FEHR PEERS

MEMORANDUM

Date: October 24, 2018

To: Erica Amsden, City of Spokane Valley

From: Chris Breiland, and Nathan Chan, Fehr & Peers

Subject: Pines Road/BNSF Grade Separation – Consolidated Traffic and Safety Analysis

SE17-0560

INTRODUCTION

As part of a larger effort to remove at-grade rail crossings in the Spokane region, Spokane Valley is working to grade separate the Pines Road/BNSF crossing and improve traffic and freight operations at the Pines Road/Trent Avenue intersection. In support of this project, Fehr & Peers prepared an existing conditions analysis, developed travel demand forecasts, traffic operations and safety analyses under year 2020 and 2040 conditions for multiple alternatives at the Pines Road / Trent Avenue intersection, as well as analysis under the scenario that closes the at-grade railroad crossing at University Road. This memo presents a summary of findings for four conceptual alternatives studied as part of the Pines Road/BNSF Grade Separation project.

Project Context

This project is part of a larger effort known as Bridging the Valley, which is a regional program to separate vehicle traffic from major train crossings between Spokane, WA and Athol, ID. Through these projects, Spokane Valley seeks to improve safety, provide reliable traffic and freight routes, and spur economic development and job creation.

The City of Spokane Valley is leading the effort to secure funding and study alternatives for the Pines Road/BNSF Grade Separation project, which is included in the City's 2018 Six-Year Transportation Improvement Program (TIP). The goals of this project include:

- Improving emergency vehicle access
- Improving safety and reduce delay caused by train/vehicle conflict
- Reducing noise from train horns at crossings
- Improving access to Trent Elementary and the neighborhood to the north of Trent Avenue

- Enhancing development capabilities of almost 230 acres of mixed-use commercial property

EXISTING CONDITIONS ANALYSIS

The existing conditions analysis includes an analysis of existing traffic operations and collision history in the area. Traffic analysis was performed for the following intersections:

1. Pines Road / Trent Avenue
2. University Road / Trent Avenue
3. Argonne Road / Trent Avenue
4. Argonne Road / Montgomery Avenue

Collision history was documented at the Pines Road/BNSF rail crossing and the Pines Road / Trent Avenue intersection.

Turning Movement Count Collection

Intersection turning movement counts were collected at the four study intersections mentioned previously during the AM (7-9 AM) and PM (4-6 PM) peak hours on Wednesday August 30, 2017.

BNSF Rail Operations

The Burlington Northern Santa Fe (BNSF) Railroad crosses Pines Road (SR 27) and University Road just south of Trent Avenue. The BNSF route is one of the company's main transcontinental lines between west coast ports and the interior of the country and hosts Amtrak's twice-daily Empire Builder between Chicago and Seattle/Portland. **Table 1** illustrates some basic operating characteristics for each of these at-grade crossings. Federal Railroad Administration (FRA) data indicates that the BNSF line hosts about 56 trains per day, mostly long-haul freight trains passing quickly through the area.

Historic collision data indicates that the grade crossings at University Road have operated safely over the last 40 years. However, a fatal vehicle collision occurred with a train at the Pines Road / BNSF crossing in 2001.

TABLE 1. OPERATING CHARACTERISTICS

Street Crossing	Average Trains per Day	Typical Train Frequency	Gates Down Average/Max (minutes)	Typical Train Speed	List of Collisions (1975-2016)
Pines Road	56	10-90 mins[1]	3/4.5 mins[1]	1 - 79 mph	2001 - fatality

Source: Federal Railroad Administration, 2017
1. Data was not collected at the BNSF and Pines Road railroad crossing. Results are from a similar study at the BNSF/Barker Road crossing prepared by Fehr & Peers in 2017.

Level of Service Standards

Level of service (LOS) is used to describe and evaluate traffic operations along major arterial corridors and intersections within a city. Levels range from LOS A to LOS F, which encompass a range of congestion types from uninterrupted traffic (LOS A) to highly-congested conditions (LOS F). The description and intersection delay thresholds of each LOS category are described in **Table 2.** These are based on the Highway Capacity Manual, which is the methodology used by Spokane Valley. The LOS for signalized intersections is measured by the average delay per vehicle entering the intersection from all approaches, while the LOS for unsignalized intersections is measured by the average delay per vehicle on the approach with the highest average delay.

TABLE 2. LEVEL OF SERVICE DESCRIPTION AND DELAY THRESHOLDS AT INTERSECTIONS

Level of Service	Description	Signalized Intersection Delay (seconds)	Unsignalized Intersection Delay (seconds)
A	Free-flowing conditions.	0-10	0-10
B	Stable operating conditions.	10-20	10-15
C	Stable operating conditions, but individual motorists are affected by the interaction with other motorists.	20-35	15-25
D	High density of motorists, but stable flow.	35-55	25-35
E	Near-capacity operations, with speeds reduced to a low but uniform speed.	55-80	35-50
F	Over-capacity conditions with long delays.	> 80	>50

Source: Highway Capacity Manual 2016, Transportation Research Board

The LOS standards for Spokane Valley defined in their Comprehensive Plan as follows:

- LOS D for major arterial corridors:
  - Argonne / Mullan between Trent Avenue and Appleway Boulevard.
  - Pines Road between Trent Avenue and 8th Avenue.
  - Evergreen Road between Indiana Avenue and 8th Avenue.
  - Sullivan Road between Wellesley Avenue and 8th Avenue.
  - Sprague Avenue / Appleway Boulevard between Fancher Road and Park Road.
- LOS D for signalized intersections not on major arterial corridors.
- LOS E for unsignalized intersections (LOS F is acceptable if the peak hour traffic signal warrant is not met).

WSDOT also uses LOS thresholds for State Highways and given that Trent Avenue is also State Route 290 (SR 290), intersections with Trent Avenue would need to operate at LOS D or better to meet WSDOT LOS standards for state routes in urban areas.

Existing Intersection Traffic Operations

Existing traffic conditions, including average vehicle delay and LOS, at the study area intersections are shown in **Table 3**. Detailed calculations are provided in **Attachment A**. These results were calculated with the following assumptions:

- Intersection peak hour factors (PHF) were consistent with 2017 counts
- Truck percentages consistent with 2017 counts (6% AM and 2% PM)
- Signal timing between AM and PM peak hours were consistent

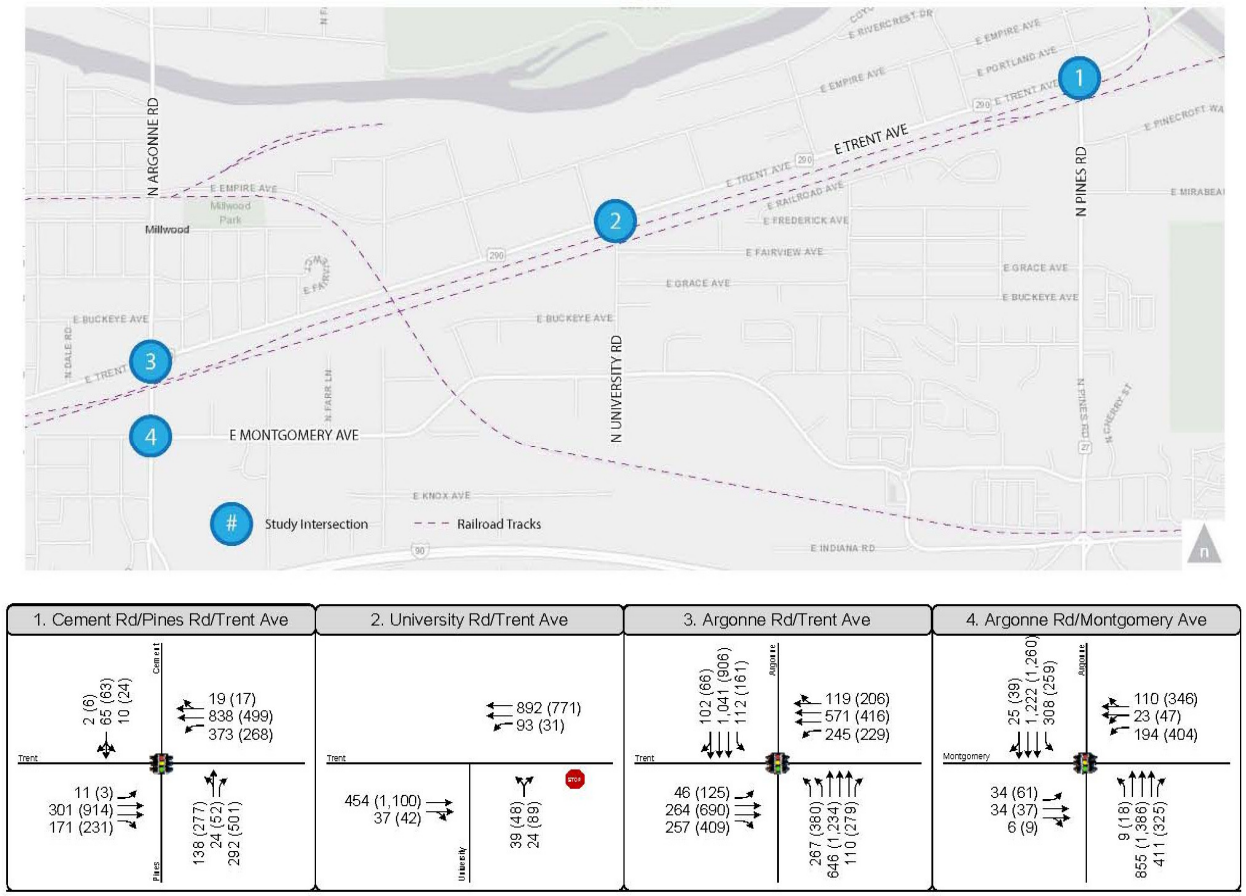
TABLE 3. 2017 EXISTING PEAK HOUR INTERSECTION OPERATIONS

ID	Intersection	Control / Approach	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Pines Road / Trent Avenue	Signal	26	C	47	D
2	University Road / Trent Avenue	TWSC / NB	17	C	29	D
3	Argonne Road / Trent Avenue	Signal	47	D	50	D
4	Argonne Road / Montgomery Avenue	Signal	33	C	39	D

Source: Fehr & Peers, 2017

Under existing conditions, all four intersections currently meet WSDOT and Spokane Valley LOS standards during the AM and PM peak hours. The existing lane configurations for each study intersection and peak hour turn movement counts are shown in **Figure 1.**

Figure 1. 2017 Existing Lane Configurations and AM (PM) Peak Hour Turning Movements



Pines Road / Trent Avenue Intersection Collision History

Vehicle collision history was analyzed over a five-year period from January 2012 to December 2016 at the Pines Road / Trent Avenue intersection. **Table 4** provides a summary of the collision history at the intersection by severity and whether the cause was related to the intersection. There were 59 collisions reported at or near the Pines Road / Trent Avenue intersection where 22 resulted in an injury while zero resulted in a fatality. 45 of the 59 collisions were found to be at the intersection or the cause was found to be related to the intersection. Of the 22 injury collisions, 18 were from collisions where the cause was related to the intersection.

TABLE 4. 2012-2016 COLLISION SUMMARY BY SEVERITY AT THE PINES ROAD / TRENT AVENUE INTERSECTION

Summary	All Collisions	Fatal Collisions	Injury Collisions	Intersection Related
5-year total	59	0	22	45
Average per year	11.8	0	4.4	9.0

Source: WSDOT, 2017

Table 5 provides a summary of crashes from 2012 to 2016 at the Pines Road / Trent Avenue intersection by crash type. Of the 59 total crashes over this period, about 46% resulted in a rear-end collision at the traffic light while about 31% were caused by an improper left-turn or failure to yield. While the remaining collisions had a variety of causes.

TABLE 5. 2012-2016 COLLISIONS BY TYPE AT THE PINES ROAD / TRENT AVENUE INTERSECTION

Severity	Total	Improper turn/failure to yield	Rear-end at traffic light	Railway Crossing Gate	Speeding	Pedestrian	Other
All crashes	59	18	27	3	2	1	8
Injury crashes	22	6	10	0	1	1	4

Source: WSDOT, 2017

Based on the analysis of recent collisions at this location, it is likely that a roundabout at this location would reduce the "improper left turn" and "rear-end at traffic light" collisions. The reduction in these types of collisions is based on a low-speed approach to the roundabouts, which make it easier to judge gaps in traffic and safely enter the traffic stream. The likelihood of injury crashes is also much lower at a roundabout. While roundabouts are generally shown to have lower injury/fatality collision rates, there can be more sideswipe and low-speed failure to yield collisions. Additionally, the grade separation would eliminate the issue of railway crossing gate collisions (although the railway grade crossing collisions are rare).

TRAVEL DEMAND FORECASTING

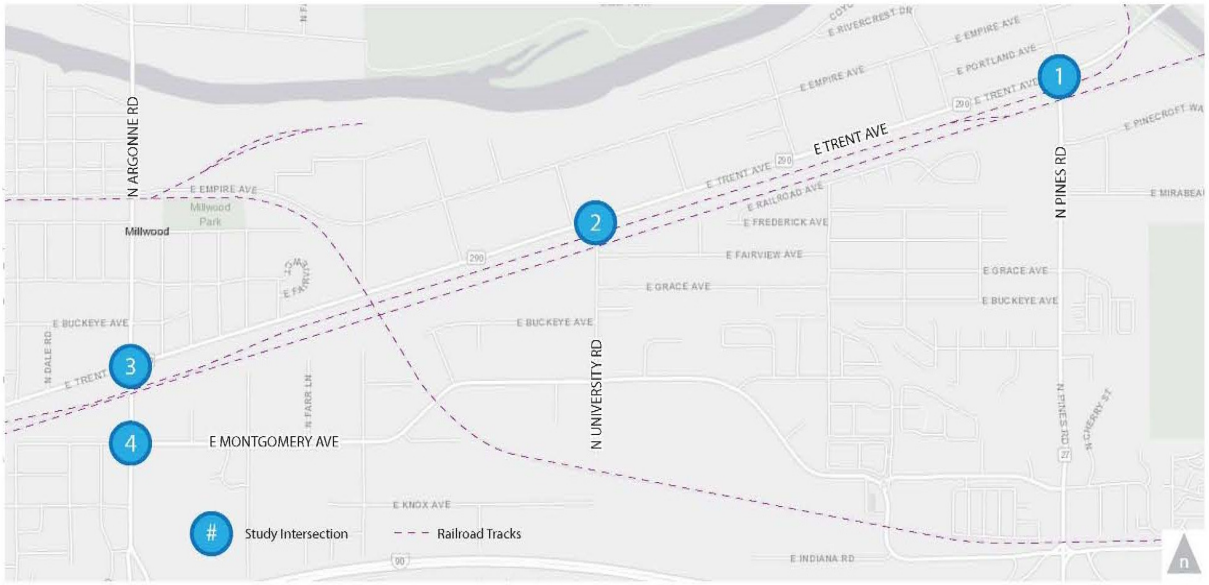
AM and PM traffic volumes at each of the study intersections were developed for 2020 and 2040 conditions.

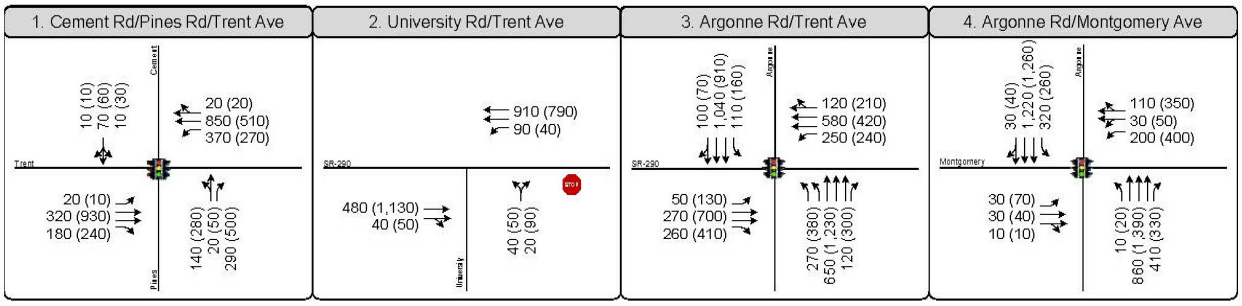
2020 Forecasts

Volumes were forecast to year 2020 using an annual growth rate calculated using the 2017 counts and the 2040 forecasted volumes from the SRTC regional travel demand model (see next section). This growth rate was then then applied to the 2017 counts to develop the 2020 forecasts. The forecasting process for the

2040 volumes is explained in the following section. The 2020 forecasted volumes and intersection lane configurations are shown in **Figure 2.**

Figure 2. 2020 No Build Lane Configurations and AM (PM) Peak Hour Turning Movement Forecasts





2040 Forecasts

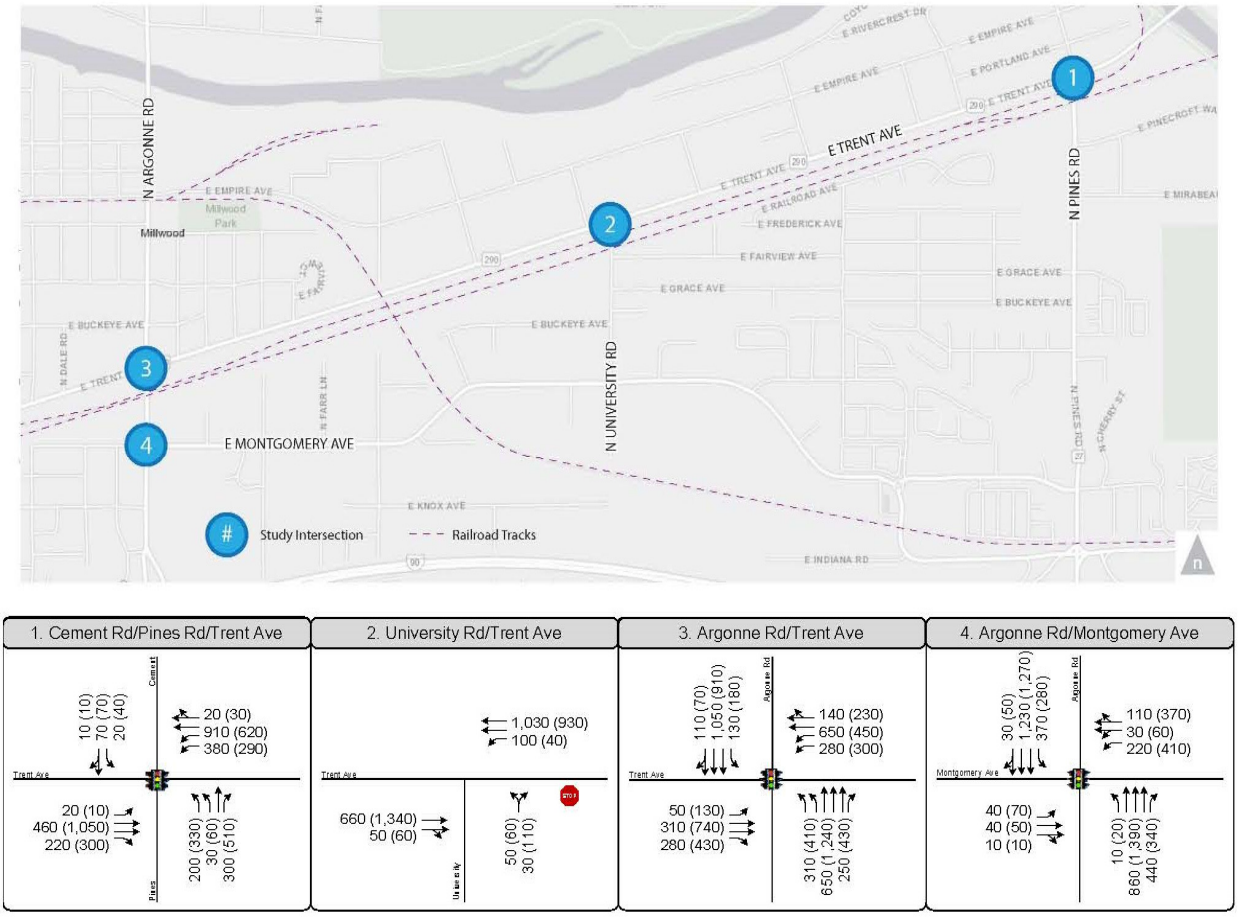
The 2040 AM and PM peak forecasts were forecasted using the SRTC regional travel demand model developed for the Horizon 2040 Regional Transportation Plan. This model was recently updated in December 2017 and it includes the regional growth forecast for Spokane Valley, Spokane County and all the surrounding jurisdictions. In addition to land use growth, there were several key transportation projects assumed in the SRTC 2040 model:

- The Barker Road/I-90 interchange would be reconfigured to a standard diamond interchange with two-lane roundabouts plus slip ramps for right-turn movements at both ramps (as reflected in I-90/Barker Rd the Interchange Justification Report)
- Barker Road between I-90 and Appleway Avenue would be widened to five lanes
- Bigelow Gulch Road would be widened to four lanes and connected to Sullivan Road

Instead of using the traffic forecasts directly from the 2040 travel demand model, 2040 AM and PM peak volumes were estimated using an industry standard approach known as the difference method. Under the difference method, the difference in traffic volumes between the 2015 and 2040 models were added to the observed counts at each of the study intersections to arrive at a 2040 forecast traffic volume. This method reduces model error by relying as much as possible on observed data rather than model output data.[1]

The 2040 forecasted volumes and lane configurations are shown in **Figure 3**.

Figure 3. 2040 No Build Lane Configurations and AM (PM) Peak Hour Intersection Turning Movement Forecasts



[1] The volume forecasts on Cement Rd show minimal growth despite increases in residential land use north of Trent Ave. The SRTC model loads these additional vehicle trips directly onto Trent Ave, bypassing Cement Rd, so these volumes do not appear in the intersection forecasts. Since the traffic volume on Cement Rd accounts for less than 5% of the total intersection volume, increasing the volume forecasts to include these additional trips would have a limited impact on the intersection operations and would not alter the conclusions of this analysis.

2020 AND 2040 ALTERNATIVES ANALYSIS

AM and PM peak hour vehicle delay and level of service (LOS) were analyzed for 2020 and 2040. There are four conceptual alternatives being studied for the Pines Road / BNSF Grade Separation Project. These four alternatives only affect the lane configuration and intersection control of the Pines Road / Trent Avenue intersection. So, the following intersections were analyzed in 2020 and 2040 under each alternative:

- No Build:
  - Pines Road / Trent Avenue
  - University Road / Trent Avenue
  - Argonne Road / Trent Avenue
  - Argonne Road / Montgomery Avenue
- Alternative 1:
  - Pines Road / Trent Avenue
- Alternative 1a (roundabout):
  - Pines Road / Trent Avenue
- Alternative 2:
  - Pines Road / Trent Avenue
- Alternative 2a (roundabout):
  - Pines Road / Trent Avenue

No Build Results

All four study intersections were analyzed under the No Build alternative which includes the following assumptions:

- 2020 intersection lane configurations and signal timings were consistent with the 2017 existing analysis
- 2040 analysis assumes consistency with the Spokane Valley Comprehensive Plan:
  - Improvements at the Pines Road / Trent Avenue intersection were assumed to be consistent with the Spokane Valley Comprehensive Plan which includes:
    - North/south split phasing changed to standard protected left turn phasing
    - Addition of a second westbound left turn pocket
    - Addition of a dedicated southbound left turn pocket
    - Reconfigured northbound approach with two left turn pockets, one through lane, and one right turn lane
  - Improvements at the Argonne Road / Trent Avenue intersection were assumed to be consistent with the Spokane Valley Comprehensive Plan which includes:
    - Restriping one westbound through lane as a dedicated left turn lane

Tables 6 and 7 show the intersection operation results for 2020 and 2040 under the No Build conditions respectively. Detailed Synchro results can be found in **Attachment B.**

TABLE 6. 2020 NO BUILD PEAK HOUR INTERSECTION OPERATIONS

ID	Intersection	Control / Approach	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Pines Road / Trent Avenue	Signal	28	C	50	D
2	University Road / Trent Avenue	TWSC / NB	18	C	32	D
3	Argonne Road / Trent Avenue	Signal	48	D	51	D
4	Argonne Road / Montgomery Avenue	Signal	33	C	40	D

Source: Fehr & Peers, 2018

TABLE 7. 2040 NO BUILD PEAK HOUR INTERSECTION OPERATIONS

ID	Intersection	Control / Approach	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Pines Road / Trent Avenue	Signal	23	C	28	C
2	University Road / Trent Avenue	TWSC / NB	24	C	**69**	**F**
3	Argonne Road / Trent Avenue	Signal	52	D	52	D
4	Argonne Road / Montgomery Avenue	Signal	37	D	43	D

Source: Fehr & Peers, 2018

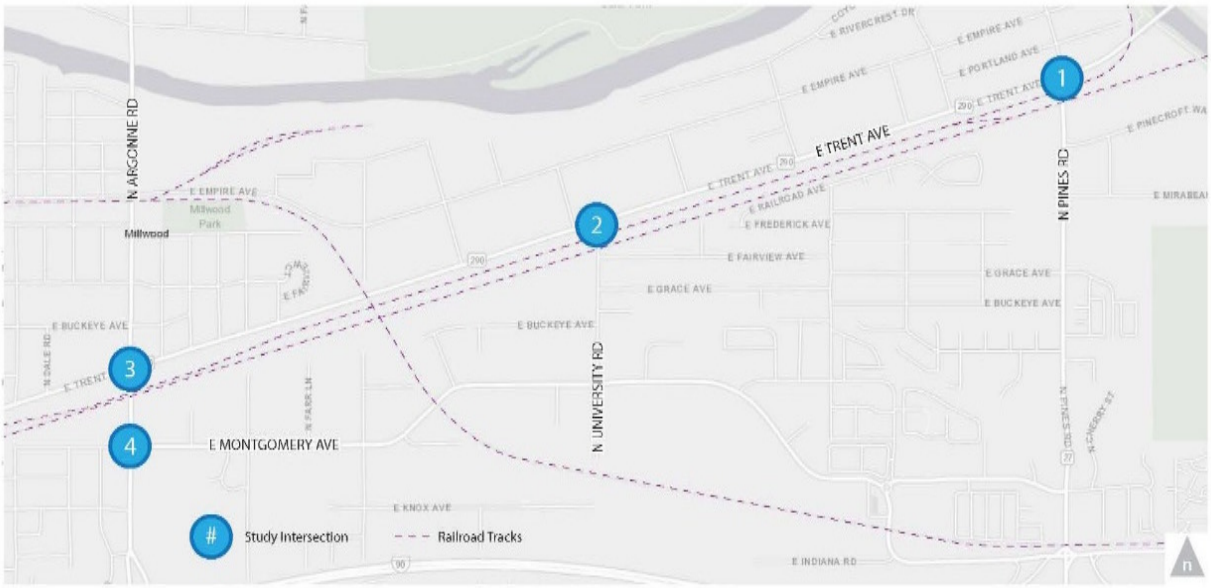
The analysis shows that under the No Build Condition, all intersections would operate at an acceptable LOS during the AM and PM peak hour in both 2020 and 2040 conditions, except for the University Road / Trent Avenue intersection. By 2040, the University Road / Trent Avenue intersection fails both the City's and WSDOT's standards during the PM peak hour.

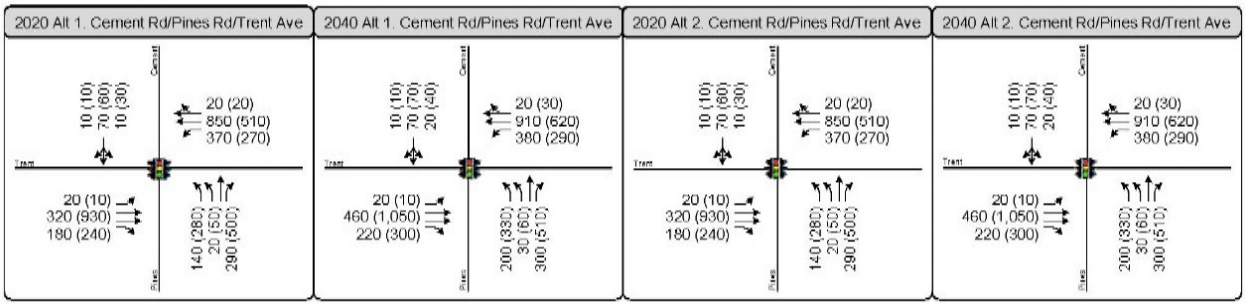
While intersection LOS standards are generally met under the No Build alternative, the delays and at-grade rail safety issues at the Pines Road / BNSF crossing are not addressed. Additionally, the queues caused by the Pines Road / Trent Avenue signal are expected to grow in the future as regional traffic volumes increase. The northbound queues at this intersection will extend back across the railroad tracks, increasing the potential for vehicle/train conflicts.

Grade Separation Alternative Results

The Pines Road / Trent Avenue intersection was evaluated under the following four BNSF grade separation alternatives. Note that a reconstruction of the Pines Road / Trent Avenue intersection is required for the grade separation to be able to depress the roadway under the railroad tracks. For roundabout alternatives (1a and 2a), forecasted traffic volumes in 2040 two eastbound and westbound lanes for the roundabouts. Conceptual drawings of the alternatives are provided in **Attachment C.** 2020 and 2040 lane configurations and turning movement forecasts are provided in **Figure 4.**

Figure 4. 2020 and 2040 Alternatives Lane Configuration and AM (PM) Peak Hour Turning Movement Forecasts





Alternative 1:

The analysis included the following additional assumptions not clearly shown in the conceptual drawings:

- There is one eastbound and westbound left-turn lane (same geometry as the No Build conditions)
- The eastbound right-turn has the same geometry as the No Build conditions
- The northbound movement has two left-turn lanes with one pocket of 150 feet and one trap lane
- The southbound approach is a single shared lane

Alternative 1a (roundabout):

This alternative was analyzed using the Sidra software (version 6.1) using the settings consistent with WSDOT's Sidra Policy Settings published in November 2015. The lane configurations were assumed to follow those in the conceptual drawings. In this case, the assumed speed on Pines Road approaching the intersection is 35 miles per hour and 25 miles per hour on Cement Road approaching the intersection. The circulating speed within the roundabout is assumed to be 15-20 miles per hour.

Alternative 2:

This analysis for this alternative includes the following assumptions in conjunction with the conceptual drawings:

- There is one eastbound left-turn lane with the same geometry as the No Build conditions
- The eastbound right-turn has the same geometry as the No Build Scenario
- There are two westbound left-turn pockets with a storage length of 175 feet
- The northbound movement has two left-turn lanes with one pocket of 150 feet and one trap lane
- The northbound movement also has one right-turn pocket of approximately 150 feet
- The southbound approach is a single shared lane

Alternative 2a (roundabout):

The lane configuration is the same as that of Alternative 1a; however, given the additional curvature of the northbound approach, the assumed speed on Pines Road approaching the intersection was decreased to 15 miles per hour.

Tables 8 and 9 show the operation analysis results for the Pines Road / Trent Avenue intersection under each alternative including the No Build for 2020 and 2040 respectively. Detailed operation results can be found in **Attachment D.**

TABLE 8. 2020 NO BUILD AND ALTERNATIVES PEAK HOUR INTERSECTION OPERATIONS

Pines Rd / Trent Ave	Control	AM Peak Hour	PM Peak Hour
		Delay / LOS	Delay / LOS
No Build	Signal	28 / C	47 / D
Alternative 1	Signal	27 / C	42 / D
Alternative 1a	Roundabout	8 / A	9 / A
Alternative 2	Signal	24 / C	32 / C
Alternative 2a	Roundabout	7 / A	7 / A

Source: Fehr & Peers, 2018

TABLE 9. 2040 NO BUILD AND ALTERNATIVES PEAK HOUR INTERSECTION OPERATIONS

Pines Rd / Trent Ave	Control	AM Peak Hour	PM Peak Hour
		Delay / LOS	Delay / LOS
No Build	Signal	23 / C	28 / C
Alternative 1	Signal	28 / C	41 / D
Alternative 1a	Roundabout	9 / A	9 / A
Alternative 2	Signal	26 / C	32 / C
Alternative 2a	Roundabout	8 / A	8 / A

Source: Fehr & Peers, 2018

In the 2020 and 2040 scenarios, both alternatives meet the City and WSDOT LOS standard. In both the AM and PM peak hour, Alternative 2 performs better than Alternative 1 in terms of delay and LOS. Similarly, the roundabout alternative (Alternative 2a) operates at an even better LOS than Alternative 2.

It is worth noting that while the intersection operations for Alternatives 2 and 2a might be slightly better than 1 and 1a, the sharp curve south of the Pines Road / Trent Avenue intersection is unusual for an arterial road and the lower speed required to negotiate this curve will negate much of the intersection operations improvements, particularly for the roundabout alternative. Additional discussion about the disadvantages of this sharp curve are included in the conclusions section.

These results show slightly more delay for Alternative 1 and 2 when compared with the No Build due to the difference in lane geometry at the southbound approach. In all Alternatives, the southbound approach

consists of a shared right, through, and left movement whereas the No Build includes a separate left turn pocket. If the Alternatives included this separate left turn pocket, the operations are anticipated to be similar to the No Build alternative. For example, the Alternative 2 PM peak hour would improve to have a delay of 32 seconds with a LOS C.

In addition to improving the operations at the intersection, roundabouts also help manage queuing in the system. Alternative 1 experiences long queuing for vehicles traveling in the eastbound and westbound directions in the 2020 PM and 2040 PM peak hours. In the eastbound direction, queues are anticipated to spill back to the previous intersection and in the westbound direction queues are anticipated to spill back onto the bridge over the Spokane River. Alternative 2 experiences long queuing in the eastbound directions during the 2020 PM and 2040 PM peak hours and in the westbound direction in the 2040 AM and PM peak hours. In the 2040 PM peak hour, both Alternative 1 and 2 experience long queuing for vehicles traveling in the northbound direction where queues are expected to spill back to the bridge under railroad tracks.

2020 AND 2040 SAFETY ANALYSIS

A safety analysis was conducted to predict average intersection collision frequency in 2020 and 2040 at the Pines Road / Trent Avenue intersection under each Alternative along based on the Highway Safety Manual (HSM) predictive method. The following scenarios were analyzed:

- No Build scenario
- Alternative 1 with a signal
- Alternative 1 with a roundabout
- Alternative 2 with a signal
- Alternative 2 with a roundabout

Methodology

We used WSDOT's spreadsheet tool for urban and suburban arterials to automate the HSM Predictive analysis[2] (see http://www.wsdot.wa.gov/Design/Support.htm). The WSDOT disclaimer should be noted as it relates to the results when using this tool.[3] The tool, which is based on the HSM predictive method, includes several inputs to predict average annual crashes by type, including:

- Intersection control type (signal or stop)
- Number of legs on intersection

[2] Safety Analysis Guide. Washington State Department of Transportation, September 2017. Pg 16.

[3] Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

- Average Annual Daily Traffic entering intersection
- Presence of lighting
- Calibration factor
- Number of approaches with left-turn and right-turn lanes
- Left-turn signal phasing (permissive, protected or permissive/protected)
- Pedestrian crossing volume
- Lanes crossed by a pedestrian
- Collision history (not applicable to multiyear forecasts)
- Presence of red-light cameras
- Right-turn on red restrictions
- Number of bus stops within 1,000 feet of the intersection
- Schools within 1,000 feet of the intersection
- Alcohol sales establishments within 1,000 feet of the intersection

For the above inputs, many variables were assumed to be consistent under all 2020 and 2040 scenarios, including:

- Lighting would be present;
- The calibration factor was set to 1 (default);
- No red-light cameras would be present;
- Right-turn on red would be allowed (under scenarios that assume signals);
- No public transit bus stops would be within 1,000 feet of the intersection;
- The Trent Elementary school would be within 1,000 feet of the intersection;
- Two alcohol establishments would be within 1,000 feet of the intersection (Dos Amigos and Valley Bar and Grill)

Intersection Type

The spreadsheet tool includes a stop control and signal control option but does not include a roundabout option. Therefore, a signal was assumed for all intersections and predicted collisions for intersections with a roundabout were adjusted from the predictions with a signal based on research provided by WSDOT and other sources (see description below).

Reduction in Collisions from Roundabouts

WSDOT references studies by the Institute for Highway Safety and Federal Highway Administration that have shown that roundabouts are safer than signals.[4] Based on those studies as compared to other control types, roundabouts typically achieve:

- A 37 percent reduction in overall collisions

[4] https://www.wsdot.wa.gov/Safety/roundabouts/benefits.htm

- A 75 percent reduction in injury collisions
- A 90 percent reduction in fatality collisions
- A 40 percent reduction in pedestrian collisions

The reduction in collisions can be attributed to lower travel speeds (typically 15-20 mph) through the intersection, eliminating the temptation to "beat the light" (all drivers must slow down), and the one-way travel pattern which reduces the likelihood of T-bone and head-on collisions.

To be consistent with WSDOT data sources, the methodology used to predict collisions with a roundabout is based on a 75% reduction in injury collisions and 37% reduction in all collisions from what would be predicted with a signal.

Average Annual Daily Traffic Forecasts

Average annual daily traffic (AADT) was forecast for the year 2020 for each approach to each intersection by applying an annual growth rate to the most recent observed daily count. The annual growth rate was calculated from the most recent observed count and the 2040 forecasted AADT from the SRTC model. Traffic volumes in 2020 were assumed to be the same under both alternatives as well as the No Build Scenario. Under Alternative 2, the north leg would tie into E Portland Avenue instead of Cement Road. Given that these are both low volume streets that provide local access to the same general area, the volumes were assumed to be the same as Alternative 1 and the No Build Scenario.

Average annual daily traffic (AADT) was forecast for the year 2040 for each approach to the intersection using the SRTC travel demand model developed to support the Horizon 2040 plan. One model run was used for 2040 forecasts under both alternatives, including the No Build Scenario. To develop forecasts, the difference method was used whereby the growth in daily traffic for each segment between the 2015 model and 2040 model was added to the existing (most recent) observed daily traffic counts as reported by City of Spokane Valley[5]. This method reduces the likelihood of model error. The 2020 and 2040 AADT outcomes using the methodologies described here are summarized in **Table 10**.

[5] http://www.spokanevalley.org/Traffic (see "Most Recent ADT")

TABLE 10: 2020 AND 2040 AADT BY APPROACH FOR EACH ALTERNATIVE

Alternative	Intersection	EB	WB	NB	SB
2020 AADT					
No Build / Alternative 1 / Alternative 2	Pines Road / Trent Avenue	11,500	13,600	8,100	800
2040 AADT					
No Build / Alternative 1 / Alternative 2	Pines Road / Trent Avenue	13,500	15,200	8,400	840

Source: WSDOT, 2018

Lane Configurations

The number of turn lanes at each intersection under each alternative as well as the maximum number of lanes a pedestrian would have to cross was based on the conceptual drawings provided in **Attachment C** and were shown previously in **Figure 4**.

Under both alternatives and the No Build Scenario, right-turn only lanes are included in the eastbound and northbound approaches, as well as two northbound left-turn lanes and one eastbound left-turn lane. Under Alternative 1 there would be one westbound left-turn lane, while under Alternative 2 and the No Build Scenario there would be two westbound left-turn lanes. Under the No Build Scenario there would be a southbound left-turn pocket, which is not assumed in Alternative 1 and 2.

Left-Turn Signal Phasing

Under Alternative 1 and 2 all left-turns would have a protected signal phasing, except for the southbound left, which would be permissive. The southbound approach is a low-volume movement that primarily provides access to the adjacent businesses. Under the No Build Scenario all left-turns would have a protected signal phase.

Pedestrian Crossing Volumes

Two-hour pedestrian counts across all four legs of the existing Pines Road / Trent Avenue intersection were collected on a weekday in August 2017 in both the AM peak period (7 AM – 9 AM) and the PM peak period (4 PM – 6 PM). The combined total pedestrian crossings during these four hours was 22. Using calibration factors from the National Bicycle and Pedestrian Documentation Project (which estimates about 20% of daily pedestrian activity occurs during these four hours), it was estimated that there are about 110 daily pedestrian crossings at the Pines Road / Trent Avenue intersection.

A 2% annual growth rate was assumed for pedestrian volumes crossing the Pines Road/Trent Avenue intersection. Therefore, it was assumed that by 2020 there would be about 120 daily pedestrian crossings at this intersection.

Data from the SRTC travel demand model shows that within the three transportation analysis zones surrounding this intersection the number of households will grow by about 125% and the number of employees will grow by about 260% between 2015 and 2040. Based on these localized growth forecasts it was assumed that pedestrian volumes would increase by about 200% between now and 2040. Therefore, it was estimated that by 2040 there would be about 330 daily pedestrian crossings of the Pines Road / Trent Avenue intersection.

Safety Analysis Findings

Using the methodology described in the previous section, Table **11** shows the average predicted crashes per year by 2040 at the Pines Road / Cement Road / Trent Avenue intersection under Alternative 1, both with a signal and with a roundabout. The findings illustrate that the Pines Road intersection is predicted to have a higher average number of injury crashes per year with a signal than with a roundabout. The results would be predicted to be similarly higher if a signal as opposed to a roundabout were assumed under the other alternatives.

TABLE 11. PREDICTED AVERAGE COLLISIONS PER YEAR BY ALTERNATIVE AT PINES ROAD / TRENT AVENUE

Intersection	Intersection Control	Predicted average collisions per year	Fatal & injury collisions per year	PDO crashes per year
Year 2020				
Alternative 1	Signal	3.9	1.4	2.5
Alternative 1a	Roundabout	2.4	0.4	2.2
Alternative 2	Signal	3.9	1.4	2.5
Alternative 2a	Roundabout	2.4	0.4	2.2
No Build	Signal	3.3	1.2	2.1
Year 2040				
Alternative 1	Signal	4.5	1.6	2.9
Alternative 1a	Roundabout	2.8	0.4	2.5
Alternative 2	Signal	4.5	1.6	2.9
Alternative 2a	Roundabout	2.8	0.4	2.5
No Build	Signal	3.9	1.4	2.5

Source: Fehr & Peers, 2017

The No Build Scenario is predicted to have slightly fewer injury crashes per year (in both 2020 and 2040) than both Alternatives 1 and 2 with a signal. This finding is primarily because the No Build Scenario assumes a separate left-turn pocket with protected left-turn signal phasing for southbound movements, while Alternative 1 and 2 do not. However, the No Build scenario is predicted to have about one more fatal and injury crash per year on average (in both 2020 and 2040) than Alternatives 1 and 2 with a roundabout.

UNIVERSITY ROAD CLOSURE SCENARIO

When evaluating the grade separation of Pines Road at the BNSF mainline, Spokane Valley, SRTC, and BNSF have also considered the benefits and consequences of closing the University Road crossing of the tracks. As part of this study, Fehr & Peers analyzed the effects of closing the at-grade railroad crossing at University Road and examined rerouted travel demand as well as intersection operations at the remaining three study intersections for the 2020 and 2040 AM and PM peak hour.

Using the SRTC regional travel demand model, traffic volumes were rerouted from the University Road / Trent Avenue intersection to adjacent intersections based on model travel patterns. **Figures 5 and 6** present the trip distribution results of closing University Road. Approximately 200 vehicles were rerouted in the 2020 scenarios and approximately 300 were rerouted in the 2040 scenarios.

Figure 5. University Road Closure – Trip Distribution (In)

Figure 6. University Road Closure – Trip Distribution (Out)

Approximately 90% of trips turning onto Trent Avenue from University Road were assumed to travel either eastbound or westbound along Trent Avenue past the adjacent study intersections.

For vehicles heading in the eastbound direction, it is assumed that approximately 50% of those vehicles are expected to reroute to Pines Road via Montgomery Avenue. The remaining 50% are expected to use other residential streets to reach Pines Road.

The rerouted vehicles were assigned to the volume forecasts at the three remaining study intersections and the intersection operations were analyzed for the 2020 and 2040 scenarios. At the Argonne Road / Trent Avenue intersection in 2040, the westbound approach is only assumed to have two through lanes (as opposed to three in the 2020 scenario).

Figures 7 and 8 show the updated traffic volume forecasts for 2020 and 2040 after the University Road closure.

Figure 7. 2020 University Road Closure Lane Configuration and AM (PM) Peak Hour Turning Movement Forecasts

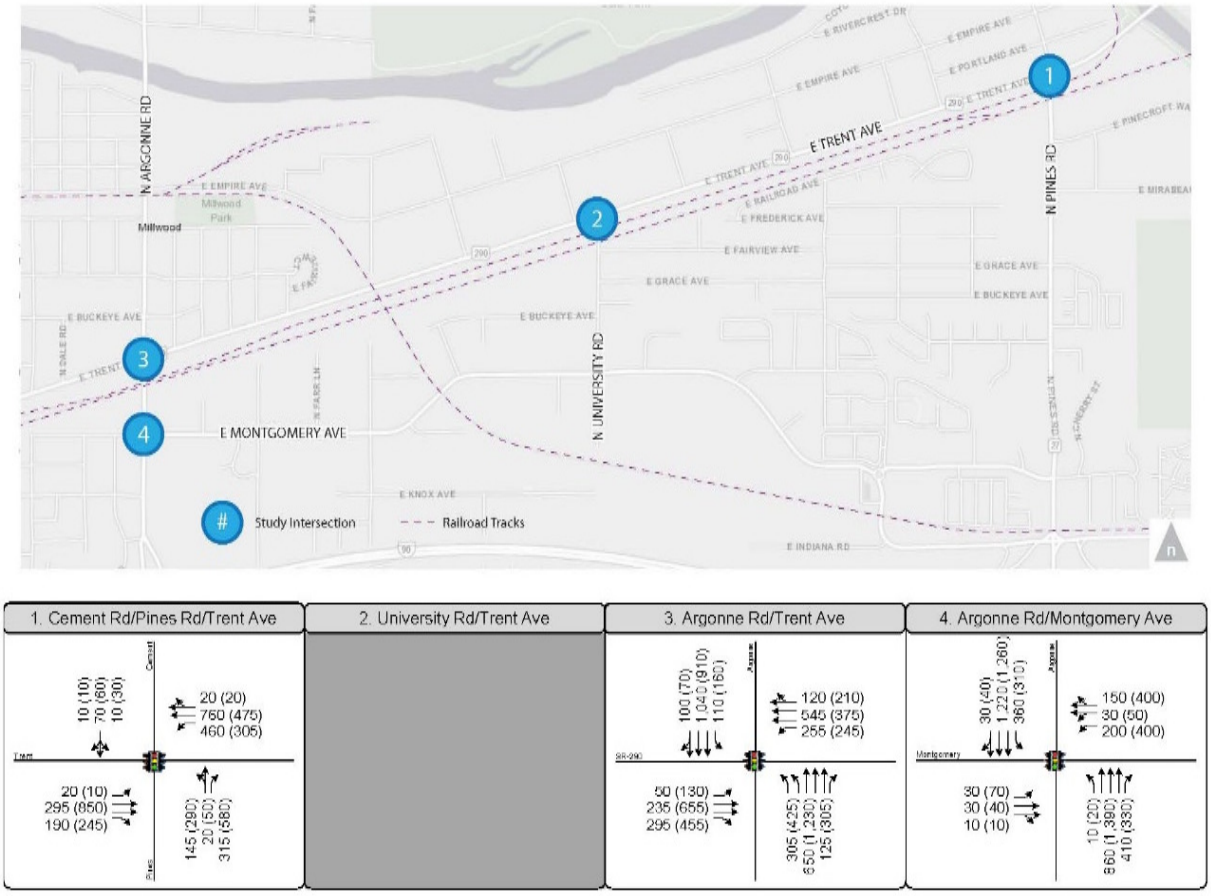
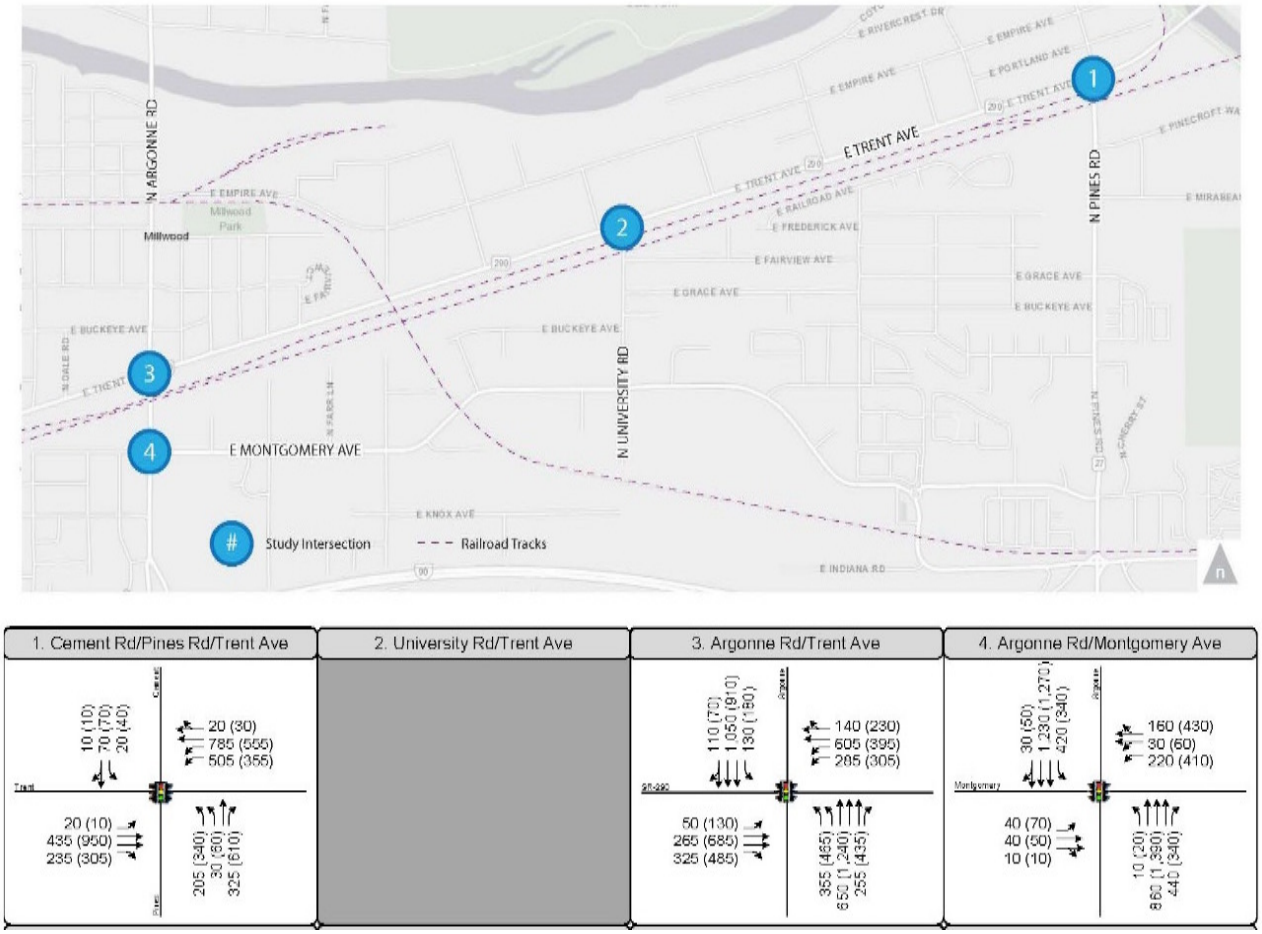


Figure 8. 2040 University Road Closure Lane Configuration and AM (PM) Peak Hour Turning Movement Forecasts



The delay and LOS results for the 2020 and 2040 University Road closure scenario are shown in **Tables 12 and 13** below and can also be found in **Attachment E**:

TABLE 12. 2020 NO BUILD AND UNIVERSITY CLOSURE PEAK HOUR INTERSECTION OPERATIONS

ID	Intersection	Control / Approach	AM Peak Hour		PM Peak Hour	
			No Build Delay / LOS	Closure Delay / LOS	No Build Delay / LOS	Closure Delay / LOS
1	Pines Road / Trent Avenue	Signal	28 / C	33 / C	50 / D	53 / D
2	University Road / Trent Avenue	TWSC / NB	18 / C		32 / D	
3	Argonne Road / Trent Avenue	Signal	48 / D	48 / D	51 / D	51 / D
4	Argonne Road / Montgomery Avenue	Signal	33 / C	34 / C	40 / D	44 / D

Source: Fehr & Peers, 2017

TABLE 13. 2040 COMPREHENSIVE PLAN AND UNIVERSITY CLOSURE PEAK HOUR INTERSECTION OPERATIONS

ID	Intersection	Control / Approach	AM Peak Hour		PM Peak Hour	
			No Build Delay / LOS	Closure Delay / LOS	No Build Delay / LOS	Closure Delay / LOS
1	Pines Road / Trent Avenue	Signal	23 / C	24 / C	28 / C	31 / C
2	University Road / Trent Avenue	TWSC / NB	24 / C		**69 / F**	
3	Argonne Road / Trent Avenue	Signal	52 / D	52 / D	52 / D	52 / D
4	Argonne Road / Montgomery Avenue	Signal	37 / D	39 / D	43 / D	51 / D

Source: Fehr & Peers, 2017

In 2020 and 2040, all intersections meet the City and WSDOT LOS standards with the closure of the University Road / BNSF crossing. While the results indicate that the University Road / BNSF crossing could be closed without resulting in any LOS impacts, and would in fact eliminate the LOS F condition at University Road/Trent Avenue,[6] consideration must be given to the drivers that would need to reroute to find an alternative route to Trent Avenue. Unlike some other areas in Spokane Valley, the residential area around the University Road/BNSF crossing is not well connected to the surrounding street grid. The UPRR tracks

[6] There are other options available to improve the LOS at this intersection including widening to include separate left and right northbound turn lanes or restricting access to be right in/out only. Additional study would be required to determine the best course of action to improve LOS.

significantly limit access to the west and south and hilly terrain limits access to the west. It is worth noting that the University Road /BNSF crossing is one of the few quiet zone crossings in the Valley. Quiet zones have enhanced safety systems at the grade crossings, which allow trains to pass without blowing their whistles.

Given the factors described above, the fact that there has not been a train/vehicle collision at this crossing in more than 40 years, and the low current and forecasted volumes (Pines Road has nearly six times the PM peak hour volume as University Road), we recommend that the University Road/BNSF crossing be maintained.

SUMMARY OF FINDINGS

Based on the analysis of the different alternatives, each concept offers different advantages and disadvantages as they relate to mobility, traffic flow, delay and safety. Under Alternatives 1 and 2, traffic operations at the redesigned Pines Road / Trent Avenue intersection show similar traffic operations and safety results when comparing the two alternatives. Overall, the roundabout alternatives perform better than the signals with respect to LOS, queuing, and safety, although the traffic signal options would still meet LOS thresholds and perform similarly to many other signalized arterial intersections in Spokane Valley and around the state.

Alternatives 2 and 2a include an intersection geometry that consists of a sharp 90 degree turn in the northbound approach to enter the intersection. This configuration can cause potential issues with truck and freight operations entering the intersection from the south as trucks may be slow in navigating the sharp turn and oversize loads may track into adjacent lanes. This configuration also presents a potential safety issue given the sharp curve as drivers would enter the curve and have limited visibility of the rest of the intersection and of the vehicles queued at the intersection. These potential visibility issues could be addressed with signage/flashing beacons/variable message signs, but these elements add cost and complexity to the project and are unnecessary for Alternatives 1 and 1a. Overall, the configuration for Alternatives 2 and 2a is unusual, which may catch unfamiliar drivers off-guard.

Since all four Alternatives only affect the Pines Road / Trent Avenue intersection, no operational issues other than those shown under the No Build condition are expected for the other study intersections.

Given that the Pines Road / Trent Avenue intersection would have the capacity to serve increased demand due to the University Road closure, the Alternatives are also expected to operate similarly in 2020 and 2040 even if University Road was closed. However, given the limited connectivity to the neighborhood around the University Road / BNSF crossing, along with the relatively low volumes of traffic and existing safety enhancements at this crossing, we recommend that the University Road grade crossing remain open.

FEHR PEERS

ATTACHMENT A: 2017 EXISTING CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	301	171	373	838	19	138	24	292	10	65	2
Future Volume (veh/h)	11	301	171	373	838	19	138	24	292	10	65	2
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1700	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	12	342	0	424	952	22	157	27	162	11	74	2
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	22	593	265	475	1495	35	206	35	214	14	94	3
Arrive On Green	0.01	0.19	0.00	0.31	0.49	0.49	0.16	0.16	0.16	0.07	0.07	0.07
Sat Flow, veh/h	1527	3047	1363	1527	3045	70	1312	226	1363	201	1350	36
Grp Volume(v), veh/h	12	342	0	424	476	498	184	0	162	87	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1527	1524	1591	1538	0	1363	1587	0	0
Q Serve(g_s), s	0.6	8.2	0.0	21.3	18.6	18.6	9.2	0.0	9.1	4.3	0.0	0.0
Cycle Q Clear(g_c), s	0.6	8.2	0.0	21.3	18.6	18.6	9.2	0.0	9.1	4.3	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.04	0.85		1.00	0.13		0.02
Lane Grp Cap(c), veh/h	22	593	265	475	748	781	241	0	214	111	0	0
V/C Ratio(X)	0.54	0.58	0.00	0.89	0.64	0.64	0.76	0.00	0.76	0.78	0.00	0.00
Avail Cap(c_a), veh/h	114	1176	526	1331	1802	1882	651	0	577	464	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	39.3	29.4	0.0	26.4	15.1	15.1	32.4	0.0	32.4	36.8	0.0	0.0
Incr Delay (d2), s/veh	18.6	0.9	0.0	6.0	0.9	0.9	5.0	0.0	5.4	11.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.5	0.0	9.7	8.0	8.3	4.2	0.0	3.7	2.2	0.0	0.0
LnGrp Delay(d),s/veh	57.9	30.2	0.0	32.4	16.0	16.0	37.4	0.0	37.8	48.1	0.0	0.0
LnGrp LOS	E	C		C	B	B	D		D	D		
Approach Vol, veh/h		354			1398			346			87	
Approach Delay, s/veh		31.2			21.0			37.6			48.1	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.2	45.4		17.6	31.0	21.6		10.1
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	6.0	95.0		34.0	70.0	31.0		23.5
Max Q Clear Time (g_c+I1), s	2.6	20.6		11.2	23.3	10.2		6.3
Green Ext Time (p_c), s	0.0	6.1		1.4	1.7	5.4		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	26.4
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	454	37	93	892	39	24
Future Vol, veh/h	454	37	93	892	39	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	499	41	102	980	43	26

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	540	0	1214	270
Stage 1	-	-	-	-	519	-
Stage 2	-	-	-	-	695	-
Critical Hdwy	-	-	4.22	-	6.92	7.02
Critical Hdwy Stg 1	-	-	-	-	5.92	-
Critical Hdwy Stg 2	-	-	-	-	5.92	-
Follow-up Hdwy	-	-	2.26	-	3.56	3.36
Pot Cap-1 Maneuver	-	-	997	-	168	716
Stage 1	-	-	-	-	551	-
Stage 2	-	-	-	-	446	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	997	-	151	716
Mov Cap-2 Maneuver	-	-	-	-	278	-
Stage 1	-	-	-	-	551	-
Stage 2	-	-	-	-	400	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	17.3
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	362	-	-	997	-
HCM Lane V/C Ratio	0.191	-	-	0.103	-
HCM Control Delay (s)	17.3	-	-	9	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	264	257	245	571	119	267	646	110	112	1041	102
Future Volume (vph)	46	264	257	245	571	119	267	646	110	112	1041	102
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2913	1303	1456	4077		2825	4185	1303	1456	4129	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2913	1303	1456	4077		2825	4185	1303	1456	4129	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	287	279	266	621	129	290	702	120	122	1132	111
RTOR Reduction (vph)	0	0	67	0	21	0	0	0	39	0	7	0
Lane Group Flow (vph)	50	287	212	266	729	0	290	702	81	122	1236	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.0	15.8	37.3	28.4	36.2		21.5	68.1	96.5	16.7	58.3	
Effective Green, g (s)	10.5	18.3	44.8	30.9	38.7		25.5	70.1	101.5	18.7	60.3	
Actuated g/C Ratio	0.07	0.12	0.30	0.21	0.26		0.17	0.47	0.68	0.12	0.40	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	101	355	389	299	1051		480	1955	881	181	1659	
v/s Ratio Prot	0.03	c0.10	0.10	c0.18	0.18		c0.10	0.17	0.02	c0.08	c0.30	
v/s Ratio Perm			0.07						0.04			
v/c Ratio	0.50	0.81	0.55	0.89	0.69		0.60	0.36	0.09	0.67	0.74	
Uniform Delay, d1	67.2	64.1	44.1	57.9	50.3		57.6	25.6	8.4	62.7	38.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.90	0.20	0.19	1.00	1.00	
Incremental Delay, d2	3.8	12.7	1.6	25.8	2.0		1.5	0.4	0.0	9.5	1.9	
Delay (s)	71.0	76.8	45.6	83.7	52.3		111.0	5.5	1.7	72.2	40.1	
Level of Service	E	E	D	F	D		F	A	A	E	D	
Approach Delay (s)		62.2			60.5			32.6			43.0	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	47.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	34	6	194	23	110	9	855	411	308	1222	25
Future Volume (vph)	34	34	6	194	23	110	9	855	411	308	1222	25
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.98		1.00	0.92		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2845		1325	2528		1456	4185	1303	1456	4173	
Flt Permitted	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2845		1325	2528		1456	4185	1303	1456	4173	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	38	38	7	218	26	124	10	961	462	346	1373	28
RTOR Reduction (vph)	0	7	0	0	103	0	0	0	271	0	1	0
Lane Group Flow (vph)	38	38	0	126	139	0	10	961	191	346	1400	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	7.5	7.5		23.1	23.1		1.2	45.0	45.0	54.4	98.2	
Effective Green, g (s)	10.0	10.0		25.6	25.6		2.2	47.0	46.0	55.4	100.2	
Actuated g/C Ratio	0.07	0.07		0.17	0.17		0.01	0.31	0.31	0.37	0.67	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	97	189		226	431		21	1311	399	537	2787	
v/s Ratio Prot	c0.03	0.01		c0.10	0.06		0.01	c0.23		c0.24	0.34	
v/s Ratio Perm									0.15			
v/c Ratio	0.39	0.20		0.56	0.32		0.48	0.73	0.48	0.64	0.50	
Uniform Delay, d1	67.1	66.2		57.0	54.6		73.3	45.9	42.3	39.1	12.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.75	0.63	
Incremental Delay, d2	2.6	0.5		9.6	2.0		16.0	3.7	4.1	4.3	0.5	
Delay (s)	69.7	66.8		66.6	56.6		89.4	49.6	46.3	33.7	8.3	
Level of Service	E	E		E	E		F	D	D	C	A	
Approach Delay (s)		68.1			60.0			48.8			13.4	
Approach LOS		E			E			D			B	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		
Description: 2017 counts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	914	231	268	499	17	277	52	501	24	63	6
Future Volume (veh/h)	3	914	231	268	499	17	277	52	501	24	63	6
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1635	1667	1667	1636	1700	1700	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	3	933	0	273	509	17	283	53	256	24	64	6
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	4	2	2	4	4	2	2	2	2	2	2
Cap, veh/h	6	1034	471	302	1592	53	314	59	330	30	80	8
Arrive On Green	0.00	0.33	0.00	0.19	0.52	0.52	0.23	0.23	0.23	0.07	0.07	0.07
Sat Flow, veh/h	1587	3106	1417	1587	3069	102	1347	252	1417	416	1108	104
Grp Volume(v), veh/h	3	933	0	273	257	269	336	0	256	94	0	0
Grp Sat Flow(s),veh/h/ln	1587	1553	1417	1587	1554	1618	1599	0	1417	1628	0	0
Q Serve(g_s), s	0.2	35.9	0.0	21.1	12.0	12.0	25.5	0.0	21.2	7.1	0.0	0.0
Cycle Q Clear(g_c), s	0.2	35.9	0.0	21.1	12.0	12.0	25.5	0.0	21.2	7.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.06	0.84		1.00	0.26		0.06
Lane Grp Cap(c), veh/h	6	1034	471	302	806	839	373	0	330	118	0	0
V/C Ratio(X)	0.48	0.90	0.00	0.91	0.32	0.32	0.90	0.00	0.78	0.80	0.00	0.00
Avail Cap(c_a), veh/h	431	1340	611	431	806	839	447	0	396	462	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	62.2	39.8	0.0	49.6	17.4	17.4	46.6	0.0	44.9	57.1	0.0	0.0
Incr Delay (d2), s/veh	47.1	7.3	0.0	17.3	0.2	0.2	19.0	0.0	7.8	11.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	16.3	0.0	10.7	5.2	5.4	13.3	0.0	9.0	3.6	0.0	0.0
LnGrp Delay(d),s/veh	109.3	47.1	0.0	66.8	17.6	17.6	65.6	0.0	52.7	68.6	0.0	0.0
LnGrp LOS	F	D		E	B	B	E		D	E		
Approach Vol, veh/h		936			799			592			94	
Approach Delay, s/veh		47.3			34.4			60.0			68.6	
Approach LOS		D			C			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.5	70.9		34.1	29.8	47.6		13.6
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	34.0	54.0		35.0	34.0	54.0		35.5
Max Q Clear Time (g_c+I1), s	2.2	14.0		27.5	23.1	37.9		9.1
Green Ext Time (p_c), s	0.0	7.4		1.6	0.7	3.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	47.0
HCM 2010 LOS	D

Intersection	
Int Delay, s/veh	2.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1100	42	31	771	48	89
Future Vol, veh/h	1100	42	31	771	48	89
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1183	45	33	829	52	96

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1228	0	1686	614
Stage 1	-	-	-	-	1205	-
Stage 2	-	-	-	-	481	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	563	-	85	435
Stage 1	-	-	-	-	247	-
Stage 2	-	-	-	-	588	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	563	-	80	435
Mov Cap-2 Maneuver	-	-	-	-	186	-
Stage 1	-	-	-	-	247	-
Stage 2	-	-	-	-	554	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	28.6
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	296	-	-	563	-
HCM Lane V/C Ratio	0.498	-	-	0.059	-
HCM Control Delay (s)	28.6	-	-	11.8	-
HCM Lane LOS	D	-	-	B	-
HCM 95th %tile Q(veh)	2.6	-	-	0.2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	125	690	409	229	416	206	380	1234	279	161	906	66
Future Volume (vph)	125	690	409	229	416	206	380	1234	279	161	906	66
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	3027	1354	1513	4133		2936	4349	1354	1513	4305	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	3027	1354	1513	4133		2936	4349	1354	1513	4305	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	128	704	417	234	424	210	388	1259	285	164	924	67
RTOR Reduction (vph)	0	0	32	0	59	0	0	0	64	0	5	0
Lane Group Flow (vph)	128	704	385	234	575	0	388	1259	221	164	986	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	16.8	35.8	60.8	20.5	39.5		25.0	52.9	73.4	19.8	42.7	
Effective Green, g (s)	19.3	38.3	68.3	23.0	42.0		29.0	54.9	78.4	21.8	44.7	
Actuated g/C Ratio	0.13	0.26	0.46	0.15	0.28		0.19	0.37	0.52	0.15	0.30	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	194	772	616	231	1157		567	1591	707	219	1282	
v/s Ratio Prot	0.08	c0.23	0.12	c0.15	0.14		0.13	c0.29	0.05	c0.11	c0.23	
v/s Ratio Perm			0.16						0.12			
v/c Ratio	0.66	0.91	0.62	1.01	0.50		0.68	0.79	0.31	0.75	0.77	
Uniform Delay, d1	62.2	54.2	31.1	63.5	45.2		56.2	42.4	20.4	61.5	48.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.83	0.38	0.18	1.00	1.00	
Incremental Delay, d2	7.9	15.0	2.0	62.6	0.3		2.3	2.8	0.2	13.1	2.8	
Delay (s)	70.1	69.2	33.1	126.1	45.5		105.1	19.0	3.9	74.6	50.8	
Level of Service	E	E	C	F	D		F	B	A	E	D	
Approach Delay (s)		57.2			67.2			34.1			54.2	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	49.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		
Description: 2015 counts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	37	9	404	47	346	18	1386	325	259	1260	39
Future Volume (vph)	61	37	9	404	47	346	18	1386	325	259	1260	39
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.97		1.00	0.90		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	2940		1377	2578		1513	4349	1354	1513	4330	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	2940		1377	2578		1513	4349	1354	1513	4330	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	62	38	9	412	48	353	18	1414	332	264	1286	40
RTOR Reduction (vph)	0	9	0	0	242	0	0	0	132	0	2	0
Lane Group Flow (vph)	62	38	0	284	287	0	18	1414	200	264	1324	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	5.5	5.5		39.5	39.5		3.0	58.0	58.0	27.0	82.0	
Effective Green, g (s)	8.0	8.0		42.0	42.0		4.0	60.0	59.0	28.0	84.0	
Actuated g/C Ratio	0.05	0.05		0.28	0.28		0.03	0.40	0.39	0.19	0.56	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	80	156		385	721		40	1739	532	282	2424	
v/s Ratio Prot	c0.04	0.01		c0.21	0.11		0.01	c0.33		c0.17	0.31	
v/s Ratio Perm									0.15			
v/c Ratio	0.78	0.25		0.74	0.40		0.45	0.81	0.38	0.94	0.55	
Uniform Delay, d1	70.1	68.1		49.0	43.8		71.9	40.0	32.4	60.1	20.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.81	0.67	
Incremental Delay, d2	36.4	0.8		11.9	1.6		7.9	4.3	2.0	30.1	0.6	
Delay (s)	106.5	68.9		60.9	45.4		79.8	44.3	34.4	78.8	14.6	
Level of Service	F	E		E	D		E	D	C	E	B	
Approach Delay (s)		90.3			50.8			42.8			25.2	
Approach LOS		F			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	39.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

FEHR PEERS

ATTACHMENT B: 2020 AND 2040 NO BUILD CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Future Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1700	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	364	0	420	966	23	159	23	160	11	80	11
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	38	607	271	469	1465	35	207	30	210	14	101	14
Arrive On Green	0.02	0.20	0.00	0.31	0.48	0.48	0.15	0.15	0.15	0.08	0.08	0.08
Sat Flow, veh/h	1527	3047	1363	1527	3042	72	1342	194	1363	169	1228	169
Grp Volume(v), veh/h	23	364	0	420	484	505	182	0	160	102	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1527	1524	1591	1537	0	1363	1566	0	0
Q Serve(g_s), s	1.2	9.1	0.0	22.0	20.2	20.2	9.5	0.0	9.4	5.3	0.0	0.0
Cycle Q Clear(g_c), s	1.2	9.1	0.0	22.0	20.2	20.2	9.5	0.0	9.4	5.3	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.05	0.87		1.00	0.11		0.11
Lane Grp Cap(c), veh/h	38	607	271	469	734	766	237	0	210	129	0	0
V/C Ratio(X)	0.61	0.60	0.00	0.90	0.66	0.66	0.77	0.00	0.76	0.79	0.00	0.00
Avail Cap(c_a), veh/h	110	1130	505	1279	1731	1808	625	0	554	440	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	40.4	30.4	0.0	27.7	16.5	16.5	33.9	0.0	33.9	37.6	0.0	0.0
Incr Delay (d2), s/veh	14.7	1.0	0.0	6.3	1.0	1.0	5.2	0.0	5.6	10.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.9	0.0	10.0	8.7	9.0	4.4	0.0	3.9	2.7	0.0	0.0
LnGrp Delay(d),s/veh	55.1	31.4	0.0	33.9	17.5	17.4	39.2	0.0	39.5	47.8	0.0	0.0
LnGrp LOS	E	C		C	B	B	D		D	D		
Approach Vol, veh/h		387			1409			342			102	
Approach Delay, s/veh		32.8			22.4			39.3			47.8	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	46.3		17.9	31.7	22.6		11.4
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	6.0	95.0		34.0	70.0	31.0		23.5
Max Q Clear Time (g_c+I1), s	3.2	22.2		11.5	24.0	11.1		7.3
Green Ext Time (p_c), s	0.0	6.4		1.4	1.7	5.6		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	27.9
HCM 2010 LOS	C

Intersection	
Int Delay, s/veh	1.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	480	40	90	910	40	20
Future Vol, veh/h	480	40	90	910	40	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	527	44	99	1000	44	22

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	571	0	1247	286
Stage 1	-	-	-	-	549	-
Stage 2	-	-	-	-	698	-
Critical Hdwy	-	-	4.22	-	6.92	7.02
Critical Hdwy Stg 1	-	-	-	-	5.92	-
Critical Hdwy Stg 2	-	-	-	-	5.92	-
Follow-up Hdwy	-	-	2.26	-	3.56	3.36
Pot Cap-1 Maneuver	-	-	971	-	160	699
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	444	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	971	-	144	699
Mov Cap-2 Maneuver	-	-	-	-	272	-
Stage 1	-	-	-	-	531	-
Stage 2	-	-	-	-	399	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	18
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	342	-	-	971	-
HCM Lane V/C Ratio	0.193	-	-	0.102	-
HCM Control Delay (s)	18	-	-	9.1	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	0.7	-	-	0.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	270	260	250	580	120	270	650	120	110	1040	100
Future Volume (vph)	50	270	260	250	580	120	270	650	120	110	1040	100
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2913	1303	1456	4078		2825	4185	1303	1456	4130	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2913	1303	1456	4078		2825	4185	1303	1456	4130	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	293	283	272	630	130	293	707	130	120	1130	109
RTOR Reduction (vph)	0	0	66	0	21	0	0	0	42	0	7	0
Lane Group Flow (vph)	54	293	217	272	739	0	293	707	88	120	1232	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.0	16.1	37.9	28.0	36.1		21.8	68.0	96.0	16.9	58.1	
Effective Green, g (s)	10.5	18.6	45.4	30.5	38.6		25.8	70.0	101.0	18.9	60.1	
Actuated g/C Ratio	0.07	0.12	0.30	0.20	0.26		0.17	0.47	0.67	0.13	0.40	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	101	361	394	296	1049		485	1953	877	183	1654	
v/s Ratio Prot	0.04	c0.10	0.10	c0.19	0.18		c0.10	0.17	0.02	c0.08	c0.30	
v/s Ratio Perm			0.07						0.05			
v/c Ratio	0.53	0.81	0.55	0.92	0.70		0.60	0.36	0.10	0.66	0.75	
Uniform Delay, d1	67.4	64.0	43.8	58.5	50.5		57.4	25.7	8.6	62.5	38.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.89	0.19	0.17	1.00	1.00	
Incremental Delay, d2	5.4	13.0	1.7	31.6	2.2		1.6	0.4	0.0	8.2	1.9	
Delay (s)	72.7	77.0	45.4	90.1	52.7		109.8	5.4	1.5	70.6	40.3	
Level of Service	E	E	D	F	D		F	A	A	E	D	
Approach Delay (s)		62.4			62.6			32.0			43.0	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	47.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	30	10	200	30	110	10	860	410	320	1220	30
Future Volume (vph)	30	30	10	200	30	110	10	860	410	320	1220	30
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.96		1.00	0.93		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2806		1325	2536		1456	4185	1303	1456	4170	
Flt Permitted	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2806		1325	2536		1456	4185	1303	1456	4170	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	34	34	11	225	34	124	11	966	461	360	1371	34
RTOR Reduction (vph)	0	10	0	0	102	0	0	0	268	0	2	0
Lane Group Flow (vph)	34	35	0	133	148	0	11	966	193	360	1403	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	7.1	7.1		23.9	23.9		1.2	46.0	46.0	53.0	97.8	
Effective Green, g (s)	9.6	9.6		26.4	26.4		2.2	48.0	47.0	54.0	99.8	
Actuated g/C Ratio	0.06	0.06		0.18	0.18		0.01	0.32	0.31	0.36	0.67	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	93	179		233	446		21	1339	408	524	2774	
v/s Ratio Prot	c0.02	0.01		c0.10	0.06		0.01	c0.23		c0.25	0.34	
v/s Ratio Perm									0.15			
v/c Ratio	0.37	0.19		0.57	0.33		0.52	0.72	0.47	0.69	0.51	
Uniform Delay, d1	67.3	66.5		56.6	54.1		73.4	45.1	41.5	40.8	12.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.78	0.64	
Incremental Delay, d2	2.4	0.5		9.8	2.0		21.6	3.4	3.9	5.2	0.5	
Delay (s)	69.7	67.1		66.4	56.1		95.0	48.5	45.4	37.1	8.6	
Level of Service	E	E		E	E		F	D	D	D	A	
Approach Delay (s)		68.2			59.7			47.8			14.4	
Approach LOS		E			E			D			B	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Future Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1635	1667	1667	1636	1700	1700	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	949	0	276	520	20	286	51	255	31	61	10
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	4	2	2	4	4	2	2	2	2	2	2
Cap, veh/h	18	1041	475	303	1570	60	314	56	328	38	75	12
Arrive On Green	0.01	0.34	0.00	0.19	0.51	0.51	0.23	0.23	0.23	0.08	0.08	0.08
Sat Flow, veh/h	1587	3106	1417	1587	3052	117	1357	242	1417	491	965	158
Grp Volume(v), veh/h	10	949	0	276	264	276	337	0	255	102	0	0
Grp Sat Flow(s),veh/h/ln	1587	1553	1417	1587	1554	1615	1599	0	1417	1614	0	0
Q Serve(g_s), s	0.8	38.3	0.0	22.3	13.0	13.1	26.9	0.0	22.1	8.1	0.0	0.0
Cycle Q Clear(g_c), s	0.8	38.3	0.0	22.3	13.0	13.1	26.9	0.0	22.1	8.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.07	0.85		1.00	0.30		0.10
Lane Grp Cap(c), veh/h	18	1041	475	303	799	831	370	0	328	126	0	0
V/C Ratio(X)	0.54	0.91	0.00	0.91	0.33	0.33	0.91	0.00	0.78	0.81	0.00	0.00
Avail Cap(c_a), veh/h	413	1282	585	413	799	831	428	0	379	438	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	64.3	41.6	0.0	51.8	18.6	18.6	49.0	0.0	47.1	59.3	0.0	0.0
Incr Delay (d2), s/veh	22.4	8.7	0.0	19.7	0.2	0.2	21.5	0.0	8.6	11.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	17.6	0.0	11.4	5.6	5.9	14.1	0.0	9.4	4.0	0.0	0.0
LnGrp Delay(d),s/veh	86.7	50.3	0.0	71.5	18.8	18.8	70.5	0.0	55.7	70.8	0.0	0.0
LnGrp LOS	F	D		E	B	B	E		E	E		
Approach Vol, veh/h		959			816			592			102	
Approach Delay, s/veh		50.7			36.6			64.1			70.8	
Approach LOS		D			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.5	73.3		35.3	31.0	49.9		14.7
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	34.0	54.0		35.0	34.0	54.0		35.5
Max Q Clear Time (g_c+I1), s	2.8	15.1		28.9	24.3	40.3		10.1
Green Ext Time (p_c), s	0.0	7.6		1.4	0.7	3.6		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	50.1
HCM 2010 LOS	D

Intersection	
Int Delay, s/veh	2.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1130	50	40	790	50	90
Future Vol, veh/h	1130	50	40	790	50	90
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1215	54	43	849	54	97

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1269	0	1753	634
Stage 1	-	-	-	-	1242	-
Stage 2	-	-	-	-	511	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	543	-	76	422
Stage 1	-	-	-	-	236	-
Stage 2	-	-	-	-	567	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	543	-	70	422
Mov Cap-2 Maneuver	-	-	-	-	175	-
Stage 1	-	-	-	-	236	-
Stage 2	-	-	-	-	522	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	31.7
HCM LOS			D

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	281	-	-	543	-
HCM Lane V/C Ratio	0.536	-	-	0.079	-
HCM Control Delay (s)	31.7	-	-	12.2	-
HCM Lane LOS	D	-	-	B	-
HCM 95th %tile Q(veh)	2.9	-	-	0.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	700	410	240	420	210	380	1230	300	160	910	70
Future Volume (vph)	130	700	410	240	420	210	380	1230	300	160	910	70
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	3027	1354	1513	4132		2936	4349	1354	1513	4303	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	3027	1354	1513	4132		2936	4349	1354	1513	4303	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	714	418	245	429	214	388	1255	306	163	929	71
RTOR Reduction (vph)	0	0	30	0	59	0	0	0	65	0	5	0
Lane Group Flow (vph)	133	714	388	245	584	0	388	1255	241	163	995	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	17.0	35.9	61.0	20.5	39.4		25.1	52.8	73.3	19.8	42.5	
Effective Green, g (s)	19.5	38.4	68.5	23.0	41.9		29.1	54.8	78.3	21.8	44.5	
Actuated g/C Ratio	0.13	0.26	0.46	0.15	0.28		0.19	0.37	0.52	0.15	0.30	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	196	774	618	231	1154		569	1588	706	219	1276	
v/s Ratio Prot	0.09	c0.24	0.13	c0.16	0.14		0.13	c0.29	0.05	c0.11	c0.23	
v/s Ratio Perm			0.16						0.13			
v/c Ratio	0.68	0.92	0.63	1.06	0.51		0.68	0.79	0.34	0.74	0.78	
Uniform Delay, d1	62.3	54.4	31.0	63.5	45.4		56.2	42.5	20.9	61.4	48.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.82	0.39	0.21	1.00	1.00	
Incremental Delay, d2	9.0	16.4	2.0	76.1	0.4		2.3	2.8	0.2	12.8	3.1	
Delay (s)	71.2	70.8	33.0	139.6	45.7		104.7	19.2	4.6	74.3	51.4	
Level of Service	E	E	C	F	D		F	B	A	E	D	
Approach Delay (s)		58.3			71.6			33.9			54.6	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	50.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	89.7%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2015 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	40	10	400	50	350	20	1390	330	260	1260	40
Future Volume (vph)	70	40	10	400	50	350	20	1390	330	260	1260	40
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.97		1.00	0.90		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	2938		1377	2577		1513	4349	1354	1513	4329	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	2938		1377	2577		1513	4349	1354	1513	4329	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	71	41	10	408	51	357	20	1418	337	265	1286	41
RTOR Reduction (vph)	0	9	0	0	251	0	0	0	134	0	2	0
Lane Group Flow (vph)	71	42	0	286	279	0	20	1418	203	265	1325	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	5.5	5.5		39.5	39.5		3.0	58.0	58.0	27.0	82.0	
Effective Green, g (s)	8.0	8.0		42.0	42.0		4.0	60.0	59.0	28.0	84.0	
Actuated g/C Ratio	0.05	0.05		0.28	0.28		0.03	0.40	0.39	0.19	0.56	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	80	156		385	721		40	1739	532	282	2424	
v/s Ratio Prot	c0.05	0.01		c0.21	0.11		0.01	c0.33		c0.18	0.31	
v/s Ratio Perm									0.15			
v/c Ratio	0.89	0.27		0.74	0.39		0.50	0.82	0.38	0.94	0.55	
Uniform Delay, d1	70.6	68.2		49.1	43.6		72.0	40.1	32.5	60.2	20.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.81	0.68	
Incremental Delay, d2	63.6	0.9		12.2	1.6		9.5	4.3	2.1	29.8	0.6	
Delay (s)	134.1	69.1		61.3	45.2		81.5	44.4	34.5	78.8	14.8	
Level of Service	F	E		E	D		F	D	C	E	B	
Approach Delay (s)		106.9			50.8			43.0			25.4	
Approach LOS		F			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	39.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Future Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1604	1604	1700
Adj Flow Rate, veh/h	23	523	0	432	1034	23	227	34	136	23	80	11
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	1	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	40	802	508	570	1310	29	325	328	541	40	137	19
Arrive On Green	0.03	0.26	0.00	0.19	0.43	0.43	0.11	0.20	0.20	0.03	0.10	0.10
Sat Flow, veh/h	1527	3047	1363	2963	3048	68	2963	1604	1363	1527	1380	190
Grp Volume(v), veh/h	23	523	0	432	517	540	227	34	136	23	0	91
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1482	1524	1592	1482	1604	1363	1527	0	1570
Q Serve(g_s), s	1.0	10.5	0.0	9.4	20.1	20.1	5.1	1.2	4.6	1.0	0.0	3.8
Cycle Q Clear(g_c), s	1.0	10.5	0.0	9.4	20.1	20.1	5.1	1.2	4.6	1.0	0.0	3.8
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	40	802	508	570	655	684	325	328	541	40	0	156
V/C Ratio(X)	0.58	0.65	0.00	0.76	0.79	0.79	0.70	0.10	0.25	0.58	0.00	0.58
Avail Cap(c_a), veh/h	111	1023	607	1298	1079	1127	779	550	730	513	0	596
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.0	22.5	0.0	26.1	16.9	16.9	29.4	22.1	13.8	33.0	0.0	29.5
Incr Delay (d2), s/veh	12.8	1.0	0.0	2.1	2.2	2.1	2.7	0.1	0.2	12.8	0.0	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	4.5	0.0	4.0	8.7	9.1	2.2	0.5	1.7	0.6	0.0	1.8
LnGrp Delay(d),s/veh	45.8	23.4	0.0	28.2	19.0	18.9	32.1	22.3	14.1	45.8	0.0	33.0
LnGrp LOS	D	C		C	B	B	C	C	B	D		C
Approach Vol, veh/h		546			1489			397			114	
Approach Delay, s/veh		24.4			21.7			25.1			35.6	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.3	20.0	19.2	23.0	13.5	12.8	7.8	34.4
Change Period (Y+Rc), s	4.5	* 6	6.0	5.0	6.0	6.0	6.0	* 5
Max Green Setting (Gmax), s	23.0	* 24	30.0	23.0	18.0	26.0	5.0	* 49
Max Q Clear Time (g_c+I1), s	3.0	6.6	11.4	12.5	7.1	5.8	3.0	22.1
Green Ext Time (p_c), s	0.0	0.9	1.7	5.0	0.5	1.0	0.0	7.4

Intersection Summary	
HCM 2010 Ctrl Delay	23.4
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	660	50	100	1030	50	30
Future Vol, veh/h	660	50	100	1030	50	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	725	55	110	1132	55	33

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	780	0	1539	390
Stage 1	-	-	-	-	753	-
Stage 2	-	-	-	-	786	-
Critical Hdwy	-	-	4.22	-	6.92	7.02
Critical Hdwy Stg 1	-	-	-	-	5.92	-
Critical Hdwy Stg 2	-	-	-	-	5.92	-
Follow-up Hdwy	-	-	2.26	-	3.56	3.36
Pot Cap-1 Maneuver	-	-	807	-	102	597
Stage 1	-	-	-	-	416	-
Stage 2	-	-	-	-	399	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	807	-	88	597
Mov Cap-2 Maneuver	-	-	-	-	212	-
Stage 1	-	-	-	-	416	-
Stage 2	-	-	-	-	345	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.9	23.6
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	280	-	-	807	-
HCM Lane V/C Ratio	0.314	-	-	0.136	-
HCM Control Delay (s)	23.6	-	-	10.2	-
HCM Lane LOS	C	-	-	B	-
HCM 95th %tile Q(veh)	1.3	-	-	0.5	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	310	280	280	650	140	310	650	250	130	1050	110
Future Volume (vph)	50	310	280	280	650	140	310	650	250	130	1050	110
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2913	1303	2825	2835		2825	4185	1303	1456	4125	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2913	1303	2825	2835		2825	4185	1303	1456	4125	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	337	304	304	707	152	337	707	272	141	1141	120
RTOR Reduction (vph)	0	0	56	0	12	0	0	0	102	0	8	0
Lane Group Flow (vph)	54	337	248	304	847	0	337	707	170	141	1253	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.2	31.5	53.3	20.4	43.7		21.8	58.3	78.7	18.8	50.3	
Effective Green, g (s)	10.7	34.0	60.8	22.9	46.2		25.8	60.3	83.7	20.8	52.3	
Actuated g/C Ratio	0.07	0.23	0.41	0.15	0.31		0.17	0.40	0.56	0.14	0.35	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	103	660	528	431	873		485	1682	727	201	1438	
v/s Ratio Prot	0.04	0.12	0.08	c0.11	c0.30		c0.12	0.17	0.04	c0.10	c0.30	
v/s Ratio Perm			0.11						0.09			
v/c Ratio	0.52	0.51	0.47	0.71	0.97		0.69	0.42	0.23	0.70	0.87	
Uniform Delay, d1	67.2	50.7	32.7	60.3	51.2		58.4	32.3	16.9	61.6	45.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.56	0.46	1.17	1.00	1.00	
Incremental Delay, d2	4.7	0.7	0.7	5.2	23.4		3.2	0.6	0.1	10.5	6.1	
Delay (s)	71.9	51.4	33.4	65.5	74.6		94.4	15.3	19.9	72.2	51.8	
Level of Service	E	D	C	E	E		F	B	B	E	D	
Approach Delay (s)		45.1			72.2			36.5			53.8	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	52.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2040 forecasts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	40	10	220	30	110	10	860	440	370	1230	30
Future Volume (vph)	40	40	10	220	30	110	10	860	440	370	1230	30
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.97		1.00	0.93		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2827		1325	2544		1456	4185	1303	1456	4170	
Flt Permitted	0.95	1.00		0.95	0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2827		1325	2544		1456	4185	1303	1456	4170	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	45	11	247	34	124	11	966	494	416	1382	34
RTOR Reduction (vph)	0	10	0	0	102	0	0	0	288	0	2	0
Lane Group Flow (vph)	45	46	0	138	165	0	11	966	206	416	1414	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	7.2	7.2		23.8	23.8		1.2	40.0	40.0	59.0	97.8	
Effective Green, g (s)	9.7	9.7		26.3	26.3		2.2	42.0	41.0	60.0	99.8	
Actuated g/C Ratio	0.06	0.06		0.18	0.18		0.01	0.28	0.27	0.40	0.67	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	94	182		232	446		21	1171	356	582	2774	
v/s Ratio Prot	c0.03	0.02		c0.10	0.06		0.01	c0.23		c0.29	0.34	
v/s Ratio Perm									0.16			
v/c Ratio	0.48	0.25		0.59	0.37		0.52	0.82	0.58	0.71	0.51	
Uniform Delay, d1	67.7	66.7		56.9	54.5		73.4	50.6	47.1	37.8	12.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.69	0.80	
Incremental Delay, d2	3.8	0.7		10.8	2.3		21.6	6.7	6.7	5.1	0.5	
Delay (s)	71.5	67.4		67.7	56.9		95.0	57.2	53.8	31.1	10.6	
Level of Service	E	E		E	E		F	E	D	C	B	
Approach Delay (s)		69.2			60.6			56.4			15.2	
Approach LOS		E			E			E			B	

Intersection Summary			
HCM 2000 Control Delay	37.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

Description: 2040 forecasts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Future Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1667	1667	1667	1667	1700	1667	1667	1667	1667	1667	1700
Adj Flow Rate, veh/h	10	1071	0	296	633	31	337	61	214	41	71	10
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	1	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	20	1304	779	388	1615	79	425	275	412	57	90	13
Arrive On Green	0.01	0.41	0.00	0.13	0.53	0.53	0.14	0.17	0.17	0.04	0.06	0.06
Sat Flow, veh/h	1587	3167	1417	3079	3073	150	3079	1667	1417	1587	1430	201
Grp Volume(v), veh/h	10	1071	0	296	326	338	337	61	214	41	0	81
Grp Sat Flow(s),veh/h/ln	1587	1583	1417	1540	1583	1640	1540	1667	1417	1587	0	1631
Q Serve(g_s), s	0.6	26.5	0.0	8.2	10.8	10.9	9.3	2.8	11.1	2.3	0.0	4.3
Cycle Q Clear(g_c), s	0.6	26.5	0.0	8.2	10.8	10.9	9.3	2.8	11.1	2.3	0.0	4.3
Prop In Lane	1.00		1.00	1.00		0.09	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	20	1304	779	388	832	862	425	275	412	57	0	103
V/C Ratio(X)	0.51	0.82	0.00	0.76	0.39	0.39	0.79	0.22	0.52	0.72	0.00	0.79
Avail Cap(c_a), veh/h	90	1725	967	769	1150	1192	734	435	549	90	0	130
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	43.2	23.0	0.0	37.2	12.5	12.5	36.7	31.9	26.1	42.0	0.0	40.7
Incr Delay (d2), s/veh	19.1	2.5	0.0	3.1	0.3	0.3	3.4	0.4	1.0	15.5	0.0	22.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	11.9	0.0	3.7	4.8	5.0	4.2	1.3	4.4	1.2	0.0	2.6
LnGrp Delay(d),s/veh	62.4	25.5	0.0	40.3	12.8	12.8	40.1	32.3	27.1	57.5	0.0	62.7
LnGrp LOS	E	C		D	B	B	D	C	C	E		E
Approach Vol, veh/h		1081			960			612			122	
Approach Delay, s/veh		25.9			21.3			34.8			60.9	
Approach LOS		C			C			C			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.2	19.5	17.1	42.3	18.2	10.5	7.1	52.3
Change Period (Y+Rc), s	6.0	5.0	6.0	* 6	6.0	5.0	6.0	6.0
Max Green Setting (Gmax), s	5.0	23.0	22.0	* 48	21.0	7.0	5.0	64.0
Max Q Clear Time (g_c+I1), s	4.3	13.1	10.2	28.5	11.3	6.3	2.6	12.9
Green Ext Time (p_c), s	0.0	1.1	0.9	7.8	0.8	0.1	0.0	9.8

Intersection Summary	
HCM 2010 Ctrl Delay	27.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Intersection	
Int Delay, s/veh	4.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1340	60	40	930	60	110
Future Vol, veh/h	1340	60	40	930	60	110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	50	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1441	65	43	1000	65	118

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1505	0	2059	753
Stage 1	-	-	-	-	1473	-
Stage 2	-	-	-	-	586	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	441	-	~ 48	352
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	519	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	441	-	~ 43	352
Mov Cap-2 Maneuver	-	-	-	-	132	-
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	468	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	68.6
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	222	-	-	441	-
HCM Lane V/C Ratio	0.823	-	-	0.098	-
HCM Control Delay (s)	68.6	-	-	14	-
HCM Lane LOS	F	-	-	B	-
HCM 95th %tile Q(veh)	6.2	-	-	0.3	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	740	430	300	450	230	410	1240	430	180	910	70
Future Volume (vph)	130	740	430	300	450	230	410	1240	430	180	910	70
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	3027	1354	2936	2873		2936	4349	1354	1513	4303	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	3027	1354	2936	2873		2936	4349	1354	1513	4303	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	755	439	306	459	235	418	1265	439	184	929	71
RTOR Reduction (vph)	0	0	27	0	42	0	0	0	68	0	5	0
Lane Group Flow (vph)	133	755	412	306	652	0	418	1265	371	184	995	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	17.6	40.5	67.6	11.5	34.4		27.1	55.6	67.1	21.4	44.9	
Effective Green, g (s)	20.1	43.0	75.1	14.0	36.9		31.1	57.6	72.1	23.4	46.9	
Actuated g/C Ratio	0.13	0.29	0.50	0.09	0.25		0.21	0.38	0.48	0.16	0.31	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	202	867	677	274	706		608	1670	650	236	1345	
v/s Ratio Prot	c0.09	c0.25	0.13	c0.10	0.23		0.14	c0.29	0.05	c0.12	0.23	
v/s Ratio Perm			0.17						0.22			
v/c Ratio	0.66	0.87	0.61	1.12	0.92		0.69	0.76	0.57	0.78	0.74	
Uniform Delay, d1	61.7	50.9	26.9	68.0	55.2		55.0	40.1	27.9	60.8	46.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.59	0.40	0.27	1.00	1.00	
Incremental Delay, d2	7.5	9.5	1.6	89.5	17.7		2.4	2.4	0.9	15.0	2.2	
Delay (s)	69.2	60.4	28.4	157.5	72.8		89.6	18.6	8.3	75.8	48.3	
Level of Service	E	E	C	F	E		F	B	A	E	D	
Approach Delay (s)		50.7			98.7			30.5			52.5	
Approach LOS		D			F			C			D	

Intersection Summary			
HCM 2000 Control Delay	52.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		
Description: 2040 forecasts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	50	10	410	60	370	20	1390	340	280	1270	50
Future Volume (vph)	70	50	10	410	60	370	20	1390	340	280	1270	50
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.98		1.00	0.90		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	2953		1377	2577		1513	4349	1354	1513	4325	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	2953		1377	2577		1513	4349	1354	1513	4325	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	71	51	10	418	61	378	20	1418	347	286	1296	51
RTOR Reduction (vph)	0	9	0	0	251	0	0	0	138	0	3	0
Lane Group Flow (vph)	71	52	0	301	305	0	20	1418	209	286	1344	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	5.5	5.5		39.5	39.5		3.0	58.0	58.0	27.0	82.0	
Effective Green, g (s)	8.0	8.0		42.0	42.0		4.0	60.0	59.0	28.0	84.0	
Actuated g/C Ratio	0.05	0.05		0.28	0.28		0.03	0.40	0.39	0.19	0.56	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	80	157		385	721		40	1739	532	282	2422	
v/s Ratio Prot	c0.05	0.02		c0.22	0.12		0.01	c0.33		c0.19	0.31	
v/s Ratio Perm									0.15			
v/c Ratio	0.89	0.33		0.78	0.42		0.50	0.82	0.39	1.01	0.56	
Uniform Delay, d1	70.6	68.4		49.8	44.1		72.0	40.1	32.7	61.0	21.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.91	0.87	
Incremental Delay, d2	63.6	1.2		14.6	1.8		9.5	4.3	2.2	46.2	0.6	
Delay (s)	134.1	69.6		64.4	45.9		81.5	44.4	34.8	101.7	18.9	
Level of Service	F	E		E	D		F	D	C	F	B	
Approach Delay (s)		104.3			52.4			43.0			33.4	
Approach LOS		F			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	43.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		
Description: 2040 forecast			
c Critical Lane Group			

FEHR PEERS

ATTACHMENT C: CONCEPTUAL DESIGNS

N

0 200 400
SCALE IN FEET

TRENT ELEMENTARY SCHOOL

N. PINES RD.

MIRBEAU PKWY

N. CHERRY ST.

E. PINECROFT WAY

N. CEMENT RD.

E. PORTLAND AVE.

E. TRENT AVE.

STORMWATER POND

TOP OF CUT

PINES 1

PINES 2

PINES 3

PINES 4

R=50'

R=30'

R=115'

PROPOSED SHARED USE PATH

STORMWATER POND

PINECROFT, LLC
0.32 AC

PINECROFT, LLC
1.84 AC

AJR, LLC
0.47 AC
0.23 AC
0.12 AC
0.13 AC

LENTZ, KIMBERLY G
0.47 AC

HARDER, DENISE ADELE
0.34 AC

STRONG FAMILY REVOCABLE LIVING TRUST
0.46 AC

ROSEYS BAR & GRILL, LLC
0.70 AC

SCHMEDDING, MICHAEL S & CAROL M
0.87 AC

EXISTING BNSF TRACK

FUTURE BNSF TRACK

10+00.00 P.O.B.
12+22.49 P.C.
14+69.04 P.T.
15+87.13 P.C.
19+15.62 P.T.
22+38.00 P.C.
23+38.78 P.C.
23+93.92 P.T.
25+01.58 P.T.
26+36.40 P.O.E.

CURVE PINES 1
Delta= 29°57'66"
R= 510.00'
T= 135.856'
L= 265.546 Ft.
e%= NC (35 MPH)

CURVE PINES 2
Delta= 45°54'37"
R= 410.00'
T= 173.657'
L= 328.529 Ft.
e%= 2% (35MPH)

CURVE PINES 3
Delta= 33°12'32"
R= 200.00'
T= 59.64'
L= 115.921 Ft.
e%= NC (20MPH)

CURVE PINES 4
Delta= 32°53'21"
R= 200.00'
T= 59.032'
L= 114.805 Ft.
e%= NC (25MPH)

PINES & TRENT ALTERNATIVE 1

City of Spokane Valley

DAVID EVANS AND ASSOCIATES INC.

HDR

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N

0 200 400
SCALE IN FEET

TRENT ELEMENTARY SCHOOL

N. PINES RD.

MIRBEAU PKWY

N. CHERRY ST.

E. PINECROFT WAY

E. PORTLAND AVE.

N. CEMENT RD.

E. TRENT AVE.

STORMWATER POND

TOP OF CUT

PINES 1

PINES 2

PINES 3

PINES 4

R=50'

R=30'

PROPOSED SHARED USE PATH

STORMWATER POND

EXISTING BNSF TRACK

PINECROFT, LLC
0.32 AC

PINECROFT, LLC
1.84 AC

AJR, LLC
0.47 AC
0.23 AC
0.12 AC
0.13 AC

LENTZ, KIMBERLY G
0.47 AC

HARDER, DENISE ADELE
0.34 AC

STRONG FAMILY REVOCABLE LIVING TRUST
0.46 AC

ROSEYS BAR & GRILL, LLC
0.70 AC

SCHMEDDING, MICHAEL S & CAROL M
0.87 AC

10+00.00 P.O.B.
12+22.49 P.C.
14+69.04 P.T.
15+87.13 P.C.
19+15.21 P.T.
20+01.53 P.C.
20+36.40 P.T.
22+38.00 P.C.
23+38.78 P.C.
23+93.92 P.T.

CURVE PINES 1
Delta= 29°57'66"
R= 510.00'
T= 135.856'
L= 265.546 Ft.
e%= NC (35 MPH)

CURVE PINES 2
Delta= 45°54'37"
R= 410.00'
T= 173.657'
L= 328.529 Ft.
e%= 2% (35MPH)

CURVE PINES 3
Delta= 33°12'32"
R= 200.00'
T= 59.64'
L= 115.921 Ft.
e%= NC (20MPH)

CURVE PINES 4
Delta= 32°53'21"
R= 200.00'
T= 59.032'
L= 114.805 Ft.
e%= NC (25MPH)

PINES & TRENT ALTERNATIVE 1 - ROUNDABOUT

City of Spokane Valley

DAVID EVANS AND ASSOCIATES INC.

HDR

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N

0 200 400

SCALE IN FEET

TRENT ELEMENTARY SCHOOL

N. PINES RD.

MIRBEAU PKWY

N. CHERRY ST.

E. PINECROFT WAY

N. CEMENT RD.

E. PORTLAND AVE.

E. TRENT AVE.

10+00.00 P.O.B.

11+50.83 P.C.

TOP OF CUT

13+90.56 P.T.

15+13.46 P.C.

16+34.40 P.T.

18+92.38 P.C.

21+55.96 P.T.

22+71.73 P.O.E.

31+12.53 P.T.

24+46.37 P.C.

28+64.77 P.C.

26+55.25 P.T.

PINES 1

PINES 2

PINES 3

PINES 4

PINES 5

R=50'

R=30'

R=80'

R=115'

R=100'

PINECROFT, LLC
0.32 AC

PROPOSED SHARED USE PATH

STORMWATER POND

TOP OF CUT

PINECROFT, LLC
1.84 AC

EXISTING BNSF TRACK

FUTURE BNSF TRACK

BRR INVESTMENTS LLC
1.00 AC

DERUWE, ROBIN RAE
0.66 AC

DEWITT LIVING TRUST
0.32 AC

FENCE

AVISTA CORPORATION
0.17 AC

AVISTA CORPORATION
0.19 AC

AVISTA CORPORATION
0.04 AC

CURVE PINES 1
Delta= 26°55'55"
R= 510.00'
T= 122.12'
L= 239.73 Ft.
e%= NC (35 MPH)

CURVE PINES 2
Delta= 13°35'13"
R= 510.00'
T= 60.75'
L= 120.94 Ft.
e%= NC (35MPH)

CURVE PINES 3
Delta= 60°24'24"
R= 250.00'
T= 145.52'
L= 263.57 Ft.
e%= 4.0% (30MPH)

CURVE PINES 4
Delta= 108°48'07"
R= 110.00'
T= 153.65'
L= 208.88 Ft.
e%= NC (20MPH)

CURVE PINES 5
Delta= 70°58'40"
R= 200.00'
T= 142.60'
L= 247.76 Ft.
e%= NC (25MPH)

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PINES & TRENT ALTERNATIVE 2

DAVID EVANS AND ASSOCIATES INC.

N

0 200 400
SCALE IN FEET

TRENT ELEMENTARY SCHOOL

N. PINES RD.

MIRBEAU PKWY

N. CHERRY ST.

E. PINECROFT WAY

E. TRENT AVE.

N. CEMENT RD.

E. PORTLAND AVE.

PINES 1

TOP OF CUT

13+90.56 P.T.

15+13.46 P.C.

16+34.40 P.T.

18+92.38 P.C.

15

10+00.00 P.O.B.

11+50.83 P.C.

R=50'

PINECROFT, LLC
0.32 AC

PINES 2

PROPOSED SHARED USE PATH

R=30'

STORMWATER POND

PINES 3

TOP OF CUT
PINECROFT, LLC
1.84 AC

EXISTING BNSF TRACK

FUTURE BNSF TRACK

20

21+62.63 P.T.

58'

R=85'

33+89.81 P.O.E.

32+66.34 P.T.

BRR INVESTMENTS LLC
1.00 AC

R=70'

PINES 5

DERUWE, ROBIN RAE
0.66 AC

30

29+44.55 P.C.

DEWITT LIVING TRUST
0.32 AC

28+61.59 P.I.

27+54.60 P.T.

25+19.20 P.C.

25

R=120'

PINES 4

R=60'

AVISTA CORPORATION
0.54 AC

AVISTA CORPORATION
0.62 AC

AVISTA CORPORATION
0.04 AC

CURVE PINES 1
Delta= 26°55'55"
R= 510.00'
T= 122.12'
L= 239.73 Ft.
e%= NC (35MPH)

CURVE PINES 2
Delta= 12°32'53"
R= 510.00'
T= 56.07'
L= 111.69 Ft.
e%= NC (35MPH)

CURVE PINES 3
Delta= 58°42'55"
R= 250.00'
T= 140.60'
L= 256.16 Ft.
e%= 4.0% (30MPH)

CURVE PINES 4
Delta= 109°55'45"
R= 110.00'
T= 156.89'
L= 211.05 Ft.
e%= NC (20MPH)

CURVE PINES 5
Delta= 109°55'45"
R= 200.00'
T= 142.60'
L= 247.76 Ft.
e%= NC (25MPH)

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PINES & TRENT ALTERNATIVE 2 - ROUNDABOUT

DAVID EVANS AND ASSOCIATES INC.

FEHR PEERS

ATTACHMENT D: 2020 AND 2040 ALTERNATIVES ANALYSIS

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	23	364	205	420	989	159	23	330	102
v/c Ratio	0.26	0.64	0.49	0.79	0.61	0.44	0.12	0.72	0.51
Control Delay	68.0	48.6	10.6	45.0	20.4	52.4	51.7	15.7	58.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.0	48.6	10.6	45.0	20.4	52.4	51.7	15.7	58.0
Queue Length 50th (ft)	15	115	0	241	248	50	14	0	61
Queue Length 95th (ft)	57	233	68	485	406	113	50	91	156
Internal Link Dist (ft)		5246			2649		2504		831
Turn Bay Length (ft)	220		260	285		150		1000	
Base Capacity (vph)	91	947	564	1070	2635	1008	547	682	372
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.38	0.36	0.39	0.38	0.16	0.04	0.48	0.27

Intersection Summary

Description: 2017 counts

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Future Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	364	0	420	966	23	159	23	160	11	80	11
Adj No. of Lanes	1	2	1	1	2	0	2	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	38	608	272	469	1466	35	451	244	208	14	101	14
Arrive On Green	0.02	0.20	0.00	0.31	0.48	0.48	0.15	0.15	0.15	0.08	0.08	0.08
Sat Flow, veh/h	1527	3047	1363	1527	3042	72	2963	1604	1363	169	1228	169
Grp Volume(v), veh/h	23	364	0	420	484	505	159	23	160	102	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1527	1524	1591	1482	1604	1363	1566	0	0
Q Serve(g_s), s	1.2	9.0	0.0	21.9	20.1	20.1	4.0	1.0	9.4	5.3	0.0	0.0
Cycle Q Clear(g_c), s	1.2	9.0	0.0	21.9	20.1	20.1	4.0	1.0	9.4	5.3	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	0.11		0.11
Lane Grp Cap(c), veh/h	38	608	272	469	734	767	451	244	208	129	0	0
V/C Ratio(X)	0.61	0.60	0.00	0.89	0.66	0.66	0.35	0.09	0.77	0.79	0.00	0.00
Avail Cap(c_a), veh/h	110	1135	508	1284	1739	1816	1210	655	557	442	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	40.2	30.3	0.0	27.5	16.4	16.4	31.6	30.3	33.9	37.5	0.0	0.0
Incr Delay (d2), s/veh	14.7	0.9	0.0	6.2	1.0	1.0	0.5	0.2	6.0	10.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	3.9	0.0	10.0	8.5	8.9	1.7	0.5	3.9	2.7	0.0	0.0
LnGrp Delay(d),s/veh	54.9	31.2	0.0	33.8	17.4	17.3	32.1	30.5	39.8	47.6	0.0	0.0
LnGrp LOS	D	C		C	B	B	C	C	D	D		
Approach Vol, veh/h		387			1409			342			102	
Approach Delay, s/veh		32.6			22.3			35.6			47.6	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	46.1		17.7	31.6	22.6		11.4
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	6.0	95.0		34.0	70.0	31.0		23.5
Max Q Clear Time (g_c+I1), s	3.2	22.1		11.4	23.9	11.0		7.3
Green Ext Time (p_c), s	0.0	6.4		1.3	1.7	5.6		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	27.2
HCM 2010 LOS	C

MOVEMENT SUMMARY

Site: Pines / Trent AM - Alt1a

Pines / Trent
2020 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	152	3.0	0.072	9.0	LOS A	0.3	7.5	0.39	0.65	33.7
8	T1	22	3.0	0.072	4.5	LOS A	0.3	7.5	0.38	0.63	27.2
18	R2	315	3.0	0.238	4.7	LOS A	1.1	28.4	0.42	0.59	35.0
Approach		489	3.0	0.238	6.1	LOS A	1.1	28.4	0.41	0.61	34.1
East: Trent Ave											
1	L2	420	3.0	0.596	11.9	LOS B	4.0	101.4	0.50	0.69	34.9
6	T1	966	3.0	0.596	7.5	LOS A	4.0	102.0	0.49	0.63	39.6
16	R2	23	3.0	0.596	7.2	LOS A	4.0	102.0	0.49	0.61	29.8
Approach		1409	3.0	0.596	8.8	LOS A	4.0	102.0	0.49	0.65	37.9
North: Cement Rd											
7	L2	11	3.0	0.187	10.2	LOS B	0.8	19.4	0.71	0.78	29.1
4	T1	76	3.0	0.187	6.1	LOS A	0.8	19.4	0.71	0.78	27.0
14	R2	11	3.0	0.187	6.5	LOS A	0.8	19.4	0.71	0.78	28.7
Approach		98	3.0	0.187	6.6	LOS A	0.8	19.4	0.71	0.78	27.4
West: Trent Ave											
5	L2	22	3.0	0.184	13.4	LOS B	1.1	27.1	0.62	0.71	30.5
2	T1	348	3.0	0.184	8.8	LOS A	1.1	28.9	0.61	0.69	39.3
12	R2	196	3.0	0.120	5.7	LOS A	0.0	0.0	0.00	0.58	41.4
Approach		565	3.0	0.184	7.9	LOS A	1.1	28.9	0.40	0.65	39.6
All Vehicles		2561	3.0	0.596	8.0	LOS A	4.0	102.0	0.46	0.65	36.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	23	364	205	420	989	159	23	330	102
v/c Ratio	0.21	0.54	0.44	0.61	0.67	0.39	0.11	0.70	0.46
Control Delay	51.6	33.7	8.0	35.6	21.3	40.3	39.6	13.7	44.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.6	33.7	8.0	35.6	21.3	40.3	39.6	13.7	44.7
Queue Length 50th (ft)	11	87	0	94	171	38	10	0	46
Queue Length 95th (ft)	46	168	54	199	383	89	40	82	125
Internal Link Dist (ft)		5246			2649		2504		831
Turn Bay Length (ft)	220		260	175		150		150	
Base Capacity (vph)	113	1179	653	2472	2898	1247	677	766	460
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.31	0.31	0.17	0.34	0.13	0.03	0.43	0.22

Intersection Summary

Description: 2017 counts

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Future Volume (veh/h)	20	320	180	370	850	20	140	20	290	10	70	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	364	0	420	966	23	159	23	160	11	80	11
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	40	724	324	571	1229	29	478	259	220	14	102	14
Arrive On Green	0.03	0.24	0.00	0.19	0.40	0.40	0.16	0.16	0.16	0.08	0.08	0.08
Sat Flow, veh/h	1527	3047	1363	2963	3042	72	2963	1604	1363	169	1228	169
Grp Volume(v), veh/h	23	364	0	420	484	505	159	23	160	102	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1482	1524	1591	1482	1604	1363	1566	0	0
Q Serve(g_s), s	1.0	6.8	0.0	8.8	18.3	18.3	3.1	0.8	7.4	4.2	0.0	0.0
Cycle Q Clear(g_c), s	1.0	6.8	0.0	8.8	18.3	18.3	3.1	0.8	7.4	4.2	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	0.11		0.11
Lane Grp Cap(c), veh/h	40	724	324	571	616	643	478	259	220	130	0	0
V/C Ratio(X)	0.58	0.50	0.00	0.74	0.79	0.79	0.33	0.09	0.73	0.78	0.00	0.00
Avail Cap(c_a), veh/h	139	1429	639	3137	2189	2286	1524	825	701	556	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	31.8	21.8	0.0	25.1	17.2	17.2	24.6	23.6	26.3	29.7	0.0	0.0
Incr Delay (d2), s/veh	12.6	0.5	0.0	1.9	2.3	2.2	0.4	0.1	4.5	9.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	2.9	0.0	3.8	8.0	8.4	1.3	0.4	3.1	2.2	0.0	0.0
LnGrp Delay(d),s/veh	44.4	22.4	0.0	27.0	19.5	19.4	25.0	23.7	30.9	39.4	0.0	0.0
LnGrp LOS	D	C		C	B	B	C	C	C	D		
Approach Vol, veh/h		387			1409			342			102	
Approach Delay, s/veh		23.7			21.7			27.7			39.4	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.7	32.7		15.7	18.7	21.7		10.0
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	6.0	95.0		34.0	70.0	31.0		23.5
Max Q Clear Time (g_c+I1), s	3.0	20.3		9.4	10.8	8.8		6.2
Green Ext Time (p_c), s	0.0	6.4		1.3	1.9	5.7		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	23.7
HCM 2010 LOS	C

MOVEMENT SUMMARY

Site: Pines / Trent - Alt2a

Pines / Trent
2020 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	152	3.0	0.072	1.9	LOS A	0.3	7.5	0.39	0.33	21.4
8	T1	22	3.0	0.072	0.7	LOS A	0.3	7.5	0.38	0.29	18.5
18	R2	315	3.0	0.238	0.8	LOS A	1.1	28.4	0.42	0.20	21.6
Approach		489	3.0	0.238	1.1	LOS A	1.1	28.4	0.41	0.25	21.4
East: Trent Ave											
1	L2	420	3.0	0.596	11.9	LOS B	4.0	101.4	0.50	0.69	34.9
6	T1	966	3.0	0.596	7.5	LOS A	4.0	102.0	0.49	0.63	39.6
16	R2	23	3.0	0.596	7.2	LOS A	4.0	102.0	0.49	0.61	29.8
Approach		1409	3.0	0.596	8.8	LOS A	4.0	102.0	0.49	0.65	37.9
North: Cement Rd											
7	L2	11	3.0	0.187	10.2	LOS B	0.8	19.4	0.71	0.78	29.1
4	T1	76	3.0	0.187	6.1	LOS A	0.8	19.4	0.71	0.78	27.0
14	R2	11	3.0	0.187	6.5	LOS A	0.8	19.4	0.71	0.78	28.7
Approach		98	3.0	0.187	6.6	LOS A	0.8	19.4	0.71	0.78	27.4
West: Trent Ave											
5	L2	22	3.0	0.184	13.4	LOS B	1.1	27.1	0.62	0.71	30.5
2	T1	348	3.0	0.184	8.8	LOS A	1.1	28.9	0.61	0.69	39.3
12	R2	196	3.0	0.120	5.7	LOS A	0.0	0.0	0.00	0.58	41.4
Approach		565	3.0	0.184	7.9	LOS A	1.1	28.9	0.40	0.65	39.6
All Vehicles		2561	3.0	0.596	7.1	LOS A	4.0	102.0	0.46	0.58	32.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	10	949	245	276	540	286	51	510	102
v/c Ratio	0.14	0.80	0.38	0.80	0.28	0.65	0.21	0.80	0.62
Control Delay	74.3	46.3	14.3	71.7	14.4	64.9	57.1	14.6	77.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.3	46.3	14.3	71.7	14.4	64.9	57.1	14.6	77.3
Queue Length 50th (ft)	9	414	52	239	102	132	43	0	90
Queue Length 95th (ft)	33	#631	147	#432	225	191	88	127	165
Internal Link Dist (ft)		5246			2649		2504		831
Turn Bay Length (ft)	220		260	285		150		1000	
Base Capacity (vph)	386	1202	646	386	1936	771	418	737	414
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.79	0.38	0.72	0.28	0.37	0.12	0.69	0.25

Intersection Summary

Description: 2017 counts

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Future Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1635	1667	1667	1636	1700	1667	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	949	0	276	520	20	286	51	255	31	61	10
Adj No. of Lanes	1	2	1	1	2	0	2	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	4	2	2	4	4	2	2	2	2	2	2
Cap, veh/h	19	1057	482	306	1592	61	638	345	294	39	76	13
Arrive On Green	0.01	0.34	0.00	0.19	0.52	0.52	0.21	0.21	0.21	0.08	0.08	0.08
Sat Flow, veh/h	1587	3106	1417	1587	3052	117	3079	1667	1417	491	965	158
Grp Volume(v), veh/h	10	949	0	276	264	276	286	51	255	102	0	0
Grp Sat Flow(s),veh/h/ln	1587	1553	1417	1587	1554	1615	1540	1667	1417	1614	0	0
Q Serve(g_s), s	0.7	34.6	0.0	20.3	11.7	11.7	9.7	3.0	20.8	7.4	0.0	0.0
Cycle Q Clear(g_c), s	0.7	34.6	0.0	20.3	11.7	11.7	9.7	3.0	20.8	7.4	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.07	1.00		1.00	0.30		0.10
Lane Grp Cap(c), veh/h	19	1057	482	306	811	842	638	345	294	128	0	0
V/C Ratio(X)	0.53	0.90	0.00	0.90	0.33	0.33	0.45	0.15	0.87	0.80	0.00	0.00
Avail Cap(c_a), veh/h	453	1406	641	453	811	842	904	489	416	480	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	58.6	37.4	0.0	47.0	16.4	16.5	41.3	38.7	45.7	54.0	0.0	0.0
Incr Delay (d2), s/veh	21.4	6.4	0.0	15.4	0.2	0.2	0.5	0.2	13.1	10.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	15.7	0.0	10.2	5.0	5.3	4.2	1.4	9.2	3.7	0.0	0.0
LnGrp Delay(d),s/veh	80.0	43.8	0.0	62.5	16.7	16.7	41.8	38.9	58.8	64.8	0.0	0.0
LnGrp LOS	F	D		E	B	B	D	D	E	E		
Approach Vol, veh/h		959			816			592			102	
Approach Delay, s/veh		44.1			32.2			48.9			64.8	
Approach LOS		D			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.4	68.2		29.7	29.0	46.6		13.9
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	34.0	54.0		35.0	34.0	54.0		35.5
Max Q Clear Time (g_c+I1), s	2.7	13.7		22.8	22.3	36.6		9.4
Green Ext Time (p_c), s	0.0	7.6		2.0	0.8	4.0		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	42.2
HCM 2010 LOS	D

MOVEMENT SUMMARY

Site: Pines / Trent PM - Alt1a

Pines / Trent
2020 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	304	3.0	0.209	10.4	LOS B	1.0	26.4	0.66	0.82	33.1
8	T1	54	3.0	0.209	5.6	LOS A	1.0	26.4	0.66	0.78	26.9
18	R2	543	3.0	0.549	7.1	LOS A	3.7	93.9	0.78	0.94	34.2
Approach		902	3.0	0.549	8.1	LOS A	3.7	93.9	0.73	0.89	33.3
East: Trent Ave											
1	L2	307	3.0	0.437	12.3	LOS B	2.3	59.3	0.55	0.76	22.6
6	T1	580	3.0	0.437	7.8	LOS A	2.4	60.2	0.54	0.67	39.5
16	R2	23	3.0	0.437	7.5	LOS A	2.4	60.2	0.54	0.64	29.7
Approach		909	3.0	0.437	9.3	LOS A	2.4	60.2	0.54	0.70	31.2
North: Cement Rd											
7	L2	33	3.0	0.174	9.1	LOS A	0.7	17.3	0.64	0.81	28.7
4	T1	65	3.0	0.174	7.1	LOS A	0.7	17.3	0.64	0.81	17.8
14	R2	11	3.0	0.174	5.4	LOS A	0.7	17.3	0.64	0.81	28.4
Approach		109	3.0	0.174	7.5	LOS A	0.7	17.3	0.64	0.81	21.0
West: Trent Ave											
5	L2	11	3.0	0.469	13.4	LOS B	3.3	83.3	0.68	0.74	30.5
2	T1	1011	3.0	0.469	8.8	LOS A	3.4	88.1	0.67	0.72	39.2
12	R2	261	3.0	0.160	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		1283	3.0	0.469	8.3	LOS A	3.4	88.1	0.53	0.69	39.4
All Vehicles		3203	3.0	0.549	8.5	LOS A	3.7	93.9	0.60	0.75	34.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	10	949	245	276	540	286	51	510	102
v/c Ratio	0.12	0.73	0.36	0.65	0.30	0.60	0.20	0.79	0.57
Control Delay	65.7	35.8	11.7	59.5	15.2	55.3	49.6	13.7	65.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.7	35.8	11.7	59.5	15.2	55.3	49.6	13.7	65.8
Queue Length 50th (ft)	8	318	40	107	97	110	36	0	75
Queue Length 95th (ft)	30	534	132	178	220	176	82	122	154
Internal Link Dist (ft)		5246			2649		2504		831
Turn Bay Length (ft)	220		260	285		150		150	
Base Capacity (vph)	445	1387	721	863	1822	889	482	772	477
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.68	0.34	0.32	0.30	0.32	0.11	0.66	0.21

Intersection Summary

Description: 2017 counts

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Future Volume (veh/h)	10	930	240	270	510	20	280	50	500	30	60	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1635	1667	1667	1636	1700	1667	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	949	0	276	520	20	286	51	255	31	61	10
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	4	2	2	4	4	2	2	2	2	2	2
Cap, veh/h	19	1145	522	364	1449	56	661	358	304	40	78	13
Arrive On Green	0.01	0.37	0.00	0.12	0.47	0.47	0.21	0.21	0.21	0.08	0.08	0.08
Sat Flow, veh/h	1587	3106	1417	3079	3052	117	3079	1667	1417	491	965	158
Grp Volume(v), veh/h	10	949	0	276	264	276	286	51	255	102	0	0
Grp Sat Flow(s),veh/h/ln	1587	1553	1417	1540	1554	1615	1540	1667	1417	1614	0	0
Q Serve(g_s), s	0.6	27.4	0.0	8.6	10.6	10.7	7.9	2.4	17.0	6.1	0.0	0.0
Cycle Q Clear(g_c), s	0.6	27.4	0.0	8.6	10.6	10.7	7.9	2.4	17.0	6.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.07	1.00		1.00	0.30		0.10
Lane Grp Cap(c), veh/h	19	1145	522	364	738	767	661	358	304	130	0	0
V/C Ratio(X)	0.52	0.83	0.00	0.76	0.36	0.36	0.43	0.14	0.84	0.78	0.00	0.00
Avail Cap(c_a), veh/h	547	1699	775	1061	850	884	1092	591	502	581	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	48.5	28.3	0.0	42.1	16.4	16.4	33.6	31.4	37.1	44.5	0.0	0.0
Incr Delay (d2), s/veh	19.9	2.3	0.0	3.2	0.3	0.3	0.4	0.2	6.4	9.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	12.1	0.0	3.8	4.6	4.8	3.4	1.2	7.2	3.1	0.0	0.0
LnGrp Delay(d),s/veh	68.4	30.6	0.0	45.4	16.7	16.7	34.0	31.6	43.6	54.4	0.0	0.0
LnGrp LOS	E	C		D	B	B	C	C	D	D		
Approach Vol, veh/h		959			816			592			102	
Approach Delay, s/veh		31.0			26.4			37.9			54.4	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.2	52.9		26.2	17.7	42.4		12.5
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	34.0	54.0		35.0	34.0	54.0		35.5
Max Q Clear Time (g_c+I1), s	2.6	12.7		19.0	10.6	29.4		8.1
Green Ext Time (p_c), s	0.0	7.6		2.2	1.1	7.0		0.4

Intersection Summary	
HCM 2010 Ctrl Delay	32.1
HCM 2010 LOS	C

MOVEMENT SUMMARY

Site: Pines / Trent PM - Alt2a

Pines / Trent
2020 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	304	3.0	0.209	3.3	LOS A	1.0	26.4	0.66	0.60	21.2
8	T1	54	3.0	0.209	1.9	LOS A	1.0	26.4	0.66	0.51	18.3
18	R2	543	3.0	0.549	3.2	LOS A	3.7	93.9	0.78	0.89	21.3
Approach		902	3.0	0.549	3.2	LOS A	3.7	93.9	0.73	0.77	21.1
East: Trent Ave											
1	L2	307	3.0	0.437	12.3	LOS B	2.3	59.3	0.55	0.76	22.6
6	T1	580	3.0	0.437	7.8	LOS A	2.4	60.2	0.54	0.67	39.5
16	R2	23	3.0	0.437	7.5	LOS A	2.4	60.2	0.54	0.64	29.7
Approach		909	3.0	0.437	9.3	LOS A	2.4	60.2	0.54	0.70	31.2
North: Cement Rd											
7	L2	33	3.0	0.174	9.1	LOS A	0.7	17.3	0.64	0.81	28.7
4	T1	65	3.0	0.174	7.1	LOS A	0.7	17.3	0.64	0.81	17.8
14	R2	11	3.0	0.174	5.4	LOS A	0.7	17.3	0.64	0.81	28.4
Approach		109	3.0	0.174	7.5	LOS A	0.7	17.3	0.64	0.81	21.0
West: Trent Ave											
5	L2	11	3.0	0.469	13.4	LOS B	3.3	83.3	0.68	0.74	30.5
2	T1	1011	3.0	0.469	8.8	LOS A	3.4	88.1	0.67	0.72	39.2
12	R2	261	3.0	0.160	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		1283	3.0	0.469	8.3	LOS A	3.4	88.1	0.53	0.69	39.4
All Vehicles		3203	3.0	0.549	7.1	LOS A	3.7	93.9	0.60	0.72	29.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	23	523	250	432	1057	227	34	341	114
v/c Ratio	0.28	0.80	0.36	0.85	0.63	0.58	0.16	0.42	0.62
Control Delay	70.0	54.7	4.8	53.0	21.2	55.8	51.1	2.6	66.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.0	54.7	4.8	53.0	21.2	55.8	51.1	2.6	66.8
Queue Length 50th (ft)	17	197	0	299	297	85	24	0	81
Queue Length 95th (ft)	51	303	49	483	426	138	59	24	161
Internal Link Dist (ft)		5151			2649		2154		831
Turn Bay Length (ft)	220		260	285		150		1000	
Base Capacity (vph)	84	810	775	685	2022	624	338	925	246
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.65	0.32	0.63	0.52	0.36	0.10	0.37	0.46

Intersection Summary

Description: 2040 forecast

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Future Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	523	0	432	1034	23	227	34	136	23	80	11
Adj No. of Lanes	1	2	1	1	2	0	2	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	37	733	478	476	1609	36	326	177	575	30	105	14
Arrive On Green	0.02	0.24	0.00	0.31	0.53	0.53	0.11	0.11	0.11	0.10	0.10	0.10
Sat Flow, veh/h	1527	3047	1363	1527	3048	68	2963	1604	1363	315	1096	151
Grp Volume(v), veh/h	23	523	0	432	517	540	227	34	136	114	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1527	1524	1592	1482	1604	1363	1561	0	0
Q Serve(g_s), s	1.4	14.3	0.0	24.7	22.0	22.0	6.7	1.8	5.8	6.5	0.0	0.0
Cycle Q Clear(g_c), s	1.4	14.3	0.0	24.7	22.0	22.0	6.7	1.8	5.8	6.5	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	0.20		0.10
Lane Grp Cap(c), veh/h	37	733	478	476	804	840	326	177	575	149	0	0
V/C Ratio(X)	0.62	0.71	0.00	0.91	0.64	0.64	0.70	0.19	0.24	0.76	0.00	0.00
Avail Cap(c_a), veh/h	101	973	585	824	1216	1271	750	406	770	292	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	43.9	31.6	0.0	30.0	15.3	15.3	38.9	36.7	16.9	40.1	0.0	0.0
Incr Delay (d2), s/veh	15.8	1.7	0.0	7.9	0.9	0.8	2.7	0.5	0.2	7.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	6.2	0.0	11.4	9.4	9.8	2.9	0.8	2.2	3.1	0.0	0.0
LnGrp Delay(d),s/veh	59.7	33.3	0.0	37.9	16.2	16.2	41.6	37.3	17.1	47.9	0.0	0.0
LnGrp LOS	E	C		D	B	B	D	D	B	D		
Approach Vol, veh/h		546			1489			397			114	
Approach Delay, s/veh		34.4			22.5			32.8			47.9	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		15.0	34.3	26.8		14.7	8.2	52.9
Change Period (Y+Rc), s		5.0	6.0	5.0		6.0	6.0	* 5
Max Green Setting (Gmax), s		23.0	49.0	29.0		17.0	6.0	* 73
Max Q Clear Time (g_c+I1), s		8.7	26.7	16.3		8.5	3.4	24.0
Green Ext Time (p_c), s		1.3	1.7	5.5		0.2	0.0	8.0

Intersection Summary	
HCM 2010 Ctrl Delay	27.8
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

MOVEMENT SUMMARY

Site: Pines / Trent AM - Alt1

Pines / Trent
2040 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	217	3.0	0.113	9.4	LOS A	0.5	12.4	0.47	0.70	33.5
8	T1	33	3.0	0.113	4.8	LOS A	0.5	12.4	0.47	0.67	27.1
18	R2	326	3.0	0.265	5.1	LOS A	1.3	32.3	0.51	0.63	34.8
Approach		576	3.0	0.265	6.7	LOS A	1.3	32.3	0.49	0.66	33.7
East: Trent Ave											
1	L2	432	3.0	0.664	13.1	LOS B	5.3	136.9	0.62	0.78	22.5
6	T1	1034	3.0	0.664	8.6	LOS A	5.3	136.9	0.61	0.73	39.1
16	R2	23	3.0	0.664	8.2	LOS A	5.3	136.7	0.61	0.71	29.6
Approach		1489	3.0	0.664	9.9	LOS A	5.3	136.9	0.61	0.74	32.1
North: Cement Rd											
7	L2	22	3.0	0.235	10.9	LOS B	1.0	25.7	0.75	0.86	28.2
4	T1	76	3.0	0.235	8.9	LOS A	1.0	25.7	0.75	0.86	17.6
14	R2	11	3.0	0.235	7.2	LOS A	1.0	25.7	0.75	0.86	27.8
Approach		109	3.0	0.235	9.1	LOS A	1.0	25.7	0.75	0.86	19.8
West: Trent Ave											
5	L2	22	3.0	0.270	13.7	LOS B	1.7	42.7	0.68	0.75	30.4
2	T1	500	3.0	0.270	9.1	LOS A	1.8	45.9	0.67	0.72	39.1
12	R2	239	3.0	0.147	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		761	3.0	0.270	8.3	LOS A	1.8	45.9	0.46	0.69	39.3
All Vehicles		2934	3.0	0.664	8.8	LOS A	5.3	136.9	0.55	0.72	33.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	23	523	250	432	1057	227	34	341	114
v/c Ratio	0.24	0.75	0.33	0.76	0.76	0.48	0.13	0.50	0.52
Control Delay	47.6	37.3	3.1	43.8	26.2	35.0	31.7	3.9	41.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.6	37.3	3.1	43.8	26.2	35.0	31.7	3.9	41.6
Queue Length 50th (ft)	11	123	0	103	189	53	15	0	50
Queue Length 95th (ft)	40	218	35	#233	#496	94	42	25	114
Internal Link Dist (ft)		5151			2649		2154		831
Turn Bay Length (ft)	220		260	175		150		150	
Base Capacity (vph)	97	894	903	565	1388	867	470	687	343
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.59	0.28	0.76	0.76	0.26	0.07	0.50	0.33

Intersection Summary

Description: 2040 forecast

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Future Volume (veh/h)	20	460	220	380	910	20	200	30	300	20	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	523	0	432	1034	23	227	34	136	23	80	11
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	40	790	526	534	1259	28	376	204	418	33	114	16
Arrive On Green	0.03	0.26	0.00	0.18	0.41	0.41	0.13	0.13	0.13	0.10	0.10	0.10
Sat Flow, veh/h	1527	3047	1363	2963	3048	68	2963	1604	1363	315	1096	151
Grp Volume(v), veh/h	23	523	0	432	517	540	227	34	136	114	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1482	1524	1592	1482	1604	1363	1561	0	0
Q Serve(g_s), s	1.0	10.2	0.0	9.3	20.1	20.1	4.8	1.3	5.1	4.7	0.0	0.0
Cycle Q Clear(g_c), s	1.0	10.2	0.0	9.3	20.1	20.1	4.8	1.3	5.1	4.7	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.04	1.00		1.00	0.20		0.10
Lane Grp Cap(c), veh/h	40	790	526	534	630	658	376	204	418	163	0	0
V/C Ratio(X)	0.58	0.66	0.00	0.81	0.82	0.82	0.60	0.17	0.32	0.70	0.00	0.00
Avail Cap(c_a), veh/h	114	1050	643	666	765	799	1022	553	715	398	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	32.1	22.1	0.0	26.3	17.4	17.4	27.5	26.0	17.8	28.9	0.0	0.0
Incr Delay (d2), s/veh	12.6	1.0	0.0	6.0	6.0	5.8	1.6	0.4	0.4	5.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	4.4	0.0	4.2	9.4	9.8	2.1	0.6	2.0	2.3	0.0	0.0
LnGrp Delay(d),s/veh	44.8	23.1	0.0	32.3	23.4	23.2	29.1	26.4	18.2	34.3	0.0	0.0
LnGrp LOS	D	C		C	C	C	C	C	B	C		
Approach Vol, veh/h		546			1489			397			114	
Approach Delay, s/veh		24.0			25.9			25.1			34.3	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		13.5	18.0	22.3		13.0	7.7	32.6
Change Period (Y+Rc), s		5.0	6.0	5.0		6.0	6.0	* 5
Max Green Setting (Gmax), s		23.0	15.0	23.0		17.0	5.0	* 34
Max Q Clear Time (g_c+I1), s		7.1	11.3	12.2		6.7	3.0	22.1
Green Ext Time (p_c), s		1.3	0.7	5.0		0.2	0.0	5.2

Intersection Summary	
HCM 2010 Ctrl Delay	25.7
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

MOVEMENT SUMMARY

Site: Pines / Trent AM - Alt2

Pines / Trent
2040 AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	217	3.0	0.113	2.2	LOS A	0.5	12.4	0.47	0.40	21.4
8	T1	33	3.0	0.113	1.0	LOS A	0.5	12.4	0.47	0.35	18.4
18	R2	326	3.0	0.265	1.1	LOS A	1.3	32.3	0.51	0.28	21.6
Approach		576	3.0	0.265	1.5	LOS A	1.3	32.3	0.49	0.33	21.3
East: Trent Ave											
1	L2	432	3.0	0.664	13.1	LOS B	5.3	136.9	0.62	0.78	22.5
6	T1	1034	3.0	0.664	8.6	LOS A	5.3	136.9	0.61	0.73	39.1
16	R2	23	3.0	0.664	8.2	LOS A	5.3	136.7	0.61	0.71	29.6
Approach		1489	3.0	0.664	9.9	LOS A	5.3	136.9	0.61	0.74	32.1
North: Cement Rd											
7	L2	22	3.0	0.235	10.9	LOS B	1.0	25.7	0.75	0.86	28.2
4	T1	76	3.0	0.235	8.9	LOS A	1.0	25.7	0.75	0.86	17.6
14	R2	11	3.0	0.235	7.2	LOS A	1.0	25.7	0.75	0.86	27.8
Approach		109	3.0	0.235	9.1	LOS A	1.0	25.7	0.75	0.86	19.8
West: Trent Ave											
5	L2	22	3.0	0.270	13.7	LOS B	1.7	42.7	0.68	0.75	30.4
2	T1	500	3.0	0.270	9.1	LOS A	1.8	45.9	0.67	0.72	39.1
12	R2	239	3.0	0.147	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		761	3.0	0.270	8.3	LOS A	1.8	45.9	0.46	0.69	39.3
All Vehicles		2934	3.0	0.664	7.8	LOS A	5.3	136.9	0.55	0.65	29.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	10	1071	306	296	664	337	61	520	122
v/c Ratio	0.17	0.94	0.33	0.88	0.35	0.73	0.24	0.77	0.65
Control Delay	72.3	56.9	2.8	77.2	15.7	64.1	53.4	19.3	71.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	72.3	56.9	2.8	77.2	15.7	64.1	53.4	19.3	71.7
Queue Length 50th (ft)	9	478	0	247	139	145	47	129	101
Queue Length 95th (ft)	30	#710	46	#447	257	209	96	224	173
Internal Link Dist (ft)		5151			2649		2154		831
Turn Bay Length (ft)	220		260	285		150		1000	
Base Capacity (vph)	60	1143	959	364	1881	578	313	693	282
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.94	0.32	0.81	0.35	0.58	0.19	0.75	0.43

Intersection Summary

Description: 2040 forecasts

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Future Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1667	1667	1667	1667	1700	1667	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	1071	0	296	633	31	337	61	214	41	71	10
Adj No. of Lanes	1	2	1	1	2	0	2	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	19	1180	735	324	1735	85	451	244	497	50	86	12
Arrive On Green	0.01	0.37	0.00	0.20	0.56	0.56	0.15	0.15	0.15	0.09	0.09	0.09
Sat Flow, veh/h	1587	3167	1417	1587	3073	150	3079	1667	1417	543	941	132
Grp Volume(v), veh/h	10	1071	0	296	326	338	337	61	214	122	0	0
Grp Sat Flow(s),veh/h/ln	1587	1583	1417	1587	1583	1640	1540	1667	1417	1616	0	0
Q Serve(g_s), s	0.7	38.1	0.0	21.7	13.4	13.4	12.5	3.9	13.7	8.8	0.0	0.0
Cycle Q Clear(g_c), s	0.7	38.1	0.0	21.7	13.4	13.4	12.5	3.9	13.7	8.8	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.09	1.00		1.00	0.34		0.08
Lane Grp Cap(c), veh/h	19	1180	735	324	894	926	451	244	497	148	0	0
V/C Ratio(X)	0.53	0.91	0.00	0.91	0.36	0.37	0.75	0.25	0.43	0.82	0.00	0.00
Avail Cap(c_a), veh/h	67	1252	768	401	946	980	635	344	581	306	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	58.4	35.4	0.0	46.3	14.2	14.2	48.6	44.9	29.5	53.0	0.0	0.0
Incr Delay (d2), s/veh	21.4	9.5	0.0	22.2	0.2	0.2	3.0	0.5	0.6	10.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	18.2	0.0	11.5	5.9	6.1	5.5	1.8	5.4	4.4	0.0	0.0
LnGrp Delay(d),s/veh	79.8	44.8	0.0	68.4	14.4	14.4	51.6	45.5	30.1	63.8	0.0	0.0
LnGrp LOS	E	D		E	B	B	D	D	C	E		
Approach Vol, veh/h		1081			960			612			122	
Approach Delay, s/veh		45.2			31.1			43.5			63.7	
Approach LOS		D			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.4	30.3	50.3		15.9	7.4	73.1
Change Period (Y+Rc), s		5.0	6.0	* 6		5.0	6.0	6.0
Max Green Setting (Gmax), s		24.5	30.0	* 47		22.5	5.0	71.0
Max Q Clear Time (g_c+I1), s		15.7	23.7	40.1		10.8	2.7	15.4
Green Ext Time (p_c), s		1.7	0.6	4.2		0.3	0.0	9.8

Intersection Summary	
HCM 2010 Ctrl Delay	40.7
HCM 2010 LOS	D

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

MOVEMENT SUMMARY

Site: Pines / Trent PM - Alt1

Pines / Trent
2040 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	359	3.0	0.275	10.8	LOS B	1.5	37.6	0.73	0.85	33.0
8	T1	65	3.0	0.275	6.0	LOS A	1.5	37.6	0.74	0.81	26.8
18	R2	554	3.0	0.617	8.1	LOS A	4.5	116.3	0.85	1.00	33.7
Approach		978	3.0	0.617	8.9	LOS A	4.5	116.3	0.80	0.94	32.9
East: Trent Ave											
1	L2	330	3.0	0.538	13.2	LOS B	3.4	87.7	0.64	0.83	22.5
6	T1	705	3.0	0.538	8.6	LOS A	3.5	88.6	0.63	0.75	39.1
16	R2	34	3.0	0.538	8.2	LOS A	3.5	88.6	0.63	0.72	29.5
Approach		1068	3.0	0.538	10.0	LOS B	3.5	88.6	0.63	0.78	31.5
North: Cement Rd											
7	L2	43	3.0	0.236	9.8	LOS A	1.0	24.9	0.70	0.84	28.4
4	T1	76	3.0	0.236	7.8	LOS A	1.0	24.9	0.70	0.84	17.7
14	R2	11	3.0	0.236	6.1	LOS A	1.0	24.9	0.70	0.84	28.1
Approach		130	3.0	0.236	8.3	LOS A	1.0	24.9	0.70	0.84	21.0
West: Trent Ave											
5	L2	11	3.0	0.552	14.7	LOS B	4.6	118.8	0.76	0.82	30.3
2	T1	1141	3.0	0.552	9.9	LOS A	4.8	121.9	0.75	0.79	38.9
12	R2	326	3.0	0.201	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		1478	3.0	0.552	9.1	LOS A	4.8	121.9	0.59	0.75	39.2
All Vehicles		3655	3.0	0.617	9.3	LOS A	4.8	121.9	0.66	0.81	33.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBT
Lane Group Flow (vph)	10	1071	306	296	664	337	61	520	122
v/c Ratio	0.14	0.88	0.32	0.71	0.38	0.68	0.23	0.84	0.61
Control Delay	59.0	42.0	2.2	56.8	16.7	51.2	43.3	22.2	58.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.0	42.0	2.2	56.8	16.7	51.2	43.3	22.2	58.4
Queue Length 50th (ft)	7	371	0	104	127	117	38	95	81
Queue Length 95th (ft)	27	#591	38	#169	252	175	82	#194	150
Internal Link Dist (ft)		5151			2649		2154		831
Turn Bay Length (ft)	220		260	175		150		150	
Base Capacity (vph)	73	1230	1028	454	1731	668	362	633	339
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.87	0.30	0.65	0.38	0.50	0.17	0.82	0.36

Intersection Summary

Description: 2040 forecasts

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Future Volume (veh/h)	10	1050	300	290	620	30	330	60	510	40	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1667	1667	1667	1667	1700	1667	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	1071	0	296	633	31	337	61	214	41	71	10
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	19	1234	788	370	1529	75	512	277	405	51	89	12
Arrive On Green	0.01	0.39	0.00	0.12	0.50	0.50	0.17	0.17	0.17	0.09	0.09	0.09
Sat Flow, veh/h	1587	3167	1417	3079	3073	150	3079	1667	1417	543	941	132
Grp Volume(v), veh/h	10	1071	0	296	326	338	337	61	214	122	0	0
Grp Sat Flow(s),veh/h/ln	1587	1583	1417	1540	1583	1640	1540	1667	1417	1616	0	0
Q Serve(g_s), s	0.6	29.9	0.0	9.0	12.5	12.5	9.8	3.0	12.2	7.1	0.0	0.0
Cycle Q Clear(g_c), s	0.6	29.9	0.0	9.0	12.5	12.5	9.8	3.0	12.2	7.1	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.09	1.00		1.00	0.34		0.08
Lane Grp Cap(c), veh/h	19	1234	788	370	788	816	512	277	405	152	0	0
V/C Ratio(X)	0.52	0.87	0.00	0.80	0.41	0.41	0.66	0.22	0.53	0.80	0.00	0.00
Avail Cap(c_a), veh/h	83	1389	857	514	860	891	756	409	518	380	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	47.0	26.9	0.0	41.0	15.2	15.2	37.4	34.6	28.7	42.5	0.0	0.0
Incr Delay (d2), s/veh	19.7	5.6	0.0	6.1	0.3	0.3	1.5	0.4	1.1	9.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	13.9	0.0	4.1	5.5	5.7	4.3	1.4	4.8	3.5	0.0	0.0
LnGrp Delay(d),s/veh	66.7	32.6	0.0	47.1	15.6	15.6	38.8	35.0	29.8	51.8	0.0	0.0
LnGrp LOS	E	C		D	B	B	D	C	C	D		
Approach Vol, veh/h		1081			960			612			122	
Approach Delay, s/veh		32.9			25.3			35.3			51.8	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		20.9	17.5	43.3		14.0	7.2	53.7
Change Period (Y+Rc), s		5.0	6.0	* 6		5.0	6.0	6.0
Max Green Setting (Gmax), s		23.5	16.0	* 42		22.5	5.0	52.0
Max Q Clear Time (g_c+I1), s		14.2	11.0	31.9		9.1	2.6	14.5
Green Ext Time (p_c), s		1.8	0.5	5.5		0.3	0.0	9.4

Intersection Summary	
HCM 2010 Ctrl Delay	31.6
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

MOVEMENT SUMMARY

Site: Pines / Trent PM - Alt2

Pines / Trent
2040 PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	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 per veh	Average Speed mph
South: Pines Rd											
3	L2	359	3.0	0.275	3.7	LOS A	1.5	37.6	0.73	0.67	21.1
8	T1	65	3.0	0.275	2.2	LOS A	1.5	37.6	0.74	0.57	18.3
18	R2	554	3.0	0.617	4.1	LOS A	4.5	116.3	0.85	1.01	21.1
Approach		978	3.0	0.617	3.8	LOS A	4.5	116.3	0.80	0.86	20.9
East: Trent Ave											
1	L2	330	3.0	0.538	13.2	LOS B	3.4	87.7	0.64	0.83	22.5
6	T1	705	3.0	0.538	8.6	LOS A	3.5	88.6	0.63	0.75	39.1
16	R2	34	3.0	0.538	8.2	LOS A	3.5	88.6	0.63	0.72	29.5
Approach		1068	3.0	0.538	10.0	LOS B	3.5	88.6	0.63	0.78	31.5
North: Cement Rd											
7	L2	43	3.0	0.236	9.8	LOS A	1.0	24.9	0.70	0.84	28.4
4	T1	76	3.0	0.236	7.8	LOS A	1.0	24.9	0.70	0.84	17.7
14	R2	11	3.0	0.236	6.1	LOS A	1.0	24.9	0.70	0.84	28.1
Approach		130	3.0	0.236	8.3	LOS A	1.0	24.9	0.70	0.84	21.0
West: Trent Ave											
5	L2	11	3.0	0.552	14.7	LOS B	4.6	118.8	0.76	0.82	30.3
2	T1	1141	3.0	0.552	9.9	LOS A	4.8	121.9	0.75	0.79	38.9
12	R2	326	3.0	0.201	6.2	LOS A	0.0	0.0	0.00	0.60	40.7
Approach		1478	3.0	0.552	9.1	LOS A	4.8	121.9	0.59	0.75	39.2
All Vehicles		3655	3.0	0.617	7.9	LOS A	4.8	121.9	0.66	0.79	29.3

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

FEHR PEERS

ATTACHMENT E: 2020 AND 2040 UNIVERSITY ROAD CLOSURE ANALYSIS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	295	190	460	760	20	145	20	315	10	70	10
Future Volume (veh/h)	20	295	190	460	760	20	145	20	315	10	70	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1700	1604	1604	1700	1604	1700
Adj Flow Rate, veh/h	23	335	0	523	864	23	165	23	188	11	80	11
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	36	517	231	565	1564	42	226	31	228	14	100	14
Arrive On Green	0.02	0.17	0.00	0.37	0.52	0.52	0.17	0.17	0.17	0.08	0.08	0.08
Sat Flow, veh/h	1527	3047	1363	1527	3032	81	1348	188	1363	169	1228	169
Grp Volume(v), veh/h	23	335	0	523	434	453	188	0	188	102	0	0
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1527	1524	1590	1536	0	1363	1566	0	0
Q Serve(g_s), s	1.5	10.4	0.0	33.3	19.6	19.6	11.8	0.0	13.5	6.5	0.0	0.0
Cycle Q Clear(g_c), s	1.5	10.4	0.0	33.3	19.6	19.6	11.8	0.0	13.5	6.5	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.05	0.88		1.00	0.11		0.11
Lane Grp Cap(c), veh/h	36	517	231	565	786	820	257	0	228	128	0	0
V/C Ratio(X)	0.64	0.65	0.00	0.93	0.55	0.55	0.73	0.00	0.82	0.80	0.00	0.00
Avail Cap(c_a), veh/h	90	931	417	1054	1427	1488	515	0	457	363	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	49.1	39.3	0.0	30.6	16.6	16.6	40.1	0.0	40.8	45.8	0.0	0.0
Incr Delay (d2), s/veh	17.4	1.4	0.0	7.1	0.6	0.6	4.0	0.0	7.3	10.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	4.5	0.0	15.1	8.3	8.7	5.3	0.0	5.6	3.2	0.0	0.0
LnGrp Delay(d),s/veh	66.5	40.7	0.0	37.7	17.2	17.2	44.1	0.0	48.1	56.6	0.0	0.0
LnGrp LOS	E	D		D	B	B	D		D	E		
Approach Vol, veh/h		358			1410			376			102	
Approach Delay, s/veh		42.3			24.8			46.1			56.6	
Approach LOS		D			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.4	58.3		22.0	43.5	23.2		12.8
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	6.0	95.0		34.0	70.0	31.0		23.5
Max Q Clear Time (g_c+I1), s	3.5	21.6		15.5	35.3	12.4		8.5
Green Ext Time (p_c), s	0.0	5.5		1.5	2.2	4.8		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	32.6
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	235	295	255	545	120	305	650	125	110	1040	100
Future Volume (vph)	50	235	295	255	545	120	305	650	125	110	1040	100
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2913	1303	1456	4072		2825	4185	1303	1456	4130	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2913	1303	1456	4072		2825	4185	1303	1456	4130	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	255	321	277	592	130	332	707	136	120	1130	109
RTOR Reduction (vph)	0	0	65	0	23	0	0	0	44	0	7	0
Lane Group Flow (vph)	54	255	256	277	699	0	332	707	92	120	1232	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.0	15.5	39.1	28.3	35.8		23.6	68.3	96.6	16.9	56.6	
Effective Green, g (s)	10.5	18.0	46.6	30.8	38.3		27.6	70.3	101.6	18.9	58.6	
Actuated g/C Ratio	0.07	0.12	0.31	0.21	0.26		0.18	0.47	0.68	0.13	0.39	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	101	349	404	298	1039		519	1961	882	183	1613	
v/s Ratio Prot	0.04	0.09	c0.12	c0.19	c0.17		c0.12	0.17	0.02	0.08	c0.30	
v/s Ratio Perm			0.08						0.05			
v/c Ratio	0.53	0.73	0.63	0.93	0.67		0.64	0.36	0.10	0.66	0.76	
Uniform Delay, d1	67.4	63.7	44.4	58.5	50.2		56.6	25.5	8.4	62.5	39.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.83	0.23	0.21	1.00	1.00	
Incremental Delay, d2	5.4	7.7	3.2	33.7	1.7		1.9	0.4	0.0	8.2	2.2	
Delay (s)	72.7	71.3	47.6	92.2	51.9		105.4	6.2	1.8	70.6	41.9	
Level of Service	E	E	D	F	D		F	A	A	E	D	
Approach Delay (s)		59.3			63.1			33.7			44.4	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	48.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	30	10	200	30	150	10	860	410	360	1220	30
Future Volume (vph)	30	30	10	200	30	150	10	860	410	360	1220	30
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.96		1.00	0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2806		1325	2503		1456	4185	1303	1456	4170	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2806		1325	2503		1456	4185	1303	1456	4170	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	34	34	11	225	34	169	11	966	461	404	1371	34
RTOR Reduction (vph)	0	10	0	0	139	0	0	0	268	0	2	0
Lane Group Flow (vph)	34	35	0	148	141	0	11	966	193	404	1403	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	7.1	7.1		23.9	23.9		1.2	46.0	46.0	53.0	97.8	
Effective Green, g (s)	9.6	9.6		26.4	26.4		2.2	48.0	47.0	54.0	99.8	
Actuated g/C Ratio	0.06	0.06		0.18	0.18		0.01	0.32	0.31	0.36	0.67	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	93	179		233	440		21	1339	408	524	2774	
v/s Ratio Prot	c0.02	0.01		c0.11	0.06		0.01	c0.23		c0.28	0.34	
v/s Ratio Perm									0.15			
v/c Ratio	0.37	0.19		0.64	0.32		0.52	0.72	0.47	0.77	0.51	
Uniform Delay, d1	67.3	66.5		57.3	54.0		73.4	45.1	41.5	42.5	12.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.78	0.65	
Incremental Delay, d2	2.4	0.5		12.5	1.9		21.6	3.4	3.9	7.5	0.5	
Delay (s)	69.7	67.1		69.8	55.9		95.0	48.5	45.4	40.8	8.6	
Level of Service	E	E		E	E		F	D	D	D	A	
Approach Delay (s)		68.2			60.7			47.8			15.8	
Approach LOS		E			E			D			B	

Intersection Summary			
HCM 2000 Control Delay	34.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

Description: 2017 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	850	245	305	475	20	290	50	580	30	60	10
Future Volume (veh/h)	10	850	245	305	475	20	290	50	580	30	60	10
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1635	1667	1667	1636	1700	1700	1667	1667	1700	1667	1700
Adj Flow Rate, veh/h	10	867	0	311	485	20	296	51	286	31	61	10
Adj No. of Lanes	1	2	1	1	2	0	0	1	1	0	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	4	2	2	4	4	2	2	2	2	2	2
Cap, veh/h	18	961	438	337	1551	64	323	56	336	38	75	12
Arrive On Green	0.01	0.31	0.00	0.21	0.51	0.51	0.24	0.24	0.24	0.08	0.08	0.08
Sat Flow, veh/h	1587	3106	1417	1587	3043	125	1364	235	1417	491	965	158
Grp Volume(v), veh/h	10	867	0	311	247	258	347	0	286	102	0	0
Grp Sat Flow(s),veh/h/ln	1587	1553	1417	1587	1554	1614	1598	0	1417	1614	0	0
Q Serve(g_s), s	0.8	35.2	0.0	25.3	12.2	12.3	27.8	0.0	25.4	8.2	0.0	0.0
Cycle Q Clear(g_c), s	0.8	35.2	0.0	25.3	12.2	12.3	27.8	0.0	25.4	8.2	0.0	0.0
Prop In Lane	1.00		1.00	1.00		0.08	0.85		1.00	0.30		0.10
Lane Grp Cap(c), veh/h	18	961	438	337	792	823	379	0	336	126	0	0
V/C Ratio(X)	0.54	0.90	0.00	0.92	0.31	0.31	0.92	0.00	0.85	0.81	0.00	0.00
Avail Cap(c_a), veh/h	410	1274	581	410	792	823	425	0	377	435	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	64.7	43.5	0.0	50.8	18.8	18.8	48.9	0.0	48.0	59.7	0.0	0.0
Incr Delay (d2), s/veh	22.4	7.4	0.0	23.8	0.2	0.2	22.9	0.0	15.5	11.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	16.0	0.0	13.3	5.3	5.5	14.7	0.0	11.4	4.1	0.0	0.0
LnGrp Delay(d),s/veh	87.1	50.9	0.0	74.7	19.0	19.0	71.8	0.0	63.5	71.3	0.0	0.0
LnGrp LOS	F	D		E	B	B	E		E	E		
Approach Vol, veh/h		877			816			633			102	
Approach Delay, s/veh		51.3			40.2			68.1			71.3	
Approach LOS		D			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.5	73.1		36.2	33.9	46.7		14.8
Change Period (Y+Rc), s	6.0	6.0		5.0	6.0	6.0		4.5
Max Green Setting (Gmax), s	34.0	54.0		35.0	34.0	54.0		35.5
Max Q Clear Time (g_c+I1), s	2.8	14.3		29.8	27.3	37.2		10.2
Green Ext Time (p_c), s	0.0	6.7		1.4	0.6	3.5		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	52.8
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	655	455	245	375	210	425	1230	305	160	910	70
Future Volume (vph)	130	655	455	245	375	210	425	1230	305	160	910	70
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	3027	1354	1513	4115		2936	4349	1354	1513	4303	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	3027	1354	1513	4115		2936	4349	1354	1513	4303	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	668	464	250	383	214	434	1255	311	163	929	71
RTOR Reduction (vph)	0	0	29	0	67	0	0	0	66	0	5	0
Lane Group Flow (vph)	133	668	435	250	530	0	434	1255	245	163	995	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	17.0	35.1	62.3	20.5	38.6		27.2	53.6	74.1	19.8	41.2	
Effective Green, g (s)	19.5	37.6	69.8	23.0	41.1		31.2	55.6	79.1	21.8	43.2	
Actuated g/C Ratio	0.13	0.25	0.47	0.15	0.27		0.21	0.37	0.53	0.15	0.29	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	196	758	630	231	1127		610	1612	714	219	1239	
v/s Ratio Prot	0.09	c0.22	0.15	c0.17	0.13		0.15	c0.29	0.05	c0.11	c0.23	
v/s Ratio Perm			0.17						0.13			
v/c Ratio	0.68	0.88	0.69	1.08	0.47		0.71	0.78	0.34	0.74	0.80	
Uniform Delay, d1	62.3	54.1	31.6	63.5	45.4		55.2	41.8	20.5	61.4	49.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.83	0.40	0.26	1.00	1.00	
Incremental Delay, d2	9.0	11.7	3.2	82.8	0.3		2.6	2.6	0.2	12.8	3.9	
Delay (s)	71.2	65.7	34.7	146.3	45.7		103.7	19.4	5.4	74.3	53.3	
Level of Service	E	E	C	F	D		F	B	A	E	D	
Approach Delay (s)		54.9			75.4			35.5			56.3	
Approach LOS		D			E			D			E	

Intersection Summary			
HCM 2000 Control Delay	51.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2015 counts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	40	10	400	50	400	20	1390	330	310	1260	40
Future Volume (vph)	70	40	10	400	50	400	20	1390	330	310	1260	40
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.97		1.00	0.89		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	2938		1377	2560		1513	4349	1354	1513	4329	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	2938		1377	2560		1513	4349	1354	1513	4329	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	71	41	10	408	51	408	20	1418	337	316	1286	41
RTOR Reduction (vph)	0	9	0	0	251	0	0	0	134	0	2	0
Lane Group Flow (vph)	71	42	0	306	310	0	20	1418	203	316	1325	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	5.5	5.5		39.5	39.5		3.0	58.0	58.0	27.0	82.0	
Effective Green, g (s)	8.0	8.0		42.0	42.0		4.0	60.0	59.0	28.0	84.0	
Actuated g/C Ratio	0.05	0.05		0.28	0.28		0.03	0.40	0.39	0.19	0.56	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	80	156		385	716		40	1739	532	282	2424	
v/s Ratio Prot	c0.05	0.01		c0.22	0.12		0.01	c0.33		c0.21	0.31	
v/s Ratio Perm									0.15			
v/c Ratio	0.89	0.27		0.79	0.43		0.50	0.82	0.38	1.12	0.55	
Uniform Delay, d1	70.6	68.2		50.0	44.2		72.0	40.1	32.5	61.0	20.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.82	0.69	
Incremental Delay, d2	63.6	0.9		15.5	1.9		9.5	4.3	2.1	78.4	0.5	
Delay (s)	134.1	69.1		65.5	46.1		81.5	44.4	34.5	128.7	15.0	
Level of Service	F	E		E	D		F	D	C	F	B	
Approach Delay (s)		106.9			53.0			43.0			36.9	
Approach LOS		F			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	44.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.5%	ICU Level of Service	E
Analysis Period (min)	15		
Description: 2017 counts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	435	235	505	785	20	205	30	325	20	70	10
Future Volume (veh/h)	20	435	235	505	785	20	205	30	325	20	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1604	1604	1604	1604	1604	1700	1604	1604	1604	1604	1604	1700
Adj Flow Rate, veh/h	23	494	0	574	892	23	233	34	164	23	80	11
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	1	1	0
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %	6	6	6	6	6	6	6	6	6	6	6	6
Cap, veh/h	39	716	470	714	1367	35	326	326	605	39	136	19
Arrive On Green	0.03	0.24	0.00	0.24	0.45	0.45	0.11	0.20	0.20	0.03	0.10	0.10
Sat Flow, veh/h	1527	3047	1363	2963	3035	78	2963	1604	1363	1527	1380	190
Grp Volume(v), veh/h	23	494	0	574	448	467	233	34	164	23	0	91
Grp Sat Flow(s),veh/h/ln	1527	1524	1363	1482	1524	1590	1482	1604	1363	1527	0	1570
Q Serve(g_s), s	1.1	10.8	0.0	13.3	16.7	16.7	5.5	1.3	5.5	1.1	0.0	4.0
Cycle Q Clear(g_c), s	1.1	10.8	0.0	13.3	16.7	16.7	5.5	1.3	5.5	1.1	0.0	4.0
Prop In Lane	1.00		1.00	1.00		0.05	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	39	716	470	714	686	716	326	326	605	39	0	154
V/C Ratio(X)	0.59	0.69	0.00	0.80	0.65	0.65	0.71	0.10	0.27	0.59	0.00	0.59
Avail Cap(c_a), veh/h	105	962	581	1221	1015	1059	732	518	768	482	0	561
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	35.1	25.4	0.0	26.0	15.6	15.6	31.3	23.6	12.8	35.1	0.0	31.4
Incr Delay (d2), s/veh	13.4	1.3	0.0	2.2	1.1	1.0	2.9	0.1	0.2	13.4	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	4.7	0.0	5.6	7.2	7.5	2.4	0.6	2.1	0.6	0.0	1.9
LnGrp Delay(d),s/veh	48.5	26.7	0.0	28.2	16.6	16.6	34.2	23.7	13.0	48.5	0.0	35.0
LnGrp LOS	D	C		C	B	B	C	C	B	D		C
Approach Vol, veh/h		517			1489			431			114	
Approach Delay, s/veh		27.7			21.1			25.3			37.7	
Approach LOS		C			C			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	6.4	20.8	23.5	22.1	14.0	13.2	7.9	37.8
Change Period (Y+Rc), s	4.5	* 6	6.0	5.0	6.0	6.0	6.0	* 5
Max Green Setting (Gmax), s	23.0	* 24	30.0	23.0	18.0	26.0	5.0	* 49
Max Q Clear Time (g_c+I1), s	3.1	7.5	15.3	12.8	7.5	6.0	3.1	18.7
Green Ext Time (p_c), s	0.0	1.0	2.3	4.3	0.6	1.1	0.0	6.4

Intersection Summary	
HCM 2010 Ctrl Delay	23.9
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	265	325	285	605	140	355	650	255	130	1050	110
Future Volume (vph)	50	265	325	285	605	140	355	650	255	130	1050	110
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2913	1303	2825	2831		2825	4185	1303	1456	4125	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2913	1303	2825	2831		2825	4185	1303	1456	4125	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	288	353	310	658	152	386	707	277	141	1141	120
RTOR Reduction (vph)	0	0	56	0	13	0	0	0	109	0	8	0
Lane Group Flow (vph)	54	288	297	310	797	0	386	707	168	141	1253	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	8.2	28.8	53.3	20.6	41.2		24.5	60.8	81.4	18.8	50.1	
Effective Green, g (s)	10.7	31.3	60.8	23.1	43.7		28.5	62.8	86.4	20.8	52.1	
Actuated g/C Ratio	0.07	0.21	0.41	0.15	0.29		0.19	0.42	0.58	0.14	0.35	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	103	607	528	435	824		536	1752	750	201	1432	
v/s Ratio Prot	0.04	0.10	c0.11	c0.11	c0.28		c0.14	0.17	0.03	0.10	c0.30	
v/s Ratio Perm			0.12						0.09			
v/c Ratio	0.52	0.47	0.56	0.71	0.97		0.72	0.40	0.22	0.70	0.88	
Uniform Delay, d1	67.2	52.1	34.3	60.3	52.4		57.0	30.5	15.5	61.6	45.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.37	0.48	1.39	1.00	1.00	
Incremental Delay, d2	4.7	0.6	1.4	5.5	23.3		3.5	0.5	0.1	10.5	6.3	
Delay (s)	71.9	52.7	35.7	65.8	75.7		81.9	15.1	21.7	72.2	52.2	
Level of Service	E	D	D	E	E		F	B	C	E	D	
Approach Delay (s)		45.6			72.9			35.3			54.2	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	51.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		
Description: 2040 forecasts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	40	10	220	30	160	10	860	440	420	1230	30
Future Volume (vph)	40	40	10	220	30	160	10	860	440	420	1230	30
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.97		1.00	0.91		1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1456	2827		1325	2503		1456	4185	1303	1456	4170	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1456	2827		1325	2503		1456	4185	1303	1456	4170	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	45	45	11	247	34	180	11	966	494	472	1382	34
RTOR Reduction (vph)	0	10	0	0	148	0	0	0	288	0	2	0
Lane Group Flow (vph)	45	46	0	161	152	0	11	966	206	472	1414	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	7.2	7.2		23.8	23.8		1.2	40.0	40.0	59.0	97.8	
Effective Green, g (s)	9.7	9.7		26.3	26.3		2.2	42.0	41.0	60.0	99.8	
Actuated g/C Ratio	0.06	0.06		0.18	0.18		0.01	0.28	0.27	0.40	0.67	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	94	182		232	438		21	1171	356	582	2774	
v/s Ratio Prot	c0.03	0.02		c0.12	0.06		0.01	c0.23		c0.32	0.34	
v/s Ratio Perm									0.16			
v/c Ratio	0.48	0.25		0.69	0.35		0.52	0.82	0.58	0.81	0.51	
Uniform Delay, d1	67.7	66.7		58.1	54.3		73.4	50.6	47.1	40.0	12.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.73	0.81	
Incremental Delay, d2	3.8	0.7		15.8	2.2		21.6	6.7	6.7	8.2	0.5	
Delay (s)	71.5	67.4		73.9	56.5		95.0	57.2	53.8	37.2	10.8	
Level of Service	E	E		E	E		F	E	D	D	B	
Approach Delay (s)		69.2			62.5			56.4			17.4	
Approach LOS		E			E			E			B	

Intersection Summary			
HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		
Description: 2040 forecasts			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	950	305	355	555	30	340	60	610	40	70	10
Future Volume (veh/h)	10	950	305	355	555	30	340	60	610	40	70	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1667	1667	1667	1667	1667	1700	1667	1667	1667	1667	1667	1700
Adj Flow Rate, veh/h	10	969	0	362	566	31	347	61	316	41	71	10
Adj No. of Lanes	1	2	1	2	2	0	2	1	1	1	1	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	19	1171	720	448	1535	84	427	352	505	55	153	22
Arrive On Green	0.01	0.37	0.00	0.15	0.50	0.50	0.14	0.21	0.21	0.03	0.11	0.11
Sat Flow, veh/h	1587	3167	1417	3079	3054	167	3079	1667	1417	1587	1430	201
Grp Volume(v), veh/h	10	969	0	362	293	304	347	61	316	41	0	81
Grp Sat Flow(s),veh/h/ln	1587	1583	1417	1540	1583	1637	1540	1667	1417	1587	0	1631
Q Serve(g_s), s	0.6	26.7	0.0	11.0	10.9	10.9	10.5	2.9	17.8	2.5	0.0	4.5
Cycle Q Clear(g_c), s	0.6	26.7	0.0	11.0	10.9	10.9	10.5	2.9	17.8	2.5	0.0	4.5
Prop In Lane	1.00		1.00	1.00		0.10	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	19	1171	720	448	796	823	427	352	505	55	0	175
V/C Ratio(X)	0.52	0.83	0.00	0.81	0.37	0.37	0.81	0.17	0.63	0.75	0.00	0.46
Avail Cap(c_a), veh/h	83	1580	903	704	1053	1089	672	399	545	83	0	175
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	47.2	27.5	0.0	39.8	14.6	14.6	40.2	31.1	25.6	46.0	0.0	40.3
Incr Delay (d2), s/veh	19.7	2.8	0.0	3.9	0.3	0.3	4.2	0.2	2.0	18.0	0.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	12.2	0.0	4.9	4.8	5.0	4.7	1.3	7.2	1.4	0.0	2.1
LnGrp Delay(d),s/veh	66.9	30.3	0.0	43.7	14.9	14.9	44.5	31.3	27.6	64.0	0.0	42.2
LnGrp LOS	E	C		D	B	B	D	C	C	E		D
Approach Vol, veh/h		979			959			724			122	
Approach Delay, s/veh		30.7			25.7			36.0			49.6	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.3	25.3	20.0	41.6	19.3	15.3	7.2	54.4
Change Period (Y+Rc), s	6.0	5.0	6.0	* 6	6.0	5.0	6.0	6.0
Max Green Setting (Gmax), s	5.0	23.0	22.0	* 48	21.0	7.0	5.0	64.0
Max Q Clear Time (g_c+I1), s	4.5	19.8	13.0	28.7	12.5	6.5	2.6	12.9
Green Ext Time (p_c), s	0.0	0.6	1.0	6.8	0.8	0.1	0.0	8.3

Intersection Summary	
HCM 2010 Ctrl Delay	31.2
HCM 2010 LOS	C

Notes

* HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	685	485	305	395	230	465	1240	435	180	910	70
Future Volume (vph)	130	685	485	305	395	230	465	1240	435	180	910	70
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0	2.5	3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95		0.97	0.91	1.00	1.00	0.91	
Frt	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	3027	1354	2936	2860		2936	4349	1354	1513	4303	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	3027	1354	2936	2860		2936	4349	1354	1513	4303	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	133	699	495	311	403	235	474	1265	444	184	929	71
RTOR Reduction (vph)	0	0	27	0	55	0	0	0	69	0	6	0
Lane Group Flow (vph)	133	699	468	311	583	0	474	1265	375	184	994	0
Turn Type	Prot	NA	pm+ov	Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	1	6	7 9	5	2		7 9	4	5	3	8	
Permitted Phases			6						4			
Actuated Green, G (s)	17.6	38.3	67.9	11.5	32.2		29.6	57.8	69.3	21.4	44.6	
Effective Green, g (s)	20.1	40.8	75.4	14.0	34.7		33.6	59.8	74.3	23.4	46.6	
Actuated g/C Ratio	0.13	0.27	0.50	0.09	0.23		0.22	0.40	0.50	0.16	0.31	
Clearance Time (s)	5.5	5.5		5.5	5.5			5.0	5.5	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	202	823	680	274	661		657	1733	670	236	1336	
v/s Ratio Prot	c0.09	c0.23	0.16	c0.11	0.20		0.16	c0.29	0.05	c0.12	0.23	
v/s Ratio Perm			0.19						0.22			
v/c Ratio	0.66	0.85	0.69	1.14	0.88		0.72	0.73	0.56	0.78	0.74	
Uniform Delay, d1	61.7	51.7	28.4	68.0	55.7		53.9	38.3	26.4	60.8	46.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.52	0.42	0.31	1.00	1.00	
Incremental Delay, d2	7.5	8.2	2.9	95.8	13.1		2.8	2.0	0.8	15.0	2.3	
Delay (s)	69.2	59.9	31.3	163.8	68.8		85.0	18.2	8.9	75.8	48.7	
Level of Service	E	E	C	F	E		F	B	A	E	D	
Approach Delay (s)		50.1			99.9			30.8			52.9	
Approach LOS		D			F			C			D	

Intersection Summary			
HCM 2000 Control Delay	51.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.3%	ICU Level of Service	E
Analysis Period (min)	15		

Description: 2040 forecasts

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	50	10	410	60	430	20	1390	340	340	1270	50
Future Volume (vph)	70	50	10	410	60	430	20	1390	340	340	1270	50
Ideal Flow (vphpl)	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625	1625
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0	4.0	3.0	3.0	
Lane Util. Factor	1.00	0.95		0.91	0.91		1.00	0.91	1.00	1.00	0.91	
Frt	1.00	0.98		1.00	0.89		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1513	2953		1377	2559		1513	4349	1354	1513	4325	
Flt Permitted	0.95	1.00		0.95	0.99		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1513	2953		1377	2559		1513	4349	1354	1513	4325	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	71	51	10	418	61	439	20	1418	347	347	1296	51
RTOR Reduction (vph)	0	9	0	0	251	0	0	0	138	0	3	0
Lane Group Flow (vph)	71	52	0	322	345	0	20	1418	209	347	1344	0
Turn Type	Split	NA		Split	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	7		8	8		1	6		5	2	
Permitted Phases									6			
Actuated Green, G (s)	5.5	5.5		39.5	39.5		3.0	58.0	58.0	27.0	82.0	
Effective Green, g (s)	8.0	8.0		42.0	42.0		4.0	60.0	59.0	28.0	84.0	
Actuated g/C Ratio	0.05	0.05		0.28	0.28		0.03	0.40	0.39	0.19	0.56	
Clearance Time (s)	5.5	5.5		5.5	5.5		4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		4.0	4.0		3.0	4.0	4.0	3.0	4.0	
Lane Grp Cap (vph)	80	157		385	716		40	1739	532	282	2422	
v/s Ratio Prot	c0.05	0.02		c0.23	0.13		0.01	c0.33		c0.23	0.31	
v/s Ratio Perm									0.15			
v/c Ratio	0.89	0.33		0.84	0.48		0.50	0.82	0.39	1.23	0.56	
Uniform Delay, d1	70.6	68.4		50.8	44.9		72.0	40.1	32.7	61.0	21.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.93	0.89	
Incremental Delay, d2	63.6	1.2		19.0	2.3		9.5	4.3	2.2	121.2	0.6	
Delay (s)	134.1	69.6		69.8	47.2		81.5	44.4	34.8	177.6	19.2	
Level of Service	F	E		E	D		F	D	C	F	B	
Approach Delay (s)		104.3			55.1			43.0			51.7	
Approach LOS		F			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	50.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.7%	ICU Level of Service	F
Analysis Period (min)	15		
Description: 2040 forecast			
c Critical Lane Group			