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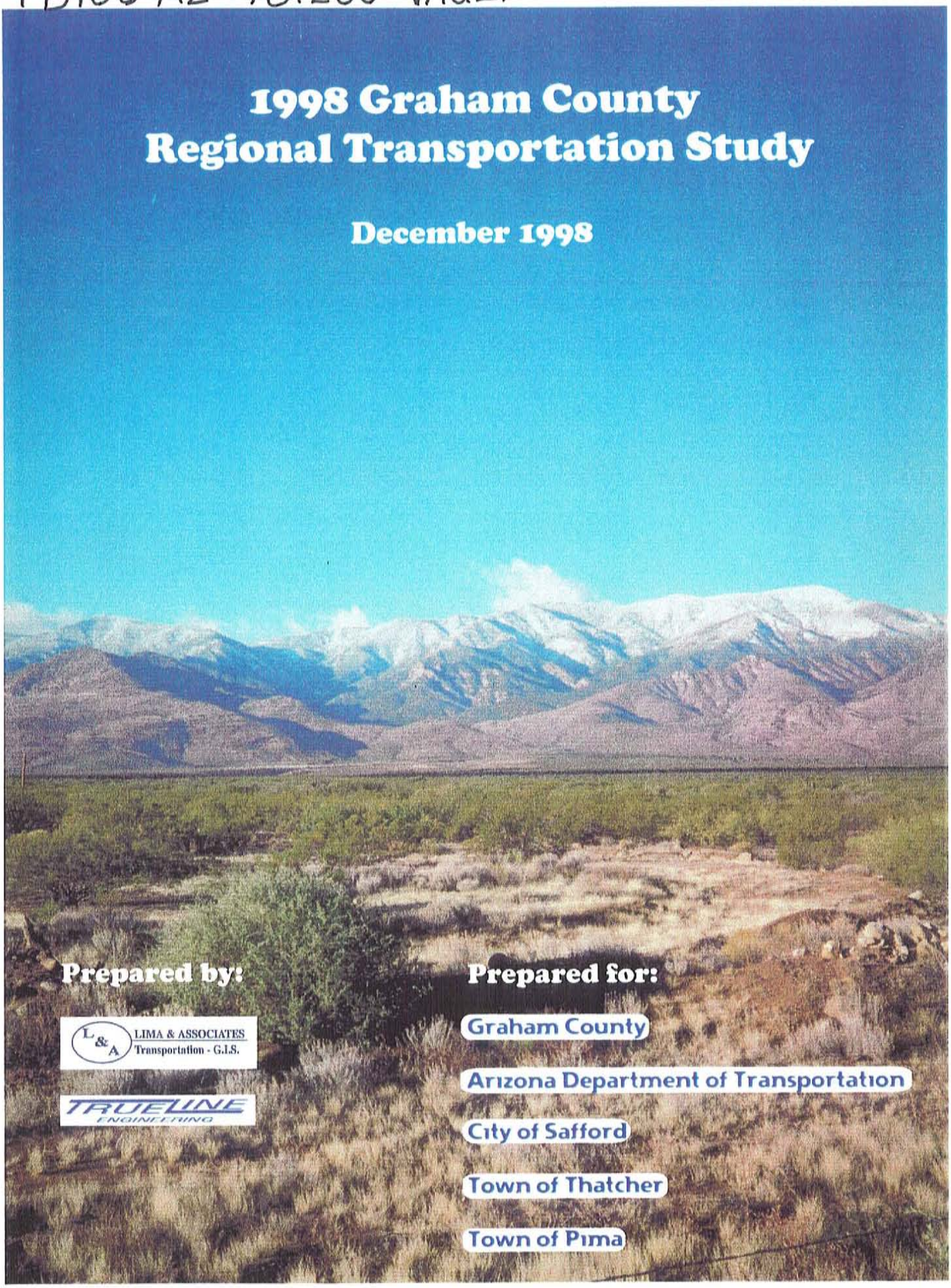
1998 Graham County Regional Transportation Study

December 1998



Prepared by:

LIMA & ASSOCIATES
Transportation - G.I.S.

TRUELINE
ENGINEERING

Prepared for:

Graham County

Arizona Department of Transportation

City of Safford

Town of Thatcher

Town of Pima

22381

1998 GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

FINAL REPORT

December 1998

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1. INTRODUCTION

OVERVIEW

Graham County is a predominantly rural area located in the southeastern corner of Arizona. The closest large urban area is Tucson, which is 130 miles southwest. Graham County is home to over 33,000 residents on 4,650 square miles. The communities of Safford, Thatcher, and Pima represent the principal center of population in the County. The San Carlos Indian Reservation covers approximately one-third of the land, less than 10 percent of the area is under individual or corporate ownership, and the remainder is public land.

The County was created from portions of Apache and Pima counties in 1881. The new County was named after the 10,720-foot Mount Graham, the highest peak in the area. The Apache Indians originally lived in the area of Graham County until American Citizens settled in the Gila River Valley. In the 1870's, farming communities began to appear along the Gila River. Using irrigation water, drawn from the river, the land became a predominately agricultural area.

Agriculture is still a very important industry. Cotton is the dominant product with other major crops being tomatoes, apples, pecans and small grains. Cattle and ostrich raising are important to the area as well.

Another major economic contributor is Phelps-Dodge Corporation, one of the largest copper producers in the world, with over 2,600 employees in Morenci. While mining production in Graham County is now quite limited, it is interesting to note that Gila, Greenlee, Cochise, and Pima Counties, all bordering on Graham County, account for 90 percent of Arizona's dollar volume in mining production. Two copper mining projects are planned for the area. In addition to Safford/Thatcher being a major shopping center for the population of Morenci and Clifton, 43 miles to the northeast, tourism has become a major industry in Graham County. Winter visitors are attracted to the area's climate and variety of natural resources, including hiking, swimming, fishing, hunting, and rock hounding. Graham County is also attracting retirees.

The economic factors point to a gradual, but accelerating growth of the communities through the continued development of the agriculture industry, the expansion of the mining industry, and the development of the tourism industry. Astrophysical industries will also develop as spin-offs of the Mount Graham International Observatory.

Study Needs

In 1992 Graham County conducted a transportation study for the Gila Valley Region, in partnership with the Arizona Department of Transportation (ADOT). This study prepared a long-range transportation plan and a transportation improvement program, which

recommended a number of improvements to the municipal street system. Many of the improvements have been completed. The County decided to update the transportation plan in light of continued growth and changes in the economic structure and seeks to define and prioritize the next set of projects to meet the growing demands in the Study Area. The purpose of this study is to update the 1992 transportation plan and to address current issues within the area.

Study Area

The Study Area for the 1998 Graham County Transportation Study has been expanded from the 1992 study. As in 1992, it includes the municipalities of Pima, Safford, Thatcher, and the unincorporated areas of Central, Solomon, and Swift Trail Junction. However, the 1998 Study Area has been expanded to include Fort Grant, Mt. Graham, and Bonita. This expansion provides for the evaluation of access to the Hydroponics Nursery in Bonita and other County needs.

Figure 1-1 shows the Study Area, which encompasses the southeastern portion of Graham County, bordered on the east by Greenlee County and on the south by Cochise County. To the west, the Study Area boundary follows a line approximately 10 miles northwest of Klondyke Road and southwest of Klondyke-Bonita Road. The San Carlos Indian Reservation defines the Study Area to the north and northwest

Model Area

As part of this study a TRANPLAN transportation model was developed for a sub-area of the Study Area. This particular area is referred to as the "Model Area." The extent of the Model Area is the same as in the 1992 study, however the system of Transportation Analysis Zones (TAZs) has been updated to represent the current land use and socioeconomic conditions. The development of the model will allow forecasting of future traffic volumes and help analyze future transportation needs.

The Model Area covers approximately 210 square miles of unincorporated Graham County land, the municipalities of Pima, Thatcher, and Safford, and the unincorporated places of Central, Solomon, Cactus Flat, Lebanon, Swift Trail Junction, and Artesia. The Model Area represents the principal center of population in the Upper Gila Valley and Graham County. The Gila River runs through the area entering from the northeast and leaving in a northwesterly direction. The Model Area represents approximately five percent of the total area of Graham County but is home to about 70 percent of the County's population. Thus, it is sometimes referred to in the report as the urban portion of the Study Area while the rest of the Study Area is sometimes referred to as the rural portion of the Study Area. The two primary highway corridors in the Study Area are US 70 following the Gila River Valley and US 191, which connects the area with Interstate 10 to the south.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

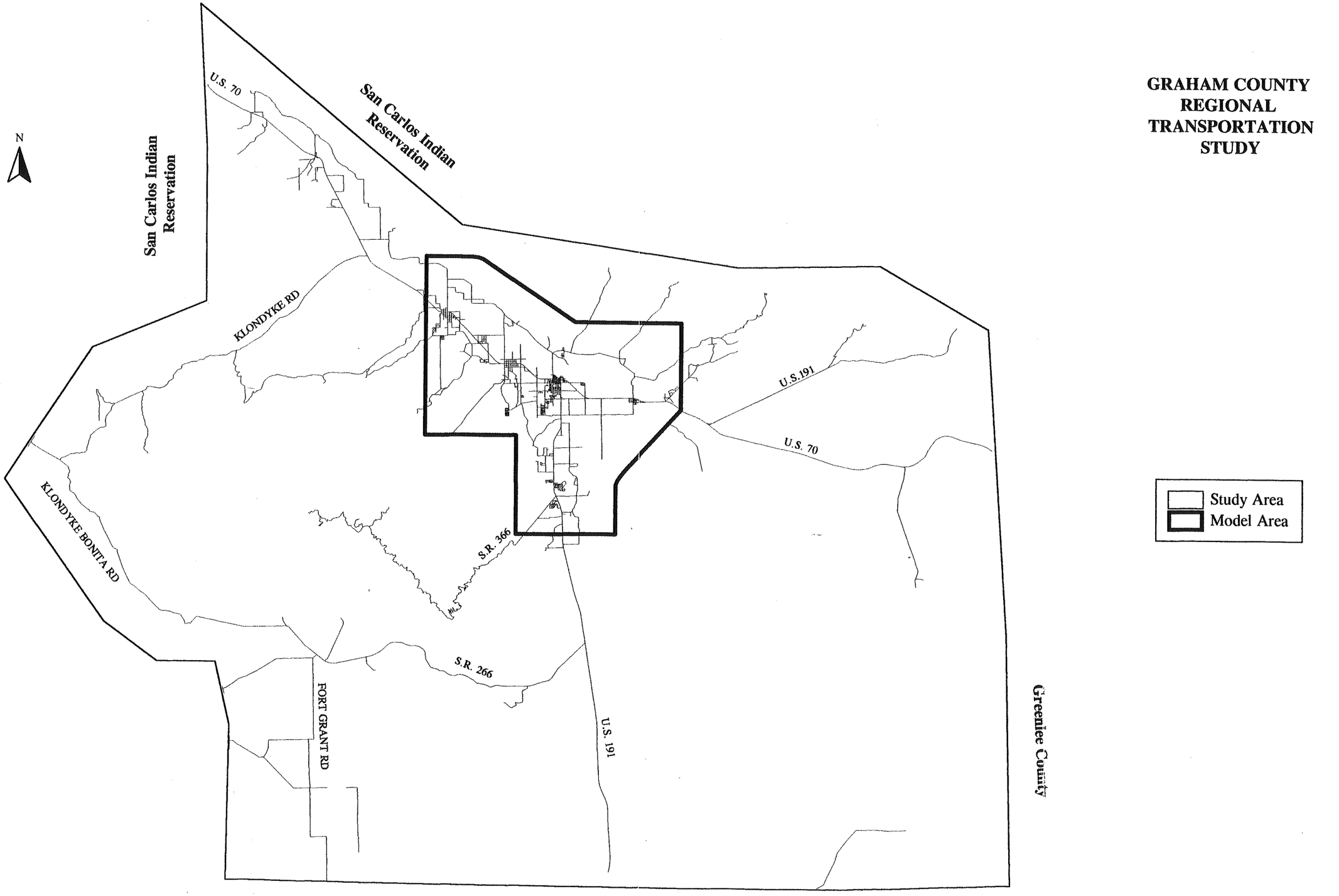

FIGURE 1-1
STUDY AREA

2. EXISTING SOCIOECONOMIC CONDITIONS

The purpose of this chapter is to present the 1998 population and employment data for the study.

POPULATION

Population data published by the Arizona Department of Economic Security (DES) have been used as a basis for the population estimates for the 1998 Graham County Transportation Study. As shown in Table 2-1, DES estimates 33,260 persons reside in Graham County in 1998. Using 1990 census data, it was estimated that 23,650 persons, or 71 percent of the County's total population, live in the Model Area in 1998.

Graham County experienced an overall population growth of 25 percent from 1990 until 1998. In the same period, the population in Safford grew by 35 percent, followed by Pima at 19 percent, and Thatcher at 11 percent.

TABLE 2-1. POPULATION CONTROL TOTALS

	1990	1998	Increase	% Growth
Graham County	26,554	33,260	6,706	25%
Model Area				
Safford	7,359	9,940	2,581	35%
Thatcher	3,763	4,170	403	11%
Pima	1,725	2,050	325	19%
County	5,980	7,490	1,510	25%
Total Model Area	18,827	23,650	4,823	25%

EMPLOYMENT

Figures published by the Safford Chamber of Commerce (Table 2-2) show that the labor force in Graham County is approximately 8,000 workers. The majority of jobs, 35 percent, are in the government sector, followed by agriculture at 24 percent. The wholesale and retail trade sector employs 21 percent of the work force and the service industry accounts for 12 percent.

While employment numbers are not available for the Model Area, it can be assumed that the change in recent years from agriculture to service, trade, and governmental sectors is even more dramatic in the urban areas of the County. This shift of employment among the sectors can be explained in part by the fact that Safford and Thatcher have developed into a regional shopping area for Graham, Greenlee, and northern Cochise counties and parts of western New Mexico. In addition, Safford and Thatcher function as the regional governmental and educational center of Graham County. The major employers in the Study Area are listed in Table 2-3.

TABLE 2-2. GRAHAM COUNTY EMPLOYMENT

Sector	Number of Employees	Percent
Agriculture	1,925	24%
Construction	175	2%
Manufacturing	175	2%
Transportation & Utilities	150	2%
Wholesale & retail trade	1,675	21%
Finance, Insurance, Real estate	100	1%
Services	950	12%
Government	2,825	35%
Total	7,975	100%

Source: Safford Chamber of Commerce 1998

TABLE 2-3. MAJOR EMPLOYERS IN THE STUDY AREA

Employer	Location	Employment Type
Bonita Nurseries	Bonita	Hydroponic Nursery
City of Safford	Safford	Government
Eastern Arizona College	Thatcher	Education
Impressive Labels	Safford	Manufacturing
Mt. Graham Hospital	Safford	Health Care
Safford Unified School District	Safford	Education
Wal-Mart	Thatcher	Retail

Source: Arizona Department of Commerce: Profile: Graham County, Arizona, 1997

POPULATION AND EMPLOYMENT DISTRIBUTION

The traffic forecasting process presented in detail in Chapter 4 uses population and employment data distributed by small geographical units called Traffic Analysis Zones (TAZ). The zones are geographical areas which represent fairly homogenous areas of similar land uses and are bounded by physical barriers and major streets. The TAZ system for the 1998 Graham County Study is shown in Figure 2-1.

The estimated 1998 model area population is 23,650, the estimated number of occupied dwelling units is 7,995, and the estimated employment is 6,612. Employment is divided into three categories: retail, office, and general. Each of these categories represents a different trip generation rate. As is often the case, some TAZs will have purely residential

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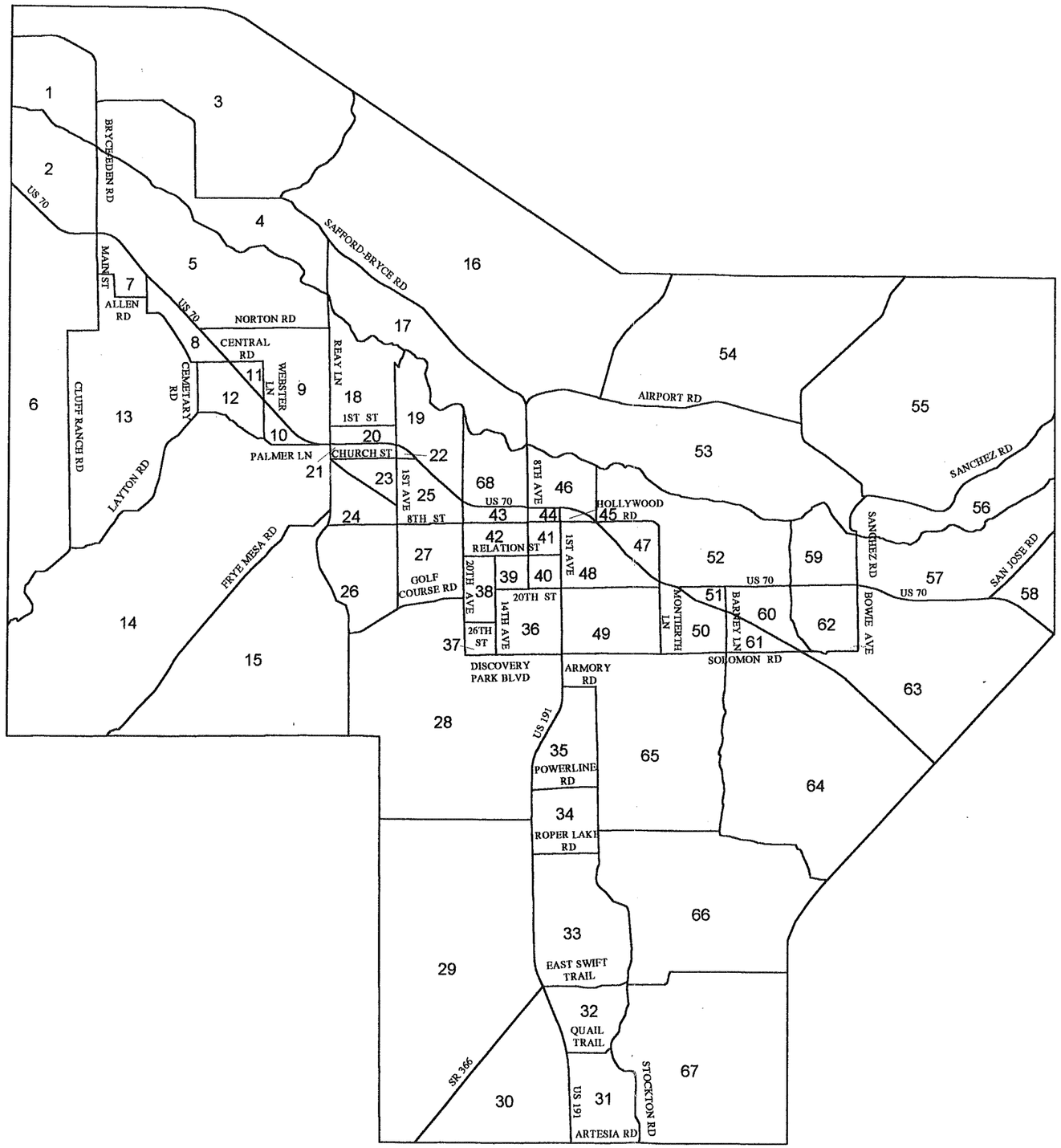


GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

Traffic Analysis Zone Boundary

64 Traffic Analysis Zone Number

FIGURE 2-1
TRAFFIC ANALYSIS ZONE SYSTEM

land uses, some will have purely commercial land uses, and others will have a mixture of residential and commercial land uses. Table 2-4 presents the 1998 population, dwelling units, and employment by TAZ. The distribution of population and dwelling units by TAZ is shown in Figure 2-2. Figure 2-3 presents the employment numbers by TAZ.

TABLE 2-4. 1998 SOCIOECONOMIC ESTIMATES BY TAZ

			1998 Employment			
TAZ	Pop 1998	DU 1998	Retail	Office	General	Total
1	57	14	0	0	0	0
2	332	109	31	4	4	39
3	79	18	0	0	0	0
4	67	21	0	0	4	4
5	217	64	20	20	50	90
6	827	254	4	4	31	39
7	442	158	20	19	0	39
8	22	9	16	10	0	26
9	390	108	18	19	40	77
10	64	18	1	1	11	13
11	26	12	4	4	31	39
12	97	33	4	4	31	39
13	527	160	3	3	20	26
14	201	55	3	3	20	26
15	1,353	420	24	4	11	39
16	282	81	0	4	21	25
17	175	61	0	20	80	100
18	96	42	17	17	18	52
19	67	36	200	100	71	371
20	767	240	17	17	18	52
21	682	237	20	150	10	180
22	50	18	9	0	0	9
23	759	173	10	75	10	95
24	298	83	10	75	10	95
25	102	29	53	400	50	503
26	263	88	21	22	21	64
27	397	130	14	50	13	77
28	617	196	0	71	122	193
29	741	268	10	10	83	103
30	259	88	10	10	83	103
31	77	23	0	0	0	0
32	79	31	0	0	0	0
33	354	132	3	3	20	26
34	92	30	0	0	2	2
35	28	14	6	6	48	60
36	2,357	732	3	3	26	32
37	6	2	0	0	0	0
38	475	219	20	20	20	60
39	983	326	7	7	6	20

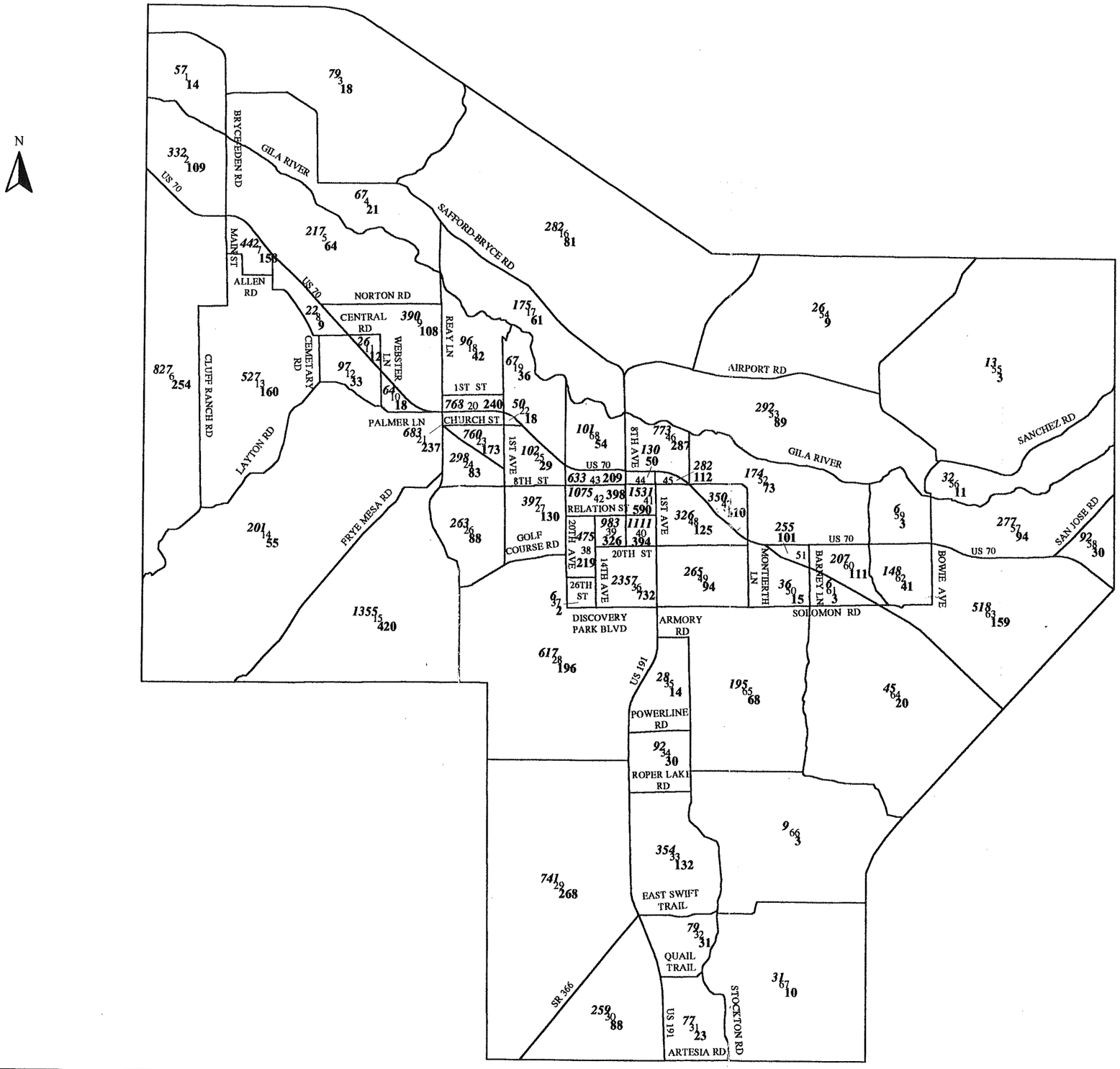
TABLE 2-4. 1998 SOCIOECONOMIC ESTIMATES BY TAZ (continued)

			1998 Employment			
TAZ	Pop 1998	DU 1998	Retail	Office	General	Total
40	1,111	394	7	7	6	20
41	1,531	590	40	69	20	129
42	1,075	399	10	70	10	90
43	633	209	138	838	120	1,096
44	130	50	43	163	26	232
45	282	112	21	21	10	52
46	773	287	317	317	158	792
47	350	110	10	10	10	30
48	326	125	34	34	35	103
49	265	94	24	24	23	71
50	36	15	1	1	2	4
51	239	101	0	0	0	0
52	174	73	4	4	5	13
53	292	89	0	0	0	0
54	26	9	0	0	25	25
55	13	3	0	25	0	25
56	32	11	0	0	0	0
57	277	94	0	0	0	0
58	92	30	0	150	98	248
59	6	3	0	0	0	0
60	207	111	0	0	0	0
61	6	3	0	0	0	0
62	148	41	2	2	16	20
63	518	159	27	27	223	277
64	45	20	5	5	93	103
65	195	68	5	5	29	39
66	25	3	3	0	10	13
67	31	10	0	0	0	0
68	101	54	150	300	62	512
Totals	23,650	7,995	1,419	3,227	1,966	6,612

TRAFFIC DESTINATIONS

This section provides a list and location (see Figure 2-4) of a number of traffic destinations, excluding downtown and shopping areas, in the Study Area. Many of them are discussed in more detail in the special topics covered in Chapter 7. Destinations have been divided into the following categories: tourism, mining, education, research, and correctional facilities.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Traffic Analysis Zone Boundary

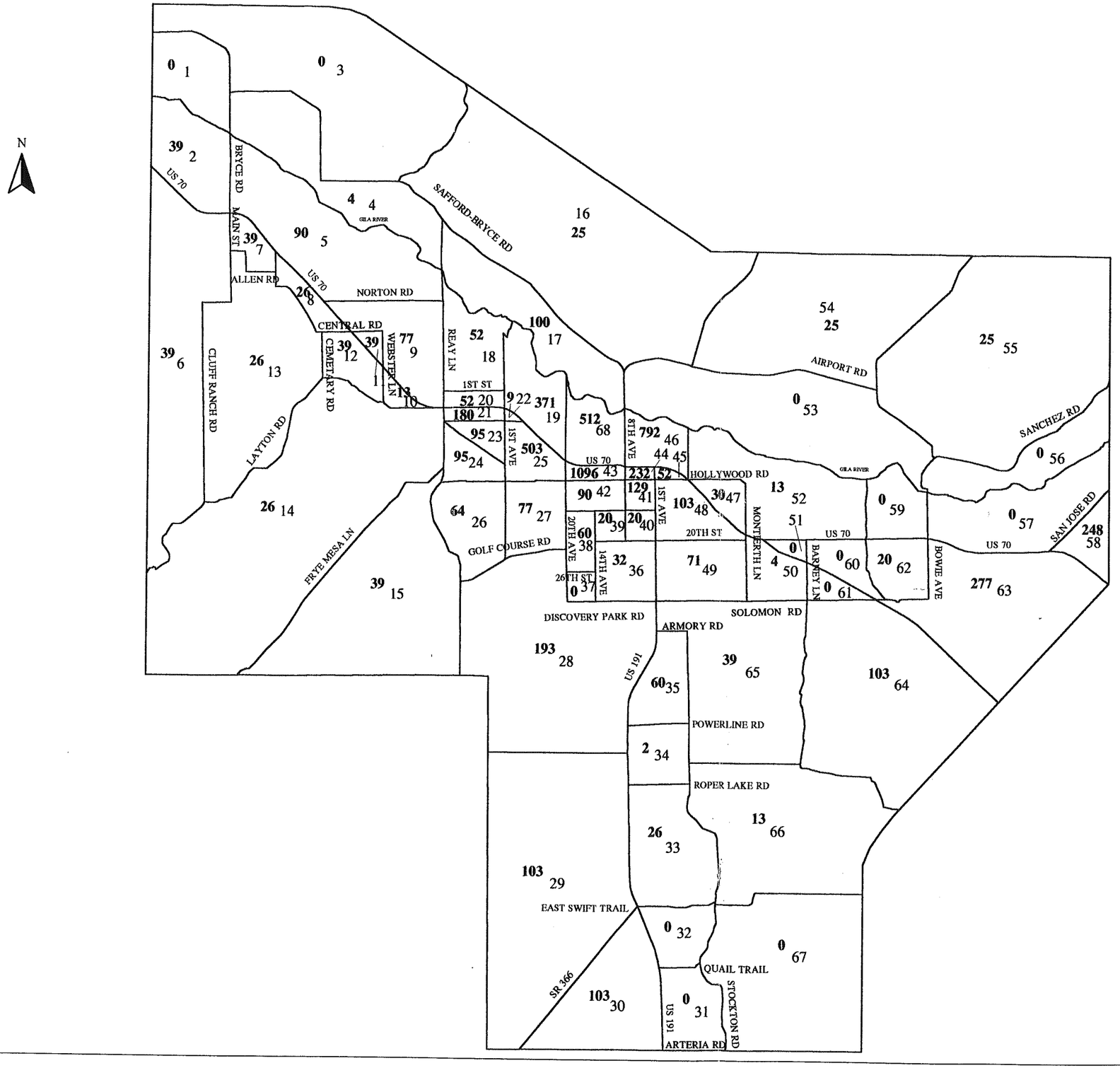
79 1998 Estimated Population

64 Traffic Analysis Zone Numbers

18 1998 Estimated Dwelling Units

FIGURE 2-2
1998 POPULATION
&
OCCUPIED DWELLING UNITS
BY TAZ

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



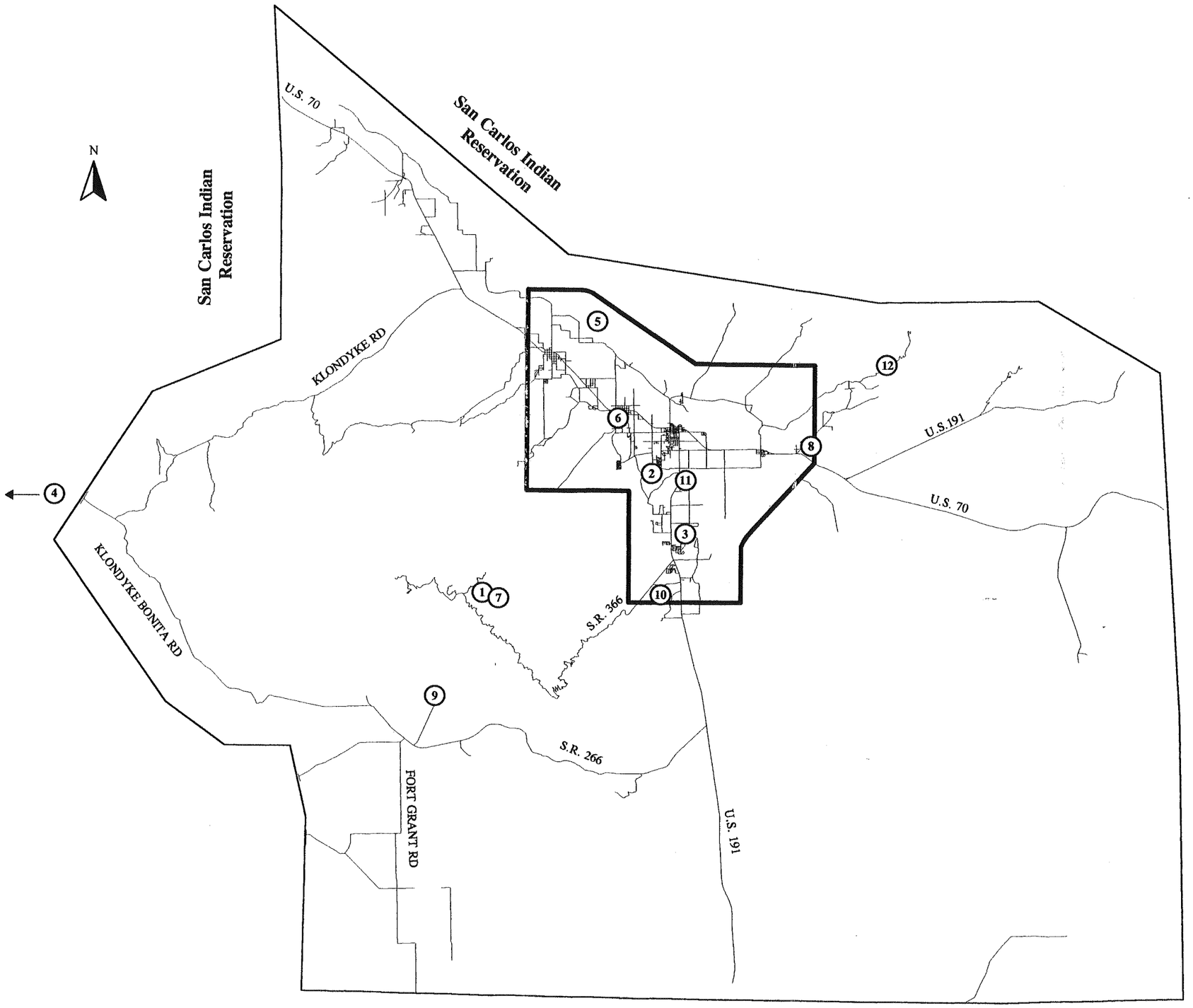
Traffic Analysis Zone Boundary

64 Traffic Analysis Zone Numbers

80 1998 Employment

FIGURE 2-3
1998 EMPLOYMENT BY TAZ

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



1. Mount Graham
2. Discovery Park
3. Roper Lake State Park
4. Aravaipa Canyon Wilderness
5. Phelps Dodge, Safford Mine
6. Eastern Arizona College
7. Mount Graham Observatory
8. Arizona State Prison-Safford
9. Fort Grant Complex
10. Safford Correctional Inst.
11. County Park/Fairgrounds
12. Gila Box Riparian National Conservation Area

Study Area
Model Area

FIGURE 2-4
TRAFFIC DESTINATIONS

Tourism

Mount Graham is a 10,720 foot "sky island" offering camping, hiking, fishing, and wildlife-viewing easily accessed by Swift Trail (Arizona Highway 366)

Graham County Park and Fairgrounds, located on SR 191 in Safford, provides a considerable number of recreational opportunities for the citizens of Graham County and southeast Arizona.

The visitor center for the Mount Graham Observatory is located in ***Discovery Park.***

Roper Lake State Park provides a public lake with a swimming beach, duck pond, fishing, picnic facilities, hot tub, and desert trail with ranger-led tours available.

Aravaipa Canyon Wilderness Area is a scenic natural preserve with hiking and horseback-riding trails along a creek which flows year-round.

The ***Gila Box Riparian National Conservation Area*** is located east of Safford.

Phelps-Dodge Morenci Copper Mine is a large open-pit copper mine. Tours are offered to the public.

Mining

The **Phelps-Dodge Safford Mine** project is anticipated to be operational by the year 2003. The Safford Mine site is located seven miles north of the City of Safford. Access to the mine will be provided on Phelps-Dodge Road, which intersects with the Safford-Bryce Road east of Reay Lane. During construction, it is expected that more than 1,000 workers will be employed at the mine and after opening approximately 350 full time employees are expected to work at the site.

Education

Eastern Arizona College employs approximately 160 full time staff members and has more than 1,400 students enrolled at the Thatcher campus. Housing on the Thatcher campus accommodates approximately 370 students. Stadium and College Avenues serve as the primary roadway links to the campus from Main Street (US 70).

Research

Mt. Graham Observatory is located on Mt. Graham near Safford. Congress approved the construction of the Observatory in November of 1988. Three telescopes will be installed on the site.

Correctional Facilities

Three correctional facilities are located in or in close proximity to the Study Area.

The **Arizona State Prison Complex-Safford** is located on San Jose Road off US 70. The complex provides both a medium and minimum-security facility of the Arizona Department of Corrections. In addition to the employment it provides, the facility is also a source of public work assistance through an inmate work program.

The minimum custody institution, Graham Unit, was opened in July 1970, with 12 inmates. The institution currently houses 715 inmates, with 100 in tents.

The medium institution, Tonto Unit, was opened in May 1992 with 40 inmates. This unit currently houses 370 inmates, with 100 inmates in tents. Additionally, the Complex Detention Unit has a capacity for 12 inmates. The complex employs a staff of 242.

The **Fort Grant Complex** has an interesting history. Established in 1872, Fort Grant served as a cavalry post until 1905. After being abandoned from 1905 until 1912, it was turned over to the newly established Arizona State government for use as a juvenile industrial school for wayward youths. In 1973, it was converted to a prison within the Arizona Department of Corrections for minimum-security male inmates.

The **Safford Federal Correctional Institution** facility was opened in 1964. Originally a minimum-security facility, the institution was converted to a low security facility for adult males on April 30, 1984. The facility is located at the base of Mount Graham in the Pinaleno Mountains, seven miles south of Safford on Hwy 366. The capacity of the institution is 722, with a staff of 188.

ENVIRONMENTAL JUSTICE SCREENING

The following two questions must be answered to address environmental justice concerns:

- Does the potentially affected community include minority and/or low-income population?

- Are the environmental impacts likely to fall disproportionately on minorities and/or low-income members of the community?

In order to answer the first question, it is necessary to define the racial and ethnic composition of the study area. Since the study area includes a large portion of unincorporated Graham County in addition to the communities of Safford, Thatcher, and Pima, exact data for the study area is not available. Therefore, to define the racial and ethnic composition, data is provided for the three communities in Table 2-5 and for the entire County in Table 2-6.

TABLE 2-5. RACIAL AND ETHNIC COMPOSITION - 1990 SAFFORD, THATCHER, AND PIMA

Race or Ethnic Group	Population	Percent of Total
White Non-Hispanic	8,805	68.5%
Black	120	0.9%
American Indian, Eskimo or Aleut	120	0.9%
Asian or Pacific Islander	138	1.1%
Hispanic	2,863	22.3%
Other Race	801	6.2%
Total	12,847	100.0%

Source: 1990 US Census of Population and Housing

TABLE 2-6. RACIAL AND ETHNIC COMPOSITION - 1990 GRAHAM COUNTY

Race of Ethnic Group	Population	Percent of Total
White Non-Hispanic	15,629	58.9%
Black	442	1.7%
American Indian, Eskimo or Aleut	3,796	14.3%
Asian or Pacific Islander	167	0.6%
Hispanic	5,112	19.3%
Other Race	1,408	5.3%
Total	25,554	100.0%

As the data indicates, the County has a much larger percentage of American Indian population (14.3 percent) than do the communities (0.9 percent). This can be explained by the fact that about one-third of Graham County is San Carlos Indian Reservation land, none of which is in the study area. Therefore, for environmental justice evaluation, the racial and ethnic composition percentages shown in Table 2-5 will be used. In addition, the socioeconomic characteristics for the three communities shown in Table 2-7 is also representative of the study area. For reference the socioeconomic characteristics of the County are provided in Table 2-8.

As shown in Table 2-5, 68.5 percent of the population is white, non-hispanic. The other 31.5 percent is primarily Hispanic. As shown in Table 2-7, 5.1 percent of the population has a work disability, 16.2 percent are over age 64, and 20.8 percent are below the poverty level. The answer to the first question is, thus, yes, the study area does include minority and low income population.

TABLE 2-7. SOCIOECONOMIC CHARACTERISTICS - 1990 SAFFORD, THATCHER, AND PIMA

Characteristic	Population	Percent of Total
Total Population	12,847	100.0%
Median Age	28.3	--
Males	6,032	47.0%
Females	6,815	53.0%
Persons with Disability	658	5.1%
Persons Over Age 64	2,076	16.2%
Households without Autos	344	8.0%
Percent Below Poverty Level	2,669	20.8%

Source: 1990 US Census of Population and Housing

TABLE 2-8. SOCIOECONOMIC CHARACTERISTICS - 1990 GRAHAM COUNTY

Characteristic	Population	Percent of Total
Total Population	26,554	100.0%
Median Age	29.0	--
Males	13,619	51.3%
Females	12,935	48.7%
Persons with Disability	1,387	5.2%
Persons Over Age 64	3,309	12.5%
Households without Autos	694	8.8%
Percent Below Poverty Level	6,523	24.6%

Source: 1990 US Census of Population and Housing

The second question to be addressed in considering environmental justice is: are the environmental impacts likely to fall disproportionately on minority and/or low-income members of the community? The 1998 Graham County Regional Transportation Study includes:

- Construction of new roadways
- Intersection improvements
- Realignment of selected intersections
- Improved transit services
- Improved bicycle facilities

The range of physical street improvements in the Plan will not disproportionately impact minority or low-income populations nor do the recommended improvements appear to impact residences or businesses. In fact, improvement of the region's transportation system will help to stimulate economic growth thereby benefiting the community at large. Therefore, it is concluded that the environmental impacts do not fall disproportionately on minority or low-income members of the community.

As projects recommended by this Plan are implemented, the project development and environmental assessment phases must identify impacts and consider how to avoid, minimize, and mitigate any potentially adverse effects.

3. EXISTING TRANSPORTATION SYSTEM

The purpose of this chapter is to provide an evaluation of the existing transportation system within the Study Area. This will lay the groundwork for the evaluation of conditions in the future. The chapter begins with a discussion of non-automotive modes followed by a discussion of the street system including an assessment of the accident data.

NON-AUTOMOTIVE MODES

Local Bus Service

Public bus service does not exist within the Study Area. Specialized service is provided by Southeast Arizona Human Resources Council and Southeast Arizona Behavioral Health Services. Taxi service is available from 8:00 a.m. to 7:00 p.m.

Intercity Bus Service

Intercity bus service is provided to the Safford-Thatcher area by Greyhound. Three busses per day travel to and from Phoenix and six busses per day travel to and from Tucson. In addition, Greyhound service is provided to and from Yuma, Flagstaff, and Sierra Vista.

Air Service

Commercial air service to the Safford Municipal Airport does not exist.

Bicycle Facilities

The 1992 Transportation Plan includes a bicycle element that identified a network of streets (shown in Figure 3-1) laid out to provide children a route between home and school. The main spine of the bicycle network is 8th Avenue between 20th Street and 2nd Street. Several east-west streets were then identified as being links to schools. Some of these streets are signed as bicycle routes. All of these streets are located in Safford.

An update of this plan is included in Chapter 8

Rail Service

As shown in Figure 3-2, running adjacent to US 70 for most of the route from Globe, the railway passes through the southern part of Thatcher and then runs parallel to 8th Street (on

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

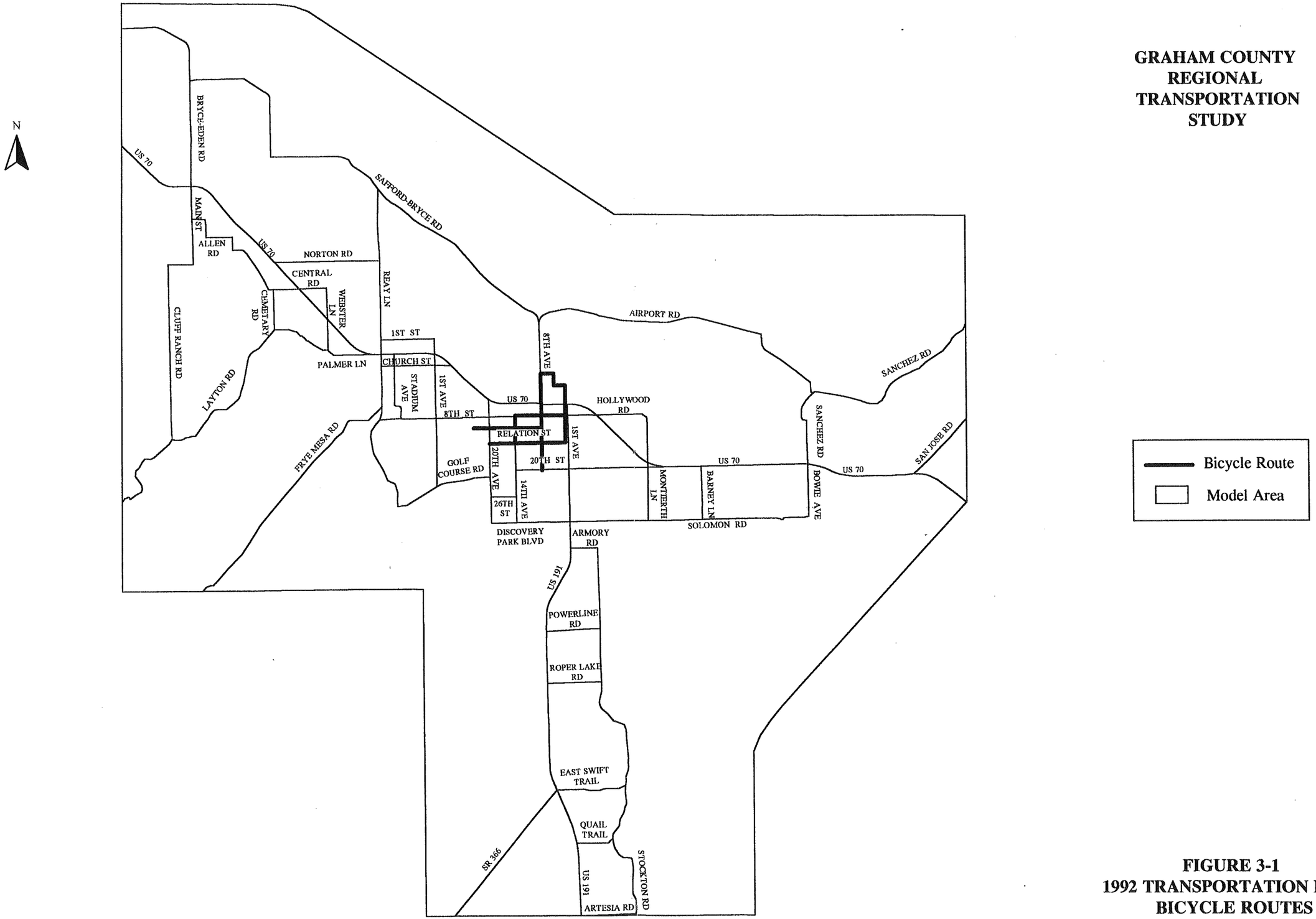


FIGURE 3-1
1992 TRANSPORTATION PLAN
BICYCLE ROUTES

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

Railroad Tracks

Model Area

FIGURE 3-2
RAILROAD TRACKS

the north side of the road) through Safford. Then it picks up US 70 on the east side of Safford and runs to the southeast before leaving the highway where US 70 turns east at Lone Star Road. The Arizona Eastern Railway runs two freight trains per day through Safford and Thatcher. Rail passenger service is not available in the area.

STREET NETWORK

The purpose of this section is to provide descriptions of the major roadways in the Study Area. The roadways discussed also form the network that is used in the traffic forecast model for evaluating future conditions. The model is discussed in Chapter 4.

This section of the report is broken into three sections. The first deals with roadways in the rural portions of the Study Area. This is followed by sections dealing with roadways in the urban areas and then bridges crossing the Gila River.

Study Area Roadways

The Study Area includes approximately 630 miles of roadways, of which 365 are located outside the model area. Nearly all of these roadways are unpaved and carry very little traffic, mainly providing access to mining operations, farming, and forest service land.

The major roadways in the Study Area located outside the Model Area are shown in Figure 3-3. Four State highways serve the area: US 70, US 191, SR 366 and SR 266. These roadways are administered by ADOT. US 70 and US 191 are major interregional facilities while SR 366 provides a connection from US 191 into the Pinaleno Mountains and the Mt. Graham Observatory. The Safford Federal Correctional Facility is located along SR 366. SR 266 heads west from US 191 to Bonita and Fort Grant, where it ends at the Fort Grant Correctional Institution.

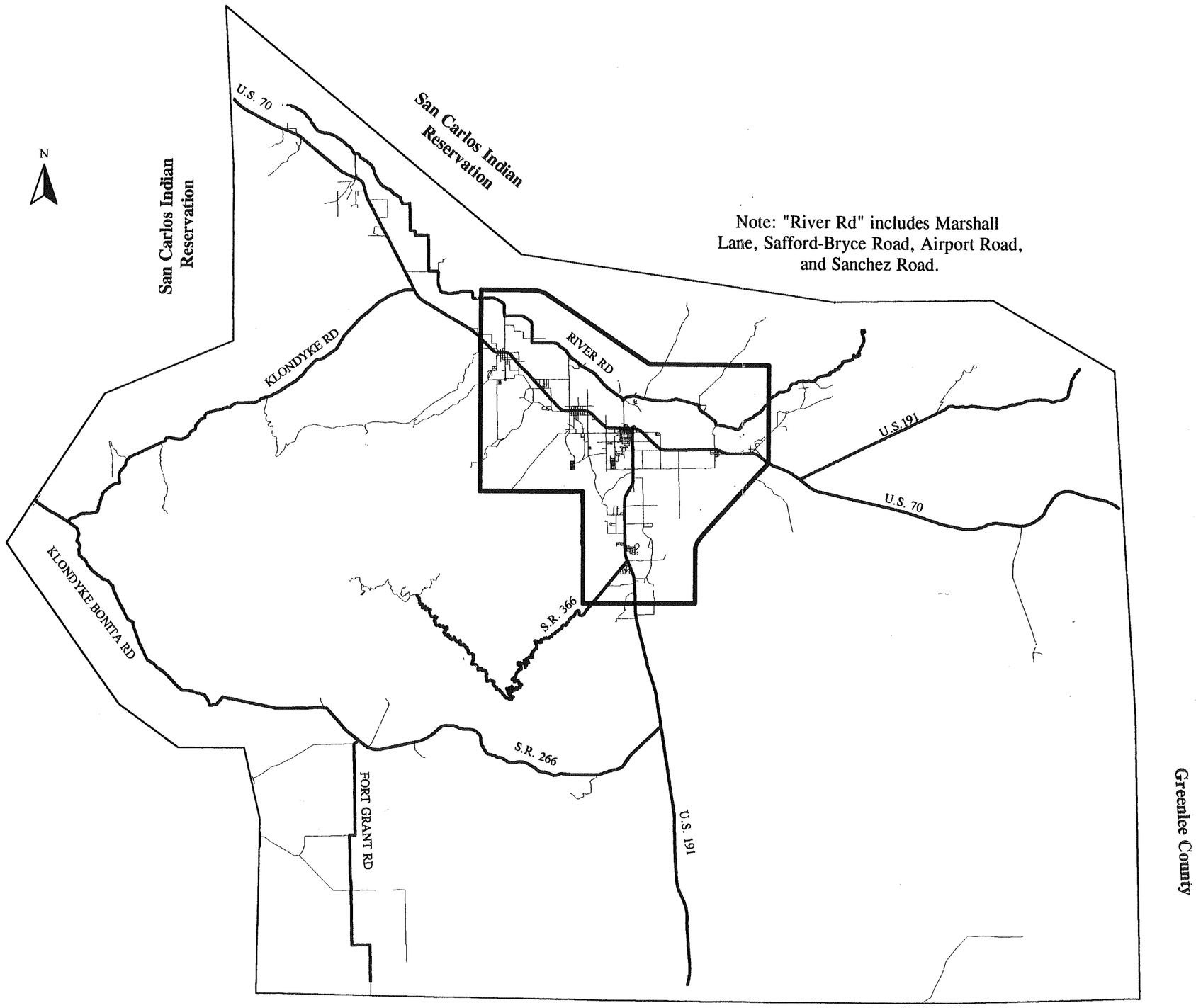
Important County roads include Fort Grant Road, Klondyke-Bonita Road, Klondyke Road, and a roadway that runs north of the Gila River identified with a number of different names.

Fort Grant Road heads south from the end of SR 266 to an interchange with I-10 at Wilcox. Bonita Hydroponic Nursery, an agricultural facility producing vegetables and apple orchards located in southern Graham County is served by this Road. Thirteen of its 32 miles are located in Graham County.

The Klondyke-Bonita Road heads in a northwesterly direction from the end of SR 266 towards the place of Klondyke and then loops back to the northeast as Klondyke Road, connecting to US 70 west of the Town of Pima. This loop is 51 miles long.

Beginning near the community of Fort Thomas, a County road runs north of and parallel to the Gila River to the community of Sanchez. Identified by different names: Fort Thomas

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Note: "River Rd" includes Marshall Lane, Safford-Bryce Road, Airport Road, and Sanchez Road.

Study Area
Model Area

FIGURE 3-3
MAJOR STUDY AREA ROADWAYS

River Road, Marshall Lane, Safford-Bryce Road, and Airport Road - this roadway could become increasingly more important as the region grows. Access between this road (for identification purposes: River Road) and US 70 is provided at all five bridges that cross the Gila River. If an emergency closure of US 70 were to occur, River Road could serve as an alternative to the highway. River Road provides access to the Safford Sanitary Landfill, the proposed Dos Pabros mine, and the Safford Municipal Airport among other sites.

Model Area Road Network

Approximately 266 miles of roadways are in the Model Area. The 130 miles of roadways that were coded into the traffic forecast model are shown in Figure 3-4. With the exception of the State Highways, and the segment of 8th Avenue between US 70 and 20th Street, which has three lanes, all of the roadways on the network have two lanes. These roadways comprise the traffic assignment network for the traffic forecast modeling process.

ADOT administers three highways in the Model Area. Since these highways are the major roadways in the region, each is discussed in some detail below. All of the State routes serve both local and Statewide traffic. US 70 and US 191 serve as major inter-regional links especially for the shipping industry and tourism. All three highways are classified as principal arterials.

US 70

This major east-west facility, designated as the Old West Highway, connects the Model Area to New Mexico in the east and through Globe into the Phoenix Metropolitan area to the west. US 70 is the main route through the area and is used by visitors and recreational users to access the White Mountain area, San Carlos Lake, and other attractions in Graham County. There are approximately 18 miles of US 70 in the Model Area. The roadway is a two-lane facility in the unincorporated areas and transitions to a four- or five-lane roadway in the incorporated areas. Table 3-1 shows the speed limits and cross section for US 70, traveling east starting at the western Town Limit of Pima.

US 191

This highway is the major north-south facility that connects US 70 in Safford with Interstate 10 approximately 32 miles to the south of Safford. The highway is designated as a scenic route and provides access to the Graham County Park and Fair Grounds and Roper Lake State Park. Both SR 266 and SR 366 connect to the State Highway system via US 191. US 191 is functionally classified as a principal arterial. Approximately 10 miles of the highway are in the model area.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

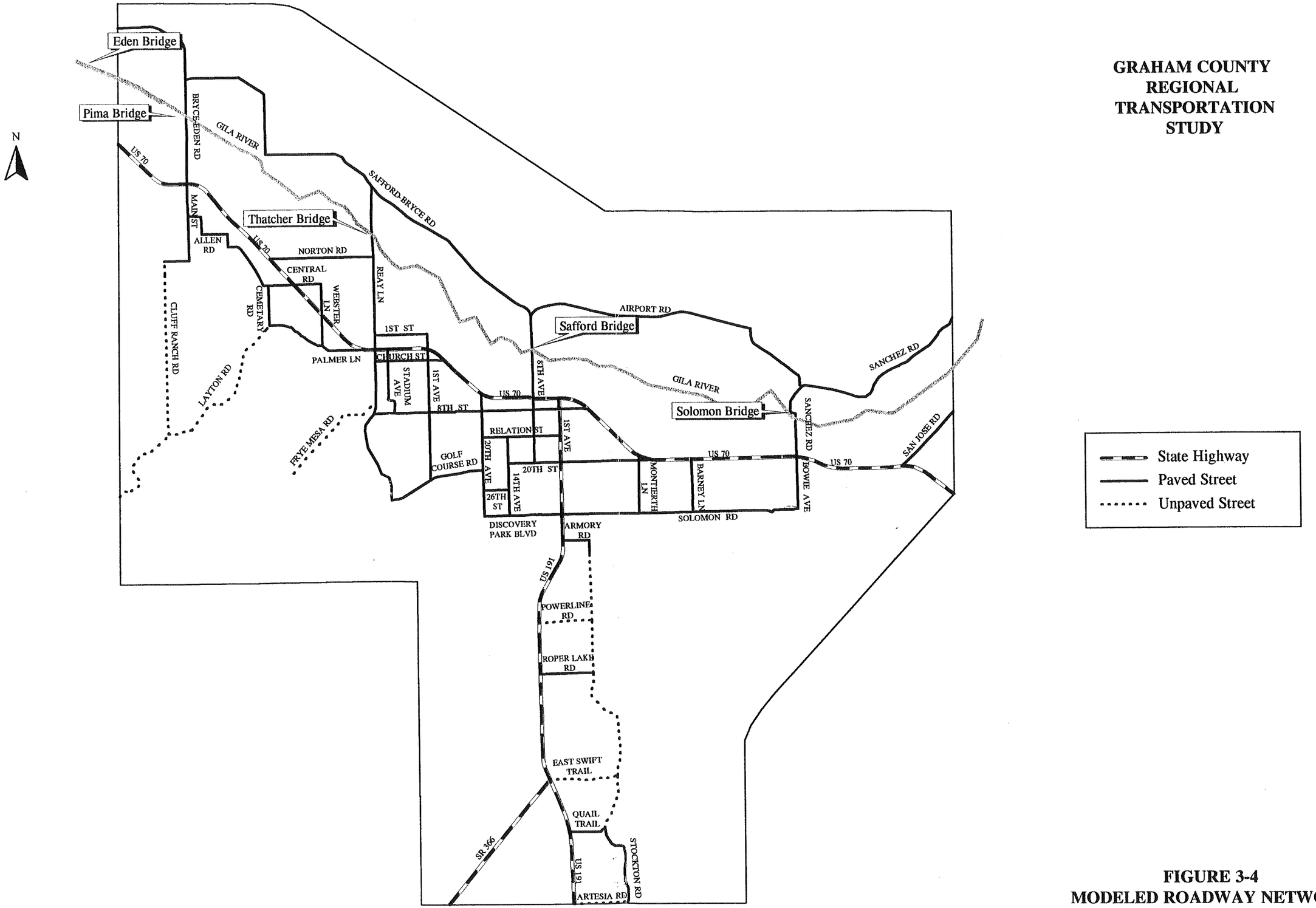


FIGURE 3-4
MODELED ROADWAY NETWORK

TABLE 3-1. CROSS SECTION, TRAFFIC SIGNALS, AND SPEED LIMITS ON US 70

Route Mile	Location	Cross Section Change/ Traffic Signal Location	Speed Limit change
0.0	Pima Town Limits	2 lane section	45 mph
0.1	Tripp Canyon Road	2 lane section	
0.3	Milepost 330	2 lane section	
0.3		2 lane section	35 mph
0.6	300 West	5 lane section	
1.0	100 East	3 lane section	
1.5	200 South	3 lane section	45 mph
1.8		2 lane section	55 mph
5.4	Thatcher City Limits	5 lane section	
5.6	Palmer Lane	5 lane section	45 mph
5.8		5 lane section	35 mph
6.7	Second Avenue	4 lane section	45 mph
7.1	Church Street	5 lane section	
7.5		5 lane section	35 mph
7.8	Walmart	Traffic Signal	
8.1	City Limit Safford	5 lane section	
8.2	20th Avenue	Traffic Signal	
9.1	8th Avenue	Traffic Signal	
9.4	5th Avenue	Traffic Signal	
9.6	US 191	Traffic Signal	
10.1		5 lane section	45 mph
10.3		3 lane section	
10.9		3 lane section	55 mph
11.7	Lone Star Lane	3 lane section	
11.8		2 lane section	
12.5	Barney Lane	2 lane section	
14.5	Bowie Ave.	2 lane section	
16.5	San Jose Rd.	2 lane section	
18.0	End of model area	2 lane section	55 mph

Except for some widening in the Safford area, the facility is primarily two lanes in width. Cross section and speed limit data for the 3.5 miles for US 191 in Safford are shown in Table 3-2. The rest of the highway to Interstate 10 is two lanes in width. The speed limit varies between 55 and 65 mph. The only traffic signal on US 191 is at its intersection with US 70 in Safford.

TABLE 3-2. US 191 CROSS SECTION AND SPEED LIMIT

Route Mile	Location	Cross section change	Speed limit change
0.0 - US 70		2 lane section	35 mph
0.1		3 lane section	
0.4	19th Street	4 lane section	
1.2	Armory Road	5 lane section	
1.4		5 lane section	45 mph
2.7	Old Country Club Rd	4 lane section	
3.1		4 lane section	
3.5		2 lane section	55 mph

SR 366

SR 366 departs from US 191 approximately eight miles south of Safford and heads westward to the top of Mount Graham. The roadway provides access to the Safford Federal Correctional Facility.

Bridges

The five bridges that cross the Gila River are very important components of the street network in the model area. Figure 3-4 shows the location of the bridges. All of the bridges provide access to development north of the river and are essential links in the roadway system.

Eden Bridge (Eden Road), Pima Bridge (Bryce-Eden Road), and Thatcher Bridge (Reay Lane)

These three bridges have single 12-foot through lanes in each direction and concrete "Jersey" barriers. The bridges do not have sidewalks and minimal shoulders of two to four feet.

Safford Bridge (8th Avenue)

Growing residential development north of the river mostly depends on this bridge which was built in the WPA era in the 1930's. The bridge has two narrow lanes, is only 23 feet wide, and is in a poor state of repair. Due to the limited width, agricultural traffic across the bridge is limited.

Solomon Bridge (Sanchez Road)

This bridge was built in 1996 by Graham County and ADOT to replace the old bridge that was damaged by floods in 1993. The new 810 feet long bridge also carries two lanes of traffic.

EXISTING TRAFFIC CONDITIONS

The purpose of this section is to provide base year traffic data for the roadway network in the Model Area. Year 1998 traffic volumes and the corresponding level of service are provided. This data will be compared to traffic volume and level of service data for future years.

Traffic Volumes

The 1998 average daily traffic volumes are shown in Figure 3-5. The traffic volumes are based on the following information:

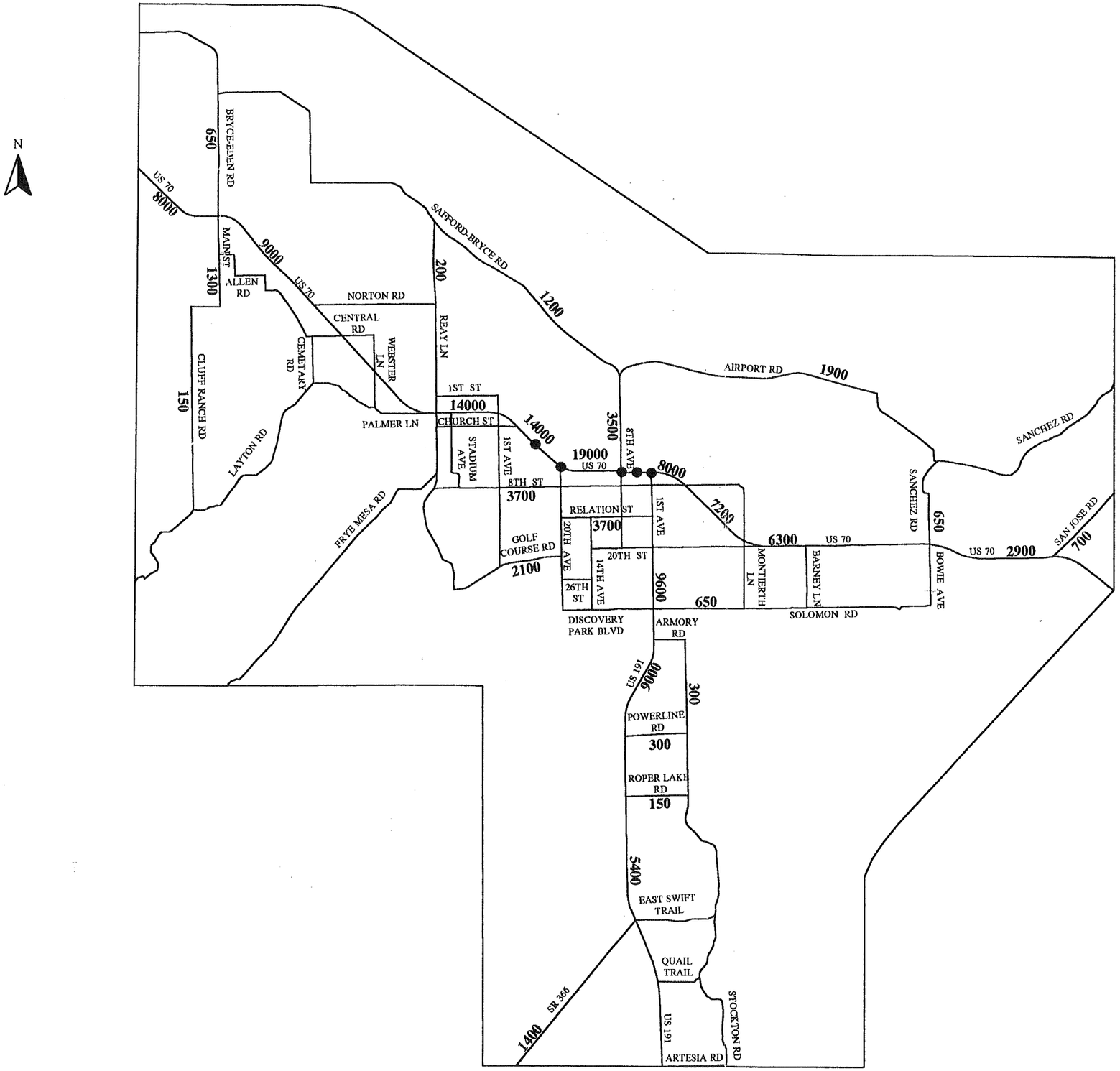
- Traffic count data provided from ADOT for US 70, US 191, and SR 366;
- Traffic count data provided by Graham County, the City of Safford, and the Town of Thatcher for specific streets on the arterial system;
- Counts taken in prior years were projected to 1998 by assuming an annual 3 percent growth rate.

Also shown on Figure 3-5 are the locations of the five traffic signals located within the Study Area. All of the signals are located on US 70, one at the driveway at WalMart and the other four at the US 70 intersections with 20th Avenue, 8th Avenue, 5th Avenue, and US 191.

TRAFFIC ACCIDENT EVALUATION

The purpose of this section is to provide an evaluation of the accident data in the region. The intent is to identify locations that may need special attention in the planning process. The data is presented in three sections. First, an overview of all accidents in the Study Area is provided. The next section deals with accidents that occurred in the rural areas of the Study Area and the final section deals with urban area accidents. Since the State highways are the major traffic carriers in the region, these last two sections deal only with the highways.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



1200 Traffic Volume (1998 projected)

● Traffic Signal Location

FIGURE 3-5
1998 TRAFFIC VOLUMES
&
TRAFFIC SIGNAL LOCATIONS

Study Area Accidents

Traffic accident data for the Study Area was obtained from ADOT for the three-year period from January 1, 1995 until December 31, 1997. In the three-year period, a total of 1,015 accidents occurred in the Study Area. The majority of these accidents occurred on State highways. US 70 had the most with 288 accidents, US 191 had 175 accidents, SR 266 had 13 accidents, and SR 366 had 42. Together these highways accounted for 518 accidents or close to half of all accidents in the Study Area.

Table 3-3 shows all accidents by severity for the study area. Over half of the accidents, 53 percent, were property damage only, while 42 percent resulted in injury, and 2 percent resulted in at least one fatality.

TABLE 3-3. ACCIDENT SEVERITY (STUDY AREA)

Type of injury	Number	Percent
Property Damage Only	534	52.6%
Injury Accident	426	41.9%
Unknown	38	3.7%
Fatal Accident	17	1.7%
Total	1,015	

Of the total 1,015 accidents, 273 or 27 percent of the collisions were intersection related, while the remaining portion occurred on roadway segments between intersections.

The first harmful event for the sixteen most common types of accidents in the Study Area is shown in Table 3-4. Overall, the most common type of accident is the multi-vehicle collision with 546 accidents (54% of the total), followed by the collision with "fixed object" (106 accidents), and "overturning" (85 accidents). Sixteen pedestrians and seven bicyclists were involved in reported traffic accidents as well.

Table 3-5 lists the accidents in the study area according to the manner of collision. The "single-vehicle" accident (461 accidents, 45 percent of the total) is by far the most frequent manner of collision. The most frequent multi-vehicle accidents were "rear-end" with 158 accidents and "angle" with 142 accidents.

TABLE 3-4. FIRST HARMFUL EVENT (STUDY AREA)

First Harmful Event	Number	Percent
Collision with other Motor Vehicle	546	53.7%
Collision with Other Fixed Object	106	10.4%
Overturning	85	8.4%
Collision with Animal Livestock	33	3.2%
Collision with Motor Vehicle Parked Properly	33	3.2%
Collision with Tree	31	3.0%
Collision with Fence	27	2.7%
Collision with Wild Game	22	2.2%
All Other Non-Collision	16	1.6%
Collision with Pedestrian	16	1.6%
Collision with Guard Rail	13	1.3%
Collision with Curb	10	1.0%
Collision with Traffic Sign	9	0.9%
Breakage of Vehicle	9	0.9%
Collision with Utility Pole	8	0.8%
Collision with Bicyclist	7	0.7%

TABLE 3-5. MANNER OF COLLISION (STUDY AREA)

Type of Collision	Number of Accidents	Percent
Single-Vehicle	461	45.4%
Rear-End	158	15.6%
Angle	142	14.0%
Sideswipe (same)	70	6.9%
Left Turn	63	6.2%
Other	43	4.2%
Backing	28	2.8%
Sideswipe (opposite)	24	2.4%
U-Turn	16	1.6%
Head-On	11	1.1%
Total	**1,015**	

Rural Area Accident Data

Of the 1,015 accidents in the Study Area, 177 occurred on rural portions of one of the four State highways. The accidents are well dispersed along the highways. In fact, there are only two locations, both on SR 366, where an average of two or more accidents per year occurred in any one-mile segment. A brief summary of accident data for each of the four rural highways is provided below:

US 70

A total of 66 accidents occurred on US 70. Most of the 49 accidents were single-vehicle accidents. The predominant types of single-vehicle accidents were collisions with fixed objects (24), overturning (8), and collisions with live stock (6) or wild animals (6).

The predominant type of the 17 two-vehicle accidents were rear-end (6), same direction sideswipe (6), and opposite direction sideswipe (3). As noted above, no distribution pattern exists, thus there does not appear to be a specific location that needs to be evaluated.

US 191

Of the 56 accidents on US 191, the most frequent type of accident is also the single-vehicle accident (50 accidents). The types of accidents are similar to those on US 70. The predominant type of accidents are collision with fixed object (22), overturning (14), and collision with wild game (7). Only one livestock accident occurred on US 191.

The six multi-vehicle accidents were equally distributed among six types of accidents – backing, head-on, rear-end, opposite direction sideswipe, same direction sideswipe, and other. As with US 70, no distribution pattern exists, thus again there does not appear to be a specific location that needs to be evaluated.

SR 366

On SR 366, 41 accidents occurred in the three-year period. Most of these 30 accidents were again single-vehicle accidents with fixed object (19) and overturning (5), being the predominant types. There was one wild game accident and one pedestrian accident on SR 366. The 11 multi-vehicle accidents were divided among opposite direction sideswipe (4), same direction sideswipe (3), and head-on (3).

The only two one-mile segments in rural locations in the Study Area with an average of two or more accidents per year were on SR 366. These two locations were at the Noon Creek (6 accidents) and Wet Canyon (7 accidents) picnic areas. Of the six accidents at Noon Creek, three were overturning, two were collisions with a fixed object, and one was with another motor vehicle. Of the seven at Wet Canyon, five were fixed object accidents and two were with another motor vehicle. Speed would seem to be the primary cause of these accidents.

SR 266

A total of 13 accidents happened on SR 266 over the three-year time period. All accidents on this road were single-vehicle accidents mostly caused by collisions with wild game (5

accidents) and collision with fixed objects (5 accidents). Again no distribution pattern occurred.

Urban Area Accident Data

This section includes an evaluation of the accidents on first US 70 and then US 191 in the urban area.

Accidents on US 70 (Urban Area)

The urban portion of US 70 extends from milepost 330 to milepost 346. Within this seventeen-mile segment, there were 216 accidents between 1/1/95 to 12/31/97. Of these, four resulted in fatalities and 108 resulted in injuries.

The majority of the accidents, 178 of the 216 or 82.4 percent, were between two or more motor vehicles. Single-vehicle accidents were distributed among many types with the most frequent being collision with bicyclist (5) and collision with pedestrians (4).

Of the 216 accidents on US 70, 82 occurred at intersections and 134 were not intersection related. On roadway segments the most frequent accident type is the "rear-end" collision (40), followed by the "single-vehicle" accident (29). At intersections, the most frequent type is the "angle" collision (27), followed by the "left turn" accident (20).

Table 3-6 lists the number of accidents, the average daily traffic, and the accident rate for particular segments on US 70 in the urban area. The accident rate represents the number of accidents per one million vehicle miles traveled (mvmt). The highest accident rate (2.29 accidents per mvmt) and the highest number of accidents (40) is found on the segment of US 70 from 1st Avenue in Thatcher to 20th Avenue. No other segment has a rate above 1.00.

TABLE 3-6. SEGMENT ACCIDENT RATES (US 70)

Segment	No. Accidents	Average ADT	Segment Length	Accident Rate
Pima City Limits to 3rd Street South in Pima	8	8,000	2.99	0.31
3rd Street South in Pima to Reay Lane	25	9,000	2.62	0.97
Reay Lane to 1st Avenue (Thatcher)	15	14,000	1.00	0.98
1st Avenue (Thatcher) to Safford City Limits (20th Avenue)	40	14,000	1.14	2.29
Safford City Limits (20th Avenue) to 8th Avenue Safford	8	20,000	1.18	0.31
8th Avenue to 1st Avenue	7	14,000	0.48	0.95
1st Avenue to Lone Star Road	19	7,200	2.53	0.95
Lone Star Mountain Rd to model area boundary	12	4,500	4.00	0.61

The predominant types of accidents on the 1st Avenue to 20th Avenue segment were rear-end, left-turn, and angle, all intersection-related and involving at least two vehicles.

The ten intersections along US 70 with the highest number of accidents are listed in Table 3-7. These intersections correspond generally with the segments carrying the highest average daily traffic (ADT). At the intersection of US 70 and 20th Avenue, 14 accidents occurred during the last three years. Half of these accidents were left turn accidents, followed by "rear-end" and "angle" accident. The intersections of 8th and 5th Avenue, both with relatively high numbers of accidents, show the same pattern: approximately half of the accidents were "left turn", followed by "rear-end" and "angle' accidents. Since intersection traffic volumes were not counted, accident rates cannot be calculated.

TABLE 3-7. INTERSECTION RELATED ACCIDENTS ON US 70

At Road	No. of accidents	Angle	Left Turn	Other	Rear-End	Sideswipe (same)	Single-Vehicle
20th Avenue	14	2	7	1	3		1
8th Avenue	10	1	5		1	2	1
5th Avenue	7	1	3		2	1	
1st Avenue	5	2			3		
Stadium Avenue	5	3			1		1
Central Road	3	1				2	
Montierth Lane	3	1			2		
Palmer & Webster Lane	3	1			1	1	
San Jose-Sanchez Road	3	2	1				
US 191	3	2	1				

US 191 Accidents (Urban Area)

In the three-year evaluation period, 119 accidents occurred on US 191, of which 69 (59%) were 'no-injury" accidents and 50 (42%) were "injury" accidents. There were no fatal accidents. Seventy-three of the accidents were multi-vehicle collisions, 46 were single-vehicle.

The accident rates for specific segments on US 191 are shown in Table 3-8. The highest accident rate (1.73 accidents per mvmt) is on the segment from Roper Lake Road to East Swift Trail (junction US 366).

TABLE 3-8. SEGMENT ACCIDENT RATES (US 191)

Segment	Number of accidents	Segment Length	ADT	Accident Rate
U.S. 70 to Solomon Road	22	2.10	9,600	1.00
Solomon Road to Roper Lake Road	28	2.50	9,000	1.14
Roper Lake Road to East Swift Trail	28	2.73	5,400	1.73
East Swift Trail to Artesia Road.	11	2.58	2,800	1.39

Table 3-9 shows the three highest intersection related accident locations on US 191. The most accidents occurred at the Upper Solomonville Road/US 191 intersection, followed by the intersections of US 191 with 20th Street and 32nd Street. Most of these accidents were "angle" collisions.

TABLE 3-9. INTERSECTION RELATED ACCIDENTS (US 191)

Intersection	Number of accidents	Angle	Left Turn	Other
Discovery Park Boulevard	8	5	2	1
20th Street	3	3		

Accidents on Other Major Roadways

To complete the assessment of accidents on major streets in the urban area, accident data on other streets in the network is presented in this section. A total of 86 accidents were reported on these streets during the three-year evaluation period.

The most frequent type of initial collision on these other roadways was a collision with "other motor vehicle" (33%), followed by collision with "other fixed object" (28%) and overturning (17%).

Accident data for the four major streets in the area with the most accidents are summarized below. The roads are discussed in the order of descending number of accidents.

8th Avenue: Safford-Bryce Road to US 70 (15 accidents)

Fifteen accidents occurred on this 2.7-mile segment of road. Eight involved multiple vehicles, half of which were reported as other. Two opposite direction sideswipe, one same direction sideswipe, and one rear-end were reported. The seven single vehicle accidents involved three fixed objects, one overturning, and three other.

Safford-Bryce Road: 8th Avenue to Bryce-Eden Road (14 accidents)

Of the fourteen accidents eleven were single vehicle, one was an opposite direction sideswipe and the others were reported as other. The single vehicle accidents were the result of six fixed objects, four overturning, and one animal.

Airport Road: 8th Avenue to Bowie Avenue (13 accidents)

Of the thirteen accidents on Airport Road, eleven were single vehicle, one was a rear-end, and one was other. The single vehicle accidents were reported as four fixed objects, three overturned, and four were the result of hitting an animal.

Bryce-Eden Road: Safford-Bryce Road to US 70 (9 accidents)

Nine accidents occurred on this 1.9-mile stretch of road. Six were single vehicle, two were rear-end, and one was an opposite direction sideswipe. Of the six single vehicle accidents, three resulted from hitting a fixed object and three vehicles overturned.

CONCLUSIONS

In general, current traffic conditions in the Study Area are good. The Level of Service provided on the roadway network is at worst B, therefore there are no critical capacity issues based on traffic volumes. The accident analysis indicated two locations on SR 366 – near the Noon Creek and the Wet Canyon picnic areas - that deserve additional attention. In the urban area, the segment of US 70 between 1st Avenue in Thatcher and 20th Avenue has by far the highest accident rate on the highway. On US 191, the segment between Roper Lake Road and East Swift Trail has the highest accident rate. These two locations will evaluated more fully as the plan is developed.

4. TRANPLAN MODEL DOCUMENTATION

The purpose of this chapter is to document the development and validation of the transportation model for the Graham County Regional Transportation Study. The model was developed using the TRANPLAN transportation forecasting microcomputer software and was calibrated using the 1998 transportation network and estimated 1998 socioeconomic data.

The following references were used in developing the calibration procedures for the Graham County TRANPLAN model.

- Federal Highway Administration, *Calibration and Adjustment of System Planning Models*, 1990.

- Institute of Transportation Engineers, *Trip Generation*, 5th Edition, 1991.

- Transportation Research Board, *NCHRP 198, Quick-Response Urban Travel Estimation Techniques and Transferable Parameters: User's Guide*, 1978.

The next section of this chapter presents a description of the transportation demand modeling process for Graham County. The final section presents the results of the TRANPLAN model calibration and validation.

TRANSPORTATION MODELING PROCESS

The Graham County transportation modeling process includes the following steps:

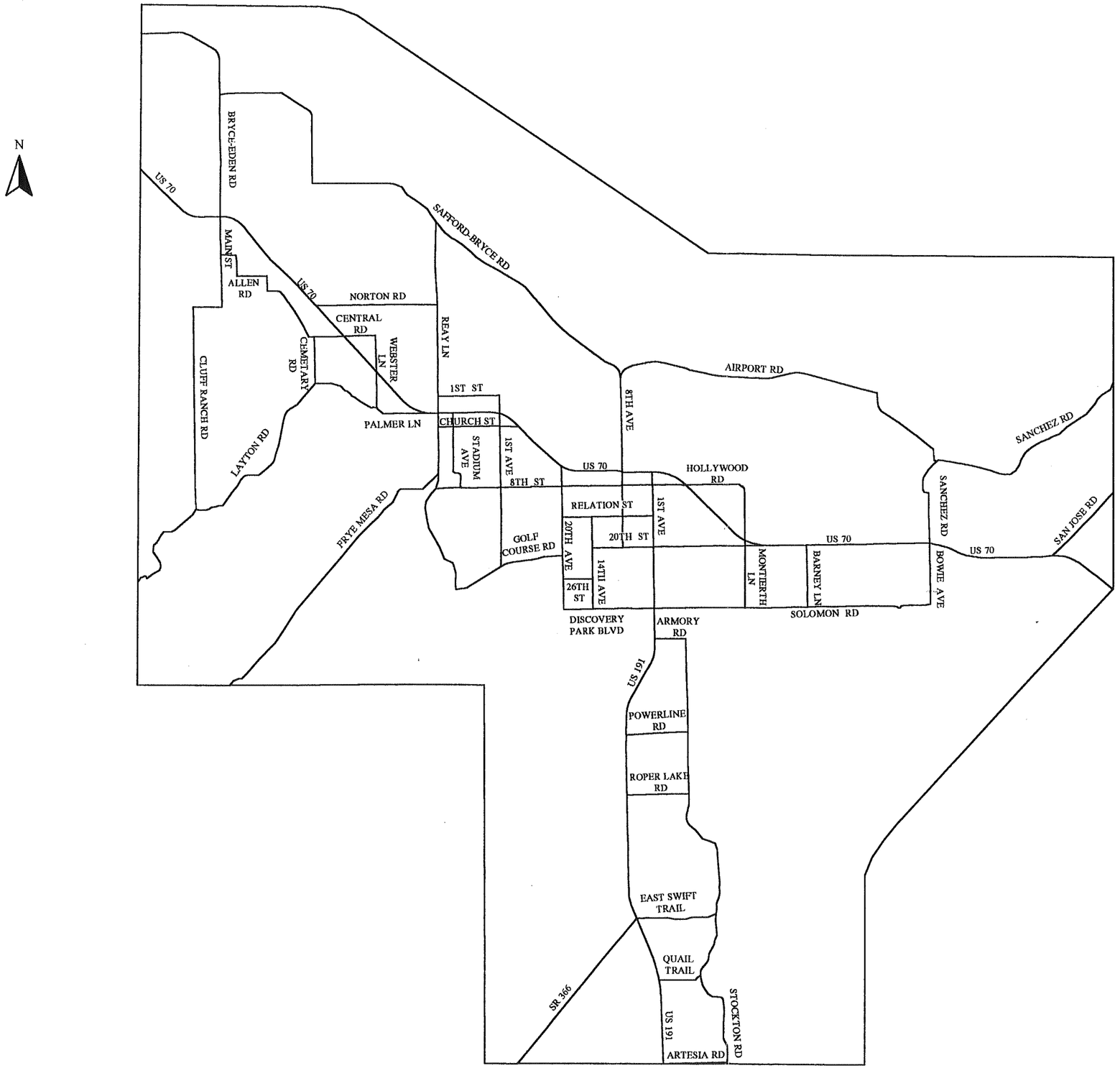
- Transportation Network Development
- Socioeconomic Data Projections
- Trip Generation
- Trip Distribution
- Traffic Assignment

A brief description of each modeling step is given below.

Transportation Network Development

The initial step in the travel demand modeling process is the development of the geographical highway network that comprises nodes and links. A node is an intersection of two or more links such as an intersection of two street segments. A network link is a street segment between two nodes. The segment of US 70 between 8th Avenue and 1st Avenue in Safford is an example of a network link.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Road

Model Area

FIGURE 4-1
1998 NETWORK

Various physical and traffic characteristics of a link in the network are contained within a database of the link characteristics. This database includes:

- A node and B node numbers
- Link distance
- Speed
- Daily link capacity
- Daily traffic volume (ground count)

Nodes and links in the Graham County network were created from the Graham County Street Centerline coverage using PC ARC/INFO Geographic Information System (GIS) software. The network was then converted to TRANPLAN transportation forecasting software format for use in the model. Figure 4-1 illustrates the 1998 highway network for the modeled area.

Socioeconomic Data Projections

As discussed in Chapter 2, population and employment data is distributed to geographic zonal units called Traffic Analysis Zones. Boundaries of the TAZs are defined based on similar land uses, physical barriers, and major streets in the transportation system. The TAZs are generally bounded by major streets (links) in the highway network.

Within the highway network, a TAZ is defined as a node called a centroid. For transportation modeling, it is assumed that all trips within a TAZ are generated at the centroid. Each TAZ centroid is connected to a roadway link by "dummy links", called centroid connectors, that represent the local streets feeding traffic to the major streets.

Socioeconomic data estimates for 1998 that were used in the calibration of the TRANPLAN model for Graham County are presented in Table 2-4 in Chapter 2.

Trip Generation

The final product of the trip generation phase is the total number of trips produced within and/or attracted to each TAZ. A trip is defined as a one-way trip between an origin and a destination.

The number of trips generated by a TAZ is a function of the residential and/or commercial land use characteristics. Residential land uses are generally referred to as "producers" of trips; commercial land uses are generally referred to as "attractors" of trips. Residential trip production is a function of the number of dwelling units. Commercial trip attraction is a function of the number of employees.

Vehicle trip rates for Graham County were developed from the Institute of Transportation Engineers Trip Generation, 5th Edition, 1991. Trip productions for internal residential

trips were estimated using a daily trip rate per dwelling unit. Due to the trip making characteristics of the study area and its geographical composition, the residential trip rate is higher than the national average of 10.0. Trip attractions for the internal commercial land uses were estimated using a trip rate per employee. Table 4-1 gives the trip generation characteristics for the various land use categories used in the trip generation analysis. Trips were estimated for three trip purposes: 1) home-based work, 2) home-based other, and 3) non home-based.

TABLE 4-1. VEHICLE TRIP GENERATION CHARACTERISTICS

Land Use Category	Socioeconomic Variable	Daily Vehicle Trips per Unit	Trip Purpose (% Trips)		
			Home-Based Work	Home-Based Other	Non Home-Based
Graham County Residential	Dwelling Units	10.7	23.0	60.0	17.0
Commercial Retail	Employees	26.0	20.0	62.0	18.0
Commercial Office	Employees	13.0	21.0	61.0	18.0
Commercial General & Industrial	Employees	7.0	29.0	58.0	13.0
College	Employees	23.0	21.0	61.0	18.0

Trip Distribution

The purpose of trip distribution is to produce a trip table of the estimated number of trips from each TAZ to every other TAZ within the study area. Vehicle trip distribution for this study was estimated using the TRANPLAN Gravity Model program. The Gravity Model assumes that the number of trips between two zones is: 1) directly proportional to the vehicle trips produced and attracted by both zones, and 2) inversely proportional to the travel time between the zones. The final product of trip distribution is a trip table that gives the number of trips from zone to zone.

The Gravity Model formula used in trip distribution estimates that the number of trips between each zone is equal to:

$$T_{ij} = \frac{P_i A_j F_{ij}}{\sum (A_j F_{ij})}$$

where:

T_{ij} = number of trips from zone I to zone J,
P_i = number of trips produced in zone I

A_j = number of trips attracted to zone J
F_{ij} = an empirically derived friction factor which is a function of the travel time between zone I and zone J

Friction factors express the effect travel time has on the number of trips traveling between two zones. A set of friction factors for a typical small area were used for the study's Gravity Model. Vehicle trips were distributed for the three trip purposes: 1) home-based work, 2) home-based other, and 3) non home-based. Table 4-2 gives a summary of the trip productions and attractions by trip purpose for the whole study area.

TABLE 4-2. 1998 VEHICLE TRIP SUMMARY

Trip Purpose	Total Trips	Percent Trips
Home-Based Work	21,141	22%
Home-Based Other	58,212	59%
Non Home-Based	18,567	19%
Total Trips	97,920	100%

Traffic Assignment

The purpose of traffic assignment is to assign vehicle trips to specific paths, or routes, in the transportation network. Trip assignment is a function of: 1) the shortest travel time along paths between zones, and 2) the level of congestion of the links within those paths. Vehicle trips for the study area were assigned to the transportation network using the TRANPLAN Equilibrium Assignment Algorithm. The Equilibrium Assignment Algorithm assigns the vehicle origin-destination trip table to the regional highway network based on the equilibrium assignment method. Equilibrium occurs when a trip in the system cannot be made by an alternate path without increasing the total travel time of all trips in the network.

The assignment process assigns both internal and external vehicle trips to the network. Internal vehicle trips are those trips with either an origin or a destination inside the study area. The Gravity Model described in the previous section produces an internal vehicle trip table. However, vehicle trips through the study area must also be assigned to the network. External-to-external trips are through trips, which pass through the study area. The external-external vehicle trip table, based on assumptions about the current socioeconomic conditions of the study area, was developed by determining the percentage of total trips originating from each external station that will pass through the study area. The internal vehicle trip table is then added to the external trip table to give a total vehicle origin-destination table. This origin-destination table is then assigned to the regional network.

There is a total of 68 internal TAZs numbered 1 through 68 and five external stations numbered 80 through 84. External stations are used to represent traffic that either originates at or is destined to places outside the study area. For this study, external stations are located on west US 70, east US 70, US 191, SR 366, and San Jose Road. TAZ numbers 69 through 79 are used as placeholders to accommodate future changes as the network and socioeconomic variables expand.

The external stations for the study area are as follows:

- 80 – US 70 west of Pima at Tripp Canyon Road
- 81 – San Jose Road approximately 2 miles northeast of San Jose
- 82 – US 70 approximately 2 miles east of the San Jose and US 70 junction
- 83 – US 191 at Artesia Road
- 84 – SR 366 at Coronado National Forest Boundary

CALIBRATION OF GRAHAM COUNTY TRANPLAN MODEL

The Graham County transportation model was calibrated using the transportation network, socioeconomic estimates, and traffic counts from 1998 and prior years. All counts were projected to 1998 by assuming an annual three percent growth rate.

The purpose of model calibration is to develop a working transportation model of the study area that replicates actual traffic counts by adjusting the model parameters. The model validation phase compares the results of the model, using the 1998 socioeconomic estimates, to actual study area data and to data from other comparable studies. The following performance measures were reviewed:

- Percent error of traffic assignment;
- Percent root mean square error.

Percent Error of Traffic Assignment

The assigned 1998 daily traffic volumes were compared with the counted daily traffic volumes for individual links. The percent error of traffic assignment is an indication of the accuracy in the transportation model's replication of the actual traffic counts. Percent error is the difference between the assigned traffic volumes and the counted traffic volumes divided by the counted traffic volumes. The computed percent error is given in Table 4-3 along with acceptable error ranges as determined by the FHWA publication, *Calibration and Adjustment of System Planning Models*. As the table shows, the percent error of the traffic assignment for the network as a whole was 4.7 percent, which is within the allowable five percent error.

TABLE 4-3. PERCENT ASSIGNMENT ERROR 1998 NETWORK

Functional Class	Percent Error	
	Computed	Acceptable Range
Major Arterials	5.3	< 10
Minor Arterials	3.4	< 15
Collectors	5.4	< 25
Total Network	4.7	< 5

Percent Root Mean Square Error

Another measure of the model's ability to accurately assign traffic volumes is the percent RMSE. The RMSE measures the deviation between the assigned traffic volumes and the counted traffic volumes and is given as:

$$RMSE = \sqrt{\frac{(count_i - vol_i)^2}{(n-1)}}$$

where:

count = actual traffic volume count on link I,
vol = model assigned traffic volume on link I, and
n = total number of links in the traffic volume group.

The percent RMSE is derived by dividing the RMSE by the average directional traffic count for a particular traffic volume group. A large percent RMSE indicates a large variation between the assigned and counted traffic volumes whereas a small percent RMSE indicates a small variation between the assigned and counted traffic volumes. The percent RMSE by facility type for the study area is given in Table 4-4.

TABLE 4-4. PERCENT ROOT MEAN SQUARE ERROR

Link Volume Group	Percent RMSE
0 - 2,499	43.0
2,500 - 4,999	12.8
5,000 - 9,999	10.8

There are no guidelines for an acceptable RMSE. However, as is the case for the Graham County model, it is important that the RMSE decrease as the link volumes increase. This is because a large error for a low volume street will not result in a different

recommendation, however, it could change the recommendation for a high volume street. As an example, a 50 percent error for a forecast volume of 4,000 vpd could result in a volume of 6,000 vpd, still a two-lane road, while a 50 percent error for a volume of 12,000 vpd could result in a volume of 18,000 and a four-lane rather than a two-lane recommendation.

The 12.8 percent RMSE error for directional volumes between 2,500 vpd and 4,999 vpd and 10.8 percent for directional volumes between 5,000 and 9,999 is good.

5. SOCIOECONOMIC PROJECTIONS

The purpose of this chapter is to present the distribution of socioeconomic data for the years 2005, 2010, and 2020. The projections were developed through discussions with, and review by, members of the Technical Advisory Committee.

POPULATION CONTROL TOTALS

The first step in the process was to develop population control totals the Model Area and for each jurisdiction. These control totals are presented in Table 5-1.

TABLE 5-1. POPULATION CONTROL TOTALS

	1998	2005	2010	2020
Graham County	33,260	39,430	43,500	50,670
Model Area				
Safford	9,940	13,100	14,500	16,000
Thatcher	4,170	5,700	6,900	10,400
Pima	2,050	2,300	2,400	2,700
County	7,490	8,400	9,300	12,800
Total Model Area	23,650	29,500	33,100	41,500

The projections were prepared using a bottoms-up approach. Population projections for the communities of Safford, Thatcher, and Pima, and the portion of Graham County within the Model Area were prepared. The sum of these projections were then compared to the Graham County population projections prepared by the Arizona Department of Economic Security that show a County increase in population from 33,260 in 1998 to 50,670 in the year 2020. This approach resulted in an increase in the Model Area's percent of population from 71 percent in 1998 to 82 percent in 2020. Because of the continuing growth of the Safford/Thatcher area as a regional hub, this increase in importance seems reasonable.

POPULATION AND EMPLOYMENT DISTRIBUTION

Using the 1998 distributions by TAZ as a starting point and reviewing development plans and growth corridors, population, dwelling units, and employment by TAZ were projected for the years 2005, 2010, and 2020. These projections are shown in Tables 5-2 (population), 5-3 (dwelling units), and 5-4 (employment). In 1998, the ratio of population to employment was 3.7 residents per employee. This same ratio was used for future year projections.

TABLE 5-2. 1998, 2005, 2010, 2020 POPULATION BY TAZ

TAZ Number	Population 1998	Population 2005	Population 2010	Population 2020
1	58	65	72	99
2	330	370	386	432
3	81	90	100	137
4	67	75	83	113
5	219	245	255	286
6	826	925	965	1,080
7	442	442	442	442
8	23	26	29	39
9	388	435	478	765
10	65	65	65	65
11	27	27	27	27
12	99	110	122	168
13	526	652	702	849
14	201	225	250	342
15	1,357	1,857	2,322	4,179
16	281	315	350	479
17	174	195	216	296
18	96	107	118	130
19	67	75	83	91
20	768	768	768	768
21	683	683	683	683
22	50	50	50	50
23	761	761	761	761
24	298	408	469	657
25	102	140	161	258
26	264	468	657	1,413
27	395	542	678	1,220
28	617	899	1,159	2,202
29	740	872	1,008	1,515
30	260	291	323	442
31	79	88	98	134
32	78	87	97	133
33	355	398	441	605
34	92	103	115	157
35	29	32	36	49
36	2,357	3,300	3,712	4,176
37	6	372	419	471
38	475	665	748	842
39	985	1,141	1,209	1,287
40	1,111	1,167	1,225	1,286
41	1,528	1,553	1,579	1,606
42	1,077	1,155	1,195	1,242

TABLE 5-2. 1998, 2005, 2010, 2020 POPULATION BY TAZ (continued)

TAZ Number	Population 1998	Population 2005	Population 2010	Population 2020
43	633	633	633	633
44	131	150	161	172
45	281	281	281	281
46	775	891	953	1,020
47	351	400	422	447
48	325	455	512	576
49	265	810	1,049	1,317
50	36	123	212	545
51	240	240	240	240
52	175	196	218	298
53	293	328	364	499
54	26	29	33	45
55	15	17	18	25
56	32	36	40	55
57	275	309	343	469
58	92	103	115	157
59	6	7	7	10
60	208	232	258	353
61	7	23	41	112
62	148	166	184	253
63	517	579	643	880
64	46	70	96	192
65	196	248	302	504
66	30	33	37	50
67	31	35	39	53
68	100	201	227	255

TABLE 5-3. 1998, 2005, 2010, 2020 DWELLING UNITS BY TAZ

TAZ Number	Dwelling Units 1998	Dwelling Units 2005	Dwelling Units 2010	Dwelling Units 2020
1	14	16	17	24
2	109	122	127	143
3	18	20	22	31
4	21	24	26	36
5	64	72	75	84
6	254	285	297	332
7	158	158	158	158
8	9	10	11	15
9	108	121	133	213
10	18	18	18	18
11	12	12	12	12
12	33	37	41	56
13	160	198	213	258
14	55	62	68	94
15	420	575	719	1,294
16	81	91	101	138
17	61	68	76	104
18	42	47	52	57
19	36	40	44	49
20	240	240	240	240
21	237	237	237	237
22	18	18	18	18
23	173	173	173	173
24	83	114	131	183
25	29	40	46	73
26	88	156	219	471
27	130	178	223	401
28	196	285	368	699
29	268	316	365	549
30	88	99	109	150
31	23	26	29	39
32	31	35	39	53
33	132	148	164	225
34	30	34	37	51
35	14	16	17	24
36	732	1,025	1,153	1,297
37	2	121	136	153
38	219	307	345	388
39	326	378	400	426
40	394	414	434	456
41	590	600	610	620

TABLE 5-3. 1998, 2005, 2010, 2020 DWELLING UNITS BY TAZ (continued)

TAZ Number	Dwelling Units 1998	Dwelling Units 2005	Dwelling Units 2010	Dwelling Units 2020
42	399	428	443	460
43	209	209	209	209
44	50	57	61	66
45	112	112	112	112
46	287	330	353	378
47	110	126	132	140
48	125	175	197	222
49	94	287	372	467
50	15	51	88	226
51	101	101	101	101
52	73	82	91	124
53	89	100	111	152
54	9	10	11	15
55	3	3	4	5
56	11	12	14	19
57	94	105	117	160
58	30	34	37	51
59	3	3	4	5
60	111	124	138	189
61	3	9	17	45
62	41	46	51	70
63	159	178	198	271
64	20	31	42	84
65	68	86	105	175
66	3	3	4	5
67	10	11	12	17
68	54	108	122	137

TABLE 5-4. 1998, 2005, 2010, 2020 EMPLOYMENT BY TAZ

TAZ Number	Employment 1998	Employment 2005	Employment 2010	Employment 2020
1	0	0	0	0
2	39	41	40	43
3	0	0	0	0
4	4	4	4	6
5	90	95	93	100
6	39	41	40	43
7	39	41	40	43
8	26	28	30	39
9	77	80	83	127
10	13	14	15	19
11	39	43	45	59
12	39	42	43	57
13	26	27	27	29
14	26	27	28	37
15	39	74	112	221
16	25	278	290	379
17	100	104	109	142
18	52	54	56	59
19	371	389	403	422
20	52	59	64	72
21	180	227	274	327
22	9	12	12	13
23	95	155	196	241
24	95	155	203	310
25	503	741	902	1,493
26	64	108	155	299
27	77	98	116	199
28	193	315	443	848
29	103	108	113	147
30	103	108	113	148
31	0	0	0	0
32	0	0	0	0
33	26	27	29	37
34	2	24	48	87
35	60	89	119	183
36	32	65	93	125
37	0	17	33	50
38	60	79	83	89
39	20	26	28	30
40	20	20	20	20
41	129	129	129	129

TABLE 5-4. 1998, 2005, 2010, 2020 EMPLOYMENT BY TAZ (continued)

TAZ Number	Employment 1998	Employment 2005	Employment 2010	Employment 2020
42	90	118	128	140
43	1,096	1,181	1,190	1,213
44	232	251	253	258
45	52	56	56	57
46	792	855	861	878
47	30	39	42	45
48	103	135	143	153
49	71	93	99	106
50	4	6	7	19
51	0	5	9	14
52	13	15	17	32
53	0	5	9	14
54	25	26	28	36
55	25	30	31	41
56	0	0	0	0
57	0	0	0	0
58	248	261	273	356
59	0	0	0	0
60	0	5	9	14
61	0	5	9	14
62	20	21	22	29
63	277	290	303	396
64	103	110	115	150
65	39	41	43	56
66	13	16	17	22
67	0	0	0	0
68	512	802	838	886

6. ANALYSIS OF FUTURE CONDITIONS

The purpose of this chapter is to present the analysis of future traffic conditions within the Model Area. The chapter begins with a description of projects ADOT has programmed for construction in the area during the next five years. This is followed by the analysis of future conditions and a discussion of the conclusions drawn from the analysis.

PROGRAMMED PROJECTS

The ADOT 5-Year Highway Construction Program FY 1999-2003 includes several projects in the study area. The estimated cost for the improvements is $12,213,000. Following is a detailed description of each programmed project.

US 70 Projects

- A pavement preservation project for approximately 5-miles from Eden Road to the Town of Pima. The cost for this project is estimated at $1,316,000 and is scheduled for 1999.

- The widening of the two-lane section of US 70 from Pima to Thatcher to five-lanes is programmed for design in 1999. The cost of the design is estimated at $800,000. Construction of the project is not yet programmed.

- In the year 2000 ADOT will construct curb, gutter, sidewalks, and lighting along U.S. 70 from Thatcher to Safford. This effort will be undertaken at a cost of $6,000,000 to "urbanize" this section of the roadway and also to provide for better and safer pedestrian and bicycle traffic along the route. Right-of-way acquisition for the project is programmed for 1999 at a cost of 100,000.

- The reconstruction of the intersection of Lone Star Road and US 70. At this particular intersection the Southern Pacific Railroad also crosses Lone Star Road. The project is mainly safety related and will eliminate the "flying Y" type intersection. Lone Star Road will cross the rail road tracks at a 90 degree angle and tie into US 70. The project is estimated at a cost of $111,000 and is scheduled for year 2000.

US 191 Projects

Currently there are no projects scheduled for US 191. However, a Design Concept Report is underway from I-10 to the intersection of State Route 266. The purpose of the study will be to develop two to three projects along US 191 to determine how to improve the roadway so it conforms to AASHTO standards. One critical issue along US 191 is insufficient sight distance, which makes passing difficult and hazardous on the highway.

SR 366 Projects

- A pavement preservation project starting at the Swift Trail intersection will chip seal/overlay 15.6 miles of the roadway at a cost of $711,000. The project is scheduled for year 2001.

- A district force account is used to provide for maintenance and small widening projects along SR 366 from 1999 until 2003. The purpose of this account is to maintain the roadway in a "sensitive environment" in close cooperation with the Forest Service and other involved agencies.

- The design and construction of roadside improvements and rockfall containment projects along SR 366 are programmed for 1999 and 2001 respectively. Both projects are safety related. Programmed design costs are $235,000 and $2,350,000 is programmed for construction.

SR 266 Projects

ADOT's 5-Year Highway Construction Program does not list any projects on State Route 266.

GRAHAM COUNTY PROJECTS

The County has the following projects currently being planned:

- Cluff Ranch Road – one mile will be constructed during the summer of 1999; eventually, five miles will be completed;
- Stockton Road – four miles to pave;
- Powerline Road – two miles to pave;
- Fort Grant Road – five miles to pave;
- Cottonwood Wash Road – construction between Main Street in Pima and US 70;
- Layton Road/Webster Road - intersection improvements;
- 8th Avenue Bridge – replace;
- 8th Avenue/Airport Road/Safford-Bryce Road – reconstruct intersection;
- 20th Avenue – extend south to 45th street;
- Klondyke Road – pave one mile;
- Safford-Bryce Road – intersection improvements;
- Norton Lane – upgrade;
- East Swift Trail – paving;
- Bowie Avenue – widen and pave;
- Clifton Street – widen and pave.

TRAFFIC ANALYSIS

The analysis of future traffic conditions is presented in this section. The section begins with a description and analysis of the existing and committed roadway system for the years 2005, 2010, and 2020, corresponding to population levels of 29,500, 33,100, and 41,500 respectively. (The 1998 population estimate is 23,650). This is followed by a description and analysis of transportation improvements needed in future years to solve future traffic problems. The goal is to maintain a transportation system that operates at Level of Service (LOS) C or better.

The analysis is based upon the relationship between level of service and the volume/capacity ratio presented in Table 6-1. The generalized capacities used in the analysis are shown in Table 6-2.

TABLE 6-1. LOS-V/C RELATIONSHIP

Level of Service	V/C Ratio
A	0.0 - 0.29
B	0.30 - 0.54
C	0.55 - 0.75
D	0.76 - 0.90
E	0.91 - 1.00
F	1.00 +

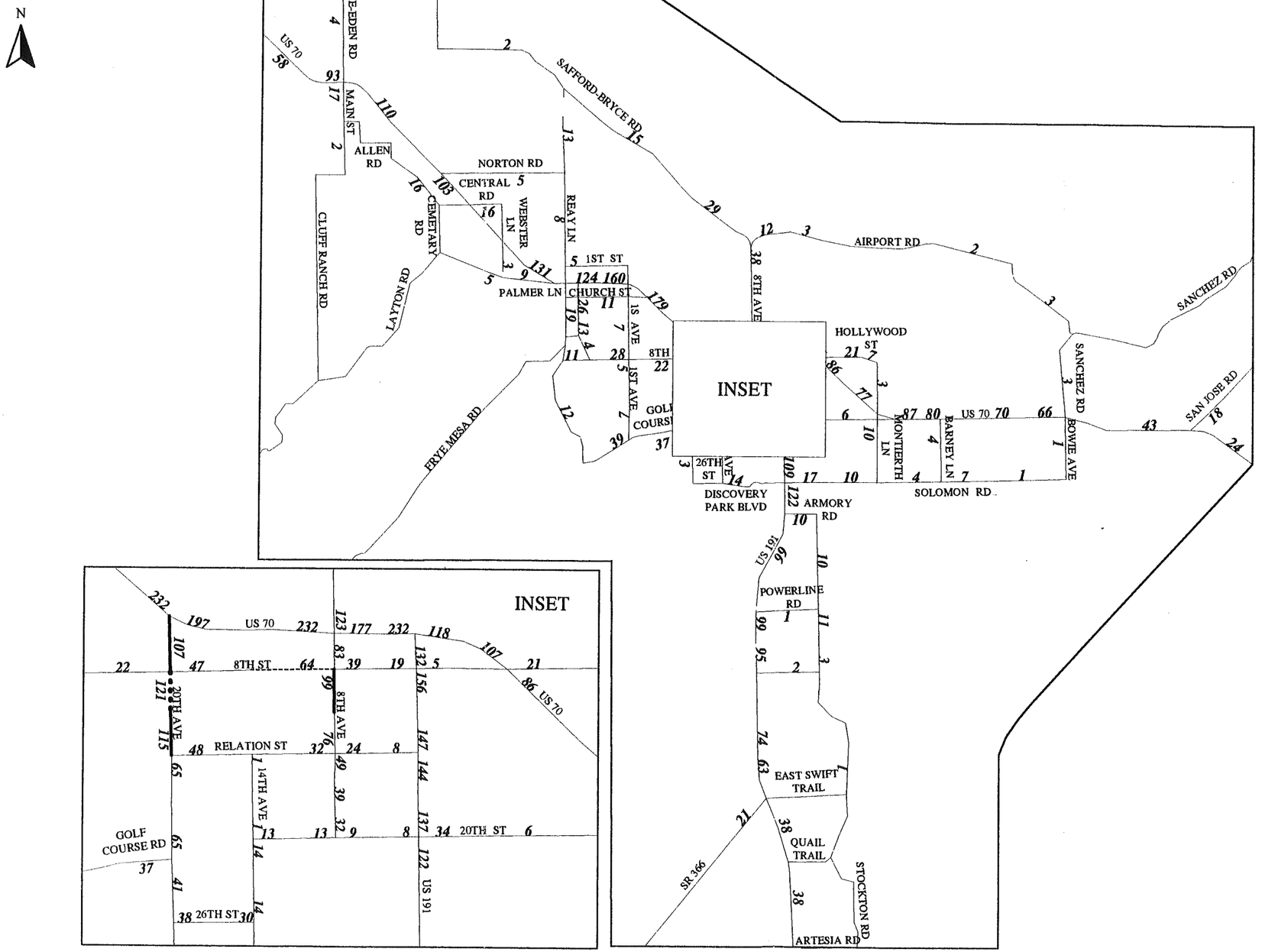
TABLE 6-2. MAXIMUM VOLUME FOR LOS

	Level of Service		
	C	D	E
Two-Lane Highway	17,700	21,250	23,600
Four-Lane Highway	35,400	45,200	47,200
Other Two-Lane	9,750	11,750	13,000
Other Four-Lane	19,500	23,400	26,000

Existing and Committed Network Evaluation

The base network used in the analysis represents the existing roadways and committed projects. The only programmed project that will affect roadway capacity and thus has been added to the existing network is the widening of US 70 between Pima and Thatcher to five-lanes. The existing and committed network was run using the 2005, 2010, and 2020 socioeconomic projections. The forecast volumes for the three years are shown in Figures 6-1, 6-2, and 6-3, respectively.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

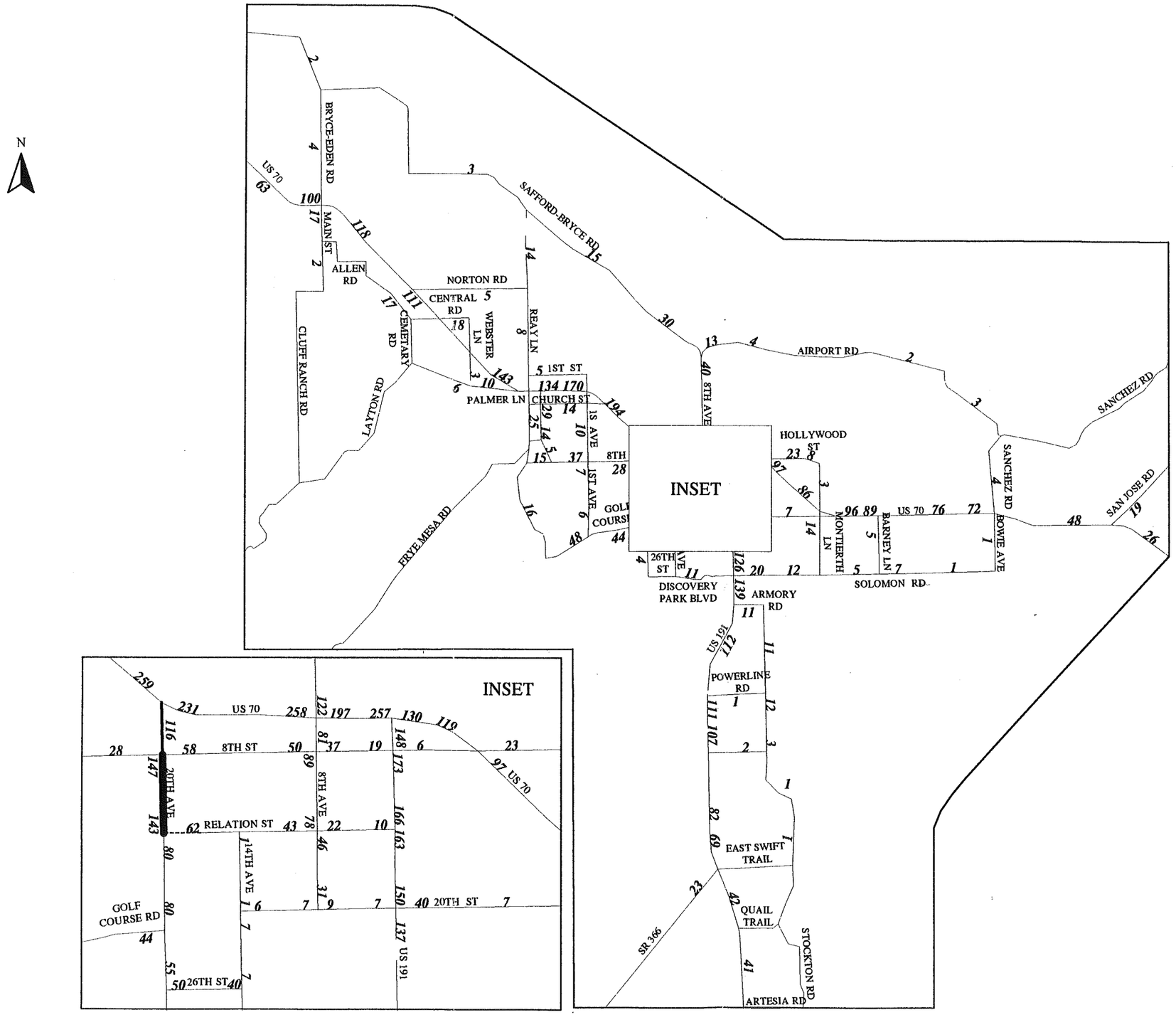
21

Level of Service

D
E
F

FIGURE 6-1
EXISTING AND COMMITTED NETWORK
2005 SE DATA
(POPULATION = 29,500)

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

21

Level of Service

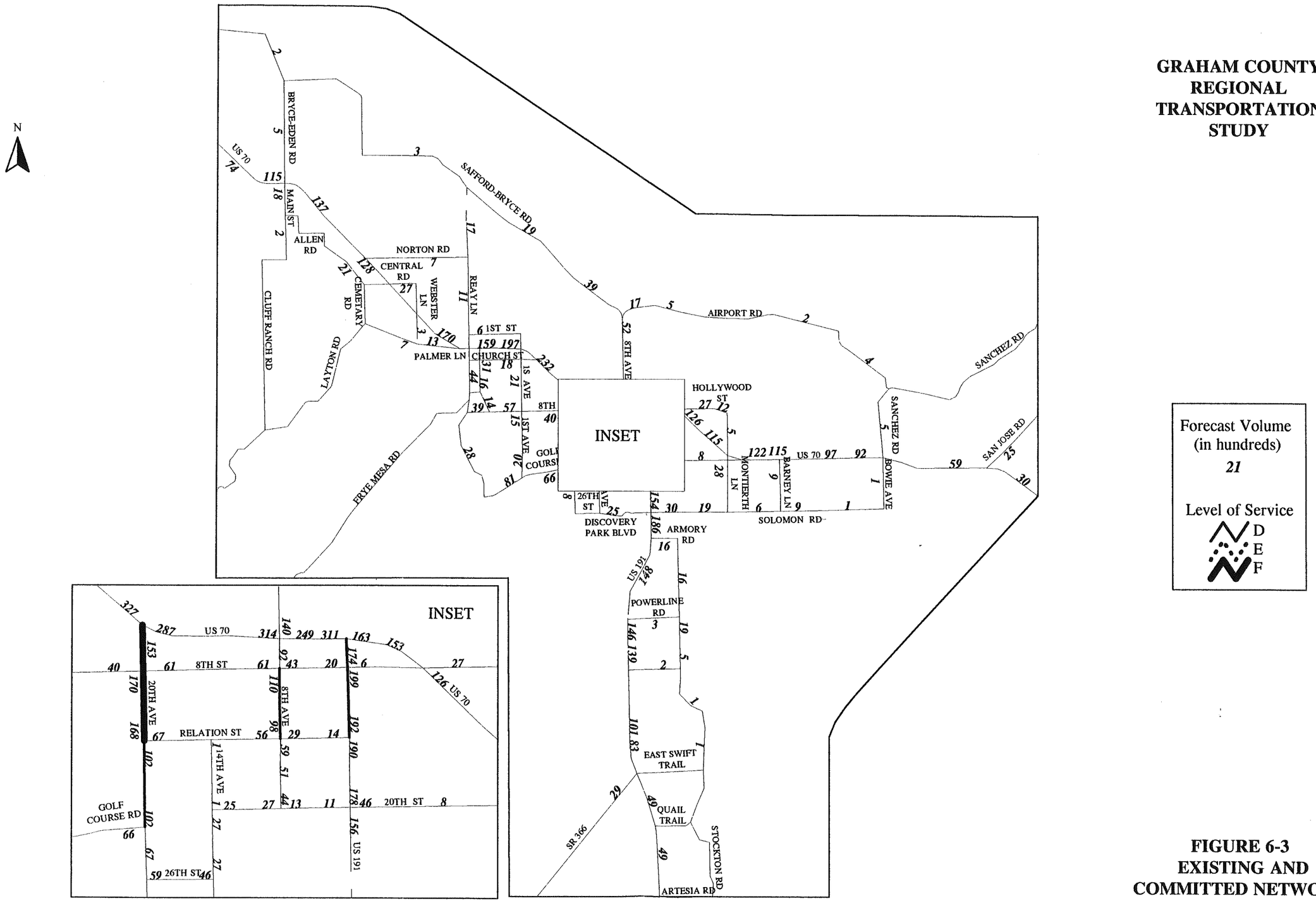
D

E

F

FIGURE 6-2
EXISTING AND COMMITTED NETWORK
2010 SE DATA
(POPULATION 33,100)

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

21

Level of Service

D
E
F

FIGURE 6-3
EXISTING AND COMMITTED NETWORK
2020 SE DATA
(POPULATION 41,500)

As the population in the region increases, travel on the roadway system will obviously increase. In 1998, there is approximately 390,000 vehicles miles traveled (VMT) within the modeled area. By the year 2005, travel in the area will increase by 23 percent to approximately 480,000 VMT. The VMT will increase to 530,000 by 2010 and to 674,000 by the year 2020. Overall, travel is forecasted to increase by nearly 73 percent over the next 22 years.

Even with the increase, the roadway system will continue to function well. As shown in the three figures, the target of providing a minimum LOS C is violated at only three locations: 20th Avenue, 8th Avenue, and US 191. These locations are discussed below:

- 20th Avenue: The main access to both Safford High School and the Mount Graham Community Hospital is provided on 20th Avenue. In addition, 20th Avenue is one of the primary north-south roadways that provide access to planned developments in the southern parts of the area. Problems start to appear in the year 2005 when the level of service on 20th Avenue between US 70 and Relation Street drops to the D/E range. It continues to deteriorate to the D/F range in 2010 and to all LOS F in 2020.

- 8th Avenue: The segment of 8th Avenue between 8th Street and Relation Street is forecast to operate at LOS D beginning in 2005. However, the volume does not increase significantly with the higher population in the year 2020. Since it parallels 20th Avenue, additional capacity in the 20th Avenue/8th Avenue corridor would appear to be needed.

- US 191: The two- to three-lane section of US 191 immediately south of US 70 will deteriorate to LOS D by the year 2020 with the volume increasing to nearly 20,000 vpd. Even now there is reported congestion during special events at the fairgrounds. To solve this problem, it is recommended that the three-lane cross-section of US 191 be widened to five lanes to match the five-lane cross-section that starts approximately 1.2 miles south of US 70.

Near-Term Network Improvements

In addition to the recommended widening of US 191, improvements must be made to alleviate the developing problem on 8th and 20th Avenues. Based on the assignments run on the existing and committed network, this is the most serious capacity problem in the area. Two options to address this problem are to widen 20th Avenue to five lanes or to provide an alternative route. Since it provides direct access to the high school, connecting 14th Avenue across the railroad tracks is the most logical alternative route.

Widening 20th Avenue would probably require the purchase of additional right-of-way, including the acquisition of residential dwelling units along the street. To avoid the disruption of persons lives, and also to provide a second access road from US 70 to Safford High School, the 14th Avenue option would be preferable. The traffic assignments

with both the 14th Avenue connection and the widening of US 191 are shown in Figures 6-4, 6-5, and 6-6 for the years 2005, 2010, and 2020 respectively.

The connection of 14th Avenue solves the 8th Avenue and 20th Avenue problems through the year 2010. However, by the year 2020, LOS E appears again on 20th Avenue. This problem is addressed in the next section that deals with long-term improvement options.

LONG-TERM NETWORK ALTERNATIVES

Even though the year 2020 network operates fairly well, several issues that have been discussed during the study process have not been addressed through the evaluation of near-term alternatives. These include the need for an alternate route bypassing the downtown areas, truck traffic to and from the mine, and the 8th Avenue bridge situation. Two alternatives to address these issues are presented in this section.

Alternate Route for US 70

As defined by the near-term improvements, the network provides enough capacity to accommodate traffic in the 2020 assignment. However, the increasing volume in the downtown areas can only be effectively relieved by providing an alternate route to the US 70/US 191 connection. Most of the "trip attractions" remain along these two major highways; however, it is questionable whether all through traffic needs to use the existing highways through the downtown areas. With the increase in volume from the southern portions of the model area, it seems that a logical addition to the network would be to connect US 70 and US 191 with a "southern bypass". This "bypass" could provide both an option for highway traffic to bypass the area and/or an alternative route for local traffic.

The bypass route would begin in the Town of Thatcher and travel south along Reay Lane to near its intersection with Golf Course Road. The route would follow a new alignment connecting to Discovery Park Boulevard at 20th Avenue and then follow the Discovery Park Boulevard alignment to US 191.

A year 2020 traffic assignment with the bypass is shown in Figure 6-7. The bypass was coded as a four-lane, 55-mph highway to maximize the affect it would have on traffic volumes. For comparison, the speeds coded on US 70 are 35 mph and those on US 191 are 45 mph. To achieve this 10 to 20 mph speed differential, access would need to be limited to selected intersections. Driveway access would not be allowed. This type of design would provide the most attractive option for both through and local traffic to use as an alternative to US 70 and US 191.

With these design assumptions the maximum forecast volume on the bypass is 14,400 vpd, decreasing volumes on US 70 by up to 7,000 vpd. The bypass also provides an alternative route for local traffic, as shown by the fact that with the bypass 20th Avenue would operate

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

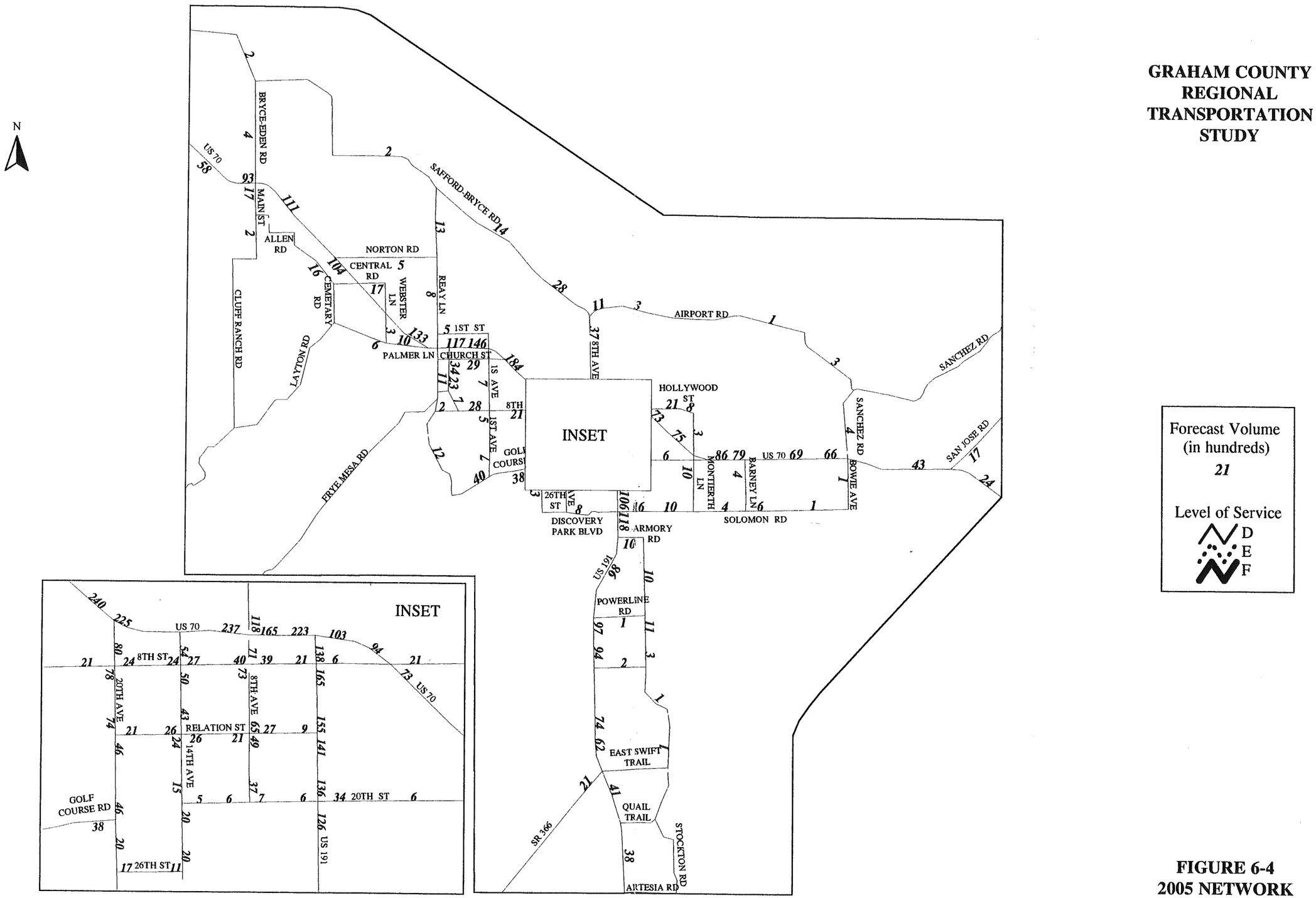
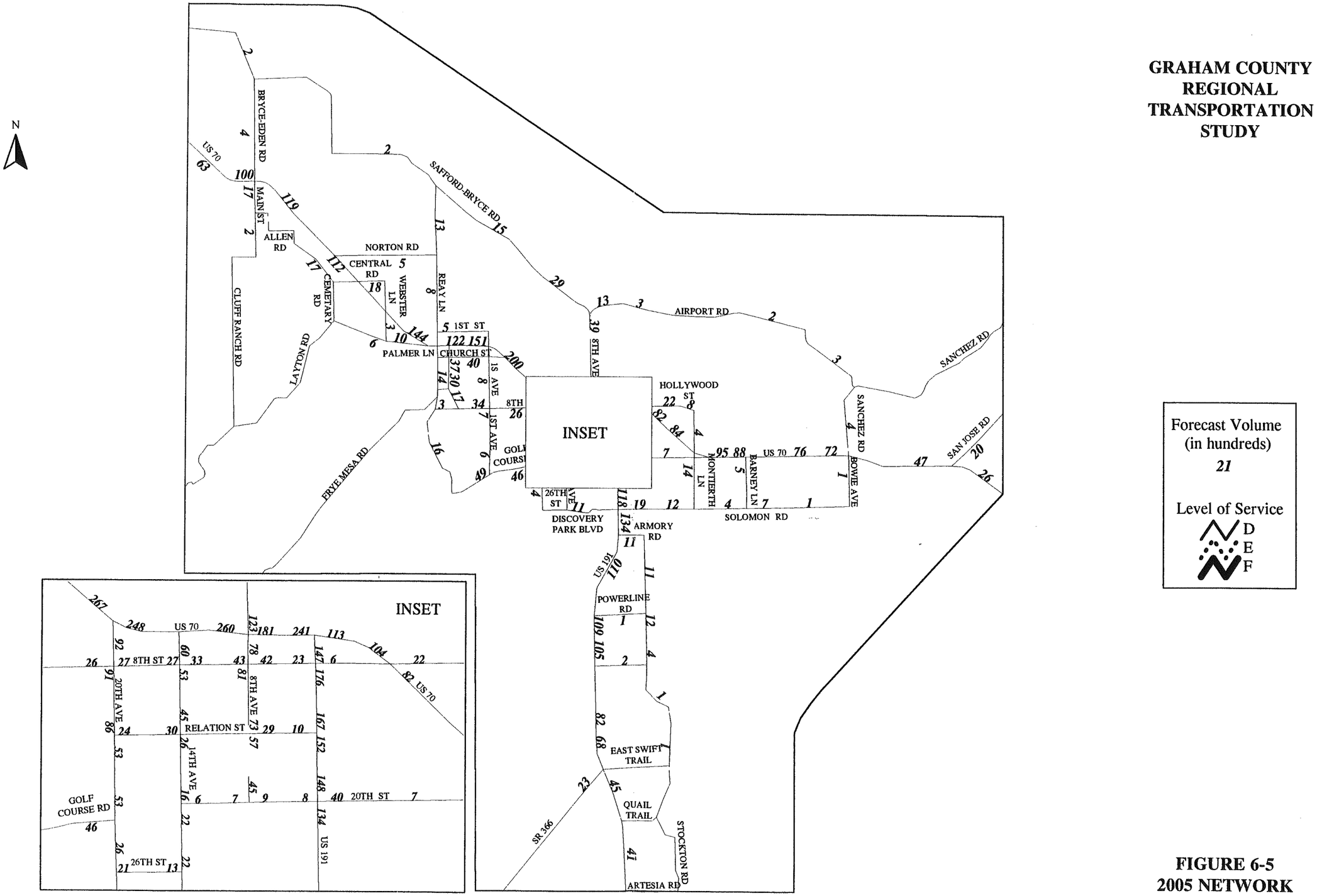


FIGURE 6-4
2005 NETWORK
2005 SE DATA
(POPULATION = 29,500)

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

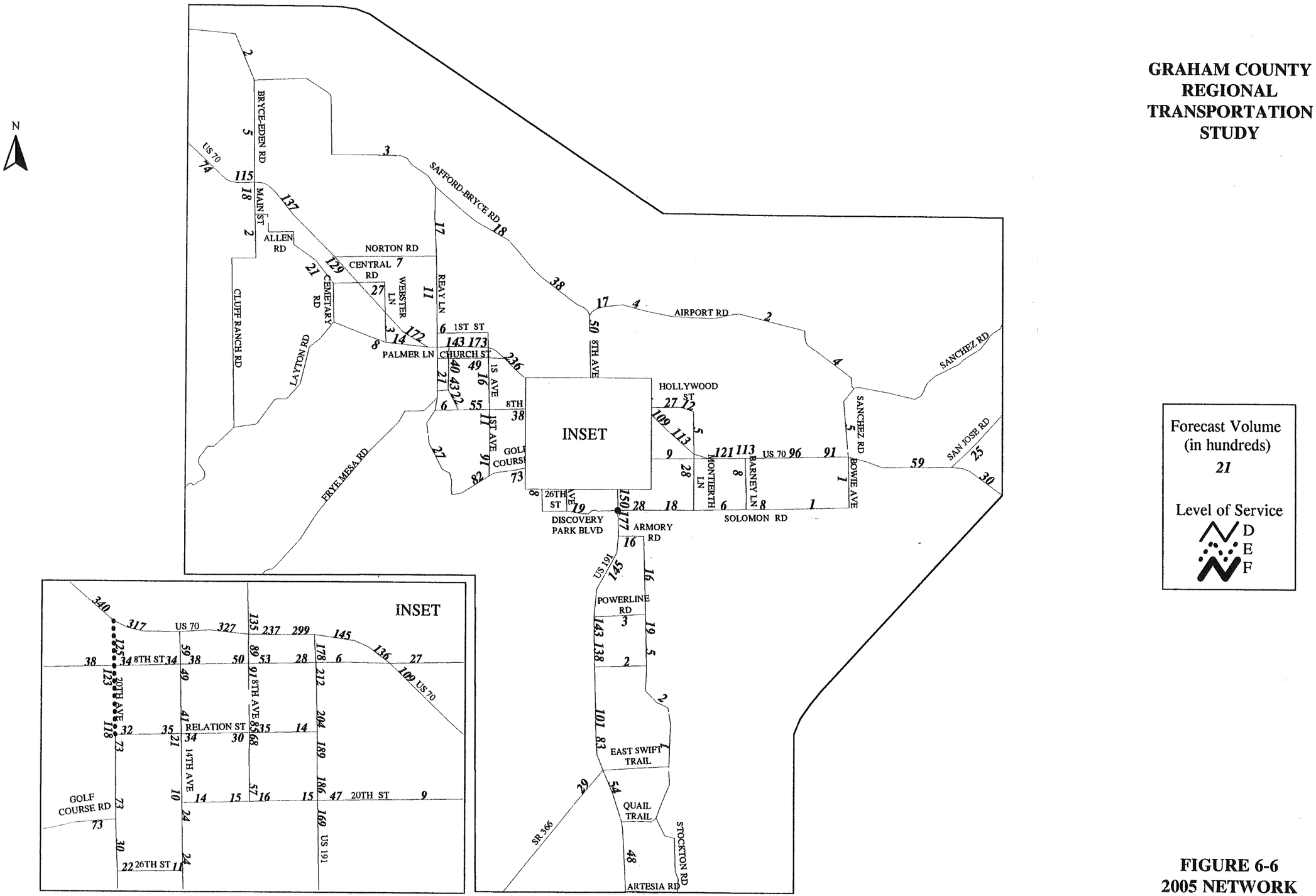
21

Level of Service

D
E
F

FIGURE 6-5
2005 NETWORK
2010 SE DATA
(POPULATION = 33,100)

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

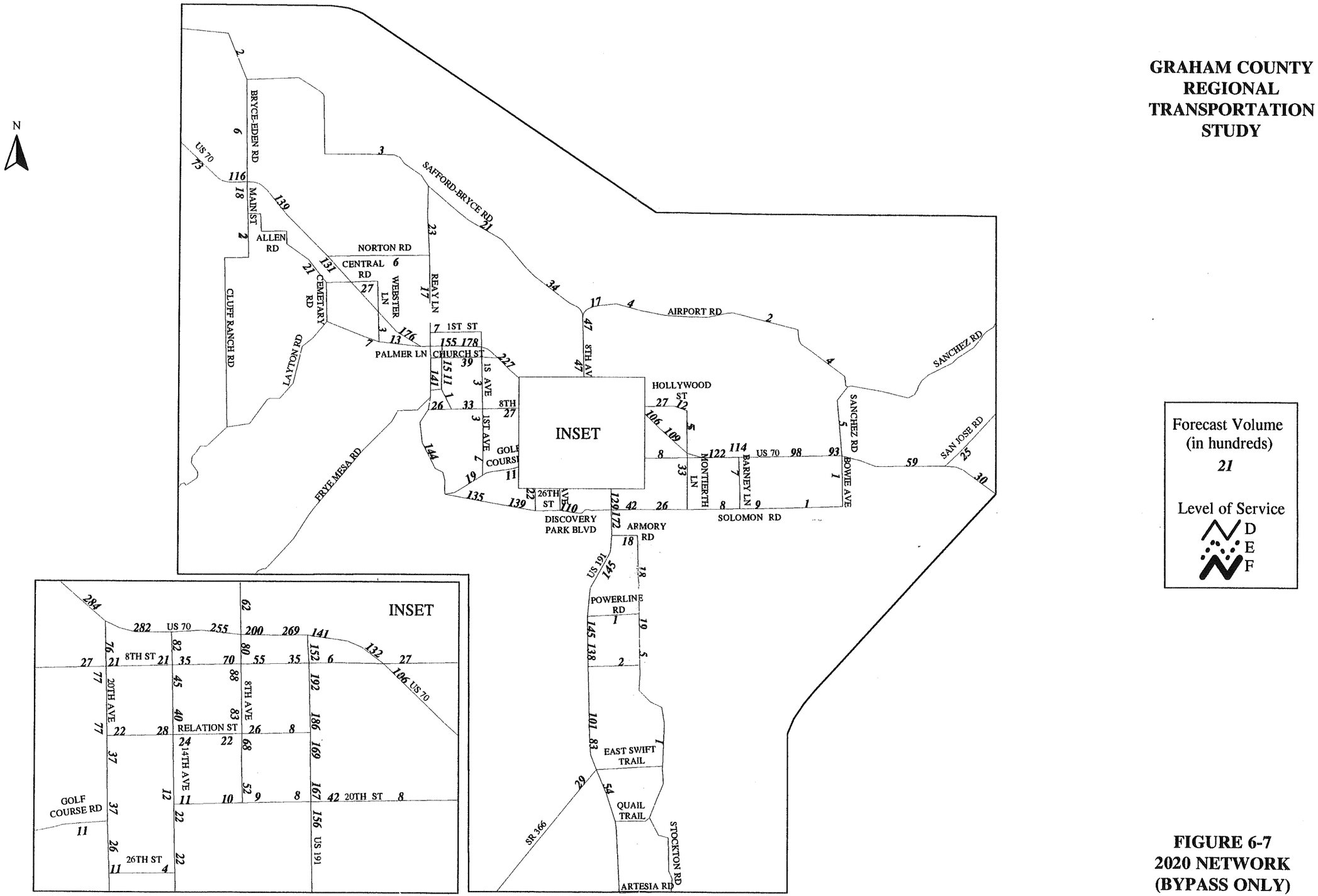
21

Level of Service

D
E
F

FIGURE 6-6
2005 NETWORK
2020 SE DATA
(POPULATION = 41,500)

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

21

Level of Service

D
E
F

FIGURE 6-7
2020 NETWORK
(BYPASS ONLY)
2020 SE DATA
(POPULATION = 41,500)

at LOS C instead of LOS D/E. Thus, an appropriately designed bypass would remove the need to consider widening 20th Avenue to five lanes.

8th Avenue Bridge Alternative

The 8th Avenue bridge crossing the Gila River is currently in need of repair and will eventually need to be replaced. The bridge provides the shortest connection from Safford-Bryce Road and Airport Road into downtown Safford to US 70 and to US 191. This traffic is contributing to the increasingly high traffic volumes in downtown Safford. Also, a certain amount of heavy trucks transporting acid to and from the mine will travel north on US 191 with the mine as a destination. With the present situation, these trucks carrying hazardous material would travel through the busiest part of Safford to reach their destination. To mitigate this situation, an extension of US 191 north across the river to Airport Road was coded into the 2020 network. This alternative is shown in Figure 6-8.

The obvious impact of a new location for the bridge is to increase traffic on US 191 and to decrease traffic on 8th Avenue. This would seem to be a desirable occurrence. Also, it would provide the most direct access route to the San Juan/Dos Probes mine for any mine traffic approaching from the south. The trucks transporting hazardous materials would not have to drive through the downtown area of Safford to reach their destination.

CONCLUSIONS

Four major construction projects have evolved through this network evaluation:

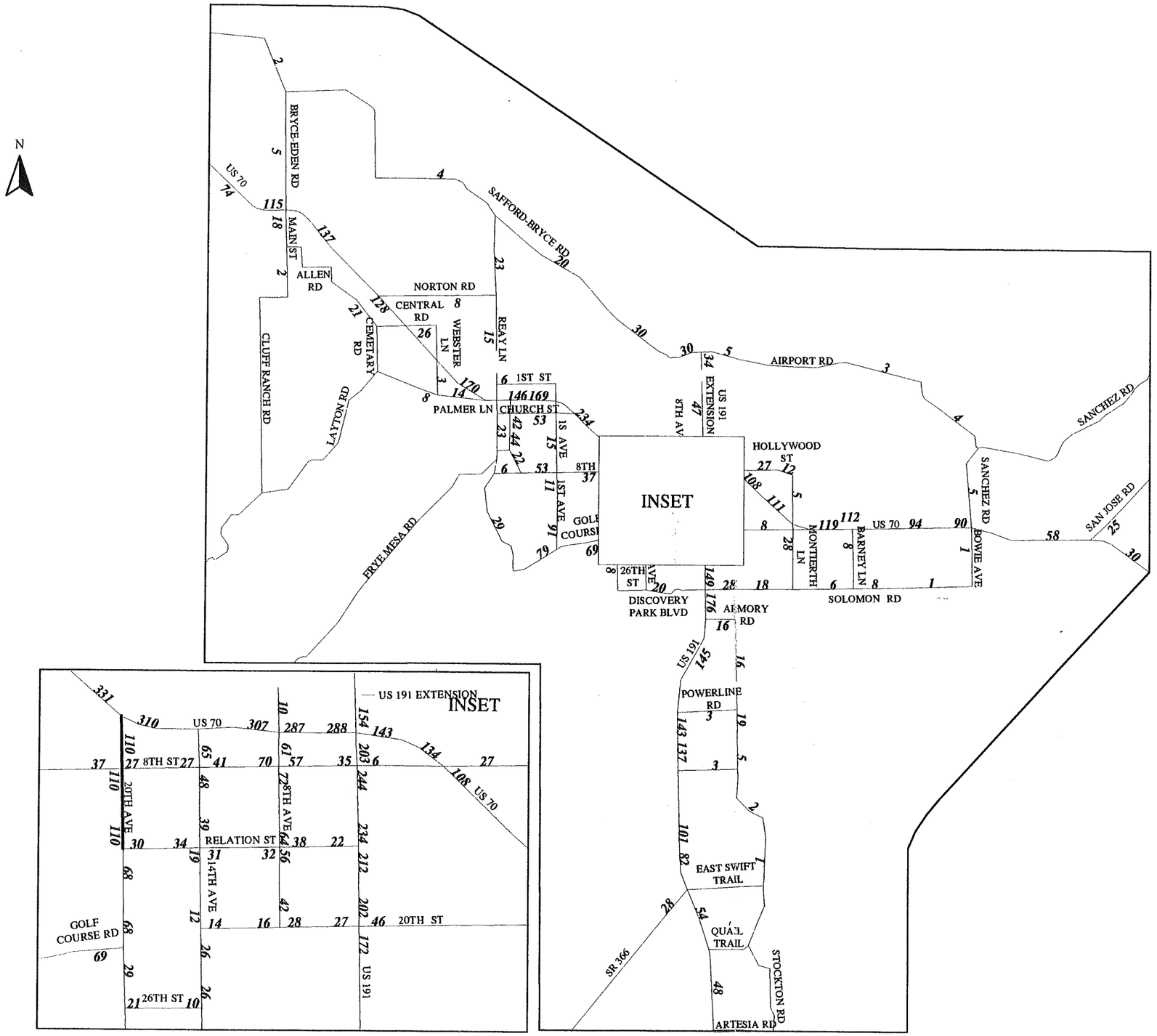
- Widen or restripe 1.2 miles of US 191 approaching US 70;
- Connect 14th Avenue across the railroad tracks;
- Construct a southern bypass; and
- Relocate the 8th Avenue bridge to align with US 191.

The US 191 and 14th Avenue projects were being seriously discussed by the jurisdictions involved even before this transportation study. The results of this analysis simply confirm what needs to be done. The concept of a southern bypass was a recommendation of the 1992 study. This 1998 analysis confirms the need to seriously consider such a project.

The idea of moving the 8th Avenue bridge comes primarily as a result of the probability of an increase in mining operations resulting in additional truck traffic through downtown Safford. The existing 8th Avenue bridge is in need of replacement. Recognizing that there are environmental and land use concerns related to the relocation of the bridge, it is recommended that this relocation alternative be evaluated in more depth.

Other projects will evolve out of the evaluation of special topics presented in the next chapter. All projects will be brought together in the recommended transportation plan presented in Chapter 8.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



Forecast Volume (in hundreds)

21

Level of Service

D
E
F

FIGURE 6-8
2020 NETWORK
(EXTENSION ONLY)
2020 SE DATA
(POPULATION = 41,500)

7. SPECIAL TOPICS

A number of transportation issues have been raised during the transportation planning process. The purpose of this chapter is to document and address these issues. The chapter begins with issues raised at the public meetings held on August 19, 1998. The next section discusses issues raised by the study team at TAC meetings. The final section provides a status report on recommendations made in the 1992 Transportation Study.

PUBLIC MEETING ISSUES

The following comments were received at the August 19 public meetings. A morning meeting was held as part of a Graham County Planning and Zoning Commission meeting. The second was an evening public meeting. A response is provided in italics.

- Prison Expansion: San Jose Road carries a high volume of traffic to the Arizona State Prison facility. Too much traffic for a rural facility. *Prison expansion is an issue that is addressed later in this chapter.*

- 8th Avenue Bridge: The bridge is in disrepair, and might need replacement, especially in light of the possible opening of the Phelps-Dodge mine. Is there any alternative funding mechanism available, such as a public-private partnership? *The 8th Avenue bridge is addressed later in this chapter. Funding options are discussed in Chapter 9.*

- Area Growth: Does the study account for growth? Utility expansion is a good way to track and forecast growth. *The study does account for growth through the use of population and employment projections that serve as key inputs into the traffic modeling process.*

- The Discovery Parkway "bypass" is currently insufficient and does not function as a bypass. A need exist for a true bypass or an alternative for east-west movement other than US 70. *The issues of alternatives to US 70 have been addressed as part of the transportation planning process.*

- US 70 should be widened between Pima and Safford. *The width of US 70 will also be addressed in the planning process. ADOT is currently preparing plans to rebuild US 70 from 1st Avenue in Thatcher to 20th Avenue in Safford.*

- Speed Control: Speed limits vary and need consistency. *This comment has been noted and has been passed on to ADOT and the communities.*

- County Park Access: Additional access is needed to the park. *Access to the County Park is an issue that is addressed later in this chapter*

- The Visitor Center for Mt. Graham Observatory will be located at Discovery Park. *This has been noted and is included in the traffic forecast process.*

- Safford-Bryce/Airport/8th Avenue Intersection: The County is currently planning improvements to the intersection. *This intersection is an issue that is addressed later in this chapter.*

- US 70 and 8th Avenue Intersection: The left-turn arrows were installed approximately two years ago by ADOT. ADOT has a signal warrant study. *This intersection will also be addressed later in this chapter.*

- Marijilda Wash: The flooding problem caused by the wash is east of US 191. East Swift Trail, the only access to US 191 from adjacent residential developments, is being flooded. *This issue will be addressed later in this chapter.*

- Bicycle Element: Interest in including a bicycle element in the study was expressed. The existing bicycle routes should be expanded to consider commuters as well as students. One possibility would be to use railroad right-of-way to build a bike path along the Eastern Arizona Railway tracks. *A bicycle element has been included in the plan.*

ISSUES RAISED BY THE STUDY TEAM

Issues raised by the study team through the study process are discussed in this section.

Intersections

A number of intersections that were in need of evaluation were identified during discussion at the first TAC meeting. These intersections, plus others, identified during field reconnaissance are summarized in Table 7-1 and located on Figure 7-1. The table includes a brief summary and recommendation.

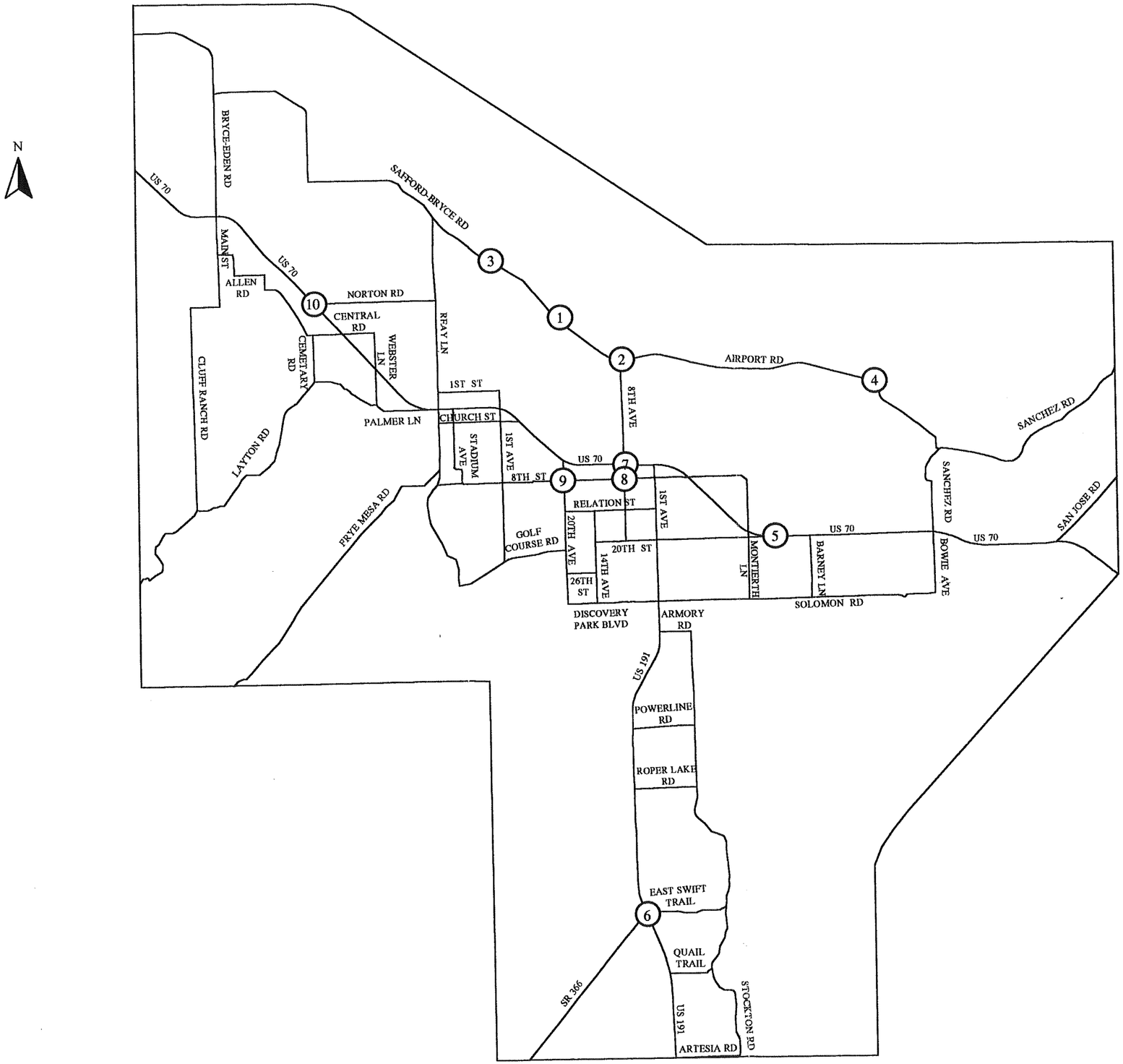
Railroad Issues

The Arizona Eastern Railway currently runs four trains a week through the region. However, because Safford/Thatcher is a growing urban area, the existing and possible future railroad crossings are becoming an issue. In addition, because the edge of 8th Street is only about 10 feet from the tracks, widening the roadway to accommodate future traffic volumes will be very expensive. With mine expansion, rail traffic may become more of an issue in the future. These issues are discussed in more detail below.

TABLE 7-1. INTERSECTION ISSUES

Intersection	Issue	Recommendation
Safford-Bryce Road /8th Avenue/Airport Road	Safety; High accident location; Access to commercial properties in close proximity west of the intersection.	Realignment of intersection, teeing 8th Avenue into Airport/Safford-Bryce Road.
Safford-Bryce Road/Landfill Road	Safety; Wash crossing	Right turn lane westbound and left turn lane eastbound, especially with truck traffic from mine. Probable widening of wash crossing.
Safford-Bryce Road/ Dos Pobres Mine Road	Safety; Entrance to the mine with increased car and truck traffic; Wash 150 feet east of intersection.	Needs to be widened to provide for expected mine traffic. Eastbound left-turn lane and westbound right turn lane needed. Wash Crossing.
Reay Lane from Safford Bryce Road to 1st Street	Safety; Irrigation ditch and utility poles only several feet from roadway.	Consider guardrail.
US 70/Lone Star Lane	Capacity; Safety; Railroad tracks	ADOT is doing a safety project.
Sanchez Road/Airport Road	Safety with increase in truck traffic to the mine.	Northbound left-turn lane needed, widen southbound lane on Airport Road to accommodate right turns; Alternative would be to realign intersection to provide straight movement from Solomon bridge to Airport Road.
US 70/8th Avenue	Capacity/Safety: Busiest intersection in town, signalized, no left turn arrows on U.S. 70. On northwest corner an "island" exists, which is used by a drive-through liquor store. Drive through windows close to intersection (60 feet) Access from property onto US 70 possible in both directions.	Examine intersection phasing, need for left turn arrows on US 70; right turn only signage needed on liquor store exit; eventually relocate business.
Airport entrance	Safety: Access to Airport on a curve; appears to have adequate, but minimal sight distance.	Add turn lanes and signage.
8th Avenue/8th Street	Safety, Capacity, Railroad: Commercial property (gas station) on northwest corner; 8th Street paralleled by railroad tracks, 8th Avenue crosses tracks in close proximity to the south; widening is limited by canal within 60 feet of 8th Street.	See discussion under Railroad Crossings.
8th Street/20th Avenue	Safety/Capacity: 20th Avenue provides access to Safford High School and Hospital.	See discussion under Railroad Crossings.
SR 366/US 191	Safety	Add northbound left-turn lane on US 191.
US 70/Norton Road	Increased truck traffic on Norton Road	Improve westbound right-turn radius

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY



1. Safford-Bryce Road/Land Fill Road
2. Safford-Bryce Road/8th Avenue Airport Road
3. Dos Pobres Mine Entrance
4. Airport Entrance
5. US 70/Lone Star Road
6. SR 366/US 191
7. US 70/8th Avenue
8. 8th Avenue/8th Street
9. 8th Street/20th Avenue
10. US 70/Norton Road

FIGURE 7-1
SPECIAL ISSUES INTERSECTIONS

Location

Other than US 70, 8th Street is the only roadway in the region that provides access from Reay Road on the west side of Thatcher to US 70 on the east side of Safford. Thus, it does provide an east-west alternate to the highway. Since, direct access to 8th Street is minimal in most locations; it provides an alternative roadway option for local traffic. However, because the tracks are so close to the roadway, widening 8th Street, or even improving intersections is very difficult.

Crossings

The 17 railroad crossings between Palmer Lane and Barney Lane are shown in Figure 7-2. Due to the location of Safford High School, the City has asked that a new crossing be allowed at 14th Avenue. In exchange, the railroad would like to close some existing crossings. Montierth Lane, and 3rd, 5th, and 6th Avenues have been mentioned as possibilities by the railroad.

Safford High School Access

Safford High School is located between 20th Avenue and 14th Avenue south of the railroad tracks. Approximately 300 parking spaces are available for students on the school property.

Traffic patterns around the school were observed from 2:30 p.m. until 3:00 p.m. on August 19, 1998. Seventy-five percent of the cars (132 of 178) leaving the main student parking lot north of the school building used the east exit and traveled south on 14th Avenue. Sixty percent (80 vehicles) turned left onto 10th Street and 52 vehicles continued south on 14th Avenue. Forty-six vehicles left the school property via Bulldog Avenue to the west. Half of the Bulldog Avenue vehicles (23) turned right to travel north on 20th Avenue and the other half turned left to travel south on 20th Avenue. One bicyclist was observed leaving the school grounds. It has been observed that during the noon hour, most vehicles leaving the school grounds use 20th Avenue to access the fast food restaurants on US 70.

Recommendations

An evaluation of a new 14th Avenue crossing has been made as part of the planning process.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

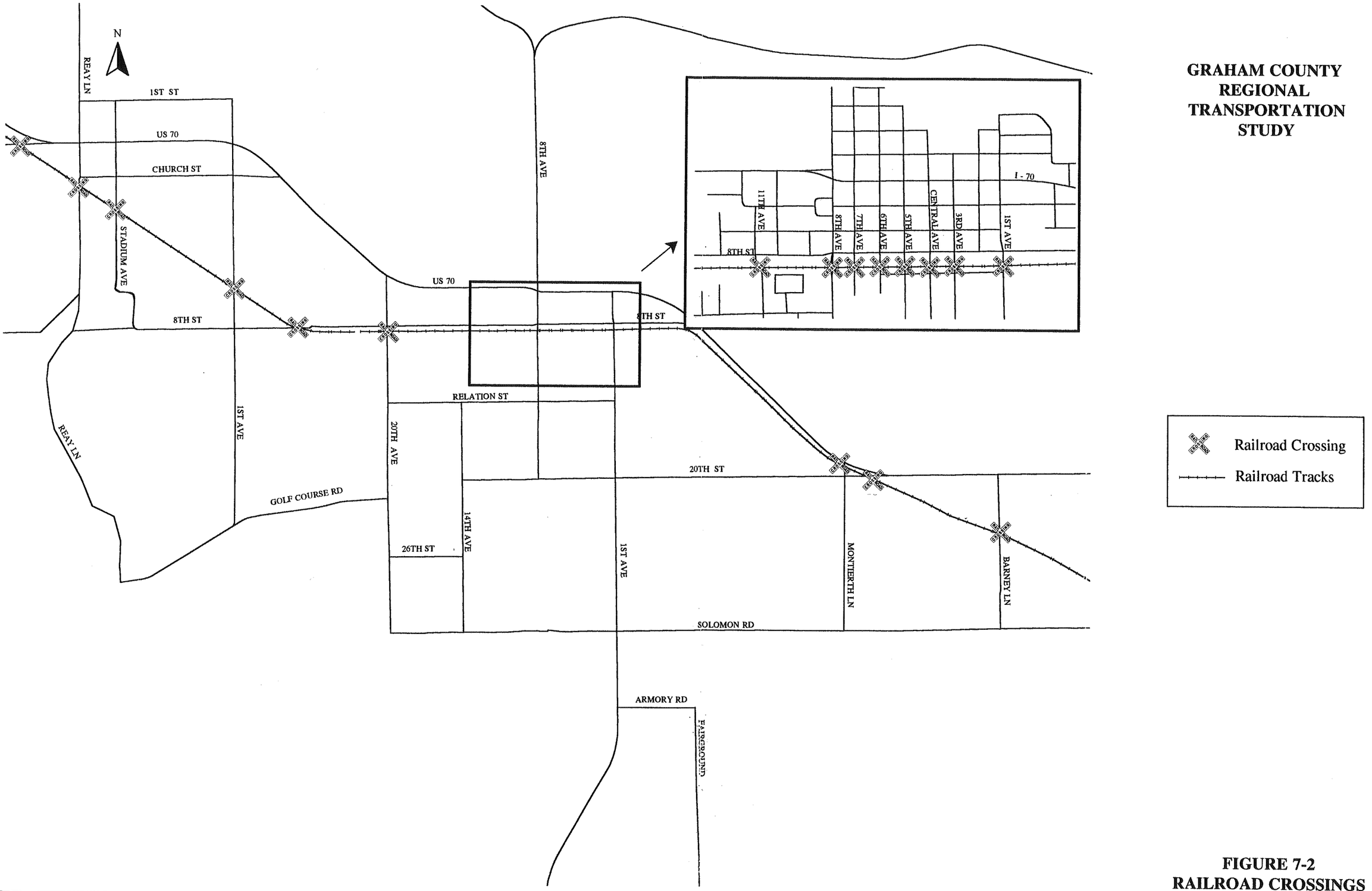


FIGURE 7-2
RAILROAD CROSSINGS

Graham County Fairgrounds and Regional Park

The Graham County Fairgrounds and Regional Park is located east of US 191 and south of Armory Road in Safford. The main entrance to the park is on Armory Road approximately one-quarter mile east of US 191. A second entrance is provided from US 191 south of Armory Road. Two points of access have been provided onto US 191 to separate northbound and southbound traffic.

A number of events take place at the park throughout the year. Events include the County Fair, horse races, rodeos, softball/baseball games and tournaments, stock car races, a fiddler's jamboree, and the normal general use such as picnics. Park personnel pointed out that during major events access to the park is insufficient to accommodate all visitor traffic, i.e., cars are queuing up on US 191 for up to 1.5 miles. For example, in the three-day period of the Graham County Fair, approximately 35,000 visitors arrived by car, an average of nearly 12,000 visitors per day. With a vehicle occupancy rate of 2.5 persons per car, 4,800 vehicles enter and exit the grounds daily during the County Fair. The parking facilities accommodate approximately 2,500 vehicles. Thus, there is insufficient parking capacity on heavy user days, resulting in spill over across US 191. The Arizona Department of Public Safety (DPS) provides officers to assist in traffic control on heavy traffic days.

Recommendations

Manual traffic control provided by DPS may be the most efficient method to handle park traffic today. However, as the region grows and the park activity grows simultaneously, other ways of controlling traffic may be necessary. Options to consider are listed below:

- Signalization at the US 191/Armory Drive Intersection – An Armory Drive traffic signal would provide traffic control for all events. Closing the US 191 access point for most events thus forcing traffic through the signal might be desirable for safety. At larger events, northbound traffic on US 191 could queue past the park exit to the highway, thereby blocking access.

- The provision of shuttle service from remote parking areas would help to alleviate traffic.

- Signalization at the US 191 Access Point – A second signal on US 191 could be timed to eliminate the northbound queue problem. Ideally, under the two-signal scenario, northbound traffic would be channeled to the Armory Drive signal and southbound traffic would be channeled to the US 191 signal within the Park to improve signal operation.

- Stockton Road Access – The extension of Stockton Road to the north would provide alternative access to the County Park. However, there is a significant

topographical constraint in the form of a valley that would make construction very expensive. With the other needs in the region, this option is not recommended now.

To develop the optimal solution for Park access, additional data would be necessary. This data would include an inventory of annual park usage. This data would include date, day, event, and traffic volume into and out of the park by time of day, and turning movements. A typical days worth of data should be collected for each unique event. Also, an accident analysis of accidents that occur on US 191 and on Armory Road should be evaluated to determine which are related to park event traffic. Using the inventory and accident data, an evaluation of the options discussed above, plus others that may surface, could be undertaken and a course of action determined.

Eastern Arizona College

Eastern Arizona College in Thatcher employs approximately 160 full time and 150 part time staff members and has more than 1,400 students attending the Thatcher campus. Currently, housing on campus exists for approximately 370 students. A count of available parking spaces found roughly 1,000 parking spots on or around the north and south campuses. Twenty percent of the parking spots are located on-street, mostly along Stadium Lane and College Avenue. The remaining 80 percent are in parking lots on campus. Stadium Lane and College Avenue act as the primary roadway links to the College campus from Main Street (US 70).

In addition to classes, many events take place on the campus. These include events in the Activity Center, Fine Arts Auditorium, and athletic venues plus visitors to the fitness Center.

Traffic and parking in the campus area is a problem. To help solve the traffic problem, a traffic signal is being constructed at the intersection of US 70 and Stadium Avenue. The college will be developing a Campus Master Plan during the fall of 1998.

Recommendations

Campus growth has been incorporated into the traffic model analysis and evaluated as part of the transportation planning process.

Marijilda Wash

Marijilda Wash crosses both Stockton Road and US 191 near the intersection of US 191 and SR 366. Box culverts handle the drainage on US 191. No drainage accommodations are provided on Stockton Road. Therefore, when water is flowing in the wash, access to approximately 350 residential lots is unavailable.

A related issue is the fact that Stockton Road provides the only alternate route to US 191 south of Discovery Park Boulevard. Thus, if US 191 is closed by an incident at the same time there is major flooding in the wash, access to Safford from the south will be blocked. Stockton Road is a two-lane facility, which is currently not paved.

Recommendations

A crossing of Marijilda Wash is included in the recommended improvements.

8th Avenue Bridge

The 8th Avenue Bridge provides the most direct connection from downtown Safford to the Airport, the landfill, and the proposed mines. The bridge has two narrow lanes and is in need of repair or replacement.

Recommendations

The County is currently evaluating replacement options for the 8th Avenue bridge. In addition, an alternative location has been selected as part of the transportation planning process. A recommendation to replace the bridge has been included in the Transportation Plan.

Fort Grant Road

The Bonita Hydroponic Nursery is located on a County Road near the Graham-Cochise county line. There is significant traffic between the nursery and Fort Grant on a six-mile paved road and on an unpaved road for the other nine miles. Completing the paving is a major issue within the County.

Recommendations

The paving of Fort Grant Road is included in the recommendations of the Transportation Plan.

Phelps-Dodge Mines

Traffic to and from the mine will occur during two distinct phases. First, during the construction phase, about 1,700 work trips are expected. An additional 200 trips per day will be generated through construction material and miscellaneous trips. Secondly, during the operations phase employee travel will occur on a three-shift basis and produce

approximately 650 trips a day. Additionally, truck transports to and from the mine are expected to be around 200 trips a day.

A Traffic Impact Study for the mine, *Transportation and Traffic Impact Analysis Dos Pobres/San Juan Project by Curtis Lueck & Associates, April 11, 1997*, found the estimated traffic associated with vehicle travel during both the construction and the operational phases of the mine can be accommodated on the existing roadway network. The report concluded the amount of traffic generated by the proposed mine is relatively minor and will be distributed throughout the day due to three-shift operations.

Recommendations

Improvements to Safford-Brice Road and Norton Road will be needed to accommodate the traffic generated by the mine. These are included in the Transportation Plan.

Discovery Park

The Visitor Center for the Mt. Graham Observatory is located in Discovery Park. Good access to the park is needed.

Recommendations

Access to the Park is currently provided off of Discovery Park Boulevard. This access will need to be maintained as improvements are made to the boulevard.

US 191 Sight Distance

Passing opportunities are limited on US 191 between I-10 and Safford because of horizontal and vertical geometry. As traffic increases this will create additional traffic congestion on the route.

Recommendations

ADOT is currently preparing a Design Concept Report that will lead to the widening of US 191. Passing sight distance will be improved during the widening.

Access Management

An access management plan for US 70 was identified as a need in the 1992 Transportation Plan. Since the area is growing to the south, access management on US 191 may be as important.

Recommendations

An access management plan should be prepared for both US 70 and US 191.

Prison Expansion

The three prison sites located within the study area are growing. Traffic to the sites will increase and needs to be considered in developing the Transportation Plan.

Recommendations

Prison expansion has been accounted for in the traffic assignment model.

STATUS OF 1992 TRANSPORTATION STUDY RECOMMENDATIONS

The 1992 Graham County Transportation Study for the Gila Valley Region recommended a number of projects for implementation in a five-, ten-, or twenty-year time frame. The status of these projects is summarized in Table 7-2.

TABLE 7-2. 1992 PLAN RECOMMENDED PROJECTS STATUS

Five-Year Plan Projects	Status
US 70/Stadium Avenue Signal	Not Implemented
20th Avenue Roadway Improvements	Not Implemented
Safford Bridge New Bridge Structure	Not Implemented
8th Avenue/Airport Road Intersection Improvements	Not Implemented
14th Avenue Extension to US 70	Not Implemented
Sanchez Road Spot Roadway Improvements	Not Implemented
Cottonwood Wash Road Extension to US 70	Not Implemented
Reay Lane Extension to Daley Estates	Complete
8th Street Extension to Reay Lane	Complete
32nd Street Extension to Daley Estates*	Not Implemented
8th Avenue Extension to 32nd Street*	Not Implemented
US 70 Intersection Improvements	Underway
San Jose Road Roadway Improvements	Not Implemented
Ten-Year Plan Projects	
Safford-Bryce Road Improve Wash Crossings	Not Implemented
Airport Road Intersection Improvements	Not Implemented
Sanchez Road New Bridge Structure	Complete
Main Street Improvements	Not Implemented
US 70 Reay Lane Intersection Improvements	Not Implemented

TABLE 7-2. 1992 PLAN RECOMMENDED PROJECTS STATUS (continued)

Ten-Year Plan Projects	Status
8th Street Upgrade Roadway	Not Implemented
20th Street Extension to 20th Avenue	Not Implemented
14th Avenue Extension to 32nd Street*	Not Implemented
US 666 Improvements	Not Implemented
US 666/SR 366 Intersection Improvements	Not Implemented
Twenty-Year Plan Projects	
US 70 Widen to Five Lanes	Under Design
US 70 Implement Access Control Plan	Not Implemented
US 666 Implement Access Control Plan/Improvements	Not Implemented
20th Avenue Extension to 45th Street	Not Implemented
Stockton Road Extension to Solomon Road	Not Implemented
Lone Star Road Roadway Upgrade	Not Implemented

* 32nd Street is now known as Discovery Park Boulevard

8. TRANSPORTATION PLAN

The purpose of this chapter is to present the Transportation Plan for Graham County. The first section of the chapter presents the elements of the Plan. This is followed by a discussion of individual projects necessary to implement the Plan. Chapter 9 presents a discussion on the implementation schedule, cost estimates and funding for the Plan.

GRAHAM COUNTY TRANSPORTATION PLAN

The Transportation Plan for Graham County is presented in four elements: the Urban Street Element, the Rural Street Element, the Bicycle Element, and the Transit Element. Each of these elements is discussed below.

Urban Street Element

Figure 8-1 shows the Street Plan for the urban area of Safford/Thatcher/Pima. The Urban Street Plan includes a hierarchy of streets functionally classified as principal arterial, minor arterial, major collector, and minor collector streets. The Functional Classification System matches the categories that are used in the Regional Transportation Plan prepared by the Southeast Arizona Government Organization (SEAGO). The right-of-way and pavement width characteristics of each classification as recommended by SEAGO are presented in Table 8-1. A definition of each classification is presented below.

TABLE 8-1. RECOMMENDED RIGHT-OF-WAY AND PAVEMENT WIDTHS BY FUNCTIONAL CLASSIFICATION

Functional Classification	Right-of-Way Width, Rural Designation	Right-of-Way Widths, Urban Designation	Pavement Width, Rural	Pavement Width, Urban
Principal Arterial	100 feet	100 feet	24/34-56 feet	24/34-56 feet
Minor Arterial	84 to 100 feet	84 feet	24/34-56 feet	24/34-56 feet
Major and Minor Collectors	60 to 84 feet	60 to 84 feet	24/34-60 feet	24/34-44 feet
Neighborhood Collectors	60 feet	56 feet	22 feet min	32 feet min
Minimum Access (Residential)	48 feet	40 feet	20 feet min	22 feet min

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

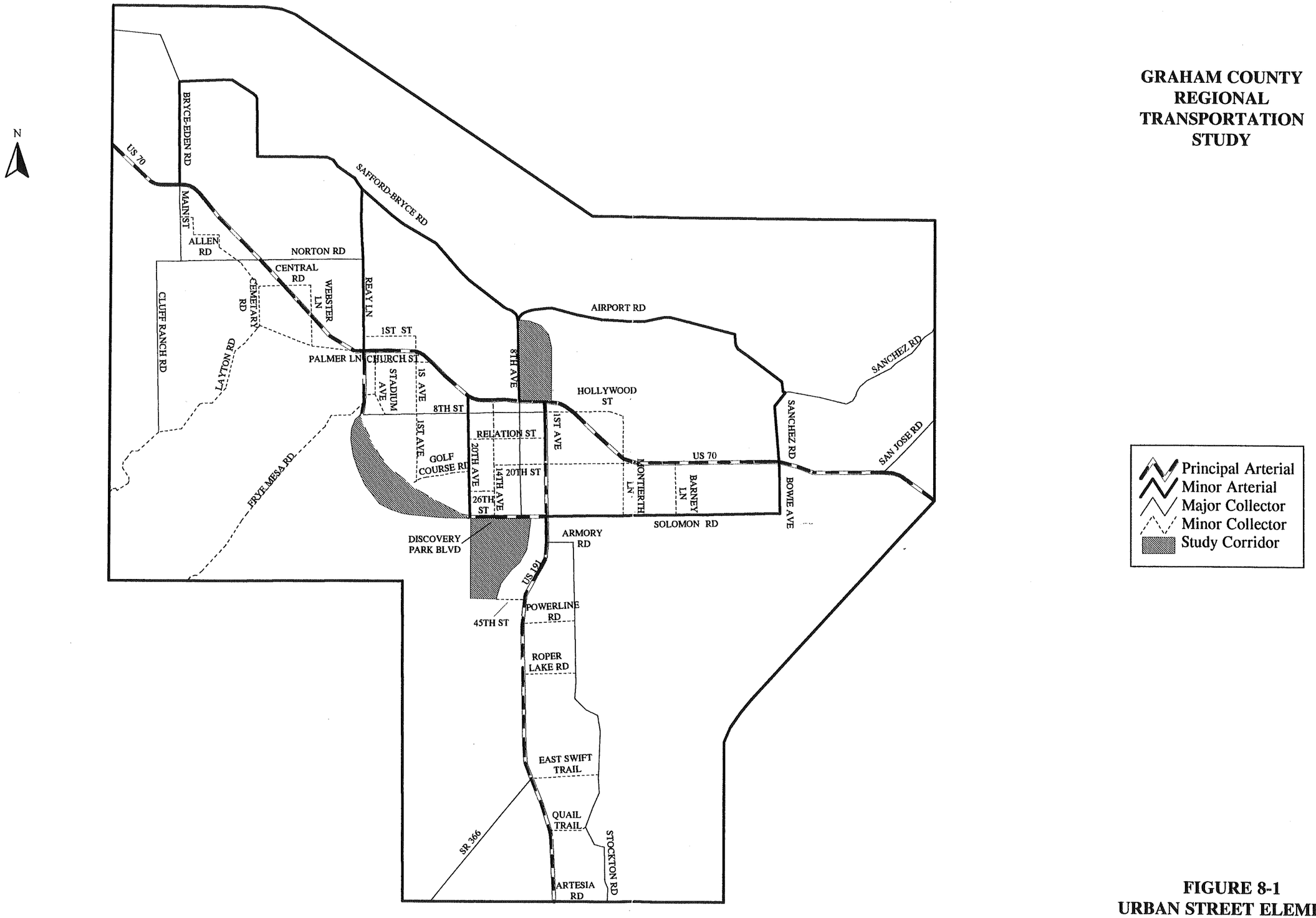


FIGURE 8-1
URBAN STREET ELEMENT

Principal Arterial Streets

The primary function of a principal arterial Street is to move traffic. Major intersections should be signalized when warranted and all other cross-streets should be stop sign controlled. Access to individual residences should not be allowed and access to commercial properties should be concentrated to driveways that serve multiple businesses. In urban areas, principal arterial streets should have a five-lane cross-section, which includes four through lanes and a two-way left-turn lane or alternatively a median with strategically placed left-turn lanes. An access management plan to help maintain a high level of service should be prepared for principal arterials.

The two major highways that serve southern Graham County, US 70, US 191, and the proposed US 70 Relief Route are classified as principal arterial streets. Safford, Thatcher, and Pima have developed around the highways, therefore they carry significantly higher traffic volumes than any other roadways in the County. The Relief Route will serve as an alternative route for both through and local traffic and will need to be designed to this higher standard in order to attract users.

Minor Arterial Streets

The primary function of a minor arterial street is also to move traffic. The primary difference between a principal arterial and a minor arterial in the urban portion of Graham County is the forecast traffic volume. Two through lanes plus a two-way left-turn lane is sufficient in most cases to handle the forecast volume.

The recommended system of minor arterial streets in the urban area of Graham County includes segments of Bryce-Eden Road, Safford-Bryce Road, Airport Road, Reay Lane, 8th Avenue, 20th Avenue, Solomon Road, Bowie Avenue, and Sanchez Road.

Major Collector Streets

Major collectors provide a dual function of carrying traffic to the arterial street system and providing access to residences and commercial establishments. Major collectors include Main Street in Pima, Cottonwood Wash Road, Norton Road, Cluff Ranch Road, 8th Street, 8th Avenue (in Safford), Sanchez Road, San Jose Road, Stockton Road, and Armory Road. SR 366 is also designated a major collector street.

Minor Collector Streets

Minor collectors also provide a dual function of carrying traffic and providing access. The difference between major and minor collectors in Graham County is primarily the length of the segment and its importance in the transportation system.

Rural Street Element

Figure 8-2 shows the Street Plan for the rural portion of southern Graham County. US 70 and south US 191 are designated as principal arterials. East US 191, SR 266, and Fort Grant Road have been designated as minor arterials. SR 366, Klondyke Road, and Klondyke-Bonita Road have been designated as major collectors.

Bicycle Element

There are three types of bicyclists: those that use a bicycle as an alternative mode of transportation, those that use a bicycle for recreation, and those that use a bicycle for physical conditioning. Bicyclists using a bicycle as an alternative mode of transportation want to ride on all streets, the same as an automobile driver. The recreational bicyclist prefers routes that are separated from motor vehicle traffic, or at a minimum on low volume streets. The training bicyclist prefers long stretches of roadway with minimal stops.

An on-street, striped bicycle lane needs to be four feet in width, measured from the edge of the gutter. Alternatively, a wide 14-foot, outside lane is acceptable for bicycle use. In fact, the wide outside lane concept is preferred by many bicyclists because the motor vehicle traffic tends to keep the outside edge of the roadway cleaner by pushing debris into the gutter pan or off the roadway rather than into a striped bicycle lane.

As new streets are constructed or old streets are widened, consideration should be given to providing adequate width for bicyclists. In addition, the provision of off-road multi-use paths should considered. A minimum 12-foot width is preferable. The Eastern Arizona Railway Company is amenable to locating such a path within its right-of-way between Pima and Thatcher. Another option would be to develop a recreational path along the banks of the Gila River. Either of these projects would be eligible for Transportation Enhancement funds.

The Bicycle Element is presented in Figure 8-3. It includes a number of existing and proposed streets designated as bicycle routes and multi-use paths within the Eastern Arizona Railway right-of-way between Pima and Thatcher and along the Gila River between Pima and Safford. No location work has been completed for either of the proposed paths. Roadway improvements to accommodate bicyclists should not be limited to those streets shown on the map. Provision for bicyclists should be considered on all roadway improvements.

Transit Element

Specialized bus service is currently the only transit service provided within southern Graham County. This service is important and needs to be continued. As the area grows, a general dial-a-ride service would probably be more efficient than fixed route service.

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

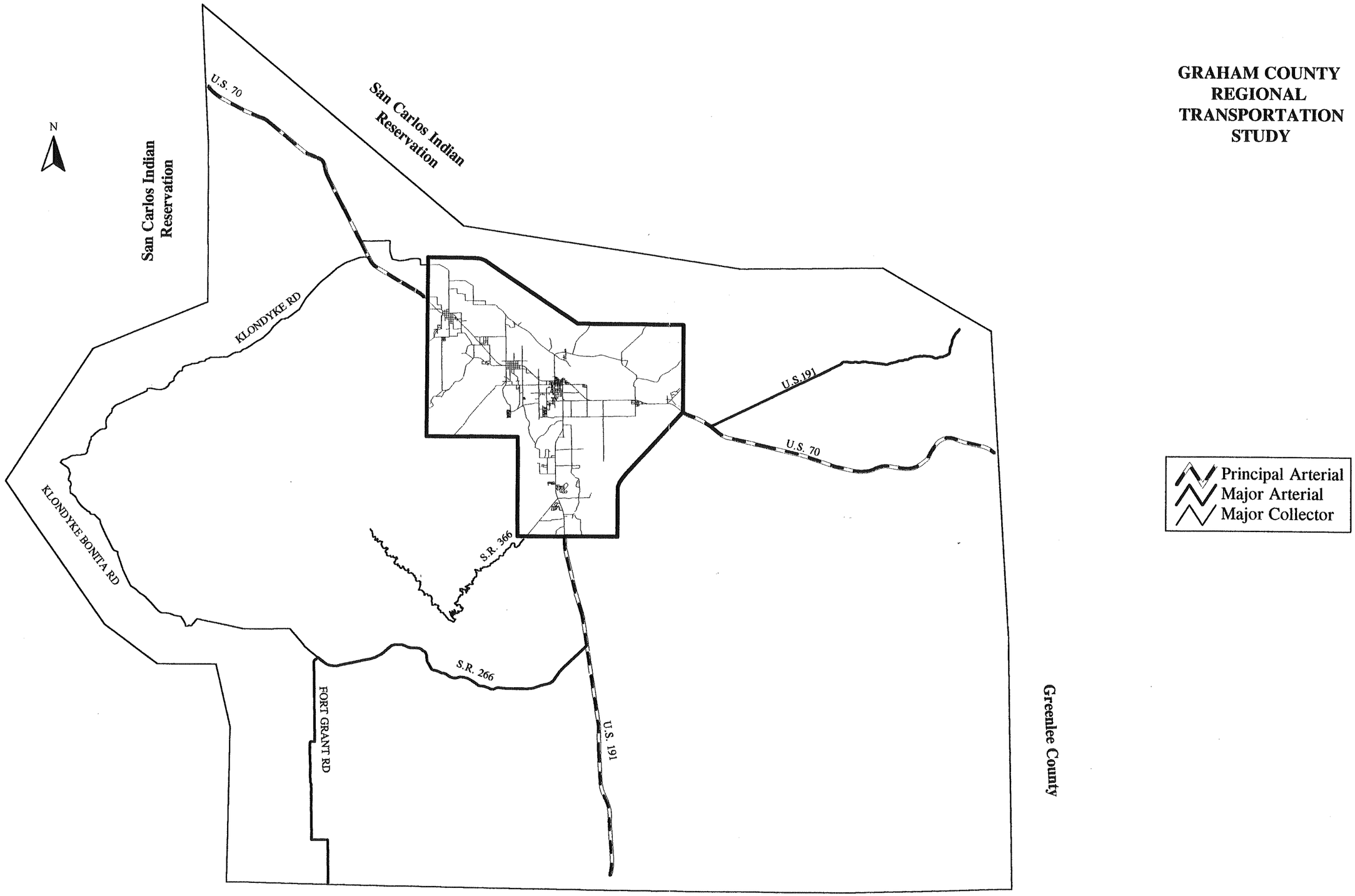


FIGURE 8-2
RURAL STREET ELEMENT

GRAHAM COUNTY REGIONAL TRANSPORTATION STUDY

FIGURE 8-3
BICYCLE ELEMENT

The communities should work with SEAGO to continue to assess and improve transit service in the area.

PROJECT DESCRIPTIONS

This section includes a number of projects that will be necessary to implement the Street Elements of the Transportation Plan. These projects have been developed from four sources: the transportation system analysis presented in Chapter 6, the special topics presented in Chapter 7, a review of projects recommended in the 1992 Graham County Transportation Study and also presented in Chapter 7, and projects being planned or programmed by the responsible jurisdictions as listed in Chapter 6.

The purpose of this section is to define and in some cases, discuss the projects. Priorities are suggested as part of the implementation plan presented in the next chapter.

As the Transportation Plan has developed, it has become apparent that a number of projects are dependent upon decisions made on both ends of the 8th Avenue corridor: specifically, the location of a new 8th Avenue replacement bridge on the north end and the location of a new South Access Route on the south end. Therefore, the first seven projects discussed below are very much interrelated and need to be considered as a group.

Reconstruct the 8th Avenue Bridge

The 8th Avenue Bridge is in very poor condition and needs to be replaced. The County is currently studying options for replacing the 8th Avenue Bridge at its current location.

An alternative to relocate the bridge to a 1st Avenue alignment was evaluated from a traffic standpoint. This alignment would reduce traffic on 8th Avenue in downtown Safford. More importantly, it would provide a direct route for truck traffic traveling between the proposed San Juan/Dos Pobres mine to US 191 and south to I-10 without traveling into downtown. However, a new location may have adverse environmental or land use impacts. Therefore, this plan recommends that a location study be undertaken to determine the best location for the replacement bridge.

8th Avenue/Airport Road/Safford-Bryce Road Intersection

The 1992 Plan recommended this "Y" intersection be reconstructed to make 8th Avenue/Airport Road the through movement. This 1998 Plan also recommends a tee intersection, but with Safford-Bryce Road/Airport Road being the through movement. This would provide for trucks traveling between the Dos Pobres mine and points west having the through movement.

This intersection is related to the location of the 8th Avenue replacement bridge. Therefore, it is recommended that this intersection be viewed as part of the bridge location study before final geometrics are determined.

South Access Route

The 1992 Transportation Study recommended 20th Avenue be extended south to provide alternative access for development on the west side of US 191. An 8th Avenue extension has been suggested as an alternative. A location study considering environmental, land use and ownership, traffic, and cost to determine the optimum location of this roadway should be undertaken.

8th Avenue Extension to Discovery Park Boulevard

The 1992 Plan suggested that 8th Avenue be extended to Discovery Park Boulevard. The location of the South Access Route will have a direct impact on the need for and the design of this extension. If the South Access Route is extended in the 8th Avenue corridor, the extension to Discovery Park Boulevard becomes more important and will need to be designed to carry more traffic. If the South Access Route follows the 20th Avenue route, 8th Avenue becomes less important.

8th Avenue/8th Street Intersection

This intersection is tightly constrained by the railroad tracks, development, and a canal. Any widening to accommodate geometric improvements will be expensive. If the South Access Route follows the 8th Avenue alignment, this intersection will need to be improved. If it follows the 20th Avenue alignment, it will probably operate acceptably for many years.

20th Avenue Improvements

The purpose of this project is to widen 20th Avenue from a two-lane roadway between US 70 and Relation Street where the three-lane section begins. Initial indications are that the roadway should be widened to a three-lane cross-section between 8th Street and Relation Street and to a four-lane cross-section between 8th Street and US 70. The cross-section will need to be reviewed based upon the decision of the South Access Route location.

8th Street/20th Avenue Intersection

This intersection is also tightly constrained by its proximity to the railroad tracks. However, based upon the traffic analysis, 20th Avenue will need to be improved and this

intersection will need to be widened. The scope of the 20th Avenue improvement is again related to the location of the South Access Route.

Connect 14th Avenue

This project calls for a 14th Avenue connection of 8th Street and 10th Street in Safford that will provide new access to Safford High School. Also, it provides a new crossing of the Eastern Arizona Railroad tracks in Safford. The project is needed to relieve congestion on 20th and 8th Avenues.

Widen US 191

This project involves widening or restriping the two- and three-lane sections of US 191 between its intersection with US 70 and the start of the five-lane section near Armory Road. The widening is needed to accommodate future growth in the region, to improve traffic operations on the highway, and also improve access to the County Park and Fair Grounds.

Construct a US 70 Relief Route

This project would provide an alternative route between US 70 and US 191 by constructing a relief route between the US 70/Reay Lane intersection in Thatcher and the US 191/Discovery Park Boulevard intersection in Safford. A good relief route in this corridor will not only relieve traffic from US 70, but also decrease traffic volumes on City streets. A location study should be undertaken to determine the exact location of this relief route. As part of the location study, an access management plan should be prepared to ensure the relief route would provide a high capacity option to the highways. Consideration should be given to local delivery trucks.

Reay Lane/US 70 Intersection

This project was recommended in the 1992 Transportation Plan and called for the construction of left-turn lanes on Reay Lane and a future traffic signal at the intersection. Improvements at this intersection will be needed; however, the level of improvement will be dependent upon the US 70 Relief Route. If the Relief Route is constructed, traffic on the south leg of Reay Lane will increase and the improvements will need to be more substantial.

Safford-Bryce Road/Landfill Road

For safety, a westbound right-turn lane and an eastbound left-turn lane are needed. This will involve widening at a wash crossing.

Safford-Bryce Road/Dos Pobres Mine Road

For safety, a westbound right-turn lane and an eastbound left-turn lane are needed. This will also involve widening at a wash crossing.

Airport Road/Airport Entrance

As activity increases at the airport and on Airport Road, a left-turn lane for traffic turning into the airport will be needed for safety.

US 70/Lone Star Road

ADOT is currently conducting a safety study to determine improvements needed at this intersection.

Sanchez Road/Airport Road

With the increase in mine traffic, the current intersection will need to be improved. Airport Road will need to be widened to facilitate right turns and a northbound left-turn lane on Sanchez Road will be needed to accommodate truck traffic. An alternative would be to reconstruct the intersection with Solomon Bridge/Airport Road being the through movement.

SR 366/US 191

A northbound left-turn lane on US 191 would improve traffic operations and safety at this intersection.

US 70/Stadium Avenue

A traffic signal is needed and is being planned to relieve congestion caused by traffic from Eastern Arizona College.

Marijilda Wash Crossing

An all-weather crossing of the Marijilda Wash is needed on Stockton Road.

Fort Grant Road/Brookeson Road/Ash Creek Road

As the Bonita Hydroponic Nursery and the apple orchards located near Fort Grant Road grow, nine miles of Fort Grant Road and other roads in the area will need to be paved.

Cottonwood Wash Connection

The connection of Cottonwood Wash between Main Street in Pima and US 70 is recommended in the 1992 Transportation Plan. The intersection should line up with Norton Road at US 70. This project will provide an alternative route for traffic in Pima.

Norton Road Improvements

The US 70/Norton Road/Reay Lane/Safford-Bryce Road corridor will be used by traffic destined to the Dos Pobres mine from the east. Improvements will need to be made to Norton Road to accommodate the increase in truck traffic.

Safford-Bryce Road Wash Crossings

Four wash crossings on Safford-Bryce Road should be improved to provide an all-weather road that does not flood. The improvements will also increase safety by correcting the vertical alignment and sight distance deficiencies.

Sanchez Road Upgrade

Several spot improvements are required on approximately four miles of Sanchez Road. Improvements are needed to correct poor pavement conditions, provide wider shoulders, and smooth horizontal curves. This project was recommended in the 1992 Transportation Study.

San Jose Road Improvements

This project, also recommended in the 1992 Transportation Study, calls for roadway widening, repaving, drainage structures, and other roadway improvements to approximately 2.5 miles of San Jose Road north of US 70. San Jose Road provides access to a residential area and the State prison facility.

Main Street (Pima) Improvements

This project includes a number of improvements for approximately 1.2 miles of Main Street south of US 70. The improvements include roadway widening, repaving, and construction of curb and gutter. This project is also a carry-over from the 1992 Transportation Study.

Connection of 14th Avenue

The 1992 Transportation Study recommended 14th Avenue be extended south from Relation Street to Discovery Park Boulevard.

Lone Star Road Upgrade

This project includes the widening, repaving, and construction of curb and gutter on Lone Star Road between US 191 and US 70.

Layton Road/Webster Road Intersection Improvements

This project provides for intersection improvements at the Layton Road/Webster Road intersection and also improvements on Layton Road.

Cluff Ranch Road Construction

This project provides for the construction of Cluff Ranch Road south from Cottonwood Wash Road.

Paving Projects

In addition to Fort Grant Road, a number of roadways in Graham County need to be paved. Among others these include Stockton Road, Powerline Road, Klondyke Road, East Swift Trail, Bowie Avenue, and Clifton Street.

9. IMPLEMENTATION PLAN

The purpose of this chapter is to present an implementation plan for the Urban and Rural Street Elements of the Graham County Transportation Plan. The next section presents a discussion on potential revenue sources. This is followed by sections presenting an implementation schedule based upon needs and a section on funding.

REVENUE SOURCES

This section discusses potential revenue sources for funding the recommended transportation improvements.

Highway User Revenue Fund (HURF)

The HURF is the primary state highway funding source. Revenues are generated by the following taxes and fees related to motor vehicle use:

- Gasoline and fuel taxes
- Motor carrier taxes
- Vehicle license taxes
- Motor vehicle registration fees
- Border crossing fees
- Other miscellaneous fees

The State Constitution restricts the use of HURF revenues to fund highways. The HURF revenues are collected and deposited into the fund and distributed to ADOT, cities, towns, and counties. Funds are distributed as an entitlement share to cities, towns, and counties in proportion to population and to the Economic Strength Project Fund. HURF distributions may be used as debt service for revenue bond projects.

Local Transportation Assistance Fund (LTAF)

The LTAF is funded by the Arizona Lottery for use by the cities and towns which request the funds. The LTAF funds are allocated in proportion to the relative population of all Arizona cities and towns. Each requesting municipality is guaranteed a minimum of ten thousand dollars. Currently, $23 million may be deposited in the LTAF from the State lottery fund each fiscal year. Cities and towns greater than 300,000 persons must use LTAF funds for public transportation. In addition, up to ten percent of funds may be used for the arts, or disabled and handicapped assistance. Safford, Thatcher, and Pima receive a total of about $100,000 per year in LTAF funds.

Federal Highway Funds

Federal funds are apportioned in accordance with the Transportation Equity Act for the 21st Century (TEA-21). The funds include the following categories:

- Interstate Construction
- Interstate Maintenance
- National Highway System
- Surface Transportation Program (STP)
- Congestion Mitigation Air Quality (CMAQ)
- Transportation Enhancement Funds
- Bridge Replacement and Rehabilitation Funds
- Safety Funds
- Rail-Highway Crossing Improvement Funds
- Highway Planning Research
- Metropolitan Planning
- Minimum Allocation
- Donor State Bonus
- Maintenance

Transportation Enhancement Funds

Transportation Enhancement Funds are one type of federal funds which are available directly for local projects. These funds are set aside by ISTEA in order to add community or environmental value to a completed or ongoing transportation project. Currently, Arizona receives about $5 million per year for transportation enhancement projects which are divided between ADOT and local government projects. Fifty percent of the Transportation Enhancement funds are retained by the Arizona State Transportation Board for ADOT projects. The remaining enhancement funds are available for local projects recommended by the metropolitan planning organizations (MPOs) and rural councils of governments (COGs). The evaluation criteria and scoring process for transportation enhancement projects are available from ADOT.

The eligible transportation enhancement activities include the following:

- Provision of facilities for pedestrians and bicycles
- Acquisition of scenic easements and scenic or historic sites
- Scenic or historic highway programs
- Landscaping and other scenic beautification
- Historic preservation
- Rehabilitation and operation of historic transportation buildings, structures or facilities

- Preservation of abandoned railway corridors (including the conversion to pedestrian or bicycle trails)
- Control and removal of outdoor advertising
- Archaeological planning and research
- Mitigation of water pollution due to highway runoff

Local government projects must be sponsored by a governmental body and must be endorsed by a MPO or rural COG. Private non-profit organizations are encouraged to work with governmental agencies to develop project applications. Transportation enhancement funds must be matched with other non-Federal funds in the amount of 20 percent of the total project costs. The maximum federal amount for a project may not exceed $500,000. In addition, the project sponsor will be responsible for the payment of costs over and above the programmed amount if the project's actual cost exceeds its programmed cost. The project sponsor must be able to pay for costs incurred and be reimbursed for expenditures. A project proposal must be specific enough to allow ADOT to determine if it is eligible for enhancement funds.

State highway system projects must be related to a State Highway and can be nominated by individuals, interest groups, and other governmental agencies, in addition to ADOT staff. Some projects associated with a State Highway may have to be sponsored by a governmental agency other than ADOT due to statutory limits on the use of State Highway funds.

Local Government Transportation Program

The Arizona Department of Transportation administers a federally funded Local Government Transportation Program for the MPOs and the rural COGs. Funds which are eligible to be distributed to the rural COGs include: 1) STP funds; 2) bridge replacement and/or rehabilitation funds; 3) safety funds; and 4) rail-highway improvement funds. Over the next five years, the Southeastern Arizona Governments Organization (SEAGO) will be allocated an estimated $1,000,000 per year for transportation improvements.

Economic Strength Projects Fund

Local governments are eligible sponsors and co-sponsors of transportation projects financed by the Arizona Economic Strength Projects Fund. This fund is sponsored by the Arizona Department of Commerce and funded by HURF. A local match must provide at least 10 percent of the project cost. The fund finances selected road projects that support economic development objectives.

Governor's Office of Community and Highway Safety

Federal funds are allocated to finance state and local government highway safety projects. These program funds, in the form of reimbursable contracts, are administered by the Governor's Office of Community and Highway Safety. Funds are provided under the National Highway Safety Act and funded through grants from the Federal Highway Administration (FHWA) and the National Highway Traffic Safety Administration (NHTSA). The safety priority areas are listed below:

NHTSA Priority Program Areas

- Police traffic services
- Emergency medical services
- Impaired driving
- Occupant protection
- Traffic records
- Motorcycle safety
- Pedestrian/bicycle safety

FHWA Priority Program Areas

- Corridor safety improvement programs
- Rural and local technical assistance programs
- Safety studies of specific safety problems
- Pedestrian and bicycle safety
- Outreach programs
- Safety management systems

Public Transit

Public transit for small urban and rural areas is funded by federal transportation funds from Sections 16, 18 and 26(a). Section 16 Program funds vehicles for specialized transportation services for the elderly or disabled. These services include passenger trips, meal deliveries, and miscellaneous trips. Revenue sources for the specialized services include older America Act funds, Community Development Block Grant funds, County funds, and private funds.

Section 18 funds general public service in rural areas. Local agencies may obtain funding for a 50 percent matching share after 17 percent of the funds are recovered from the fare box. Funds for capital expenditures are available at an 80/20 percent federal/local funding share.

Transit planning funds are available to local communities through Section 26(a), statewide planning transit assistance. Local communities may obtain funding for transit planning at support level of 80 percent federal, 20 percent local share.

Pedestrian/Bicyclist Funding

Revenue sources for bicycle facilities primarily for transportation are available from the following sources:

- Federal funds are available to construct bicycle transportation facilities and pedestrian walkways on land adjacent to any highway on the National Highway System (NHS).

- Federal Lands Highway Funds are available to construct bicycle facilities and pedestrian walkways in connection with roads, highways, and parkways. These funds are allocated at the discretion of the department administering the funds.

Other funds for bicycle and pedestrian facilities are:

- National Recreational Trails Fund which provides funds for recreational programs for bicyclists and pedestrians.

- The Scenic Byways Program can fund bicycle facilities along highways.

- Federal Transit Funds can be used to provide bicycle and pedestrian access to transit facilities including shelters, and bicycle parking facilities.

- The Arizona State Parks Board Heritage Fund legislation stipulated the use of Arizona Lottery Fund revenues for trails. Eligible projects are trail land acquisition, design, engineering, development and renovation activities, and trail support facilities.

Community Development Block Grant (CDBG)

Community Development Block Grant (CDBG) funds come from the United States Department of Housing and Urban Development, disbursed in Arizona by the state Department of Commerce. Grant funds to rural communities in southeastern Arizona are allocated yearly through an application process coordinated by SEAGO.

Local Financing

Local Property Tax/General Obligation Bonds

Cities have the power to levy a primary and secondary property tax. A secondary property tax may be used to pay debt service upon General Obligation Bonds (GOBs) which may be used for roadway improvements. These bonds are backed by the full faith and credit of a jurisdiction and are subject to state imposed limits.

Local Sales Tax

Revenue from any local sales tax may be put toward any expense including transportation. The yield from sales taxes varies as retail sales vary from year to year.

Improvement Districts

Improvement Districts may be formed whereby property owners pay for capital projects that benefit their area including roadways, landscaping, street lighting, sidewalks, and traffic signals. Communities may partially fund the improvement from other sources when there is a primary benefit within the district and a secondary benefit throughout the community. Property owners are notified before the formation of a district. Owners are assessed for the improvement and pay either a one-time fee or by installments.

Private Funds

Private funds are another possible revenue source. These funds include developer exactions, contributions, and right-of way donations.

IMPLEMENTATION SCHEDULE

The projects necessary to implement the Graham County Transportation Plan are presented in three time frames: 1999 to 2005, 2006 to 2010, and 2011 to 2020. A fourth grouping lists mine related projects. These projects are currently programmed for the 1999 to 2005 time frame but could be delayed depending upon the opening of the mine. Projects that address congestion, safety, and operational problems which surfaced from the transportation analysis were given the highest priority. A cost estimate and jurisdiction are provided for each project. If special funding might be available for a project, it is also listed.

1999 to 2005 Projects

- 8th Avenue Bridge reconstruction ($8,000,000 – County – Bridge Replacement))
- 8th Avenue/Airport Road/Safford-Bryce Road intersection ($310,000 – County - Safety)
- 20th Avenue improvements including the 8th Street intersection ($2,235,000 – Safford/Thatcher)
- 14th Avenue, 8th Street to 10th Street connection ($295,000 – Safford – Rail Highway Crossing)

The total estimated cost for the 1999 to 2005 projects is $10,840,000, $8,000,000 of which is for the 8th Avenue Bridge. Another $2.2 million is for the 20th Avenue project, located on the boundary between Safford and Thatcher.

1999 to 2005 Mine Related Projects

- Safford-Bryce Road/Dos Pobres Mine Road intersection ($450,000 – County - Safety)
- Safford-Bryce Road/Landfill Road intersection ($365,000 – County-Safety)
- Safford-Bryce Road wash crossings ($1,020,000 – County - Safety)
- Norton Road improvements ($1,930,000 - County)
- Airport Road/Airport Entrance intersection ($95,000 – County - Safety)
- Sanchez Road/Airport Road intersection ($425,000 – County - Safety)

The total estimated cost for the 1999 to 2005 mine-related projects is $4,285,000, all located in the County. The total 1999 to 2005 estimated cost is $15,125,000.

2006 to 2010 Projects

- US 191 from I-10 to US 70 ($23,000,000 - ADOT)
- US 70 Relief Route including US 70/Reay Lane Intersection ($2,895,000 – Regional)
- 8th Avenue Extension to 32nd Street ($2,530,000 - Safford)
- US 70/Lone Star Road intersection ($111,000 – ADOT)
- US 191/SR 366 intersection ($115,000 - ADOT)
- Marijilda Wash Crossing ($395,000 - County)
- Fort Grant Road paving ($1,400,000 - County)
- Cluff Ranch Road construction ($475,000 - County)

Excluding the $23,000,000 ADOT has budgeted for US 191 improvements, the total estimated cost for the 2006 to 2010 projects is $7,921,000. Nearly $2.9 million is for the US 70 Relief Route project, which connects to two ADOT highways and traverses parts of Thatcher, Safford, and the County.

2011 to 2020 Projects

- South Access Route ($4,800,000 - County)
- 14th Avenue extension to Discovery Park Boulevard ($4,800,000 - Safford)
- Cottonwood Wash Connection ($2,400,000 - County)
- Solomon Road improvements ($7,040,000 - County)
- Stockton Road improvements ($635,000 - County)
- Sanchez Road improvements ($2,400,000 – County - Safety)
- San Jose Road improvements ($2,400,000 – County - Safety)
- Main Street improvements ($2,400,000 - Pima)
- Lone Star Road improvements ($1,400,000 - County)

The total estimated cost for the 2011 to 2020 projects is $28,275,000.

FUNDING

The major source of funding for roadway improvements is Highway User Revenue Funds (HURF). These funds are collected primarily from gasoline taxes by the State and distributed each year to the cities and counties. Information received from the ADOT Office of Fiscal Planning indicates the FY 1998 HURF distribution for Graham County is approximately $2,902,000 allocated as follows:

Graham County	$1,793,800
City of Safford	$662,100
Town of Thatcher	$304,100
Town of Pima	$142,000

With roughly 50 percent of this funding being used for operations and maintenance, about $1.5 million is available for construction projects. Assuming the same funding level will be available every year, a comparison of estimated costs and approximate revenues is shown in Table 9-1.

TABLE 9-1. TRANSPORTATION PLAN FUNDING

Period	Revenue[1]	Cost	Difference
1999-2005	$10.5 M	$15.1 M	<$4.6 M>
2006-2010	$7.5 M	$7.9 M	<$0.4 M>
2011-2020	$15.0 M	$28.3 M	<$13.3 M>
Total	$33.0 M	$51.5 M	<$18.3 M>

(1) $1.5 M/year available for construction

As indicated in the table, there will be a shortfall of over $18 million dollars over the next 22 years. Some of this may be recovered through special funding on some projects as mentioned above. However, other projects not included in this Plan will need to be constructed during this time frame. This exacerbates the funding problem. This shortfall can only be covered through private contributions or an increase in taxes.

Half-Cent Sales Tax

One method that can be used to cover the funding shortfall is the half-cent sales tax. This option is authorized in ARS 42-1484: *County Transportation Excise Tax For Roads; Counties With Population Of Four Hundred Thousand Or Fewer Persons*. The half-cent sales tax has been implemented in Maricopa, Pinal, and Yavapai counties and the City of Yuma.

This tax, that would require a vote of the people to enact, would generate an estimated $1.2M per year in Graham County. If the additional income were used only for project construction, this would increase the dollars available to nearly $2.7 million per year. Twenty years of the tax would raise $24 million, enough to cover the projected shortfall.

RECOMMENDED STUDIES

The Urban Street Plan includes three corridors for which exact alignments need to be determined: 8th Avenue, US 70 Relief Route, and South Access Route. Since it is important to determine the location before development occurs in the corridor, it is suggested that location studies be undertaken soon. Also as discussed in the previous chapter, location decisions on the 8th Street Bridge and the South Access Route will affect other elements of the Plan. In addition, it is suggested that Access Management Plans be prepared for both US 70 and US 191 and a Design Concept Report be prepared for Solomon Road and Bowie Avenue. These two roadways are classified as minor arterials and will provide the eastern portion of the US 70 Relief Route Thus, there are six studies that are important to the development of the Transportation Plan:

- 8th Avenue Bridge location study
- South Access Route location study
- US 70 Relief Route location study
- US 191 Access Management Plan
- US 70 Access Management Plan
- Solomon Road/Bowie Avenue Design Concept Report

Completion of these studies within the next two-years is recommended.