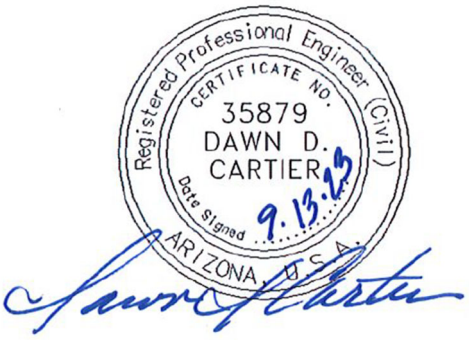
CivTech



September 13, 2023

Jessica Cassolato
Development DirectorCover
The Dinerstein Companies
1010 S. Coast Highway 101, Suite 106
Encinitas, CA, 92024

RE: MEMORANDUM FOR LEGACY NORTH – NORTH OF LEGACY BLVD. & WEST OF MILLER ROAD – SCOTTSDALE, ARIZONA

Dear Ms. Cassolato:

CivTech has been retained to provide a due diligence for the Legacy North residential development, located in the northwest corner of Miller Road/76th Street and Legacy Boulevard, in Scottsdale. The proposed development is planned to provide 108 townhomes, with an additional 320 dwelling units of multi-family apartments.

It should be noted that the proposed site was originally included within the approved June 2011, Crossroads East Master Traffic Impact Mitigation Analysis (TIMA). As documented in the Crossroads East TIMA the proposed site was identified as Parcel 5 (P5) and was shown to include approximately 593,287-SF of general office use. In the most recent approved Cavesson TIMA, the proposed site was considered as part of the 2030 background traffic. The site was considered to be 50% built out and therefore was generating ½ of the trips for Parcel 5 when compared to the buildout analysis considered in the Crossroads East TIMA. For comparison, the updated proposed Legacy North residential development site trips are compared to 50% of the original Crossroads East trips which represents the 2030 horizon year.

A Vicinity Map is shown in **Figure 1**.

SITE ACCESS

The proposed site is planned to provide three (3) gated site access driveways. A copy of the proposed site plan and access is provided in **Attachment A**.

- Access A – is planned as the main site access to the 108 townhome units. Access A will be a full movement access located on Miller Road approximately 600-feet north of Legacy Boulevard.

- Access B – is located on Legacy Boulevard approximately 700-feet west of Miller Road. Per the site plan attached Access B is planned as the main site access to the 320-DU of multifamily apartments. Per City request this access will be restricted to a right-in/right-out only.

- Access C – is planned as an exit only to the 320-DU of multifamily apartments. Access C will be a restricted left-out/right-out access located on Miller Road approximately 400-ft north of Legacy Boulevard.

BACKGROUND AND PURPOSE

As noted above, the proposed development is located at the northwest corner of Miller Road and Legacy Boulevard. The purpose of this statement is to document any anticipated offsite infrastructure needs required to accommodate new traffic from the site. The expected number of daily and peak hour trips generated by the proposed development, the trip distribution, and the trip assignments at the site access roadway along Miller Road and Legacy Boulevard were utilized in this effort.

EXISTING CONDITIONS

The parcel of land on which the proposed development will be located is currently vacant land. Directly surrounding the site to the south is a water treatment plant, to the east across 88th St the land is used for residential homes.

Figure 1 – Vicinity Map

EXISTING ROADWAYS AND INTERSECTION

Legacy Boulevard is an east-west fully improved median divided roadway with two (2) lanes in each direction of travel. The roadway begins at East of Hayden Road and terminates west at Scottsdale Road. The posted speed limit within the vicinity of the site is 45 mph.

TRIP GENERATION

The potential trip generation for the proposed Legacy North development was estimated utilizing the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 11th Edition* and *Trip Generation Handbook, 3rd Edition*. The ITE *Trip Generation Manual* contains data collected by various transportation professionals for a wide range of different land uses. The anticipated trip generation is summarized in **Table 1** and trip generation calculations have been included as **Attachment B**.

Table 1 – Trip Generation and Comparison

Land Use	ITE Code	ITE Land Use Name	Quantity	Units+	AM Distribution		PM Distribution	
					In	Out	In	Out
Proposed Land Use								
Single Family Attached	215	Single-Family Attached Housing	108	DUs	31%	69%	57%	43%
Apartments	220	Multifamily Housing (Low-Rise)	320	DUs	24%	76%	63%	37%
Crossroads Land Use								
General Office	710	General Office Use (50%)	296.644	KSF	88%	12%	17%	83%

Land Use	ADT		AM Peak Hour				PM Peak Hour			
	Rate	Total	Rate	In	Out	Total	Rate	In	Out	Total
Proposed										
Single Family Attached	7.2	778	0.48	16	36	52	0.57	35	27	62
Apartments	6.65	2,126	0.38	29	93	122	0.49	100	58	158
Total		2,904		45	129	174		135	85	220
50% of Crossroads East										
General Office	6.33	1,878	0.98	256	35	291	1.15	58	284	342
Trip Difference (Delta)		**1,026**		***-(211)***	**94**	***-(117)***		***77***	***-(199)***	***-(122)***

+ KSF = kilo square feet, multiply value by 1,000 for square feet; DU's = dwelling units

The proposed Legacy North development is anticipated to generate a total of 2,904 weekday trips with 174 AM Peak Hour trips (45 in/129 out) and 220 PM Peak Hour trips (135 in/85 out).

Assuming that 50% of the original Crossroads East TIMA parcel (P5) is built out by 2030 as general office, the original Cavasson TIMA assumed a total of 1,878 weekday trips with 291 AM Peak Hour trips (256 in/35 out) and 342 PM Peak Hour trips (58 in/ 284 out).

In comparing the trip generation for the Legacy North residential development to the number of trips assumed from parcel P5 in the Cavasson TIMA, the residential development is anticipated to generate 1,026 more daily trips with 117 less trips (-211in/+94 out) occurring in the AM peak hour and 122 less trips (+77 in/-199 out) occurring during the PM peak hour. Residential better distributed trips throughout the day. Even though more trips could be expected in 2030, the peak hour traffic anticipated will reduce. The trips anticipated from the residential development, when compared to those assumed within the 2011 Crossroads East TIMA, will remain nearly the same for the daily total with a drastic reduction in AM and PM peak hour trips.

TRIP DISTRIBUTION AND ASSIGNMENT.

Keeping consistent with both the June 2011 Crossroads East TIMA and May 2019 Cavasson TIMA, a single trip distribution pattern was assumed for the proposed Legacy North development. It is

expected that the proposed residential development will generate trips based on future employment within a 12-mile radius of the site. The 12-mile radius was evaluated using the projected employment 2030 trip distribution percentages within both approved TIMA reports, which depicted the majority of the employment centers located south and west of the site, respectively. Due to the proximity of the Loop 101 (Pima Freeway) it is anticipated the majority of the site volumes would travel east on Legacy Boulevard to the Hayden Road TI which is a more direct access to the south. **Table 2** represents the trip distribution percentages. **Figure 2** represents the expected site generated traffic.

TABLE 2 – SITE TRIP DISTRIBUTION

Direction (To/From)	Percentage
East on Legacy Boulevard	50%
West on Legacy Boulevard	40%
North on Miller Road	10%
Total	**100%**

The percentages presented in **Table 2** above, were applied to the site trips generated to determine the AM and PM peak hour site traffic at the study area intersections. **Figure 1** presents the resulting site generated traffic for all proposed Legacy North development.

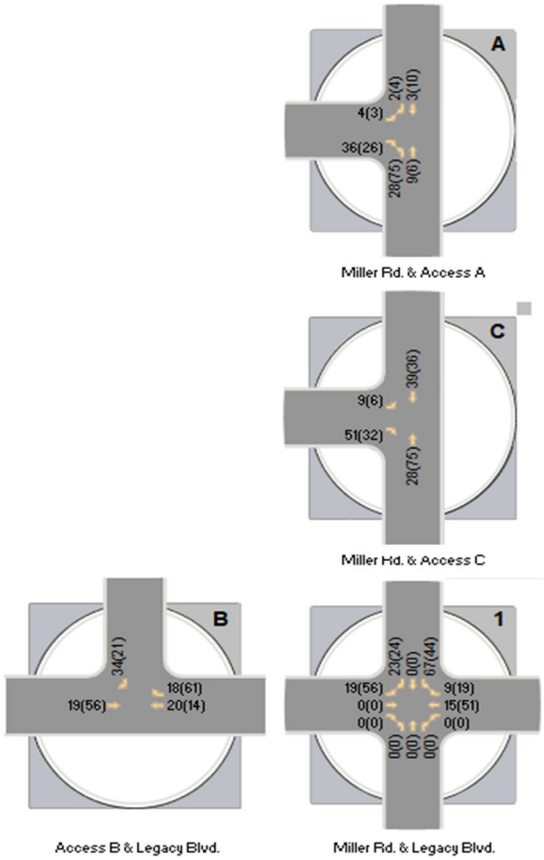


Figure 1 – Legacy North Site Volumes

FUTURE BACKGROUND TRAFFIC

To determine the projected 2030 background volumes, the projected 2030 Total volumes from the approved May 2019, Cavasson TIMA were used with the removal of the proposed parcel (P5) traffic. Excerpts of the background traffic figures from other approved TIMA's are included in **Attachment C**. The calculated volumes for the 2030 background traffic volumes are presented in **Figure 2**.

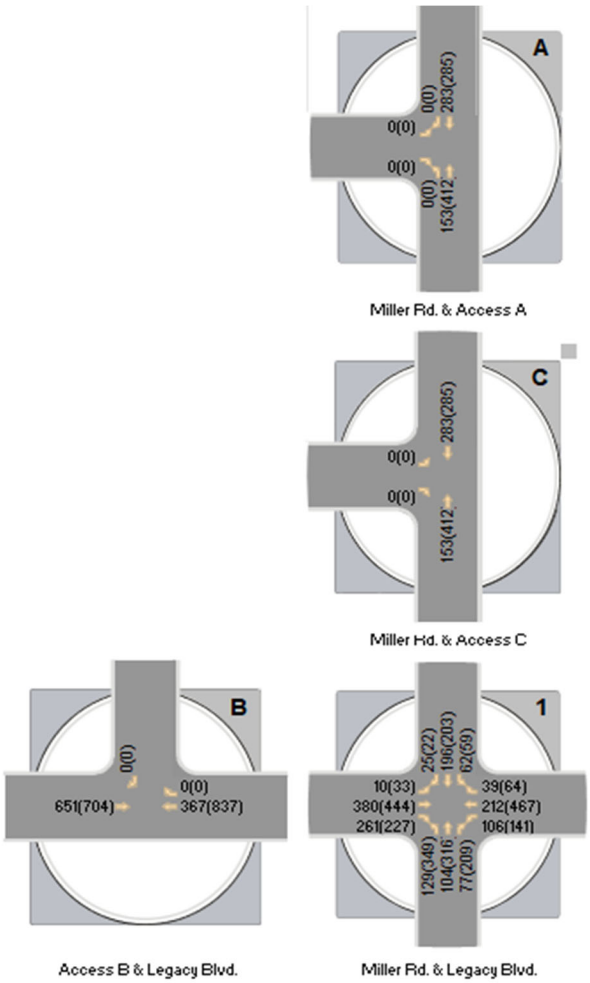


Figure 2 – 2030 Background with Cavasson TIMA Volumes

TOTAL TRAFFIC

Total traffic was determined by adding the site generated traffic to the estimated projected background traffic. Total peak hour traffic volumes for the opening year of 2030 are shown in **Figure 3**.

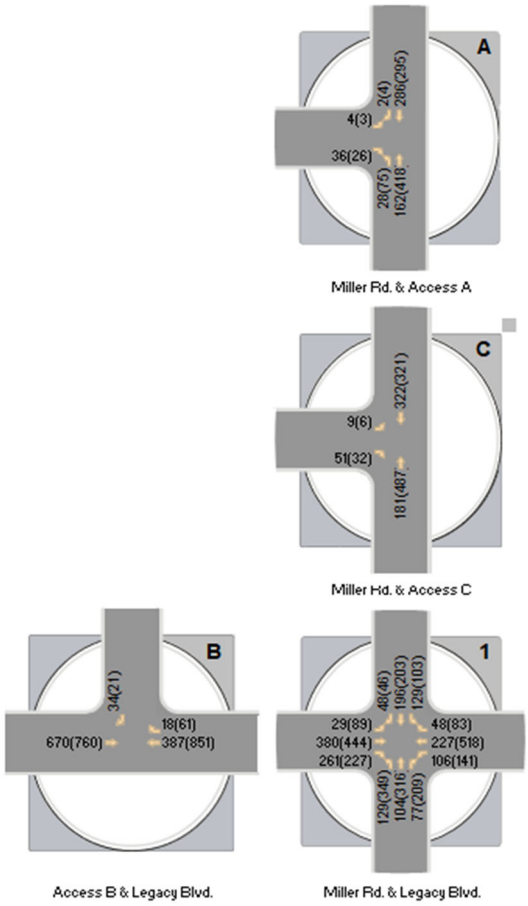


Figure 3 – 2030 Total Volumes

TRAFFIC AND IMPROVEMENT ANALYSIS

The overall intersection and approach levels of service are summarized in **Table 3** for the 2030 total traffic conditions. Detailed analysis worksheets for 2030 total analysis can be found in **Attachment D**.

TABLE 3 – 2030 PEAK HOUR LEVELS OF SERVICE

ID	Intersection	Intersection Control	Approach/ Movement	2030	
				AM	(PM)
1	Miller Rd. & Legacy Blvd.	Signal	NB	C	(C)
			SB	B	(C)
			EB	C	(C)
			WB	C	(C)
			Overall	C	(C)
A	Miller Rd. & Access A	1-way stop (EB)	NB Left	A	(A)
			EB Left	B	(B)
			EB Right	B	(B)

TABLE 4 – 2030 PEAK HOUR LEVELS OF SERVICE

ID	Intersection	Intersection Control	Approach/ Movement	2030	
				AM	(PM)
B	Access B & Legacy Blvd.	1-way stop (SB)	SB Right	A	(B)
C	Miller Rd. & Access C	1-way stop (EB)	EB Shared	B	(B)

The results of the synchro analysis summarized in **Table 3** indicates that all study intersection operate with overall acceptable levels of service (LOS C or better) under proposed 2030 conditions with the Legacy North development.

QUEUING ANALYSIS

The site access points were analyzed to determine the storage needed to accommodate the expected traffic volumes for the horizon year 2030 at the left and right turn lanes.

LEFT TURN STORAGE ANALYSIS

Left-turn lanes are required at all street intersections on major collectors and arterials per the City of Scottsdale Design Standards and Policy Manual (DS&PM).

DECELERATION LANES

Per the City of Scottsdale standards, right turn deceleration lanes are generally deemed warranted at a driveway when the following three (3) conditions are satisfied:

1. *At least 5,000 vehicles per day are expected to use the adjacent street;*
2. *The 85th percentile traffic speed on the adjacent street is 35 MPH or higher, or 45 MPH or higher for a one (1) lane per direction roadway;*
3. *At least 30 vehicles will make right turns into a driveway during a peak hour.*

In general, the deceleration lanes are a minimum length of 100-feet with a standard length of 160-feet. Modifications of the design standard are allowed on a case-by-case analysis. Right-turn deceleration lane queue lengths have been calculated and are shown in **Table 4** for the 2030 horizon year.

TABLE 4 – DECELERATION LANE CRITERIA

Intersection	Movement	PM Peak Volume	Criteria		
			1	2	3
Access A	SB Right	4	No	Yes	No
Access B	WB Right	61	Yes	Yes	Yes

Based on the right-turn lane criteria a dedicated right turn deceleration lane is warranted at Access B along Legacy. A right turn deceleration lane is not warranted at Access A along Miller Road.

TRAFFIC SIGNAL WARRANT ANALYSIS

CivTech conducted a traffic signal warrant analysis for the intersection of **Miller Road and Legacy Boulevard**. In the signal warrant analysis below, CivTech utilized projected existing, background, and total traffic volumes for the intersection. These volumes include existing volumes grown to account for regional growth added to the volumes produced by the proposed development. The signal warrant analysis worksheets can be found in **Attachment E**.

The traffic signal warrant analysis was performed in accordance with standard traffic signal warranting criteria found in the *Manual on Uniform Traffic Control Devices, 2009 Edition* (MUTCD). The MUTCD describes eight conditions under which a traffic signal might be warranted, designated Warrants 1 through 8, and indicates that, "The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the [eight] traffic signal warrants and other factors related to existing operation and safety at the study location" while cautioning that, "The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal." The MUTCD suggests that traffic control signals should not be installed unless one or more of the signal warrants are met. However, the satisfaction of a warrant or warrants is not in itself justification for a signal. Every situation is unique and warrant guidelines must be supplemented by the effects of specific site conditions and the application of good engineering judgment. Installation of a traffic signal should improve the overall safety and/or operation of an intersection and should be considered only when deemed necessary by careful traffic analysis and after less restrictive solutions have been attempted. It was this criterion to which the anticipated approach traffic volumes at the one (1) study intersection were compared to determine whether or not a traffic signal is currently warranted.

Warrant 1: Eight-Hour Vehicular Volume

The Eight-Hour Vehicular Volume Warrant is intended for locations where either of the following two conditions, or a combination of both, exist for each of any 8 hours of an average day and is, thus, the principal reason to consider the installation of a traffic signal: a large volume of intersecting traffic or traffic volumes so heavy on the major street that entering vehicles suffer extensive delay or conflict.

Condition A: Minimum Vehicular Volume

Condition A, the Minimum Vehicular Volume, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The need for a traffic control signal shall be considered if the vehicles per hour given in both of the 100 percent columns of Condition A in **Table 4C-1** of the MUTCD (reproduced below) occur on the major street and the higher-volume minor-street approaches, respectively, to the intersection for each of any 8 hours of an average day.

Condition B: Interruption of Continuous Traffic

Condition B, the Interruption of Continuous Traffic, is intended for application at locations where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. The need for a traffic control signal shall be

considered if the vehicles per hour given in both of the 100 percent columns of Condition B in **Table 4C-1** of the MUTCD occur on the major-street and the higher-volume minor-street approaches, respectively, to the intersection for each of any 8 hours of an average day.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

[a] Basic minimum hourly volume.
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures.
[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.
[d] May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.

Combination of Conditions: A and B

The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems. The need for a traffic control signal shall be considered if the vehicles per hour given in both of the 80 percent columns of Conditions A and Condition B in **Table 4C-1** of the MUTCD occur on the major-street and the higher-volume minor-street approaches, respectively, to the intersection for each of any 8 hours of an average day.

Warrant 2: Four-Hour Vehicular Volume

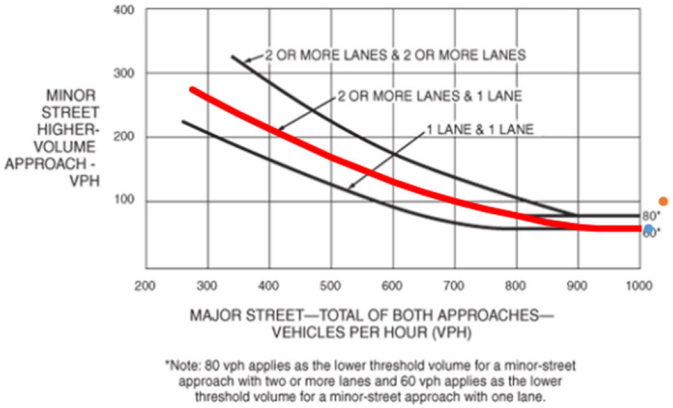
The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor street approach (one direction only) all fall above the applicable curve in **Figure 4C-2** (this and all other referenced figures are attached) for the existing combination of approach lanes.

Warrant 2: Four-Hour Vehicular Volume

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor street approach (one direction only) all fall above the applicable curve in **Figure 4C-2** (this and all other referenced figures are attached) for the existing combination of approach lanes.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Since the posted speed limit on Hayden Road exceeds 40 mph, **Figure 4C-2** was used.

Warrant 3: Peak-Hour Vehicular Volume

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. It shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

   1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach; or 5 vehicle-hours for a two-lane approach, and

   2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and

   3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

If the posted speed limit on the major street exceeds 40 mph, Figure 4C-4 may be used in place of Figure 4C-3 to satisfy the criteria in the second category of the Standard. Since the posted speed limit on Hayden Road is 45 mph, Figure 4C-4 was used for this analysis.

*Please note that the values for Warrants 2 and 3 shown on **Attachment E** were automatically calculated using formulae, not determined by the plotting method described in the MUTCD. These formulae approximate the curves in the MUTCD; they were developed by others and found in the Indiana Supplement to the year 2000 MUTCD.*

Table 5 summarizes the volume-based warrant analysis results for the existing conditions.

Table 5 – Traffic Signal Analysis Summary Warrants 1 – 3

Intersection	Warrant 1				Warrant 2	Warrant 3
	Condition A	Condition B	Combination of A & B	Overall		
Existing Scenario						
Miller Road and Legacy Boulevard	No	No	No	No	No	No
Existing + Site Scenario						
Miller Road and Legacy Boulevard	No	No	No	No	No	No
Horizon Year 2030 – No Build Scenario						
Miller Road and Legacy Boulevard	No	No	No	No	**Yes**	**Yes**
Horizon Year 2030 – Build Scenario						
Miller Road and Legacy Boulevard	No	No	No	No	**Yes**	**Yes**

The results of the volume-based traffic signal warrants analysis indicate that traffic volumes on Miller Road and Legacy Boulevard exceed the criteria for Warrants 2 and 3 under Background conditions, that is, without the proposed project. Worksheets used for the signal warrant analysis are included in **Attachment E**. While a traffic signal is warranted and the City may desire that a signal be constructed at the intersection, in CivTech's professional judgment, since the patrons of the subject development will not directly benefit from the signal in terms of access (left turns out, etc.), the developer should not be required by the City to contribute to the cost of the signal.

CONCLUSIONS

From the above, the following can be concluded:

- The proposed development is planned to provide 108 townhomes, with an additional 320 dwelling units of multi-family apartments.
- The proposed Legacy North development is anticipated to generate a total of 2,904 weekday trips with 174 AM Peak Hour trips (45 in/129 out) and 220 PM Peak Hour trips (135 in/85 out).
- At 50% of the original Crossroads East TIMA parcel (P5) general office development estimated to generate a total of 1,878 weekday trips with 291 AM Peak Hour trips (256 in/35 out) and 342 PM Peak Hour trips (58 in/ 284 out).
- In comparing the trip generation, the Legacy North residential development is anticipated to generate 1,026 more daily trips with 117 less trips (-211in/+94 out) occurring in the AM peak hour and 122 less trips (+77 in/-199 out) occurring during the PM peak hour.
- The results of the synchro analysis summarized in **Table 3** indicates that all study intersection operate with overall acceptable levels of service (LOS C or better) under proposed 2030 conditions with the Legacy North development.
- Based on the right-turn lane criteria dedicated deceleration lanes it is suggested that the proposed site Access B be considered for a dedicated right-turn lane.
- The results of the volume-based traffic signal warrants analysis indicate that traffic volumes on Miller Road and Legacy Boulevard exceed the criteria for Warrants 2 and 3 under 2030 Background conditions, that is, without the proposed project. It should also be noted that signal warrants are not meet at Legacy Boulevard under existing conditions even with full buildout of the site.
- The completion of Miller Road from the Freeway to Legacy Boulevard will provide a much needed infrastructure connection for residences to the north of the site. The shifting traffic patterns will exceed the MUTCD warrants for a traffic signal at the Miller Road and Legacy Boulevard intersection. It is likely the City of Scottsdale will make this funding and construction request of the developer.
- The Miller Road half street improvement between the Village at Greyhawk Condominiums and Legacy Boulevard will be required of the developer. This half street improvement will likely require the constructed of sidewalk, curb and getter on the west side of the road along with a minimum pavement section of 32 feet.
- All other infrastructure in the immediate area has been constructed, no other improvements are anticipated.

Please contact me with any questions you may have on this Traffic Memo.

Sincerely,

CivTech

Dawn Cartier, P.E.

Attachments (5)

A. Review Comments And Responses
B. Legacy North Site Plan
C. Trip Generation Calculations
D. Excerpts from Approved TIMA's
E. Peak Hour LOS Capacity Analysis
F. Signal Warrant Analysis

ATTACHMENT A

REVIEW COMMENTS AND RESPONSES

NWC Miller Rd & Legacy Blvd Traffic Memo **CivTech, Inc.** **Review Comments & Responses**

1st Submittal

Disposition Codes: (1) Will Comply (2) Will Evaluate (3) Delete Comment (4) Defer to Consultant/Owner

Reviewer Name, Agency: **Phil Kercher, City of Scottsdale**

Item	Review Comment	(Code) & Response
1.	Please revise the site plan and circulation plan to show a traffic signal at the intersection of Miller & Legacy, to be constructed as part of this project. Refer to the circulation master plan and Stipulation 3.2 of case 19-ZN-2002#6 (Crossroads East).	(2) Will evaluate - After conducting signal warrant analysis of exisitng volumes plus site volumes, a signal at Miller Road and Legacy Boulevard is not warranted.
2.	Please revise all applicable plans to show full-width improvements, including paving, curb, gutter and sidewalks, for Miller Road from Legacy to the Grayhawk boundary, to be constructed as part of this project. Refer to the circulation master plan and Stipulation 3.2 of case 19-ZN-2002#6.	(1) Will comply - developer is responsible for the improvements along Miller Road from Legacy Boulevard to the Grayhawk boundary.
3.	Per previous discussions, please revise all applicable plans to eliminate left-in access along Legacy Blvd.	Report and Analysis has been updated to restict Legacy Blvd./Access B to a right-in/right-out
4.	Please revise all applicable plans to show a westbound right-tun deceleration lane at the site driveway on Legacy Blvd. Refer to Section 5-3.206 of the DSPM.	(1) Will comply - Per study, westbound right turn deceleration lane is recommended.
5.	Traffic Engineering recommends extending the internal drive located in the southern portion of the site to connect to Miller Road to provide more direct access for many of the units.	Access A opperates with acceptable levels of service with all of the townhome traffic. Additional access is not necessary.

ATTACHMENT B

LEGACY NORTH SITE PLAN


3-Story End Units
3-Story Townhomes
Amenity
2k SF
3-Story Townhomes
Gate
Townhome
Entry
3-Story Apartments
3-Story Apartments
Apartment
Exit
Miller Road
Pool
30x55
3-Story Apartments
Leasing/Amenity
6k SF
3-Story Apartments
Gate
Apartment
Entry
Legacy Blvd.

ATTACHMENT C

TRIP GENERATION CALCULATIONS

Methodology Overview

This form facilitates trip generation estimation using data within the Institute of Transportation Engineer's (ITE) Trip Generation Manual, 11th Edition and methodology described within ITE's Trip Generation Handbook, 3rd Edition. These references will be referred to as Manual and Handbook, respectively. The Manual contains data collected by various transportation professionals for a wide range of different land uses, with each land use category represented by a land use code (LUC). Average rates and equations have been established that correlate the relationship between an independent variable that describes the development size and generated trips for each categorized LUC in various settings and time periods. The Handbook indicates an established methodology for how to use data contained within the Manual when to use the fitted curve instead of the average rate and when to adjustments to the volume of trips are appropriate and how to do so. The methodology steps are represented visually in boxes in Figure 3.1. This worksheet applies calculations for each box if applicable.

This tool will focus on vehicular trips for a 24-hour period on a typical weekday as well as its AM peak hour and PM peak hour. Other time period(s) may be of interest.

Land Use Types and Size

Proposed Use	Amount	Units	ITE LUC	ITE Land Use Name
Single Family Attached	108	Dwelling Units	215	Single-Family Attached Housing
LR-Apartments No Rail	320	Dwelling Units	220	Multifamily Housing (Low-Rise Not Close to Rail)

Equation Type: Equation Used [Equated Rate] (Type Abbreviations: Weighted Average Rate ("WA"), Fitted Curve (**Type: Equation Used [Equated Rate]**

Proposed Use	ADT	AM Peak Hour	PM Peak Hour	(not used)
Single Family Attached	WA: T=X*7.2 [7.20]	WA: T=X*0.48 [0.48]	WA: T=X*0.57 [0.57]	
LR-Apartments No Rail	FC: T=6.41*X+75.31 [6.65]	FC: T=0.31*X+22.85 [0.38]	FC: T=0.43*X+20.55 [0.49]	

Baseline Vehicular Trips

	ADT				AM Peak Hour				PM Peak Hour				(not used)			
Proposed Use	% In	In	Out	Total	% In	In	Out	Total	% In	In	Out	Total	% In	In	Out	Total
Single Family Attached	50%	389	389	778	31%	16	36	52	57%	35	27	62				
LR-Apartments No Rail	50%	1,063	1,063	2,126	24%	29	93	122	63%	100	58	158				

External Vehicular Trips

	ADT				AM Peak Hour				PM Peak Hour				(not used)			
Proposed Use		In	Out	Total		In	Out	Total		In	Out	Total		In	Out	Total
Single Family Attached		389	389	778		16	36	52		35	27	62				
LR-Apartments No Rail		1,063	1,063	2,126		29	93	122		100	58	158				
Totals		**1,452**	**1,452**	**2,904**		**45**	**129**	**174**		**135**	**85**	**220**				

ATTACHMENT D

EXCERPTS FROM APPROVED TIMA'S

Crossroads East

Traffic
Impact
Mitigation
Analysis

June 2011
Project No.11-410

Prepared For:
Arizona State Land Department
1616 West Adams Street
Phoenix, Arizona 85007

For Submittal to:
City of Scottsdale

Prepared By:

CivTech

10605 North Hayden Road
Suite 140
Scottsdale, Arizona 85260
480.659.4250

Figure 6: Site Plan and Access

TRIP GENERATION

2030 Trip Generation

The methodology presented above was utilized to develop trip rates associated with each land use for the planned Crossroads East densities and intensities. This was primarily conducted using fitted curve equation rates over the gross square footage and number of dwelling units proposed. Once the rate for each land use was calculated using the gross development anticipated, the rate was fixed and applied to the uses shown within each individual parcel. **Table 7** depicts the trip generation rates applied for each land use type within the Crossroads East area.

Table 7 – Crossroads East Trip Rates and Splits

Land Use	ITE Code	Size		Weekday Generated Trip Rates and Splits						
				Daily	AM Peak Hour			PM Peak Hour		
		Quantity	Units	Rate	Enter	Exit	Total	Enter	Exit	Total
Industrial Park	130	1,000	SF	5.25	82%	18%	0.49	21%	79%	0.79
Manufacturing	140	1,000	SF	3.87	78%	22%	0.82	36%	64%	0.77
Warehousing	150	1,000	SF	3.13	79%	21%	0.19	25%	75%	0.18
Apartment	220	1	DU	6.10	20%	80%	0.49	65%	35%	0.56
General Office	710	1,000	SF	6.33	88%	12%	0.98	17%	83%	1.15
Shopping Center	820	1,000	SF	19.96	61%	39%	0.37	49%	51%	2.01

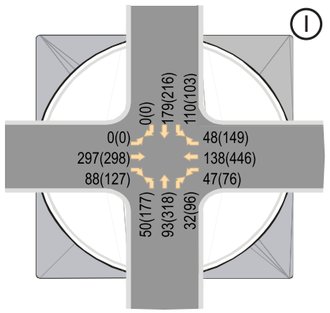
Since the Crossroads East Planning Area is so large, the trip generation has been summarized in terms of areas bound by adjacent roadways or landmarks. These areas are summarized as the following:

- ***Area North***: the area bound by Legacy Boulevard to the north, Scottsdale Road to the west, Pima Freeway (Loop 101) to the south and Hayden Road to the east.
- ***Area South***: the area bound by the Loop 101 to the north, Scottsdale Road to the west, Princess Drive to the south and Hayden Road to the east.

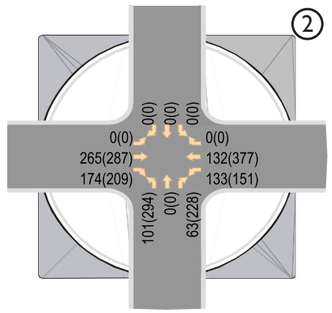
In horizon year 2030, it is anticipated that the Crossroads East Planning Area will be fully built-out. Utilizing the trip generation equations for the proposed land uses and using ITE guidelines for development of trip generation rates, the trips generated by the Crossroads East development are summarized in **Table 8**. Detailed trip generation calculation worksheets for the Crossroads East development are provided in **Appendix F**.

Table 8 – Crossroads East Trip Generation

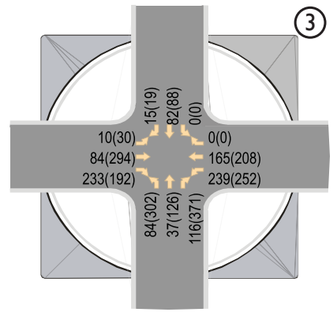
Parcel	Land Use	ITE Code	Size		Weekday Generated Trips						
					Daily	AM Peak Hour			PM Peak Hour		
			Quantity	Units	Total	Enter	Exit	Total	Enter	Exit	Total
P-5	General Office	710	593,287	SF	3,755	512	70	582	116	567	683
P-6	Apartment	220	1,291	DU	7,870	127	507	634	466	251	717
	Shopping Center	820	15,682	SF	313	4	2	6	15	16	31
P-7	Industrial Park	130	466,092	SF	2,446	186	41	227	77	290	366
	Manufacturing	140	466,092	SF	1,805	298	84	382	130	231	361
	Warehousing	150	466,092	SF	1,457	70	19	89	22	65	86
P-8	Apartment	220	543	DU	3,310	53	213	267	196	106	301
	General Office	710	388,904	SF	2,462	336	46	381	76	371	448
	Shopping Center	820	583,355	SF	11,644	131	83	214	573	597	1170
P-9	Industrial Park	130	646,866	SF	3,395	259	57	316	107	402	509
	Manufacturing	140	646,866	SF	2,505	413	116	530	180	320	501
	Warehousing	150	646,866	SF	2,022	97	26	123	30	90	119
	Shopping Center	820	423,403	SF	8,452	95	61	155	416	433	849
P-10	Shopping Center	820	351,529	SF	7,017	79	50	129	345	360	705
	Industrial Park	130	507,474	SF	2,663	203	45	248	84	315	399
	Manufacturing	140	507,474	SF	1,965	324	91	415	141	251	393
	Warehousing	150	507,474	SF	1,586	76	20	97	23	70	94
P-11	Shopping Center	820	347,609	SF	6,939	78	50	128	342	356	697
P-12	Industrial Park	130	480,612	SF	2,522	192	42	234	79	299	378
	Manufacturing	140	480,612	SF	1,861	307	87	393	134	238	372
	Warehousing	150	480,612	SF	1,502	72	19	92	22	67	89
	Shopping Center	820	459,994	SF	9,182	103	66	169	452	470	922
P-13	Industrial Park	130	490,776	SF	2,576	196	43	239	81	305	386
	Manufacturing	140	490,776	SF	1,900	313	88	402	137	243	380
	Warehousing	150	490,776	SF	1,534	74	20	94	23	68	91
P-14	Apartment	220	981	DU	5,980	96	385	482	354	191	545
	General Office	710	660,718	SF	4,182	570	78	648	129	631	760
	Shopping Center	820	991,077	SF	19,783	222	142	364	974	1,014	1,988
P-15	Apartment	220	628	DU	3,828	62	247	308	227	122	349
	General Office	710	914,760	SF	5,790	790	108	897	179	874	1,053
	Shopping Center	820	133,294	SF	2,661	30	19	49	131	136	267
Total					**134,906**	**2,925**	**6,368**	**9,293**	**6,261**	**9,745**	**16,006**
Internal Capture (20%)					*(27,196)*	*(1,284)*	*(590)*	*(1,873)*	*(1,262)*	*(1,965)*	*(3,227)*
Total External Trips					**107,710**	**5,084**	**2,335**	**7,420**	**4,999**	**7,781**	**12,780**



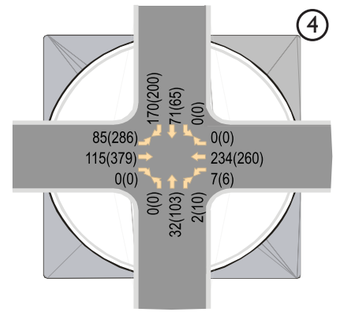
Scottsdale Rd. & Thompson Peak Pkwy



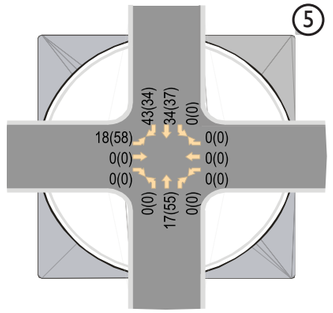
Miller Rd. & Thompson Peak Pkwy



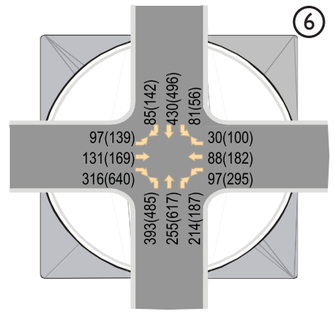
Hayden Rd. & Thompson Peak Pkwy



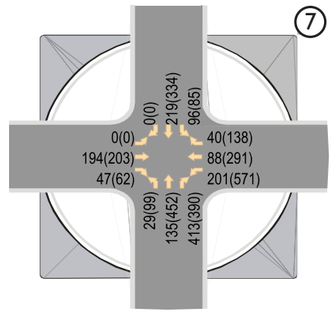
Pima Rd. & Thompson Peak Pkwy



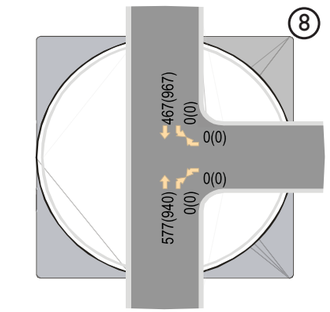
Pima Rd. & Hualapai Dr.



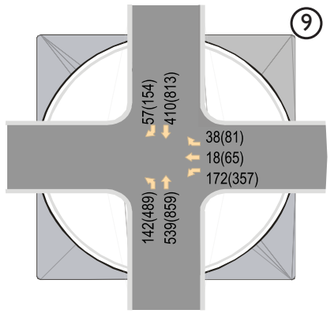
Hayden Rd. & Legacy Blvd.



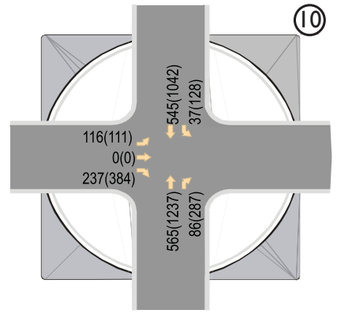
Scottsdale Rd.& Legacy Blvd.



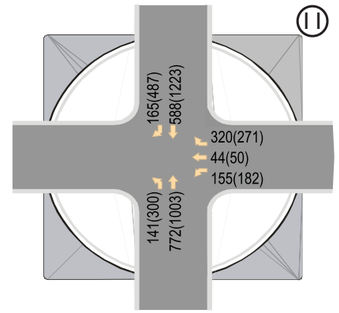
Scottsdale Rd. & 19200 North



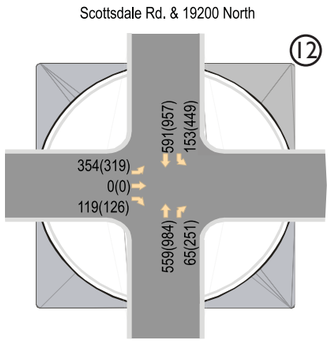
Scottsdale Rd. & Loop 101 WB Ramps



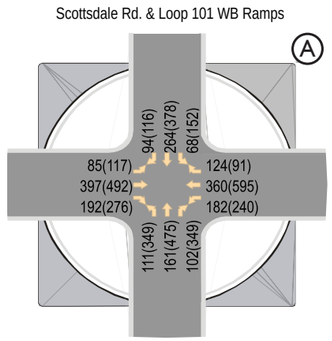
Scottsdale Rd. & Loop 101 EB Ramps



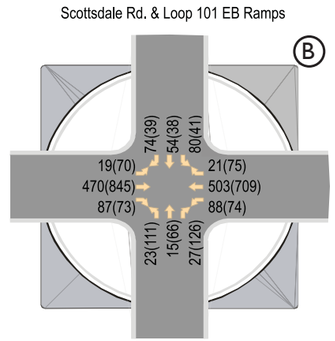
Hayden Rd. & Loop 101 WB Ramps



Scottsdale Rd. & 19200 North

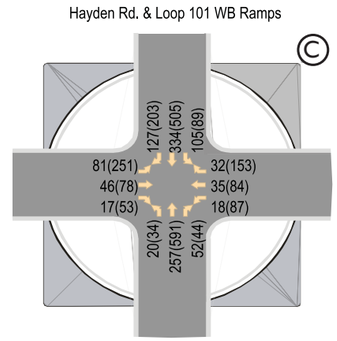


Scottsdale Rd. & Loop 101 WB Ramps



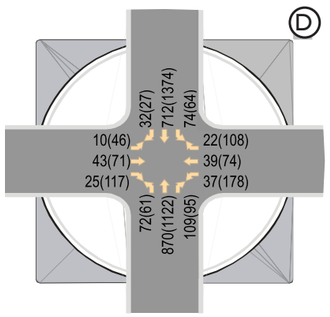
Scottsdale Rd. & Loop 101 EB Ramps

B



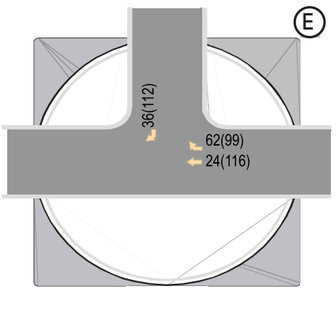
Hayden Rd. & Loop 101 WB Ramps

C

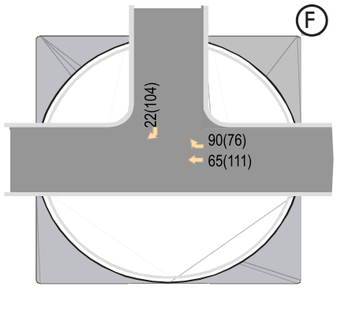


Hayden Rd. & Loop 101 EB Ramps

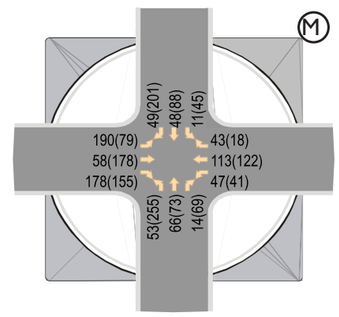
D



Miller Rd. & Legacy Blvd.



F



M

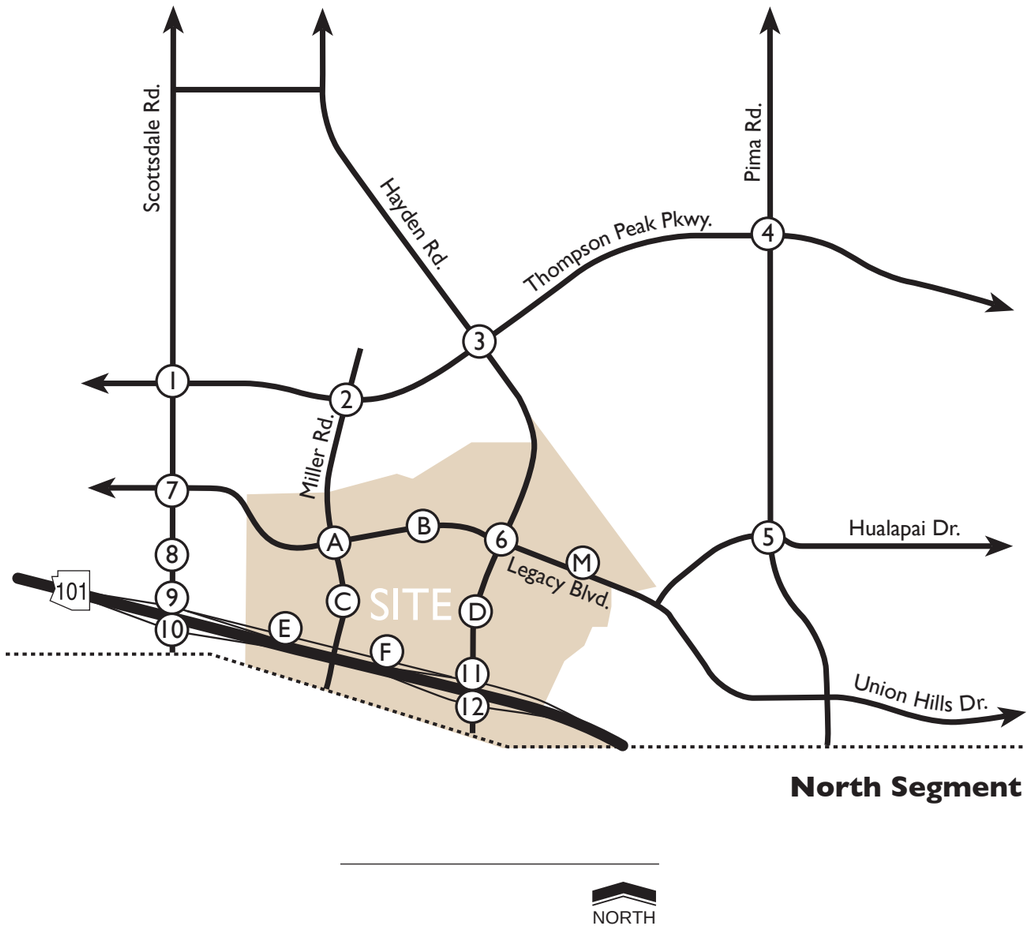


Figure 9: 2030 Peak Hour Site Generated Traffic - North

Cavasson Scottsdale

Traffic Impact Mitigation Anlaysis

Southwest Corner of Hayden Road
and Legacy Boulevard
in Scottsdale, Arizona

May 2019
Project No. 17-0310

Prepared For:

Nationwide Realty Investors
375 North Front Street, Suite 200
Columbus, Ohio 43215-2220

For Submittal to:
City of Scottsdale

Prepared By:

CivTech

10605 North Hayden Road
Suite 140
Scottsdale, Arizona 85260
480-659-4250

Figure 4: Site Plan and Access

The methodology discussed was utilized to develop trip rates associated with each land use for the planned Cavasson Phase I densities and intensities. This was primarily conducted using fitted curve equation rates with exception of the fast food restaurant which required the use of land use average trip rates from the ITE manual were applied. **Table 3** depicts the trip generation rates applied for each land use type within the proposed Cavasson development.

Table 3 –Trip Rates and Directional Splits

Land Use	ITE Code	Size		Weekday Generated Trip Rates and Splits						
				Daily	AM Peak Hour			PM Peak Hour		
		Quantity	Units	Rate	*Enter*	*Exit*	Total	*Enter*	*Exit*	Total
Hotel	310	135	Keys	8.36	*59%*	*41%*	0.49	*51%*	*49%*	0.68
Apartment	220	350	DU	7.53	*23%*	*77%*	0.42	*63%*	*37%*	0.44
General Office	710	740,000	SF	9.73	*86%*	*14%*	0.95	*16%*	*84%*	0.99
Shopping Center	820	11,000	SF	48.16	*57%*	*43%*	1.26	*52%*	*48%*	4.54
Fast Food	930	6,000	SF	315.17	*67%*	*33%*	2.07	*55%*	*45%*	14.13

Opening Year 2020 - Phase I Trip Generation

By opening year 2020, it is anticipated that the Phase I development will be fully constructed. Utilizing the ITE guidelines for development of trip generation rates, the trips generated by the Cavasson Phase I development are summarized in **Table 4**. Detailed trip generation calculation worksheets for the Phase I Cavasson development are provided in **Appendix F**.

Table 4 – Phase I Trip Generation

Land Use	ITE Code	Size		Weekday Generated Trips						
				Daily	AM Peak Hour			PM Peak Hour		
		Quantity	Units	Total	Enter	Exit	Total	Enter	Exit	Total
Hotel	310	135	Keys	1,128	39	27	66	47	45	92
Apartment	220	350	DU	2,636	34	113	147	97	57	154
General Office	710	740,000	SF	7,200	605	98	703	117	616	733
Shopping Center	820	11,000	SF	530	8	6	14	26	24	50
Fast Food Restaurant	930	6,000	SF	1,892	8	4	12	47	38	85
Total				**13,386**	**694**	**248**	**942**	**334**	**780**	**1,114**
Internal Capture Reductions				*(936)*	*(20)*	*(7)*	*(27)*	*(14)*	*(30)*	*(44)*
Total External Trips				**12,450**	**674**	**241**	**915**	**320**	**750**	**1,070**

As shown in **Table 5**, Phase I of the Cavasson Development is anticipated to generate 12,4506 daily trips to the external roadway system, with 915 occurring during the AM peak hour and 1,070 occurring during the PM peak hour. These are the anticipated trips which will be assigned to the external street network surrounding the study area.

Horizon year 2030 - Phase II (Buildout) Trip Generation

By horizon year 2030, it is anticipated that Phase II of the Cavasson development will be fully built-out. Utilizing the trip generation equations for the proposed land uses and using ITE guidelines for development of trip generation rates, the trips generated by the Cavasson Phase II development are summarized in **Table 5**. Detailed trip generation calculation worksheets for the Cavasson development are provided in **Appendix F**.

Table 5 – Buildout Trip Generation

Land Use	ITE Code	Size		Weekday Generated Trips						
				Daily	AM Peak Hour			PM Peak Hour		
		Quantity	Units	Total	Enter	Exit	Total	Enter	Exit	Total
Hotel	310	400	Keys	3,344	116	80	196	139	133	272
Apartment	220	1,600	DU	12,048	155	517	672	444	260	704
General Office	710	1,800,000	SF	17,514	1,471	239	1,710	285	1,497	1,782
Shopping Center	820	194,000	SF	9,344	139	105	244	458	423	881
Fast Food Restaurant	930	12,000	SF	3,782	17	8	25	94	76	170
Total				**46,032**	**1,898**	**949**	**2,847**	**1,420**	**2,389**	**3,809**
Internal Capture Reductions				*(11,048)*	*(191)*	*(94)*	*(285)*	*(255)*	*(431)*	*(686)*
Total External Trips				**34,984**	**1,707**	**855**	**2,562**	**1,165**	**1,958**	**3,123**

As shown in **Table 5**, Phase I and Phase II (full build) of the Cavasson Development is anticipated to generate 34,984 daily trips to the external roadway system, with 2,562 occurring during the AM peak hour and 3,123 occurring during the PM peak hour. These are the anticipated trips which will be assigned to the external street network surrounding the study area.

TRIP DISTRIBUTION

Daily trips were distributed to the roadway network based on the Maricopa Association of Governments (MAG) estimate of total employment and population within a 10-mile radius of the site. The radius selected is based on the average trip length to this land use as discussed in the Nationwide Public Transportation Survey Urban Travel Patterns report (December 1999). It was determined that the major travel pattern for the site-generated traffic is primarily to the south and west.

By horizon year 2030, it is assumed that a portion of study area will be constructed. As the surrounding Crossroads East development builds out, the internal collector roads and adjacent arterial roads will be constructed and will be utilized to disperse site generated traffic. This includes the following improvements and extensions:

- ***64th Street***, extension from Bell Road to Jomax Road.
- ***Legacy Boulevard***, extension from Scottsdale Road to 56th Street and from Hayden Road to Pima Road.
- ***Miller Road***, underpass built at Loop 101.
- ***Deer Valley Drive (Thompson Peak Parkway),*** extension from 56th Street to Scottsdale Road.
- ***Internal Collectors***, full construction of all internal collectors to the Crossroads East development.

FUTURE BACKGROUND TRAFFIC

CivTech applied a growth rate to the seasonally adjusted existing traffic counts conducted for this study to obtain the background traffic volumes along the adjacent roadway network. Historic traffic count data from the City of Scottsdale website were reviewed; the traffic counts in 2014 (11,900 ADT) and 2016 (12,400 ADT) on Thompson Peak Parkway between Scottsdale Road and Hayden Rod were compared. The comparison results in a calculated growth rate of 2% per year. Therefore, the calculated 2% per year growth rate was applied from existing traffic counts conducted in 2018 to project likely traffic in the future year 2025. A reduced 1% growth rate was applied from year 2025 to year 2030. **Table 7** below illustrates the calculated growth rate and estimated expansion factors for each study horizon year.

Table 7 – Calculated Growth Rates and Expansion Factors

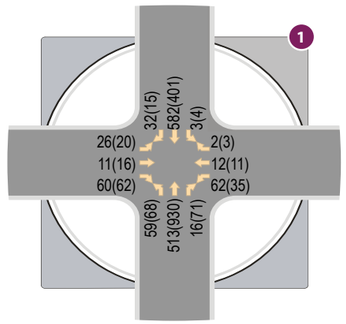
Year	Growth Rate	Expansion Factor
Seasonally Adjusted (2018)	3%	1.03
Adjusted 2018 to 2020	2%	1.042
Adjusted 2018 to 2030	2% (2018-2025) 1% (2026-2030)	1.216

To account for the likely development of the surrounding proposed Crossroads East parcels approximately 50% of the site traffic from the Crossroads East TIA was applied to the background volumes for study horizon year 2030. A copy of the Crossroads East site volumes and worksheets used to calculate the growth rate factors are included in **Appendix H**.

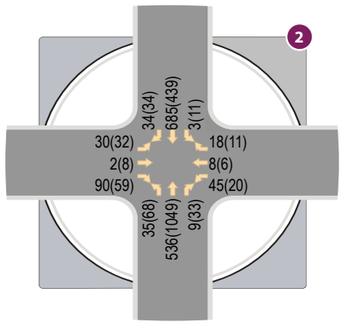
Opening year 2020 calculated background traffic volumes are presented in **Figures 8A**, **8B**, and **8C**. Horizon year 2030 calculated background traffic volumes are presented in **Figures 9A**, **9B**, and **9C**, respectively.

TOTAL TRAFFIC

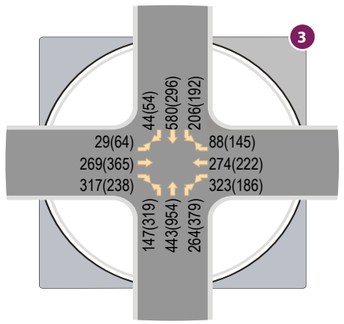
The total traffic volumes were determined for each horizon year by adding the site generated traffic volumes and the background traffic volumes. The total traffic volumes for the 2020 horizon year are illustrated in **Figures 10A**, **10B** and **10C**. The total traffic volumes for horizon year 2030 are illustrated in **Figure 11A**, **11B**, and **11C**.



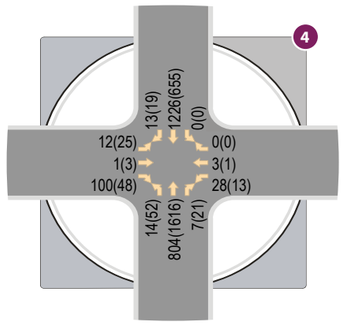
Hayden Rd & Deer Valley Rd



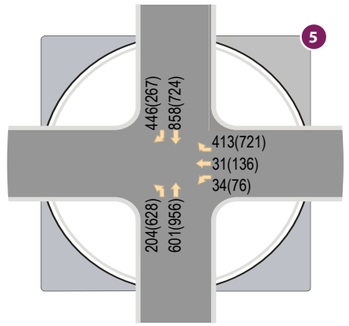
Hayden Rd & Grayhawk Dr



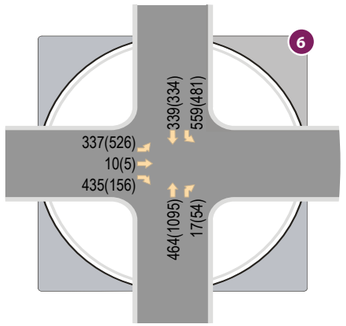
Hayden Rd & Thompson Peak Pkwy



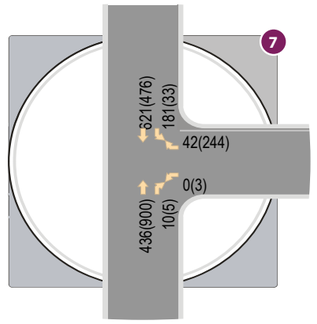
Hayden Rd & Legacy Blvd



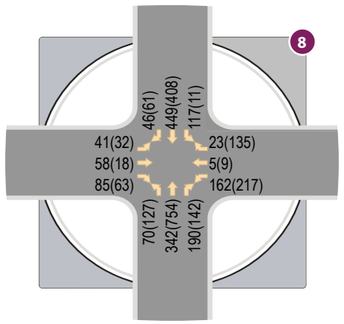
Hayden Rd & Loop 101 WB Ramps



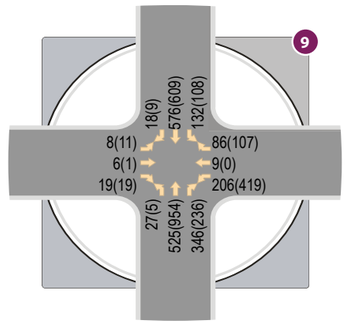
Hayden Rd & Loop 101 EB Ramps



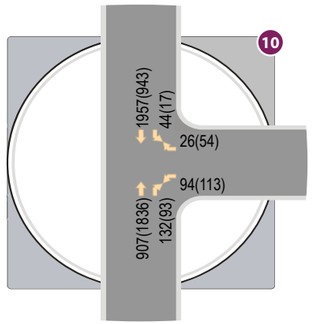
Hayden Rd & Mayo Blvd



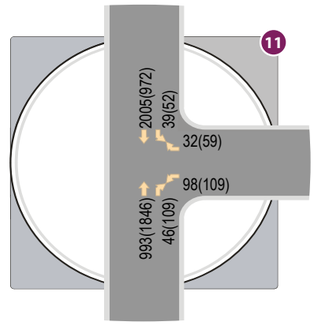
Hayden Rd & Princess Dr



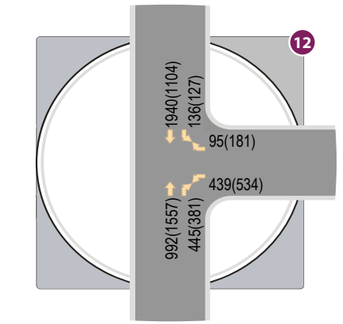
Hayden Rd & Bell Rd



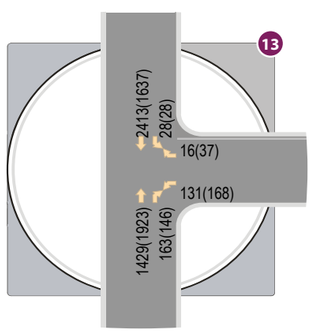
Scottsdale Rd & Deer Valley Rd



Scottsdale Rd & Grayhawk Dr



Scottsdale Rd & Thompson Peak Pkwy



Scottsdale Rd & Legacy Blvd

LEGEND

XX(XX) - AM(PM) Peak Hour Traffic Volumes

XX,XXX Average Daily Traffic

NORTH

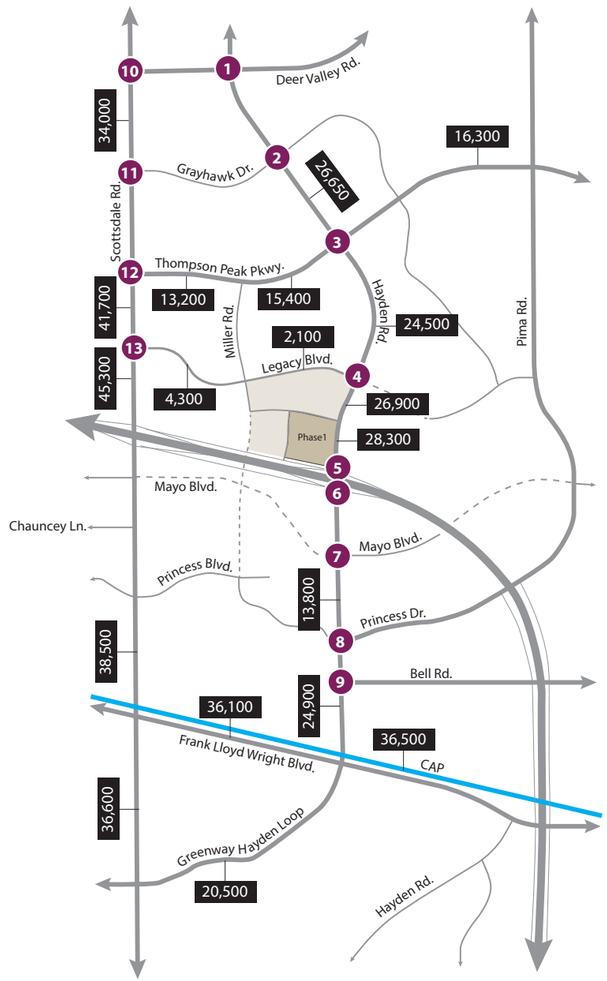
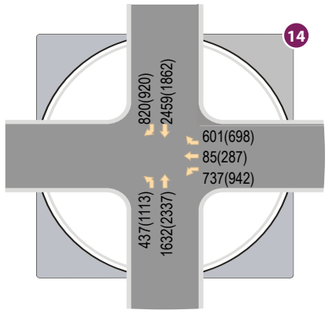
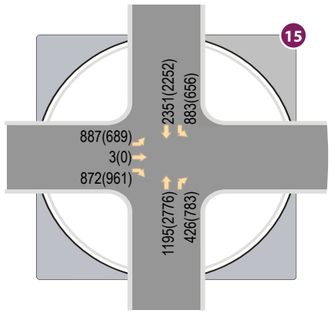


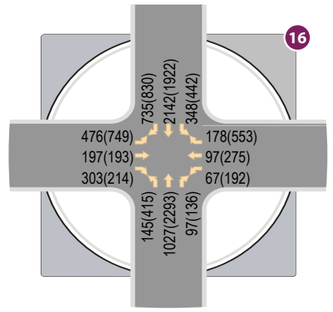
Figure 10A: 2020 Total Traffic Volumes



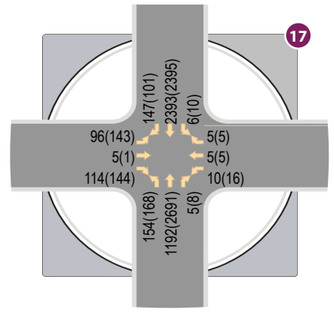
Scottsdale Rd & Loop 101 WB Ramps



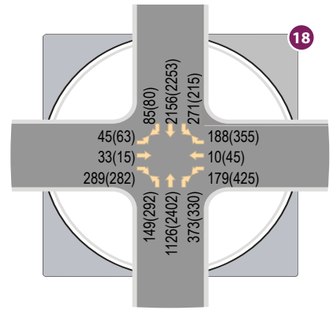
Scottsdale Rd & Loop 101 EB Ramps



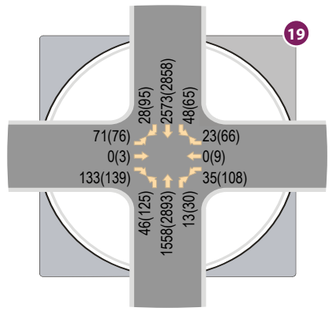
Scottsdale Rd & mayo Blvd



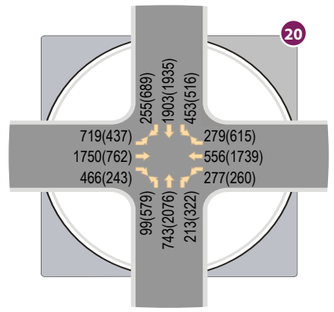
Scottsdale Rd & Chauncey Ln



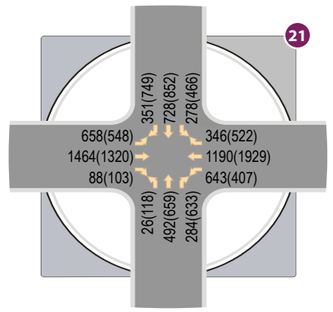
Scottsdale Rd & Peincess Blvd



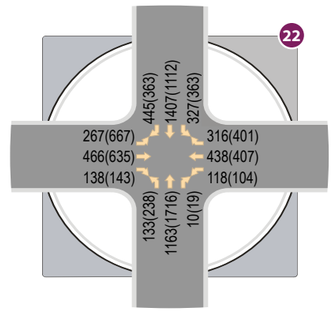
Scottsdale Rd & 17050 North



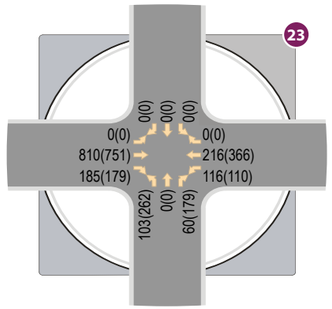
Scottsdale Rd & Frank Lloyd Wright Blvd



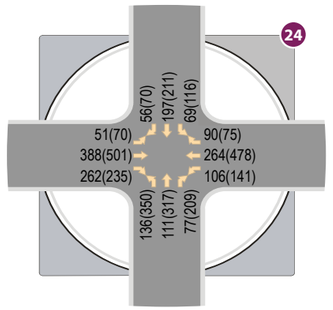
Greenway-Hayden & Frank Lloyd Wright Blvd



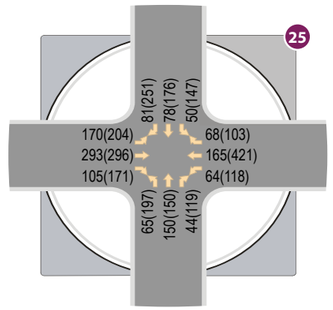
Pima Rd & Thompson Peak Pkwy



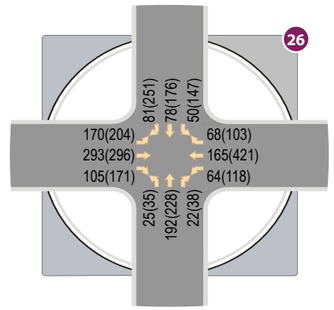
Miller Rd & Thompson Peak Pkwy



Miller Rd & Legacy Blvd



Miller Rd & Mayo Blvd



Miller Rd & Princess Dr

LEGEND

XX(XX) - AM(PM) Peak Hour Traffic Volumes

NORTH

Figure 11B: 2030 Total Traffic Volumes

ATTACHMENT E

PEAK HOUR LOS CAPACITY ANALYSIS

AM Peak Hour
1: Miller Rd. & Legacy Blvd.

Legacy North (Buildout)
09/15/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	380	261	106	227	48	129	104	77	129	196	48
Future Volume (veh/h)	29	380	261	106	227	48	129	104	77	129	196	48
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	32	422	290	118	252	53	143	116	86	143	218	53
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	2	2	2	2	2	2
Cap, veh/h	385	848	378	315	986	440	230	741	628	637	583	142
Arrive On Green	0.03	0.24	0.24	0.07	0.28	0.28	0.07	0.40	0.40	0.07	0.40	0.40
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	3456	1870	1585	1781	1453	353
Grp Volume(v), veh/h	32	422	290	118	252	53	143	116	86	143	0	271
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1728	1870	1585	1781	0	1807
Q Serve(g_s), s	1.1	8.3	13.8	3.9	4.5	2.0	3.3	3.2	2.8	3.8	0.0	8.5
Cycle Q Clear(g_c), s	1.1	8.3	13.8	3.9	4.5	2.0	3.3	3.2	2.8	3.8	0.0	8.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.20
Lane Grp Cap(c), veh/h	385	848	378	315	986	440	230	741	628	637	0	725
V/C Ratio(X)	0.08	0.50	0.77	0.37	0.26	0.12	0.62	0.16	0.14	0.22	0.00	0.37
Avail Cap(c_a), veh/h	747	1408	628	609	1408	628	813	741	628	929	0	725
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	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.9	26.6	28.6	20.8	22.7	21.8	36.7	15.7	15.6	12.5	0.0	17.0
Incr Delay (d2), s/veh	0.1	0.5	3.3	0.7	0.1	0.1	2.7	0.5	0.5	0.2	0.0	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	3.4	5.4	1.6	1.8	0.7	1.4	1.4	1.0	1.4	0.0	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	22.0	27.0	31.9	21.5	22.8	21.9	39.5	16.1	16.0	12.7	0.0	18.5
LnGrp LOS	C	C	C	C	C	C	D	B	B	B	A	B
Approach Vol, veh/h		744			423			345			414	
Approach Delay, s/veh		28.7			22.3			25.8			16.5	
Approach LOS		C			C			C			B	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.3	36.5	10.2	23.8	9.9	36.9	7.1	26.9
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	19.0	32.0	19.0	32.0	19.0	32.0	19.0	32.0
Max Q Clear Time (g_c+I1), s	5.8	5.2	5.9	15.8	5.3	10.5	3.1	6.5
Green Ext Time (p_c), s	0.3	0.9	0.2	3.5	0.3	1.6	0.0	1.8

Intersection Summary	
HCM 6th Ctrl Delay	24.2
HCM 6th LOS	C

PM Peak Hour
1: Miller Rd. & Legacy Blvd.

Legacy North (Buildout)
09/15/2023

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	89	444	227	141	518	83	349	316	209	103	203	46
Future Volume (veh/h)	89	444	227	141	518	83	349	316	209	103	203	46
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	99	493	252	157	576	92	388	351	232	114	226	51
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	2	2	2	2	2	2
Cap, veh/h	263	760	339	304	865	386	485	813	689	441	525	118
Arrive On Green	0.06	0.21	0.21	0.09	0.24	0.24	0.14	0.43	0.43	0.06	0.36	0.36
Sat Flow, veh/h	1781	3554	1585	1781	3554	1585	3456	1870	1585	1781	1477	333
Grp Volume(v), veh/h	99	493	252	157	576	92	388	351	232	114	0	277
Grp Sat Flow(s),veh/h/ln	1781	1777	1585	1781	1777	1585	1728	1870	1585	1781	0	1810
Q Serve(g_s), s	3.8	11.4	13.4	6.0	13.2	4.2	9.8	11.8	8.7	3.6	0.0	10.5
Cycle Q Clear(g_c), s	3.8	11.4	13.4	6.0	13.2	4.2	9.8	11.8	8.7	3.6	0.0	10.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.18
Lane Grp Cap(c), veh/h	263	760	339	304	865	386	485	813	689	441	0	643
V/C Ratio(X)	0.38	0.65	0.74	0.52	0.67	0.24	0.80	0.43	0.34	0.26	0.00	0.43
Avail Cap(c_a), veh/h	530	1263	563	518	1263	563	729	813	689	709	0	643
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	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.8	32.3	33.1	24.7	30.8	27.4	37.5	17.7	16.8	16.5	0.0	22.1
Incr Delay (d2), s/veh	0.9	0.9	3.2	1.4	0.9	0.3	3.8	1.7	1.3	0.3	0.0	2.1
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	1.7	4.9	5.3	2.6	5.6	1.6	4.3	5.2	3.3	1.5	0.0	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.7	33.3	36.3	26.1	31.7	27.7	41.3	19.4	18.2	16.9	0.0	24.2
LnGrp LOS	C	C	D	C	C	C	D	B	B	B	A	C
Approach Vol, veh/h		844			825			971			391	
Approach Delay, s/veh		33.4			30.2			27.8			22.1	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	43.7	12.7	23.8	17.1	36.5	10.0	26.4
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	19.0	32.0	19.0	32.0	19.0	32.0	19.0	32.0
Max Q Clear Time (g_c+I1), s	5.6	13.8	8.0	15.4	11.8	12.5	5.8	15.2
Green Ext Time (p_c), s	0.2	2.8	0.3	3.9	0.8	1.5	0.2	3.9

Intersection Summary	
HCM 6th Ctrl Delay	29.3
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	35	28	162	286	2
Future Vol, veh/h	4	35	28	162	286	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	160	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	39	31	180	318	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	561	319	320	0	-	0
Stage 1	319	-	-	-	-	-
Stage 2	242	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	489	722	1240	-	-	-
Stage 1	737	-	-	-	-	-
Stage 2	798	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	477	722	1240	-	-	-
Mov Cap-2 Maneuver	561	-	-	-	-	-
Stage 1	719	-	-	-	-	-
Stage 2	798	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.4	1.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1240	-	561	722	-	-
HCM Lane V/C Ratio	0.025	-	0.008	0.054	-	-
HCM Control Delay (s)	8	-	11.5	10.3	-	-
HCM Lane LOS	A	-	B	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0	0.2	-	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	26	75	418	295	4
Future Vol, veh/h	3	26	75	418	295	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	160	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	29	83	464	328	4

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	960	330	332	0	-	0
Stage 1	330	-	-	-	-	-
Stage 2	630	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	285	712	1227	-	-	-
Stage 1	728	-	-	-	-	-
Stage 2	531	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	266	712	1227	-	-	-
Mov Cap-2 Maneuver	390	-	-	-	-	-
Stage 1	678	-	-	-	-	-
Stage 2	531	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.7	1.2	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1227	-	390	712	-	-
HCM Lane V/C Ratio	0.068	-	0.009	0.041	-	-
HCM Control Delay (s)	8.1	-	14.3	10.3	-	-
HCM Lane LOS	A	-	B	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0	0.1	-	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑	↱		↱
Traffic Vol, veh/h	0	670	387	18	0	35
Future Vol, veh/h	0	670	387	18	0	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	160	-	-	160	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	744	430	20	0	39

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	215
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.32
Pot Cap-1 Maneuver	0	-	-	-	0	790
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	790
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	9.8
HCM LOS			A

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	790
HCM Lane V/C Ratio	-	-	-	0.049
HCM Control Delay (s)	-	-	-	9.8
HCM Lane LOS	-	-	-	A
HCM 95th %tile Q(veh)	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑	↱		↱
Traffic Vol, veh/h	0	760	851	61	0	21
Future Vol, veh/h	0	760	851	61	0	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	160	-	-	160	-	0
Veh in Median Storage, #	-	0	0	-	1	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	844	946	68	0	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	473
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.32
Pot Cap-1 Maneuver	0	-	-	-	0	538
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	538
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	538
HCM Lane V/C Ratio	-	-	-	0.043
HCM Control Delay (s)	-	-	-	12
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	51	0	181	322	0
Future Vol, veh/h	9	51	0	181	322	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	57	0	201	358	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	559	358	-	0	-	0
Stage 1	358	-	-	-	-	-
Stage 2	201	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	-	-
Pot Cap-1 Maneuver	490	686	0	-	-	0
Stage 1	707	-	0	-	-	0
Stage 2	833	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	490	686	-	-	-	-
Mov Cap-2 Maneuver	490	-	-	-	-	-
Stage 1	707	-	-	-	-	-
Stage 2	833	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	647	-
HCM Lane V/C Ratio	-	0.103	-
HCM Control Delay (s)	-	11.2	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.3	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	6	32	0	487	321	0
Future Vol, veh/h	6	32	0	487	321	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	36	0	541	357	0

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	898	357	-	0	-	0
Stage 1	357	-	-	-	-	-
Stage 2	541	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	-	-
Pot Cap-1 Maneuver	310	687	0	-	-	0
Stage 1	708	-	0	-	-	0
Stage 2	583	-	0	-	-	0
Platoon blocked, %				-	-	
Mov Cap-1 Maneuver	310	687	-	-	-	-
Mov Cap-2 Maneuver	310	-	-	-	-	-
Stage 1	708	-	-	-	-	-
Stage 2	583	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	11.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT
Capacity (veh/h)	-	576	-
HCM Lane V/C Ratio	-	0.073	-
HCM Control Delay (s)	-	11.7	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.2	-

ATTACHMENT F

SIGNAL WARRANT ANALYSIS

Legacy North (Existing)

Signal Warrant Analysis

MUTCD Warrants 1-3

Major Street: Legacy Boulevard — Speed Limit: 45 — Lanes:* 2
Minor Street: Miller Road — Speed Limit: 35 — Lanes:* 1
Locale: Scottsdale — *Number of Approach Lanes of Moving Traffic:

Major Street vph - total of both approaches	1	1	0	0	0	7	19	23	25	17	25	16	25	20	19	18	13	29	10	14	4	5	4	1
Minor Street volume - higher-volume approach (vph)	0	2	0	0	0	1	5	5	5	6	14	8	24	13	11	18	31	38	19	17	5	5	6	3
Direction of higher-volume minor approach	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
Beginning of hour	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00

Critical speed of major street traffic above 40 mph — X
In built-up area of isolated community less than 10,000 population
Urban

Warrant 1, Eight-Hour Vehicular Volume

Condition A *Minimum Vehicular Volume* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	500	600	600	500																									
(100%[a])	150	150	200	200																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	350	420	420	350	**420**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(70%[c])	105	105	140	140	**105**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Condition B *Interruption of Cont. Traffic* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	750	900	900	750																									
(100%[a])	75	75	100	100																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	525	630	630	525	**630**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(70%[c])	53	53	70	70	**53**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Combination *of Conditions A & B* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Condition A	400	480	480	400																									
(80%[b])	120	120	160	160																									
Condition B	600	720	720	600																									
(80%[b])	60	60	80	80																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Condition A	280	336	336	280	**336**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(56%[d])	84	84	112	112	**84**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Condition B	420	504	504	420	**504**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(56%[d])	42	42	56	56	**42**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Warrant 2, Four Hour Vehicular Volume

Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Warrant 3, Peak Hour

Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Volume-Based Traffic Signal Warrants Analysis Summary

Warrant		Hour(s) of the Day	Hours Required to Meet Warrant	Hours Met	Is Warrant Met?
Warrant 1. Eight-Hour Vehicular Volume	Condition A: Minimum Vehicular Volume	Any Eight Hours	8	0	No
	Condition B: Interruption of Continuous Traffic	Any Eight Hours	8	0	No
	Combination of Condition A & Condition B	Any Eight Hours	8	0	No
	Overall (at least 1 of the 3 conditions required to meet warrant)				**No**
Warrant 2. Four-Hour Vehicular Volume		Any Four Hours	4	0	**No**
Warrant 3. Peak Hour		Any One/Peak Hour	1	0	**No**

Legacy North (Existing + Site)

Signal Warrant Analysis

MUTCD Warrants 1-3

Major Street: Legacy Boulevard — Speed Limit: 45 — Lanes:* 2
Minor Street: Miller Road — Speed Limit: 35 — Lanes:* 1
Locale: Scottsdale — *Number of Approach Lanes of Moving Traffic:

Major Street vph - total of both approaches	2	51	0	0	0	61	80	186	139	76	89	175	40	32	30	29	21	46	16	22	106	8	6	2
Minor Street volume - higher-volume approach (vph)	0	11	0	0	0	6	28	28	28	33	77	44	132	72	61	99	171	210	105	94	28	28	33	17
Direction of higher-volume minor approach	NB	SB	NB	NB	NB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB
Beginning of hour	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00

Critical speed of major street traffic above 40 mph — X
In built-up area of isolated community less than 10,000 population
Urban

Warrant 1, Eight-Hour Vehicular Volume

Condition A *Minimum Vehicular Volume* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	500	600	600	500																									
(100%[a])	150	150	200	200																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	350	420	420	350	**420**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(70%[c])	105	105	140	140	**105**	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes	Yes	Yes	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Condition B *Interruption of Cont. Traffic* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	750	900	900	750																									
(100%[a])	75	75	100	100																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	525	630	630	525	**630**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(70%[c])	53	53	70	70	**53**	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Combination *of Conditions A & B* — Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Condition A	400	480	480	400																									
(80%[b])	120	120	160	160																									
Condition B	600	720	720	600																									
(80%[b])	60	60	80	80																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Condition A	280	336	336	280	**336**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(56%[d])	84	84	112	112	**84**	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Condition B	420	504	504	420	**504**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
(56%[d])	42	42	56	56	**42**	No	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Warrant 2, Four Hour Vehicular Volume

Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Warrant 3, Peak Hour

Criteria — Hour

Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Volume-Based Traffic Signal Warrants Analysis Summary

Warrant		Hour(s) of the Day	Hours Required to Meet Warrant	Hours Met	Is Warrant Met?
Warrant 1. Eight-Hour Vehicular Volume	Condition A: Minimum Vehicular Volume	Any Eight Hours	8	0	No
	Condition B: Interruption of Continuous Traffic	Any Eight Hours	8	0	No
	Combination of Condition A & Condition B	Any Eight Hours	8	0	No
	Overall (at least 1 of the 3 conditions required to meet warrant)				**No**
Warrant 2. Four-Hour Vehicular Volume		Any Four Hours	4	0	**No**
Warrant 3. Peak Hour		Any One/Peak Hour	1	0	**No**

Legacy North (Background)

Signal Warrant Analysis

MUTCD Warrants 1-3

Major Street: Legacy Boulevard — Speed Limit: 45 — Lanes:* 2

Minor Street: Miller Road — Speed Limit: 35 — Lanes:* 1

Locale: Scottsdale — *Number of Approach Lanes of Moving Traffic:

Major Street vph - total of both approaches	14	453	0	0	0	535	699	1,632	1,220	671	780	1,536	341	273	259	246	177	396	136	191	933	68	55	14
Minor Street volume - higher-volume approach (vph)	0	44	0	0	0	22	109	109	109	131	305	174	523	283	240	392	676	828	414	371	109	109	131	65
Direction of higher-volume minor approach	NB	SB	NB	NB	NB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB
Beginning of hour	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00

Critical speed of major street traffic above 40 mph — X

In built-up area of isolated community less than 10,000 population

Urban

Warrant 1, Eight-Hour Vehicular Volume

Condition A *Minimum Vehicular Volume*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	500	600	600	500																									
(100%[a])	150	150	200	200																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	350	420	420	350	**420**	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(70%[c])	105	105	140	140	**105**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Condition B *Interruption of Cont. Traffic*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	750	900	900	750																									
(100%[a])	75	75	100	100																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	525	630	630	525	**630**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(70%[c])	53	53	70	70	**53**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Combination *of Conditions A & B*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Condition A	400	480	480	400																									
(80%[b])	120	120	160	160																									
Condition B	600	720	720	600																									
(80%[b])	60	60	80	80																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Condition A	280	336	336	280	**336**	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No	No	No
(56%[d])	84	84	112	112	**84**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Condition B	420	504	504	420	**504**	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(56%[d])	42	42	56	56	**42**	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Warrant 2, Four Hour Vehicular Volume					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Warrant met?	**Yes**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**

Warrant 3, Peak Hour					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No
Warrant met?	**Yes**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**

Volume-Based Traffic Signal Warrants Analysis Summary

Warrant		Hour(s) of the Day	Hours Required to Meet Warrant	Hours Met	Is Warrant Met?
Warrant 1. Eight-Hour Vehicular Volume	Condition A: Minimum Vehicular Volume	Any Eight Hours	8	7	No
	Condition B: Interruption of Continuous Traffic	Any Eight Hours	8	7	No
	Combination of Condition A & Condition B	Any Eight Hours	8	7	No
	Overall (at least 1 of the 3 conditions required to meet warrant)				**No**
Warrant 2. Four-Hour Vehicular Volume		Any Four Hours	4	14	**Yes**
Warrant 3. Peak Hour		Any One/Peak Hour	1	7	**Yes**

Legacy North (Total)

Signal Warrant Analysis

MUTCD Warrants 1-3

Major Street: Legacy Boulevard — Speed Limit: 45 — Lanes:* 2
Minor Street: Miller Road — Speed Limit: 35 — Lanes:* 1
Locale: Scottsdale
*Number of Approach Lanes of Moving Traffic:

Major Street vph - total of both approaches	14	503	0	0	0	588	759	1,794	1,334	731	844	1,695	356	284	270	256	185	413	142	199	1,035	71	57	14
Minor Street volume - higher-volume approach (vph)	0	53	0	0	0	26	132	132	132	158	368	211	632	342	289	474	816	1,000	500	447	132	132	158	79
Direction of higher-volume minor approach	NB	SB	NB	NB	NB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB	SB
Beginning of hour	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00

Critical speed of major street traffic above 40 mph X
In built-up area of isolated community less than 10,000 population
Urban

Warrant 1, Eight-Hour Vehicular Volume

Condition A *Minimum Vehicular Volume*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	500	600	600	500																									
(100%[a])	150	150	200	200																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	350	420	420	350	**420**	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(70%[c])	105	105	140	140	**105**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Condition B *Interruption of Cont. Traffic*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Minimum Reqmts	750	900	900	750																									
(100%[a])	75	75	100	100																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Minimum Reqmts	525	630	630	525	**630**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(70%[c])	53	53	70	70	**53**	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Combination *of Conditions A & B*					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Condition A	400	480	480	400																									
(80%[b])	120	120	160	160																									
Condition B	600	720	720	600																									
(80%[b])	60	60	80	80																									
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**																								
Condition A	280	336	336	280	**336**	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No	No	No
(56%[d])	84	84	112	112	**84**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Condition B	420	504	504	420	**504**	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	Yes	No	No	No
(56%[d])	42	42	56	56	**42**	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Warrant met?	**No**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**

Warrant 2, Four Hour Vehicular Volume					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Warrant met?	**Yes**					**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	**No**

Warrant 3, Peak Hour					Criteria	Hour																					
Lanes (**M**/**m**):	1/1	2+/1	2+/2+	1/2+	**2/1**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
100% *See to the right*																													
70% *See to the right*					**Use**	No	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	No
Warrant met?	**Yes**					**No**	**No**	**No**	**No**	**No**	**No**	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**Yes**	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**	**No**

Volume-Based Traffic Signal Warrants Analysis Summary

Warrant		Hour(s) of the Day	Hours Required to Meet Warrant	Hours Met	Is Warrant Met?
Warrant 1. Eight-Hour Vehicular Volume	Condition A: Minimum Vehicular Volume	Any Eight Hours	8	7	No
	Condition B: Interruption of Continuous Traffic	Any Eight Hours	8	7	No
	Combination of Condition A & Condition B	Any Eight Hours	8	7	No
	Overall (at least 1 of the 3 conditions required to meet warrant)				**No**
Warrant 2. Four-Hour Vehicular Volume		Any Four Hours	4	15	**Yes**
Warrant 3. Peak Hour		Any One/Peak Hour	1	10	**Yes**