



# KITTELSON & ASSOCIATES, INC.

TRANSPORTATION ENGINEERING / PLANNING

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October 13, 2015

Project #: 19056

Kerry Martin  
Sozo Sports of Central Washington  
1200 Chesterley Drive, Suite 140  
Yakima, WA 98902

***RE: Transportation Impact Analysis for the Yakima Sports Complex***

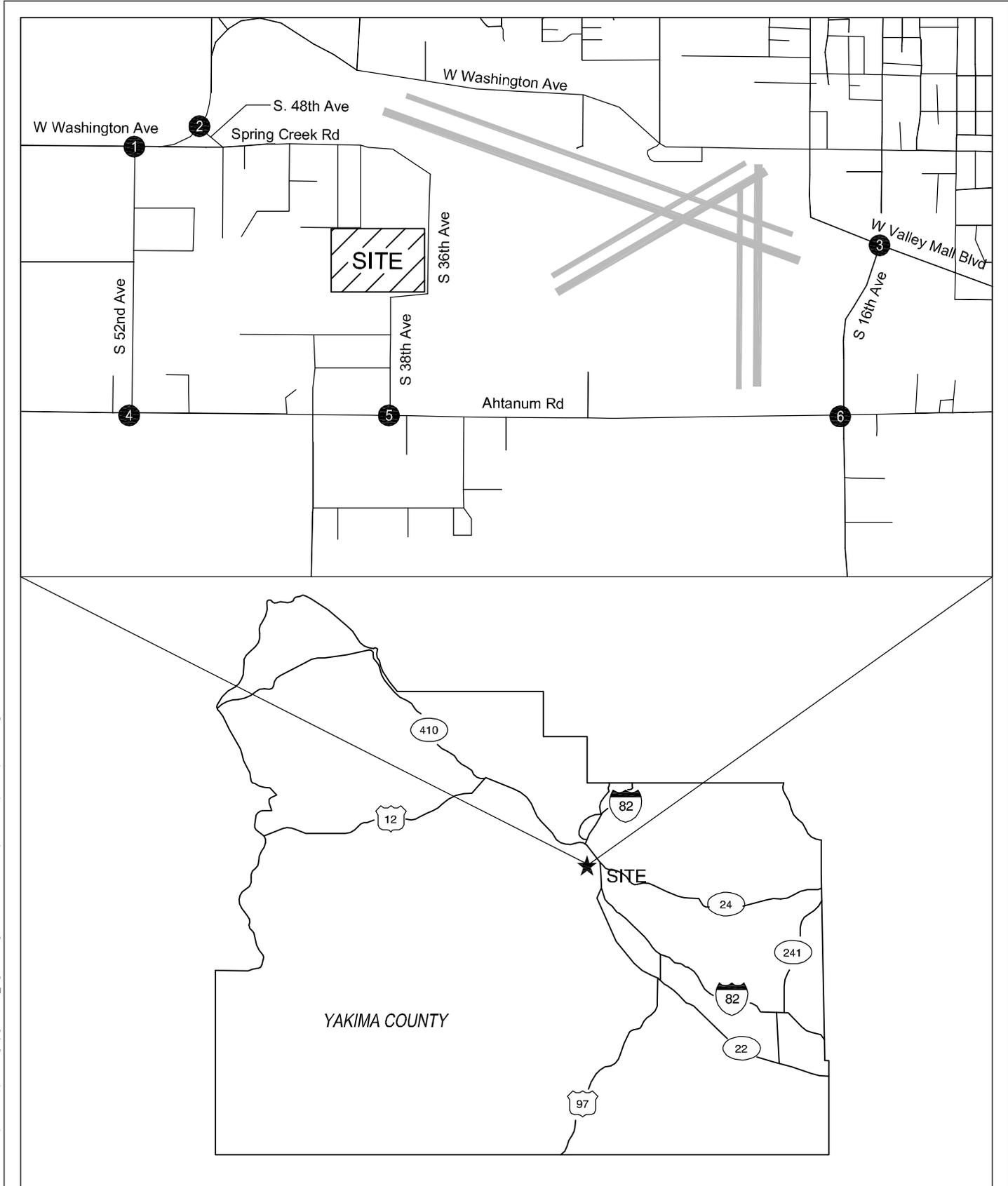
Dear Kerry,

This report presents the results of Kittelson & Associates Inc.'s transportation impact analysis for the proposed Yakima Sports Complex. The results of this study indicate that with the identified mitigation measures, the proposed sports complex can be constructed while maintaining acceptable traffic operations and safety at the study intersections. Additional details of the study methodology, findings, and recommendations are provided herein.

## INTRODUCTION

SOZO Sports is proposing to develop a multi-use sports complex at 2210 S 38<sup>th</sup> Avenue in Yakima. The 58-acre sports complex will have 13 outdoor soccer fields and an 80,000 square foot indoor facility that will house six courts that can be used for indoor soccer, volleyball, and basketball. The remainder of the indoor facility will include space for concessions, private training facilities, restrooms, miscellaneous facility space, and administrative offices. For the purposes of this study, full build-out of the envisioned complex is anticipated to be completed by 2017. Phase two of this project may include the development of an adjacent 60 acres; however this longer-term phase and its transportation impacts are not included in the analysis.

Access to the sports complex will be provided via two new driveways off of S 36<sup>th</sup> Avenue. Figure 1 illustrates the site vicinity map and Figure 2 illustrates a draft version of the proposed site plan and site access driveways. Given the preliminary nature of the current site plan, this traffic study does not include an operations assessment of the S 36<sup>th</sup> Avenue site-access driveways. A supplemental assessment of the site access conditions will be prepared when a more formal site layout is decided upon.



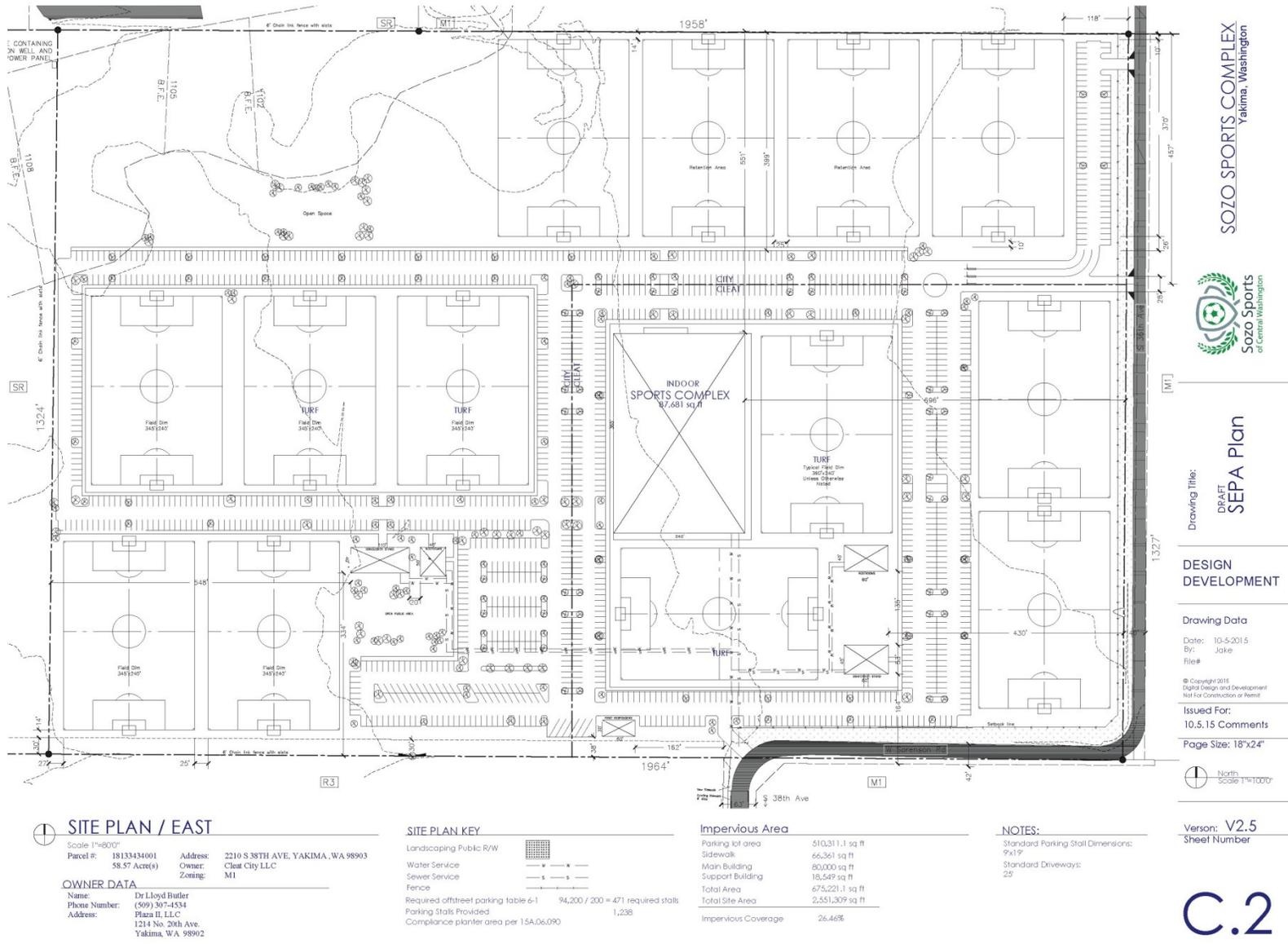
● - Study Intersections

Site Vicinity Map  
Yakima, Washington

Figure  
**1**

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Figure 2 – Draft Site Development Plan (Draft site plan prepared by Digital Design and Development 10/5/15 and is subject to further refinement.)



## SCOPE OF THE REPORT/METHODOLOGY

This analysis determines the transportation-related impacts associated with the proposed development and has been prepared in accordance with City of Yakima and Yakima County requirements for a traffic impact analysis. The study intersections and scope of this project are based on consultation with City and County staff. Operational analyses have been performed at the following intersections:

- S 52<sup>nd</sup> Avenue/W Washington Avenue
- S 48<sup>th</sup> Avenue/W Washington Avenue
- S 16<sup>th</sup> Avenue/W Valley Mall Boulevard
- S 52<sup>nd</sup> Avenue/Ahtanum Road
- S 38<sup>th</sup> Avenue/Ahtanum Road
- S 16<sup>th</sup> Avenue/Ahtanum Road
- Proposed site driveways

This report evaluates the following transportation scenarios:

- Year 2015 existing transportation-system conditions within the site vicinity during the weekday PM peak hour and Saturday afternoon peak hour;
- Forecast year 2017 background traffic conditions during the weekday p.m. peak hour and Saturday peak hour of generator without build-out of the site;
- Trip generation and assignment for the proposed development;
- Forecast year 2017 total traffic conditions during the weekday p.m. peak hour and Saturday peak hour of generator with build-out of the site; and
- Recommended improvements/intersection considerations.

All level of service analyses described in this report was performed in accordance with the procedures stated in the *2010 Highway Capacity Manual* (Reference 1).

The analysis herein evaluates the peak 15-minute flow rate during the peak hour analysis period. For this reason, the analyses reflect conditions that are only likely to occur for 15-minutes out of each average peak hour; therefore, the study intersections will likely operate more efficiently during the other times of day.

## JURISDICTIONAL REQUIREMENTS

The City of Yakima, which has jurisdiction over the intersections on W Washington Avenue, W Valley Mall Boulevard, and S 36<sup>th</sup> Avenue, has an operational standard of LOS D or better.

Yakima County has jurisdiction over the three study intersections on Athanum Road with an operational standard of LOS C or better.

## EXISTING CONDITIONS

The existing conditions analysis identifies site conditions and the current operational and geometric characteristics of the study area roadways and intersections. The purpose of this section is to set the stage for a basis of comparison to future conditions.

### Transportation Facilities

Table 1 summarizes the existing transportation facilities and roadways in the study area. Figure 3 illustrates the existing lane configurations and traffic control devices in place at the study intersections.

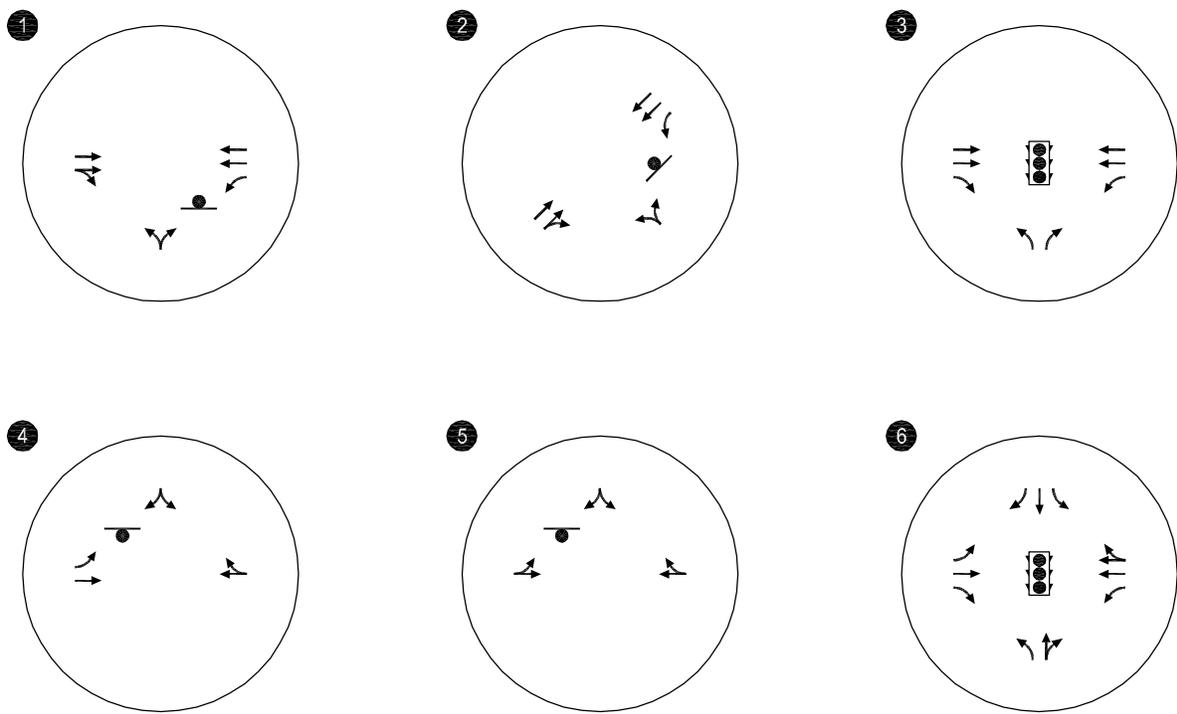
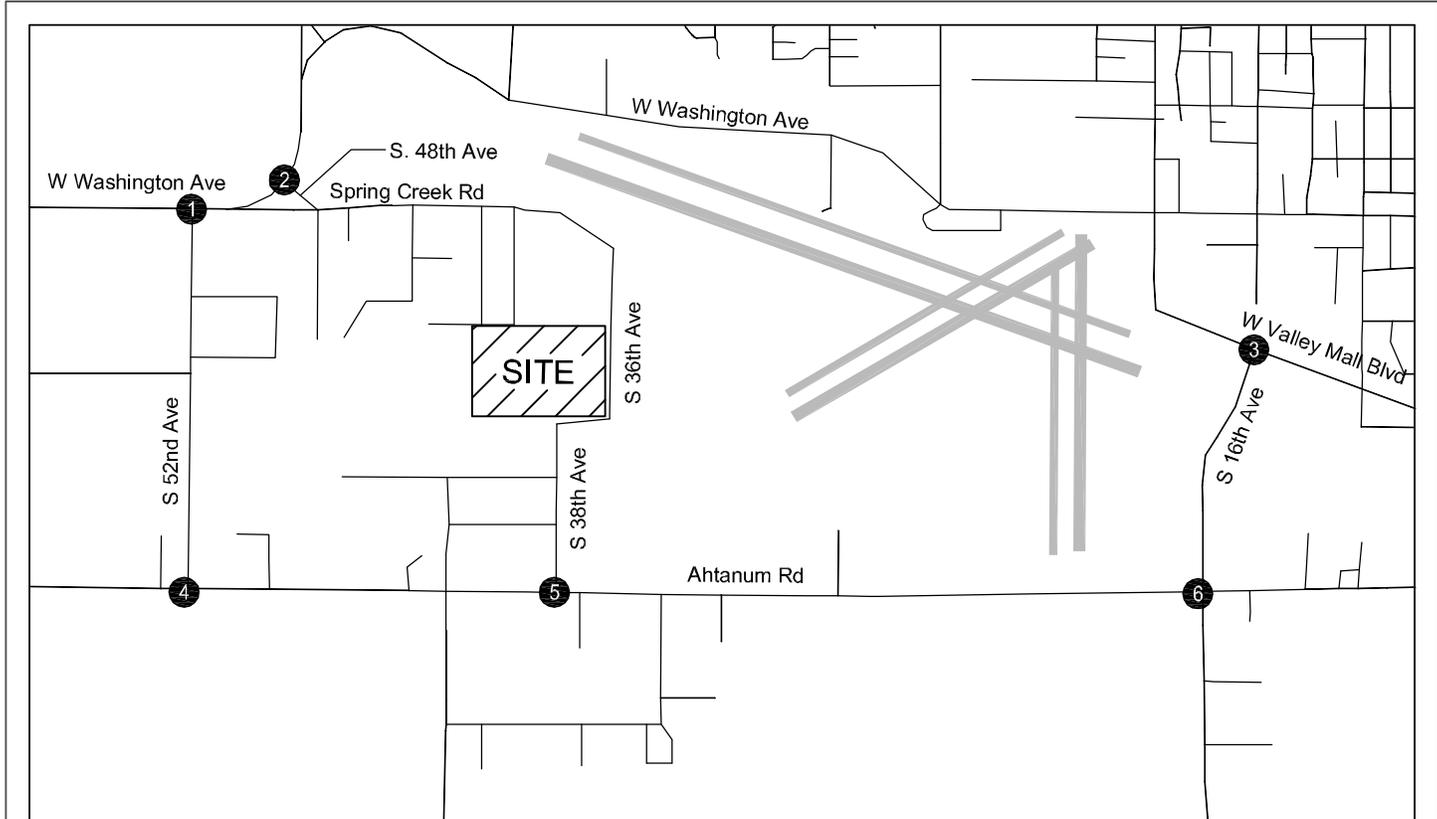
**Table 1 - Existing Transportation Facilities**

Roadway	Functional Classification <sup>1</sup>	Number of Lanes	Posted Speed (mph)	Sidewalks	Bicycle Lanes	On-Street Parking
W Washington Avenue	Principal Arterial (Urban)	5 Lanes	40	Yes	No	No
Spring Creek Road	Local Access	2 Lanes	35	No	No	No
Ahtanum Road	Minor Arterial (Urban)	2 lanes (4 Lanes between S 26 <sup>th</sup> Avenue and S 16 <sup>th</sup> Avenue)	50 (West of S 26 <sup>th</sup> Avenue) 45 (East of S 26 <sup>th</sup> Avenue)	Partial	No	No
S 52 <sup>nd</sup> Avenue	Collector Arterial (urban)	2 Lanes	40	No	No	No
S 38 <sup>th</sup> Avenue	Local Access	2 Lanes	35	West Side Only	No	No
S 36 <sup>th</sup> Avenue	Local Access	2 Lanes	35	No	No	No
S 16 <sup>th</sup> Avenue	Arterial (Urban)	2 Lanes	35	East Side Only	No	No

<sup>1</sup> Source: City of Yakima Functional Class and traffic Volumes Map (November 2010)

### Pedestrian and Bicycle Facilities

The proposed project site is located in a predominately rural area with limited pedestrian and bicycle infrastructure. Continuous sidewalks are present on both sides of W Washington Avenue, on the west side of S 38<sup>th</sup> Avenue between Ahtanum Road and W Sorenson Road, and on the east side of S 16<sup>th</sup> Avenue north of Ahtanum Road. Sidewalks are also present on the north side of Ahtanum Road for approximately ½ mile west of S 16<sup>th</sup> Avenue and on the south side of Ahtanum Road for approximately ¼ mile west of S 16<sup>th</sup> Avenue. W Washington Avenue has shared bicycle lane infrastructure.



-  - STOP SIGN
-  - TRAFFIC SIGNAL

**Existing Lane Configurations  
& Traffic Control Devices  
Yakima, Washington**

**Figure  
3**

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## EXISTING TRAFFIC OPERATIONS

Manual turning-movement counts were conducted at the study intersections in May 2015 prior to the end of the 2014/2015 school year. The counts were conducted on a typical mid-week day during the evening (4:00 to 6:00 p.m.) peak time period and on a typical Saturday afternoon (12:00 to 2:00 p.m.). The system-wide evening and Saturday afternoon peak hours were found to occur between 4:35 - 5:35 p.m. and 12:00 - 1:00 p.m., respectively. *Attachment “A” includes the traffic count data used in this study.*

Figures 4 and 5 summarize the level-of-service analysis for the study intersections under existing traffic conditions during the weekday p.m. and Saturday peak hours, respectively. As shown, all of the study intersections currently operate acceptably. *Attachment “B” includes the existing traffic operations worksheets.*

### Crash Analysis

Crash records were obtained from WSDOT for the five-year period from January 1, 2010, through available 2015 (the 2015 data is partial and preliminary). The detailed crash data covering all reported crashes that occurred at the study intersections were reviewed in an effort to identify potential intersection safety issues or trends. The intersection crash data are summarized in Table 2, including types and severity of crashes. *Attachment “C” contains the crash data provided by WSDOT*

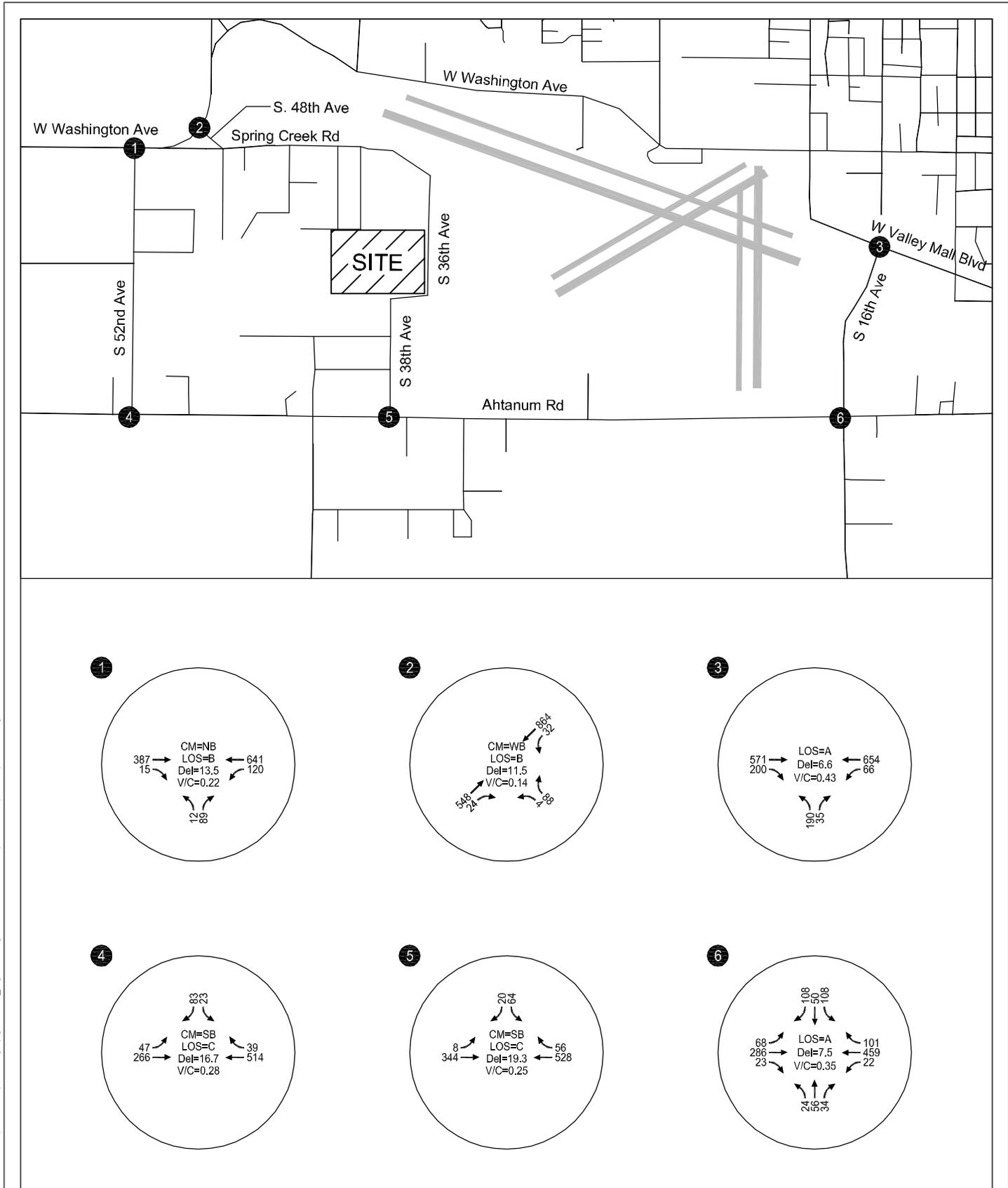
**Table 2 - Intersection Crash History (January 1, 2010 - Available 2015 Data)**

Intersection	Collision Type				Severity			Total	Estimated Crash Rate <sup>2</sup>
	Rear End	Turn	Angle	Other	PDO <sup>1</sup>	Injury	Fatal		
S 52 <sup>nd</sup> Avenue/W Washington Avenue	0	3	0	0	1	2	0	3	0.13
S 48 <sup>th</sup> Avenue/W Washington Avenue	0	0	0	0	0	0	0	0	0.0
S 16 <sup>th</sup> Avenue/W Valley Mall Boulevard	0	2	0	0	1	1	0	2	0.06
S 52 <sup>nd</sup> Avenue/Ahtanum Road	0	1	0	1	1	1	0	2	0.11
S 38 <sup>th</sup> Avenue/Ahtanum Road	0	0	0	0	0	0	0	0	0.0
S 16 <sup>th</sup> Avenue/Ahtanum Road	1	6	4	0	9	2	0	11	0.45

<sup>1</sup> PDO: Property Damage Only

<sup>2</sup> Crash Rate = (Total Crashes) / (365 days/year x daily entering vehicles / 1,000,000)

As shown in Table 2, the S 16th Avenue/Ahtanum Road intersection has experienced the most crashes over the most recent five-year period. The majority of the crashes were turning crashes, with five of the six attributed to southbound vehicles making left turns and not yielding to the oncoming vehicle. Further analysis of the crashes at this intersection as well as the other intersections did not reveal any discernable patterns or obvious geometric/operational concerns.

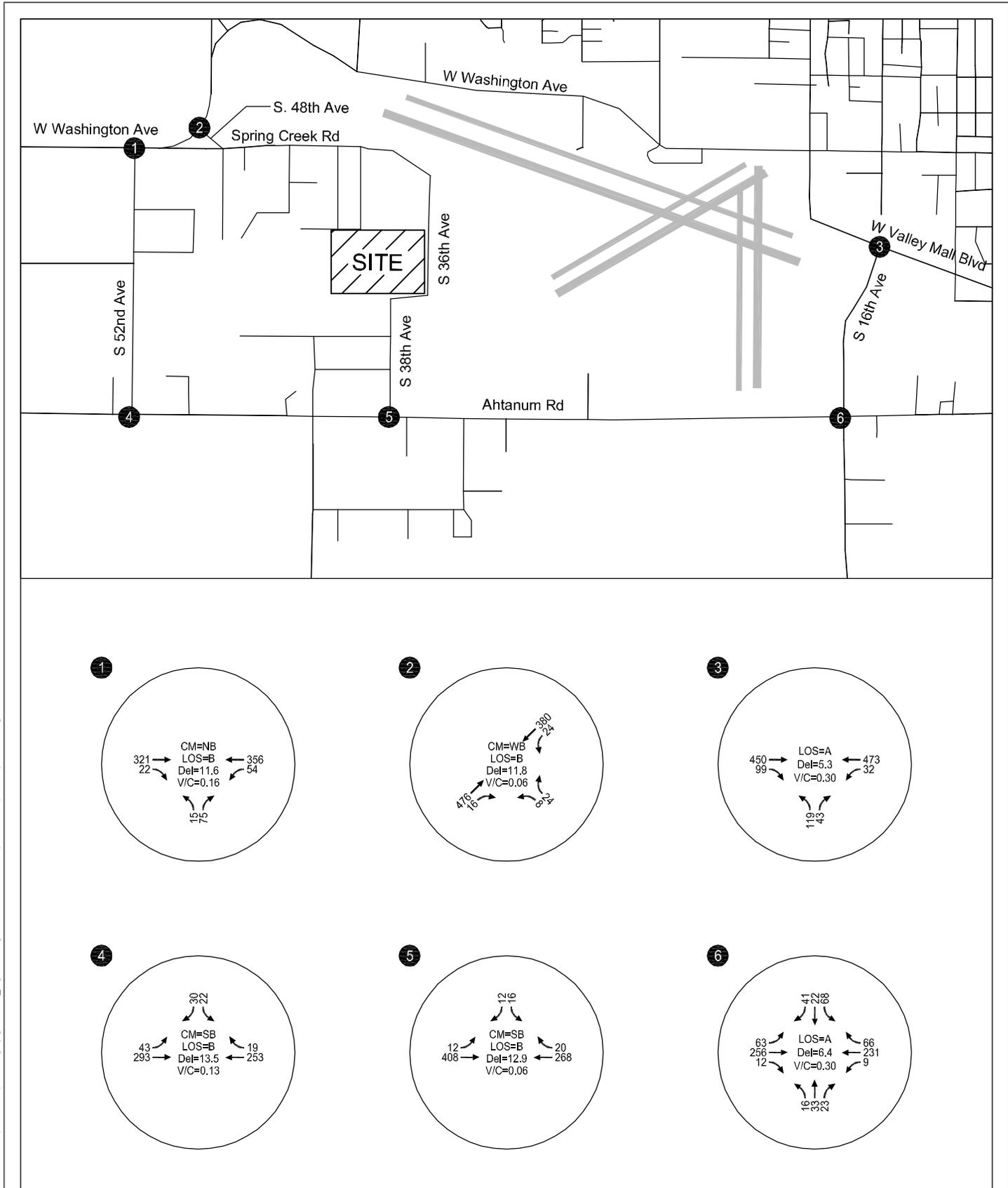


LOS = INTERSECTION LEVEL OF SERVICE  
 Del = INTERSECTION AVERAGE CONTROL DELAY  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**Existing Traffic Conditions  
 Weekday PM Peak Hour  
 Yakima, Washington**

**Figure  
 4**

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LOS = INTERSECTION LEVEL OF SERVICE  
 Del = INTERSECTION AVERAGE CONTROL DELAY  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**Existing Traffic Conditions  
 Saturday Midday Peak Hour  
 Yakima, Washington**

**Figure  
 5**

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## TRANSPORTATION IMPACT ANALYSIS

The transportation impact analysis identifies how the study intersections will operate upon full build-out of the proposed sports complex in year 2017. The impact of traffic generated by the sports complex during typical weekday p.m. and Saturday midday peak hours were examined as follows:

- Developments and transportation improvements planned in the study area were identified and included in the analysis;
- Year 2017 background traffic conditions (without the proposed sports complex) were analyzed at the study intersections during the weekday p.m. and Saturday midday peak hour;
- Background traffic conditions were developed by applying an annual growth rate to the existing traffic volumes to account for regional growth in the site vicinity;
- Typical site-generated trips were estimated for build-out of the site;
- A site trip distribution pattern was derived based on existing travel patterns, a review of the local market service area, and discussions with City and County staff; and
- Year 2017 total traffic conditions (with the proposed sports complex) were analyzed at the study intersections during the weekday p.m. and Saturday afternoon peak hour.

### 2017 Background Traffic Conditions

The background traffic analysis identifies how the study area's transportation system will operate in the year the proposed soccer complex is expected to open (2017), but without the traffic generated by the sports complex itself. To account for general traffic growth in the site vicinity, a 1-2 percent annual growth rate was assumed and applied to the existing traffic volumes. This growth rate is consistent with other traffic studies being performed in the project vicinity and was confirmed for use by City of Yakima staff.

### ***Planned Developments and Transportation Improvements***

City of Yakima and Yakima County staff was contacted to identify any in-process developments or transportation improvements that may affect travel patterns in the vicinity of the proposed project. Although not an officially approved development project at the time this report was prepared, Yakima County staff requested that the projected traffic volumes from the proposed Borton Fruit packing complex at 2202 Ahtanum Road be included in the background traffic volumes. Utilizing the trip generation and assignment volumes from the proposed development's traffic impact study, weekday p.m. and Saturday midday volumes were extracted and applied to the study intersections. *Attachment "D"* contains a graphical summary of the estimated Borton Fruit site-generated trips. These trips were then added to the forecast growth volumes to generate the 2017 background traffic volumes as documented in Figures 6 and 7.

## 2017 Background Traffic Intersection Operations

As shown in Figures 6 and 7, all of the study intersections are forecast to continue to operate acceptably during the weekday p.m. and Saturday midday peak hours. *Attachment “D” contains the worksheets used to evaluate year 2017 background traffic conditions.*

## PROPOSED REDEVELOPMENT PLAN

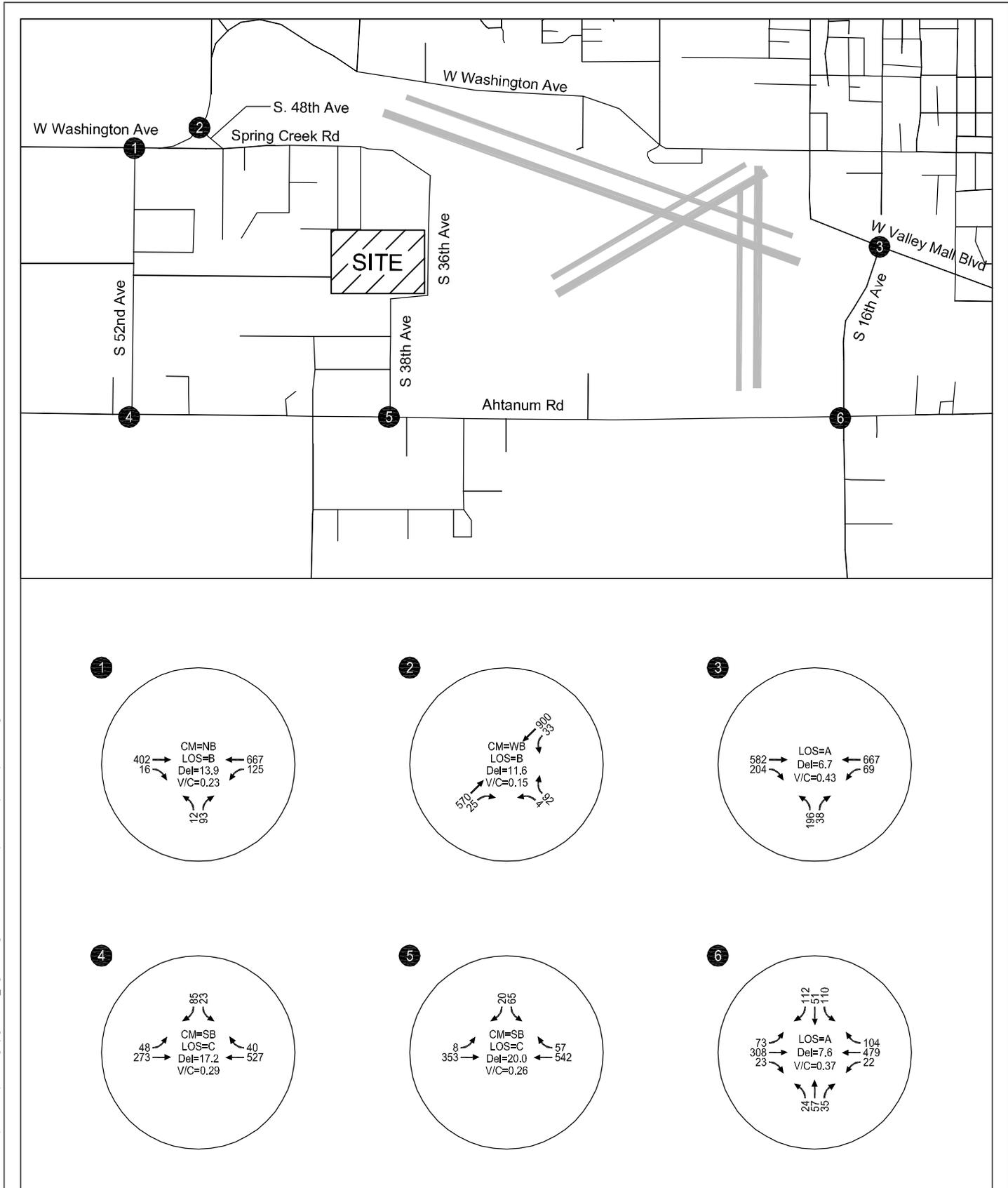
SOZO Sports is proposing to construct a 58-acre soccer complex. At full buildout, the complex will include 13 outdoor soccer fields and an 80,000 square foot multi-use indoor facility. The indoor facility will have six courts that can accommodate a variety of recreational activities including indoor soccer, volleyball, and/or basketball events. It will also include support space, concessions, restrooms, a private training complex, and administrative offices. Main access to the site will be provided via two new site driveways on S. 38th Avenue. This analysis assumes the development will be built out and in use by the year 2017.

### Trip Generation Estimate

To estimate the trip generation potential of the proposed soccer complex, the data presented in the Institute of Transportation Engineers (ITE) reference *Trip Generation, 9th Edition* (Reference 2) was reviewed. For the 13 outdoor soccer fields, the “Soccer Complex” land use would provide a reasonable estimate of the typical<sup>1</sup> weekday p.m. and Saturday midday peak hour trip profiles. The indoor facility, however, is unique in that it is not accurately represented by any of the land use categories in the trip generation reference manual. Detailed conversations with the project design team revealed that each indoor soccer, volleyball, and basketball field/court will generate a proportionately similar level of use to each outdoor soccer field. Based on these assumptions, the trip generation for the indoor facility was calculated using the same “Soccer Complex” land use category. Tables 3 and 4 summarize the daily, weekday p.m. and Saturday afternoon peak-hour trips for the proposed soccer complex.

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<sup>1</sup> It is recognized that the proposed soccer complex can and will most likely host large regional soccer/athletic tournaments at various times of the year. However, given that these events will be relatively infrequent, the trip generation analysis is focused on typical weekday p.m. and Saturday midday levels of activity. This activity is assumed to include a variety of youth and adult soccer practices/games.

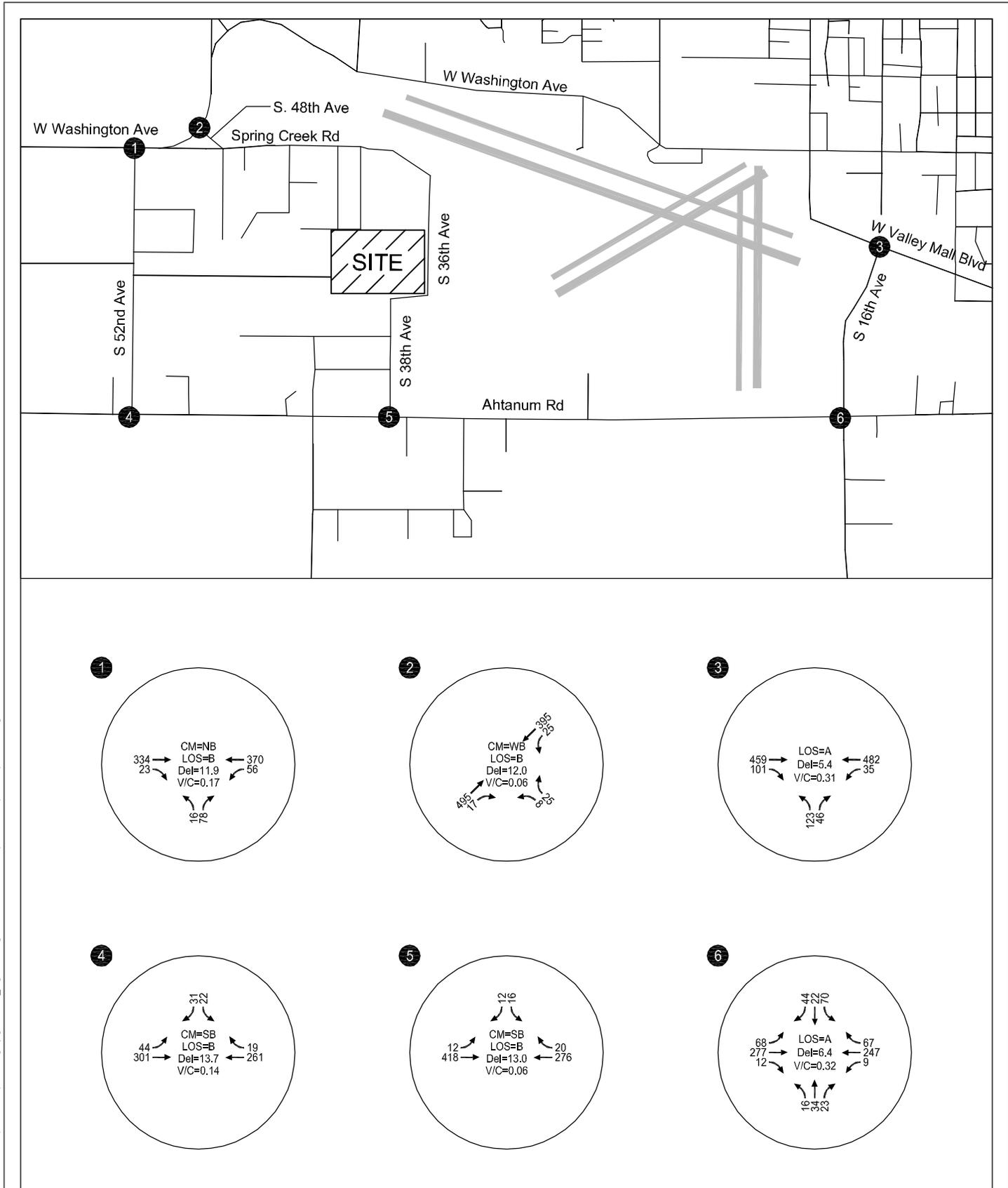


LOS = INTERSECTION LEVEL OF SERVICE  
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 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

**2017 Background Traffic Conditions  
 Weekday PM Peak Hour  
 Yakima, Washington**

Figure 6

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LOS = INTERSECTION LEVEL OF SERVICE  
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**2017 Background Traffic Conditions  
 Saturday Midday Peak Hour  
 Yakima, Washington**

Figure 7

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**Table 3 - Proposed Yakima Sports Complex Trip Generation - Weekday PM Peak Hour**

Land Use	ITE Code	Size (Fields)	Daily Trips	Weekday P.M. Peak Hour		
				Total	In	Out
Soccer Complex	488	13 Fields	928	230	154	76
Soccer Complex (Indoor Facility)	488	6 Fields	428	106	71	35
Total New Trips			1,356	336	225	111

**Table 4 - Proposed Yakima Sports Complex Trip Generation - Saturday Midday Peak Hour**

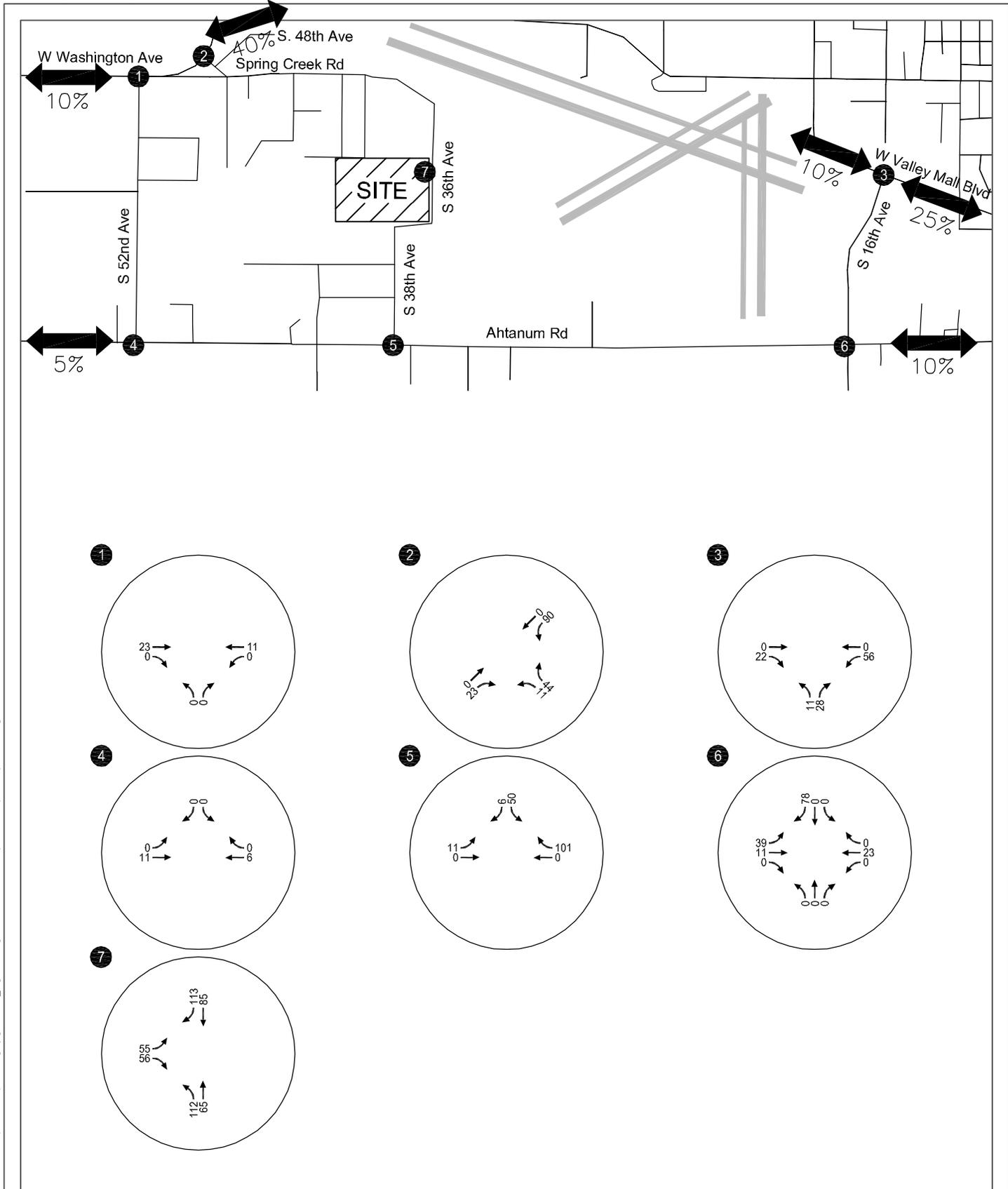
Land Use	ITE Code	Size (Fields)	Daily Trips	Saturday Peak Hour of Generator		
				Total	In	Out
Soccer Complex	488	13 Fields	1,528	394	189	205
Soccer Complex (Indoor Facility)	488	6 Fields	706	182	87	95
Total New Trips			2,234	576	276	300

**Site Trip Distribution/Trip Assignment**

The site-generated trips shown in Tables 3 and 4 were distributed onto the roadway network according to existing traffic patterns, a review of the local market service area, various routing choices, the proposed site layout, and the marketing plans being developed by SOZO Sports. Figures 8 and 9 illustrate the resulting trip distribution pattern for the proposed development and the assignment of site-generated trips during the weekday p.m. and Saturday afternoon peak hour.

**2017 TOTAL TRAFFIC CONDITIONS**

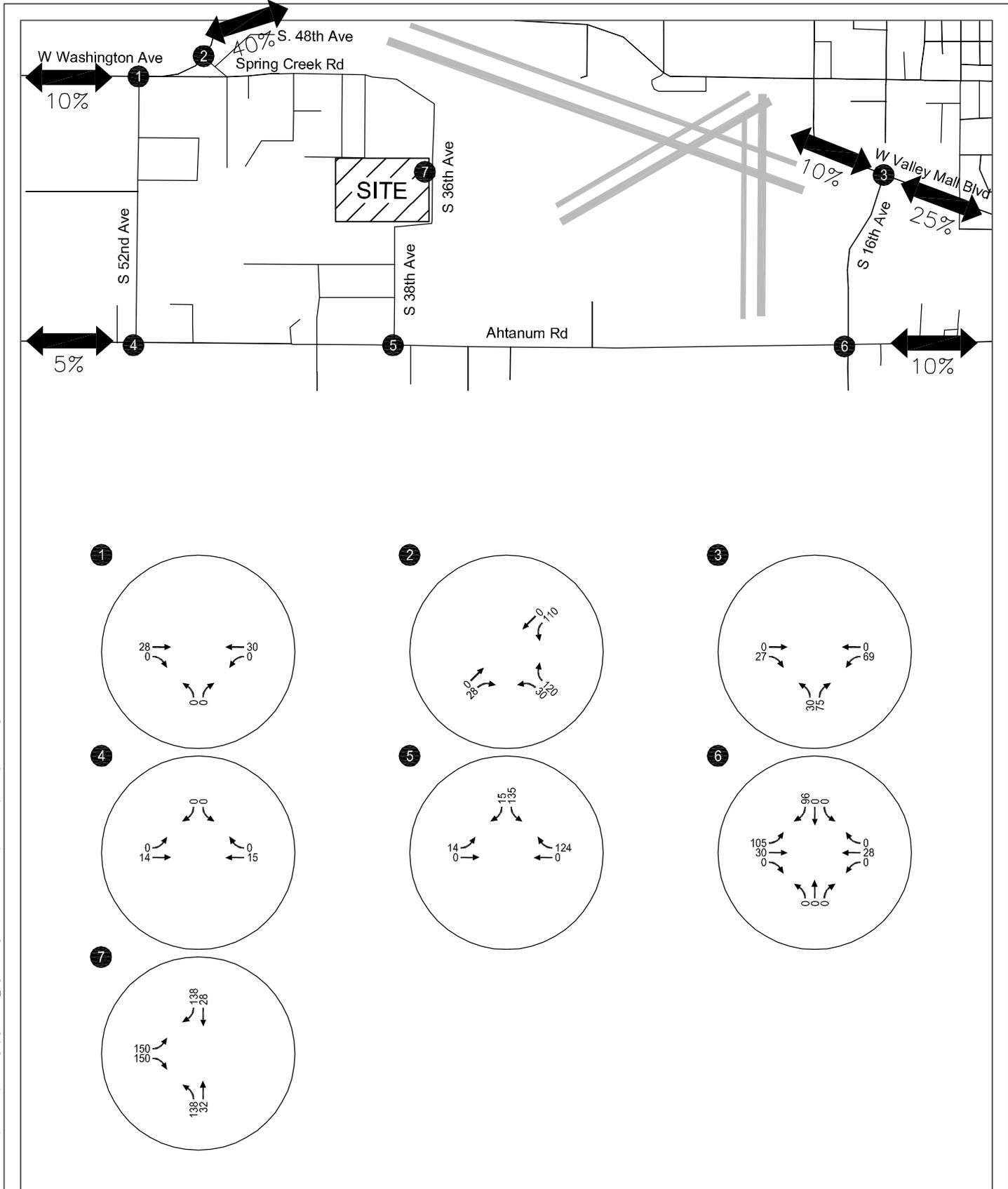
The total traffic conditions analysis estimates how the study area’s transportation system will operate with the traffic generated by the proposed sports complex. The year 2017 background traffic volumes shown in Figures 6 and 7 were added to the site-generated traffic shown in Figures 8 and 9 to arrive at the total traffic volumes shown in Figures 10 and 11. As shown in Figures 10 and 11, all of the study intersections are forecast to continue to operate acceptably with the exception of the S. 38<sup>th</sup> Avenue/Ahtanum Road intersection during the weekday PM peak hour. *Attachment “E” includes the 2017 Total Traffic Conditions analysis worksheets.*



**Site Generated Traffic & Trip Distribution  
Weekday PM Peak Hour  
Yakima, Washington**

**Figure  
8**

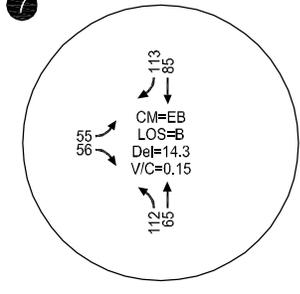
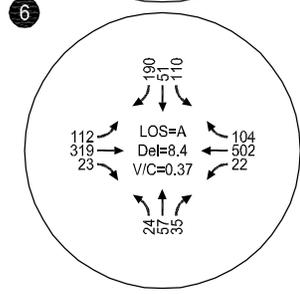
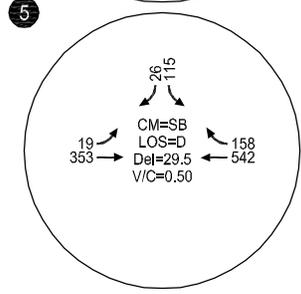
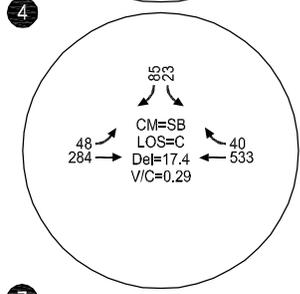
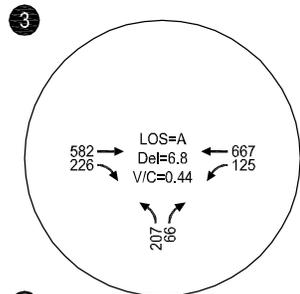
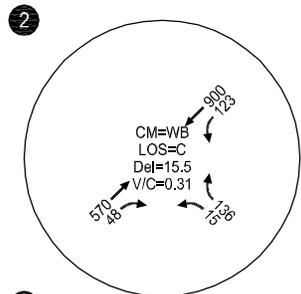
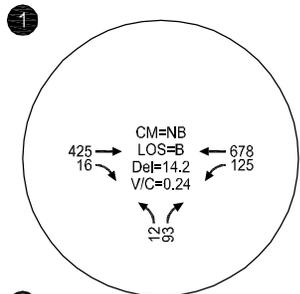
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**Site Generated Traffic & Trip Distribution  
Saturday Midday Peak Hour  
Yakima, Washington**

**Figure  
9**

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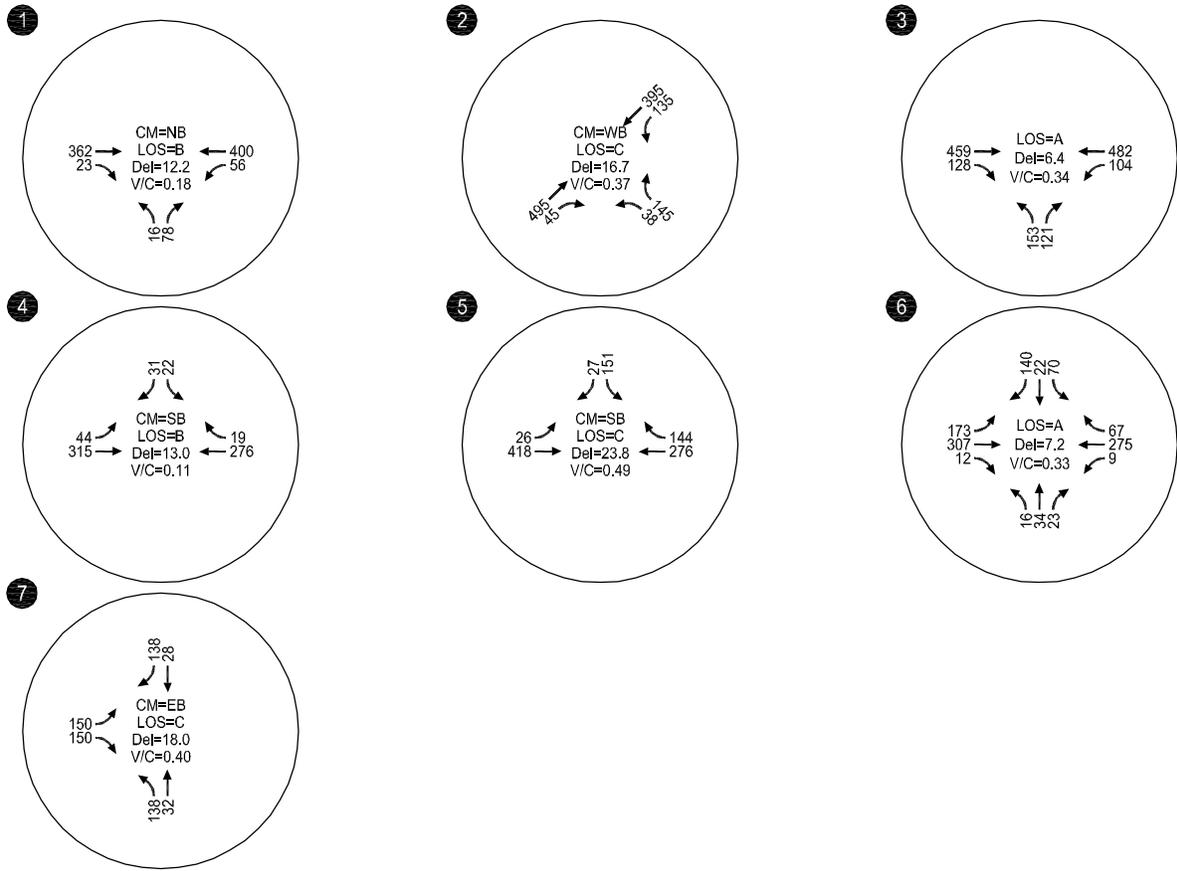


LOS = INTERSECTION LEVEL OF SERVICE  
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### 2017 Total Traffic Conditions Weekday PM Peak Hour Yakima, Washington

Figure 10

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LOS = INTERSECTION LEVEL OF SERVICE  
 Del = INTERSECTION AVERAGE CONTROL DELAY  
 V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

### 2017 Total Traffic Conditions Saturday Midday Peak Hour Yakima, Washington

Figure  
**11**

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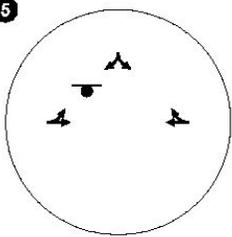
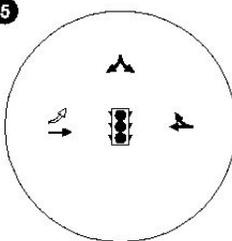
### S. 38<sup>th</sup> Avenue/Ahtanum Road Intersection

As shown in Figure 10, the southbound approach at the unsignalized S. 38<sup>th</sup> Avenue/Ahtanum Road intersection is projected to operate with a critical movement delay that exceeds Yakima County’s level of service “C” standard during the weekday p.m. peak hour. Given these findings, a signal warrant analysis was subsequently performed at the intersection in accordance with the procedures outlined in the *2009 Manual on Uniform Traffic Control Devices (MUTCD)*. The following volume-based traffic signal warrants were evaluated as part of the analysis:

- Warrant 1: Eight-Hour Vehicle Volume (1A – Minimum Vehicular Volume and 1B - Interruption of Continuous Traffic)
- Warrant 2: Four-Hour Vehicular Volume
- Warrant 3: Peak Hour

From this analysis, it was found that the intersection would meet traffic signal warrants #1, #2, and #3. The signal warrant worksheets that address MUTCD Warrants #1-3 are included in Attachment “F”. With signalization, the intersection is forecast to operate at an acceptable level of service “A” as shown in Table 5.

**Table 5 - S. 38<sup>th</sup> Avenue/Ahtanum Road Mitigation Summary**

S. 38 <sup>th</sup> Avenue/Ahtanum Road	Weekday PM Peak Hour	
	Delay/LOS	V/C
Existing Unsignalized Configuration		
	Critical Movement = Southbound Approach	
	29.5 / D	0.50
Assumed Future Signalized Configuration <sup>1</sup>		
	11.7 / B	0.66

Note: Hollow arrows represent assumed new travel lanes.

<sup>1</sup> Given the existing rural two-lane configuration of Ahtanum Road, signalization assumes the construction of a 100-foot eastbound left-turn lane with protected left-turn phasing. Although not assumed as part of the signalization analysis and not necessary to address level of service or capacity constraints, a westbound right-turn lane on Ahtanum Road would provide additional operations and safety benefits and should be considered if sufficient right-of-way can be acquired.

**Iteration of Signalization Needs**

As documented, full buildout of the proposed soccer complex results in a level of service degradation of the S. 38th Avenue/Ahtanum Road Intersection from level of service “C” to “D”. A signal warrant analysis indicates that signalization of the intersection would be warranted under these conditions, whereby a subsequent signalization analysis has shown that acceptable operations can be restored to the intersection.

At the request of City and County staff, an iterative analysis was performed at this intersection to help determine how much of the proposed soccer complex can be constructed before triggering level of service “D” conditions and the need for signalization. As shown in Table 6, the equivalent of eleven soccer fields can be constructed while maintaining Yakima County’s level of service “C” standard during the weekday p.m. peak hour. Beyond eleven fields, projected traffic volumes would be high enough to result in level of service “D” conditions and the need for signalization.

**Table 6 - S. 38<sup>th</sup> Avenue/Ahtanum Road Maximum Level of Service Threshold**

S. 38 <sup>th</sup> Avenue/Ahtanum Road	Weekday PM Peak Hour	
	Delay/LOS	V/C
	Critical Movement = Southbound Approach	
11 Fields	24.6 / C	0.39
12 Fields	25.0 / D	0.40

**W. Washington Avenue/S. 48<sup>th</sup> Avenue Intersection**

Although the critical westbound S. 48<sup>th</sup> Avenue approach to the W. Washington Avenue intersection is forecast to continue to operate at acceptable levels of service during the 2017 weekday PM and Saturday midday peak hour, field observations, existing travel patterns, and forecast traffic volumes indicate that the vast majority of movements on this approach are and will be making a right-turn onto W. Washington Avenue. As an existing single-lane approach, this heavy right-turn volume has the potential to be significantly delayed by left-turning vehicles, resulting in long vehicle queues. A second exclusive right-turn lane on the S. 48<sup>th</sup> Avenue approach (from W. Washington Avenue to Spring Creek Road) would better accommodate the existing and projected right-turn movement and minimize delays to the predominate right-turn maneuver. This right-turn lane would also be useful to accommodate traffic during special events.

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## FINDINGS AND RECOMMENDATIONS

Based on the results of this transportation impact analysis, the proposed Yakima Sports Complex can be developed while maintaining acceptable levels of service at the study intersections. The findings and recommendations of this analysis are summarized below.

### Existing Conditions

- All study intersections currently operate at acceptable levels of service during the weekday p.m. and Saturday midday peak hours.

### Year 2017 Background Conditions

- With the assumed local and regional traffic growth, all study intersections are forecast to continue to operate at acceptable levels of service during the weekday p.m. and Saturday midday peak hours.

### Proposed Development Plan

- The proposed sports complex is estimated to generate approximately 1,355 daily weekday trips, with 336 trips (225 in, 111 out) occurring during the weekday p.m. peak hour and approximately 2,232 daily Saturday trips, with 576 trips (276 in, 300 out) during the Saturday midday peak hour. These trip generation estimates are representative of typical weekday and Saturday conditions and do not reflect trips associated with major tournaments of similar large-scale special events.

### Year 2017 Total Traffic Conditions

- All study intersections are forecast to continue to operate at acceptable levels of service during the weekday p.m. and Saturday afternoon peak hours with the exception of the S. 38<sup>th</sup> Avenue/Ahtanum Road intersection.
  - At the construction and utilization of the equivalent of twelve or more soccer fields, the southbound approach at the unsignalized S. 38th Avenue/Ahtanum Road intersection is forecast to operate with a critical movement delay that exceeds Yakima County's level of service "C" standard during the weekday p.m. peak hour.
    - A traffic signal warrant analysis concluded that the intersection meets the volume-based traffic signal warrants #1, #2, and #3.
    - Assuming signalization and the construction of a 100-foot eastbound left-turn lane, the S. 38th Avenue/Ahtanum Road intersection would operate at an acceptable level of service "B".

- Although not needed to address level of service or capacity issues, a westbound right-turn lane on Ahtanum Road would provide additional operations and safety benefits.
- Field observations, existing travel patterns, and forecast traffic volumes indicate that the vast majority of movements on the S. 48<sup>th</sup> Avenue approach to the W. Washington Avenue/S. 48<sup>th</sup> Avenue intersection are/will be turning right onto W. Washington Avenue. As an existing single-lane approach, this heavy right-turn volume has the potential to be delayed by left-turning vehicles, resulting in long vehicle queues. A second exclusive lane (exclusively for right-turning vehicles) on the S. 48<sup>th</sup> Avenue approach (from Spring Creek Road to W. Washington Avenue) would better accommodate the existing and projected right-turn movement and minimize delays to the predominate right-turn maneuver.

## RECOMMENDATIONS

The following list summarizes improvements recommended in conjunction with site development:

- The S. 38<sup>th</sup> Avenue/Ahtanum Road intersection should be signalized. Based on the iterations analysis, signalization would be needed at the equivalent of 12 or more soccer fields. As part of the signalization project, Ahtanum Road should be widened to provide a 100-foot eastbound left-turn lane.
- A second exclusive lane (for right-turning vehicles) should be constructed on the S. 48<sup>th</sup> Avenue (from Spring Creek Road to W. Washington Avenue) approach to the W. Washington Avenue/S. 48<sup>th</sup> Avenue intersection. This second lane should be constructed as part of the initial development of the soccer complex.
- Any new landscaping, signage or above-ground utilities along the S. 36<sup>th</sup> Avenue site frontage should be installed and maintained to ensure they do not interfere with the vision clearance triangles at the two proposed site driveways.

We trust this letter adequately addresses the traffic impacts associated with the proposed Yakima Sports Complex. Please contact us if you have any questions.

Sincerely,  
KITTELSON & ASSOCIATES, INC.



Matt Hughart, AICP  
Associate Planner



Julia Kuhn, P.E.  
Principal Engineer

## REFERENCES

1. Transportation Research Board. *Highway Capacity Manual*. 2010.
2. Washington State Department of Transportation. *WSDOT Design Manual*. 2013.
3. Institute of Transportation Engineers. *Trip Generation, 9<sup>th</sup> Edition*. 2012.

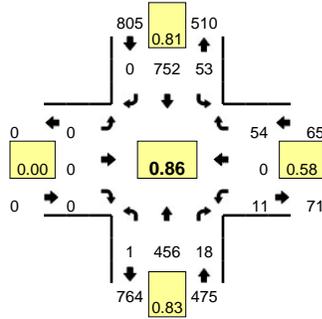
## ATTACHMENTS

- A. Traffic Count Data
- B. Existing Traffic Operations Worksheets
- C. WSDOT Crash Data
- D. 2017 Background Traffic Operations Worksheets
- E. 2017 Total Traffic Operations Worksheet
- F. Signal Warrant Worksheets

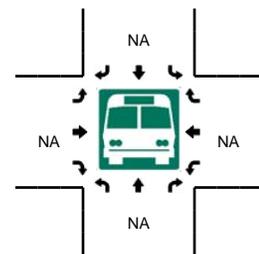
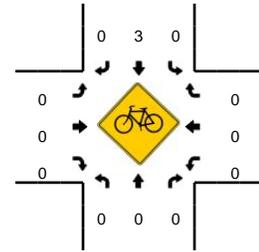
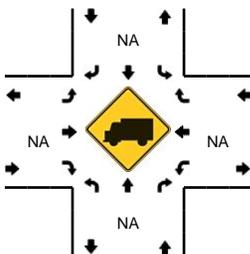
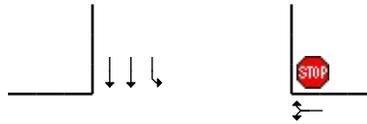
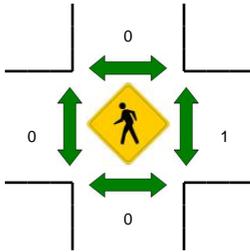
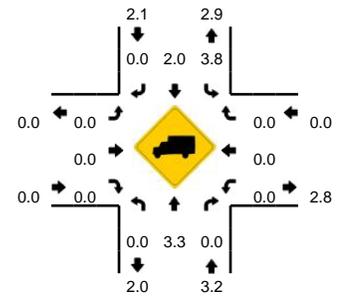
## Appendix A Traffic Counts

**LOCATION:** W Washington Ave -- S 48th Ave  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391901  
**DATE:** Thu, May 28 2015



**Peak-Hour: 4:35 PM -- 5:35 PM**  
**Peak 15-Min: 5:10 PM -- 5:25 PM**



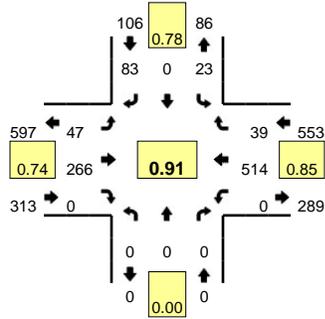
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	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
4:00 PM	0	27	2	0	4	43	0	0	0	0	0	0	0	0	0	6	0	82	
4:05 PM	0	42	1	0	5	32	0	0	0	0	0	0	0	4	0	7	0	91	
4:10 PM	0	27	1	0	3	59	0	0	0	0	0	0	0	0	0	4	0	94	
4:15 PM	0	35	1	0	6	46	0	0	0	0	0	0	0	0	0	2	0	90	
4:20 PM	0	19	0	0	4	56	0	0	0	0	0	0	0	1	0	3	0	83	
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4:35 PM	0	31	0	1	6	68	0	0	0	0	0	0	0	0	0	2	0	108	
4:40 PM	0	36	1	0	8	39	0	0	0	0	0	0	0	1	0	4	0	89	
4:45 PM	0	45	0	0	10	48	0	0	0	0	0	0	0	2	0	3	0	108	
4:50 PM	0	31	5	0	4	54	0	0	0	0	0	0	0	2	0	4	0	100	
4:55 PM	0	29	2	0	2	65	0	0	0	0	0	0	0	0	0	3	0	101	1122
5:00 PM	0	30	1	0	2	48	0	0	0	0	0	0	0	0	0	4	0	85	1125
5:05 PM	0	41	2	0	7	59	0	0	0	0	0	0	0	2	0	5	0	116	1150
5:10 PM	0	54	0	0	1	57	0	0	0	0	0	0	0	1	0	8	0	121	1177
5:15 PM	0	40	6	0	5	85	0	0	0	0	0	0	0	0	0	12	0	148	1235
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5:50 PM	0	30	0	0	5	63	0	0	0	0	0	0	0	1	0	2	0	101	1349
5:55 PM	0	32	0	0	2	39	0	0	0	0	0	0	0	2	0	0	0	75	1323
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total		
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U			
All Vehicles	0	548	24	0	32	864	0	0	0	0	0	0	0	4	0	88	0	1560	
Heavy Trucks	0	12	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	28	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	4	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad																			
Stopped Buses																			

Comments: N/A

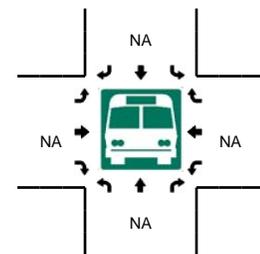
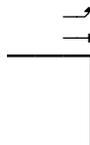
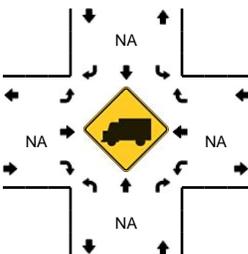
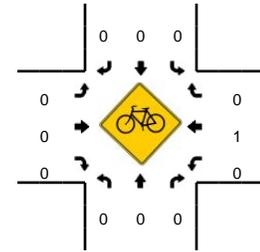
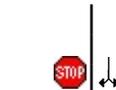
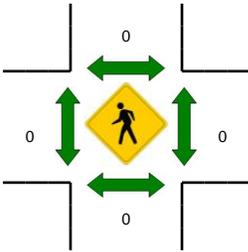
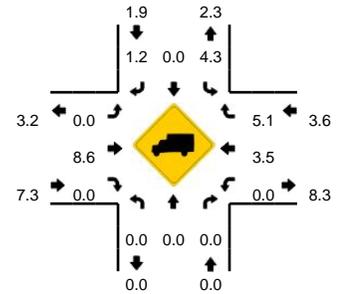


**LOCATION:** S 52nd Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391905  
**DATE:** Thu, May 28 2015



**Peak-Hour: 4:35 PM -- 5:35 PM**  
**Peak 15-Min: 5:15 PM -- 5:30 PM**



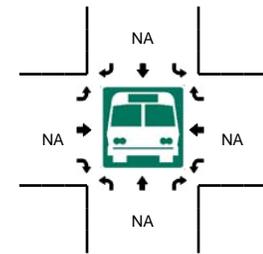
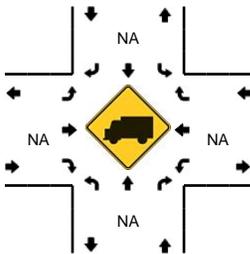
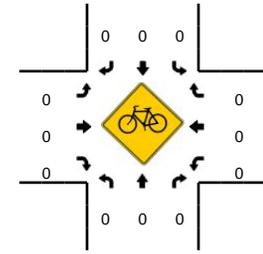
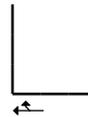
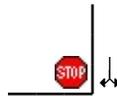
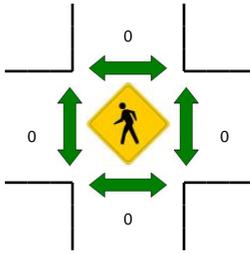
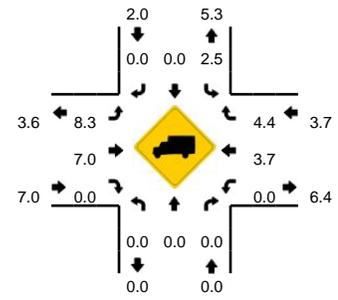
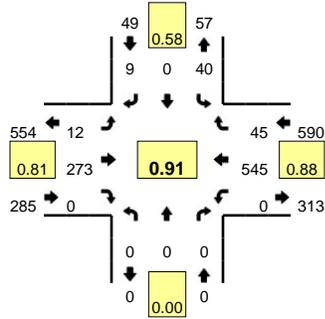
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	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	0	0	7	0	6	23	0	0	0	35	2	0	73	
4:05 PM	0	0	0	0	2	0	0	0	5	27	0	0	0	35	1	0	70	
4:10 PM	0	0	0	0	3	0	7	0	5	19	0	0	0	39	4	0	77	
4:15 PM	0	0	0	0	3	0	6	0	2	18	0	0	0	25	2	0	56	
4:20 PM	0	0	0	0	0	0	9	0	3	15	0	0	0	31	3	0	61	
4:25 PM	0	0	0	0	2	0	3	0	4	22	0	0	0	34	2	0	67	
4:30 PM	0	0	0	0	3	0	6	0	7	22	0	0	0	33	1	0	72	
4:35 PM	0	0	0	0	1	0	6	0	5	19	0	0	0	42	4	0	77	
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4:45 PM	0	0	0	0	0	0	7	0	6	41	0	0	0	42	2	0	98	
4:50 PM	0	0	0	0	1	0	11	0	3	22	0	0	0	37	1	0	75	
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Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	32	0	104	0	40	272	0	0	0	572	48	0	1068	
Heavy Trucks	0	0	0	0	4	0	0	0	0	28	0	0	0	24	4	0	60	
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Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stopped Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments: N/A

**LOCATION:** S 38th Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391907  
**DATE:** Thu, May 28 2015

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**Peak 15-Min: 4:35 PM -- 4:50 PM**

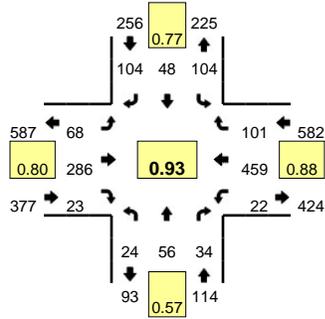


5-Min Count Period Beginning At	S 38th Ave (Northbound)				S 38th Ave (Southbound)				Ahtanum Rd (Eastbound)				Ahtanum Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	0	0	0	4	0	1	0	0	24	0	0	0	32	3	0	64	
4:05 PM	0	0	0	0	0	0	0	0	1	30	0	0	0	34	6	0	71	
4:10 PM	0	0	0	0	4	0	1	0	0	20	0	0	0	35	2	0	62	
4:15 PM	0	0	0	0	2	0	0	0	0	18	0	0	0	28	3	0	51	
4:20 PM	0	0	0	0	1	0	0	0	1	16	0	0	0	32	1	0	51	
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5:30 PM	0	0	0	0	1	0	1	0	0	25	0	0	0	34	3	0	64	924
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5:45 PM	0	0	0	0	1	0	0	0	0	17	0	0	0	26	2	0	46	840
5:50 PM	0	0	0	0	2	0	0	0	0	15	0	0	0	37	3	0	57	828
5:55 PM	0	0	0	0	1	0	0	0	1	17	0	0	0	27	2	0	48	802
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	64	0	20	0	8	344	0	0	0	528	56	0	1020	
Heavy Trucks	0	0	0	0	4	0	0	0	0	12	0	0	0	44	4	0	64	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stopped Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

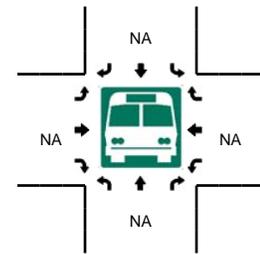
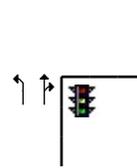
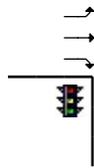
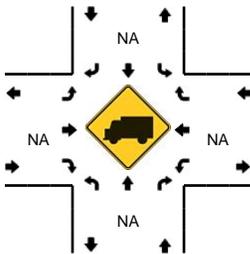
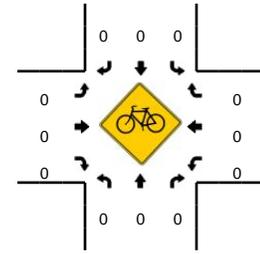
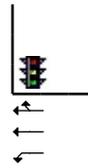
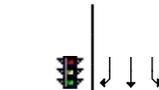
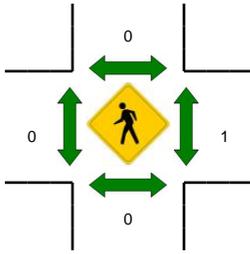
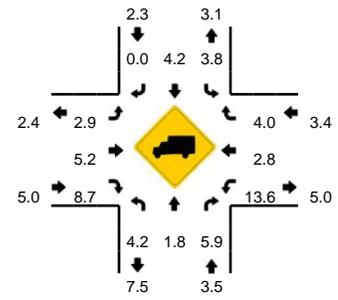
Comments: N/A

**LOCATION:** S 16th Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391909  
**DATE:** Thu, May 28 2015



**Peak-Hour: 4:35 PM -- 5:35 PM**  
**Peak 15-Min: 5:10 PM -- 5:25 PM**



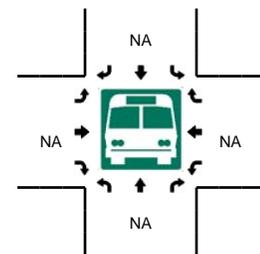
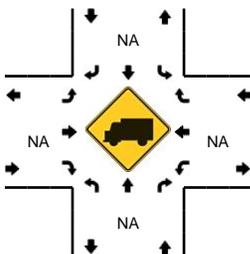
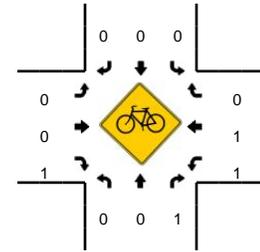
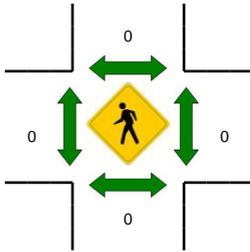
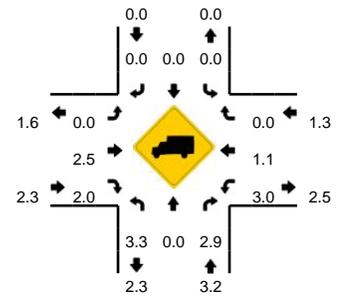
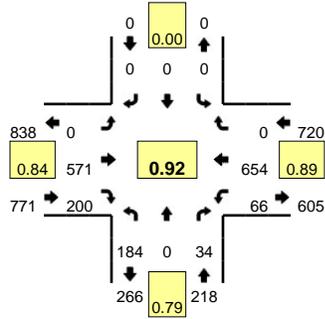
5-Min Count Period Beginning At	S 16th Ave (Northbound)				S 16th Ave (Southbound)				Ahtanum Rd (Eastbound)				Ahtanum Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	3	8	4	0	11	3	7	0	7	28	2	0	2	25	5	0	105	
4:05 PM	0	4	6	0	8	3	10	0	3	20	2	0	1	40	13	0	110	
4:10 PM	1	8	2	0	5	4	6	0	3	21	2	0	3	20	7	0	82	
4:15 PM	1	3	0	0	8	6	12	0	8	19	0	0	0	37	13	0	107	
4:20 PM	0	3	1	0	8	5	6	0	2	16	1	0	4	40	9	0	95	
4:25 PM	0	1	3	0	10	3	9	0	5	22	1	0	3	27	8	0	92	
4:30 PM	1	2	1	0	9	2	9	0	11	29	1	0	0	33	7	0	105	
4:35 PM	1	9	2	0	10	4	7	0	8	27	3	0	1	46	8	0	126	
4:40 PM	0	0	3	0	13	4	8	0	8	25	2	0	4	26	6	0	99	
4:45 PM	2	4	1	0	13	7	7	0	7	38	0	0	0	41	4	0	124	
4:50 PM	1	3	3	0	11	4	7	0	6	31	0	0	0	36	7	0	109	
4:55 PM	0	4	3	0	8	2	7	0	6	21	0	0	2	36	9	0	98	1252
5:00 PM	7	10	5	0	5	3	3	0	4	16	3	0	3	37	13	0	109	1256
5:05 PM	3	10	4	0	10	3	6	0	3	21	1	0	0	38	10	0	109	1255
5:10 PM	2	4	5	0	13	3	17	0	5	24	0	0	0	51	9	0	133	1306
5:15 PM	3	3	1	0	6	5	11	0	3	17	4	0	4	38	10	0	105	1304
5:20 PM	3	4	0	0	7	5	16	0	5	22	2	0	3	42	9	0	118	1327
5:25 PM	1	4	7	0	3	3	10	0	4	20	2	0	2	36	9	0	101	1336
5:30 PM	1	1	0	0	5	5	5	0	9	24	6	0	3	32	7	0	98	1329
5:35 PM	3	2	2	0	10	4	10	0	4	22	0	0	1	33	10	0	101	1304
5:40 PM	0	3	2	0	12	3	6	0	9	20	0	0	0	22	9	0	86	1291
5:45 PM	1	0	1	0	6	3	6	0	5	21	0	0	1	28	5	0	77	1244
5:50 PM	3	4	1	0	10	3	4	0	2	10	1	0	0	26	6	0	70	1205
5:55 PM	3	3	2	0	11	1	5	0	0	16	2	0	3	29	4	0	79	1186
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	32	44	24	0	104	52	176	0	52	252	24	0	28	524	112	0	1424	
Heavy Trucks	4	0	0		4	0	0		0	16	0		8	20	4		56	
Pedestrians		0				0				0				0			0	
Bicycles		0				0				0				0			0	
Railroad																		
Stopped Buses																		

Comments: N/A

**LOCATION:** S 16th Ave -- W Valley Mall Blvd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391911  
**DATE:** Thu, May 28 2015

**Peak-Hour: 4:35 PM -- 5:35 PM**  
**Peak 15-Min: 5:05 PM -- 5:20 PM**

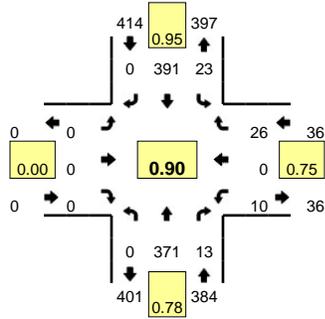


5-Min Count Period Beginning At	S 16th Ave (Northbound)				S 16th Ave (Southbound)				W Valley Mall Blvd (Eastbound)				W Valley Mall Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	9	0	7	0	0	0	0	0	0	49	12	0	7	45	0	0	129	
4:05 PM	20	0	5	0	0	0	0	0	0	59	14	0	9	49	0	0	156	
4:10 PM	14	0	2	0	0	0	0	0	0	68	10	0	4	41	0	0	139	
4:15 PM	16	0	3	0	0	0	0	0	0	65	18	0	11	55	0	0	168	
4:20 PM	17	0	3	0	0	0	0	0	0	44	16	0	6	32	0	0	118	
4:25 PM	11	0	1	0	0	0	0	0	0	42	10	0	7	67	0	0	138	
4:30 PM	20	0	5	0	0	0	0	0	0	43	15	0	5	40	0	0	128	
4:35 PM	18	0	4	0	0	0	0	0	0	50	23	0	6	60	0	0	161	
4:40 PM	15	0	0	0	0	0	0	0	0	50	13	0	6	54	0	0	138	
4:45 PM	11	0	2	0	0	0	0	0	0	52	26	0	2	46	0	0	139	
4:50 PM	13	0	6	0	0	0	0	0	0	45	18	0	4	46	0	0	132	
4:55 PM	14	0	1	0	0	0	0	0	0	46	14	0	3	55	0	0	133	1679
5:00 PM	24	0	3	0	0	0	0	0	0	49	5	0	1	56	0	0	138	1688
5:05 PM	16	0	6	0	0	0	0	0	0	58	19	0	8	42	0	0	149	1681
5:10 PM	18	0	2	0	0	0	0	0	0	59	22	0	11	57	0	0	169	1711
5:15 PM	14	0	2	0	0	0	0	0	0	53	18	0	4	56	0	0	147	1690
5:20 PM	11	0	3	0	0	0	0	0	0	34	13	0	8	59	0	0	128	1700
5:25 PM	20	0	1	0	0	0	0	0	0	34	9	0	8	63	0	0	135	1697
5:30 PM	10	0	4	0	0	0	0	0	0	41	20	0	5	60	0	0	140	1709
5:35 PM	6	0	7	0	0	0	0	0	0	42	14	0	6	67	0	0	142	1690
5:40 PM	15	0	4	0	0	0	0	0	0	42	12	0	3	59	0	0	135	1687
5:45 PM	15	0	4	0	0	0	0	0	0	44	9	0	8	43	0	0	123	1671
5:50 PM	6	0	2	0	0	0	0	0	0	41	16	0	1	45	0	0	111	1650
5:55 PM	10	0	0	0	0	0	0	0	0	31	10	0	5	30	0	0	86	1603
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	192	0	40	0	0	0	0	0	0	680	236	0	92	620	0	0	1860	
Heavy Trucks	4	0	4	0	0	0	0	0	0	8	8	0	4	0	0	0	28	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad																		
Stopped Buses																		

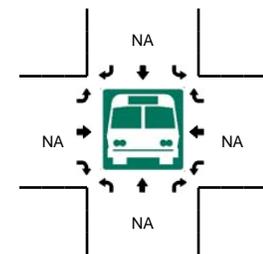
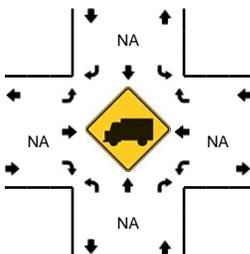
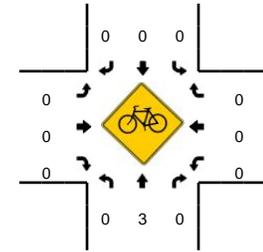
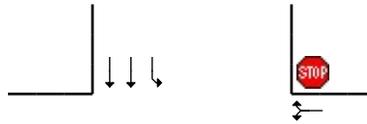
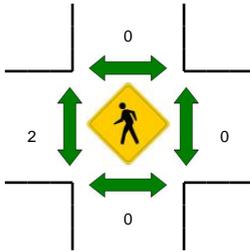
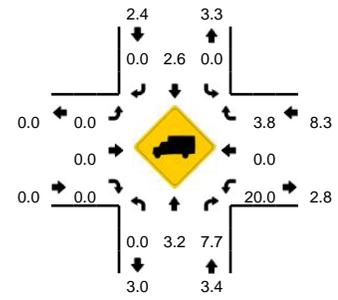
Comments: N/A

**LOCATION:** W Washington Ave -- S 48th Ave  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391902  
**DATE:** Sat, May 30 2015



**Peak-Hour: 12:00 PM -- 1:00 PM**  
**Peak 15-Min: 12:10 PM -- 12:25 PM**



5-Min Count Period Beginning At	W Washington Ave (Northbound)				W Washington Ave (Southbound)				S 48th Ave (Eastbound)				S 48th Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	0	24	0	0	1	36	0	0	0	0	0	0	0	0	3	0	64	
12:05 PM	0	25	0	0	3	30	0	0	0	0	0	0	0	0	1	0	59	
12:10 PM	0	50	1	0	3	32	0	0	0	0	0	0	1	0	2	0	89	
12:15 PM	0	40	1	0	1	34	0	0	0	0	0	0	0	0	1	0	77	
12:20 PM	0	29	2	0	2	29	0	0	0	0	0	0	1	0	3	0	66	
12:25 PM	0	34	1	0	2	33	0	0	0	0	0	0	1	0	2	0	73	
12:30 PM	0	33	0	0	3	32	0	0	0	0	0	0	1	0	2	0	71	
12:35 PM	0	33	0	0	0	31	0	0	0	0	0	0	4	0	1	0	69	
12:40 PM	0	31	3	0	4	39	0	0	0	0	0	0	0	0	1	0	78	
12:45 PM	0	27	0	0	2	28	0	0	0	0	0	0	0	0	5	0	62	
12:50 PM	0	25	3	0	1	33	0	0	0	0	0	0	0	0	4	0	66	
12:55 PM	0	20	2	0	1	34	0	0	0	0	0	0	2	0	1	0	60	834
1:00 PM	0	28	2	0	2	36	0	0	0	0	0	0	2	0	6	0	76	846
1:05 PM	0	30	1	0	2	27	0	0	0	0	0	0	2	0	3	0	65	852
1:10 PM	0	27	1	0	3	45	0	0	0	0	0	0	0	0	1	0	77	840
1:15 PM	0	23	1	0	2	41	0	0	0	0	0	0	0	0	3	0	70	833
1:20 PM	0	32	3	0	2	45	0	0	0	0	0	0	0	0	6	0	88	855
1:25 PM	0	30	0	0	3	39	0	0	0	0	0	0	0	0	1	0	73	855
1:30 PM	0	26	1	0	3	25	0	0	0	0	0	0	0	0	2	0	57	841
1:35 PM	0	37	0	0	4	40	0	0	0	0	0	0	0	0	4	0	85	857
1:40 PM	0	39	2	0	1	44	0	0	0	0	0	0	1	0	0	0	87	866
1:45 PM	0	39	3	0	2	50	0	0	0	0	0	0	0	0	2	0	96	900
1:50 PM	0	24	3	0	4	41	0	0	0	0	0	0	1	0	3	0	76	910
1:55 PM	0	31	0	0	1	37	0	0	0	0	0	0	0	0	2	0	71	921
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	476	16	0	24	380	0	0	0	0	0	0	8	0	24	0	928	
Heavy Trucks	0	16	4		0	8	0		0	0	0		0	0	0		28	
Pedestrians		0				0				8				0			8	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Railroad																		
Stopped Buses																		

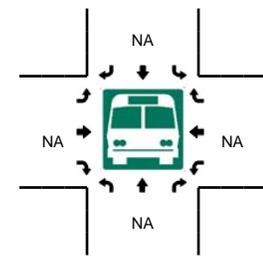
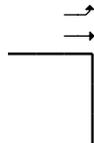
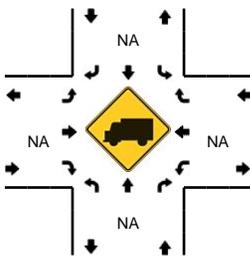
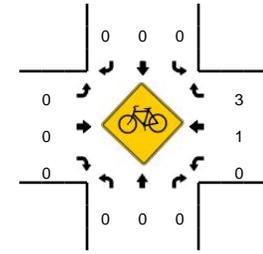
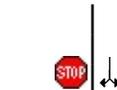
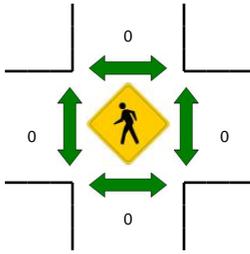
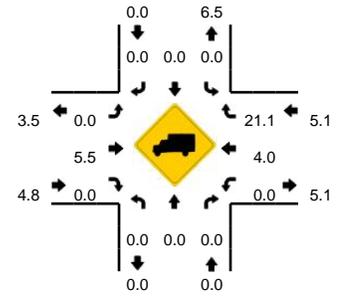
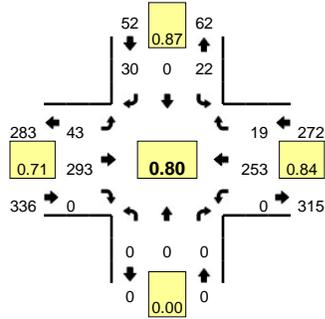
Comments: N/A



**LOCATION:** S 52nd Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391906  
**DATE:** Sat, May 30 2015

**Peak-Hour: 12:00 PM -- 1:00 PM**  
**Peak 15-Min: 12:10 PM -- 12:25 PM**



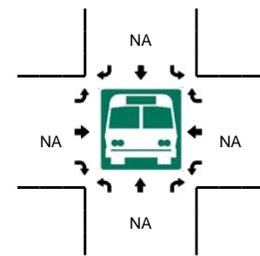
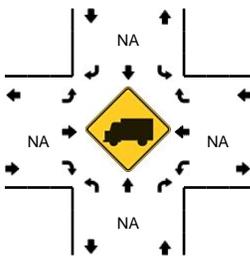
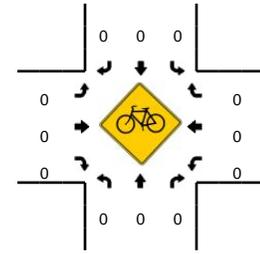
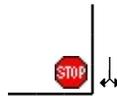
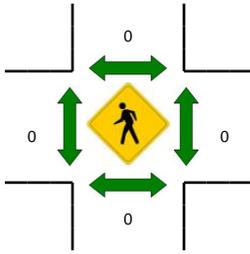
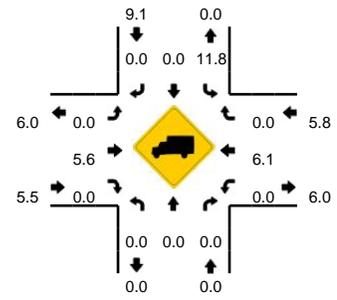
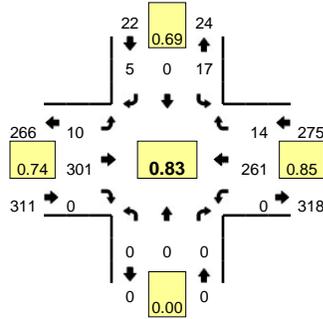
5-Min Count Period Beginning At	S 52nd Ave (Northbound)				S 52nd Ave (Southbound)				Ahtanum Rd (Eastbound)				Ahtanum Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	0	0	0	0	3	0	4	0	2	25	0	0	0	20	2	0	56	
12:05 PM	0	0	0	0	0	0	3	0	3	20	0	0	0	18	0	0	44	
12:10 PM	0	0	0	0	3	0	1	0	11	39	0	0	0	21	3	0	78	
12:15 PM	0	0	0	0	3	0	3	0	5	37	0	0	0	9	2	0	59	
12:20 PM	0	0	0	0	1	0	4	0	5	22	0	0	0	35	3	0	70	
12:25 PM	0	0	0	0	2	0	1	0	4	31	0	0	0	15	1	0	54	
12:30 PM	0	0	0	0	2	0	2	0	3	14	0	0	0	24	2	0	47	
12:35 PM	0	0	0	0	2	0	2	0	4	30	0	0	0	23	4	0	65	
12:40 PM	0	0	0	0	1	0	3	0	3	24	0	0	0	28	0	0	59	
12:45 PM	0	0	0	0	4	0	2	0	2	16	0	0	0	20	0	0	44	
12:50 PM	0	0	0	0	1	0	1	0	1	12	0	0	0	21	0	0	36	
12:55 PM	0	0	0	0	0	0	4	0	0	23	0	0	0	19	2	0	48	660
1:00 PM	0	0	0	0	5	0	2	0	3	14	0	0	0	14	1	0	39	643
1:05 PM	0	0	0	0	2	0	2	0	1	13	0	0	0	14	1	0	33	632
1:10 PM	0	0	0	0	0	0	2	0	5	23	0	0	0	34	4	0	68	622
1:15 PM	0	0	0	0	0	0	4	0	8	22	0	0	0	15	1	0	50	613
1:20 PM	0	0	0	0	2	0	4	0	1	17	0	0	0	22	5	0	51	594
1:25 PM	0	0	0	0	6	0	1	0	3	19	0	0	0	17	2	0	48	588
1:30 PM	0	0	0	0	4	0	4	0	3	18	0	0	0	14	3	0	46	587
1:35 PM	0	0	0	0	3	0	5	0	2	23	0	0	0	15	2	0	50	572
1:40 PM	0	0	0	0	2	0	4	0	5	14	0	0	0	21	1	0	47	560
1:45 PM	0	0	0	0	1	0	4	0	2	19	0	0	0	15	1	0	42	558
1:50 PM	0	0	0	0	0	0	0	0	2	28	0	0	0	18	4	0	52	574
1:55 PM	0	0	0	0	5	0	3	0	2	12	0	0	0	23	0	0	45	571
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	28	0	32	0	84	392	0	0	0	260	32	0	828	
Heavy Trucks	0	0	0	0	0	0	0	0	0	28	0	0	0	12	8	0	48	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	
Railroad																		
Stopped Buses																		

Comments: N/A

**LOCATION:** S 38th Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391908  
**DATE:** Sat, May 30 2015

**Peak-Hour: 12:00 PM -- 1:00 PM**  
**Peak 15-Min: 12:10 PM -- 12:25 PM**



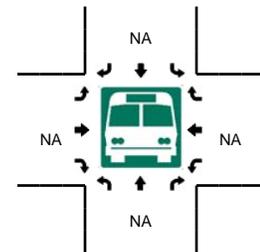
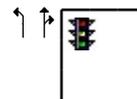
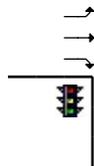
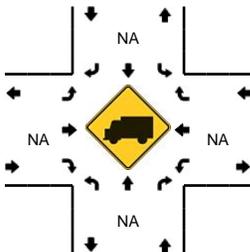
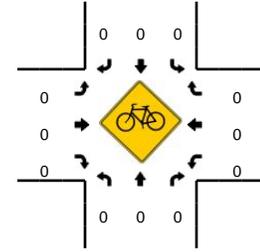
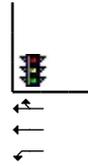
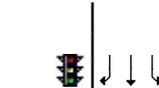
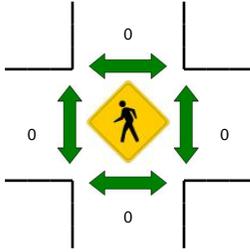
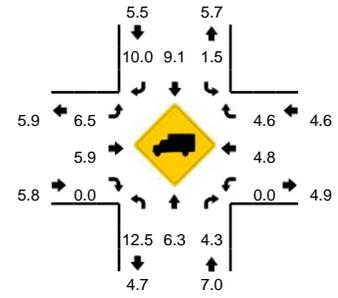
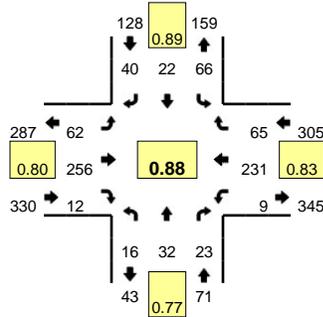
5-Min Count Period Beginning At	S 38th Ave (Northbound)				S 38th Ave (Southbound)				Ahtanum Rd (Eastbound)				Ahtanum Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	0	0	0	0	2	0	0	0	1	24	0	0	0	22	0	0	49	
12:05 PM	0	0	0	0	0	0	0	0	0	26	0	0	0	17	1	0	44	
12:10 PM	0	0	0	0	2	0	2	0	1	32	0	0	0	21	2	0	60	
12:15 PM	0	0	0	0	2	0	1	0	2	42	0	0	0	16	1	0	64	
12:20 PM	0	0	0	0	0	0	0	0	0	28	0	0	0	30	2	0	60	
12:25 PM	0	0	0	0	1	0	0	0	1	27	0	0	0	18	0	0	47	
12:30 PM	0	0	0	0	3	0	0	0	0	20	0	0	0	28	2	0	53	
12:35 PM	0	0	0	0	1	0	1	0	1	27	0	0	0	24	1	0	55	
12:40 PM	0	0	0	0	3	0	0	0	1	24	0	0	0	25	1	0	54	
12:45 PM	0	0	0	0	1	0	1	0	2	19	0	0	0	22	2	0	47	
12:50 PM	0	0	0	0	1	0	0	0	0	14	0	0	0	23	2	0	40	
12:55 PM	0	0	0	0	1	0	0	0	1	18	0	0	0	15	0	0	35	608
1:00 PM	0	0	0	0	2	0	0	0	1	18	0	0	0	18	1	0	40	599
1:05 PM	0	0	0	0	1	0	2	0	1	19	0	0	0	19	2	0	44	599
1:10 PM	0	0	0	0	1	0	2	0	1	13	0	0	0	28	1	0	46	585
1:15 PM	0	0	0	0	2	0	2	0	1	27	0	0	0	20	0	0	52	573
1:20 PM	0	0	0	0	0	0	0	0	1	12	0	0	0	28	0	0	41	554
1:25 PM	0	0	0	0	1	0	0	0	0	26	0	0	0	21	1	0	49	556
1:30 PM	0	0	0	0	1	0	1	0	1	21	0	0	0	15	0	0	39	542
1:35 PM	0	0	0	0	3	0	0	0	0	23	0	0	0	18	1	0	45	532
1:40 PM	0	0	0	0	2	0	2	0	1	21	0	0	0	19	1	0	46	524
1:45 PM	0	0	0	0	1	0	1	0	0	21	0	0	0	13	1	0	37	514
1:50 PM	0	0	0	0	2	0	0	0	1	26	0	0	0	24	1	0	54	528
1:55 PM	0	0	0	0	1	0	0	0	1	17	0	0	0	25	0	0	44	537
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	16	0	12	0	12	408	0	0	0	268	20	0	736	
Heavy Trucks	0	0	0	0	4	0	0	0	0	28	0	0	0	28	0	0	60	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stopped Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments: N/A

**LOCATION:** S 16th Ave -- Ahtanum Rd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391910  
**DATE:** Sat, May 30 2015

**Peak-Hour: 12:00 PM -- 1:00 PM**  
**Peak 15-Min: 12:15 PM -- 12:30 PM**



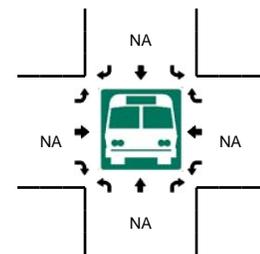
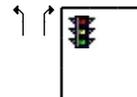
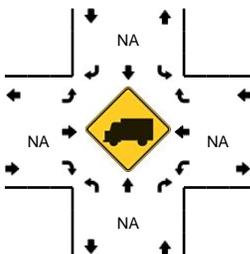
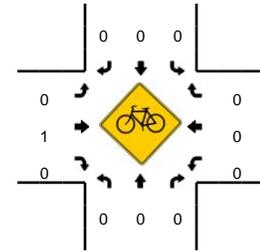
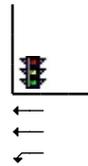
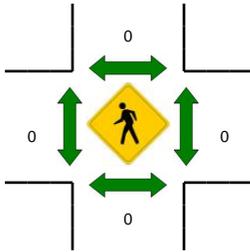
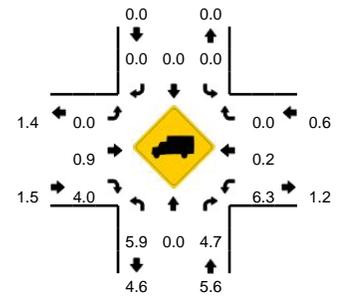
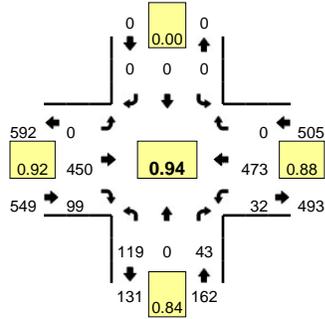
5-Min Count Period Beginning At	S 16th Ave (Northbound)				S 16th Ave (Southbound)				Ahtanum Rd (Eastbound)				Ahtanum Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	0	3	4	0	6	0	5	0	6	17	1	0	0	17	5	0	64	
12:05 PM	1	7	1	0	5	3	7	0	6	23	0	0	0	21	3	0	77	
12:10 PM	0	1	1	0	3	2	2	0	7	23	0	0	0	10	6	0	55	
12:15 PM	2	3	1	0	10	1	3	0	4	32	1	0	1	23	6	0	87	
12:20 PM	2	1	2	0	3	0	2	0	9	26	1	0	4	24	4	0	78	
12:25 PM	1	3	2	0	8	3	5	0	4	23	1	0	0	16	6	0	72	
12:30 PM	1	0	3	0	4	1	3	0	9	21	1	0	1	21	2	0	67	
12:35 PM	1	3	3	0	4	4	2	0	4	17	1	0	1	29	8	0	77	
12:40 PM	1	1	0	0	7	1	1	0	3	23	1	0	1	20	9	0	68	
12:45 PM	6	3	5	0	6	1	3	0	4	20	1	0	0	13	8	0	70	
12:50 PM	1	3	0	0	6	4	5	0	4	16	2	0	1	23	7	0	72	
12:55 PM	0	4	1	0	4	2	2	0	2	15	2	0	0	14	1	0	47	834
1:00 PM	1	2	1	0	5	3	3	0	3	19	1	0	1	24	4	0	67	837
1:05 PM	1	1	0	0	2	1	4	0	5	17	1	0	0	18	6	0	56	816
1:10 PM	0	3	1	0	3	3	2	0	3	8	0	0	1	21	5	0	50	811
1:15 PM	1	0	1	0	4	3	2	0	4	27	1	0	1	23	6	0	73	797
1:20 PM	1	3	2	0	2	3	5	0	2	15	0	0	0	19	6	0	58	777
1:25 PM	0	1	0	0	4	2	3	0	3	17	2	0	0	19	6	0	57	762
1:30 PM	1	2	2	0	9	0	1	0	2	17	1	0	2	16	8	0	61	756
1:35 PM	0	2	0	0	7	5	1	0	13	17	2	0	0	16	3	0	66	745
1:40 PM	0	1	3	0	2	3	3	0	5	17	0	0	0	16	4	0	54	731
1:45 PM	1	4	1	0	5	3	2	0	2	17	2	0	0	17	3	0	57	718
1:50 PM	0	2	2	0	5	2	4	0	5	15	0	0	0	25	5	0	65	711
1:55 PM	0	3	0	0	5	1	1	0	3	22	1	0	0	19	0	0	55	719
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	20	28	20	0	84	16	40	0	68	324	12	0	20	252	64	0	948	
Heavy Trucks	0	0	0		4	4	4		8	24	0		0	12	4		60	
Pedestrians		0				0				0				0			0	
Bicycles		0	0			0	0			0	0			0	0		0	
Railroad																		
Stopped Buses																		

Comments: N/A

**LOCATION:** S 16th Ave -- W Valley Mall Blvd  
**CITY/STATE:** Yakima, WA

**QC JOB #:** 13391912  
**DATE:** Sat, May 30 2015

**Peak-Hour: 12:00 PM -- 1:00 PM**  
**Peak 15-Min: 12:25 PM -- 12:40 PM**



5-Min Count Period Beginning At	S 16th Ave (Northbound)				S 16th Ave (Southbound)				W Valley Mall Blvd (Eastbound)				W Valley Mall Blvd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
12:00 PM	14	0	2	0	0	0	0	0	0	34	9	0	5	42	0	0	106	
12:05 PM	10	0	6	0	0	0	0	0	0	46	11	0	2	32	0	0	107	
12:10 PM	9	0	7	0	0	0	0	0	0	33	13	0	1	41	0	0	104	
12:15 PM	9	0	3	0	0	0	0	0	0	33	4	0	2	37	0	0	88	
12:20 PM	10	0	5	0	0	0	0	0	0	31	3	0	1	38	0	0	88	
12:25 PM	8	0	2	0	0	0	0	0	0	33	13	0	5	54	0	0	115	
12:30 PM	9	0	6	0	0	0	0	0	0	39	3	0	2	42	0	0	101	
12:35 PM	11	0	1	0	0	0	0	0	0	46	7	0	4	37	0	0	106	
12:40 PM	9	0	3	0	0	0	0	0	0	33	13	0	0	34	0	0	92	
12:45 PM	15	0	3	0	0	0	0	0	0	43	7	0	2	42	0	0	112	
12:50 PM	9	0	2	0	0	0	0	0	0	29	12	0	5	34	0	0	91	
12:55 PM	6	0	3	0	0	0	0	0	0	50	4	0	3	40	0	0	106	1216
1:00 PM	7	0	1	0	0	0	0	0	0	35	7	0	1	31	0	1	83	1193
1:05 PM	8	0	0	0	0	0	0	0	0	35	6	0	3	39	0	0	91	1177
1:10 PM	11	0	2	0	0	0	0	0	0	36	5	1	4	36	0	0	95	1168
1:15 PM	9	0	2	0	0	0	0	0	0	35	5	0	3	36	0	0	90	1170
1:20 PM	10	0	3	0	0	0	0	0	0	29	6	0	3	43	0	0	94	1176
1:25 PM	5	0	2	0	0	0	0	0	0	37	10	0	3	34	0	0	91	1152
1:30 PM	11	0	3	0	0	0	0	0	0	40	7	0	2	39	0	0	102	1153
1:35 PM	12	0	3	0	0	0	0	0	0	39	9	0	2	40	0	0	105	1152
1:40 PM	15	0	4	0	0	0	0	0	0	40	6	0	1	38	0	0	104	1164
1:45 PM	8	0	1	0	0	0	0	0	0	33	10	0	2	37	0	0	91	1143
1:50 PM	5	0	4	0	0	0	0	0	0	35	7	0	3	36	0	0	90	1142
1:55 PM	5	0	3	0	0	0	0	0	0	31	4	0	1	31	0	0	75	1111
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	112	0	36	0	0	0	0	0	0	472	92	0	44	532	0	0	1288	
Heavy Trucks	8	0	4	0	0	0	0	0	0	8	0	0	0	0	0	0	20	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Railroad																		
Stopped Buses																		

Comments: N/A

## Appendix B 2015 Existing Traffic Conditions



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	
Volume (veh/h)	387	15	120	641	12	89
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	450	17	140	745	14	103
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			467		1110	234
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			467		1110	234
tC, single (s)			4.1		7.0	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.3
p0 queue free %			87		92	87
cM capacity (veh/h)			1090		169	771

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	300	167	140	373	373	117
Volume Left	0	0	140	0	0	14
Volume Right	0	17	0	0	0	103
cSH	1700	1700	1090	1700	1700	542
Volume to Capacity	0.18	0.10	0.13	0.22	0.22	0.22
Queue Length 95th (ft)	0	0	11	0	0	20
Control Delay (s)	0.0	0.0	8.8	0.0	0.0	13.5
Lane LOS			A			B
Approach Delay (s)	0.0		1.4			13.5
Approach LOS						B

**Intersection Summary**

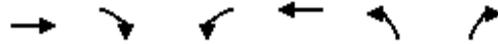
Average Delay		1.9				
Intersection Capacity Utilization		34.0%		ICU Level of Service		A
Analysis Period (min)		15				



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	4	88	548	24	32	864
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	88	548	24	32	864
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1057	287			573	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1057	287			573	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	88			97	
cM capacity (veh/h)	216	715			981	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	92	365	207	32	432	432
Volume Left	4	0	0	32	0	0
Volume Right	88	0	24	0	0	0
cSH	650	1700	1700	981	1700	1700
Volume to Capacity	0.14	0.21	0.12	0.03	0.25	0.25
Queue Length 95th (ft)	12	0	0	3	0	0
Control Delay (s)	11.5	0.0	0.0	8.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	11.5	0.0		0.3		
Approach LOS	B					

Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			36.2%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Volume (vph)	571	200	66	654	190	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1752	3574	1752	1568
Flt Permitted	1.00	1.00	0.42	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	768	3574	1752	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	621	217	72	711	207	38
RTOR Reduction (vph)	0	0	0	0	0	27
Lane Group Flow (vph)	621	217	72	711	207	11
Heavy Vehicles (%)	2%	2%	3%	1%	3%	3%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	17.1	37.0	17.1	17.1	10.4	10.4
Effective Green, g (s)	17.1	37.0	17.1	17.1	10.4	10.4
Actuated g/C Ratio	0.46	1.00	0.46	0.46	0.28	0.28
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1635	1583	354	1651	492	440
v/s Ratio Prot	0.18			c0.20	c0.12	
v/s Ratio Perm		0.14	0.09			0.01
v/c Ratio	0.38	0.14	0.20	0.43	0.42	0.02
Uniform Delay, d1	6.5	0.0	5.9	6.7	10.8	9.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.3	0.2	0.7	0.0
Delay (s)	6.7	0.2	6.2	6.9	11.5	9.7
Level of Service	A	A	A	A	B	A
Approach Delay (s)	5.0			6.8	11.2	
Approach LOS	A			A	B	

**Intersection Summary**

HCM 2000 Control Delay	6.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	37.0	Sum of lost time (s)	9.5
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

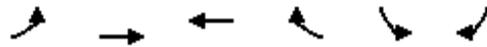
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	47	266	514	39	23	83
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	52	292	565	43	25	91
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	608				982	586
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	608				982	586
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				90	82
cM capacity (veh/h)	981				260	512

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	52	292	608	116
Volume Left	52	0	0	25
Volume Right	0	0	43	91
cSH	981	1700	1700	423
Volume to Capacity	0.05	0.17	0.36	0.28
Queue Length 95th (ft)	4	0	0	28
Control Delay (s)	8.9	0.0	0.0	16.7
Lane LOS	A			C
Approach Delay (s)	1.3		0.0	16.7
Approach LOS				C

Intersection Summary			
Average Delay		2.3	
Intersection Capacity Utilization	49.1%		ICU Level of Service A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	8	344	528	56	64	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	344	528	56	64	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	584				916	556
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	584				916	556
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	99				79	96
cM capacity (veh/h)	962				300	534

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	352	584	84
Volume Left	8	0	64
Volume Right	0	56	20
cSH	962	1700	335
Volume to Capacity	0.01	0.34	0.25
Queue Length 95th (ft)	1	0	24
Control Delay (s)	0.3	0.0	19.3
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	19.3
Approach LOS			C

Intersection Summary			
Average Delay		1.7	
Intersection Capacity Utilization	42.6%		ICU Level of Service A
Analysis Period (min)	15		

Yakima Sports Complex  
6: S 16th Ave & Ahtanum Rd

Existing Weekday PM  
9/29/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	68	286	23	22	459	101	24	56	34	108	50	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810	1482	1583	3404		1736	1722		1735	1827	1615
Flt Permitted	0.42	1.00	1.00	0.57	1.00		0.72	1.00		0.69	1.00	1.00
Satd. Flow (perm)	782	1810	1482	955	3404		1319	1722		1268	1827	1615
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	73	308	25	24	494	109	26	60	37	116	54	116
RTOR Reduction (vph)	0	0	12	0	30	0	0	29	0	0	0	91
Lane Group Flow (vph)	73	308	13	24	573	0	26	68	0	116	54	25
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	3%	5%	9%	14%	3%	4%	4%	2%	6%	4%	4%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	21.1	21.1	21.1	21.1	21.1		8.6	8.6		8.6	8.6	8.6
Effective Green, g (s)	21.1	21.1	21.1	21.1	21.1		8.6	8.6		8.6	8.6	8.6
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53		0.22	0.22		0.22	0.22	0.22
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	415	961	787	507	1809		285	373		274	395	349
v/s Ratio Prot		c0.17			0.17			0.04				0.03
v/s Ratio Perm	0.09		0.01	0.03			0.02			c0.09		0.02
v/c Ratio	0.18	0.32	0.02	0.05	0.32		0.09	0.18		0.42	0.14	0.07
Uniform Delay, d1	4.8	5.3	4.4	4.5	5.2		12.4	12.7		13.4	12.6	12.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.0	0.0	0.1		0.1	0.2		1.1	0.2	0.1
Delay (s)	5.0	5.4	4.4	4.5	5.3		12.6	12.9		14.5	12.7	12.5
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		5.3			5.3			12.8			13.3	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	39.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	
Volume (veh/h)	321	22	54	356	15	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	357	24	60	396	17	83
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			381		687	191
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			381		687	191
tC, single (s)			4.2		7.3	7.0
tC, 2 stage (s)						
tF (s)			2.2		3.8	3.3
p0 queue free %			95		95	90
cM capacity (veh/h)			1160		313	813

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	238	143	60	198	198	100
Volume Left	0	0	60	0	0	17
Volume Right	0	24	0	0	0	83
cSH	1700	1700	1160	1700	1700	642
Volume to Capacity	0.14	0.08	0.05	0.12	0.12	0.16
Queue Length 95th (ft)	0	0	4	0	0	14
Control Delay (s)	0.0	0.0	8.3	0.0	0.0	11.6
Lane LOS			A	B		
Approach Delay (s)	0.0		1.1	11.6		
Approach LOS				B		

**Intersection Summary**

Average Delay			1.8			
Intersection Capacity Utilization			28.4%	ICU Level of Service	A	
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	8	24	476	16	24	380
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	24	476	16	24	380
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	722	246			492	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	722	246			492	
tC, single (s)	7.2	7.0			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	97	97			98	
cM capacity (veh/h)	318	748			1082	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	32	317	175	24	190	190
Volume Left	8	0	0	24	0	0
Volume Right	24	0	16	0	0	0
cSH	559	1700	1700	1082	1700	1700
Volume to Capacity	0.06	0.19	0.10	0.02	0.11	0.11
Queue Length 95th (ft)	5	0	0	2	0	0
Control Delay (s)	11.8	0.0	0.0	8.4	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	11.8	0.0		0.5		
Approach LOS	B					

Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			29.9%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Volume (vph)	450	99	32	473	119	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frbp, ped/bikes	1.00	0.98	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1521	1703	3610	1703	1538
Flt Permitted	1.00	1.00	0.48	1.00	0.95	1.00
Satd. Flow (perm)	3574	1521	857	3610	1703	1538
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	479	105	34	503	127	46
RTOR Reduction (vph)	0	0	0	0	0	36
Lane Group Flow (vph)	479	105	34	503	127	10
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	1%	4%	6%	0%	6%	5%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	16.1	32.5	16.1	16.1	6.9	6.9
Effective Green, g (s)	16.1	32.5	16.1	16.1	6.9	6.9
Actuated g/C Ratio	0.50	1.00	0.50	0.50	0.21	0.21
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1770	1521	424	1788	361	326
v/s Ratio Prot	0.13			c0.14	c0.07	
v/s Ratio Perm		0.07	0.04			0.01
v/c Ratio	0.27	0.07	0.08	0.28	0.35	0.03
Uniform Delay, d1	4.8	0.0	4.3	4.8	10.9	10.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.1	0.1	0.7	0.0
Delay (s)	4.9	0.1	4.4	4.9	11.6	10.2
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.0			4.9	11.2	
Approach LOS	A			A	B	

**Intersection Summary**

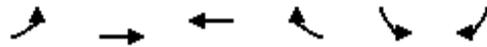
HCM 2000 Control Delay	5.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	32.5	Sum of lost time (s)	9.5
Intersection Capacity Utilization	39.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	43	293	253	19	22	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	54	366	316	24	28	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	340				802	328
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	340				802	328
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				92	95
cM capacity (veh/h)	1230				340	718

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	54	366	340	65
Volume Left	54	0	0	28
Volume Right	0	0	24	38
cSH	1230	1700	1700	489
Volume to Capacity	0.04	0.22	0.20	0.13
Queue Length 95th (ft)	3	0	0	11
Control Delay (s)	8.1	0.0	0.0	13.5
Lane LOS	A			B
Approach Delay (s)	1.0		0.0	13.5
Approach LOS				B

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		31.1%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	12	408	268	20	16	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	12	408	268	20	16	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	288				710	278
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	288				710	278
tC, single (s)	4.1				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	99				96	98
cM capacity (veh/h)	1286				382	766

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	420	288	28
Volume Left	12	0	16
Volume Right	0	20	12
cSH	1286	1700	486
Volume to Capacity	0.01	0.17	0.06
Queue Length 95th (ft)	1	0	5
Control Delay (s)	0.3	0.0	12.9
Lane LOS	A		B
Approach Delay (s)	0.3	0.0	12.9
Approach LOS			B

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		41.1%	ICU Level of Service
Analysis Period (min)		15	A

Yakima Sports Complex  
6: S 16th Ave & Ahtanum Rd

Existing Saturday  
9/29/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	63	256	12	9	231	66	16	33	23	68	22	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1703	1792	1615	1805	3323		1612	1696		1770	1743	1468
Flt Permitted	0.55	1.00	1.00	0.58	1.00		0.74	1.00		0.72	1.00	1.00
Satd. Flow (perm)	984	1792	1615	1105	3323		1257	1696		1332	1743	1468
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	72	291	14	10	262	75	18	38	26	77	25	47
RTOR Reduction (vph)	0	0	6	0	31	0	0	22	0	0	0	40
Lane Group Flow (vph)	72	291	8	10	306	0	18	42	0	77	25	7
Heavy Vehicles (%)	6%	6%	0%	0%	5%	5%	12%	6%	4%	2%	9%	10%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	22.7	22.7	22.7	22.7	22.7		5.7	5.7		5.7	5.7	5.7
Effective Green, g (s)	22.7	22.7	22.7	22.7	22.7		5.7	5.7		5.7	5.7	5.7
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.59		0.15	0.15		0.15	0.15	0.15
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	581	1059	954	653	1964		186	251		197	258	217
v/s Ratio Prot		c0.16			0.09			0.02			0.01	
v/s Ratio Perm	0.07		0.01	0.01			0.01			c0.06		0.00
v/c Ratio	0.12	0.27	0.01	0.02	0.16		0.10	0.17		0.39	0.10	0.03
Uniform Delay, d1	3.5	3.8	3.2	3.2	3.5		14.1	14.3		14.8	14.1	14.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.0	0.0	0.0		0.2	0.3		1.3	0.2	0.1
Delay (s)	3.6	4.0	3.2	3.2	3.6		14.4	14.6		16.1	14.3	14.1
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		3.9			3.6			14.5			15.1	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	38.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

## Appendix C Crash Data

OFFICER REPORTED CRASHES THAT OCCURRED at OR in the vicinity of THE FOLLOWING INTERSECTIONS & ROAD SEGMENTS IN THE CITY OF UNION GAP & YAKIMA CC

VALLEY MALL BLVD @ 16th AVE

AHTANUM RD (CO RD #30260, MP 4.930 - 4.970) @ 52nd AVE (CO RD #34990, MP 0.000 - 0.020

AHTANUM RD (CO RD #30260, MP 4.050 - 4.090) @ 38th AVE (CO RD #35510, MP 0.000 - 0.020

SORENSEN RD (CO RD #35540, MP 0.000 - 0.020) becomes 38th AVE (CO RD #35510, MP 0.370 - 0.390

52nd AVE (CO RD #34990, MP 0.080 - 0.710) FROM HUMMINGBIRD LN TO LYONS LOOP

1/1/2010 - available 2015 (2015 data is partial and preliminary)

UNDER 23 UNITED STATES CODE -- SECTION 409. THIS DATA CANNOT BE USED IN DISCOVERY OR AS EVIDENCE

AT TRIAL IN ANY ACTION FOR DAMAGES AGAINST THE WSDOT, OR ANY JURISDICTIONS INVOLVED IN THE DATA

JURISDICTION	CITY	PRIMARY TRAFFICWAY	MILE POST	BLOCK NUMBER	INTERSECTING TRAFFICWAY	CO ONLY INTERSECTING COUNTY ROAD MILEPOST	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# J	# F	# A	# E	# D	# S	# L	VEHICLE 1 TYPE	VEHICLE 2 TYPE	JUNCTION RELATIONSHIP	ROADWAY SURFACE CONDITIONS	LIGHTING CONDITIONS	FIRST COLLISION TYPE / OBJECT STRUCK	VEH 1 ACTION	VEH 2 ACTION	MV DRIVER CONT CIRC 1 (UNIT 1)	MV DRIVER CONT CIRC 2 (UNIT 2)	VEH 1 COMP DIR FROM	VEH 1 COMP DIR TO	VEH 2 COMP DIR FROM	VEH 2 COMP DIR TO	IMPACT LOCATION (Effective for City, County & Misc 1/1/2010; SR's indefinite)
City Street	Union Gap	W VALLEY MALL BLVD			S 16TH AVE		E218276	1/3/2013	15:45	No Injury	0	0	2	0	0	0	0	Truck Tractor & Semi-Trailer	School Bus	At Intersection and Related	Wet	Daylight	Entering at angle	Making Left Turn	Stopped at Signal or Stop Sign	Improper Turn	None	East	South	South	Vehicle Stopped	Intersecting Trafficway (WITH
City Street	Union Gap	W VALLEY MALL BLVD	700		S 16TH AVE		E360044	9/24/2014	5:28	Possible Injury	1	0	2	0	0	0	0	Passenger Car	Pickup, Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Dark-Street Lights On	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	East	South	West	East	Lane of Primary Trafficway Intersecting Trafficway (WITH Intent to Access)
County Road		30260	4.950		34990	0.000	E284226	11/11/2013	18:15	Possible Injury	1	0	2	0	0	0	0	Pickup, Panel Truck or Vanette under 10,000 lb	Passenger Car	At Intersection and Related	Dry	Dark-No Street Lights	Entering at angle	Making Left Turn	Going Straight Ahead	Under Influence of Alcohol	None	North	East	East	West	Intersecting Trafficway (WITH Intent to Access)
County Road		30260	4.950		34990	0.000	E302695	1/25/2014	5:30	No Injury	0	0	1	0	0	0	0	Passenger Car		At Intersection and Related	Ice	Dawn	Fence	Going Straight		Inattention	None	North	South			Past the Outside

JURISDICTION	PRIMARY TRAFFICWAY	BLOCK NUMBER	INTERSECTING TRAFFICWAY	REPORT NUMBER	DATE	TIME	MOST SEVERE INJURY TYPE	# INJ	#FAT	# P E W I D A H S L	# P E W I D A H S L	VEHICLE 1 TYPE	VEHICLE 2 TYPE	JUNCTION RELATIONSHIP	ROADWAY SURFACE CONDITIONS	LIGHTING CONDITIONS	FIRST COLLISION TYPE / OBJECT STRUCK	VEH 1 ACTION	VEH 2 ACTION	MV DRIVER CONT CIRC 1 (UNIT 1)	MV DRIVER CONT CIRC 1 (UNIT 2)	VEH 1 COMP DIR FROM	VEH 1 COMP DIR TO	VEH 2 COMP DIR FROM	VEH 2 COMP DIR TO	IMPACT LOCATION (Effective for City, County & Misc 1/1/2010; SR's indefinite)	
City Street	S 16TH AVE		ANTANUM RD	3541185	6/9/2011	11:30	No Injury	0	0	0	2	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	North	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE		W AHTANUM RD	3541410	9/4/2012	16:15	No Injury	0	0	0	2	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	North	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE	2400	W AHTANUM RD	3541134	5/31/2011	16:40	No Injury	0	0	0	2	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	North	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE	2600	W AHTANUM RD	3075140	8/12/2010	20:58	No Injury	0	0	0	2	0	Passenger Car	Passenger Car	At Intersection and Related	Dry	Dark-Street Lights On	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	North	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE	1500	W AHTANUM RD	3540914	7/14/2011	14:32	No Injury	0	0	0	2	0	Passenger Car	Passenger Car	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	North	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE	2600	W AHTANUM RD	3632307	10/8/2013	12:44	No Injury	0	0	0	2	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	West	North	East	West	Lane of Primary Trafficway
City Street	S 16TH AVE	2400	W AHTANUM RD	3543152	4/3/2012	10:38	No Injury	0	0	0	2	0	Pickup,Panel Truck or Vanette under 10,000 lb	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	Driver Operating Handheld Telecommunicat	None	West	East	South	North	Lane of Primary Trafficway
City Street	S 16TH AVE	2600	W AHTANUM RD	3368342	5/10/2010	12:35	Possible Injury	1	0	0	2	0	Pickup,Panel Truck or Vanette under 10,000 lb	Truck (Flatbad, Van, etc)	At Intersection and Related	Wet	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	Disregard Stop and Go Light	None	North	South	East	West	Lane of Primary Trafficway
City Street	W AHTANUM RD	1600	S 16TH AVE	3610332	10/23/2012	18:25	Possible Injury	1	0	0	2	0	Truck - Double Trailer	Passenger Car	At Intersection and Related	Dry	Dusk	Entering at angle	Going Straight Ahead	Making Left Turn	Disregard Stop and Go Light	None	East	West	North	East	Lane of Primary Trafficway
City Street	W AHTANUM RD	1600	S 16TH AVE	3075290	7/30/2013	17:12	No Injury	0	0	0	2	0	Passenger Car	Passenger Car	At Intersection and Related	Dry	Daylight	Entering at angle	Going Straight Ahead	Going Straight Ahead	Disregard Stop and Go Light	None	West	East	North	South	Lane of Primary Trafficway
City Street	W AHTANUM RD	1600	S 16TH AVE	3368071	5/22/2011	11:50	No Injury	0	0	0	2	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	From same direction - both going straight - one stopped - rear-end	Going Straight Ahead	Stopped for Traffic	Exceeding Reas. Safe Speed	None	West	East	West	Vehicle Stopped	Lane of Primary Trafficway
City Street	W WASHINGTON AVE	5200	S 52ND AVE	3632018	3/1/2013	7:55	No Injury	0	0	0	2	0	Passenger Car	Pickup,Panel Truck or Vanette under 10,000 lb	At Intersection and Related	Dry	Daylight	Entering at angle	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	South	West	West	East	Lane of Primary Trafficway
City Street	W WASHINGTON AVE	5000	S 52ND AVE	E431475	6/8/2015	10:30	Possible Injury	1	0	0	2	0	Passenger Car	Passenger Car	At Intersection and Related	Dry	Daylight	From opposite direction - one left turn - one straight	Making Left Turn	Going Straight Ahead	Did Not Grant RW to Vehicle	None	East	South	West	East	Lane of Primary Trafficway
City Street	W WASHINGTON AVE	5200	S 52ND AVE	2941966	1/30/2013	1:54	Evident Injury	1	0	1	0	0	Passenger Car		At Intersection and Related	Dry	Dark-Street Lights On	Vehicle overturned	Making Left Turn		Exceeding Reas. Safe Speed		East	South			Past the Outside Shoulder of Primary Trafficway

## Bart Rudolph

---

**From:** Brown, Julie <BrownJu@wsdot.wa.gov>  
**Sent:** Monday, September 14, 2015 9:48 AM  
**To:** Bart Rudolph  
**Subject:** RE: Crash Data

Hi Bart,

I took another look at your data and the reports on the excel spreadsheet that show *at or within the vicinity of* the intersection of 48<sup>th</sup> Ave @ Washington Ave are for the north-leg of 48<sup>th</sup> Ave not the *south-leg* that you were looking for as shown on the map below.

Hope this helps...if you have any questions please contact our office.

Thanks,

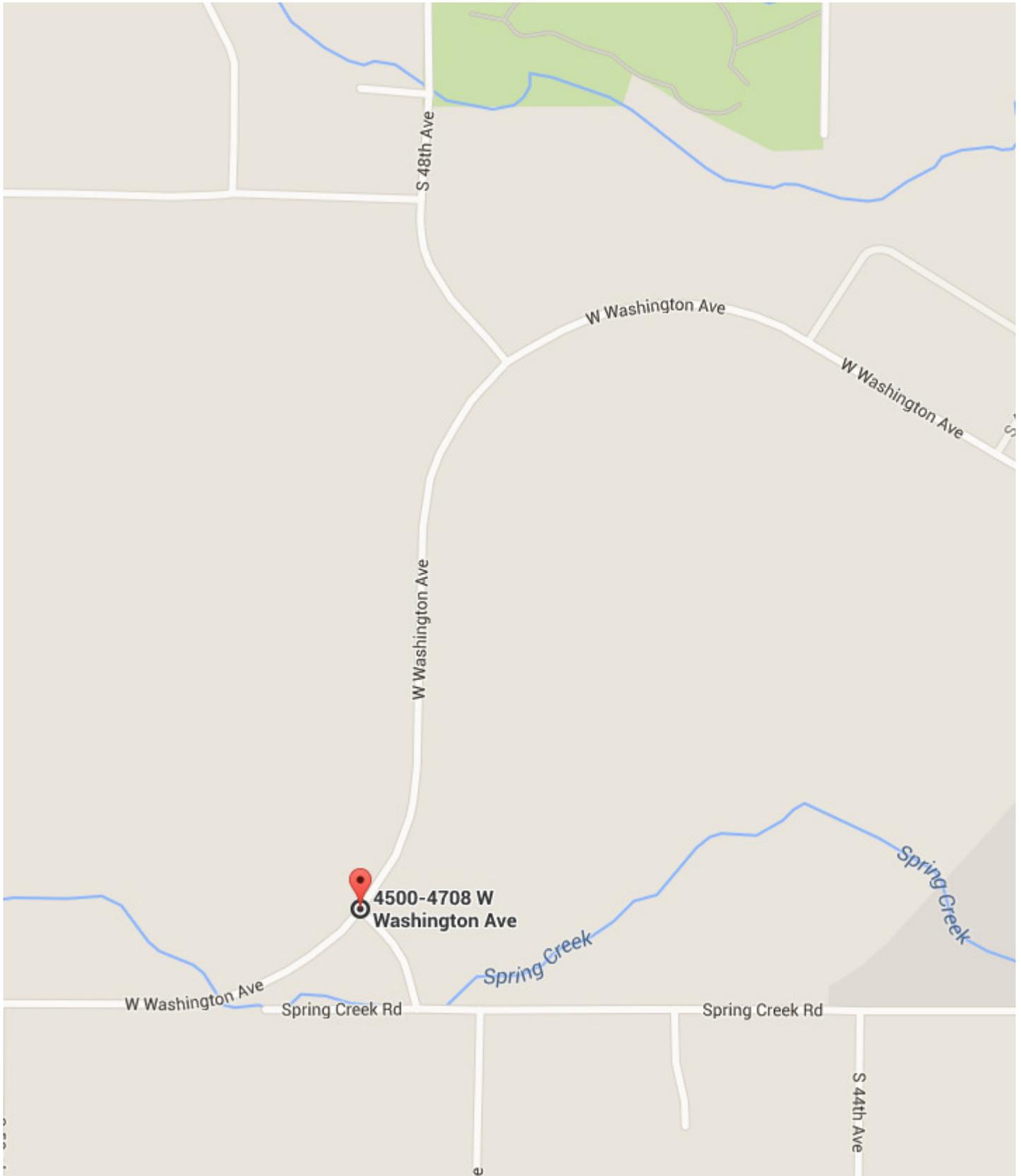
Julie

---

**From:** Bart Rudolph [<mailto:brudolph@kittelson.com>]  
**Sent:** Friday, September 11, 2015 4:43 PM  
**To:** Brown, Julie  
**Subject:** FW: Crash Data

Hi Julie -

I'm having some difficulty querying the crash data for the S 48<sup>th</sup> Ave/S Washington Ave intersection. There appears to be two intersections that fit this description and the block numbers range from 1600 to 5200 in the data set you provided. Would it be possible for you to help me query just the crashes for the intersection marked below?



Thanks!

Bart Rudolph  
Senior Planner

[Kittelson & Associates, Inc.](#)

Transportation Engineering / Planning  
907.443.8107 (direct)  
907.952.0785 (cell)

---

**From:** Brown, Julie [<mailto:BrownJu@wsdot.wa.gov>]  
**Sent:** Tuesday, July 07, 2015 9:51 AM  
**To:** Bart Rudolph  
**Cc:** Mahugh, Jim  
**Subject:** Crash Data

Hi Bart,

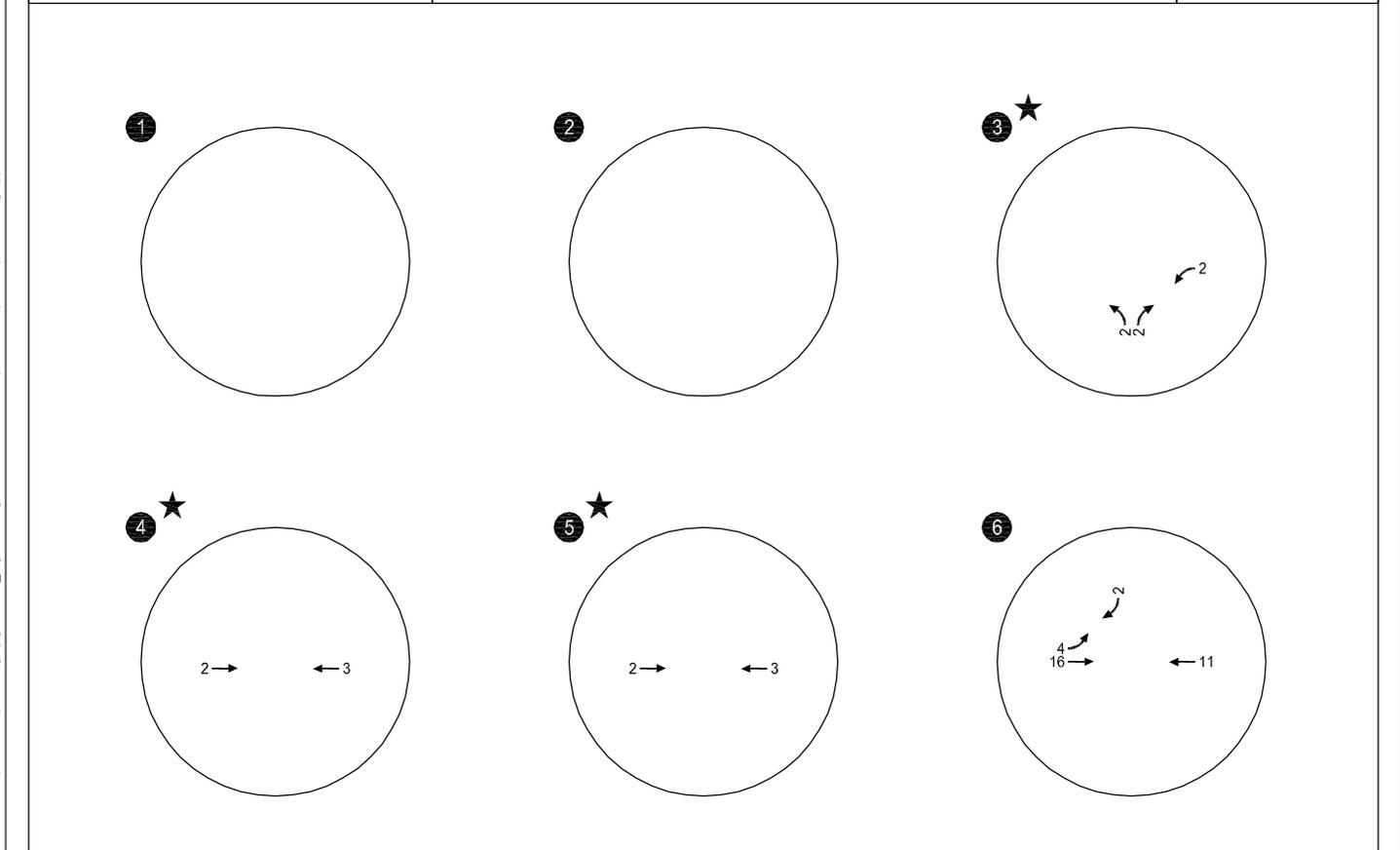
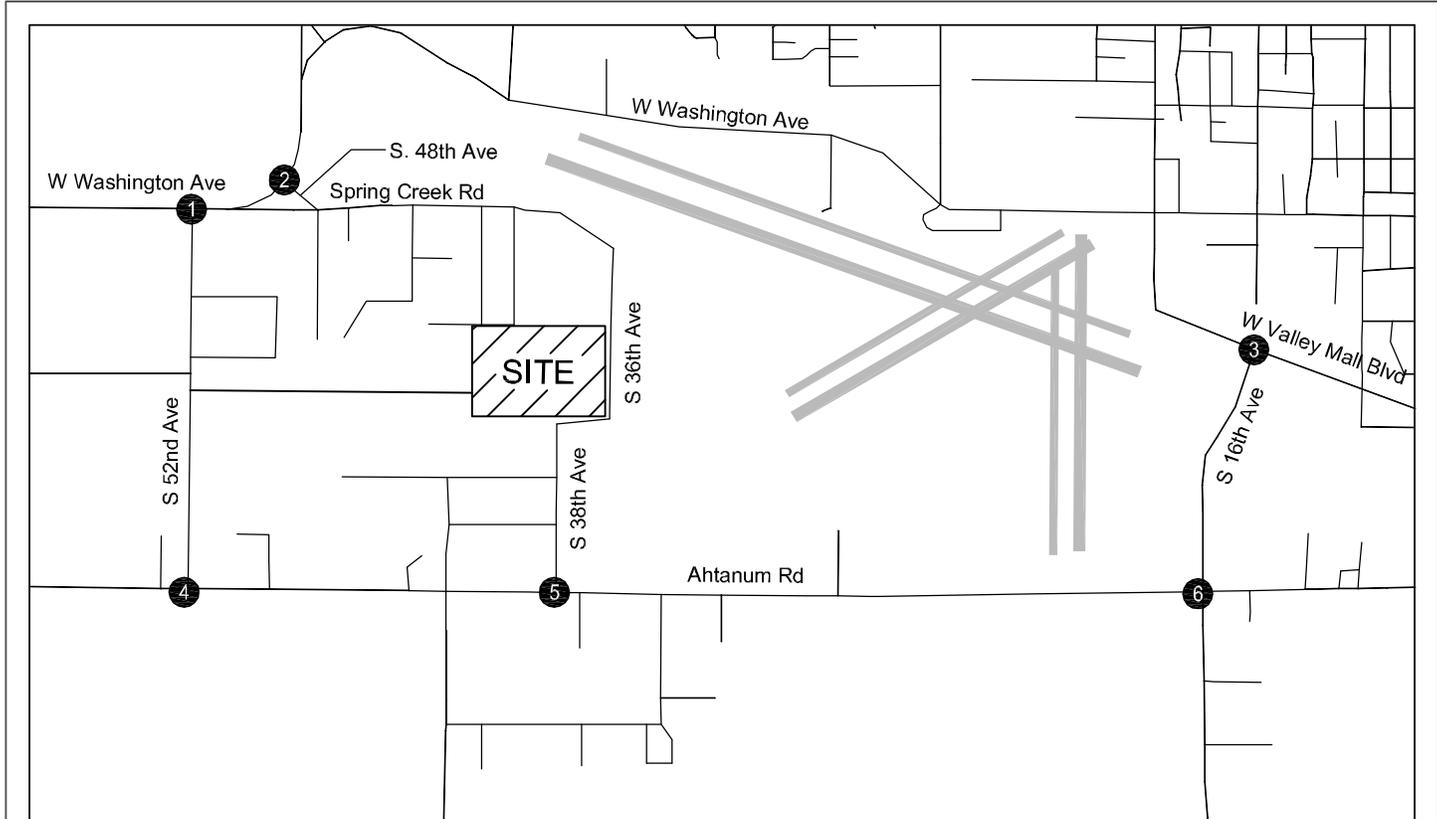
Here is the Crash Data you requested, I noticed that a couple of your intersections run through the City of Union Gap and a few in the County. If you need those segments please let me know and I can run just those for you. If you have any questions please contact our office.

Thank you,

**Julie Brown**

WSDOT Crash Data and Reporting Branch  
7345 Linderson Way SW  
PO BOX 47380  
Tumwater WA 98504  
Desk: 360-570-2464 Fax: 360-570-2449  
[Brownju@wsdot.wa.gov](mailto:Brownju@wsdot.wa.gov)

Appendix D 2017 Background Traffic  
Conditions

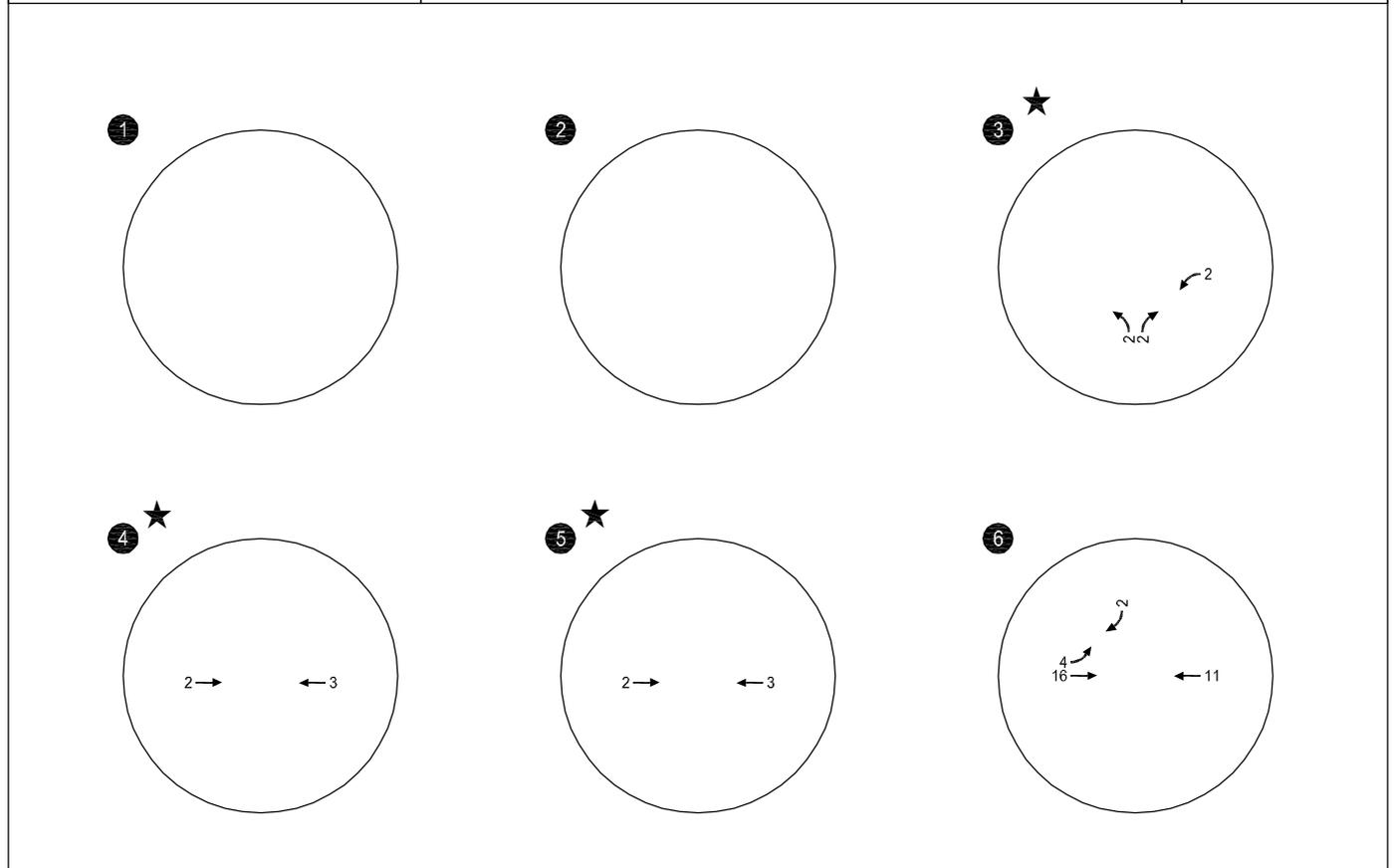
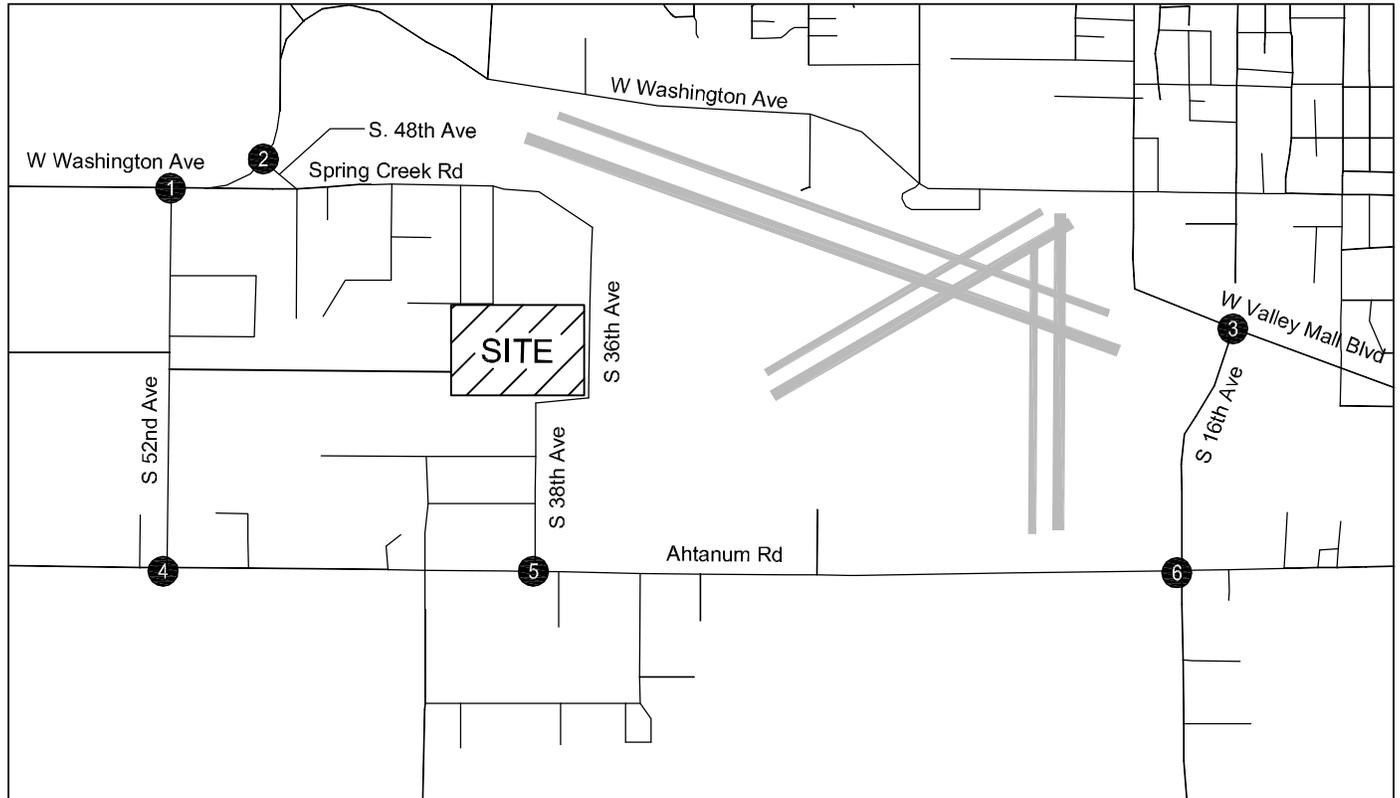


★ Projected volumes based on the August 2015 Borton Fruit TIA

**In-Process - Borton & Sons Facility  
Weekday PM  
Yakima, Washington**

**Figure  
D1**

K:\V\_\Portland\proj\file\19056 - Yakima Sports Complex\dwgs\figs\19056\_Figure1.dwg Oct 13, 2015 - 3:04pm - brudolph - Layout Tab - Fig Appendix D1



★ Projected volumes based on the August 2015 Borton Fruit TIA

**In-Process - Borton & Sons Facility  
Saturday  
Yakima, Washington**

**Figure  
D2**

K:\V\_\Portland\proj\file\19056 - Yakima Sports Complex\dwgs\figs\19056\_Figure1.dwg Oct-13, 2015 - 3:04pm - bradolph - Layout Tab - Fig Appendix D2



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↘	
Volume (veh/h)	402	16	125	667	12	93
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	467	19	145	776	14	108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			486		1155	243
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			486		1155	243
tC, single (s)			4.1		7.0	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.3
p0 queue free %			86		91	86
cM capacity (veh/h)			1073		157	761

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	312	174	145	388	388	122
Volume Left	0	0	145	0	0	14
Volume Right	0	19	0	0	0	108
cSH	1700	1700	1073	1700	1700	528
Volume to Capacity	0.18	0.10	0.14	0.23	0.23	0.23
Queue Length 95th (ft)	0	0	12	0	0	22
Control Delay (s)	0.0	0.0	8.9	0.0	0.0	13.9
Lane LOS	A			B		
Approach Delay (s)	0.0		1.4			13.9
Approach LOS						B

Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			35.0%	ICU Level of Service	A	
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T		T	T
Volume (veh/h)	4	92	570	25	33	900
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	4	92	570	25	33	900
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1100	298			596	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1100	298			596	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	87			97	
cM capacity (veh/h)	202	703			962	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	96	380	215	33	450	450
Volume Left	4	0	0	33	0	0
Volume Right	92	0	25	0	0	0
cSH	637	1700	1700	962	1700	1700
Volume to Capacity	0.15	0.22	0.13	0.03	0.26	0.26
Queue Length 95th (ft)	13	0	0	3	0	0
Control Delay (s)	11.6	0.0	0.0	8.9	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	11.6	0.0		0.3		
Approach LOS	B					

Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			37.5%		ICU Level of Service	A
Analysis Period (min)			15			

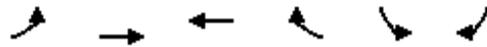


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Volume (vph)	582	204	69	667	196	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1752	3574	1752	1568
Flt Permitted	1.00	1.00	0.41	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	759	3574	1752	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	633	222	75	725	213	41
RTOR Reduction (vph)	0	0	0	0	0	29
Lane Group Flow (vph)	633	222	75	725	213	12
Heavy Vehicles (%)	2%	2%	3%	1%	3%	3%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	17.3	37.4	17.3	17.3	10.6	10.6
Effective Green, g (s)	17.3	37.4	17.3	17.3	10.6	10.6
Actuated g/C Ratio	0.46	1.00	0.46	0.46	0.28	0.28
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1637	1583	351	1653	496	444
v/s Ratio Prot	0.18			c0.20	c0.12	
v/s Ratio Perm		0.14	0.10			0.01
v/c Ratio	0.39	0.14	0.21	0.44	0.43	0.03
Uniform Delay, d1	6.6	0.0	6.0	6.8	10.9	9.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.3	0.2	0.7	0.0
Delay (s)	6.8	0.2	6.3	7.0	11.6	9.7
Level of Service	A	A	A	A	B	A
Approach Delay (s)	5.1			6.9	11.3	
Approach LOS	A			A	B	

**Intersection Summary**

HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	37.4	Sum of lost time (s)	9.5
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

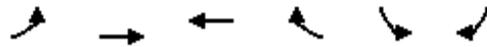
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	48	273	527	40	23	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	53	300	579	44	25	93
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	623				1007	601
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	623				1007	601
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				90	81
cM capacity (veh/h)	968				250	502

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	53	300	623	119
Volume Left	53	0	0	25
Volume Right	0	0	44	93
cSH	968	1700	1700	414
Volume to Capacity	0.05	0.18	0.37	0.29
Queue Length 95th (ft)	4	0	0	29
Control Delay (s)	8.9	0.0	0.0	17.2
Lane LOS	A			C
Approach Delay (s)	1.3		0.0	17.2
Approach LOS				C

Intersection Summary			
Average Delay		2.3	
Intersection Capacity Utilization		50.0%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	8	353	542	57	65	20
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	353	542	57	65	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	599				940	570
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	599				940	570
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	99				78	96
cM capacity (veh/h)	949				290	524

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	361	599	85
Volume Left	8	0	65
Volume Right	0	57	20
cSH	949	1700	324
Volume to Capacity	0.01	0.35	0.26
Queue Length 95th (ft)	1	0	26
Control Delay (s)	0.3	0.0	20.0
Lane LOS	A		C
Approach Delay (s)	0.3	0.0	20.0
Approach LOS			C

Intersection Summary			
Average Delay		1.7	
Intersection Capacity Utilization	43.5%		ICU Level of Service A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	308	23	22	479	104	24	57	35	110	51	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810	1482	1583	3405		1736	1721		1735	1827	1615
Flt Permitted	0.41	1.00	1.00	0.56	1.00		0.72	1.00		0.69	1.00	1.00
Satd. Flow (perm)	764	1810	1482	935	3405		1317	1721		1265	1827	1615
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	78	331	25	24	515	112	26	61	38	118	55	120
RTOR Reduction (vph)	0	0	12	0	29	0	0	30	0	0	0	94
Lane Group Flow (vph)	78	331	13	24	598	0	26	69	0	118	55	26
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	3%	5%	9%	14%	3%	4%	4%	2%	6%	4%	4%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	21.2	21.2	21.2	21.2	21.2		8.6	8.6		8.6	8.6	8.6
Effective Green, g (s)	21.2	21.2	21.2	21.2	21.2		8.6	8.6		8.6	8.6	8.6
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53		0.22	0.22		0.22	0.22	0.22
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	406	964	789	498	1813		284	371		273	394	348
v/s Ratio Prot		c0.18			0.18			0.04				0.03
v/s Ratio Perm	0.10		0.01	0.03			0.02			c0.09		0.02
v/c Ratio	0.19	0.34	0.02	0.05	0.33		0.09	0.19		0.43	0.14	0.07
Uniform Delay, d1	4.8	5.3	4.4	4.5	5.3		12.5	12.7		13.5	12.6	12.4
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.0	0.0	0.1		0.1	0.2		1.1	0.2	0.1
Delay (s)	5.1	5.5	4.4	4.5	5.4		12.6	13.0		14.6	12.8	12.5
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		5.4			5.3			12.9			13.4	
Approach LOS		A			A			B			B	

**Intersection Summary**

HCM 2000 Control Delay	7.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	39.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	
Volume (veh/h)	334	23	56	370	16	78
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	371	26	62	411	18	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			397		714	198
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			397		714	198
tC, single (s)			4.2		7.3	7.0
tC, 2 stage (s)						
tF (s)			2.2		3.8	3.3
p0 queue free %			95		94	89
cM capacity (veh/h)			1144		299	803

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	247	149	62	206	206	104
Volume Left	0	0	62	0	0	18
Volume Right	0	26	0	0	0	87
cSH	1700	1700	1144	1700	1700	624
Volume to Capacity	0.15	0.09	0.05	0.12	0.12	0.17
Queue Length 95th (ft)	0	0	4	0	0	15
Control Delay (s)	0.0	0.0	8.3	0.0	0.0	11.9
Lane LOS			A			B
Approach Delay (s)	0.0		1.1			11.9
Approach LOS						B

Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			29.0%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	8	25	495	17	25	395
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	8	25	495	17	25	395
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	751	256			512	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	751	256			512	
tC, single (s)	7.2	7.0			4.1	
tC, 2 stage (s)						
tF (s)	3.7	3.3			2.2	
p0 queue free %	97	97			98	
cM capacity (veh/h)	304	737			1064	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	33	330	182	25	198	198
Volume Left	8	0	0	25	0	0
Volume Right	25	0	17	0	0	0
cSH	548	1700	1700	1064	1700	1700
Volume to Capacity	0.06	0.19	0.11	0.02	0.12	0.12
Queue Length 95th (ft)	5	0	0	2	0	0
Control Delay (s)	12.0	0.0	0.0	8.5	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.0	0.0		0.5		
Approach LOS	B					

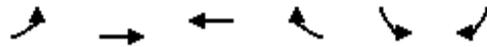
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			30.8%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Volume (vph)	459	101	35	482	123	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frbp, ped/bikes	1.00	0.98	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3574	1521	1703	3610	1703	1538
Flt Permitted	1.00	1.00	0.47	1.00	0.95	1.00
Satd. Flow (perm)	3574	1521	850	3610	1703	1538
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	488	107	37	513	131	49
RTOR Reduction (vph)	0	0	0	0	0	38
Lane Group Flow (vph)	488	107	37	513	131	11
Confl. Bikes (#/hr)		1				
Heavy Vehicles (%)	1%	4%	6%	0%	6%	5%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	16.0	32.5	16.0	16.0	7.0	7.0
Effective Green, g (s)	16.0	32.5	16.0	16.0	7.0	7.0
Actuated g/C Ratio	0.49	1.00	0.49	0.49	0.22	0.22
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1759	1521	418	1777	366	331
v/s Ratio Prot	0.14			c0.14	c0.08	
v/s Ratio Perm		0.07	0.04			0.01
v/c Ratio	0.28	0.07	0.09	0.29	0.36	0.03
Uniform Delay, d1	4.9	0.0	4.4	4.9	10.8	10.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	0.1	0.1	0.1	0.7	0.0
Delay (s)	5.0	0.1	4.5	5.0	11.6	10.1
Level of Service	A	A	A	A	B	B
Approach Delay (s)	4.1			4.9	11.2	
Approach LOS	A			A	B	

**Intersection Summary**

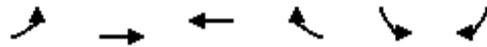
HCM 2000 Control Delay	5.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	32.5	Sum of lost time (s)	9.5
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	44	301	261	19	22	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	55	376	326	24	28	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	350				824	338
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	350				824	338
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				92	95
cM capacity (veh/h)	1220				330	709

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	55	376	350	66
Volume Left	55	0	0	28
Volume Right	0	0	24	39
cSH	1220	1700	1700	480
Volume to Capacity	0.05	0.22	0.21	0.14
Queue Length 95th (ft)	4	0	0	12
Control Delay (s)	8.1	0.0	0.0	13.7
Lane LOS	A			B
Approach Delay (s)	1.0		0.0	13.7
Approach LOS				B

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		31.6%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↔		↘	
Volume (veh/h)	12	418	276	20	16	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	12	418	276	20	16	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	296				728	286
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	296				728	286
tC, single (s)	4.1				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.6	3.3
p0 queue free %	99				96	98
cM capacity (veh/h)	1277				373	758

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	430	296	28
Volume Left	12	0	16
Volume Right	0	20	12
cSH	1277	1700	476
Volume to Capacity	0.01	0.17	0.06
Queue Length 95th (ft)	1	0	5
Control Delay (s)	0.3	0.0	13.0
Lane LOS	A		B
Approach Delay (s)	0.3	0.0	13.0
Approach LOS			B

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		41.7%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	68	277	12	9	247	67	16	34	23	70	22	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1703	1792	1615	1805	3328		1612	1698		1770	1743	1468
Flt Permitted	0.54	1.00	1.00	0.57	1.00		0.74	1.00		0.71	1.00	1.00
Satd. Flow (perm)	965	1792	1615	1081	3328		1257	1698		1331	1743	1468
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	77	315	14	10	281	76	18	39	26	80	25	50
RTOR Reduction (vph)	0	0	6	0	31	0	0	22	0	0	0	43
Lane Group Flow (vph)	77	315	8	10	326	0	18	43	0	80	25	7
Heavy Vehicles (%)	6%	6%	0%	0%	5%	5%	12%	6%	4%	2%	9%	10%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	22.4	22.4	22.4	22.4	22.4		5.7	5.7		5.7	5.7	5.7
Effective Green, g (s)	22.4	22.4	22.4	22.4	22.4		5.7	5.7		5.7	5.7	5.7
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.59		0.15	0.15		0.15	0.15	0.15
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	567	1053	949	635	1956		188	254		199	260	219
v/s Ratio Prot		c0.18			0.10			0.03			0.01	
v/s Ratio Perm	0.08		0.01	0.01			0.01			c0.06		0.01
v/c Ratio	0.14	0.30	0.01	0.02	0.17		0.10	0.17		0.40	0.10	0.03
Uniform Delay, d1	3.5	3.9	3.3	3.3	3.6		14.0	14.1		14.7	14.0	13.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.2	0.0	0.0	0.0		0.2	0.3		1.3	0.2	0.1
Delay (s)	3.6	4.1	3.3	3.3	3.6		14.2	14.4		16.0	14.1	13.9
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		4.0			3.6			14.4			15.0	
Approach LOS		A			A			B			B	

**Intersection Summary**

HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	38.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

## Appendix E 2017 Total Traffic Conditions



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↙	↑↑	↘	
Volume (veh/h)	425	16	125	678	12	93
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	494	19	145	788	14	108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			513		1188	256
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			513		1188	256
tC, single (s)			4.1		7.0	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.3
p0 queue free %			86		91	86
cM capacity (veh/h)			1049		148	746

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	329	183	145	394	394	122
Volume Left	0	0	145	0	0	14
Volume Right	0	19	0	0	0	108
cSH	1700	1700	1049	1700	1700	511
Volume to Capacity	0.19	0.11	0.14	0.23	0.23	0.24
Queue Length 95th (ft)	0	0	12	0	0	23
Control Delay (s)	0.0	0.0	9.0	0.0	0.0	14.2
Lane LOS			A			B
Approach Delay (s)	0.0		1.4			14.2
Approach LOS						B

Intersection Summary						
Average Delay			1.9			
Intersection Capacity Utilization			35.6%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T		T	T
Volume (veh/h)	15	136	570	48	123	900
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	136	570	48	123	900
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1291	310			619	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1291	310			619	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	80			87	
cM capacity (veh/h)	137	691			943	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	151	380	238	123	450	450
Volume Left	15	0	0	123	0	0
Volume Right	136	0	48	0	0	0
cSH	493	1700	1700	943	1700	1700
Volume to Capacity	0.31	0.22	0.14	0.13	0.26	0.26
Queue Length 95th (ft)	32	0	0	11	0	0
Control Delay (s)	15.5	0.0	0.0	9.4	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	15.5	0.0		1.1		
Approach LOS	C					

Intersection Summary						
Average Delay			2.0			
Intersection Capacity Utilization			43.3%		ICU Level of Service	A
Analysis Period (min)			15			

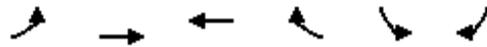


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↑	↑↑	↑	↑
Volume (vph)	582	226	125	667	207	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1752	3574	1752	1568
Flt Permitted	1.00	1.00	0.41	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	759	3574	1752	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	633	246	136	725	225	72
RTOR Reduction (vph)	0	0	0	0	0	51
Lane Group Flow (vph)	633	246	136	725	225	21
Heavy Vehicles (%)	2%	2%	3%	1%	3%	3%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	18.3	38.9	18.3	18.3	11.1	11.1
Effective Green, g (s)	18.3	38.9	18.3	18.3	11.1	11.1
Actuated g/C Ratio	0.47	1.00	0.47	0.47	0.29	0.29
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1664	1583	357	1681	499	447
v/s Ratio Prot	0.18			c0.20	c0.13	
v/s Ratio Perm		0.16	0.18			0.01
v/c Ratio	0.38	0.16	0.38	0.43	0.45	0.05
Uniform Delay, d1	6.6	0.0	6.6	6.8	11.4	10.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.2	0.7	0.2	0.8	0.1
Delay (s)	6.8	0.2	7.3	7.0	12.2	10.1
Level of Service	A	A	A	A	B	B
Approach Delay (s)	5.0			7.1	11.7	
Approach LOS	A			A	B	

**Intersection Summary**

HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	38.9	Sum of lost time (s)	9.5
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

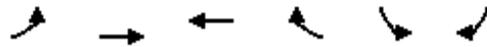
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	48	284	533	40	23	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	53	312	586	44	25	93
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	630				1025	608
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	630				1025	608
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				90	81
cM capacity (veh/h)	962				244	498

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	53	312	630	119
Volume Left	53	0	0	25
Volume Right	0	0	44	93
cSH	962	1700	1700	407
Volume to Capacity	0.05	0.18	0.37	0.29
Queue Length 95th (ft)	4	0	0	30
Control Delay (s)	9.0	0.0	0.0	17.4
Lane LOS	A			C
Approach Delay (s)	1.3		0.0	17.4
Approach LOS				C

Intersection Summary			
Average Delay		2.3	
Intersection Capacity Utilization		50.3%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	19	353	542	158	115	26
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	353	542	158	115	26
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	700				1012	621
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	700				1012	621
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	98				56	95
cM capacity (veh/h)	870				259	491

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	372	700	141
Volume Left	19	0	115
Volume Right	0	158	26
cSH	870	1700	284
Volume to Capacity	0.02	0.41	0.50
Queue Length 95th (ft)	2	0	65
Control Delay (s)	0.7	0.0	29.5
Lane LOS	A		D
Approach Delay (s)	0.7	0.0	29.5
Approach LOS			D

Intersection Summary			
Average Delay		3.7	
Intersection Capacity Utilization		52.8%	ICU Level of Service A
Analysis Period (min)		15	

Yakima Sports Complex  
6: S 16th Ave & Ahtanum Rd

Total Weekday PM  
10/13/2015



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	319	23	22	502	104	24	57	35	110	51	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810	1482	1583	3409		1736	1721		1735	1827	1615
Flt Permitted	0.40	1.00	1.00	0.55	1.00		0.72	1.00		0.69	1.00	1.00
Satd. Flow (perm)	745	1810	1482	924	3409		1317	1721		1265	1827	1615
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	120	343	25	24	540	112	26	61	38	118	55	204
RTOR Reduction (vph)	0	0	13	0	29	0	0	28	0	0	0	149
Lane Group Flow (vph)	120	343	12	24	623	0	26	71	0	118	55	55
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	3%	5%	9%	14%	3%	4%	4%	2%	6%	4%	4%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	20.8	20.8	20.8	20.8	20.8		11.3	11.3		11.3	11.3	11.3
Effective Green, g (s)	20.8	20.8	20.8	20.8	20.8		11.3	11.3		11.3	11.3	11.3
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49		0.27	0.27		0.27	0.27	0.27
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	368	894	732	456	1684		353	461		339	490	433
v/s Ratio Prot		c0.19			0.18			0.04			0.03	
v/s Ratio Perm	0.16		0.01	0.03			0.02			c0.09		0.03
v/c Ratio	0.33	0.38	0.02	0.05	0.37		0.07	0.15		0.35	0.11	0.13
Uniform Delay, d1	6.4	6.6	5.4	5.5	6.6		11.5	11.8		12.4	11.6	11.7
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3	0.0	0.0	0.1		0.1	0.2		0.6	0.1	0.1
Delay (s)	6.9	6.9	5.4	5.6	6.7		11.6	11.9		13.0	11.7	11.8
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		6.9			6.7			11.8			12.2	
Approach LOS		A			A			B			B	

Intersection Summary

HCM 2000 Control Delay	8.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	42.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	55	56	112	65	85	113
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	69	70	140	81	106	141
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	538	177	248			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	538	177	248			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	92	89			
cM capacity (veh/h)	454	871	1330			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	69	70	221	248
Volume Left	69	0	140	0
Volume Right	0	70	0	141
cSH	454	871	1330	1700
Volume to Capacity	0.15	0.08	0.11	0.15
Queue Length 95th (ft)	13	7	9	0
Control Delay (s)	14.3	9.5	5.4	0.0
Lane LOS	B	A	A	
Approach Delay (s)	11.9		5.4	0.0
Approach LOS	B			

Intersection Summary				
Average Delay			4.7	
Intersection Capacity Utilization		34.4%	ICU Level of Service	A
Analysis Period (min)		15		



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↵	↑↑	↵	
Volume (veh/h)	362	23	56	400	16	78
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	421	27	65	465	19	91
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			448		797	224
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			448		797	224
tC, single (s)			4.1		7.0	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.3
p0 queue free %			94		94	88
cM capacity (veh/h)			1109		294	783

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	281	167	65	233	233	109
Volume Left	0	0	65	0	0	19
Volume Right	0	27	0	0	0	91
cSH	1700	1700	1109	1700	1700	610
Volume to Capacity	0.17	0.10	0.06	0.14	0.14	0.18
Queue Length 95th (ft)	0	0	5	0	0	16
Control Delay (s)	0.0	0.0	8.4	0.0	0.0	12.2
Lane LOS			A			B
Approach Delay (s)	0.0		1.0			12.2
Approach LOS						B

Intersection Summary						
Average Delay			1.7			
Intersection Capacity Utilization			29.8%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↙		↑↑		↘	↓↓
Volume (veh/h)	38	145	495	45	135	395
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	38	145	495	45	135	395
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	986	271			541	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	986	271			541	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	82	80			87	
cM capacity (veh/h)	215	732			1009	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	183	330	210	135	198	198
Volume Left	38	0	0	135	0	0
Volume Right	145	0	45	0	0	0
cSH	488	1700	1700	1009	1700	1700
Volume to Capacity	0.37	0.19	0.12	0.13	0.12	0.12
Queue Length 95th (ft)	43	0	0	12	0	0
Control Delay (s)	16.7	0.0	0.0	9.1	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	16.7	0.0		2.3		
Approach LOS	C					

Intersection Summary						
Average Delay			3.4			
Intersection Capacity Utilization			43.6%		ICU Level of Service	A
Analysis Period (min)			15			

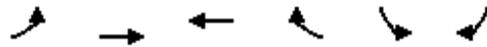


Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↑	↓	↑↑	↓	↑
Volume (vph)	459	128	104	482	153	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.9	4.0	4.9	4.9	4.6	4.6
Lane Util. Factor	0.95	1.00	1.00	0.95	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3539	1583	1752	3574	1752	1568
Flt Permitted	1.00	1.00	0.47	1.00	0.95	1.00
Satd. Flow (perm)	3539	1583	865	3574	1752	1568
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	499	139	113	524	166	132
RTOR Reduction (vph)	0	0	0	0	0	96
Lane Group Flow (vph)	499	139	113	524	166	36
Heavy Vehicles (%)	2%	2%	3%	1%	3%	3%
Turn Type	NA	Free	Perm	NA	Prot	Perm
Protected Phases	2			6	8	
Permitted Phases		Free	6			8
Actuated Green, G (s)	14.9	33.6	14.9	14.9	9.2	9.2
Effective Green, g (s)	14.9	33.6	14.9	14.9	9.2	9.2
Actuated g/C Ratio	0.44	1.00	0.44	0.44	0.27	0.27
Clearance Time (s)	4.9		4.9	4.9	4.6	4.6
Vehicle Extension (s)	4.0		3.0	3.0	3.5	3.5
Lane Grp Cap (vph)	1569	1583	383	1584	479	429
v/s Ratio Prot	0.14			c0.15	c0.09	
v/s Ratio Perm		0.09	0.13			0.02
v/c Ratio	0.32	0.09	0.30	0.33	0.35	0.08
Uniform Delay, d1	6.1	0.0	6.0	6.1	9.8	9.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	0.1	0.4	0.1	0.5	0.1
Delay (s)	6.2	0.1	6.4	6.2	10.3	9.2
Level of Service	A	A	A	A	B	A
Approach Delay (s)	4.9			6.3	9.8	
Approach LOS	A			A	A	

**Intersection Summary**

HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	33.6	Sum of lost time (s)	9.5
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

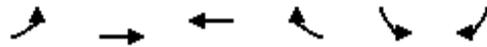
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	44	315	276	19	22	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	48	346	303	21	24	34
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	324				757	314
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	324				757	314
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				93	95
cM capacity (veh/h)	1247				358	729

Direction, Lane #	EB 1	EB 2	WB 1	SB 1
Volume Total	48	346	324	58
Volume Left	48	0	0	24
Volume Right	0	0	21	34
cSH	1247	1700	1700	510
Volume to Capacity	0.04	0.20	0.19	0.11
Queue Length 95th (ft)	3	0	0	10
Control Delay (s)	8.0	0.0	0.0	13.0
Lane LOS	A			B
Approach Delay (s)	1.0		0.0	13.0
Approach LOS				B

Intersection Summary			
Average Delay		1.5	
Intersection Capacity Utilization		32.3%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔		↔	
Volume (veh/h)	26	418	276	144	151	27
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	26	418	276	144	151	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	420				818	348
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	420				818	348
tC, single (s)	4.2				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.3				3.5	3.3
p0 queue free %	98				55	96
cM capacity (veh/h)	1108				337	700

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	444	420	178
Volume Left	26	0	151
Volume Right	0	144	27
cSH	1108	1700	366
Volume to Capacity	0.02	0.25	0.49
Queue Length 95th (ft)	2	0	64
Control Delay (s)	0.7	0.0	23.8
Lane LOS	A		C
Approach Delay (s)	0.7	0.0	23.8
Approach LOS			C

Intersection Summary			
Average Delay		4.4	
Intersection Capacity Utilization	60.0%		ICU Level of Service B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	173	307	12	9	275	67	16	34	23	70	22	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	0.99		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1752	1810	1482	1583	3396		1736	1714		1735	1827	1615
Flt Permitted	0.53	1.00	1.00	0.56	1.00		0.74	1.00		0.72	1.00	1.00
Satd. Flow (perm)	983	1810	1482	936	3396		1355	1714		1309	1827	1615
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	186	330	13	10	296	72	17	37	25	75	24	151
RTOR Reduction (vph)	0	0	6	0	33	0	0	20	0	0	0	120
Lane Group Flow (vph)	186	330	7	10	335	0	17	42	0	75	24	31
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	3%	5%	9%	14%	3%	4%	4%	2%	6%	4%	4%	0%
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		6			2			8			4	
Permitted Phases	6		6	2			8			4		4
Actuated Green, G (s)	21.6	21.6	21.6	21.6	21.6		8.3	8.3		8.3	8.3	8.3
Effective Green, g (s)	21.6	21.6	21.6	21.6	21.6		8.3	8.3		8.3	8.3	8.3
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.54		0.21	0.21		0.21	0.21	0.21
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	532	979	802	506	1838		281	356		272	380	335
v/s Ratio Prot		0.18			0.10			0.02			0.01	
v/s Ratio Perm	c0.19		0.00	0.01			0.01			c0.06		0.02
v/c Ratio	0.35	0.34	0.01	0.02	0.18		0.06	0.12		0.28	0.06	0.09
Uniform Delay, d1	5.2	5.1	4.2	4.2	4.7		12.7	12.8		13.3	12.7	12.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2	0.0	0.0	0.0		0.1	0.1		0.6	0.1	0.1
Delay (s)	5.6	5.3	4.2	4.3	4.7		12.8	13.0		13.8	12.8	12.9
Level of Service	A	A	A	A	A		B	B		B	B	B
Approach Delay (s)		5.4			4.7			12.9			13.2	
Approach LOS		A			A			B			B	

**Intersection Summary**

HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	39.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	150	150	138	32	28	138
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	188	188	172	40	35	172
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	506	121	208			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	506	121	208			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	60	80	87			
cM capacity (veh/h)	463	935	1376			

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	188	188	212	208
Volume Left	188	0	172	0
Volume Right	0	188	0	172
cSH	463	935	1376	1700
Volume to Capacity	0.40	0.20	0.13	0.12
Queue Length 95th (ft)	48	19	11	0
Control Delay (s)	18.0	9.8	6.7	0.0
Lane LOS	C	A	A	
Approach Delay (s)	13.9		6.7	0.0
Approach LOS	B			

Intersection Summary			
Average Delay		8.3	
Intersection Capacity Utilization		37.6%	ICU Level of Service A
Analysis Period (min)		15	

Appendix F    Signal Warrant Analysis  
Worksheets



**KITTELSON & ASSOCIATES, INC.**

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**Project #:** 19056  
**Project Name:** SOZO Sports  
**Analyst:** BHR  
**Date:** 10/13/2015  
**File:**

K:\M\_Portland\projfile\19056 - Yakima Sports Complex\Excel\Signal Warrants\Ahtanum\_38th\Signal Warrant Analysis\_TT 2017 PM.xls\Data Input

**Intersection:** Ahtanum Road/S 38th Ave  
**Scenario:** TT 2017 PM

**Analysis Traffic Volumes**

Hour	Begin	End	Major Street		Minor Street	
			EB	WB	NB	SB
5:00 PM	6:00 PM		372	700	0	141
2nd	Highest Hour		356	670	0	135
3rd	Highest Hour		340	640	0	129
4th	Highest Hour		324	610	0	123
5th	Highest Hour		308	580	0	117
6th	Highest Hour		292	550	0	111
7th	Highest Hour		276	520	0	105
8th	Highest Hour		260	490	0	99
9th	Highest Hour		238	448	0	90
10th	Highest Hour		205	385	0	78
11th	Highest Hour		167	315	0	63
12th	Highest Hour		160	301	0	61
13th	Highest Hour		145	273	0	55
14th	Highest Hour		134	252	0	51
15th	Highest Hour		134	252	0	51
16th	Highest Hour		130	245	0	49
17th	Highest Hour		74	140	0	28
18th	Highest Hour		41	77	0	16
19th	Highest Hour		37	70	0	14
20th	Highest Hour		15	28	0	6
21st	Highest Hour		11	21	0	4
22nd	Highest Hour		11	21	0	4
23rd	Highest Hour		7	14	0	3
24th	Highest Hour		7	14	0	3

**Warrant Summary**

Warrant	Name	Analyzed?	Met?
#1	Eight-Hour Vehicular Volume	Yes	Yes
#2	Four-Hour Vehicular volume	Yes	Yes
#3	Peak Hour	Yes	Yes*
#4	Pedestrian Volume	No	-
#5	School Crossing	No	-
#6	Coordinated Signal System	No	-
#7	Crash Experience	No	-
#8	Roadway Network	No	-

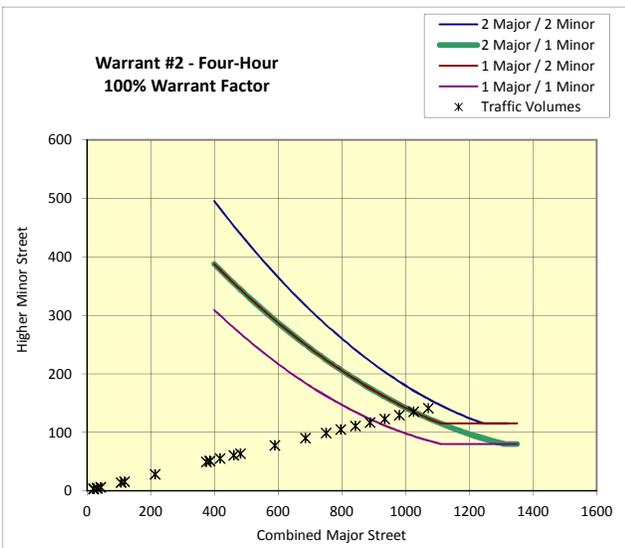
**Input Parameters**

Volume Adjustment Factor =	1.0
North-South Approach =	minor
East-West Approach =	Major
Major Street Thru Lanes =	1
Minor Street Thru Lanes =	1
Speed > 40 mph?	Yes
Population < 10,000?	No
Warrant Factor	70%
Peak Hour or Daily Count?	Peak Hour
Major Street: 4th-Highest Hour / Peak Hour	87%
Major Street: 8th-Highest Hour / Peak Hour	70%
Minor Street: 4th-Highest Hour / Peak Hour	87%
Minor Street: 8th-Highest Hour / Peak Hour	70%

**Warrant #1 - Eight Hour**

Warrant Factor	Condition	Major Street Requirement	Minor Street Requirement	Hours That Condition Is Met	Condition for Warrant Factor Met?	Signal Warrant Met?
100%	A	500	150	0	No	Yes
	B	750	75	8	Yes	
80%	A	400	120	4	No	Yes
	B	600	60	9	Yes	
70%	A	350	105	7	No	Yes
	B	525	53	10	Yes	

**Warrant #2 - Four-Hour  
100% Warrant Factor**



**Warrant #3 - Peak Hour  
100% Warrant Factor**

