April 13, 2020

Mike Keenan
Project Manager
Capital Projects
Spokane Public Schools
2815 E Garland Ave.
Spokane, WA 99207

Re: Environmental Noise Report
Site: NW Middle School, Spokane School Dist.

Dear Mike,

This report presents the results of the noise survey conducted for the proposed Northwest Middle School located at 4918 W Wellesley Ave in Spokane, Washington. The purpose of this report is to document the extent and impact of environmental noise due to traffic and other sources in the immediate vicinity of the school. This report contains data on the existing and predicted noise environments, impact criteria, and evaluation of the data as they relate to the criteria and recommendations for improvement where appropriate.

The proposed site is bordered to the south by Wellesley Ave, east by the VA hospital, to the west by Fairmount memorial park, and to the north by Joe Albie stadium. Weather conditions during the period of measurement was overcast with some precipitation and light winds.

Hourly noise measurements were conducted with Svantek 971 Environmental Noise Monitors on April 9 – 10, 2020. Equipment conforms to American National Standards Institute (ANSI) requirements for Type 1 instruments and is under current calibration.

Our review was completed in accordance with WAC 246-366-030 Site Approval for Educational Facilities and WAC 246-366-110 Sound Control as required by the Health and Safety Guide for K-12 Schools in Washington.

PRIMARY AND SECONDARY SCHOOL REGULATIONS
WAC-246-366-030: Noise from any source at a proposed site for a new school, an addition to an existing school, or a portable classroom shall not exceed an hourly average of 55 dBA and shall not exceed an hourly maximum of 75 dBA during the time of day the school is in session; except sites exceeding these levels are acceptable if a plan for sound reduction is included in the new construction proposal and the plan for sound reduction is approved by the health offices.

WAC-246-366-110: Interior background noise levels at any student location within the classroom shall not exceed 45 dBA for 30 seconds.

Noise Measurements

Continuous noise measurements were conducted at the project site to quantify the existing noise environment. Measurements ran between 8 AM and 4 PM on April 9 – 10, 2020. The noise monitors were placed at locations representative of the highest noise impacts to the site. Monitors were placed at the locations indicated in the figure, and in addition short-term measurements were conducted at the monitor locations and at other locations at the site. Each of the noise monitors were placed at approximately 5 feet above grade. Measurement locations are presented in the following figure:

Figure 1: Site Plan and Measurement Locations

Measurement Results

Primary noise sources impacting the site include the mechanical system at VA hostpial to the east, traffic noise from Wellesley Ave, and some aircraft flyover.

The hourly Leq and Lmax measurements are presented in the following charts:

The following table presents the hourly Leq and Lmax levels measured at the monitoring locations during school hours (between 8 AM and 4 PM):

Monitor	Leq	Lmax
Location 1	40 – 45	55 – 67
Location 2	42 – 47	51 – 68

According to the measurement results, the Hourly Leq and Lmax noise are within the WAC noise limits at both monitoring locations.

Short-Term Measurements

Location	Leq	Lmax	Meets W.A.C.
M1	44	48	YES
M2	47	54	YES
S1	44	56	YES
S2	45	62	YES
S3	47	66	YES
S4	54	73	YES

According to the measurement results, the measured short-term Leq and Lmax noise levels meet the WAC requirements.

No additional noise reduction measures are necessary to meet WAC requirements for the proposed site.

Please contact us if you have questions or need further information.

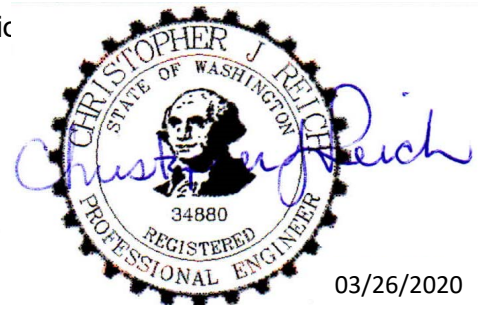
Sincerely,
SSA Acoustics, LLP

Alan Burt, P.E.
PARTNER
ACOUSTICAL CONSULTANT

T·O ENGINEERS

memo

TO:	Inga Note, P.E., City Transportation Engineer Patty Kells, P.E., Development Services Transportatic
FROM:	Bill White, Regional Transportation Lead Christopher J. Reich, P.E., Reich Engineering, LLC
DATE:	March 2020
JOB NO.:	190578
RE:	Joe Albi Stadium and New Northwest Middle School, Transportation Threshold Determination
CC:	Scott Farkus, Spokane Public Schools Gregory Forsyth, Spokane Public Schools



03/26/2020

☐ **Urgent** ☒ **For Review** ☒ **Please Comment** ☒ **Please Reply** ☐ **For Your Use**

This memorandum summarizes the transportation threshold determination (TTD) prepared for the Joe Albi Stadium replacement and new Northwest Middle School land use projects proposed in Spokane, Washington. The purpose of this TTD is to provide trip generation and level-of-service (LOS) evaluations for site driveways and the Wellesley Avenue/Assembly Street intersection. While not a full traffic impact analysis, the TTD is intended to provide the City summary data from which to provide a transportation concurrency determination (in support of permitting).

This TTD study was commissioned by Capital Projects and Planning staff with Spokane Public Schools (SPS). The memorandum will be submitted to the City as lead land use jurisdiction. Other agencies can comment by invitation of City Engineering and Planning staffs. Questions about this study can be addressed by staff with the Spokane office of T-O Engineering.

PROJECT DESCRIPTION

Spokane Public Schools has secured $553.2 million to improve existing schools and construct new schools as the function of a 2018 voter-approved facilities bond with a matching State grant. The 2018 bond and State grant is dedicated towards modernizing or reconstruction of six existing schools, construction of three new schools, and replacement/modernization of Joe Albi Stadium. This TTD has been developed to address conditions related to Joe Albi and the new Northwest Middle School, as they are adjacent to each other and impact similar roadways.

Per scope coordination with the City transportation engineers office, an analysis of PM peak hour traffic conditions was provided for Wellesley Avenue/Assembly Street. These engineers plan to construct a roundabout and an analysis of forecast conditions will help staff with planning and design. An analysis was also provided to address school impacts during peak generator hours. The study was developed in compliance with standard practice and various City guidelines.

Joe Albi Stadium

Opened historically as “Memorial Stadium” in 1950, Joe Albi has been used primarily by Spokane Public Schools and Mead School District for high school football and band competitions for over 30-years. The stadium has a current seating capacity of 28,650, but the largest events have not exceeded 5,500 persons in more current history (in the last 10 to 15-years).

Primary access is provided to nearly 30-acres of unimproved parking by four graveled approaches that extend north from Wellesley Avenue, west of Assembly Street. Alternatively, patrons can park in the paved lots of Dwight Merkel Sports Complex located northeast of the Stadium, as accessed

through a paved approach extending from Assembly Avenue in alignment with Rowan Avenue. Parking in either area sends most site-generated trips through the Wellesley Avenue/Assembly Street intersection located southeast of the Stadium.

Joe Albi is largely in a state of disrepair; thus, this "same place" replacement provides the most cost-effective action to remediate these issues (as opposed to renovation). The proposal includes a substantial reduction in capacity to accommodate up to 6,000 spectators in designated seating. The proposal reduces the footprint of the stadium to free space for parking and vehicle circulation. The north end of the stadium would have locker rooms and administration space with the south concessions. Restrooms would be located under seating at east and west sides of the stadium.

Construction plans include development of nearly 16-acres of paved public parking aligned north, south, and east of the stadium. The lot south would be substantially condensed to free area for the Middle School. Parking would be accessed through two paved approach extending north from Wellesley Avenue, one in alignment with Hartley Street and the other offset marginally from/east of Royal Court. The site could also be accessed through a paved easement extending to Dwight Merkel approach and parking. Officials, staff, and buses are expected to park on the north end of the stadium, traveling the east Wellesley Avenue and Dwight Merkel Approaches.

Northwest Middle School

The Northwest Middle School would be constructed on approximately 20-acres which currently accommodates the bulk of Joe Albi parking. No formal site plan has been developed for the school yet (currently being developed by project architects), but this will be a 135,000 to 139,000 square-foot facility built for up to 750-students.

SPS Capital Projects and Planning staff incorporate best practices into transportation design of schools. Thus, even though designs have not formally been developed, it can be assumed that separate inbound and outbound access will be developed for the school, sharing the approach discussed previously. For the purpose of this TTD study, it was assumed inbound traffic would access the site via the east Albi approach aligned near Royal Court and exit at the west approach near Hartley Street. Any additional access would promote capacities and performances beyond those stated subsequently with this report.

Figure 1 provides a site location map. **Figure 2** provide a concept plan for Joe Albi. No plans are yet available for the middle school. Site details were largely based on discussion with SPS staff, which could be modified during design processes. The conclusions of this report should largely remain sufficient so long as capacities/attendances don't change substantially, nor include route choices that alter how traffic travels through the Wellesley Avenue/Assembly Street intersection.

Trip Generation Potentials

As indicated, this TTD study primarily addresses PM peak hour traffic conditions. This is the hour City Engineers use in verifying the capacities and adequacies of the street system. However, AM and PM peak generator hour trip generation were also developed to assess school impacts on adjacent streets. Summary trip generation potentials are discussed with the following sections.

The stadium is in operation with much traffic discussed subsequently already reflected in counts. To that end, adjustments were made to counts, as discussed in a following section, to address this occurrence. However, there will be a shift in the distribution and assignment of trips given the new parking configuration. Also, the new middle school will attract trips to that area. As such, full trip generation potentials were assumed to assess new school impacts, and to address a change in assignments at the Wellesley Avenue/Assembly Street intersection, in particular.

Joe Albi Stadium, Attendance

The TTD reviews forecast traffic conditions assuming an 85th percentile attendance condition for the stadium. The 85th percentile condition is used frequently in traffic analyses and design as the maximum or 100 percent attendance condition precipitates need for costly infrastructure. This is of minimum benefit given these extreme attendance conditions occur infrequently during the year.

The 85th percentile attendance condition was based on a review of year 2016 and 2017 event data provided for Joe Albi stadium by SPS officials. Per this data, 69 events occurred on 43 days over two-years between football games and band competitions. Recorded attendance ranged from 270 to 5,335 persons per event with an average of 1,065 attendees and an 85th percentile attendance of 1,425. Peak days included two events with an 85th percentile attendance of 2,375.

To generate a conservative analysis, an 85th percentile day attendance condition with two events was reviewed by this study. The first event included the 1,425-attendees expected with an 85th percentile single event. The second event including 950-attendees, the balance of the 85th percentile day event less the 85th percentile single event (2,375 - 1,425 = 950). A summary of the 85th percentile event conditions assumed for this study are shown with **Table 1** for the weekday.

Table 1. 85th Percentile Attendance Condition

Condition	Attendances
Primary Event 85th Percentile Attendance	1,425
Second Event Attendance	950
85th Percentile Day Attendance	**2,375**

A review of the attendance data indicates 5 out of 43 attendance-day conditions and 6 out of 69 single event conditions had attendances that exceeded the 85th percentile conditions shown with Table 1. The conclusion is the 85th percentile attendance assumption addresses stadium travel demands for most of the year. Moreover, Mead School District officials are working to construct their own stadium, further reducing events and day events that exceed 85th percentile conditions. Mead versus Mt. Spokane was the highest attended event two years running.

Joe Albi Stadium, Trip Generation Potentials

Per SPS records, the first of a two-event day condition typically starts around 4:30 to 5:00 PM on a weekday with the second event starting around 7:00 to 7:30 PM. Attendees leave the first event in the evening while attendees for the second event are approaching the stadium. Thus, the peak demand for the stadium occurs during the timeframe of overlap between the two event conditions; sometime between 6:00 and 7:30 PM. Outbound trips tend to have a higher impact on access operations. As such, the larger event was assumed first as this will generate more outbound traffic during this peak event/design hour.

Land use trip generation is generally forecast using the methodologies outlined in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (10th Edition, 2017). The Manual provides rates and equations used for predicting the traffic characteristics for residential, commercial, employment, and entertainment land uses, and is the most widely applied and accepted resource for trip predictions throughout the Unities States.

However, ITE trip generation regarding this type of sports venue is incomplete and not applicable to the Joe Albi project. As such, an attendance-based approach was developed for estimating trip generation.

The attendance approach relies on travel mode assumption and vehicle occupancy as the basis of estimation. Person trips are calculated and distributed between travel modes as based on data provided by SPS staff. Vehicle occupancy rates are assumed and trip generation is forecast, followed by directional distribution assumptions. Methodology calculations/steps are as follows.

- **Attendance.** This study reviews 85th percentile attendances for the weekday design hour. An attendance potential of up to 1,425 spectators for the first event and 950 spectators for the second event was assumed based on gate data provided by SPS officials. In addition, 250 additional "set" attendees were assumed per event as comprised of teams, coaches, bands, cheer squads, and event staff. These latter set attendees are identified separately due to varying travel mode use. Thus, a total of 1,675 persons were assumed for the first event and 1,200 attendees for the second event.
- **Person Trips.** Forecasts were being developed for the peak/design hour initially, so a ratio of 1-person trip per attendee was assumed. This results in the assumption of 1,675-person trips for the first event and 1,200-person trips for the second event of the stadium.
- **Travel Mode.** The primary travel modes will be personal automobile for spectators and SPS officials indicate school buses are often used to reduce single-occupancy vehicle demands for participates. Spectators were assumed to have an 80-percent personal automobile and 20-percent school bus travel mode split. Conversely, SPS staff indicate most additional attendees (teams, coaches, cheer, etc.) will primarily arrive via bus with some arriving via automobile. As such, 80-percent of these attendees were assumed to arrive by bus with remaining 20-percent by personal automobile. Overall, 1,190-person trips for the first event and 810-person trips for the second event should arrive by automobile, with the balance of 485 first event and 390 second event attendees arriving by school/charter bus.
- **Vehicle Occupancy.** Industry resources indicate a typical range of 2 to 4 persons can be assumed per auto when attending special events. This was confirmed based upon discussions with SPS staff. To assure conservative trip generation potentials, 2.5- persons per auto was assumed for this study, representing the lower end of occupancies resulting in higher trip generation potentials. SPS staff indicate vehicle occupancy in the range of 35-persons per bus is typical with events and this assumption was used for school bus users. This results in 476 automobile trips and 13 school bus trips for the peak/design hour of the first event, for a total of 489 trips. There would be a total of 324 automobile trips and 11 school bus trips for the second event peak/design hour, for a total of 335 trips.
- **Directional Distribution.** After person trips are calculated, travel demand is then thought of in terms of inbound and outbound vehicle trips. Events have heavy inbound distribution prior to the event with heavy outbound distribution following the spectator activity. In this case, a 95 to 5-percent directional split was assumed prior and 5 to 95 percent following special event activities. Thus, a directional split of 24 entering and 465 exiting trips would be calculated for the first event with 318 entering and 17 exiting trips for the second event.
- **Peak/Design Hour Volumes.** The last step is to combine event volumes noted above, with the result of 342 entering trips and 482 exiting trips forecast for the peak/design hour for a total of 824 trips.

Summary calculations are shown in **Table 2** for the design hour. These are trips approaching and departing the stadium between two consecutive events on the 85th percentile attendance day.

Table 2. Trip Generation Potentials, Joe Albi Stadium				
Calculation/Step	**First Event**		**Second Event**	
Attendees				
- Spectators	1,425		950	
- Set Attend. (Players, Coaches, Refs, etc.)	250		250	
Total Attendees	1,675		1,200	
Person Trips (1 trip per person)	1,675		1,275	
Travel Mode, Spectators				
- Automobile (80%)	1,140		760	
- School Bus (20%)	285		190	
Travel Mode, Set Attend.				
- Automobile (20%)	50		50	
- School Bus (80%)	200		200	
Travel Mode, Total				
- Automobile (20%)	1,190		810	
- School Bus (80%)	485		390	
Vehicle Occupancy				
- Automobile (2.5 persons/veh)	476		324	
- School Bus (35 persons/bus)	13		11	
Trip Totals	489		335	
Vehicle Distribution	In (5%)	Out (95%)	In (95%)	Out (5%)
- Trips	24	465	318	17
Peak/Design Hour Trips	**342 inbound**		**482 outbound**	
	824 Total Design Hour Trips			

Weekday trip generation for a shouldn't markedly exceed that of peak hours given there is nominal campus operation outsides these times. However, for evaluations discussed subsequently, a 115-percent forecasting factor was used to estimate a weekday trip total of approximately 950 trips.

New Northwest Middle School, Trip Generation Potentials

Trip generation for the new middle school was established using the methods outlined by the *Trip Generation Manual*. This resource provides solid data from which to base travel for the school, as compared with the stadium. ITE Land Use Code 522 was used to calculate trips using rates that equate travel density to the 750-student capacity.

A summary of trip generation is shown with **Table 3** for weekday and AM and PM peak generator hours, and for the PM peak hour of the work commute. A generator hour is the timeframe of peak trip generation for a proposed facility; in this case, from about 8:15 to 9:15 AM and 2:45 PM to 3:45 PM. These hours reflect the drop off and pickup timeframes of students in relation to the 9:00 AM start and 3:30 PM departure bells.

Table 3. Trip Generation Potentials, New Northwest Middle School										
		AM Generator Hour			PM Generator Hour			PM Peak Hour		
Land Use	**Weekday**	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
School, 750 students	**1,600**	**289**	**236**	**525**	**121**	**142**	**263**	**62**	**66**	**128**

As shown, the middle school would generate approximately 1,600 weekday trips assuming an attendance of up to 750 students. About 525 trips would occur during the AM generator hour, 263 trips during the PM generator hour, and 128 trips during the PM peak hour. The peak hourly trips shown would comprise 8 percent of all weekday trips generated by the proposed school.

SPS Projects, Trip Generation Potentials

The purpose of a TTD or any similar design-level traffic study is generating conservative (high), yet reasonable, forecasts from which to help vet capacity issues and improvement need. The final step in the process was combining trip generation potentials for the stadium and the school, with results primarily being an assessment of weekday and PM peak hour trip totals from which to base capacity evaluations. This is conservative because PM peak hour volumes may overlap for the two land uses, but not necessarily occur concurrently. Thus, the capacity discussions provided subsequently should be considered comparable to an 85th percentile design evaluation as the resulting forecasts should address 85-percent of hourly conditions throughout the typical year. A summary of trip generation totals for the project is provided with **Table 4**.

Table 4. Trip Generation Potentials, SPS Project Totals

Land Use	Weekday	PM Peak Hour		
		In	Out	Total
Joe Albi Stadium	950	342	482	824
Middle School	1,600	62	66	128
Total	**2,550**	**404**	**548**	**952**

As shown, SPS projects would generate a total of 2,550 weekday trips. About 952 of these trips would be generated during the PM peak hour.

Trip Distribution and Assignment

Trip distribution and assignment is the process of identifying likely travel for development-related traffic, in this case for Joe Albi stadium and the Northwest Middle School. The traffic generated by the development must be distributed and assigned to analyze impacts to the roadway and intersection network within a reasonable study area.

This study used a simple two-step approach in estimating travel patterns for the SPS proposal. First, average daily traffic (ADT) counts were obtained from the City Street Department portal for Wellesley Avenue and Assembly Street. Counts were compared to get a sense of traffic densities on adjacent roadways. Distributions were established initially based on this comparison as these counts, emulating how drivers are traveling the area. Later, it is identified that ADT counts were collected to support capacity evaluations for this TTD. However, City counts were used in the distribution process as consistency was desired for this comparison/analysis process.

These “raw” count-based distributions were adjusted to account for the origin-destination factors in comparing the site location with areas from which patrons and/or students would be traveling. This resulted in separate distribution patterns developed for Joe Albi and the School, respectively.

Joe Albi Stadium, Trip Distribution Estimates

Spokane Public Schools is part of the Greater Spokane League when it comes to sporting events and associated extracurricular activities. The League is comprised of Ferris, Gonzaga Preparatory School, Lewis and Clark, Shadle, Rogers, North Central, Central Valley, University, Mt. Spokane, and Mead High Schools. Three of these schools are situated essentially north and east of the Joe Albi with near-vicinity approach/departure routes that include Assembly Street to the north and Wellesley Avenue to the east (traveling arterials such as Francis Avenue, A Street, the Maple/Ash couplet, etc. to access these roads). There are seven schools essentially situated to the south and east of Joe Albi with near-vicinity approach/departure routes that include Assembly Street to the south and Wellesley Avenue to the east (using periphery arterials like Northwest Boulevard,

Driscoll Boulevard, the Maple/Ash couplet, and even I-90, etc. to access these roads). Given this understanding, it can be generally surmised that about 30-percent of high school traffic can be anticipated to/from the north and east with 70-percent to/from the south and east.

However, we still must understand how travelers enter and exit this area, as based on raw count data. Thus, the final step is raw count-based distributions were reconciled with the 70-30 origin-destination adjustments to provide a cumulative assessment of just how travelers are likely to approach and depart the stadium using Assembly Street and Wellesley Avenue. A summary of the adjusted distributions used for the study for Joe Albi are summarized with **Table 5**.

Table 5. Trip Distribution Analysis and Forecasts, Joe Albi Stadium

Location	Volume Average	Raw Count Distribution	O-D Raw Distribution	Forecast Distribution
Assembly St N/of Wellesley Ave	10,600	40%	½ of 30%	25%
Assembly St S/of Wellesley Ave	11,200	42%	½ of 70%	40%
Wellesley Ave E/of Assembly St	4,900	18%	½ of 30% + ½ of 70%	35%
Total Cordon/Screen Line	**26,700**	**100%**	**100%**	**100%**

The east and west approaches along Wellesley Avenue and the Dwight Merkel approach along Assembly Street are anticipated to support site trips. Travel distance was used as the basis for approach distributions, meaning travelers are most likely to use the shortest distance of travel in accessing different parking areas surrounding the stadium. Given this supposition, about 30-percent of trips are anticipated at the west and 40-percent east approach along Wellesley Avenue. About 30-percent of trips are expected to use the Dwight Merkel approach of Assembly Street.

New Northwest Middle School, Trip Distribution Estimates

SPS officials have yet to perform a districting process for the School. With that said, Glover Middle School is 1.6 miles to the east on Wellesley Avenue and Salk Middle School is 2.6 miles to the northeast traveling Assembly Street or A Street and Francis Avenue. To gain a sense of potential attendance districting, boundaries were assumed about equidistant from existing schools with Rowan Avenue being the approximate northerly boundary (0.5-miles), to about the G Street alignment to the east (0.8-miles), and then Garland Avenue to the south (0.5-miles).

Not including the project site, this district would encompass about 1.4 square-miles. About 0.8 square-miles (57-percent) would be most directly accessed by Assembly Street north of Wellesley Avenue. About 0.3 square-miles (21-percent) would be most directly accessed by Wellesley Avenue east of Assembly Street. About 0.1 square-miles (8-percent) would be most directly accessed by Assembly Avenue south of Wellesley Avenue. Finally, about 0.2 square-miles (14-percent) would be accessed by Wellesley Avenue west of Assembly Street.

The count and area-based origin/destination information above was reconciled as before, but with the addition of counts on Wellesley Avenue west of Assembly Street. A typical weekday count of 2,950 ADT, from data collected to support this study (described subsequently) was included into the factoring process. This additional count was included because there is a residential area south of the stadium area that could generate school trips. With the prior distributions, the distribution analysis was accounting for approach and departure routes from area high schools.

Revised raw distributions and described area assumptions were compared to estimate arrival and departure assumptions between the Middle School with Assembly Street and Wellesley Avenue. Summary distribution assumptions are shown with **Table 6**.

Table 6. Trip Distribution Analysis and Forecasts, New Middle School				
Location	Volume Average	Raw Distribution	O-D Raw Distribution	Forecast Distribution
Assembly St N/of Wellesley Ave	10,600	36%	57%	45%
Assembly St S/of Wellesley Ave	11,200	38%	8%	25%
Wellesley Ave E/of Assembly St	4,900	17%	21%	20%
Wellesley Ave W/of Assembly St	2,940	10%	14%	10%
Total Cordon/Screen Line	**29,640**	**100%**	**100%**	**100%**

The east Wellesley Avenue approach at Royal Court was assumed to serve inbound school trips with outbound trips assumed at the west Hartley Street approach. Inbound and outbound trips were separated as counterclockwise operations is assumed through the site, as standard practice in the safe mobilities of school traffic. Again, provision of another driveway would only serve to distribute trips further and provide more sufficient adequacies in accessing one or both projects.

Trips were assigned to streets based on described distribution patterns for Joe Albi and the Middle School. The resulting weekday and PM peak hour assignments are shown with **Figure 3**.

Traffic Volumes

This study primarily reviews traffic conditions based on review of the weekday and PM peak hour. Counts were performed with intention of collecting data outside and during sporting operations, for purpose of comparison. Tube and turn movement counts were collected to support this study.

Tube Counts. 24-Hour/tube counts were collected for Assembly Street and Wellesley Avenue on Wednesday, Thursday, and Friday of October 23 to 25 and October 30 to November 1. Sporting events occurred on Thursday and Friday of both weeks. Summary highlights from tube counts are shown with **Table 7**. Shown are weekday and peak hourly counts for Assembly Street and for Wellesley Avenue during the weekdays noted above. Also shown is the start of each peak hour counted from these timeframes.

Table 7. Summary Tube Counts, Wellesley Avenue and Assembly Street						
	Wednesday		Thursday		Friday	
Location	10/23/2019	10/30/2019	10/24/2019	10/31/2019	10/25/2019	11/01/2019
Assembly St N/of Wellesley Ave						
- ADT Count	11,955	11,135	12,665	11,910	12,840	11,840
- AM Peak Hour Count	7:00 AM, 1043	6:45 AM, 979	7:15 AM, 1087	7:15 AM, 1039	7:15 AM, 898	6:45 AM, 867
- PM peak Hour Count	3:45 PM, 1049	4:40 PM, 965	4:30 AM, 1126	4:00 PM, 1055	3:15 PM, 1065	4:15 PM, 1015
Assembly St S/of Wellesley Ave						
- ADT Count	14,730	Bad Count	15,280	Bad Count	16,211	Bad Count
- AM Peak Hour Count	7:00 AM, 1487	Not Available	7:15 AM, 1522	Not Available	7:00 AM,1303	Not Available
- PM peak Hour Count	4:00 PM, 1290		4:30 AM, 1260		315 PM, 1270	
Wellesley Ave E/of Assembly St						
- ADT Count	3,095	3,340	3,530	3,740	3,895	3,990
- AM Peak Hour Count	7:45 AM, 200	11:00 AM, 240	7:45 AM, 224	11:00 AM, 264	11:00 AM, 265	11:00 AM, 247
- PM peak Hour Count	5:15 PM, 316	3:15 PM, 314	4:00 PM, 350	4:30 PM, 374	4:00 PM, 403	4:30 PM, 342
Wellesley Ave W/of Assembly St						
- ADT Count	2,915	2,940	3,585	3,490	4,315	4,194
- AM Peak Hour Count	7:00 AM, 364	7:00 AM, 352	7:00 AM, 352	7:00 AM, 354	7:00 AM, 330	7:00 AM, 321
- PM peak Hour Count	3:45 PM, 363	3:45 PM, 365	4:00 PM, 467	3:45 PM, 451	6:45 PM, 626	3:45 PM, 548

A few conclusions are derived from the counts shown with Table 6. First, ADT volumes are higher on Fridays versus Wednesdays and Thursdays. ADT counts are higher on Thursdays versus Wednesdays. Typically, Friday counts tend to be higher than weekday counts as travelers have work and recreation-commutes during the day. However, count differentials are enough to conclude that Joe Albi activities influence travel on Friday.

In fact, the average count on Wellesley Avenue west of Assembly Street is 1,327 ADT higher on Fridays versus Wednesdays and 610 ADT higher on Thursdays versus Wednesdays. A prediction of 950-weekday trips for the existing stadium appears to fall within this range, even factoring high Friday recreational travels. Trip generation prediction appears to be reasonable as compared with existing traffic counts.

Turn Movement Counts. Turning movement counts were performed for the Wellesley Avenue/Assembly Street intersection Wednesday October 23 through Friday October 25, 2019. These counts help with the analysis of intersection capacities. The objective is to determine when total entering volumes (TEV) occur so conservative evaluations can be prepared. Counts were performed from 3:00 to 6:00 PM with the peak hour volume from each count identified and used in daily TEV comparisons.

The three-day count data is shown right with TEV ranging from 1,359 on Wednesday to a high of 1,438 on Friday. Friday turn movement counts were used in the capacity analysis discussed later as they were 5 to 79 TEV higher than the other counts. The Friday count should already reflect some degree of Joe Albi activity (with most stadium activities occurring after this time); thus, use of this data should be considered conservative and useful in establishing a design hour as some duplicity occurs in trip generation potentials.

Note, peak hour approach volumes can differ from ADT/tube counts to turn movement counts for two reasons. First, the intersection peak is driven by all turning traffic at an intersection, not just the approach volumes. Second, tube counts are typically placed away from intersections (clear of controls, turn lanes, etc.) and traffic can divert from roads and driveways located between tube apparatus and an intersection.

Turning Movement Counts

Wednsday 10/23/2019 (4:00 to 5:00 PM)

				419	1046	627					
				IN		OUT					
				49	317	53					
				SBR	SBT	SBL					
125	OUT	111	EBL	TEV =			WBR	54	IN	128	
441		83	EBT	1359			WBT	54		276	
316	IN	122	EBR				WBL	20	OUT	148	
				NBL	NBT	NBR					
				22	462	12					
				OUT		IN					
				459	955	496	PHF = 0.91				

Thursday 10/24/2019 (4:30 to 5:30 PM)

				447	1051	604					
				IN		OUT					
				67	287	93					
				SBR	SBT	SBL					
225	OUT	109	EBL	TEV =			WBR	77	IN	198	
527		86	EBT	1433			WBT	108		395	
302	IN	107	EBR				WBL	13	OUT	197	
				NBL	NBT	NBR					
				50	418	18					
				OUT		IN					
				407	893	486	PHF = 0.93				

Friday 10/25/2019 (4:00 to 5:00 PM)

				425	1125	700					
				IN		OUT					
				85	277	63					
				SBR	SBT	SBL					
223	OUT	105	EBL	TEV =			WBR	87	IN	186	
474		58	EBT	1438			WBT	82		319	
251	IN	88	EBR				WBL	17	OUT	133	
				NBL	NBT	NBR					
				56	508	12					
				OUT		IN					
				382	958	576	PHF = 0.93				

Traffic Forecasts

Year 2022 forecasts are normally comprised of baseline growth plus the assignment of trips generated by Joe Albi and the Middle School. Historical traffic counts available from the City Street Department were reviewed for a period extending from 1992 to 2019 near the Wellesley Avenue/Assembly Street intersection. A linear regression analysis was performed to identify historical trends. The analysis indicates traffic has been increasing at a 1.2-percent annual growth rate on Wellesley Avenue and a 0.6-percent annual growth rate on Assembly Street.

Normally, counts are adjusted with the baseline rate to address non-project related growth within a study area. The application of a 1 or 2-percent growth rate over three years (since the collection of counts) would result in roughly a 3.1 to 6.1 percent total growth rate, when compounded over three years. However, turn movement counts on Friday were nearly 6-percent higher than counts on Wednesday, and there was a greater disparity noticed with tube/daily counts.

As such, NO baseline growth was addressed in the year 2022 analysis condition. The peak Friday counts were used from the perspective higher turning volumes, to assure a conservative analysis, but it does not make sense to reflect growth upon growth using rates. Project trips were combined with existing counts to generate year 2022 buildout forecasts shown with attached worksheets.

Note a PM peak hour analysis was performed for the school approach and the Rowan Avenue and Assembly Street intersection. For the analysis, traffic volumes were extended/extrapolated to establish through volumes at identified locations, assuming a 50-percent volume reduction to the Veterans Hospital and a shopping center. Turning volumes were assumed at Assembly Street/Rowan Avenue so some form of forecast capacity analysis could be performed. Turning volumes were also assumed at Hartley Street and Royal Court given driveway alignments.

LOS/Capacity Analysis

A LOS analysis was performed to forecast capacities for project approach and Wellesley Avenue/Assembly Street, as this intersection would be most impacted by approaching and departing trips. The analysis was performed using SIDRA Network 8.0 (Akcelik, 2019), a software tool that applies the methods of the current Highway Capacity Manual (TRB, 2016). This software was selected over Synchro, the City typical application, to provide consistency between all-way stop and roundabout analyses. The roundabout analysis was requested by the City a, discussed subsequently, as this improvement is planned for the Wellesley Avenue and Assembly Street intersection.

LOS are the function of control delays experienced by drivers at a stopped signal movement, stop sign, or yield sign. The LOS A through LOS F scales help quantify driver experiences and expectations, with different control delay thresholds used for signals and roundabouts versus all or two-way stops (the City uses signal delay thresholds for roundabouts, similar to WSDOT practice). The City maintains a LOSE standard (within this area) given the LOS A (free flow) to LOS F (congested) mobility range. Improvements may be warranted when intersections and stopped approaches do not meet this LOS standard.

Wellesley Avenue is a two-lane *urban principal arterial* east of Assembly Street with sidewalk, curb, and gutter and a posted speed limit of 35 mph. West of Assembly street, this is a 25-mph two-lane *local street* extended mostly without sidewalk, curb, or gutter. Assembly Street has a core three-lane cross section, less widening to five-lanes just north and south of the Wellesley Avenue intersection. This is an *urban principal arterial* through the study area with a posted speed of 30 mph.

Wellesley Avenue/Assembly Street is an all-way stop with 100-foot left-turn pockets provided for northbound and southbound traffic, as well as two through lanes in each direction. Right turns are performed from outer lanes on both intersection approach. There are only single approach lanes located in the eastbound and westbound directions from which all through, left, and right-turns are performed.

Future SPS driveways on Wellesley Avenue were assumed to be stop-controlled with no turn lanes. The east and west approaches to Rowan Avenue are stop-controlled at Assembly

Street. There are northbound (115-pocket) and southbound (75-foot pocket) left-turn lanes with an eastbound right-turn pocket provided within the eastbound approach.

A summary of resulting LOS for the Wellesley Avenue/Ass intersection and future site driveways is shown with **Table 8** for the PM peak hour. Also shown is average vehicle control delays for each location. LOS is the function of the average control delay for all movements at a signalized intersection or all-way stop, or the worse approach or movement at a one or two-way stop.

Table 8. Year 2022 Summary LOS

All-Way Stop	PM Peak Hour LOS	PM Peak Hour Delay
Wellesley Ave/Assembly St		
- Existing	E	37.4
- Future With-Project	F	115.3
One or Two-Way Stop	**PM Peak Hour LOS**	**PM Peak Hour Delay**
Rowan Ave/Assembly St		
- Future With-Project	F	95.6 (EB)
Wellesley Ave/East Drive/Hartley St		
- Future With-Project	E	35.2 (SB)
Wellesley Ave/West Drive/Royal Ct		
- Future With-Project	B	13.2 (SB)

Forecast LOS conditions were provided for the Wellesley Avenue and Assembly Street approach and the Wellesley Avenue/Assembly Street intersection. As shown, the intersection currently functions in the LOS E range, dropping to LOS F under the with-project condition. The Rowan Avenue/Assembly intersection is also forecast at LOS F, a function of the eastbound approach, but LOS F was noted for the westbound approach as well. All southbound site approaches are forecast to function at LOS E or better during the PM peak hour, an acceptable condition.

The forecast 95th percentile queues of note from summary worksheets include:

- The eastbound lane for Wellesley Avenue/Assembly Street is forecast at 49-vehicles.
- The northbound through lanes at Wellesley Avenue/Assembly Street are forecast at 12.5 vehicles per lane.
- The eastbound lane at Rowan Avenue/Assembly Street is forecast at 6 vehicles.

The majority of these 95th percentile queue potentials are due to a release of traffic following a sporting event and would not occur otherwise.

Street Capacity

An ancillary capacity evaluation was performed to quantify overall mobility of Wellesley Avenue following development of SPS projects. Street capacity was reviewed per guidelines provided with the *Quality/Level of Service Handbook* (Florida DOT, 2013). This method predicts ADT capacity thresholds for various LOS categories based on HCM measures versus roadway cross sections.

A LOS C capacity standard is typically used for local streets and LOS D for arterials. The higher standard is used for arterials because drivers expect increased traffic densities and delay along more primary commute/travel routes versus local streets. The thresholds for collectors are typically taken as the average calculated between the local and arterial street limits, as drivers have a higher degree of congestion expected, but not to the level of an arterial.

Capacity thresholds were identified from generalized LOS-volume tables shown with the appendix of the above referenced Handbook, and then modified to reflect suburban routes with posted speeds of less than 35-mph. The resulting capacity volume thresholds for locals, collectors, and arterials is shown with **Table 9** for two-way streets. These are the upper limits in daily traffic a street can support theoretically prior to experiencing an unsatisfactory LOS. These thresholds are not finite; rather, just an approximation of capacity limitations.

Table 9. Trip Distribution Analysis and Forecasts, New Middle School

Road Class	2-Lanes	3-Lanes	4-Lanes	5-Lanes	6-Lane	7-Lanes
Local	5,700	6,000	8,300	8,700	13,400	14,100
Collector*	8,700	9,200	16,200	17,000	25,500	26,800
Arterial	11,700	12,300	24,100	25,300	37,500	39,400

Source: Adapted from Quality/Level of Service Handbook (Florida DOT, 2013)

A volume-to-capacity (V/C) ratio is a metric used to represent capacity versus volume standards numerically. When a V/C of 1.0 is surpassed for a LOS standard, the practical capacity of the roadway is exceeded. A general practice is to start planning for roadway improvements when a V/C exceeds 0.80, as traffic is “approaching” standard.

The City does not formally review arterial capacity in assessing concurrency, but this has been provided as a planning tool to help the City understand the performance of Wellesley Avenue adjacent to the school specifically.

Capacity Results. Traffic counts range from 2,915 to 4,315 ADT on Wellesley Avenue west of Assembly Street, the street segment with the highest potential impact from SPS projects. As compared with turn movement data, ADT counts distinctly reflect the existing traffic activities of Joe Albi. Thus, for this analysis, the peak Wednesday ADT count was used in forecasting as it should not reflect stadium activities. From Table 7, the peak Wednesday count is 2,940 ADT.

Traffic was forecasts as described previously. Counts were combined with ADT forecasts for the stadium and new middle school, less baseline growth. A summary of the forecasting process and the resulting future with-project ADT is as follows:

Forecast ADT** = 2,940 (existing) + 580 (Albi) + 1,450 (School) = **4,970 ADT

As shown, 4,970 ADT is forecast by year 2022 along Wellesley Street west of Assembly Street following construction of SPS projects. This compares with a threshold volume of 5,700 ADT for a local street to maintain overall mobility, calculating to a V/C of 0.87. This V/C indicates volumes are “approaching” standard for a two-lane local street. Note that street capacity analysis does not address design standards the City may have for a two-lane roadway.

Wellesley Avenue/Assembly Street Roundabout

As indicated, Wellesley Avenue/Assembly Street would function in the LOS F range with baseline growth combined with SPS project development. An analysis was performed to assess design factors to establish a roundabout sufficient to address long-term forecasts. Engineering designs are traditionally established using 20-year horizon. A 1.0-percent annual growth rate was used to forecast year 2040 traffic volumes for the PM peak hour, a rate that better reflects historical trends. This results in 123.3-percent growth overall, with volumes shown with **Figure 3**.

Roundabout geometric needs were established using SIDRA 8.0 (Akcelik, 2019), an intersection operation analysis software. SIDRA was used to establish overall dimensions as based on traffic

forecasts. The analysis (capacity/operations) was performed based on PM peak/commute hour forecasts, as the design hour of the weekday.

The SIDRA analysis was provided in compliance with "WSDOT Sidra Policy Settings," as per local practices. A summary of factors/assumptions used in the analysis include:

- Lane geometries set to a width of 15 feet.
- The Capacity evaluation is based on calculations provided by Sidra standard.
- LOS comparisons are based on criteria provided for signalized.
- Geometric delays are not included in the analysis.
- A circulating width of 18 to 20 feet for a single lane roundabout.
- An entry radius of 90' assumed.
- A 1.0 environmental factor is used in calculations.
- Unbalanced flows were reviewed per Sidra.

WSDOT Policy indicates a desirable condition occurs when roundabout lane groups experience V/C of less than 0.90. This criterion was used as a basis for geometric determinations with roundabout analysis, both for the intersection overall and for individual intersection approach.

Capacity Results. The analysis assumes a 140 to 150-foot diameter roundabout with dedicated northbound lefts and eastbound right-turn lanes to provide capacity for heavier turn movements. This established need for a double circulatory lane on the east side of the roundabout to address through and turn movements. An additional southbound receiving lane would also be necessitated to accommodate right-turn volumes. The remainder of the intersection was assumed to have single approach and existing lanes, as well as single circulation lanes. The resulting performances are shown with **Table 10** for the PM peak/design hour.

Table 10. Year 2040 Summary Performances

Roundabout	PM Peak Hour		
	LOS	Delay	V/C
Wellesley Ave/Assembly St			
- Northbound Approach	A	5.8	0.58
- Southbound Approach	A	6.7	0.63
- Eastbound Approach	A	5.4	0.49
- Westbound Approach	B	8.9	0.61
- **Total Intersection**	**A**	**8.3**	**0.63**

As shown, this roundabout would function within the LOS A/B range for all approaches, and for the intersection overall. A LOS E or better condition is desired, so the intersection functions within this tolerance. Control delays are shown to be at 8.9 seconds or less and the V/C 0.63 or less for approaches, and the intersection overall. A V/C ration of 0.90 is desired for all movements and overall; thus, operations are also within this tolerance. Finally, the 95th percentile queues were reduced to 6-vehicles or less on all approaches to the intersection, let alone the critical eastbound and westbound approaches noted for the all-way stop.

This roundabout (design evaluated) should address forecast year 2040 volumes for the PM peak/design hour. Any reduction from recommendations would yield a V/C greater than 0.90.

School Approach

A LOS/capacity analysis was performed to review the performance of driveways during the peak generator hours of the Middle School. As shown with Table 3, there are about 525 trips generated by the school during an 8:15 to 9:15 AM generator hour. From tube counts on Wellesley Avenue west of Assembly Street, a peak through volume (both directions of 156 vehicles was noted during this timeframe on October 30. Per Table 3, 263 trips are generated by the school during the 2:45 to 3:45 PM generator hour. Peak through volumes of 325 were noted on Wellesley Avenue on October 31. These volumes were used to evaluate forecast driveway capacities.

Project trips were combined with counts to develop forecast volumes, with no growth rate applied to assure consistency in methodology. Only school trips were assigned to streets for this analysis based on the distributions discussed previously with no assignments addressed for Joe Albi, as stadium operations would not occur during generator hours. The resulting summary approach volumes are shown with **Figure 3** for the peak generator hours.

The LOS analysis was performed using SIDRA with the results shown with **Table 11** for the peak generator hours. Again, recall LOS is the function of the stopped movement at driveways with the east driveway assuming bus activity only, the center driveway inbound parents and employee movements, and the west outbound parent/employee movements.

Table 11. Year 2020 Summary Driveway LOS, AM and PM Generators

	AM Generator Hour		PM Generator Hour	
One-Way Stop	LOS	Delay		
Wellesley Ave/East Drive/Hartley St	B	12.2	B	11.7
Wellesley Ave/West Drive/Royal Ct	B	11.3	B	12.6

As shown, driveways would function in the LOS A/B range during school peak generator hours. This means the proposed driveway configuration with one inbound/outbound bus approach, one inbound parent/staff approach, and one outbound parent/staff approach would be sufficient to address the normal operations of the proposed Northwest Middle School. 95th percentile queue potentials were also shown to be nominal (less than three to four vehicles) during these hours.

Summary and Recommendation

Officials with SPS in Spokane have proposed to reconstruct Joe Albi Stadium to a reduced seating capacity of 6,000 attendees and construct a new Northwest Middle School to a capacity of up to 750-students on a site located northwest of the Wellesley Avenue/Assembly Street intersection.

Projects would be accessed by an approach in alignment with Hartley Street and one moderately offset from Royal Court along Wellesley Avenue. Access to Joe Albi would also be secured from an approach in alignment with Rowan Avenue along Assembly Street, currently accessing Dwight Merkel. The Joe Albi complex would have three paved parking areas north, south, and east of the stadium. It is assumed access to the Middle School would have counterclockwise circulation from the east/Royal Court approach to the west/Hartley Street approach along Wellesley Avenue, per standard safe practices with schools.

Extensive traffic counts were collected to help assess the current impact of Joe Albi on the area, and to also help with development of traffic forecasts. A capacity evaluation was developed based on a review of weekday and PM peak hour traffic forecasts developed for the 2022 completion year of both projects. Traffic forecasts were developed assuming conservative trip generation, with the resulting 85th-percentile volumes meant to present design-hour and design-weekday

traffic conditions. Both projects are forecast to generate a potential of 2,550 weekday trips with 952-trips generated during the PM peak hour.

Capacity issues are forecast at Wellesley Avenue/Assembly Street and Rowan Avenue/Assembly Street, as determined through LOS, control delay, and/or queueing analysis. The City has planned a roundabout at Wellesley Avenue/Assembly Street. A year 2040 analysis, a design analysis in compliance with regional planning practices, was performed to help recommend a geometric footprint for this intersection. It was determined a primarily single lane roundabout with a designated northbound left-turn departure and westbound receiving lane to/from Wellesley Avenue and an eastbound right-turn lane with a southbound receiving lane along Assembly Street would be sufficient to accommodate forecast traffic volumes. These long-range volumes included SPS project trips plus additional growth through year 2040, with appropriate mobility/capacity compliances established based on LOS, the V/C ratio, and queuing.

To be clear, the need for this roundabout would be apparent in the future without SPS projects. The analysis was performed to determine what capacities may be warranted as a result of current traffic, baseline growth, and the stadium and school projects.

Although the Rowan Avenue/Assembly Street intersection does experience a forecast LOS issue, this congestion is only expected to occur following special events. Thus, the recommendations section subsequent discusses mitigation strategies in alternative to physical improvements. A street capacity analysis indicates Wellesley Avenue should have the practical capacity to address SPS traffic as a two-lane facility. An analysis of middle school peak generator hours, without Joe Albi activities indicates sufficient approach operations without need for additional improvements.

Recommendations and Conclusions

The study has developed design recommendations to assist the City with infrastructure planning. The following actions are recommended to accommodate forecast traffic volumes:

- The Wellesley Avenue/Assembly Street roundabout can largely have singular circulation lanes and approach/departure lanes. Recommended additions include northbound left and eastbound right-turn lanes with added exiting/departure lane for the west and south legs of the intersection. This would maintain capacity through year 2040.
- Although LOS standard is met for site driveways and the cross-section of a two-lane street, Wellesley Avenue is not constructed to a typical design standard sufficient for multi-modal travel; meaning the bikes and pedestrians associated with the Middle School. To that end, frontage improvements of half street widening, sidewalk, curb, and gutter should be provided along property fronts controlled by the District to address this need.
- Rowan Avenue/Assembly Street would experience LOS/capacity following well attended events. There is minimal benefit in constructing physical improvements that are only used seasonally a few times per year. Thus, continued use of traffic control personnel to direct vehicles at congested areas, including the Rowan Avenue/Assembly Street intersection and approach along Wellesley Avenue should be considered for high-attendance events.

Project participation in recommendations would be coordinated between SPS and City officials. This study supports provision of a certificate of concurrency for the proposed development actions following coordination/agreement with City officials. Here ends the transportation threshold determination prepared for Joe Albi Stadium and the Northwest Middle School proposals. Please contact our office with questions or comments.

Prepared by William (Bill White), T-O Engineers
In Association with Christopher J. Reich, P.E., Reich Engineering, LLC

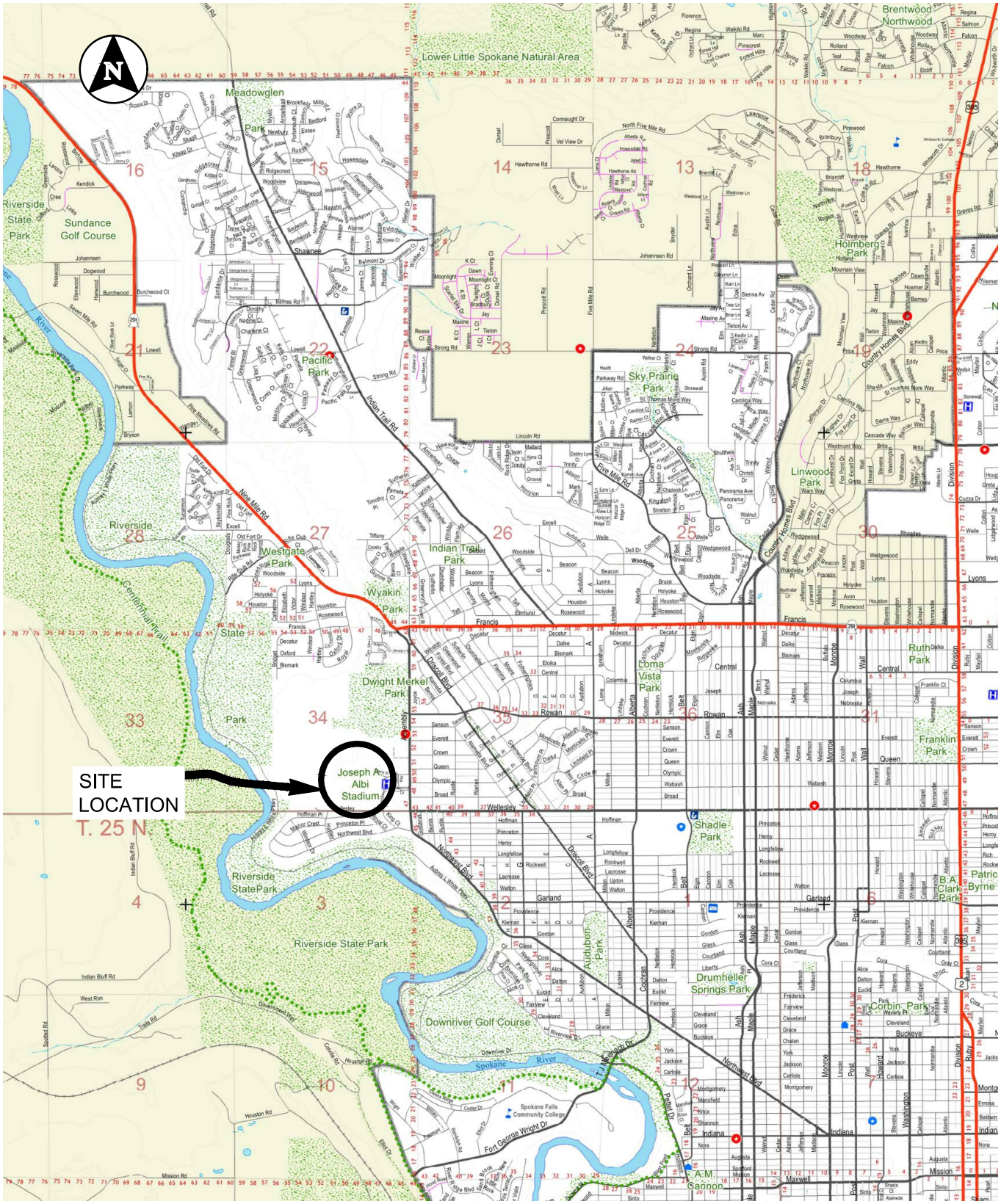


FIGURE 1

SITE LOCATION MAP

JOE ALBI STADIUM AND NEW MIDDLE SCHOOL PROJECTS

T-O ENGINEERS

121 W. PACIFIC AVENUE SUITE 200
SPOKANE, WA 99201

PHONE: (509) 319-2580 WWW.TO-ENGINEERS.COM

E-FILE: 190578_JoeAlbi_Figures.dwg DATE: 3/16/20 JOB: 200063

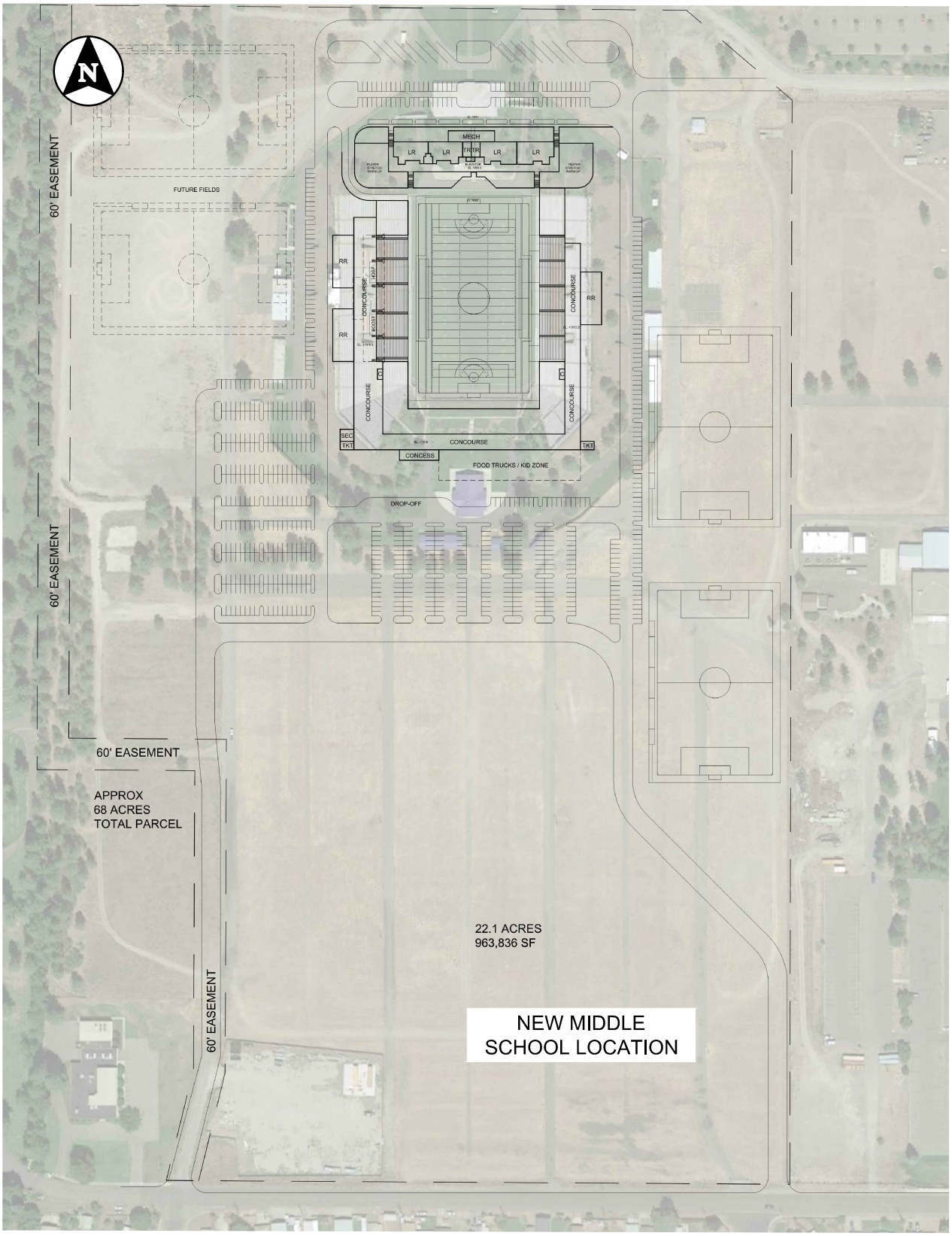


FIGURE 2

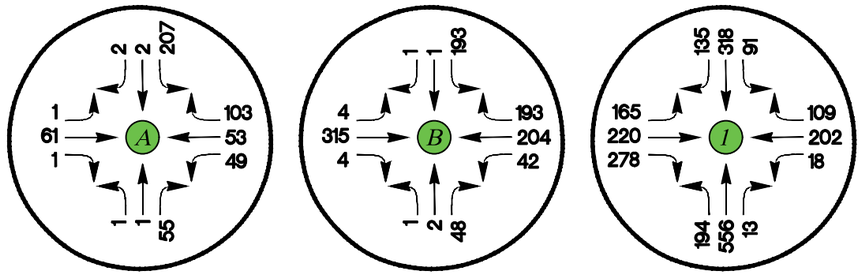
CONCEPT SITE PLAN

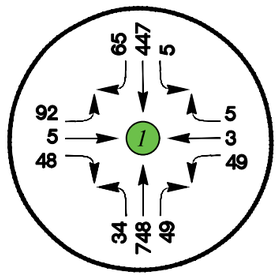
JOE ALBI STADIUM AND NEW MIDDLE SCHOOL PROJECTS

T-O ENGINEERS
121 W. PACIFIC AVENUE SUITE 200
SPOKANE, WA 99201
PHONE: (509) 319-2580 WWW.TO-ENGINEERS.COM

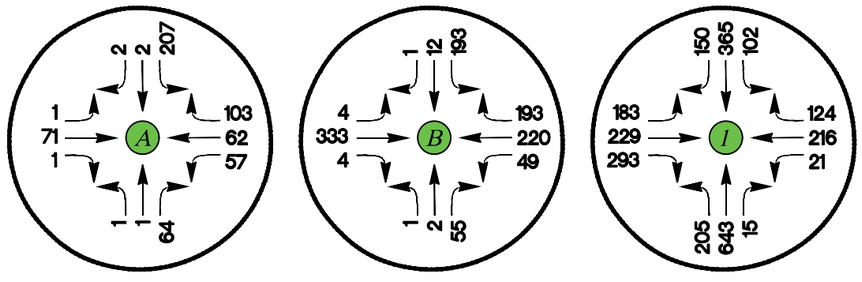
E-FILE: 190578_JoeAlbi_Figures.dwg DATE: 3/16/20 JOB: 200063

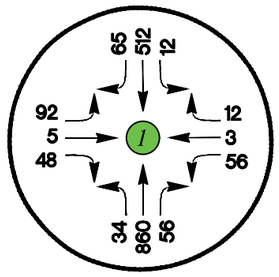
FORECAST YEAR 2022
PM PEAK HOUR





FORECAST YEAR 2040
PM PEAK HOUR





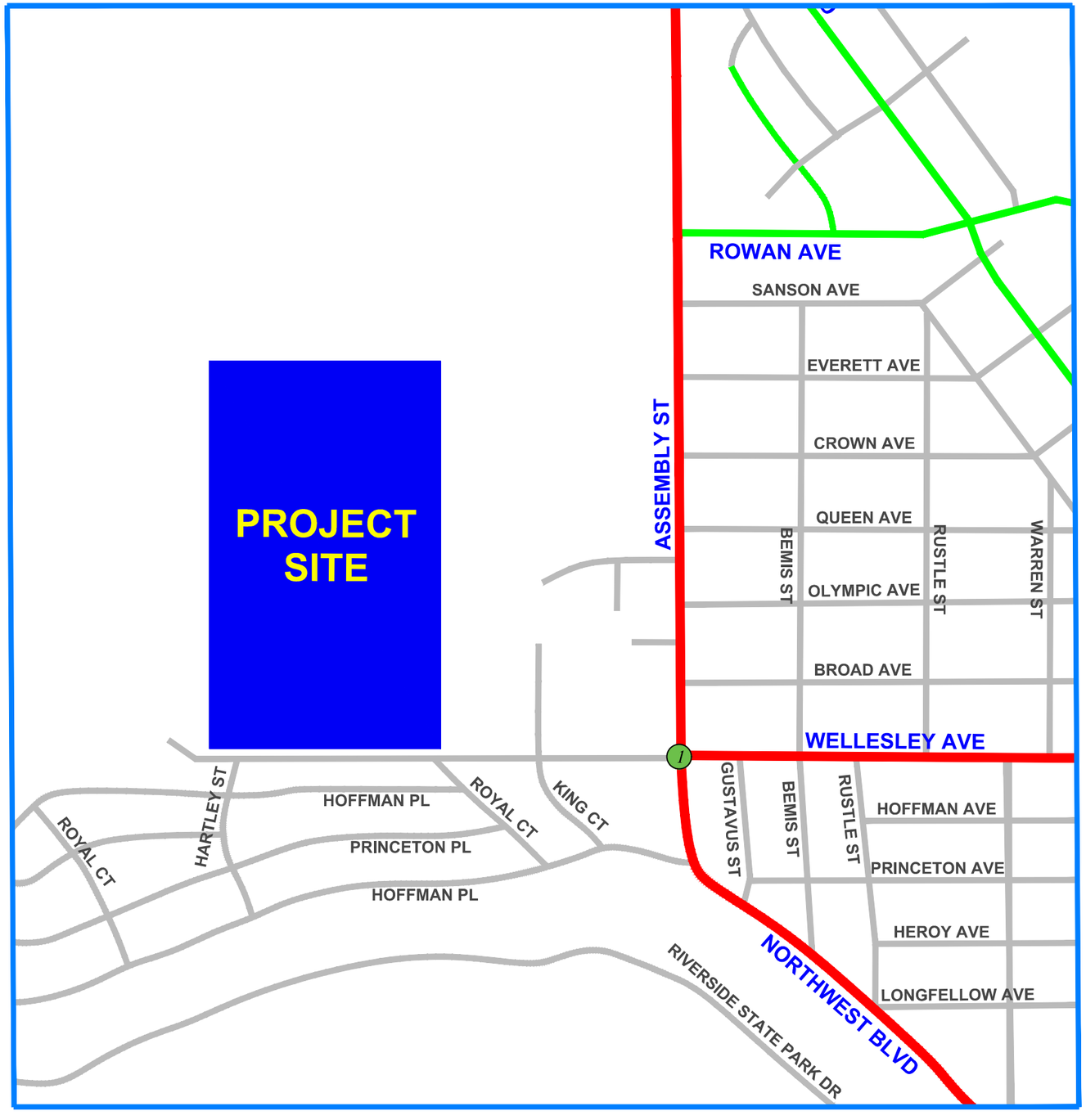


FIGURE 3
TRAFFIC FORECASTS
JOE ALBI STADIUM AND NEW MIDDLE SCHOOL PROJECTS

T-O ENGINEERS
121 W. PACIFIC AVENUE SUITE 200
SPOKANE, WA 99201
PHONE: (509) 319-2580 WWW.TO-ENGINEERS.COM
E-FILE: 190578_JoeAlbi_Figures.dwg DATE: 3/27/20 JOB: 200063

MOVEMENT SUMMARY

Site: 101 [Wellesley Ave & Assembly St]

Wellesley & Assembly
Joe Albi and New Middle School
Existing Condition
Site Category: (None)
Stop (All-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Assembly Street												
3	L2	60	3.0	0.202	9.9	LOS A	0.7	18.9	0.95	1.23	2.19	30.0
8	T1	546	3.0	0.892	54.7	LOS F	8.7	222.0	1.00	2.05	5.67	18.7
18	R2	13	3.0	0.892	53.3	LOS F	8.7	222.0	1.00	2.07	5.74	19.0
Approach		619	3.0	0.892	50.3	LOS F	8.7	222.0	1.00	1.97	5.33	19.4
East: RoWellesley AvenueadName												
1	L2	18	3.0	0.701	40.6	LOS E	4.5	115.9	1.00	1.64	3.82	21.2
6	T1	88	3.0	0.701	40.6	LOS E	4.5	115.9	1.00	1.64	3.82	21.2
16	R2	94	3.0	0.701	40.6	LOS E	4.5	115.9	1.00	1.64	3.82	21.2
Approach		200	3.0	0.701	40.6	LOS E	4.5	115.9	1.00	1.64	3.82	21.2
North: Assembly Street												
7	L2	68	3.0	0.242	11.2	LOS B	0.9	23.5	0.96	1.26	2.27	29.5
4	T1	298	3.0	0.655	27.8	LOS D	4.0	101.1	1.00	1.58	3.56	24.2
14	R2	91	3.0	0.655	26.5	LOS D	4.0	101.1	1.00	1.58	3.58	24.6
Approach		457	3.0	0.655	25.1	LOS D	4.0	101.1	0.99	1.53	3.37	24.9
West: Wellesley Avenue												
5	L2	113	3.0	0.645	26.0	LOS D	3.9	98.8	0.99	1.58	3.58	24.7
2	T1	62	3.0	0.645	26.0	LOS D	3.9	98.8	0.99	1.58	3.58	24.7
12	R2	95	3.0	0.645	26.0	LOS D	3.9	98.8	0.99	1.58	3.58	24.6
Approach		270	3.0	0.645	26.0	LOS D	3.9	98.8	0.99	1.58	3.58	24.7
All Vehicles		1546	3.0	0.892	37.4	LOS E	8.7	222.0	1.00	1.73	4.25	21.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Wellesley Ave & Assembly St]

Wellesley & Assembly
Joe Albi and New Middle School
Future With-Project, PM Peak Hour Analysis
Site Category: (None)
Stop (All-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: Assembly Street												
3	L2	209	3.0	0.767	40.4	LOS E	5.5	141.8	1.00	1.74	4.26	21.2
8	T1	598	3.0	1.066	101.0	LOS F	14.8	380.1	1.00	2.58	8.02	13.4
18	R2	14	3.0	1.066	99.1	LOS F	14.8	380.1	1.00	2.63	8.23	13.6
Approach		820	3.0	1.066	85.6	LOS F	14.8	380.1	1.00	2.37	7.07	14.8
East: RoWellesley AvenueadName												
1	L2	19	3.0	0.849	44.5	LOS E	7.8	200.9	1.00	2.01	5.47	20.5
6	T1	217	3.0	0.849	44.5	LOS E	7.8	200.9	1.00	2.01	5.47	20.5
16	R2	117	3.0	0.849	44.5	LOS E	7.8	200.9	1.00	2.01	5.47	20.4
Approach		354	3.0	0.849	44.5	LOS E	7.8	200.9	1.00	2.01	5.47	20.4
North: Assembly Street												
7	L2	98	3.0	0.410	17.9	LOS C	1.8	46.4	1.00	1.37	2.63	27.1
4	T1	342	3.0	0.959	78.2	LOS F	10.2	260.2	1.00	2.14	6.06	15.6
14	R2	145	3.0	0.959	75.1	LOS F	10.2	260.2	1.00	2.18	6.25	16.0
Approach		585	3.0	0.959	67.4	LOS F	10.2	260.2	1.00	2.02	5.54	16.9
West: Wellesley Avenue												
5	L2	177	3.0	1.427	224.1	LOS F	52.3	1337.7	1.00	5.68	21.80	7.7
2	T1	237	3.0	1.427	224.1	LOS F	52.3	1337.7	1.00	5.68	21.80	7.7
12	R2	299	3.0	1.427	224.1	LOS F	52.3	1337.7	1.00	5.68	21.80	7.7
Approach		713	3.0	1.427	224.1	LOS F	52.3	1337.7	1.00	5.68	21.80	7.7
All Vehicles		2472	3.0	1.427	115.3	LOS F	52.3	1337.7	1.00	3.19	10.72	12.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

Rowan & Assembly
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	37	3.0	0.036	3.8	LOS A	0.1	3.6	0.46	0.33	0.46	32.8
8	T1	761	3.0	0.447	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	39.6
18	R2	49	3.0	0.447	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	38.1
Approach		847	3.0	0.447	0.2	NA	0.1	3.6	0.02	0.01	0.02	39.2
East: RoadName												
1	L2	49	3.0	0.525	68.1	LOS F	2.3	58.8	0.93	1.04	1.34	17.3
6	T1	3	3.0	0.525	59.2	LOS F	2.3	58.8	0.93	1.04	1.34	17.3
16	R2	11	3.0	0.525	44.5	LOS E	2.3	58.8	0.93	1.04	1.34	17.4
Approach		63	3.0	0.525	63.7	LOS F	2.3	58.8	0.93	1.04	1.34	17.3
North: RoadName												
7	L2	11	3.0	0.013	4.6	LOS A	0.0	1.3	0.55	0.41	0.55	32.2
4	T1	456	3.0	0.293	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	39.4
14	R2	70	3.0	0.293	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	37.8
Approach		537	3.0	0.293	0.1	NA	0.0	1.3	0.01	0.01	0.01	39.0
West: RoadName												
5	L2	99	3.0	0.926	137.1	LOS F	6.6	167.9	0.99	1.37	2.50	11.0
2	T1	5	3.0	0.926	129.7	LOS F	6.6	167.9	0.99	1.37	2.50	11.0
12	R2	52	3.0	0.095	12.4	LOS B	0.4	10.7	0.59	0.51	0.59	28.8
Approach		156	3.0	0.926	95.6	LOS F	6.6	167.9	0.86	1.08	1.87	13.9
All Vehicles		1603	3.0	0.926	11.9	NA	6.6	167.9	0.13	0.16	0.25	31.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

East Drive/Royal/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.079	14.4	LOS B	0.3	8.1	0.48	0.37	0.48	29.0
8	T1	2	3.0	0.079	17.2	LOS C	0.3	8.1	0.48	0.37	0.48	29.1
18	R2	48	3.0	0.079	10.6	LOS B	0.3	8.1	0.48	0.37	0.48	29.2
Approach		52	3.0	0.079	11.0	LOS B	0.3	8.1	0.48	0.37	0.48	29.2
East: RoadName												
1	L2	43	3.0	0.283	5.3	LOS A	0.6	15.1	0.14	0.01	0.14	34.3
6	T1	213	3.0	0.283	2.9	LOS A	0.6	15.1	0.14	0.01	0.14	35.9
16	R2	208	3.0	0.283	2.9	LOS A	0.6	15.1	0.14	0.01	0.14	34.6
Approach		463	3.0	0.283	3.1	NA	0.6	15.1	0.14	0.01	0.14	35.1
North: RoadName												
7	L2	208	3.0	0.655	35.3	LOS E	5.2	133.5	0.86	1.15	1.86	22.2
4	T1	1	3.0	0.655	34.2	LOS D	5.2	133.5	0.86	1.15	1.86	22.3
14	R2	1	3.0	0.655	28.4	LOS D	5.2	133.5	0.86	1.15	1.86	22.3
Approach		210	3.0	0.655	35.2	LOS E	5.2	133.5	0.86	1.15	1.86	22.2
West: RoadName												
5	L2	4	3.0	0.187	4.6	LOS A	0.1	1.4	0.02	0.00	0.02	37.0
2	T1	332	3.0	0.187	1.5	LOS A	0.1	1.4	0.02	0.00	0.02	38.8
12	R2	4	3.0	0.187	3.1	LOS A	0.1	1.4	0.02	0.00	0.02	37.3
Approach		341	3.0	0.187	1.5	NA	0.1	1.4	0.02	0.00	0.02	38.8
All Vehicles		1066	3.0	0.655	9.3	NA	5.2	133.5	0.26	0.25	0.46	32.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

West Drive/Hartley/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.060	9.9	LOS A	0.3	6.5	0.19	0.08	0.19	29.5
8	T1	1	3.0	0.060	11.1	LOS B	0.3	6.5	0.19	0.08	0.19	29.6
18	R2	56	3.0	0.060	8.9	LOS A	0.3	6.5	0.19	0.08	0.19	29.8
Approach		58	3.0	0.060	8.9	LOS A	0.3	6.5	0.19	0.08	0.19	29.8
East: RoadName												
1	L2	49	3.0	0.131	3.4	LOS A	0.4	9.4	0.09	0.01	0.09	34.1
6	T1	54	3.0	0.131	2.4	LOS A	0.4	9.4	0.09	0.01	0.09	35.7
16	R2	111	3.0	0.131	1.9	LOS A	0.4	9.4	0.09	0.01	0.09	34.4
Approach		214	3.0	0.131	2.3	NA	0.4	9.4	0.09	0.01	0.09	34.6
North: RoadName												
7	L2	223	3.0	0.342	13.3	LOS B	2.2	57.2	0.57	0.51	0.67	28.3
4	T1	2	3.0	0.342	13.2	LOS B	2.2	57.2	0.57	0.51	0.67	28.4
14	R2	2	3.0	0.342	11.4	LOS B	2.2	57.2	0.57	0.51	0.67	28.5
Approach		227	3.0	0.342	13.2	LOS B	2.2	57.2	0.57	0.51	0.67	28.3
West: RoadName												
5	L2	1	3.0	0.035	2.8	LOS A	0.0	0.2	0.01	0.00	0.01	37.7
2	T1	62	3.0	0.035	0.3	LOS A	0.0	0.2	0.01	0.00	0.01	39.6
12	R2	1	3.0	0.035	1.5	LOS A	0.0	0.2	0.01	0.00	0.01	38.0
Approach		65	3.0	0.035	0.4	NA	0.0	0.2	0.01	0.00	0.01	39.5
All Vehicles		563	3.0	0.342	7.2	NA	2.2	57.2	0.29	0.22	0.33	31.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

West Drive/Hartley/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.033	9.4	LOS A	0.1	3.5	0.14	0.05	0.14	29.6
8	T1	1	3.0	0.033	9.8	LOS A	0.1	3.5	0.14	0.05	0.14	29.7
18	R2	31	3.0	0.033	8.7	LOS A	0.1	3.5	0.14	0.05	0.14	29.8
Approach		33	3.0	0.033	8.7	LOS A	0.1	3.5	0.14	0.05	0.14	29.8
East: RoadName												
1	L2	31	3.0	0.039	2.6	LOS A	0.1	3.8	0.10	0.01	0.10	34.9
6	T1	32	3.0	0.039	1.9	LOS A	0.1	3.8	0.10	0.01	0.10	36.6
16	R2	1	3.0	0.039	2.6	LOS A	0.1	3.8	0.10	0.01	0.10	35.2
Approach		65	3.0	0.039	2.3	NA	0.1	3.8	0.10	0.01	0.10	35.7
North: RoadName												
7	L2	239	3.0	0.308	11.3	LOS B	1.8	45.4	0.40	0.25	0.40	28.9
4	T1	8	3.0	0.308	11.6	LOS B	1.8	45.4	0.40	0.25	0.40	29.0
14	R2	8	3.0	0.308	10.4	LOS B	1.8	45.4	0.40	0.25	0.40	29.1
Approach		254	3.0	0.308	11.3	LOS B	1.8	45.4	0.40	0.25	0.40	28.9
West: RoadName												
5	L2	1	3.0	0.022	2.5	LOS A	0.0	0.2	0.01	0.00	0.01	37.6
2	T1	39	3.0	0.022	0.2	LOS A	0.0	0.2	0.01	0.00	0.01	39.5
12	R2	1	3.0	0.022	1.2	LOS A	0.0	0.2	0.01	0.00	0.01	38.0
Approach		41	3.0	0.022	0.3	NA	0.0	0.2	0.01	0.00	0.01	39.5
All Vehicles		392	3.0	0.308	8.4	NA	1.8	45.4	0.28	0.17	0.28	30.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

East Drive/Royal/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.066	12.0	LOS B	0.2	6.1	0.47	0.38	0.47	28.6
8	T1	13	3.0	0.066	15.3	LOS C	0.2	6.1	0.47	0.38	0.47	28.7
18	R2	22	3.0	0.066	10.3	LOS B	0.2	6.1	0.47	0.38	0.47	28.8
Approach		35	3.0	0.066	12.2	LOS B	0.2	6.1	0.47	0.38	0.47	28.7
East: RoadName												
1	L2	32	3.0	0.237	4.8	LOS A	0.4	9.8	0.11	0.01	0.11	33.7
6	T1	63	3.0	0.237	3.0	LOS A	0.4	9.8	0.11	0.01	0.11	35.2
16	R2	280	3.0	0.237	2.3	LOS A	0.4	9.8	0.11	0.01	0.11	34.0
Approach		375	3.0	0.237	2.6	NA	0.4	9.8	0.11	0.01	0.11	34.1
North: RoadName												
7	L2	1	3.0	0.006	13.6	LOS B	0.0	0.6	0.30	0.17	0.30	28.6
4	T1	1	3.0	0.006	13.3	LOS B	0.0	0.6	0.30	0.17	0.30	28.7
14	R2	1	3.0	0.006	8.7	LOS A	0.0	0.6	0.30	0.17	0.30	28.8
Approach		3	3.0	0.006	11.8	LOS B	0.0	0.6	0.30	0.17	0.30	28.7
West: RoadName												
5	L2	18	3.0	0.173	4.3	LOS A	0.2	5.1	0.07	0.00	0.07	36.6
2	T1	278	3.0	0.173	1.6	LOS A	0.2	5.1	0.07	0.00	0.07	38.4
12	R2	10	3.0	0.173	3.4	LOS A	0.2	5.1	0.07	0.00	0.07	36.9
Approach		306	3.0	0.173	1.8	NA	0.2	5.1	0.07	0.00	0.07	38.2
All Vehicles		720	3.0	0.237	2.8	NA	0.4	9.8	0.11	0.02	0.11	35.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

West Drive/Hartley/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.075	10.7	LOS B	0.3	8.1	0.31	0.18	0.31	29.5
8	T1	1	3.0	0.075	11.0	LOS B	0.3	8.1	0.31	0.18	0.31	29.5
18	R2	63	3.0	0.075	9.4	LOS A	0.3	8.1	0.31	0.18	0.31	29.7
Approach		66	3.0	0.075	9.4	LOS A	0.3	8.1	0.31	0.18	0.31	29.7
East: RoadName												
1	L2	48	3.0	0.071	3.1	LOS A	0.3	7.0	0.20	0.04	0.20	35.0
6	T1	66	3.0	0.071	2.1	LOS A	0.3	7.0	0.20	0.04	0.20	36.7
16	R2	1	3.0	0.071	3.0	LOS A	0.3	7.0	0.20	0.04	0.20	35.3
Approach		115	3.0	0.071	2.5	NA	0.3	7.0	0.20	0.04	0.20	35.9
North: RoadName												
7	L2	143	3.0	0.244	12.7	LOS B	1.2	30.4	0.54	0.46	0.54	28.5
4	T1	4	3.0	0.244	12.6	LOS B	1.2	30.4	0.54	0.46	0.54	28.6
14	R2	4	3.0	0.244	10.5	LOS B	1.2	30.4	0.54	0.46	0.54	28.7
Approach		152	3.0	0.244	12.6	LOS B	1.2	30.4	0.54	0.46	0.54	28.5
West: RoadName												
5	L2	1	3.0	0.080	2.9	LOS A	0.0	0.2	0.00	0.00	0.00	37.6
2	T1	145	3.0	0.080	0.6	LOS A	0.0	0.2	0.00	0.00	0.00	39.5
12	R2	1	3.0	0.080	1.7	LOS A	0.0	0.2	0.00	0.00	0.00	37.9
Approach		147	3.0	0.080	0.6	NA	0.0	0.2	0.00	0.00	0.00	39.5
All Vehicles		480	3.0	0.244	6.1	NA	1.2	30.4	0.26	0.18	0.26	33.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Site1]

East Drive/Royal/Wellesley
Joe Albi and New Middle School
Future With-Project Traffic Conditions
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed mph
South: RoadName												
3	L2	1	3.0	0.093	12.5	LOS B	0.4	9.6	0.44	0.32	0.44	29.1
8	T1	5	3.0	0.093	13.9	LOS B	0.4	9.6	0.44	0.32	0.44	29.2
18	R2	59	3.0	0.093	10.3	LOS B	0.4	9.6	0.44	0.32	0.44	29.3
Approach		66	3.0	0.093	10.6	LOS B	0.4	9.6	0.44	0.32	0.44	29.3
East: RoadName												
1	L2	48	3.0	0.174	4.2	LOS A	0.5	12.8	0.19	0.02	0.19	34.4
6	T1	114	3.0	0.174	2.5	LOS A	0.5	12.8	0.19	0.02	0.19	36.0
16	R2	117	3.0	0.174	2.3	LOS A	0.5	12.8	0.19	0.02	0.19	34.7
Approach		280	3.0	0.174	2.7	NA	0.5	12.8	0.19	0.02	0.19	35.1
North: RoadName												
7	L2	1	3.0	0.006	13.4	LOS B	0.0	0.6	0.39	0.24	0.39	28.7
4	T1	1	3.0	0.006	12.8	LOS B	0.0	0.6	0.39	0.24	0.39	28.8
14	R2	1	3.0	0.006	8.9	LOS A	0.0	0.6	0.39	0.24	0.39	28.9
Approach		3	3.0	0.006	11.7	LOS B	0.0	0.6	0.39	0.24	0.39	28.8
West: RoadName												
5	L2	8	3.0	0.154	3.9	LOS A	0.1	1.9	0.03	0.00	0.03	37.0
2	T1	266	3.0	0.154	1.2	LOS A	0.1	1.9	0.03	0.00	0.03	38.8
12	R2	6	3.0	0.154	2.6	LOS A	0.1	1.9	0.03	0.00	0.03	37.3
Approach		280	3.0	0.154	1.3	NA	0.1	1.9	0.03	0.00	0.03	38.8
All Vehicles		628	3.0	0.174	3.0	NA	0.5	12.8	0.14	0.04	0.14	35.8

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

T·O ENGINEERS

memo

TO:	Inga Note, P.E., City Transportation Engineer Patty Kells, Development Services Transportation
FROM:	Bill White, Regional Transportation Lead
DATE:	July 2020
JOB NO.:	190578
RE:	Joe Albi Stadium and New Northwest Middle School, Transportation Threshold Determination Supplemental Study #1
CC:	Gregory Forsyth, Spokane Public Schools

☐**Urgent** ☒**For Review** ☒**Please Comment** ☒**Please Reply** ☐**For Your Use**

This memorandum provides supplemental transportation information and analyses to support the Joe Albi Stadium and new Northwest Middle School transportation threshold determination (TTD), submitted by T-O Engineering on March 26, 2020. This supplement was prepared to address the following additional information requests:

- Review PM peak hour traffic impacts of a more "typical" stadium and school condition.
- Review pedestrian facilities and provide recommendations.

This is not intended as a stand-alone document. Rather, this supplemental memorandum should be reviewed in context to the March 2020 TTD to obtain a project description, understand study approach and methodologies, and review prior conclusions. This supplement provides analyses and conclusions for the bullet points defined above only.

PM Peak Hour Impacts

The TTD reviews forecast transportation conditions for the Joe Albi replacement project and the new Northwest Middle School. It is worth noting Joe Albi would be reduced from a current seating capacity of 28,650 down to 6,000 seats. This represents a substantial decrease in traffic volumes historically generated by the site at full occupancy.

With that said, the TTD presents "high-end" trip generation forecasts by reviewing the travel demands of a highly attended, 85th percentile condition of back-to-back football games. The TTD suggests this condition is only forecast to occur five to six times per year, as based on historical attendance data. And even then, this was an overestimation as historical data previously included Mead football games, which is where the noted maximum-attendance conditions of years past occurred. As Mead will be moving to their own football stadium in 2020/21, this 85th percentile condition is likely two or three times per year, if at all.

Based on this understanding, City of Spokane development services staff requested a revised analysis of PM peak hour conditions assuming only "typical" transportation activities for the typical year. This includes normal operation of the Middle School, and this supplement anticipates some maintenance and operation at Joe Albi. The supposition is common daily traffic conditions are those where no event activities occur, given there are only 22 notable event days forecast at the Stadium (on Thursday and Friday) out of 180 school (and even summer) days each year.

Typical weekday and PM peak hour trip generation forecasts have been revisited with **Table 1**. This shows ITE Trip Generation Manual potentials for the middle school. Documented with the TTD. This also assumes up to 50 weekday trips being generated with maintenance and operation

activities of Joe Albi, with 10 of these trips occurring equally during the PM peak hour. This later number is a conservative assumption to reflect some activity at the stadium.

Table 1. "Typical" Trip Generation, Middle School & Albi Maintenance

Land Use	Weekday	PM Peak Hour		
		In	Out	Total
Middle School, 750 students	1,600	62	66	128
Joe Albi Maintenance	<50	5	5	10
Property Totals	**1,650**	**67**	**71**	**138**

As shown, the two projects would generate 1,650 weekday trips with 138 trips generated during the PM peak hour. Peak hour trips were distributed and assigned to the street system, as described with the TTD. **Table 2** provides a summary of intersection counts, assignments, future without-project traffic volumes, and future with-project traffic volumes for the PM peak hour. 2022 is the forecast completion and occupancy year of the project. The following acronyms are used with **Table 2** to describe movements for Wellesley Avenue/Assembly Street intersection:

- EBL, Eastbound Left-turn
- EBT, Eastbound Through
- EBR, Eastbound Right-Turn
- WBL, Westbound Left-Turn
- WBT, Westbound Through
- WBR, Westbound Right-Turn
- NBL, Northbound Left-Turn
- NBT, Northbound Through
- NBR, Northbound Right-Turn
- SBL, Southbound Left-Turn
- SBT, Southbound Through
- SBR, Southbound Right-Turn
- TEV, Total Entering Volumes

Table 2. Existing and Forecast Traffic Volumes, Wellesley/Assembly, PM Peak Hour

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TEV
Existing	105	58	88	17	82	87	56	508	12	63	277	85	1,428
Future Without-Project	111	62	93	18	87	92	59	539	13	67	294	90	1,525
Trip Assignments	30	15	19	18	0	14	18	0	0	0	0	28	124
Future With-Project	141	77	112	18	101	92	77	539	13	67	294	118	1,649

As shown, a total of 1,428 TEV currently travel through the Wellesley Avenue/Assembly Street intersection. Baseline growth forecasts this to 1,525 TEV during the PM peak hour. The projects will assign 124 PM peak hour trips to the intersection that, when combined with baseline forecasts, result in total year 2022 forecasts of 1,649 TEV for the PM peak hour.

LOS Analysis

Wellesley Avenue/Assembly Street is an all-way stop with 200-foot left-turn pockets provided for northbound and southbound traffic, as well as two through lanes in each direction. Right turns are performed from outer lanes on both intersection approach. There are only single approach lanes located in the eastbound and westbound directions from which all through, left, and right-turns are performed.

The LOS analysis was updated for the Wellesley Avenue/Assembly Street intersection based on the PM peak hour volumes shown with **Table 3**. The analysis was updated because a roundabout was assumed with the future conditions analysis of the TTD, but City staff indicates a shortfall in funding which prohibits construction within the next two or three years. A such, the study was revised to reflect an all-way stop through year 2022.

A summary of revised LOS is provided with **Table 3** for the PM peak hour. Also shown is average vehicle control delays for each location. LOS is the function of the average control delay for all movements at an all-way stop. LOS were provided based on existing, future without-project, and future with-project conditions. Note the LOS analysis was updated for this supplement using Synchro Suite 11 (Trafficware, 2020), which is the preferred analysis suite for the City of Spokane. This is called out specifically because the LOS results for the all-way stop are marginally improved versus what was presented with the TTD using an alternate software.

Table 3. Existing and Forecast Summary LOS

Wellesley Avenue/Assembly Street All-Way Stop	PM Peak Hour	
	LOS	Delay
Existing PM Peak Hour	C	21.2
Future Without-Project PM Peak Hour	D	26.0
Future With-Project PM Peak Hour	E	36.9

The City maintains a LOS E threshold for unsignalized intersections. This is an average control delay of up to 50 seconds being experienced by the typical driver prior to clearing the intersection. The LOS F threshold is noted after 50 seconds, where driver's tolerance for delay is considered intolerable for unsignalized intersections.

As shown, the intersection currently functions at LOS C during the PM peak hour. The intersection degrades to LOS D with baseline traffic growth forecast by year 2020, and then LOS E with the addition of project trips. Project impacts are measured in terms of the average control delay, with proposed traffic causing a 10.9 second increase in delays during the PM peak hour. This increase is not desirable, but it is tolerable and within allowable practice on the short-term given City plans to improve the intersection within a roundabout in the future. Delays and queue potentials are noted to be highest in the eastbound and northbound directions.

Pedestrian Mobility

Per a Guide for the Planning, Design, and Operation of Pedestrian Facilities (AASHT0, 2004), the typical student can be expected to walk or bike at up to a mile to access a middle school. As such, it is standard practice to review collector and arterial approach routes to identify the sufficiency of pedestrian facilities and crossings, to assure safety for students. Typically, local streets are not a part of approach/departure analyses because shared use of vehicle right-of-way, if there are no pedestrian accommodations, is of minimal concern due to low traffic volumes.

Wellesley Avenue will provide the primary approach/departure route for pedestrians in accessing area collector and arterial streets. Given this understanding and review of guidelines above, students will walk/bike to/from:

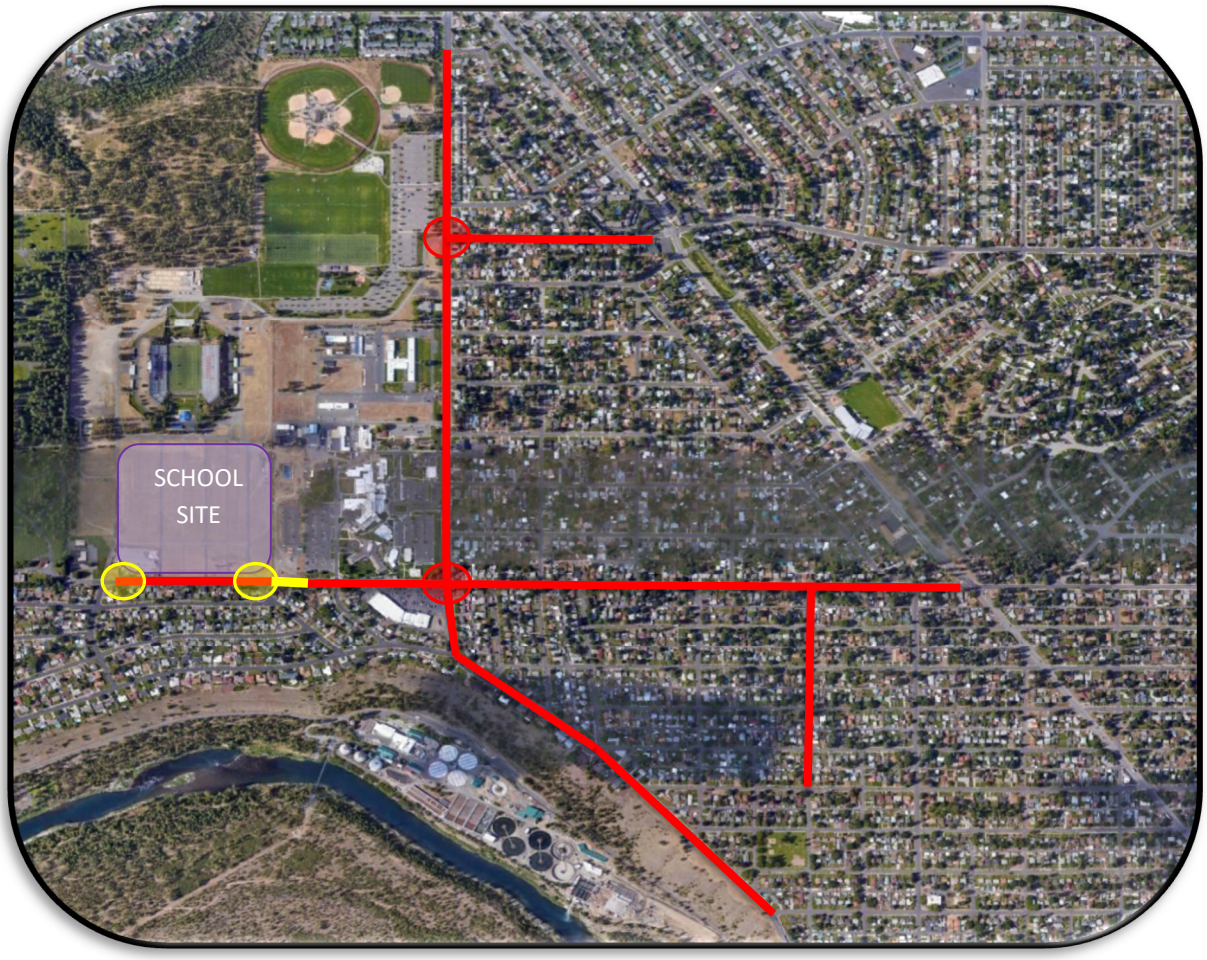
- Assembly Street north of Wellesley Avenue, extending to about Winston Drive,
- Rowan Avenue north of Wellesley Avenue, via travel by Assembly Street and extending to Driscoll Boulevard,
- Wellesley Avenue east of Assembly Street, extending to about Driscoll Boulevard,
- Wellesley Avenue east of Assembly, extending to Rockwell Avenue via travel by G Street,
- Assembly Street south of Wellesley Avenue, extending to about Providence Avenue, and
- The entirety of the development south of the proposed school.

The following graphic shows the pedestrian/bike approach and departure routes for the Middle School, highlighted in purple. Shown in red are where sidewalk is available on one or both sides of arterial routes, with crossings highlighted in red circles at arterial intersections. As shown

sidewalks and crossings appear to be sufficient throughout developed neighborhoods. Shown in yellow are areas where pedestrian accommodations should be considered; a 300-foot section of sidewalk along the north side of Wellesley Avenue to access the school and then two crossing locations to capture students approaching from the neighborhood.

In terms of the sidewalk section, the middle school would not front nor control the property needed to extend sidewalk further than what has been shown in red, as the property is owned by the adjacent VA hospital. It is recommended the school district and city coordinate to determine a way this sidewalk can be infilled along the north side of the street. Contiguous sidewalk north-side seems most reasonable given: 1) location of the school north side, 2) this is a shorter gap to address versus south side of the road (where less sidewalk is aligned), and 3) there is a marked/controlled crossing at Wellesley Avenue/Assembly Street where students from the south and east can access the north side of the street. Until this gap can be addressed, it is worth noting there is wide and useable shoulder where students can walk to access school facilities.

Although not collectors, consideration should be given to placing marked and signed crossings at Royal Court and Hartley Street. The neighborhood south is comprised of about 250 homes. The placement of crosswalk at these locations would “capture” students at either side of the school, at intersections to this neighborhood, and allow them to safely access the new middle school. Standard practice is to provide continental striping and advance MUTCD signage for crossings, but as a lower volume street (traffic drops substantially west of the Veterans Hospital), additional controls do not seem necessary. As this is public ROW and the crossings front the school, these improvements can be developed with school construction.



SUMMARY AND RECOMMENDATION

This supplemental study was developed in support of the Joe Albi Stadium and New Northwest Middle School TTD, as requested by City of Spokane development services staff. The revised analysis performed for the "typical" PM peak hour indicates acceptable traffic conditions, in compliance with City practice, through year 2022 for Wellesley Avenue/Assembly Street. The City has a roundabout programmed at this intersection to improve traffic operations/capacity further in the future.

A review of pedestrian conditions indicates there is 300-feet of missing sidewalk along the north side of Wellesley Avenue, and need a two crossings of Wellesley Avenue adjacent to the school. A summary of recommendations is as follows:

1. Work with the City to determine how the 300 feet of missing sidewalk can be extended on the northside of Wellesley Avenue to school facilities. As previously stated, the school does not front nor control the property.
2. Signed and striped pedestrian crossings are recommended at Royal Court and Hartley Street with school construction.

Here ends the supplemental analysis. Please contact our office with questions or comments.

Intersection	
Intersection Delay, s/veh	21.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	105	58	88	17	82	87	56	508	12	63	277	85
Future Vol, veh/h	105	58	88	17	82	87	56	508	12	63	277	85
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	115	64	97	19	90	96	62	558	13	69	304	93
Number of Lanes	0	1	0	0	1	0	1	2	0	1	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	1	1
HCM Control Delay	23.6	17.9	25.3	15.6
HCM LOS	C	C	D	C

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	42%	9%	100%	0%	0%
Vol Thru, %	0%	100%	93%	23%	44%	0%	100%	52%
Vol Right, %	0%	0%	7%	35%	47%	0%	0%	48%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	56	339	181	251	186	63	185	177
LT Vol	56	0	0	105	17	63	0	0
Through Vol	0	339	169	58	82	0	185	92
RT Vol	0	0	12	88	87	0	0	85
Lane Flow Rate	62	372	199	276	204	69	203	195
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.138	0.781	0.415	0.623	0.463	0.161	0.442	0.406
Departure Headway (Hd)	8.071	7.552	7.504	8.137	8.149	8.364	7.844	7.494
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	442	476	476	441	439	426	457	477
Service Time	5.86	5.341	5.293	5.926	5.945	6.157	5.636	5.287
HCM Lane V/C Ratio	0.14	0.782	0.418	0.626	0.465	0.162	0.444	0.409
HCM Control Delay	12.2	32.6	15.6	23.6	17.9	12.8	16.8	15.4
HCM Lane LOS	B	D	C	C	C	B	C	C
HCM 95th-tile Q	0.5	7	2	4.1	2.4	0.6	2.2	1.9

Intersection	
Intersection Delay, s/veh	26
Intersection LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	111	62	93	18	87	92	59	539	13	67	294	90
Future Vol, veh/h	111	62	93	18	87	92	59	539	13	67	294	90
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	122	68	102	20	96	101	65	592	14	74	323	99
Number of Lanes	0	1	0	0	1	0	1	2	0	1	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	1	1
HCM Control Delay	28.5	20.2	33.2	17.4
HCM LOS	D	C	D	C

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	42%	9%	100%	0%	0%
Vol Thru, %	0%	100%	93%	23%	44%	0%	100%	52%
Vol Right, %	0%	0%	7%	35%	47%	0%	0%	48%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	59	359	193	266	197	67	196	188
LT Vol	59	0	0	111	18	67	0	0
Through Vol	0	359	180	62	87	0	196	98
RT Vol	0	0	13	93	92	0	0	90
Lane Flow Rate	65	395	212	292	216	74	215	207
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.153	0.873	0.465	0.693	0.516	0.18	0.495	0.455
Departure Headway (Hd)	8.478	7.957	7.907	8.533	8.585	8.795	8.272	7.921
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	423	454	455	424	420	408	435	455
Service Time	6.226	5.704	5.654	6.278	6.335	6.544	6.021	5.67
HCM Lane V/C Ratio	0.154	0.87	0.466	0.689	0.514	0.181	0.494	0.455
HCM Control Delay	12.8	45.1	17.4	28.5	20.2	13.5	18.9	17.2
HCM Lane LOS	B	E	C	D	C	B	C	C
HCM 95th-tile Q	0.5	9.1	2.4	5.1	2.9	0.6	2.7	2.3

Intersection	
Intersection Delay, s/veh	36.9
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	141	77	112	18	101	92	77	539	13	67	294	118
Future Vol, veh/h	141	77	112	18	101	92	77	539	13	67	294	118
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	155	85	123	20	111	101	85	592	14	74	323	130
Number of Lanes	0	1	0	0	1	0	1	2	0	1	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	1	1
HCM Control Delay	54.5	25	43.8	20.9
HCM LOS	F	C	E	C

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	43%	9%	100%	0%	0%
Vol Thru, %	0%	100%	93%	23%	48%	0%	100%	45%
Vol Right, %	0%	0%	7%	34%	44%	0%	0%	55%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	77	359	193	330	211	67	196	216
LT Vol	77	0	0	141	18	67	0	0
Through Vol	0	359	180	77	101	0	196	98
RT Vol	0	0	13	112	92	0	0	118
Lane Flow Rate	85	395	212	363	232	74	215	237
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.216	0.952	0.508	0.904	0.597	0.195	0.538	0.566
Departure Headway (Hd)	9.209	8.683	8.633	8.97	9.266	9.518	8.99	8.586
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	389	419	417	403	390	376	401	420
Service Time	6.982	6.455	6.405	6.735	7.039	7.292	6.763	6.359
HCM Lane V/C Ratio	0.219	0.943	0.508	0.901	0.595	0.197	0.536	0.564
HCM Control Delay	14.5	62.8	20.1	54.5	25	14.6	21.8	22.1
HCM Lane LOS	B	F	C	F	C	B	C	C
HCM 95th-tile Q	0.8	10.9	2.8	9.5	3.7	0.7	3.1	3.4