

Off-site State Route Traffic Analysis: SR 202 and S. Chandler Blvd.

Project No. ST85100397-1

Prepared for:



City of Phoenix

Prepared by:

BURGESS & NIPLE

April 2017



Figures

Figure 1: South Mountain Freeway (SMF) Alignment and Construction Schedule.....	2
Figure 2: Ahwatukee Foothills Village Boundary.....	4
Figure 3: Study Area.....	6
Figure 4: Pedestrian HAWK Signal on 32nd Street.....	7
Figure 5: Commuting Preferences in the Study Area.....	7
Figure 6: ALEX route Map.....	8
Figure 7: Pecos Road and 40th Street Park and Ride (PNR).....	9
Figure 8: Valley Metro Survey of "How Commuters got to PNR?" – 2013.....	9
Figure 9: Study Process.....	11
Figure 10: Chandler Boulevard Extension.....	12
Figure 11: Study Area Land Use Map.....	14
Figure 12: Existing Peak Hour Turning Movement Counts.....	17
Figure 13: 24 Hour Link Counts.....	18
Figure 14: Destination Zones from the Study Area.....	20
Figure 15: Distribution of Traffic Originating in the Study Area.....	21
Figure 16: Distribution of Traffic Arriving in the Study Area.....	22
Figure 17: Existing Year Model Network and TAZ Structure.....	26
Figure 18: Near Term Model Network and TAZ Structure.....	27
Figure 19: Cordon and ScreenLines.....	28
Figure 20: Changes in Traffic Circulation Post SMF Construction.....	32
Figure 21: Near-Term Traffic Volumes.....	33
Figure 22: Eight-hour vehicular volume.....	39
Figure 23: Four Hour Warrant Analysis - 40th Street and PNR/Cottonwood Lane.....	40
Figure 24: Peak Hour Warrant Analysis - 40th Street and PNR/Cottonwood Lane.....	41
Figure 25: Eight-hour Vehicular Warrant Analysis - 32nd Street and Liberty Lane.....	43
Figure 26 :Eight Hour vehicular Warrant - 24th Street and Liberty Lane.....	45
Figure 27: Four Hour Warrant Analysis - 24th Street and Liberty Lane (East Leg).....	46

Tables

Table 1: Comparison of before and after conditions using Cordon Analysis.....	24
Table 2: Comparison of before and after conditions using Screenline Analysis.....	24
Table 3: Existing Operational Analysis Summary.....	30
Table 4: Near-Term Traffic Analysis Summary.....	35



Executive Summary

Ahwahtukee Foothills, a City of Phoenix (City) urban village, is generally located in the northwest quadrant of the system interchange of I-10 Maricopa Freeway and Pecos Road. In the existing conditions, Ahwahtukee Foothills is serviced by five primary east-west arterial streets and five north-south arterial streets. The north-south arterial streets connect Ahwahtukee Foothills to Pecos Road and east-west arterial streets connect it to I-10 and the City of Chandler. The east-west arterial streets are: Pecos Road, Chandler Boulevard, Ray Road, Warner Road and Elliott Road. The north-south arterial streets are: 17th Avenue, Desert Foothills Parkway, 24th Street, 32nd Street, and 40th Street.

The Arizona Department of Transportation (ADOT) is constructing the new State Route 202L (Loop 202) South Mountain Freeway (SMF). The new SMF Pecos Segment will border Ahwahtukee Foothills and replace Pecos Road. The SMF will include access to/from Ahwahtukee Foothills via the intersections at 17th Avenue, Desert Foothills Parkway, 24th Street, and 40th Street; there is no direct access at 32nd Street.

There are concerns that the access modification will change travel and circulation patterns resulting in:

1. An additional burden on some key intersections and corridors creating operational inefficiencies; and
2. Higher traffic on some collector and local streets (cut through traffic).

This Off-site State Route Traffic Analysis (Study) investigated the traffic circulation patterns within the Study Area and estimated the changes as a result of the construction of SMF. The pattern changes were computed using a combination of Origin-Destination information based on big data analytics, recent traffic counts, regional travel demand model estimates, and commonly used engineering practices.

Origin-Destination analysis for the existing and post SMF construction (near term) conditions indicates that about 12% of the Study Area traffic using I-10 (north of the Study Area) will shift to the SMF after its completion. Analysis of the estimated travel patterns post SMF construction as a result of this shift and due to the elimination of access from 32nd Street indicates that:

1. Traffic operates at Level of Service D or better at all the major intersections in the study corridor;
2. The minor streets at the intersection of PNR/Cottonwood Lane and 40th Street operate at a LOS F; and
3. There will not be significant increase in traffic on Liberty Lane (cut-through) because of the elimination of access to the east-west movements from 32nd Street onto the SMF.

The Study also assessed the need for intersection signalization at three un-signalized intersections using warrant analysis. Results of the warrant analysis are:

- The Pecos Road Park and Ride Driveways/Cottonwood Lane intersection with 40th Street meets the 4 hour and the peak hour warrants. Signalizing the intersection during the peak hours will reduce traffic delays on the minor streets and may improve the safety at the intersection.
- The intersection of Liberty Lane and 32nd Street does not meet the warrants for a traffic signal. The pedestrian HAWK signal at this location should be left in place and reviewed for effectiveness after the construction of the South Mountain Freeway.
- The intersection of Liberty Lane and 24th Street does not meet warrants for signalization.



The SMF will include 13 new TIs, four of which are in the Pecos Segment. In the existing conditions, Pecos Road is mostly a four lane divided arterial roadway providing access to the Ahwatukee Foothills Village via the intersections at 17th Avenue, Desert Foothills Parkway, 24th Street, 32nd Street, and 40th Street. Once constructed, the SMF eliminates the access at 32nd Street to/from Ahwatukee Foothills.

The City of Phoenix (COP) initiated the Offsite Traffic Analysis Study: Loop 202 and S. Chandler Blvd study (Study) to quantify the changes to the traffic circulation patterns in Ahwatukee Foothills as a result of the construction of the SMF. Larger variations and increases in traffic on the local and collector roads within Ahwatukee Foothills, as a result of SMF construction, may necessitate changes to the traffic control types at the intersections of some local/collector roads with major/minor north-south connections to the Pecos Segment of the SMF. The current study will also take a deeper look at the intersection operations at the major intersections in the Study Area. The Study Area, study process, and analysis results are presented in the sections below.



The Study Area, shown in **Figure 3**, is approximately 12 square miles in size and is mostly residential in nature. The northern boundary of the Study Area parallels Chandler Boulevard and lies approximately half way between Chandler Boulevard and Ray Road; the southern border of the Study Area coincides with the existing Pecos Road and the eastern boundary coincides with 48th Street. Traffic volumes in the Study Area are characterized by typical commuting peaks, between 7 AM to 9 AM and 4 PM to 6 PM. Some roadways within the Study Area experience afternoon school departure peaks (2:30 PM to 3:30 PM) due to their proximity to the schools in the area. Public schooling in the Study Area is provided by the Kyrene School District and the Tempe Union School District. The schools associated with the Kyrene School District are all elementary schools and traffic to/from these schools is mostly vehicular in nature. The only school associated with the Tempe Union School District is the Desert Vista High School. The closest major street intersections to this school, 32nd Street and Frye Road and 32nd Street and Liberty Lane, are both built to accommodate non-motorist traffic.

Within the Study Area, Chandler Boulevard is classified as a major arterial and has a speed limit of 45 mph. Between 17th Avenue and Desert Foothills Parkway, Chandler Boulevard has two eastbound lanes, two westbound lanes and a center two-way left-turn lane; Between Desert Foothills Parkway and 24th Street, Chandler Boulevard has a four lane cross section with a wide median and pocket left-turn lanes to access properties adjacent to the roadway or to make left-turn maneuvers at major intersections. Between 24th Street and 32nd Street, Chandler Boulevard has two eastbound lanes, two westbound lanes and a center two-way left-turn lane. East of 32nd Street, Chandler Boulevard has three travel lanes in each direction and left-turn pocket lane for left turning maneuvers to adjacent properties and major intersections. In the Study Area, the entire length of Chandler Boulevard has bike lanes in both directions. The average annual daily traffic (AADT) on Pecos Road varies between 4,000 (east of 17th Avenue) and 40,000 (near I-10) - (Source: COP).

Within the Study Area, Pecos Road is classified as a major arterial and connects to the I-10 and Loop 202 (Santan Freeway) system TI on the east end. The entire stretch of Pecos Road has two travel lanes in each direction with pocket left-turn lanes at every intersection. The speed limit on Pecos Road is 50 mph west of its intersection with 40th Street and 45 mph east of it. The access road to the 40th Street and Pecos Road Park and Ride, situated west of the 40th Street and Pecos Road intersection, was closed in January 2017 in preparation for the construction of the SMF. The AADT on Pecos Road varies between 4,000 (east of 17th Avenue) and 40,000 (near I-10) – (Source: COP).



The north-south streets in the Study Area (40th Street, 32nd Street, 24th Street, Desert Foothills Parkway, and 17th Avenue) are all classified as major arterial streets. The posted speed limit on 40th Street, 24th Street, Desert Foothills Parkway, and 17th Avenue is 40 mph; the posted speed limit on 32nd Street is 35 mph. The Desert Vista High School is located in the southwest corner of 32nd Street and Frye Road. There is a crosswalk, with a pedestrian HAWK signal, on 32nd Street at its intersection with Liberty Lane as shown in **Figure 4**.

Figure 4: Pedestrian HAWK Signal on 32nd Street



With the exception of the intersections of Chandler Boulevard with Ray Road and 17th Avenue, all the major intersections in the Study Area are signalized. The intersections of Liberty Lane with the north-south major streets are all stop controlled intersections. A recently conducted signal warrant analysis, by the COP, for the intersections of Chandler Boulevard and 17th Avenue, Liberty Lane and 24th Street (east leg), and Liberty Lane and 32nd Street indicated that these intersections do not meet the warrants for signalization. However, the analysis was conducted with the current traffic circulation patterns within the Study Area (pre SMF).

Commuting preferences (Source – MAG) in the Study Area are shown in **Figure 5**. Most drivers in the Study Area prefer to drive alone (80 percent), with about 10 percent using car pools and public transportation.

Figure 5: Commuting Preferences in the Study Area








COMMUTING TO WORK	PERCENT
Car or Truck - drive alone	80.3%
Car or Truck - carpool	8.3%
Public Transportation	1.9%
Bicycle	0.5%
Walked	0.9%
Other means (Taxicab, motorcycle, etc.)	1.1%
Work at home	7.1%
Totals	100%

Figure 7: Pecos Road and 40th Street Park and Ride (PNR)



The Pecos Road and 40th Street PNR is one of the major commuter lots in the region. The lot has 906 spaces of parking, all of which are covered. The Park-and-Ride Survey conducted by Valley Metro in 2013 indicated that, on a typical day, 60% of these spaces are utilized. Due to the proximity of the lot to the I-10 freeway, the lot is also popular with Valley Metro’s commuters using vanpools. The lot draws commuter traffic from Ahwatukee Foothills, and downtown commuters from other southeast valley areas of the Cities of Chandler and Gilbert. The 2013 PNR survey results, shown in **Figure 8** (conducted by Valley Metro) indicated that vast majority (90 percent) of respondents accessing the PNRs arrived by driving alone or were dropped off by car.

Figure 8: Valley Metro Survey of "How Commuters got to PNR?" – 2013

MODE	NUMBER	PERCENT
 Drove alone	1,123	79%
 Dropped off by car	160	11%
 Vanpool/Carpool	66	5%
 Bicycle	31	2%
 Walk	18	1%
 Other	25	2%
 No Response	3	0%
Totals	1,426	100%

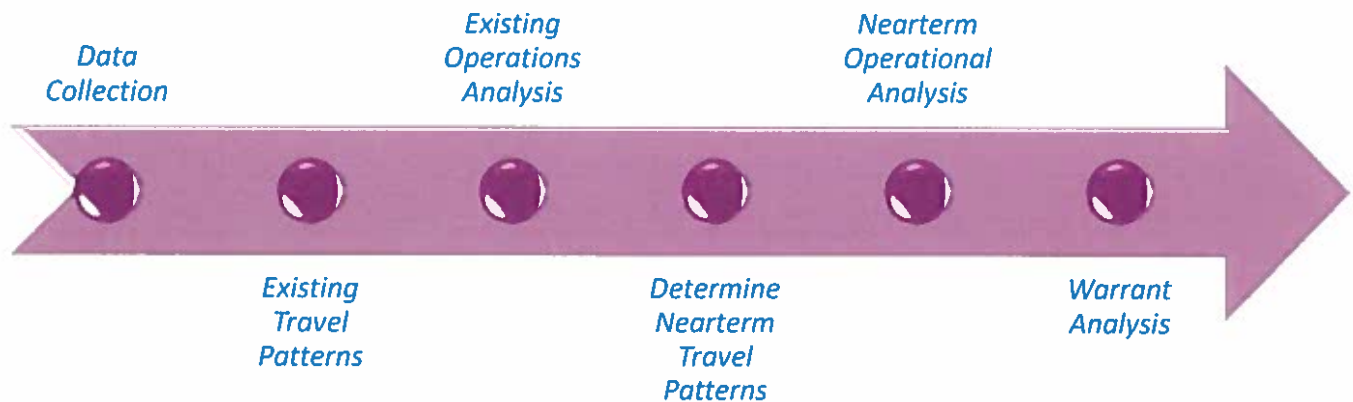


1.5. Study Process

The study process began with the understanding the history of the SMF project and concerns associated with traffic circulation issues in Ahwatukee Foothills. SMF study documents and stakeholder input were reviewed to get a better understanding of perceptions associated with traffic operations in the Study Area in general.

Once the Study Area issues and concerns were identified, the process shown in **Figure 9** was used to perform the study. The sections below will discuss the individual steps associated with this process.

Figure 9: Study Process





3.0 Land Use and Socioeconomic Conditions

3.1. Land Ownership

Most of the land in the Study Area is privately owned. Recent (2015) socioeconomic information available from MAG indicates that the population in the Study Area is around 50,000 with the number of dwelling units around 20,000. Around 80 percent of the housing units in the Study Area are single family detached units. Few parcels in the area are owned by the COP (Parks) and the Arizona State Land Department owns few parcels, totaling a little over 345 acres, north of Pecos Road between 19th Ave and 27th Ave. The Kyrene School District and the Tempe Union School district own the parcels associated with schools identified in the Study Area as shown in *Figure 3*.

3.2. Land Use

The entire Study Area falls within Maricopa County and within the COP. Existing land use in the Study Area, shown in *Figure 11*, was assessed using the MAG 2016 land use dataset and aerial imagery. It is evident from the land use map that most of the Study Area is residential in nature. There is very minimal commercial activity in the area; the nearest major commercial center to the Study Area is the Ahwatukee Foothills Towne Center with several big box retail facilities, restaurants and entertainment facilities.



3.3. Near-term Development and Growth Trends

There are some active housing developments in the Study Area near Chandler Boulevard and 11th Avenue (Rosewood Canyon Estates) and near Chandler Boulevard and 27th Avenue. Other known housing developments in the area include the Promontory at Foothills West subdivision by Taylor Morrison and the Agave Heights Discovery Collection. The MAG future land use map also indicates slight growth in the residential neighborhoods and dwelling units in the Study Area.

The near-term growth trends were derived using the select Traffic Analysis Zones Projections Report for the MAG region. Details of the zone structure and the expected trends are included in Appendix A. The Study Area is expected to grow in population by about 0.6% per year between the existing and near-term conditions; the number of dwelling units are expected to grow by about 300. The increase in traffic volume, as a result of this growth in population and dwelling units, is expected to be small.



Figure 13: 24 Hour Link Counts

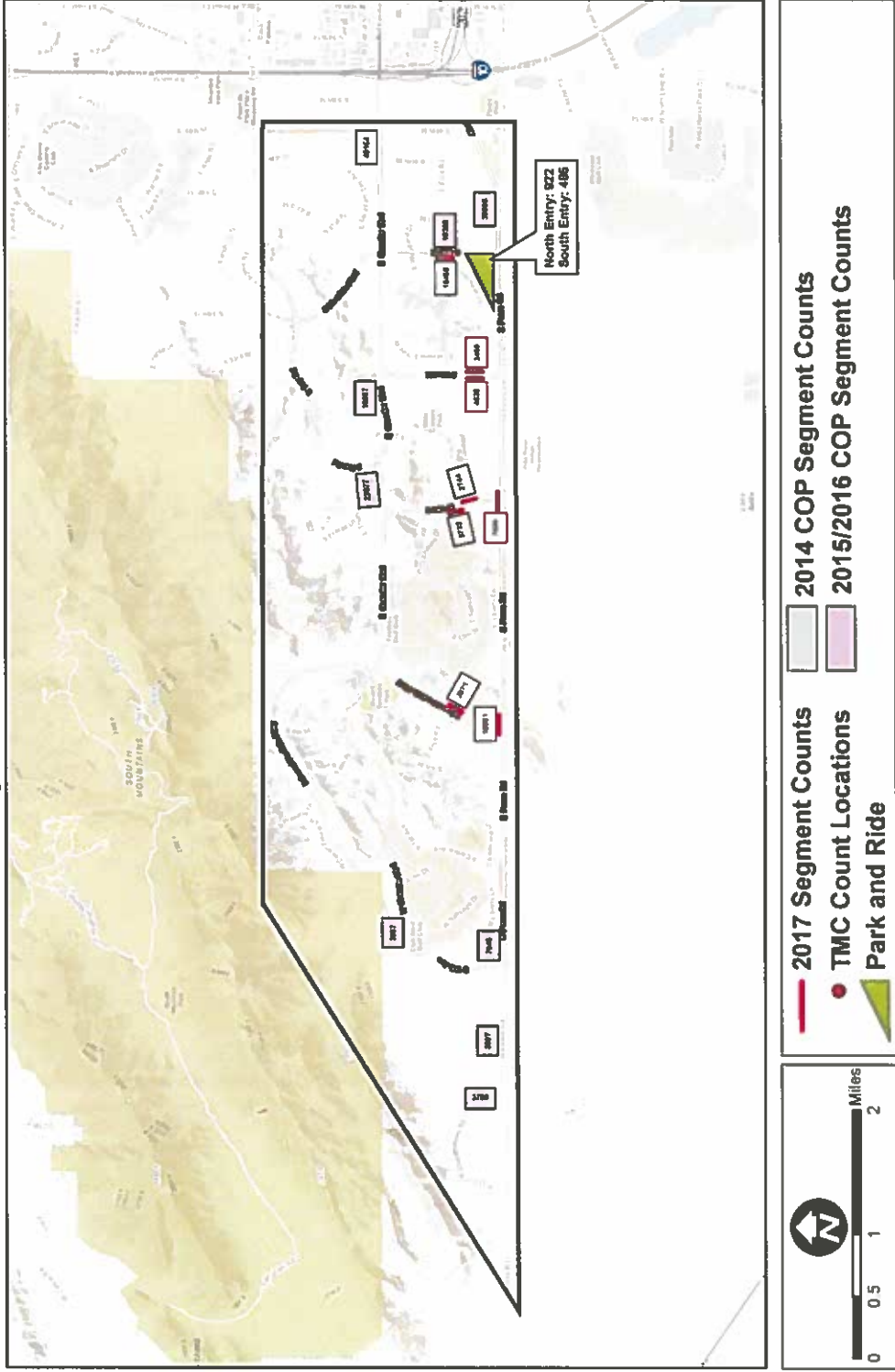


Figure 14: Destination Zones from the Study Area

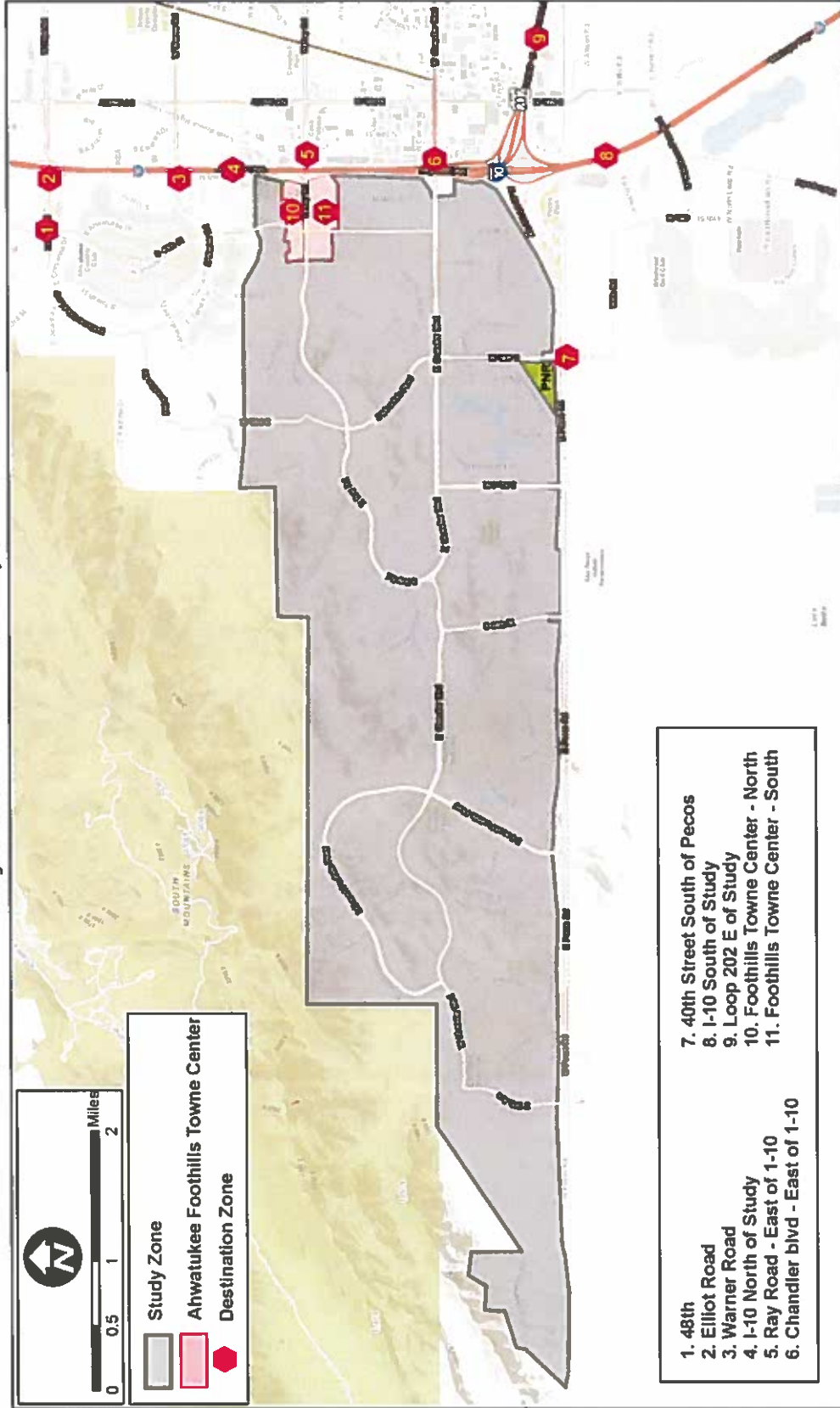
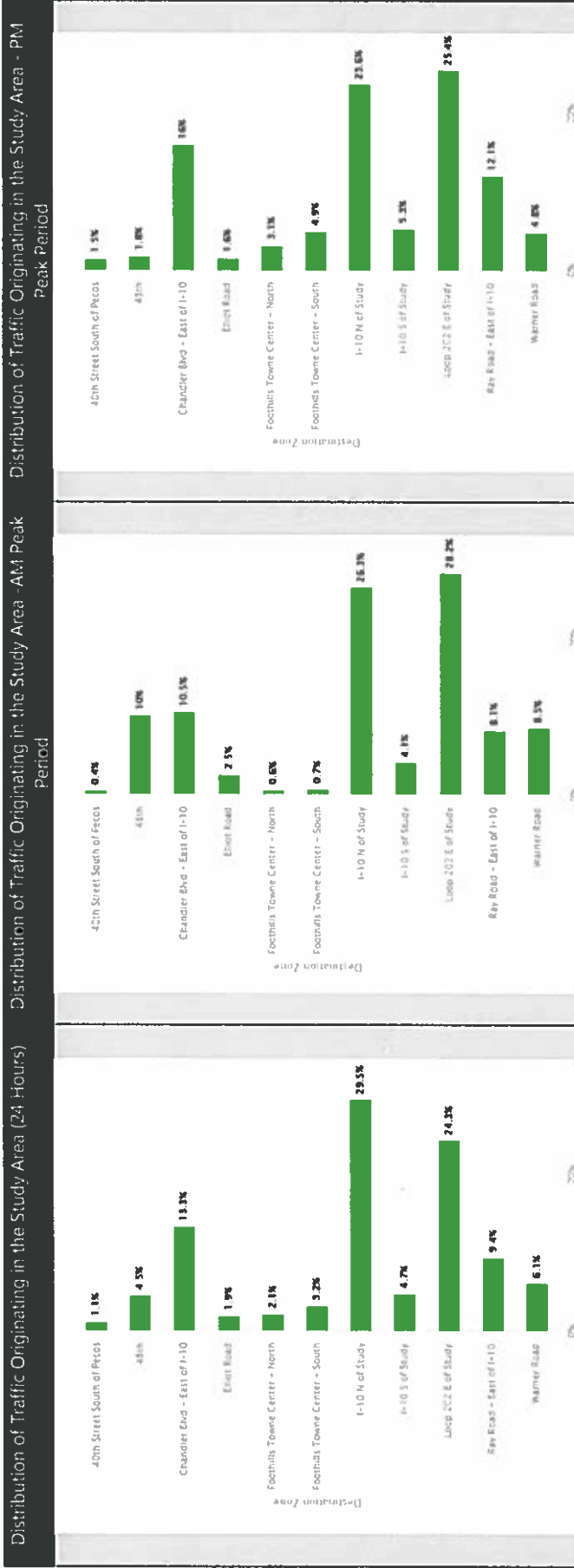




Figure 15: Distribution of Traffic Originating in the Study Area





4.3. Regional Travel Demand Model Patterns

MAG develops and maintains the regional travel demand model for the greater Phoenix area. The model uses the land use and socioeconomic data to estimate travel demand on the transportation network within the region. The region is divided into several traffic analysis zones (TAZ), to better estimate demand patterns. TAZ delineation is generally based on the land-use and census information. While regional travel demand models like the MAG model provide a robust big-picture analysis, they are prone to inaccurate estimations on local roads. The model estimates for larger time horizons (24 hours or Peak Periods) are fairly accurate but are usually not accurate for finer time scales. On the network side, the model represents almost all of the freeway and higher functional class roadways in the region. However, local roads like Liberty Lane or other similar Study Area circulation links are usually not included in their entirety. Moreover, the travel demand estimates on such links can vary significantly from observed traffic volumes.

The Study Area in the MAG model is represented by 16 TAZ (IDs: 994, 995, 996, 997, 998, 999, 1001, 1002, 1005, 1006, 1007, 1620, 2711, 2803, 2911, and 2912). Existing year model network and TAZ structure is shown in **Figure 17**; the near-term transportation network (with the SMF) and TAZ structure is shown in **Figure 18**.

To understand how the travel demand from the study region shifts as a result of the construction of the SMF, model estimates for the TAZ's identified above were compared before and after SMF construction. The Study Area travel demand model estimates are derived using an analysis methodology called "Select Zone Analysis" (SZA). This analysis reveals information about the total number of trips expected to/from the Study Area. Specifically, information about the following can be obtained from the models:

- The destinations of trips originating in the Study Area and the network links they use to get to those destinations.
- The origins of the trips arriving in the Study Area and the network links they use to get to the Study Area.

Comparison of traffic volumes, crossing an imaginary cordon line for the Ahwatukee area as shown in **Figure 19**, between the existing and near term conditions indicates that the travel demand estimates to/from the Study Area grows by about 7 percent. Computations to arrive at this growth are shown in **Table 1**.



the Study Area. Another important consideration is that the only freeway that can be directly accessed from Chandler Boulevard is I-10. All the vehicles that access SMF from the Study Area have to access it via the north-south connections of 40th Street, 24th Street, Desert Foothills Parkway and 17th Avenue. The other longer circuitous routes to the SMF from the Study Area are via Ray Road/Warner Road and I-10. Model assignments indicate that a few vehicles take the indirect route to the SMF via Ray Road and I-10, but not via Warner Road and I-10.

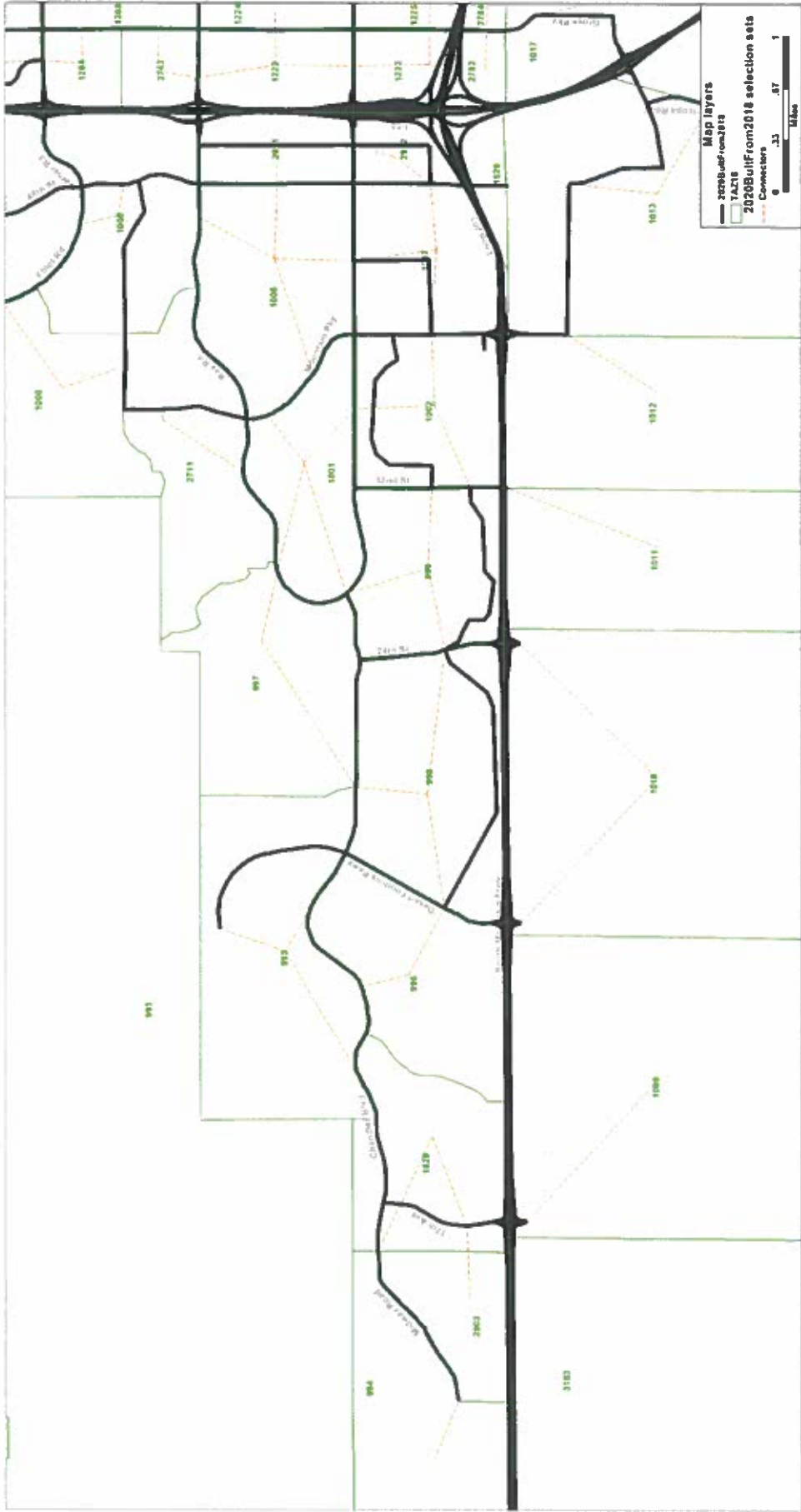
Model estimates for the distribution of the traffic on SMF from/to the Study Area are as following:

- Ray Road – 1%
- 40th Street – 19%
- 24th Street – 10%
- Desert Foothills – 22%
- 17th Avenue – 48%

Even though the percentage increases appear high, the actual volume of increase on the north-south connector streets as a result of SMF is less than 150 vehicles during the peak hours. This is because the shift in traffic from Chandler Boulevard and I-10 north of the Study Area gets distributed on four north-south connector roads to the SMF.



Figure 18: Near Term Model Network and TAZ Structure





4.4. Traffic Operations Analysis Summary

Traffic operational analysis was conducted using the latest version of Synchro (Version 10); analysis results are presented in the **Table 3** below. The results indicate that most of the intersections analyzed, operate at a Level of Service (LOS) D or better. The only exception to this is the 40th Street and PNR/Cottonwood Lane intersection. The stop controlled movements at this intersection operate at a LOS E in the existing conditions. Increase in traffic volume on 40th Street as a result of traffic shifting from 32nd Street will worsen this situation.



5.0 Post Construction Traffic Conditions

5.1. Traffic Assignments

The post construction traffic assignments were derived using a combination of the observed (StreetLight data based) origin-destination information, regional travel demand model estimates and the traffic counts gathered for the study. Traffic volumes were first redistributed to account for the elimination of east-west access from 32nd street on the southern Study Area boundary (lack of a TI at 32nd Street and SMF). The volumes were then adjusted to account for the shift in traffic from I-10 north of the Study Area to the SMF. The changes in travel patterns as a result of the SMF construction are shown in **Figure 20**. Peak hour turning movement estimates resulting from the distribution area shown in **Figure 21**.



Figure 21: Near-Term Traffic Volumes

Table 4: Near-Term Traffic Analysis Summary

Intersection	Approach	Near Term Conditions			
			AM Peak Hour		PM Peak Hour
Chandler & 17th	EB	0	A	0	A
	WB	7.3	A	5.7	A
	NB	13.1	B	11.5	B
	SB	-	-	-	-
	Overall	6.2	A	6.6	A
Chandler & Desert Foot Hills	EB	52.4	D	43.9	D
	WB	36.6	D	38.4	D
	NB	28.5	C	16.8	B
	SB	21.2	C	14.3	B
	Overall	35.4	D	30.5	C
Chandler & 24th	EB	20.2	C	17.7	B
	WB	9.9	A	10.4	B
	NB	51.2	A	13	A
	SB	-	-	-	-
	Overall	22.3	C	13.4	B
Chandler & 32nd	EB	23.4	C	19.9	B
	WB	14.9	B	11.4	B
	NB	19.8	A	11.5	A
	SB	-	-	-	-
	Overall	20.1	C	14.1	B
Chandler & 40th	EB	40.7	D	44.8	D
	WB	28.2	C	36.8	D
	NB	36.5	D	31.2	C
	SB	31.2	C	34.7	C
	Overall	36	D	37.8	D
Pecos & 17th	EB	-	-	-	-
	WB	0.3	A	0.5	A
	NB	16.1	B	12	B
	SB	10.8	B	8.3	A
	Overall	10	A	6.7	A
Pecos & 32nd	EB	24.6	C	24.6	C
	WB	34	C	34	C
	NB	34.1	C	34.1	C
	SB	39.5	D	39.5	D
	Overall	30.9	C	30.9	C
Pecos & 40th	EB	-	-	-	-
	WB	22.4	C	5.8	A
	NB	26.2	C	14	B
	SB	9.8	A	3.3	A
	Overall	15.3	B	5.2	A
32nd & Frye	EB	34.5	C	31.4	C
	WB	50	D	43.7	D
	NB	16	B	9	A
	SB	22.2	C	9.5	A
	Overall	32.1	C	22.3	C
40th and Cottonwood	EB	48.2	E	32	D
	WB	229.6	F	108.5	F
	NB	0.1	A	0.1	A
	SB	0.3	A	0.6	A
	Overall	11	B	2.8	A

**Warrant 4. Pedestrian Volume**

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

The need for a traffic control signal at an intersection or midblock crossing would be considered if:

- Pedestrian volume crossing the major street during an average day is more than 100 for any four hours or 190 during any one hour, and
- The number of adequate gaps per hour in the traffic stream is less than 60 gaps during the same hours that the volume criterion is satisfied.

Warrant 4 was not assessed because pedestrian traffic is not heavy at the identified intersections and because pedestrian delay is not a concern in the Study Area.

Warrant 5. School Crossing

This warrant is intended for application where the principal reason to consider installing a traffic control signal is where schoolchildren are crossing the major street. The intersection of 32nd Street and Liberty Lane has a school crossing with a HAWK signal. It is expected that the HAWK signal will remain in place even after the construction of the SMF when the through traffic on 32nd Street is expected to decrease substantially during school arrival/departure times. If traffic circulation patterns change significantly, this intersection may however warrant a traditional signal, in which case the HAWK signal will be replaced with a normal signal control.

However, the location has to meet warrants 1,, 2 or 3 for the installation of a traditional signal.

Warrant 6. Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Warrant 6 was not assessed because none of the locations identified will be part of coordinated signal system.

Warrant 7. Crash Experience

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. Review of crash data and crash analysis is beyond the scope of this study.

Warrant 8. Roadway Network

Warrant 8 applies to the intersection of two or more major routes where a traffic control signal might be justified to encourage concentration and organization of traffic flow on a roadway network. Warrant 8 is not applicable to the intersections analyzed.

Warrant 9. Intersection Near a Grade Crossing

Warrant 9 is intended for use at a location where none of the other eight warrants are satisfied, but the intersection is near a grade crossing. The warrant is not applicable in the Study Area.


Figure 22: Eight-hour vehicular volume

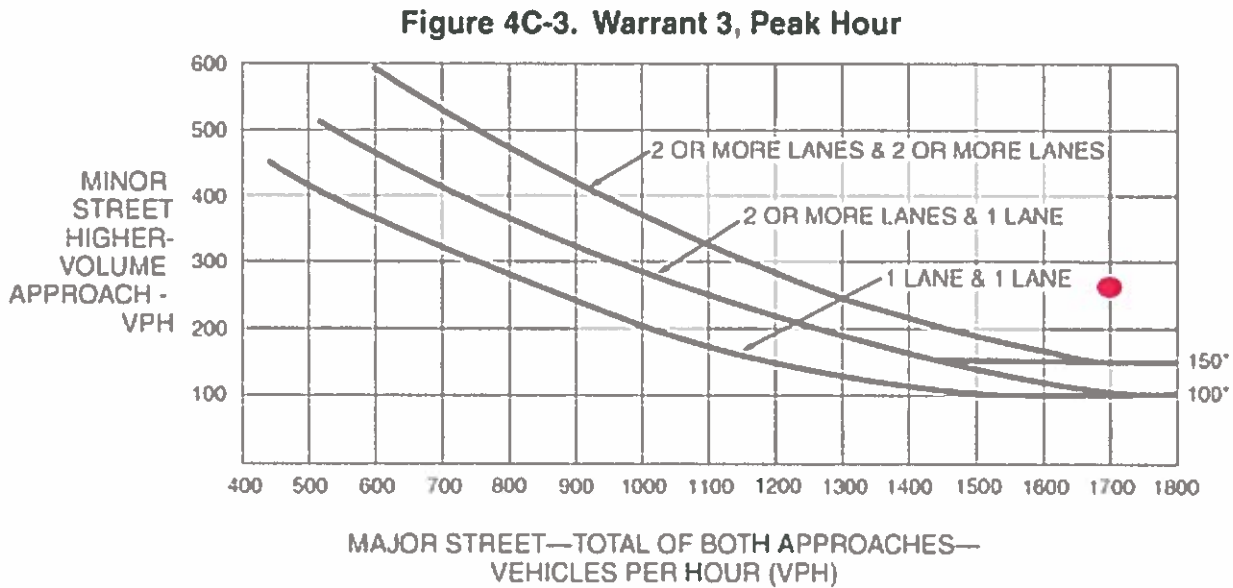
		ADJUSTED HOURLY VOLUMES			Condition A				Condition B			
CONDI- TION	NO. LANE	MAJOR ST 2-WAY	MINOR ST 1-WAY (EB/NB)	MINOR ST 1-WAY (WB/SB)	100%		80%		100%		80%	
• NORM	1		x	x	500	150	400	120	750	75	600	60
	2+	x			600	200	480	160	900	100	720	80
• 70%	1				350	105	280	84	525	53	420	42
	2+				420	140	336	112	630	70	504	56
	Mid-1AM	71	0									
	1AM-2AM	36	0									
	2AM-3AM	36	0									
	3AM-4AM	49	2									
	4AM-5AM	95	3									
	5AM-6AM	340	12									
	6AM-7AM	813	51		x		x				x	
	7AM-8AM	1722	56	109	x		x		x	x	x	
	8AM-9AM	1246	20	72	x		x		x		x	
	9AM-10AM	850	9		x		x				x	
	10AM-11AM	795	8		x		x				x	
	11AM-NOON	900	11		x		x		x		x	
	NOON-1PM	983	8		x		x		x		x	
	1PM-2PM	964	9		x		x		x		x	
	2PM-3PM	1234	9		x		x		x		x	
	3PM-4PM	1407	56		x		x		x		x	
	4PM-5PM	1535	200	50	x	x	x	x	x	x	x	x
	5PM-6PM	1700	241	47	x	x	x	x	x	x	x	x
	6PM-7PM	1316	181		x	x	x	x	x	x	x	x
	7PM-8PM	861	13		x		x				x	
	8PM-9PM	661	15		x		x					
	9PM-10PM	449	7									
	10PM-11PM	254	0									
	11PM-MID	139	3									
HOURS MET					3	3	4	5				
CRITERIA MET					No	No	No	No				

* CONDITION IS DETERMINED BY ENVIRONMENT: USE 70% VALUES IF 85 PERCENTILE SPEED EXCEEDS 40 MPH ON THE MAJOR APPROACH OR IF LOCATION IS IN THE BUILT-UP AREA OF AN ISOLATED COMMUNITY WITH A POPULATION OF LESS THAN 10,000.



Analysis of this location using Warrant 3 is shown in **Figure 24**. The plotted point shows the traffic exiting the peak traffic exiting the PNR in the PM Peak hour. It has to be noted that the MUTCD states that this warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. The Pecos Road and 40th Street PNR qualifies as a high-occupancy vehicle facility as it is mostly used by commuters during the peak periods.

Figure 24: Peak Hour Warrant Analysis - 40th Street and PNR/Cottonwood Lane



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

The need for a traffic control signal shall be considered at his location since the criteria listed below are met at this location.

- 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)



5.3.2. 32nd Street and Liberty Lane Intersection - Warrant Analysis

This intersection currently has a school crossing and a HAWK signal cross the 32nd Street. Liberty Lane is the minor road and is currently stop controlled. Due to the elimination of access from 32nd Street to SMF, the through traffic on 32nd Street is expected to decrease significantly. However, there are some concerns that the circulation pattern changes will result in an increase in the Liberty Lane traffic. This concern leads to the speculation that this intersection may necessitate a traditional signal post SMF. Warrant analysis at this location is conducted using the estimated traffic.

Analysis of this location using Warrant 1 is shown in **Figure 25**. It can be concluded from the analysis that the location does not satisfy Warrant 1 criteria.

Figure 25: Eight-hour Vehicular Warrant Analysis - 32nd Street and Liberty Lane

		ADJUSTED HOURLY VOLUMES			Condition A				Condition B			
COND-IT	NO LANE	MAJOR ST 2-WAY	MINOR ST 1-WAY (EB/NB)	MINOR ST 1-WAY (WB/SB)	100%		80%		100%		80%	
• NORM	1		X	x	500	150	400	120	750	75	600	60
	2+	x			600	200	480	160	900	100	720	80
• 70%	1				350	105	280	84	525	53	420	42
	2+				420	140	336	112	630	70	504	56
	Mid-1AM	18	3	5								
	1AM-2AM	10	1	3								
	2AM-3AM	5	1	3								
	3AM-4AM	8	3	5								
	4AM-5AM	23	8	13								
	5AM-6AM	73	28	30								
	6AM-7AM	143	75	74					x		x	
	7AM-8AM	266	164	149	x		x		x		x	
	8AM-9AM	242	147	108			x		x		x	
	9AM-10AM	173	49	75					x		x	
	10AM-11AM	152	43	52								
	11AM-NOON	159	49	58								
	NOON-1PM	175	63	58								x
	1PM-2PM	169	52	70								x
	2PM-3PM	213	108	83					x		x	
	3PM-4PM	218	127	93			x		x		x	
	4PM-5PM	233	83	75					x		x	
	5PM-6PM	281	115	106					x		x	
	6PM-7PM	244	76	72					x		x	
	7PM-8PM	181	72	65								x
	8PM-9PM	131	32	34								
	9PM-10PM	111	33	18								
	10PM-11PM	50	17	13								
	11PM-MID	26	6	9								
HOURS MET					0	0	0	0	0	0	0	0
CRITERIA MET					No	No	No	No	No	No	No	No

* CONDITION IS DETERMINED BY ENVIRONMENT: USE 70% VALUES IF 85 PERCENTILE SPEED EXCEEDS 40 MPH ON THE MAJOR APPROACH OR IF LOCATION IS IN THE BUILT-UP AREA OF AN ISOLATED COMMUNITY WITH A POPULATION OF LESS THAN 10,000.



5.3.3. 24th Street and Liberty Lane Intersection - Warrant Analysis

This intersection currently has a stop control on Liberty Lane and 24th Street is the free flowing major street. There are some concerns that the circulation pattern changes will result in an increase in the Liberty Lane traffic. This concern leads to the speculation that this intersection may necessitate a traditional signal post SMF. Warrant analysis at this location is conducted using the estimated traffic.

Analysis of this location using Warrant 1 is shown in **Figure 26**. It can be concluded from the analysis that the location does not satisfy Warrant 1 criteria.

Figure 26 :Eight Hour vehicular Warrant - 24th Street and Liberty Lane

COND- ITION	NO. LANE	ADJUSTED HOURLY VOLUMES			Condition A				Condition B			
		MAJOR ST 2-WAY	MINOR ST 1-WAY (EB/NB)	MINOR ST 1-WAY (WB/SB)	100%		80%		100%		80%	
- NORM	1		X	x	500	150	400	120	750	75	600	60
	2+	x			600	200	480	160	900	100	720	80
- 70%	1				350	105	280	84	525	53	420	42
	2+				420	140	336	112	630	70	504	56
	Mid-1AM	53		3								
	1AM-2AM	29		1								
	2AM-3AM	14		4								
	3AM-4AM	25		5								
	4AM-5AM	70		27								
	5AM-6AM	216		63								x
	6AM-7AM	424		233	x	x	x	x	x	x	x	x
	7AM-8AM	789		289	x	x	x	x	x	x	x	x
	8AM-9AM	719		138	x		x	x	x		x	x
	9AM-10AM	513		60			x					x
	10AM-11AM	450		73								x
	11AM-NOON	471		99						x		x
	NOON-1PM	519		90			x			x		x
	1PM-2PM	501		62			x					x
	2PM-3PM	632		224	x	x	x	x	x	x		x
	3PM-4PM	647		231	x	x	x	x	x	x		x
	4PM-5PM	692		122	x		x	x	x	x		x
	5PM-6PM	835		157	x	x	x	x	x	x	x	x
	6PM-7PM	725		117	x		x		x	x	x	x
	7PM-8PM	537		103			x		x			x
	8PM-9PM	389		51								
	9PM-10PM	331		39								
	10PM-11PM	149		19								
	11PM-MID	78		6								
HOURS MET					4	6	0	3				
CRITERIA MET					No	No	No	No				



6.0 Summary and Conclusions

This report documented the analysis of the changes of Ahwatukee Foothills traffic operations due to the construction of SMF.

Origin-Destination analysis for the existing and near term conditions indicates that about 12% of the Study Area traffic using I-10 North will shift to SMF after its completion. Analysis of the estimated travel patterns post SMF construction as a result of this shift and due to the elimination of access from 32nd Street indicates that:

- Traffic operates at Level of Service D or better at all the major intersections in the study corridor; and
- The minor streets at the intersection of PNR/Cottonwood Lane and 40th Street operate at a LOS F in the near-term conditions.
- There will not be significant increase in traffic on Liberty Lane (cut-through) because of the elimination of access to the east-west movements from 32nd Street onto SMF.

The study also assessed the need for signalization at three un-signalized intersections using warrant analysis. Results of the warrant analysis are:

- The Pecos Road Park and Ride Driveways/Cottonwood Lane intersection with 40th Street meets the four hour and the peak hour warrants. Signalizing the intersection during the peak hours will reduce traffic delays on the minor streets and may improve safety at the intersection. It has to be noted that the warrant analysis for this location was performed using existing traffic volumes.
- The intersection of Liberty Lane and 32nd Street does not meet the warrants for a traditional traffic signal. The pedestrian HAWK signal at this location should be left in place and reviewed for effectiveness after the construction of the South Mountain Freeway.
- The intersection of Liberty Lane and 24th Street does not meet warrants for signalization.