

# Windhaven Apartments DRAFT Traffic Impact Analysis

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**WINDHAVEN APARTMENTS  
DRAFT TRAFFIC IMPACT ANALYSIS**

SUBMITTED TO:

**CITY OF SPOKANE**

May 2016

**PREPARED BY:**

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MMI PROJECT #: 5594.002

## EXECUTIVE SUMMARY

Windhaven First Addition is an approved City residential development that occupies 49.48 acres aligned north of Barnes Road and west of Indian Trail Road within the Indian Trail neighborhood of Spokane. The project was initially approved in year 2006 for the construction of 286 single family homes developed approximately five years. No homes have been constructed yet; although the street infrastructure for the development is complete. This includes primary vehicle access to Barnes Road via Forest Lane and Pamela Lane, with secondary access provided to the adjacent apartment development (to the east) via Jamestown Lane. The project is within an RSF zone of the City with a site Comprehensive Plan designation of Residential 4-10.

Due to evolving market conditions, the project proponent has recently proposed to develop up to 750 apartment units on the site as opposed to single family homes. The proposal results in a density of 15.2 homes per acres, which exceeds the approved residential density. Thus, a Comprehensive Plan amendment and zone change would be needed to accommodate the proposal; specifically to a RMF zone and Comprehensive Plan designation of Residential 15-30.

Note the proposed apartment density marginally exceeds minimum zoning and Comprehensive Plan allowances, and is just under half of maximum allowable densities (of up to 30 apartments per acre). The reduced density was accommodated to minimize the traffic impacts of the proposed development on the Indian Trail neighborhood; as this was expressed as a concern of citizens living within the area. The developers have reduced site densities considerable from initial development proposals.

Site access is promoted as described previously, with primary access provided via Forest Lane and Pamela Street and secondary access via Jamestown Lane.

Per City concurrency evaluations, Windhaven First Addition with 286 homes is vested to generate 210 trips during the AM peak hour and 271 trips during the PM peak hour. This would represent the trip generation equivalent of 460 apartment units. This distinction is important because it demonstrates that 46 percent of the current apartment proposal could be developed before surpassing vested/programmed traffic generation levels. A comparison of trip generation equivalencies is provided below.

Vested Residential Land Use & Trip Comparisons							
Residential Land Use	Dwelling Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Family Homes (ITE Code 210)	286	65	145	210	179	92	271
General Apartment Units (ITE Code 220)	460	46	183	229	176	95	271

This TIA is responsible for addressing the net gain in trips over those vested/identified above. The 750 unit apartment proposal represents a net gain in trip generation of 161 trips during the

AM peak hour and 159 trips during the PM peak hour over those vested/associated with single family home development. Summary trip generation gains are shown on the next page.

Project Trip Generation Gains – Proposed Apartments Vrs. Vested Single Family							
Land Use	Dwelling Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Apartments - ITE Code 220	750	74	297	371	280	150	430
Single Family Homes - ITE Code 210	286	65	145	210	179	92	271
<b>Net Gain Site Trips</b>	--	<b>9</b>	<b>152</b>	<b>161</b>	<b>101</b>	<b>58</b>	<b>159</b>

About 21 percent of project trips are anticipated to/from the east on Barnes Road (via the new extension and connection to Strong Road). About 9 percent of project trips are anticipated to/from the north and 70 percent to/from the south on Indian Trail Road. The majority of project trips along Indian Trail Road south will travel to/from the east on Francis Avenue; distributing throughout a study area that addresses the Alberta Street and Maple/Ash Couplet intersections with Francis Avenue.

## TRAFFIC FORECASTS AND CAPACITY

City officials require this study address traffic operations principally for site access intersections and seven off-site intersections most impacted by development within the Indian Trail neighborhood. The analysis was required for the AM and PM peak hours of the typical weekday, as based on the forecast year 2021 completion year of the project. A summary of study intersections include:

- ◆ Shawnee Avenue/Indian Trail Road
- ◆ Barnes Road/Indian Trail Road
- ◆ Strong Road/Indian Trail Road
- ◆ Indian Trail Road/Francis Avenue
- ◆ Alberta Street/Francis Avenue
- ◆ Ash Street/Francis Avenue
- ◆ Maple Street/Francis Avenue
- ◆ Barnes Road/Forest Lane (Project Access)
- ◆ Barnes Road/Pamela Lane (Project Access)

**Existing Conditions.** Traffic counts were performed during typical weekdays in March, with a follow-up count in April (for Shawnee Road/Indian Trail Road intersection) to capture the peak demands of the morning and afternoon commutes. These counts were performed specifically while local schools were in session, as to capture the travel demands of these special traffic generators.

City of *Spokane Administrative Policy and Procedure for Transportation Concurrency Level of Service Standards* defines a LOS E standard for signalized and unsignalized intersections aligned along a principal arterial. An analysis of existing traffic operations indicates there were no levels-of-service (LOS) issues identified within the field, as all intersections were shown to function at LOS E or better between the AM and PM peak hours. Existing intersection LOS conclusions are shown on the next page.

Existing LOS and Delay - AM and PM Peak Hours				
Signalized Intersections	AM Peak		PM Peak	
	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>
Shawnee Ave/Indian Trail Rd	B	17.3	A	7.7
Barnes Rd/Indian Trail Rd	B	18.1	B	14.4
Strong Rd/Indian Trail Rd	A	9.7	B	18.9
Indian Trail Rd/Francis Ave	B	12.3	A	7.9
Alberta St/Francis Ave	D	36.4	C	32.2
Ash St/Francis Ave	C	22.3	C	20.4
Maple St/Francis Ave	B	17.4	D	38.8
1. LOS = Levels-of-Service 2. Del = Delay in seconds				

Secondary lane capacity analyses and speed counts were performed discretionarily to support conclusions for Indian Trail Road. The lane analysis was used to help identify whether adequate capacity exists for through traffic (northbound and southbound movements) outside of study intersections along Indian Trail Road. Lane capacities were reviewed for three count locations within the vicinity of the “bottleneck” on Indian Trail Road: 1) north of Weile Avenue (south of bottleneck); 2) north of Kathleen Avenue (within bottleneck); and 3) north of Lowell Avenue (north of Bottleneck). A summary of the lane capacity analysis is shown below.

Existing Indian Trail Lane Capacity - AM and PM Peak Hours									
Indian Trail Road	Capacity			AM Peak Hour			PM Peak Hour		
	NB	SB	Tot	NB	SB	Tot	NB	SB	Tot
N/of Weile Ave	1,800	1,800	3,600	287	1,114	1,401	1,099	450	1,549
N/of Kathleen Ave	900	900	1,800	283	1,151	1,434	1,085	449	1,534
N/of Lowell Ave	900	900	1,800	246	954	1,200	807	384	1,191

As shown, lane capacity is sufficient within the four lane section of Indian Trail north Road north of Weile Avenue. However, existing counts are shown to exceed directional lane capacities within specifically within the bottleneck area north of Kathleen Avenue. There is minor lane capacity exceptions noted north of Lowell Avenue, but overall capacity appears to be sufficient north of the bottleneck. A comparison/review of this data does suggest need for lane widening as based on existing count data.

Despite the lane capacity results above, travel speeds within the corridor do not seem to be overly compromised. Speed counts were performed at the locations identified/reviewed above, south of, within, and north of the bottleneck area along Indian Trail Road. Average travel speeds were found to be 3 to 6 mph above the posted 30 mph speed limit along the roadway during AM and PM peak hours in both travel directions. The conclusion from this is that, while

additional capacity is needed, the travel time of typical commuters is not yet impacted. A summary of speed data is shown on the next page.

Indian Trail ADT and Speed Counts - AM and PM Peak Hours					
Indian Trail Road	ADT	Average Speed - Northbound		Average Speed - Southbound	
		AM Peak	PM Peak	AM Peak	PM Peak
N/of Weile Ave	17,299	36.5	36.8	36.0	35.7
N/of Kathleen Ave	16,821	37.9	36.8	34.8	37.9
N/of Lowell Ave	13,555	34.3	31.9	33.4	33.2

**Future Conditions.** Future 2021 traffic volumes were developed for operational analyses assuming: 1) baseline (non-development associated) traffic growth, 2) the development of eleven study area pipeline projects (including vested Windhaven First Addition), and 3) the assignment of project trips. A 0.5 percent annual growth rate was applied to counts to reflect baseline (non-development) traffic growth. This growth was combined with the trips generated by pipeline projects to generate future without project traffic forecasts. The trip generation of these developments is shown below.

Vested Residential Land Use & Trip Comparisons by TAZ								
TAZ and Development	Dwelling Units/Homes		AM Peak Hour			PM Peak Hour		
	Single	Multi	In	Out	Total	In	Out	Total
TAZ 29								
- Hunts Point	183	48	48	119	167	142	72	214
- Windhaven First	286	0	65	145	210	179	92	271
- Ponderosa Ridge 3 <sup>rd</sup>	12	0	6	13	19	10	5	15
- Ponderosa Ridge 4 <sup>th</sup>	25	0	8	19	27	20	10	30
<b>Subtotal TAZ 29</b>	<b>506</b>	<b>48</b>	<b>127</b>	<b>296</b>	<b>423</b>	<b>351</b>	<b>179</b>	<b>530</b>
TAZ 30								
- Diamond Rock	0	96	10	41	51	46	25	71
- Replat McCarroll	13	0	6	13	19	11	6	17
- McCarroll's 3 <sup>rd</sup>	10	0	5	12	17	9	5	14
- McCarroll's 4 <sup>th</sup>	15	0	6	14	20	13	7	20
- McCarroll's East	7	28	8	26	34	21	10	31
- Woodridge View	7	0	5	10	15	6	3	9
<b>Subtotal TAZ 30</b>	<b>52</b>	<b>124</b>	<b>40</b>	<b>116</b>	<b>156</b>	<b>106</b>	<b>56</b>	<b>162</b>
TAZ 31								
- Estates at Rocky	15	0	6	14	20	13	7	20
- Westwinds PUD	19	0	7	16	23	16	8	24
<b>Subtotal TAZ 31</b>	<b>34</b>	<b>0</b>	<b>13</b>	<b>30</b>	<b>43</b>	<b>29</b>	<b>15</b>	<b>44</b>
<b>Total Pipeline Trips</b>	<b>592</b>	<b>172</b>	<b>180</b>	<b>442</b>	<b>622</b>	<b>486</b>	<b>250</b>	<b>736</b>



Finally, project trip assignments (shown previously) and future without project traffic volumes were combined to generate future with-project traffic forecasts. The resulting traffic forecasts result in growth rates of between 6 and 7 percent annually on Indian Trail Road, which far exceeds historical growth rates ranging between 1 and 1.5 percent annually. Thus, traffic forecasts are very conservative for year 2021 and may be more representative of long term traffic growth (beyond year 2021).

Future intersection analyses indicated that no LOS issues were noted based upon a review of future year 2021 traffic forecasts. This determination is made because no study intersection is forecast to function below LOS E on the principal arterials of Indian Trail Road or Francis Avenue during the peak hours. LOS at site access intersections are also shown to operate acceptably at LOS C or better during the peak hours. The resulting, forecast LOS, both without and with project development, are shown on the following Table.

Forecast Year 2021 LOS and Delay - AM and PM Peak Hours								
Year 2021 Condition	Future Without Project Traffic				Future With Project Traffic			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Signalized Intersections	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>
Shawnee Ave/Indian Trail Rd	B	17.9	A	8.2	B	17.9	A	8.3
Barnes Rd/Indian Trail Rd	C	26.8	B	20.0	D	43.6	C	23.0
Strong Rd/Indian Trail Rd	C	20.2	D	52.4	D	37.3	E	68.8
Indian Trail Rd/Francis Ave	C	20.3	B	10.1	C	29.6	B	10.7
Alberta St/Francis Ave	E	65.6	D	53.7	E	78.3	E	59.4
Ash St/Francis Ave	C	26.1	C	21.3	C	28.9	C	21.5
Maple St/Francis Ave	B	17.6	D	51.4	B	17.6	D	54.0
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Unsignalized Intersections	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay
Forest Ln/Barnes Rd	B	10.6	B	10.2	B	11.4	B	10.6
Pamela Ln/Barnes Rd	B	31.1	B	12.0	C	19.0	C	14.0
1. LOS = Levels-of-Service 2. Del = Delay in seconds								

City of Spokane traffic engineering staff routinely works to “optimize” traffic signal performance in order to improve intersection and corridor mobility; especially along arterials such as Francis Avenue and Indian Trail. Although this study demonstrates no LOS issues at study intersections, as compared with code, it should be noted that enhanced performances (via improved LOS and/or reduced average vehicle delay) were identified analytically by modifying signal cycle lengths or phase splits in response to the higher travel demands identified with forecast traffic volumes. This confirms City staff should have the ability to maintain traffic operations beyond levels stated in the report as the area continues to grow in the future.

Forecast lane capacity was still shown to be sufficient within the four lane section of Indian Trail north Road north of Weile Avenue. Forecast traffic volumes further demonstrate the need for

lane widening along Indian Trail Road north of Kathleen Avenue (within bottleneck) and north of Lowell Avenue (north of Bottleneck). This determination is confirmed because forecast traffic volumes well exceed single lane capacity in the southbound direction during the AM peak hour and the northbound direction during the PM peak hour. Forecast lane volume comparisons are shown below.

Future With-Project Indian Trail Lane Capacity - AM and PM Peak Hours									
Indian Trail Road	Capacity			AM Peak Hour			PM Peak Hour		
	NB	SB	Tot	NB	SB	Tot	NB	SB	Tot
N/of Weile Ave	1,800	1,800	3,600	376	1,396	1,772	1,351	732	2,083
N/of Kathleen Ave	900	900	1,800	385	1,483	1,868	1,410	781	2,191
N/of Lowell Ave	900	900	1,800	371	1,360	1,731	1,211	790	2,001

**Pedestrian, Bike, and Transit.** Pedestrian, bicycle, and transit access conditions are favorable within the project vicinity. Sidewalk is contiguous between the developments and nearby transit stops, shopping centers, and public facilities (a library and a park). There are commute bicycle routes on Indian Trail Road and Barnes Road; although some form of designated bike lanes for recreational facilities would be ideal in the future (such remediation is beyond the scope of development projects). Finally STA transit access to Indian Trail Road is sufficient on weekdays, with transit stops located within walking distance about ¼- mile east of Windhaven.

### IMPROVEMENT RECOMMENDATION AND MITIGATION

The project is responsible for mitigating traffic impacts via transportation impact fee (TIF) contribution. The fee scheduled for the Northwest Service Area, within which the project is located, is \$483.49 per unit for two-story apartments and \$296.33 for three-story apartments. Thus, the Windhaven development would be conditioned with up to **\$362,620** of traffic impact fees (\$483.49 \* 750 two-story apartments), as collected prior to the issuance of any building permit on a per-unit/home or development phase basis.

A short term improvement was recommended and long term improvement confirmed for Indian Trail Road, in order to promote traffic mobility and safety. These recommendations and project mitigation proposals are as follows:

- 1. Improvement.** Restripe Indian Trail Avenue to include two southbound travel lanes and one northbound travel lane, while maintaining a TWLTL, between Kathleen Avenue and Lowell Avenue. The project could be accommodated with narrow, but still acceptable, travel lanes striped within the 43 to 44 foot paved section that exists along this section of the arterial. This would provide needed and more desirable (by the neighborhood) southbound capacity along Indian Trail Road; helping to maintain mobility and emergency egress until widening could occur.

**Mitigation.** The project proponent has offered to front the costs of restriping Indian Trail Road, either to be managed/constructed privately or as a City project, to provide more immediate congestion relief. The costs for this would be reduced from the total Windhaven TIF potential of \$362,620 owed/conditioned for the project.



- 2. Improvement.** Lane capacity analyses confirm the need for widening Indian Trail Road between Kathleen Avenue and Lowell Avenue. This is a congestion improvement that would enhance mobility and provide for improved emergency ingress and egress.

**Mitigation.** The project proponent has offered to front a substantial portion of the Windhaven total TIF, as opposed to a per unit or phase basis, so City officials would have more immediate opportunities for design, ROW acquisition, and/or “match” funding (for grants) to advance the ultimate widening of Indian Trail Road. This should allow the project to advance more quickly versus what may normally occur within TIF processes.

These concessions would be a function of a development agreement per specifics developed between the City and the project proponent. The conditions would be promoted shortly following Comp. Plan amendment, zone change approvals, and/or construction approvals, as coordinated with the City.

## **PUBLIC PARTICIPATION**

To be added to final TIA following comments collected at May 25 project public meeting.

## **SUMMARY**

The improvements and mitigation described will address project-related deficiencies noted throughout the TIA (specifically for Indian Trail Road). The project will contribute \$362,620 towards mitigation of area deficiencies, via the TIF; specifically working to promote intermediate and long-term improvements for Indian Trail Road, if approved by the City. Thus, this TIA should successfully support the zone change and comprehensive plan modifications being sought with the 750 unit apartment project proposal being sought for Windhaven, as project impacts will be addressed.

No further recommendations are provided by this TIA.

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Technical Appendix D: Pipeline Project Trip Assignments

## 1 INTRODUCTION

Windhaven First Addition is an approved residential planned unit development (PUD) located within the Indian Trail neighborhood of Spokane, Washington. The project is located within a Residential Single Family (RSF) zone of the City with a Comprehensive Plan designation of Residential 4-10. Approved by City officials in the year 2006, the roadway infrastructure for the development has been constructed but no homes have been built.

As a result of evolving market conditions, the project proponent would like to develop apartment units on the site in-lieu of single family homes. A Comprehensive Plan amendment and zone change would be needed to accommodate this development modification. Specifically, Residential Multifamily (RMF) zone and Residential 15-30 Comprehensive Plan designations would be needed (and are being sought) to allow for apartment development.

Through the growth management act (GMA), City officials have planned for and certified transportation concurrency for roads within the Indian Trail neighborhood, as based on historical land use development proposals (Windhaven and other development projects). Zone and Comprehensive Plan changes could impact concurrency determinations. As such, City officials have requested due-diligence, in terms of a development traffic study, to assess the impact of a revised development proposal.

This report summarizes the Traffic Impact Analysis (TIA) performed for the Windhaven Apartments development proposed in the City of Spokane, Washington. The analysis identifies the transportation impacts of the current development proposal on primary arterials and roadways located within and providing access to the Indian Trail neighborhood. The scope and work program for this study was developed in coordination with technical staff from City of Spokane, and was performed in accordance with City of Spokane Road TIA Guidelines.

The City of Spokane is lead agency for this project and will provide principal TIA review. Any additional agencies would provide secondary review per the request of City officials.

### 1.1 PROJECT DESCRIPTION

**Approved Project.** The Windhaven First Addition project site occupies 49.48 acres aligned north of Barnes Road just under 1,000 feet west of Indian Trail Road within the Indian Trail neighborhood of Spokane. The approved project includes the construction of up to 286 single family homes programmed for construction over approximately five years. The project was historically approved for development by City officials in year 2006 within an RSF zone of the City and with a site Comprehensive Plan designation of Residential 4-10. The approved proposal represents a density of 5.8 single family homes per acre.

According to Spokane Municipal Code, the Residential Single-Family zone *“is a low density single-family residential zone. It allows a minimum of four and a maximum of ten dwelling units per acre. One- and two-story builds characterize the allowed housing. The major type of new development will be attached and detached single-family residences.”*

According to the City Comprehensive Plan, the Residential 4-10 *“designation allows single-family residences, and attached (zero-lot line) single-family residences. The allowed density is*



*a minimum of four units and a maximum of ten units per acre. Allowed structure types are single-family residences, attached (zero-lot line) single family residences, or two-family residences in appropriate areas."*

Primary access to the project has already been constructed via Forest Lane and Pamela Lane; two local streets extending into the development from Barnes Road (along southern boundary of site). Secondary access would be promoted through an extension of Jamestown Lane into the adjacent apartment development east of Windhaven. A final access was historically developed for vehicle traffic via an extension of Moore Street to Shawnee Avenue (along northern boundary of site). However, this approach would be used only for pedestrian access in the future.

As shown (right), Windhaven has already been developed with a network of local streets. North-south circulation streets include Concord Lane, Windhaven Lane, and Camden Lane. East-west circulation includes Jamestown Lane, Georgetown Lane, Morgantown Lane, Yorktown Lane, and Youngstown Lane.



Aerial: Existing Windhaven Site (Source: Google Maps)

**Project Proposal.** The project proponent has recently proposed to develop up to 750 apartment units on the 49.48 acre site, as a result of changing market demands. The proposal results in a density of 15.2 homes per acre, which exceeds the approved residential density. Thus, this proposal dictates that a Comprehensive Plan amendment and zone change would be needed to accommodate the apartment proposal; specifically to a RMF zone and Comprehensive Plan designation of Residential 15-30. The current apartment proposal results in a density that just marginally exceeds minimum zoning and Comprehensive Plan allowances, and just under half of maximum allowable density (nearly 1,500 apartments could be developed under these City designations). The reduced apartment densities

According to Spokane Municipal Code, the Residential Multifamily (RMF) zone *"is a medium-density residential zone. Allowed housing is characterized by one to four story structures and a higher percentage of building coverage than in the RTF zone. The major types of development will include attached and detached single-family residential, condominiums, apartments, duplexes, townhouses and row houses. The minimum and maximum densities are fifteen and thirty units per acre."*

The Residential 15-30 land use is simply described within the City Comprehensive Plan as a *"designation that allows higher density residential use at a density of 15 to 30 units per acre."*

Site access and internal circulation would be promoted as described previously. Primary access would be provided via the Barnes Road intersections with Forest Lane and Pamela Street. Secondary access would be provided by an extension of Jamestown Lane into the adjacent apartment complex. Pedestrian access only would be provided via Moose Street. Internal circulation would be promoted by three north-south and five east-west local streets.

Figure 1 provides a vicinity map locating Windhaven. Figure 2 provides the current site plan for the proposed apartment development. Note this plan will evolve with time. As such, this study was intentionally developed to review a high unit count for the site in order to present a worse-case analysis of project transportation impacts.

### 1.1.1 Project Scope

City transportation engineering staff has reviewed capacity conditions for primary roadways aligned within the Indian Trail neighborhood. To be clear, there are long term improvement needs confirmed within the area; in particular, the widening of Indian Trail Road to a four lane section between Lowell Avenue and Excell Avenue. However, city staff has been able to confirm transportation concurrency for Indian Trail roadways within the immediate future. This means they have been able to demonstrate that adequate capacity would generally be available to accommodate some traffic growth. Currently there are 12 development projects vested and approved via the Comprehensive Plan process.

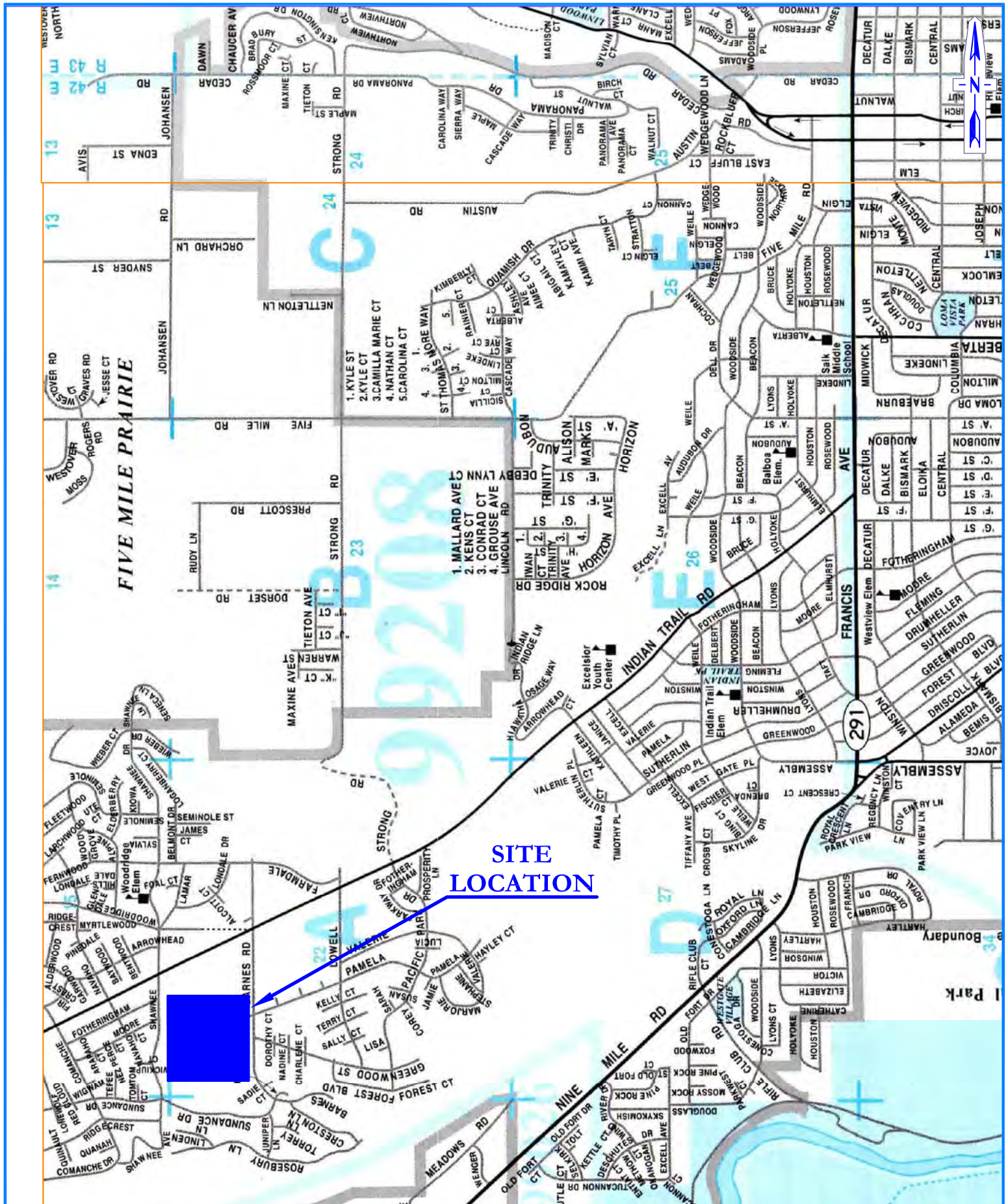
Windhaven First Addition is one of the development projects vested and addressed within the current Comprehensive Plan. As indicated, 286 single family homes were approved historically and, according to City resources, this development would be allowed to generate 210 trips during the AM peak hour and 271 during the PM peak hour of the work commute under the previous Comprehensive Plan and zoning approval.

According to comparisons developed using the *Trip Generation Manual* (ITE 9th Edition, 2012), the trips generated by 286 homes is equivalent to the trips generated by 460 apartment units. Thus, from a transportation perspective, 286 single family homes and 460 apartments are generally equivalent. A summary of this comparison is provided in Table 1.

Table 1. Vested Residential Land Use & Trip Comparisons							
Residential Land Use	Dwelling Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Single Family Homes (ITE Code 210)	286	65	145	210	179	92	271
General Apartment Units (ITE Code 220)	460	46	183	229	176	95	271

Transportation concurrency is reviewed within the City of Spokane based upon PM peak hour traffic conditions. As shown above, the trips generated by 286 homes and 460 apartments are equal during the PM peak hour. There is a minor differential during the AM peak hour. Trip generation was based upon equations that relate trips to dwelling units for single and multi-family homes. Further discussion on trip generation is provided within Section 3.2.





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WINDHAVEN APARTMENTS  
TRAFFIC IMPACT ANALYSIS

SPOKANE

WA

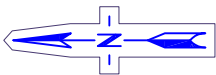
SITE LOCATION

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FIGURE NUMBER

1





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SPOKANE

WINDHAVEN APARTMENTS  
TRAFFIC IMPACT ANALYSIS

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5594.002

FIGURE NUMBER

2

PRELIMINARY SITE PLAN  
(Source: JR Bonnet Engineering)

## 1.2 ANALYSIS SCOPE AND METHODOLOGY

The purpose of this TIA is to review the traffic and transportation impacts of the proposed development on vicinity arterials and recommend improvements and strategies, as needed, to mitigate impacts in order to assure adequate transportation capacities. This section describes the primary scope and methods used to evaluate traffic conditions and determine potential improvements for the project study area.

### 1.2.1 Project Scope

A TIA evaluates roadway capacity primarily through an examination of intersection operations. Congestion and increased vehicle delays are experienced more rapidly at intersections versus road segments (between intersections) due to the number and frequency of conflicts (i.e. turning vehicles and stopping or slowing movements).

The scope for this study was established in coordination with City of Spokane and Washington State Department of Transportation (WSDOT) engineering officials. Per direction, this study quantifies traffic operations and capacity based principally on intersection level-of-service (LOS), as performed by direction for the intersections of:

- ◆ Shawnee Avenue/Indian Trail Road
- ◆ Barnes Road/Indian Trail Road
- ◆ Strong Road/Indian Trail Road
- ◆ Indian Trail Road/Francis Avenue
- ◆ Alberta Street/Francis Avenue
- ◆ Ash Street/Francis Avenue
- ◆ Maple Street/Francis Avenue
- ◆ Barnes Road/Forest Lane (Project Access)
- ◆ Barnes Road/Pamela Lane (Project Access)

Per the direction of local agency staff, the analysis was performed for the AM and PM peak/commute hours of the weekday, which are the highest hours of capacity demand within this area of Spokane. The forecast analysis horizon year for this study is 2021, which is the completion and final occupancy year of the proposed development.

### 1.2.1 Methodology - Intersection Operations

Intersection capacity was evaluated using the level-of-service (LOS) methodologies of the *Highway Capacity Manual* (TRB, 2010). The *Highway Capacity Manual* (HCM) is a nationally recognized and locally accepted method of measuring traffic flow and congestion for intersections. Criteria range from LOS A, indicating free-flow conditions with minimal vehicle delays, to LOS F, indicating congestion with significant vehicle delays (and operational failures).

LOS for a signalized intersection is defined in terms of the average control delay experienced by all vehicles at the intersection, as measured over a specific time period such as a peak hour. LOS for a one or two-way stop controlled intersection or driveway is the function of average control delays experienced by vehicles in a particular approach or approach movement over a timeframe such as a peak hour. Typically, the stopped approach or movement experiencing the worst LOS is reported. Finally, LOS at an all-way stop-controlled intersection is defined by the average control delays experienced by all vehicles at the intersection, as with signals, but the LOS thresholds are associated with delays for unsignalized intersections.

Table 2 outlines the LOS criteria for signalized and unsignalized intersections from the *Highway Capacity Manual*. As shown, LOS thresholds, as a function of delay, vary between signalized

and unsignalized intersections. This is because driver tolerances for delay have been documented to be much higher at signalized versus unsignalized intersections.

Table 2. Intersection Level of Service Criteria		
Level of Service	Signalized: Control Delay (sec/veh)	Unsignalized: Control Delay (sec/veh)
A	≤10	≤10
B	>10 – 20	>10 - 15
C	>20 – 35	>15 - 25
D	>35 – 55	>25 - 35
E	>55 – 80	>35 - 50
F	> 80	>50
Source: <i>Highway Capacity Manual</i> (TRB, 2010)		

LOS was determined for this study using Synchro Version 9.1, (Trafficware, 2015). This software tool can apply the analysis methodologies of HCM 2010 and is a standard industry software application.

LOS thresholds for the City of Spokane are highlighted by “Transportation Concurrency Level of Service Standards”, which is an administrative policy and procedure document available from the City clerk’s office. Section 5.2.1.3 indicates LOS E is the threshold for “signalized arterial intersections along Principal or Minor arterials identified on Comprehensive Plan Map TR3.” This standard applies to all signalized study intersections, as they are located along the principal arterials of Francis Avenue and Indian Trail Road. Section 5.2.2 indicates LOS E is the operational threshold for movements at unsignalized intersections. Road improvements and/or transportation demand strategies may be required to help mitigate capacity issues, as determined via results that fall below City LOS thresholds.

## 1.2.2 Methodology – Vehicle Queues

Average and 95<sup>th</sup> percentile queue analyses were performed to provide guidance regarding turn pocket impacts for signalized intersections. Average queues are those most typically predicted to occur at an intersection with some frequency. 95<sup>th</sup> percentile queues represent near-maximum queue conditions predicted to occur only a few times during the peak hour. While it is not ideal to have 95<sup>th</sup> percentile queue potentials exceed turn lane/pocket storage length, it is acceptable so long as average queues can be accommodated. A turn lane/pocket issue is prevalent when average queues exceed storage length. Thus some form of improvement may need to be considered; typically in the form of signal phase adjustment, turn lane/pocket adjustment, and sometimes even the provision of a second turn lane.

Queues are presented in terms of total “stacking” vehicles with the equivalent queue length provided in feet. For this study, an average length of 25-feet was used per vehicle, as recommended by the HCM, and via standard industry practices. This space includes the length of the vehicle plus spacing between vehicles. Queue determinations were provided using Synchro, which also bases evaluations on HCM methodologies.



### 1.2.3 Methodology – Lane Capacity

A lane capacity analysis was developed as a secondary measure and method for evaluating traffic conditions specifically for Indian Trail Road. This analysis was performed due to the “bottleneck” that exists along the roadway; caused by a narrowing of the arterial from four lanes south of Excell Avenue to three lanes north.

The lane capacity analysis was performed based upon peak hourly volume data provided by the Year 2011-2035 Spokane Metropolitan Transportation Plan (SRTC, 2011). Generally, the Plan provides vehicle per hour per lane (vphpl) capacity thresholds distinguished by functional classification and operating speed. According to this table, the best approximation of Indian Trail Road is that of a 30 mph urban arterial collector arterial; both with a practical capacity of 900 vphpl. Therefore, this was used as the basis for reviewing lane capacities for the roadway.

**Table 2.2 SRTC Regional Demand Model Street Typology**

Street Type	Type Number	Capacity (vphpl)	Operating Speed
Rural Freeway	1	2000	70
Rural Local Street	9	500	25
I-90, SR 195 to Freya-NSC	10	1800	60
Urban Interstate	11	2000	60
Urban Expressway	12	2000	60
Urban Arterial	14	1100	40
Urban Arterial – CBD	15	900	30
Collector Arterial	17	900	35
Urban Arterial-CBD–One-way	18	800	30
Local Street	23	500	25
Neighborhood Collector	20	600	30
Ramps	50	1600	40
Rural Highways	52	1800	60
Urban Arterial Ramp	53	1000	50
I-90 Viaduct Ramp, SR 195-Freya	54	1200	40
Local Road	60	1000	25
Exclusive Light-rail Transit Link	66	1000	35
Fairchild AFB	99	500	25

Hourly Lane Capacity Thresholds (Source: SRTC)

Note these are capacity thresholds typically associated and used with the development of a forecast travel demand model and are not typically used as a primary means for evaluating capacities on city roadways. However, this secondary means was sought specifically as a method for reviewing “through” traffic capacity on Indian Trail Road, as primary analysis measures focus on intersection operations.

Thus, the conclusions of this TIA were primarily derived from intersection analyses and the methodologies of the HCM. Secondary conclusions were derived from lane capacity analyses, and other considerations such as travel speed and queuing.

## 2 EXISTING CONDITIONS

This section describes existing traffic conditions within the project study area. Described are study roadways, current traffic volumes, and existing operations and capacity conditions.

### 2.1 ROADWAY NETWORK

The study focuses on traffic operations for a number of intersections located along the roadways of Indian Trail Road, Barnes Road, Strong Road, Francis Avenue, Alberta Street, Ash Street, and Maple Street. A description of study roadways is provided as follows, in order of descending functional classification:

- ◆ **Francis Avenue.** Also designated State Route 291, Francis Avenue is an *urban principal arterial*. The roadway has a five lane cross section, which includes a two-way left-turn lane (TWLTL), with contiguous sidewalk, curb, and gutter along both sides of the roadway. The posted speed limit is 35 mph within the study area. The current City traffic flow map indicates the arterial supports between 26,000 and 29,000 average daily traffic (ADT) within the study area east of Indian Trail Road, dropping to 11,900 ADT west.
- ◆ **Indian Trail Road.** This *urban principal arterial* has a speed limit of 35 mph within the City of Spokane. City traffic flow map indicates the roadway supports about 17,100 ADT north of Francis Avenue, dropping to 11,000 ADT north of Strong Road. Curb, sidewalk, and gutter are contiguous on both sides of the roadway throughout the project study area. Precluding intersection configurations, general lane geometrics are as follows:
  - Four travel lanes immediately north of Francis Avenue to about Elmhurst Avenue (approximate 500 foot section).
  - Five lanes (including a TWLTL) adjacent to Indian Trail Center between Elmhurst Avenue and Holyoke Avenue (nearly a 900 foot section).
  - Four lanes from Holyoke Avenue north to about Excell Avenue (about a 3,600 foot section).
  - Three lanes (including a TWLTL) north of Excell Avenue to Lowell Avenue (about a 5,100 foot section). A traffic “bottleneck” has been noted to occur in the four to three lane transition area within the vicinity of Excell Avenue.
  - Four lanes with two southbound, one northbound, and one TWLTL between Lowell Avenue and Barnes Road (nearly a 1,500 foot section) adjacent to Sundance Plaza.
  - Three lanes (including a TWLTL) north of Excell Avenue to nearly City limits (section length is greater than a mile).
- ◆ **Maple Street & Ash Street Couplet.** These are urban principal arterials throughout the majority of the City. Maple Street is a two-lane northbound arterial and Ash Street a two lane southbound arterial; both with posted speeds of 30 mph within the vicinity of Francis Avenue. Sidewalk, curb, and gutter are contiguous along both sides of both roadways within the project study area. City traffic flow maps indicate about 25,000 ADT south and nearly 28,000 ADT north of Francis Avenue on the couplet.
- ◆ **Alberta Street.** This is an *urban minor arterial* with a three-lane cross-section, including a TWLTL, and a posted speed limit of 30 mph south of Francis Avenue. North of Francis Avenue, this *local street* with a two-lane cross-section and posted speed limit of 25 mph. Curb, gutter, and sidewalk are contiguous along the arterial. Traffic flow maps indicate the roadway supports 10,600 ADT south of Francis Avenue with no counts to the north.



- ◆ **Barnes Road.** This is an *urban major collector* for approximately ½ mile on either side of Indian Trail Road. The collector primarily has a two-lane cross-section east of Indian Trail Road. The roadway has a five-lane cross section for about 1,300 feet west of Francis Avenue, adjacent to Sundance Plaza; continuing an approximate 2,000 additional feet as a three lane roadway (including a TWLTL). The speed limit is 25 mph within the study area. Curb, gutter, and sidewalk are contiguous along the majority of the roadway. City traffic flow maps indicate the roadway supports about 2,000 ADT on either side of Indian Trail Road.
- ◆ **Shawnee Avenue.** This is currently classified as an *urban major collector* within the City. The roadway has a two-lane cross section, improved with sidewalks, curb, and gutter. The posted speed limit is 25 mph with a 20 mph school zone west of Indian Trail Road. The roadway supports about 2,300 ADT.
- ◆ **Strong Road.** This is currently classified as an *urban major collector* within the City. The roadway has a two-lane cross section, improved with sidewalks, curb, and gutter west of Indian Trail Road. A 40-foot wide, unimproved section (a gravel roadway) is aligned east of Indian Trail Road. The posted speed limit is 25 mph. The roadway is estimated to support less than 2,000 vehicles per day within the study area.

A summary of existing intersection turn lane locations and traffic control conditions (signal, one-way, two-way, or all way stops) is provided in Table 3. Shown are different traffic movements at intersections and whether a turn-lane is provided. If no specific lane is shown, then turns are performed from adjacent, shared through-lane. Also indicated are traffic control conditions for the intersection. Controls and lanes are denoted with an “X”. Turn lanes are denoted with a “1” for a single-lane, “2” for a double-lane, etc.

Table 3. Existing Intersection Geometrics and Traffic Controls												
Intersection	Traffic Control				Intersection Geometrics							
	Traffic Signal	One-Way Stop	Two-Way Stop	All-Way Stop	NB Left Turn Lane	NB Right Turn Lane	SB Left Turn Lane	SB Right Turn Lane	WB Left Turn Lane	WB Right Turn Lane	EB Left Turn Lane	EB Right Turn Lane
Shawnee Ave/Indian Trail Rd	X	-	-	-	1	1	1	1	1	-	1	-
Barnes Rd/Indian Trail Rd	X	-	-	-	1	1	1	1 <sup>3</sup>	1	-	1	-
Strong Rd/Indian Trail Rd	X	-	-	-	1	1	1	1	-	-	1	-
Indian Trail Rd/Francis Ave	X	-	-	-	-	-	2 <sup>1</sup>	-	-	1	1	-
Alberta St/Francis Ave	X	-	-	-	-2 <sup>1</sup>	-	1	-	1	-	1	-
Ash St/Francis Ave	X	-	-	-	-	-	1	1	1	-	-	-
Maple St/Francis Ave	X	-	-	-	2 <sup>2</sup>	-	-	-	-	-	1	-
Barnes Rd/Forest Ln	-	X	-	-	-	-	-	-	-	-	1	-
Barnes Rd/Pamela Ln	-	-	X	-	-	-	-	-	1	-	1	-
<ol style="list-style-type: none"> <li>1. Double left-turn lane with right-turns shared from outer left-turn lane.</li> <li>2. Double left-turn lane with through movements shared from inner left-turn lane.</li> <li>3. Widened pocket that continues as a through lane south of intersection.</li> </ol>												

## 2.2 TRAFFIC COUNTS

Traffic counts were collected specifically for this study on typical weekdays in March and April of 2016 (Tuesday through Thursday). Traffic counts were performed in the morning between 7:00 and 9:00 AM and in the afternoon/evening between 4:00 PM to 6:00 PM in order to identify the AM and PM peak hours of commute traffic activity for each intersection.

The peak volume for each intersection was used in traffic analyses, respectively, in order to assure a worst-case review of capacity demands. As such, the peak hour did vary between intersections during the morning and afternoon timeframes. With that said, a prevalent 7:00 to 8:00 AM peak hour was noted on Indian Trail Road in the morning. A 5:00 to 6:00 PM peak was noted at nearly all study intersections during the evening. Original count worksheets are provided in Section B of the technical Appendix.

Typically, raw counts are used directly in LOS analysis. However, in some situations, a reconciliation of arrival versus departure volumes must be performed to fully consider travel demands at intersection. A departure volume is noted as vehicle traffic crosses the stop-bar and enters an intersection; typically recorded and used in analyses as specific through and turn movements are identified. However, in some instances arrival volumes must also be recorded as vehicle traffic does not always make it through the stop-bar during a typical signal cycle. Residual traffic must therefore wait in queues until the next green phase (or more) allows them to clear the intersection. The difference in arrival less departure traffic represents additional travel demands upon through and turning movements at an intersection. Thus, this differential is recorded and then combined with base/raw traffic counts in order to fully review travel demands upon an intersection.

Upon scope coordination with City and State agencies, it was determined there were particular approaches of concern where vehicle traffic did not clear the stop-bar and had to wait through an additional signal cycle on Francis Avenue and Indian Trail Road. The movements and timeframes of concern are as follows:

- ◆ Eastbound Alberta Street/Francis Avenue - AM Peak Hour
- ◆ Eastbound Ash Street/Francis Avenue - AM Peak Hour
- ◆ Southbound Indian Trail Road/Francis Avenue - AM Peak Hour
- ◆ Northbound Maple Street/Francis Avenue - PM Peak Hour
- ◆ Westbound Maple Street/Francis Avenue - PM Peak Hour
- ◆ Westbound Indian Trail Road/Francis Avenue - PM Peak Hour

Follow-up counts were performed in March 2016 for the traffic movements specified, for the respective AM and PM peak hours noted through weekday counts. Data collected included arrival volumes, departing traffic (crossing the stop-line), and then the remaining vehicles that queue following the end of the green signal phase. Counts were performed for every signal cycle, with residual queues/vehicle identified following many signal cycles. These residual vehicles were summarized for each approach noted above and combined, as needed, with raw counts to assure maximum travel demands would be assessed with this TIA.

A summary of this comparison is provided in Table 4 for the AM and PM peak hours. The original count worksheets are provided in Technical Appendix B. The original count worksheets show arrival, departure, and queue volumes on a per cycle basis.

**Table 4. Arrival, Departure, and Queue Volume Comparisons**

Location & Approach	Timeframe	Original Count	Additional Arrival Count	Additional Departure Count	Queue Volume
Eastbound Alberta St/Francis Ave	AM Peak	1,175	1,228	193	1,413 ✓
Eastbound Ash St/Francis Ave <sup>1</sup>	AM Peak	1,053	1,029	61	1,090 ✓
Southbound Indian Trail Rd/Francis Ave	AM Peak	1,113	1,129	20	1,149 ✓
Northbound Maple St/Francis Ave	PM Peak	1,374	1,406	31	1,437 ✓
Westbound Maple St/Francis Ave	PM Peak	1,362	1,362	28	1,390 ✓
Westbound Indian Trail Rd/Francis Ave	PM Peak	1,636 ✓	997	7	1,004
1. Through volume only impacted.					

As shown, the majority of follow up counts exceed original counts when factoring in the residential queues (i.e. the balance remaining between arrival and departure counts). The only exception occurs within the westbound approach to the Indian Trail Road/Francis Avenue intersections. As such, the higher of count volumes were used in the analysis, as denoted with a check (✓). The resulting traffic gains for these approaches were proportioned to each movement based on turning volume count data. [Figure 3](#) and [Figure 4](#) provide a summary of the resulting AM and PM peak hour counts for study intersections.

**Speed Counts.** Speed counts were performed at three locations to further review the impact of the “bottleneck”. Counters were placed on Indian Trail Road: 1) north of Weile Avenue (south of bottleneck); 2) north of Kathleen Avenue (within bottleneck); and 3) north of Lowell Avenue (north of Bottleneck). Average speeds and corresponding ADT are summarized in [Table 5](#).

**Table 5. Indian Trail ADT and Speed Counts - AM and PM Peak Hours**

Indian Trail Road	ADT	Average Speed - Northbound		Average Speed - Southbound	
		AM Peak	PM Peak	AM Peak	PM Peak
N/of Weile Ave	17,299	36.5	36.8	36.0	35.7
N/of Kathleen Ave	16,821	37.9	36.8	34.8	37.9
N/of Lowell Ave	13,555	34.3	31.9	33.4	33.2

As shown, ADT counts range between 17,300 ADT south to 13,555 north of the bottleneck. The posted speed limit is 30 mph. Counts indicate average speeds exceed the posted limit by 3 to nearly 8 mph throughout analysis limits in both directions. There is a minimal difference in average speeds between the four lane section south of the bottleneck and the three lane section within the bottleneck.

**School Traffic.** This statement has been provided to simply acknowledge that all traffic counts were performed while local schools were in operation within the study area. Area schools can generate traffic that results in higher demand on City roadways. Thus, counts were performed to assure the activities of schools such as Indian Trail Elementary, Woodridge Elementary, Westview Elementary, Balboa Elementary, and Salk Middle School are addressed.







## 2.3 TRAFFIC OPERATIONS & CAPACITY

The LOS and capacity analyses were performed based on a review of the adjusted traffic volumes summarized in Section 2.2 and the geometric conditions described in Section 2.1. Signal timing data was provided by City of Spokane staff via Synchro files and timing cards.

This data includes information such as phase minimum and maximum splits, all-red and yellow times, pedestrian timing data, additional vehicle passage and gaps, etc.; generally the working parameters of an actuated traffic signal. No optimization or adjustment was made to these files as to maintain precise City timings noted in the field, including coordination details for the Ash and Maple Street intersections with Francis Avenue.

Table 6 provides a summary of LOS for the AM and PM peak hours. Also shown are average control vehicle delays for each intersection. Note there are no project turning movements that currently occur at the Forest Lane and Pamela Lane intersections with Barnes Road. As such, these intersections were not included in the analysis.

Table 6. Existing LOS and Delay - AM and PM Peak Hours				
Signalized Intersections	AM Peak		PM Peak	
	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>
Shawnee Ave/Indian Trail Rd	B	17.3	A	7.7
Barnes Rd/Indian Trail Rd	B	18.1	B	14.4
Strong Rd/Indian Trail Rd	A	9.7	B	18.9
Indian Trail Rd/Francis Ave	B	12.3	A	7.9
Alberta St/Francis Ave	D	36.4	C	32.2
Ash St/Francis Ave	C	22.3	C	20.4
Maple St/Francis Ave	B	17.4	D	38.8
1. LOS = Levels-of-Service 2. Del = Delay in seconds				

As shown, all study intersections currently function within acceptable LOS ranges, as no signalized intersection functions below LOS E. This indicates that no capacity improvements would be warranted on the basis of existing traffic operations, as there is sufficient roadway capacity. LOS summary worksheets are provided in Section C of the Technical Appendix.

**Queue Potentials.** Existing queue potentials were reviewed for study intersections. As indicated, both average and 95<sup>th</sup> percentile queues are considered. Most acceptable conditions are those where average and 95<sup>th</sup> percentile queues do not exceed lane/pocket storage. Tolerable conditions are those where average queues do not exceed lane storage/pocket length, even when 95<sup>th</sup> percentile queues do exceed storage. Unacceptable conditions are noted where both average and 95<sup>th</sup> percentile queues exceed available lane/pocket storage.

Summary queue conditions are provided in Table 7 for the AM and PM peak hours. Again, queues are represented in terms of vehicle demands versus vehicle storage. A sense of length



impacts is determined roughly by multiplying vehicles times a transportation industry spacing standard of 25 feet.

Table 7. Existing Queue Potentials - AM and PM Peak Hours					
Signalized Intersections	Lane Capacity	AM Peak		PM Peak	
		Avg.	95%	Avg.	95%
Shawnee Ave/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	7 vehicles <sup>1</sup> 3 vehicles 3 vehicles <sup>1</sup> 3 vehicles 3 vehicles 3 vehicles	1 vehicle 0 vehicle 1 vehicle 0 vehicle 5 vehicle 1 vehicle	1 vehicles 1 vehicle 1 vehicle 0 vehicle 6 vehicles 1 vehicles	1 vehicle 1 vehicle 1 vehicle 1 vehicle 1 vehicle 0 vehicle	1 vehicle 1 vehicle 1 vehicle 1 vehicle 2 vehicles 1 vehicles
Barnes Rd/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	8 vehicles <sup>1</sup> 5 vehicles 7 vehicles <sup>1</sup> 6 vehicles 4 vehicles	1 vehicle 0 vehicle 1 vehicle 3 vehicles 1 vehicle	2 vehicles 1 vehicle 1 vehicle 6 vehicles 2 vehicles	2 vehicles 1 vehicle 1 vehicle 1 vehicle 1 vehicle	5 vehicles 5 vehicles 1 vehicle 3 vehicles 3 vehicles
Strong Rd/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Eastbound Right-Turn Lane	7 vehicles <sup>1</sup> 4 vehicles 7 vehicles <sup>1</sup> 4 vehicles 8 vehicles	1 vehicle 0 vehicle 1 vehicle 1 vehicle 1 vehicle	1 vehicle 0 vehicle 1 vehicle 1 vehicle 2 vehicles	1 vehicle 0 vehicle 1 vehicle 0 vehicle 0 vehicle	2 vehicles 0 vehicle 1 vehicle 1 vehicle 1 vehicle
Indian Trail Rd/Francis Ave – Westbound Right-Turn Lane – Eastbound Left-Turn Lane	16 vehicles <sup>2</sup> 2 vehicles	0 vehicle 1 vehicle	2 vehicles 2 vehicles	1 vehicle 1 vehicle	7 vehicles 3 vehicles
Alberta St/Francis Ave – Northbound Left-Turn Lane – Southbound Left-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	9 vehicles <sup>1</sup> 4 vehicles 8 vehicles <sup>1</sup> 8 vehicles <sup>1</sup>	4 vehicles 2 vehicles 3 vehicles 1 vehicle	7 vehicles 4 vehicles 8 vehicles 1 vehicle	8 vehicles 1 vehicle 2 vehicles 1 vehicle	17 vehicles 3 vehicles 5 vehicles 2 vehicles
Ash St/Francis Ave – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Westbound Left-Turn Lane	21 vehicles 21 vehicles 20 vehicles <sup>1,3</sup>	6 vehicles 4 vehicle 2 vehicles	9 vehicles 7 vehicles 6 vehicles	5 vehicles 7 vehicles 6 vehicles	8 vehicles 12 vehicles 7 vehicles
Maple St/Francis Ave – Northbound Left-Turn Lane – Eastbound Left-Turn Lane	13 vehicles 20 vehicles <sup>1,3</sup>	1 vehicle 6 vehicles	1 vehicle 8 vehicles	9 vehicle 9 vehicles	16 vehicle 16 vehicles
<sup>1.</sup> Transitions into a TWL/TL, so additional storage can be available. <sup>2.</sup> Free movement which turns into a designated receiving lane, so queues not as critical. <sup>3.</sup> The designated left-turn lane is broken by an intersection so queue pocket is a two-length measurement.					

As shown, the majority of average queues are accommodated within available turn lane/pocket lengths, which represent acceptable or tolerable conditions. The only exception occurs within the westbound left-turn lane for the Shawnee Road/Indian Trail intersection. Both analytically and through visual inspection in the field, queues extend beyond the available turn pocket for about 10 to 15 minutes of the peak hour(s) as a result of activities associated with Woodridge

Elementary school. Outside these short timeframes, queue activity is minimal; thus, there would be minimal cost-benefit to extending the lane for a 20 to 30 minute queue impact per day.

95<sup>th</sup> percentile exceptions are noted at the following locations:

- ◆ Shawnee Avenue/Indian Trail Road – Westbound left turn 95<sup>th</sup> percentile queues exceed storage by 3 vehicles during the AM peak hour.
- ◆ Indian Trail Road/Francis Avenue – Eastbound left-turn 95<sup>th</sup> percentile demands exceed storage by one vehicle during the PM peak hour.
- ◆ Alberta Street/Francis Avenue – Northbound left-turn 95<sup>th</sup> percentile queues exceed storage by 8 vehicles; although there is a shared left-turn lane at this intersection also. As such, this impact may be somewhat overstated during the PM peak hour.

**Indian Trail Lane Capacity.** Lane capacities were reviewed for three count locations on Indian Trail Road: 1) north of Weile Avenue (south of bottleneck); 2) north of Kathleen Avenue (within bottleneck); and 3) north of Lowell Avenue (north of Bottleneck). As indicated, a practical lane capacity is 900 vphpl as based on information provided by the SRTC. A summary of existing approach counts versus capacity is provided in Table 8 for the AM and PM peak hours.

Note the lane capacity analysis is based on a review of through-lane capacity only (northbound and southbound travel lanes). A TWLTL helps traffic operationally as it accommodates neighborhood turning traffic, but it has minimal influence on the movement of through traffic.

Table 8. Existing Indian Trail Lane Capacity - AM and PM Peak Hours									
Indian Trail Road	Capacity			AM Peak Hour			PM Peak Hour		
	NB	SB	Tot	NB	SB	Tot	NB	SB	Tot
N/of Weile Ave	1,800	1,800	3,600	287	1,114	1,401	1,099	450	1,549
N/of Kathleen Ave	900	900	1,800	283	1,151	1,434	1,085	449	1,534
N/of Lowell Ave	900	900	1,800	246	954	1,200	807	384	1,191

As shown, lane capacity is sufficient within the four lane section of Indian Trail north Road north of Weile Avenue. However, existing counts are shown to exceed directional lane capacities within the bottleneck area north of Kathleen Avenue. Specifically, counts exceed southbound lane capacities during the AM peak hour and northbound capacities during the PM peak hour, by approximately 200 to 250 vehicles. There is minor lane capacity exceptions noted north of Lowell Avenue, but overall capacity appears to be sufficient north of the bottleneck.

This review was based on data collected from machine counters. There is some difference between approach volumes from these counts versus turn movement counts because: 1) machine and tube counts were performed on different days and 2) differences in count location.

## 2.4 TRANSIT

Spokane Transit Authority (STA) operates one accessible route within reasonable vicinity of Windhaven. STA Route 23 “Maple/Ash” accesses the Indian Trail neighborhood on weekdays

only, with no service provided on weekends. The weekday route operates on a 30 minute rotation, operating along Indian Trail Road between 7:00 AM and 6:30 PM. The route circulates between the downtown Plaza and Meadow Park Glen (a bus turnaround north of Blackfoot Avenue) principally via Monroe Street, Broadway Avenue, the Maple/Ash Couplet, Rowan Street, Alberta Street, Francis Avenue, and Indian Trail Road.

The nearest transit stops to Windhaven are located at the Barnes Road/Indian Trail Road intersection. Located approximately  $\frac{1}{4}$  mile to the east, these stops are within reasonable walking distance for typical transit users.

## **2.5 PEDESTRIAN AND BICYCLE FACILITIES**

Pedestrian access/mobility and circulation is generally well-served within the project study area. This supposition is based on the consideration of sidewalk being available on most arterial roadways leading to/from the development. Specifically, sidewalk is available between the development and destinations such as STA transit access, the nearby Sundance Plaza shopping center (Albertsons, Rite Aid, Starbucks, Subway, and other shops and restaurants), Pacific Park (on Lowell Avenue), and the Indian Trail Spokane public library.

According to the Spokane Regional Transportation Council website, Indian Trail Road and Barnes Road are two designated bike routes within the project vicinity. Both roadways are designated as “Shared Roadway” routes, defined as a select roadway allowing both vehicular traffic and bicycle traffic to share the street. There is no signage, striping, or designated bike lanes along these types of bicycle routes.

### 3 FUTURE 2021 TRAFFIC CONDITIONS

This section summarizes year 2021 future traffic conditions. Described are future roadway network changes, future traffic volumes, and forecast traffic operations and capacity.

#### 3.1 ROADWAY NETWORK

**Project One.** An improvement project is programmed and fully funded for the study area. *The City of Spokane Six Year Capital Improvement Program* (City of Spokane, 2016) highlights the Barnes Road, Phoebe to Strong “Safety” project programmed for construction in year 2017. The project includes the construction of a two lane roadway with offset sidewalks constructed about 2,200 feet between Phoebe Drive (west) and Strong Road (east).

The project will improve access to the Five Mile neighborhood (east of the Indian Trail neighborhood) and north of Spokane, as opposed to continued and lengthier travel via Francis Avenue, the Maple/Ash couplet, and/or other arterials. The project is anticipated to divert 80 percent of existing traffic turning to/from the east at the Strong Road/Indian Trail Intersection to the new connection via Barnes Road. In addition, future development trips are anticipated to use the new roadway, as described in the next section.

Given this is programmed and fully funded prior to the year 2021 analysis/horizon year of this study, the capacity benefit from this improvement project was included in forecast analyses.

**Project Two.** The North Indian Trail Road Widening project has been incorporated into the City of Spokane Transportation Impact Fee program. The project includes the widening of Indian Trail Road with two through lanes constructed between Barnes Road (north) and Excell Avenue (south), maintaining the TWLTL; including any signal upgrades.



Barnes Rd Improvement Alignment (Source: City)

The timeline for this project cannot yet be determined. City officials are aware of the need and citizens of the Indian Trail neighborhood support the project. However, the City currently lacks the funding needed to construct this \$3,000,000 project. As such, this project is not yet programmed in the *Six Year Capital Improvement Program*. Given these conditions, the improvement was NOT reflected in future year 2021 analyses.

**Pavement Preservation.** There are a number of pavement preservation projects programmed by the City throughout the Indian Trail neighborhood. These will improve street conditions but



do not impact circulation or capacity. They are mentioned only as they are listed in the *Capital Improvement Program*.

There are no other agency or development improvements planned or programmed within the five-year analysis timeframe of this project. Other than the trips diverted as a result of the Barnes Road extension, no other improvements or changes to forecast conditions were considered.

## 3.2 TRAFFIC FORECASTS

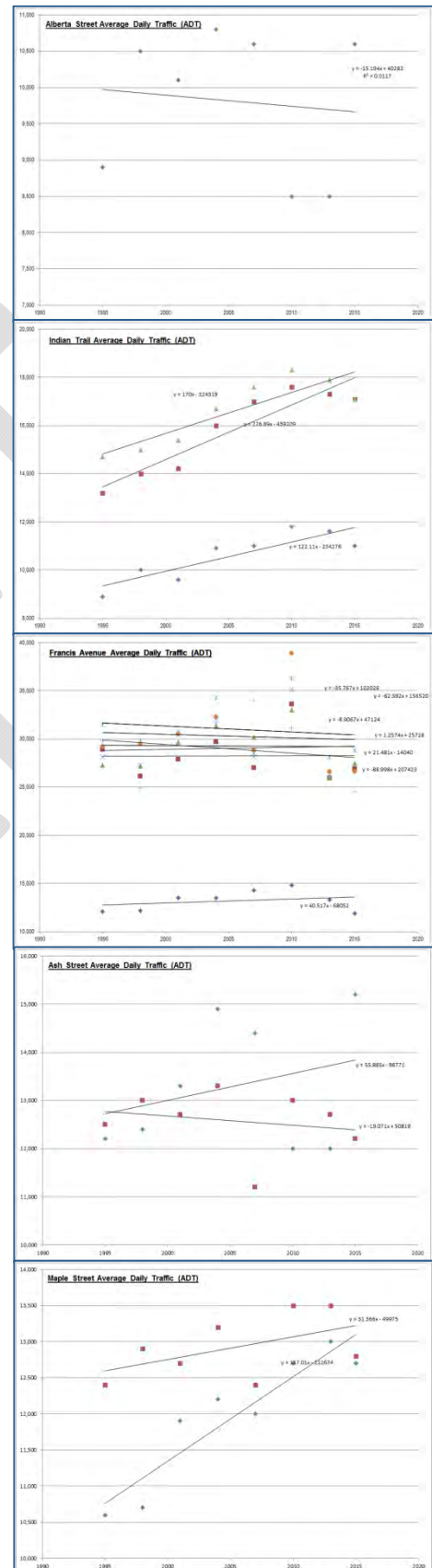
Year 2021 traffic forecasts were comprised of baseline growth, the trips generated by other vested, but yet to be constructed developments projects, and the trips generated by the proposed development. Baseline traffic growth refers to the increase of through traffic not typically associated with development of projects within the project study area. Baseline growth is projected with the use of traffic growth rates. To establish the growth rate for this study, historical traffic counts were reviewed for study arterials.

Traffic growth was compared based on historical year 1995 to 2015 ADT counts, as available for Indian Trail Road, Francis Avenue, Alberta Street, Ash Street, and Maple Street (multiple locations). Counts indicate minimal and even negative growth on the majority of City roadways; however, positive growth was noted specifically for Indian Trail Road, ranging between 1.0 and 1.5 percent annually. The statistical average growth rate of all count points reviewed was 0.3 percent annually.

Based on this analysis, a 0.5% annual growth rate was applied to counts to forecast baseline 2021 traffic forecasts. This rate is conservative (high) for the majority of the study area. The baseline growth rate was seemingly moderate for Indian Trail Road. However, it must be understood the 1.0 to 1.5 percent annual growth rate almost directly reflects development growth within the Indian Trail neighborhood throughout the last 20 years. The impact of development growth is discussed in the following sections. Once the trips generated by these developments and Windhaven are reflected in forecasts, the annual growth rate for the roadway well exceeds historical growth for Indian Trail Road. Thus, all traffic forecasts are ultimately conservative (high-end) for this TIA.

### 3.2.1 Pipeline Projects

Per coordination with agencies, the trips generated by eleven vested land use projects, known as pipeline projects, were addressed within this study. These projects have been approved by the City of Spokane, but are in the process of being developed. As such, the trips generated by these



projects are not yet recorded in counts and need to be addressed in forecasts as they have rights to future capacity. A summary of pipeline projects are as follows:

1. **Hunts Point.** 183 single family and 48 multifamily homes aligned on 52.56 acres south of Pacific Park Drive and west of Indian Trail Road. No homes have been developed (as of yet) on the site.
2. **Windhaven First Addition.** 289 single family homes aligned on 49.48 acres north of Barnes Road and west of Indian Trail Road. No homes have been developed (as of yet) on the site.
3. **Ponderosa Ridge 3<sup>rd</sup> Addition.** 12 single family homes yet to be developed out of 43 approved on 9.94 acres aligned north of Barnes Road and west of Sundance Drive.
4. **Ponderosa Ridge 4<sup>th</sup> Addition.** 25 single family homes aligned on 18.95 acres west and east of Rosebury Lane. No homes have been developed (as of yet) on the site.
5. **Diamond Rock.** 96 apartment units developed on 4.32 acres aligned within the southeast quadrant of the Barnes Road/Indian Trail Road intersection.
6. **Replat McCarroll's Addition Phase 2.** 13 single family homes aligned on 2.69 acres north of Barnes Road and east of Woodridge Drive. No homes have been developed.
7. **McCarroll's East 3<sup>rd</sup> Addition.** 10 single family homes yet to be developed out of 44 approved on 19.18 acres aligned north of Barnes Road and east of Seminole Street.
8. **McCarroll's East 4<sup>th</sup> Addition.** 15 single family homes aligned on 8.85 acres south of Barnes Road and east of James Street. No homes have been developed (as of yet).
9. **McCarroll's East.** 133 single family and 28 multifamily homes aligned on 118.2 acres south of Barnes Road.
10. **Woodridge View 1<sup>st</sup> Addition.** 7 single family homes yet to be developed out of 40 approved on 24.72 acres aligned north of Seminole Drive and east of Fleetwood Court.
11. **Estates at Rocky Ridge.** 15 single family homes yet to be developed out of 42 approved on 13.17 acres aligned south of Lincoln Road and east of Hiawatha Drive.
12. **Westwinds PUD.** 19 single family homes yet to be developed out of 36 approved on 19.96 acres aligned south of Strong Road and west of Upper Mayes Lane.

The assignment of pipeline project trips was developed based upon trip generation and trip distribution information provided by City traffic engineers. In summary, City staff performed trip generation calculations based upon information provided within the ITE *Trip Generation Manual*, as based upon a comparison of rate and equation data that correlate site trips to dwelling units for single and multi-family land uses. And then, using the regional travel demand model, the City identified the likely distribution patterns of trips throughout the project study area.

The City congregated trip generation and distribution information into three transportation analysis zones (TAZ's). A TAZ a transportation analysis and modeling term which refers to a geographical area that experiences similarities in travel characteristics (i.e. approaching and departing access/traffic trends); as bordered by arterials, agency limits, or topographical features (cliffs, rivers/streams, etc.). They simply allow for the organization of transportation data, both for analytical reasons and for the presentation of information. With this understanding, a summary of trip generation for TAZ 29, 30, and 31 are shown in Table 9 for the AM and PM peak hours. Trip generation is shown per development within each TAZ.



Table 9. Vested Residential Land Use & Trip Comparisons by TAZ								
TAZ and Development	Dwelling Units/Homes		AM Peak Hour			PM Peak Hour		
	Single	Multi	In	Out	Total	In	Out	Total
TAZ 29								
- Hunts Point	183	48	48	119	167	142	72	214
- Windhaven First	286	0	65	145	210	179	92	271
- Ponderosa Ridge 3 <sup>rd</sup>	12	0	6	13	19	10	5	15
- Ponderosa Ridge 4 <sup>th</sup>	25	0	8	19	27	20	10	30
<b>Subtotal TAZ 29</b>	<b>506</b>	<b>48</b>	<b>127</b>	<b>296</b>	<b>423</b>	<b>351</b>	<b>179</b>	<b>530</b>
TAZ 30								
- Diamond Rock	0	96	10	41	51	46	25	71
- Replat McCarroll	13	0	6	13	19	11	6	17
- McCarroll's 3 <sup>rd</sup>	10	0	5	12	17	9	5	14
- McCarroll's 4 <sup>th</sup>	15	0	6	14	20	13	7	20
- McCarroll's East	7	28	8	26	34	21	10	31
- Woodridge View	7	0	5	10	15	6	3	9
<b>Subtotal TAZ 30</b>	<b>52</b>	<b>124</b>	<b>40</b>	<b>116</b>	<b>156</b>	<b>106</b>	<b>56</b>	<b>162</b>
TAZ 31								
- Estates at Rocky	15	0	6	14	20	13	7	20
- Westwinds PUD	19	0	7	16	23	16	8	24
<b>Subtotal TAZ 31</b>	<b>34</b>	<b>0</b>	<b>13</b>	<b>30</b>	<b>43</b>	<b>29</b>	<b>15</b>	<b>44</b>
<b>Total Pipeline Trips</b>	<b>592</b>	<b>172</b>	<b>180</b>	<b>442</b>	<b>622</b>	<b>486</b>	<b>250</b>	<b>736</b>

As shown, the 592 single family and 172 multi-family homes approved within the Indian Trail neighborhood generate 622 trips during the AM peak hour and 736 trips during the PM peak hour. Overall, about 71 percent of these trips are generated by TAZ 29, 23 percent by TAZ 30, and 6 percent by TAZ 31, as averaged between the AM and PM peak hours.

As indicated, City staff also provided TAZ distribution information as based upon information gained from the regional travel demand model. Project trips were assigned to the study area based upon these distributions. Trip distributions for each TAZ are summarized below.

**TAZ 29** - Located west of Indian Trail Road, all trips from this TAZ are anticipated to access or travel through Indian Trail Road. Overall 4 percent of trips from TAZ 29 are anticipated to access Indian Trail Road via Shawnee Avenue, 49 percent via Barnes Avenue, 25 percent via Strong Road, and 22 percent via Pacific Park Drive. The distribution of trips outside of the study area is as follows (100 percent distributions to/from):

- ◆ **Barnes Road.** 21 percent of trips are anticipated to/from the east of Indian Trail Road; via the new connection with Strong Road.
- ◆ **Indian Trail Road.** 9 percent of project trips are anticipated to/from the north of Barnes Road.
- ◆ **Francis Avenue.** 6 percent of project trips are anticipated to/from the west of Indian Trail Road and 25 percent to/from the east of the Maple/Ash Couplet.
- ◆ **A Street.** 8 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Alberta Street.** 12 percent of project trips are anticipated to/from the south and 3 percent to/from the north of Francis Avenue.

- ◆ **Belt Street.** 1 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Maple/Ash Couplet.** 9 percent of project trips are anticipated to/from the south and 6 percent to/from the north of Francis Avenue.

**TAZ 30** - Located east of Indian Trail Road, the majority of trips from this TAZ will access or cross Indian Trail Road. Overall 57 percent of trips from TAZ 30 are anticipated to access Indian Trail Road via Barnes Avenue, 1 percent via Lowell Avenue, and 10 percent via Strong Road. Of these trips, the distribution outside of the study area is as follows (68 percent distributions to/from):

- ◆ **Barnes Road.** 6 percent of trips are anticipated to/from the west of Indian Trail Road.
- ◆ **Strong Road.** 2 percent of trips are anticipated to/from the west of Indian Trail Road.
- ◆ **Indian Trail Road.** 7 percent of project trips are anticipated to/from the north of Barnes Road.
- ◆ **Francis Avenue.** 5 percent of project trips are anticipated to/from the west of Indian Trail Road and 13 percent to/from the east of the Maple/Ash Couplet.
- ◆ **A Street.** 4 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Alberta Street.** 6 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Maple/Ash Couplet.** 7 percent of project trips are anticipated to/from the south and 18 percent to/from the north of Francis Avenue.

**TAZ 31** - Located on the western edge of the Indian Trail neighborhood, a minority of these trips from this TAZ will access or cross Indian Trail Road. Overall 14 percent of trips from TAZ 31 are anticipated to access Indian Trail Road via Barnes Avenue, 2 percent via Lowell Avenue, and 2 percent via Strong Road. Of these trips, the distribution outside of the study area is as follows (18 percent distributions to/from):

- ◆ **Barnes Road.** 2 percent of trips are anticipated to/from the west of Indian Trail Road.
- ◆ **Strong Road.** 2 percent of trips are anticipated to/from the west of Indian Trail Road.
- ◆ **Indian Trail Road.** 4 percent of project trips are anticipated to/from the north of Barnes Road.
- ◆ **Francis Avenue.** 5 percent of project trips are anticipated to/from the west of Indian Trail Road and 1 percent to/from the east of the Maple/Ash Couplet.
- ◆ **A Street.** 1 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Alberta Street.** 1 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Maple/Ash Couplet.** 1 percent of project trips are anticipated to/from the south and 1 percent to/from the north of Francis Avenue.

Note that a number of trips will travel through the study area as a result of travel via the Five Mile Road and Cedar Road intersections with the Maple/Ash Couplet (or Country Homes Boulevard). About 47 percent of TAZ 31 trips will impact the study area, via Maple/Ash north. Of these trips, about 20 percent anticipated to/from the east and 2 percent to/from the west (of Maple/Ash) on Francis Avenue, and 25 percent are anticipated to/from the south (of Francis Avenue) via the Maple/Ash Couplet.

Figure 5 and Figure 6 provide a summary of pipeline project trip assignments for the AM and PM peak hours at study intersections. Also highlighted are pipeline project locations and rough TAZ boundaries. Pipeline trips were combined with baseline forecasts to develop the future without project traffic volumes, as shown on Figure 7 and Figure 8 for the peak hours. TAZ trips assignments are provided in Section D of the Technical Appendices.

**Windhaven First Addition.** The trips generated by Windhaven First Addition were purposefully included in future without-project traffic forecasts. This is because the trips associated with these 286 homes are already programmed/approved for the Indian Trail neighborhood. Thus, these would be considered pipeline project trips, just like any other approved, but yet to be constructed, development project.

### 3.2.2 Trip Generation

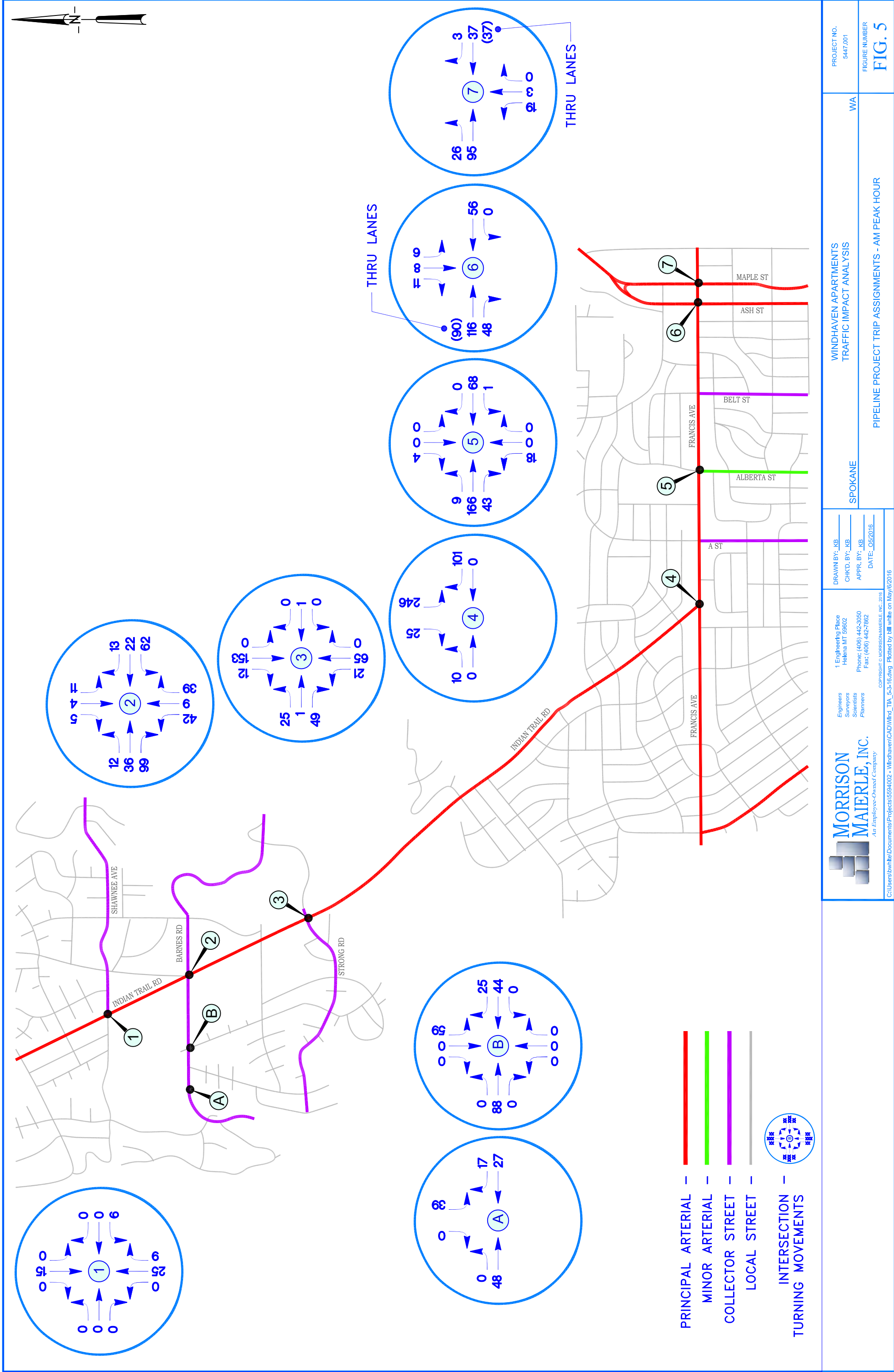
Trip generation was predicted using the methods outlined in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th Edition, 2012). The Trip Generation Manual is a nationally recognized and locally accepted method for forecasting trip generation for a range of commercial, retail, and residential land uses. The forecasting methods were developed based on the survey of other existing land use developments located throughout the United States.

Trip generation was determined using ITE Code 220 for Apartment land uses. The ITE describes this land use as “rental dwelling units located within the same building with at least three other dwelling units.” Trip generation was determined based on equations that estimate trips according to the number of dwelling units. Equations were used over rates because more than 10 surveys/studies were used to develop ITE equations with a resulting data regression fit of near or in excess of 0.75.

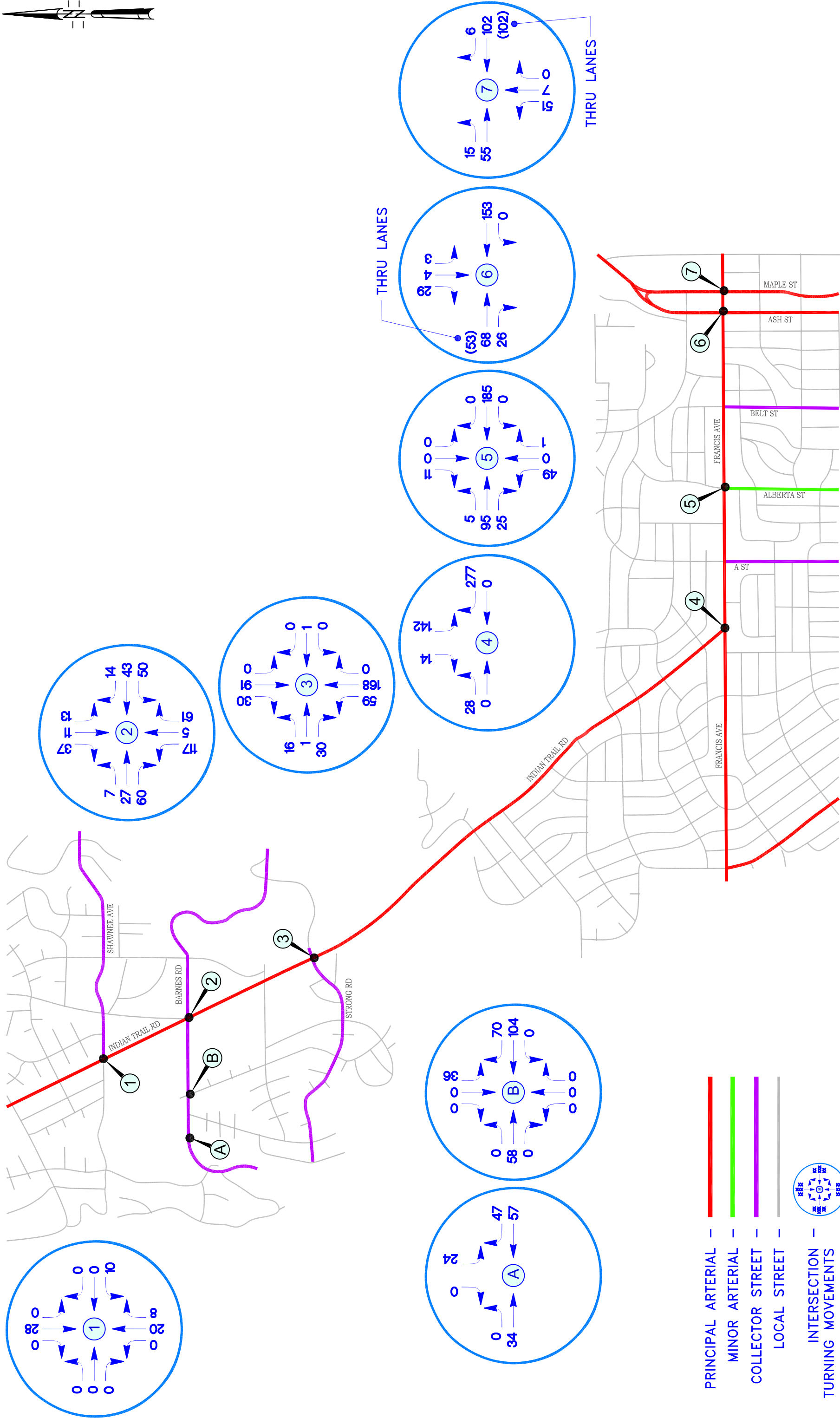
As indicated, the site has already been approved for development of 286 single family homes. According to Table 1, this represents the trips of approximately 460 apartment units. However, because trip generation is based upon linear regression equations, trip generation projections were developed for 750 apartment units. The trip generation associated with Windhaven First addition and 286 homes, as specified by City data, was then subtracted from these totals to determine the net gain in site-generated trips. A summary of trip forecasts are shown in Table 10 for the AM and PM peak hours.


Table 10. Project Trip Generation Gains							
Land Use	Dwelling Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Apartments - ITE Code 220	750	74	297	371	280	150	430
Single Family Homes - ITE Code 210	286	65	145	210	179	92	271
Net Gain Site Trips	--	9	152	161	101	58	159

As the project proposal results in a net gain in trip generation of 161 trips during the AM peak hour and 159 trips during the PM peak hour. These trips represent the net gain in traffic over those vested and approved by the City of Spokane.







 <b>MORRISON MAIERLE, INC.</b> <i>An Employee-Owned Company</i>	1 Engineering Place Helena MT 59602  Phone: (406) 442-3050 Fax: (406) 442-1862	DRAWN BY: KB CHKD. BY: KB APPR. BY: KB DATE: 05/2016	WINDHAVEN APARTMENTS TRAFFIC IMPACT ANALYSIS  SPOKANE	PROJECT NO. 5447.001
	WINDHAVEN PROJECT TRIP ASSIGNMENTS - PM PEAK HOUR		WA	FIGURE NUMBER <b>FIG. 6</b>







### 3.2.3 Trip Distribution

As Windhaven is located with City TAZ 29, the assignment of site trip gains was based on the distribution patterns established for this zone. The only difference is all project trips would use the Barnes Road intersection to access Indian Trail Road. Approximately 40 percent of project trips would access Windhaven via Barnes Road and 60 percent via Pamela Lane.

A summary of overall site distributions is again as follows:

- ◆ **Barnes Road.** 21 percent of trips are anticipated to/from the east of Indian Trail Road, vial the new connection with Strong Road.
- ◆ **Indian Trail Road.** 9 percent of project trips are anticipated to/from the north of Barnes Road.
- ◆ **Francis Avenue.** 6 percent of project trips are anticipated to/from the west of Indian Trail Road and 25 percent to/from the east of the Maple/Ash Couplet.
- ◆ **A Street.** 8 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Alberta Street.** 12 percent of project trips are anticipated to/from the south and 3 percent to/from the north of Francis Avenue.
- ◆ **Belt Street.** 1 percent of project trips are anticipated to/from the south of Francis Avenue.
- ◆ **Maple/Ash Couplet.** 9 percent of project trips are anticipated to/from the south and 6 percent to/from the north of Francis Avenue.

The resulting trip gain assignments are shown on Figure 9 for the AM peak hour and Figure 10 for the PM peak hour. Future with project traffic volumes and project trip assignments were then combined to generate the future year 2021 with project traffic forecasts, as shown on Figure 11 for the AM peak hour and Figure 12 for the PM peak hour.

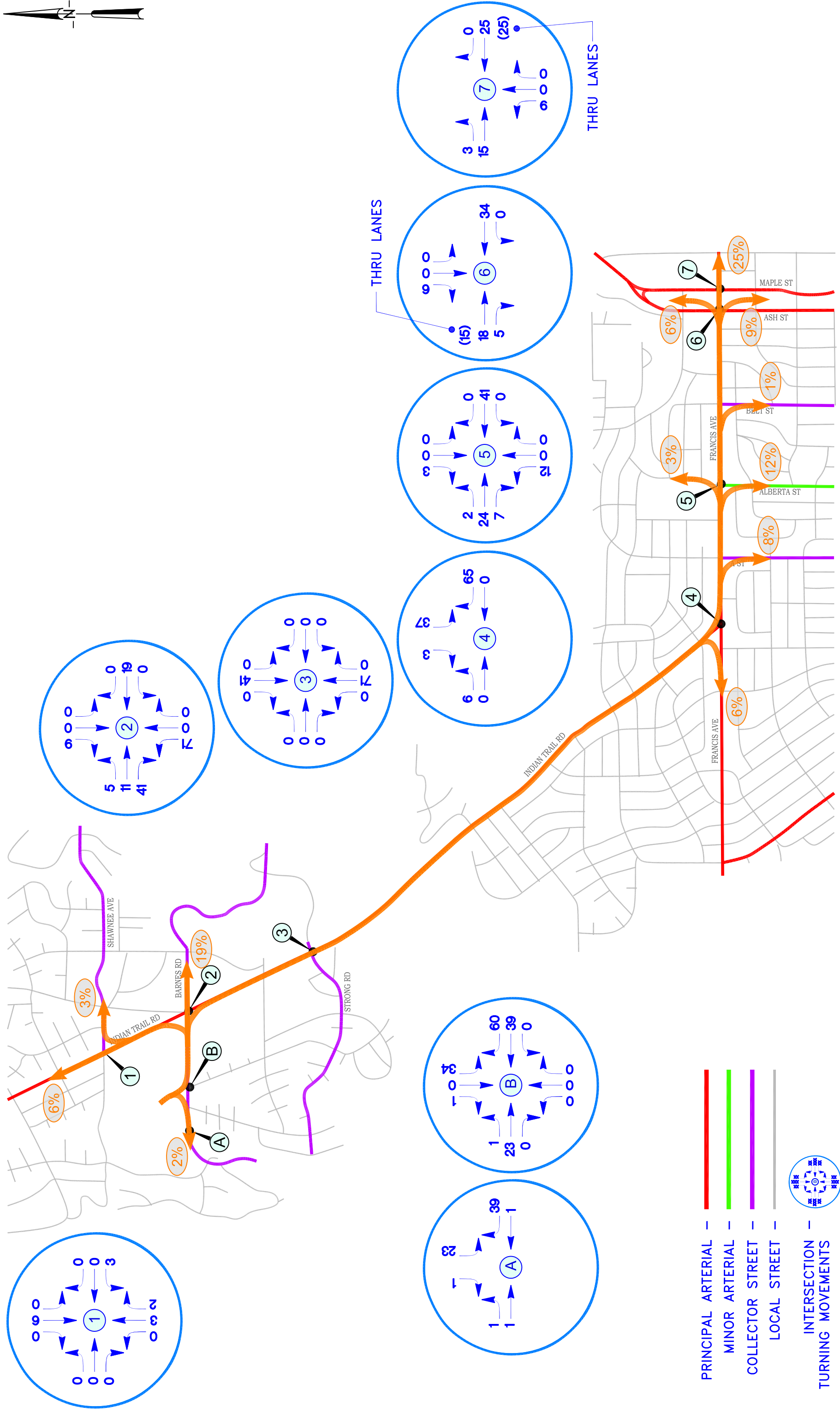
**Indian Trail Traffic Gains.** As indicated, traffic has historically increased on Indian Trail Road at a rate of 1.0 to 1.5 percent annually. The resulting future with project traffic volumes result in growth rates that range between 6 and 7 percent annually during the AM and PM peak hours (ranging between 30 and 40 percent overall). Thus, traffic forecasts are very conservative for year 2021; more likely reflecting traffic forecasts several years beyond this horizon as pipeline projects will require more than five years to be fully developed and occupied.

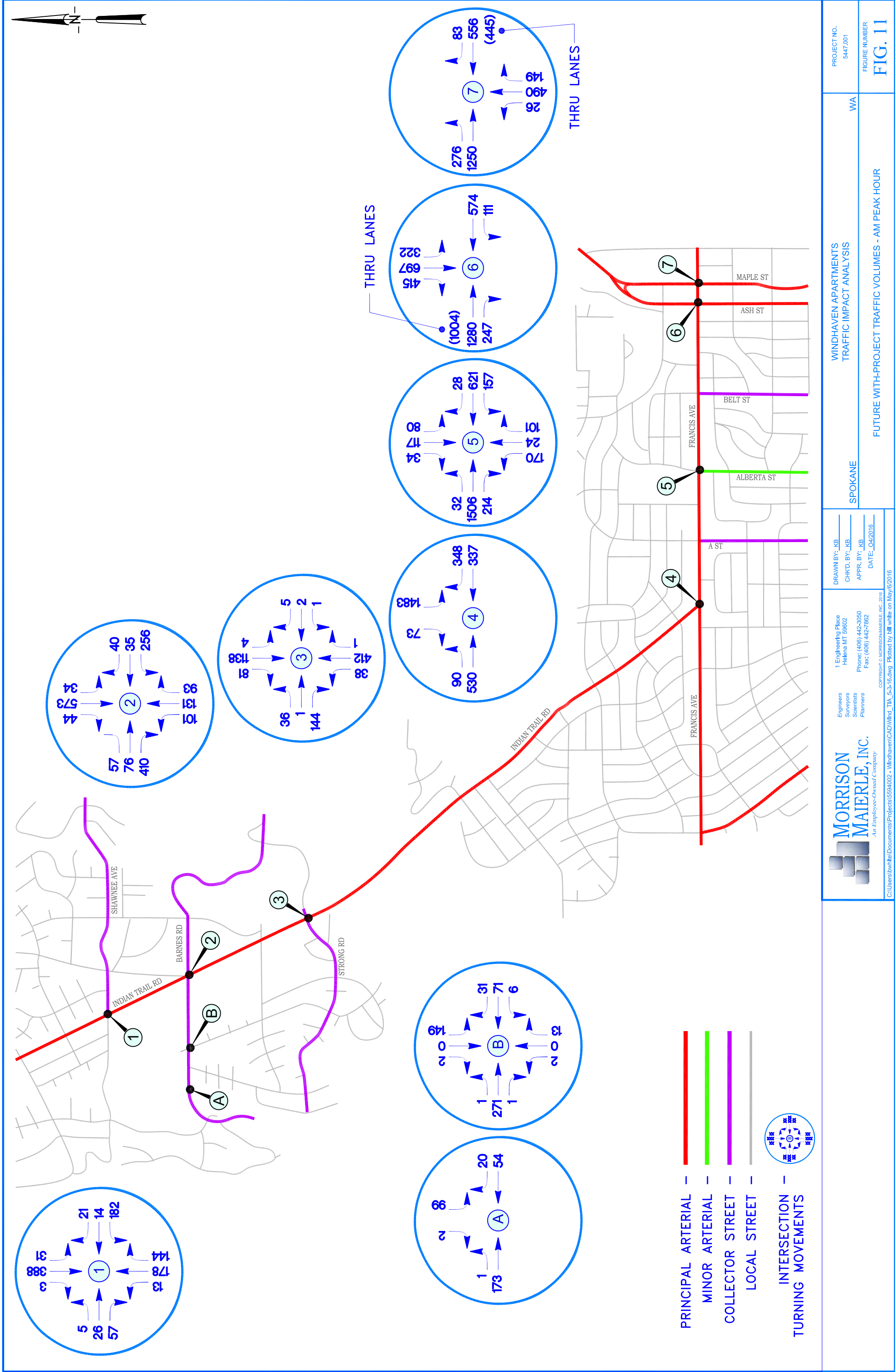
**Barnes Road Extension.** As indicated, the City has programmed the Barnes Road, Phoebe to Strong "Safety" project for construction in year 2017. The traffic diverted/forecast by this TIA as a result of this improvement for Barnes Road east of Indian Trail Road includes: the assignment of pipeline project trips, the assignment of Windhaven project trips, and some background traffic growth. The results are traffic projections that are 75 percent to 100 percent higher than counts during the PM and AM peak hours, respectively.

City officials reviewed the potential traffic gains associated with this project as a factor studied with a February 2015 Street Department Technical Memorandum prepared for the Five Mile and Strong Road intersection. Generally, the analysis concludes that a 5.5 percent annual traffic increase can be expected by year 2040 as a result of the Barnes Road extension project; which reflect the diversion of traffic to the new route plus the increase of traffic as a result of development growth. This growth was established based upon information secured from the











Spokane regional travel demand model. The hand forecasting methodologies used in this study result in a 10 to 15 percent annual increase on the roadway connection during peak hours, which well exceeds the City projections of City staff.

These paragraphs have been added to this section to confirm that, while traffic increases on Barnes Road and Strong Road may occur (as a result of the extension) for numerous reasons (i.e. access to the Sundance Plaza Shopping Center, schools, alternative emergency routes, weather conditions, etc.), the overall forecasts are conservative when compared with the results of the City Technical Memorandum and, by extension, the results generated by the regional travel demand model. Thus, no additional traffic diversions of forecasts were addressed with this project, as the resulting traffic forecasts would likely be unrealistic for the year 2021 analysis horizon of this study.

### 3.3 TRAFFIC OPERATIONS

LOS and capacity analyses were performed based on a review of traffic forecasts, as summarized in Section 3.2, versus the road geometrics and traffic control conditions described in Section 3.1. This analysis was performed initially based on the current geometric conditions, as the Barnes Road extension only causes traffic to divert and does not impact capacity. The Indian Trail Road widening project was not included as the project is not fully funded. Table 11 provides a summary of resulting future without and with project LOS and control delays for the AM and PM peak hours.

Table 11. Forecast Year 2021 LOS and Delay - AM and PM Peak Hours								
Year 2021 Condition	Future Without Project Traffic				Future With Project Traffic			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Signalized Intersections	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>	LOS <sup>1</sup>	Delay <sup>2</sup>
Shawnee Ave/Indian Trail Rd	B	17.9	A	8.2	B	17.9	A	8.3
Barnes Rd/Indian Trail Rd	C	26.8	B	20.0	D	43.6	C	23.0
Strong Rd/Indian Trail Rd	C	20.2	D	52.4	D	37.3	E	68.8
Indian Trail Rd/Francis Ave	C	20.3	B	10.1	C	29.6	B	10.7
Alberta St/Francis Ave	E	65.6	D	53.7	E	78.3	E	59.4
Ash St/Francis Ave	C	26.1	C	21.3	C	28.9	C	21.5
Maple St/Francis Ave	B	17.6	D	51.4	B	17.6	D	54.0
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Unsignalized Intersections	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay	LOS <sup>1</sup>	Delay
Forest Ln/Barnes Rd	B	10.6	B	10.2	B	11.4	B	10.6
Pamela Ln/Barnes Rd	B	31.1	B	12.0	C	19.0	C	14.0
1. LOS = Levels-of-Service 2. Del = Delay in seconds								

As indicated, LOS E is the threshold for signalized and unsignalized intersections along principal arterials within the City of Spokane. As shown, there are no intersection forecast to function below minimum thresholds during the forecast AM and PM peak hours. To be clear,



this does not say the typical driver may not experience some frustration as the result of longer wait times at intersections during peak hours, as compared with other timeframes of the typical weekday. However, principal arterials are intended to move high traffic volumes within the City and this LOS standard reflects this condition. Thus, citizens within the City have come to expect expect delays and higher traffic volumes along principal arterials; especially as the regional continues to growth.

A summary of conditions for each intersection is as follows:

- ◆ **Shawnee Avenue/Indian Trail Road.** This intersection operates within the LOS A/B range during peak hours, which is well above minimum thresholds. The highest traffic impacts at this intersection occur during the AM peak hour when the work commute and school traffic activities overlap.
- ◆ **Barnes Road/Indian Trail Road.** This signalized intersection will operate at acceptable LOS during the AM and PM peak hours, both without and with project development in year 2021. The work commute and shopping activities have the highest impacts upon this intersection during the AM peak hour.
- ◆ **Strong Road/Indian Trail Road.** This signalized intersection will operate at acceptable LOS during both peak hours. The work commute has the highest impact upon this intersection during the PM peak hour.
- ◆ **Barnes Road/Indian Trail Road.** This signalized intersection will operate at acceptable LOS during the AM and PM peak hours, both without and with project development in year 2021. The morning work commute will have the highest impact upon the intersection, as Indian Trail Road drivers wait to turn onto Francis Avenue.
- ◆ **Alberta Street/Francis Avenue.** This signalized intersection will function primarily within the LOS E range during the AM and PM peak hours. The works commutes, and to a lesser extent Salk Middle school travel demands, have high impacts at this intersection. Although operating within LOS tolerances, this intersection was identified to have the worse congestion analytically and through field observations and was the least improved by signal optimization evaluation (see below).
- ◆ **Ash Street/Francis Avenue.** This signalized intersection will operate at acceptable LOS C during the AM and PM peak hours, both without and with project development in year 2021. Impacts to this intersection principally occur as a result of the work commute.
- ◆ **Maple Street/Francis Avenue.** This signalized intersection will operate at acceptable LOS during the AM and PM peak hours, both without and with project development in year 2021. The highest impacts occur during the evening/homebound work commute.

It should be noted City of Spokane traffic engineering staff routinely works to “optimize” traffic signal performance in order to improve intersection and corridor mobility; especially along principal arterials such as Francis Avenue and Indian Trail. Although this study demonstrates no LOS issues at study intersections, as compared with code, it should be noted that enhanced performances (via improved LOS and/or reduced average vehicle delay) were identified analytically by modifying signal cycle lengths or phase splits in response to the higher travel demands identified with forecast traffic volumes. This confirms that City staff should have the ability to maintain traffic operations beyond levels stated in the report as the area continues to grow in the future.

**Queue Potentials.** Future with-project queue potentials were reviewed for signalized study intersections. Future without-project queuing was not shown as there was no difference in queue results. Again, most acceptable conditions are those where average and 95<sup>th</sup> percentile queues do not exceed lane/pocket storage. Tolerable conditions are those where average queues do not exceed lane storage/pocket length, even when 95<sup>th</sup> percentile queues do exceed storage. Unacceptable conditions are noted where both average and 95<sup>th</sup> percentile queues exceed available lane/pocket storage. A summary of queue conditions is shown by Table 12 for the AM and PM peak hours.

Table 12. Future With-Project Queue Potentials - AM and PM Peak Hours					
Signalized Intersections	Lane Capacity	AM Peak		PM Peak	
		Avg.	95%	Avg.	95%
Shawnee Ave/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	7 vehicles <sup>1</sup> 3 vehicles 3 vehicles <sup>1</sup> 3 vehicles 3 vehicles 3 vehicles	1 vehicle 1 vehicle 1 vehicle 0 vehicle 5 vehicle 1 vehicle	1 vehicles 1 vehicle 1 vehicle 0 vehicle 7 vehicles 1 vehicles	1 vehicle 1 vehicle 1 vehicle 1 vehicle 1 vehicle 0 vehicle	1 vehicle 1 vehicle 1 vehicle 1 vehicle 2 vehicles 1 vehicles
Barnes Rd/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	8 vehicles <sup>1</sup> 5 vehicles 7 vehicles <sup>1</sup> 6 vehicles 4 vehicles	1 vehicle 0 vehicle 1 vehicle 4 vehicles 1 vehicle	3 vehicles 2 vehicle 2 vehicles 9 vehicles 3 vehicles	4 vehicles 1 vehicle 1 vehicle 2 vehicles 2 vehicles	14 vehicles 6 vehicles 2 vehicles 5 vehicles 4 vehicles
Strong Rd/Indian Trail Rd – Northbound Left-Turn Lane – Northbound Right-Turn Lane – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Eastbound Right-Turn Lane	7 vehicles <sup>1</sup> 4 vehicles 7 vehicles <sup>1</sup> 4 vehicles 8 vehicles	1 vehicle 0 vehicle 1 vehicle 1 vehicle 2 vehicles	2 vehicles 0 vehicle 1 vehicle 1 vehicle 3 vehicles	1 vehicle 0 vehicle 1 vehicle 1 vehicle 1 vehicle	3 vehicles 0 vehicle 1 vehicle 1 vehicle 1 vehicle
Indian Trail Rd/Francis Ave – Westbound Right-Turn Lane – Eastbound Left-Turn Lane	16 vehicles <sup>2</sup> 2 vehicles	0 vehicle 1 vehicle	2 vehicles 2 vehicles	22 vehicles 2 vehicle	33 vehicles 7 vehicles
Alberta St/Francis Ave – Northbound Left-Turn Lane – Southbound Left-Turn Lane – Westbound Left-Turn Lane – Eastbound Left-Turn Lane	9 vehicles <sup>1</sup> 4 vehicles 8 vehicles <sup>1</sup> 8 vehicles <sup>1</sup>	5 vehicles 2 vehicles 3 vehicles 1 vehicle	8 vehicles 4 vehicles 9 vehicles 2 vehicles	11 vehicles 2 vehicle 5 vehicles 1 vehicle	21 vehicles 3 vehicles 10 vehicles 3 vehicles
Ash St/Francis Ave – Southbound Left-Turn Lane – Southbound Right-Turn Lane – Westbound Left-Turn Lane	21 vehicles 21 vehicles 20 vehicles <sup>1,3</sup>	6 vehicles 5 vehicles 3 vehicles	10 vehicles 9 vehicles 6 vehicles	5 vehicles 9 vehicles 6 vehicles	8 vehicles 18 vehicles 7 vehicles
Maple St/Francis Ave – Northbound Left-Turn Lane – Eastbound Left-Turn Lane	13 vehicles 20 vehicles <sup>1,3</sup>	1 vehicle 7 vehicles	2 vehicle 9 vehicles	8 vehicles 6 vehicles	20 vehicle 17 vehicles
<sup>1.</sup> Transitions into a TWLTL, so additional storage can be available. <sup>2.</sup> Free movement which turns into a designated receiving lane, so queues not as critical. <sup>3.</sup> The designated left-turn lane is broken by an intersection so queue pocket is a two-length measurement.					

As shown, all average queues are accommodated within available turn lane/pocket lengths, again with the exception of the westbound left-turns at Shawnee Avenue/Indian Trail Road during the short duration of school traffic. 95<sup>th</sup> percentile exceptions are noted at the following locations:

- ◆ Shawnee Avenue/Indian Trail Road – The 95<sup>th</sup> percentile queue exceeds the turn pocket by 4 vehicles during the AM peak hour.
- ◆ Barnes Road/Indian Trail Road – 95<sup>th</sup> percentile queues will exceed storage within the northbound left-turn lane, northbound right turn lane, and westbound left-turn lane between the peak hours. There are no average queue exceptions within the northbound right-turn or westbound left-turn lanes. There were queue issues noted in the northbound left-turn lane turning the PM peak hour.
- ◆ Indian Trail Road/Francis Avenue – Eastbound left-turn 95<sup>th</sup> percentile demands exceed storage by 5 vehicles during the PM peak hour; although average queues are within lane storage. Average and 95<sup>th</sup> percentile queues exceed storage “on paper” within the westbound right-turn lane. This issue may be overstated though, as in the field this designated right turn has free movement that transitions directly into a northbound lane with no immediate conflict.
- ◆ Alberta Street/Francis Avenue – Average and 95<sup>th</sup> percentile queues exceed storage within the northbound left-turn lane during both peak hours; although again there is a shared left-turn lane at this intersection. Thus, this issue may be moderately overstated (although drivers do indicate long wait times at the intersection). 95<sup>th</sup> percentile queues exceed storage within the westbound left-turn lane during both peak hours; although there are no average queue issues. This lane does transition into a TWLTL, so additional storage is available outside of through lanes.
- ◆ Maple Street/Francis Avenue – 95<sup>th</sup> percentile queues exceed available storage within the northbound left-turn lane at the intersection during the PM peak hour. Average queues are accommodated with the lane.

**Indian Trail Lane Capacity.** Forecast lane capacities were reviewed for the three count locations identified previously along on Indian Trail Road. Capacities were reviewed for the future with-project condition only, as there was minimal difference in results between this and the without-project condition. A summary of the resulting lane capacities are shown in Table 13 for the AM and PM peak hours.

Table 13. Future With-Project Indian Trail Lane Capacity - AM and PM Peak Hours									
Indian Trail Road	Capacity			AM Peak Hour			PM Peak Hour		
	NB	SB	Tot	NB	SB	Tot	NB	SB	Tot
N/of Weile Ave	1,800	1,800	3,600	376	1,396	1,772	1,351	732	2,083
N/of Kathleen Ave	900	900	1,800	385	1,483	1,868	1,410	781	2,191
N/of Lowell Ave	900	900	1,800	371	1,360	1,731	1,211	790	2,001

As shown, lane capacity is still sufficient within the four lane section of Indian Trail Road north of Weile Avenue. Forecast traffic volumes further demonstrate the need for lane widening along

Indian Trail Road, as volumes well exceed single lane capacity in the southbound direction during the AM peak hour and the northbound direction during the PM peak hour.

### **3.4 TRANSIT**

STA is responsible for adjusting transit service throughout the City. Routes can be changed, alternated, diverted, or increased upon petition; however, there needs to be a very compelling reason to make a change. The completion of Windhaven alone would not provide the platform for any change. And given there is adequate weekday service, this TIA does not find any reason to do so regardless. In addition, the close proximity of transit access, within  $\frac{1}{4}$  mile to the east, does not dictate the need for service to be diverted nearer to the Windhaven site.

### **3.5 PEDESTRIAN AND BICYCLE FACILITIES**

As indicated, pedestrian access/mobility and circulation is generally well-served within the project study area; with adequate sidewalk access provided between Windhaven and nearby public facilities, transit, and shopping centers. No improvements seem to be necessary in relation to project development.

Designated commuter bike routes are available within the study area on Indian Trail Road and Barnes Road. Again, these are facilities where vehicle and bike activity share common right-of-way along both streets. Ideally, a recreational bike route would be of benefit to the Indian Trail neighborhood, as delineated via designated bike lanes and/or off-street roadways or pathways. However, while identified via this study as a need for the area, this is a non-project related issue.



## **4 IMPROVEMENT RECOMMENDATION & MITIGATION**

There were no operational deficiencies (LOS exceptions) for study intersections. Some 95<sup>th</sup> percentile queue issues were noted with this analyses; however, it is not typical nor recommended by this study to recommend maximum queues as these are conditions that only occur a few times each peak hour (minimal cost-to-benefit). Thus, on the basis of intersection operations and queue potentials, there were no improvement needs identified within the project study area and no project-specific improvements to mitigate unacceptable traffic impacts.

With that said, existing and forecast traffic volumes were noted to exceed lane capacities within and north of the traffic bottleneck area of Indian Trail Road (north of Kathleen Avenue). As such, this section recommends an intermediate measure to help with traffic mobility within the short term future and confirms the need for long-term roadway widening. Also discussed are the development mitigation fee potential and a recommended use of development funds.

### **4.1 INDIAN TRAIL ROAD RESTRIPIING – SHORT TERM**

Currently, Indian Trail Road is comprised of a three-lane cross section north of Kathleen Avenue to Lowell Avenue, a distance of about 4,600 feet. This includes one northbound, one southbound, and one center two-way left-turn lane (TWLTL). The width of the roadway ranges from 43 and 44 feet between Kathleen Avenue and Lowell Avenue. The northbound and southbound lanes have a width of about 15 feet, respectively, and the TWLTL about 13 feet.

Travel demands appear to be most significant (with higher volume) and most condensed during the AM peak hour of the typical weekday. In addition, citizens of the Indian Trail neighborhood confirm morning congestion, especially exiting the area, is of most concern on the bases of emergency egress and general traffic congestion. As such, this study recommends the restriping of Indian Trail Avenue to include two southbound travel lanes and one northbound travel lane, while maintaining a TWLTL. City officials agree maintaining the TWLTL is important for better preserves safety along the roadway, as versus an additional northbound lane.

Prevailing design resources such as *A Policy on Geometric Design of Highways and Streets* (AASHTO, 2011) indicate “Lane widths of 3.0 m [10 ft] may be used in more constrain areas where track and bus volumes are relatively low and speeds are less than 60 km/h [35 mph].” In fact, this resource goes on to indicate narrower lanes/streets have the advantages of slowing travel speeds and reducing pedestrian crossing times. Thus, the roadway could be restriped to include two 10.5 foot southbound travel lanes, an 11 foot TWLTL, and an 11 foot northbound travel lane; all within a minimum street width of 43 feet.

It is estimated this project would include the removal of approximately 4,500 s.f. of existing roadway stripe with application of about 6,000 s.f. of new stripe. This would provide needed and more desirable (by the neighborhood) southbound capacity along Indian Trail Road; helping to maintain mobility and emergency egress until widening could occur. The narrowing could also slow travel speeds, noted with this study to exceed posted speed limits during peak hours.

### **4.2 INDIAN TRAIL ROAD WIDENING – LONG TERM**

The lane capacity analysis confirms widening of Indian Trail Road is ultimately needed to help move through traffic in both the northbound and southbound travel directions. Counts currently

support this need, with year 2021 traffic forecasts demonstrating even further need. As indicated, this improvement is already programmed into the City TIF. Thus, the project is a priority for City officials, and they will likely move the project forward as soon as sufficient funding is secured for the project.

### **4.3 MITIGATION - TRAFFIC IMPACT FEES**

**Traffic Impact Fees.** The project is responsible for mitigating traffic impacts via transportation impact fee (TIF) contribution, as defined in Spokane Municipal Code Chapter 17D.075. The fee scheduled for the Northwest Service Area, within which the project is located, is \$483.49 per unit for two-story apartments and \$296.33 for three-story apartments. Thus, the Windhaven development would be conditioned with up to **\$362,620** of traffic impact fees ( $\$483.49 \times 750$  two-story apartments), as collected prior to the issuance of any building permit on a per-unit/home or development phase basis (\$483.49 per unit at a time).

Normally, a development TIF contribution is placed into an account dedicated towards improvements located within a specific service area: in this instance, the Northwest Service Area. City officials work to address/construct improvements within the service area as quickly as possible, but the timing of improvement construction is highly dependent upon funding acquisitions between the TIF and a number of other sources and a number of other factors. Safety issues, high congestion, and even funding specification, limitation, or accumulation can vary for each improvement. Thus, there is no guarantee that a developer contribution within a given neighborhood (of a service area) would go towards specific improvements due to the variability of these aforementioned conditions.

For example, there are currently a number of roundabouts specified within the Northwest Service Area of the City. Opportunities for specific intersection safety or efficiency grants may arise through State or Federal Government resources in the future, and these may require specific “match” moneys to secure. Thus, City officials would use TIF funds as “match” money to secure the grant, and this would move a roundabout(s) into a position for construction over other improvements within the Northwest Service Area. In other words, City officials must be adaptable and opportunistic in securing funds for TIF improvements, even at the expense of other improvements.

**Development Recommendation.** There is need for improvements to Indian Trail Road, both intermediate and long term, in order to assure safety and mobility for the arterial. As such, the project proponent has offered the following through this TIA to help advance the interests of the City and specifically the Indian Trail neighborhood. The project proponent offers to:

- 1) Front the costs of restriping Indian Trail Road, either to be managed/constructed privately or as a City project, to provide more immediate congestion relief. The costs for this would be reduced from the total TIF potential of \$362,620 owed/conditioned for the project.
- 2) Front a substantial portion of the total TIF, as opposed to a per unit or phase basis, so City officials would have more immediate opportunities for design, ROW acquisition, and/or “match” funding to advance the ultimate widening of Indian Trail Road more quickly versus what may normally occur within TIF processes.

These concessions would be a function of a development agreement per specifics developed between the City and the project proponent.

## **5 PUBLIC INVOLEMENT**

To be added to final TIA following comments collected at May 25 project public meeting.

DRAFT

## 6 SUMMARY AND CONCLUSIONS

Windhaven First Addition is an approved City residential development that occupies 49.48 acres aligned north of Barnes Road and west of Indian Trail Road within the Indian Trail neighborhood of Spokane. The project was initially approved in year 2006 for the construction of 286 single family homes developed approximately five years. No homes have been constructed yet; although the street infrastructure for the development is complete. This includes primary vehicle access to Barnes Road via Forest Lane and Pamela Lane, with secondary access provided to the adjacent apartment development (to the east) via Jamestown Lane. The project is within an RSF zone of the City with a site Comprehensive Plan designation of Residential 4-10.

Due to evolving market conditions, the project proponent has recently proposed to develop up to 750 apartment units on the site as opposed to single family homes. The proposal results in a density of 15.2 homes per acres, which exceeds the approved residential density. Thus, a Comprehensive Plan amendment and zone change would be needed to accommodate the proposal; specifically to a RMF zone and Comprehensive Plan designation of Residential 15-30.

Note the proposed apartment density marginally exceeds minimum zoning and Comprehensive Plan allowances, and is just under half of maximum allowable densities (of up to 30 apartments per acre). The reduced density was accommodated to minimize the traffic impacts of the proposed development on the Indian Trail neighborhood; as this was expressed as a concern of citizens living within the area. The developers have reduced site densities considerable from initial development proposals.

Site access is promoted as described previously, with primary access provided via Forest Lane and Pamela Street and secondary access via Jamestown Lane.

Per City concurrency evaluations, Windhaven First Addition with 286 homes is vested to generate 210 trips during the AM peak hour and 271 trips during the PM peak hour. This would represent the trip generation equivalent of 460 apartment units. This distinction is important because it demonstrates that 46 percent of the current apartment proposal could be developed before surpassing vested/programmed traffic generation levels.

This TIA is responsible for addressing the net gain in trips over those vested/identified above. The current 750 unit apartment proposal represents a net gain in trip generation of 161 trips during the AM peak hour and 159 trips during the PM peak hour over those vested/associated with single family home development. About 21 percent of project trips are anticipated to/from the east on Barnes Road (via the new extension and connection to Strong Road). About 9 percent of project trips are anticipated to/from the north and 70 percent to/from the south on Indian Trail Road. The majority of project trips along Indian Trail Road south will travel to/from the east on Francis Avenue; distributing throughout a study area that addresses the Alberta Street and Maple/Ash Couplet intersections with Francis Avenue.

### 6.1 TRAFFIC FORECASTS AND CAPACITY

City officials require this study address traffic operations principally for site access intersections and seven off-site intersections most impacted by development within the Indian Trail neighborhood. The analysis was required for the AM and PM peak hours of the typical weekday, as based on the forecast year 2021 completion year of the project.



**Existing Conditions.** Traffic counts were performed during typical weekdays in March and April to capture the peak demands of the morning and afternoon commutes. These counts were performed specifically while local schools were in session, as to capture the travel demands of these special traffic generators.

*City of Spokane Administrative Policy and Procedure for Transportation Concurrency Level of Service Standards* defines a LOS E standard for signalized and unsignalized intersections aligned along a principal arterial. An analysis of existing traffic operations indicates there were no levels-of-service (LOS) issues identified within the field, as all intersections were shown to function at LOS E or better between the AM and PM peak hours.

Secondary lane capacity analyses and speed counts were performed discretionarily to support conclusions for Indian Trail Road. The lane analysis was used to help identify whether adequate capacity exists for through traffic (northbound and southbound movements) outside of study intersections along Indian Trail Road. Lane capacities were reviewed for three count locations within the vicinity of the “bottleneck” on Indian Trail Road: 1) north of Weile Avenue (south of bottleneck); 2) north of Kathleen Avenue (within bottleneck); and 3) north of Lowell Avenue (north of Bottleneck).

The analysis indicates lane capacity is sufficient within the four lane section of Indian Trail north Road north of Weile Avenue. However, existing counts are shown to exceed directional lane capacities within specifically within the bottleneck area north of Kathleen Avenue. There is minor lane capacity exceptions noted north of Lowell Avenue, but overall capacity appears to be sufficient north of the bottleneck. A comparison/review of this data does suggest need for lane widening as based on existing count data.

Despite lane capacity results, travel speeds within the corridor do not seem to be overly compromised. Speed counts were performed at the locations identified/reviewed above, south of, within, and north of the bottleneck area along Indian Trail Road. Average travel speeds were found to be 3 to 6 mph above the posted 30 mph speed limit along the roadway during AM and PM peak hours in both travel directions. The conclusion from this is that, while additional capacity is needed, the travel time of typical commuters is not yet impacted.

**Future Conditions.** Future 2021 traffic volumes were developed for operational analyses assuming: 1) baseline (non-development associated) traffic growth, 2) the development of eleven study area pipeline projects (including vested Windhaven First Addition), and 3) the assignment of project trips. A 0.5 percent annual growth rate was applied to counts to reflect baseline (non-development) traffic growth. This growth was combined with the trips generated by pipeline projects to generate future without project traffic forecasts.

Finally, project trip assignments and future without project traffic volumes were combined to generate future with-project traffic forecasts. The resulting traffic forecasts result in growth rates of between 6 and 7 percent annually on Indian Trail Road, which far exceeds historical growth rates ranging between 1 and 1.5 percent annually. Thus, traffic forecasts are very conservative for year 2021 and may be more representative of long term traffic growth (beyond year 2021).

Future intersection analyses indicated that no LOS issues were noted based upon a review of future year 2021 traffic forecasts. This determination is made because no study intersection is

forecast to function below LOS E on the principal arterials of Indian Trail Road or Francis Avenue during the peak hours. LOS at site access intersections are also shown to operate acceptably at LOS C or better during the peak hours.

City of Spokane traffic engineering staff routinely works to “optimize” traffic signal performance in order to improve intersection and corridor mobility; especially along arterials such as Francis Avenue and Indian Trail. Although this study demonstrates no LOS issues at study intersections, compared with code, it should be noted that enhanced performances (via improved LOS and/or reduced average vehicle delay) were identified analytically by modifying signal cycle lengths or phase splits in response to the higher travel demands identified with forecast traffic volumes. This confirms City staff should have the ability to maintain traffic operations beyond levels stated in the report as the area continues to grow in the future.

Forecast lane capacity was still shown to be sufficient within the four lane section of Indian Trail north Road north of Weile Avenue. Forecast traffic volumes further demonstrate the need for lane widening along Indian Trail Road north of Kathleen Avenue (within bottleneck) and north of Lowell Avenue (north of Bottleneck). This determination is confirmed because forecast traffic volumes well exceed single lane capacity in the southbound direction during the AM peak hour and the northbound direction during the PM peak hour.

**Pedestrian, Bike, and Transit.** Pedestrian, bicycle, and transit access conditions are favorable within the project vicinity. Sidewalk is contiguous between the developments and nearby transit stops, shopping centers, and public facilities (a library and a park). There are commute bicycle routes on Indian Trail Road and Barnes Road; although some form of designated bike lanes for recreational facilities would be ideal in the future (such remediation is beyond the scope of development projects). Finally STA transit access to Indian Trail Road is sufficient on weekdays, with transit stops located within walking distance about ¼- mile east of Windhaven.

## **6.2 IMPROVEMENT RECOMMENDATIONS AND MITIGATION**

The project is responsible for mitigating traffic impacts via transportation impact fee (TIF) contribution. The fee scheduled for the Northwest Service Area, within which the project is located, is \$483.49 per unit for two-story apartments and \$296.33 for three-story apartments. Thus, the Windhaven development would be conditioned with up to **\$362,620** of traffic impact fees ( $\$483.49 \times 750$  two-story apartments), as collected prior to the issuance of any building permit on a per-unit/home or development phase basis.

A short term improvement was recommended and long term improvement confirmed for Indian Trail Road, in order to promote traffic mobility and safety. These recommendations and project mitigation proposals are as follows:

- 1. Improvement.** Restripe Indian Trail Avenue to include two southbound travel lanes and one northbound travel lane, while maintaining a TWLTL, between Kathleen Avenue and Lowell Avenue. The project could be accommodated with narrow, but still acceptable, travel lanes striped within the 43 to 44 foot paved section that exists along this section of the arterial. This would provide needed and more desirable (by the neighborhood) southbound capacity along Indian Trail Road; helping to maintain mobility and emergency egress until widening could occur.

**Mitigation.** The project proponent has offered to front the costs of restriping Indian Trail Road, either to be managed/constructed privately or as a City project, to provide more

immediate congestion relief. The costs for this would be reduced from the total Windhaven TIF potential of \$362,620 owed/conditioned for the project.

- 2. Improvement.** Lane capacity analyses confirm the need for widening Indian Trail Road between Kathleen Avenue and Lowell Avenue. This is a congestion improvement that would enhance mobility and provide for improved emergency ingress and egress.

**Mitigation.** The project proponent has offered to front a substantial portion of the Windhaven total TIF, as opposed to a per unit or phase basis, so City officials would have more immediate opportunities for design, ROW acquisition, and/or “match” funding (for grants) to advance the ultimate widening of Indian Trail Road. This should allow the project to advance more quickly versus what may normally occur within TIF processes.

These concessions would be a function of a development agreement per specifics developed between the City and the project proponent. The conditions would be promoted shortly following Comp. Plan amendment, zone change approvals, and/or construction approvals, as coordinated with the City.

### **6.3 PUBLIC PARTICIPATION**

To be added to final TIA following comments collected at May 25 project public meeting.

### **6.4 SUMMARY**

The improvements and mitigation described will address project-related deficiencies noted throughout the TIA (specifically for Indian Trail Road). The project will contribute \$362,620 towards mitigation of area deficiencies, via the TIF; specifically working to promote intermediate and long-term improvements for Indian Trail Road, if approved by the City. Thus, this TIA should successfully support the zone change and comprehensive plan modifications being sought with the 750 unit apartment project proposal being sought for Windhaven, as project impacts will be addressed.

No further recommendations are provided by this TIA.

## Appendix A

### Glossary of Terms

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This section of the Technical Appendix provides a glossary of terms. The *Highway Capacity Manual* (TRB, 2010) and the *Transportation Impact Analyses for Site Development* (ITE, 2005) were used to help with the development of the following definitions:

- ◆ **Access point** – An intersection, driveway, or opening on a roadway that provides access to a land use or facility.
- ◆ **All-way stop-controlled** – An intersection with stop signs located on all approaches.
- ◆ **Arterial** – (General Definition) A signalized street that primarily serves through-traffic and secondarily provides access to abutting properties.
- ◆ **Average daily traffic (ADT)** – The average 24 hour traffic volume at a given location on a roadway.
- ◆ **Capacity** – The number of vehicles or persons that can be accommodated on a roadway, roadway section, or at an intersection over a specified period of time. Capacity is also a term used to define limits for transit, pedestrian, and bicycle facilities. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- ◆ **Collector street** – (General Definition) A surface street providing land access and traffic circulation within residential, commercial, and industrial areas.
- ◆ **Cycle** – A complete sequence of cycle indicators.
- ◆ **Cycle length** – The total time for a signal to complete one cycle.
- ◆ **Delay** – The additional travel time experienced by a driver, passenger, or pedestrian.
- ◆ **Demand** – The number of users desiring service on a highway system or street over a specified time period. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- ◆ **Departing sight distance** – The length of road required for a vehicle to turn from a stopped position at an intersection (or driveway) and accelerate to travel speed.
- ◆ **Downstream** – The direction of traffic flow.
- ◆ **Functional class** – A transportation facility defined by the traffic service it provides.
- ◆ **Growth factor** – A percentage increase applied to current traffic demands or counts to estimate future demands/volumes.
- ◆ **Level of Service** – The standard used to evaluate traffic operating conditions of the transportation system. This is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to maneuver. Operating conditions are categorized as LOS A through LOS “F”. LOS A generally represents the most favorable driving conditions and LOS F represents the least favorable conditions.
- ◆ **Mainline** – The primary through roadway as distinct from ramps, auxiliary lanes, and collector-distributor roads.
- ◆ **Major Street** – The street not controlled by stop signs at a two-way stop-controlled intersection.
- ◆ **Minor arterial** – (General Definition) A functional category of a street allowing trips of moderate length within a relatively small geographical area.
- ◆ **Operational analysis** – A use of capacity analysis to determine the level of service on an existing or projected facility, with known or projected traffic, roadway, and control conditions.

- ◆ **Peak Generator Hour** – The single hour (or hours) in a day during which trip generation for a development or land use is highest.
- ◆ **Peak hour** – Single hour (or hours) in a day during which the maximum traffic volume occurs on a given facility (roadway, intersection, etc.). Typically the peak hour is known as the “rush” hour that occurs during the AM or PM work commutes of the typical weekday. The absolute peak hour of the day can also be referred to as the design hour.
- ◆ **Peak Generator Hour** – The peak hourly volume generated by a particular development or land use. In the context of traffic reports, the generator hour can occur in the morning and afternoon, described as AM and PM peak generator hours, respectively.
- ◆ **Peak hour factor** – The hourly volume during the maximum-volume hour of the day divided by the peak 15-minute flow rate within the peak hour; a measure of traffic demand fluctuation within the peak hour.
- ◆ **Principal Arterial** - (General Definition) A major surface street with relatively long trips between major points, and with through-trips entering, leaving, and passing through the urban area.
- ◆ **Queue** – A line of vehicles, bicycles, or persons waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slower moving vehicles or people joining the rear of the queue are usually considered a part of the queue.
- ◆ **Roadside obstruction** – An object or barrier along a roadside or median that affects traffic flow, whether continuous (e.g., a retaining wall) or not continuous (e.g., light supports or a bridge abutment).
- ◆ **Road characteristic** – A geometric characteristic of a street or highway, including the type of facility, number and width of lanes, shoulder widths and lateral clearances, design speed, and horizontal and vertical alignment.
- ◆ **Roundabout** – An unsignalized intersection with a circulatory roadway around a central island with all entering vehicles yielding to the circulating traffic.
- ◆ **Shoulder** – A portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, emergency use, and lateral support of the subbase, base, and surface courses.
- ◆ **Stopping sight distance** – The length of road needed for a moving vehicle to come to a complete stop prior to an obstruction sighted on the road.
- ◆ **Traffic conditions** – A characteristic of traffic flow, including distribution of vehicle types in the traffic stream, directional distribution of traffic, lane use distribution of traffic, and type of driver population on a given facility.
- ◆ **Travel speed** – The average speed, in miles per hour, of a traffic computed as the length of roadway segment divided by the average travel time of the vehicles traversing the segment.
- ◆ **Travel time** – The average time spent by vehicles traversing a highway segment, including control delay, in seconds per vehicle or minutes per vehicle.
- ◆ **Trip Distribution and Assignment** – The predicted travel patterns of vehicle trips as they approach and depart a land use. Distribution refers to the travel pattern, usually defined in percentages or fractions, and assignment refers to vehicle trip ends.

- ◆ **Traffic forecast** – The predicted traffic volume of the analysis horizon year or time period. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- ◆ **Traffic impact analysis** – A *traffic impact analysis* (TIA) is an engineering and planning study that forecasts the potential traffic and transportation impacts of a proposed development on an area, neighborhood, or community. Reports can also be referred to as a traffic impact study (TIS).
- ◆ **Trip generation** – The number of vehicle trips generated by a development or land use. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- ◆ **Two-way left-turn lane** – A lane in the median area that extends continuously along a street or highway and is marked to provide a deceleration and storage area, out of the through-traffic stream, for vehicles traveling in either direction to use in marking left turns at intersections and driveways.
- ◆ **Two-way stop-controlled** – The type of traffic control at an intersection where drivers on the minor street or driver turning left from the major street wait for a gap in the major-street traffic to complete a maneuver. Typically the minor approaches are stop-controlled.
- ◆ **Unsignalized intersection** – An intersection not controlled by traffic signals.
- ◆ **Upstream** – The direction from which traffic is flowing.
- ◆ **Volume** – The number of persons or vehicles passing a point on a lane, roadway, or other traffic-way during some time interval, often one hour, expressed in vehicles, bicycles, or persons per hour.
- ◆ **Volume-to-capacity ratio** – The ratio of flow rate to capacity for a transportation facility.
- ◆ **Walkway** – A facility provided for pedestrian movement and segregated from vehicle traffic by a curb, or provide for on a separate right-of-way.

## Appendix B

### Summary Traffic Counts

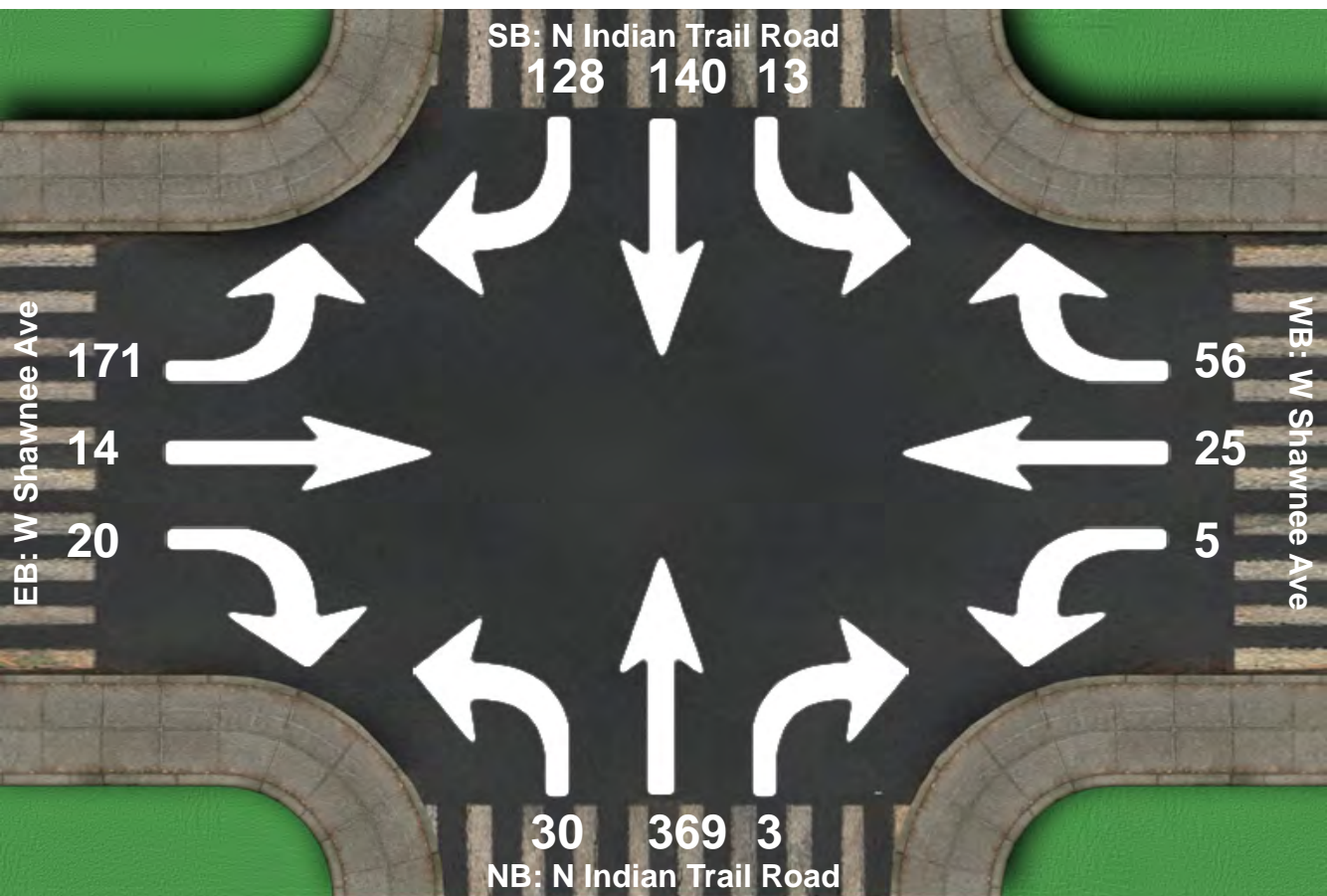
DRAFT



# Intersection Peak Hour

Location: N Indian Trail Road at W Shawnee Ave, Spokane, WA  
GPS Coordinates:  
Date: 2016-04-28  
Day of week: Thursday  
Weather:  
Analyst: MMI

NORTH  
(COUNT BOARD  
REVERSED)



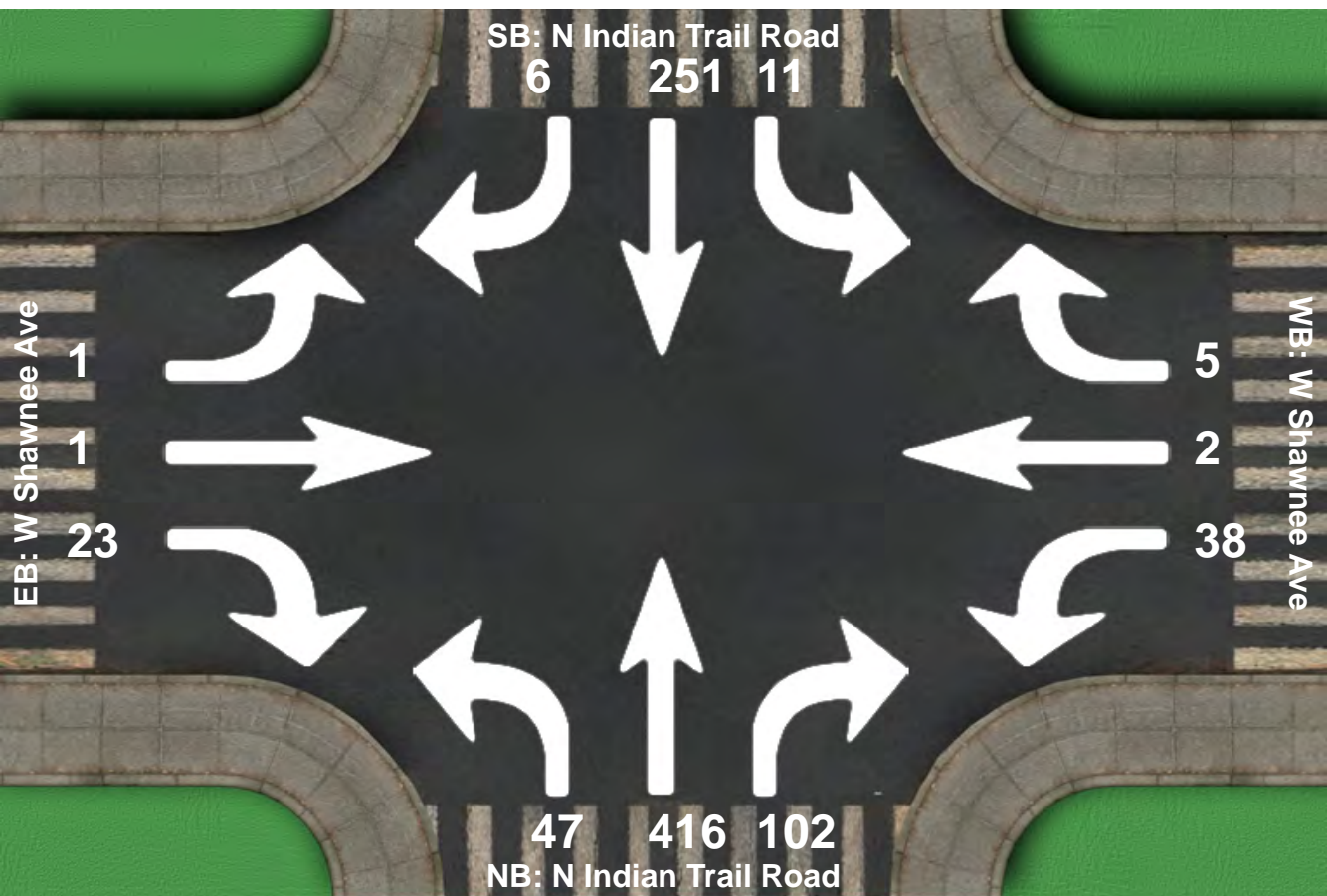
# Intersection Peak Hour

07:45 - 08:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	13	140	128	5	25	56	30	369	3	171	14	20	974
Factor	0.65	0.71	0.71	0.62	0.37	0.74	0.75	0.81	0.75	0.59	0.44	0.62	0.73
Approach Factor	0.76			0.72			0.81			0.58			

# Intersection Peak Hour

Location: N Indian Trail Road at W Shawnee Ave, Spokane, WA  
GPS Coordinates:  
Date: 2016-04-27  
Day of week: Wednesday  
Weather:  
Analyst: MMI



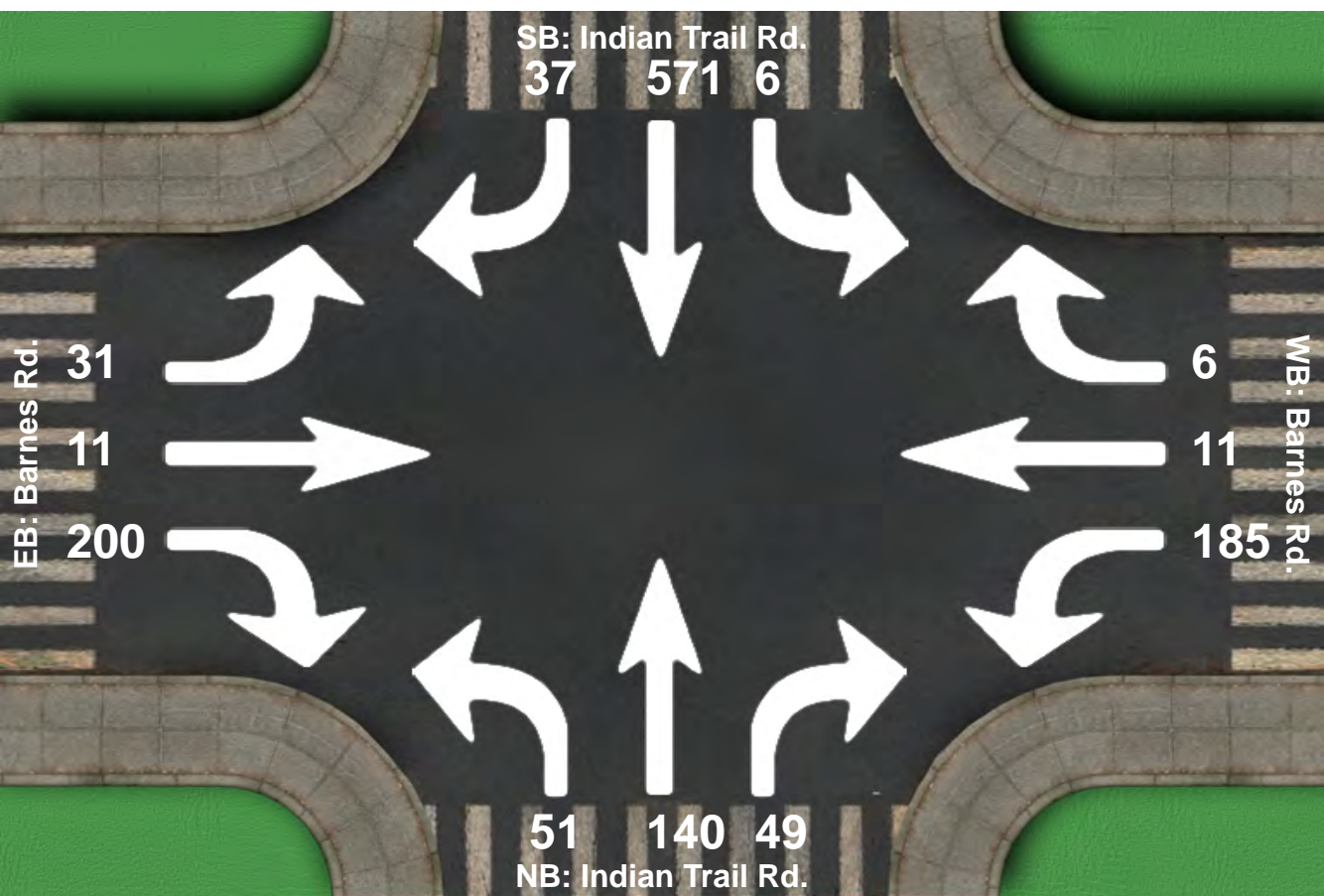
## Intersection Peak Hour

16:45 - 17:45

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	11	251	6	38	2	5	47	416	102	1	1	23	903
Factor	0.55	0.92	0.50	0.79	0.50	0.42	0.69	0.94	0.82	0.25	0.25	0.57	0.93
Approach Factor	0.96			0.80			0.94			0.62			

# Intersection Peak Hour

Location: Indian Trail Rd. at Barnes Rd., Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-02  
Day of week: Wednesday  
Weather: Showers  
Analyst: Mike McCluskey



# Intersection Peak Hour

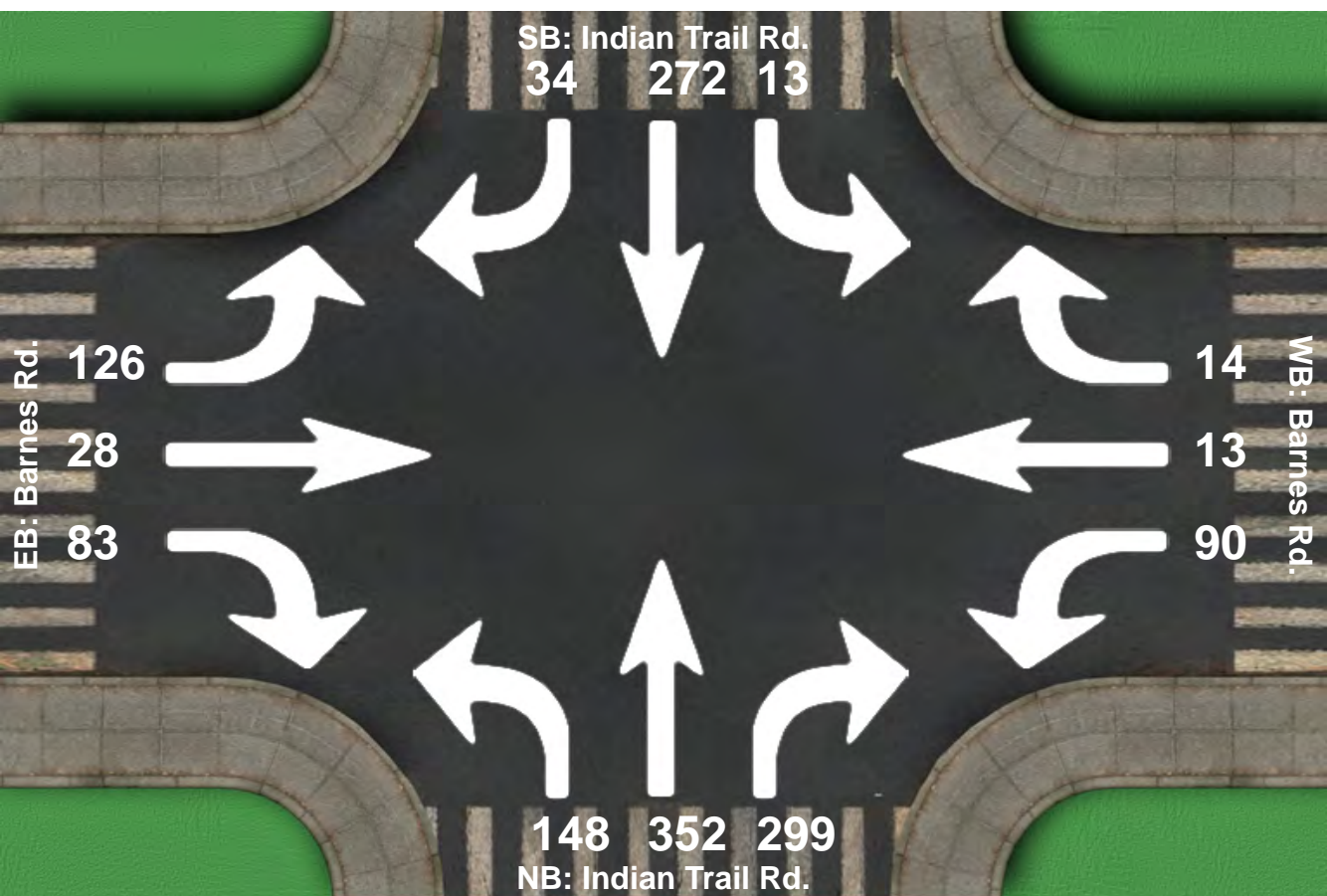
07:00 - 08:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	6	571	37	185	11	6	51	140	49	31	11	200	1298
Factor	0.75	0.86	0.77	0.89	0.55	0.50	0.75	0.80	0.58	0.60	0.55	0.85	0.92
Approach Factor	0.86			0.89			0.78			0.89			



# Intersection Peak Hour

Location: Indian Trail Rd. at Barnes Rd., Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-02  
Day of week: Wednesday  
Weather: Cloudy  
Analyst: Mike McCluskey



# Intersection Peak Hour

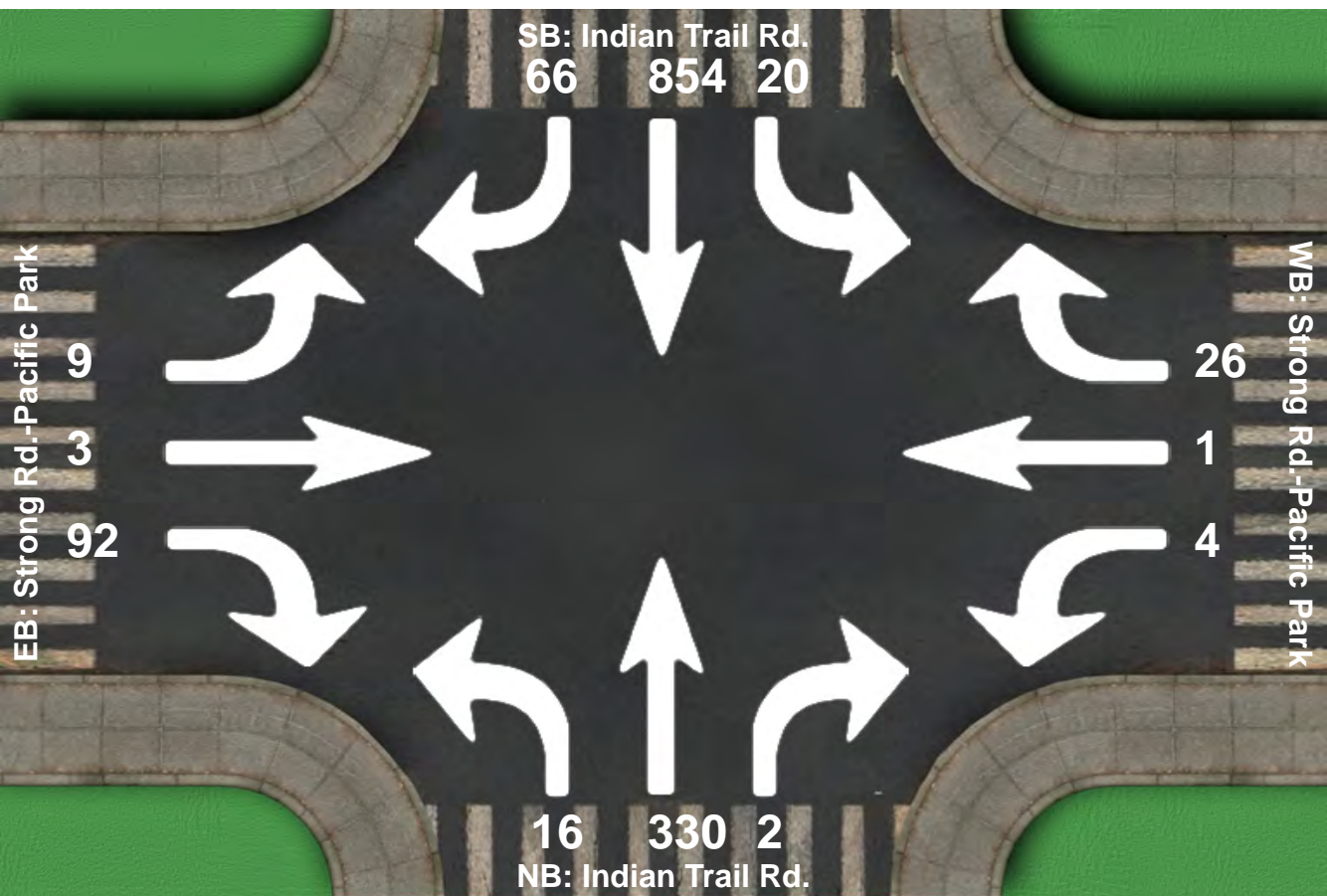
17:00 - 18:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	13	272	34	90	13	14	148	352	299	126	28	83	1472
Factor	0.65	0.80	0.77	0.83	0.54	0.70	0.82	0.81	0.79	0.88	0.58	0.90	0.92
Approach Factor	0.82			0.94			0.89			0.83			



# Intersection Peak Hour

Location: Indian Trail Rd. at Strong Rd.-Pacific Park, Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-03  
Day of week: Thursday  
Weather: Rain  
Analyst: Mike McCluskey



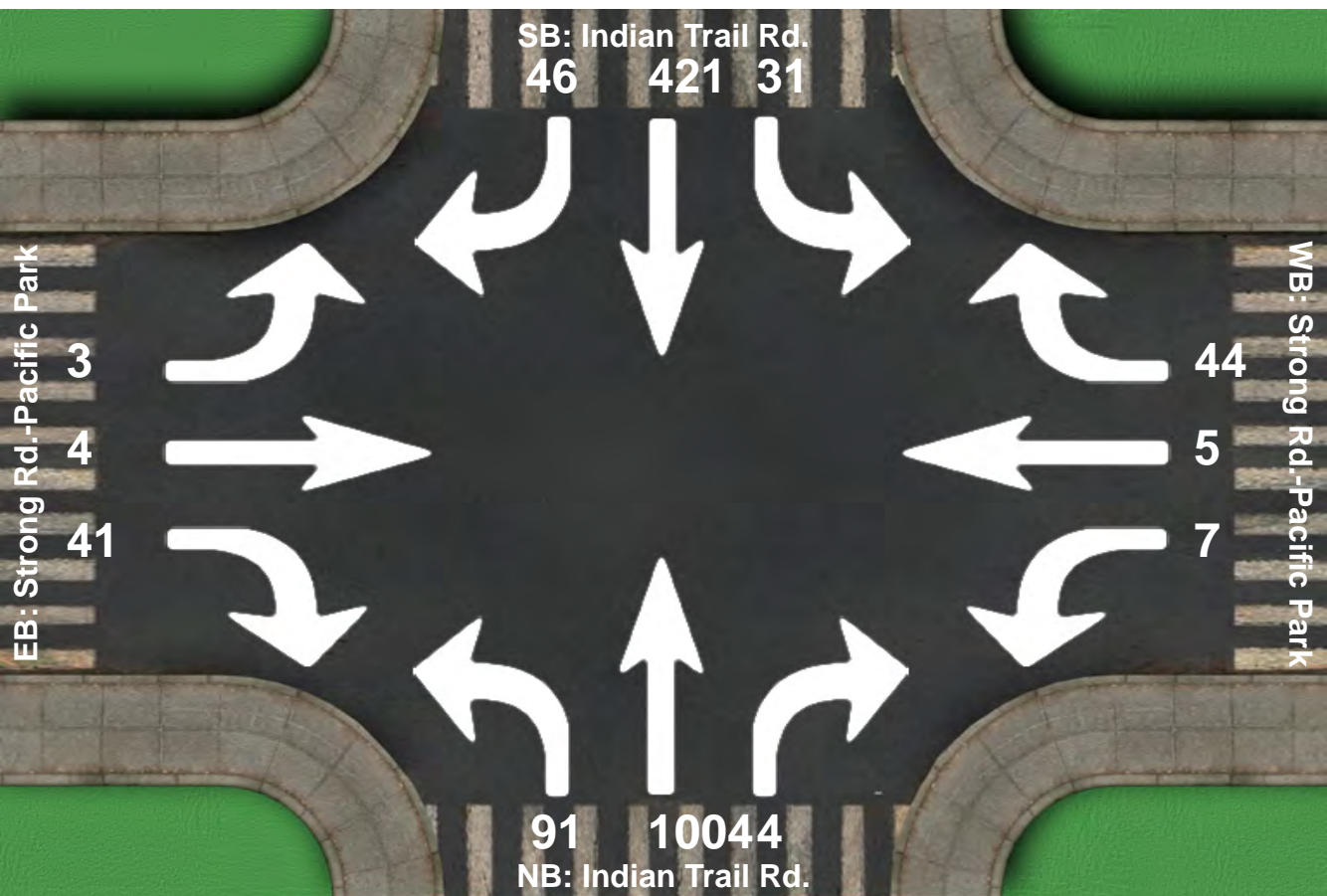
# Intersection Peak Hour

07:30 - 08:30

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	20	854	66	4	1	26	16	330	2	9	3	92	1423
Factor	0.50	0.86	0.53	0.33	0.25	0.72	0.57	0.91	0.25	0.75	0.38	0.79	0.90
Approach Factor	0.84			0.70			0.92			0.81			

# Intersection Peak Hour

Location: Indian Trail Rd. at Strong Rd.-Pacific Park, Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-03  
Day of week: Thursday  
Weather: Cloudy  
Analyst: Mike McCluskey



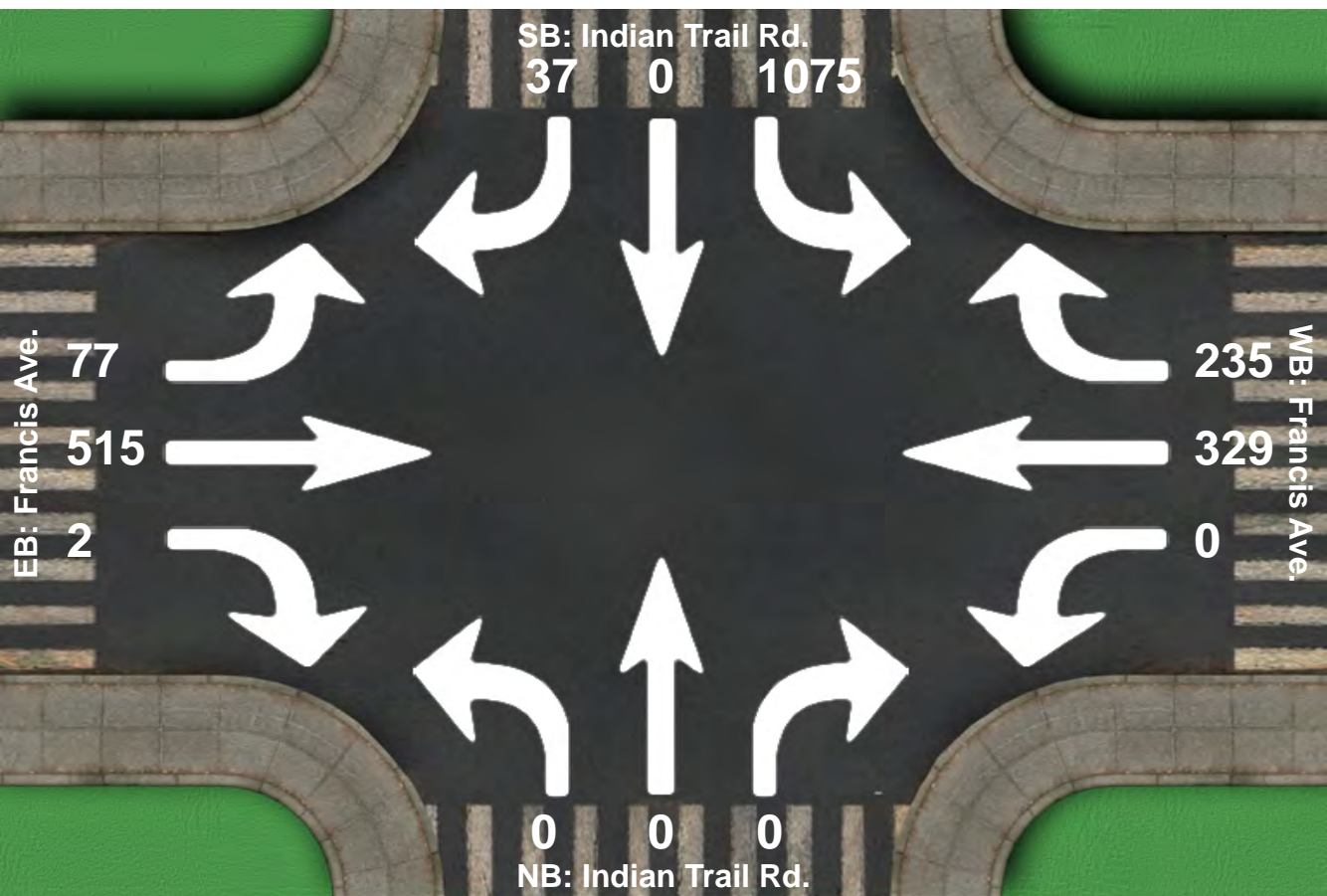
## Intersection Peak Hour

17:00 - 18:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	31	421	46	7	5	44	91	1004	4	3	4	41	1701
Factor	0.77	0.92	0.77	0.58	0.42	0.73	0.84	0.87	0.50	0.25	0.50	0.68	0.94
Approach Factor	0.94			0.74			0.89			0.75			

# Intersection Peak Hour

Location: Indian Trail Rd. at Francis Ave., Spokane WA.  
GPS Coordinates:  
Date: 2016-03-08  
Day of week: Tuesday  
Weather: Sunny  
Analyst: Mike McCluskey



## Intersection Peak Hour

07:00 - 08:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	1075	0	37	0	329	235	0	0	0	77	515	2	2270
Factor	0.88	0.00	0.51	0.00	0.89	0.74	0.00	0.00	0.00	0.64	0.84	0.25	0.90
Approach Factor	0.86			0.83			0.00			0.89			

Intersection: Indian Trail Rd/Francis Ave  
 Project: Windhaven  
 City: Spokane, WA

Date: 3/8/2016  
 Time: 5:00 PM  
 Analyst: MMI

Francis Avenue	N - S Street:				Indian Trail Road								Francis Avenue	
					IN	0.84	OUT							
					522	0%	1149							
						0								
					77	SBT	445							
					SBR		SBL							
	OUT	705	141	EBL					WBR	1008	1636	IN		
	0.93	0%	454	EBT					WBT	628	0.0067	0.98		
	IN	595	0	EBR					WBL	0	900	OUT		
	Total PHF: 0.94 Total Trucks: 0 Total Entering: 2754				NBL		NBR							
0					NBT	1								
					0									
0					100%	1								
OUT					0.25	IN								
E - W Street	N - S Street:				Indian Trail Road								E - W Street	

#### Total Volumes:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	0	0	1	90	0	17	42	110	0	0	154	242	656
15 - 30	0	0	0	109	0	28	34	117	0	0	170	244	702
30 - 45	0	0	0	134	0	21	42	118	0	0	147	270	732
45 - 60	0	0	0	112	0	11	23	109	0	0	157	252	664
Total	0	0	1	445	0	77	141	454	0	0	628	1008	2754

#### Automobiles:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15				90		17	42	109			152	241	651
15 - 30				109		28	34	116			168	243	698
30 - 45				134		21	42	118			147	269	731
45 - 60				112		11	23	109			156	249	660
Total	0	0	0	445	0	77	141	452	0	0	623	1002	2740

#### Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15	0		1				0	1			2	1	5
15 - 30	0		0				0	1			2	1	4
30 - 45	0		0				0	0			0	1	1
45 - 60	0		0				0	0			1	3	4
Total	0	0	1	0	0	0	0	2	0	0	5	6	14



Intersection: **Alberta St/Francis Ave**  
 Project: **Windhaven**  
 City: **Spokane, WA**

Date: **3/15/2016**  
 Time: **7:15 AM**  
 Analyst: **MMI**

Francis Avenue	N - S Street:				Alberta Street										Francis Avenue		
					IN	0.70	OUT										
					221	0%	65										
						114											
					29	SBT	78										
									SBR		SBL						
	OUT	712	15	EBL					WBR	27	716	IN					
	0.88	1%	1036	EBT					WBT	536	0.0307	0.86					
	IN	1175	124	EBR					WBL	153	1212	OUT					
					NBL		NBR										
E - W Street					147	NBT	98								E - W Street		
	Total PHF: 0.93								23								
	Total Trucks: 0				391				4%								
	Total Entering: 2380				OUT				0.77								
N - S Street:				Alberta Street													

#### Total Volumes:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	19	2	16	24	27	7	4	286	45	33	102	10	575
15 - 30	30	7	24	29	43	7	2	298	35	32	126	7	640
30 - 45	47	4	36	14	26	10	5	254	26	47	147	3	619
45 - 60	51	10	22	11	18	5	4	198	18	41	161	7	546
Total	147	23	98	78	114	29	15	1036	124	153	536	27	2380

#### Automobiles:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	17	2	15	24	26	7	4	286	45	33	98	10	567
15 - 30	30	7	24	29	43	7	2	294	35	31	120	7	629
30 - 45	42	3	36	14	26	10	5	252	26	45	144	3	606
45 - 60	48	10	22	11	18	5	4	194	18	40	156	7	533
Total	137	22	97	78	113	29	15	1026	124	149	518	27	2335

#### Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15	2	0	1	0	1	0	0	0	0	0	4	0	8
15 - 30	0	0	0	0	0	0	0	4	0	1	6	0	11
30 - 45	5	1	0	0	0	0	0	2	0	2	3	0	13
45 - 60	3	0	0	0	0	0	0	4	0	1	5	0	13
Total	10	1	1	0	1	0	0	10	0	4	18	0	45

Intersection: Alberta St/Francis Ave  
 Project: Windhaven  
 City: Spokane, WA

Date: 3/15/2016  
 Time: 5:00 PM  
 Analyst: MMI

Francis Avenue	N - S Street:				Alberta Street										Francis Avenue
					IN	0.69	OUT								
					113	1%	159								
						49									
					25	SBT	39								
									SBR		SBL				
	OUT	1637	33	EBL					WBR	18	1399	IN			
	0.87	0%	862	EBT					WBT	1240	0.0214	0.97			
	IN	972	77	EBR					WBL	141	1025	OUT			
					NBL		NBR								
				372	NBT	124									
Total PHF: 0.96					108										
Total Trucks: 0				267	0%	604									
Total Entering: 3088				OUT	0.95	IN									
E - W Street	N - S Street:				Alberta Street										E - W Street

#### Total Volumes:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	96	28	27	6	8	7	6	206	12	30	313	7	746
15 - 30	88	29	40	11	14	7	10	207	18	39	298	4	765
30 - 45	85	28	24	16	21	4	5	206	22	34	326	2	773
45 - 60	103	23	33	6	6	7	12	243	25	38	303	5	804
Total	372	108	124	39	49	25	33	862	77	141	1240	18	3088

#### Automobiles:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	96	28	27	6	8	6	6	206	12	30	303	7	735
15 - 30	87	29	40	11	14	7	10	207	18	39	295	4	761
30 - 45	84	28	24	16	21	4	5	206	22	34	317	2	763
45 - 60	102	23	33	6	6	7	12	243	25	38	295	5	795
Total	369	108	124	39	49	24	33	862	77	141	1210	18	3054

#### Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15	0		0			1		0			10		11
15 - 30	1		0			0		0			3		4
30 - 45	1		0			0		0			9		10
45 - 60	1		0			0		0			8		9
Total	3	0	0	0	0	1	0	0	0	0	30	0	34

Intersection: Ash St/Francis Ave  
 Project: Windhaven  
 City: Spokane, WA

Date: 3/10/2016  
 Time: 7:15 AM  
 Analyst: MMI

Francis Avenue	N - S Street:				Ash Street										Francis Avenue
					IN	0.95	OUT								
					1374	3%	0								
						673									
					393	SBT	308								
									SBR		SBL				
	OUT	895	0	EBL					WBR	0	610	IN			
	0.87	1%	1053	EBT					WBT	502	0.0656	0.83			
	IN	1234	181	EBR					WBL	108	1361	OUT			
					NBL		NBR								
0					NBT	0									
					0										
962					#DIV/0!	0									
OUT					#DIV/0!	IN									
E - W Street	N - S Street:				Ash Street										E - W Street

#### Total Volumes:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	0	0	0	86	185	88	0	260	50	24	99	0	792
15 - 30	0	0	0	92	171	98	0	299	56	23	130	0	869
30 - 45	0	0	0	63	172	88	0	293	37	34	150	0	837
45 - 60	0	0	0	67	145	119	0	201	38	27	123	0	720
Total	0	0	0	308	673	393	0	1053	181	108	502	0	3218

#### Automobiles:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15				84	183	86		258	50	24	89		774
15 - 30				89	165	96		295	53	20	124		842
30 - 45				60	159	86		292	37	34	141		809
45 - 60				65	142	117		201	38	27	111		701
Total	0	0	0	298	649	385	0	1046	178	105	465	0	3126

#### Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15				2	2	2		2	0	0	10		18
15 - 30				3	6	2		4	3	3	6		27
30 - 45				3	13	2		1	0	0	9		28
45 - 60				2	3	2		0	0	0	12		19
Total	0	0	0	10	24	8	0	7	3	3	37	0	92

Intersection: Ash St/Francis Ave  
 Project: Windhaven  
 City: Spokane, WA

Date: 3/10/2016  
 Time: 5:00 PM  
 Analyst: MMI

Francis Avenue		N - S Street:				Ash Street								Francis Avenue	
						IN	0.94	OUT							
						1140	4%					0			
						562									
						362	SBT	216							
						SBR		SBL							
		OUT	1666	0	EBL					WBR	0	1523	IN		
		0.98	1%	961	EBT					WBT	1304	0.0492	0.96		
		IN	1054	93	EBR					WBL	219	1177	OUT		
		Total PHF: 0.98 Total Trucks: 0 Total Entering: 3717				NBL		NBR							
0	NBT					0									
874	#DIV/0!					0									
OUT	#DIV/0!					IN									
E - W Street		N - S Street:				Ash Street								E - W Street	



Intersection: Maple St/Francis Ave  
 Project: Windhaven  
 City: Spokane, WA

Date: 3/9/2016  
 Time: 7:15 AM  
 Analyst: MMI

Francis Avenue	N - S Street:				Maple Street								Francis Avenue
					IN	#DIV/0!	OUT						
					0	#DIV/0!	788						
					0								
					0	SBT	0						
					SBR	SBL							
	OUT	510	235	EBL					WBR	78	582	IN	
	0.88	1%	1089	EBT					WBT	504	0.0275	0.87	
	IN	1324	0	EBR					WBL	0	1234	OUT	
					NBL	NBR							
6					NBT	145							
E - W Street	Total PHF: 0.93												
	Total Trucks: 0				0	4%	626						
	Total Entering: 2532				OUT	0.97	IN						
	N - S Street:				Maple Street								

#### Total Volumes:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	2	120	33	0	0	0	40	293	0	0	117	17	622
15 - 30	2	122	34	0	0	0	70	308	0	0	110	14	660
30 - 45	0	118	44	0	0	0	69	283	0	0	141	26	681
45 - 60	2	115	34	0	0	0	56	205	0	0	136	21	569
Total	6	475	145	0	0	0	235	1089	0	0	504	78	2532

#### Automobiles:

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15		118	32				39	290			114	14	607
15 - 30		116	33				69	306			106	13	643
30 - 45		116	43				68	278			141	23	669
45 - 60		115	31				56	203			135	20	560
Total	0	465	139	0	0	0	232	1077	0	0	496	70	2479

#### Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15	2	2	1				1	3			3	3	15
15 - 30	2	6	1				1	2			4	1	17
30 - 45	0	2	1				1	5			0	3	12
45 - 60	2	0	3				0	2			1	1	9
Total	6	10	6	0	0	0	3	12	0	0	8	8	53

Date:	3/9/2016
Time:	5:00 PM
Analysist:	MMI

Francis Avenue	N - S Street:				Maple Street										Francis Avenue
					IN	#DIV/0!	OUT								
					0	#DIV/0!	1378								
					0										
					0	SBT	0								
					SBR	SBL									
	OUT	1501	308	EBL							WBR	207	1362	IN	
	0.9%	1%	879	EBT							WBT	1155	0.0338	0.9%	
	IN	1187	0	EBR							WBL	0	1044	OUT	
	E - W Street					NBL	NBR								
346						NBT	165								
Total PHF: 0.97										863					
Total Trucks: 0				0	0%	1374									
Total Entering: 3923				OUT	0.95	IN									
N - S Street:				Maple Street										E - W Street	

**Total Volumes:**

	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	83	202	35	0	0	0	72	222	0	0	295	48	957
15 - 30	81	221	50	0	0	0	80	228	0	0	297	58	1015
30 - 45	96	231	36	0	0	0	83	221	0	0	284	49	1000
45 - 60	86	209	44	0	0	0	73	208	0	0	279	52	951
Total	346	863	165	0	0	0	308	879	0	0	1155	207	3923

**Automobiles:**

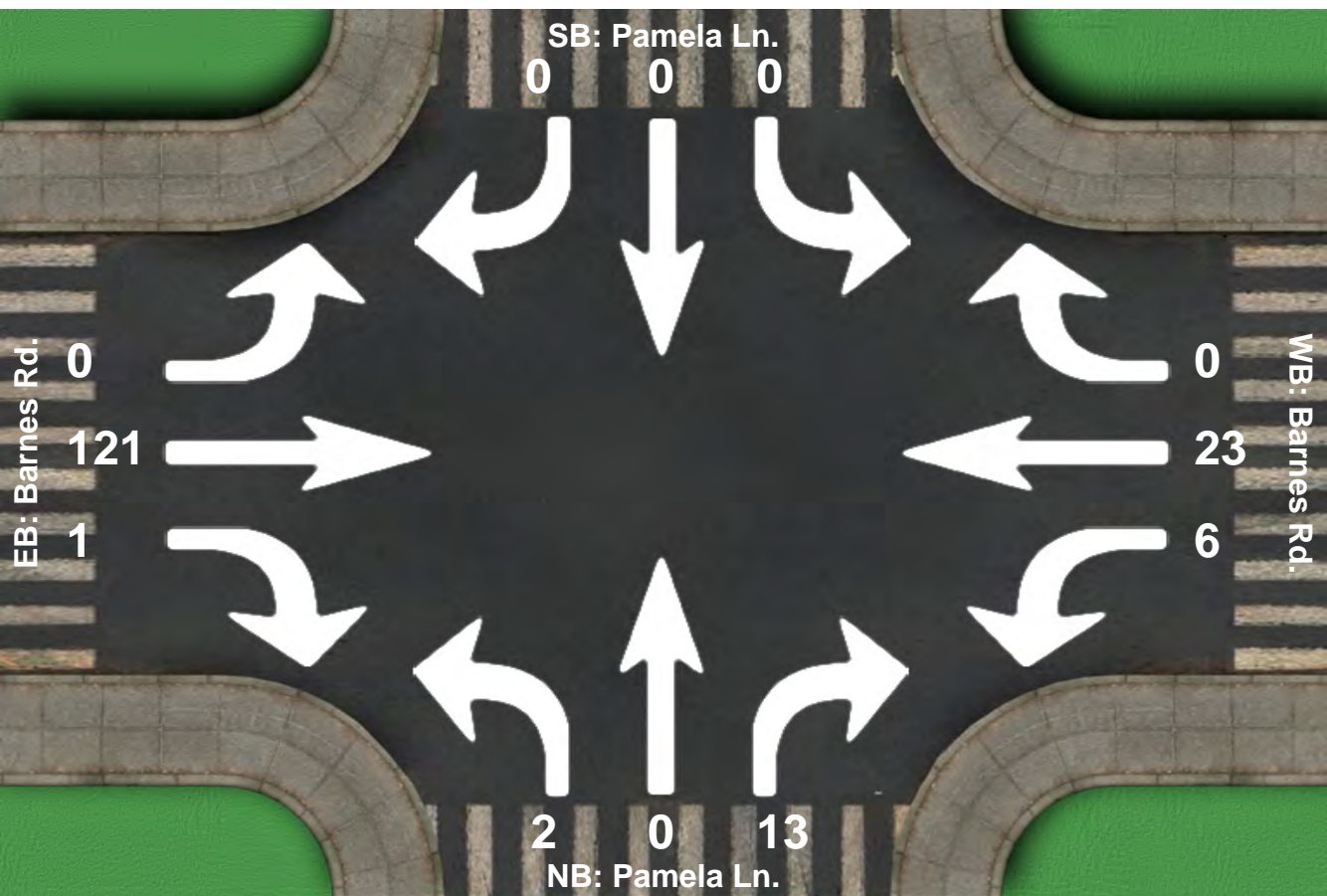
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	Total
0 - 15	83	202	34				71	221			288	45	944
15 - 30	81	221	50				79	228			285	56	1000
30 - 45	96	230	36				83	221			274	48	988
45 - 60	86	208	44				71	205			270	50	934
Total	346	861	164	0	0	0	304	875	0	0	1117	199	3866

Heavy Vehicles: Approach Entered only - TM not correct

	NB Approach			SB Approach			EB Approach			WB Approach			Total
0 - 15	0	0	1				1	1			7	3	13
15 - 30	0	0	0				1	0			12	2	15
30 - 45	0	1	0				0	0			10	1	12
45 - 60	0	1	0				2	3			9	2	17
Total	0	2	1	0	0	0	4	4	0	0	38	8	57

# Intersection Peak Hour

Location: Pamela Ln. at Barnes Rd., Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-01  
Day of week: Tuesday  
Weather: Clear  
Analyst: Mike McCluskey



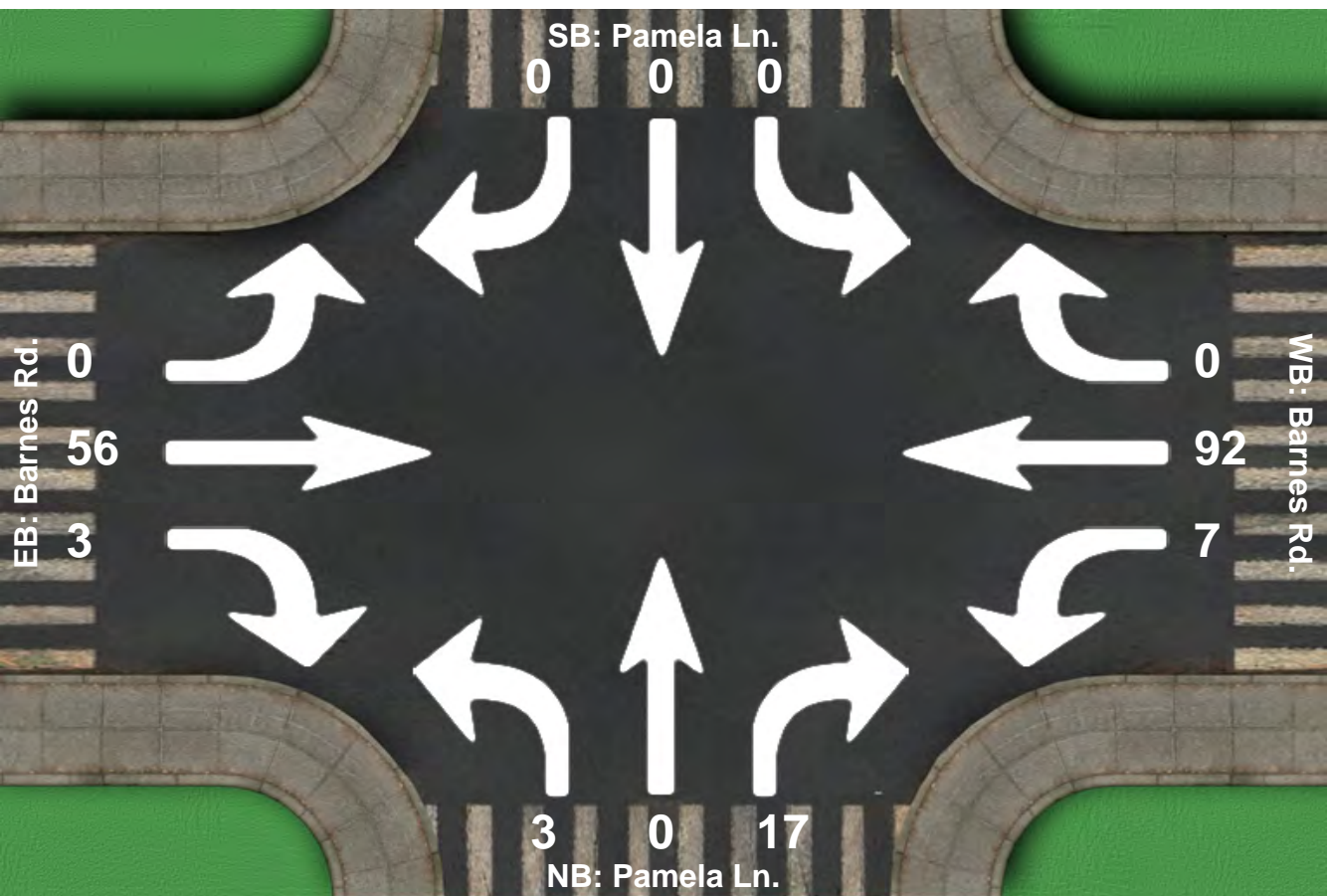
## Intersection Peak Hour

07:00 - 08:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	6	23	0	2	0	13	0	121	1	166
Factor	0.00	0.00	0.00	0.38	0.64	0.00	0.50	0.00	0.81	0.00	0.70	0.25	0.74
Approach Factor	0.00			0.66			0.94			0.71			

# Intersection Peak Hour

Location: Pamela Ln. at Barnes Rd., Spokane, WA.  
GPS Coordinates:  
Date: 2016-03-01  
Day of week: Tuesday  
Weather: Rain  
Analyst: Mike McCluskey



## Intersection Peak Hour

17:00 - 18:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	0	7	92	0	3	0	17	0	56	3	178
Factor	0.00	0.00	0.00	0.44	0.77	0.00	0.38	0.00	0.71	0.00	0.88	0.38	0.95
Approach Factor	0.00			0.82			0.83			0.82			

























## Appendix C

### LOS Summary Worksheets

DRAFT

1: Indian Trail Road & Shawnee Ave  
Existing - AM Peak Hour
























Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	25	56	171	14	20	13	140	128	30	363	3
Future Volume (veh/h)	5	25	56	171	14	20	13	140	128	30	363	3
Number	3	8	18	7	4	14	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)	0.99		0.99	0.99		0.99	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	7	34	77	234	19	27	18	192	175	41	497	4
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	418	126	286	348	174	247	480	945	835	659	966	862
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.52	0.52	0.05	0.54	0.54
Sat Flow, veh/h	1369	488	1105	1255	670	952	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	7	0	111	234	0	46	18	192	175	41	497	4
Grp Sat Flow(s),veh/h/ln	1369	0	1592	1255	0	1621	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.3	0.0	4.3	14.2	0.0	1.7	0.4	4.4	4.6	0.8	13.8	0.1
Cycle Q Clear(g_c), s	2.0	0.0	4.3	18.6	0.0	1.7	0.4	4.4	4.6	0.8	13.8	0.1
Prop In Lane	1.00		0.69	1.00		0.59	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	418	0	413	348	0	420	480	945	835	659	966	862
V/C Ratio(X)	0.02	0.00	0.27	0.67	0.00	0.11	0.04	0.20	0.21	0.06	0.51	0.00
Avail Cap(c_a), veh/h	418	0	413	348	0	420	664	945	835	815	966	862
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.8	0.0	23.0	30.4	0.0	22.1	8.7	9.9	9.9	7.4	11.3	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.3	5.0	0.0	0.1	0.0	0.5	0.6	0.0	2.0	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	0.1	0.0	2.0	5.4	0.0	0.8	0.2	2.3	2.1	0.4	7.3	0.0
LnGrp Delay(d),s/veh	22.8	0.0	23.4	35.4	0.0	22.2	8.8	10.3	10.5	7.4	13.3	8.2
LnGrp LOS	C		C	D		C	A	B	B	A	B	A
Approach Vol, veh/h		118			280			385			542	
Approach Delay, s/veh		23.4			33.2			10.3			12.8	
Approach LOS		C			C			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.9	45.0		25.0	6.6	46.3		25.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.8	6.6		20.6	2.4	15.8		6.3				
Green Ext Time (p_c), s	0.0	6.4		0.0	0.0	5.9		1.8				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			17.3									
HCM 2010 LOS			B									
<b>Notes</b>												

## 2: Indian Trail Road & Barnes Rd























### Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	11	200	185	11	6	51	140	49	6	571	37
Future Volume (veh/h)	31	11	200	185	11	6	51	140	49	6	571	37
Number	3	8	18	7	4	14	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)	0.99		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	34	12	217	201	12	7	55	152	53	7	621	40
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	457	349	294	545	306	179	314	611	499	476	951	61
Arrive On Green	0.04	0.22	0.22	0.14	0.31	0.30	0.06	0.38	0.38	0.02	0.34	0.34
Sat Flow, veh/h	1513	1588	1341	1513	978	570	1469	1605	1310	1469	2796	180
Grp Volume(v), veh/h	34	12	217	201	0	19	55	152	53	7	325	336
Grp Sat Flow(s),veh/h/ln	1513	1588	1341	1513	0	1548	1469	1605	1310	1469	1466	1510
Q Serve(g_s), s	1.0	0.4	9.2	5.7	0.0	0.5	1.4	4.0	1.6	0.2	11.5	11.6
Cycle Q Clear(g_c), s	1.0	0.4	9.2	5.7	0.0	0.5	1.4	4.0	1.6	0.2	11.5	11.6
Prop In Lane	1.00		1.00	1.00		0.37	1.00		1.00	1.00		0.12
Lane Grp Cap(c), veh/h	457	349	294	545	0	485	314	611	499	476	499	514
V/C Ratio(X)	0.07	0.03	0.74	0.37	0.00	0.04	0.18	0.25	0.11	0.01	0.65	0.65
Avail Cap(c_a), veh/h	797	674	569	745	0	657	625	1074	877	846	981	1010
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.0	18.8	22.3	13.2	0.0	14.7	11.9	13.0	12.2	12.5	17.1	17.1
Incr Delay (d2), s/veh	0.1	0.0	3.6	0.4	0.0	0.0	0.3	0.3	0.1	0.0	2.1	2.0
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	0.2	3.7	2.4	0.0	0.2	0.6	1.8	0.6	0.1	4.9	5.0
LnGrp Delay(d),s/veh	17.1	18.8	25.9	13.6	0.0	14.7	12.2	13.3	12.4	12.5	19.2	19.2
LnGrp LOS	B	B	C	B		B	B	B	B	B	B	B
Approach Vol, veh/h		263			220			260			668	
Approach Delay, s/veh		24.4			13.7			12.9			19.1	
Approach LOS		C			B			B			B	
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	4.6	27.3	6.2	23.2	7.0	24.8	11.9	17.5				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	2.2	6.0	3.0	2.5	3.4	13.6	7.7	11.2				
Green Ext Time (p_c), s	0.0	6.1	0.0	1.1	0.1	5.8	0.5	0.9				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			18.1									
HCM 2010 LOS			B									
<b>Notes</b>												













### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	3	92	4	1	26	16	330	2	20	854	66
Future Volume (veh/h)	9	3	92	4	1	26	16	330	2	20	854	66
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	10	3	102	4	1	29	18	367	2	22	949	73
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	278	66	223	280	55	221	309	1187	1007	739	1187	1006
Arrive On Green	0.15	0.15	0.15	0.15	0.15	0.15	0.69	0.69	0.69	0.69	0.69	0.69
Sat Flow, veh/h	1017	446	1500	1014	372	1486	534	1714	1455	979	1714	1453
Grp Volume(v), veh/h	13	0	102	5	0	29	18	367	2	22	949	73
Grp Sat Flow(s),veh/h/ln	1463	0	1500	1385	0	1486	534	1714	1455	979	1714	1453
Q Serve(g_s), s	0.0	0.0	3.1	0.0	0.0	0.9	1.2	4.2	0.0	0.5	19.2	0.8
Cycle Q Clear(g_c), s	0.3	0.0	3.1	0.1	0.0	0.9	20.4	4.2	0.0	4.7	19.2	0.8
Prop In Lane	0.77		1.00	0.80		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	344	0	223	335	0	221	309	1187	1007	739	1187	1006
V/C Ratio(X)	0.04	0.00	0.46	0.01	0.00	0.13	0.06	0.31	0.00	0.03	0.80	0.07
Avail Cap(c_a), veh/h	875	0	777	837	0	770	323	1230	1044	764	1230	1042
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	18.3	0.0	19.5	18.3	0.0	18.6	12.4	3.0	2.4	3.9	5.3	2.5
Incr Delay (d2), s/veh	0.0	0.0	1.5	0.0	0.0	0.3	0.4	0.7	0.0	0.1	5.7	0.1
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	0.0	1.4	0.1	0.0	0.4	0.2	2.2	0.0	0.1	10.6	0.4
LnGrp Delay(d),s/veh	18.4	0.0	21.0	18.3	0.0	18.8	12.7	3.7	2.4	4.0	11.0	2.6
LnGrp LOS	B		C	B		B	B	A	A	A	B	A
Approach Vol, veh/h		115			34			387			1044	
Approach Delay, s/veh		20.7			18.7			4.1			10.3	
Approach LOS		C			B			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		38.7		11.5		38.7		11.5				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		22.4		2.9		21.2		5.1				
Green Ext Time (p_c), s		11.5		0.6		12.5		0.6				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			9.7									
HCM 2010 LOS			A									
<b>Notes</b>												

#### 4: Francis Ave #14 & Indian Trail Road Existing - AM Peak Hour





















Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	77	517	329	235	1111	38		
Future Volume (veh/h)	77	517	329	235	1111	38		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	86	574	366	0	1234	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	422	1154	1154	512	1546	695		
Arrive On Green	0.35	0.35	0.35	0.00	0.47	0.00		
Sat Flow, veh/h	981	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	86	574	366	0	1234	0		
Grp Sat Flow(s),veh/h/ln	981	1629	1629	1445	1633	1530		
Q Serve(g_s), s	3.2	6.4	3.8	0.0	14.9	0.0		
Cycle Q Clear(g_c), s	7.0	6.4	3.8	0.0	14.9	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	422	1154	1154	512	1546	695		
V/C Ratio(X)	0.20	0.50	0.32	0.00	0.80	0.00		
Avail Cap(c_a), veh/h	835	2524	2524	1120	1828	827		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	13.5	11.8	10.9	0.0	10.4	0.0		
Incr Delay (d2), s/veh	0.3	0.4	0.2	0.0	2.2	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	0.9	2.9	1.7	0.0	7.0	0.0		
LnGrp Delay(d),s/veh	13.8	12.2	11.1	0.0	12.6	0.0		
LnGrp LOS	B	B	B		B			
Approach Vol, veh/h		660	366		1234			
Approach Delay, s/veh		12.4	11.1		12.6			
Approach LOS		B	B		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		20.5				20.5		26.0
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		35.1				35.1		25.1
Max Q Clear Time (g_c+I1), s		5.8				9.0		16.9
Green Ext Time (p_c), s		6.7				6.5		4.2
Intersection Summary								
HCM 2010 Ctrl Delay			12.3					
HCM 2010 LOS			B					
Notes								



5: Alberta St & Francis Ave #14  
Existing - AM Peak Hour


Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	1246	149	153	536	27	147	23	98	78	114	29
Future Volume (veh/h)	18	1246	149	153	536	27	147	23	98	78	114	29
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		0.97	1.00		0.97
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	1800	1767	1800	1731	1800	1800	1800	1832	1872	1800	1872	1872
Adj Flow Rate, veh/h	19	1340	160	165	576	29	144	45	105	84	123	31
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	494	1425	169	240	1681	85	258	72	168	237	198	50
Arrive On Green	0.06	0.47	0.46	0.10	0.51	0.50	0.15	0.15	0.13	0.14	0.14	0.12
Sat Flow, veh/h	1714	3022	359	1648	3314	167	1714	479	1117	1714	1433	361
Grp Volume(v), veh/h	19	741	759	165	297	308	144	0	150	84	0	154
Grp Sat Flow(s),veh/h/ln	1714	1678	1702	1648	1710	1770	1714	0	1595	1714	0	1794
Q Serve(g_s), s	0.6	43.3	44.1	4.9	10.7	10.8	8.1	0.0	9.2	4.6	0.0	8.4
Cycle Q Clear(g_c), s	0.6	43.3	44.1	4.9	10.7	10.8	8.1	0.0	9.2	4.6	0.0	8.4
Prop In Lane	1.00		0.21	1.00		0.09	1.00		0.70	1.00		0.20
Lane Grp Cap(c), veh/h	494	791	803	240	867	898	258	0	240	237	0	248
V/C Ratio(X)	0.04	0.94	0.95	0.69	0.34	0.34	0.56	0.00	0.62	0.35	0.00	0.62
Avail Cap(c_a), veh/h	576	816	828	256	867	898	445	0	414	362	0	379
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.5	25.9	26.3	22.1	15.2	15.3	40.8	0.0	41.9	40.4	0.0	42.2
Incr Delay (d2), s/veh	0.0	17.2	18.8	5.6	0.1	0.1	0.7	0.0	1.0	0.3	0.0	0.9
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	0.3	23.7	24.9	2.6	5.1	5.2	3.9	0.0	4.1	2.2	0.0	4.2
LnGrp Delay(d),s/veh	12.5	43.1	45.0	27.7	15.3	15.3	41.5	0.0	42.9	40.8	0.0	43.2
LnGrp LOS	B	D	D	C	B	B	D		D	D		D
Approach Vol, veh/h		1519			770			294			238	
Approach Delay, s/veh		43.7			18.0			42.2			42.3	
Approach LOS		D			B			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	10.0	57.5		18.7	14.0	53.5		17.5				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	11.0	49.0		25.0	11.0	49.0		20.0				
Max Q Clear Time (g_c+I1), s	2.6	12.8		11.2	6.9	46.1		10.4				
Green Ext Time (p_c), s	0.0	6.3		0.8	0.1	1.3		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay				36.4								
HCM 2010 LOS				D								
Notes												

# 6: Ash St #4S & Francis Ave #14

## Existing - AM Peak Hour


















Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↖	↑↑					↖	↑↑	↖
Traffic Volume (vph)	0	855	181	108	502	0	0	0	0	308	673	393
Future Volume (vph)	0	855	181	108	502	0	0	0	0	308	673	393
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3175		1605	3353					1716	3307	1523
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3175		1605	3353					1716	3307	1523
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	919	195	116	540	0	0	0	0	331	724	423
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	0	198
Lane Group Flow (vph)	0	1096	0	116	540	0	0	0	0	331	724	225
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		38.0		9.1	52.0					28.5	28.5	28.5
Effective Green, g (s)		38.9		10.0	52.9					29.1	29.1	29.1
Actuated g/C Ratio		0.43		0.11	0.59					0.32	0.32	0.32
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1372		178	1970					554	1069	492
v/s Ratio Prot		c0.35		c0.07	0.16						c0.22	
v/s Ratio Perm										0.19		0.15
v/c Ratio		0.80		0.65	0.27					0.60	0.68	0.46
Uniform Delay, d1		22.2		38.3	9.1					25.5	26.4	24.2
Progression Factor		1.00		0.94	0.39					0.85	0.86	0.94
Incremental Delay, d2		4.9		6.2	0.3					1.6	1.6	0.6
Delay (s)		27.1		42.2	3.9					23.3	24.4	23.3
Level of Service		C		D	A					C	C	C
Approach Delay (s)		27.1			10.7			0.0			23.8	
Approach LOS		C			B			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			22.3			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.73									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			67.1%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

# 7: Maple St #3N & Francis Ave #14

## Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	235	1089	0	0	396	78	6	475	145	0	0	0
Future Volume (vph)	235	1089	0	0	396	78	6	475	145	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.96				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3260		1454	4412				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3260		1454	4412				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	253	1171	0	0	426	84	6	511	156	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	66	0	0	0	0
Lane Group Flow (vph)	253	1171	0	0	494	0	5	602	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	24.1	61.1			32.1		19.4	19.4				
Effective Green, g (s)	25.0	62.0			33.0		20.0	20.0				
Actuated g/C Ratio	0.28	0.69			0.37		0.22	0.22				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	450	2265			1195		323	980				
v/s Ratio Prot	0.16	0.36			0.15							
v/s Ratio Perm							0.00	0.14				
v/c Ratio	0.56	0.52			0.41		0.02	0.61				
Uniform Delay, d1	27.8	6.8			21.3		27.3	31.5				
Progression Factor	0.91	0.61			1.00		1.00	1.00				
Incremental Delay, d2	0.7	0.7			1.1		0.0	1.2				
Delay (s)	26.0	4.7			22.3		27.3	32.7				
Level of Service	C	A			C		C	C				
Approach Delay (s)		8.5			22.3			32.6			0.0	
Approach LOS		A			C			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.4				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			67.1%				ICU Level of Service		C			
Analysis Period (min)			15									
Description: Count Date 7/20/09												























9: Barnes & Pamela  
Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	121	1	6	23	0	2	0	13	0	0	0
Future Vol, veh/h	0	121	1	6	23	0	2	0	13	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	74	74	74	74	74	74	74	74	74	74	74	74
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	164	1	8	31	0	3	0	18	0	0	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	31	0	0	165	0	0	211	211	164	220	212	31
Stage 1	-	-	-	-	-	-	164	164	-	47	47	-
Stage 2	-	-	-	-	-	-	47	47	-	173	165	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1582	-	-	1413	-	-	746	686	881	736	685	1043
Stage 1	-	-	-	-	-	-	838	762	-	967	856	-
Stage 2	-	-	-	-	-	-	967	856	-	829	762	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1582	-	-	1413	-	-	743	682	881	718	681	1043
Mov Cap-2 Maneuver	-	-	-	-	-	-	743	682	-	718	681	
Stage 1	-	-	-	-	-	-	838	762	-	967	851	-
Stage 2	-	-	-	-	-	-	962	851	-	812	762	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			1.6			9.3			0		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	860	1582	-	-	1413	-	-	-				
HCM Lane V/C Ratio	0.024	-	-	-	0.006	-	-	-				
HCM Control Delay (s)	9.3	0	-	-	7.6	-	-	0				
HCM Lane LOS	A	A	-	-	A	-	-	A				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-				

1: Indian Trail Road & Shawnee Ave  
Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	1	23	38	2	5	47	416	102	11	251	6
Future Volume (veh/h)	1	1	23	38	2	5	47	416	102	11	251	6
Number	3	8	18	7	4	14	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)	0.98		0.98	0.98		0.98	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	1	1	25	41	2	5	51	447	110	12	270	6
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	289	8	193	265	60	149	820	1160	1025	613	1093	976
Arrive On Green	0.13	0.13	0.13	0.13	0.13	0.13	0.06	0.64	0.64	0.03	0.61	0.61
Sat Flow, veh/h	1405	58	1456	1342	451	1128	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	1	0	26	41	0	7	51	447	110	12	270	6
Grp Sat Flow(s),veh/h/ln	1405	0	1514	1342	0	1579	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.0	0.0	1.0	1.9	0.0	0.3	0.7	7.8	1.8	0.2	4.6	0.1
Cycle Q Clear(g_c), s	0.3	0.0	1.0	2.9	0.0	0.3	0.7	7.8	1.8	0.2	4.6	0.1
Prop In Lane	1.00		0.96	1.00		0.71	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	289	0	201	265	0	209	820	1160	1025	613	1093	976
V/C Ratio(X)	0.00	0.00	0.13	0.15	0.00	0.03	0.06	0.39	0.11	0.02	0.25	0.01
Avail Cap(c_a), veh/h	528	0	459	494	0	478	998	1160	1025	844	1093	976
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.3	0.0	25.6	26.8	0.0	25.3	3.9	5.6	4.5	4.6	5.9	5.0
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.3	0.0	0.1	0.0	1.0	0.2	0.0	0.5	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	0.0	0.0	0.4	0.7	0.0	0.1	0.3	4.2	0.8	0.1	2.4	0.0
LnGrp Delay(d),s/veh	25.3	0.0	25.9	27.1	0.0	25.3	3.9	6.6	4.7	4.6	6.4	5.0
LnGrp LOS	C		C	C		C	A	A	A	A	A	A
Approach Vol, veh/h		27			48			608			288	
Approach Delay, s/veh		25.9			26.8			6.0			6.3	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.0	47.1		13.6	8.1	45.0		13.6				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.2	9.8		4.9	2.7	6.6		3.0				
Green Ext Time (p_c), s	0.0	5.8		0.2	0.0	5.9		0.2				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			7.7									
HCM 2010 LOS			A									
<b>Notes</b>												



## 2: Indian Trail Road & Barnes Rd























### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	83	28	126	90	13	14	148	352	299	13	272	34
Future Volume (veh/h)	83	28	126	90	13	14	148	352	299	13	272	34
Number	3	8	18	7	4	14	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)	0.99		0.99	0.99		0.99	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	90	30	137	98	14	15	161	383	325	14	296	37
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	498	336	283	471	156	167	515	641	524	322	833	103
Arrive On Green	0.08	0.21	0.21	0.08	0.21	0.20	0.12	0.40	0.40	0.03	0.32	0.32
Sat Flow, veh/h	1513	1588	1340	1513	728	780	1469	1605	1310	1469	2624	325
Grp Volume(v), veh/h	90	30	137	98	0	29	161	383	325	14	164	169
Grp Sat Flow(s),veh/h/ln	1513	1588	1340	1513	0	1507	1469	1605	1310	1469	1466	1483
Q Serve(g_s), s	2.4	0.8	4.8	2.6	0.0	0.8	3.5	10.0	10.6	0.3	4.6	4.7
Cycle Q Clear(g_c), s	2.4	0.8	4.8	2.6	0.0	0.8	3.5	10.0	10.6	0.3	4.6	4.7
Prop In Lane	1.00		1.00	1.00		0.52	1.00		1.00	1.00		0.22
Lane Grp Cap(c), veh/h	498	336	283	471	0	323	515	641	524	322	465	471
V/C Ratio(X)	0.18	0.09	0.48	0.21	0.00	0.09	0.31	0.60	0.62	0.04	0.35	0.36
Avail Cap(c_a), veh/h	847	774	653	816	0	735	809	1233	1007	737	1126	1140
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	14.3	16.9	18.5	14.3	0.0	16.9	8.9	12.6	12.8	11.6	14.0	14.0
Incr Delay (d2), s/veh	0.2	0.1	1.3	0.2	0.0	0.1	0.3	1.3	1.7	0.1	0.6	0.7
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	1.0	0.4	1.9	1.1	0.0	0.4	1.4	4.6	4.0	0.1	1.9	2.0
LnGrp Delay(d),s/veh	14.5	17.0	19.8	14.5	0.0	17.0	9.2	13.9	14.5	11.7	14.6	14.7
LnGrp LOS	B	B	B	B		B	A	B	B	B	B	B
Approach Vol, veh/h		257			127			869			347	
Approach Delay, s/veh		17.6			15.1			13.3			14.5	
Approach LOS		B			B			B			B	
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	4.9	25.3	7.7	15.4	9.3	20.9	7.8	15.3				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	2.3	12.6	4.4	2.8	5.5	6.7	4.6	6.8				
Green Ext Time (p_c), s	0.0	7.5	0.2	0.8	0.4	7.9	0.2	0.7				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			14.4									
HCM 2010 LOS			B									
<b>Notes</b>												

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Existing - PM Peak Hour













Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	4	41	7	5	44	91	1004	4	31	421	46
Future Volume (veh/h)	3	4	41	7	5	44	91	1004	4	31	421	46
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	3	4	44	7	5	47	97	1068	4	33	448	49
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	196	218	299	256	154	297	595	1123	953	174	1123	951
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	511	1090	1500	761	771	1490	870	1714	1455	509	1714	1453
Grp Volume(v), veh/h	7	0	44	12	0	47	97	1068	4	33	448	49
Grp Sat Flow(s),veh/h/ln	1602	0	1500	1532	0	1490	870	1714	1455	509	1714	1453
Q Serve(g_s), s	0.0	0.0	1.3	0.0	0.0	1.4	3.2	31.3	0.1	3.5	6.7	0.7
Cycle Q Clear(g_c), s	0.2	0.0	1.3	0.3	0.0	1.4	9.9	31.3	0.1	34.8	6.7	0.7
Prop In Lane	0.43		1.00	0.58		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	413	0	299	410	0	297	595	1123	953	174	1123	951
V/C Ratio(X)	0.02	0.00	0.15	0.03	0.00	0.16	0.16	0.95	0.00	0.19	0.40	0.05
Avail Cap(c_a), veh/h	838	0	709	819	0	705	595	1123	953	174	1123	951
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.7	0.0	18.1	17.7	0.0	18.2	6.8	8.7	3.3	24.6	4.4	3.4
Incr Delay (d2), s/veh	0.0	0.0	0.2	0.0	0.0	0.2	0.6	17.4	0.0	2.4	1.1	0.1
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	0.1	0.0	0.6	0.1	0.0	0.6	0.9	19.7	0.0	0.6	3.4	0.3
LnGrp Delay(d),s/veh	17.7	0.0	18.4	17.8	0.0	18.4	7.3	26.1	3.3	27.0	5.5	3.5
LnGrp LOS	B		B	B		B	A	C	A	C	A	A
Approach Vol, veh/h		51			59			1169			530	
Approach Delay, s/veh		18.3			18.3			24.5			6.6	
Approach LOS		B			B			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		40.0		15.0		40.0		15.0				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		33.3		3.4		36.8		3.3				
Green Ext Time (p_c), s		1.7		0.4		0.0		0.4				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			18.9									
HCM 2010 LOS			B									
<b>Notes</b>												

#### 4: Francis Ave #14 & Indian Trail Road





















##### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	141	454	628	1008	445	77		
Future Volume (veh/h)	141	454	628	1008	445	77		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	150	483	668	0	473	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	495	1795	1795	797	844	363		
Arrive On Green	0.55	0.55	0.55	0.00	0.26	0.00		
Sat Flow, veh/h	743	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	150	483	668	0	473	0		
Grp Sat Flow(s),veh/h/ln	743	1629	1629	1445	1633	1530		
Q Serve(g_s), s	6.0	3.3	4.9	0.0	5.3	0.0		
Cycle Q Clear(g_c), s	10.9	3.3	4.9	0.0	5.3	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	495	1795	1795	797	844	363		
V/C Ratio(X)	0.30	0.27	0.37	0.00	0.56	0.00		
Avail Cap(c_a), veh/h	810	3178	3178	1411	2409	1096		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	8.4	5.0	5.3	0.0	13.5	0.0		
Incr Delay (d2), s/veh	0.4	0.1	0.2	0.0	0.6	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	1.3	1.5	2.2	0.0	2.4	0.0		
LnGrp Delay(d),s/veh	8.8	5.1	5.5	0.0	14.1	0.0		
LnGrp LOS	A	A	A		B			
Approach Vol, veh/h		633	668		473			
Approach Delay, s/veh		6.0	5.5		14.1			
Approach LOS		A	A		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		27.2				27.2		14.9
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		40.1				40.1		30.1
Max Q Clear Time (g_c+I1), s		6.9				12.9		7.3
Green Ext Time (p_c), s		10.0				9.4		2.3
Intersection Summary								
HCM 2010 Ctrl Delay			7.9					
HCM 2010 LOS			A					
Notes								

5: Alberta St & Francis Ave #14  
Existing - PM Peak Hour


Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	33	862	77	141	1240	18	372	108	124	39	49	25
Future Volume (veh/h)	33	862	77	141	1240	18	372	108	124	39	49	25
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		0.98	1.00		0.95
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	1800	1766	1800	1731	1800	1800	1800	1849	1872	1800	1872	1872
Adj Flow Rate, veh/h	34	898	80	147	1292	19	314	215	129	41	51	26
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	213	1200	107	317	1463	22	425	267	160	182	122	62
Arrive On Green	0.06	0.39	0.37	0.11	0.42	0.41	0.25	0.25	0.23	0.11	0.11	0.09
Sat Flow, veh/h	1714	3116	278	1648	3450	51	1714	1076	646	1714	1150	586
Grp Volume(v), veh/h	34	483	495	147	640	671	314	0	344	41	0	77
Grp Sat Flow(s),veh/h/ln	1714	1678	1716	1648	1710	1791	1714	0	1722	1714	0	1736
Q Serve(g_s), s	1.1	23.7	23.7	4.7	32.8	32.8	16.0	0.0	17.9	2.1	0.0	4.0
Cycle Q Clear(g_c), s	1.1	23.7	23.7	4.7	32.8	32.8	16.0	0.0	17.9	2.1	0.0	4.0
Prop In Lane	1.00		0.16	1.00		0.03	1.00		0.38	1.00		0.34
Lane Grp Cap(c), veh/h	213	646	661	317	725	759	425	0	427	182	0	184
V/C Ratio(X)	0.16	0.75	0.75	0.46	0.88	0.88	0.74	0.00	0.81	0.23	0.00	0.42
Avail Cap(c_a), veh/h	393	801	820	421	811	850	575	0	578	395	0	400
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	20.3	25.2	25.4	17.9	25.2	25.2	32.9	0.0	34.0	38.9	0.0	40.1
Incr Delay (d2), s/veh	0.1	2.2	2.1	0.4	9.7	9.3	1.9	0.0	4.3	0.2	0.0	0.6
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	0.5	11.3	11.5	2.1	17.2	18.2	7.8	0.0	9.0	1.0	0.0	1.9
LnGrp Delay(d),s/veh	20.4	27.4	27.5	18.3	34.9	34.6	34.9	0.0	38.2	39.1	0.0	40.6
LnGrp LOS	C	C	C	B	C	C	C		D	D		D
Approach Vol, veh/h		1012			1458			658			118	
Approach Delay, s/veh		27.2			33.1			36.6			40.1	
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	10.0	45.2		26.7	14.0	41.2		13.2				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	16.0	44.0		30.0	16.0	44.0		20.0				
Max Q Clear Time (g_c+I1), s	3.1	34.8		19.9	6.7	25.7		6.0				
Green Ext Time (p_c), s	0.0	4.4		1.7	0.2	6.0		0.2				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				32.2								
HCM 2010 LOS				C								
<b>Notes</b>												

# 6: Ash St #4S & Francis Ave #14

## Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑					↑	↑↑	↑
Traffic Volume (vph)	0	653	93	219	1304	0	0	0	0	216	562	362
Future Volume (vph)	0	653	93	219	1304	0	0	0	0	216	562	362
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3203		1605	3353					1716	3307	1524
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3203		1605	3353					1716	3307	1524
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)	0	666	95	223	1331	0	0	0	0	220	573	369
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	0	0	0	54
Lane Group Flow (vph)	0	750	0	223	1331	0	0	0	0	220	573	315
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		38.6		20.1	63.6					26.9	26.9	26.9
Effective Green, g (s)		39.5		21.0	64.5					27.5	27.5	27.5
Actuated g/C Ratio		0.40		0.21	0.64					0.28	0.28	0.28
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1265		337	2162					471	909	419
v/s Ratio Prot		0.23		0.14	c0.40						0.17	
v/s Ratio Perm										0.13		c0.21
v/c Ratio		0.59		0.66	0.62					0.47	0.63	0.75
Uniform Delay, d1		23.9		36.2	10.5					30.2	31.8	33.1
Progression Factor		1.00		0.83	0.40					0.90	0.91	0.90
Incremental Delay, d2		2.1		2.2	0.8					0.7	1.4	7.3
Delay (s)		25.9		32.2	5.0					27.9	30.5	37.0
Level of Service		C		C	A					C	C	D
Approach Delay (s)		25.9			8.9			0.0			32.1	
Approach LOS		C			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			20.4			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			85.9%			ICU Level of Service				E		
Analysis Period (min)			15									


















c Critical Lane Group



# 7: Maple St #3N & Francis Ave #14

## Existing - PM Peak Hour

## Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	308	897	0	0	960	211	362	903	172	0	0	0
Future Volume (vph)	308	897	0	0	960	211	362	903	172	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.97		1.00	0.98				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3251		1454	4468				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3251		1454	4468				
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	318	925	0	0	990	218	373	931	177	0	0	0
RTOR Reduction (vph)	0	0	0	0	19	0	0	24	0	0	0	0
Lane Group Flow (vph)	318	925	0	0	1189	0	336	1121	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	20.1	63.1			38.1		27.4	27.4				
Effective Green, g (s)	21.0	64.0			39.0		28.0	28.0				
Actuated g/C Ratio	0.21	0.64			0.39		0.28	0.28				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	340	2104			1267		407	1251				
v/s Ratio Prot	c0.20	0.28			c0.37							
v/s Ratio Perm							0.23	0.25				
v/c Ratio	0.94	0.44			0.94		0.83	0.90				
Uniform Delay, d1	38.8	9.0			29.3		33.7	34.6				
Progression Factor	1.19	1.14			1.00		1.00	1.00				
Incremental Delay, d2	30.5	0.6			14.3		12.8	8.6				
Delay (s)	76.7	10.9			43.6		46.5	43.2				
Level of Service	E	B			D		D	D				
Approach Delay (s)		27.8			43.6			44.0			0.0	
Approach LOS		C			D			D			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			38.8				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			85.9%				ICU Level of Service			E		
Analysis Period (min)			15									
Description: Count Date 7/20/09												























9: Barnes & Pamela Lane  
Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	0	56	3	7	92	0	3	0	17	0	0	0
Future Vol, veh/h	0	56	3	7	92	0	3	0	17	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	59	3	7	97	0	3	0	18	0	0	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	97	0	0	62	0	0	173	173	61	181	174	97
Stage 1	-	-	-	-	-	-	61	61	-	112	112	-
Stage 2	-	-	-	-	-	-	112	112	-	69	62	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1496	-	-	1541	-	-	790	720	1004	781	719	959
Stage 1	-	-	-	-	-	-	950	844	-	893	803	-
Stage 2	-	-	-	-	-	-	893	803	-	941	843	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1496	-	-	1541	-	-	787	717	1004	764	716	959
Mov Cap-2 Maneuver	-	-	-	-	-	-	787	717	-	764	716	
Stage 1	-	-	-	-	-	-	950	844	-	893	799	-
Stage 2	-	-	-	-	-	-	889	799	-	924	843	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.5			8.8			0		
HCM LOS							A			A		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	964	1496	-	-	1541	-	-	-				
HCM Lane V/C Ratio	0.022	-	-	-	0.005	-	-	-				
HCM Control Delay (s)	8.8	0	-	-	7.3	-	-	0				
HCM Lane LOS	A	A	-	-	A	-	-	A				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-				

1: Indian Trail Road & Shawnee Ave  
Future Without-Project - AM Peak Hour
























Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	26	57	181	14	21	13	169	140	31	387	3
Future Volume (veh/h)	5	26	57	181	14	21	13	169	140	31	387	3
Number	3	8	18	7	4	14	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)	0.99		0.99	0.99		0.99	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	7	36	78	248	19	29	18	232	192	42	530	4
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	415	130	283	345	166	253	455	944	834	622	966	863
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.52	0.52	0.05	0.54	0.54
Sat Flow, veh/h	1367	504	1091	1252	640	977	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	7	0	114	248	0	48	18	232	192	42	530	4
Grp Sat Flow(s),veh/h/ln	1367	0	1595	1252	0	1616	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.3	0.0	4.5	15.4	0.0	1.8	0.4	5.5	5.1	0.8	15.1	0.1
Cycle Q Clear(g_c), s	2.1	0.0	4.5	19.8	0.0	1.8	0.4	5.5	5.1	0.8	15.1	0.1
Prop In Lane	1.00		0.68	1.00		0.60	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	415	0	413	345	0	419	455	944	834	622	966	863
V/C Ratio(X)	0.02	0.00	0.28	0.72	0.00	0.11	0.04	0.25	0.23	0.07	0.55	0.00
Avail Cap(c_a), veh/h	415	0	413	345	0	419	640	944	834	776	966	863
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.9	0.0	23.1	31.0	0.0	22.1	9.0	10.1	10.0	7.4	11.6	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.4	7.1	0.0	0.1	0.0	0.6	0.6	0.0	2.2	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	0.1	0.0	2.0	6.0	0.0	0.8	0.2	2.9	2.4	0.4	8.0	0.0
LnGrp Delay(d),s/veh	22.9	0.0	23.5	38.0	0.0	22.2	9.0	10.7	10.7	7.5	13.9	8.2
LnGrp LOS	C		C	D		C	A	B	B	A	B	A
Approach Vol, veh/h		121			296			442			576	
Approach Delay, s/veh		23.4			35.5			10.6			13.4	
Approach LOS		C			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.0	45.0		25.0	6.6	46.4		25.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.8	7.5		21.8	2.4	17.1		6.5				
Green Ext Time (p_c), s	0.0	7.2		0.0	0.0	6.5		1.9				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				17.9								
HCM 2010 LOS				B								
<b>Notes</b>												

## 2: Indian Trail Road & Barnes Rd

### Future Without-Project - AM Peak Hour























Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	44	47	304	256	33	40	95	131	93	34	573	43
Future Volume (veh/h)	44	47	304	256	33	40	95	131	93	34	573	43
Number	3	8	18	7	4	14	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		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	48	51	330	278	36	43	103	142	101	37	623	47
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	485	441	373	552	266	318	273	550	449	430	863	65
Arrive On Green	0.05	0.28	0.28	0.16	0.39	0.38	0.08	0.34	0.34	0.05	0.31	0.31
Sat Flow, veh/h	1513	1588	1343	1513	685	818	1469	1605	1310	1469	2762	208
Grp Volume(v), veh/h	48	51	330	278	0	79	103	142	101	37	330	340
Grp Sat Flow(s),veh/h/ln	1513	1588	1343	1513	0	1504	1469	1605	1310	1469	1466	1505
Q Serve(g_s), s	1.8	2.0	19.4	10.0	0.0	2.8	3.7	5.3	4.5	1.4	16.5	16.5
Cycle Q Clear(g_c), s	1.8	2.0	19.4	10.0	0.0	2.8	3.7	5.3	4.5	1.4	16.5	16.5
Prop In Lane	1.00		1.00	1.00		0.54	1.00		1.00	1.00		0.14
Lane Grp Cap(c), veh/h	485	441	373	552	0	584	273	550	449	430	458	470
V/C Ratio(X)	0.10	0.12	0.88	0.50	0.00	0.14	0.38	0.26	0.23	0.09	0.72	0.72
Avail Cap(c_a), veh/h	717	501	423	617	0	584	463	798	652	664	729	748
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	22.2	28.5	14.9	0.0	16.4	18.0	19.5	19.3	17.5	25.2	25.2
Incr Delay (d2), s/veh	0.1	0.1	18.0	0.7	0.0	0.1	0.9	0.4	0.4	0.1	3.1	3.0
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	0.9	9.1	4.2	0.0	1.2	1.5	2.4	1.7	0.6	7.0	7.2
LnGrp Delay(d),s/veh	19.5	22.3	46.5	15.6	0.0	16.5	18.9	19.9	19.7	17.6	28.2	28.2
LnGrp LOS	B	C	D	B		B	B	B	B	B	C	C
Approach Vol, veh/h		429			357			346			707	
Approach Delay, s/veh		40.6			15.8			19.5			27.6	
Approach LOS		D			B			B			C	
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	6.9	32.2	7.3	36.0	9.3	29.8	16.4	26.9				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	3.4	7.3	3.8	4.8	5.7	18.5	12.0	21.4				
Green Ext Time (p_c), s	0.0	6.5	0.1	2.1	0.2	5.8	0.4	0.7				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			26.8									
HCM 2010 LOS			C									
<b>Notes</b>												

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd

#### Future Without-Project - AM Peak Hour













Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	1	144	1	2	5	38	406	1	4	1031	81
Future Volume (veh/h)	36	1	144	1	2	5	38	406	1	4	1031	81
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	40	1	160	1	2	6	42	451	1	4	1146	90
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	347	7	234	140	206	232	167	1184	1005	665	1184	1003
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.69	0.69	0.69	0.69	0.69	0.69
Sat Flow, veh/h	1349	45	1500	309	1318	1486	436	1714	1455	908	1714	1453
Grp Volume(v), veh/h	41	0	160	3	0	6	42	451	1	4	1146	90
Grp Sat Flow(s),veh/h/ln	1394	0	1500	1627	0	1486	436	1714	1455	908	1714	1453
Q Serve(g_s), s	1.3	0.0	5.3	0.0	0.0	0.2	3.5	5.8	0.0	0.1	32.5	1.1
Cycle Q Clear(g_c), s	1.3	0.0	5.3	0.1	0.0	0.2	36.0	5.8	0.0	5.9	32.5	1.1
Prop In Lane	0.98		1.00	0.33		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	354	0	234	346	0	232	167	1184	1005	665	1184	1003
V/C Ratio(X)	0.12	0.00	0.68	0.01	0.00	0.03	0.25	0.38	0.00	0.01	0.97	0.09
Avail Cap(c_a), veh/h	832	0	748	872	0	741	167	1184	1005	665	1184	1003
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.1	0.0	20.8	18.6	0.0	18.6	24.9	3.4	2.5	4.6	7.5	2.7
Incr Delay (d2), s/veh	0.1	0.0	3.5	0.0	0.0	0.0	3.6	0.9	0.0	0.0	19.5	0.2
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	0.0	2.4	0.0	0.0	0.1	0.8	2.9	0.0	0.0	21.1	0.5
LnGrp Delay(d),s/veh	19.3	0.0	24.3	18.6	0.0	18.7	28.4	4.3	2.5	4.6	27.0	2.8
LnGrp LOS	B		C	B		B	C	A	A	A	C	A
Approach Vol, veh/h		201			9			494			1240	
Approach Delay, s/veh		23.3			18.7			6.4			25.2	
Approach LOS		C			B			A			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		40.0		12.1		40.0		12.1				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		38.0		2.2		34.5		7.3				
Green Ext Time (p_c), s		0.0		0.9		0.6		0.8				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			20.2									
HCM 2010 LOS			C									
<b>Notes</b>												























4: Francis Ave #14 & Indian Trail Road  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	89	530	337	342	1385	64		
Future Volume (veh/h)	89	530	337	342	1385	64		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	99	589	374	0	1539	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	397	1141	1141	507	1622	734		
Arrive On Green	0.35	0.35	0.35	0.00	0.50	0.00		
Sat Flow, veh/h	974	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	99	589	374	0	1539	0		
Grp Sat Flow(s),veh/h/ln	974	1629	1629	1445	1633	1530		
Q Serve(g_s), s	4.3	7.5	4.4	0.0	23.5	0.0		
Cycle Q Clear(g_c), s	8.8	7.5	4.4	0.0	23.5	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	397	1141	1141	507	1622	734		
V/C Ratio(X)	0.25	0.52	0.33	0.00	0.95	0.00		
Avail Cap(c_a), veh/h	725	2240	2240	994	1622	734		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	15.7	13.5	12.5	0.0	12.5	0.0		
Incr Delay (d2), s/veh	0.4	0.4	0.2	0.0	12.3	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	1.2	3.4	2.0	0.0	13.3	0.0		
LnGrp Delay(d),s/veh	16.1	13.9	12.7	0.0	24.9	0.0		
LnGrp LOS	B	B	B		C			
Approach Vol, veh/h		688	374		1539			
Approach Delay, s/veh		14.2	12.7		24.9			
Approach LOS		B	B		C			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.3				22.3		30.0
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		35.1				35.1		25.1
Max Q Clear Time (g_c+I1), s		6.4				10.8		25.5
Green Ext Time (p_c), s		7.0				6.7		0.0
Intersection Summary								
HCM 2010 Ctrl Delay			20.3					
HCM 2010 LOS			C					
Notes								













5: Alberta St & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	27	1444	196	157	617	28	168	24	101	80	117	34
Future Volume (veh/h)	27	1444	196	157	617	28	168	24	101	80	117	34
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		0.97	1.00		0.97
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	1800	1767	1800	1731	1800	1800	1800	1833	1872	1800	1872	1872
Adj Flow Rate, veh/h	29	1553	211	169	663	30	158	58	109	86	126	37
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	447	1400	187	221	1683	76	269	88	165	242	195	57
Arrive On Green	0.06	0.47	0.46	0.09	0.51	0.49	0.16	0.16	0.14	0.14	0.14	0.12
Sat Flow, veh/h	1714	2976	398	1648	3332	151	1714	560	1052	1714	1380	405
Grp Volume(v), veh/h	29	866	898	169	340	353	158	0	167	86	0	163
Grp Sat Flow(s),veh/h/ln	1714	1678	1695	1648	1710	1773	1714	0	1611	1714	0	1785
Q Serve(g_s), s	0.9	50.4	50.4	6.2	13.2	13.2	9.2	0.0	10.5	4.9	0.0	9.3
Cycle Q Clear(g_c), s	0.9	50.4	50.4	6.2	13.2	13.2	9.2	0.0	10.5	4.9	0.0	9.3
Prop In Lane	1.00		0.23	1.00		0.08	1.00		0.65	1.00		0.23
Lane Grp Cap(c), veh/h	447	790	798	221	864	896	269	0	252	242	0	252
V/C Ratio(X)	0.06	1.10	1.13	0.76	0.39	0.39	0.59	0.00	0.66	0.36	0.00	0.65
Avail Cap(c_a), veh/h	527	790	798	237	864	896	431	0	405	351	0	365
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.3	28.3	28.5	27.3	16.4	16.4	42.0	0.0	43.1	41.6	0.0	43.7
Incr Delay (d2), s/veh	0.0	61.4	72.4	11.3	0.1	0.1	0.8	0.0	1.1	0.3	0.0	1.0
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	36.7	39.6	5.5	6.2	6.4	4.4	0.0	4.7	2.3	0.0	4.7
LnGrp Delay(d),s/veh	13.3	89.8	101.0	38.6	16.5	16.5	42.7	0.0	44.2	41.9	0.0	44.7
LnGrp LOS	B	F	F	D	B	B	D		D	D		D
Approach Vol, veh/h		1793			862			325			249	
Approach Delay, s/veh		94.1			20.8			43.5			43.8	
Approach LOS		F			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	10.0	59.0		19.9	14.0	55.0		18.2				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	11.0	49.0		25.0	11.0	49.0		20.0				
Max Q Clear Time (g_c+I1), s	2.9	15.2		12.5	8.2	52.4		11.3				
Green Ext Time (p_c), s	0.0	8.4		0.8	0.1	0.0		0.5				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				65.6								
HCM 2010 LOS				E								
<b>Notes</b>												


















6: Ash St #4S & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑					↑	↑↑	↑
Traffic Volume (vph)	0	966	233	111	571	0	0	0	0	322	697	414
Future Volume (vph)	0	966	233	111	571	0	0	0	0	322	697	414
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3164		1605	3353					1716	3307	1523
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3164		1605	3353					1716	3307	1523
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	1039	251	119	614	0	0	0	0	346	749	445
RTOR Reduction (vph)	0	22	0	0	0	0	0	0	0	0	0	163
Lane Group Flow (vph)	0	1268	0	119	614	0	0	0	0	346	749	282
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		37.6		9.1	51.6					28.9	28.9	28.9
Effective Green, g (s)		38.5		10.0	52.5					29.5	29.5	29.5
Actuated g/C Ratio		0.43		0.11	0.58					0.33	0.33	0.33
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1353		178	1955					562	1083	499
v/s Ratio Prot		c0.40		c0.07	0.18						c0.23	
v/s Ratio Perm										0.20		0.18
v/c Ratio		0.94		0.67	0.31					0.62	0.69	0.56
Uniform Delay, d1		24.6		38.4	9.6					25.5	26.3	25.0
Progression Factor		1.00		0.94	0.44					0.86	0.87	0.79
Incremental Delay, d2		13.5		6.9	0.4					1.9	1.8	1.4
Delay (s)		38.1		43.2	4.6					23.7	24.7	21.0
Level of Service		D		D	A					C	C	C
Approach Delay (s)		38.1			10.9			0.0			23.4	
Approach LOS		D			B			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			26.1			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			72.9%			ICU Level of Service				C		
Analysis Period (min)			15									
c Critical Lane Group												

7: Maple St #3N & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	267	1212	0	0	443	83	25	490	149	0	0	0
Future Volume (vph)	267	1212	0	0	443	83	25	490	149	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.97				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3264		1454	4413				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3264		1454	4413				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	287	1303	0	0	476	89	27	527	160	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	49	0	0	0	0
Lane Group Flow (vph)	287	1303	0	0	550	0	24	641	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	24.1	60.4			31.4		20.1	20.1				
Effective Green, g (s)	25.0	61.3			32.3		20.7	20.7				
Actuated g/C Ratio	0.28	0.68			0.36		0.23	0.23				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	450	2239			1171		334	1014				
v/s Ratio Prot	0.18	0.40			0.17							
v/s Ratio Perm							0.02	0.15				
v/c Ratio	0.64	0.58			0.47		0.07	0.63				
Uniform Delay, d1	28.5	7.6			22.2		27.1	31.2				
Progression Factor	0.87	0.55			1.00		1.00	1.00				
Incremental Delay, d2	1.5	0.7			1.4		0.1	1.3				
Delay (s)	26.4	4.9			23.6		27.2	32.5				
Level of Service	C	A			C		C	C				
Approach Delay (s)		8.8			23.6			32.3			0.0	
Approach LOS		A			C			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.6				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			72.9%				ICU Level of Service			C		
Analysis Period (min)			15									
Description: Count Date 7/20/09												

8: Barnes & Forest Lane  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection						
Int Delay, s/veh	1.5					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	1	173	53	17	39	1
Future Vol, veh/h	1	173	53	17	39	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	74	74	74	74	74	74
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	234	72	23	53	1
Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	95	0	-	0	319	83
Stage 1	-	-	-	-	83	-
Stage 2	-	-	-	-	236	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1499	-	-	-	674	976
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	803	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1499	-	-	-	674	976
Mov Cap-2 Maneuver	-	-	-	-	694	-
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	802	-
Approach	EB		WB		SB	
HCM Control Delay, s	0		0		10.6	
HCM LOS					B	
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1499	-	-	-	699	
HCM Lane V/C Ratio	0.001	-	-	-	0.077	
HCM Control Delay (s)	7.4	-	-	-	10.6	
HCM Lane LOS	A	-	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.3	

























9: Barnes & Pamela  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	2.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	1	212	1	6	68	25	2	1	13	59	1	1
Future Vol, veh/h	1	212	1	6	68	25	2	1	13	59	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	74	74	74	74	74	74	74	74	74	74	74	74
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	286	1	8	92	34	3	1	18	80	1	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	126	0	0	288	0	0	416	432	287	424	416	109
Stage 1	-	-	-	-	-	-	290	290	-	125	125	-
Stage 2	-	-	-	-	-	-	126	142	-	299	291	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1460	-	-	1274	-	-	547	516	752	540	527	945
Stage 1	-	-	-	-	-	-	718	672	-	879	792	-
Stage 2	-	-	-	-	-	-	878	779	-	710	672	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1460	-	-	1274	-	-	542	512	752	524	523	945
Mov Cap-2 Maneuver	-	-	-	-	-	-	542	512	-	524	523	
Stage 1	-	-	-	-	-	-	718	672	-	878	787	-
Stage 2	-	-	-	-	-	-	870	774	-	692	672	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.5			10.3			13.1		
HCM LOS							B			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	698	1460	-	-	1274	-	-	528				
HCM Lane V/C Ratio	0.031	0.001	-	-	0.006	-	-	0.156				
HCM Control Delay (s)	10.3	7.5	-	-	7.8	-	-	13.1				
HCM Lane LOS	B	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.6				

1: Indian Trail Road & Shawnee Ave  
Future Without-Project - PM Peak Hour
























Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	1	24	49	2	5	48	446	112	11	286	6
Future Volume (veh/h)	1	1	24	49	2	5	48	446	112	11	286	6
Number	3	8	18	7	4	14	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)	0.98		0.98	0.98		0.98	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	1	1	26	53	2	5	52	480	120	12	308	6
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	297	8	203	273	63	157	779	1151	1017	578	1084	968
Arrive On Green	0.14	0.14	0.14	0.14	0.14	0.14	0.06	0.64	0.64	0.03	0.61	0.61
Sat Flow, veh/h	1406	56	1457	1342	451	1127	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	1	0	27	53	0	7	52	480	120	12	308	6
Grp Sat Flow(s),veh/h/ln	1406	0	1513	1342	0	1578	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.0	0.0	1.1	2.4	0.0	0.3	0.7	8.8	2.0	0.2	5.5	0.1
Cycle Q Clear(g_c), s	0.3	0.0	1.1	3.5	0.0	0.3	0.7	8.8	2.0	0.2	5.5	0.1
Prop In Lane	1.00		0.96	1.00		0.71	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	297	0	210	273	0	219	779	1151	1017	578	1084	968
V/C Ratio(X)	0.00	0.00	0.13	0.19	0.00	0.03	0.07	0.42	0.12	0.02	0.28	0.01
Avail Cap(c_a), veh/h	524	0	455	489	0	474	954	1151	1017	808	1084	968
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.2	0.0	25.5	26.9	0.0	25.1	4.1	6.0	4.7	4.8	6.2	5.2
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.3	0.0	0.1	0.0	1.1	0.2	0.0	0.7	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	0.0	0.0	0.5	0.9	0.0	0.1	0.3	4.6	0.9	0.1	2.9	0.0
LnGrp Delay(d),s/veh	25.2	0.0	25.7	27.3	0.0	25.2	4.1	7.1	5.0	4.8	6.9	5.2
LnGrp LOS	C		C	C		C	A	A	A	A	A	A
Approach Vol, veh/h		28			60			652			326	
Approach Delay, s/veh		25.7			27.0			6.5			6.8	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.0	47.1		14.2	8.1	45.0		14.2				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.2	10.8		5.5	2.7	7.5		3.1				
Green Ext Time (p_c), s	0.0	6.5		0.3	0.0	6.6		0.3				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			8.2									
HCM 2010 LOS			A									
<b>Notes</b>												

## 2: Indian Trail Road & Barnes Rd























### Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	92	56	189	153	57	64	269	330	374	52	264	49
Future Volume (veh/h)	92	56	189	153	57	64	269	330	374	52	264	49
Number	3	8	18	7	4	14	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)	0.99		0.99	1.00		0.99	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	100	61	205	166	62	70	292	359	407	57	287	53
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	417	335	283	455	177	200	536	655	535	334	731	133
Arrive On Green	0.08	0.21	0.21	0.12	0.25	0.24	0.17	0.41	0.41	0.06	0.30	0.30
Sat Flow, veh/h	1513	1588	1340	1513	707	798	1469	1605	1310	1469	2475	451
Grp Volume(v), veh/h	100	61	205	166	0	132	292	359	407	57	168	172
Grp Sat Flow(s),veh/h/ln	1513	1588	1340	1513	0	1505	1469	1605	1310	1469	1466	1460
Q Serve(g_s), s	3.6	2.2	10.2	5.8	0.0	5.2	8.9	12.2	19.0	1.9	6.5	6.7
Cycle Q Clear(g_c), s	3.6	2.2	10.2	5.8	0.0	5.2	8.9	12.2	19.0	1.9	6.5	6.7
Prop In Lane	1.00		1.00	1.00		0.53	1.00		1.00	1.00		0.31
Lane Grp Cap(c), veh/h	417	335	283	455	0	377	536	655	535	334	433	431
V/C Ratio(X)	0.24	0.18	0.72	0.36	0.00	0.35	0.54	0.55	0.76	0.17	0.39	0.40
Avail Cap(c_a), veh/h	650	579	488	629	0	548	631	922	753	594	842	839
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.4	23.1	26.2	17.3	0.0	22.1	12.1	16.1	18.1	15.5	20.0	20.1
Incr Delay (d2), s/veh	0.3	0.3	3.5	0.5	0.0	0.6	0.9	1.0	3.8	0.2	0.8	0.8
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	1.5	1.0	4.0	2.4	0.0	2.2	3.6	5.6	7.4	0.8	2.7	2.8
LnGrp Delay(d),s/veh	19.7	23.4	29.7	17.7	0.0	22.7	13.0	17.1	21.9	15.8	20.8	20.9
LnGrp LOS	B	C	C	B		C	B	B	C	B	C	C
Approach Vol, veh/h		366			298			1058			397	
Approach Delay, s/veh		25.9			19.9			17.8			20.1	
Approach LOS		C			B			B			C	
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	7.4	33.1	9.0	21.9	15.4	25.1	11.8	19.1				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	3.9	21.0	5.6	7.2	10.9	8.7	7.8	12.2				
Green Ext Time (p_c), s	0.1	7.1	0.2	1.7	0.5	8.5	0.4	1.5				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			20.0									
HCM 2010 LOS			B									
<b>Notes</b>												













### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	2	72	1	2	9	152	1200	1	6	528	81
Future Volume (veh/h)	22	2	72	1	2	9	152	1200	1	6	528	81
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	23	2	77	1	2	10	162	1277	1	6	562	86
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	384	28	303	160	260	302	496	1119	950	131	1119	948
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	1278	139	1500	358	1284	1490	757	1714	1455	419	1714	1453
Grp Volume(v), veh/h	25	0	77	3	0	10	162	1277	1	6	562	86
Grp Sat Flow(s),veh/h/ln	1416	0	1500	1642	0	1490	757	1714	1455	419	1714	1453
Q Serve(g_s), s	0.6	0.0	2.4	0.0	0.0	0.3	7.8	36.0	0.0	0.0	9.3	1.2
Cycle Q Clear(g_c), s	0.7	0.0	2.4	0.1	0.0	0.3	17.1	36.0	0.0	36.0	9.3	1.2
Prop In Lane	0.92		1.00	0.33		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	412	0	303	419	0	302	496	1119	950	131	1119	948
V/C Ratio(X)	0.06	0.00	0.25	0.01	0.00	0.03	0.33	1.14	0.00	0.05	0.50	0.09
Avail Cap(c_a), veh/h	791	0	707	845	0	703	496	1119	950	131	1119	948
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.8	0.0	18.5	17.6	0.0	17.7	9.4	9.6	3.3	27.6	5.0	3.5
Incr Delay (d2), s/veh	0.1	0.0	0.4	0.0	0.0	0.0	1.7	74.7	0.0	0.7	1.6	0.2
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	0.0	1.0	0.0	0.0	0.1	1.9	39.7	0.0	0.1	4.9	0.5
LnGrp Delay(d),s/veh	17.9	0.0	18.9	17.6	0.0	17.7	11.1	84.3	3.3	28.2	6.6	3.7
LnGrp LOS	B		B	B		B	B	F	A	C	A	A
Approach Vol, veh/h		102			13			1440			654	
Approach Delay, s/veh		18.7			17.7			76.0			6.4	
Approach LOS		B			B			E			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		40.0		15.2		40.0		15.2				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		38.0		2.3		38.0		4.4				
Green Ext Time (p_c), s		0.0		0.4		0.0		0.4				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			52.4									
HCM 2010 LOS			D									
<b>Notes</b>												

4: Francis Ave #14 & Indian Trail Road  
Future Without-Project - PM Peak Hour





















Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	172	465	644	1310	598	93		
Future Volume (veh/h)	172	465	644	1310	598	93		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	183	495	685	0	636	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	459	1796	1796	797	947	417		
Arrive On Green	0.55	0.55	0.55	0.00	0.29	0.00		
Sat Flow, veh/h	731	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	183	495	685	0	636	0		
Grp Sat Flow(s),veh/h/ln	731	1629	1629	1445	1633	1530		
Q Serve(g_s), s	9.6	4.1	6.0	0.0	8.7	0.0		
Cycle Q Clear(g_c), s	15.6	4.1	6.0	0.0	8.7	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	459	1796	1796	797	947	417		
V/C Ratio(X)	0.40	0.28	0.38	0.00	0.67	0.00		
Avail Cap(c_a), veh/h	649	2644	2644	1173	2004	912		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	10.9	6.0	6.4	0.0	15.8	0.0		
Incr Delay (d2), s/veh	0.7	0.1	0.2	0.0	0.8	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	2.0	1.8	2.7	0.0	4.0	0.0		
LnGrp Delay(d),s/veh	11.5	6.1	6.6	0.0	16.6	0.0		
LnGrp LOS	B	A	A		B			
Approach Vol, veh/h		678	685		636			
Approach Delay, s/veh		7.6	6.6		16.6			
Approach LOS		A	A		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		31.9				31.9		18.7
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		40.1				40.1		30.1
Max Q Clear Time (g_c+I1), s		8.0				17.6		10.7
Green Ext Time (p_c), s		10.7				9.4		3.1
<b>Intersection Summary</b>								
HCM 2010 Ctrl Delay			10.1					
HCM 2010 LOS			B					
<b>Notes</b>								





















5: Alberta St & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	39	979	104	145	1456	18	430	111	128	40	50	36
Future Volume (veh/h)	39	979	104	145	1456	18	430	111	128	40	50	36
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		0.98	1.00		0.96
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	1800	1766	1800	1731	1800	1800	1800	1850	1872	1800	1872	1872
Adj Flow Rate, veh/h	41	1020	108	151	1517	19	348	255	133	42	52	38
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	97	1165	123	181	1490	19	450	299	156	186	107	78
Arrive On Green	0.06	0.38	0.37	0.11	0.43	0.42	0.26	0.26	0.24	0.11	0.11	0.09
Sat Flow, veh/h	1714	3062	324	1648	3459	43	1714	1140	594	1714	986	721
Grp Volume(v), veh/h	41	559	569	151	749	787	348	0	388	42	0	90
Grp Sat Flow(s),veh/h/ln	1714	1678	1708	1648	1710	1792	1714	0	1734	1714	0	1707
Q Serve(g_s), s	2.5	32.9	33.0	9.6	45.8	45.8	20.0	0.0	22.7	2.4	0.0	5.3
Cycle Q Clear(g_c), s	2.5	32.9	33.0	9.6	45.8	45.8	20.0	0.0	22.7	2.4	0.0	5.3
Prop In Lane	1.00		0.19	1.00		0.02	1.00		0.34	1.00		0.42
Lane Grp Cap(c), veh/h	97	638	650	181	737	772	450	0	455	186	0	185
V/C Ratio(X)	0.42	0.88	0.88	0.84	1.02	1.02	0.77	0.00	0.85	0.23	0.00	0.49
Avail Cap(c_a), veh/h	258	716	729	248	737	772	514	0	520	353	0	351
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	48.5	30.6	30.8	46.4	30.3	30.3	36.3	0.0	37.6	43.3	0.0	45.0
Incr Delay (d2), s/veh	1.1	10.0	9.9	12.2	37.6	37.2	5.3	0.0	10.6	0.2	0.0	0.7
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	1.2	17.0	17.3	5.0	29.2	30.5	10.1	0.0	12.2	1.1	0.0	2.5
LnGrp Delay(d),s/veh	49.6	40.7	40.7	58.7	67.9	67.5	41.6	0.0	48.2	43.6	0.0	45.7
LnGrp LOS	D	D	D	E	F	F	D		D	D		D
Approach Vol, veh/h		1169			1687			736			132	
Approach Delay, s/veh		41.0			66.9			45.1			45.0	
Approach LOS		D			E			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	10.0	50.7		31.0	15.7	45.1		14.7				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	16.0	44.0		30.0	16.0	44.0		20.0				
Max Q Clear Time (g_c+I1), s	4.5	47.8		24.7	11.6	35.0		7.3				
Green Ext Time (p_c), s	0.0	0.0		1.4	0.1	4.1		0.3				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				53.7								
HCM 2010 LOS				D								
<b>Notes</b>												


















6: Ash St #4S & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	722	122	225	1490	0	0	0	0	224	580	400
Future Volume (vph)	0	722	122	225	1490	0	0	0	0	224	580	400
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3192		1605	3353					1716	3307	1524
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3192		1605	3353					1716	3307	1524
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)	0	737	124	230	1520	0	0	0	0	229	592	408
RTOR Reduction (vph)	0	14	0	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	0	847	0	230	1520	0	0	0	0	229	592	355
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		37.7		20.1	62.7					27.8	27.8	27.8
Effective Green, g (s)		38.6		21.0	63.6					28.4	28.4	28.4
Actuated g/C Ratio		0.39		0.21	0.64					0.28	0.28	0.28
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1232		337	2132					487	939	432
v/s Ratio Prot		0.27		0.14	c0.45						0.18	
v/s Ratio Perm										0.13		c0.23
v/c Ratio		0.69		0.68	0.71					0.47	0.63	0.82
Uniform Delay, d1		25.7		36.4	12.1					29.6	31.2	33.4
Progression Factor		1.00		0.82	0.43					0.89	0.90	0.89
Incremental Delay, d2		3.1		1.8	0.8					0.7	1.3	11.6
Delay (s)		28.8		31.6	6.1					27.0	29.5	41.3
Level of Service		C		C	A					C	C	D
Approach Delay (s)		28.8			9.5			0.0			32.9	
Approach LOS		C			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			21.3			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			92.8%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

7: Maple St #3N & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	331	956	0	0	1086	222	422	933	176	0	0	0
Future Volume (vph)	331	956	0	0	1086	222	422	933	176	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.97		1.00	0.98				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3257		1454	4468				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3257		1454	4468				
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	341	986	0	0	1120	229	435	962	181	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	23	0	0	0	0
Lane Group Flow (vph)	341	986	0	0	1332	0	387	1168	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	20.1	63.1			38.1		27.4	27.4				
Effective Green, g (s)	21.0	64.0			39.0		28.0	28.0				
Actuated g/C Ratio	0.21	0.64			0.39		0.28	0.28				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	340	2104			1270		407	1251				
v/s Ratio Prot	c0.21	0.30			c0.41							
v/s Ratio Perm							c0.27	0.26				
v/c Ratio	1.00	0.47			1.05		0.95	0.93				
Uniform Delay, d1	39.5	9.3			30.5		35.3	35.1				
Progression Factor	1.16	1.04			1.00		1.00	1.00				
Incremental Delay, d2	47.1	0.7			39.1		32.1	12.6				
Delay (s)	92.9	10.3			69.6		67.4	47.7				
Level of Service	F	B			E		E	D				
Approach Delay (s)		31.5			69.6			52.6			0.0	
Approach LOS		C			E			D			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			51.4				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			1.01									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			92.8%				ICU Level of Service		F			
Analysis Period (min)			15									
Description: Count Date 7/20/09												

8: Barnes & Forest Lane  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection

Int Delay, s/veh 0.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	1	95	155	47	24	1
Future Vol, veh/h	1	95	155	47	24	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	103	168	51	26	1

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	220	0	299
Stage 1	-	-	194
Stage 2	-	-	105
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1349	-	692
Stage 1	-	-	839
Stage 2	-	-	919
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1349	-	691
Mov Cap-2 Maneuver	-	-	713
Stage 1	-	-	839
Stage 2	-	-	918

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1349	-	-	-	718
HCM Lane V/C Ratio	0.001	-	-	-	0.038
HCM Control Delay (s)	7.7	-	-	-	10.2
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

9: Barnes & Pamela  
Future Without-Project - PM Peak Hour























Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	1	116	3	7	199	70	3	1	17	36	1	1
Future Vol, veh/h	1	116	3	7	199	70	3	1	17	36	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	122	3	7	209	74	3	1	18	38	1	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	283	0	0	125	0	0	388	424	124	396	388	246
Stage 1	-	-	-	-	-	-	126	126	-	261	261	-
Stage 2	-	-	-	-	-	-	262	298	-	135	127	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1462	-	-	571	522	927	564	547	793
Stage 1	-	-	-	-	-	-	878	792	-	744	692	-
Stage 2	-	-	-	-	-	-	743	667	-	868	791	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1279	-	-	1462	-	-	567	519	927	550	544	793
Mov Cap-2 Maneuver	-	-	-	-	-	-	567	519	-	550	544	
Stage 1	-	-	-	-	-	-	877	791	-	743	689	-
Stage 2	-	-	-	-	-	-	737	664	-	849	790	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.2			9.5			12		
HCM LOS							A			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	822	1279	-	-	1462	-	-	554				
HCM Lane V/C Ratio	0.027	0.001	-	-	0.005	-	-	0.072				
HCM Control Delay (s)	9.5	7.8	-	-	7.5	-	-	12				
HCM Lane LOS	A	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.2				



1: Indian Trail Road & Shawnee Ave  
Future With-Project - AM Peak Hour
























Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	26	57	182	14	21	13	178	144	31	388	3
Future Volume (veh/h)	5	26	57	182	14	21	13	178	144	31	388	3
Number	3	8	18	7	4	14	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)	0.99		0.99	0.99		0.99	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	7	36	78	249	19	29	18	244	197	42	532	4
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	415	130	283	345	166	253	454	944	834	611	966	863
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.03	0.52	0.52	0.05	0.54	0.54
Sat Flow, veh/h	1367	504	1091	1252	640	977	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	7	0	114	249	0	48	18	244	197	42	532	4
Grp Sat Flow(s),veh/h/ln	1367	0	1595	1252	0	1616	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.3	0.0	4.5	15.5	0.0	1.8	0.4	5.8	5.2	0.8	15.2	0.1
Cycle Q Clear(g_c), s	2.1	0.0	4.5	19.9	0.0	1.8	0.4	5.8	5.2	0.8	15.2	0.1
Prop In Lane	1.00		0.68	1.00		0.60	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	415	0	413	345	0	419	454	944	834	611	966	863
V/C Ratio(X)	0.02	0.00	0.28	0.72	0.00	0.11	0.04	0.26	0.24	0.07	0.55	0.00
Avail Cap(c_a), veh/h	415	0	413	345	0	419	638	944	834	765	966	863
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.9	0.0	23.1	31.0	0.0	22.1	9.0	10.2	10.1	7.5	11.7	8.2
Incr Delay (d2), s/veh	0.0	0.0	0.4	7.2	0.0	0.1	0.0	0.7	0.7	0.0	2.3	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	0.1	0.0	2.0	6.0	0.0	0.8	0.2	3.0	2.5	0.4	8.0	0.0
LnGrp Delay(d),s/veh	22.9	0.0	23.5	38.2	0.0	22.2	9.0	10.9	10.7	7.5	13.9	8.2
LnGrp LOS	C		C	D		C	A	B	B	A	B	A
Approach Vol, veh/h		121			297			459			578	
Approach Delay, s/veh		23.4			35.6			10.7			13.4	
Approach LOS		C			D			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.0	45.0		25.0	6.6	46.4		25.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.8	7.8		21.9	2.4	17.2		6.5				
Green Ext Time (p_c), s	0.0	7.3		0.0	0.0	6.7		1.9				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				17.9								
HCM 2010 LOS				B								
<b>Notes</b>												

## 2: Indian Trail Road & Barnes Rd























### Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	57	76	410	256	35	40	101	131	93	34	573	44
Future Volume (veh/h)	57	76	410	256	35	40	101	131	93	34	573	44
Number	3	8	18	7	4	14	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		0.99	1.00		1.00	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	62	83	446	278	38	43	110	142	101	37	623	48
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	507	471	399	514	282	319	267	547	446	421	845	65
Arrive On Green	0.05	0.30	0.30	0.15	0.40	0.39	0.08	0.34	0.34	0.04	0.31	0.31
Sat Flow, veh/h	1513	1588	1343	1513	707	800	1469	1605	1310	1469	2757	212
Grp Volume(v), veh/h	62	83	446	278	0	81	110	142	101	37	331	340
Grp Sat Flow(s),veh/h/ln	1513	1588	1343	1513	0	1507	1469	1605	1310	1469	1466	1504
Q Serve(g_s), s	2.4	3.4	26.0	10.4	0.0	3.0	4.2	5.6	4.8	1.5	17.7	17.8
Cycle Q Clear(g_c), s	2.4	3.4	26.0	10.4	0.0	3.0	4.2	5.6	4.8	1.5	17.7	17.8
Prop In Lane	1.00		1.00	1.00		0.53	1.00		1.00	1.00		0.14
Lane Grp Cap(c), veh/h	507	471	399	514	0	600	267	547	446	421	449	461
V/C Ratio(X)	0.12	0.18	1.12	0.54	0.00	0.13	0.41	0.26	0.23	0.09	0.74	0.74
Avail Cap(c_a), veh/h	716	471	399	569	0	600	435	751	613	639	686	704
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.5	22.9	30.8	15.3	0.0	16.8	19.3	20.9	20.6	19.0	27.2	27.2
Incr Delay (d2), s/veh	0.1	0.2	81.5	0.9	0.0	0.1	1.0	0.4	0.4	0.1	3.4	3.3
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	1.0	1.5	18.6	4.4	0.0	1.3	1.8	2.5	1.8	0.6	7.6	7.8
LnGrp Delay(d),s/veh	19.6	23.0	112.3	16.1	0.0	16.9	20.3	21.2	21.0	19.1	30.6	30.5
LnGrp LOS	B	C	F	B		B	C	C	C	B	C	C
Approach Vol, veh/h		591			359			353			708	
Approach Delay, s/veh		90.0			16.3			20.9			30.0	
Approach LOS		F			B			C			C	
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	7.0	33.9	7.9	38.9	10.0	30.8	16.8	30.0				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	3.5	7.6	4.4	5.0	6.2	19.8	12.4	28.0				
Green Ext Time (p_c), s	0.0	6.5	0.1	2.9	0.2	5.7	0.4	0.0				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			43.6									
HCM 2010 LOS			D									
<b>Notes</b>												













### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	1	144	1	2	5	38	412	1	4	1138	81
Future Volume (veh/h)	36	1	144	1	2	5	38	412	1	4	1138	81
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	40	1	160	1	2	6	42	458	1	4	1264	90
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	347	7	234	140	206	232	138	1184	1005	659	1184	1003
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.69	0.69	0.69	0.69	0.69	0.69
Sat Flow, veh/h	1349	45	1500	309	1318	1486	389	1714	1455	902	1714	1453
Grp Volume(v), veh/h	41	0	160	3	0	6	42	458	1	4	1264	90
Grp Sat Flow(s),veh/h/ln	1394	0	1500	1627	0	1486	389	1714	1455	902	1714	1453
Q Serve(g_s), s	1.3	0.0	5.3	0.0	0.0	0.2	0.0	5.9	0.0	0.1	36.0	1.1
Cycle Q Clear(g_c), s	1.3	0.0	5.3	0.1	0.0	0.2	36.0	5.9	0.0	6.0	36.0	1.1
Prop In Lane	0.98		1.00	0.33		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	354	0	234	346	0	232	138	1184	1005	659	1184	1003
V/C Ratio(X)	0.12	0.00	0.68	0.01	0.00	0.03	0.30	0.39	0.00	0.01	1.07	0.09
Avail Cap(c_a), veh/h	832	0	748	872	0	741	138	1184	1005	659	1184	1003
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	19.1	0.0	20.8	18.6	0.0	18.6	26.1	3.4	2.5	4.7	8.1	2.7
Incr Delay (d2), s/veh	0.1	0.0	3.5	0.0	0.0	0.0	5.6	1.0	0.0	0.0	46.2	0.2
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	0.0	2.4	0.0	0.0	0.1	0.8	3.0	0.0	0.0	31.7	0.5
LnGrp Delay(d),s/veh	19.3	0.0	24.3	18.6	0.0	18.7	31.7	4.4	2.5	4.7	54.3	2.8
LnGrp LOS	B		C	B		B	C	A	A	A	F	A
Approach Vol, veh/h		201			9			501			1358	
Approach Delay, s/veh		23.3			18.7			6.6			50.8	
Approach LOS		C			B			A			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		40.0		12.1		40.0		12.1				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		38.0		2.2		38.0		7.3				
Green Ext Time (p_c), s		0.0		0.9		0.0		0.8				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			37.3									
HCM 2010 LOS			D									
<b>Notes</b>												





















4: Francis Ave #14 & Indian Trail Road  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	90	530	337	348	1483	73		
Future Volume (veh/h)	90	530	337	348	1483	73		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	100	589	374	0	1648	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	397	1144	1144	508	1620	733		
Arrive On Green	0.35	0.35	0.35	0.00	0.50	0.00		
Sat Flow, veh/h	974	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	100	589	374	0	1648	0		
Grp Sat Flow(s),veh/h/ln	974	1629	1629	1445	1633	1530		
Q Serve(g_s), s	4.4	7.5	4.4	0.0	26.0	0.0		
Cycle Q Clear(g_c), s	8.8	7.5	4.4	0.0	26.0	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	397	1144	1144	508	1620	733		
V/C Ratio(X)	0.25	0.52	0.33	0.00	1.02	0.00		
Avail Cap(c_a), veh/h	724	2238	2238	993	1620	733		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	15.7	13.5	12.5	0.0	13.2	0.0		
Incr Delay (d2), s/veh	0.4	0.4	0.2	0.0	26.7	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	1.2	3.4	2.0	0.0	17.5	0.0		
LnGrp Delay(d),s/veh	16.1	13.9	12.7	0.0	39.9	0.0		
LnGrp LOS	B	B	B		F			
Approach Vol, veh/h		689	374		1648			
Approach Delay, s/veh		14.2	12.7		39.9			
Approach LOS		B	B		D			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		22.4				22.4		30.0
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		35.1				35.1		25.1
Max Q Clear Time (g_c+I1), s		6.4				10.8		28.0
Green Ext Time (p_c), s		7.0				6.7		0.0
Intersection Summary								
HCM 2010 Ctrl Delay			29.6					
HCM 2010 LOS			C					
Notes								

5: Alberta St & Francis Ave #14  
Future With-Project - AM Peak Hour













Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	32	1506	214	157	621	28	170	24	101	80	117	34
Future Volume (veh/h)	32	1506	214	157	621	28	170	24	101	80	117	34
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		0.97	1.00		0.97
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	1800	1767	1800	1731	1800	1800	1800	1833	1872	1800	1872	1872
Adj Flow Rate, veh/h	34	1619	230	169	668	30	159	60	109	86	126	37
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	444	1391	194	221	1682	76	270	90	164	242	195	57
Arrive On Green	0.06	0.47	0.46	0.09	0.50	0.49	0.16	0.16	0.14	0.14	0.14	0.12
Sat Flow, veh/h	1714	2959	412	1648	3334	150	1714	573	1041	1714	1380	405
Grp Volume(v), veh/h	34	905	944	169	342	356	159	0	169	86	0	163
Grp Sat Flow(s),veh/h/ln	1714	1679	1693	1648	1710	1773	1714	0	1614	1714	0	1785
Q Serve(g_s), s	1.1	50.4	50.4	6.2	13.3	13.3	9.2	0.0	10.6	4.9	0.0	9.3
Cycle Q Clear(g_c), s	1.1	50.4	50.4	6.2	13.3	13.3	9.2	0.0	10.6	4.9	0.0	9.3
Prop In Lane	1.00		0.24	1.00		0.08	1.00		0.64	1.00		0.23
Lane Grp Cap(c), veh/h	444	789	796	221	863	895	270	0	254	242	0	252
V/C Ratio(X)	0.08	1.15	1.19	0.77	0.40	0.40	0.59	0.00	0.66	0.36	0.00	0.65
Avail Cap(c_a), veh/h	524	789	796	236	863	895	430	0	405	350	0	365
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.4	28.4	28.6	27.3	16.5	16.5	41.9	0.0	43.1	41.6	0.0	43.7
Incr Delay (d2), s/veh	0.0	80.5	96.5	11.4	0.1	0.1	0.8	0.0	1.1	0.3	0.0	1.0
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	40.9	44.8	5.5	6.3	6.6	4.4	0.0	4.8	2.3	0.0	4.7
LnGrp Delay(d),s/veh	13.4	108.9	125.1	38.7	16.6	16.6	42.7	0.0	44.2	42.0	0.0	44.8
LnGrp LOS	B	F	F	D	B	B	D		D	D		D
Approach Vol, veh/h		1883			867			328			249	
Approach Delay, s/veh		115.3			20.9			43.5			43.8	
Approach LOS		F			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	10.0	59.0		20.0	14.0	55.0		18.2				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	11.0	49.0		25.0	11.0	49.0		20.0				
Max Q Clear Time (g_c+I1), s	3.1	15.3		12.6	8.2	52.4		11.3				
Green Ext Time (p_c), s	0.0	9.1		0.8	0.1	0.0		0.5				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				78.3								
HCM 2010 LOS				E								
<b>Notes</b>												




















6: Ash St #4S & Francis Ave #14  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑					↑	↑↑	↑
Traffic Volume (vph)	0	1004	247	111	574	0	0	0	0	322	697	415
Future Volume (vph)	0	1004	247	111	574	0	0	0	0	322	697	415
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.97		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3162		1605	3353					1716	3307	1523
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3162		1605	3353					1716	3307	1523
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	0	1080	266	119	617	0	0	0	0	346	749	446
RTOR Reduction (vph)	0	22	0	0	0	0	0	0	0	0	0	162
Lane Group Flow (vph)	0	1324	0	119	617	0	0	0	0	346	749	284
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		37.6		9.1	51.6					28.9	28.9	28.9
Effective Green, g (s)		38.5		10.0	52.5					29.5	29.5	29.5
Actuated g/C Ratio		0.43		0.11	0.58					0.33	0.33	0.33
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1352		178	1955					562	1083	499
v/s Ratio Prot		c0.42		c0.07	0.18						c0.23	
v/s Ratio Perm										0.20		0.19
v/c Ratio		0.98		0.67	0.32					0.62	0.69	0.57
Uniform Delay, d1		25.4		38.4	9.6					25.5	26.3	25.0
Progression Factor		1.00		0.95	0.44					0.84	0.86	0.78
Incremental Delay, d2		20.0		6.9	0.4					1.9	1.8	1.4
Delay (s)		45.3		43.2	4.6					23.4	24.4	20.9
Level of Service		D		D	A					C	C	C
Approach Delay (s)		45.3			10.9			0.0			23.2	
Approach LOS		D			B			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			28.9			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.83									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			74.5%			ICU Level of Service				D		
Analysis Period (min)			15									
c Critical Lane Group												

7: Maple St #3N & Francis Ave #14  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	276	1250	0	0	445	83	26	490	149	0	0	0
Future Volume (vph)	276	1250	0	0	445	83	26	490	149	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.97				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3264		1454	4413				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3264		1454	4413				
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	297	1344	0	0	478	89	28	527	160	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	44	0	0	0	0
Lane Group Flow (vph)	297	1344	0	0	552	0	25	646	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	24.1	60.4			31.4		20.1	20.1				
Effective Green, g (s)	25.0	61.3			32.3		20.7	20.7				
Actuated g/C Ratio	0.28	0.68			0.36		0.23	0.23				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	450	2239			1171		334	1014				
v/s Ratio Prot	0.18	0.41			0.17							
v/s Ratio Perm							0.02	0.15				
v/c Ratio	0.66	0.60			0.47		0.07	0.64				
Uniform Delay, d1	28.7	7.7			22.3		27.1	31.3				
Progression Factor	0.86	0.53			1.00		1.00	1.00				
Incremental Delay, d2	1.8	0.8			1.4		0.1	1.3				
Delay (s)	26.6	4.9			23.6		27.2	32.6				
Level of Service	C	A			C		C	C				
Approach Delay (s)		8.8			23.6			32.4			0.0	
Approach LOS		A			C			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.4				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			74.5%				ICU Level of Service		D			
Analysis Period (min)			15									
Description: Count Date 7/20/09												

8: Barnes & Forest Lane  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection						
Int Delay, s/veh	3.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	1	173	54	20	99	2
Future Vol, veh/h	1	173	54	20	99	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	74	74	74	74	74	74
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	234	73	27	134	3
Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	100	0	-	0	322	86
Stage 1	-	-	-	-	86	-
Stage 2	-	-	-	-	236	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1493	-	-	-	672	973
Stage 1	-	-	-	-	937	-
Stage 2	-	-	-	-	803	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	1493	-	-	-	672	973
Mov Cap-2 Maneuver	-	-	-	-	693	-
Stage 1	-	-	-	-	937	-
Stage 2	-	-	-	-	802	-
Approach	EB		WB		SB	
HCM Control Delay, s	0		0		11.4	
HCM LOS					B	
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1493	-	-	-	697	
HCM Lane V/C Ratio	0.001	-	-	-	0.196	
HCM Control Delay (s)	7.4	-	-	-	11.4	
HCM Lane LOS	A	-	-	-	B	
HCM 95th %tile Q(veh)	0	-	-	-	0.7	























9: Barnes & Pamela  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	5.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	1	271	1	6	71	31	2	1	13	149	1	2
Future Vol, veh/h	1	271	1	6	71	31	2	1	13	149	1	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	74	74	74	74	74	74	74	74	74	74	74	74
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	366	1	8	96	42	3	1	18	201	1	3
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	138	0	0	368	0	0	505	524	367	512	503	117
Stage 1	-	-	-	-	-	-	370	370	-	133	133	-
Stage 2	-	-	-	-	-	-	135	154	-	379	370	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1446	-	-	1191	-	-	478	458	678	472	471	935
Stage 1	-	-	-	-	-	-	650	620	-	870	786	-
Stage 2	-	-	-	-	-	-	868	770	-	643	620	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1446	-	-	1191	-	-	473	455	678	456	468	935
Mov Cap-2 Maneuver	-	-	-	-	-	-	473	455	-	456	468	
Stage 1	-	-	-	-	-	-	650	620	-	869	781	-
Stage 2	-	-	-	-	-	-	858	765	-	625	620	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.4			11			19		
HCM LOS							B			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	625	1446	-	-	1191	-	-	459				
HCM Lane V/C Ratio	0.035	0.001	-	-	0.007	-	-	0.448				
HCM Control Delay (s)	11	7.5	-	-	8	-	-	19				
HCM Lane LOS	B	A	-	-	A	-	-	C				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	2.3				

1: Indian Trail Road & Shawnee Ave  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis
























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	1	24	52	2	5	48	450	114	11	292	6
Future Volume (veh/h)	1	1	24	52	2	5	48	450	114	11	292	6
Number	3	8	18	7	4	14	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)	0.98		0.98	0.98		0.98	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	1800	1800	1800	1748	1800	1800	1800	1800	1872	1800	1782	1872
Adj Flow Rate, veh/h	1	1	26	56	2	5	52	484	123	12	314	6
Adj No. of Lanes	1	1	0	1	1	0	1	1	1	1	1	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	3	0	0	0	0	0	0	1	0
Cap, veh/h	299	8	205	274	63	158	772	1149	1016	573	1082	966
Arrive On Green	0.14	0.14	0.14	0.14	0.14	0.14	0.06	0.64	0.64	0.03	0.61	0.61
Sat Flow, veh/h	1406	56	1457	1342	451	1127	1714	1800	1591	1714	1782	1591
Grp Volume(v), veh/h	1	0	27	56	0	7	52	484	123	12	314	6
Grp Sat Flow(s),veh/h/ln	1406	0	1513	1342	0	1578	1714	1800	1591	1714	1782	1591
Q Serve(g_s), s	0.0	0.0	1.1	2.6	0.0	0.3	0.7	9.0	2.0	0.2	5.7	0.1
Cycle Q Clear(g_c), s	0.3	0.0	1.1	3.6	0.0	0.3	0.7	9.0	2.0	0.2	5.7	0.1
Prop In Lane	1.00		0.96	1.00		0.71	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	299	0	212	274	0	222	772	1149	1016	573	1082	966
V/C Ratio(X)	0.00	0.00	0.13	0.20	0.00	0.03	0.07	0.42	0.12	0.02	0.29	0.01
Avail Cap(c_a), veh/h	523	0	454	488	0	473	947	1149	1016	802	1082	966
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.1	0.0	25.4	26.9	0.0	25.1	4.1	6.0	4.8	4.9	6.3	5.2
Incr Delay (d2), s/veh	0.0	0.0	0.3	0.4	0.0	0.1	0.0	1.1	0.2	0.0	0.7	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	0.0	0.0	0.5	1.0	0.0	0.1	0.3	4.8	1.0	0.1	2.9	0.0
LnGrp Delay(d),s/veh	25.1	0.0	25.7	27.3	0.0	25.1	4.1	7.2	5.0	4.9	7.0	5.2
LnGrp LOS	C		C	C		C	A	A	A	A	A	A
Approach Vol, veh/h		28			63			659			332	
Approach Delay, s/veh		25.7			27.1			6.5			6.9	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.0	47.1		14.3	8.1	45.0		14.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	40.0		20.0	10.0	40.0		20.0				
Max Q Clear Time (g_c+I1), s	2.2	11.0		5.6	2.7	7.7		3.1				
Green Ext Time (p_c), s	0.0	6.6		0.3	0.0	6.8		0.3				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			8.3									
HCM 2010 LOS			A									
<b>Notes</b>												



## 2: Indian Trail Road & Barnes Rd























### Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	97	67	229	153	76	64	339	330	374	52	264	58
Future Volume (veh/h)	97	67	229	153	76	64	339	330	374	52	264	58
Number	3	8	18	7	4	14	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		0.99	1.00		0.99	1.00		1.00	1.00		0.99
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	1588	1588	1588	1588	1652	1685	1543	1605	1543	1543	1543	1620
Adj Flow Rate, veh/h	105	73	249	166	83	70	368	359	407	57	287	63
Adj No. of Lanes	1	1	1	1	1	0	1	1	1	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	416	373	315	449	223	188	537	658	537	322	619	134
Arrive On Green	0.08	0.24	0.24	0.11	0.27	0.26	0.21	0.41	0.41	0.06	0.26	0.26
Sat Flow, veh/h	1513	1588	1341	1513	827	697	1469	1605	1310	1469	2395	518
Grp Volume(v), veh/h	105	73	249	166	0	153	368	359	407	57	174	176
Grp Sat Flow(s),veh/h/ln	1513	1588	1341	1513	0	1524	1469	1605	1310	1469	1466	1447
Q Serve(g_s), s	4.0	2.9	13.7	6.2	0.0	6.4	13.3	13.3	20.8	2.2	7.8	8.1
Cycle Q Clear(g_c), s	4.0	2.9	13.7	6.2	0.0	6.4	13.3	13.3	20.8	2.2	7.8	8.1
Prop In Lane	1.00		1.00	1.00		0.46	1.00		1.00	1.00		0.36
Lane Grp Cap(c), veh/h	416	373	315	449	0	410	537	658	537	322	379	374
V/C Ratio(X)	0.25	0.20	0.79	0.37	0.00	0.37	0.69	0.55	0.76	0.18	0.46	0.47
Avail Cap(c_a), veh/h	617	527	445	598	0	506	548	839	686	555	767	757
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	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.0	24.0	28.2	18.0	0.0	23.4	14.6	17.6	19.8	19.1	24.5	24.5
Incr Delay (d2), s/veh	0.3	0.3	6.2	0.5	0.0	0.6	3.5	1.0	4.4	0.3	1.2	1.3
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	1.7	1.3	5.6	2.6	0.0	2.7	5.8	6.1	8.1	0.9	3.3	3.4
LnGrp Delay(d),s/veh	20.3	24.3	34.4	18.5	0.0	23.9	18.0	18.6	24.2	19.4	25.7	25.9
LnGrp LOS	C	C	C	B		C	B	B	C	B	C	C
Approach Vol, veh/h		427			319			1134			407	
Approach Delay, s/veh		29.2			21.1			20.4			24.9	
Approach LOS		C			C			C			C	
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	7.6	36.1	9.6	25.1	19.4	24.3	12.3	22.4				
Change Period (Y+Rc), s	4.0	4.9	4.0	4.5	4.0	4.9	4.0	4.5				
Max Green Setting (Gmax), s	16.0	40.1	16.0	25.5	16.0	40.1	16.0	25.5				
Max Q Clear Time (g_c+I1), s	4.2	22.8	6.0	8.4	15.3	10.1	8.2	15.7				
Green Ext Time (p_c), s	0.1	6.9	0.2	2.0	0.1	8.5	0.3	1.6				
Intersection Summary												
HCM 2010 Ctrl Delay			23.0									
HCM 2010 LOS			C									
Notes												













### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	2	72	1	2	9	152	1271	1	6	569	81
Future Volume (veh/h)	22	2	72	1	2	9	152	1271	1	6	569	81
Number	3	8	18	7	4	14	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)	0.99		1.00	1.00		0.99	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	1800	1765	1765	1800	1765	1765	1714	1714	1714	1714	1714	1714
Adj Flow Rate, veh/h	23	2	77	1	2	10	162	1352	1	6	605	86
Adj No. of Lanes	0	1	1	0	1	1	1	1	1	1	1	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	2	2	2	5	5	5	5	5	5
Cap, veh/h	384	28	303	160	260	302	468	1119	950	131	1119	948
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.65	0.65	0.65	0.65	0.65	0.65
Sat Flow, veh/h	1278	139	1500	358	1284	1490	727	1714	1455	390	1714	1453
Grp Volume(v), veh/h	25	0	77	3	0	10	162	1352	1	6	605	86
Grp Sat Flow(s),veh/h/ln	1416	0	1500	1642	0	1490	727	1714	1455	390	1714	1453
Q Serve(g_s), s	0.6	0.0	2.4	0.0	0.0	0.3	8.5	36.0	0.0	0.0	10.4	1.2
Cycle Q Clear(g_c), s	0.7	0.0	2.4	0.1	0.0	0.3	18.9	36.0	0.0	36.0	10.4	1.2
Prop In Lane	0.92		1.00	0.33		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	412	0	303	419	0	302	468	1119	950	131	1119	948
V/C Ratio(X)	0.06	0.00	0.25	0.01	0.00	0.03	0.35	1.21	0.00	0.05	0.54	0.09
Avail Cap(c_a), veh/h	791	0	707	845	0	703	468	1119	950	131	1119	948
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	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.8	0.0	18.5	17.6	0.0	17.7	10.2	9.6	3.3	27.6	5.1	3.5
Incr Delay (d2), s/veh	0.1	0.0	0.4	0.0	0.0	0.0	2.0	102.3	0.0	0.7	1.9	0.2
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	0.0	1.0	0.0	0.0	0.1	1.9	48.3	0.0	0.1	5.5	0.5
LnGrp Delay(d),s/veh	17.9	0.0	18.9	17.6	0.0	17.7	12.3	111.9	3.3	28.2	7.0	3.7
LnGrp LOS	B		B	B		B	B	F	A	C	A	A
Approach Vol, veh/h		102			13			1515			697	
Approach Delay, s/veh		18.7			17.7			101.2			6.8	
Approach LOS		B			B			F			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		40.0		15.2		40.0		15.2				
Change Period (Y+Rc), s		4.9		* 4.2		4.9		* 4.2				
Max Green Setting (Gmax), s		35.1		* 26		35.1		* 26				
Max Q Clear Time (g_c+I1), s		38.0		2.3		38.0		4.4				
Green Ext Time (p_c), s		0.0		0.4		0.0		0.4				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay			68.8									
HCM 2010 LOS			E									
<b>Notes</b>												





















#### 4: Francis Ave #14 & Indian Trail Road Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Movement	EBL	EBT	WBT	WBR	SEL	SER		
Lane Configurations								
Traffic Volume (veh/h)	178	465	644	1375	635	97		
Future Volume (veh/h)	178	465	644	1375	635	97		
Number	1	6	2	12	3	18		
Initial Q (Qb), veh	0	0	0	0	0	0		
Ped-Bike Adj(A_pbT)	1.00			1.00	1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	0.99	1.00	1.00		
Adj Sat Flow, veh/h/ln	1714	1714	1714	1714	1714	1800		
Adj Flow Rate, veh/h	189	495	685	0	676	0		
Adj No. of Lanes	1	2	2	1	2	1		
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94		
Percent Heavy Veh, %	5	5	5	5	5	0		
Cap, veh/h	450	1787	1787	793	979	432		
Arrive On Green	0.55	0.55	0.55	0.00	0.30	0.00		
Sat Flow, veh/h	731	3343	3343	1445	3265	1530		
Grp Volume(v), veh/h	189	495	685	0	676	0		
Grp Sat Flow(s),veh/h/ln	731	1629	1629	1445	1633	1530		
Q Serve(g_s), s	10.5	4.3	6.3	0.0	9.6	0.0		
Cycle Q Clear(g_c), s	16.8	4.3	6.3	0.0	9.6	0.0		
Prop In Lane	1.00			1.00	1.00	1.00		
Lane Grp Cap(c), veh/h	450	1787	1787	793	979	432		
V/C Ratio(X)	0.42	0.28	0.38	0.00	0.69	0.00		
Avail Cap(c_a), veh/h	617	2533	2533	1124	1920	874		
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00		
Upstream Filter(I)	1.00	1.00	1.00	0.00	1.00	0.00		
Uniform Delay (d), s/veh	11.6	6.3	6.8	0.0	16.3	0.0		
Incr Delay (d2), s/veh	0.8	0.1	0.2	0.0	0.9	0.0		
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0		
%ile BackOfQ(50%),veh/ln	2.2	1.9	2.8	0.0	4.4	0.0		
LnGrp Delay(d),s/veh	12.4	6.4	7.0	0.0	17.2	0.0		
LnGrp LOS	B	A	A		B			
Approach Vol, veh/h		684	685		676			
Approach Delay, s/veh		8.1	7.0		17.2			
Approach LOS		A	A		B			
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2				6		8
Phs Duration (G+Y+Rc), s		32.9				32.9		19.8
Change Period (Y+Rc), s		4.9				4.9		4.9
Max Green Setting (Gmax), s		40.1				40.1		30.1
Max Q Clear Time (g_c+I1), s		8.3				18.8		11.6
Green Ext Time (p_c), s		10.8				9.2		3.3
Intersection Summary								
HCM 2010 Ctrl Delay			10.7					
HCM 2010 LOS			B					
Notes								













5: Alberta St & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	41	1003	111	145	1498	18	442	111	128	40	50	39
Future Volume (veh/h)	41	1003	111	145	1498	18	442	111	128	40	50	39
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		0.98	1.00		0.96
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	1800	1766	1800	1731	1800	1800	1800	1851	1872	1800	1872	1872
Adj Flow Rate, veh/h	43	1045	116	151	1560	19	354	264	133	42	52	41
Adj No. of Lanes	1	2	0	1	2	0	1	1	0	1	1	0
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	0	2	2	4	0	0	0	0	0	0	0	0
Cap, veh/h	95	1154	128	180	1487	18	455	306	154	188	104	82
Arrive On Green	0.06	0.38	0.37	0.11	0.43	0.42	0.27	0.27	0.25	0.11	0.11	0.09
Sat Flow, veh/h	1714	3046	338	1648	3460	42	1714	1155	582	1714	951	750
Grp Volume(v), veh/h	43	575	586	151	770	809	354	0	397	42	0	93
Grp Sat Flow(s),veh/h/ln	1714	1678	1706	1648	1710	1792	1714	0	1737	1714	0	1701
Q Serve(g_s), s	2.6	35.0	35.1	9.7	46.5	46.5	20.7	0.0	23.6	2.4	0.0	5.6
Cycle Q Clear(g_c), s	2.6	35.0	35.1	9.7	46.5	46.5	20.7	0.0	23.6	2.4	0.0	5.6
Prop In Lane	1.00		0.20	1.00		0.02	1.00		0.34	1.00		0.44
Lane Grp Cap(c), veh/h	95	636	646	180	735	770	455	0	461	188	0	186
V/C Ratio(X)	0.45	0.91	0.91	0.84	1.05	1.05	0.78	0.00	0.86	0.22	0.00	0.50
Avail Cap(c_a), veh/h	254	705	716	244	735	770	506	0	513	347	0	345
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	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	49.4	31.7	31.9	47.2	30.8	30.8	36.8	0.0	38.1	43.9	0.0	45.7
Incr Delay (d2), s/veh	1.2	13.6	13.5	13.1	46.4	46.2	5.9	0.0	11.9	0.2	0.0	0.8
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	1.3	18.5	18.9	5.1	31.3	32.8	10.5	0.0	12.8	1.2	0.0	2.7
LnGrp Delay(d),s/veh	50.7	45.3	45.4	60.3	77.3	77.0	42.6	0.0	50.0	44.1	0.0	46.5
LnGrp LOS	D	D	D	E	F	F	D		D	D		D
Approach Vol, veh/h		1204			1730			751			135	
Approach Delay, s/veh		45.6			75.7			46.6			45.8	
Approach LOS		D			E			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	10.0	51.4		31.8	15.8	45.5		15.0				
Change Period (Y+Rc), s	4.0	6.0		5.0	4.0	6.0		5.0				
Max Green Setting (Gmax), s	16.0	44.0		30.0	16.0	44.0		20.0				
Max Q Clear Time (g_c+I1), s	4.6	48.5		25.6	11.7	37.1		7.6				
Green Ext Time (p_c), s	0.0	0.0		1.2	0.1	2.4		0.3				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				59.4								
HCM 2010 LOS				E								
<b>Notes</b>												


















6: Ash St #4S & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑					↑	↑↑	↑
Traffic Volume (vph)	0	736	127	225	1524	0	0	0	0	224	580	406
Future Volume (vph)	0	736	127	225	1524	0	0	0	0	224	580	406
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	11	12	12	12	12	12	13	12	13
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95					1.00	0.95	1.00
Frpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	0.98
Flpb, ped/bikes		1.00		1.00	1.00					1.00	1.00	1.00
Frt		0.98		1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (prot)		3190		1605	3353					1716	3307	1524
Flt Permitted		1.00		0.95	1.00					0.95	1.00	1.00
Satd. Flow (perm)		3190		1605	3353					1716	3307	1524
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)	0	751	130	230	1555	0	0	0	0	229	592	414
RTOR Reduction (vph)	0	14	0	0	0	0	0	0	0	0	0	53
Lane Group Flow (vph)	0	867	0	230	1555	0	0	0	0	229	592	361
Confl. Peds. (#/hr)			3	3					1			4
Heavy Vehicles (%)	0%	4%	5%	3%	2%	0%	2%	2%	2%	3%	3%	2%
Bus Blockages (#/hr)	0	2	0	0	0	0	0	0	0	0	2	0
Turn Type		NA		Prot	NA					Perm	NA	Perm
Protected Phases		5		6	2						4	
Permitted Phases										4		4
Actuated Green, G (s)		37.6		20.1	62.6					27.9	27.9	27.9
Effective Green, g (s)		38.5		21.0	63.5					28.5	28.5	28.5
Actuated g/C Ratio		0.38		0.21	0.64					0.28	0.28	0.28
Clearance Time (s)		4.9		4.9	4.9					4.6	4.6	4.6
Vehicle Extension (s)		3.0		2.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1228		337	2129					489	942	434
v/s Ratio Prot		0.27		0.14	c0.46						0.18	
v/s Ratio Perm										0.13		c0.24
v/c Ratio		0.71		0.68	0.73					0.47	0.63	0.83
Uniform Delay, d1		26.0		36.4	12.4					29.5	31.1	33.5
Progression Factor		1.00		0.81	0.44					0.88	0.90	0.88
Incremental Delay, d2		3.4		1.7	0.8					0.7	1.3	12.4
Delay (s)		29.4		31.4	6.3					26.8	29.2	42.0
Level of Service		C		C	A					C	C	D
Approach Delay (s)		29.4			9.6			0.0			33.0	
Approach LOS		C			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			21.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)				12.0		
Intersection Capacity Utilization			93.9%			ICU Level of Service				F		
Analysis Period (min)			15									
c Critical Lane Group												

7: Maple St #3N & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	335	971	0	0	1111	222	431	933	176	0	0	0
Future Volume (vph)	335	971	0	0	1111	222	431	933	176	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	11	12	12	12	12	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	0.95			0.95		0.86	0.86				
Frpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.97		1.00	0.98				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1621	3288			3259		1454	4468				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1621	3288			3259		1454	4468				
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	345	1001	0	0	1145	229	444	962	181	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	23	0	0	0	0
Lane Group Flow (vph)	345	1001	0	0	1358	0	391	1173	0	0	0	0
Confl. Peds. (#/hr)			2			4	1					1
Confl. Bikes (#/hr)						1			2			
Heavy Vehicles (%)	2%	4%	0%	0%	2%	2%	1%	1%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Turn Type	Prot	NA			NA		Perm	NA				
Protected Phases	2	6			1			4				
Permitted Phases							4					
Actuated Green, G (s)	20.1	63.1			38.1		27.4	27.4				
Effective Green, g (s)	21.0	64.0			39.0		28.0	28.0				
Actuated g/C Ratio	0.21	0.64			0.39		0.28	0.28				
Clearance Time (s)	4.9	4.9			4.9		4.6	4.6				
Vehicle Extension (s)	2.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	340	2104			1271		407	1251				
v/s Ratio Prot	c0.21	0.30			c0.42							
v/s Ratio Perm							c0.27	0.26				
v/c Ratio	1.01	0.48			1.07		0.96	0.94				
Uniform Delay, d1	39.5	9.3			30.5		35.5	35.1				
Progression Factor	1.15	1.02			1.00		1.00	1.00				
Incremental Delay, d2	50.0	0.7			45.6		34.4	13.1				
Delay (s)	95.5	10.2			76.1		69.8	48.2				
Level of Service	F	B			E		E	D				
Approach Delay (s)		32.1			76.1			53.6			0.0	
Approach LOS		C			E			D			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			54.0				HCM 2000 Level of Service		D			
HCM 2000 Volume to Capacity ratio			1.02									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			93.9%				ICU Level of Service		F			
Analysis Period (min)			15									
Description: Count Date 7/20/09												



8: Barnes & Forest Lane  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

Intersection

Int Delay, s/veh 1.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	1	96	155	86	46	1
Future Vol, veh/h	1	96	155	86	46	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	75	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	104	168	93	50	1

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	262	0	322
Stage 1	-	-	215
Stage 2	-	-	107
Critical Hdwy	4.12	-	6.42
Critical Hdwy Stg 1	-	-	5.42
Critical Hdwy Stg 2	-	-	5.42
Follow-up Hdwy	2.218	-	3.518
Pot Cap-1 Maneuver	1302	-	672
Stage 1	-	-	821
Stage 2	-	-	917
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1302	-	671
Mov Cap-2 Maneuver	-	-	697
Stage 1	-	-	821
Stage 2	-	-	916

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1302	-	-	-	699
HCM Lane V/C Ratio	0.001	-	-	-	0.073
HCM Control Delay (s)	7.8	-	-	-	10.6
HCM Lane LOS	A	-	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

9: Barnes & Pamela  
Future With-Project - PM Peak Hour











Windhaven Apartments Traffic Impact Analysis

Intersection												
Int Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Traffic Vol, veh/h	1	138	3	7	238	130	3	1	17	70	1	1
Future Vol, veh/h	1	138	3	7	238	130	3	1	17	70	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	75	-	-	75	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	145	3	7	251	137	3	1	18	74	1	1
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	387	0	0	148	0	0	484	551	147	492	485	319
Stage 1	-	-	-	-	-	-	149	149	-	334	334	-
Stage 2	-	-	-	-	-	-	335	402	-	158	151	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1171	-	-	1434	-	-	493	442	900	487	482	722
Stage 1	-	-	-	-	-	-	854	774	-	680	643	-
Stage 2	-	-	-	-	-	-	679	600	-	844	772	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1171	-	-	1434	-	-	489	439	900	474	479	722
Mov Cap-2 Maneuver	-	-	-	-	-	-	489	439	-	474	479	
Stage 1	-	-	-	-	-	-	853	773	-	679	640	-
Stage 2	-	-	-	-	-	-	674	597	-	825	771	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.1			9.8			14		
HCM LOS							A			B		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	769	1171	-	-	1434	-	-	476				
HCM Lane V/C Ratio	0.029	0.001	-	-	0.005	-	-	0.159				
HCM Control Delay (s)	9.8	8.1	-	-	7.5	-	-	14				
HCM Lane LOS	A	A	-	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.6				

# 1: Indian Trail Road & Shawnee Ave

## Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	7	111	234	46	18	192	175	41	497	4
v/c Ratio	0.02	0.22	0.75	0.10	0.04	0.20	0.19	0.06	0.50	0.00
Control Delay	21.6	10.3	42.7	12.9	8.2	13.8	3.1	8.0	16.1	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.6	10.3	42.7	12.9	8.2	13.8	3.1	8.0	16.1	0.0
Queue Length 50th (ft)	3	13	113	7	3	51	0	7	111	0
Queue Length 95th (ft)	10	34	151	24	11	90	17	19	235	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	360	521	327	497	548	946	914	742	992	948
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.21	0.72	0.09	0.03	0.20	0.19	0.06	0.50	0.00











### Intersection Summary

Description: Northwest TSA

## 2: Indian Trail Road & Barnes Rd

### Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	34	12	217	201	19	55	152	53	7	661
v/c Ratio	0.07	0.03	0.46	0.38	0.03	0.19	0.24	0.09	0.02	0.68
Control Delay	16.3	29.2	7.8	20.7	19.5	16.8	19.7	1.6	15.8	29.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	29.2	7.8	20.7	19.5	16.8	19.7	1.6	15.8	29.7
Queue Length 50th (ft)	9	5	0	83	5	13	38	0	2	137
Queue Length 95th (ft)	33	22	58	150	23	46	131	8	11	291
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	634	623	654	541	658	417	951	802	545	1666
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.02	0.33	0.37	0.03	0.13	0.16	0.07	0.01	0.40

#### Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	13	102	5	29	18	367	2	22	949	73
v/c Ratio	0.05	0.30	0.02	0.10	0.07	0.29	0.00	0.03	0.75	0.07
Control Delay	17.7	8.2	17.0	7.9	5.4	5.0	0.0	4.5	13.6	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	8.2	17.0	7.9	5.4	5.0	0.0	4.5	13.6	2.7
Queue Length 50th (ft)	4	3	1	0	1	33	0	2	151	2
Queue Length 95th (ft)	14	32	8	15	12	118	0	12	#584	19
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	665	727	676	683	265	1273	1061	686	1273	1064
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.14	0.01	0.04	0.07	0.29	0.00	0.03	0.75	0.07

#### Intersection Summary

Description: Count Date 6/3/09

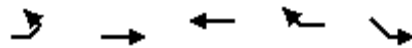
Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

#### 4: Francis Ave #14 & Indian Trail Road Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	86	574	366	261	1276
v/c Ratio	0.30	0.54	0.34	0.40	0.80
Control Delay	15.2	15.7	13.3	3.8	17.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	15.2	15.7	13.3	3.8	17.5
Queue Length 50th (ft)	19	72	42	0	139
Queue Length 95th (ft)	45	107	67	35	#360
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	596	2202	2278	1078	1602
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.14	0.26	0.16	0.24	0.80

#### Intersection Summary

Description: Count Date 6/12/15

Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.









Queue shown is maximum after two cycles.



## 5: Alberta St & Francis Ave #14

### Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	19	1500	165	605	142	146	84	154
v/c Ratio	0.04	0.99	0.74	0.32	0.56	0.45	0.33	0.55
Control Delay	12.9	51.2	44.5	16.3	52.7	21.9	46.2	48.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	51.2	44.5	16.3	52.7	21.9	46.2	48.9
Queue Length 50th (ft)	5	500	62	94	96	33	53	94
Queue Length 95th (ft)	19	#868	#206	217	177	103	107	171
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	526	1519	227	1896	399	451	353	390
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.99	0.73	0.32	0.36	0.32	0.24	0.39

### Intersection Summary

Description: Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

# 6: Ash St #4S & Francis Ave #14

## Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↙	↓	↗
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1114	116	540	331	724	423
v/c Ratio	0.80	0.65	0.27	0.60	0.68	0.61
Control Delay	28.4	54.2	4.2	25.6	25.6	10.6
Queue Delay	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	28.4	54.2	4.5	25.6	25.6	10.6
Queue Length 50th (ft)	280	70	25	157	187	89
Queue Length 95th (ft)	#438	#143	37	230	233	187
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1390	178	1970	648	1249	757
Starvation Cap Reductn	0	0	810	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.65	0.47	0.51	0.58	0.56

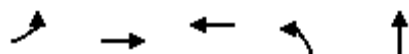
### Intersection Summary

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

## 7: Maple St #3N & Francis Ave #14

### Existing - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	253	1171	510	5	668
v/c Ratio	0.56	0.52	0.42	0.02	0.64
Control Delay	29.7	5.3	22.6	24.0	29.8
Queue Delay	0.7	0.7	0.0	0.0	0.0
Total Delay	30.5	6.0	22.6	24.0	29.8
Queue Length 50th (ft)	146	99	104	2	118
Queue Length 95th (ft)	m194	128	167	11	145
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	450	2265	1211	436	1383
Starvation Cap Reductn	49	677	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.63	0.74	0.42	0.01	0.48

### Intersection Summary

Description: Count Date 7/20/09











Northwest TSA

m Volume for 95th percentile queue is metered by upstream signal.

# 1: Indian Trail Road & Shawnee Ave

## Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	1	26	41	7	51	447	110	12	270	6
v/c Ratio	0.00	0.07	0.15	0.02	0.06	0.33	0.09	0.02	0.22	0.01
Control Delay	22.0	9.8	24.6	15.4	6.9	10.0	3.1	7.6	12.2	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	9.8	24.6	15.4	6.9	10.0	3.1	7.6	12.2	0.0
Queue Length 50th (ft)	0	0	16	1	5	54	0	1	54	0
Queue Length 95th (ft)	4	18	41	10	28	276	28	10	163	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	405	498	385	511	848	1357	1218	773	1230	1154
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.05	0.11	0.01	0.06	0.33	0.09	0.02	0.22	0.01











### Intersection Summary

Description: Northwest TSA

## 2: Indian Trail Road & Barnes Rd

### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	90	30	137	98	29	161	383	325	14	333
v/c Ratio	0.20	0.08	0.33	0.23	0.07	0.33	0.51	0.44	0.04	0.39
Control Delay	17.3	26.8	7.6	17.6	17.5	15.7	23.4	8.2	14.8	25.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.3	26.8	7.6	17.6	17.5	15.7	23.4	8.2	14.8	25.7
Queue Length 50th (ft)	21	10	0	24	4	30	88	14	2	52
Queue Length 95th (ft)	69	39	46	75	29	111	338	119	17	141
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	557	648	623	519	620	552	956	869	577	1714
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.05	0.22	0.19	0.05	0.29	0.40	0.37	0.02	0.19

#### Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd

Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	7	44	12	47	97	1068	4	33	448	49
v/c Ratio	0.02	0.11	0.03	0.12	0.15	0.81	0.00	0.17	0.34	0.04
Control Delay	16.4	6.8	16.6	6.7	5.8	18.3	0.5	8.6	5.9	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.4	6.8	16.6	6.7	5.8	18.3	0.5	8.6	5.9	2.1
Queue Length 50th (ft)	2	0	3	0	12	300	0	4	64	0
Queue Length 95th (ft)	10	19	14	20	38	#690	1	22	151	11
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	729	701	700	693	637	1314	1095	191	1314	1099
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.06	0.02	0.07	0.15	0.81	0.00	0.17	0.34	0.04

#### Intersection Summary

Description: Count Date 6/3/09

Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

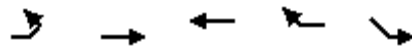
Queue shown is maximum after two cycles.



#### 4: Francis Ave #14 & Indian Trail Road

##### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	150	483	668	1072	555
v/c Ratio	0.48	0.29	0.39	0.85	0.57
Control Delay	14.5	7.5	8.1	9.4	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.5	7.5	8.1	9.4	18.0
Queue Length 50th (ft)	23	34	51	0	61
Queue Length 95th (ft)	82	76	108	#177	144
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	485	2560	2648	1359	2015
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.31	0.19	0.25	0.79	0.28

##### Intersection Summary

Description: Count Date 6/12/15

Northwest TSA









# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

## 5: Alberta St & Francis Ave #14

### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	978	147	1311	318	312	41	77
v/c Ratio	0.20	0.73	0.52	0.85	0.82	0.75	0.19	0.31
Control Delay	18.7	34.1	21.8	35.6	58.7	49.4	46.7	40.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.7	34.1	21.8	35.6	58.7	49.4	46.7	40.0
Queue Length 50th (ft)	10	284	47	412	203	180	26	38
Queue Length 95th (ft)	33	497	109	#720	#426	#360	64	91
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	327	1431	344	1544	494	519	367	402
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.68	0.43	0.85	0.64	0.60	0.11	0.19

#### Intersection Summary

Description: Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

## 6: Ash St #4S & Francis Ave #14

### Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↙	↓	↗
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	761	223	1331	220	573	369
v/c Ratio	0.60	0.66	0.62	0.47	0.63	0.78
Control Delay	26.2	36.6	5.2	30.3	32.2	35.8
Queue Delay	0.1	0.0	1.9	0.0	0.0	0.0
Total Delay	26.3	36.6	7.2	30.3	32.2	35.8
Queue Length 50th (ft)	196	150	141	117	169	177
Queue Length 95th (ft)	267	m175	m159	185	223	284
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1275	337	2161	514	992	509
Starvation Cap Reductn	0	0	635	0	0	0
Spillback Cap Reductn	47	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.66	0.87	0.43	0.58	0.72






#### Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

# 7: Maple St #3N & Francis Ave #14

## Existing - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

					
Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	318	925	1208	336	1145
v/c Ratio	0.94	0.44	0.94	0.83	0.90
Control Delay	80.4	11.1	43.6	52.2	44.4
Queue Delay	0.0	1.4	0.9	0.0	0.0
Total Delay	80.4	12.5	44.5	52.2	44.4
Queue Length 50th (ft)	216	164	375	232	265
Queue Length 95th (ft)	#378	177	#523	#405	#353
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	340	2104	1286	407	1274
Starvation Cap Reductn	0	918	0	0	0
Spillback Cap Reductn	0	0	15	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.94	0.78	0.95	0.83	0.90

### Intersection Summary

Description: Count Date 7/20/09











Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

1: Indian Trail Road & Shawnee Ave  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis











										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	7	114	248	48	18	232	192	42	530	4
v/c Ratio	0.02	0.22	0.78	0.10	0.04	0.25	0.21	0.06	0.54	0.00
Control Delay	21.6	10.3	44.7	12.6	8.2	14.2	3.1	8.0	16.9	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.6	10.3	44.7	12.6	8.2	14.2	3.1	8.0	16.9	0.0
Queue Length 50th (ft)	3	14	122	7	3	63	0	7	121	0
Queue Length 95th (ft)	10	35	161	24	11	107	17	19	254	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	358	521	326	495	518	933	912	700	981	938
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.22	0.76	0.10	0.03	0.25	0.21	0.06	0.54	0.00

Intersection Summary

Description: Northwest TSA

2: Indian Trail Road & Barnes Rd  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	48	51	330	278	79	103	142	101	37	670
v/c Ratio	0.12	0.15	0.61	0.52	0.13	0.34	0.23	0.18	0.08	0.72
Control Delay	18.6	32.3	9.0	23.2	14.7	17.9	22.9	5.9	15.3	33.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	32.3	9.0	23.2	14.7	17.9	22.9	5.9	15.3	33.5
Queue Length 50th (ft)	14	22	0	96	13	24	46	0	8	145
Queue Length 95th (ft)	46	63	76	225	57	76	125	36	34	311
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	557	563	685	539	610	396	840	724	561	1494
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.09	0.48	0.52	0.13	0.26	0.17	0.14	0.07	0.45

Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA



### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	41	160	3	6	42	451	1	4	1146	90
v/c Ratio	0.16	0.48	0.01	0.02	0.34	0.36	0.00	0.01	0.93	0.09
Control Delay	19.1	18.0	16.3	0.2	17.7	6.0	0.0	4.8	27.2	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.1	18.0	16.3	0.2	17.7	6.0	0.0	4.8	27.2	3.2
Queue Length 50th (ft)	11	30	1	0	4	48	0	0	273	4
Queue Length 95th (ft)	31	72	6	1	#50	152	0	4	#758	24
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	613	721	762	698	123	1236	1031	592	1236	1035
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.22	0.00	0.01	0.34	0.36	0.00	0.01	0.93	0.09

#### Intersection Summary

Description: Count Date 6/3/09

Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

#### 4: Francis Ave #14 & Indian Trail Road Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	99	589	374	380	1610
v/c Ratio	0.35	0.55	0.34	0.52	1.01
Control Delay	16.0	15.7	13.2	4.3	43.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	16.0	15.7	13.2	4.3	43.6
Queue Length 50th (ft)	22	74	43	0	217
Queue Length 95th (ft)	52	111	68	41	#508
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	584	2185	2260	1108	1587
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.27	0.17	0.34	1.01

#### Intersection Summary

Description: Count Date 6/12/15

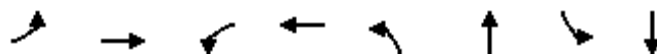
Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

5: Alberta St & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	29	1764	169	693	163	153	86	163
v/c Ratio	0.08	1.18	0.75	0.41	0.62	0.47	0.34	0.57
Control Delay	13.4	116.0	45.3	20.5	54.8	23.6	46.8	50.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	116.0	45.3	20.5	54.8	23.6	46.8	50.1
Queue Length 50th (ft)	8	~765	64	150	113	40	55	101
Queue Length 95th (ft)	26	#1125	#213	262	201	112	110	182
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	461	1500	228	1676	395	445	349	385
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	1.18	0.74	0.41	0.41	0.34	0.25	0.42

### Intersection Summary

Description: Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

6: Ash St #4S & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

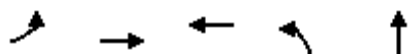
	→	↙	←	↘	↓	↖
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1290	119	614	346	749	445
v/c Ratio	0.94	0.67	0.31	0.61	0.69	0.67
Control Delay	39.9	55.5	5.0	26.0	25.9	13.6
Queue Delay	0.4	0.0	0.4	0.0	0.0	0.0
Total Delay	40.4	55.5	5.4	26.0	25.9	13.6
Queue Length 50th (ft)	360	72	34	165	193	110
Queue Length 95th (ft)	#555	#147	47	243	243	210
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1373	178	1954	648	1249	726
Starvation Cap Reductn	0	0	778	0	0	0
Spillback Cap Reductn	8	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.95	0.67	0.52	0.53	0.60	0.61

Intersection Summary

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

7: Maple St #3N & Francis Ave #14  
Future Without-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	287	1303	565	24	690
v/c Ratio	0.64	0.58	0.48	0.07	0.65
Control Delay	30.2	5.4	23.9	25.3	30.9
Queue Delay	1.2	1.4	0.0	0.0	0.0
Total Delay	31.4	6.8	23.9	25.3	30.9
Queue Length 50th (ft)	159	107	120	12	127
Queue Length 95th (ft)	m201	m128	187	33	156
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	450	2241	1188	436	1368
Starvation Cap Reductn	49	678	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.72	0.83	0.48	0.06	0.50

Intersection Summary











Description: Count Date 7/20/09

Northwest TSA

m Volume for 95th percentile queue is metered by upstream signal.

1: Indian Trail Road & Shawnee Ave  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	1	27	53	7	52	480	120	12	308	6
v/c Ratio	0.00	0.08	0.20	0.02	0.07	0.35	0.10	0.02	0.25	0.01
Control Delay	22.0	9.6	25.4	15.4	6.9	10.2	3.4	7.6	12.5	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	9.6	25.4	15.4	6.9	10.2	3.4	7.6	12.5	0.0
Queue Length 50th (ft)	0	0	21	1	5	60	1	1	63	0
Queue Length 95th (ft)	4	19	50	10	28	303	33	10	187	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	405	499	384	511	818	1357	1219	749	1230	1154
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.05	0.14	0.01	0.06	0.35	0.10	0.02	0.25	0.01











Intersection Summary

Description: Northwest TSA



2: Indian Trail Road & Barnes Rd  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	100	61	205	166	132	292	359	407	57	340
v/c Ratio	0.25	0.18	0.46	0.36	0.29	0.60	0.54	0.56	0.15	0.45
Control Delay	18.6	30.8	8.1	19.8	20.4	22.0	27.9	9.3	16.0	28.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	30.8	8.1	19.8	20.4	22.0	27.9	9.3	16.0	28.6
Queue Length 50th (ft)	28	24	0	49	32	71	128	22	12	64
Queue Length 95th (ft)	77	69	57	122	99	214	337	145	47	145
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	520	558	600	492	571	500	811	815	534	1464
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.11	0.34	0.34	0.23	0.58	0.44	0.50	0.11	0.23

Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	25	77	3	10	162	1277	1	6	562	86
v/c Ratio	0.07	0.18	0.01	0.03	0.30	0.97	0.00	0.05	0.43	0.08
Control Delay	17.2	6.1	16.0	2.4	7.4	36.2	0.0	6.7	6.8	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.2	6.1	16.0	2.4	7.4	36.2	0.0	6.7	6.8	2.0
Queue Length 50th (ft)	7	0	1	0	22	~546	0	1	88	1
Queue Length 95th (ft)	22	25	6	4	72	#873	0	6	206	16
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	626	721	748	685	543	1312	1094	123	1312	1105
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.11	0.00	0.01	0.30	0.97	0.00	0.05	0.43	0.08

#### Intersection Summary

Description: Count Date 6/3/09

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

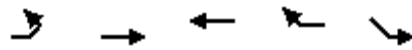
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

4: Francis Ave #14 & Indian Trail Road  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	183	495	685	1394	735
v/c Ratio	0.55	0.27	0.37	1.09	0.75
Control Delay	19.3	8.8	9.5	60.1	26.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	19.3	8.8	9.5	60.1	26.4
Queue Length 50th (ft)	45	51	76	~476	142
Queue Length 95th (ft)	#140	97	138	#757	198
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	330	1810	1873	1283	1373
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.27	0.37	1.09	0.54

Intersection Summary

Description: Count Date 6/12/15

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.









Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

5: Alberta St & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	41	1128	151	1536	354	343	42	90
v/c Ratio	0.36	0.91	0.76	1.01	0.86	0.79	0.20	0.37
Control Delay	65.7	47.9	76.8	59.3	64.9	54.0	49.4	40.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.7	47.9	76.8	59.3	64.9	54.0	49.4	40.4
Queue Length 50th (ft)	31	418	112	604	267	236	31	48
Queue Length 95th (ft)	72	#660	#234	#978	#501	#440	66	100
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	238	1304	228	1522	450	475	336	370
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.87	0.66	1.01	0.79	0.72	0.13	0.24
<b>Intersection Summary</b>								
Description: Northwest TSA								
# 95th percentile volume exceeds capacity, queue may be longer.								
Queue shown is maximum after two cycles.								

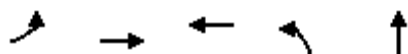
6: Ash St #4S & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↙	←	↘	↓	↖
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	861	230	1520	229	592	408
v/c Ratio	0.69	0.68	0.71	0.47	0.63	0.84
Control Delay	29.0	35.1	6.4	29.4	31.2	40.4
Queue Delay	0.2	0.0	11.3	0.0	0.0	0.0
Total Delay	29.2	35.1	17.7	29.4	31.2	40.4
Queue Length 50th (ft)	238	153	170	120	172	203
Queue Length 95th (ft)	312	m162	m169	192	230	#357
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1243	337	2130	514	992	509
Starvation Cap Reductn	0	0	605	0	0	0
Spillback Cap Reductn	46	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.68	1.00	0.45	0.60	0.80
<b>Intersection Summary</b>						
#	95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.					
m	Volume for 95th percentile queue is metered by upstream signal.					

7: Maple St #3N & Francis Ave #14  
Future Without-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	341	986	1349	387	1191
v/c Ratio	1.00	0.47	1.05	0.95	0.94
Control Delay	93.6	10.5	69.0	70.8	48.7
Queue Delay	0.0	2.0	15.8	0.0	0.0
Total Delay	93.6	12.5	84.8	70.8	48.7
Queue Length 50th (ft)	~234	128	~490	281	280
Queue Length 95th (ft)	#414	182	#627	#495	#378
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	340	2104	1287	407	1273
Starvation Cap Reductn	0	925	0	0	0
Spillback Cap Reductn	0	0	47	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.00	0.84	1.09	0.95	0.94

Intersection Summary

Description: Count Date 7/20/09

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.











# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.



1: Indian Trail Road & Shawnee Ave  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis











										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	7	114	249	48	18	244	197	42	532	4
v/c Ratio	0.02	0.22	0.78	0.10	0.04	0.26	0.22	0.06	0.54	0.00
Control Delay	21.6	10.3	44.8	12.6	8.2	14.4	3.1	8.0	17.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.6	10.3	44.8	12.6	8.2	14.4	3.1	8.0	17.0	0.0
Queue Length 50th (ft)	3	14	123	7	3	67	0	7	122	0
Queue Length 95th (ft)	10	35	162	24	11	112	17	19	255	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	358	520	326	495	517	932	914	690	979	937
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.22	0.76	0.10	0.03	0.26	0.22	0.06	0.54	0.00

Intersection Summary

Description: Northwest TSA

2: Indian Trail Road & Barnes Rd  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	62	83	446	278	81	110	142	101	37	671
v/c Ratio	0.16	0.24	0.78	0.53	0.15	0.35	0.23	0.18	0.08	0.72
Control Delay	18.9	33.8	17.5	23.6	15.6	18.2	23.0	5.9	15.4	33.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	33.8	17.5	23.6	15.6	18.2	23.0	5.9	15.4	33.8
Queue Length 50th (ft)	19	38	35	99	15	27	48	0	9	152
Queue Length 95th (ft)	56	94	176	225	60	81	125	36	34	311
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	556	558	707	530	584	395	834	719	561	1480
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.15	0.63	0.52	0.14	0.28	0.17	0.14	0.07	0.45

Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↙
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	41	160	3	6	42	458	1	4	1264	90
v/c Ratio	0.15	0.49	0.01	0.02	0.34	0.37	0.00	0.01	1.03	0.09
Control Delay	18.9	19.8	16.3	0.2	17.8	6.2	0.0	5.0	49.1	3.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	19.8	16.3	0.2	17.8	6.2	0.0	5.0	49.1	3.4
Queue Length 50th (ft)	11	35	1	0	5	52	0	0	~480	4
Queue Length 95th (ft)	31	78	6	1	#50	155	0	4	#861	25
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	613	710	759	695	123	1231	1027	584	1231	1029
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.23	0.00	0.01	0.34	0.37	0.00	0.01	1.03	0.09

#### Intersection Summary

Description: Count Date 6/3/09

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

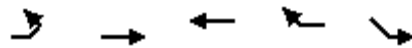
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

#### 4: Francis Ave #14 & Indian Trail Road Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	100	589	374	387	1729
v/c Ratio	0.35	0.55	0.34	0.52	1.09
Control Delay	16.1	15.7	13.2	4.3	68.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	16.1	15.7	13.2	4.3	68.4
Queue Length 50th (ft)	22	74	43	0	~306
Queue Length 95th (ft)	52	111	68	41	#561
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	584	2185	2260	1110	1589
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.17	0.27	0.17	0.35	1.09

#### Intersection Summary

Description: Count Date 6/12/15

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

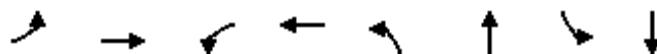
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

5: Alberta St & Francis Ave #14  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	1849	169	698	165	153	86	163
v/c Ratio	0.09	1.23	0.75	0.42	0.62	0.47	0.34	0.57
Control Delay	13.4	140.4	45.5	20.6	55.0	23.5	46.9	50.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	140.4	45.5	20.6	55.0	23.5	46.9	50.1
Queue Length 50th (ft)	9	~834	65	152	114	40	55	101
Queue Length 95th (ft)	30	#1202	#214	266	203	112	110	183
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	458	1498	227	1672	394	444	349	385
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	1.23	0.74	0.42	0.42	0.34	0.25	0.42

Intersection Summary

Description: Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

6: Ash St #4S & Francis Ave #14  
Future With-Project - AM Peak Hour

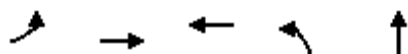
Windhaven Apartments Traffic Impact Analysis

	→	↙	←	↘	↓	↗
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	1346	119	617	346	749	446
v/c Ratio	0.98	0.67	0.32	0.61	0.69	0.67
Control Delay	47.3	55.5	5.0	25.7	25.5	13.6
Queue Delay	1.7	0.0	0.4	0.0	0.0	0.0
Total Delay	49.0	55.5	5.4	25.7	25.5	13.6
Queue Length 50th (ft)	~395	72	34	165	193	112
Queue Length 95th (ft)	#591	#148	47	241	243	215
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1373	178	1954	648	1249	725
Starvation Cap Reductn	0	0	777	0	0	0
Spillback Cap Reductn	13	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.99	0.67	0.52	0.53	0.60	0.62
<b>Intersection Summary</b>						
~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.						
# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.						



7: Maple St #3N & Francis Ave #14  
Future With-Project - AM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	297	1344	567	25	690
v/c Ratio	0.66	0.60	0.48	0.07	0.65
Control Delay	30.2	5.4	24.0	25.3	31.2
Queue Delay	1.4	1.7	0.0	0.0	0.0
Total Delay	31.7	7.1	24.0	25.3	31.2
Queue Length 50th (ft)	162	109	121	12	128
Queue Length 95th (ft)	m201	m126	188	33	157
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	450	2238	1185	436	1363
Starvation Cap Reductn	49	677	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.74	0.86	0.48	0.06	0.51

Intersection Summary











Description: Count Date 7/20/09

Northwest TSA

m Volume for 95th percentile queue is metered by upstream signal.

1: Indian Trail Road & Shawnee Ave  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis











										
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	1	27	56	7	52	484	123	12	314	6
v/c Ratio	0.00	0.08	0.21	0.02	0.07	0.36	0.10	0.02	0.26	0.01
Control Delay	22.0	9.6	25.6	15.4	6.9	10.3	3.4	7.6	12.5	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.0	9.6	25.6	15.4	6.9	10.3	3.4	7.6	12.5	0.0
Queue Length 50th (ft)	0	0	23	1	5	60	1	1	65	0
Queue Length 95th (ft)	4	19	52	10	28	306	33	10	192	0
Internal Link Dist (ft)		582		639		1510			2454	
Turn Bay Length (ft)	75		100		110		110	80		125
Base Capacity (vph)	405	499	384	511	812	1357	1219	746	1230	1154
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.00	0.05	0.15	0.01	0.06	0.36	0.10	0.02	0.26	0.01

Intersection Summary

Description: Northwest TSA

2: Indian Trail Road & Barnes Rd  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

										
Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	105	73	249	166	153	368	359	407	57	350
v/c Ratio	0.26	0.22	0.52	0.37	0.35	0.74	0.53	0.56	0.15	0.46
Control Delay	18.8	31.3	8.3	20.0	24.1	29.1	27.6	9.2	16.0	28.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.8	31.3	8.3	20.0	24.1	29.1	27.6	9.2	16.0	28.6
Queue Length 50th (ft)	29	29	0	49	45	95	128	22	12	65
Queue Length 95th (ft)	80	80	62	122	126	#353	337	145	47	147
Internal Link Dist (ft)		645			932		1282			1510
Turn Bay Length (ft)	115			125		125		125	150	
Base Capacity (vph)	508	550	623	483	561	497	797	807	529	1435
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.13	0.40	0.34	0.27	0.74	0.45	0.50	0.11	0.24

Intersection Summary

Description: Count Date: 6/23/2009

Northwest TSA

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

### 3: Indian Trail Road & Pacific Park Dr/Strong Rd Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↘	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	25	77	3	10	162	1352	1	6	605	86
v/c Ratio	0.07	0.18	0.01	0.03	0.32	1.03	0.00	0.05	0.46	0.08
Control Delay	17.2	6.1	16.0	2.4	7.9	50.6	0.0	6.7	7.2	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.2	6.1	16.0	2.4	7.9	50.6	0.0	6.7	7.2	2.2
Queue Length 50th (ft)	7	0	1	0	23	~601	0	1	99	1
Queue Length 95th (ft)	22	25	6	4	75	#938	0	6	231	17
Internal Link Dist (ft)	592		788			1204			76	
Turn Bay Length (ft)		100		75	125		100	125		100
Base Capacity (vph)	626	721	748	685	510	1312	1094	123	1312	1104
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.11	0.00	0.01	0.32	1.03	0.00	0.05	0.46	0.08

#### Intersection Summary

Description: Count Date 6/3/09

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

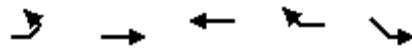
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

#### 4: Francis Ave #14 & Indian Trail Road Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	WBR	SEL
Lane Group Flow (vph)	189	495	685	1463	779
v/c Ratio	0.59	0.28	0.37	1.14	0.77
Control Delay	21.9	9.4	10.1	83.5	26.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	9.4	10.1	83.5	26.7
Queue Length 50th (ft)	50	54	80	~549	154
Queue Length 95th (ft)	#171	102	145	#843	213
Internal Link Dist (ft)		1085	1073		1042
Turn Bay Length (ft)	75			255	
Base Capacity (vph)	321	1779	1840	1279	1348
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.59	0.28	0.37	1.14	0.58

#### Intersection Summary

Description: Count Date 6/12/15

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.









Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

5: Alberta St & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	43	1161	151	1579	359	350	42	93
v/c Ratio	0.38	0.92	0.78	1.02	0.88	0.81	0.20	0.39
Control Delay	66.5	48.2	79.2	63.1	68.2	56.7	49.5	39.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.5	48.2	79.2	63.1	68.2	56.7	49.5	39.8
Queue Length 50th (ft)	32	437	112	~682	272	244	31	49
Queue Length 95th (ft)	75	#692	#234	#1021	#512	#456	66	101
Internal Link Dist (ft)		1154		1366		1768		464
Turn Bay Length (ft)	175		175		150		100	
Base Capacity (vph)	232	1270	223	1542	439	463	327	362
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.91	0.68	1.02	0.82	0.76	0.13	0.26

Intersection Summary

Description: Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

6: Ash St #4S & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis

	→	↙	←	↘	↓	↖
Lane Group	EBT	WBL	WBT	SBL	SBT	SBR
Lane Group Flow (vph)	881	230	1555	229	592	414
v/c Ratio	0.71	0.68	0.73	0.47	0.63	0.85
Control Delay	29.6	34.7	6.7	29.2	30.9	41.2
Queue Delay	0.2	0.0	16.8	0.0	0.0	0.0
Total Delay	29.8	34.7	23.5	29.2	30.9	41.2
Queue Length 50th (ft)	246	153	173	120	171	207
Queue Length 95th (ft)	322	m157	m171	192	231	#366
Internal Link Dist (ft)	1572		250		508	
Turn Bay Length (ft)						400
Base Capacity (vph)	1240	337	2127	514	992	509
Starvation Cap Reductn	0	0	600	0	0	0
Spillback Cap Reductn	47	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.68	1.02	0.45	0.60	0.81

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

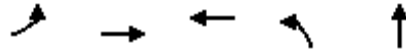
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



7: Maple St #3N & Francis Ave #14  
Future With-Project - PM Peak Hour

Windhaven Apartments Traffic Impact Analysis



Lane Group	EBL	EBT	WBT	NBL	NBT
Lane Group Flow (vph)	345	1001	1374	391	1196
v/c Ratio	1.01	0.48	1.07	0.96	0.94
Control Delay	95.8	10.4	75.4	72.8	49.2
Queue Delay	0.0	2.3	13.4	0.0	0.0
Total Delay	95.8	12.6	88.8	72.8	49.2
Queue Length 50th (ft)	~241	132	~507	284	281
Queue Length 95th (ft)	#420	184	#645	#502	#380
Internal Link Dist (ft)		250	280		1251
Turn Bay Length (ft)				115	
Base Capacity (vph)	340	2104	1287	407	1273
Starvation Cap Reductn	0	925	0	0	0
Spillback Cap Reductn	0	0	59	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.01	0.85	1.12	0.96	0.94

Intersection Summary

Description: Count Date 7/20/09

Northwest TSA

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

## Appendix D

### Individual Pipeline Project Assignments

DRAFT

Windhaven Apartments

TAZ29 Assignment Total - AM Peak Hour

Indian Trail Road/Shawnee Road													
		12	30	17									
		IN		OUT									
		0	12	0									
		SBR	SBT	SBL									
0	OUT	0	EBL	TEV =		WBR	0	IN	6				
0		0	EBT	42		WBT	0		13				
0	IN	0	EBR			WBL	6	OUT	7				
		NBL	NBT	NBR									
		0	17	7									
		OUT		IN									
		18	42	25									
Indian Trail Road/Barnes Road													
		17	41	24									
		IN		OUT									
		5	4	8									
		SBR	SBT	SBL									
		WBR	3	IN	27								
		WBT	14		89								
		WBL	9	OUT	62								
		NBL	NBT	NBR									
		42	9	21									
		OUT		IN									
		111	183	72									
Indian Trail Road/Strong Road													
		111	183	72									
		IN		OUT									
		11	101	0									
		SBR	SBT	SBL									
32	OUT	25	EBL	TEV =		WBR	0	IN	0				
106		0	EBT	254		WBT	0		0				
74	IN	49	EBR			WBL	0	OUT	0				
		NBL	NBT	NBR									
		21	47	0									
		OUT		IN									
		150	219	68									
Indian Trail Road/Multiple Middle													
		150	219	68									
		IN		OUT									
		2	148	0									
		SBR	SBT	SBL									
28	OUT	5	EBL	TEV =		WBR	0	IN	0				
92		0	EBT	303		WBT	0		0				
64	IN	59	EBR			WBL	0	OUT	0				
		NBL	NBT	NBR									
		25	64	0									
		OUT		IN									
		207	296	89									
Indian Trail Road/Francis Avenue													
		207	296	89									
		IN		OUT									
		18	0	189									
		SBR	SBT	SBL									
18	OUT	8	EBL	TEV =		WBR	81	IN	81				
25		0	EBT	296		WBT	0		271				
8	IN	0	EBR			WBL	0	OUT	189				
		NBL	NBT	NBR									
		0	0	0									
		OUT		IN									
		0	0	0									
Alberta Avenue/Francis Avenue													
		4	13	9									
		IN		OUT									
		4	0	0									
		SBR	SBT	SBL									
		WBR	0	IN	52								
		WBT	52		173								
		WBL	0	OUT	121								
		NBL	NBT	NBR									
		237	237	237									
		IN		OUT									
		166	166	166									
		OUT		IN									
		15	0	0									
		OUT		IN									
		36	51	15									
Ash Street/Francis Avenue													
		8	8	8									
		IN		OUT									
		8	0	0									
		SBR	SBT	SBL									
		EBL	0	OUT	51								
		EBT			169								
		EBR			118								
		NBL	NBT	NBR									
		169	169	169									
		IN		OUT									
		27	27	27									
		OUT		IN									
		27	27	27									
		OUT		IN									
		0	0	0									
		OUT		IN									
Maple Street/Francis Avenue													
		0	18	18									
		IN		OUT									
		0	0	0									
		SBR	SBT	SBL									
		EBL	18	OUT	43								
		EBT			135								
		EBR			74								
		NBL	NBT	NBR									
		135	135	135									
		IN		OUT									
		0	0	0									
		OUT		IN									
		0	11	0									
		OUT		IN									
		0	11	0									
		OUT		IN									

Windhaven Apartments

TAZ29 Assignment Total - PM Peak Hour

Indian Trail Road/Shawnee Avenue											

Windhaven Apartments

TAZ30 Assignment Total - AM Peak Hour

Indian Trail Road/Shawnee Road										
		2	9	7						
		IN		OUT						
		0	2	0						
		SBR	SBT	SBL						
0	OUT	0	EBL	TEV = 11		WBR	0	IN	0	
0		0	EBT			WBT	0		2	
0	IN	0	EBR			WBL	0	OUT	1	
		NBL	NBT	NBR						
		0	7	1						
		OUT		IN						
		3	11	8						
Indian Trail Road/Barnes Road										
		3	11	8						
		IN		OUT						
		0	0	3						
		SBR	SBT	SBL						
7	OUT	0	EBL	7	OUT	0	EBL	8	IN	66
9		2	EBT	9	9	2	EBT	7	7	89
2	IN	0	EBR	2	IN	0	EBR	51	OUT	23
		NBL	NBT	NBR						
		0	0	18						
		OUT		IN						
		51	69	18						
Indian Trail Road/Strong Road										
		51	69	18						
		IN		OUT						
		1	50	0						
		SBR	SBT	SBL						
2	OUT	0	EBL	TEV = 70		WBR	0	IN	1	
3		0	EBT			WBT	1		2	
1	IN	0	EBR			WBL	0	OUT	0	
		NBL	NBT	NBR						
		0	17	0						
		OUT		IN						
		50	67	17						
Indian Trail Road/Multiple Middle										
		50	67	17						
		IN		OUT						
		0	50	0						
		SBR	SBT	SBL						
0	OUT	0	EBL	TEV = 83		WBR	0	IN	12	
0		0	EBT			WBT	0		16	
0	IN	0	EBR			WBL	12	OUT	4	
		NBL	NBT	NBR						
		0	17	4						
		OUT		IN						
		61	83	21						
Indian Trail Road/Francis Avenue										
		61	83	21						
		IN		OUT						
		6	0	56						
		SBR	SBT	SBL						
6	OUT	2	EBL	TEV = 83		WBR	19	IN	19	
8		0	EBT			WBT	0		75	
2	IN	0	EBR			WBL	0	OUT	56	
		NBL	NBT	NBR						
		0	0	0						
		OUT		IN						
		0	0	0						
Alberta Avenue/Francis Avenue										
		0	0	0						
		IN		OUT						
		0	0	0						
		SBR	SBT	SBL						
		TEV = 69		EBL	0	IN	15	15	0	
				EBT	44	EBT	59	15	59	
				EBR	7	IN	7	OUT	44	
		NBL	NBT	NBR						
		2	0	0						
		OUT		IN						
		7	9	2						
Ash Street/Francis Avenue										
		3	3	0						
		IN		OUT						
		3	0	0						
		SBR	SBT	SBL						
		TEV = 59		EBL	0	OUT	15	15	0	
				EBT	23	EBT	59	23	59	
				EBR	21	IN	21	OUT	44	
		NBL	NBT	NBR						
		0	0	0						
		OUT		IN						
		21	21	0						
Maple Street/Francis Avenue										
		0	8	8						
		IN		OUT						
		0	0	0						
		SBR	SBT	SBL						
		TEV = 36		EBL	8	OUT	12	12	8	
				EBT	15	EBT	36	36	15	
				EBR	0	OUT	23	23	0	
		NBL	NBT	NBR						
		7	0	0						
		OUT		IN						
		0	7	7						

## Windhaven Apartments

## TAZ30 Assignment Total - PM Peak Hour

Indian Trail Road/Shawnee Avenue																	
		6		10		3											
		IN		OUT													
		0		6		0											
		SBR		SBT		SBL											
0		OUT		0		EBL		TEV =		WBR		0		IN		1	
0		0		EBT		11		0		WBT		0		2			
0		IN		0		EBR		0		WBL		1		OUT		1	
		NBL		NBT		NBR											
		0		3		1											
		OUT		IN													
		7		11		4											
Indian Trail Road/Barnes Road																	
		7		11		4											
		IN		OUT													
		0		0		7											
		SBR		SBT		SBL											
3		OUT		0		EBL		TEV =		WBR		4		IN		32	
10				6		EBT		92		WBT		3		6		92	
6		IN		0		EBR		6		WBL		25		OUT		60	
		NBL		NBT		NBR											
		0		0		47											
		OUT		IN													
		25		71		47											
Indian Trail Road/Strong Road																	
		25		71		47											
		IN		OUT													
		1		24		0											
		SBR		SBT		SBL											
1		OUT		1		EBL		TEV =		WBR		0		IN		1	
3				1		EBT		73		WBT		1		2			
2		IN		0		EBR		0		WBL		0		OUT		1	
		NBL		NBT		NBR											
		0		0		46											
		OUT		IN													
		24		70		46											
Indian Trail Road/Multiple Middle																	
		24		70		46											
		IN		OUT													
		0		24		0											
		SBR		SBT		SBL											
0		OUT		0		EBL		TEV =		WBR		0		IN		6	
0		0		EBT		86		0		WBT		0		16			
0		IN		0		EBR		0		WBL		6		OUT		11	
		NBL		NBT		NBR											
		0		46		11											
		OUT		IN													
		30		86		56											
Indian Trail Road/Francis Avenue																	
		30		86		56											
		IN		OUT													
		3		0		27											
		SBR		SBT		SBL											
3		OUT		5		EBL		TEV =		WBR		51		IN		51	
8				0		EBT		86		WBT		0		78			
5		IN		0		EBR		25		IN		3		EBR		27	
		NBL		NBT		NBR											
		0		0		0											
		OUT		IN													
		0		0		0											
Alberta Avenue/Francis Avenue																	
		0		0		0											
		IN		OUT													
		0		0		0											
		SBR		SBT		SBL											
47		OUT		0		EBL		TEV =		WBR		0		IN		40	
71				21		EBT		71		WBT		40		62		92	
25		IN		3		EBR		0		WBL		0		OUT		21	
		NBL		NBT		NBR											
		6		0		0											
		OUT		IN													
		3		10		6											
Maple Street/Francis Avenue																	
		0		4		4											
		IN		OUT													
		0		0		0											
		SBR		SBT		SBL											
7		IN		7		0		TEV =		WBR		0		IN		33	
7		OUT		0		0		62		WBT		33		44		44	
7		0		0		0		11		WBL		0		OUT		11	
		NBL		NBT		NBR											
		19		0		0											
		OUT		IN													
		0		19		19											

# Windhaven Apartments

## TAZ31 Assignment Total - AM Peak Hour

[illegible]



Windhaven Apartments

TAZ31 Assignment Total - PM Peak Hour

Indian Trail Road/Shawnee Avenue																							
			1	0	TEV = 2			SBR	SBT	SBL	WBR	0	IN	0									
			IN	OUT							WBT	0		0									
			0	1							WBL	0	OUT	0									
			SBR	SBT				SBL															
0	OUT	0	EBL					NBL	NBT	NBR													
0		0	EBT				0	0	0														
0	IN	0	EBR				OUT		IN														
			1	2	1																		
Indian Trail Road/Barnes Road																							
			1	2	1																		
			IN	OUT																			
			0	0	1																		
			SBR	SBT	SBL	WBR	1	IN	2														
0	OUT	0	EBL				WBT	0															
1		1	EBT				WBL	1	OUT	4													
1	IN	0	EBR				NBL	NBT	NBR														
			0	0	2																		
			OUT		IN																		
			1	4	2																		
Indian Trail Road/Strong Road																							
			1	4	2																		
			IN	OUT																			
			0	1	0																		
			SBR	SBT	SBL	WBR	0	IN	0														
0	OUT	0	EBL				WBT	0		0													
1		0	EBT				WBL	0	OUT	0													
1	IN	0	EBR				NBL	NBT	NBR														
			0	2	0																		
			OUT		IN																		
			1	3	2																		
Indian Trail Road/Multiple Middle																							
			1	3	2																		
			IN	OUT																			
			0	1	0																		
			SBR	SBT	SBL	WBR	0	IN	0														
0	OUT	0	EBL				WBT	0	IN	0													
0		0	EBT				WBL	0	OUT	1													
0	IN	0	EBR				NBL	NBT	NBR														
			0	2	1																		
			OUT		IN																		
			1	4	3																		
Indian Trail Road/Francis Avenue																							
			1	4	3																		
			IN	OUT																			
			1	0	1																		
			SBR	SBT	SBL	WBR	1	IN	1														
1	OUT	1	EBL				WBT	0	2														
2		0	EBT				WBL	0	OUT	1													
1	IN	0	EBR				NBL	NBT	NBR														
			0	0	0																		
			OUT		IN																		
			0	0	0																		
			OUT		IN																		
			0	0	0																		
Alberta Avenue/Francis Avenue																							
			0	0	0																		
			IN	OUT																			
			0	0	0																		
			SBR	SBT	SBL	WBR	0	IN	1														
			0	0	0																		
			OUT		IN																		
			0	0	1																		
Ash Street/Francis Avenue																							
			7	7	0																		
			IN	OUT																			
			1	4	3																		
			SBR	SBT	SBL	WBR	0	IN	1														
			0	0	0																		
			OUT		IN																		
			1	2	1																		
Maple Street/Francis Avenue																							
			7	7	0																		
			IN	OUT																			
			1	4	3																		
			SBR	SBT	SBL	WBR	0	IN	1														
			0	0	0																		
			OUT		IN																		
			1	2	1																		
			OUT		IN																		
			0	0	0																		

