Lake Havasu City

McCulloch Corridor Improvement Study

Working Paper #1:

Existing and Future Conditions Analysis

Prepared for:

Lake Havasu City

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act
ADOT	Arizona Department of Transportation
ADT	Average Daily Traffic
APTNA	Arkansas Public Transportation Needs Assessment
ASU	Arizona State University
BLOS	Bicycle Level of Service
DTS	Downtown Transfer Station
FHWA	Federal Highway Administration
FY	Fiscal Year
HAT	Havasu Area Transit
HCM	*Highway Capacity Manual*
HDR	HDR Engineering, Inc.
ITE	Institute of Transportation Engineers
LIB	League of Illinois Bicyclists
LOS	Level of Service
NHTSA	National Highway Transportation Safety Administration
PARA	Planning Assistance for Rural Arizona
TAZ	Traffic Analysis Zone
TIP	Transportation Improvement Program
UMS	Uptown McCulloch Main Street District
VMT	Vehicle Miles of Travel
WACOG	Western Arizona Council of Governments

1.0 Introduction

The Arizona Department of Transportation (ADOT), in cooperation with Lake Havasu City (City), is conducting a long-range corridor study for Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue (referred to in this study collectively as the corridor). The primary purpose of the study is to develop a vision for the Mesquite/McCulloch/Swanson corridor that balances the City's Main Street Uptown District revitalization goals with the need to accommodate future travel demand along the entire corridor. The study will recommend a program of projects to address multimodal transportation needs and will serve as a guide for community development, project funding applications, and project information.

The Lake Havasu City McCulloch Corridor Improvement Study is being funded by ADOT's Multimodal Planning Division's Planning Assistance for Rural Areas (PARA) program. The PARA program is funded through the Federal Highway Administration's (FHWA) State Planning and Research program to non-metropolitan communities for the purpose of conducting transportation planning studies. PARA funds may be applied to address a broad range of planning issues related to road and nonmotorized transportation modes.

The purpose of this working paper is to provide a baseline of existing and future transportation conditions for use in evaluating improvement alternatives that address the multimodal needs of the Mesquite/McCulloch/Swanson Corridor.

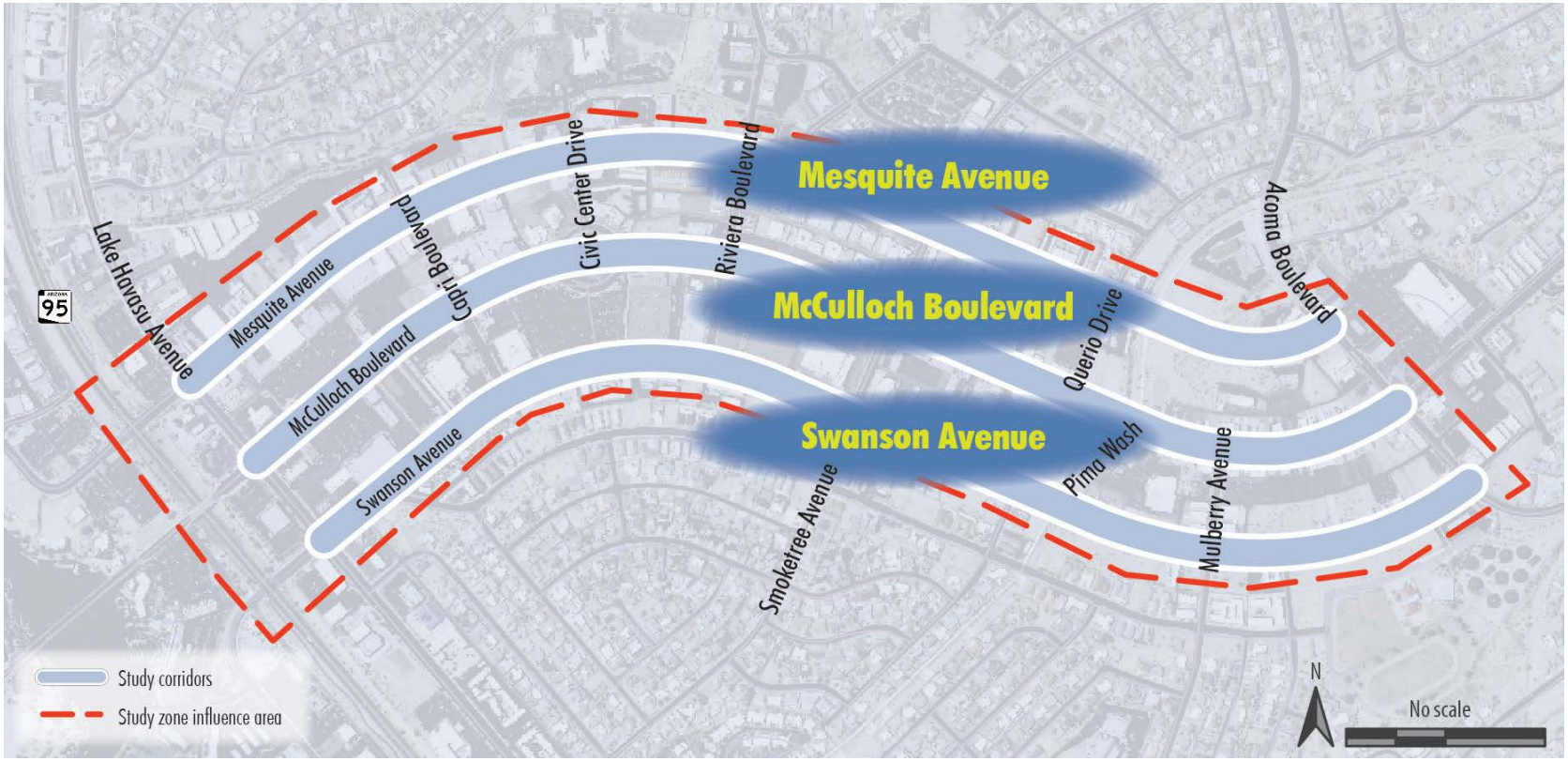
1.1 Study Area Goal

Recent efforts to revitalize the Lake Havasu Main Street Uptown District on McCulloch Boulevard are paying off. Sidewalk and streetscape improvements provide a more seamless pedestrian experience. New restaurants and night spots are attracting a steady clientele. A trolley service recently began along McCulloch Boulevard giving tourists an easy connection between the London Bridge area and the Uptown District attractions.

Figure 1 shows the study area and the wider study zone influence area for this multimodal plan. The study area is the focus of transportation issue identification and alternative development. The influence area will be used to capture possible impacts that would affect the study area.

Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue provide a connection between the Uptown District and the river activities. The City's long term vision for the McCulloch Boulevard through the Uptown District is a walkable, pedestrian-friendly urban street experience. The goal is to have McCulloch Boulevard be a 'complete street' providing space for bicyclists, pedestrians, public transit, and motorized vehicles.

Figure 1 Study Area and Influence Area



2.0 Previous and Current Studies

This section identifies previous and current planning studies reviewed for the preparation of this document.

2002 Lake Havasu City General Plan

The *General Plan* provides an overall citywide vision for development in Lake Havasu City and contains goals and policies related to transportation, economic development, and land use. The *General Plan* states the City should take appropriate steps to create and enhance the availability of parking for the downtown area as not to obstruct future business development and existing business expansion plans. The Plan encourages the creation of a multimodal transportation system and access to community activity centers, such as the downtown. It also recommends a corridor study be completed for the McCulloch Corridor.

2007 Lake Havasu City Regional/Urban Design Action Team Plan(R/UDAT)

The *Lake Havasu City R/UDAT*, completed under the American Institute of Architects R/UDAT program, recommends that Mesquite and Swanson Avenues be used as transitional areas between the commercial core (McCulloch Boulevard) and the adjacent residential neighborhoods. Instead of adding lanes, the R/UDAT recommends eliminating the center-turn lane, except at intersections; adding bike lanes in each direction; adding on-street parking in defined areas; and including other traffic calming measures to reduce speeds to 25 mph.

2006 Bridgewater Channel Redevelopment Plan

The *Bridgewater Channel Redevelopment Plan* was prepared by students from the University of Arizona in 2006. It is a comprehensive examination of, and plan for, the redevelopment of the Bridgewater Channel area. The plan notes the importance of sales tax revenues and the value of tourism to the local and regional economy.

2005 Lake Havasu City Small Area Transportation Study (SATS)

The purpose of the *SATS* was to evaluate future travel demand throughout the City and to develop a roadway plan to meet the demand. This study recommended that Mesquite and Swanson Avenues be reconstructed/restriped with two lanes in one direction, a center left-turn lane, and one lane in the other direction. The long-term recommendation was to convert them into one-way couplets with three lanes of travel. The main reason for these recommendations was to maximize the capacity of the roads.

1998 Pedestrian and Bike Path Plan

The *Pedestrian and Bike Path Plan* mapped a network of sidewalks, multiuse paths, and bike routes using striping and signing to integrate with the existing roadway system and to provide safe travel for transportation and recreation purposes.

3.0 Existing Road System Conditions

This section describes the existing conditions of Lake Havasu City's road system including the functional classification, road characteristics, traffic volumes, level of service (LOS), and crash history. The existing road lanes for each road are displayed in Figure 2 and the intersection control and turning lane configurations are presented in Figure 3.

3.1 Road Function Classification

Functional classification is the grouping of highways, roads, and streets into classes based on mobility and land access. In general, arterials provide greater mobility with less direct access to land, while local roads and collectors provide more access to land with less mobility. The City's *General Plan* identifies four road classifications found in the City: principal arterial, minor arterial, collector, and minor road. Using the system described in the *General Plan*, the roads within the study area would be classified as follows:

- Principal arterial: US 95
- Minor arterial: Lake Havasu Avenue and Acoma Boulevard
- Collector: Mesquite Avenue, McCulloch Boulevard, Mulberry Avenue, Swanson Avenue, Capri Boulevard, Riviera Boulevard, and Smoketree Avenue
- Minor road: Del Rio Lane, Library Lane, Civic Center Drive, Jay's Way, Scott Drive, Wings Loop, Querio Drive, Mulberry Avenue, Van Vilet Lane, and Magnolia Drive

The road classification for the roads in the study area is displayed in Figure 4.

Figure 2 | Existing Road Lanes

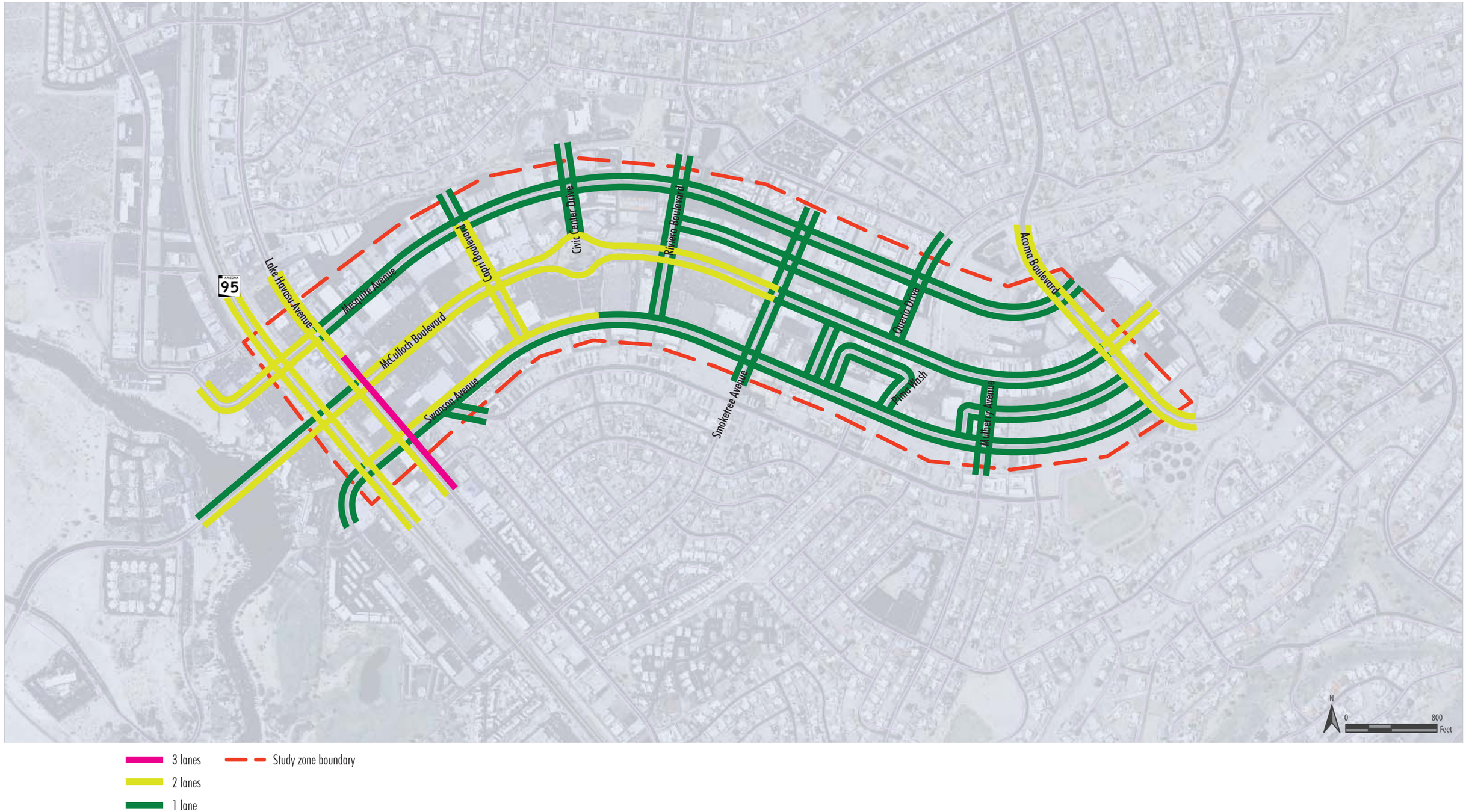
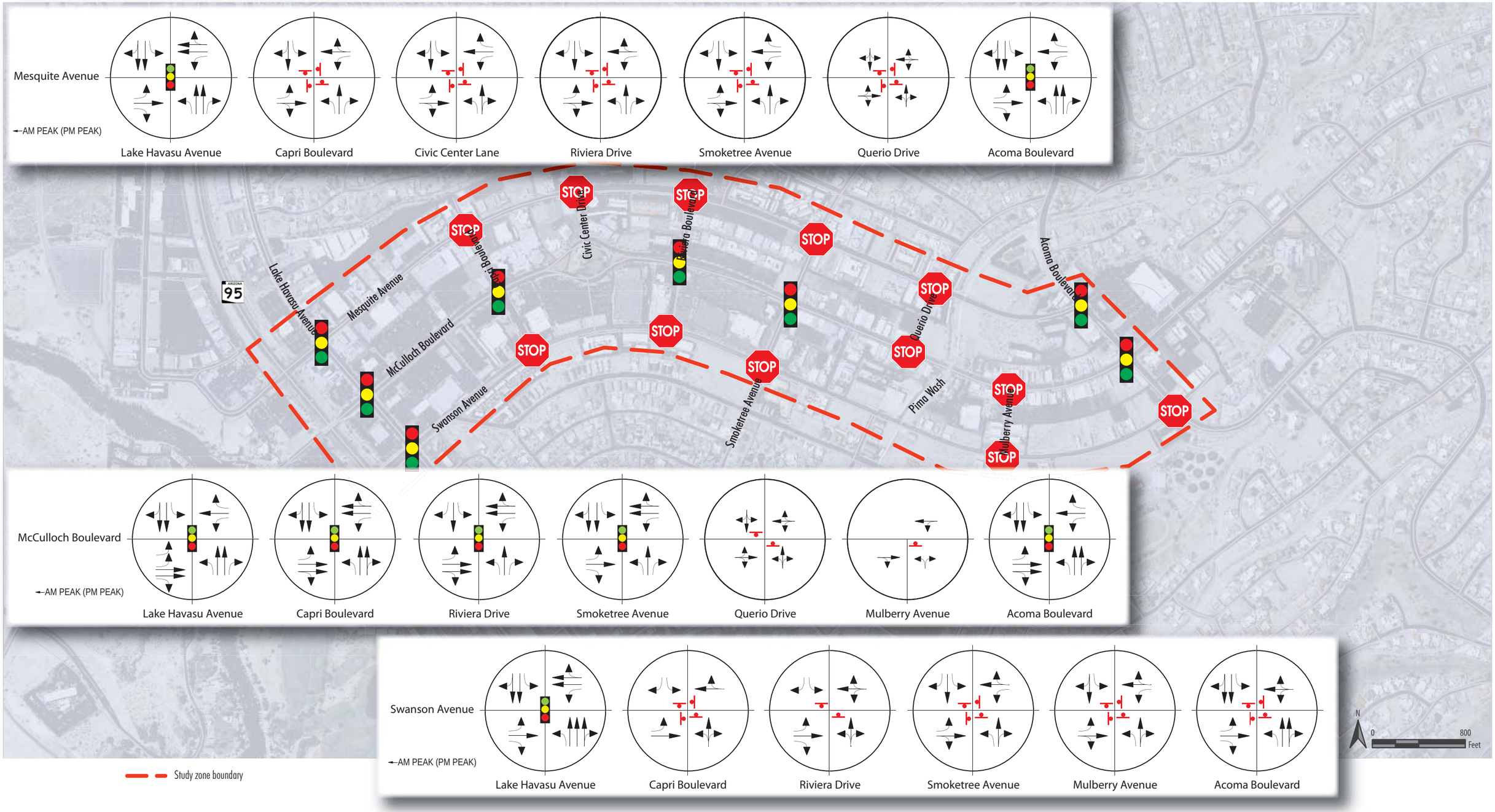


Figure 3 | Existing Interesection Control and Turning Lane Configurations



Principal arterial
Minor arterial
Collector
Minor road
Study zone boundary

3.2 Existing Roadway Characteristics

Field surveys and aerial photography were used to identify the major road characteristics for Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue. The findings are summarized below in Table 1.

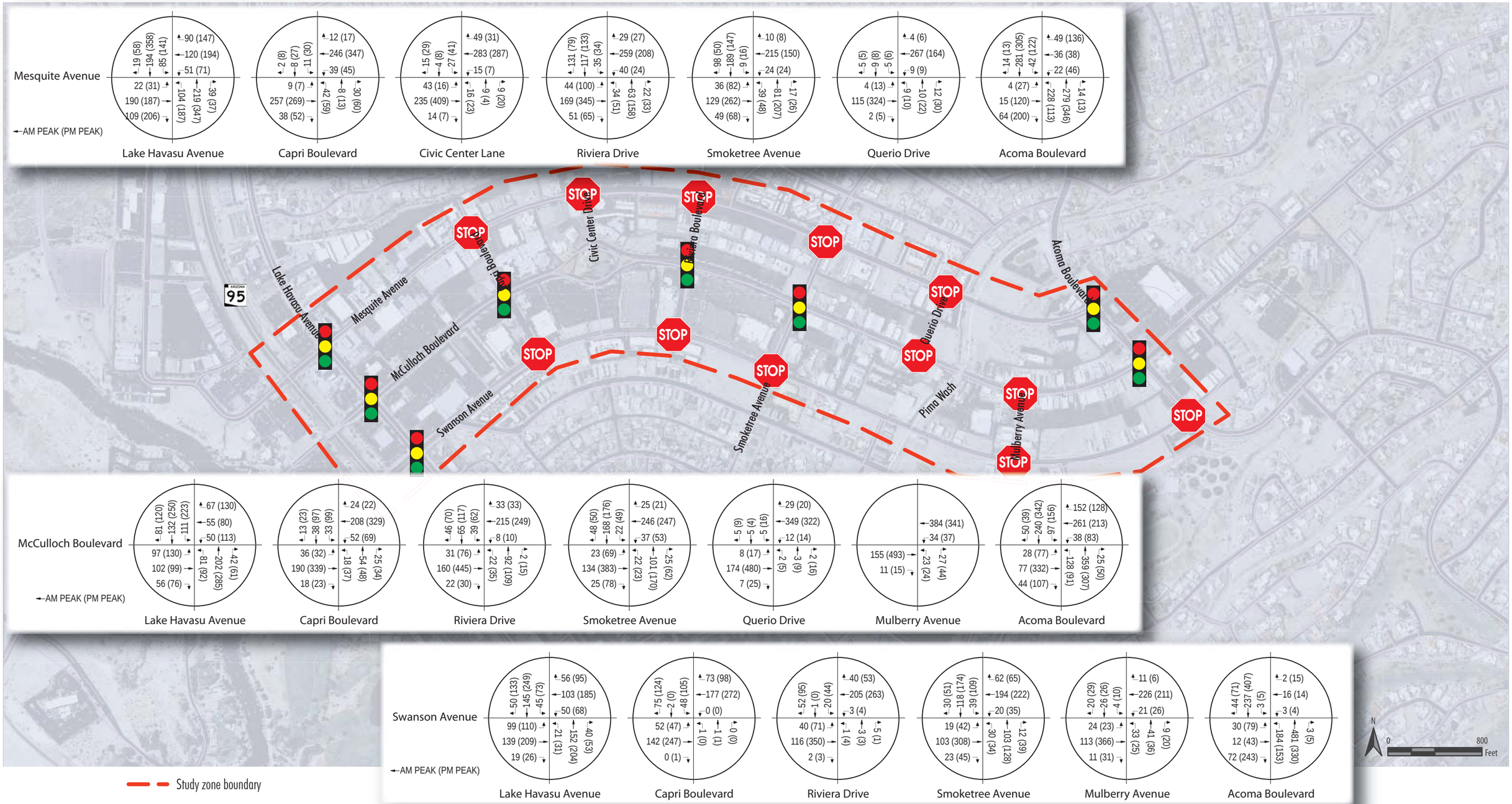
3.3 Existing Traffic Levels

Table 1 Study Corridor Road Characteristics

Road	Limits	Directional through lanes	Speed limit (mph)	Median type
Mesquite Avenue	Lake Havasu Avenue to Smoketree Avenue	1 eastbound 1 westbound	30	paved TWLTL
	Smoketree Avenue to Querio Drive	1 eastbound 1 westbound	30	paved TWLTL
	Querio Drive to Acoma Boulevard	1 eastbound 1 westbound	30	paved TWLTL
McCulloch Boulevard	Lake Havasu Avenue to Smoketree Avenue	2 eastbound 2 westbound	30	raised
	Smoketree Avenue to Acoma Boulevard	1 eastbound 1 westbound	25	none
Swanson Avenue	Lake Havasu Avenue to Civic Center Drive	1 eastbound 2 westbound	30	paved TWLTL
	Civic Center Drive to Acoma Boulevard	1 eastbound 2 westbound	30	paved TWLTL

TWLTL = two-way left-turn lane

An extensive traffic count exercise was conducted for the study the week of December 5, 2011. The data collection locations are presented in Appendix A. Each intersection was counted between 7 and 9 a.m. and between 4 and 6 p.m. Each road segment (as noted in the figure in the appendix) was counted for a 72-hour period in 15 minute intervals.


Mesquite Avenue
AM PEAK (PM PEAK)
Lake Havasu Avenue
19 (58) 194 (358) 85 (141) 90 (147) 120 (194) 51 (71) 22 (31) 190 (187) 109 (206) 104 (187) 219 (347) 39 (37)
Capri Boulevard
2 (8) 8 (27) 11 (30) 12 (17) 246 (347) 39 (45) 9 (7) 257 (269) 38 (52) 42 (59) 8 (13) 30 (60)
Civic Center Lane
15 (29) 4 (8) 27 (41) 49 (31) 283 (287) 15 (7) 43 (16) 235 (409) 14 (7) 16 (23) 9 (4) 9 (20)
Riviera Drive
131 (79) 117 (133) 35 (34) 29 (27) 259 (208) 40 (24) 44 (100) 169 (345) 51 (65) 34 (51) 63 (158) 22 (33)
Smoketree Avenue
98 (50) 189 (147) 9 (16) 10 (8) 215 (150) 24 (24) 36 (82) 129 (262) 49 (68) 39 (48) 81 (207) 17 (26)
Querio Drive
5 (5) 6 (8) 5 (9) 4 (6) 267 (164) 9 (9) 4 (13) 115 (324) 2 (5) 9 (10) 10 (22) 12 (30)
Acoma Boulevard
14 (13) 281 (305) 42 (122) 49 (136) 36 (38) 22 (46) 4 (27) 15 (120) 64 (200) 228 (113) 279 (346) 14 (13)
McCulloch Boulevard
AM PEAK (PM PEAK)
Lake Havasu Avenue
81 (120) 132 (250) 111 (223) 67 (130) 55 (80) 50 (113) 97 (130) 102 (99) 56 (76) 81 (92) 202 (285) 42 (61)
Capri Boulevard
13 (23) 38 (97) 33 (99) 24 (22) 208 (329) 52 (69) 36 (32) 190 (339) 18 (23) 18 (37) 54 (48) 25 (34)
Riviera Drive
46 (70) 65 (117) 39 (62) 33 (33) 215 (249) 8 (10) 31 (76) 160 (445) 22 (30) 22 (35) 92 (109) 2 (15)
Smoketree Avenue
48 (50) 168 (176) 22 (49) 25 (21) 246 (247) 37 (53) 23 (69) 134 (383) 25 (78) 22 (23) 101 (170) 25 (62)
Querio Drive
5 (9) 5 (4) 5 (16) 29 (20) 349 (322) 12 (14) 8 (17) 174 (480) 7 (25) 2 (5) 3 (9) 2 (16)
Mulberry Avenue
384 (341) 34 (37) 155 (493) 11 (15) 23 (24) 27 (44)
Acoma Boulevard
50 (39) 240 (342) 97 (156) 152 (128) 261 (213) 38 (83) 28 (77) 77 (332) 44 (107) 128 (91) 359 (307) 25 (50)
Swanson Avenue
AM PEAK (PM PEAK)
Lake Havasu Avenue
50 (133) 145 (249) 45 (73) 56 (95) 103 (185) 50 (68) 99 (110) 139 (209) 19 (26) 21 (31) 152 (204) 40 (53)
Capri Boulevard
75 (124) 2 (0) 48 (105) 73 (98) 177 (272) 0 (0) 52 (47) 142 (247) 0 (1) 1 (0) 1 (1) 0 (0)
Riviera Drive
52 (95) 1 (0) 20 (44) 40 (53) 205 (263) 3 (4) 40 (71) 116 (350) 2 (3) 1 (4) 3 (3) 5 (1)
Smoketree Avenue
30 (15) 118 (174) 39 (109) 62 (65) 194 (222) 20 (35) 19 (42) 103 (308) 23 (45) 30 (34) 103 (128) 12 (39)
Mulberry Avenue
20 (26) 26 (92) 4 (10) 11 (6) 226 (211) 21 (26) 24 (23) 113 (366) 11 (31) 33 (25) 41 (36) 9 (20)
Acoma Boulevard
44 (71) 237 (407) 3 (5) 2 (15) 16 (14) 3 (4) 30 (79) 12 (43) 72 (243) 184 (153) 481 (330) 3 (5)
Lake Havasu Avenue
Mesquite Avenue
McCulloch Boulevard
Swanson Avenue
Capri Boulevard
Civic Center Drive
Riviera Boulevard
Smoketree Avenue
Querio Drive
Pima Wash
Mulberry Avenue
Acoma Boulevard
95
STOP
N
0
800
Feet
Study zone boundary

Intersection Turning Movement Counts

The peak hour volumes for the intersections are presented in Figure 5. Notable observations from the figure include:

- The highest hourly through traffic volumes along McCulloch Boulevard and Swanson Avenue are in the eastern area at Mulberry Avenue. The highest through traffic volume along Mesquite Avenue is in the western area at Civic Center Drive.
- The highest total intersection traffic volumes occur at the intersections of Lake Havasu Avenue and Acoma Boulevard.

Road Segment Counts

This section presents information related to the segment counts conducted on Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue between Lake Havasu Avenue and Capri Boulevard. A general summary of the existing conditions are provided in Table 2.

Table 2 Existing Traffic Conditions, Lake Havasu Boulevard to Capri Boulevard

Road	Average daily traffic volume	Average speed	85th-percentile speed	Truck percentage (%)
Mesquite Avenue	10,220	30.3	34.7	4.1
McCulloch Boulevard	10,020	30.7	35.9	1.8
Swanson Avenue	9,130	29.3	33.9	3.8

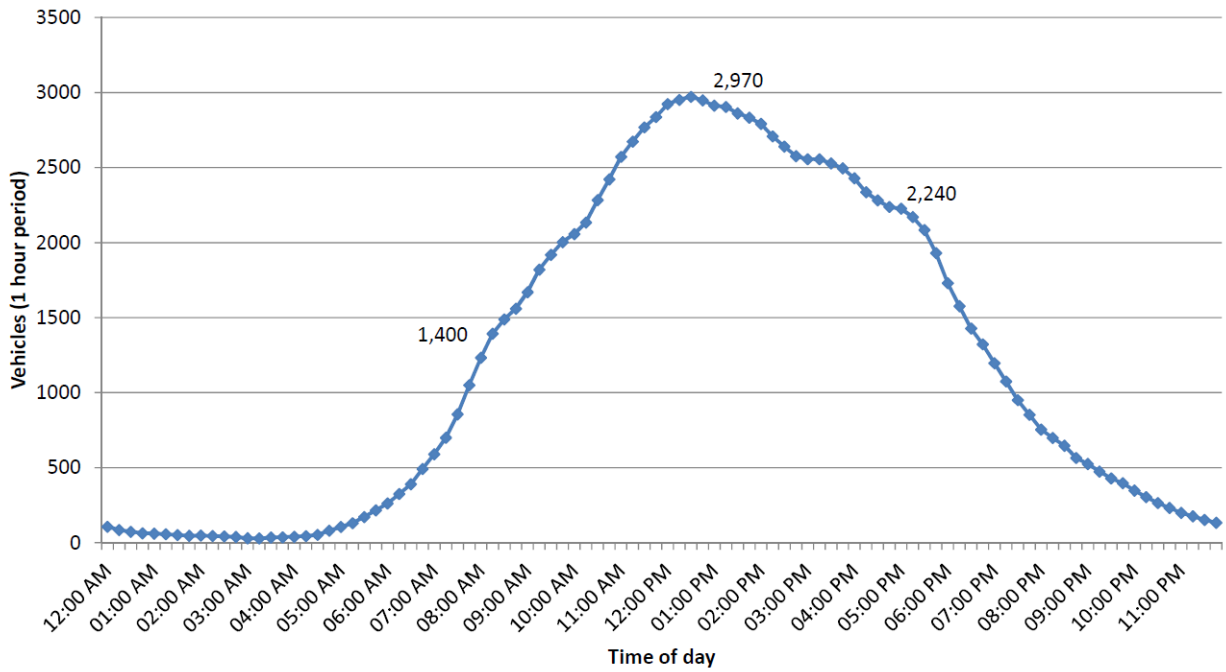
Source: Traffic counts performed the week of December 5, 2011

Notable observations from the table include:

- Average daily traffic is relatively evenly distributed among the three roads in the study area corridor.
- The average speeds on the roads are right at the speed limit of 30 mph. The 85th-percentile speeds are within 5 mph of the speed limit.
- Approximately 4 percent of the total traffic on Mesquite and Swanson Avenues is large trucks while 2 percent of the traffic on McCulloch Boulevard is large trucks.

The segment count data for the three roads shown in Table 2 were combined to evaluate the travel pattern throughout the day. The traffic counts provided information related to the number of vehicles by 15 minute intervals. This data was averaged over the 72-hour period and summed for each of the three roads to create the hourly travel distribution presented in Figure 6. Each data point along the curve represents the previous hourly traffic volume at that time of day.

Figure 6 Daily Trip Distribution, Lake Havasu Boulevard to Capri Boulevard



Notable observations from the figure include:

- The hourly traffic volume in the morning between 7 and 8 a.m. is 1,400 vehicles, in the midday between 11 a.m. and 12 p.m. is 2,970, and in the evening between 4 and 5 p.m. is 2,240.
- The peak hour of travel along the three primary roads in the corridor between Lake Havasu Avenue and Capri Boulevard is during the midday. This period is approximately 25-30 percent higher than the evening peak hour and over twice as high as the morning peak hour.

3.4 Operational Analysis

Level of Service

Level of service is a quantitative measurement of operational characteristics of traffic and the perception of the traffic conditions by both motorists and passengers. There are six levels of service defined in the *Highway Capacity Manual* (HCM). Each level of service is given a letter designation from A to F, with A representing the optimal or best condition and F the worst (Transportation Research Board 2000). Road segment level of service is characterized by the HCM as follows:

- LOS A: Best, free flow operations (on uninterrupted flow facilities) and very low delay (on interrupted flow facilities). Freedom to select desired speeds and to maneuver within traffic is extremely high.
- LOS B: Flow is stable, but presence of other users is noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within traffic.

- LOS C: Flow is stable, but the operation of users is becoming affected by the presence of other users. Maneuvering within traffic requires substantial vigilance on the part of the user.
- LOS D: High density but stable flow. Speed and freedom to maneuver are severely restricted. The driver is experiencing a generally poor level of comfort and convenience.
- LOS E: Flow is at or near capacity. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within traffic is extremely difficult. Comfort and convenience levels are extremely poor.
- LOS F: Worst, facility has failed, or a breakdown has occurred.

LOS A, B, and C are generally considered to be satisfactory service levels, while the influence of congestion becomes more noticeable at LOS D. LOS E is undesirable and is considered by most agencies to be the limit of acceptable delay, and LOS F conditions are considered to be unacceptable to most drivers. The City's *General Plan* does not designate a design LOS, however, for this study, LOS C will be designated as desirable and LOS D will be designated as minimum for the analysis of intersections and road segments.

Analysis Results

The intersection traffic analysis was performed using Synchro/SimTraffic simulation analysis package (Version 7, Build Series 773, Revision 8) developed by Trafficware, Inc. Synchro is a widely used traffic analysis tool that evaluates intersection delays and congestion based on procedures similar to those described in the 2000 *Highway Capacity Manual* (TRB 2000). It is often used for localized intersection analyses, signal coordination, and traffic study work. SimTraffic is a microsimulation tool that provides network measures of effectiveness and allows the user to visually review the geometry and traffic progression. Combined, they were used to evaluate the intersection performance. The results of the analysis are summarized in Table 3 and shown graphically in Figure 7.

Notable observations from the table and figure include:

- All but one of the intersections operates at LOS C or better during the AM and PM peak hour.
- The all-way stop controlled intersection at Swanson Avenue and Acoma Boulevard operates at LOS D, near capacity, during the PM peak hour

Table 3 Existing Intersection Level of Service Analysis Results

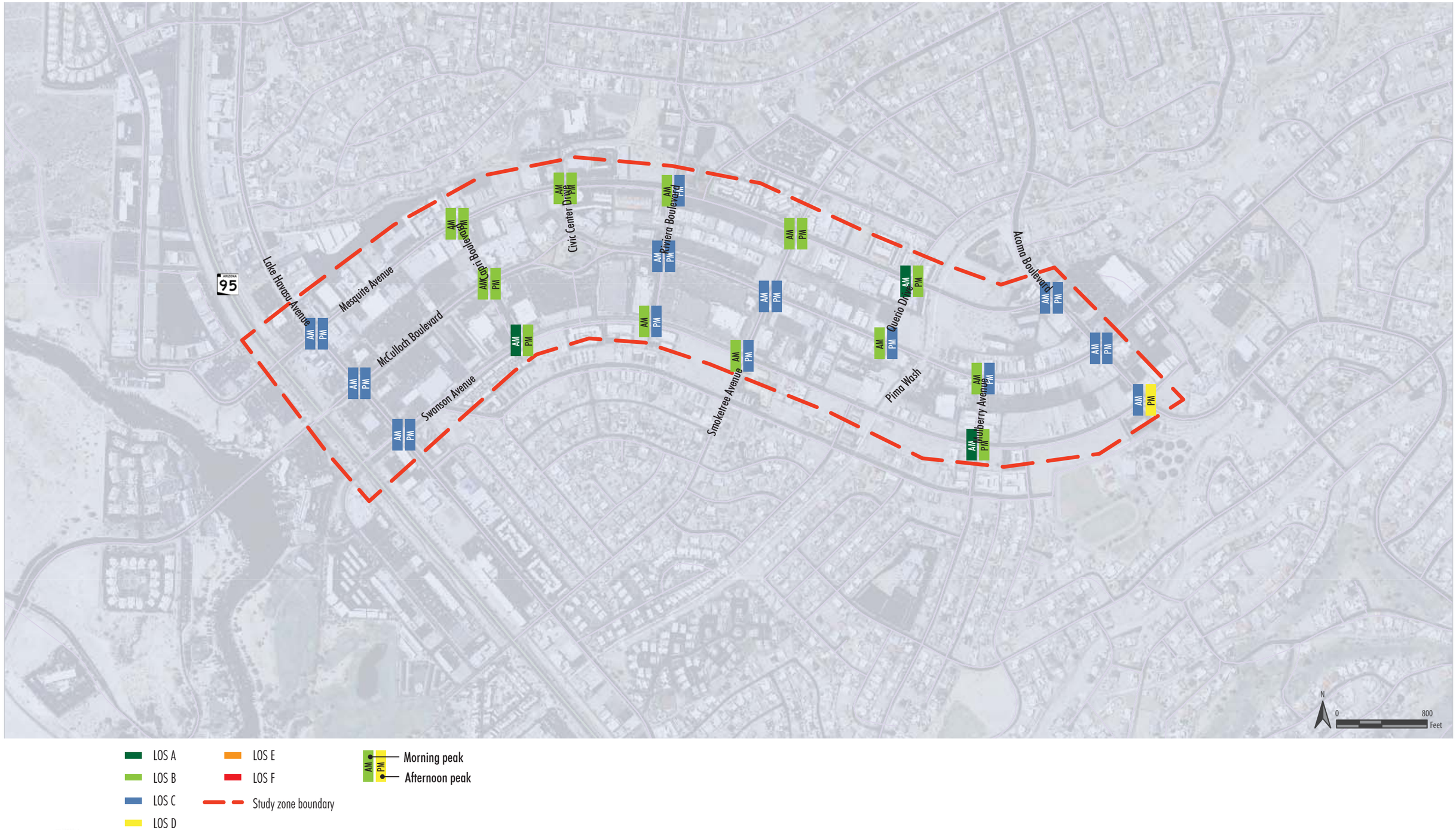
Intersection	Intersection Control Type	AM Peak		PM Peak	
		LOS	Average Control Delay	LOS	Average Control Delay
Mesquite Avenue at Lake Havasu Avenue	Signal	C	28.8	C	27.8
Mesquite Avenue at Capri Boulevard	AWSC	B	10.0	B	13.3
Mesquite Avenue at Civic Center Drive	AWSC	B	10.4	B	14.0
Mesquite Avenue at Riviera Drive	AWSC	B	12.7	C	20.6
Mesquite Avenue at Smoketree Avenue	AWSC	B	11.9	B	14.5
Mesquite Avenue at Querio Drive	AWSC	A	9.0	B	10.0
Mesquite Avenue at Acoma Boulevard	Signal	C	28.6	C	28.9
McCulloch Boulevard at Lake Havasu Avenue	Signal	C	26.1	C	27.6
McCulloch Boulevard at Capri Boulevard	Signal	B	16.1	B	18.6
McCulloch Boulevard at Riviera Drive	Signal	C	21.8	C	20.6
McCulloch Boulevard at Smoketree Avenue	Signal	C	22.8	C	22.5
McCulloch Boulevard at Querio Drive	SSSC	B	13.4	C	20.3
McCulloch Boulevard at Mulberry Avenue	SSSC	B	11.8	C	16.5
McCulloch Boulevard at Acoma Boulevard	Signal	C	30.8	C	34.3
Swanson Avenue at Lake Havasu Avenue	Signal	C	31.0	C	30.7
Swanson Avenue at Capri Boulevard	AWSC	A	8.0	B	10.2
Swanson Avenue at Riviera Drive	SSSC	B	10.7	C	20.7

Table 3 Existing Intersection Level of Service Analysis Results

Intersection	Intersection Control Type	AM Peak		PM Peak	
		LOS	Average Control Delay	LOS	Average Control Delay
Swanson Avenue at Smoketree Avenue	AWSC	B	10.1	C	18.6
Swanson Avenue at Mulberry Avenue	AWSC	A	8.7	B	12.4
Swanson Avenue at Acoma Boulevard	AWSC	C	16.9	D	33.9

AWSC = all-way stop control; SSSC = side-street stop control

Source: HDR Engineering, Inc., February 2012


Lake Havasu Avenue
Mesquite Avenue
McCulloch Boulevard
Swanson Avenue
AKA Boulevard
Civic Center Drive
Riviera Boulevard
Smoketree Avenue
Pima Wash
Querio Drive
Acoma Boulevard
Mulberry Avenue
95
AM
PM
N
0
800
Feet
LOS A
LOS B
LOS C
LOS D
LOS E
LOS F
Study zone boundary
Morning peak
Afternoon peak

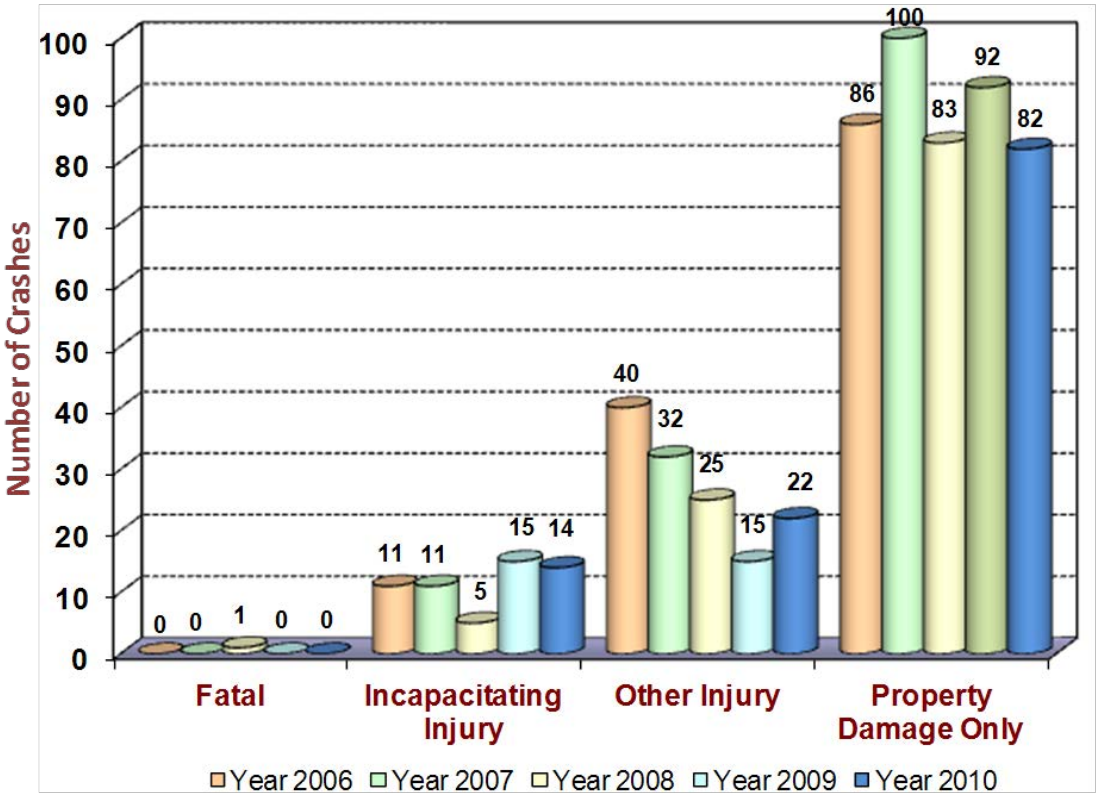
3.5 Crash Data

A crash analysis was conducted to identify crash patterns, trends, and types. The analysis included the three major corridors—McCulloch Boulevard, Swanson Avenue, and Mesquite Avenue—between US 95 and Acoma Boulevard during the 5-year period from January 1, 2006 to December 31, 2010. The crash data was obtained from the ADOT Traffic Safety Division and includes crashes that occurred along these roadways and at or near the intersections. The data provided by ADOT contains information regarding the date, time, location, severity, type, and cause of the crash as well as the environmental conditions at the time of the crash.

Crash Summary

A total of 634 crashes involving 1,262 vehicles were reported within the study area during the 5-year analysis period. There was one fatal crash and 190 (30 percent of total) injury crashes (both incapacitating and possible injury). The remaining 443 crashes (70 percent of total) were non-injury, property damage only, or unreported. Figure 8 presents the yearly crash trend and severity for the analysis period.

Figure 8 Crash Trend During 5-Year Crash Analysis Period



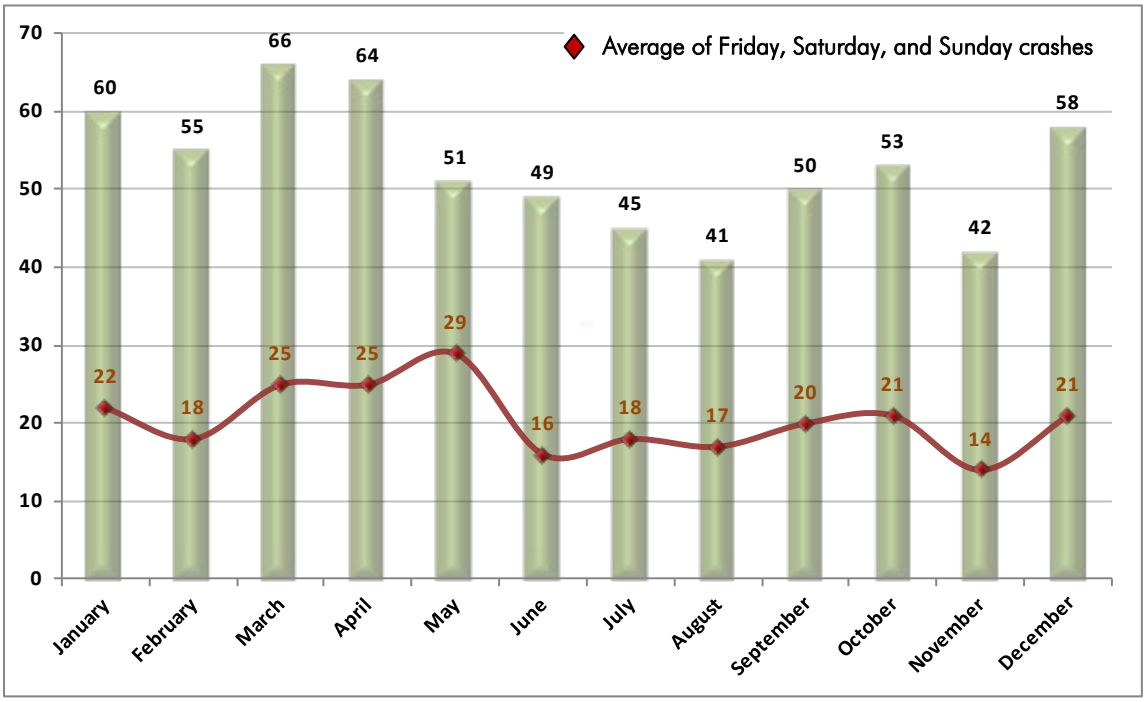
Source: ADOT Traffic Safety Division, data from January 1, 2006 to December 31, 2010

The only fatal crash took place on Swanson Avenue between Mariposa Drive and Mulberry Avenue on

November 18, 2008. Three vehicles were involved in a head-on crash under clear weather condition during daytime. No alcohol or drugs were involved with this fatal crash.

Crashes were analyzed by month of the year. Average Friday, Saturday, and Sunday crashes were summarized to compare the monthly trend with the weekend crashes. This is helpful to identify whether the influx of visitors during the summer break and long weekends has any direct influence on the number of crashes along the study corridors. Figure 9 shows the highest number of crashes was during the month of March (66 crashes) while the highest average Friday through Sunday crashes was in the month of May (29 crashes, 57percent of total crashes of that month). The average crashes on Friday through Sunday were higher during the spring months (March through May).

Figure 9 Crash Trend by Months and Average of Friday, Saturday, and Sunday Crashes



Source: ADOT Traffic Safety Division, data from January 1, 2006 to December 31, 2010

Crash Type

Various crash types from the ADOT database that occurred during the analysis period were analyzed. Rear end and angle crashes were the predominant crash types that occurred along the study corridors with 241 (38 percent) and 149 (24 percent) crashes respectively. There were 101 sideswipe crashes (16 percent of the total crashes), 70 single vehicle crashes (11 percent), 39 left-turn crashes (6 percent) and 34 other crash types (5 percent).

Most of the crashes (548 crashes, 86 percent) were multi-vehicle crashes. There were 30 crashes (5 percent) involving pedestrians and bicyclists. Fifty-six crashes (9 percent) were comprised of overturning vehicles, collisions with fixed objects, and unknown or unreported crashes.

About 86 percent of crashes took place under clear weather conditions. The remaining 11percent of crashes occurred in cloudy weather conditions and 3 percent in rainy or other weather conditions. Approximately 79 percent of crashes were in daylight and 21 percent of crashes were in dawn, dusk or dark conditions.

Corridor Crashes by Severity and Type

Out of the total 634 crashes, 177 (28 percent) crashes were along McCulloch Boulevard followed by 95 crashes along Mesquite Avenue (15 percent) and 72 crashes on Swanson Avenue (11 percent). The remaining 290 crashes (46 percent) occurred on the side streets intersecting these three major corridors. The combined crashes along the three major corridors were 54 percent of all crashes within the vicinity area.

Table 4 shows the breakdown of crash types and severity by corridor. McCulloch Boulevard has 76 rear end and 41 single vehicle crash types with 47 injury crashes at various levels. Swanson Avenue corridor has 26 rear end and 24 angle crashes with one fatal (discussed previously) and 22 injury crashes. Mesquite Avenue had 34 rear end and 30 angle crashes with 34 injury crashes.

Table 4 Crash Types by Corridor

Description	Corridors Between US 95 and Acoma Boulevard			
	Swanson Avenue	McCulloch Boulevard	Mesquite Avenue	All Cross-streets Combined
Crash Type				
Single Vehicle	5	41	5	19
Angle	24	20	30	75
Left-Turn	9	3	5	22
Rear End	26	76	34	105
Sideswipe	6	27	16	52
Other/ Unknown	2	10	5	17
Severity				
Fatal	1	0	0	0
Incapacitating Injury	6	16	9	25
Other Injury	16	31	25	62
Property Damage	49	130	61	203
Total (634 crashes)	**72 (11%)**	**177 (28%)**	**95 (15%)**	**290 (46%)**

Source: ADOT Traffic Safety Division, data from January 1, 2006 to December 31, 2010

Intersection Crashes

The majority of crashes occur at intersections because of the high number of potential conflict points with other vehicles, pedestrians, and bicyclists. For this reason, crashes at intersections were analyzed further to identify high crash locations and potential mitigation measures. The crash rate at each intersection was calculated as a function of the crashes per million entering vehicles (MEV). Six intersections were found to have a crash rate higher than 1.0 crash per MEV. The intersections of Lake Havasu Avenue at Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue have crash rates of 1.54, 1.44 and 1.20, respectively. Because the crash rate is a function of the number of entering vehicles at that intersection, higher crashes do not always result in a higher crash rate. The intersection of McCulloch Boulevard at Mulberry Avenue had only 33 crashes but due to the lower MEV, the crash rate was 1.52. Table 5 summarizes the intersections with crash rates above 1.0.

The crash types at these six high crash intersections are shown in Figure 10. Overall, rear end is the most dominant crash type followed by angle crashes. The following section provides additional detail for each intersection related to potential causes and mitigation measures to improve operations.

Table 5 High Crash Intersections

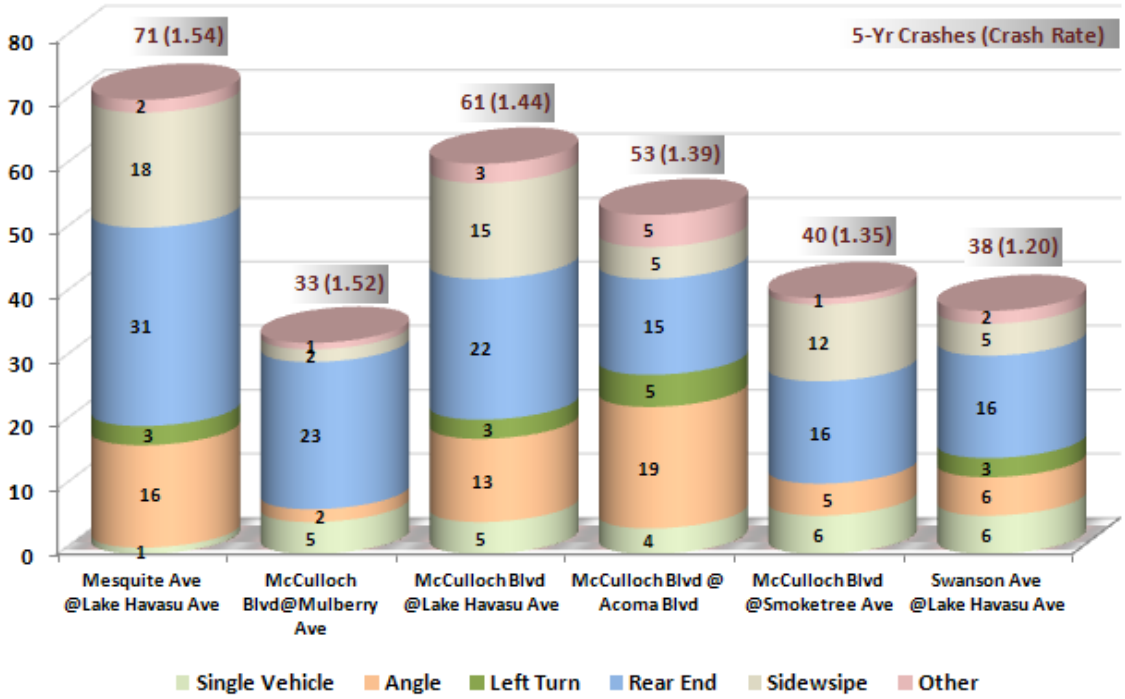
Intersection Name	5-Year Total Crashes	Daily Entering Volume	Crash Rate
Mesquite Avenue at Lake Havasu Avenue	71	25,300	1.54
McCulloch Boulevard at Mulberry Avenue	33	11,900	1.52
McCulloch Boulevard at Lake Havasu Avenue	61	23,200	1.44
McCulloch Boulevard at Acoma Boulevard	53	20,900	1.39
McCulloch Boulevard at Smoketree Avenue	40	16,200	1.35
Swanson Avenue at Lake Havasu Avenue	38	17,300	1.20

Note: Table shows total crashes during five-year analysis period.

Intersection Crash Rate = Total 5-Year Crashes x 1,000,000)/(Daily Entering Volume x 365 x 5)

Source: ADOT Traffic Safety Division, data from January 1, 2006 to December 31, 2010

Figure 10 Crashes by Type at High Crash Intersections



Source: ADOT Traffic Safety Division, data from January 1, 2006 to December 31, 2010

Intersection Assessment

Crash type, pattern, and driver behaviors were reviewed for the six high crash intersections. Notable observations, primary causes, and intersection assessments are summarized for each intersection below.

Mesquite Avenue at Lake Havasu Avenue

This intersection had 71 crashes and a crash rate of 1.54 during the 5-year analysis period. Notable observations include:

- High number of rear-end and angle crashes
- Heavy turning movements at intersection
- Driver distraction and failed to yield right-of-way were primary causes
- 61 crashes were during daylight and 10 were during dawn, dusk or nighttime

Installation of an exclusive westbound right-turn lane on Mesquite Avenue at Lake Havasu Avenue is recommended. Inadequate yellow and lack of all-red signal phase could be a potential cause for high number of angle crashes. Signal timing and phasing optimization with better visibility may improve the safety at this location.

McCulloch Boulevard and Mulberry Avenue

Although a moderate number of crashes (33) occurred over the 5-years analysis period, a low volume of entering vehicles yielded a high crash rate (1.52) at this intersection. Notable observations include:

- High number of rear-end and single vehicle crashes
- Driver distraction, failed to yield right-of-way, and following too closely were the primary causes
- Two crashes occurred with parked vehicles, two with pedestrians, and two with the curb
- 26 crashes were during daylight and 7 were during dawn, dusk or nighttime conditions
- In 2008, a bump-out was constructed at this intersection; there were 8, 6, 3, 10, and 6 crashes in 2006, 2007, 2008, 2009, and 2010, respectively

Enforcing speed limit and violation of traffic control are the potential countermeasures to alleviate the issue. Flexible reflective delineators along McCulloch Boulevard may enhance driver attention. Improvements in intersection lighting conditions are also recommended.

McCulloch Boulevard and Lake Havasu Avenue

This intersection had 61 crashes (1.44 crash rate) over the 5-year analysis period including 22 rear-end and 15 sideswipe crashes. Notable observations include:

- High number of rear end and sideswipe crashes
- Heavy turning movements at intersection
- Driver distraction, speeding, and failed to yield right-of-way were primary causes
- Six crashes involved pedestrian and/or bicyclists
- 53 crashes were during daylight and 8 were during dawn, dusk or nighttime

Considering the high number of pedestrian and bicyclist movements, potential mitigation could include installing advance pedestrian warning signs with flashes at the intersection of McCulloch Avenue at Lake Havasu Avenue to alert drivers about the presence of pedestrians and bicyclists. Monitoring speed and

red light violation, signal optimization, and LED visible traffic signal head would also improve the traffic safety.

McCulloch Boulevard and Acoma Boulevard

There were 53 crashes (1.39 crash rate) during the 5-year analysis period. Notable observations include:

- High number of angle and rear end crashes
- High number of turning traffic movements
- Driver inattention, disregarding red light, speeding, and failed to yield right-of-way were the primary causes of crashes
- Four crashes involved pedestrian and/or bicyclists and two with parked vehicle
- 43 crashes during daylight, 10 crashes during dawn, dusk or nighttime

Installing signs and/or flashing warning lights to alert drivers to the presence of pedestrians may help. Signal optimization and LED visible traffic signal heads may also improve the traffic safety.

Unrestricted access to the business facility near the intersection may be the contributing factor to angle crashes. Prohibiting left turns from the driveways near the intersection could improve traffic safety.

McCulloch Boulevard and Smoketree Avenue

Out of 40 total crashes during the 5-year analysis period, this intersection had 16 rear-end and 12 sideswipe crashes with a crash rate of 1.35. Notable crash characteristics include:

- High number of rear-end and sideswipe crashes
- Driver inattention, followed too closely, and improper lane change are the major cause of crashes
- Three crashes involved bicyclists, three with parked vehicles, and three with a signal sign post
- 34 crashes were during daylight and 6 were during dusk or dark conditions.

Installing recessed pavement markers along with lane markings would improve visibility. Installing signs to warn drivers about the pedestrian and parking activity at this intersection would also improve safety. Speeding and sudden stops at the traffic signal could be contributing factors to the high number of rear end crashes.

Swanson Avenue and Lake Havasu Avenue

This intersection had 38 crashes with a 1.20 crash rate during the 5-year analysis period. Notable crash characteristics include:

- High number of rear-end, angle, and single-vehicle crashes
- Driver inattention and failed to yield right-of-way are the primary causes of crashes
- Four crashes involved a traffic sign post
- Heavy right- and left-turn movements occur to and from Swanson Avenue
- 27 crashes were during daylight and 11 were during dusk or dark conditions.

Installation of an exclusive southbound right-turn lane on Lake Havasu Avenue at Swanson Avenue would enhance safety. Speeding and reckless driving are the potential contributing factors to the high

number of single-vehicle crashes. Traffic signal timing and phasing optimization with adequate yellow and all-red interval may help reduce angle and rear-end crashes.

Intersection Assessment Summary

In general, driver education, speed enforcement, periodic monitoring of traffic control (signal, stop, and yield sign), improved traffic signal visibility, pavement marking and striping, and advance warning for pedestrian and bicyclists activity are among the few measures that could be implemented to enhance road user safety throughout the corridor.

4.0 Existing Transit Conditions

Havasu Area Transit (HAT), Lake Havasu City's public transportation system, provides service to Lake Havasu City, Desert Hills, Horizon Six, and the Shops at Lake Havasu. HAT provides fixed route bus service and Curbside service (demand responsive service) for seniors and persons with disabilities.

4.1 Current Transit Operations

Fixed Route Transit Service

Fixed route bus service is comprised of five routes, which connect every sixty minutes at the Downtown Transfer Station (DTS) and provide passengers with a free transfer between routes. One route (the Trolley) provides service on more frequent headways (30 minutes) on Fridays and Saturdays. Operating characteristics are provided in Table 6, while a map of the routes is included in Figure 11.

Table 6 HAT Fixed Route Bus Service Operating Characteristics

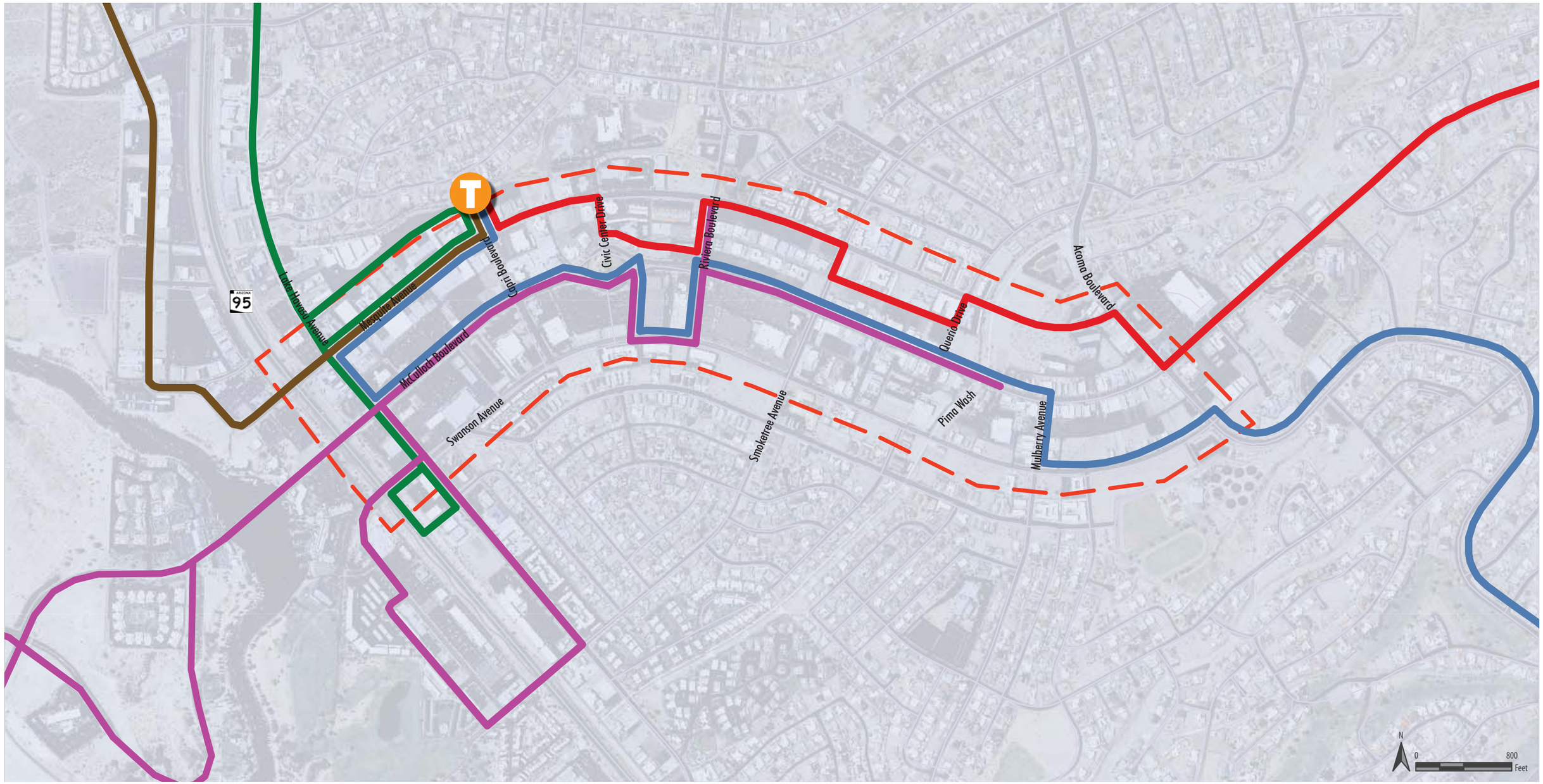
Route	Weekday Headway	Friday/Saturday Headway	Weekday Hours	Friday Hours	Saturday Hours
Trolley Route	60	30	9:00A - 6:00P	9:00A - 6:00P	9:00A - 6:00P
Red Route	60	60	6:05A - 7:05P	6:05A - 7:05P	8:05A - 6:05P
Blue Route	60	60	6:00A - 7:00P	6:00A - 7:00P	8:00A - 6:00P
Brown Route	60	60	5:50A - 7:00P	5:50A - 7:00P	7:50A - 6:00P
Green Route	60	60	9:00A - 3:30P	9:00A - 3:30P	9:00A - 3:30P

Source: 2011 HAT Transit Service Guide

Three routes operate from approximately 6 a.m. to 7 p.m. on weekdays (Red, Blue, and Brown), while these same routes operate from approximately 8 a.m. to 6 p.m. on Saturdays. The Trolley and Green Route begin service after the other routes and also end service earlier in the day. There is no service on Sundays and city holidays (with the exception of Good Friday and Veterans Day).

HAT is structured as a traditional hub-and-spoke or radial transit system. The DTS is located at 83 Capri Lane, north of Mesquite Avenue behind a commercial strip development and provides approximately 250 parking stalls on the 3 acre site. . All five HAT routes are scheduled to meet at the DTS at approximately 25 minutes past the hour and depart at 30 minutes past the hour. This service configuration provides passenger access to all routes at a single location with a relatively seamless transfer option.

Fixed route passenger fares start at $1.25 per trip (age 5 and over). Frequent system users can purchase a monthly pass for $36.00. Additionally, HAT sells 30-pack Bus Bucks for $30. Each Bus Buck is valid for $1 and can be used on fixed route service or Curbside service.



Trollley route
Red route
Brown route
Blue route
Green route
Transit center
Study zone boundary

Demand Responsive Service

HAT's demand responsive service, Curbside service, was Lake Havasu City's primary transit service until fours years ago when the first fixed route service was implemented. Today, Curbside provides service for seniors, qualified persons with disabilities, and individuals who live outside the fixed route area. Curbside service is a first come, first served shared ride program. HAT recommends that users request trips with a 24-hour advanced reservation; however, same day trip requests are accepted pending availability.

Curbside service operates Monday through Friday from 6:30 a.m. to 7:00 p.m., and on Saturdays from 8:00 a.m. to 6:00 p.m. Consistent with HAT's fixed route service, Curbside service is not provided on Sundays or city holidays, except Good Friday and Veterans Day.

Curbside fares range from $2.50 for seniors age 65 and over and qualified persons with disabilities, while all other qualified trips (outside of fixed route service area) age 5 to 65 are required to pay a $3.75 fare.

Fixed Route and Demand Responsive Service Passenger Facilities and Fleet

HAT's primary capital asset inventory includes passenger facilities and transit vehicles. Passenger facilities, including bus stops and the DTS, are provided for the convenience and comfort of HAT's fixed route transit riders. HAT has 88 bus stops, excluding the DTS, located throughout the service area. Bus stops include a range of amenities from a simple sign to a passenger shelter with a bench. The DTS has three passenger shelters and includes marked slots for all five HAT bus routes. Table 7 provides an inventory of the number of bus stops by route.

Table 7 HAT Bus Stops by Route

Route	Stop Locations
Blue	15
Brown	19
Green	14
Trolley	20
Red	20
Total	88

Source: 2011 HAT Transit Service Guide

Transit Fleet

HAT's transit vehicle fleet consists of 20 revenue vehicles and one non-revenue vehicle. HAT's 20 revenue vehicles are comprised of six different models from five different manufacturers. A majority of the fleet (85 percent) is powered by diesel fuel, while the remainder of the vehicles are powered by unleaded fuel. All of the revenue vehicles are American with Disabilities Act (ADA) accessible with the exception of the four trolley vehicles. An inventory of HAT's fleet is provided in Table 8.

Table 8 HAT Transit Fleet Inventory

Year	Make	Model	Quantity	Fuel	Seats	ADA Accessible
2003	Ford	Startrans	5	Diesel	8	Yes
2006	Classic American Trolleys	Trolley	4	Diesel	22	No
2007	Chevrolet	Aero Elite	6	Diesel	20	Yes
2008	International	EZ Trans	2	Diesel	21	Yes
2008	Braun	Entervan	2	Unleaded	5	Yes
2009	Chevrolet	Arboc	1	Unleaded	10	Yes
2011	Chevrolet	Pickup	1	Unleaded	4	No

Source: WACOG Regional Transportation Coordination Plan Transit Provider Service and Inventory Form - 2011 Plan Update

Fixed Route and Demand Responsive Service Operations and Capital Costs

HAT is partially funded through the ADOT administered Federal Transit Administration 5311 Rural Transit Grant Program. The funding helps HAT operate, service, purchase, and maintain transit capital assets including vehicles and passenger facilities. Lake Havasu City's 2011-12 Annual Budget identifies HAT costs in four major categories: personnel, operations and maintenance, capital, and contingency. Table 9 provides a summary of the actual or budgeted expenditures between fiscal year (FY) 2009 and 2012, while Table 10 provides the percent of expenditures by category.

Table 9 HAT Actual or Budgeted Expenditures FY 2009 to FY 2012 - Total

Expenditure Category	Actual FY 2009 ($)	Actual FY 2010 ($)	Budget FY 2011 ($)	Budget FY 2012 ($)
Personnel	1,331,488	1,110,836	1,133,426	1,025,804
Operations and Maintenance	504,146	440,771	645,559	650,700
Capital	83,580	45,753	668,250	103,066
Contingency	0	7,908	20,000	20,000
Total	1,919,214	1,605,268	2,467,235	1,799,570

Source: Lake Havasu City 2011-12 Annual Budget (page 230)

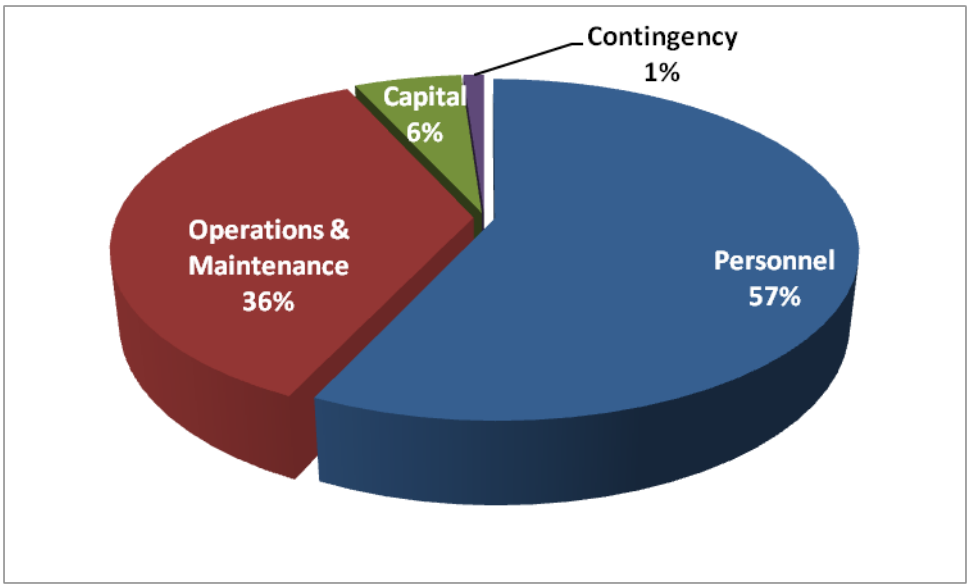
Table 10 HAT Actual or Budgeted Expenditures FY 2009 to FY 2012 - Percent

Expenditure Category	Actual FY 2009 (%)	Actual FY 2010 (%)	Budget FY 2011 (%)	Budget FY 2012 (%)
Personnel	69.4	69.2	45.9	57.0
Operations and Maintenance	26.3	27.5	26.2	36.2
Capital	4.4	2.9	27.1	5.7
Contingency	0.0	0.5	0.8	1.1
Total	100.0	100.0	100.0	100.0

Source: Lake Havasu City 2011-12 Annual Budget (page 230)

HAT's projected fiscal year 2012 budget is approximately $1.8 million. By category, personnel costs are projected to be lower than in any year reported; however, operating and maintenance costs are expected to be the highest. Combined, fiscal year 2012 budgeted cost for personnel and operations is expected to represent 92.3 percent of all fiscal year 2012 expenditures. Compared with previous fiscal years (fiscal year 2009 through fiscal year 2011), fiscal year 2012 has the lowest percentage of budget allocated to personnel and operations and maintenance, with the exception of fiscal year 2011, which has an atypical allocation for transit capital. Figure 12 illustrates the fiscal year 2012 budgeted expenditures by category.

Figure 12 FY 2012 Expenditures by Category



Source: Lake Havasu City 2011-12 Annual Budget (page 230)

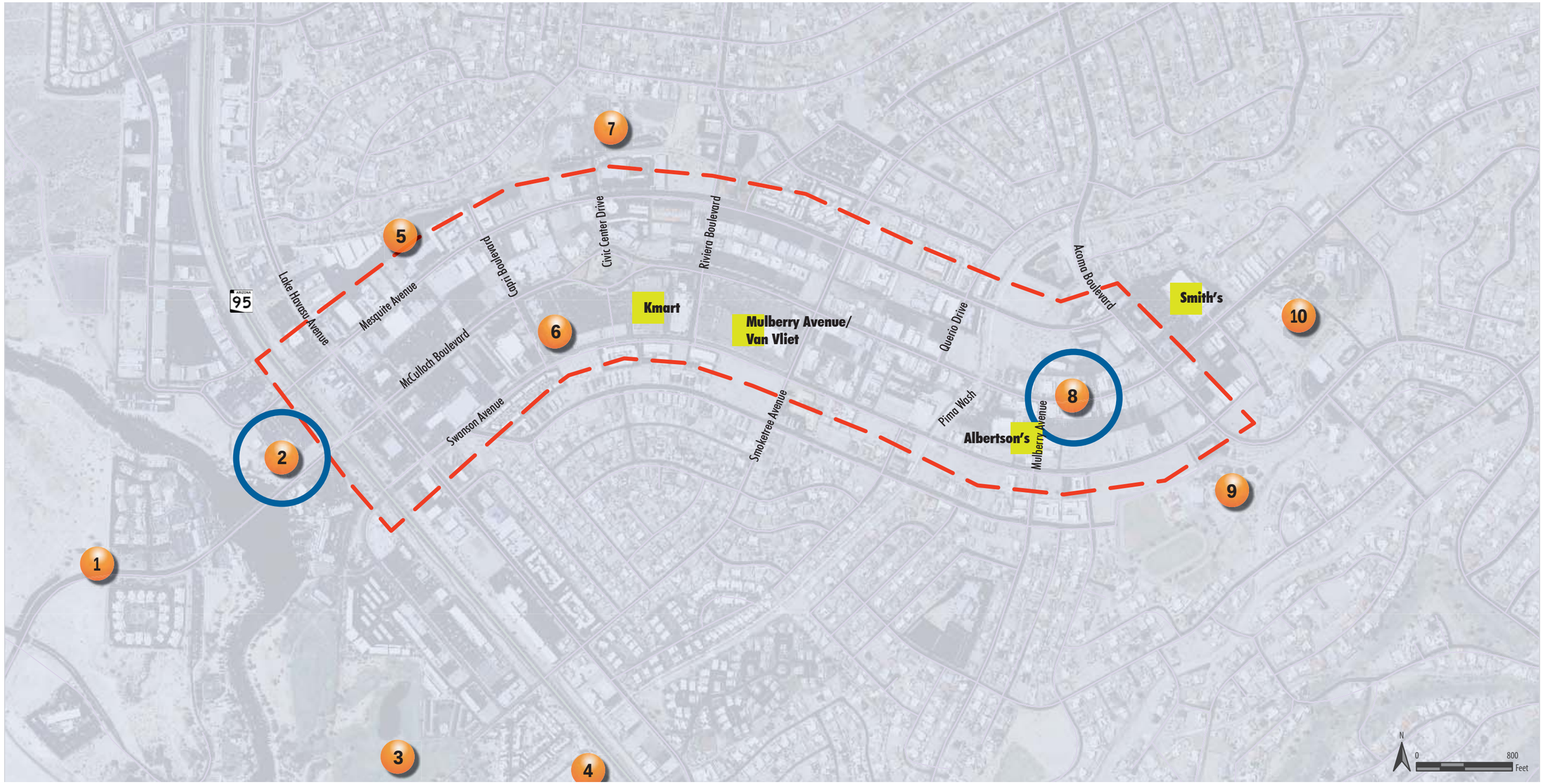
4.2 Current Activity Centers

Analyzing HAT's existing ridership data by stop is invaluable in identifying the top destinations or activity centers accessed by HAT passengers. Excluding the passenger boardings at the DTS, the highest ranked stop location in the HAT system, all of HAT's top boarding locations are near a retail, multi-family, or light industrial land use. The top five boarding locations (with the exception of the DTS) are located near large retail stores including Wal-Mart, Bashas', Smith's, and Albertsons. While these locations provide shopping access to community members and visitors, they also represent mid-sized employment centers. Finally, half of the top ten boarding locations are located within the central business corridor, along or near McCulloch Boulevard. A ranked list, by total annual boardings of the top passenger boarding locations in HAT's service area, is provided in Table 11. Figure 13 illustrates HAT's top boarding locations and activity centers.

Table 11 HAT Top Passenger Boarding Locations

Stop\Location	Nearby Major Land Uses	FY 2011 Annual Boardings	Route
DTS	Small Retail and Medical	42,117	All
Shops at Lake Havasu/Wal-Mart	Large Retail	4,959	Green
Bashas' South	Large Retail and Multi-Family Residential	4,332	Blue
Smith's	Large Retail	3,192	Red
Albertsons	Large Retail	2,584	Blue
Mulberry Avenue/Van Vilet	Large Retail	2,192	Blue
Lake Drive/London Bridge Road	Mobile Home\RV Residential	2,046	Green
Kmart	Large Retail	1,958	Blue
Commander Drive/San Juan Drive	Light Industrial and Multi-Family Residential	1,830	Brown
Neighbors/Chemehuevi Boulevard	Church, Small Retail, and Multi-Family Residential	1,776	Blue
Havasupai Boulevard/ Kiowa Boulevard	Elementary School and Multi-Family Residential	1,617	Brown

Source: *FY-2011 HAT Ridership Report*



# Activity center (general)	1. Pittsburg Point	6. County Library
Activity center (transit)*	2. London Bridge	7. Medical Center
Commercial nodes**	3. Rotary Park	8. Uptown District
Study zone boundary	4. Aquatic Center	9. ASU Campus
	5. Transit Center	10. City Hall

* Transit stops in the Study Area with the highest annual boardings
** as identified in the City of Lake Havasu City General Plan Update Future Transportation/Circulation Plan (Aug. 2005)

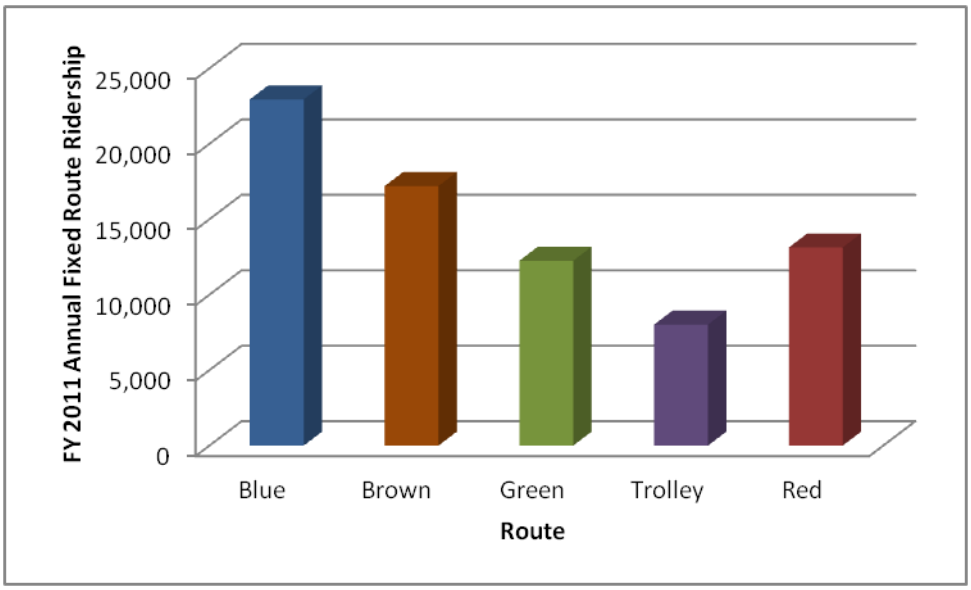
4.3 Transit Demand

Existing transit demand is expressed by actual ridership data collected by HAT during FY 2011. However, there is potential unmet demand for service in areas of the region without direct access to fixed route transit service, and during weekday nights and on Sundays when service is unavailable. Section 7.2 discusses the potential existing unmet demand estimated from the Arkansas Public Transportation Needs Assessment (APTNA) transit demand methodology. A summary and analysis of HAT's existing transit service demand is documented herein.

Existing Fixed Route Transit Demand

In fiscal year 2011, HAT counted nearly 74,000 passenger boardings on the fixed route transit services. Figure 14 provides a summary of ridership by route. More than half (55 percent) of the passenger boardings are accommodated by two routes: Blue and Brown. The Blue route alone accounts for nearly one-third (31 percent) of HAT's ridership, while the Brown route accounts for another 23 percent. Because the Trolley started operation in July 2011, the Trolley ridership total shown in Figure 14 reflects a partial year of operation.

Figure 14 Fiscal Year 2011 Annual Fixed Route Transit Ridership by Route



Source: FY-2011 HAT Ridership Report

As a radial configuration, passenger transfers are an important part of HAT's ridership. During fiscal year 2011, transfers at the DTS accounted for 41 percent of HAT's ridership. The transfer rate indicates that 3 out of 5 linked passenger trips taken on HAT are completed by using more than one route. Looking more closely at HAT's ridership data, the total passenger boardings (transfers and paid boardings) that occurred at the DTS during fiscal year 2011 exceeded 42,000 passengers, or 57 percent of all system boardings.

On a route level basis, the number of transfers by route does not necessarily correlate with total passenger boardings. The Blue route has more total passenger boardings than any route; however,

the Brown route has slightly more total transfers than the Blue route. On a percentage basis, the Blue route has the lowest transfer rate (passengers transferring to the route) at 32 percent; 9 percentage points lower than the system average of 41 percent. The Trolley route has the highest passenger transfer rate at 47 percent. The relatively high transfer rate on the Trolley route provides evidence of the strong demand in Lake Havasu City's central business corridor, where the Trolley operates.

Furthermore, while the origin and destination of transferring passengers is not known, HAT's ridership data indicates that 57 percent of total passenger transfers occur on the Blue, Red, and Trolley routes; all of which serve segments of Lake Havasu City's central business corridor. Table 12 provides a summary of HAT's fiscal year 2011 ridership information.

Table 12 HAT Fiscal Year 2011 Passenger Boarding's and Transfers at the DTS

Route	Total Boardings	Transfers at DTS	Percent Transfers (%)	Paid Boardings at DTS	Total DTS Boardings	Percent DTS Boardings (%)
Blue	22,947	7,371	32.1	3,243	10,614	46.3
Brown	17,198	7,505	43.6	2,898	10,403	60.5
Green	12,252	5,518	45.0	2,870	8,388	68.5
Trolley	8,019	3,793	47.3	1,225	5,018	62.6
Red	13,131	5,997	45.7	1,697	7,694	58.6
Total	73,547	30,184	41.0	11,933	42,117	57.3

Source: *FY-2011 HAT Ridership Report*

Demand Responsive Transit Demand

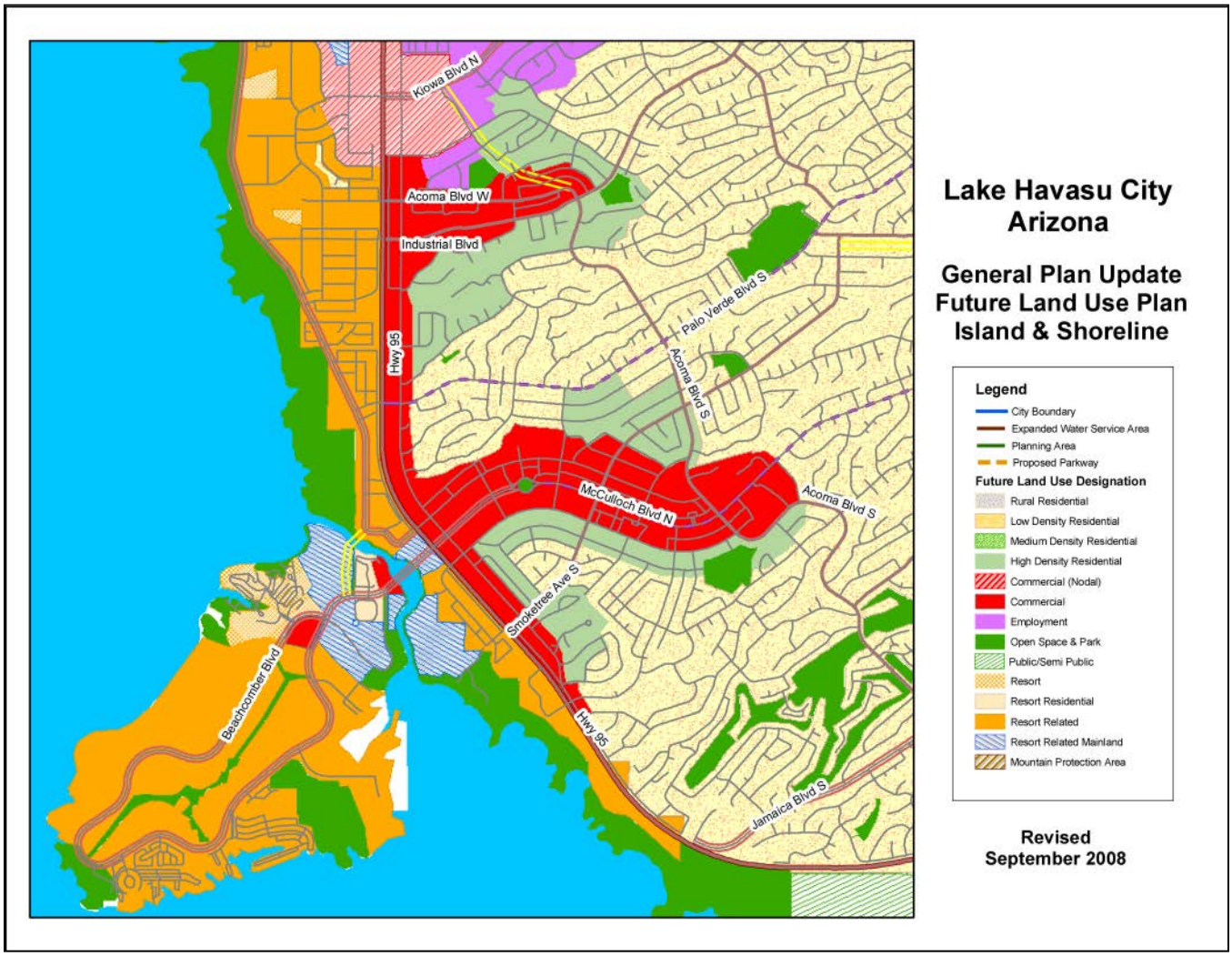
Ridership data is not currently available for HAT's Curbside service.

5.0 Land Use and Socioeconomics

5.1 Future Land Use

The Lake Havasu City General Plan Future Land Use map identifies future land uses for Lake Havasu City. The majority of land use in the study area is commercial surrounded by high density residential. Figure15 shows the Lake Havasu City General Plan Land Use Map for the Island and Shoreline Area.

Figure 15 Future Island and Shoreline Land Use Plan



Source: *Lake Havasu City General Plan*, 2002, Revised 2008

5.2 Title VI and Environmental Justice Populations

The Environmental Protection Agency and FHWA define environmental justice as the "fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies." Environmental justice principles and procedures are followed to improve all levels of transportation decision making. Title VI of the Civil Rights Act of 1964 prohibits discrimination on the basis of race, color, or national origin. The 1994 Executive Order 12898 on environmental justice addresses minority and low-income populations. The rights of women, the elderly, and the disabled are protected under related statutes. These Presidential Executive Orders and other related statutes fall under the umbrella of Title VI.

There are three fundamental environmental justice principles applicable to the transportation project development process:

- to avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low income populations
- to ensure the full and fair participation by all potentially affected communities in the transportation decision-making process
- to prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations

Effective transportation decision making depends on understanding and properly addressing the unique needs of different socioeconomic groups. Properly implemented, environmental justice principles and procedures improve all levels of transportation decision making.

The five minority groups addressed by Title VI and Executive Order 12898, Environmental Justice, are:

1. Black (a person having origins in any of the black racial groups of Africa)
2. Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)
3. Asian American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands)
4. American Indian and Alaskan Native (a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition)
5. Some other race, or persons of more than one race

The protected populations considered in this analysis are described below:

- Minority populations include people who identify themselves as Hispanic or Latino, Black or African American, American Indian and Alaskan Native, Asian, Native Hawaiian and Other Pacific Islander, persons of some other race, or persons of more than one race.
- Low-income populations include people living in households with an income at or below the U.S. Department of Health and Human Services poverty guidelines. Low-income populations may have greater difficulty locating replacement housing in the area. They may rely on public services and facilities, such as public transit and public recreational amenities, to a greater extent than the general population.

- Elderly populations consist of people who are age 65 and older. While elderly citizens often drive, the National Highway Traffic Safety Administration (NHTSA) reports that both high-speed and high-traffic routes may present a problem for some (NHTSA, 2007). In addition, the elderly may have a need for transit service or may opt to use transit if it is offered.
- Disabled populations are civilian, non-institutionalized persons aged 5 and over with disabilities (such as sensory, physical, mental, self-care, going outside of home, and employment disabilities).
- Female head-of-household populations consist of households headed by a female with no husband present and with her own children under the age of 18. These households tend to have lower incomes than households headed by married couples or a single man and oftentimes have a greater need for affordable housing.

A member of the low-income population is defined as "a person whose household income is at or below the Department of Health and Human Services poverty guidelines." The Department of Health and Human Services poverty guidelines state that the poverty level for a family of four in 2010 is $22,050 (note, however, that this income level cannot be compared directly with current income levels because the value of money changes year to year).

The protected populations for Lake Havasu City, Mohave County, and Arizona are shown in Table 13.

Table 13 Title VI and Environmental Justice Populations

	Arizona (%)	Mohave County (%)	Lake Havasu (%)
Minority	42.2	20.4	16.0
Hispanic or Latino	29.6	14.8	12.1
Black or African American	4.1	0.9	0.7
American Indian or Alaskan Native	4.6	2.2	1.0
Asian	2.8	1.1	1.0
Native Hawaiian or Other Pacific Islander	0.2	0.2	0.1
Some Other Race	11.9	6.0	4.7
More than One Race	3.4	2.7	2.3
Persons Living Below the Poverty Level*	15.3	16.1	11.5
Disabled**	11.5	18.0	14.9
Age 65 and Older	13.8	23.3	26.9
Female Heads of Household	37.3	34.2	32.6

Source: U.S. Census Bureau, Census 2010, SF-1, Redistricting Data (PL94-171) Summary File; *U.S. Census Bureau, 2006-2010 American Community Survey; **U.S. Census Bureau, 2008-2010 American Community Survey.

Compared to Mohave County and the State of Arizona, Lake Havasu City has:

- Fewer minorities
- Fewer persons living below the poverty level
- Fewer female heads of households
- More persons age 65 and older

6.0 Future Traffic Conditions

The following sections describe the evaluation process for the existing conditions. The process includes identification of planned improvements, updating the travel demand model and related input data, and analysis of the future road network using the revised travel demand projections.

6.1 Planned Improvements

There are no specific road improvements funded in the study area. The City has appropriated funding in their annual budget for implementing recommendations from this study. The WACOG Transportation Improvement Program (TIP) and State TIP (STIP) include approximately $400,000 for design in fiscal year 2014 and approximately $2.1 million for construction during fiscal year 2016.

The future road network includes the improvements outside of the study area that were proposed in the *Lake Havasu City SATS* (ADOT 2004), such as the new bridge connecting the Island and SR 95.

6.2 Travel Demand Model Update

The forecast year traffic volumes for the *Lake Havasu City SATS* (ADOT 2004) were developed through the application of the Lake Havasu travel demand model. The original model was developed using the TP+ modeling software and was validated using 2004/2005 traffic data. For this study, several enhancements to the modeled network were made to improve the forecasting accuracy of the model. Prior to making the enhancements, the study team decided to covert the model from TP+ to the TransCAD modeling software since the TransCAD offers an internal scenario manager that simplifies changes and allows multiple scenarios to run without updating the complicated scripts. Also, converting the model to TransCAD enables easy back-and-forth integration with ADOT's statewide model because it uses the same software.

The following sections present the steps taken to convert the model, enhancements to the model, review of the latest demographic and road network data, and validation of the new model.

Converting TP+ model to TransCAD

Input Conversion

The first step of converting the model was to import the base model inputs into TransCAD. The inputs were:

- zonal demographics
- highway network
- trip distribution friction factors

The existing (2004) and future (2030) zonal demographics files, which contain population, retail employment, general employment, and office employment for each traffic analysis zone (TAZ), were converted to a format compatible with TransCAD. The highway network file which describes all the links, intersections, and TAZ centroids was georeferenced using geographic information software before importing. The friction factors file was converted to a database file to be useable in TransCAD's trip distribution routine.

Implement Model Steps

The next step of converting the model was to use TransCAD Model Manager to recreate the model steps described in the TP+ script files. The model steps are described in Table 14.

Table 14 TP+ Model Steps

Model Step	Inputs	Outputs
Trip generation	• Population and employment	• Trip productions and attractions
Path time skim	• Highway network	• Time matrix
Add destination time to selected paths	• Time matrix	• Time matrix with destination times
Trip distribution	• Productions and attractions • Path times • Friction factors	• Zone to zone productions and attractions
Production/attraction to origin/destination	• Production/attraction trips	• Origin/destination trips
Highway assignment	• Highway network • OD trips	• Loaded network

Base Year Model Verification

The TransCAD model conversion was validated by comparing the results with the results of the 2004 TP+ model. The trip generation and path skim steps produced identical results. The other steps produced slightly different results because TransCAD's standard trip distribution and highway assignment produce slightly different results from TP+ even using identical inputs.

Model Enhancements

Once converted to TransCAD, a few enhancements were made to the model to allow for more detailed and meaningful results:

- TAZs were divided to provide more detail. The total TAZs increased from 121 to 135. The 2004 population and employment data for the new zones were estimated using the land use data and aerial photographs. The 2030 population and employment were split using the same percentages as the 2004 data.
- The highway network was updated to add missing links for roads in the study area. Also, links in the network were georeferenced to aerial photographs to allow more accurate measurements.
- Model steps were added to allow a single run to produce results for the overall model area as well as the study area.
- Trip generation for student trips to the future Arizona State University (ASU) campus was added to the model. Trip rates were determined using production and attraction rates from ITE's *Trip Generation 8th Edition*.

Demographic Data and Highway Network Updates

The base year population was updated to 2010 using the Census 2010 population by census block. The data for each block was assigned to the TAZ that enclosed the block centroid. The match was visually checked and a few adjustments to the data allocation were made for blocks that did not match closely with a single TAZ. Figures 16 to 19 show the existing (2010) and future (2030) population and employment density.

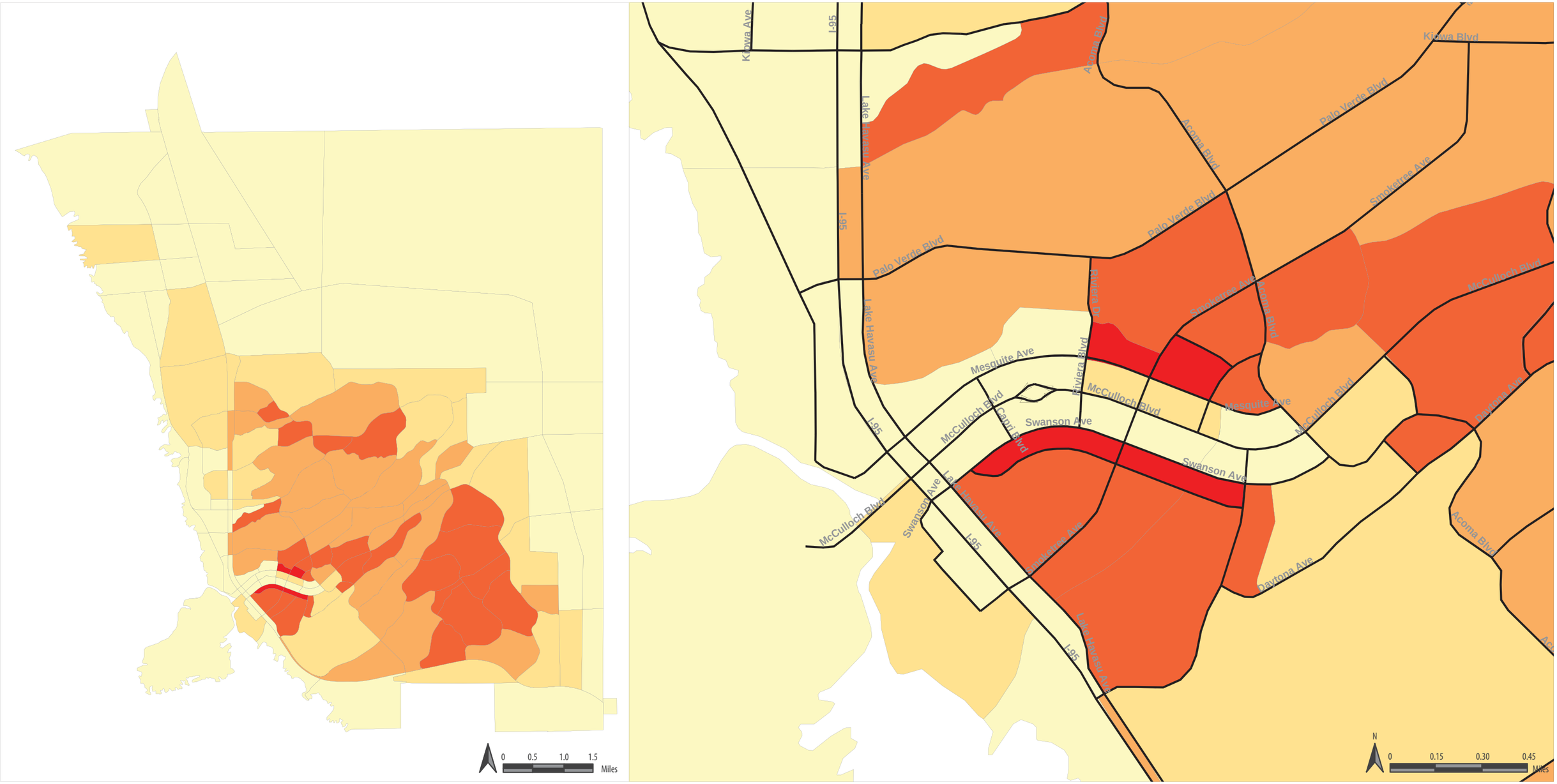
A future ASU campus in zone 46 southeast of the corridor was added into the 2030 demographic data. The future enrollment at the campus was specified as 4,000 students. Research found that campus employment ratios are approximately 1 employee per 20 students, so 150 general employees and 50 office employees were added to zone 46.

Table 15 Demographic Summary

	2010 Data	2030 Data
Population	52,527	103,801
Total Employment	23,400	42,957
Retail Employment	9,325	19,150
General Employment	9,915	16,322
Office Employment	4,160	7,485

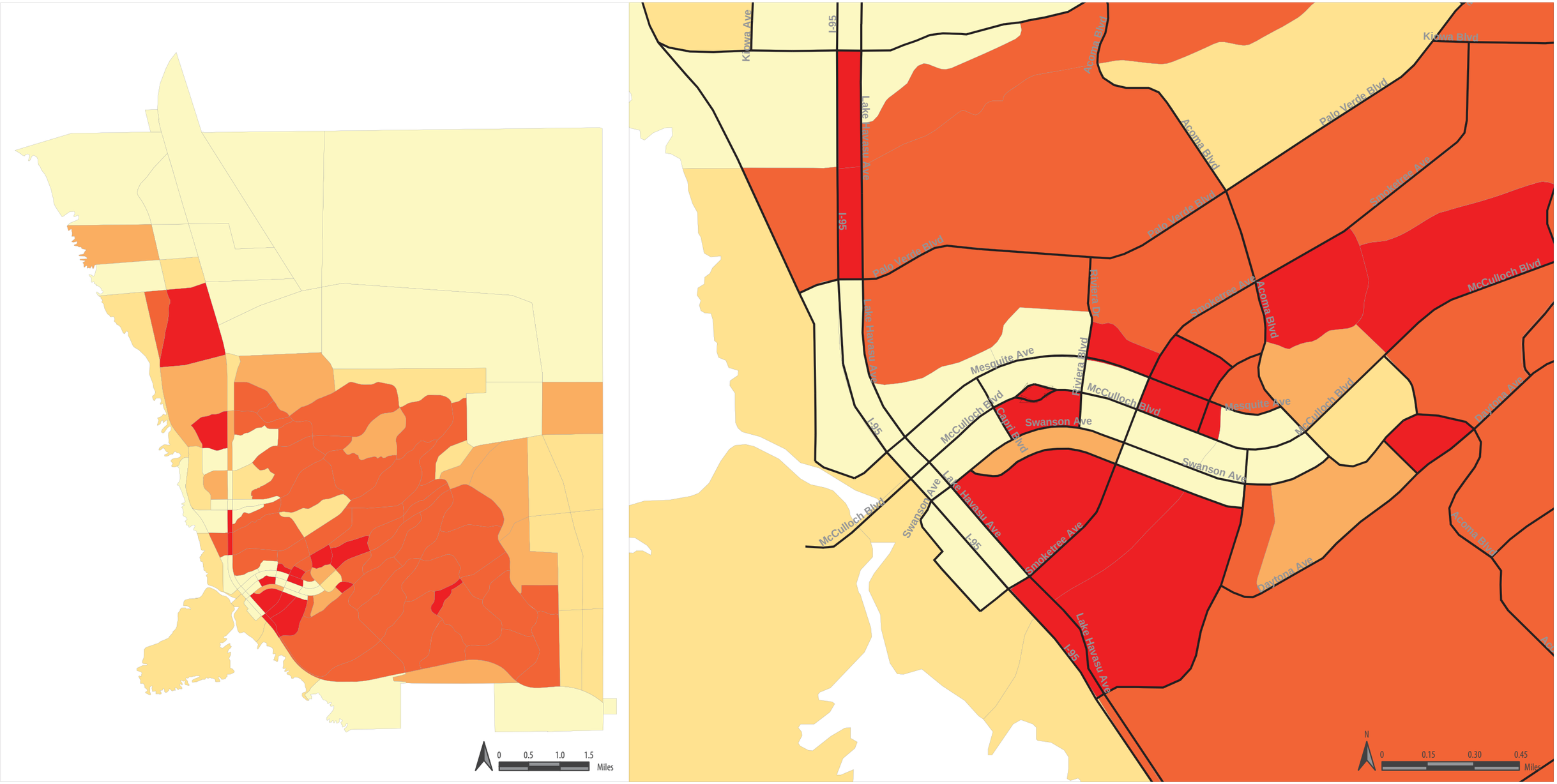
Source: U.S. Census Bureau, Census 2010; Arizona Department of Economic Security, Research Administration, Population Statistics Unit, December 2006.

The future highway network was updated to match the Lake Havasu City *SATS* Recommended Plan. Roadway link capacities were increased and new roads were added as specified in the plan. TAZs were connected to the new roadway links as needed.



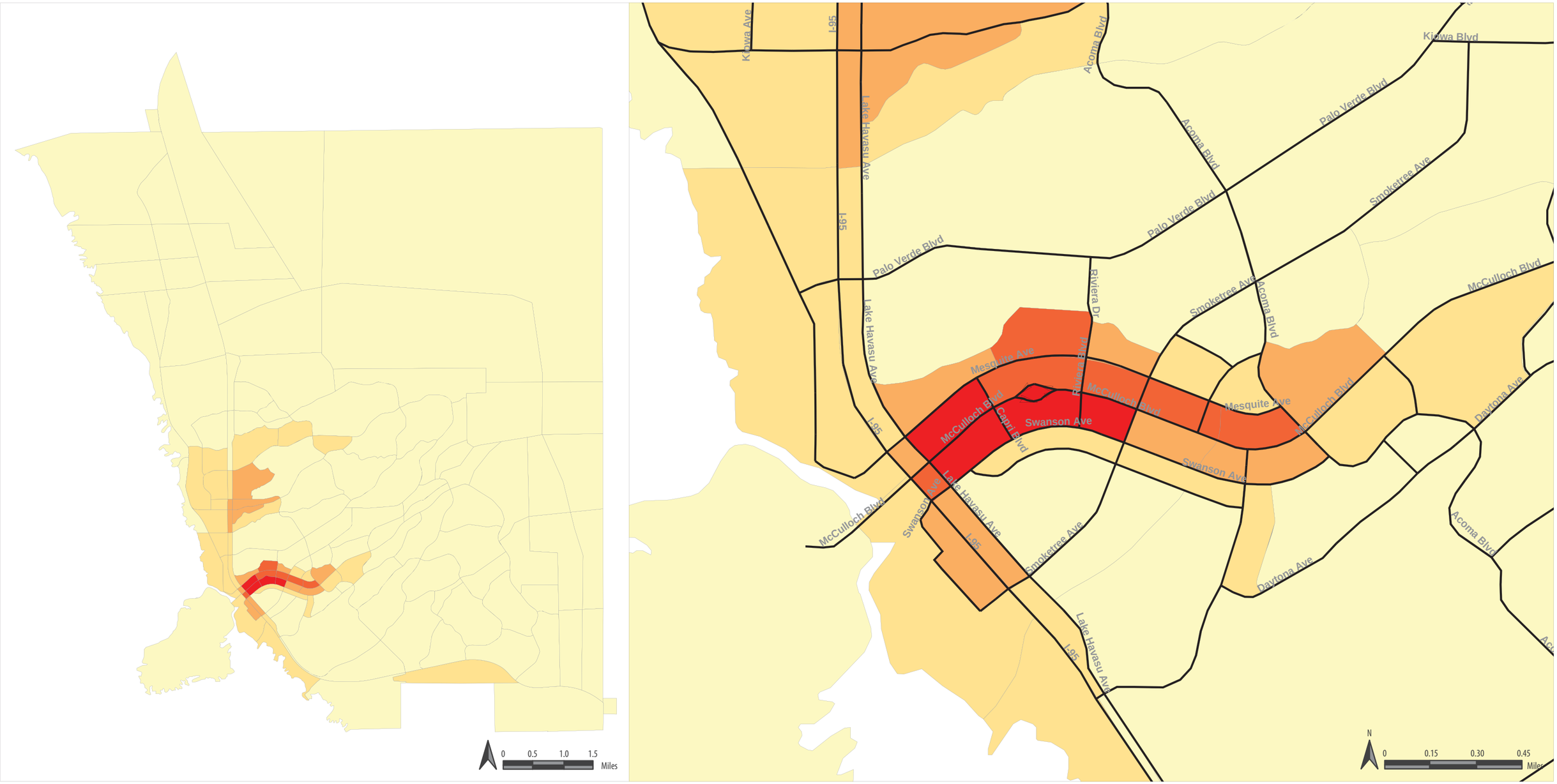
People per Square Mile

- 0 to 500
- 500 to 1,500
- 1,500 to 2,500
- 2,500 to 5,000
- 5,000 to 10,000



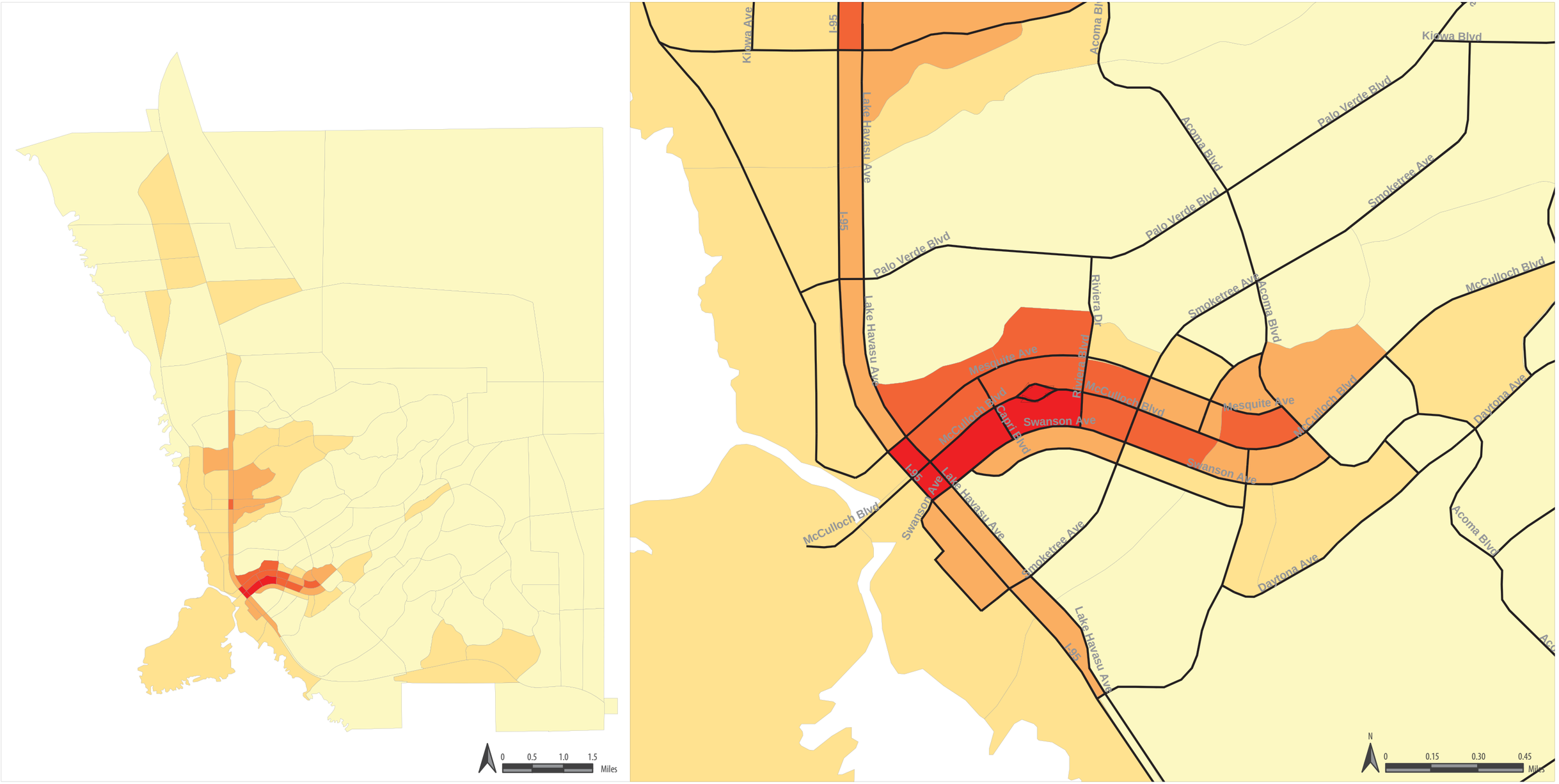
People per Square Mile

- 0 to 500
- 500 to 1,500
- 1,500 to 2,500
- 2,500 to 5,000
- 5,000 to 10,000



Total Employment per Square Mile

- 1 to1,000
- 1,000 to 5,000
- 5,000 to 10,000
- 10,000 to 20,000
- 20,000 and greater



Total Employment per Square Mile

- 1 to1,000
- 1,000 to 5,000
- 5,000 to 10,000
- 10,000 to 20,000
- 20,000 and greater

Revised model validation

After all of the model updates were completed, an existing year model run was performed. The existing year model traffic assignment results were compared to traffic counts collected in December, 2011, at three locations at each end of the corridor. The results of the comparison for vehicles entering the study area and exiting the study area are presented in Tables 16 and 17, respectively. The range of percent-variance is between negative 41.8 percent and positive 58.3 percent. When totaled at all of the locations, the difference between the counts and model is less than 3 percent for both entering and exiting traffic. Less variance between observed traffic counts and model volume estimates on the segment basis is desirable. However, the overall corridor entering and exiting model volume estimates track closely with the traffic count observations. This model validation is sufficient for the development of traffic growth factors to estimate future peak hour traffic volumes.

Table 16 Traffic Counts versus Link Volumes, Entering Vehicles

Route	Location	Direction	2011 Count	Model	Percent-Variance (%)
McCulloch Boulevard	between Lake Havasu Avenue and Capri Boulevard	eastbound	5,368	5,720	6.6
Mesquite Avenue	between Lake Havasu Avenue and Capri Boulevard	eastbound	4,940	4,260	-13.8
Swanson Avenue	between Lake Havasu Avenue and Capri Boulevard	eastbound	3,865	6,120	58.3
Acoma Boulevard	between Mesquite Avenue and Sotol Lane	southbound	5,626	3,400	-39.6
McCulloch Boulevard	between Acoma Boulevard and Agave Drive	westbound	6,219	6,440	3.6
Acoma Boulevard	south of Swanson Avenue	northbound	8,199	7,480	-8.8
		Total traffic entering the study area	34,217	33,420	-2.3

Table 17 Traffic Counts versus Link Volumes, Exiting Vehicles

Route	Location	Direction	2011 Count	Model	Percent-Variance (%)
McCulloch Boulevard	between Lake Havasu Avenue and Capri Boulevard	westbound	4,853	5,450	12.3
Mesquite Avenue	between Lake Havasu Avenue and Capri Boulevard	westbound	5,080	4,300	-15.4
Swanson Avenue	between Lake Havasu Avenue and Capri Boulevard	westbound	5,267	6,180	17.3
Acoma Boulevard	between Mesquite Avenue and Sotol Lane	northbound	5,924	3,450	-41.8
McCulloch Boulevard	between Acoma Boulevard and Agave Drive	eastbound	5,371	6,520	21.4
Acoma Boulevard	south of Swanson Avenue	southbound	7,675	7,350	-4.2
		Total traffic exiting the study area	34,170	33,250	-2.7

Model Results

Three alternatives of the model were run:

- Existing year demographics on the existing roadway network
- Future year demographics on the existing roadway network
- Future year demographics on the future roadway network

A cut-line analysis was performed on the corridor using the 2011 counts and the three model scenarios described above. The cut lines, located at each end of the corridor, are summarized in Table 18.

Table 18 Cut-line Traffic Volumes

Cut line	Direction	2011 Count	2011 Model	2030 Existing Model	2030 Future Model
West end of corridor	eastbound	14,173	16,100	21,950	17,160
	westbound	15,200	15,930	21,740	17,060
East end of corridor	westbound	20,044	17,320	21,620	24,250
	eastbound	18,970	17,320	21,780	24,400

6.3 Operational Analysis

The future conditions operational analysis used similar methodology as the existing conditions analysis. The same Synchro network of roads and intersections were analyzed using the future traffic volumes presented in Figure 20. The results of the future conditions analysis is summarized in Table 19 and shown graphically in Figure 21.

Notable observations from the table and figures include:

- Nine of the twenty intersections are projected to operate at LOS E or F during either the AM or PM peak hour.
- Seven of the poorly performing intersections are all-way stop controlled; whereas, the other two intersections are stop controlled on the side streets only.
- The signal controlled intersection of McCulloch Boulevard and Acoma Boulevard is projected to operate at LOS D during the PM peak hour.

The results of the future conditions operational analysis support previous recommendations from the *Lake Havasu City SATS* (ADOT 2004) related to the need for intersection enhancements to address the LOS E or F conditions projected for the study corridors.

Daily Vehicle Volume/Link Capacity Ratio
0.00 to 0.25
0.25 to 0.50
0.50 to 0.75
0.75 to 1.00
1.00 to 1.25
1.25 to 1.50
1.50 to 1.75
> 1.75
Daily Vehicle Volume
25000
12500
6250
N
0
0.05
0.10
0.15
Miles

Table 19 Future Intersection Level of Service Analysis Results

Intersection	Intersection Control Type	AM Peak		PM Peak	
		LOS	Average Control Delay	LOS	Average Control Delay
Mesquite Avenue at Lake Havasu Avenue	Signal	C	30.3	C	33.9
Mesquite Avenue at Capri Boulevard	AWSC	B	11.6	F	>50
Mesquite Avenue at Civic Center Lane	AWSC	C	16.6	F	>50
Mesquite Avenue at Riviera Drive	AWSC	C	23.2	F	>50
Mesquite Avenue at Smoketree Avenue	AWSC	D	31.0	F	>50
Mesquite Avenue at Querio Drive	AWSC	B	11.1	B	13.1
Mesquite Avenue at Acoma Boulevard	Signal	C	29.3	C	31.4
McCulloch Boulevard at Lake Havasu Avenue	Signal	C	28.3	C	31.1
McCulloch Boulevard at Capri Boulevard	Signal	B	17.2	C	21.2
McCulloch Boulevard at Riviera Drive	Signal	C	20.3	C	23.1
McCulloch Boulevard at Smoketree Avenue	Signal	C	27.3	C	25.2
McCulloch Boulevard at Querio Drive	SSSC	B	12.7	E	36.8
McCulloch Boulevard at Mulberry Avenue	SSSC	B	12.0	C	25.0
McCulloch Boulevard at Acoma Boulevard	Signal	C	31.7	D	38.0
Swanson Avenue at Lake Havasu Avenue	Signal	C	26.2	C	32.0
Swanson Avenue at Capri Boulevard	AWSC	A	9.2	C	20.7
Swanson Avenue at Riviera Drive	SSSC	C	21.4	E	42.4
Swanson Avenue at Smoketree Avenue	AWSC	B	12.6	F	>50
Swanson Avenue at Mulberry Avenue	AWSC	B	10.6	F	>50
Swanson Avenue at Acoma Boulevard	AWSC	F	>50	F	>50

AWSC = all-way stop control; SSSC = side-street stop control
Source: HDR Engineering, Inc., February 2012

Lake Havasu Avenue
Mesquite Avenue
McCulloch Boulevard
Swanson Avenue
Acoma Boulevard
Civic Center Drive
Riviera Boulevard
Smoketree Avenue
Querio Drive
Pima Wash
Mulberry Avenue
95
AM
PM
N
0
800
Feet
LOS A
LOS B
LOS C
LOS D
LOS E
LOS F
Study zone boundary
Morning peak
Afternoon peak

7.0 Future Transit Conditions

The existing transit system provides a basic level of transit service to meet general mobility needs of the community. By offering fixed route service with regularly scheduled trips, and supplementing the service with demand responsive service for the general public, HAT is able to fill in some geographic gaps in service. However, in the future, increased service levels (headways more frequent than 60 minutes) and expanded service span in the community's growth areas will help HAT meet potential increases in general transit demand. This section identifies potential future corridor activity centers and transit demand.

7.1 Potential Future Corridor Activity Centers

As documented in Chapter 4, half of the top ten boarding locations in the HAT system are located in the study area. The arrival of the ASU campus near Swanson Avenue and Acoma Boulevard will likely further increase demand for transit service in the corridor. The significant demand currently documented in the central business corridor is likely driven by passengers accessing retail, medical, and government services as well as jobs. From a transit service perspective, there would be some significant advantages to treating the entire central business corridor as a single activity center with multiple activity nodes. By adjusting transfer meet times at the DTS, overlapping transit service could operate with increased frequency in the central business corridor at no additional operating cost. This approach would allow HAT to efficiently address potential future growth in demand at multiple locations within the central business corridor.

The City recently purchased a parcel near Pima Wash between Mesquite Avenue and McCulloch Boulevard. This parcel may be considered for a new transit center and parking lot.

7.2 Future Transit Demand

Applying the APTNA method to the Lake Havasu City area provides a methodology to help determine future transit demand based on transit dependent populations in a defined geographic area. Additional demand associated with choice riders is not accounted for in the APTNA method. The APTNA method utilizes calibrated trip rates of three demographic groups including elderly persons age 60 and over, persons with a disability under age 60, and persons of low income under age 60.

The ATPNA methodology was applied for a similar set of demographic data based off of the 2000 US Census for Lake Havasu City and three incremental growth scenarios:

- Scenario 1: 25 percent of total population growth from 2000 with all APTNA applicable demographic rates held constant
- Scenario 2: 25 percent of total population growth with a double rate of senior population
- Scenario 3: 50 percent of total population growth with a double rate of senior population

The APTNA demand estimates indicate that current total transit demand (Section 4.3) is potentially not being met as observed by current fixed route ridership. Table 20 identifies the trip rates used for the APTNA assessment, while Table 21 provides the estimated future demand for the three conceptual growth scenarios.

Table 20 APTNA Annual Transit Trip Rates

Demographic Group	Trip Rates: Annual One-way Passenger Trips	Lake Havasu City 2000 Census Data (%)
Elderly persons Age 60 and Over	6.8	26[A]
Persons with Disability Under Age 60	4.5	21[B]
Low Income Persons Under Age 60	20.5	10[C]

Source: *Northwest Arkansas Transit Assessment Study*, March 2000

[A] *Age 65 or over*

[B] *All persons with a disability*

[C] *All persons living below the poverty level*

Table 21 APTNA Estimated Future Trip Demand

Scenario	APTNA Estimated Annual Transit Trip Demand
2000 Census Population	194,592
2010 Census Population	243,725
Future Scenario 1	304,657
Future Scenario 2	418,509
Future Scenario 3	502,211

Source: 2000 and 2010 US Census

Summary

The results of the analysis indicate that even small changes in general population growth (25 percent through 50 percent) and/or increase in elderly population may have significant impacts on future transit demand in Lake Havasu City.

8.0 Non-Motorized and Parking Conditions

8.1 Parking Conditions

Parking is an expressed, on-going concern, especially in the Uptown District. As is typical, most drivers—locals and tourists—want to park in front of the business they are going to, and will drive around the block more than once in order to try to obtain their desired spot. However, there is plenty of parking behind most of the buildings in the Uptown District. Reasons why it might not be used as much as expected include a lack of wayfinding/direction signs; the poor condition of rear parking lots; a lack of signs and/or entrances at the rear of buildings, where available; a perceived sense that it's farther to walk to the desired business; or a lack of lighting. Unstriped, unmaintained parking areas in particular make it difficult to confirm if and where parking is allowed, especially for visitors, making the parking areas inefficient in terms of maximizing parking capacity.

To get a broad sense of parking availability in the Uptown District, the consultant team used aerial maps to count parking stalls, including on-street parking. Parking stalls were counted if they were clearly striped. Stalls were not counted if they appeared to be predominantly for a specific building (gas station, hotel, etc.), if it appeared to be used for a trash dumpster, or if there was a car visible but no apparent 'official' stall markings. All these parking stalls are within 200 to 250 feet of the buildings, not an onerous distance given the typical shopping mall parking lot can put a shopper upwards of 800 feet from the building during peak shopping periods.

Using the same aerials, general square footage of the businesses in the Uptown District was calculated, including vacant lots, in anticipation they will be built out in the future. As this effort was not an official parking study, the type of business was not a factor nor were detailed building square footages calculated or requested. Again, this was just to get a sense as to whether there appears to be a serious lack of parking in Uptown.

The *Uptown McCulloch Main Street District* (UMS) parking guidelines require most retail/commercial uses to provide 1 stall per 500 square feet of gross floor area. This calculation was used for all the businesses with the exception of restaurants. There were seven restaurants noted in the area. The parking requirement for restaurants is 1 stall per 75 square feet of gross floor area, including outdoor seating. A factor of 70 percent was used to calculate the dining area versus kitchen area.

Table 22 and Figure 22 display the results of the research. From the information gathered, there does not appear to be an overall lack of parking but there is certainly an issue with where available parking is distributed. The City recently purchased a parcel near Pima Wash between Mesquite Avenue and McCulloch Boulevard. This parcel may be considered for a new transit center and parking lot.

The UMS report also has the suggested guideline to provide a 20-foot wide pedestrian access link within each block, every 250 feet, connecting McCulloch Boulevard to the rear parking structures and/or parking areas. This appears to be met on all blocks except the two blocks on the south side of McCulloch Boulevard, from Querio Drive to Scott Drive and Scott Drive to Smoketree Avenue (see Figure 22).

Table 22 Parking Availability in the Uptown District

Area	Marked spaces	Remarks	SF of building (including vacant lots); not including restaurants	Parking needed (1 per 500 SF)	SF of restaurants (number reflects 30% less for production area)	Parking needed (1 per 75 SF)	Parking space difference
1. Acoma to Mulberry, south side of McCulloch to alley	305		80,300	161	0	0	+144
2. Acoma to Querio Drive, north side of McCulloch to alley	191		59,100	118	8,500	80	-7
3. Mulberry to Pima Wash, south side of McCulloch to Swanson	252		54,700	109	15,600	146	-3
4. Pima Wash to Scott Drive, south side of McCulloch to alley/hotel	134	Includes random parking behind buildings (32 +/-) where no striping exists and is not paved in spots. Does not include hotel parking	51,100	102	14,900	139	-107
5. Querio to Smoketree, north side of McCulloch to alley	340	Includes what appears to be approx. 30 unmarked spots at NWC of block along	85,900	172	5,000	47	+121

		alley					
6. Scott Drive to Smoketree, south side of McCulloch to alley	168		39,800	80	7,000	66	+22
Total	1,371		370,900	742	51,000	478	+151

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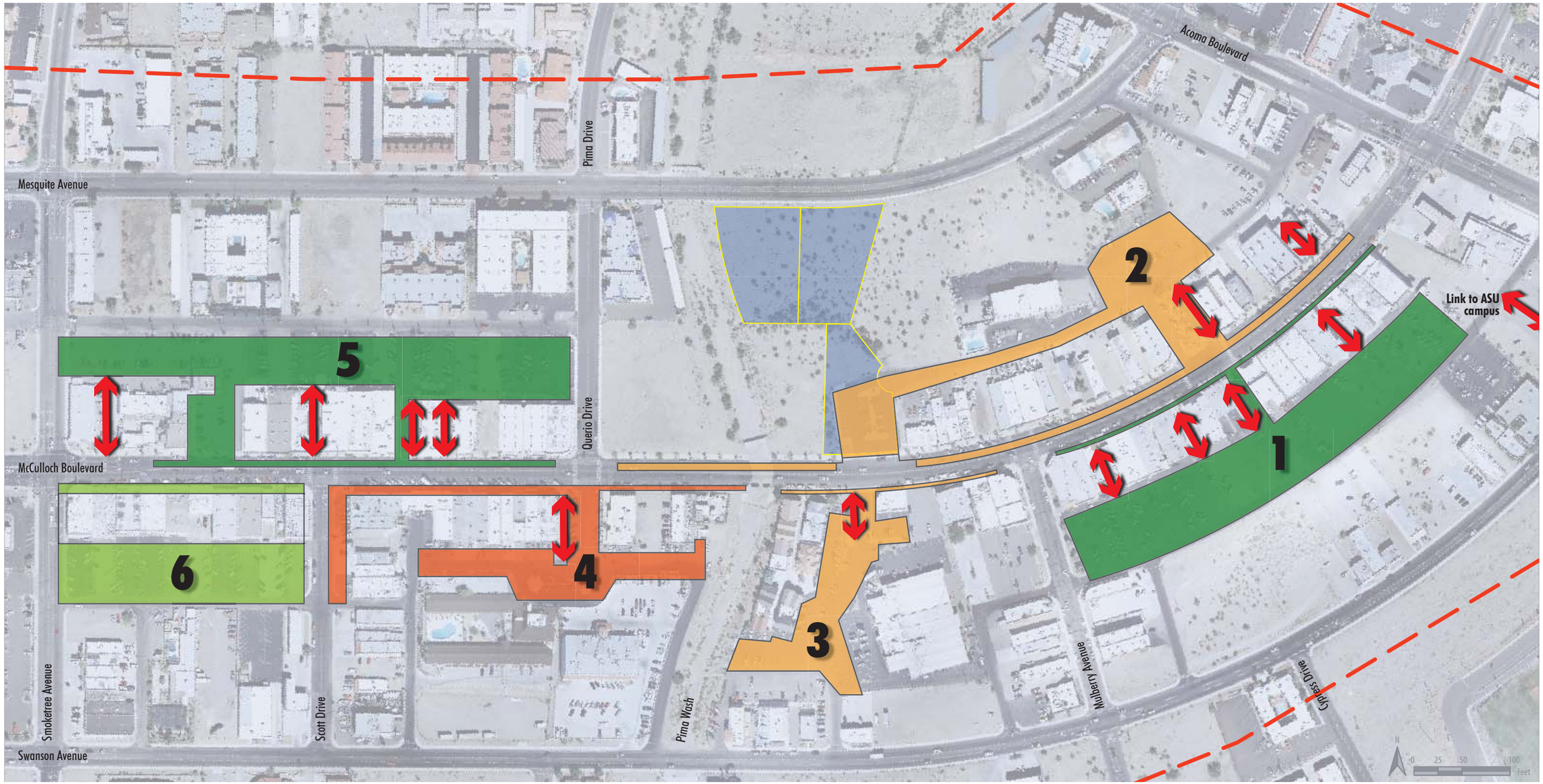
Figure 22 | Existing Parking Capacity and Pedestrian Access (Uptown)



Excess parking available
Extra parking available
Short on parking
Very short on parking
City-owned parcels
Existing pedestrian pass-through routes
6 Study zone number
Study area boundary

8.2 Sidewalk Conditions and Pedestrian Amenities

Along the three study corridors (Mesquite Avenue, McCulloch Boulevard, and Swanson Avenue) there are a variety of existing facilities for pedestrian and bicyclists; the majority of which are for pedestrians, with virtually none specifically for bicyclists. Sidewalks are the main pedestrian facility, with all three corridors having sidewalks on both sides for almost the entire distance between Lake Havasu Avenue and Acoma Drive. Sidewalks are the most basic facility for pedestrians. The elderly, children, and those with physical impairments are the most likely to use them as a means of getting around.

Following are detailed descriptions of the existing facilities, by corridor.

Mesquite Avenue

Mesquite Avenue has standard, attached sidewalks on both sides of the street. The sidewalks are 5 to 6 feet wide and in good condition. Six feet is the minimum preferred width for sidewalks along arterials (Image 1).[1] This width provides comfortable room for two wheelchairs to pass or for two people to walk side by side. The recommended pedestrian zone dimension of 5 feet is met (see Image 2-Sidewalk Zones).[2] The recommended curb zone of 6 inches exists and is in addition to the pedestrian zone. There is no planter/furniture zone. A frontage zone does not exist and is not generally needed because the sidewalk is almost always adjacent to landscaped areas. There is no buffer of either landscaped area or on-street parking between the pedestrian traffic and vehicular traffic (Image 1).

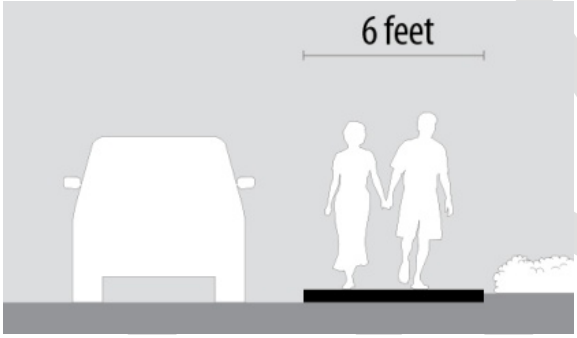


Image 1 – Sidewalk section

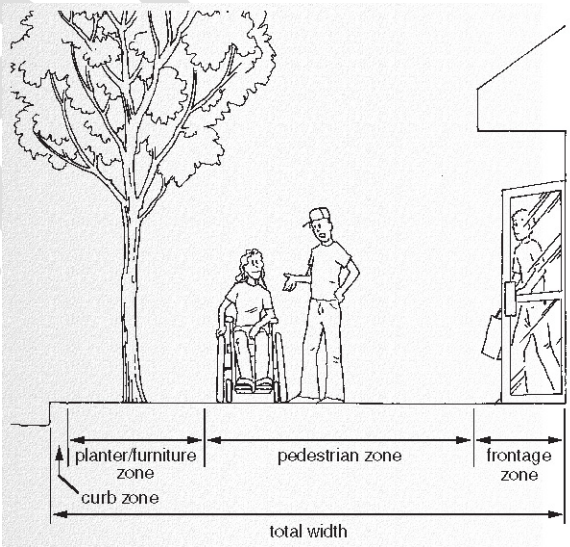


Image 2 – Sidewalk zones

Source of images: *Figure 4-4, Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide.*

[1] *Guide for the Planning, Design, and Operation of Pedestrian Facilities. Washington, D.C.: American Association of State Highway and Transportation Officials, 2004.*
[2] *Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide. Chapter 4. Washington D.C. US Department of Transportation, Federal Highway Administration. 2001.*

Two short segments, one east of Pima Wash and one west of Riviera Boulevard, both on the north side of the road, are the only sections without a sidewalk; the properties are vacant in these sections.

None of the driveways are ADA-compliant driveways. Non-compliant driveways incorporate the sidewalk crossing at the curb line as part of the driveway as it is sloping rapidly toward the street. Compliant driveways wrap the sidewalk behind the driveway apron where the sidewalk can remain on a continuous plane (see Image 3).

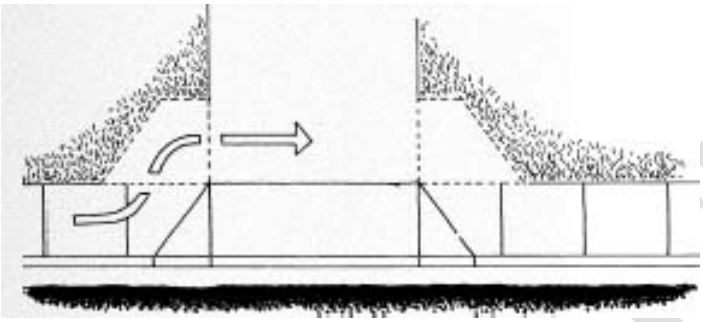


Image 3 – ADA-compliant level landings at driveway crossings

Source: *Figure 4-11, Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide.*

Given that the running grade of the street, and the sidewalk, are naturally steeper than the allowable 5 percent for ADA purposes, there are not likely to be many manually-propelled wheelchair users along this corridor, or the other two study corridors. However, ADA-compliant driveways also benefit other pedestrians such as those with walkers, canes, or crutches or people pushing strollers or carts, helping to minimize the stumbling or slipping that can occur when walking at an angle.

There are crosswalks at most intersections (see Table 22). However, the curb ramps do not have truncated domes or other tactile surfaces to warn those with visual impairments of a crossing and are not directional.

Street lighting is limited predominantly to signalized intersections. Adjacent building and parking lot lighting provide some sidewalk lighting.

There is some landscape beyond the back of sidewalk; however, since it is mostly shrubs, it does not provide much, if any, shade. There are no adjacent buildings from which to hang awnings or canopies to provide shade. The pedestrian environment is fairly severe.

Swanson Avenue

Swanson Avenue has standard, attached sidewalks on both sides of the street. The sidewalks are 5 to 6 feet wide and in good condition. The recommended pedestrian zone dimension of 5 feet is met.[3] The recommended curb zone of 6 inches exists and is in addition to the pedestrian zone. There is no

[3] *Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide. Chapter 4. Washington D.C. US Department of Transportation, Federal Highway Administration. 2001.*

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planter/furniture zone. A frontage zone does not exist and is not generally needed because the sidewalk is almost always adjacent to landscaped areas. There is no buffer of either landscaped area or on-street parking between the pedestrian traffic and vehicular traffic. None of the driveways are ADA-compliant driveways.

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Street lighting is limited predominantly to signalized intersections. Adjacent building and parking lot lighting provide some sidewalk lighting. There is some landscape beyond the back of sidewalk; however, since it is mostly shrubs, it does not provide much, if any, shade. There are no adjacent buildings from which to hang awnings or canopies to provide shade. The pedestrian environment is fairly severe.

McCulloch Boulevard, east of Smoketree Avenue

Uptown McCulloch Boulevard is an active tourist destination during the tourist season. Visitors stay in the numerous hotels and resorts scattered throughout the area. The Uptown District with its shops and restaurants is one of several Lake Havasu City tourist destinations. The Uptown District is also a destination for residents as many of the businesses provide local services such as insurance, travel, hardware, and personal services. One of the newest businesses in the Uptown District is the Lake Havasu City Campus of ASU, located at the old Daytona Middle School at Swanson Avenue and Acoma Boulevard. The campus is scheduled to open in the fall of 2012. At this time, there is no direct, convenient pedestrian connection between the Uptown District and the campus; however, there are easements available in which to create these facilities.

There are fairly recent pedestrian improvements along McCulloch Boulevard. The sidewalk was improved, is in good condition, and is generally about 10 feet wide from curb to building face (see Image 4). Ten feet is the minimum comfortable sidewalk dimension[4] in active areas to allow room for benches, trash cans, newspaper boxes, and outdoor dining, to name a few uses. Based on the recommended minimums[5], the sidewalk in this area should be 12 feet wide, with a 6-inch curb zone, 48-inch planter/furniture zone, 60-inch pedestrian zone, and a 30-inch frontage zone. However, giving the physical constraints, 10 feet is a workable dimension. There is buffer of both landscape and on-street parking between pedestrian traffic and vehicular traffic. None of the driveways are ADA-compliant driveways.

There is a bench and trash can approximately every 160 feet (including both sides of the street), providing resting spots and adding to the life of the street. Street and pedestrian lighting is provided on a combined pole located every 120 to 130 feet. The style of the fixture adds to the character of the street.

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[4] *Guide for the Planning, Design, and Operation of Pedestrian Facilities. Washington, D.C.: American Association of State Highway and Transportation Officials, 2004.*

[5] *Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide. Chapter 4. Washington D.C. US Department of Transportation, Federal Highway Administration. 2001.*

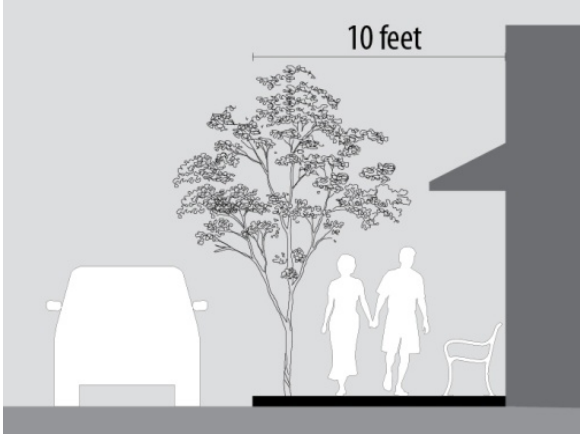

Image 4 – Sidewalk section

There are five pedestrian crossings: Scott Drive, Querio Drive, Pima Wash, Mulberry Avenue, and at the entrance to Birch Square (see Table 22). Pima Wash is signed for pedestrians; the other four have high-visibility crosswalks. However, the curb ramps at these crossings do not have truncated domes or other tactile surfaces to warn those with visual impairments and are not directional. The consultant team was told that a fair amount of jaywalking occurs along McCulloch Boulevard in the Uptown District.

There is a new bump out at Mulberry Avenue on the north side of the road where two crosswalks from the south side connect across McCulloch Boulevard. The bump out was enhanced with additional benches, trees, and trash cans. However, the consultant team was told, by city staff, that, more than one westbound vehicle, in an effort to go around someone turning left onto Mulberry Avenue, has driven through the parking stalls (if they were empty) and up onto the sidewalk.

In this urban setting, there is less available room for landscape. There are tree wells with grates approximately every 25 to 30 feet on center; however, many of these trees are palms which provide little shade but do provide vertical identifying elements for the District. There are a few businesses that are set back a few feet or have planters adjacent to the sidewalk that provide additional landscape but no shade. Almost none of the buildings have awnings or canopies that could provide shade.

McCulloch Boulevard, west of Smoketree Avenue

The west portion of McCulloch Boulevard is dominated by strip malls and large building businesses set back from the street; this contrasts with the Uptown area which is dominated by small, narrow businesses set close to the street. This segment of McCulloch Boulevard has standard, attached sidewalks on both sides of the street. The sidewalks are 6 to 7 feet wide and in good condition. The recommended pedestrian zone dimension of 5 feet is met.[6] The recommended curb zone of 6 inches exists and is in addition to the pedestrian zone. There is no planter/furniture zone. A frontage zone does not exist and is not generally needed because the sidewalk is almost always adjacent to

[6] *Designing Trails and Sidewalks for Access, Part II of II: Best Practices Design Guide. Chapter 4. Washington D.C. US Department of Transportation, Federal Highway Administration. 2001.*

landscaped areas. There is no buffer of either landscaped area or on-street parking between the pedestrian traffic and vehicular traffic.

None of the driveways are ADA-compliant driveways.

There are crosswalks at most intersections (see Table 22); however, the curb ramps do not have truncated domes or other tactile surfaces to warn those with visual impairments of a crossing and are not directional. There are no apparent crossings of McCulloch Boulevard to reach Wheeler Park and no parking inside the park circle making this feature difficult to reach on foot. While this is not a typical park where one would expect to see families picnicking, if it were more accessible there might be some daytime users who would come to take a stroll around or sit in the shade of the trees.

Street lighting is limited predominantly to signalized intersections. Adjacent building and parking lot lighting provide some sidewalk lighting.

There is some landscape beyond the back of sidewalk; however, since it is mostly shrubs, it does not provide much, if any, shade. There are no adjacent buildings from which to hang awnings or canopies to provide shade. The pedestrian environment is fairly austere.

Pima Wash Path

The City continues to improve the Pima Wash pedestrian and bicycle facility that crosses the study corridors generally perpendicularly. Currently, the path extends from Acoma Boulevard at the northeast end to SR 95 at the southwest end. From Acoma Boulevard to McCulloch Boulevard, the path is on the south and east side of the wash, and from McCulloch Boulevard to SR 95 it is on the west and north side. The Pima Wash path is an important non-motorized route for area residents. T

Arizona State University

Arizona State University's Lake Havasu City campus is scheduled to open for classes in the fall of 2012. Opening enrollment is predicted to be several hundred students but as it gets established, the number of students will rise to approximately 4,000. The campus location, at the old Daytona Middle School site, is only two blocks from the east end of Uptown. While most of the students will be commuter students, there will likely be a fair amount of pedestrian traffic between Uptown and the campus, predominantly during school hours. Creating pedestrian and bicycle facilities within the existing easements that connect these destinations will help facilitate this movement, bringing more business to the area. This connection would also provide a connection for customers of the hotel on the corner of Acoma and Swanson Boulevards to gain easy pedestrian access to Uptown shops.

In addition to the campus site, the university recently contracted with the Days Inn on McCulloch Boulevard, just west of Capri Boulevard, as a future dormitory facility. The dormitory will be in easy bicycling distance (1.3 miles) from the campus. Providing safe, direct bicycle access between the two destinations will encourage students to use this form of transportation rather than driving unnecessarily.

Crossings

Table 23 summarizes the nonmotorized crossings of the study corridors.

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Table 23 Nonmotorized Crossings of the Study Corridors

Cross Street	Mesquite Avenue	McCulloch Boulevard	Swanson Avenue
Lake Havasu Avenue	4-way, signal; 4-way crosswalks	4-way, signal; 4-way crosswalks	4-way, signal; 4-way crosswalks
Capri Boulevard	4-way stop; 4-way crosswalks	4-way, signal; 4-way crosswalks	3-way stop; 3-way crosswalks
Civic Center Boulevard	4-way stop; 4-way crosswalks	1-way stop; crosswalk parallel to McCulloch, across Civic Center Blvd; north side only; south side n/a; vehicles do not stop on McCulloch	n/a (no intersection)
Riviera Boulevard	4-way, stop; 4-way crosswalks	4-way, signal; 4-way crosswalks	1-way stop; crosswalk parallel to Swanson, across north only (south n/a); vehicles do not stop on Swanson
Smoketree Avenue	4-way stop; 4-way crosswalks	4-way, signal; 4-way crosswalks	4-way stop; 4-way crosswalks
Scott Drive	n/a (no intersection)	1-way stop; high-visibility cross-walks across McCulloch; crosswalk parallel to McCulloch on south side; vehicles do not stop on McCulloch	1-way stop; crosswalk parallel to Swanson, across north only (south n/a); vehicles do not stop on Swanson
Querio Drive/ Pima Dive	2-way stop; crosswalks parallel to Mesquite on both north and south side; no crosswalks across Mesquite; vehicles on Mesquite do not stop	2-way stop; high-visibility crosswalks across McCulloch; vehicles do not stop on McCulloch	n/a
Pima Wash	High-visibility cross-walks across Mesquite; vehicles do not stop on Mesquite, except when pedestrian are in crosswalk	High-visibility cross-walks across McCulloch; vehicles do not stop on McCulloch	High-visibility cross-walks across Swanson; vehicles do not stop on Swanson
Mulberry Avenue	n/a (no intersection)	1-way stop; high-visibility crosswalks across McCulloch; crosswalk parallel to McCulloch, south side; vehicles do not stop on McCulloch	4-way stop; 2 crosswalks parallel to Swanson; vehicular

Table 23 Nonmotorized Crossings of the Study Corridors

Cross Street	Mesquite Avenue	McCulloch Boulevard	Swanson Avenue
Birch Square	n/a (no intersection)	1-way stop; high-visibility crosswalks across McCulloch; crosswalk parallel to McCulloch, north side; vehicles do not stop on McCulloch	n/a (no intersection)
Acoma Boulevard	4-way, signal; 4-way crosswalks	4-way, signal; 4-way crosswalks	4-way, stop; 4-way crosswalks

Safety

All of the study corridors are generally well lit by streetlights. They are also generally busy vehicular routes and thus have many eyes on the area at all times of the day and night. The corridors appear to be well maintained which discourages vandalism or graffiti. There are many vacant lots along all the corridors. They are, however, overall clean and weed-free so don't appear threatening or provide hiding spots.

8.3 Bicycle Facilities

There are no bicycle lanes or other bicycle amenities in the study area with the exception of occasional bike racks.

8.4 Bicycle and Pedestrian Existing Condition Levels of Service

Existing bicycle and pedestrian levels of service (BLOS and PLOS respectively) were calculated along the corridors in the study area (McCulloch, Swanson, and Mesquite). The methodology used was developed by the League of Illinois Bicyclists (LIB)[7] and Sprinkle Consulting, Inc., and is becoming the emerging national standard for quantifying the bicycle or pedestrian friendliness of a roadway. While other level-of-service indices relate to traffic capacity, BLOS indicates bicyclist comfort level for specific roadway geometries and traffic conditions and, similarly, PLOS measures the walking condition. Future levels of service will be calculated when improvements are proposed later in this study.

BLOS and PLOS evaluation is useful in several ways:

(a) To identify the most appropriate routes for inclusion in the community bicycle/pedestrian network.

(b) "Weak links" in the network can be determined and sites needing improvements can be prioritized.

[7] "Bike/Ped Level of Service Measures and Calculators." League of Illinois Bicyclists. League of Illinois Bicyclists, 2011. Web. 07 Oct. 2011. <http://www.bikelib.org>.

(c) Alternate treatments for improving bicycle and pedestrian friendliness of a roadway can be evaluated.

(d) Road selection formulas can include BLOS and PLOS to encourage implementation of bicycle and pedestrian planning goals.

(e) These can be used as performance measures that can be tied to goals and policies for all road projects. Policies can range from simply reporting bicycle/pedestrian impact up to target LOS levels.

Bicycle Level of Service

Bicycle level of service is a qualitative/quantitative measurement indicating the comfort level of a bicyclist relative to the specific roadway and traffic conditions. The BLOS measures on-road bicycling conditions; it is not applicable to off-road sidewalks, separate trails, or side paths. The parameters used in the LOS model (available online at the LIB website) that affect the comfort and safety of bicyclists are: traffic volume, traffic speed, percentage of heavy truck traffic, percentage of occupied parking, number of traffic lanes, pavement condition, width of outside traffic lane, and width of extra pavement (shoulder/parking/bike lanes). Roadways with a better (lower) score are more attractive (and usually safer) for cyclists. Table 24 illustrates BLOS levels.

Table 24 Bicycle Level of Service Levels and Scores

Level of Service	BLOS Score	Compatibility Level
A	≤ 1.5	Extremely High
B	> 1.5 and ≤ 2.5	Very High
C	> 2.5 and ≤ 3.5	Moderately High
D	> 3.5 and ≤ 4.5	Moderately Low
E	> 4.5 and ≤ 5.5	Very Low
F	> 5.5	Extremely Low

Pedestrian Level of Service (PLOS)

PLOS measure the walker's perception of comfort and safety. PLOS is measured at mid-block cross sections, including any sidewalks and buffers, but is not measured at intersections. The parameters used in the LOS model (available online at the LIB website) that affect the comfort and safety of bicyclists are: traffic volume, traffic speed, percentage of heavy truck traffic, percentage of occupied parking, number of traffic lanes, pavement condition, width of outside traffic lane, width of extra pavement (shoulder/parking/bike lanes), sidewalk width, sidewalk buffer width, and spacing of trees. Table 25 describes the PLOS levels and scores for measurement.

Table 25 Pedestrian Level of Service Levels and Scores

Level of Service	PLOS Score	Compatibility Level
A	≤ 1.5	Extremely High
B	> 1.5 and ≤ 2.5	Very High
C	> 2.5 and ≤ 3.5	Moderately High
D	> 3.5 and ≤ 4.5	Moderately Low
E	> 4.5 and ≤ 5.5	Very Low
F	> 5.5	Extremely Low

Methodology

The BLOS analysis was performed using the BLOS/PLOS Calculator Form developed by League of Illinois Bicyclists and Sprinkle Consulting, Inc. This form uses the BLOS model and PLOS model which are based on the equations below:

$$BLOS = 0.507 \ln(Vol_{15}/L) + 0.199\, SP_t(1+10.38HV)^2 + 7.066(1/PR_5)^2 - 0.005\, W_e^2 + 0.760$$

Vol_{15} = volume of directional traffic in 15 minute time period

L = total number of through lanes

SP_t = effective speed limit = $1.1199 \ln(SP_p-20) + 0.8103$, where SP_p is posted speed

HV = percentage of heavy vehicles

PR_5 = FHWA's 5-point surface condition rating (5=best)

W_e = average effective width of outside through lane = $W_t + W_l - \Sigma W_r$

W_t = total width of outside lane and shoulder/parking pavement

W_l = width of paving from outside lane stripe to pavement edge

ΣW_r = width reduction due to encroachments in outside lane

$$PLOS = -1.227 \ln(Wol + Wl + fP \times \%OSP + fb \times Wb + fSW \times WS) + 0.009\,(Vol15/L) + 0.0004\, SPD2 + 6.046$$

W_{ol} = width of outside lane

W_l = width from outside lane stripe to pavement edge (shoulder, parking, bike lanes)

F_p = on-street parking effect coefficient

$\%OSP$ = percent of segment with on-street parking

F_b = buffer area barrier coefficient

W_b = buffer width (between edge of pavement and sidewalk)

f_{SW} = sidewalk presence coefficient

W_S = width of sidewalk

Vol_{15} = volume of directional traffic in 15 minute time period

L = total number of through lanes

SPD = average running speed of traffic

Study Scenarios and Assumptions

The analysis was conducted along the three project corridors for existing conditions in 2011. The BLOS and PLOS was conducted using the existing traffic provided by the city (various dates from 2006 to 2011), existing roadway conditions, and speed limits. The following are some of the additional assumptions used for conducting the analysis.

1. Percentage of heavy vehicles = 2 percent (McCulloch Boulevard); 4 percent (Mesquite and Swanson Avenues)
2. FHWA's pavement condition rating = 4 (where Default is 4-Good, 5-Best, and 1-Worst)

Analysis Findings

For Existing 2011, the study roadway segments operate at BLOS 'C' or better, and PLOS 'C'. Table 24 below shows the BLOS and PLOS at various segments in the study area. The detailed BLOS and PLOS analysis reports with input variables and the output results are included in Appendix B.

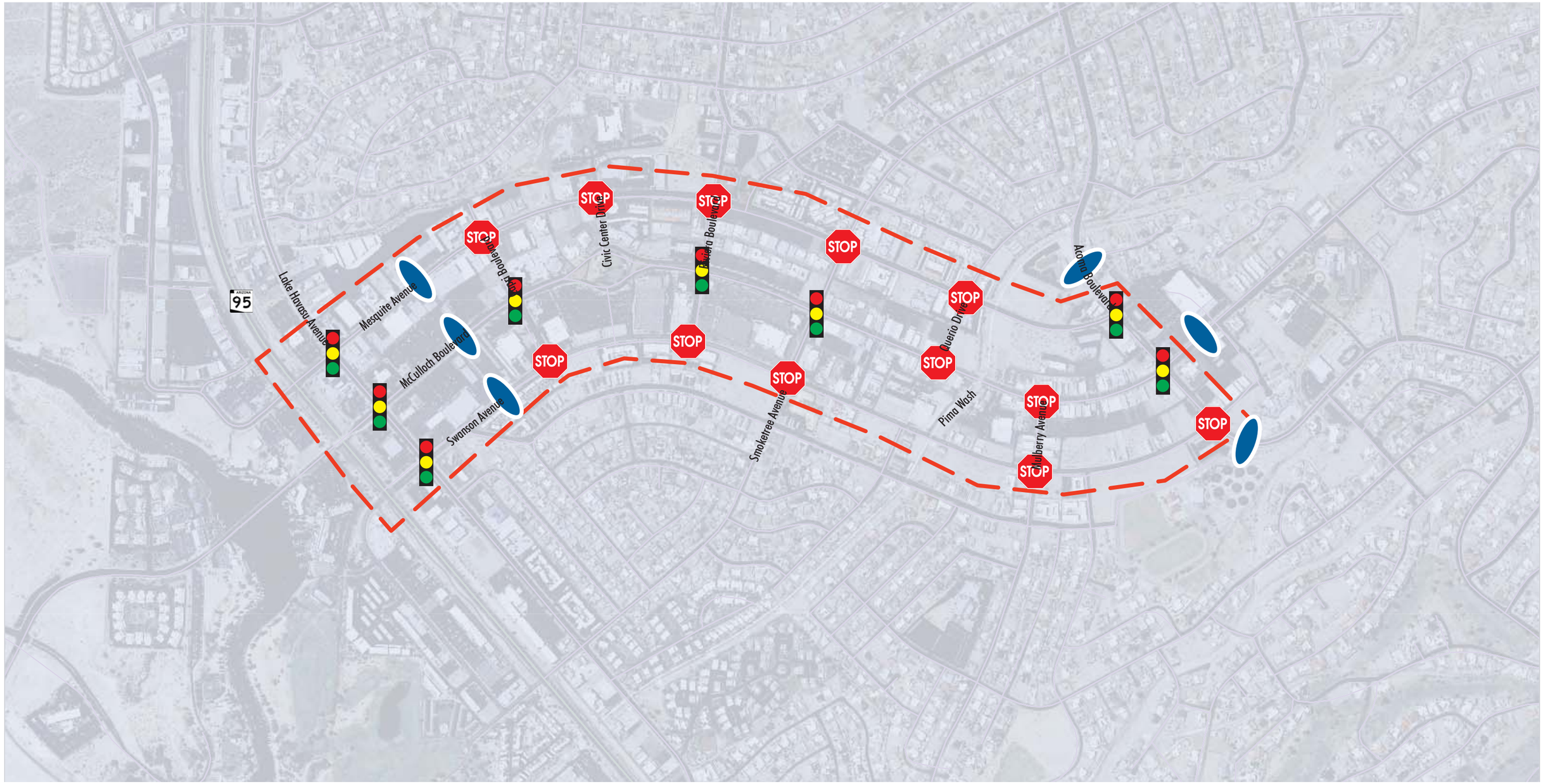
Table 26 BLOS and PLOS along Study Corridors

Segment	From	To	Speed Limit (mph)	Existing		
				Traffic Volume (ADT)	BLOS	PLOS
McCulloch Boulevard	Lake Havasu Avenue	Smoketree Avenue	30	11,544	C (3.24)	C (2.54)
McCulloch Boulevard	Smoketree Avenue	Acoma Boulevard	25	14,150	B (2.15)	C (2.75)
Mesquite Avenue	Lake Havasu Avenue	Acoma Boulevard	30	7,464	D (3.59)	C (2.76)
Swanson Avenue	Lake Havasu Avenue	Acoma Boulevard	30	8,733	D (3.67)	C (2.85)

Appendix A

Traffic Count Data

DRAFT



Signalized intersection count location

Unsignalized intersection count location

72-hour segment count with speed and classification

Study zone boundary

Traffic Research and Analysis, Inc.
3844 East Indian School Road
Phoenix, AZ 85018
(602) 840-1500

Site ID	File Name	Route	Location	Direction	Count Type	Count Dur	Start Date	Start Time	Avg Vol	AM PkHr	AM PkVol	AM PHF	PM PkHr	PM PkVol	PM PHF	Day Corr	Dir Split	pctSU	pctCB	Avg Spd	Spd 50pct	Spd 85pct	Latitude	Longitude
1	1105284	MCCULLOCH BLVD	Btwn LAKE HAVASU AVE & CAPRI BLVD	EB	SPD	72	12/6/2011	0:00	5368	11:45	551	0.9661	12:00	555	0.9720	0.9702	52.5%	1.6%	0.8%	30.6	30.9	35.0	34.4768	-114.3412
1	1105285	MCCULLOCH BLVD	Btwn LAKE HAVASU AVE & CAPRI BLVD	WB	SPD	72	12/6/2011	0:00	4853	11:30	499	0.9247	12:00	461	0.9665	0.9712	47.5%	3.4%	2.2%	29.9	29.9	34.4	34.4768	-114.3412
2	1105286	MESQUITE AVE	Btwn LAKE HAVASU AVE & CAPRI BLVD	EB	SPD	72	12/6/2011	0:00	4940	11:45	466	0.9061	12:30	523	0.9165	0.9702	49.3%	1.2%	0.6%	32.1	32.3	37.5	34.4770	-114.3435
2	1105287	MESQUITE AVE	Btwn LAKE HAVASU AVE & CAPRI BLVD	WB	SPD	72	12/6/2011	0:00	5080	11:15	577	0.8992	12:00	524	0.8176	0.9804	50.7%	0.9%	0.2%	29.3	29.7	34.3	34.4776	-114.3425
3	1105288	SWANSON AVE	Btwn LAKE HAVASU AVE & CAPRI BLVD	EB	SPD	72	12/6/2011	0:00	3865	11:45	359	0.9293	12:30	402	0.9306	0.9663	42.3%	0.3%	0.3%	29.4	29.5	34.1	34.4745	-114.3408
3	1105289	SWANSON AVE	Btwn LAKE HAVASU AVE & CAPRI BLVD	WB	SPD	72	12/6/2011	0:00	5267	11:45	556	0.9419	12:00	524	0.8978	0.9729	57.7%	4.3%	2.6%	29.1	29.1	33.6	34.4746	-114.3440
4	1105290	ACOMA BLVD	Btwn MESQUITE AVE & SOTOL LN	NB	SPD	72	12/6/2011	0:00	5924	7:15	456	0.8335	14:30	513	0.8691	0.9574	51.3%	4.6%	2.5%	34.1	34.0	38.6	34.4775	-114.3247
4	1105291	ACOMA BLVD	Btwn MESQUITE AVE & SOTOL LN	SB	SPD	72	12/6/2011	0:00	5626	7:30	498	0.7372	14:30	539	0.8188	0.9392	48.7%	1.7%	0.6%	36.5	36.6	41.2	34.4775	-114.3246
5	1105292	MCCULLOCH BLVD	Btwn ACOMA BLVD & AGAVE DR	EB	SPD	72	12/6/2011	0:00	5371	11:45	420	0.9844	16:30	547	0.8650	0.9787	46.3%	1.3%	0.8%	32.4	33.5	38.9	34.4765	-114.3213
5	1105293	MCCULLOCH BLVD	Btwn ACOMA BLVD & AGAVE DR	WB	SPD	72	12/6/2011	0:00	6219	7:30	538	0.7779	12:00	496	0.9317	0.9671	53.7%	2.8%	1.5%	33.5	33.7	39.2	34.4767	-114.3213
6	1105294	ACOMA BLVD	S of SWANSON AVE	NB	SPD	72	12/6/2011	0:00	8199	7:30	824	0.7977	13:00	656	0.9671	0.9660	51.7%	1.9%	0.8%	31.6	31.7	34.9	34.4741	-114.3203
6	1105295	ACOMA BLVD	S of SWANSON AVE	SB	SPD	72	12/6/2011	0:00	7675	11:45	582	0.9132	16:30	770	0.8455	0.9690	48.3%	1.2%	0.6%	27.7	27.7	31.6	34.4741	-114.3203

Traffic Research & Analysis, Inc.
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(602) 840-1500 FAX (602) 840-1577

JOB #	File ID	N/S Sts	E/W Sts	Start Date/Time	End Date/Time	Int	Total	Pk Hour	Pk Hr Ttl
11107	1100599	QUERIO DR	MESQUITE AVE	12/6/2011 7:00	12/6/2011 8:45	15	795	7:45:00 AM	467
11107	1100599	QUERIO DR	MESQUITE AVE	12/6/2011 16:00	12/6/2011 17:45	15	1084	4:15:00 PM	602
11107	1100600	MULBERRY AVE	SWANSON AVE	12/6/2011 7:00	12/6/2011 8:45	15	941	7:45:00 AM	570
11107	1100600	MULBERRY AVE	SWANSON AVE	12/6/2011 16:00	12/6/2011 17:45	15	1535	4:30:00 PM	863
11107	1100601	QUERIO DR	MCCULLOCH BLVD	12/6/2011 7:00	12/6/2011 8:45	15	1063	8:00:00 AM	601
11107	1100601	QUERIO DR	MCCULLOCH BLVD	12/6/2011 16:00	12/6/2011 17:45	15	1758	4:00:00 PM	944
11107	1100602	NONE / MULBERRY AVE	MCCULLOCH BLVD	12/6/2011 7:00	12/6/2011 8:45	15	1134	8:00:00 AM	634
11107	1100602	NONE / MULBERRY AVE	MCCULLOCH BLVD	12/6/2011 16:00	12/6/2011 17:45	15	1769	4:15:00 PM	954
11107	1100603	ACOMA BLVD	MESQUITE AVE	12/6/2011 7:00	12/6/2011 8:45	15	2191	7:30:00 AM	1262
11107	1100603	ACOMA BLVD	MESQUITE AVE	12/6/2011 16:00	12/6/2011 17:45	15	2735	4:15:00 PM	1479
11107	1100604	ACOMA BLVD	MCCULLOCH BLVD	12/6/2011 7:00	12/6/2011 8:45	15	2901	7:30:00 AM	1665
11107	1100604	ACOMA BLVD	MCCULLOCH BLVD	12/6/2011 16:00	12/6/2011 17:45	15	3648	4:15:00 PM	1925
11107	1100605	ACOMA BLVD	SWANSON AVE	12/6/2011 7:00	12/6/2011 8:45	15	2110	7:30:00 AM	1239
11107	1100605	ACOMA BLVD	SWANSON AVE	12/6/2011 16:00	12/6/2011 17:45	15	2703	4:30:00 PM	1433
11107	1100606	CIVIC CENTER LN	MESQUITE AVE	12/7/2011 7:00	12/7/2011 8:45	15	1343	7:45:00 AM	754
11107	1100606	CIVIC CENTER LN	MESQUITE AVE	12/7/2011 16:00	12/7/2011 17:45	15	1631	4:15:00 PM	882
11107	1100607	RIVIERA DR	MESQUITE AVE	12/7/2011 7:00	12/7/2011 8:45	15	1760	8:00:00 AM	994
11107	1100607	RIVIERA DR	MESQUITE AVE	12/7/2011 16:00	12/7/2011 17:45	15	2378	4:30:00 PM	1272
11107	1100608	RIVIERA DR	MCCULLOCH BLVD	12/7/2011 7:00	12/7/2011 8:45	15	1212	8:00:00 AM	735
11107	1100608	RIVIERA DR	MCCULLOCH BLVD	12/7/2011 16:00	12/7/2011 17:45	15	2317	4:00:00 PM	1270
11107	1100609	RIVIERA DR	SWANSON AVE	12/7/2011 7:00	12/7/2011 8:45	15	835	7:45:00 AM	502
11107	1100609	RIVIERA DR	SWANSON AVE	12/7/2011 16:00	12/7/2011 17:45	15	1587	4:00:00 PM	926
11107	1100610	SMOKETREE AVE	MCCULLOCH BLVD	12/7/2011 7:00	12/7/2011 8:45	15	1548	8:00:00 AM	876
11107	1100610	SMOKETREE AVE	MCCULLOCH BLVD	12/7/2011 16:00	12/7/2011 17:45	15	2531	4:00:00 PM	1401
11107	1100611	SMOKETREE AVE	MESQUITE AVE	12/7/2011 7:00	12/7/2011 8:45	15	1567	7:45:00 AM	905
11107	1100611	SMOKETREE AVE	MESQUITE AVE	12/7/2011 16:00	12/7/2011 17:45	15	1981	4:15:00 PM	1088
11107	1100612	SMOKETREE AVE	SWANSON AVE	12/7/2011 7:00	12/7/2011 8:45	15	1342	7:45:00 AM	794
11107	1100612	SMOKETREE AVE	SWANSON AVE	12/7/2011 16:00	12/7/2011 17:45	15	2226	4:00:00 PM	1280
11107	1100613	CAPRI BLVD	MESQUITE AVE	12/8/2011 7:00	12/8/2011 8:45	15	1185	8:00:00 AM	696
11107	1100613	CAPRI BLVD	MESQUITE AVE	12/8/2011 16:00	12/8/2011 17:45	15	1754	4:15:00 PM	961
11107	1100614	CAPRI BLVD	SWANSON AVE	12/8/2011 7:00	12/8/2011 8:45	15	933	8:00:00 AM	571
11107	1100614	CAPRI BLVD	SWANSON AVE	12/8/2011 16:00	12/8/2011 17:45	15	1624	4:15:00 PM	895
11107	1100615	CAPRI BLVD	MCCULLOCH BLVD	12/8/2011 7:00	12/8/2011 8:45	15	1135	8:00:00 AM	709
11107	1100615	CAPRI BLVD	MCCULLOCH BLVD	12/8/2011 16:00	12/8/2011 17:45	15	2048	4:15:00 PM	1152
11107	1100616	LAKE HAVASU AVE	MCCULLOCH BLVD	12/8/2011 7:00	12/8/2011 8:45	15	1782	8:00:00 AM	1076
11107	1100616	LAKE HAVASU AVE	MCCULLOCH BLVD	12/8/2011 16:00	12/8/2011 17:45	15	3183	4:15:00 PM	1659
11107	1100617	LAKE HAVASU AVE	MESQUITE AVE	12/8/2011 7:00	12/8/2011 8:45	15	2088	8:00:00 AM	1242
11107	1100617	LAKE HAVASU AVE	MESQUITE AVE	12/8/2011 16:00	12/8/2011 17:45	15	3646	4:15:00 PM	1964
11107	1100618	LAKE HAVASU AVE	SWANSON AVE	12/8/2011 7:00	12/8/2011 8:45	15	1579	8:00:00 AM	919
11107	1100618	LAKE HAVASU AVE	SWANSON AVE	12/8/2011 16:00	12/8/2011 17:45	15	2790	4:00:00 PM	1463

Appendix B

Bicycle and Pedestrian Level of Service Analysis Reports

DRAFT

McCulloch east of Smoketree BLOS

BLOS and BCI for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bikelane width:	9 ft
Bidirectional ADT traffic volume:	14150 (veh/day)
Posted speed limit:	25 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied on-street parking:	66%
Parking time-limit:	0 minutes

	Score	Level-of-service	Compatibility Level
BLOS:	2.15	B (1.51-2.50)	Very High
BCI:	2.7	C (2.31-3.40)	Moderately High

McCulloch east of Smoketree PLOS

BLOS and PLOS for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bike lane/marked parking width:	9 ft
Bidirectional ADT traffic volume:	14150 (veh/day)
Posted speed limit:	25 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied parking:	66%
% of segment with sidewalks:	100%
Sidewalk width:	10 ft
Sidewalk buffer/parkway width:	0 ft
Buffer/parkway avg tree spacing:	25 ft

	Score	Level-of-service	Compatibility Level
BLOS:	2.15	B (1.51-2.50)	Very High
PLOS:	2.75	C (2.51-3.50)	Moderately High

McCulloch west of Smoketree BLOS

BLOS and BCI for the following road segment

Lanes per direction:	2
Outside lane width:	15 ft
Paved shoulder/bikelane width:	0 ft
Bidirectional ADT traffic volume:	11544 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied on-street parking:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	3.24	C (2.51-3.50)	Moderately High
BCI:	3.05	C (2.31-3.40)	Moderately High

McCulloch west of Smoketree PLOS

BLOS and PLOS for the following road segment

Lanes per direction:	2
Outside lane width:	15 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	11544 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied parking:	0%
% of segment with sidewalks:	100%
Sidewalk width:	6 ft
Sidewalk buffer/parkway width:	0 ft
Buffer/parkway avg tree spacing:	100 ft

	Score	Level-of-service	Compatibility Level
BLOS:	3.24	C (2.51-3.50)	Moderately High
PLOS:	2.54	C (2.51-3.50)	Moderately High

Mesquite BLOS

BLOS and BCI for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bikelane width:	0 ft
Bidirectional ADT traffic volume:	7464 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied on-street parking:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	3.22	C (2.51-3.50)	Moderately High
BCI:	3.07	C (2.31-3.40)	Moderately High

Mesquite PLOS

BLOS and PLOS for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	7464 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied parking:	0%
% of segment with sidewalks:	95%
Sidewalk width:	6 ft
Sidewalk buffer/parkway width:	0 ft
Buffer/parkway avg tree spacing:	100 ft

	Score	Level-of-service	Compatibility Level
BLOS:	3.22	C (2.51-3.50)	Moderately High
PLOS:	2.76	C (2.51-3.50)	Moderately High

Swanson BLOS

BLOS and BCI for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bikelane width:	0 ft
Bidirectional ADT traffic volume:	8733 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied on-street parking:	0%

	Score	Level-of-service	Compatibility Level
BLOS:	3.3	C (2.51-3.50)	Moderately High
BCI:	3.2	C (2.31-3.40)	Moderately High

Swanson PLOS

BLOS and PLOS for the following road segment

Lanes per direction:	1
Outside lane width:	16 ft
Paved shoulder/bike lane/marked parking width:	0 ft
Bidirectional ADT traffic volume:	8733 (veh/day)
Posted speed limit:	30 mph
Heavy vehicle percentage:	2%
FHWA's pavement condition rating:	4
% of segment with occupied parking:	0%
% of segment with sidewalks:	100%
Sidewalk width:	6 ft
Sidewalk buffer/parkway width:	0 ft
Buffer/parkway avg tree spacing:	100 ft

	Score	Level-of-service	Compatibility Level
BLOS:	3.3	C (2.51-3.50)	Moderately High
PLOS:	2.85	C (2.51-3.50)	Moderately High