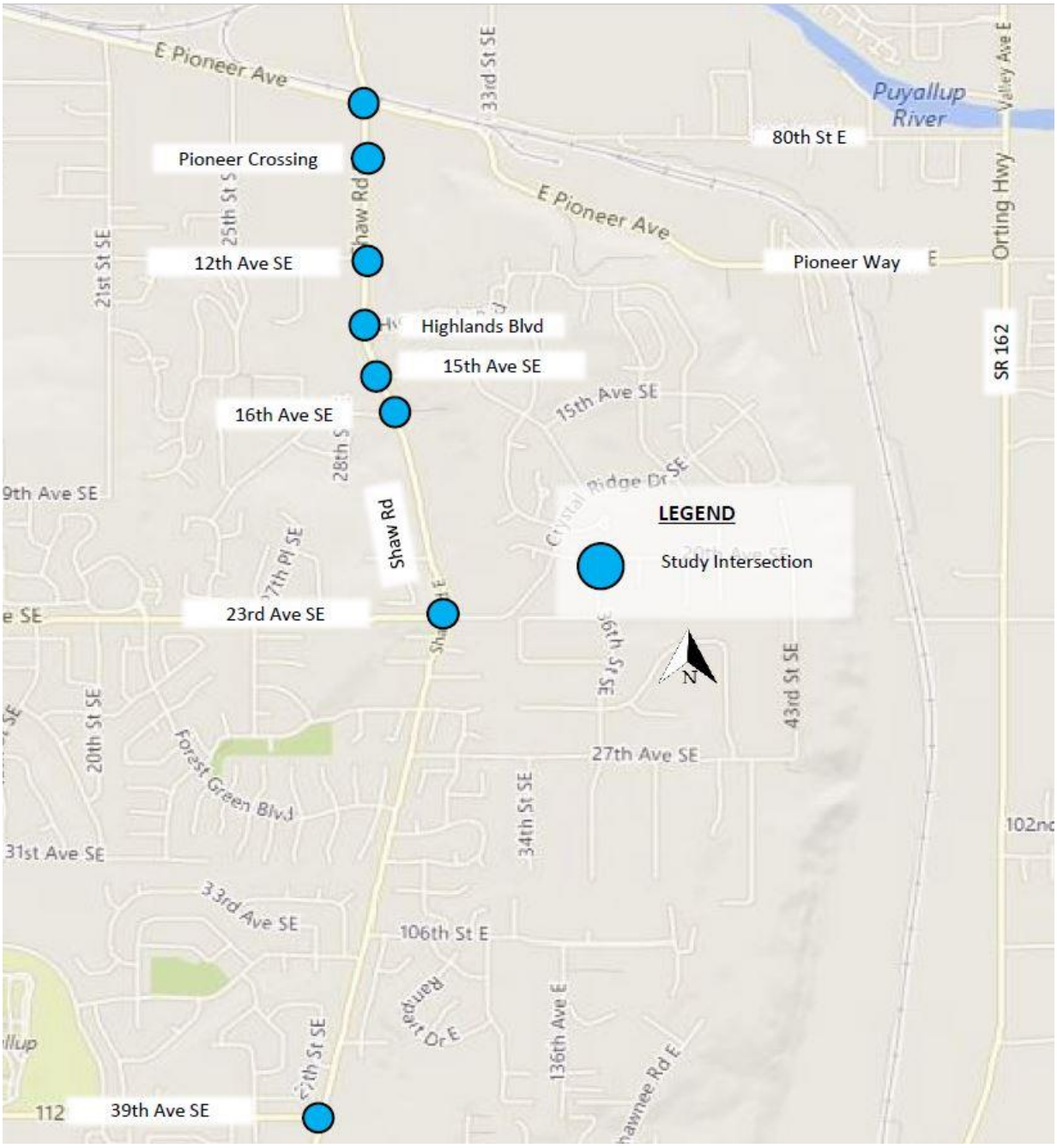


Figure 1. Study Area and Intersections

2.3 Level of Service Analysis

Level of service (LOS) is a term commonly used by transportation practitioners to measure and describe the operational characteristics of intersections, roadway segments, and other facilities. This term equates seconds of delay per vehicle at intersections to letter grades "A" through "F," with "A" representing optimum conditions and "F" representing breakdown or over-capacity flows. The LOS for a signal-controlled intersection is defined by average delay of all movements. The LOS for an unsignalized two-way-stop-controlled (TWSC) intersection is defined by the worst movement delay. The complete methodology is established in the 2010 *Highway Capacity Manual*. **Table 1** presents the delay thresholds for each LOS grade at unsignalized and signalized intersections.

Table 1. Level of Service Definitions for Intersections

Level of Service	Brief Description	Unsignalized Intersections (average delay/vehicle in seconds)	Signalized Intersections (average delay/vehicle in seconds)
A	Free-flow conditions	< 10	< 10
B	Stable conditions with some affect from other vehicles	10 to 15	10 to 20
C	Stable conditions with significant affect from other vehicles	15 to 25	20 to 35
D	High-density traffic conditions still with stable flow	25 to 35	35 to 55
E	At or near capacity flows	35 to 50	55 to 80
F	Over-capacity conditions	> 50	> 80

Source: *Highway Capacity Manual* (2010), Chapters 16 and 17

The City of Puyallup Comprehensive Plan establishes LOS D as the standard for PM peak hour intersection performance in the study area, except for the Shaw Road corridor, where LOS E is acceptable.

VISSIM micro-simulation software was used to analyze the traffic operations at the study intersections and along the study corridor. The results are reported in accordance with the HCM 6 methodologies.

3.0 Existing Conditions

3.1 Adjacent Roadways

The key roadways in the project vicinity are:

- Shaw Road, with a posted speed limit of 35 mph, is a north-south roadway classified as a major arterial. It is a 5-lane roadway north of 12th Avenue SE and a 2-lane section between 12th Avenue SE and 23rd Avenue SE. South of 23rd Avenue SE, Shaw Road was recently improved to a 3-lane section with a TWLTL.
- E Pioneer, with a posted speed limit of 35 mph, is classified as a major arterial. It is a 5-lane roadway west of Shaw Road and a 2-lane roadway east of Shaw Road.

- 23rd Avenue SE, with a posted speed limit of 30 mph, is a 2-lane roadway classified as a minor arterial.
- Other side street roadways in the study area are mainly residential collector streets.

3.2 Traffic Volumes

The traffic volume data from June 2018 study titled "*Shaw Road Subarea Traffic Study*" was used as base volumes for existing conditions (2020) peak hour volume estimation. Existing conditions (2020) base peak hour volumes were developed by applying a uniform growth rate of 1% per year to the 2018 peak hour turning movement volumes. This growth rate was finalized after discussions and approval from City of Puyallup staff. In addition, the final Existing Conditions (2020) peak hour volumes included traffic generated from any recently opened and soon to be opened proposed developments (Pioneer Crossing and Van Lierop).

The existing conditions AM and PM peak hour intersection traffic volumes are shown in **Appendix A**.

4.0 2040 Traffic

4.1 No Build and Build Traffic Volumes

The 2040 No Build and Build traffic volumes were developed for this study to provide a baseline for assessing and comparing future potential improvement alternatives. The traffic volumes for this condition were obtained by applying a 1 percent per year growth rate to the existing 2020 peak hour traffic volumes and adding traffic generated by the following proposed developments in the study area:

- Puyallup Corporate Center
- Van Lierop Park
- East Town Crossing
- Knutson

The growth rate was obtained using the PSRC demand model and the growth rate was refined based on the discussions with the City of Puyallup staff. The 2040 No Build conditions AM and PM peak hour intersection traffic volumes are shown in **Appendix B**.

4.2 Roadway Improvements

The City of Puyallup has two roadway projects that are under construction to improve traffic conditions in the study area. The following is the list of the private and public projects that are assumed to be in place by year 2022, i.e., before the occupancy of the proposed Knutson development:

- (No Build and Build) Adding eastbound and westbound left-turn pockets at the Shaw Road/23rd Avenue SE intersection (City project that is currently under construction).
- (No Build and Build) Modifying the eastbound, westbound, and southbound left-turn phasing to protected plus permissive phasing (flashing yellow arrows) at the Shaw Road/23rd Avenue SE intersection (City project that is currently under construction).

5.0 Traffic Analysis

This section presents a comparison of traffic operations and summarizes measures of effectiveness for 2020 Existing, 2040 No Build, and 2040 Build 4 (preferred alternative) alternatives. The results for other alternatives (Build 1, Build 1A, Build 2, Build 2A, Build 3, and Build 3A) are shown in **Appendix C**.

5.1 Measures of Effectiveness

The purpose of computing one or more traffic performance MOEs is to quantify the project's impacts on the local roadway network. The following MOEs were used to quantify the project's impacts.

- Level of Service (LOS)
- Average intersection delay
- 95th percentile queue length
- Overall corridor throughput
- Peak direction travel time

5.2 Level of Service and Delay Summary

Table 2 and **Table 3** show the 2020 Existing, 2040 No Build, and 2040 Build 4 (Preferred Alternative) LOS summary for AM and PM peak hours, respectively.

Table 2. AM Peak Hour Intersection LOS Summary

Intersection	Existing		2040 No Build		2040 Build 4	
	LOS	Delay	LOS	Delay	LOS	Delay
Shaw Rd/E Pioneer	**C**	30.8	**E**	67.8	**E**	64.8
Shaw Rd/Pioneer Crossing	**A**	4.7	**A**	9.4	**A**	9.7
Shaw Rd/12th Ave	**C**	17.6	**C**	21.7	**A**	6.1
Shaw Rd/Highlands Blvd	**E**	45.6	**F**	>500	**A***	8.4
Shaw Rd/15th Ave	**B**	10.1	**C**	16.9	**C**	15.3
Shaw Rd/16th Ave	**D**	25.5	**F**	71.3	**B**	12.3
Shaw Rd/23rd Ave	**B**	14.0	**C**	24.6	**C**	23.2
Shaw Rd/39th Ave	**B**	10.5	**B**	15.9	**B**	16.9

Note: Delay is based on the average of 10 VISSIM micro-simulation runs.
*Reported average approach delay for WB approach including delay from free-right and stop-controlled left.

Table 3. PM Peak Intersection LOS Summary

Intersection	Existing		2040 No Build		2040 Build 4	
	LOS	Delay	LOS	Delay	LOS	Delay
Shaw Rd/E Pioneer	**E**	36.1	**F**	157.7	**E**	78.5
Shaw Rd/Pioneer Crossing	**C**	16.7	**C**	22.4	**B**	14.4
Shaw Rd/12th Ave	**E**	44.6	**F**	>500	**C**	16.2
Shaw Rd/Highlands Blvd	**F**	61.0	**F**	72.4	**A***	7.5
Shaw Rd/15th Ave	**B**	12.8	**C**	17.6	**B**	11.7
Shaw Rd/16th Ave	**E**	49.5	**F**	58.5	**C**	18.0
Shaw Rd/23rd Ave	**D**	52.4	**E**	60.5	**C**	28.5
Shaw Rd/39th Ave	**D**	51.4	**F**	100.3	**E**	67.0

Note: Delay is based on the average of 10 VISSIM micro-simulation runs.
*Reported average approach delay for WB approach including delay from free-right and stop-controlled left.

Under the 2040 Build 4 alternative, the improvement to westbound stop-controlled approach at Highlands Boulevard will provide sufficient space for a separated left turn lane and right turn lane. The right-turn movement will have minimal delay as vehicles can turn free into the 2nd northbound lane beginning at this location along Shaw Road. The left-turn movement will be stop-controlled. The reported LOS and delay at the Shaw Rd/Highlands Blvd intersection is the average approach delay that includes the delay for both right-turn and left-turn movements.

5.3 Queue Length Summary

Table 4 and **Table 5** shows the 2020 Existing, 2040 No Build, and 2040 Build 4 (Preferred Alternative) 95th percentile queue lengths summary on critical study intersection approaches for AM and PM peak hours, respectively. The 95th percentile queue is a queue length that has only a 5% probability of being exceeded during a given analysis period.

Table 4. AM Peak 95th Percentile Queue Comparison (feet)

Location	2020 Existing	2040 No Build	2040 Build 4
SB at Shaw-Pioneer	100	142	122
WB at Shaw-Pioneer	345	1,256	1,249
NB at Shaw-Pioneer	224	487	417
EB at Shaw-Pioneer	85	292	210
EB at 12th	13	8	8
WB at Highlands	101	684	41
WB at 15th	18	20	20
EB at 16th	26	93	15
SB at 23rd	141	216	143
WB at 23rd	45	85	81
NB at 23rd	298	816	697
EB at 23rd	90	124	114

Table 5. PM Peak 95th Percentile Queue Comparison (feet)

Location	2020 Existing	2040 No Build	2040 Build 4
SB at Shaw-Pioneer	228	1,582	547
NB at Shaw-Pioneer	106	175	188
EB at Shaw-Pioneer	134	861	582
WB at Shaw-Pioneer	197	1,218	1,206
EB at 12th	17	455	23
WB at Highlands	12	25	12
WB at 15th	4	4	4
EB at 16th	2	5	0
SB at 23rd	1,419	1,418	245
NB at 23rd	96	308	186
EB at 23rd	83	212	86
WB at 23rd	30	133	33

5.4 Throughput and Demand Served (PM Peak)

The overall network throughput (at all the study intersections) also serves as a measure of the overall network efficiency. Lower network throughput indicates the existence of bottle necks along the Shaw Road corridor. **Table 6** and **Table 7** shows the AM and PM peak hour throughput and percent demand served comparison between 2040 No Build and 2040 Build 4 scenarios.

Percent demand shows the percentage of the projected future demand that the roadway network can serve. Higher demand served percentages indicates better traffic operations.

Table 6. AM Peak Network Throughput and Percent Demand Served Comparison

Intersection	Existing AM		2040 No Build		2040 Build 4	
	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served
Shaw Rd/E Pioneer	2,475	98%	3,268	94%	3,301	95%
Shaw Rd/Pioneer Crossing	1,741	98%	2,247	95%	2,300	97%
Shaw Rd/12th Ave	1,736	98%	2,196	95%	2,255	97%
Shaw Rd/Highlands Blvd	1,682	98%	2,132	95%	2,190	98%
Shaw Rd/15th Ave	1,526	98%	1,977	97%	1,991	98%
Shaw Rd/16th Ave	1,488	98%	1,919	97%	1,933	98%
Shaw Rd/23rd Ave	1,602	97%	2,051	97%	2,058	98%
Shaw Rd/39th Ave	1,883	98%	2,371	99%	2,377	99%

Table 7. PM Peak Network Throughput and Percent Demand Served Comparison

Intersection	Existing		2040 No Build		2040 Build 4	
	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served
Shaw Rd/E Pioneer	2,795	99%	3,199	84%	3,633	95%
Shaw Rd/Pioneer Crossing	1,983	97%	2,250	85%	2,560	96%
Shaw Rd/12th Ave	1,963	97%	2,143	82%	2,515	96%
Shaw Rd/Highlands Blvd	1,904	97%	2,118	84%	2,438	96%
Shaw Rd/15th Ave	1,771	97%	1,926	82%	2,259	97%
Shaw Rd/16th Ave	1,690	97%	1,854	83%	2,144	97%
Shaw Rd/23rd Ave	1,822	96%	2,015	84%	2,306	96%
Shaw Rd/39th Ave	2,062	96%	2,204	82%	2,508	94%

5.5 Travel Time

Table 8 shows the southbound travel time comparison summary for the PM peak hour. **Table 9** shows the northbound travel time comparison summary for the AM peak hour.

Table 8. AM Peak NB Travel Time Comparison (Minutes)

Segment	2020 Existing	2040 No Build	2040 Build 4
Shaw Rd NB - 23rd Ave to E Pioneer	2.46	2.80	2.68

Table 9. PM Peak SB Travel Time Comparison (Minutes)

Segment	2020 Existing	2040 No Build	2040 Build 4
Shaw Rd SB – E Pioneer to 23rd Ave	4.77	5.30	2.63

6.0 Findings

6.1 Selection of Preferred Alternative

Various combination of capacity improvements were analyzed in Build 1, Build 2, and Build 3 alternatives. These three alternatives provided traffic operations comparison between 1 SB and 2 SB lanes, 1 NB and 2 NB lanes, and capacity improvements at the Shaw Rd/23rd Ave intersection. Based on the results of Builds 1 through 3, a preferred alternative was developed and selected that incorporated the capacity improvements that provided the best traffic operations. **Appendix C** shows detailed comparisons between 2040 No Build and all of the 2040 Build alternatives. The preferred alternative contains the following capacity improvements:

- 2 SB Lanes along Shaw Road and 2 SB through lanes at the Shaw Rd/23rd Ave intersection (Based on comparison between Build 1 and Build 2 results): As shown in the PM peak hour throughout comparisons in **Appendix C**, 2 SB lanes significantly increase the percent demand served. Providing these two improvements will increase the overall throughput at each of the study intersections by approximately 225 vehicles per hour. In addition, these capacity additions also improve the LOS at unsignalized intersections along Shaw Road. The SB travel time between Pioneer Way to 23rd Ave is also improved by over 40%.
- 1 NB lane from 23rd Avenue SE to Highlands Boulevard and 2 NB lanes north of Highlands Boulevard: As shown in the AM peak hour throughout and LOS comparisons in **Appendix C**, the percent demand served at the south end of the study area and intersection LOS at Shaw Rd/23rd Ave intersection remains relatively unchanged between Build 1, Build 1A, Build 2, and Build 2A alternatives. This is due to the metering of NB traffic at the Shaw Rd/39th Ave intersection. However, a second NB lane would provide benefits at unsignalized intersections that have a westbound stop control. For example, Highlands Boulevard has a westbound heavy right-out movement during the AM peak hour and a second NB lane will help reduce the delay at the intersection. As shown in the LOS comparison table, the delay at this intersection is reduced by more than 90% with this alternative.

6.2 AM Peak

AM peak hour LOS summary is shown in **Table 2**. Under 2040 No Build conditions, the unsignalized intersections that have a westbound stop-controlled approach are anticipated to operate at LOS F with the Shaw Rd/Highlands Blvd intersection (WB approach) operating at a delay of more than 500 seconds per vehicle. The Shaw Rd/Pioneer Way intersection worsens from LOS C under existing conditions to LOS E under No Build conditions. With the preferred build alternative, all the study intersections operate at acceptable LOS levels

As shown in **Table 4**, the 95th percentile queue length is consistently lower in 2040 Build 4 alternative compared to the 2040 No Build alternative. Significant queue length improvements can be seen along westbound approach at the Shaw Rd/Highlands Blvd intersection, southbound and northbound approaches at the Shaw Rd/23rd Ave intersection. As shown in **Table 8**, the northbound travel time between 23rd Avenue SE and Pioneer Way is reduced from 2.80 minutes in 2040 No Build to 2.68 minutes in 2040 Build 1, while providing higher volume throughput.

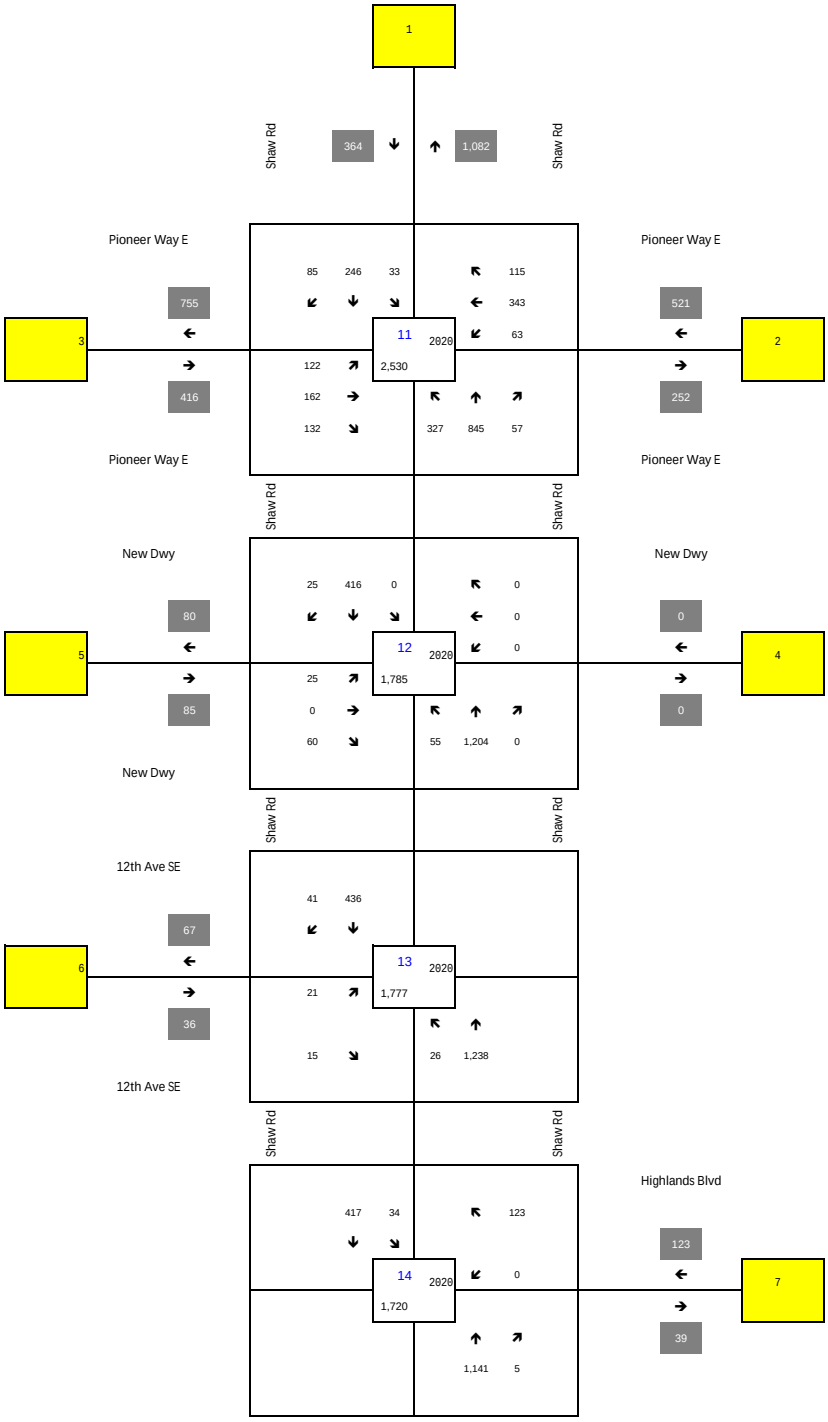
6.3 PM Peak

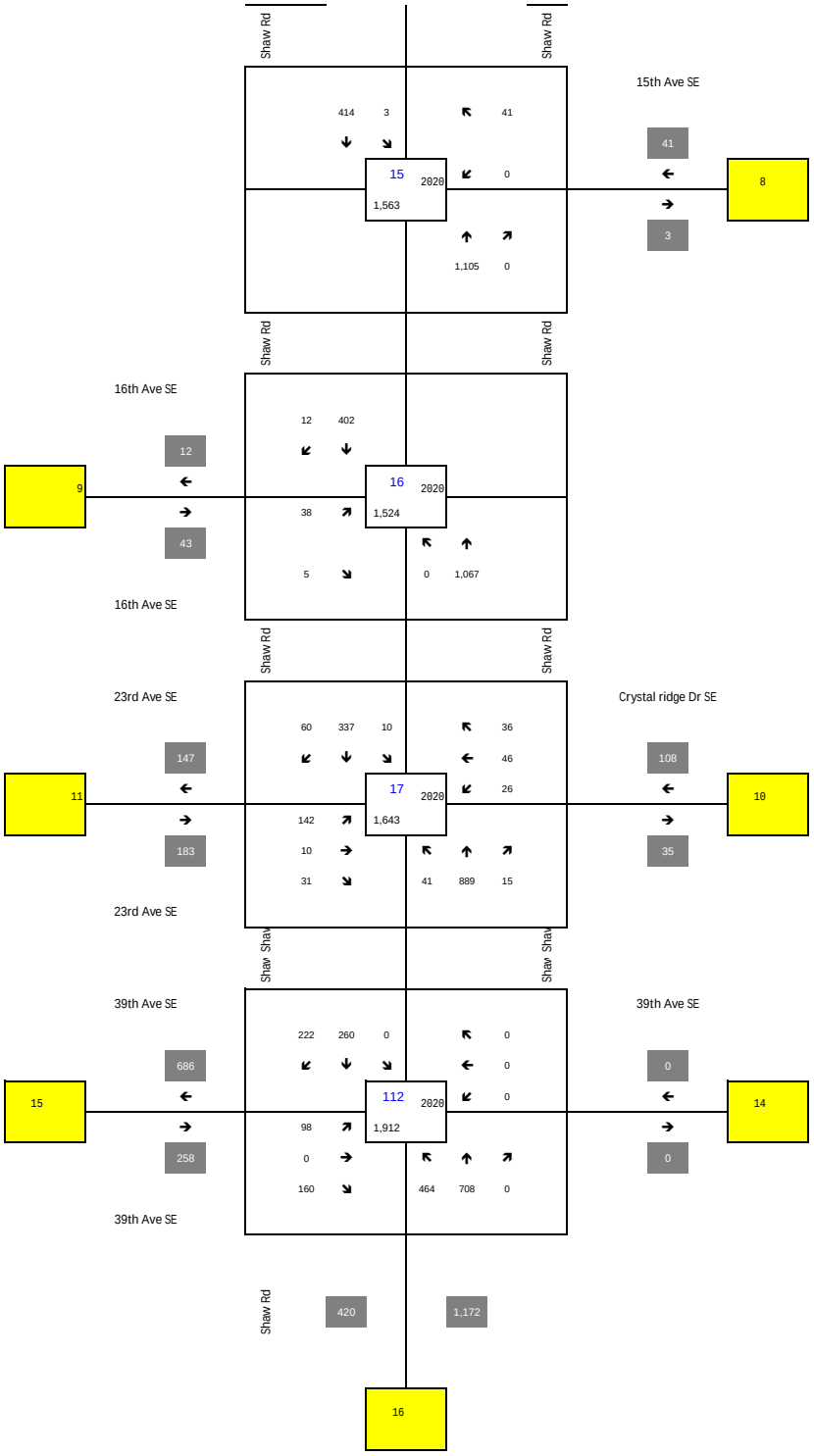
PM peak hour LOS summary is shown in **Table 3**. Five study intersections operate at LOS F under the 2040 No Build conditions with the Shaw Rd/12th Ave intersection (EB approach) operating at a delay of more than 500 seconds per vehicle. With the preferred build alternative, all the study intersections operate at acceptable LOS levels including all unsignalized intersections.

As shown in **Table 5**, the 95th percentile queue length is consistently lower in 2040 Build 4 alternative compared to the 2040 No Build alternative. Significant queue length improvements can be seen along southbound and eastbound approaches at the Shaw Rd/E Pioneer intersection, eastbound approach at the Shaw Rd/12th Ave intersection, southbound approach at the Shaw Rd/23rd Ave intersection. As shown in **Table 7**, under Build 4 alternative, the study intersections serve approximately 300 to 400 more vehicles per hour compared to No Build alternative (~10% higher volume served). In addition to higher volume served, the SB travel time between E Pioneer and 23rd Ave also improves from 5.3 minutes under No Build to 2.63 minutes under the Build 4 alternative, a greater than 50 percent reduction.

Appendix A
2020 Existing Traffic Volumes

2020 AM Peak Hour Volumes

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Crystal ridge Dr SE
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337
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889
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23rd Ave SE
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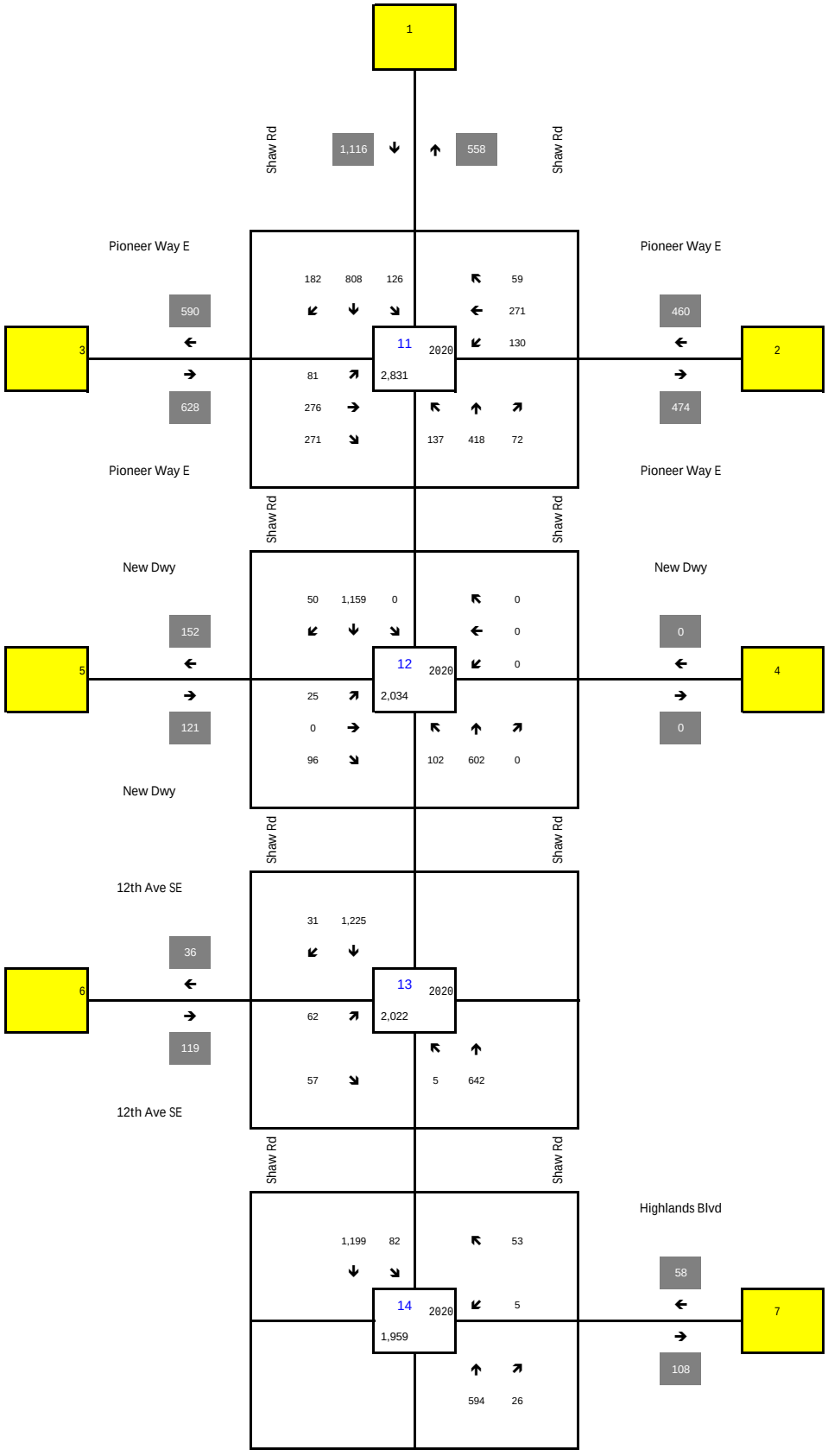
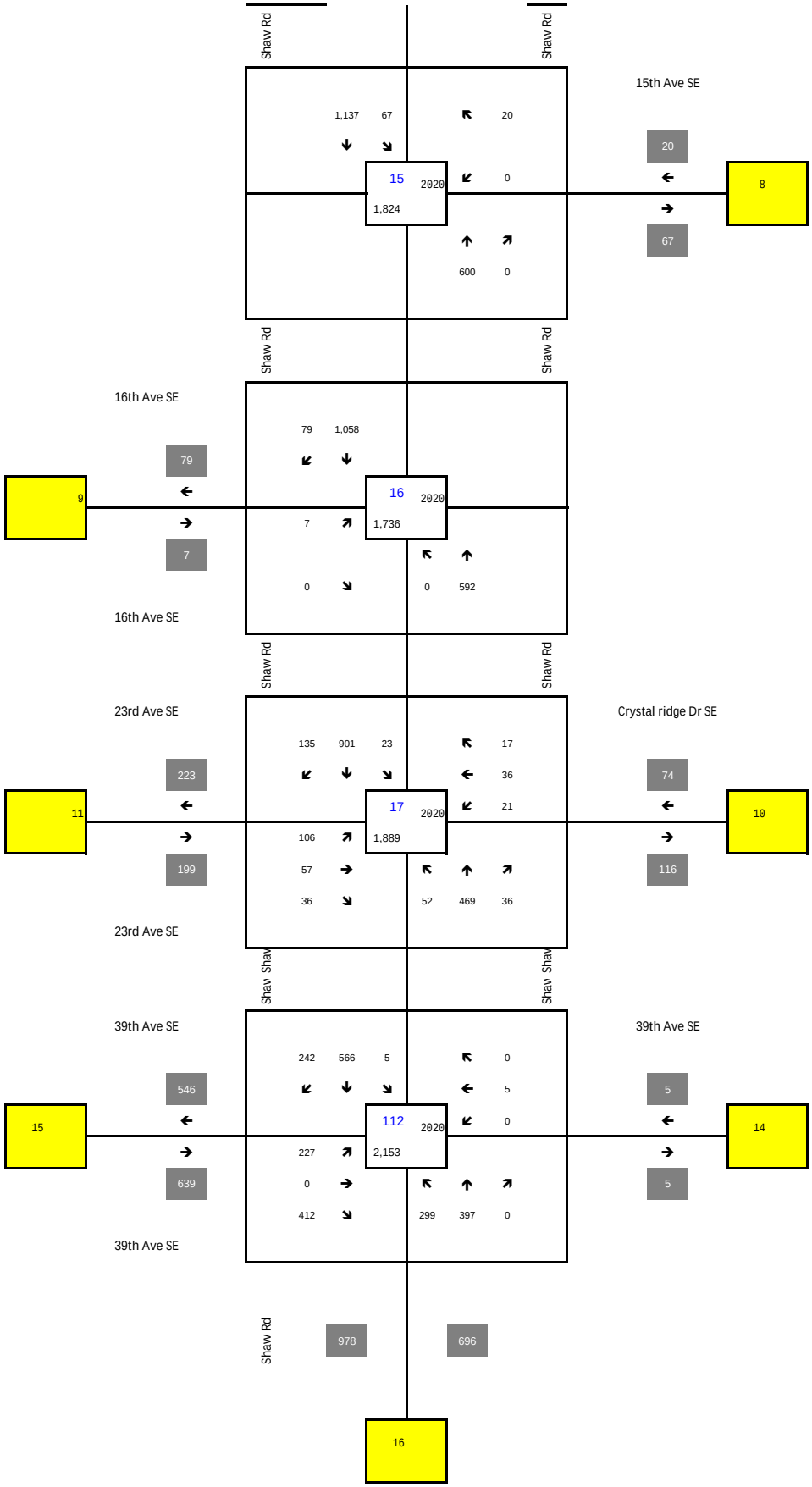
2020 Existing PM Peak Hour Volume

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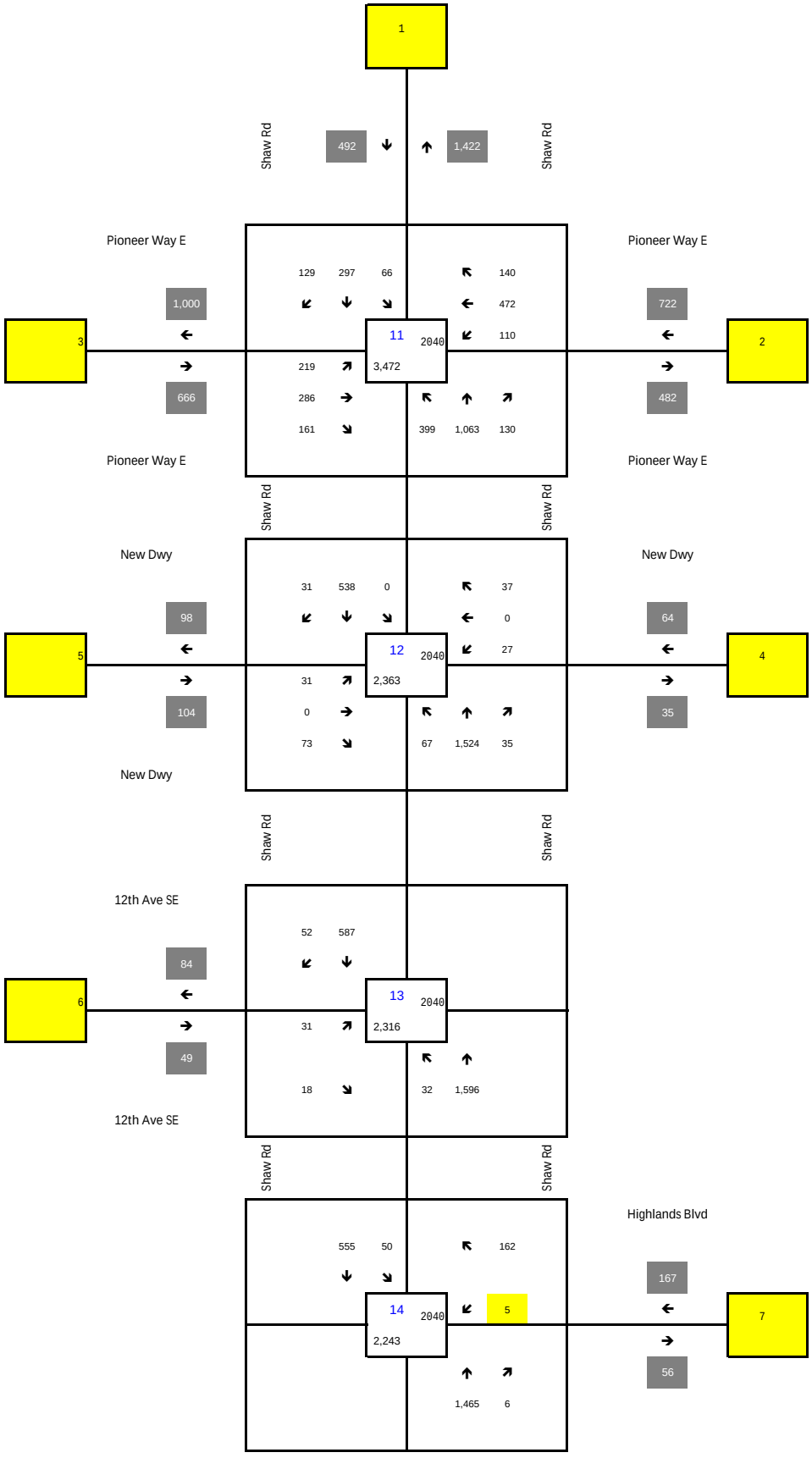
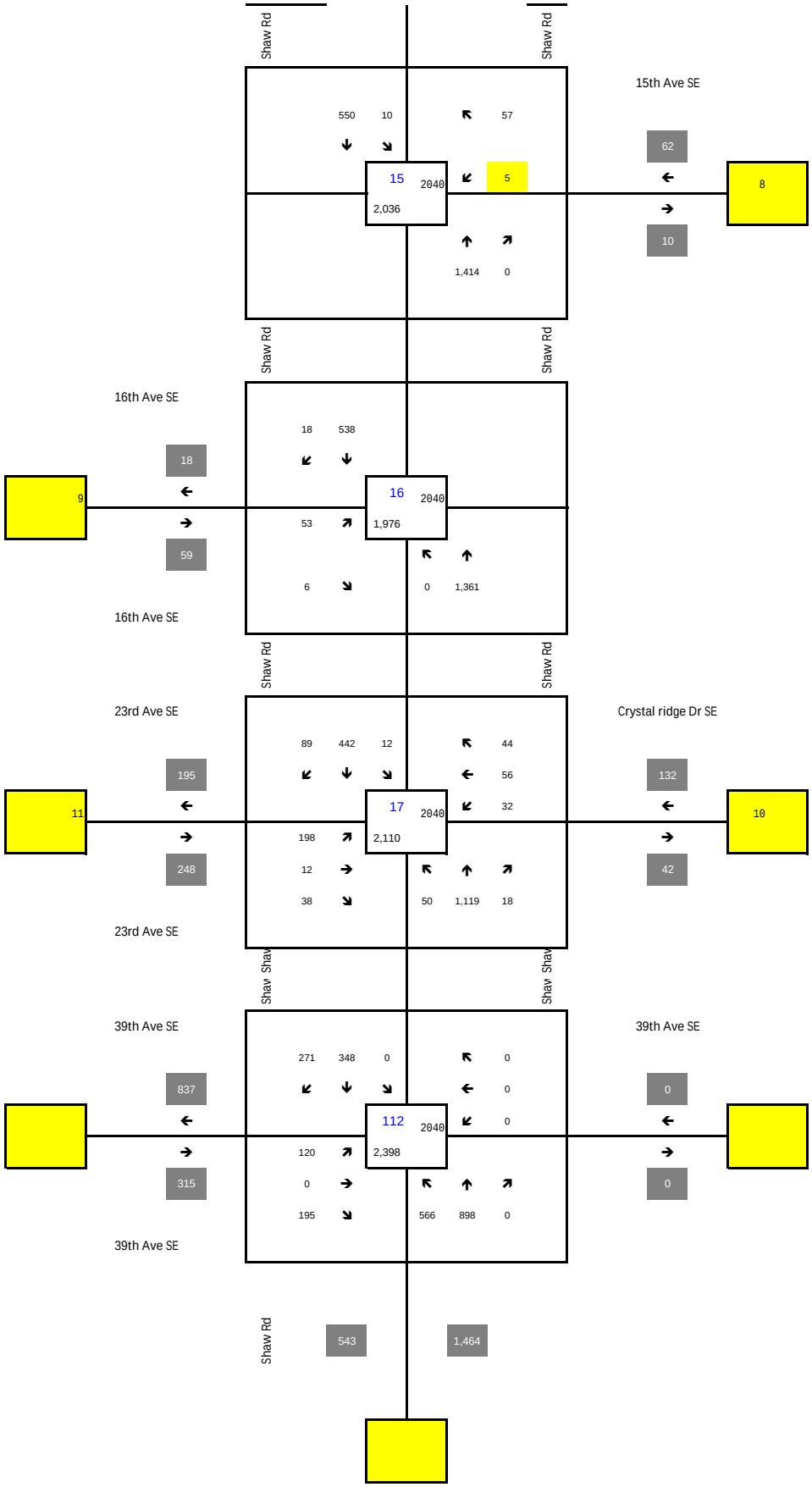
Appendix B
2040 No Build and Build Traffic Volumes

2040 No Build and Build AM Peak Hour Traffic Volumes

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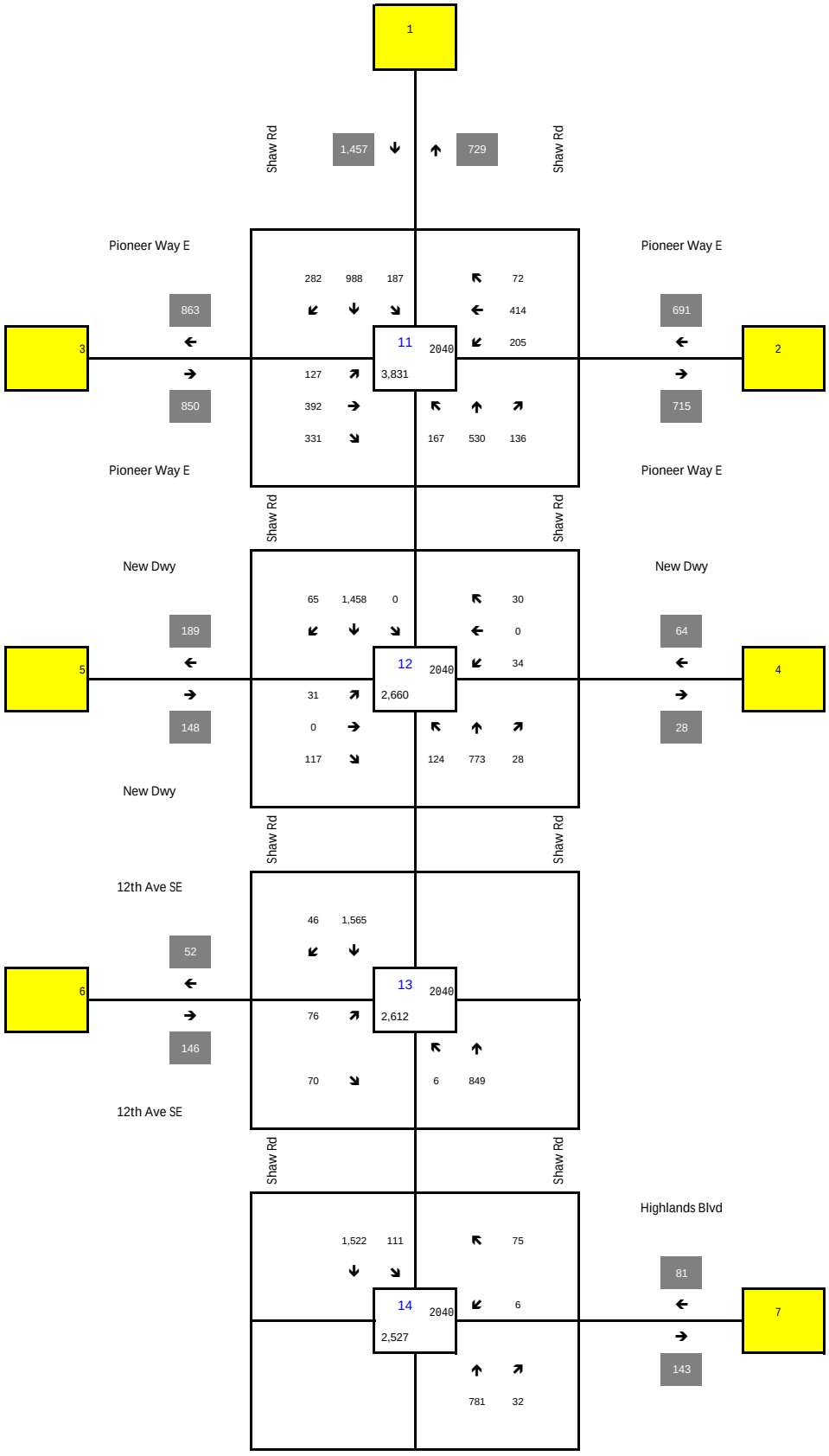
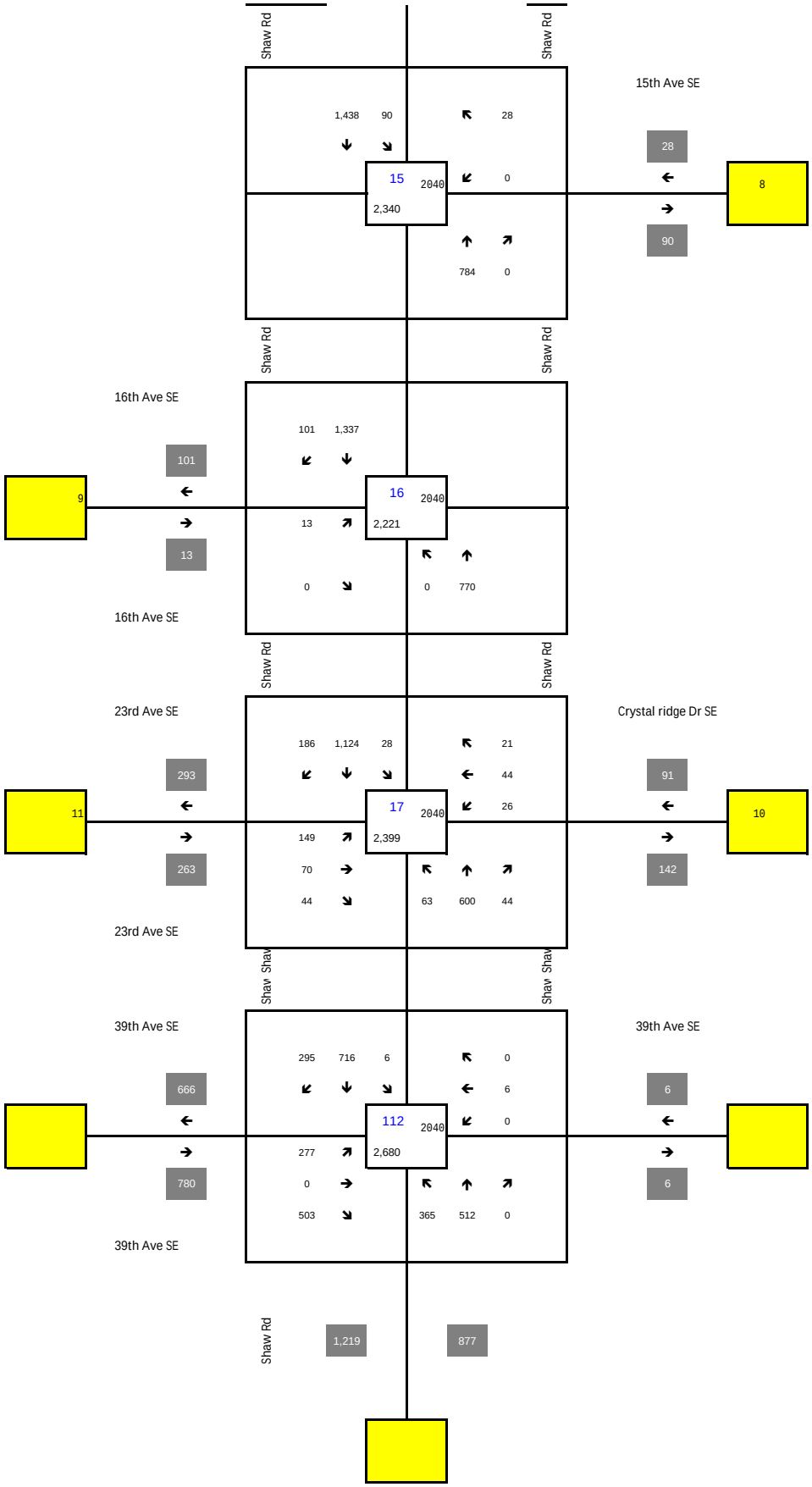
2040 No Build and Build PM Peak Hour Volumes

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Shaw Rd
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Appendix C
Measures of Effectiveness

AM Peak Hour Intersection LOS Summary

Intersection	Existing		2040 No Build		2040 Build 1 1 SB/1 NB, TWLTL				2040 Build 2 2 SB/1 NB, TWLTL				2040 Build 3 2 SB/2 NB, TWLTL				2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands	
					1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		2 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 2 SB Thru at 23rd	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Shaw Rd/Pioneer Way	C	30.8	E	67.8	E	66.9	E	68.1	E	66.9	E	68.1	E	65.7	E	65.7	E	64.8
Shaw Rd/Pioneer Crossing	A	4.7	A	9.4	A	9.2	A	9.4	A	9.2	A	9.4	B	14.9	B	14.9	A	9.7
Shaw Rd/12th Ave	C	17.6	C	21.7	A	8.2	A	8.4	A	8.2	A	8.4	A	6.0	A	6.0	A	6.1
Shaw Rd/Highlands Blvd	E	45.6	F	>500	F	486.6	F	>500	F	486.6	F	>500	B	11.5	B	11.5	A	8.4
Shaw Rd/15th Ave	B	10.1	C	16.9	C	18.6	C	21.8	C	18.6	C	21.8	A	8.3	A	8.3	C	15.3
Shaw Rd/16th Ave	D	25.5	F	71.3	C	15.1	C	16.1	C	15.1	C	16.1	A	8.3	A	8.3	B	12.3
Shaw Rd/23rd Ave	B	14.0	C	24.6	C	24.5	B	18.4	C	24.5	B	18.4	B	14.7	B	14.7	C	23.2
Shaw Rd/39th Ave	B	10.5	B	15.9	B	16.7	B	16.4	B	16.7	B	16.4	B	16.2	B	16.2	B	16.9

Notes:

NBT 2nd through lane has 165 ft of storage upstream of the intersection and 500 ft merge distance downstream of the intersection

SBT 2nd through lane has 500 ft of storage upstream of the intersection and 300 ft merge distance downstream of the intersection

All alternatives assume the existing configuration on Shaw Road from 39th Avenue to 300' south of the 23rd Avenue intersection.

AM Peak Hour Intersection Throughput Comparison

Intersection	Existing AM		2040 No Build		2040 Build 1 1 SB/1 NB, TWLTL				2040 Build 2 2 SB/1 NB, TWLTL				2040 Build 3 2 SB/2 NB, TWLTL				2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands	
					1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		2 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 2 SB Thru at 23rd	
	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served
Shaw Rd/Pioneer Way	2,475	98%	3,268	94%	3,263	94%	3,275	94%	3,263	94%	3,275	94%	3,321	96%	3,321	96%	3,301	95%
Shaw Rd/Pioneer Crossing	1,741	98%	2,247	95%	2,252	95%	2,250	95%	2,252	95%	2,250	95%	2,307	98%	2,307	98%	2,300	97%
Shaw Rd/12th Ave	1,736	98%	2,196	95%	2,207	95%	2,205	95%	2,207	95%	2,205	95%	2,262	98%	2,262	98%	2,255	97%
Shaw Rd/Highlands Blvd	1,682	98%	2,132	95%	2,139	95%	2,140	95%	2,139	95%	2,140	95%	2,196	98%	2,196	98%	2,190	98%
Shaw Rd/15th Ave	1,526	98%	1,977	97%	1,978	97%	1,983	97%	1,978	97%	1,983	97%	1,998	98%	1,998	98%	1,991	98%
Shaw Rd/16th Ave	1,488	98%	1,919	97%	1,921	97%	1,926	97%	1,921	97%	1,926	97%	1,938	98%	1,938	98%	1,933	98%
Shaw Rd/23rd Ave	1,602	97%	2,051	97%	2,055	97%	2,060	98%	2,055	97%	2,060	98%	2,067	98%	2,067	98%	2,058	98%
Shaw Rd/39th Ave	1,883	98%	2,371	99%	2,374	99%	2,374	99%	2,374	99%	2,374	99%	2,378	99%	2,378	99%	2,377	99%

AM Peak Hour 95th Percentile Queue Lengths (ft)

Location	2020 Existing	2040 No Build	2040 Build 1 1 SB/1 NB, TWLTL		2040 Build 2 2 SB/1 NB, TWLTL		2040 Build 3 2 SB/2 NB, TWLTL		2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands
			1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	2 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 2 SB Thru at 23rd
SB at Shaw-Pioneer	100	142	139	129	139	129	124	124	122
WB at Shaw-Pioneer	345	1,256	1,255	1,249	1,255	1,249	1,249	1,249	1,249
NB at Shaw-Pioneer	224	487	470	483	470	483	515	515	417
EB at Shaw-Pioneer	85	292	248	295	248	295	238	238	210
EB at 12th	13	8	8	8	8	8	8	8	8
WB at Highlands	101	684	684	685	684	685	31	31	41
WB at 15th	18	20	19	20	19	20	19	19	20
EB at 16th	26	93	16	10	16	10	23	23	15
SB at 23rd	141	216	185	90	185	90	162	162	143
WB at 23rd	45	85	85	58	85	58	58	58	81
NB at 23rd	298	816	779	207	779	207	214	214	697
EB at 23rd	90	124	156	81	156	81	101	101	114

AM Peak Travel Time Comparison (minutes)

Segment	2020 Existing	2040 No Build	2040 Build 1 1 SB/1 NB, TWLTL		2040 Build 2 2 SB/1 NB, TWLTL		2040 Build 3 2 SB/2 NB, TWLTL		2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands
			1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	2 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 2 SB Thru at 23rd
Shaw Rd NB - 23rd Ave to Pioneer Way	2.46	2.80	2.73	2.81	2.73	2.81	2.82	2.82	2.68

PM Peak Hour Intersection LOS Summary

Intersection	Existing		2040 No Build		2040 Build 1 1 SB/1 NB, TWLTL				2040 Build 2 2 SB/1 NB, TWLTL				2040 Build 3 2 SB/2 NB, TWLTL				2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands	
					1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 2 SB Thru at 23rd	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Shaw Rd/Pioneer Way	E	36.1	F	157.7	F	137.5	F	121.9	E	78.5	E	75.1	E	77.6	F	83.0	E	78.5
Shaw Rd/Pioneer Crossing	C	16.7	C	22.4	B	19.5	B	16.4	B	14.0	B	14.7	B	14.7	B	15.2	B	14.4
Shaw Rd/12th Ave	E	44.6	F	>500	F	467.4	F	305.9	B	14.8	C	19.6	C	24.6	C	16.2	C	16.2
Shaw Rd/Highlands Blvd	F	61.0	F	72.4	C	19.4	C	17.1	C	18.5	C	18.5	C	23.8	D	29.7	A	7.5
Shaw Rd/15th Ave	B	12.8	C	17.6	B	12.6	B	11.9	B	14.9	B	12.2	B	14.3	B	10.1	B	11.7
Shaw Rd/16th Ave	E	49.5	F	58.5	F	53.7	F	67.8	D	29.4	C	22.8	E	36.2	C	21.3	C	18.0
Shaw Rd/23rd Ave	D	52.4	E	60.5	D	52.5	C	23.5	E	63.5	C	29.6	D	52.8	C	29.3	C	28.5
Shaw Rd/39th Ave	D	51.4	F	100.3	D	52.1	E	56.3	F	83.0	E	70.8	F	85.4	F	96.2	E	67.0

Notes:

NBT 2nd through lane has 165 ft of storage upstream of the intersection and 500 ft merge distance downstream of the intersection

SBT 2nd through lane has 500 ft of storage upstream of the intersection and 300 ft merge distance downstream of the intersection

All alternatives assume the existing configuration on Shaw Road from 39th Avenue to 300' south of the 23rd Avenue intersection.

PM Peak Hour Intersection Throughput Comparison

Intersection	Existing		2040 No Build		2040 Build 1 1 SB/1 NB, TWLTL				2040 Build 2 2 SB/1 NB, TWLTL				2040 Build 3 2 SB/2 NB, TWLTL				2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands	
					1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		2 NB and 1 SB Thru at 23rd		2 NB and 2 SB Thru at 23rd		1 NB and 2 SB Thru at 23rd	
	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served	Vol Served	% Demand Served
Shaw Rd/Pioneer Way	2,795	99%	3,199	84%	3,352	88%	3,486	91%	3,632	95%	3,637	95%	3,629	95%	3,630	95%	3,633	95%
Shaw Rd/Pioneer Crossing	1,983	97%	2,250	85%	2,355	89%	2,476	93%	2,551	96%	2,562	96%	2,558	96%	2,551	96%	2,560	96%
Shaw Rd/12th Ave	1,963	97%	2,143	82%	2,265	87%	2,416	93%	2,490	95%	2,507	96%	2,514	96%	2,512	96%	2,515	96%
Shaw Rd/Highlands Blvd	1,904	97%	2,118	84%	2,225	88%	2,363	93%	2,402	95%	2,430	96%	2,436	96%	2,434	96%	2,438	96%
Shaw Rd/15th Ave	1,771	97%	1,926	82%	2,024	87%	2,158	92%	2,211	94%	2,253	96%	2,248	96%	2,257	96%	2,259	97%
Shaw Rd/16th Ave	1,690	97%	1,854	83%	1,944	88%	2,078	94%	2,080	94%	2,139	96%	2,124	96%	2,140	96%	2,144	97%
Shaw Rd/23rd Ave	1,822	96%	2,015	84%	2,086	87%	2,247	94%	2,192	91%	2,298	96%	2,259	94%	2,294	96%	2,306	96%
Shaw Rd/39th Ave	2,062	96%	2,204	82%	2,342	87%	2,512	94%	2,450	91%	2,496	93%	2,455	92%	2,458	92%	2,508	94%

PM Peak Hour 95th Percentile Queue Lengths (ft)

Location	2020 Existing	2040 No Build	2040 Build 1 1 SB/1 NB, TWLTL		2040 Build 2 2 SB/1 NB, TWLTL		2040 Build 3 2 SB/2 NB, TWLTL		2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands
			1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	2 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 2 SB Thru at 23rd
SB at Shaw-Pioneer	228	1,582	1,466	1,359	522	472	577	684	547
NB at Shaw-Pioneer	106	175	174	203	201	196	196	185	188
EB at Shaw-Pioneer	134	861	1,017	713	559	558	461	547	582
WB at Shaw-Pioneer	197	1,218	1,220	1,218	1,203	1,217	1,186	1,199	1,206
EB at 12th	17	455	458	382	27	21	27	23	23
WB at Highlands	12	25	16	15	14	16	14	16	19
WB at 15th	4	4	4	4	4	4	4	4	4
EB at 16th	2	5	3	5	4	3	4	0	0
SB at 23rd	1,419	1,418	1,335	163	1,505	226	1,352	234	245
NB at 23rd	96	308	311	66	271	77	84	84	186
EB at 23rd	83	212	217	84	198	85	100	86	86
WB at 23rd	30	133	139	33	38	30	35	32	33

PM Peak Travel Time Comparison (minutes)

Segment	2020 Existing	2040 No Build	2040 Build 1 1 SB/1 NB, TWLTL		2040 Build 2 2 SB/1 NB, TWLTL		2040 Build 3 2 SB/2 NB, TWLTL		2040 Build 4 2SB/1NB, TWLTL 2 NB from Highlands
			1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	2 NB and 1 SB Thru at 23rd	2 NB and 2 SB Thru at 23rd	1 NB and 2 SB Thru at 23rd
Shaw Rd SB - Pioneer Way to 23rd Ave	4.77	5.30	4.54	2.97	4.29	2.65	4.05	2.70	2.63