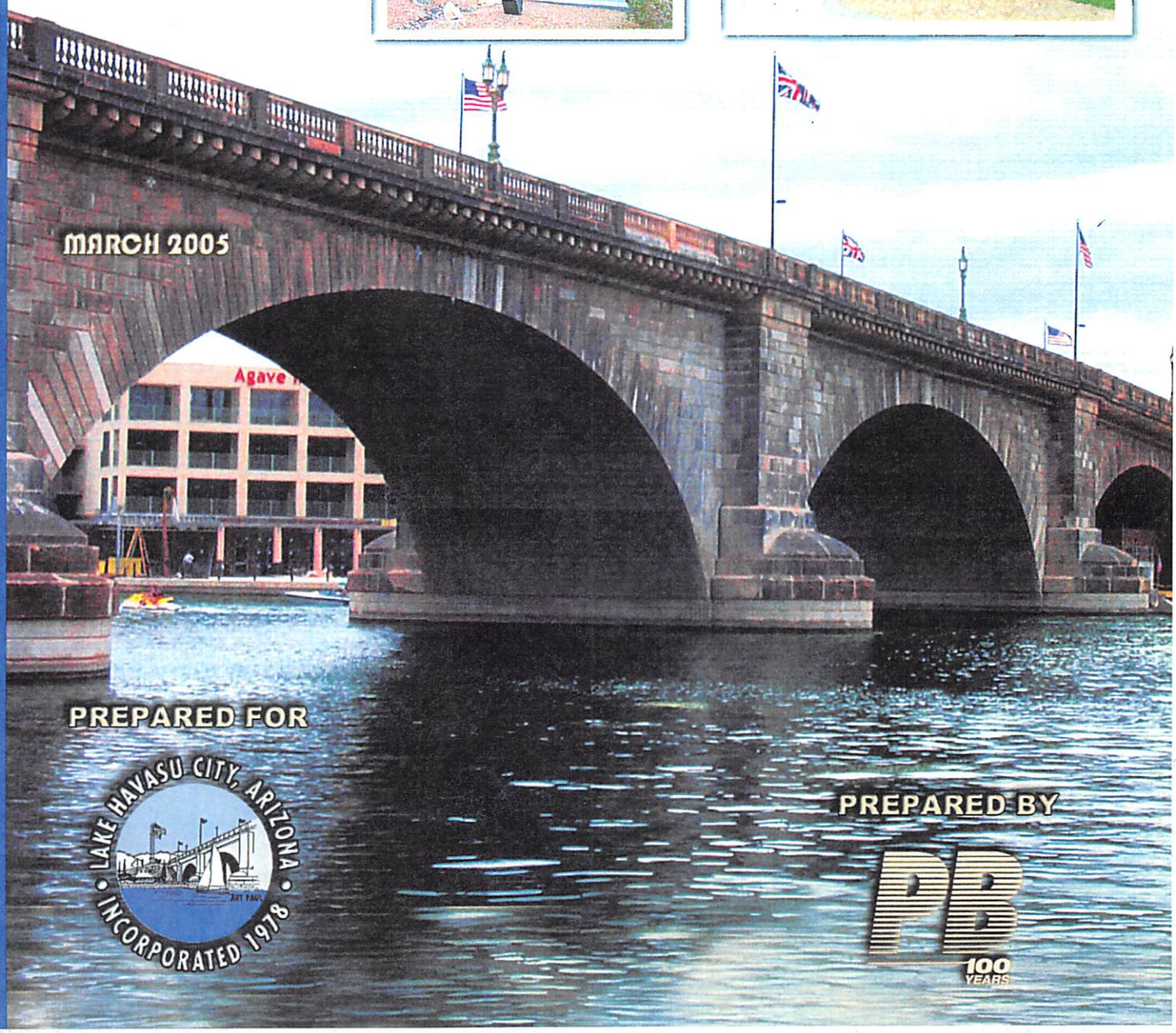
FINAL REPORT

# Lake Havasu City

## Small Area Transportation Study Update



MARCH 2005

PREPARED FOR

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PREPARED BY

PB 100 YEARS

# FINAL REPORT

Prepared for

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# I. INTRODUCTION

This Transportation Study has been undertaken because of the continued high rate of growth within Lake Havasu City and the surrounding unincorporated areas of Mohave County. The purpose of this study is to evaluate the demand on the arterial street system and to develop a roadway plan to accommodate that demand. This study builds upon the SATS reports developed in 1991 and 1997 which were also incorporated in the 1994 and 2002 Lake Havasu City General Plan and Plan Updates.

## A Background

According to the 2000 census, Lake Havasu City, like many cities and towns in Arizona, has had significant growth. The population for the City increased from 24,363 in 1990 to 41,938 in 2000, a growth of 72 percent. The 2004 population estimate for the City was 52,205 people (Arizona Department of Economic Security, July 1, 2004). Mohave County had a 66 percent growth rate from 1990 to 2000. With this growth comes a need to provide additional infrastructure, which includes the transportation system.

## B. Study Process

In order to complete the study, there are a number of work tasks that are performed. During the course of the project, products were prepared to document the results of certain work tasks. These products, submitted in draft form and subject to review and comment, form the basis of the final report.

The products prepared during the course of the study include:

- Transportation Goals, Policies, and Objectives
- Summary of Existing Conditions
- Summary of Future Conditions
- Summary of Transportation Options
- Summary of Public Meeting
- Draft Final Report

This report is the Final Report and presents information on existing and future conditions, alternatives to accommodate future growth, the recommended street plan, and implementation.

A Technical Advisory Committee made up of elected officials and staff from the City, Western Arizona Council of Governments (WACOG) and ADOT guided the study. The TAC provided input throughout the course of the study and reviewed deliverables.

## C. Study Area

The study area includes the corporate limits of Lake Havasu City. In addition, a portion of Mohave County surrounding the City is also part of the study area. Generally, the study area extends from the airport on the north, to the Mohave Mountains on the east, to Sara Park on the south, and to the Lake on the west. The study area is shown in Figure 1.

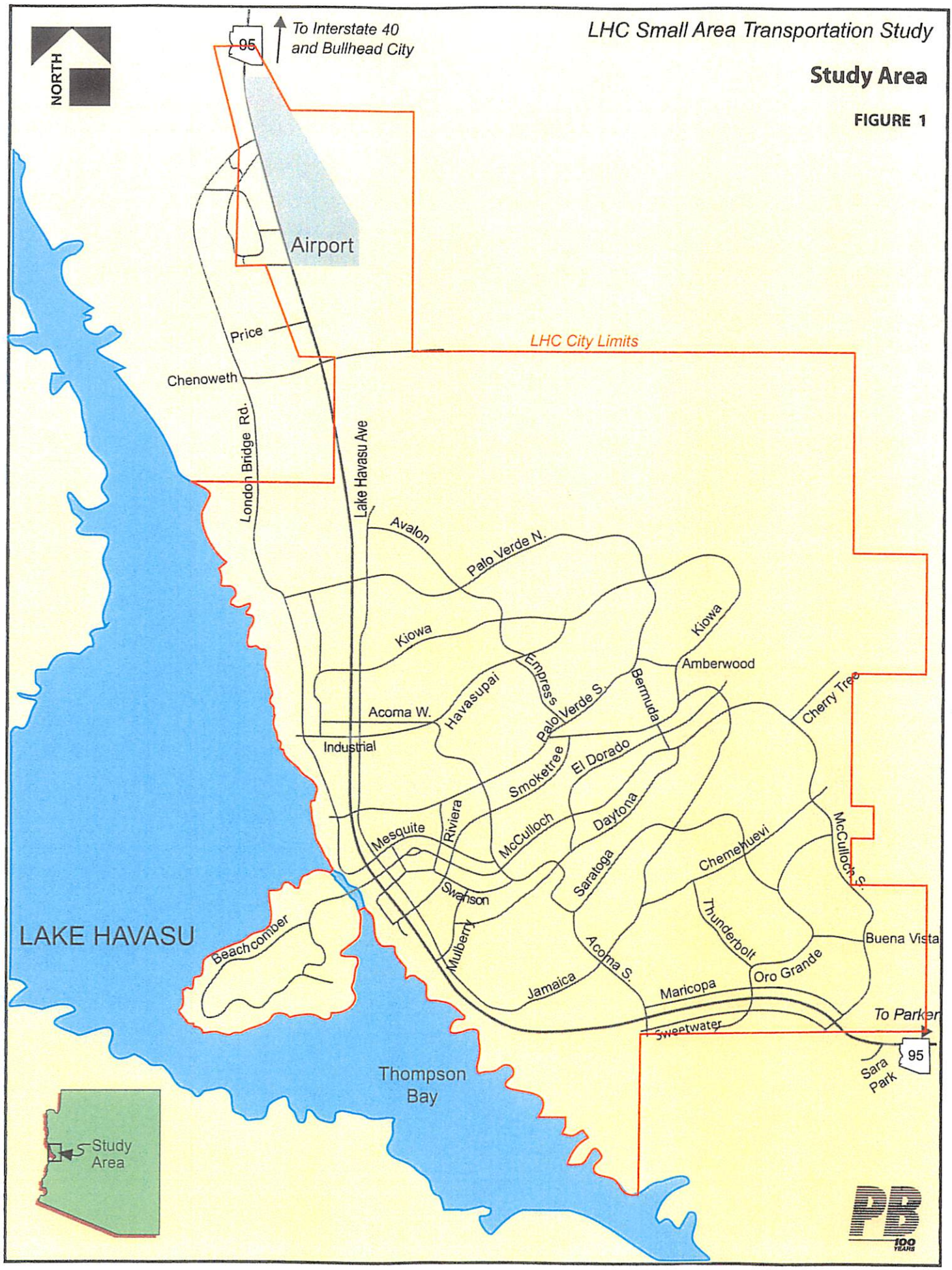
## D. Public Involvement

Public participation is an integral part of a transportation planning study. As part of the Lake Havasu City Transportation Study, input was obtained from the public and elected officials. Also, the Draft Report was presented to the City Council at a regularly scheduled meeting. A summary of the public involvement activities is described below.

### Public Meetings

Two Public Open Houses were held to present information and to receive citizen comments on issues and concerns with the transportation system in Lake Havasu City. The meetings were held on May 19, 2004 and November 17, 2004.

The meetings were staffed by City, ADOT and consultant personnel who were available to provide information, answer questions, and receive comments. Exhibits related to the Transportation Study were provided. Comment forms were made available for use in submitting written comments. The comments were summarized and presented to the Technical Advisory Committee for consideration.


LHC Small Area Transportation Study
Study Area
FIGURE 1
NORTH
To Interstate 40
and Bullhead City
95
Airport
Price
Chenoweth
LHC City Limits
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Empress
Havasupai
Palo Verde S.
Bermuda
Cherry Tree
Acoma W.
Industrial
El Dorado
Smoketree
Daytona
Riviera
Mesquite
McCulloch
Saratoga
Chemehuevi
McCulloch S.
Swanson
Thunderbolt
Buena Vista
Mulberry
Acoma S.
Oro Grande
Jamaica
Maricopa
To Parker
Sweetwater
95
Sara Park
LAKE HAVASU
Beachcomber
Thompson Bay
Study Area
PB
100 YEARS

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# II. GOALS, POLICIES AND OBJECTIVES

The Lake Havasu City General Plan 2002 includes three goals for the future transportation system throughout the City. The goals and policies were reviewed by the TAC as part of the Small Area Transportation Study process. The goals and associated policies are listed below (Lake Havasu City General Plan 2002, pages 56-58).

Goal: Provide for the mobility of all segments of the population in an efficient, cost-effective, and safe multimodal transportation system.

Policies:

1. Maximize circulation access to community activity centers such as the downtown area bounded by Mesquite, Swanson, Lake Havasu, and Acoma Avenues; the hospital and other emergency services; employment and retail centers along Highway 95 and at the airport; and recreational areas along the waterfront, Island, and parks.
2. Prioritize transportation improvements and aggressively pursue federal, state, local, and private funding sources for the development of the circulation system.
3. A balance of transportation modes should be attained and maintained to provide mobility for those who cannot or choose not to drive motor vehicles. Create a transit system, beyond the existing door-to-door service, that connects residential, commercial, employment, and activity/recreational areas to provide travel options.
4. Develop Standard Guidelines for Transportation-Related Projects that build upon the foundation provided in the Transportation/Circulation Element.
5. Ensure that multimodal services and facilities are connected to provide a "seamless" system. This requires that someone can walk or bicycle to catch a bus or that park-and-ride facilities are provided in close proximity to highways.
6. Transportation improvements must build upon the existing system to promote system efficiency and ensure connections.
7. When reviewing new projects, traffic impacts must be analyzed. New development must not degrade mobility as a

result of its development. If the development negatively impacts mobility, mitigation strategies must be addressed.

8. Embrace promising transportation and information technologies to promote system efficiencies such as coordinated signalization systems and other means of optimizing traffic flow.
9. Relieve traffic congestion associated with accidents by increasing coordination and communication between responding agencies.
10. Develop design guidelines to retrofit existing roadways to connect out to the parkway.
11. Minimize congestion by designing streets with adequate capacity for peak travel demands.
12. Minimize rights-of-way costs associated with transportation projects through early acquisition of properties for planned facilities.
13. Provide a transportation circulation system that fosters an aesthetically pleasing community image.
14. Maintain the integrity of residential neighborhoods by creating an appropriate and supportive circulation system.
15. Improve all arterial connector streets and future Highway 95 improvements to include boulevard-style green space for parkway amenities to add consistency and a higher quality image to the community from the traveler's perspective.

Goal: Develop a basic network of facilities to serve pedestrians and bicyclists.

Policies:

1. Encourage land uses that foster pedestrian and bicycle travel.
2. Emphasize pedestrian and bicycle facilities within and between developments to encourage walking and bicycling as major modes of travel. Require pedestrian circulation plans to be submitted, along with vehicular circulation plans, as a part of the review process for new development proposals.
3. Encourage pedestrian- and bicycle-friendly areas on widened roadways.
4. Develop pedestrian and bicycle standards that provide American Disabilities Act (ADA) accessible surface and clearance for all pedestrian areas where possible.

5. Utilize traffic-calming techniques in pedestrian areas to reduce vehicular speed limits and encourage a bicycle- and pedestrian-friendly environment.

6. Provide bicycle-friendly areas on all arterials throughout the Lake Havasu City planning area.

7. Encourage pedestrian and bicycle trips to all major employment, commercial, and activity centers by ensuring that adequate storage/security (bike racks) facilities are made available.

8. Implement the Pedestrian and Bike Path Plan (1998) that proposes a comprehensive system throughout the planning area.

Goal: Improve the access to and around the Island and Shoreline.

Policies:

1. Provide facilities to support the recreational development of the Island and Shoreline.
2. Encourage the development of the second bridge to the Island area to promote the Island's development.
3. McCulloch Boulevard and Beachcomber Boulevard on the Island should be expanded to four lanes.
4. Develop bicycle access to the Island's second bridge.
5. Continue to expand public access to the Island and Shoreline.
6. Create hiking/biking trails or paths along the Shoreline both on the Island and Mainland.

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# III. EXISTING CONDITIONS

Existing conditions provide the baseline for the study. It provides for a review of the current operating conditions as well as a basis for projecting future conditions. Several measures of existing conditions, which have been selected for documentation and analysis, include:

- Land use
- Socioeconomic data
- Environmental justice considerations
- Street system inventory
- Traffic counts
- Traffic analysis

Each of these measures is presented in the following subsections of this chapter.

## A. LAND USE

An understanding of the land use data is important for understanding travel characteristics in an area. Land use information is converted to population and employment data for use in the travel modeling. Land use classifications include:

- residential
- commercial
- industrial
- public

In general, commercial areas are located along McCulloch Boulevard, Lake Havasu Avenue, State Route 95, and on the Island. Industrial development and other employment areas are at the Airport and along Industrial Boulevard, Kiowa Boulevard, and London Bridge Road. Residential areas exist throughout the study area. Public lands include parks, schools, and government facilities.

Major traffic generators in the study area include Lake Havasu Municipal Airport, Havasu Regional Medical Center, Lake Havasu High School, Mohave Community

College, City Hall, downtown shopping area, Walmart shopping area, and the London Bridge area commercial developments.

## B. SOCIOECONOMIC DATA

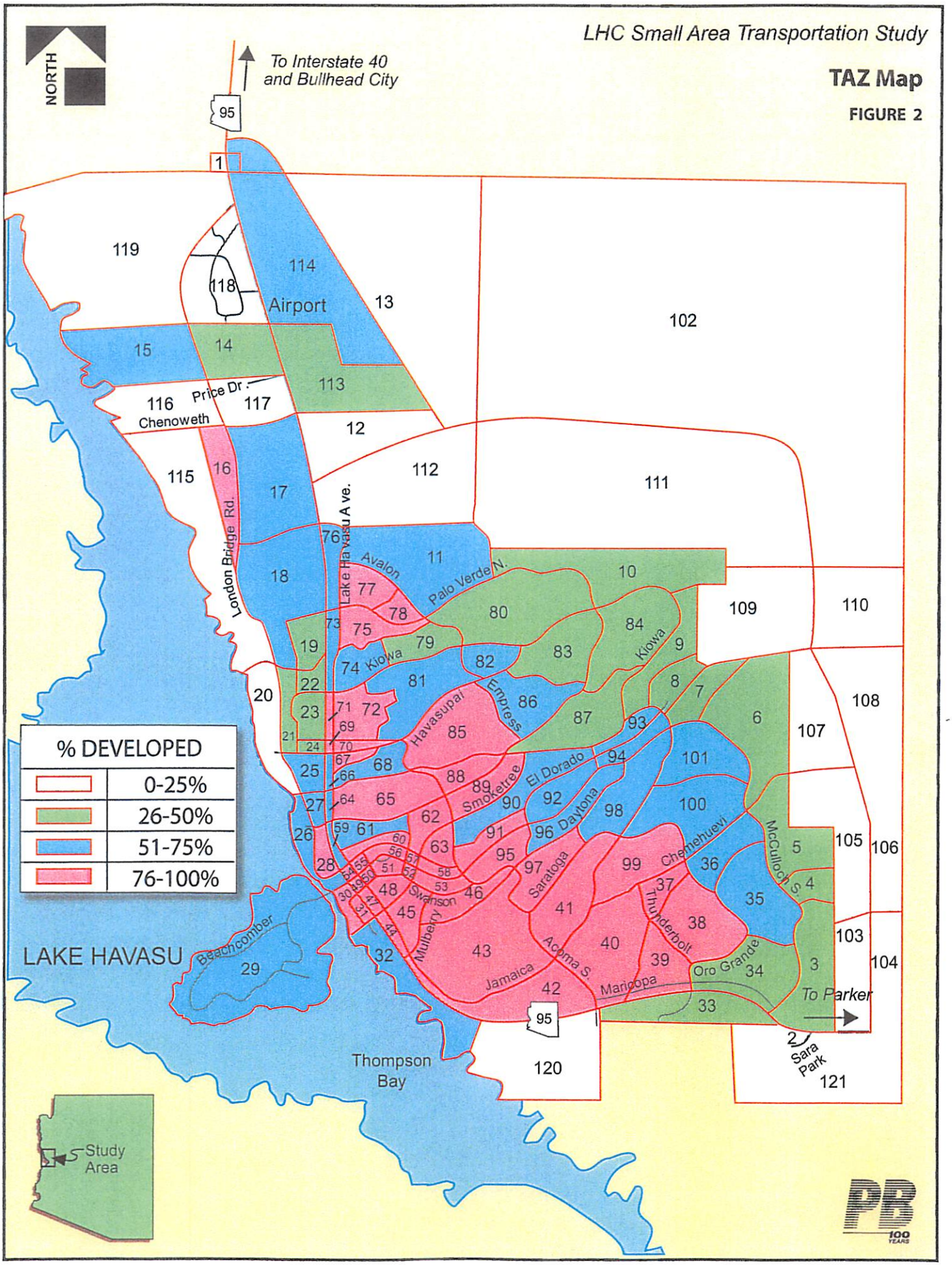
Growth rates can be an indication of future growth and therefore are important in developing traffic forecasts. Also, population and employment are direct inputs to the travel-forecasting model to determine the number of trips being made each day. Specifically, in the traffic model, population produces trips and employment attracts trips.

Population data for Arizona, Mohave County and Lake Havasu City is presented in Table 1 for the years 1990 and 2000. As shown in the table, the highest growth rate from 1990 to 2000 was calculated for Lake Havasu City with an 84% increase.

**TABLE 1**
**POPULATION GROWTH, 1990 to 2000**

| | 1990 | 2000 | 2004 | Percent Change (1990-2000) | Percent Change (2000-2004) |
|---|---|---|---|---|---|
| Arizona | 3,665,339 | 5,130,632 | 5,832,150 | 40% | 14% |
| Mohave County | 93,497 | 155,032 | 180,210 | 66% | 16% |
| Lake Havasu City | 24,363 | 41,938 | 52,205 | 72% | 25% |

To tabulate existing and future population and employment data, a system of traffic analysis zones have been established for the area. Traffic analysis zones (TAZs) are geographic subdivisions of the study area that are used in the database of the travel forecasting model. Similar land uses, physical barriers, or major transportation corridors define the zone boundaries. The study area has 121 TAZs that are shown in Figure 2. Two of the zones represent external zones at the edge of the study area on SR 95. Population for Lake Havasu City study area (including the surrounding unincorporated area) is presented for the year 2004 by TAZ in Table 2.


LHC Small Area Transportation Study
TAZ Map
FIGURE 2
NORTH
To Interstate 40 and Bullhead City
95
Airport
Price Dr.
Chenoweth
London Bridge Rd.
Lake Havasu Ave.
Avalon
Palo Verde N.
Kiowa
Havasupai
Empress
El Dorado
Smoketree
Daytona
Chemehuevi
McCulloch S.
Saratoga
Swanson
Mulberry
Acoma S.
Thunderbolt
Jamaica
Mariopa
Oro Grande
To Parker
Sara Park
LAKE HAVASU
Beachcomber
Thompson Bay
Study Area
% DEVELOPED
0-25%
26-50%
51-75%
76-100%

## TABLE 2
## EXISTING POPULATION by TAZ

| TAZ | EXISTING POPULATION | TAZ | EXISTING POPULATION | TAZ | EXISTING POPULATION | TAZ | EXISTING POPULATION |
|---|---|---|---|---|---|---|---|
| 1 | NA | 32 | 148 | 63 | 340 | 94 | 1171 |
| 2 | NA | 33 | 544 | 64 | 50 | 95 | 646 |
| 3 | 1251 | 34 | 707 | 65 | 941 | 96 | 282 |
| 4 | 557 | 35 | 1193 | 66 | 50 | 97 | 291 |
| 5 | 724 | 36 | 614 | 67 | 0 | 98 | 221 |
| 6 | 928 | 37 | 288 | 68 | 336 | 99 | 421 |
| 7 | 273 | 38 | 1431 | 69 | 0 | 100 | 633 |
| 8 | 137 | 39 | 692 | 70 | 6 | 101 | 633 |
| 9 | 794 | 40 | 1489 | 71 | 2 | 102 | 1036 |
| 10 | 677 | 41 | 1182 | 72 | 225 | 103 | 1130 |
| 11 | 1494 | 42 | 872 | 73 | 102 | 104 | 1659 |
| 12 | 7 | 43 | 1984 | 74 | 4 | 105 | 1101 |
| 13 | 4 | 44 | 148 | 75 | 479 | 106 | 2 |
| 14 | 7 | 45 | 1444 | 76 | 93 | 107 | 0 |
| 15 | 358 | 46 | 364 | 77 | 728 | 108 | 0 |
| 16 | 191 | 47 | 4 | 78 | 197 | 109 | 4 |
| 17 | 2030 | 48 | 646 | 79 | 367 | 110 | 0 |
| 18 | 898 | 49 | 0 | 80 | 1659 | 111 | 0 |
| 19 | 509 | 50 | 0 | 81 | 1184 | 112 | 0 |
| 20 | 50 | 51 | 646 | 82 | 180 | 113 | 4 |
| 21 | 97 | 52 | 0 | 83 | 651 | 114 | 0 |
| 22 | 2 | 53 | 0 | 84 | 696 | 115 | 67 |
| 23 | 180 | 54 | 0 | 85 | 1329 | 116 | 0 |
| 24 | 0 | 55 | 0 | 86 | 1433 | 117 | 351 |
| 25 | 0 | 56 | 0 | 87 | 1123 | 118 | 2 |
| 26 | 206 | 57 | 0 | 88 | 251 | 119 | 609 |
| 27 | 256 | 58 | 340 | 89 | 494 | 120 | 2 |
| 28 | 7 | 59 | 6 | 90 | 1171 | 121 | 0 |
| 29 | 379 | 60 | 2 | 91 | 646 | | |
| 30 | 167 | 61 | 588 | 92 | 282 | | |
| 31 | 0 | 62 | 509 | 93 | 291 | **TOTAL** | **54,241** |

The employment data presented here is an estimate of the number of people employed within the study area. The information is based on employment data of major employers and previous studies. The number of employees in the study area is shown in Table 3. As shown in the table, employees in the area have increased by nearly 57% in the ten years between 1990 and 2000. Downtown is a major employment center. Other large employers include the City of Lake Havasu City, Mohave Community College, Sterilite, Utility companies, and Havasu Regional Medical Center.

**TABLE 3**
**EMPLOYMENT IN STUDY AREA**

| Year | Employees |
|---|---|
| 1990 | 11,800 |
| 2000 | 18,500 |

## Title VI Populations

Title VI of the Civil Rights Act of 1964 and related statutes assure that individuals are not subjected to discrimination on the basis of race, color, national origin, age, sex, or disability. In February 1994, President Clinton signed Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." The purpose of the order was to focus attention on the "environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice." The Order does not supersede existing laws or regulations; rather, it requires consideration and inclusion of these targeted populations as mandated in previous legislation including:

- Title VI of the Civil Rights Act of 1964
- National Environmental Policy Act of 1969 (NEPA)
- Section 309 of the Clean Air Act
- Freedom of Information Act

The U.S. Department of Transportation issued its final order to implement the provisions of Executive Order 12898 on April 15, 1997. This final order requires that information be obtained concerning the race, color or national origin, and

income level of populations served or affected by proposed programs, policies, and activities. It further requires that steps be taken to avoid disproportionately high and adverse impacts on these populations.

One of the first steps in assuring environmental justice is the identification of those populations specifically targeted by the Order – minority and low-income populations.

According to the 2000 U.S. Census, the racial composition of Lake Havasu City was predominantly white with about 12.9 percent minorities as shown in Table 4.

**TABLE 4**

**2000 RACIAL DEMOGRAPHICS (by percentage)**

| AREA | WHITE NOT HISPANIC | AFRICAN AMERICAN | NATIVE AMERICAN | ASIAN | OTHER | HISPANIC OR LATINO |
|---|---|---|---|---|---|---|
| Lake Havasu City | 87.1% | 0.5% | 1.0% | 1.0% | 2.5% | 7.9% |

The Executive Order also requires the consideration of persons older than 60 years of age. According to the 2000 U.S. Census, approximately 33 percent of the population in Lake Havasu City is 60 years or older. In addition, the Order mandates that impacts on low-income people must also be considered. There are nearly 4,000 people living below the poverty level according to the 2000 Census data. Socioeconomic data for the year 2000 for Lake Havasu City and Mohave County are listed in Table 5.

**TABLE 5**

**LOW INCOME AND DISABLED POPULATION**

| | LAKE HAVASU CITY | MOHAVE COUNTY |
|---|---|---|
| Females | 50.8% | 50.3% |
| Males | 49.2% | 49.7% |
| Persons with disability | 25% | 24% |
| Persons over age 60 | 33% | 27% |
| Persons living below the poverty level | 10% | 14% |

SOURCE: US Bureau of the Census, Census 2000

An assessment of the impacts on the named populations from any of the proposed roadway improvements is presented in Chapter VI.

## C. Existing Street System

The existing street system is described in detail in the following sections. The existing street system in Lake Havasu City is composed of a state highway, an arterial street system, and collector and local streets. The cross-sections of the existing roadways vary from five-lane paved with curb and gutter to a few two-lane unpaved streets in the unincorporated areas.

The street system inventory for the roadways within the study area included:

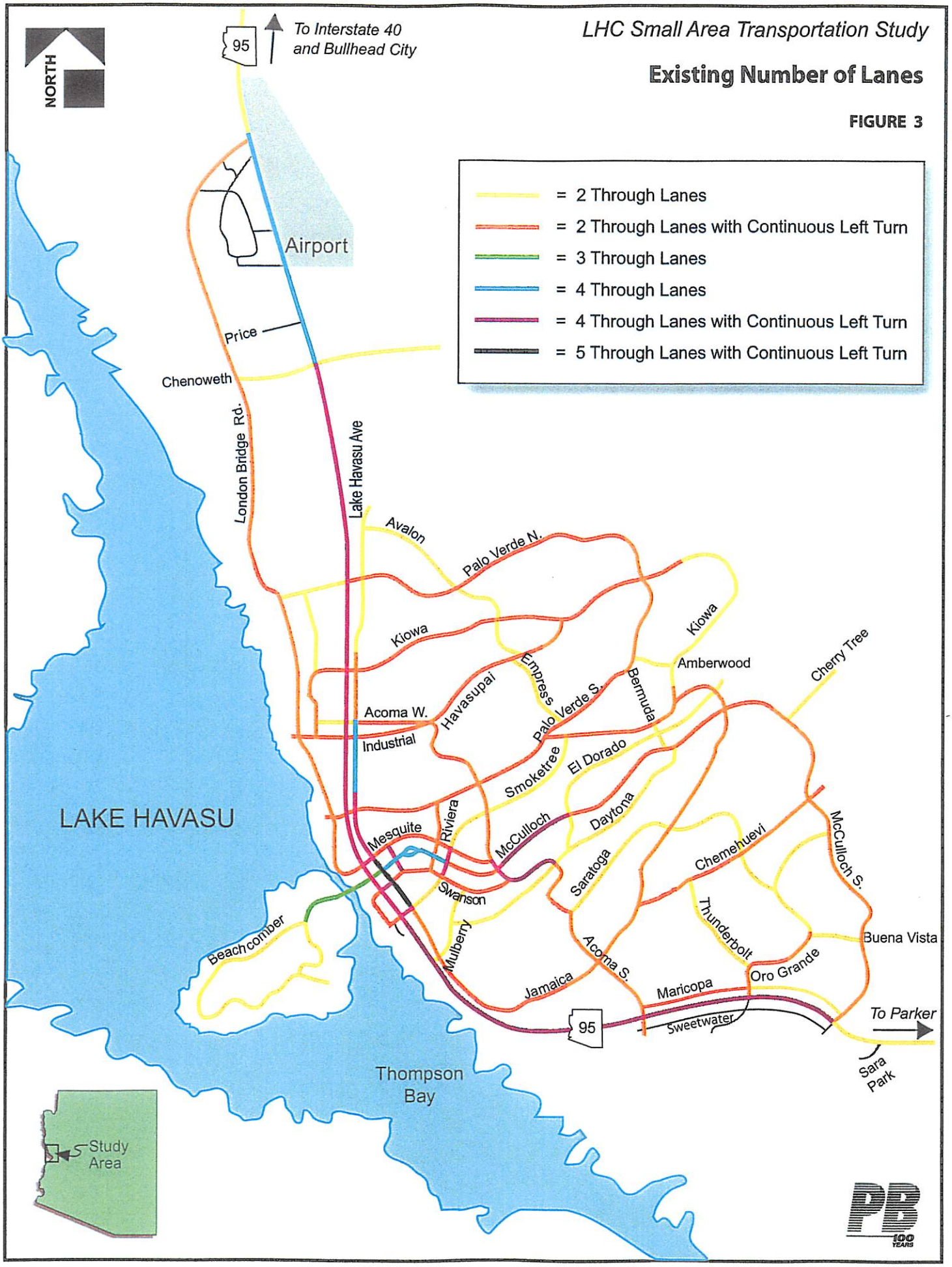
- Right of way
- Pavement widths
- Number of lanes

The existing right of way widths for the roadways within the City are based on the type of roadway. The right of way widths, which were established as part of the original master plan for the City, are listed in Table 6. Also shown in the table are the curb-to-curb pavement widths by type of roadway. The existing number of lanes is shown in Figure 3.

**TABLE 6**
**EXISTING RIGHT OF WAY WIDTHS**

| Roadway Type | Right-of Way | Pavement Width |
|---|---|---|
| Boulevards | 84 feet | 54 feet |
| Avenues | 70 feet | 44 feet |
| Drives | 60 feet | 42 feet |
| Cul-de-sacs | 50 feet | 36 feet |

There are some exceptions to these standards, including both Chenoweth and London Bridge Road which have right of ways or easements of 100'. Beachcomber and McCulloch, on the Island, have easements of 200'. The Parkway will have a right of way of 200' or more.


LHC Small Area Transportation Study
Existing Number of Lanes
FIGURE 3
NORTH
95
To Interstate 40 and Bullhead City
= 2 Through Lanes
= 2 Through Lanes with Continuous Left Turn
= 3 Through Lanes
= 4 Through Lanes
= 4 Through Lanes with Continuous Left Turn
= 5 Through Lanes with Continuous Left Turn
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Cherry Tree
Empress
Havasupai
Palo Verde S.
Bermuda
Acoma W.
Industrial
El Dorado
Smoketree
Riviera
Daytona
McCulloch
Mesquite
Chemehuevi
McCulloch S.
Saratoga
Swanson
Thunderbolt
Buena Vista
Beachcomber
Mulberry
Acoma S.
Oro Grande
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
LAKE HAVASU
Thompson Bay
Study Area
PB 100 YEARS

### Speed Limits

Lake Havasu City recognizes the need to have reasonable, enforceable and safe speed limits throughout the community. Historically, Lake Havasu City has utilized a rule of thumb that included a general 25 MPH speed limit for the majority of the streets in the City. The more traveled avenues and boulevards are signed at 35 MPH and portions of London Bridge Road are signed at 45 MPH. The existing speed limits are shown in Figure 4.

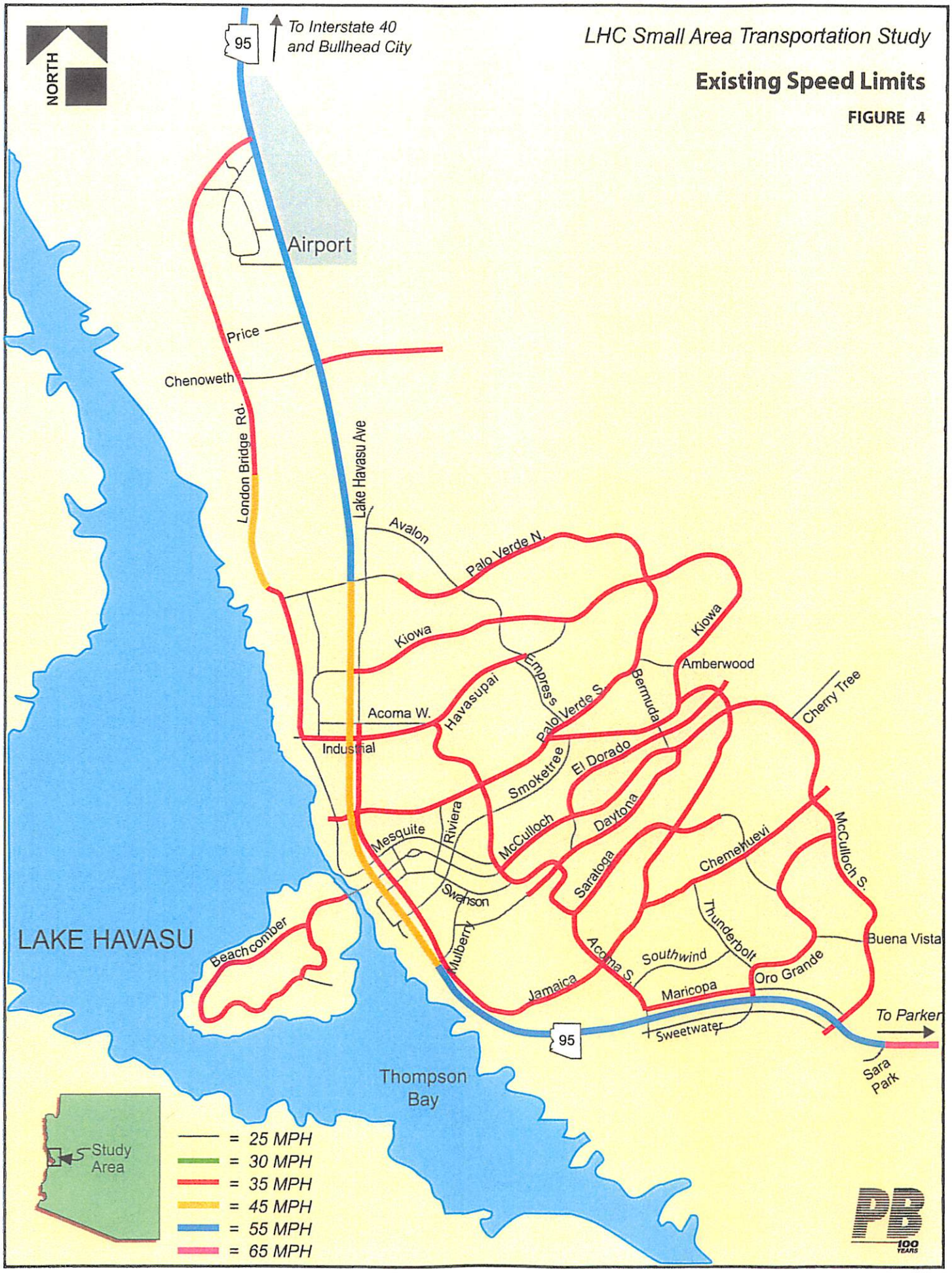
### Functional Classification

The roles and standards for each type of roadway must be established in order to plan an efficient and effective system. In general, State Route 95 provides regional access to Lake Havasu City from other areas of the county and state. The role of the state highway and arterials is to carry through traffic and to provide for the mobility of the community. Whereas, the collector and local streets provide land access and carry local traffic to the neighborhoods and distribute traffic to the arterials. The existing federal functional classification system for Lake Havasu City area streets is shown in Figure 5.

## D. Existing Traffic

Existing daily traffic volumes on the street system in the study area are shown in Figure 6. The data on City streets were obtained from counts conducted by the City in 2002 and 2003. The traffic volumes on SR95 were obtained from ADOT. The existing data on SR 95 were obtained prior to the completion of ADOT's major widening and improvement project of SR 95 from South McCulloch Blvd to north of the airport.

As shown in the figure, the highest daily traffic volumes are on State Route 95 specifically, the segment between Acoma Boulevard West and Kiowa Boulevard with 27,600 vehicles and the segment Industrial Boulevard and South Palo Verde with 22,600 vehicles. Other high volume locations include Acoma Boulevard south of McCulloch Boulevard with 17,000 vehicles, Lake Havasu Avenue south of Mesquite with 15,200 vehicles, and McCulloch Boulevard west of Riviera with 15,000 vehicles.


LHC Small Area Transportation Study
Existing Speed Limits
FIGURE 4
NORTH
95
To Interstate 40 and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
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Kiowa
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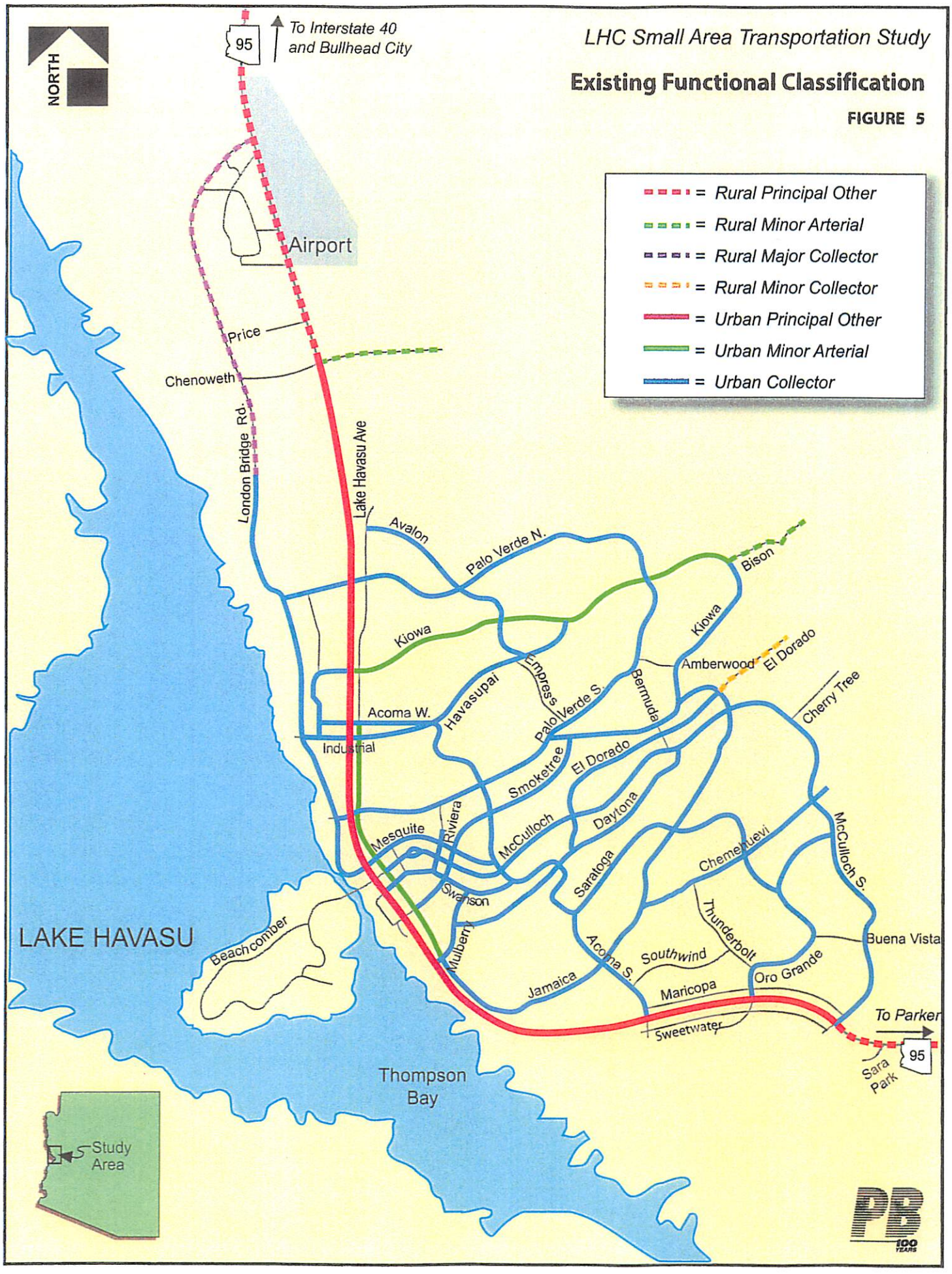
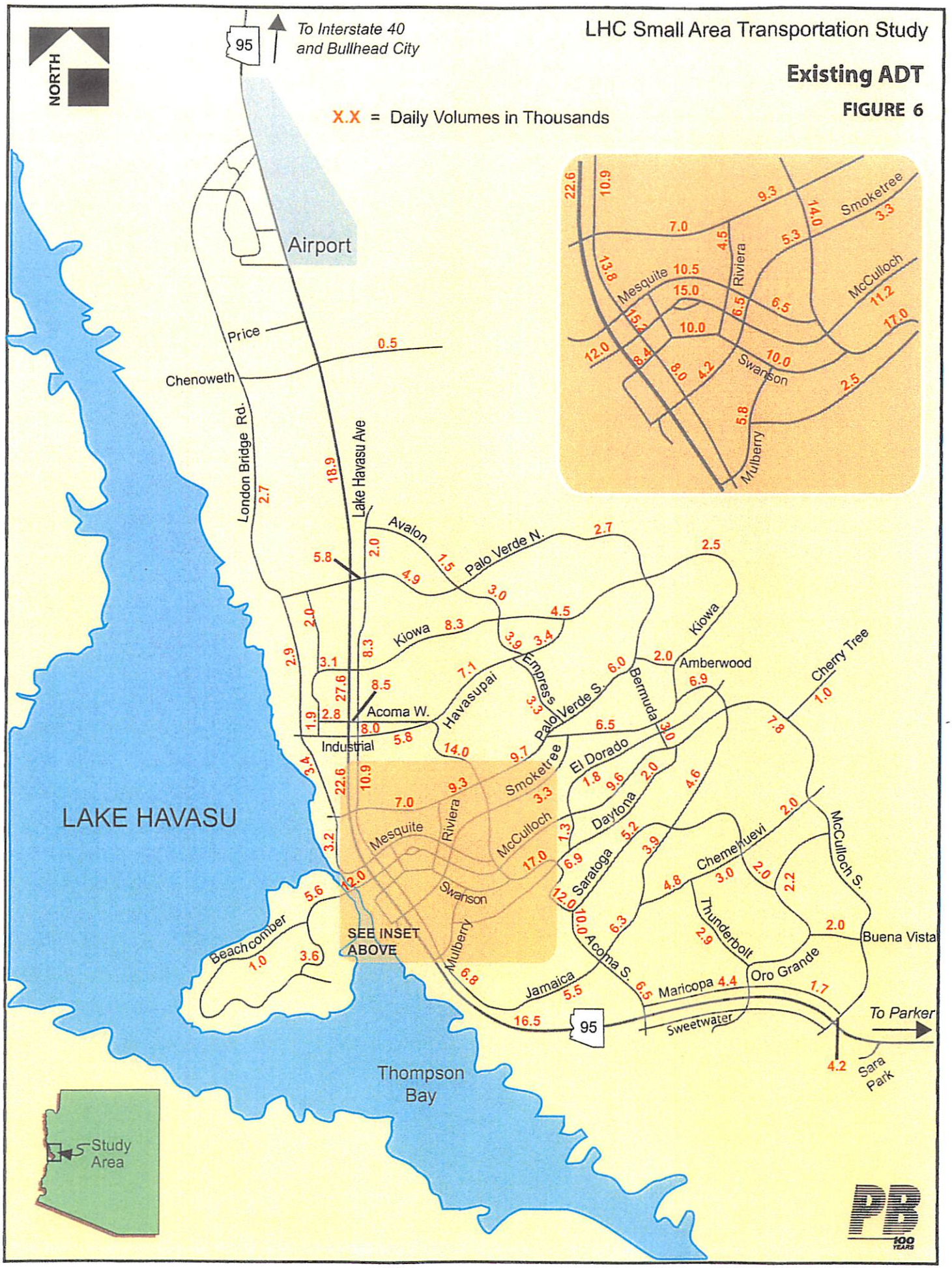
Palo Verde S.
Bermuda
Cherry Tree
Acoma W.
Industrial
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Beachcomber
LAKE HAVASU
Acoma S.
Southwind
Oro Grande
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
Thompson Bay
Study Area
= 25 MPH
= 30 MPH
= 35 MPH
= 45 MPH
= 55 MPH
= 65 MPH
PB
100 YEARS


LHC Small Area Transportation Study
Existing Functional Classification
FIGURE 5
NORTH
95
To Interstate 40 and Bullhead City
= Rural Principal Other
= Rural Minor Arterial
= Rural Major Collector
= Rural Minor Collector
= Urban Principal Other
= Urban Minor Arterial
= Urban Collector
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Bison
Kiowa
Kiowa
Amberwood
El Dorado
Cherry Tree
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
Smoketree
El Dorado
Daytona
Mesquite
Riviera
McCulloch
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Beachcomber
Acoma S.
Southwind
Oro Grande
Jamaica
Maricopa
Sweetwater
To Parker
95
Sara Park
LAKE HAVASU
Thompson Bay
Study Area
PB
100 YEARS


LHC Small Area Transportation Study
Existing ADT
FIGURE 6
X.X = Daily Volumes in Thousands
NORTH
To Interstate 40 and Bullhead City
95
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Saratoga
Swanson
Mulberry
Chemehuevi
McCulloch S.
Thunderbolt
Buena Vista
Oro Grande
Acoma S.
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
Beachcomber
SEE INSET ABOVE
LAKE HAVASU
Thompson Bay
Study Area
PB 100 YEARS

## E. Operating Conditions

A review of existing traffic conditions included an analysis of road segment traffic operations. The results of the analysis are expressed in terms of level of service (LOS). Level of service (LOS) is the term used to describe the degree of traffic congestion.

The various levels of service range from A to F with A being the best operating conditions and F being the worst operating conditions. LOS is generally defined as follows:

- **Level of Service A** represents free flow.
- **Level of Service B** is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable.
- **Level of Service C** is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream.
- **Level of Service D** represents high-density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience.
- **Level of Service E** represents operating conditions at or near the capacity level. All speeds are reduced to a low but relatively uniform value.
- **Level of Service F** is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point.

The following section present the analysis of the traffic conditions along roadway segments (daily traffic).

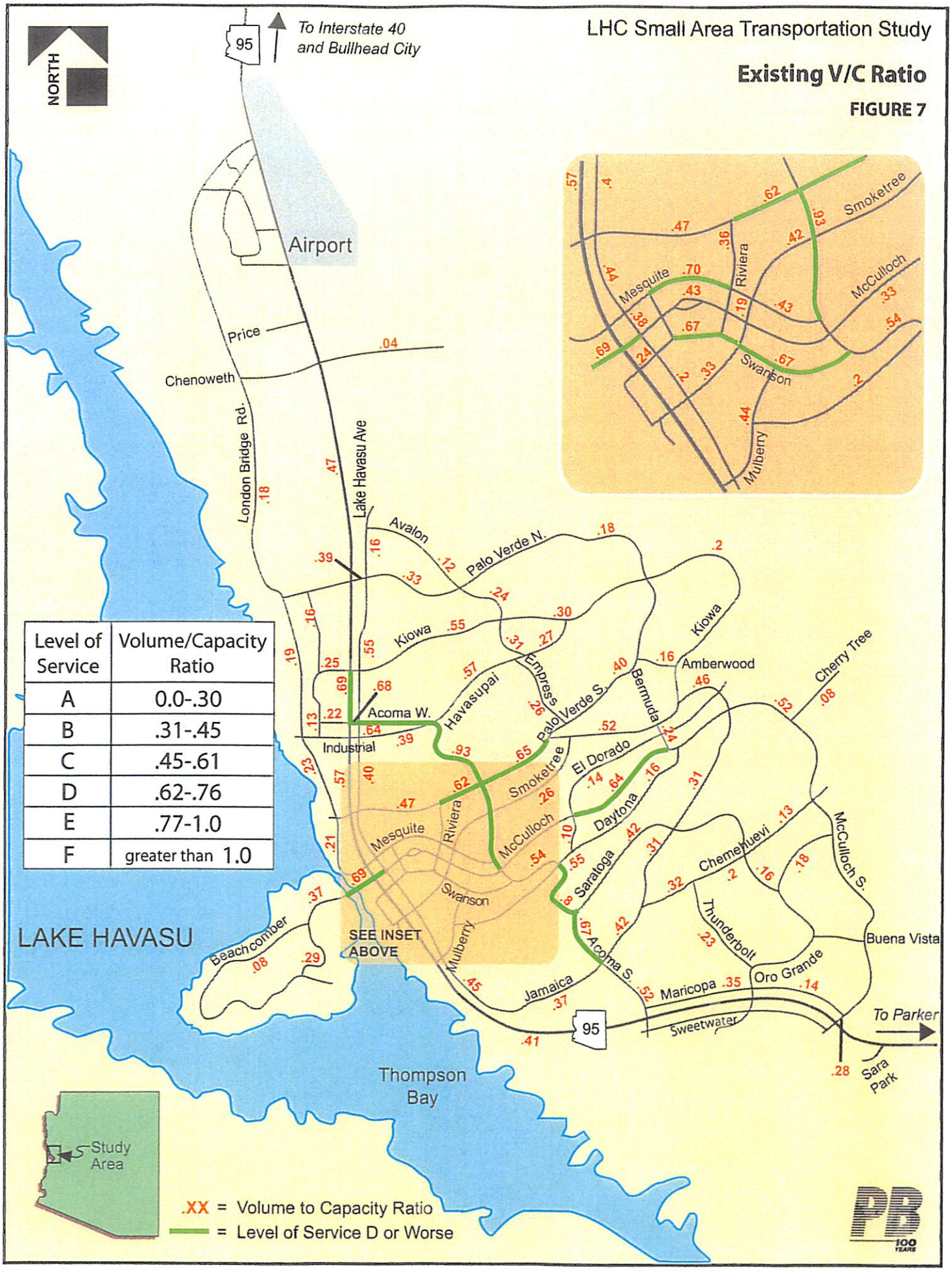
## Roadway Segments

To examine the operating conditions of arterial street segments, the daily traffic volumes are compared to LOS D volumes for various types of roadway as shown in Table 7. If these standards are exceeded on a roadway, travel speeds are greatly reduced and the ability to pass is restricted.

**TABLE 7**
**ROADWAY SEGMENT DAILY VOLUMES FOR LOS D and CAPACITY**
**(Vehicles per day)**

| ROADWAY | LANES | DAILY VOLUME at LOS D | DAILY VOLUME at capacity |
|---|---|---|---|
| collector | 2 through lanes | 10,000 | 12,500 |
| arterial | 2 through & center left turn lane | 12,000 | 15,000 |
| arterial | 4 through & center left turn lane | 25,000 | 31,250 |
| arterial | 4 through & a median | 27,500 | 34,375 |
| State highway | 4 lanes & a center left turn lane | 32,000 | 40,000 |

Based on the existing street system, the current traffic volume forecasts were compared to the volumes listed in Table 6. Segments with volumes exceeding the standards are identified as deficiencies and are shown in Figure 7.




| Level of Service | Volume/Capacity Ratio |
|---|---|
| A | 0.0-.30 |
| B | .31-.45 |
| C | .45-.61 |
| D | .62-.76 |
| E | .77-1.0 |
| F | greater than 1.0 |

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# IV. FUTURE CONDITIONS

The Lake Havasu City area population and employment has steadily increased over the last fourteen years. The impact of this growth on the transportation system needs to be quantified so that necessary improvements can be identified and programmed for implementation.

The horizon year for this transportation study is 2030.

## A. Growth Forecasts

The primary measure of growth used in this study was population and employment. The current population of the Lake Havasu City area is 52,205 and there are 23,305 people employed there. The population and employment in the study area is tabulated by traffic analysis zones (TAZs) for use in the travel forecasting model.

Population and employment forecasts for the year 2030 are based on information presented in the Lake Havasu City General Plan as well as input from City staff. The estimated population for the horizon year is 103,804. The future employment was estimated using a similar employment to population ratio as exists today as well as input from City staff. The estimated future employment is 42,760 people. The General Plan was used to allocate the employment increase in the City.

Overall, population growth is spread throughout the City with the north and northeast areas showing a high percentage increase. Employment increases are expected throughout the City with no one area of concentration. The projected population and employment by TAZ is shown in Table 8.

## B. Planned Street System

In order to perform an analysis of future traffic operations, a future base street system must be established. The future base street system for this analysis assumes that the existing street system is maintained and there are no additions.

## TABLE 8
## BUILD OUT POPULATION AND EMPLOYMENT

| TAZ | POPULATION | EMPLOYMENT | | | |
|---|---|---|---|---|---|
| | | Retail | General | Office | Total |
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 2517 | 75 | 50 | 75 | 200 |
| 4 | 1139 | 0 | 0 | 0 | 0 |
| 5 | 1262 | 25 | 25 | 25 | 75 |
| 6 | 1587 | 50 | 75 | 25 | 150 |
| 7 | 432 | 25 | 0 | 0 | 25 |
| 8 | 271 | 0 | 0 | 0 | 0 |
| 9 | 1626 | 25 | 25 | 0 | 50 |
| 10 | 1239 | 0 | 75 | 0 | 75 |
| 11 | 2462 | 25 | 25 | 25 | 75 |
| 12 | 23 | 300 | 250 | 200 | 750 |
| 13 | 21 | 50 | 50 | 0 | 100 |
| 14 | 19 | 450 | 200 | 100 | 750 |
| 15 | 1951 | 100 | 25 | 25 | 150 |
| 16 | 1151 | 50 | 150 | 75 | 275 |
| 17 | 6593 | 0 | 75 | 110 | 185 |
| 18 | 2039 | 25 | 50 | 25 | 100 |
| 19 | 1406 | 25 | 75 | 0 | 100 |
| 20 | 50 | 100 | 100 | 50 | 250 |
| 21 | 165 | 450 | 450 | 350 | 1250 |
| 22 | 5 | 625 | 250 | 125 | 1000 |
| 23 | 408 | 350 | 150 | 150 | 650 |
| 24 | 0 | 75 | 75 | 25 | 175 |
| 25 | 5 | 300 | 350 | 100 | 750 |
| 26 | 269 | 200 | 300 | 50 | 550 |
| 27 | 327 | 100 | 200 | 50 | 350 |
| 28 | 14 | 150 | 100 | 75 | 325 |
| 29 | 1499 | 1750 | 1750 | 300 | 3800 |
| 30 | 211 | 250 | 250 | 50 | 550 |
| 31 | 0 | 250 | 75 | 25 | 350 |
| 32 | 188 | 50 | 400 | 100 | 550 |
| 33 | 1086 | 350 | 500 | 300 | 1150 |

## TABLE 8 (continued)
## BUILD OUT POPULATION AND EMPLOYMENT

| TAZ | POPULATION | EMPLOYMENT | | | |
|---|---|---|---|---|---|
| | | Retail | General | Office | Total |
| 34 | 1422 | 550 | 150 | 150 | 850 |
| 35 | 2044 | 25 | 25 | 25 | 75 |
| 36 | 1032 | 25 | 25 | 25 | 75 |
| 37 | 499 | 25 | 0 | 0 | 25 |
| 38 | 2348 | 25 | 25 | 50 | 100 |
| 39 | 1176 | 300 | 150 | 50 | 500 |
| 40 | 2336 | 300 | 100 | 25 | 425 |
| 41 | 2223 | 0 | 25 | 0 | 25 |
| 42 | 1455 | 100 | 25 | 25 | 150 |
| 43 | 3246 | 0 | 100 | 0 | 100 |
| 44 | 188 | 25 | 75 | 50 | 150 |
| 45 | 1986 | 25 | 50 | 75 | 150 |
| 46 | 557 | 75 | 100 | 75 | 250 |
| 47 | 5 | 75 | 150 | 50 | 275 |
| 48 | 930 | 100 | 125 | 75 | 300 |
| 49 | 0 | 100 | 50 | 50 | 200 |
| 50 | 0 | 500 | 100 | 100 | 700 |
| 51 | 930 | 600 | 100 | 75 | 775 |
| 52 | 0 | 200 | 75 | 50 | 325 |
| 53 | 7 | 450 | 125 | 125 | 700 |
| 54 | 0 | 125 | 25 | 50 | 200 |
| 55 | 0 | 500 | 0 | 50 | 550 |
| 56 | 0 | 150 | 150 | 300 | 600 |
| 57 | 0 | 150 | 50 | 100 | 300 |
| 58 | 513 | 325 | 175 | 75 | 575 |
| 59 | 12 | 300 | 75 | 50 | 425 |
| 60 | 2 | 350 | 600 | 175 | 1125 |
| 61 | 951 | 0 | 50 | 50 | 100 |
| 62 | 807 | 50 | 50 | 0 | 100 |
| 63 | 506 | 50 | 100 | 75 | 225 |
| 64 | 500 | 225 | 25 | 25 | 275 |
| 65 | 1596 | 25 | 25 | 0 | 50 |
| 66 | 500 | 200 | 25 | 0 | 225 |

## TABLE 8 (continued)
## BUILD OUT POPULATION AND EMPLOYMENT

| TAZ | POPULATION | EMPLOYMENT | | | |
|---|---|---|---|---|---|
| | | Retail | General | Office | Total |
| 67 | 0 | 200 | 300 | 25 | 525 |
| 68 | 610 | 0 | 125 | 25 | 150 |
| 69 | 0 | 50 | 50 | 50 | 150 |
| 70 | 28 | 350 | 225 | 50 | 625 |
| 71 | 2 | 175 | 100 | 25 | 300 |
| 72 | 334 | 275 | 1700 | 200 | 2175 |
| 73 | 218 | 175 | 300 | 25 | 500 |
| 74 | 7 | 300 | 525 | 125 | 950 |
| 75 | 800 | 0 | 125 | 25 | 150 |
| 76 | 155 | 50 | 50 | 50 | 150 |
| 77 | 1176 | 0 | 25 | 0 | 25 |
| 78 | 290 | 0 | 0 | 0 | 0 |
| 79 | 856 | 275 | 275 | 175 | 725 |
| 80 | 3327 | 300 | 25 | 0 | 325 |
| 81 | 2322 | 375 | 300 | 150 | 825 |
| 82 | 408 | 175 | 100 | 25 | 300 |
| 83 | 1218 | 100 | 25 | 25 | 150 |
| 84 | 1582 | 0 | 100 | 0 | 100 |
| 85 | 2420 | 25 | 100 | 50 | 175 |
| 86 | 2703 | 0 | 25 | 25 | 50 |
| 87 | 2169 | 0 | 0 | 0 | 0 |
| 88 | 399 | 0 | 150 | 25 | 175 |
| 89 | 858 | 0 | 100 | 25 | 125 |
| 90 | 1898 | 50 | 75 | 25 | 150 |
| 91 | 1169 | 600 | 50 | 50 | 700 |
| 92 | 543 | 25 | 0 | 25 | 50 |
| 93 | 501 | 0 | 0 | 0 | 0 |
| 94 | 364 | 75 | 50 | 25 | 150 |
| 95 | 728 | 250 | 150 | 450 | 850 |
| 96 | 1046 | 25 | 25 | 25 | 75 |
| 97 | 986 | 0 | 50 | 0 | 50 |
| 98 | 1703 | 50 | 100 | 50 | 200 |
| 99 | 1782 | 25 | 0 | 0 | 25 |

**TABLE 8 (continued)**
**BUILD OUT POPULATION AND EMPLOYMENT**

| TAZ | POPULATION | EMPLOYMENT | | | |
|---|---|---|---|---|---|
| | | Retail | General | Office | Total |
| 100 | 2745 | 0 | 0 | 0 | 0 |
| 101 | 1907 | 25 | 25 | 25 | 75 |
| 102 | 200 | 0 | 50 | 0 | 50 |
| 103 | 500 | 50 | 25 | 25 | 100 |
| 104 | 500 | 25 | 25 | 25 | 75 |
| 105 | 500 | 50 | 25 | 25 | 100 |
| 106 | 500 | 25 | 25 | 25 | 75 |
| 107 | 500 | 100 | 50 | 50 | 200 |
| 108 | 500 | 25 | 25 | 25 | 75 |
| 109 | 500 | 50 | 25 | 25 | 100 |
| 110 | 1350 | 25 | 25 | 25 | 75 |
| 111 | 500 | 75 | 75 | 50 | 200 |
| 112 | 250 | 75 | 50 | 75 | 200 |
| 113 | 476 | 200 | 225 | 225 | 650 |
| 114 | 9 | 0 | 700 | 100 | 800 |
| 115 | 766 | 0 | 50 | 50 | 100 |
| 116 | 250 | 50 | 0 | 0 | 50 |
| 117 | 250 | 50 | 200 | 100 | 350 |
| 118 | 13 | 2000 | 0 | 250 | 2250 |
| 119 | 500 | 0 | 25 | 0 | 25 |
| 120 | 500 | 175 | 225 | 100 | 500 |
| 121 | 250 | 50 | 75 | 25 | 150 |
| **TOTAL** | **103,804** | **19,150** | **16,175** | **7,435** | **42,760** |

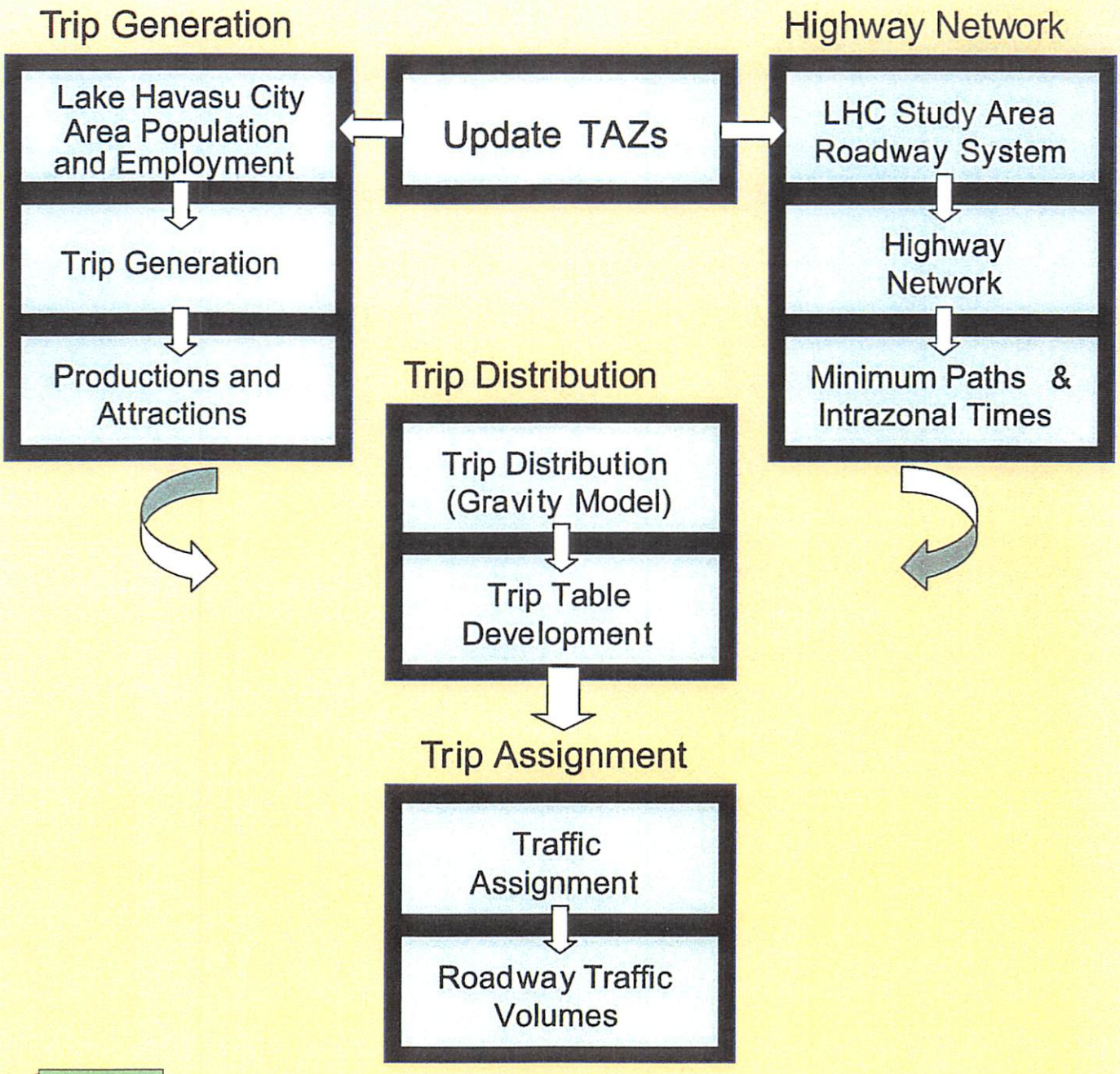
## C. Travel Forecasting Model

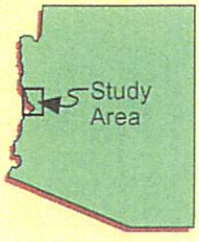
The transportation modeling procedure involves a number of steps. A flow chart summary of the process is presented in Figure 8. To begin with, there are two distinct sets of tasks to be performed which provide the input to a third set. One set involves the compilation of land use data and trip generation rates for the study

NORTH

**Travel Forecasting Process**

**FIGURE 8**



area. This information is then used to calculate trip productions and attractions for each zone.

The other set of concurrent tasks which need to be completed includes the identification of the street system to be included in the model and the development of the highway network to represent the street system. The network data includes the TAZs (traffic analysis zones), street segment lengths, speed, and capacity. Using the street segment lengths and speeds in the network, the minimum time paths between zones are determined.

The productions and attractions for each zone and the minimum paths between zones are used as the inputs to the third set of tasks, the trip distribution and assignment process. Trip distribution is accomplished using a mathematical model. The most commonly used distribution model is the gravity model which assumes that the attraction of trips between zones is inversely proportional to the distance between zones. The result of the gravity model is a trip table which is a matrix of all trips distributed to/from each zone. These trips are then assigned to the street system, via the minimum paths (based on time) to produce traffic forecasts for the network.

## Model Calibration

Before the transportation model can be used to forecast traffic volumes, the model's representation of existing traffic conditions must be validated. The first step was to convert the 1997 model from TRANPLAN to TP+ and to develop the existing land use data for each zone. Then, trip generation, distribution and assignment are performed using the modeling software. The result is a loaded highway network with computer-simulated volumes.

The converted network was verified to make sure it properly represents the existing street system.

Trip generation rates were also derived from published sources and previous models developed for cities and towns in Arizona. From these rates, the total number of trips generated in each internal zone was calculated to identify the relative trip intensity of each of the zones. The rates were adjusted for the Lake Havasu City area to account for the tourist and seasonal population.

In addition to the trips generated by internal zones, the amount of traffic generated by the external zones needs to be estimated. External zones represent traffic entering and exiting the model area from outside the City's planning area. Traffic from external zones is distributed as through traffic to another external zone or as internal trips to a TAZ.

The traffic assignment was accomplished using a capacity restrained process. The capacity restrained assignment is an effort to replicate the actual traffic condition based on the capacity of the streets. If the volume on a road reaches capacity, the path times are re-calculated and the traffic is then re-assigned to the shortest time path.

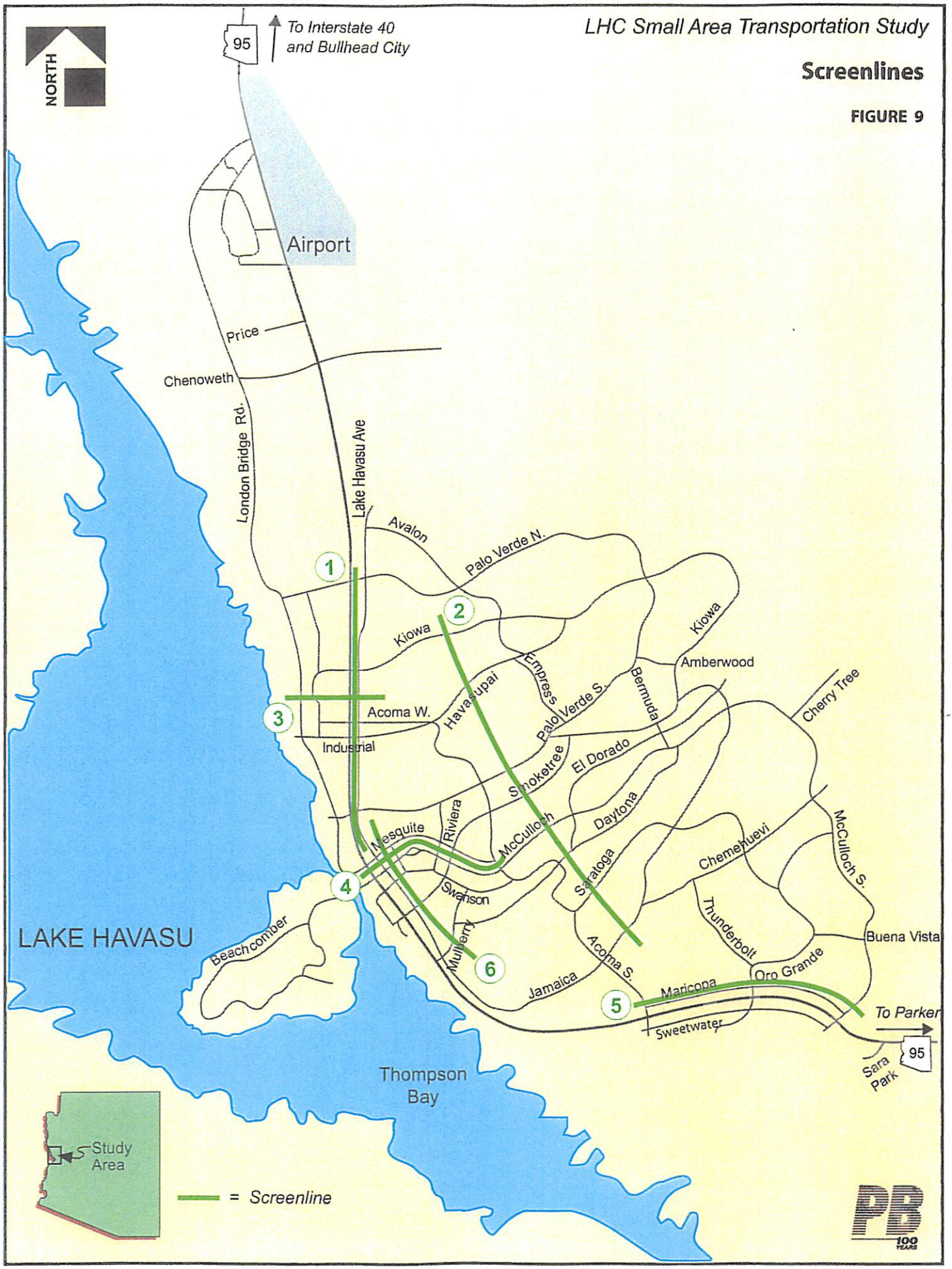
### Calibration Factors

The computer simulated volumes were compared to the existing traffic to determine how well the existing conditions were being simulated. A number of model parameters and factors can be adjusted to improve the simulation. This adjustment process is the calibration of the model. The factors which can be adjusted include the street segment speed and capacity, friction factors, and intrazonal trip times. The friction factors are used to define the effect that the distance between zones has on the relative attractiveness of trips between zones. The intrazonal trip times add time to the trip within a zone so that a certain percentage of trips must leave a zone to be satisfied.

Initially, coarse adjustments were made to the model to shift traffic and replicate travel patterns. Before "fine tuning" the volumes, an additional check was made of the overall traffic in the area using screenlines.

### Screenlines

Another means of analyzing traffic movement in an area is by examining volumes across screenlines. A screenline is an imaginary line across which all the traffic flows can be counted and summed. This technique provides a convenient means for examining major travel trends and removes the discrepancies that are inherent in model generated volumes on individual street segments. The screenlines used for this analysis are shown in Figure 9.


LHC Small Area Transportation Study
Screenlines
FIGURE 9
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Cherry Tree
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
El Dorado
Smoketree
Daytona
Mesquite
Riviera
McCulloch
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Beachcomber
Acoma S.
Jamaica
Maricopa
Oro Grande
Sweetwater
To Parker
95
Sara Park
LAKE HAVASU
Thompson Bay
Study Area
= Screenline
1
2
3
4
5
6
PB
100 YEARS

In the calibration process, screenlines are used to verify the total amount of traffic on area streets. If the total simulated traffic volume across a screenline is lower (or higher) than the existing traffic volumes, then a percentage adjustment is made to the computer simulated volumes across the screenline. This percentage is then applied to adjust the individual forecasts. The comparison between existing and simulated volumes indicates that the model results are reasonable and that existing volumes are being replicated well. As shown in Table 9, the simulation volumes across all but one of the screenlines are within 10 percent of existing traffic counts.

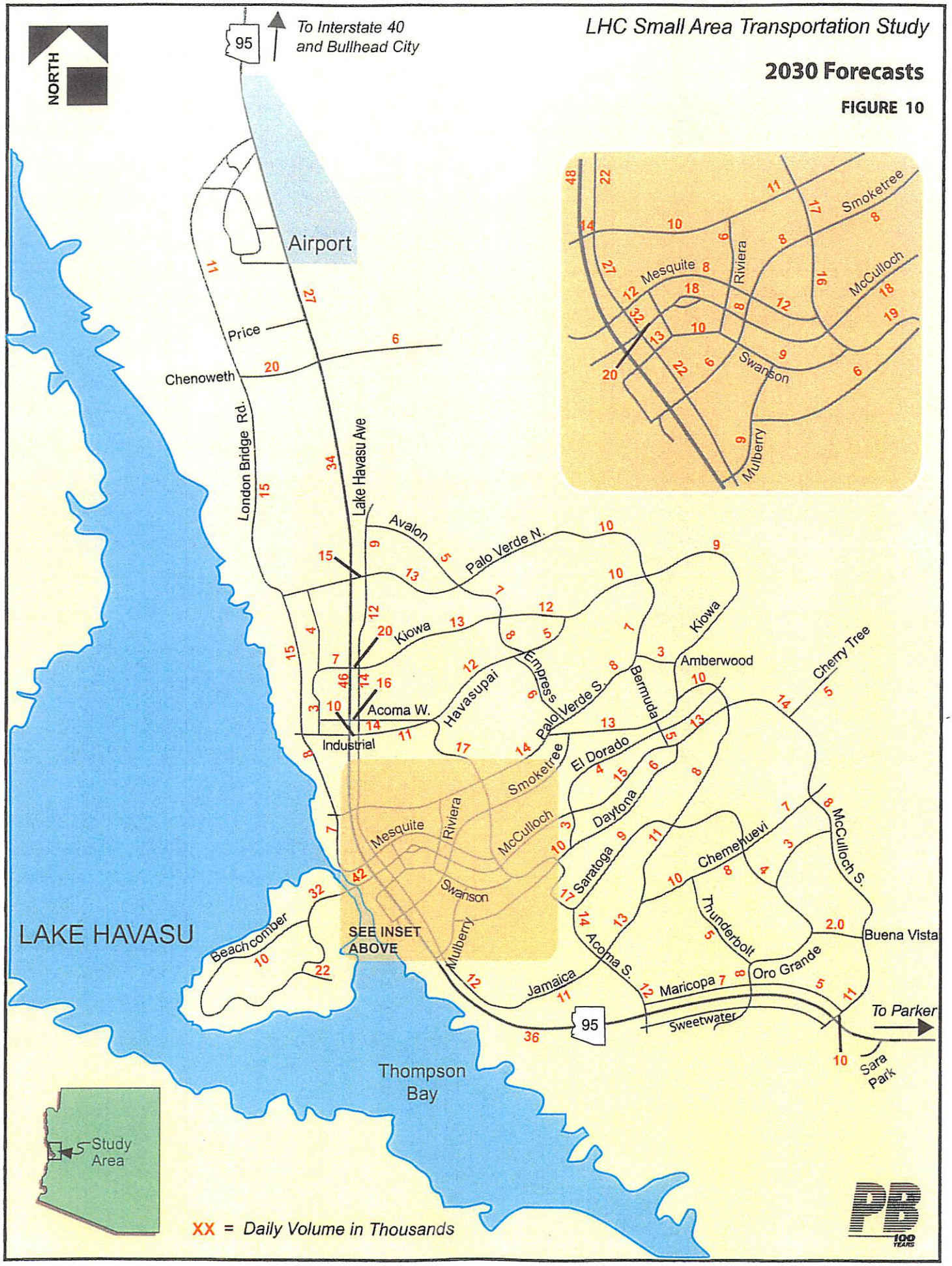
**TABLE 9**
**SCREENLINE COMPARISONS**
**Existing vs. Model**

| SCREENLINE | EXISTING DAILY VOLUMES | MODEL DAILY VOLUMES | MODEL/EXISTING |
|---|---|---|---|
| 1 | 35,500 | 38,500 | 1.08 |
| 2 | 58,000 | 63,200 | 1.09 |
| 3 | 40,000 | 39,800 | 1.00 |
| 4 | 63,800 | 68,100 | 1.07 |
| 5 | 14,700 | 18,000 | 1.22 |
| 6 | 45,000 | 43,000 | 0.96 |

## D. Travel Forecasts

With the travel forecasting model properly calibrated, traffic forecasts can be developed. The model input for the future condition was based on the population and employment data and the planned street system previously described. In addition, traffic at the external zones was increased to account for growth outside the study area. The volumes at the externals were increased by 50% in accordance with the Arizona Department of Economic Security population growth forecasts for the State and Mohave County.

The daily forecasts for the year 2030 are shown in Figure 10. The forecasts were derived from the model output and adjusted where appropriate. The


LHC Small Area Transportation Study
2030 Forecasts
FIGURE 10
NORTH
95
To Interstate 40 and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
El Dorado
Smoketree
Mesquite
Riviera
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Oro Grande
Acoma S.
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
Beachcomber
SEE INSET ABOVE
LAKE HAVASU
Thompson Bay
Study Area
XX = Daily Volume in Thousands
PB 100 YEARS

adjustments were made to account for known estimation errors in the model and remove discontinuities that are inevitable in model-generated numbers.

As expected, the daily traffic volumes on the street system throughout the study are expected to increase between 2004 and 2030. It should be noted that the traffic forecasts are based on the assumption that the growth rate and development presented in the "Growth Forecasts" section occur by 2030.

In 2030, the highest traffic forecasts are projected for segments of SR 95, Lake Havasu Avenue, and McCulloch Boulevard. Specifically, SR 95 between Acoma and Kiowa would carry 46,000 vehicles per day, Lake Havasu Avenue would carry 32,000 vehicles per day between Mesquite and Swanson, and the bridge onto the island would carry 42,000 vehicles per day. London Bridge Road also shows significant percentage increases from 4,000 vehicles per day to 15,000 vehicles per day.

Screenlines can also be used to examine the location and amount of traffic growth in the area. Table 10 lists the existing traffic count and the 2030 forecasts for each screenline. To document overall traffic growth, the percent increase between existing and future is presented in the last column of the table.

As shown in the table, the highest growth is projected across screenlines number 1 and number 5.

**TABLE 10**
**TRAFFIC GROWTH ACROSS SCREENLINES**
Existing vs. 2030 Model

| SCREENLINE | EXISTING DAILY VOLUMES | 2030 FORECAST VOLUMES | % increase |
|---|---|---|---|
| 1 | 35,500 | 75,000 | 211% |
| 2 | 58,000 | 97,000 | 167% |
| 3 | 40,000 | 75,000 | 188% |
| 4 | 63,800 | 102,000 | 160% |
| 5 | 14,700 | 31,000 | 211% |
| 6 | 45,000 | 60,000 | 133% |

# E. Operating Conditions

A review of future traffic conditions involved the analysis of projected road segment traffic operations. The results of the analysis are expressed in terms of level of service (LOS) as previously described in Chapter II.

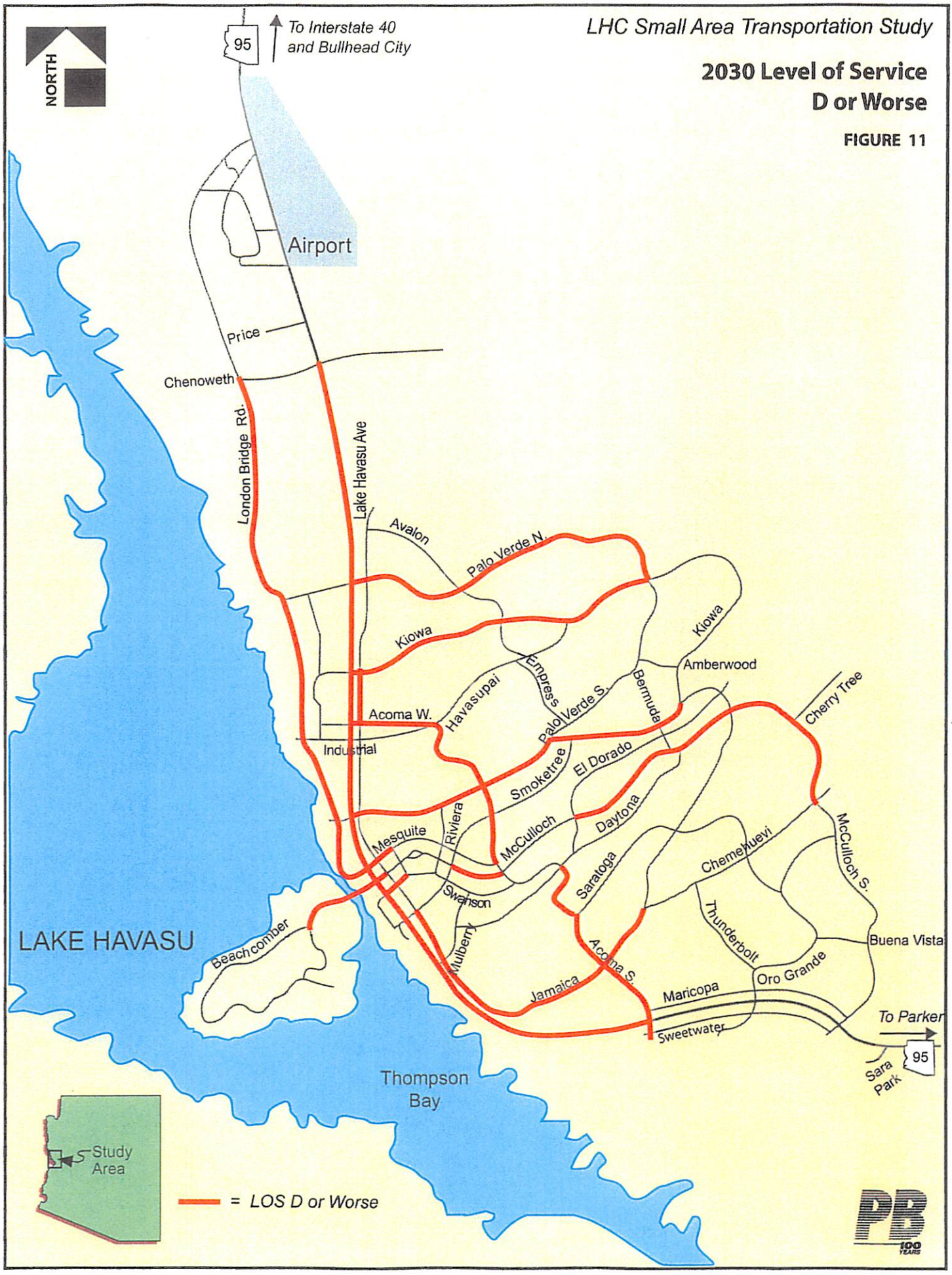
The following section present the analysis of the traffic conditions along roadway segments (daily traffic).

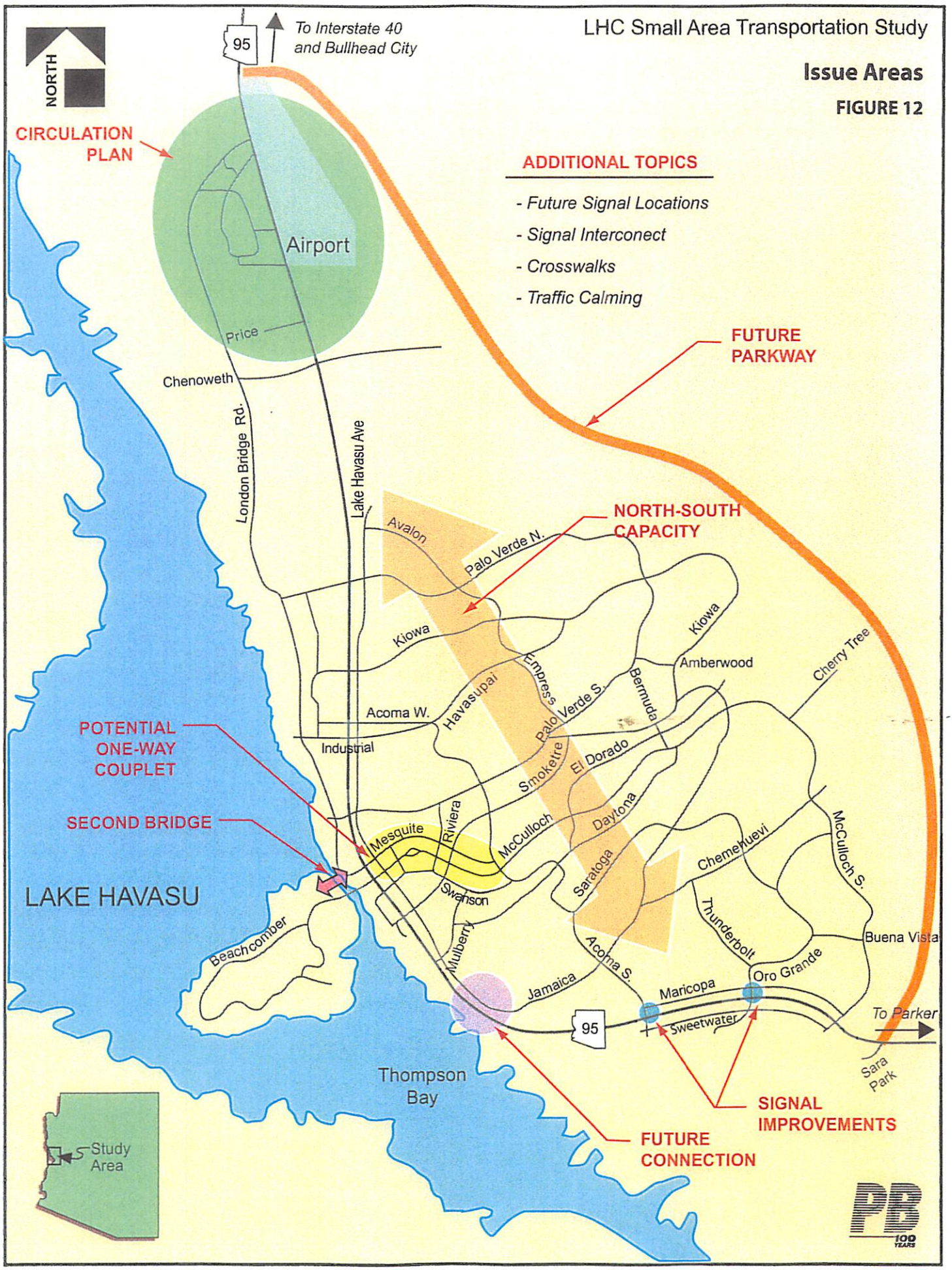
## Roadway Segments

To examine the operating conditions of arterial street segments, the daily traffic volumes are compared to LOS D volumes for various types of roadway as previously shown in Table 7. If these standards are exceeded on a roadway, travel speeds are greatly reduced and the ability to pass is restricted.

The 2030 forecasts were compared to the volumes for Level of Service D. Roadway segments that are projected to have LOS D or worse are shown in Figure 11. A review of the figure indicates that approximately 38 miles of roadways are expected to be at LOS D or worse by 2030.

In addition to the level of service evaluation, a number of other mobility and circulation issues were identified for study. These are summarized in Figure 12.


LHC Small Area Transportation Study
2030 Level of Service
D or Worse
FIGURE 11
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Empress
Havasupai
Palo Verde S.
Bermuda
Cherry Tree
Acoma W.
Industrial
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Oro Grande
Acoma S.
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
95
LAKE HAVASU
Beachcomber
Thompson Bay
Study Area
= LOS D or Worse
PB


LHC Small Area Transportation Study
Issue Areas
FIGURE 12
NORTH
To Interstate 40 and Bullhead City
95
CIRCULATION PLAN
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
ADDITIONAL TOPICS
- Future Signal Locations
- Signal Interconect
- Crosswalks
- Traffic Calming
FUTURE PARKWAY
NORTH-SOUTH CAPACITY
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Cherry Tree
Havasupai
Empress
Palo Verde S.
Bermuda
Acoma W.
Industrial
POTENTIAL ONE-WAY COUPLET
Smoketre
El Dorado
SECOND BRIDGE
Mesquite
Riviera
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
LAKE HAVASU
Swanson
Thunderbolt
Buena Vista
Beachcomber
Mulberry
Acoma S.
Oro Grande
Jamaica
Maricopa
To Parker
95
Sweetwater
Sara Park
Thompson Bay
SIGNAL IMPROVEMENTS
FUTURE CONNECTION
Study Area
PB
100 YEARS

LAKE HAVASU CITY, ARIZONA
INCORPORATED 1978

# V. ALTERNATIVES AND ANALYSIS

According to the City's General Plan, at build out, Lake Havasu City will double in population and employment. With this growth, comes an increase in traffic volumes and a decrease in mobility and accessibility. The traffic forecasts and operating conditions were presented in the previous chapter. In addition, comments and concerns have been received from the public. This chapter presents potential improvements and additions to the street system to address the projected growth and transportation concerns.

## A. Evaluation Measures

The evaluation measures are a list of factors that should be considered in the review of a potential improvement project. The measures are not all quantifiable; some are purely qualitative. The measures are included in the project descriptions to identify potential benefits, impacts, and constraints. More detailed analysis of the measures would be required during the concept development and design phase of a project. The criteria and their means of measurement are described below.

### Cost

Construction cost estimates will be calculated for each potential improvement. The costs are planning level costs based on a unit cost for each project type. The cost is calculated in 2004 dollars and has not been adjusted for inflation. Costs are a major factor in establishing priorities for improvements and are used to compare to available revenue.

### Right of Way Impacts

The need for new right of way for an improvement should be determined as early as possible in the project development process since the acquisition of right of way typically takes longer than the design and construction. This is a qualitative measure that identifies if additional right of way is needed for a project.

### Building Acquisitions

This is a quantitative measure that documents the number of buildings expected to be acquired as part of the improvement. The number is a conservative estimate at the planning stage.

### Relief of Congestion

Relief of congestion is a quantitative measure that compares the base condition level of service with the LOS after the improvement. This measure gives an indication of the overall impact of the improvement on the area transportation system.

### Traffic Service

This is a measure of the projected traffic volumes that an improvement is expected to attract. The description of each improvement will include the daily traffic volume.

### Mobility and Accessibility

This is a qualitative measure of the project's ability to improve the circulation in an area and provide access for new developments. It will be measured in terms of improved travel time between activity centers.

### Engineering Challenges

There can be unique conditions that must be overcome in order to develop a feasible project. These often require special design features in order to construct a project. Engineering challenges are identified in the project descriptions so that they can be used in the prioritization of projects. Engineering challenges could include drainage patterns, terrain, railroad crossings, and utilities.

## B. Description of Cross Sections

The following section describes the features of the street cross sections that will be considered in the evaluation of the potential improvements.

THREE LANE CROSS SECTION

The three-lane cross section provides one travel lane in each direction with a center two way left turn lane. The cross section can include bike lanes, curb,

gutter, and sidewalk. If curb, gutter, and sidewalk are not provided, 8' shoulders would be. At a major intersection, this cross section could be widened to provide one left turn lane, two through lanes, and one right turn lane on each approach, if warranted by the traffic volumes.

The suggested right of way for this cross section is 80 feet. The estimated construction cost for one mile of this cross section would vary as described below.

- With curb, gutter, and sidewalk, no bike lanes $1.6 million per mile
- With curb, gutter, sidewalk, and bike lanes $1.8 million per mile
- With shoulders $1.0 million per mile

FIVE LANE CROSS SECTION

The five-lane cross section provides two travel lanes in each direction with a center two way left turn lane. The cross section includes curb, gutter, and sidewalk and may or may not have bike lanes. If curb, gutter, and sidewalk are not provided, 8' shoulders would be. At a major intersection, this cross section could be widened to provide two left turn lanes, two through lanes, and one right turn lane on each approach, if warranted by the traffic volumes.

The suggested right of way for this cross section is 100 feet. The estimated construction cost for one mile of this cross section would vary as described below.

- With curb, gutter, and sidewalk, no bike lanes $2.1 million per mile
- With curb, gutter, sidewalk, and bike lanes $2.3 million per mile

FOUR LANE DIVIDED CROSS SECTION

The four-lane divided cross section provides two travel lanes in each direction with a 4' inside shoulder and an 8' outside shoulder. At a major intersection, this cross section could be widened to provide two left turn lanes, two through lanes, and one right turn lane on each approach, if warranted by the traffic volumes.

The suggested right of way for this cross section is 200 feet. The estimated construction cost for one mile of this cross section would be $2.2 million per mile.

## C. Potential Improvements

A number of potential improvements have been developed to accommodate future traffic, improve accessibility to all parts of the City, to improve mobility within and through the City, and to provide opportunity for development.

Mesquite/Swanson One-Way Streets

This option would convert both Mesquite and Swanson to one-way streets. Mesquite was evaluated as one-way in the westbound direction and Swanson in the eastbound direction. The direction of travel could be reversed if it is more conducive to local businesses and provides a more logical terminus.

According to the Institute of Transportation Engineers (ITE) Traffic Engineering Handbook, the capacity of each street should be equal. Additionally, the one-way pair should be adjacent streets, although systems with two-way parallel streets in between operate satisfactorily. Given the proximity of Mesquite, McCulloch, and Swanson, and the familiarity of the users; the one-way operation should be understood.

One-way streets, which are generally used to increase the capacity of the roadway network, may also improve safety. An intersection of a one-way street with a two-way street has significantly fewer conflict points than the intersection of two two-way streets. One way streets can also reduce vehicle/pedestrian conflicts.

Advantages of one-way streets include:

- Reduced intersection delay
- Reduced travel time
- Improved bus operations
- Improved signal progression
- Potential for on-street parking

Disadvantages of one-way streets include:

- Perception that business is negatively impacted
- Transition from one-way to two-way

Mesquite and Swanson were coded into the traffic model as one-way streets to assess the traffic impact. Two variations were examined. One was to extend the one-way from Lake Havasu Avenue to Smoketree and one was to extend the one-way from Lake Havasu Avenue to Acoma.

There is little difference in the traffic impacts of the two options. Mesquite and Swanson would each carry 7,000 to 8,000 vehicles per day in the future. The impact on adjacent streets is shown on Figures13 and 14 for the two options. The volume on McCulloch increases 1,000 to 5,000 vehicles per day compared to the future base. The volume on Lake Havasu Avenue increases 2,000 to 3,000 between Smoketree and South Palo Verde.

The capacity of a three lane street with one lane in each direction plus a two way left turn lane is 13,900 vehicles per day. The level of service D service volume is 10,600 vehicles per day. The total level of service D volume of Mesquite and Swanson with the existing lane configuration is 21,200 vehicles per day. The capacity of a three lane one-way street is 18,800 vehicles per day. The level of service D service volume is 14,300 vehicles per day. The total level of service D volume of Mesquite and Swanson with the one-way lane configuration would be 28,600 vehicles per day.

The cost to convert Mesquite and Swanson from two-way streets to one-way streets is $25,000. The cost includes removal of existing pavement markings, new pavement markings and new signs. There is no right of way required and traffic service is improved.

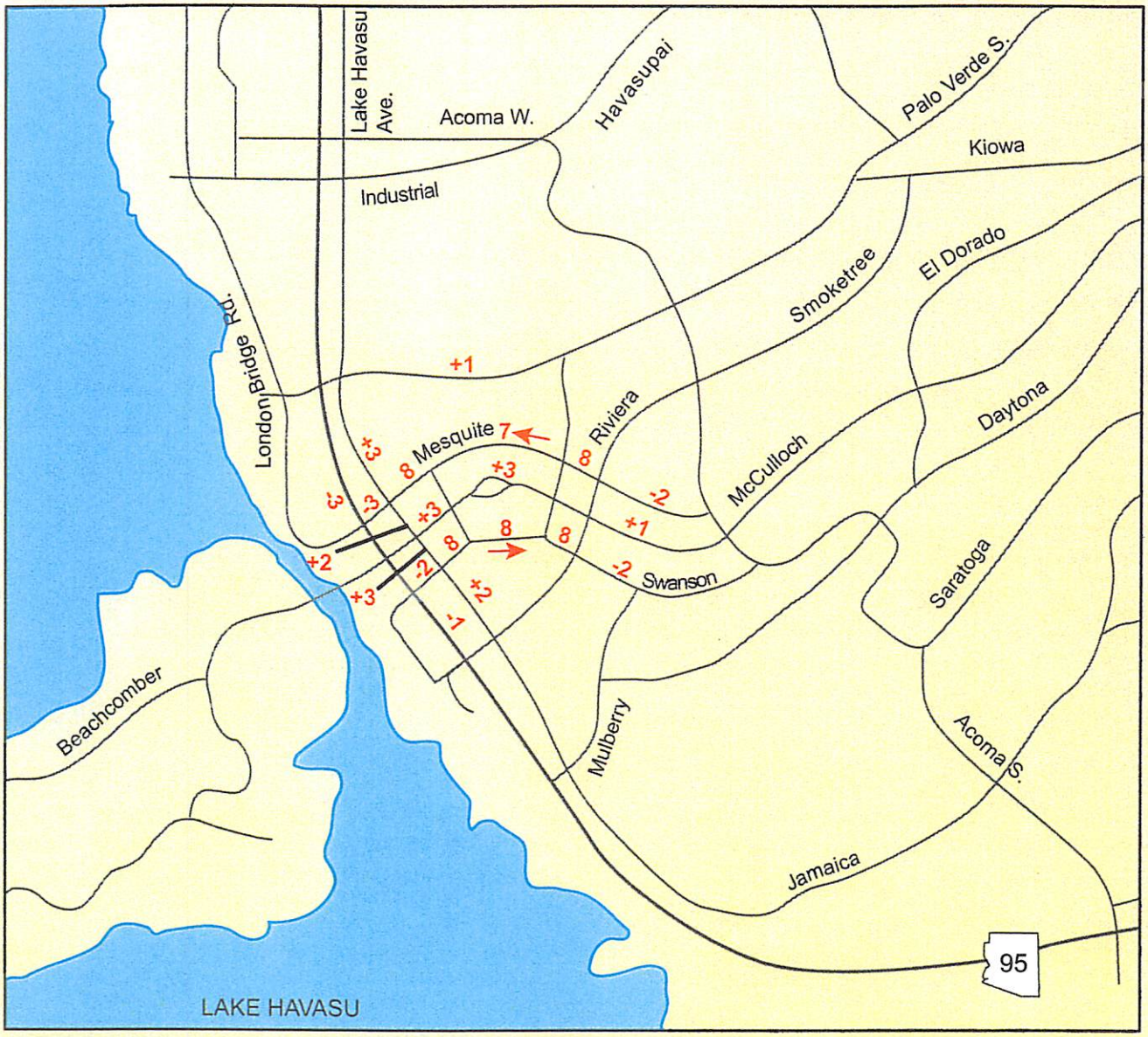
Another option that was discussed was the restriping/reconstruction of both Mesquite and Swanson to provide two lanes in one direction, a center left turn lane and one lane in the other direction. Initial review indicates that this configuration would provide similar capacity to the one-way couplet option. Advantages include the additional capacity. Disadvantages include cost and the elimination of on-street parking.

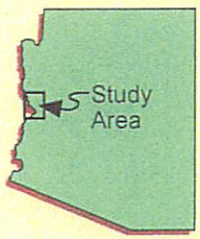
It is the TAC's recommendation that this lane configuration is implemented in the near future and the one-way couplet option is studied for the long term.

NORTH

## Mesquite/Swanson One-Way
## Lake Havasu to Smoketree

**FIGURE 13**



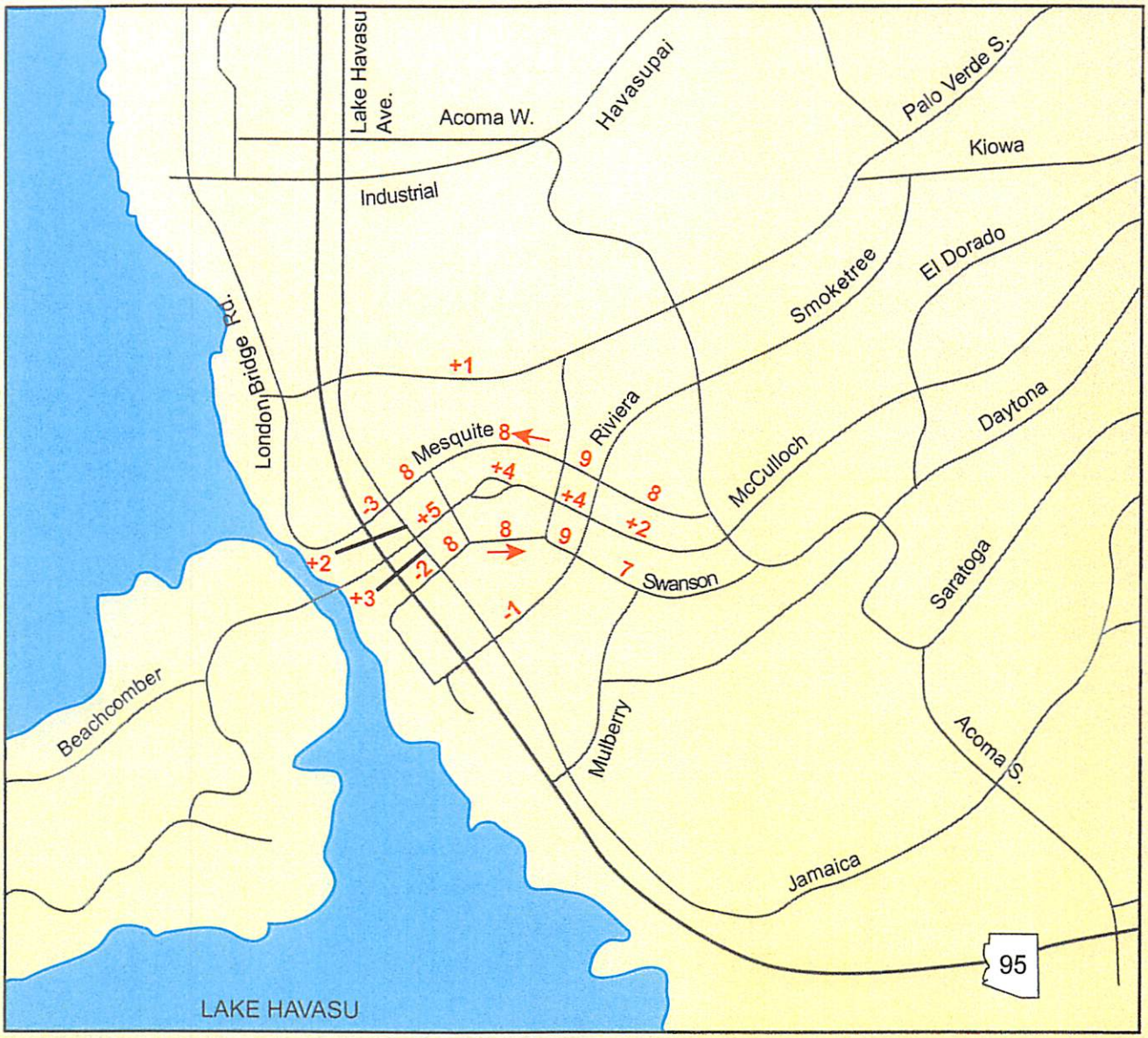

XX = *Traffic Forecast*

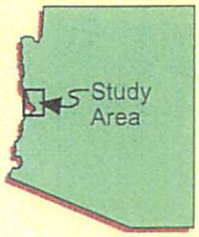
+/- XX = *Change Compared to Base Forecast*

NORTH

## Mesquite/Swanson One-Way
## Lake Havasu to Acoma

**FIGURE 14**




XX = *Traffic Forecast*

+/- XX = *Change Compared to Base Forecast*

Lake Havasu Avenue Extension and North Area Circulation

With this option, several new streets are added to the north area including extending Lake Havasu Avenue north 1.75 miles to Chenoweth and extending Chenoweth east about 1.75 miles. An unnamed north-south street would extend from North Palo Verde to Chenoweth, approximately 1.9 miles and an unnamed east-west street would extend from SR 95 east, then turn southeast and connect to Cherry Tree, a distance of six miles. It should be noted that this last street is also a portion of the Parkway which is discussed elsewhere.

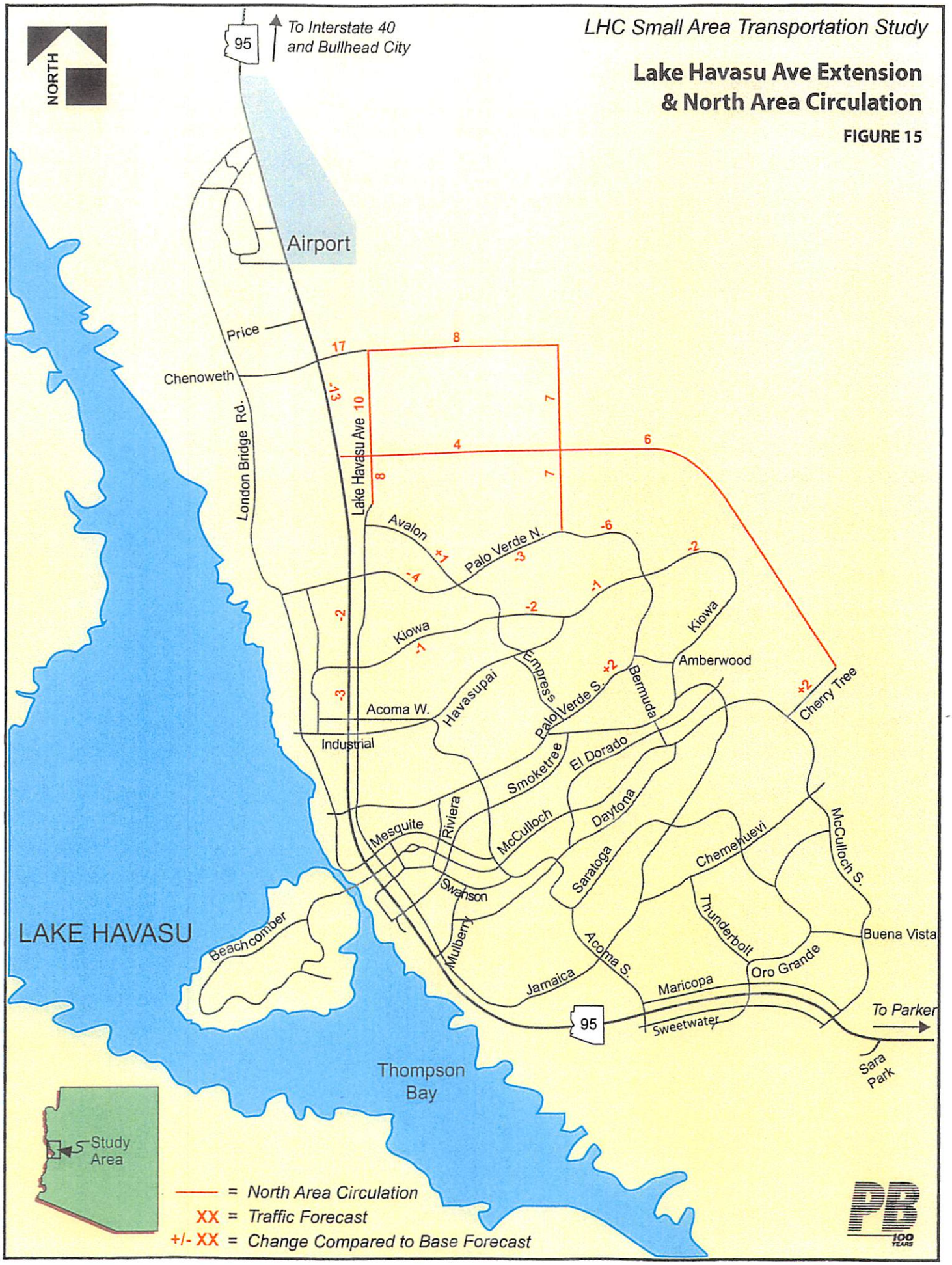
These new streets were coded into the traffic model to evaluate the impact of these additional streets. As can be seen in Figure 15, Chenoweth would carry 8,000 to 17,000 vehicles per day and the Lake Havasu Avenue extension would carry 8,000 to 10,000 vehicles per day. The traffic volume on SR 95 would be reduced 13,000 vehicles per day between North Palo Verde and Chenoweth. Other reductions from 1,000 to 4,000 would occur on North Palo Verde and Kiowa.

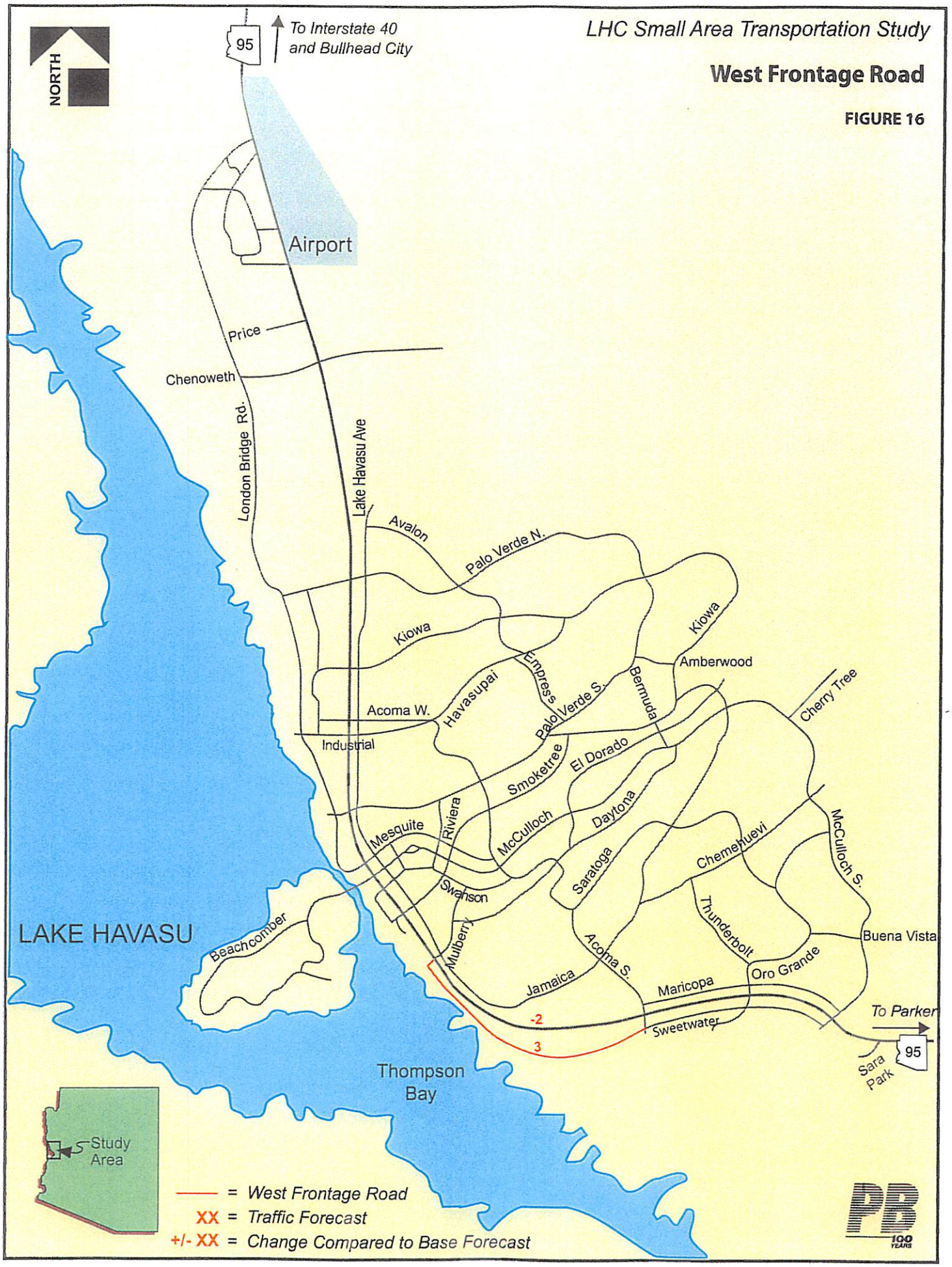
The cost for the north area streets if they are all constructed as three lane streets is $19.4 million. New right of way is required, but it is expected that much of it will be dedicated as new development occurs. One to two residences may be impacted with the extension of Lake Havasu Avenue. Traffic congestion on the north end of SR 95 is greatly alleviated with this improvement. Mobility and accessibility is enhanced by providing new access to the airport.

West Frontage Road

The West Frontage Road alternative is a new roadway that connects Sweetwater at Acoma South to Mulberry following the SR 95 alignment. The primary purpose of this alternative is to provide access to potential development on the west side of SR 95 so that access does not have to be provided from SR 95. This alternative was coded into the travel forecasting model as a three lane roadway. The traffic impact of this alternative is shown in Figure 16. This portion of the West Frontage Road would divert about 3,000 vehicles per day from SR 95.

The cost for the West Frontage Road with curb, gutter, and sidewalk would be $3.6 million. New right of way is required, but it is expected that much of it will be dedicated as new development occurs. No buildings will be impacted. The West Frontage Road will have little or no impact on traffic congestion, but will improve mobility by limiting access onto SR 95.


LHC Small Area Transportation Study
Lake Havasu Ave Extension
& North Area Circulation
FIGURE 15
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Cherry Tree
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Oro Grande
Acoma S.
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
Beachcomber
LAKE HAVASU
Thompson Bay
Study Area
= North Area Circulation
XX = Traffic Forecast
+/- XX = Change Compared to Base Forecast
PB
100 YEARS


LHC Small Area Transportation Study
West Frontage Road
FIGURE 16
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Empress
Havasupai
Palo Verde S.
Bermuda
Cherry Tree
Acoma W.
Industrial
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
McCulloch S.
Chemehuevi
Saratoga
Swanson
Thunderbolt
Buena Vista
LAKE HAVASU
Beachcomber
Mulberry
Acoma S.
Oro Grande
Jamaica
Maricopa
To Parker
-2
3
Sweetwater
95
Sara Park
Thompson Bay
Study Area
= West Frontage Road
XX = Traffic Forecast
+/- XX = Change Compared to Base Forecast
PB
100 YEARS

2nd Bridge Terminus

The City continues to study the location and features of the 2nd Bridge to the island. The 2nd Bridge is planned north of the existing London Bridge. As part of this study, two alternate termini for the bridge were examined. One option is to connect the crossing to London Bridge Road and one option is to connect the bridge to SR 95.

These two options were coded into the travel forecasting model for comparison. The results are presented in Figures 17 and 18. When the crossing connects to SR 95, slightly more traffic (2,000 vehicles per day) uses the second crossing compared to the connection to London Bridge Road. When the second crossing connects to London Bridge Road, traffic increases 1,000 to 4,000 vehicles per day compared to no impact when to SR 95.

North-South Corridor

In this central area of the City, the streets are curvilinear. Many of the local roads in the street system are discontinuous and do not connect between arterials. Traffic cannot follow a direct path to its destination, thus creating circuitous trips.

As the area continues to grow, traffic volumes within the center of the City will continue to increase as previously shown in the 2030 traffic forecasts. Acoma Boulevard provides an access route through the center of the City. However, it is curvilinear and its capacity is limited by existing residential development frontage with driveways directly onto the roadway.

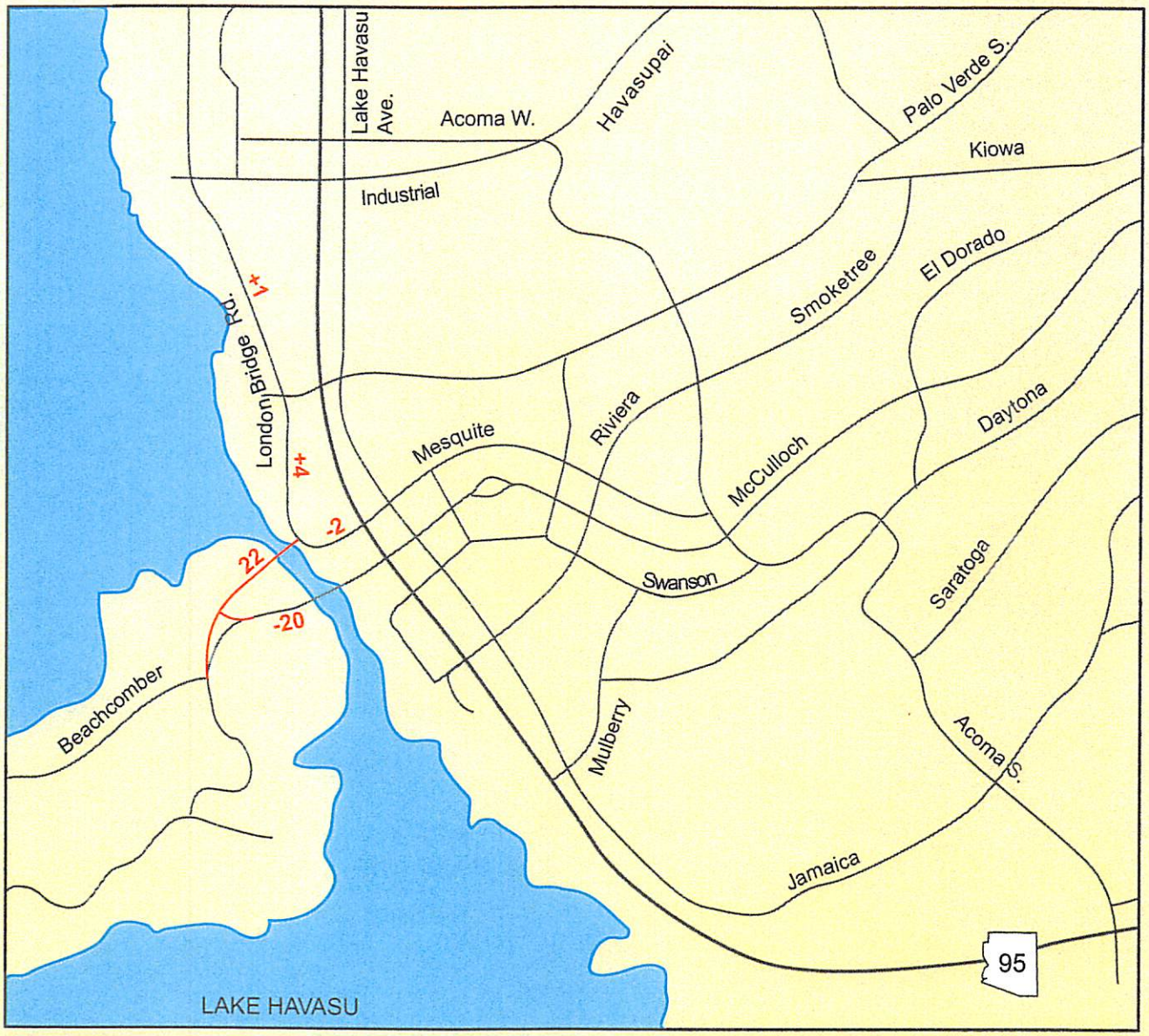
The proposed North-South Corridor would extend from SR 95 east of the Sara Park entrance to north of the Airport. The Corridor, which follows a northwesterly diagonal route, is approximately 17 miles long.

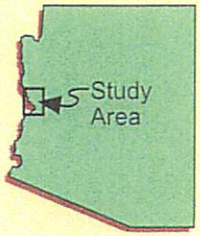
Existing land uses along the southern half of the Corridor is primarily residential. The northern half is currently undeveloped. The General Plan indicates that future land uses would be residential, employment, and open space.

NORTH

## 2nd Bridge Connection to London Bridge Rd.

**FIGURE 17**




—— = *2nd Bridge Connection*

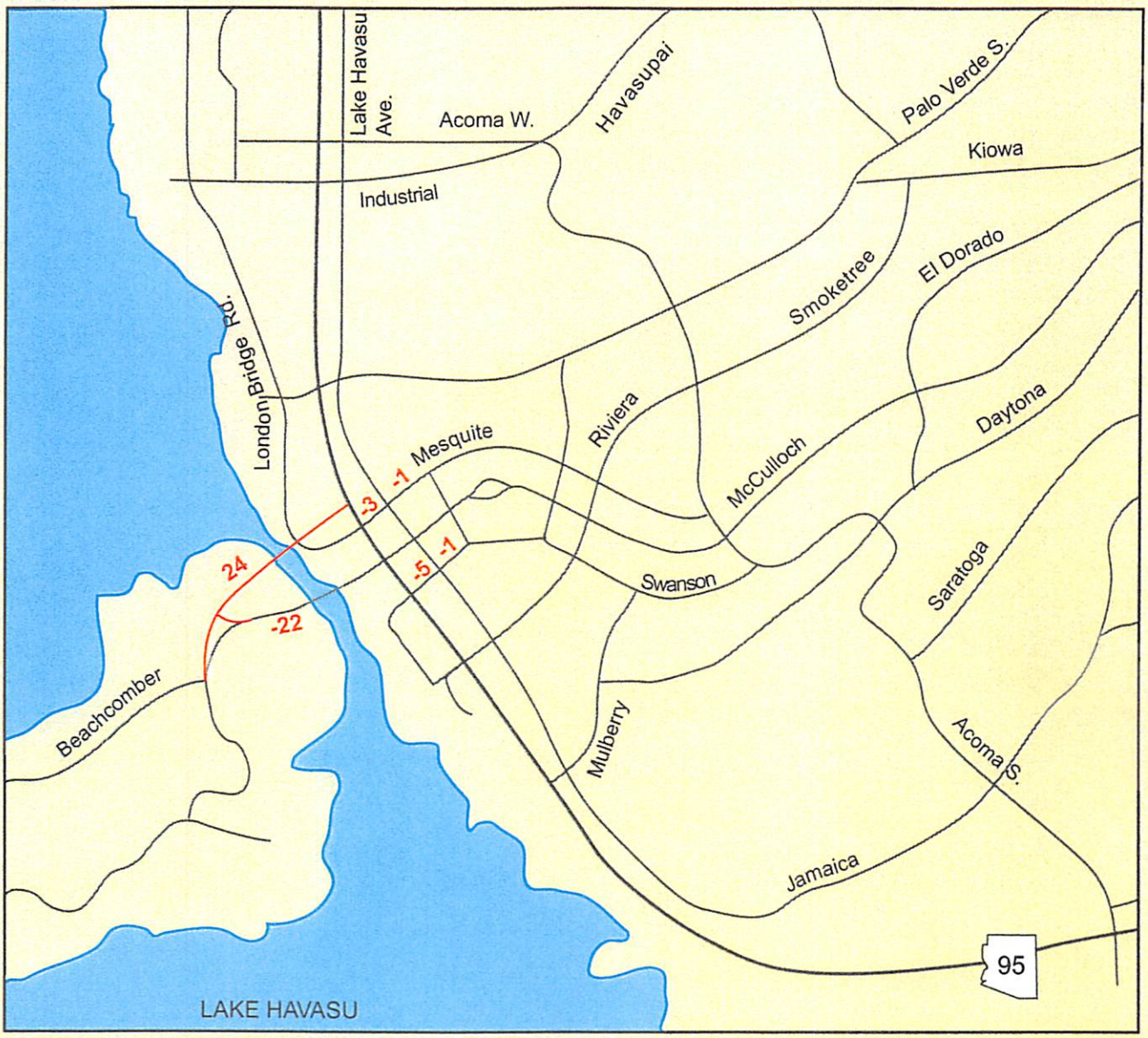
XX = *Traffic Forecast*

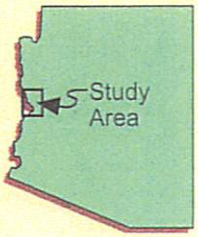
+/- XX = *Change Compared to Base Forecast*

PB 100 YEARS

## 2nd Bridge Connection to SR 95

**FIGURE 18**




—— = *2nd Bridge Connection*

XX = *Traffic Forecast*

+/- XX = *Change Compared to Base Forecast*

The Corridor was input to the travel forecasting model to evaluate traffic demand and impacts. The Corridor forecasts are shown in Figure 19. The daily traffic on the North-South Corridor is expected to range from 14,000 to 35,000 vehicles. According to the model forecasts, the Corridor will reduce traffic volumes on several area streets including Lake Havasu Avenue, SR 95, South McCulloch, and London Bridge Road.

Development of this corridor would require the elimination of 40 - 45 crossings or the incorporation of these crossing (and associated delays) in to the corridor. The proposed Corridor would have a limited number of access points as shown on the figure. This preliminary plan shows access points at South McCulloch (2), Chemehuevi, Kiowa, Palo Verde, and Chenoweth.

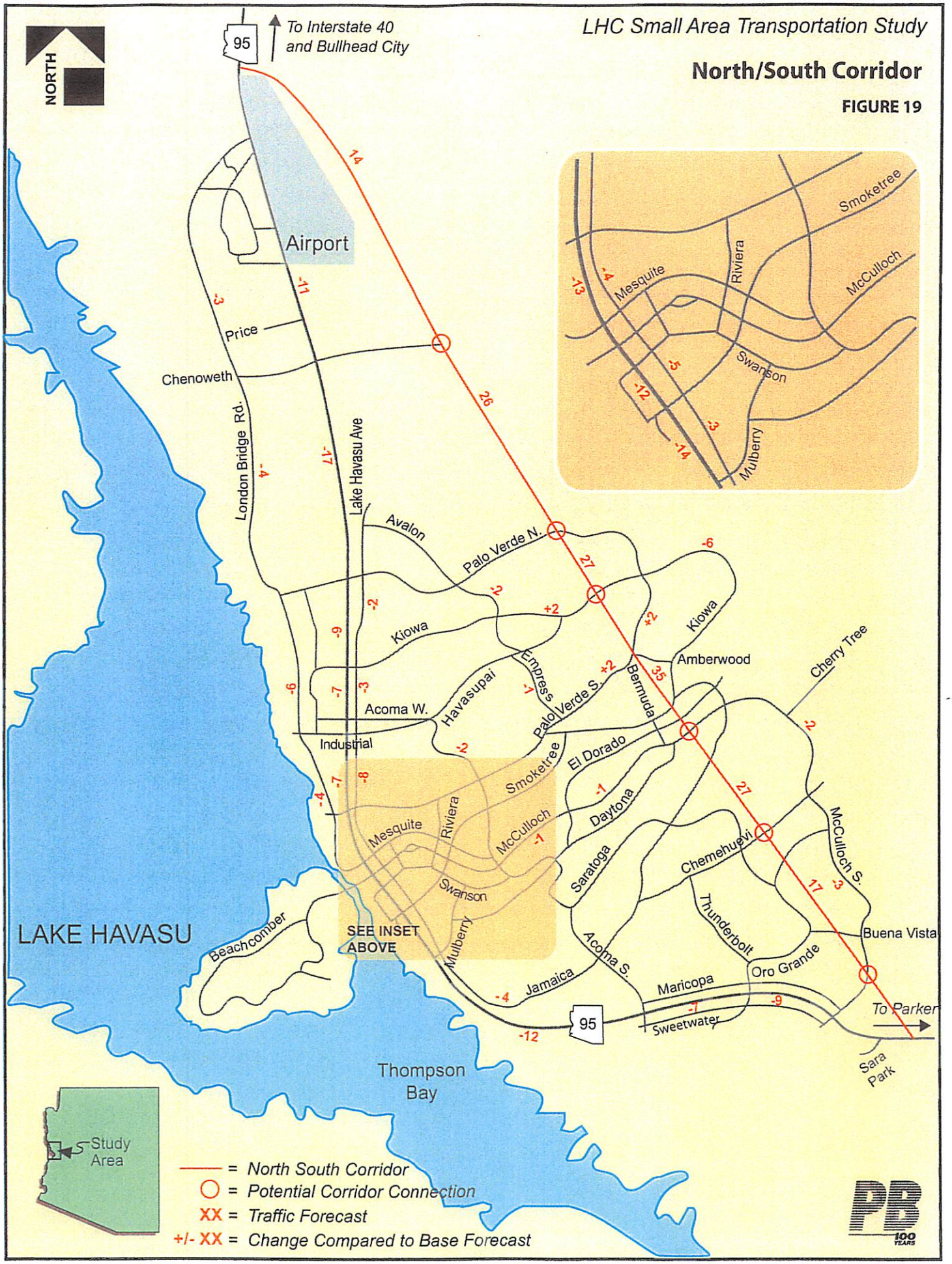
Approximately 200 acres of right of way would have to be acquired including 110 houses. The construction cost of the Corridor is estimated to be $40 million.

Parkway

In the current street system, SR 95 is the only continuous route through the study area. The Parkway is a proposed north-south roadway that would function as a major arterial on the eastside of the study area. It would provide an alternative to SR 95 for traffic that is not destined to properties or developments on the west side of the City. The ultimate roadway width would have two through lanes in each direction with a two-way center left turn lane or a raised median. A raised median would provide a measure of access control beneficial to a major arterial.

The proposed Parkway would extend from SR 95 near the Sara Park entrance north to SR 95 north of the Lake Havasu City Airport. The Parkway location has been initially identified as following a north-south route from SR 95 on the south end to approximately ten miles north. At this point it turns west and follows an east-west alignment for five miles. At a point, two miles east of SR 95 the roadway turns north on a diagonal route parallel to the runway connecting to SR 95 north of the Airport. The roadway would be approximately 21 miles in length.

At the south end of the corridor, the land is a developing area with new residential subdivisions planned. As the Parkway turns to the west, the land is largely undeveloped. The Parkway would provide access to this area and allow for


LHC Small Area Transportation Study
North/South Corridor
FIGURE 19
NORTH
To Interstate 40 and Bullhead City
95
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Havasupai
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Acoma W.
Industrial
Smoketree
El Dorado
Mesquite
Riviera
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Swanson
Mulberry
Thunderbolt
Buena Vista
Beachcomber
SEE INSET ABOVE
Acoma S.
Jamaica
Oro Grande
Maricopa
Sweetwater
To Parker
Sara Park
LAKE HAVASU
Thompson Bay
Study Area
= North South Corridor
= Potential Corridor Connection
XX = Traffic Forecast
+/- XX = Change Compared to Base Forecast
PB 100 YEARS

additional developments. The General Plan indicates that future land uses would include employment, commercial developments and open space. Continuing to the north, it would serve as an additional access to the Airport and surrounding industrial development.

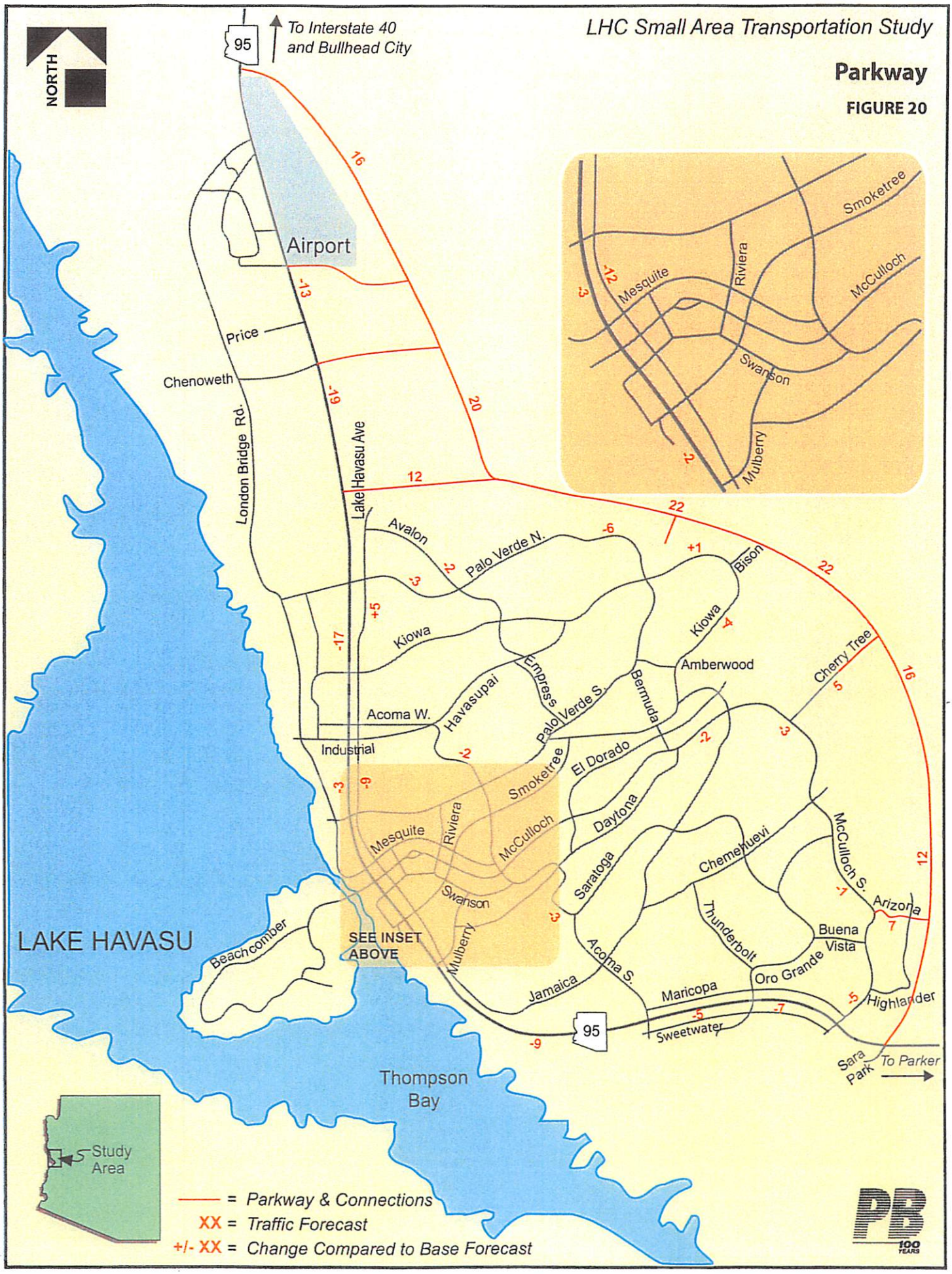
The Parkway is proposed to be a limited access facility with access provided at several defined intersections. Local street access is being shown at Arizona Boulevard, Cherry Tree Boulevard, the MCC/BLM Park Area northwest of Bison, Chenoweth, and the Airport Industrial Park Roadway. Two new streets are also proposed as part of the corridor plan to provide indirect access to SR 95 to the Parkway. One roadway would continue from the east-west segment of the Parkway and intersect SR 95 north of the wash approximately one-half mile north of the SR 95/North Palo Verde intersection. The other new street would be an east-west roadway just south of the Airport property.

To examine the traffic impacts of a Parkway, this roadway was added to the street system in the travel forecasting model. The results are shown in Figure 20. It is important to remember that future land uses are included in the model and are inherent in the results. The 2030 daily traffic volumes on the Parkway are projected to range from 12,000 vehicles near the south end to 22,000 vehicles per day along the middle of the route.

The changes in traffic volumes on adjacent streets are also on the figure. A decrease in daily traffic volumes is expected to occur on SR 95, Lake Havasu Avenue, London Bridge Road, Palo Verde, Acoma Blvd and McCulloch Blvd South. The largest decrease in traffic is shown on SR 95 north of Kiowa with a decrease of 17,000 vehicles per day.

Approximately 380 acres of right of way is needed. Land ownership in the area includes private land owners, BLM, and the State Land Department. No building acquisitions would be required for the Parkway construction. The estimated cost of construction is $47 million.

Design considerations include drainage and environmental conditions. There are several watercourses that could cross the proposed Parkway alignment and would require pipes and box culverts to protect the roadway from the design year storm.


LHC Small Area Transportation Study
Parkway
FIGURE 20
NORTH
95
To Interstate 40 and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Bison
Amberwood
Cherry Tree
Acoma W.
Industrial
Havasupai
Empress
Palo Verde S.
Bermuda
El Dorado
Smoketree
Mesquite
Riviera
McCulloch
Daytona
Saratoga
Chemehuevi
McCulloch S.
Arizona
Buena Vista
Thunderbolt
Oro Grande
Swanson
Mulberry
Beachcomber
Jamaica
Acoma S.
Maricopa
Sweetwater
Highlander
Sara Park
To Parker
LAKE HAVASU
Thompson Bay
SEE INSET ABOVE
Study Area
= Parkway & Connections
XX = Traffic Forecast
+/- XX = Change Compared to Base Forecast
PB 100 YEARS

Construction segments would have to be five to six miles to develop usable segments. The Parkway could be built initially as two lanes until the demand warrants four through lanes.

The recommendation of the TAC is that the Parkway be developed as a limited access higher speed roadway. The intention of this recommendation is that this corridor would serve as a location for a long-range option for SR 95 with a width of six lanes. In this context, the minimum right-of-way necessary would be 200 feet plus any additional slope easements. In order to preserve the option for a state highway designation, the number of at-grade access points should be limited. Potential access points include SR 95, Arizona Boulevard, Cherry Tree Boulevard, the future northern park area, Chenoweth, and North of the Airport. At a maximum, intersections should be limited to one per two or more miles. This configuration would require developments to rely on frontage roads to provide direct access to their projects.

## D. Special Topics

A number of special topics were addressed during the course of the study. The topics included issues and concerns that affect the overall efficiency and safety of the transportation system. The topics may be addressed by modifying or establishing a policy that guides future projects and developments. The topics include speed limits, jake break noise/truck routes, crosswalks, mailbox placement, and traffic calming.

Speed Limits

Speed limits in the community were analyzed in conjunction with the Small Area Transportation Study (SATS) and presented to the Technical Advisory Committee (TAC). Speed studies completed over the last 8 years indicate that the majority of drivers are exceeding the posted speed limits but are driving in a safe manner as evidenced by a review of the accident data. Detailed explanations of speed limit signage and effects are included as a separate handout from this report.

It is proposed that the City's historical policy (as described in the Existing Conditions chapter) be supplemented by a more uniform application of engineering

judgment and field studies that also recognizes that growth and changes have occurred in the community. By raising the speed limits on those roadways found to be appropriate, we will bring our community more in compliance with accepted engineering and traffic safety guidelines. These changes would be done under the authority designated to the City in ARS 28-703.

**28-703. Alteration of speed limits by local authority.**

**A.** If a local authority determines on the basis of an engineering and traffic investigation that the maximum speed permitted under this article is greater or less than is reasonable or safe under the conditions found to exist on any part of a street or highway in its jurisdiction, the local authority may determine and declare a reasonable and safe maximum speed limit at the location and, based on the investigation, may:

1. Decrease the limit at intersections.
2. Increase the limit within any business or residence district to not more than sixty-five miles per hour.
3. Decrease the limit outside any business or residence district.
4. Increase or decrease the speed limit on streets adjacent to school grounds.

**B.** A local authority shall determine by an engineering and traffic investigation the proper maximum speed for all arterial streets in its jurisdiction and shall declare a reasonable and safe maximum limit on the arterial streets in its jurisdiction that may be more or less than the maximum speed permitted under this article for a business or residence district.

**C.** A local authority may decrease the limit to not less than fifteen miles per hour on an unpaved street or road within any district in its jurisdiction if the local authority determines that the limit is necessary to achieve or maintain national ambient air quality standards.

**D.** An altered limit established as provided for in this section is effective at all times, or during hours of darkness, or at other times as may be determined if appropriate signs giving notice of the altered limit are erected on the street or highway.

**E.** The alteration of maximum speed limits on state highways or extensions of state highways in a municipality by a local authority is not effective until the director approves the alteration.

**F.** A local authority shall not make more than six alterations per mile along a street or highway pursuant to this section, except for reduced

limits at intersections. The difference between adjacent limits shall not be more than ten miles per hour except for school crossings.

The SATS TAC recommends that the speed limits in Lake Havasu City be standardized to the largest extent possible by establishing a standard 35 MPH speed limit on all fully widened avenues and boulevards, subject to an engineering and traffic investigation. The preliminary data with regards to the 85$^{th}$ percentile speed on the majority of Lake Havasu City's roadways indicates that this finding is consistent with standard engineering procedures and the driving characteristics of the traveling public in our community.

When changes are proposed to a speed limit on a roadway, the following steps will be completed:

- a comprehensive review of the roadway geometrics will be completed to ensure that sight distance at intersections is maintained.
- a review of the accident data for the roadway will be completed. A current 85$^{th}$ percentile speed study will also be completed for that section of the roadway in which the speed limit is being changed.

Proposed changes include the standardization of a short 25 MPH zone near schools, the creation of a 30 MPH zone in heavier business/parking areas, the extension of the 35 MPH zone onto completed avenues, boulevards and the appropriate drives (after an engineering and traffic study) and the use of the 45 MPH zone on some rural type roadways such as London Bridge Road. Avenues, Boulevards, or Drives will not normally be signed for 35 MPH unless the majority of the roadway is widened.

The 30 MPH zone for use in business/parking areas will be limited to commercial areas that would normally be signed 35 MPH but due to a large amount of on street parking and pedestrian activity are being signed at the lower speed limit. If the 35 MPH zone is currently in place in a location and the accident data indicates no safety concerns exist, the speed limit will not be reduced to the lesser speed.

25 MPH Speed Limit Signs would normally be posted off of a higher speed zone roadway. 25 MPH Signs and School Signs would be placed on all roadways adjacent to a school. The 15 MPH School Zone Signs and crosswalks would only

be placed at locations that met the Arizona Department of Transportation School Zone warrants.

It is suggested that a public notification process be developed to provide citizen input to the proposed Speed Limit changes.

Preliminary data gathered indicates that the roadways listed in Table 11 are expected to meet the engineering and traffic studies criteria for speed limit changes. The recommended speed limits are also shown graphically in Figure 21.

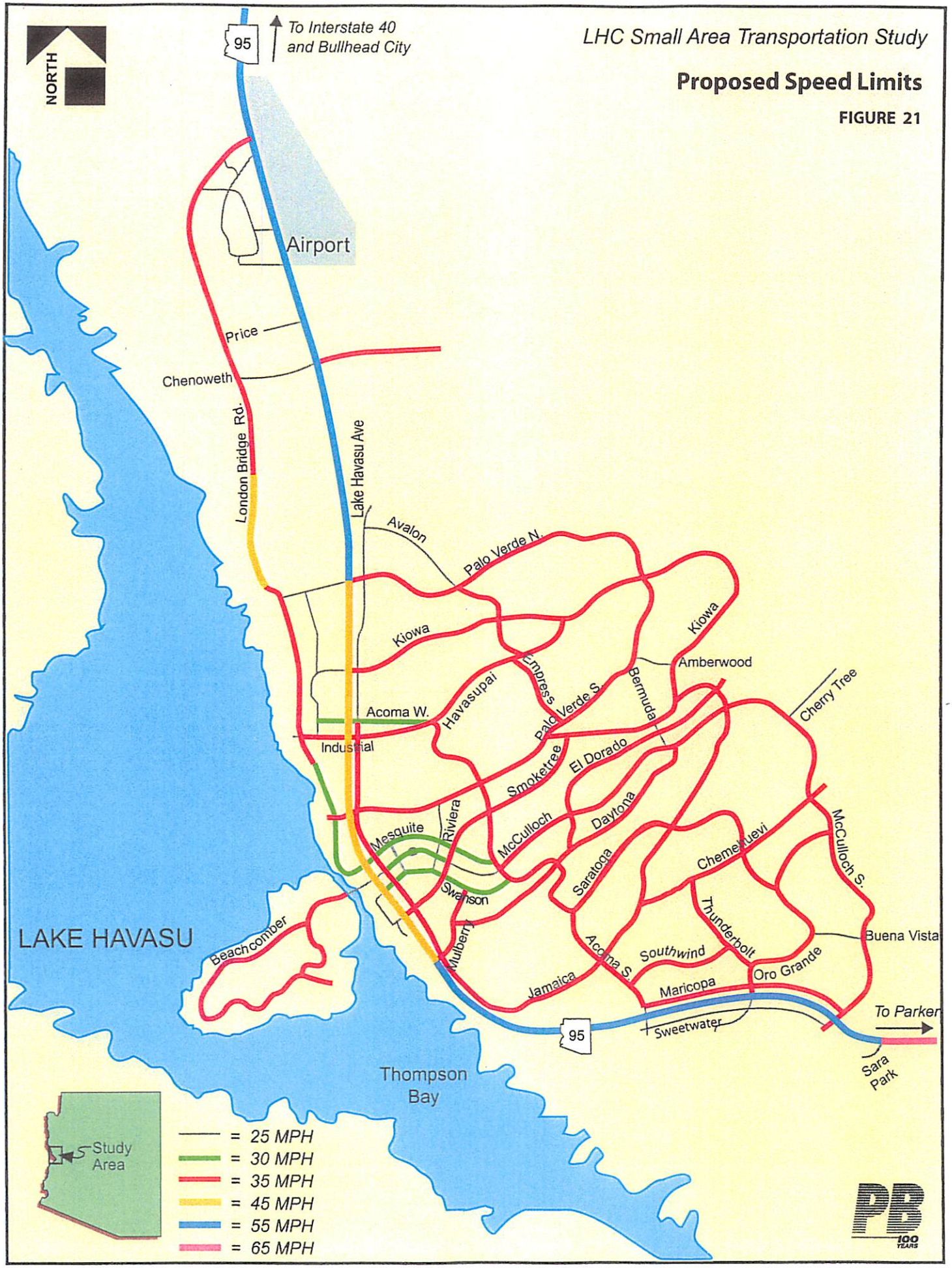
**TABLE 11**
**PROPOSED SPEED LIMIT CHANGES (preliminary)**

| ROADWAY | LIMITS | | AVG. 85th % SPEED (mph) | COMMENTS |
|---|---|---|---|---|
| | From | To | | |
| **SUGGESTED 35 MPH ZONES*** | | | | |
| Avalon Avenue | Havasupai | No Palo Verde | 34.0 | |
| Empress Drive | Palo Verde | Havasupai | 37.0 | Not an Avenue or Boulevard |
| London Bridge Road | Dover | north of Sailing Hawks | 39.3 | Remove 25 MPH at Kirk and Replace with 25 MPH Advisory |
| Mulberry Avenue | Entire Length | | 35.5 | |
| Smoketree Avenue | Entire Length | | 32.5 | 30 or 35 MPH |
| Southwind Avenue | Entire Length | | 36.8 | |
| Thunderbolt Avenue | Entire Length | | 33.6 | 30 or 35 MPH |
| Saratoga Avenue | Acoma | Saddleback | 39.9 | Change 25 MPH to 35 MPH at end of Saratoga |
| **SUGGESTED 30 MPH ZONES** | | | | |
| Acoma | Kiowa | Industrial | 35.5 | 30 MPH |
| Swanson | Entire Length | | 32.3 | 30 MPH |
| Mesquite | Entire Length | | 32.1 | 30 MPH |
| McCulloch Boulevard | LH Ave | Smoketree | 30.3 | 30 MPH |
| London Bridge Road | SR 95 | Countryshire | 30.8 | 30 MPH |

*North Lake Havasu Avenue, North Avalon, Sweetwater to 35 MPH once widened.

Jake Brake Noise/Truck Routes

The issue of Engine Brake (Jake Brake) Signs and Ordinances or Truck Route Designations in the community were analyzed in conjunction with the Small Area


LHC Small Area Transportation Study
Proposed Speed Limits
FIGURE 21
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Kiowa
Amberwood
Embress
Havasupai
Palo Verde S.
Bermuda
Cherry Tree
Acoma W.
Industrial
Smoketree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Chemehuevi
McCulloch S.
Saratoga
Swanson
Thunderbolt
Buena Vista
LAKE HAVASU
Beachcomber
Mulberry
Acoma S.
Southwind
Oro Grande
Jamaica
Maricopa
To Parker
95
Sweetwater
Sara Park
Thompson Bay
Study Area
= 25 MPH
= 30 MPH
= 35 MPH
= 45 MPH
= 55 MPH
= 65 MPH
PB
100 YEARS

Transportation Study (SATS) and presented to the Technical Advisory Committee (TAC).

City staff has received comments regarding trucks. The comments include concerns about truck noise and the number of trucks on City streets. For the most part, truck complaints (noise or traffic) do not represent a large percentage of the issues brought up by the public (1%). In addition, the issues and concerns are typically related to a nuisance issue as opposed to a safety issue.

A review of accident data indicates that only a small percentage of accidents involve trucks. As an example, for the last three months of the year, there were 213 accidents with only 13 involving trucks. Of those 13, all the incidents occurred in one of three areas: the downtown, SR 95 Highway areas or in signed construction areas. None of the truck accidents would have been impacted by a truck route or engine brake ordinance.

The issues associated with jake brake noise and truck traffic can be addressed in one of two ways: with signing or with a City ordinance.

Although an attempt to address both issues can be made by installing signs, true compliance requires some level of enforcement on the part of the Police Department. The placement of signs that are not enforced reduces the effectiveness of all signs. In addition, signs cost approximately $100.00 per installation and have an ongoing maintenance cost.

An Internet search shows that many communities have tried to address this issue with very comprehensive ordinances. A review of the documentation also shows that the issue is very controversial with regards to the trucking industry, safety, noise and enforcement.

A survey of 14 Arizona communities indicated that only four have an Engine Brake Ordinance (Bullhead City, Flagstaff, Peoria and Phoenix). Ten of the communities have some truck restrictions, typically weight limits in residential areas, but only eight install signs. The communities surveyed include Bullhead City, Chandler, Flagstaff, Gilbert, Glendale, Kingman, Mesa, Parker, Peoria, Phoenix, Prescott, Scottsdale, Tempe and Tucson.

If action is desired, there are several levels of activity that could be accomplished. They include the following:

**Engine Brake Ordinance Action Possibilities**

- Take No Action (Recommended by the TAC)
- Install Signs at Limited Locations entering the community without the benefit of an ordinance. (Not enforceable) – Voluntary Compliance, some installation and maintenance cost. Creates the expectation from the public that we will enforce the signs.
- Install Signs at Limited Locations entering the community and on SR 95 with an ordinance. (Enforcement issues related to how enforced and to what extent forces are delegated to the activity.) Some installation and maintenance costs.
- Install Signs entering the community, on SR 95 and at certain other roadways such as McCulloch Boulevard or other main avenues and boulevards. (Enforcement issues and placement issues – which roadways qualify and how.) Enforcement, installation and maintenance costs.

Truck Route Designation Action Possibilities

- Take No Action (Recommended by the TAC)
- Install Signs at Limited Locations entering the community without the benefit of an ordinance. (Not enforceable) – Voluntary Compliance, some installation and maintenance cost. Creates the expectation from the public that we will enforce the signs.
- Install Signs at Limited Locations entering the community with an ordinance. Enforcement issues related to how enforced and to what extent forces are delegated to the activity) (General limitation of trucks to Avenues and Boulevards without specific signage.) Some installation and maintenance costs.
- Install Signs entering the community and at certain other roadways such as McCulloch Boulevard or other main avenues and boulevards that designate actual truck routes. (Enforcement issues and placement issues – which roadways qualify and how?) This would require a large

number of signs along the designated routes with an increase in the installation and maintenance costs for the additional signage.

As the community continues to grow and increase in density, traffic volumes will continue to increase and the number of truck issues will continue to grow until build-out occurs. This issue could be revisited in the future, but at this point, due to the lack of a significant number of complaints and the issue of cost, compliance and enforcement, it is the SATS TAC recommendation that no action be taken on these issues at this time.

Crosswalks

The issue of crosswalks in the community was analyzed in conjunction with the Small Area Transportation Study (SATS) and presented to the Technical Advisory Committee (TAC).

The City receives requests for school crosswalks and requests from commercial property owners for mid-block crosswalks. For example, the latest request for a crosswalk was received for Paseo Del Sol and the City Parking Lot across from the London Bridge Shopping Center.

The 2003 MUTCD allows for additional crosswalk treatments that were previously unavailable. These include the use of sharks teeth yield symbols that have been installed at the Golf Course Crosswalks and the use of in-street pedestrian flashers.

Currently, there are 29 non-stop condition crosswalks at intersections located in school zones, at high pedestrian areas in downtown and at the London Bridge. There are 2 mid-block crosswalks located on Acoma Boulevard for the golf course.

Lake Havasu City recognizes the need to provide reasonable and safe pedestrian crossing areas on roadways in the community. Historically, Lake Havasu City has utilized a rule of thumb that limited these non-stop conditions crossings to school zone crosswalks meeting the ADOT criteria, and existing crosswalks as listed above. The rule-of-thumb guidelines seemed to be effective as the current accident data indicates that there have been no mid-block or school crosswalk accidents involving pedestrians. However, there have been accidents involving vehicles that have stopped for pedestrians and golf carts being rear-ended by other

vehicles. This type of accident has occurred on both McCulloch Boulevard and Acoma Boulevard.

*Crosswalk Policy*

Federal, State and City studies indicate that marked crossings do not increase the safety for the pedestrian. It is generally accepted that a pedestrian crossing at an intersection where vehicles are required to stop presents a safer condition than at locations where vehicles are not required to stop. In addition, drivers expect pedestrian crossings at intersections as opposed to mid block locations.

With this in mind, Lake Havasu City's policy would be to install crosswalks at stop condition intersections that have sidewalks. The City would not install crosswalks at non-stop condition intersections or mid-block locations except in special cases such as School Zones meeting the ADOT criteria, designated bike path and multi-use path crossings, special locations of heavy activity, or pre-existing conditions. However, every effort will be made to have all crossings made at an intersection to avoid a mid block condition.

In cases where a mid-block or non-stop condition crosswalk is installed due to heavy crossing use, consideration should be given to creating a Pedestrian Island refuge with special signage. If traffic lane configuration does not allow the use of the Pedestrian Island, alternative treatments such as curb bump outs should be considered.

Lake Havasu City will conduct an Engineering Study to determine if a location should have a crosswalk if it is an existing use, or as a follow-up to the installation of a new crossing. The data collected will include a count of the pedestrians/bicyclists using the location. The ADOT Safe School Area Guidelines will be utilized as a basis for any recommendations. Periodically, studies of existing crossings will also be completed to review the crossings functions. Specific volume criteria will be developed for each crosswalk type.

*Approved Typical Treatments –*

- **Normal Stop Condition Crosswalk Treatment –** Standard Crosswalk Striping, No Signs.
- **Standard School Crosswalk Treatment** – As per ADOT Manual, FYG Signs with in-street signage. 25 MPH Zone prior to 15 MPH School Zone.

No Pedestrian Yield Lines or Signs (Sharkteeth) due to number of other signs. Normal crosswalk lines (yellow).

As stated above, the City limits the use of mid block and non-stop condition crosswalks. In the event that a mid block or non-stop condition intersection is approved, the following treatments will be used.

- **Normal Crosswalk Treatment Non-Stop Condition** – Pedestrian Ahead and Pedestrian Crosswalk Signs, Pedestrian Yield Lines, and Signs (Sharkteeth) and normal crosswalk lines (white). This treatment is restricted to low volume uses and is typical of crosswalks that were in use prior to July 1, 1994. Higher volume crosswalks may require the installation of a Pedestrian Refuge Island.
- **Mid-Block Crosswalk Treatment** – London Bridge Area and Multi-Use Pathway Crossings require special treatment due to the large number of pedestrian users and the unexpected nature of these mid-block crossings. It is anticipated that there will be 5 multi-use pathway crossings (Lake Havasu Avenue – existing, Magnolia, Swanson, McCulloch, and Mesquite). Three (3) of the 4 locations have high traffic volumes. The Magnolia Drive crossing is on a low volume roadway. It is the SATS recommendation that for high volume roadway mid-block crossings, Lake Havasu City adopt a pedestrian refuge treatment or a curb extension treatment. These treatments will reduce the exposure of the pedestrian/bicyclist and provide a physical indicator to the traveling public that something out of the ordinary may occur. For low volume traffic roadways, the standard "Normal Crosswalk Treatment" for the mid-block crosswalk is recommended. For this purpose, high volume roadways would have an ADT of more than 5,000 vehicles. It is also recommended that we utilize the appropriate pedestrian refuge or curb extension treatment on the other crossings. If parking is allowed on the roadway, the curb extension provides the best treatment. If a continuous left-turn lane is provided, the pedestrian refuge island provides the best treatment. Other types of treatments that are not recommended would include the use of flags or flashers, overhead signs or raised speed humps or tables.
- **Downtown Crosswalk Treatment** – Due to the fact that pedestrian and yield to pedestrian signs would be blocked from view by parked cars, and to the fact that the locations are at intersections and that pedestrians can be

expected in a downtown area, crosswalks will be marked only. Because the locations will not have the advanced signage typical of our "Normal Crosswalk Treatment", the City will install the more visible "Zebra Striped" crosswalk markings that have been historically utilized in the downtown area.

Mailbox Placement

The issue of roadside mailboxes in the community was analyzed in conjunction with the Small Area Transportation Study (SATS) and presented to the Technical Advisory Committee (TAC). Increasing roadway safety is the primary reason for reviewing this issue. That is, the safety of both vehicles and pedestrians.

The safety of vehicles is related to the fact that the mailbox is a fixed object close to the roadway. Accident data indicates that Lake Havasu City averages (6) six vehicle/mailbox accidents per month. Overall, accidents involving mailboxes represent 8.9% of the total accidents in the community.

For pedestrians there is the issue of a clear pathway around the mailbox on a sidewalk. ADA standards require 36" of clear pathway along a sidewalk. Several mailbox installations in the community have reduced the existing sidewalk to less than the 36" clear pathway.

The AASHTO (American Association of State Highway and Transportation Officials) Guide for Erecting Mailboxes on Highways suggests that highway agencies and local jurisdictions use the guidelines to develop their own regulations, installation policies, and standards. The primary question reviewed by the TAC was whether Lake Havasu City should develop standards for mailbox installations in our community to regulate construction and locations.

This issue can be further broken down into two specific actions.

- Should Lake Havasu City regulate the location of the support of the mailboxes in our community? (Related to recommended face of mailbox being 6" to 12" from face of curb and providing the 36" of clear pathway for an ADA route on a sidewalk)
- Should Lake Havasu City regulate the construction of the support for the mailbox? (Related to the mailbox support as a fixed object near the roadway.)

Staff recommended that, as a minimum, installation of mailboxes should be regulated to ensure that the mailbox and its support are located no closer than 6" to 12" from the face of the curb and does not restrict the sidewalk clear pathway to anything less than 36". For roadways without shoulders, the mailbox and support must be at least 8" to 12" from the edge of roadway.

A review of 14 communities in Arizona indicated that only Parker requires a right of way permit for mailboxes and Tucson reviews an installation based on a complaint and enforces a standard detail with either a 2" steel post or 4"X4" wood post support.

The SATS TAC recommends that at this time, the City continue its existing policy with regards to these issues and not provide any oversight for mailboxes in the public right of way. Staff did recommend that the city provide some oversight with regards to the ADA issue of blocking the pathway on the sidewalk. Staff also recommended that the issue be brought forward to point out the safety concern with regards to the number of accidents involving mailboxes.

Bike Lane Considerations

Lake Havasu City's roadway sections are based on the existing right-of-way widths. The original roadway layout with boulevards, avenues, drives and cul-de-sacs has worked well in the past. The existing sections do not provide for bike lanes when configured with 4 lanes on drives and avenues and 5 lanes on boulevards. However as traffic volumes increase and vehicle types change, there may need to be adjustments made in the future.

It is the SATS Committee and staff's recommendation that Lake Havasu City continue the typical sections as originally developed with only minor modifications as needed. The creation of a wider paved section on higher volume roadways to accommodate bicycles or increased lane width does not appear to be cost effective at this time. It is suggested that any new developments use a modified section that will be created as an internal review by the Engineering Division.

Another way to address bicycle and pedestrian mobility issues would be the use of sidewalks and less busy parallel roadways. This subject will be addressed as a part of a Pathway/Bikeway Study to be completed this year.

Traffic Calming

As a part of the Small Area Transportation Study Update process, the issue of Traffic Calming was analyzed. The purpose of traffic calming is to make modifications to existing streets which have the effect of reducing speed. Measures could include diverters, speed humps, roundabouts, closures, chicanes and chokers.

Lake Havasu City recognizes the need to provide a method to reduce speeds and ensure compliance with the appropriate speed limits in the City. Historically, Lake Havasu City has done speed and volume studies in response to speed complaints received by the Public Works Department. The information is passed on to the Police Department for inclusion in their enforcement efforts. The Police Department also utilizes their speed radar trailer to assist in these activities.

Methods to "encourage" drivers to reduce the speed at which they drive include increased enforcement and/or traffic calming.

Increasing enforcement might include additional resources (Police Officers) or the adoption of mechanical means (Photo Radar). Currently, the Police Department uses a radar trailer to "inform" the driving public of the speed they are traveling. Expansion of this program would require the purchase of additional equipment.

Traffic Calming would require the development of a comprehensive program to select the appropriate measures, determine locations and establish policies to implement. Some communities require "votes" from the neighborhood and financial participation from the adjacent property owners. It is not uncommon for communities to have dedicated funding for these efforts. The development of a Traffic Calming program would require significant staff and City Council effort to determine the appropriate program for Lake Havasu City.

As the community continues to grow and increase in density, traffic volumes will continue to increase and it is likely that the number of speeding complaints will

increase. The choices to address the speed complaints include 1) continue with current practice, 2) modify the current practice to include formal guidelines and reporting procedures, 3) increase enforcement efforts, or 4) initiate a formalized and funded Traffic Calming program.

The modified current practice would include a speed study if one had not been completed within the last two years and the collection of traffic volume and speed data would within four weeks. Also, a formal report documenting this information would be submitted to the Public Works Director and the Police Department. This information will also be provided to the complaining party, along with the recommended action.

The increase in enforcement efforts would be defined by the following categories of speed study results:

- Category 1 (85$^{th}$ Percentile Speed within +/- 5 mph of Speed Limit and excessive speed instances less than 5% (+15 MPH) or 3% (+25 MPH)). This would include adding the location to the list for Speed Radar Trailer placement with a low priority and using some officer enforcement if available.
- Category 2 (85$^{th}$ Percentile Speed + 5 mph of Speed Limit and/or excessive speed greater than 5% (+15 MPH) or 3% (+25 MPH)). This would include adding the location to the list for Speed Radar Trailer placement with a high priority and using an officer for enforcement.
- Category 3 (85$^{th}$ Percentile Speed + 10 mph of Speed Limit and/or excessive speed greater than 10% (+15 MPH) or 5% (+25 MPH)). This would include adding the location to the list for Speed Radar Trailer placement with a high priority and using an officer for enforcement as soon as possible. It would also include follow-up on the part of the Police Department with regards to a violations report.

Due to the lack of a significant number of pedestrian/bicyclist accidents related to vehicular speeds, fairly good compliance with the posted speed limits, the proposed changes to several roadway speed limits to ensure better compliance, and the need for resources to be utilized in other areas, it is recommended that a formal Traffic Calming Program involving physical barriers or roadway modifications not be pursued at this time.

It is recommended that a formal complaint/evaluation process be developed and that enforcement efforts be increased to include increasing the number of speed radar trailers, additional officers and an evaluation of the use of photo radar.

Roundabouts

Roundabouts are being considered as an intersection treatment in many communities across Arizona. The concept and potential applications in Lake Havasu City were presented to the TAC as part of this study.

It is estimated that over the next 5 years, nearly 90 modern roundabouts will be constructed on major roadways in Arizona. Initial concerns regarding the use of roundabouts were the amount of right of way required and driver understanding. The Federal Roundabout Guidelines indicate that a roundabout circle of 100 feet or more is needed to provide adequate capacity for the typical traffic volumes in Lake Havasu City. Specific signing and markings would be needed to direct drivers on how to utilize any roundabouts with more than one lane.

There are many examples of roundabouts that could be applied to Lake Havasu City. Public understanding and acceptance of roundabouts is growing. If this concept were to be implemented in Lake Havasu City, a public review and acceptance process should be implemented.

Modern roundabouts are designed geometric intersections that can be designed to allow for trucks, trailers and oversized vehicles to traverse the intersection safely. Roundabouts should not be confused with old style traffic circles or rotaries.

The concept of the modern roundabout is the design geometrics that allow for a maximum travel speed through the roundabout of less than 25 mph (usually 18 to 23 mph), an analysis of the actual turn movements and the construction of the applicable lanes. In addition, stop delay at a modern roundabout is significantly less than a typical traffic signal in most applications because traffic is flowing continuously. The capacity of the roundabout provides the increased capacity at the node (intersection) where it is needed. With a traffic signal, a design may provide additional lane capacity to make up for the lost time in the red phase.

It is recommended that the use of roundabouts in Lake Havasu City be studied further and include public meetings to present the concept. Possible locations for the use of the modern roundabouts include minor intersections such as Briarcrest and Empress Drive, intersection of a major street with a minor street (Jamaica and McCulloch, Kiowa and North Palo Verde, Jamaica and Acoma) and major intersections (Daytona and Acoma, Smoketree and Acoma and Palo Verde and Acoma). In addition, the use of a modern roundabout could replace a multi-way stop at locations such as Rainbow and Acoma or Saratoga and Acoma. Another application of a roundabout might be at the intersection of McCulloch and Beachcomber Boulevards. An additional benefit of roundabouts may be the delay of re-striping or widening to five lanes on streets such as Acoma Boulevard.

Traffic Signal Modifications

Traffic signals provide a positive means to control traffic at intersections by alternating the assignment of traffic entering the intersection. Signals can have left turn phases that can be protected only (left turn on arrow only) or protected-permissive (left turn on arrow and green ball). Traffic signals can operate independently of others or can be coordinated with other signals to enhance traffic flow. The 'right' traffic signal timing and operation at each signalized intersection will result in the most effective transportation system.

Various traffic signal improvements can be very effective at reducing congestion and travel time. These type improvements can be very cost effective at reducing congestion on roadways. Traffic signals do not need to be completely changed in order to realize significant improvements in traffic flow. Often, one small improvement, such as interconnecting several signals that were previously operating independently, can produce significant results.

Studies have shown that this type of improvement has resulted in travel time reductions between 10% and 20 %. Signal re-timing efforts in California at 3,172 signals across the state resulted in a benefit-cost ratio of 58 to 1. This resulted in a 15% reduction in delay, 16% reduction in stops, and a 7.2% reduction in travel time throughout the system. The costs for this type of improvement are between $2000 and $3000 per intersection in hardware improvements and $5,000 to $15,000 per traffic signal for interconnect.

In addition to signal coordination, signal timing and the left turn phasing can be adjusted to increase capacity. For example, protective-permissive left turn phasing with third car detection or permissive protection can increase the green time for through traffic, however, the impact on the left turn movements should be carefully evaluated on a case by case basis.

ADOT is currently planning traffic signal coordination improvements for SR 95. The work will be done in phases, with the middle section (North Palo Verde to Smoketree) being the first phase.

As traffic volumes and delay continue to increase, it is recommended that signalized intersections should be examined to determine if signal timing and/or phasing modifications would be appropriate.

## Roadway Drainage

The issue of roadway drainage and w-section treatment was also discussed. The City's w-section for a roadway cross-section treatment was developed to carry the largest amount of storm water possible while maintaining an area for traffic to drive during storm events. However, when a roadway is restriped to provide three lanes (two through lanes and a two-way center left turn lane), the through traffic lanes may be subject to flooding during a storm.

Options to improve drainage include using a crown section, using a crown section with higher curbs (10"), or installing storm drains.

A typical crown section would reduce the effective drainage area in the roadway and could cause flooding along the roadway shoulders. The increase in curb height (10" total height) on a typical crown section would not have the same drainage capacity as a standard w-section. In addition, this treatment would create additional safety and aesthetics concerns.

The addition of storm drains would assist in the removal of on-street drainage. Concerns with storm drain construction include cost and utility conflicts. Given the limited number of rain days each year, this solution is not cost effective for the majority of the City's roadways. However, it is recommended that the

Transportation Division examine the feasibility and cost/benefit of installing storm drains on major roadways when they are reconstructed in the future and consider the use of storm drains on new roadways.

## Pavement Design and Maintenance

As a part of this study, the asphaltic concrete thickness for Lake Havasu City roadways was discussed. The existing pavement section standard is 2" of asphaltic concrete (AC) over 4" of aggregate base (AB). Maintenance for major roadways includes routine chip seal and slurry seal treatments.

As both traffic volumes and vehicle loads increase on City streets, the pavement performance and maintenance needs should be reviewed. For example, based on current pavement conditions, a significant amount of pavement rehabilitation resources will need to be expended in rehabilitating major downtown roadways including Mesquite, Swanson and McCulloch, as well as portions of Acoma and Lake Havasu Avenue. It is recommended an evaluation of pavement section needs be conducted to determine appropriate actions and long term maintenance needs.

It was the consensus of the TAC that the Transportation Division should develop a long-range roadway maintenance program for major roadways (over and above routine chip seal and slurry seal treatments) and that this cost be included in budget discussions.

LAKE HAVASU CITY, ARIZONA
INCORPORATED 1978

# VI. RECOMMENDED PLAN

The previous section presented an evaluation of alternatives that addressed one or more future transportation issue areas. This chapter identifies those projects that are recommended to be included in the transportation plan and a suggested priority for implementation. Also included is an assessment of the environmental justice considerations, functional classification, and an evaluation of the estimated plan cost and anticipated revenue.

## A. Recommended Plan

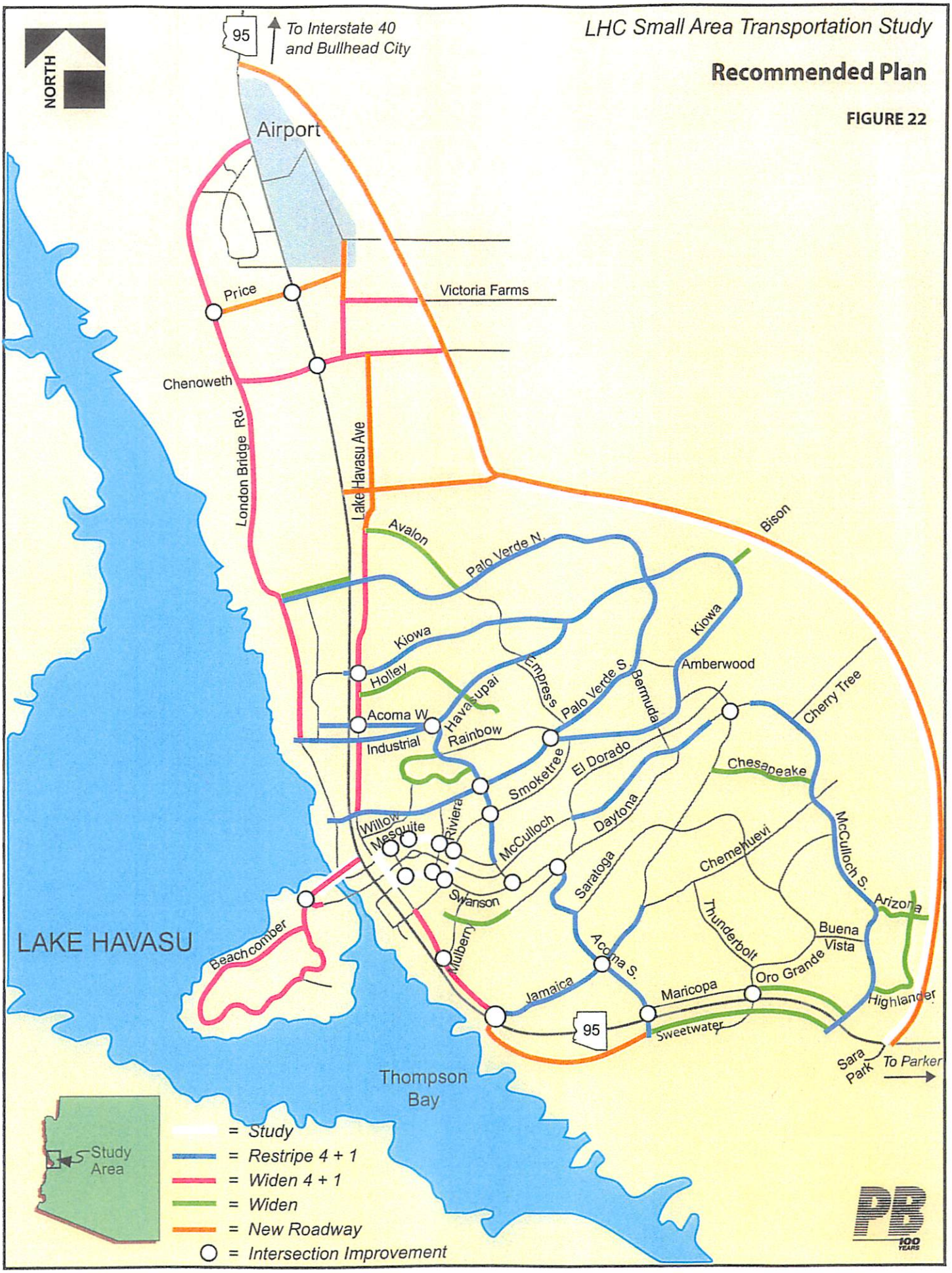
The development of the recommended plan considers a number of qualitative and quantitative factors including level of service, right of way, existing land use, future land use, cost, and engineering difficulties. In some cases, more than one alternative may address the same issue or concern and they have been included in the recommended plan. However, in other instances, only one alternative that provides the most effective solution may be included. In addition, there are alternatives that are not included in the recommended plan because of cost, engineering difficulties, lack of community support, or other constraints. The plan is a tool for City and County staff and decision makers to use to guide the future transportation system of the area. It represents the best information currently available regarding planned growth, opportunities, and constraints.

The recommended plan is shown in Figure 22. The plan includes a variety of improvements including widening, new roadways, re-striping, intersection improvements, and studies. These projects represent a future transportation system that will accommodate the City's growth and provide for the mobility and accessibility of residents and visitors.

It should also be noted that not all of the projects that were evaluated are included in the recommended plan. The following alternative is not included.

- North-South Corridor – The recommended Parkway project will provide similar benefits and address many of the same issues.

The projects are also summarized in Table 12. The table groups the projects by type and responsible jurisdiction. It should be noted that some of the re-striping


LHC Small Area Transportation Study
Recommended Plan
FIGURE 22
NORTH
95
To Interstate 40 and Bullhead City
Airport
Price
Victoria Farms
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Bison
Kiowa
Kiowa
Holley
Acoma W.
Industrial
Havasupai
Rainbow
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Smoketree
El Dorado
Chesapeake
Willow
Mesquite
Riviera
McCulloch
Daytona
Chemehuevi
McCulloch S.
Saratoga
Swanson
Arizona
Thunderbolt
Buena Vista
Mulberry
Acoma S.
Oro Grande
Jamaica
Maricopa
Highlander
Beachcomber
LAKE HAVASU
Sweetwater
Sara Park
To Parker
Thompson Bay
Study Area
= Study
= Restripe 4 + 1
= Widen 4 + 1
= Widen
= New Roadway
= Intersection Improvement
PB
100 YEARS

projects occur on streets that currently have on-street parking. Prior to implementing these projects, the City will need to evaluate the availability of off-street parking to accommodate the demand. Additionally, the projects listed as Mohave County or ADOT jurisdiction are part of the recommended plan, but do not imply any financial commitment to the project.

**TABLE 12**

**SUMMARY OF RECOMMENDED PROJECTS**

| LOCATION | FROM | TO | AGENCY |
|---|---|---|---|
| **WIDEN TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | |
| London Bridge Rd | City Limit (south of Chenoweth) | SR 95 (north) | Mohave County |
| London Bridge Rd | Industrial | City Limit (south of Chenoweth) | LHC |
| Chenoweth | London Bridge Rd | SR 95 | Mohave County |
| Chenoweth | SR95 | New Parkway | LHC |
| Beachcomber Blvd | McCulloch | 2nd Bridge connection | LHC |
| Lake Havasu Ave | Acoma West | Kiowa | LHC |
| Lake Havasu Ave | Kiowa | North Palo Verde | LHC |
| Lake Havasu Ave | North Palo Verde | Avalon | LHC |
| Lake Havasu Ave | Smoketree | Jamaica | LHC |
| Lake Havasu Ave | South Palo Verde | Industrial | LHC |
| SR 95 | McCulloch Blvd South | Sara Park | LHC |
| New Parkway (2 to 4 lanes) | SR 95 (south) | SR 95 (north) | LHC |
| Victoria Farms Rd | N/S Frontage Rd | Parkway | LHC |
| Daytona Ave | Cottonwood Dr | Daytona Loop | LHC |
| Avalon Ave | North Palo Verde | Lake Havasu Ave | LHC |
| Chesapeake Blvd | | | LHC |
| Arizona Blvd | | | LHC |
| Highlander Ave | | | LHC |
| Sweetwater Ave | | | LHC |
| Maricopa Ave | Oro Grande | McCulloch | LHC |
| North Palo Verde | London Bridge Rd | SR 95 | LHC |
| Willow Ave | | | LHC |
| Rainbow Ave | Acoma | Acoma | LHC |
| Holley Ave | | | LHC |
| Bison Blvd | Kiowa | New Parkway | LHC |
| Mesquite/Swanson (2/1 lane unbalance) | Lake Havasu Ave | Acoma | LHC |

## TABLE 12 (continued)

## SUMMARY OF RECOMMENDED PROJECTS

| LOCATION | FROM | TO | AGENCY |
|---|---|---|---|
| **RE-STRIPE TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | |
| Jamaica | Lake Havasu Ave | Chemehuevi | LHC |
| North Palo Verde | SR 95 | Kiowa | LHC |
| North Palo Verde | London Bridge Rd | SR 95 | LHC |
| Kiowa | SR 95 | North Palo Verde | LHC |
| South Palo Verde | SR 95 | Kiowa | LHC |
| South Palo Verde (add medians at alleys | SR 95 | London Bridge Rd | LHC |
| Kiowa | South Palo Verde | Jamaica | LHC |
| Acoma West | SR 95 | Industrial | LHC |
| Acoma | Industrial | Mesquite | LHC |
| Acoma West (add medians at alleys) | Kiowa | SR 95 | LHC |
| Acoma South | Daytona | SR 95 | LHC |
| McCulloch | El Dorado | Cherry Tree | LHC |
| McCulloch | Cherry Tree | SR 95 | LHC |
| Industrial Blvd (add medians at alleys) | London Bridge Rd | SR 95 | LHC |
| Industrial Blvd | SR 95 | Acoma West | LHC |
| Havasupai Blvd | Acoma West | Kiowa | LHC |
| **NEW ROADWAY OR ROADWAY EXTENSION** | | | |
| Jamaica | Lake Havasu Ave | SR 95 | LHC/ADOT |
| Lake Havasu Ave | Northern Terminus | Chenoweth | LHC |
| East/West Connector | SR 95 | Parkway | LHC |
| Parkway-Initial two lanes | SR 95 (south) | SR 95 (north) | LHC |
| N/S Frontage Rd | Victoria Farms Rd | Air Industrial Rd | LHC |
| Price Dr | City Limit | SR 95 | LHC |
| Price Dr | London Bridge Rd | City Limit | Mohave County |
| Sweetwater | Acoma South | Mulberry | LHC |
| 2nd Bridge | Island | SR 95 | LHC |

## TABLE 12 (continued)

## SUMMARY OF RECOMMENDED PROJECTS

| LOCATION | FROM | TO | AGENCY |
|---|---|---|---|
| **INTERSECTION IMPROVEMENTS** | | | |
| London Bridge Rd & Price Dr | | | Mohave County |
| London Bridge Rd & SR 95 | | | LHC |
| SR 95/Mulberry/Lake Havasu Ave | | | LHC |
| SR 95/Maricopa/Acoma South | | | LHC |
| SR 95/Maricopa/Oro Grande | | | LHC |
| Daytona/Acoma | | | LHC |
| Smoketree/Acoma | | | LHC |
| Palo Verde/Acoma | | | LHC |
| Acoma West/Lake Havasu Ave | | | LHC |
| Kiowa/Lake Havasu Ave | | | LHC |
| McCulloch/Beachcomber | | | LHC |
| Mesquite/Riviera | | | LHC |
| Mesquite/Capri | | | LHC |
| Mesquite/Civic Center | | | LHC |
| Mesquite/Smoketree | | | LHC |
| Swanson/Riviera | | | LHC |
| Swanson/Capri | | | LHC |
| Swanson/Smoketree | | | LHC |
| Kiowa/Palo Verde | | | LHC |
| Jamaica & Acoma | | | LHC |
| Acoma & Industrial | | | LHC |
| Acoma & Swanson | | | LHC |
| Jamaica & McCulloch | | | LHC |
| SR 95 & Chenoweth | | | LHC/ Mohave County |
| **STUDIES** | | | |
| 2nd Bridge | Island | SR 95 | LHC |
| Extend Jamaica | Lake Havasu Ave | SR 95 | LHC/ADOT |
| Mesquite/Swanson | Lake Havasu Ave | Acoma | LHC |
| New Parkway DCR | | | LHC/ADOT |

**TABLE 12 (continued)**
**SUMMARY OF RECOMMENDED PROJECTS**

| LOCATION | FROM | TO | AGENCY |
|---|---|---|---|
| **OTHER PROJECTS** | | | |
| SR 95 multi-use path extension | North Palo Verde | Chenoweth | LHC |
| Multi-use path – Sara Park | | | LHC |
| Multi—use path – Powerline | | | LHC |
| Island multi-use path & SR 95 connection | | | LHC |
| Multi-use path expansion – opposite side on SR 95 | | | LHC |
| Parkway multi-use path or bike lanes | | | LHC |
| Residential street widening | | | LHC |
| Sidewalk expansion | | | LHC |
| North MCC Park Area roadway improvements | | | LHC |
| McCulloch Blvd: Smoketree to Acoma – intersection improvements | | | LHC |
| London Bridge crosswalk lighting | | | LHC |

Several of the new roadways included in the recommended plan should be added to the Federal functional classification system for the City. Table 13 presents suggested classifications for the additions. As new roadways are constructed, the City and WACOG should review the functional classification and determine if modifications or additions are appropriate.

**TABLE 13**
**POSSIBLE FUNCTIONAL CLASSIFICATION MODIFICATIONS**

| ROADWAY | FROM | TO | SUGGESTED FUNCTIONAL CLASSIFICATION |
|---|---|---|---|
| Chenoweth | London Bridge Rd | Parkway | Urban Minor Arterial |
| Lake Havasu Ave | Acoma | N Palo Verde | Urban Minor Arterial |
| Lake Havasu Ave | N Palo Verde | Chenoweth | Urban Collector |
| Parkway | Entire length | | Urban Principal Other |

## B. Title VI Review

The USDOT Title VI Regulations state that in determining the site or location of facilities, selection cannot be made with the purpose or effect of excluding persons from, denying them the benefits of, or subjecting them to discrimination under any program to which this regulation applies. The first question is: are there minority

and/or low-income populations in Lake Havasu City? This was described in Chapter II and is shown by census tract in Figure 23.

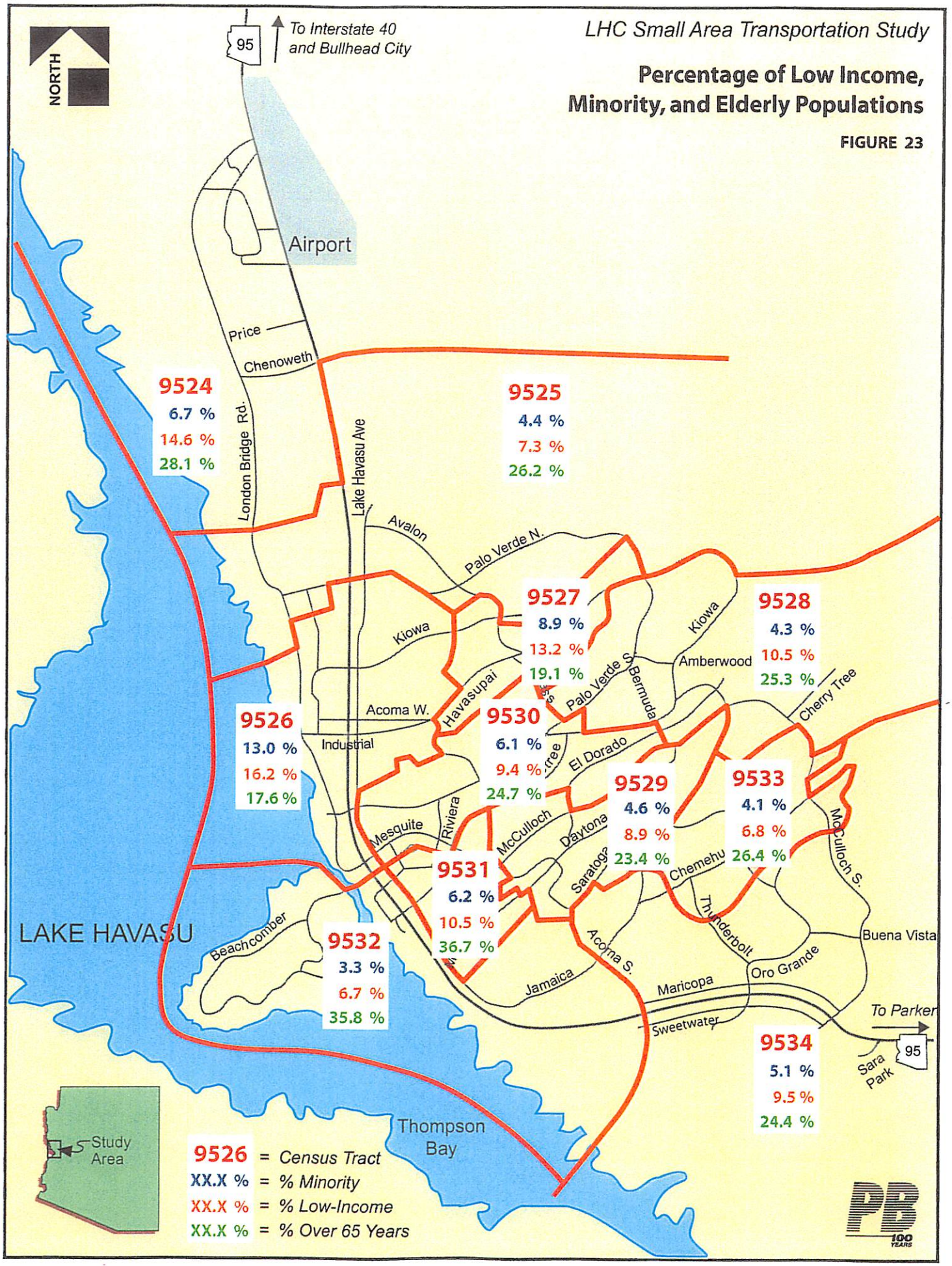
According to the regulations, in developing potential improvements, a project cannot be selected that will cause an adverse impact or disproportionately high impact on any one segment of the population regardless of gender, age, income, and/or race. Therefore, the next question is: are the environmental impacts of a project likely to impact one of the minority or low-income populations disproportionately?

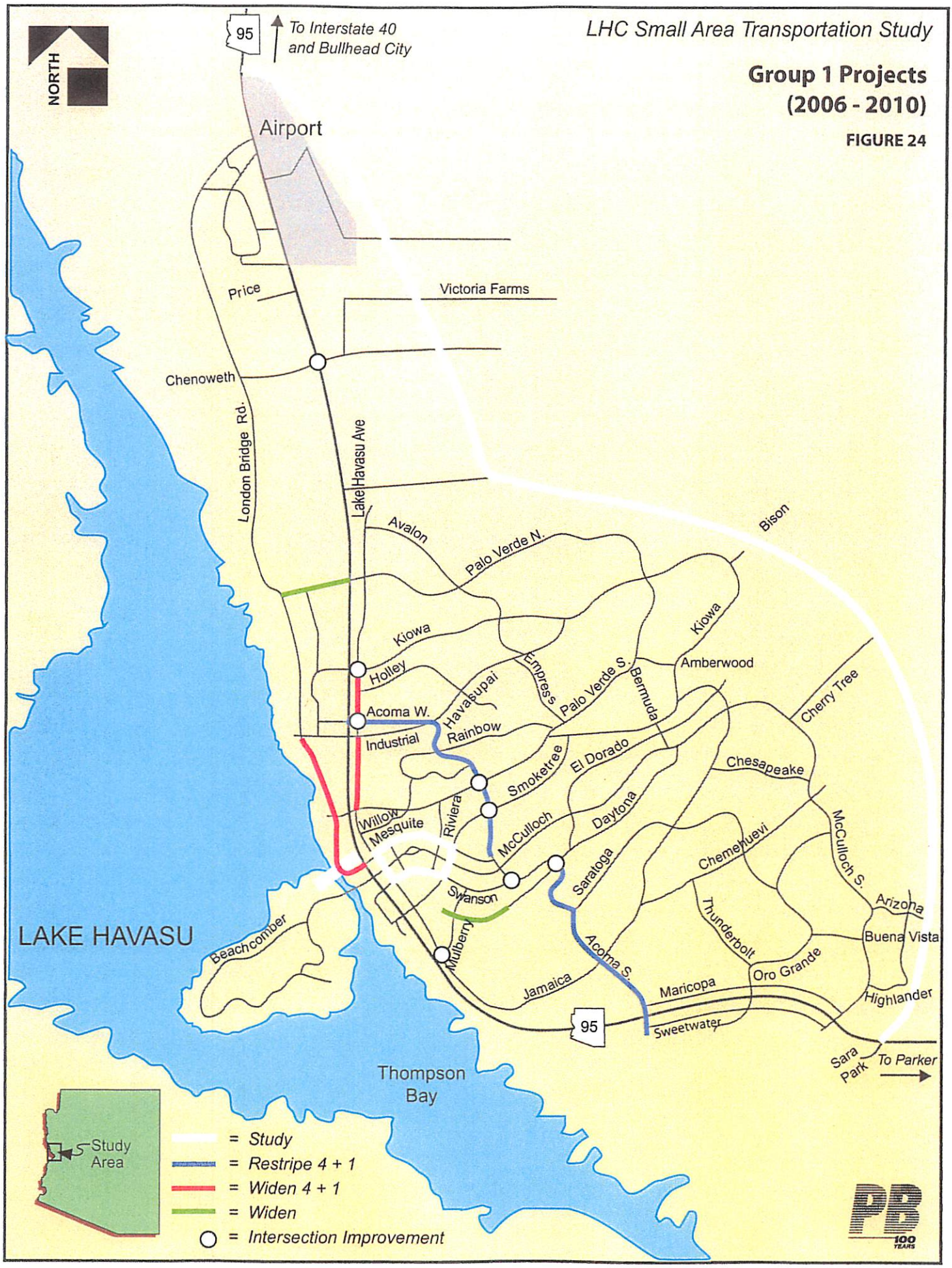
The Lake Havasu City Area Transportation Study is a long-range planning study prepared to address the transportation needs in the area for the next twenty years. The projects are proposed to improve the City's transportation system and benefit the community as a whole. The roadway widenings, extensions, re-striping, and intersection improvements will not adversely impact or place disproportionately high impacts on minority or low-income populations.

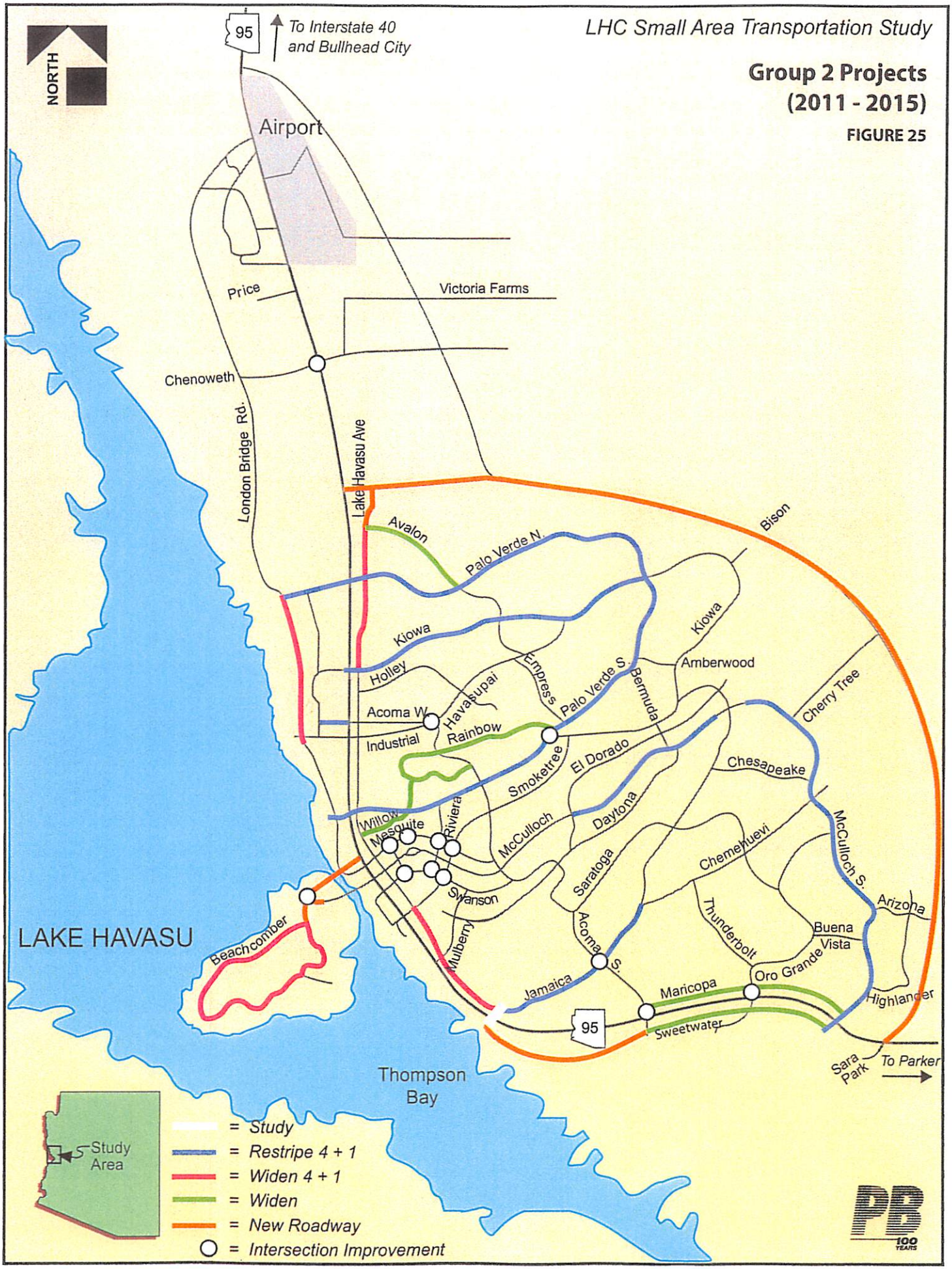
## C. Implementation

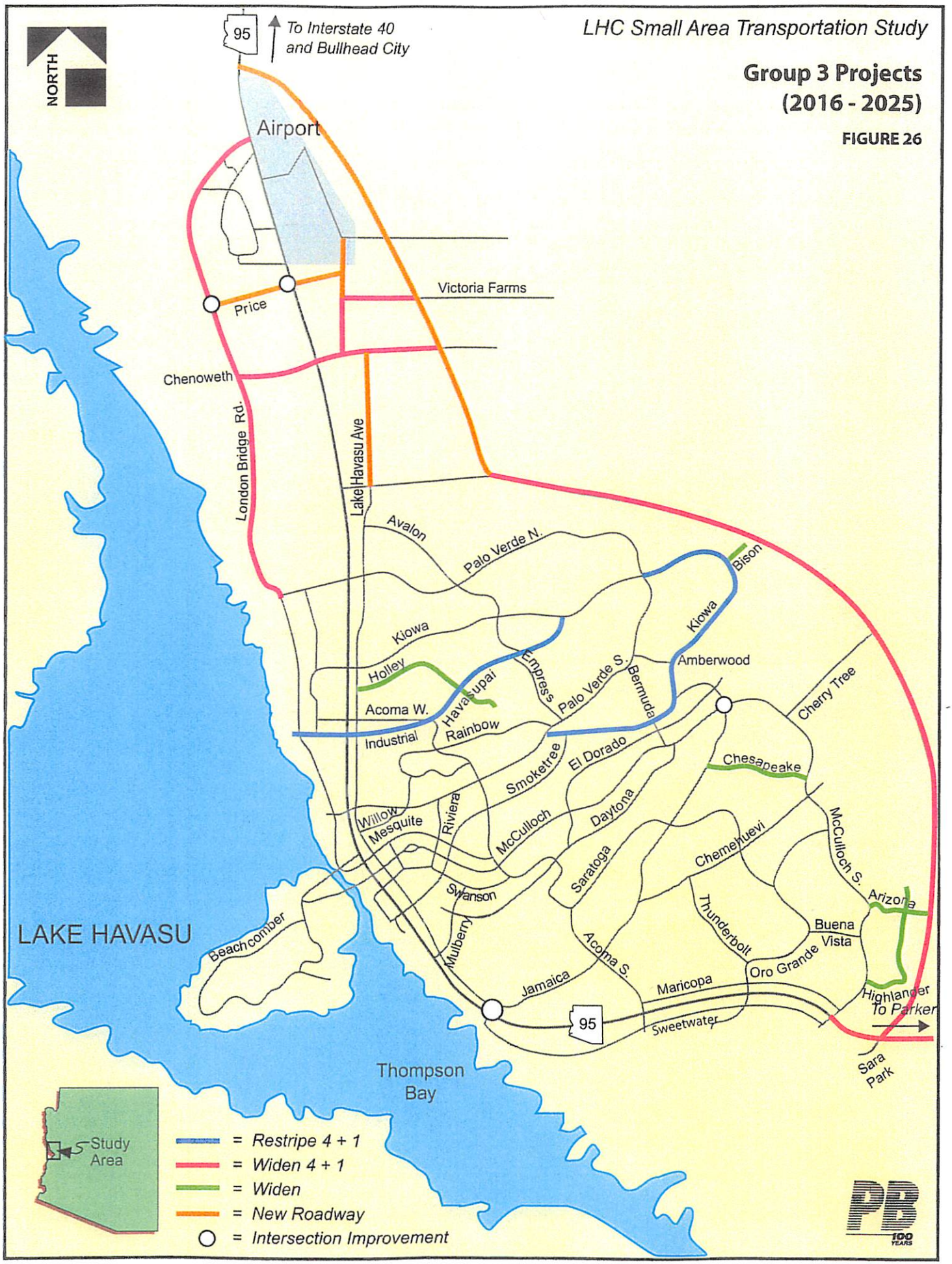
The basis for this transportation plan is the projected population and employment used in the travel forecasting model. The analysis contained in this study is based on a population projection of 103,804 people for the year 2030. The recommended plan is the street system that is needed to meet this population threshold. If the growth rate or pattern of growth in the study area changes, the priority of projects may change and the implementation should be reviewed. The implementation of the plan is divided into Group 1, 2, and 3 which represent short term, mid term, and long term elements respectively as shown in Figures 24-26.

Tables 14 to 16 present a summary of the implementation plan along with an estimated construction cost in 2004 dollars. Some of the widening projects have been divided into multiple segments to provide manageable projects with respect to cost and construction. The major projects such as new routes or realignments of existing routes include a Design Concept Report (DCR) study in advance of the project design and construction. The DCR will define the location and design criteria for the new route or realignment.


LHC Small Area Transportation Study
Percentage of Low Income, Minority, and Elderly Populations
FIGURE 23
NORTH
To Interstate 40 and Bullhead City
95
Airport
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Kiowa
Acoma W.
Industrial
Havasupai
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
El Dorado
Riviera
Mesquite
McCulloch
Daytona
Saratoga
Chemehu
Thunderbolt
McCulloch S.
Buena Vista
Oro Grande
Acoma S.
Jamaica
Maricopa
Sweetwater
To Parker
Sara Park
LAKE HAVASU
Beachcomber
Thompson Bay
Study Area
9524
6.7 %
14.6 %
28.1 %
9525
4.4 %
7.3 %
26.2 %
9526
13.0 %
16.2 %
17.6 %
9527
8.9 %
13.2 %
19.1 %
9528
4.3 %
10.5 %
25.3 %
9529
4.6 %
8.9 %
23.4 %
9530
6.1 %
9.4 %
24.7 %
9531
6.2 %
10.5 %
36.7 %
9532
3.3 %
6.7 %
35.8 %
9533
4.1 %
6.8 %
26.4 %
9534
5.1 %
9.5 %
24.4 %
9526 = Census Tract
XX.X % = % Minority
XX.X % = % Low-Income
XX.X % = % Over 65 Years
PB 100 YEARS


LHC Small Area Transportation Study
Group 1 Projects
(2006 - 2010)
FIGURE 24
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Victoria Farms
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Bison
Kiowa
Kiowa
Holley
Acoma W.
Industrial
Havasupai
Rainbow
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Smoketree
El Dorado
Chesapeake
Willow
Mesquite
Riviera
McCulloch
Daytona
Chemehuevi
McCulloch S.
Saratoga
Swanson
Arizona
Thunderbolt
Buena Vista
Mulberry
Acoma S.
Oro Grande
Beachcomber
Jamaica
Maricopa
Highlander
95
Sweetwater
Sara Park
To Parker
LAKE HAVASU
Thompson Bay
Study Area
= Study
= Restripe 4 + 1
= Widen 4 + 1
= Widen
= Intersection Improvement
PB
100 YEARS


LHC Small Area Transportation Study
Group 2 Projects
(2011 - 2015)
FIGURE 25
NORTH
95
To Interstate 40
and Bullhead City
Airport
Price
Victoria Farms
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Bison
Kiowa
Kiowa
Holley
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Acoma W.
Havasupai
Industrial
Rainbow
Smoketree
El Dorado
Chesapeake
Willow
Mesquite
Riviera
McCulloch
Daytona
McCulloch S.
Saratoga
Chemehuevi
Swanson
Mulberry
Acoma S.
Thunderbolt
Arizona
Buena Vista
Oro Grande
Jamaica
Maricopa
Highlander
Sweetwater
Sara Park
To Parker
LAKE HAVASU
Beachcomber
Thompson Bay
Study Area
= Study
= Restripe 4 + 1
= Widen 4 + 1
= Widen
= New Roadway
= Intersection Improvement
PB
100 YEARS


LHC Small Area Transportation Study
Group 3 Projects
(2016 - 2025)
FIGURE 26
NORTH
95
To Interstate 40
and Bullhead City
Airport
Victoria Farms
Price
Chenoweth
London Bridge Rd.
Lake Havasu Ave
Avalon
Palo Verde N.
Bison
Kiowa
Kiowa
Holley
Havasupai
Empress
Palo Verde S.
Bermuda
Amberwood
Cherry Tree
Acoma W.
Industrial
Rainbow
Smoketree
El Dorado
Chesapeake
Willow
Mesquite
Riviera
McCulloch
Daytona
Chemehuevi
McCulloch S.
Saratoga
Swanson
Arizona
Thunderbolt
Buena
Vista
Mulberry
Acoma S.
Oro Grande
Beachcomber
Jamaica
Maricopa
Highlander
To Parker
95
Sweetwater
Sara
Park
LAKE HAVASU
Thompson
Bay
Study
Area
= Restripe 4 + 1
= Widen 4 + 1
= Widen
= New Roadway
= Intersection Improvement
PB
100 YEARS

While these tables provides a recommended implementation, actual implementation of projects will depend on a number of factors including available funding, cost sharing, joint participation, and development contributions.

**TABLE 14**
**GROUP 1 PROJECTS**

| LOCATION | FROM | TO | GROUP | COST* |
|---|---|---|---|---|
| **WIDEN TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| London Bridge Rd | South Palo Verde | Industrial | 1 | $2,300 |
| Lake Havasu Ave | Acoma West | Kiowa | 1 | $250 |
| Lake Havasu Ave | South Palo Verde | Industrial | 1 | $500 |
| **WIDEN** | | | | |
| Daytona Ave | Cottonwood Dr | Daytona Loop | 1 | $500 |
| North Palo Verde | London Bridge Rd | SR 95 | 1 | $1,000 |
| **RE-STRIPE TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| Acoma West | SR 95 | Industrial | 1 | $1 |
| Acoma | Industrial | Mesquite | 1 | $1.5 |
| Acoma South | Daytona | SR 95 | 1 | $1.5 |
| **INTERSECTION IMPROVEMENTS** | | | | |
| SR 95/Mulberry/Lake Havasu Ave | | | 1 | $250 |
| Daytona/Acoma | | | 1 | $250 |
| Smoketree/Acoma | | | 1 | $250 |
| Kiowa/Lake Havasu Ave | | | 1 | $250 |
| Palo Verde/Acoma | | | 1 | $250 |
| Acoma West/Lake Havasu Ave | | | 1 | $250 |
| **STUDIES** | | | | |
| 2nd Bridge | Island | SR 95 | 1 | $150 |
| Mesquite/Swanson | Lake Havasu Ave | Smoketree | 1 | $150 |
| New Parkway DCR | | | 1 | $350 |
| **OTHER PROJECTS** | | | | |
| Island multi-use path & SR 95 connection | | | 1 | $20 |
| Multi-use path expansion – opposite side on SR 95 | | | 1 | $100 |
| Residential street widening ($1,000,000 per year) | | | 1 | $5,000 |
| Sidewalk expansion ($75,000 per year) | | | 1 | $375 |
| North MCC Park Area roadway improvements | | | 1 | $1,500 |
| London Bridge crosswalk lighting | | | 1 | $50 |
| **GROUP 1 PROJECT COST** | | | | **$13,749** |

*cost in 2004 dollars in thousands

## TABLE 15
## GROUP 2 PROJECTS

| LOCATION | FROM | TO | GROUP | COST* |
|---|---|---|---|---|
| **WIDEN TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| London Bridge Rd | Industrial | North Palo Verde | 2 | $3,450 |
| Beachcomber Blvd | McCulloch | 2nd Bridge connection | 2 | $575 |
| Lake Havasu Ave | Kiowa | North Palo Verde | 2 | $2,300 |
| Lake Havasu Ave | North Palo Verde | Avalon | 2 | $1,150 |
| Lake Havasu Ave | Smoketree | Jamaica | 2 | $3,450 |
| **WIDEN** | | | | |
| Avalon Ave | North Palo Verde | Lake Havasu Ave | 2 | $1,250 |
| Sweetwater Ave | | | 2 | $2,000 |
| Maricopa Ave | | | 2 | $1,000 |
| Willow Ave | | | 2 | $1,000 |
| Rainbow Ave | | | 2 | $2,000 |
| **RE-STRIPE TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| Jamaica | Lake Havasu Ave | Chemehuevi | 2 | $2 |
| North Palo Verde | SR 95 | Kiowa | 2 | $3 |
| North Palo Verde | London Bridge Rd | SR 95 | 2 | $1 |
| South Palo Verde | SR 95 | Kiowa | 2 | $4 |
| South Palo Verde (add medians at alleys | SR 95 | London Bridge Rd | 2 | $100 |
| Acoma West (add medians at alleys) | Kiowa | SR 95 | 2 | $100 |
| Kiowa | SR 95 | North Palo Verde | 2 | $3 |
| McCulloch | El Dorado | Cherry Tree | 2 | $2 |
| McCulloch | Cherry Tree | SR 95 | 2 | $4 |
| **STUDIES** | | | | |
| Extend Jamaica | Lake Havasu Ave | SR 95 | 2 | $250 |
| **NEW ROADWAY OR ROADWAY EXTENSION** | | | | |
| Jamaica | Lake Havasu Ave | SR 95 | 2 | $500 |
| Lake Havasu Ave | Northern Terminus | Parkway Connector | 2 | $1,150 |
| East/West Connector | SR 95 | Parkway | 2 | $2,300 |
| Parkway-Initial two lanes | SR 95 (south) | SR 95 (north) | 2 | $23,310 |
| Sweetwater | Acoma South | Mulberry | 2 | $2,000 |
| 2nd Bridge | Island | SR 95 | 2 | $14,000 |

*cost in 2004 dollars in thousands

## TABLE 15 (continued)
## GROUP 2 PROJECTS

| LOCATION | FROM | TO | GROUP | COST* |
|---|---|---|---|---|
| **INTERSECTION IMPROEMENTS** | | | | |
| SR 95/Maricopa/Acoma South | | | 2 | $250 |
| SR 95/Maricopa/Oro Grande | | | 2 | $250 |
| Mesquite/Riviera | | | 2 | $250 |
| Mesquite/Capri | | | 2 | $250 |
| Mesquite/Civic Center | | | 2 | $250 |
| Mesquite/Smoketree | | | 2 | $250 |
| Swanson/Riviera | | | 2 | $250 |
| Swanson/Capri | | | 2 | $250 |
| Swanson/Smoketree | | | 2 | $250 |
| McCulloch/Beachcomber | | | 2 | $250 |
| Kiowa/Palo Verde | | | 2 | $250 |
| **OTHER PROJECTS** | | | | |
| Multi-use path – Sara Park | | | 2 | $500 |
| SR 95 multi-use path extension | North Palo Verde | Chenoweth | 2 | $750 |
| **GROUP 2 PROJECT COST** | | | | **$65,904** |

*cost in 2004 dollars in thousands

## TABLE 16
## GROUP 3 PROJECTS

| LOCATION | FROM | TO | GROUP | COST* |
|---|---|---|---|---|
| **WIDEN TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| London Bridge Rd | Chenoweth | SR 95 (north) | 3 | $6,900 |
| London Bridge Rd | North Palo Verde | Chenoweth | 3 | $5,750 |
| Chenoweth | London Bridge Rd | SR 95 | 3 | $1,730 |
| Chenoweth | SR95 | New Parkway | 3 | $3,450 |
| SR 95 | McCulloch Blvd South | Sara Park | 3 | $1,150 |
| **WIDEN** | | | | |
| New Parkway (2 to 4 lanes) | SR 95 (south) | SR 95 (north) | 3 | $23,310 |
| Victoria Farms Rd | N/S Frontage Rd | Parkway | 3 | $1,000 |
| Chesapeake Blvd | | | 3 | $1,000 |
| Arizona Blvd | | | 3 | $750 |
| Highlander Ave | | | 3 | $1,500 |
| Holley Ave | | | 3 | $2,000 |
| Bison Blvd | Kiowa | end | 3 | $500 |
| **RE-STRIPE TO FOUR THROUGH LANES WITH A CONTINUOUS LEFT TURN LANE** | | | | |
| Kiowa | South Palo Verde | Jamaica | 3 | $3 |
| Industrial Blvd | London Bridge Rd | Acoma West | 3 | $1.5 |
| Havasupai Blvd | Acoma West | Kiowa | 3 | $2 |
| **NEW ROADWAY OR ROADWAY EXTENSION** | | | | |
| Lake Havasu Ave | Parkway Connector | Chenoweth | 3 | $1,500 |
| N/S Frontage Rd | Victoria Farms Rd | Air Industrial Rd | 3 | $750 |
| Price Dr | City Limit | SR 95 | 3 | $500 |
| Price Dr | London Bridge Rd | City Limit | 3 | $500 |
| **INTERSECTION IMPROEMENTS** | | | | |
| London Bridge Rd & Price Dr | | | 3 | $250 |
| **OTHER PROJECTS** | | | | |
| Multi—use path – Powerline | | | 3 | $250 |
| Parkway multi-use path or bike lanes | | | 3 | $250 |
| **GROUP 3 PROJECT COST** | | | | **$53,047** |

*cost in 2004 dollars in thousands

The total estimated plan cost is $132,700,000.

# D. Cost/Revenue

This section summarizes the estimated cost of the recommended plan and documents the revenue based on current funding sources.

## Cost

The cost of the recommended plan was listed by project group in the previous section. A summary of the group cost is presented in Table 17 below.

**TABLE 17**
**COST SUMMARY**

| PRIORITY | COST (in thousands) |
|---|---|
| Group 1 | $13,749 |
| Group 2 | $65,904 |
| Group 3 | $53,047 |
| **TOTAL** | **$132,700** |

The costs presented here are based on an evaluation by the study team and represent a planning level estimate. This analysis is based on several assumptions that are intended to simplify the financial analysis. These costs should be reviewed annually as part of the City and County budgeting process and updated as needed. The costs shown are in 2004 dollars and not adjusted for inflation.

## Existing Revenue Sources

The City currently uses several revenue sources as discussed below to fund transportation. These sources can be used for capital projects and also for operations and maintenance.

*Local Transportation Assistance Fund (LTAF)*

The Local Transportation Assistance Fund is generated by the state lottery. The amount distributed to cities and towns has been a constant $23 million over the last several years and is also expected to continue. This money is distributed on a population basis to incorporated cities. LTAF can be used for any transportation purpose including streets, traffic, transit, airports, and bicycles and can be used for

operations and maintenance or capital improvements. Lake Havasu City's allocation from LTAF is approximately $241,000 per year.

### Highway User Revenue Fund (HURF)

The Highway User Revenue Funds are primarily gasoline and vehicle license tax. They are available to the State, counties, cities, and towns. The state receives 50.5 percent of the HURF dollars to be used statewide, cities towns receive 27.5 percent, cities over 300,000 population receive an additional 3 percent, and counties receive 19 percent. The local distribution is based on population and gasoline sales. The HURF revenues have historically increased because of increased population in the state. HURF can be used for streets only, but can be used for operations and maintenance or capital improvements. Lake Havasu City's allocation from HURF was $4.372 million in fiscal year 2004.

### Surface Transportation Program (STP)

The Surface Transportation Program (STP) provides flexible funding that may be used by States and localities for projects on any Federal-aid highway including the National Highway System (NHS), bridge projects on any public road, transit capital projects, and public bus terminals and facilities. These funds are distributed by ADOT and WACOG.

STP funds administered by WACOG may be available for City projects. Lake Havasu City, Kingman, Bullhead City, Quartzite, Colorado City, Parker, Mohave County, LaPaz County, and four Indian Tribes are eligible for the STP funds. The City can submit projects to be considered for funding on an annual basis.

### Developer Contributions

It is common practice for the City to require developers to dedicate right-of-way for all streets adjacent to new development and to construct or improve all or a portion of adjacent streets.

## Cost/Revenue Comparison

Currently, the City uses all of their HURF and LTAF funds for operations and maintenance of the existing transportation system. Therefore, no funds are available for capital projects, except for STP funds that the City may receive from WACOG and developer contributions.

LAKE HAVASU CITY, ARIZONA
INCORPORATED 1978

# APPENDIX

# INTERSECTION TRAFFIC CONTROL

## Existing Conditions and Planned Improvements

| INTERSECTION | EXISTING CONDITION | FUTURE IMPROVEMENT* |
|---|---|---|
| SR 95 at South McCulloch | Traffic Signal | Coordination |
| SR 95 at Oro Grande | Traffic Signal | Coordination |
| SR 95 at South Acoma | Traffic Signal | Coordination |
| SR 95 at Mulberry | Traffic Signal | Coordination |
| SR 95 at Smoketree | Traffic Signal | Coordination |
| SR 95 at Swanson | Traffic Signal | Coordination |
| SR 95 at Mesquite/London Bridge Road | Traffic Signal | Coordination |
| SR 95 at South Palo Verde | Traffic Signal | Coordination |
| SR 95 at Industrial | Traffic Signal | Coordination |
| SR 95 at West Acoma | Traffic Signal | Coordination |
| SR 95 at Kiowa | Traffic Signal | Coordination |
| SR 95 at North Palo Verde | Traffic Signal | Coordination |
| SR 95 at Retail Centre | Traffic Signal | Coordination |
| SR 95 at Airport Centre | Traffic Signal | Coordination |
| SR 95 at Centre Loop | Traffic Signal | Coordination |
| SR 95 at London Bridge Road | Traffic Signal | Coordination |
| SR 95 at Shopping Center (New) | Not Existing | Traffic Signal |
| SR 95 at Jamaica | Not Existing | Traffic Signal |
| SR 95 at Price Drive/Business Park | Driveway/Not Existing | Traffic Signal |
| SR 95 at Chenoweth Drive | 2 Way Stop | Traffic Signal |
| | | |
| Lake Havasu Avenue at Industrial | Traffic Signal | Coordination |
| Lake Havasu Avenue at South Palo Verde | Traffic Signal | Coordination |
| Lake Havasu Avenue at Mesquite | Traffic Signal | Coordination |
| Lake Havasu Avenue at McCulloch | Traffic Signal | Coordination |
| Lake Havasu Avenue at Swanson | Traffic Signal | Coordination |
| Lake Havasu Avenue at Smoketree | Traffic Signal | Coordination |
| Lake Havasu Avenue at Mulberry | Traffic Signal | Coordination |
| Lake Havasu at Acoma | Multi-Way Stop | Traffic Signal |
| Lake Havasu at Kiowa | Multi-Way Stop | Traffic Signal |
| Lake Havasu at North Palo Verde | Multi-Way Stop | Traffic Signal |
| | | |
| McCulloch Boulevard at Beachcomber | 2 Way Stop | Traffic Signal |
| McCulloch Boulevard at Capri | Traffic Signal | Coordination |
| McCulloch Boulevard at Riviera | Traffic Signal | Coordination |
| McCulloch Boulevard at Smoketree | Traffic Signal | Coordination |
| McCulloch Boulevard at Jamaica | Multi-Way Stop | Traffic Signal |
| | | |
| Acoma at Industrial/Havasupai | Multi-Way Stop | Traffic Signal |
| Acoma at South Palo Verde | Multi-Way Stop | Traffic Signal |
| Acoma at Smoketree | Multi-Way Stop | Traffic Signal |
| Acoma at Mesquite | Traffic Signal | Coordination |
| Acoma at McCulloch | Traffic Signal | Coordination |
| Acoma at Swanson | Multi-Way Stop | Traffic Signal |
| Acoma at Daytona | Multi-Way Stop | Traffic Signal |
| Acoma at Jamaica | Multi-Way Stop | Traffic Signal |

# INTERSECTION TRAFFIC CONTROL (cont'd)

| INTERSECTION | EXISTING CONDITION | FUTURE IMPROVEMENT* |
|---|---|---|
| Mesquite at Smoketree | Multi-Way Stop | Traffic Signal |
| Mesquite at Riviera | Multi-Way Stop | Traffic Signal |
| Mesquite at Civic Center | Multi-Way Stop | Traffic Signal |
| Mesquite at Capri | Multi-Way Stop | Traffic Signal |
| | | |
| Swanson at Mulberry | Multi-Way Stop | Traffic Signal |
| Swanson at Smoketree | Multi-Way Stop | Traffic Signal |
| Swanson at Riviera | Multi-Way Stop | Traffic Signal |
| Swanson at Capri | Multi-Way Stop | Traffic Signal |
| | | |
| Acoma at Rainbow North | 2 Way Stop | Multi-Way Stop |
| Acoma at Saratoga | 2 Way Stop | Multi-Way Stop |
| McCulloch at Chemehuevi | 2 Way Stop | Multi-Way Stop |
| McCulloch at El Dorado | 2 Way Stop | Multi-Way Stop |
| | | |
| Daytona at Mulberry | 2 Way Stop | Multi-Way Stop |
| El Dorado at Bermuda | 2 Way Stop | Multi-Way Stop |
| Mesquite at Querio | 2 Way Stop | Multi-Way Stop |
| | | |
| Palo Verde at Riviera | Multi-Way Stop | Traffic Signal |
| Palo Verde at Kiowa (High School) | Multi-Way Stop | Traffic Signal |
| Palo Verde at Kiowa | Multi-Way Stop | Traffic Signal |
| Palo Verde at Avalon | Multi-Way Stop | Traffic Signal |
| Palo Verde at London Bridge Road | 2 Way Stop | Multi-Way Stop |
| | | |
| Kiowa at Avalon | Multi-Way Stop | Traffic Signal |
| Kiowa at Jamaica | Multi-Way Stop | Traffic Signal |
| Kiowa at Bermuda | 2 Way Stop | Multi-Way Stop |
| Kiowa at Smoketree | 2 Way Stop | Multi-Way Stop |
| Kiowa at Industrial | Multi-Way Stop | Traffic Signal |
| | | |
| London Bridge Road at Industrial | Multi-Way Stop | Traffic Signal |
| | | |
| Saratoga at Chemehuevi | Multi-Way Stop | Multi-Way Stop |
| Saratoga at Jamaica | Multi-Way Stop | Multi-Way Stop |
| | | |
| Cherry Tree at McCulloch | 2 Way Stop | Multi-Way Stop |
| Arizona at McCulloch Boulevard | 2 Way Stop | Multi-Way Stop |
| | | |
| Chemehuevi at Jamaica | 2 Way Stop | Multi-Way Stop |
| London Bridge Road at 2nd Bridge Connection | Not Existing | Traffic Signal |

# INTERSECTION TRAFFIC CONTROL (cont'd)

| INTERSECTION | EXISTING CONDITION | FUTURE IMPROVEMENT* |
|---|---|---|
| Kirk at Aviation (after 1994) | Multi-Way Stop | Not planned |
| Cisco at Smoketree | Multi-Way Stop | Not planned |
| Bluegrass at Moonshine | Multi-Way Stop | Not planned |
| Yazoo at Ponchatrain | Multi-Way Stop | Not planned |
| Sarasota at Monterey | Multi-Way Stop | Not planned |
| Challenger at Highlander | Multi-Way Stop | Not planned |
| Pony at Apache | Multi-Way Stop | Not planned |
| Star at Thunderbolt | Multi-Way Stop | Not planned |
| | | |
| | | |
| Avalon at Palisades | 2 Way Stop** | Not planned |
| Bison at Colt | 2 Way Stop** | Not planned |
| Bison at Duke | 2 Way Stop** | Not planned |

*Traffic signal installation to be considered based on warrant study
**Multi-way stop removed since 1994