Appendix to the Circulation Element

The following provides background information in support of the goals and policies of the Circulation element for streets, freeways, transit and airports. Current city activities, plans and recent accomplishments are described.

STATE AND REGIONAL PLANS

Arizona Department of Transportation (ADOT)

The Arizona Department of Transportation (ADOT) is responsible for building and operating a system of highways statewide, and all the regional freeways are part of this system. The department has a Planning Division that has responsibilities for statewide transportation planning. The five-year program for ADOT must be approved by the State Transportation Board.

Transportation Vision 21

Governor Jane Dee Hull established the Transportation Vision 21 Task Force in February 1999. Executive Order 99-2 charged the Task Force with reviewing and evaluating current transportation practices, resources and infrastructures, and with recommending and prioritizing the transportation goals, funding and specific plans that will establish a vision for transportation in Arizona for the 21st Century.

The followings are the Task Force's Interim Findings (dated September 15, 1999):

- There is a clear need to develop an integrated, comprehensive, multi-modal transportation plan for Arizona. Such a plan must include roads, rail, transit, highways, air, bicycles, pedestrians, and freight as well as travel reduction programs, pipelines, electronic transmissions, and telecommunications.

- The Task Force recognizes that there are undoubtedly insufficient existing revenues to complete existing transportation programs. It is, however, unable at this time to specifically quantify the shortfall due to the differences in methodologies among the various existing transportation needs studies.

- The State of Arizona has experienced tremendous population and economic growth over the past half century. Arizona's growth is projected to continue into the next century, growing to a population of 7.4 million by 2020.

- While there are ongoing efforts by all of the governmental participants in Arizona's transportation system to streamline the transportation planning and programming process, the Task Force has found limited coordination within jurisdictional boundaries.

- To develop a responsive, credible and supportable plan, it is essential that the Task Force have accurate, timely, standardized assessments of the current transportation system and projected transportation needs throughout the state.

- Future long-range planning efforts would be greatly facilitated by:
  a) complete, consistent, and reliable standardization of information
  b) improved coordination among governmental agencies and elected officials
  c) greater technical assistance from the State to the Councils of Government and other regional planning entities

- Public testimony indicates that basic maintenance of existing facilities is not funded at necessary levels, and there is a clear need for increased revenues for transportation purposes throughout the state.

- There is significant frustration, at all levels, resulting from the length of time required to complete identified, major transportation improvements ranging from design concept to final construction.

- Increasing local and commercial traffic has fostered demand for bypass routes in both urban and rural communities.

- Public testimony throughout the state by local elected officials and local administrators supports the allocation of all of the Flight Property Tax to the State Aviation Fund.

- Many transportation concerns are common to both urban and rural communities, however, there are some unique needs in rural and tribal communities. Among important issues to rural communities are increased demand for para-transit service, growing congestion on state highways and major arterial streets and increasing commercial traffic.

- State and regional transportation plans should reflect growth management strategies.

- It is readily apparent that policy-makers must prioritize transportation expenditures, ensure efficient use of all available resources and be willing to pool resources to effectively meet basic long-range system needs.

- There is a need to perform comprehensive multi-modal transportation needs assessments in the future. These assessments should use a standardized, approved methodology.

Maricopa Association of Governments

The Maricopa Association of Governments (MAG) is a local council of governments established to coordinate activities of regional importance among the municipal, tribal, county and state agencies serving the Maricopa County area. The governing body of MAG is the Regional Council comprised of elected officals from other cities, towns and Indian communities, as well as a member of the County Board of Supervisors, a member of the State Transportation Board, and the chairman of the Citizen Transportation Oversight Committee.

MAG also serves as the designated Metropolitan Planning Organization (MPO) for the region. Federal transportation regulations require urbanized areas with a population in excess of 50,000 to form an MPO and develop long-range transportation plans. Urbanized areas of over 200,000 persons are also considered to be Transportation Management Areas, or TMAs. Additional transportation planning responsibilities which relate to air quality issues are placed on TMAs.

The MAG Long Range Transportation Plan is updated annually. This multi-modal plan contains the freeway system plan and a summary of the Long Range Transit Plan prepared by the RPTA.

Regional Public Transportation Authority

In addition to MAG, the Phoenix urbanized area is also served by the Regional Public Transportation Authority (RPTA). The RPTA was created by state legislation with the passage of Proposition 300 in 1985. It currently performs regional transit planning functions, operates the regional rideshare program, provides a limited amount of regional bus service, and generally helps coordinate transit services between jurisdictions.

STREETS AND FREEWAYS

The Phoenix Street Classification System assigns every street to a functional street class. The function reflects the typical trip distances, access controls, traffic separation, volumes and other factors that the street is or will be designed to handle. The following street classification definitions are used as general planning guidelines rather than rigid definitions.

Freeways and expressways

- Provide for long-distance traffic movement within Phoenix and between Phoenix and other cities.

- Provide no service to abutting land.

- Access points are limited to other freeways, expressways, and selected arterial streets with typical minimum spacing of one mile.

- Opposing traffic flows are physically separated and cross streets are grade separated except that expressways may have at-grade signalized intersections, spaced at least one mile apart.

- Traffic volumes are normally over 50,000 average daily trips.
- Travel by pedestrians, bicycles and low-powered vehicles is prohibited.

Major Arterials

- Provide for long-distance traffic movement within Phoenix and between Phoenix and other cities.
- Provide very limited service to abutting land.
- Have access control through frontage roads, raised medians and the spacing and location of driveways and intersections.
- Opposing traffic flows are physically separated by a raised median.
- Traffic signals are coordinated for progressive movement.
- Traffic volumes are typically 30,000 to 60,000 average daily trips.
- Normally three through lanes in each direction are provided. There may be four lanes in the peak direction of movement or four lanes in each direction when the street serves as an extension of a freeway or expressway.
- Travel by pedestrians, and bicycles will be considered.

Arterials

- Provide for moderately long distance traffic movement within Phoenix or between Phoenix and adjacent cities.
- Provides moderate service to abutting land.
- Provides access control through frontage roads, raised medians, and the spacing and location of driveways and intersections.
- Separates opposing traffic flows by a raised median or a continuous left-turn lane.
- Traffic signals are coordinated for progressive movement.
- Traffic volumes are typically 15,000 to 50,000 average daily trips.
- Normally two or three through lanes in each direction.
- Travel by pedestrians and bicycles will be considered.

Collector

- Provides for short-distance trips of less than three miles.
- Primarily functions to collect and distribute traffic between local streets or high volume traffic generators and arterial streets. A small group of existing streets operating under unique conditions are included in this classification. These streets differ from other collectors in that they accommodate medium distance trips of less than six miles and relieve arterial streets in congested areas.
- Provides direct access to abutting land and some access control through raised medians and spacing and location of driveways and intersections.
- Are generally unseparated but may have a continuous left-turn or median.
- Some traffic signals are coordinated.
- Traffic volumes are typically 5,000 to 30,000 average daily trips.
- Collectors normally have one or two lanes in each direction.
- Travel by pedestrians, bicycles and low-powered vehicles will be considered.

Minor Collector

- Provides for short-distance movement of less than three miles.

- Primarily functions to collect and distribute traffic between local streets and arterial streets.
- Provides direct access to abutting land and has some access control through spacing and location of driveways and intersections.
- Minor collectors are generally unseparated but may have a continuous left-turn land.
- Traffic signalization should discourage through traffic from using the collector street.
- Traffic volumes are typically 1,000 to 8,000 average daily trips.
- Minor collectors have one lane in each direction.
- Travel by pedestrians, bicycles, and low-powered vehicles will be considered.

Local Streets

- Provides for short-distance traffic movement of less than one half mile.
- Not intended for through traffic.
- Connects to collector, minor collector and arterial streets.
- Primarily functions to provide direct access to abutting land and for traffic movements within neighborhoods.
- Traffic volumes are under 1,000 average daily trips.
- Local streets have one lane in each direction. Travel by pedestrians, bicycles, and low-powered vehicles will be considered.

The design of local streets is based upon the characteristics of standardized vehicle known as the "design vehicle." The design vehicle essentially matches the requirements of the largest fire truck expected to use the street in response to emergencies. Unfortunately, these trucks are typically so large that the design vehicle serves as a speeding enabler; the streets have to be so wide and turning radii so large that people are encouraged to speed on their own local street. Many studies have shown that the majority of speeders on typical residential streets are local residents. Things get worse when the local street attracts "cut-through" traffic.

The resulting dilemma is how to maintain or improve emergency response times and maintain or improve the effectiveness of emergency procedures and practices while deterring speeding and encouraging more use of the streets by other modes of travel. Examples of the latter include bicyclists and users of slow and very slow vehicles, among other potential street space users. Study of this problem is recommended.

Level of Service on Streets

The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level-of-service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. Actual level-of-service varies throughout the day on a given facility typically in direct relation to changes in the hourly traffic volumes, although the stated level-of-service rating is usually based on peak-hour operations.

Levels-of-service for signalized intersections are defined in terms of delay. Delay is measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period.

Level-of-service A describes operations with very low delay, i.e., less than 5 seconds per vehicle. This occurs when traffic signal progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all.

Level-of-service B describes operations with delay in the range of 5.1 to 15 seconds per vehicle. This generally occurs with good traffic signal progression and/or short signal cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-service C describes operations with delay in the range of 15.1 to 25 seconds per vehicle. These higher delays may result from fair traffic signal progression and/or longer signal cycle length. Individual cycle failures may begin to appear in this level, i.e., not all cars waiting are able to pass through on one cycle. The number of vehicles stopping at the intersection is significant at this level, although many still pass through without stopping.

Level-of-service D describes operations with delay in the range of 25.1 to 40 seconds per vehicle. At level D the influence of congestion becomes more noticeable. Longer delay may result from some combination of unfavorable traffic signal progression, long cycle lengths, or high volume to capacity ratio. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-service E describes operations with delay in the range of 40 to 60 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor traffic signal progression, long cycle time, and high volume to capacity ratios. Individual cycle failures are frequent occurrences.

Level-of-service F describes operations with delay in excess of 60 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with over saturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high volume capacity ratios below 1.00 with many individual cycle failures. Poor traffic signal progression and long cycle lengths may also be major contributing causes to such delay levels.

The following general statements may be made regarding arterial level of service.

Level-of-service A describes primarily free flow-operations at average travel speeds usually about 90 percent of the free flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Delays while stopped at signalized intersections are minimal.

Level-of-service B represents reasonably unimpeded operations at average travel speeds usually about 70 percent of the free flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and delays while stopped are not bothersome. Drivers are not generally subjected to appreciable tension.

Level-of-service C represents stable operations. However, ability to maneuver and change lanes in mid-block locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordination may contribute to lower average travel speeds of about 50 percent of the average free flow speed for the arterial class. Motorists will experience appreciable tension while driving.

Level-of-service D borders on a range on which small increases in flow may cause substantial increase in approach delay and, hence, decrease in arterial speed. This may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free flow speed.

Level-of-service E is characterized by significant approach delays and average travel speeds of one-third the free flow speed or lower. Such operations are caused by some combination or adverse signal progression, high signal density, extensive queuing at critical intersections, and inappropriate signal timing.

Level-of-service F characterizes arterial flow at extremely low speeds below one-third to one-quarter of the free flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse signal progression is frequently a contributor to this condition.

In general, the various levels of services are defined as follows for uninterrupted flow facilities such as freeways:

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream.

Level-of-service D represents high-density, but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Operations at this level are usually unstable.

Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse that point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

The level of service policy included in this plan states that facilities should be provided to achieve a level of service D. With many facilities now operating at a level of service F and projections of an increasing proportion of facilities operating at level of service F, a proportion of the projected vehicles using these facilities must be diverted to other modes of travel. The following table is an attempt at quantifying the amount of diversion that would be needed. For urban freeways and arterials a reduction of about 15 to 25 percent is required.

The following maps from the MAG 1998 congestion study show the expansion of freeway miles and arterial street intersections that are experiencing low levels of service as a result of being at or over capacity. Levels of service A, B and C are considered under capacity, D is near capacity, E is at capacity and F is over capacity. A map showing the lengthening peak traffic period is also included.

REDUCTION IN VEHICLES NEEDED TO ACHIEVE LEVEL OF SERVICE D FOR FACILITIES OPERATING AT LEVEL OF SERVICE

Facility Type/ Design Speed	Max. Service Flow for LOS D*	Min. Service Flow for LOS F	Minimum Reduction in Vehicles Needed
Freeway - 70 MPH	2015	2300	12.4
Freeway - 65 MPH	1952	2300	15.0
Freeway - 60 MPH	1825	2300	20.6
Freeway - 55 MPH	1760	2300	23.5
Signalized Intersection (Arterial LOS)	1200	1400	14.3

*Highway Capacity Manual, Special Report 209 (1994) Transportation Research Board, Washington D.C.

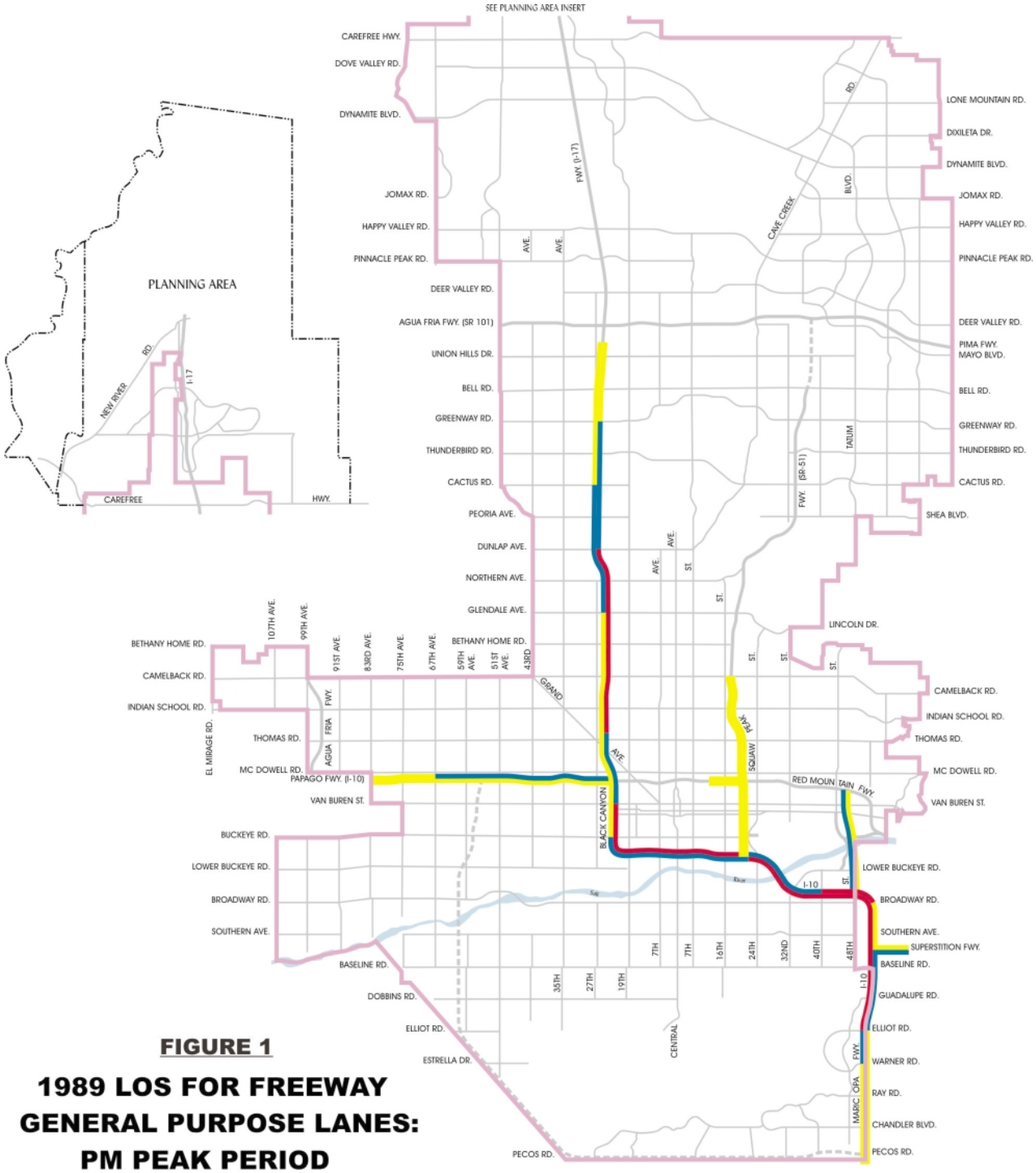

FIGURE 1

1989 LOS FOR FREEWAY GENERAL PURPOSE LANES: PM PEAK PERIOD

- UNDER CAPACITY
- NEAR CAPACITY
- AT or OVER CAPACITY

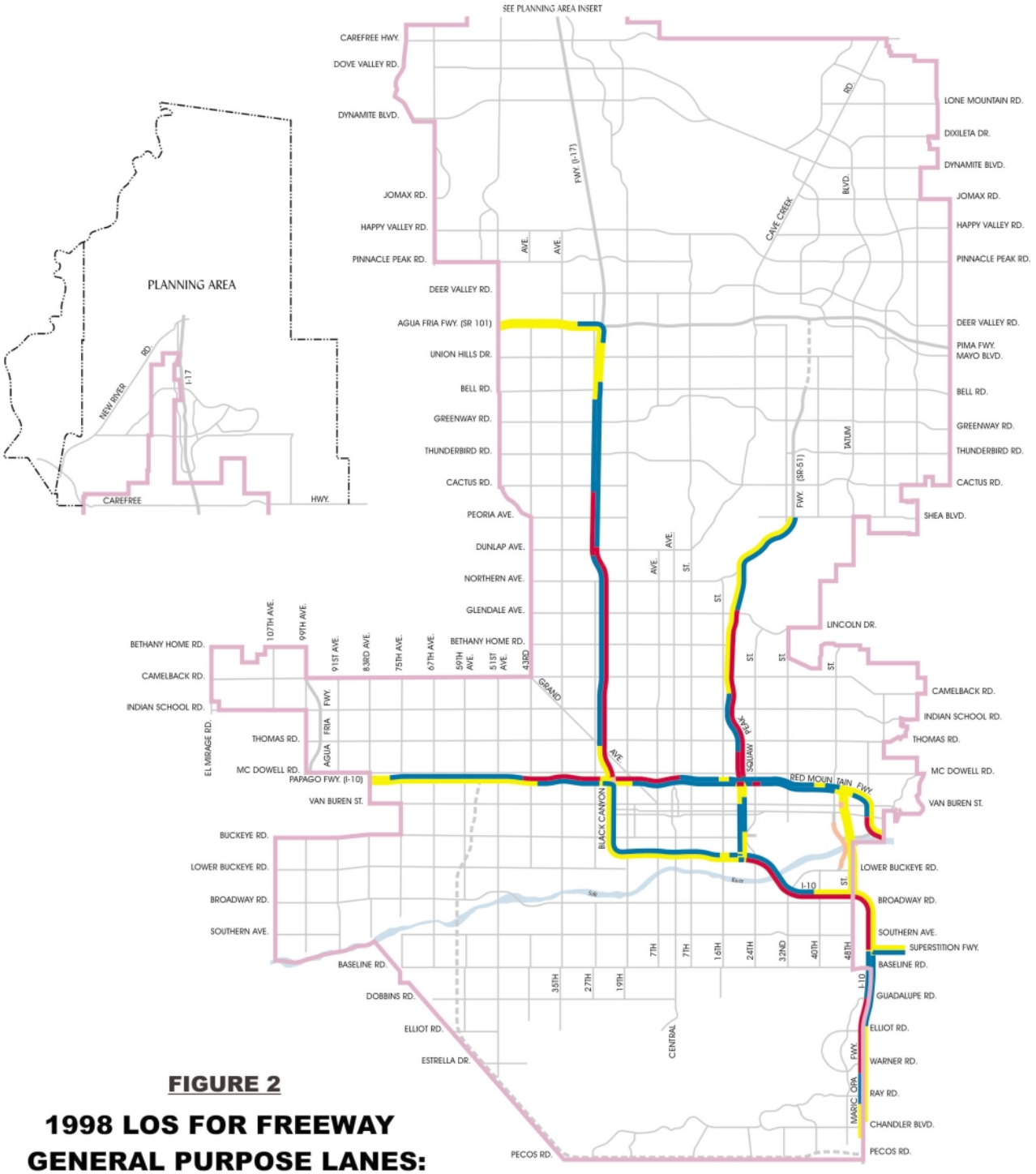

FIGURE 2

1998 LOS FOR FREEWAY GENERAL PURPOSE LANES: PM PEAK PERIOD

LOS A
LOS B or C
LOS D or E
LOS F

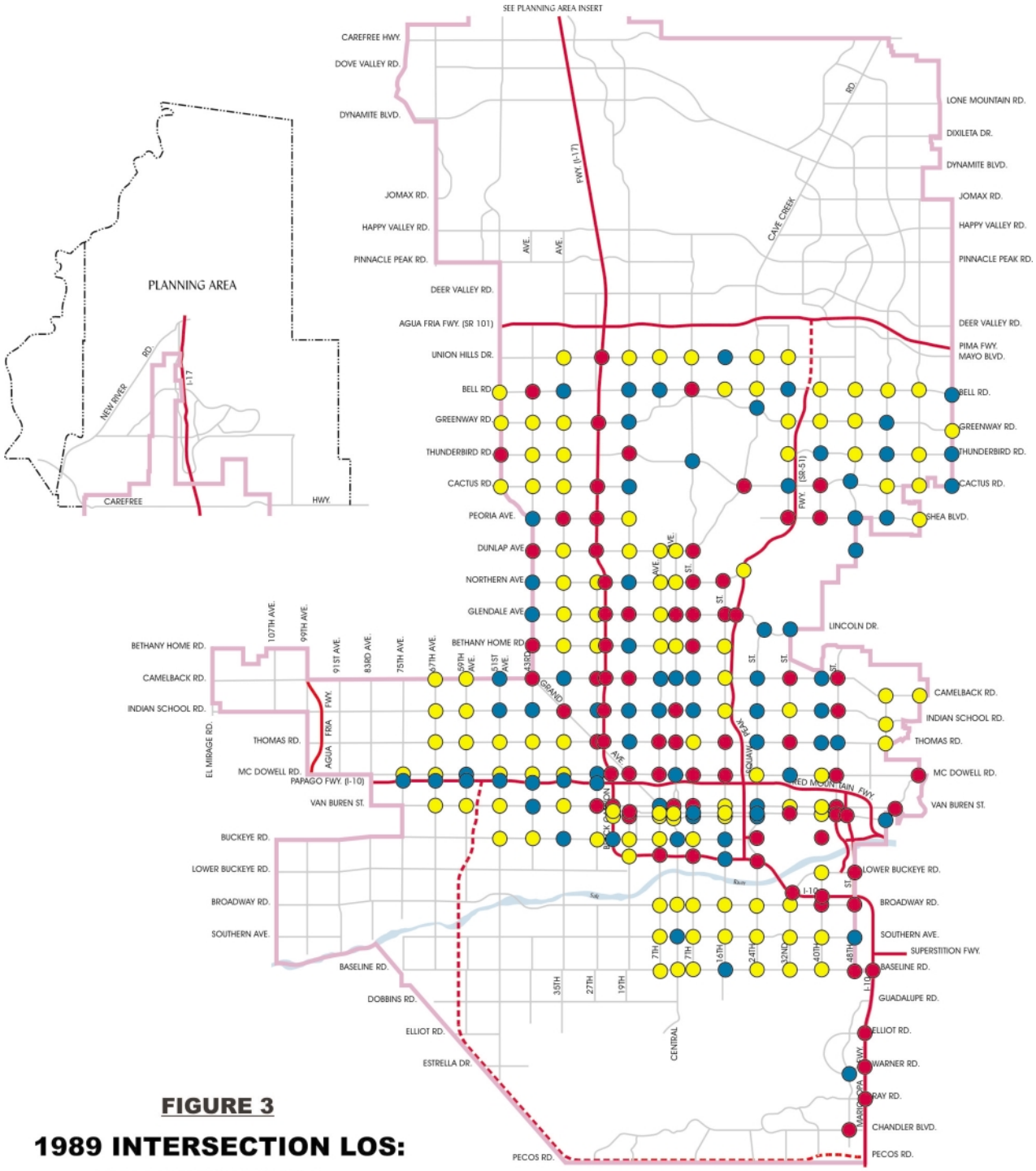

FIGURE 3

1989 INTERSECTION LOS:
PM PEAK HOUR

- UNDER CAPACITY
- NEAR CAPACITY
- AT or OVER CAPACITY

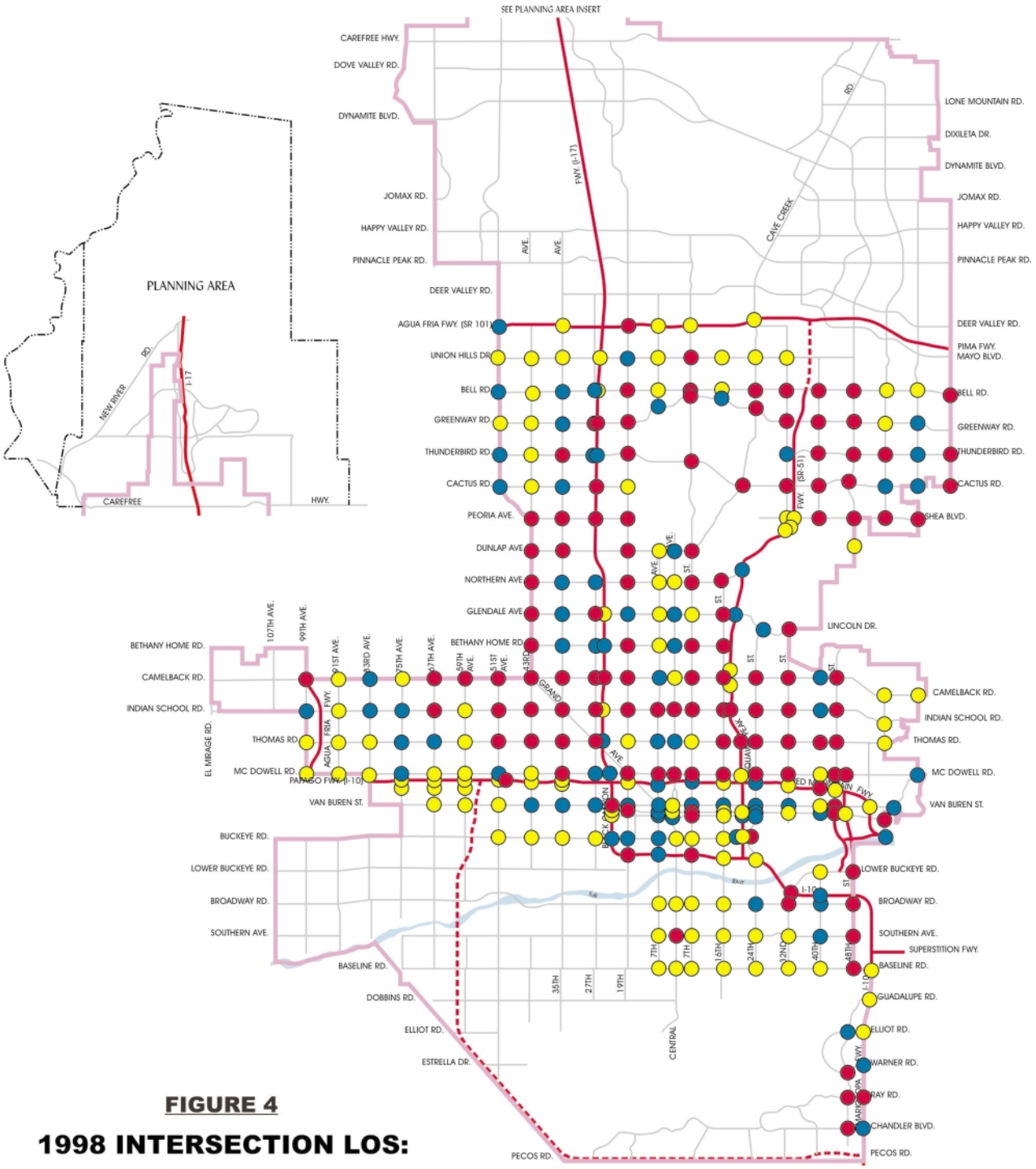

FIGURE 4

1998 INTERSECTION LOS:
PM PEAK HOUR

- UNDER CAPACITY
- NEAR CAPACITY
- AT or OVER CAPACITY

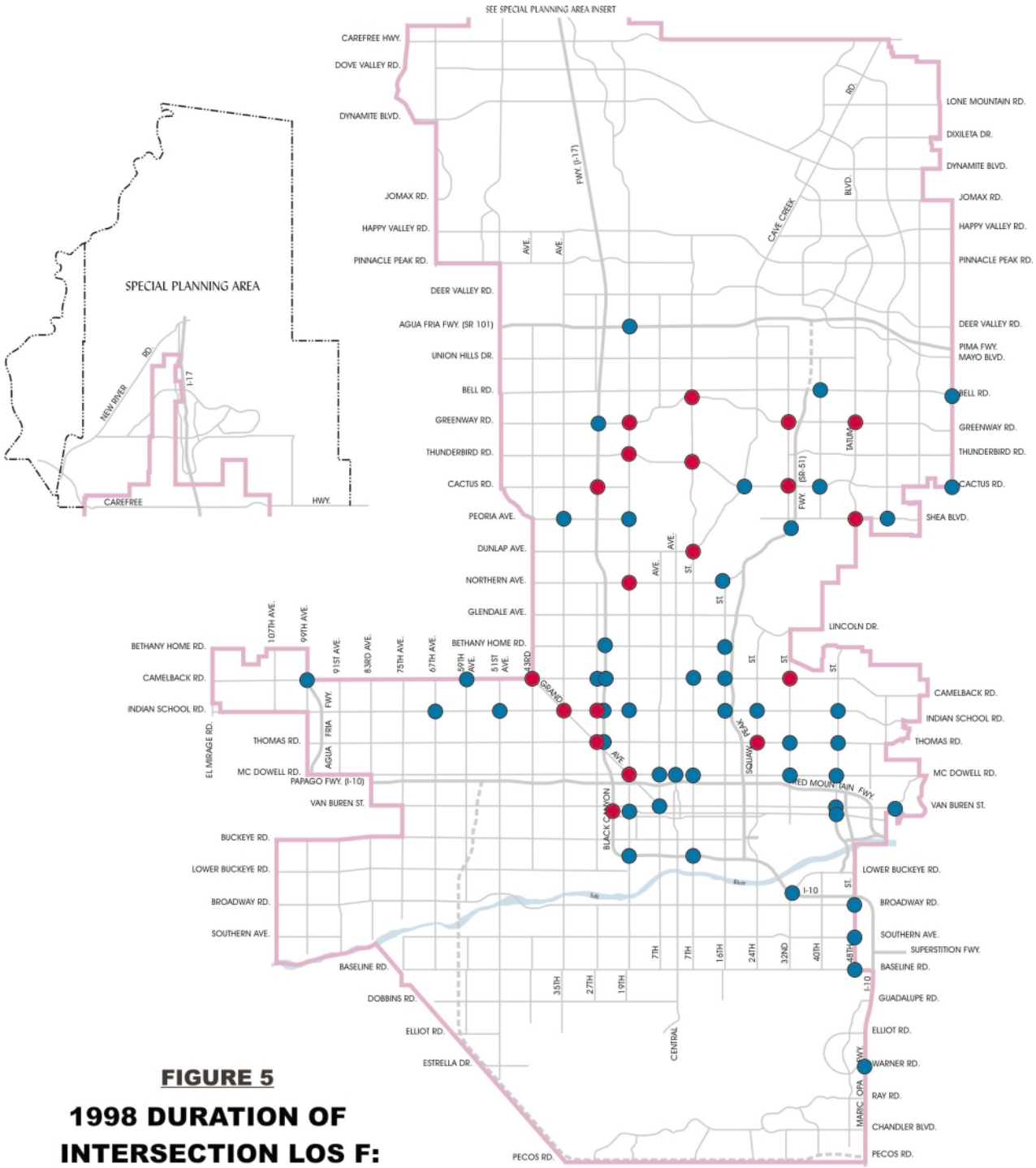

FIGURE 5

1998 DURATION OF INTERSECTION LOS F: PM PEAK PERIOD

- 15 - 59 MINUTES
- 60 MINUTES OR MORE

TRAFFIC CALMING

Standardization of the driving experience so motorists know what to expect has been the hallmark of good traffic engineering practice. Our streets are much safer because of it. Recently, however, there is a growing awareness that the geometric design of local and collector streets has some shortcomings that defy the one size fits all remedy. For almost a generation, there has been a growing chorus of parents and local residents in communities, not just here but in Europe, Australia, Japan and elsewhere, who have agitated successfully for workable solutions. They have teamed up with traffic engineering professionals to add to the mix of recognized and tested street categories and to the range of traffic control devices designed into them.

TRANSIT

Local Bus

Local bus service is the primary mode of public transportation in the city of Phoenix. Current local bus routes vary in frequency and hours of operation. Route restructuring has continued to move from radial route structure toward a modified grid system to match the street system of the city. Local routes are numbered to match the street address system of the city and Maricopa County. For example, service on 19th Avenue is now Route 19 and service on Camelback Road (5000 north on the street address system) is now Route 50.

The Transit 2000 plan will have local bus service on all major streets in the city. Local buses will run from 5 a.m. to midnight Monday through Saturday and from 6 a.m. to 10 p.m. on Sundays and holidays. Weekday service will operate every 15 minutes during the peak hours (5 to 9 a.m. and from 3 to 7 p.m.) and at least every 30 minutes the rest of the day.

Service standards assist in the development of new transit services as well as provide a guide for evaluating existing services. Revised fixed route service standards were developed in coordination with the preparation of this document to reflect the goal of providing an effective and efficient transit system.

Dial-A-Ride

The Americans with Disabilities Act (ADA) requires that "complimentary paratransit service" be provided to persons within three-quarters of a mile of transit service, who cannot access the fixed route bus. The city of Phoenix Dial-a-Ride provides this door-to-door service as well as Dial-a-Ride service for ambulatory seniors, and even for the general public during hours that fixed route service does not operate on Sundays and holidays.

The Phoenix Reserve-a-Ride system also provides paratransit services. This system provides mobility for seniors which is focused on trips to senior centers and other similar specified destinations.

The Transit 2000 plan has led to doubling the amount of Dial-a-Ride service provided within the first year. Service hours would match the local bus service by operating from 5 a.m. to midnight, Monday through Friday and from 5 a.m. to 10 p.m. on Saturdays, Sundays and holidays.

Bus Rapid Transit Service

Bus rapid transit service, along with a supporting network of Park-and-Ride lots and high-occupancy vehicle (HOV) facilities, helps to reduce traffic congestion within heavily traveled corridors, providing a more balanced transportation system. Bus rapid transit service is designed to provide an alternative mode for persons traveling to and from work, and thus helps to replace peak period automobile trips (and thereby reduce auto emissions). (Seventy-two percent of riders responding to a recent survey stated that they would drive alone if the bus were not available.) Bus rapid transit service also enhances employers' abilities to offer travel options for work trips; thereby helping them comply with the Maricopa County trip reduction ordinance.

The Transit 2000 plan proposes that bus rapid transit service operate in five corridors providing 64 miles of commuter-oriented service (See the Bus Rapid Transit map). These new routes would serve central Phoenix by providing 10 to 15 minute service from 5 a.m. to a.m. and from 3 p.m. to 7 p.m. in the Black Canyon, Squaw Peak, I-10 to West Phoenix, I-10 to the Ahwatukee/Desert Foothills area and South Central Avenue corridors.

Light Rail Transit

Light rail transit offers high-speed, high-capacity transit service in corridors where the demand for

transit ridership is beyond what can reasonably be provided with buses. Light rail stops about every mile and can carry up to 450 people per train during peak periods of the day. Light rail attracts both peak hour work trips and all-day mobility trips because it connects major activity centers throughout the region.

The Transit 2000 plan proposes a total of 24 miles of light rail transit. A 17-mile line would operate from Metrocenter, through downtown Phoenix, to the east side of Sky Harbor Airport. At buildout, an additional seven miles would be built along one of the freeway corridors yet to be determined, where travel demand exists.

Light rail service provides bi-directional service Monday through Saturday from 5 a.m. to midnight, and Sundays and holidays from 6 a.m. to 10 p.m. Service is planned to operate every 10 minutes during peak hours (5 to 9 a.m. and from 3 to 7 p.m.) and every 15 to 20 minutes the rest of the day.

Light rail transit is not only a more effective mode of carrying passengers in such high demand corridors; it also has been seen to stimulate infill and reinvestment in other urban areas where it has been developed.

Successful patronage of light rail transit depends on a level of feeder bus service considerably more robust than that currently provided within the city. The above expansion goals for bus meet this requirement.

Limited Stop Bus Service

Limited stop bus service is an additional level of bus service designed to serve the longer distance, suburb to suburb commute trips. Limited stop routes are in addition to the regular local bus routes and run during peak periods only. Limited stop routed are differentiated from local routes because they only stop about once every mile, while local routes typically stop every quarter mile or less. By overlaying limited stop service in the same corridor as local bus service, passenger travel times can be reduced by as much as 25 percent.

The Transit 2000 plan proposes to implement two limited stop routes on Camelback Road and Bell Road as a demonstration of the value of this type of transit service.

Neighborhood Bus Service

In addition to regional fixed route bus and bus rapid transit services, neighborhood bus service has a place in a comprehensive public transportation system. Conventional bus routes operate with large vehicles along arterial thoroughfares to maximize accessibility to large numbers of riders. There are some neighborhoods that are isolated from these conventional services by geographic elements that break up the standard grid pattern of routes. Neighborhood circulators typically use smaller buses that provide more flexibility and routing within a small geographic area.

Such service has two functions. One is to connect passengers to regional bus routes and rapid transit services from within residential neighborhoods or other locations not served by the regional system. The second is to operate neighborhood routes that serve a number of trip origins and destinations lying within close proximity to each other.

The neighborhood bus concept also provides an effective way of serving the public transportation requirements of many seniors for whom conventional bus service is inappropriate and Dial-a-Ride unnecessarily expensive to supply. The Transit 2000 plan proposes to provide two demonstration neighborhood bus routes, one in the Ahwatukee area and one in the Desert Foothills area.

Transit Capital Facilities

A successful public transportation system requires more than just buses and drivers. Facilities are required, of course, for vehicle storage and maintenance. But beyond those, there are other types of capital investments in various transit system amenities that can provide comfort and encouragement to transit riders and allow for a more complete integration of the transit system into the residential, commercial, retail, governmental, educational and cultural developments in our various communities. Such amenities must take into account the special conditions of climate and urban form that are unique to the Valley.

Transit Marketing and Promotion

It will be difficult for expanded transit service, such as proposed in the Transit 2000 plan, to attract the market share it is capable of serving without more

aggressive marketing and promotion. Such efforts should feature comprehensive community education, ridership promotion, media marketing and on-going market research.

The Roadside Pedestrian Conditions Model

Depending on roadway and traffic conditions, providing a sidewalk is the first step to better accommodating and encouraging pedestrian travel. However, the amount of separation (or buffering) between the pedestrian travel way and moving traffic is a major factor in how pedestrians perceive the safety of their environment. MAG has selected an objective, reliable scientific method that reflects the pedestrian's sense of comfort while walking along a given roadway. The method is use of the Roadside Pedestrian Conditions (RPC) Model. The Model was developed in 1998 and has been adopted by several metropolitan areas and state departments of transportation across the United States. It uses measurable traffic and roadway variables such as:

- Lateral separation between pedestrians and motor vehicle traffic (including the presence and width of sidewalks)
- Amount and speed of motor vehicle traffic Percentage of heavy vehicles (trucks)
- Number of travel lanes
- Presence of a paved shoulder, bikelane, or on-street parking
- Width of buffer between sidewalk and roadway
- Trees or other "protective" barriers in the buffer

Based on these factors the RPC Model produces statistically calibrated results that are stratified into six grades, or levels of service. Level "A" reflects the best conditions for pedestrians and Level "F" represents the worst conditions. The RPC Model was used to develop the tables and matrices of the performance guidelines for roadway design in the MAG Pedestrian Plan 2000. Areas and streets with the highest concentration of pedestrian traffic should be provided with the highest level of service. See the MAG Pedestrian Plan 2000 for tables showing the lateral separation needed under given roadway and buffer conditions.

AVIATION

The City of Phoenix Aviation Department owns and operates Phoenix Sky Harbor International Airport, Phoenix Deer Valley Airport and Phoenix Goodyear Airport. Together this system of airports provides safe, modern, convenient aviation facilities for everyone to use from the largest commercial or military transport to the smallest, lightest general aviation aircraft. Through these airports, Phoenix is conveniently connected to the entire world and serves as the Gateway to the Southwest.

Phoenix Sky Harbor International Airport, 4.5 miles east of downtown, is the state's major airport. Three passenger terminals are occupied by 20 airlines, which provide non-stop service to 98 cities in the United States and around the world. Four cargo terminals provide approximately 363,600 square feet of covered space and are occupied by approximately 20 tenants. Since 1996, Phoenix Sky Harbor has welcomed nonstop transatlantic flights to London. There are also nonstop flights to Jamaica, various Canadian cities, including Toronto and Vancouver, and numerous nonstop flights to resort and business destinations in Mexico including Guaymas, Acapulco, Puerto Vallarta, and Mexico City. Service to Frankfurt began in March of 2001. Business connections and tourism have increased significantly as a result. Phoenix Sky Harbor International Airport is the 11th-busiest airport in the world in terms of passengers and the 5th-busiest in terms of aircraft landings and takeoffs. In 1999, Phoenix Sky Harbor handled 33,554,347 passengers and 331,584 tons of freight with 562,714 total aircraft operations.

SKY HARBOR OPERATIONS, 1999

Total Domestic Passenger Traffic	32,737,732
Total International Passenger Traffic	816,615
Total Air Cargo (tons)	331,584
Total Aircraft Operations	562,714

Phoenix Deer Valley Airport, located 17 miles north of downtown Phoenix, is classified as a general aviation reliever airport for Phoenix Sky Harbor International Airport. Phoenix Deer Valley Airport has been experiencing recent steady growth. Aircraft take-offs and landings have increased to over 300,000 in the last 12 month period, making Deer Valley the 45th

busiest airport in the United States. Current averages are 1,000 operations per day. These are the highest figures since the boom year of 1979. The average growth in aircraft operations over the last five years has averaged 7 percent per year. Deer Valley recently acquired an additional 120 acres. Some of this land will be used for developing additional corporate hangars. Deer Valley has installed an additional 234 T-hangars which gives the airport the ability to have over 1,000 aircraft based there.

Phoenix Goodyear Airport, located outside of the city of Phoenix boundary in the west Valley, is also classified as a general aviation reliever airport for Phoenix Sky Harbor Airport. Phoenix Goodyear Airport has also been experiencing rapid growth. Total aircraft operations from 1995 to 1999 more than doubled from 62,106 to 140,400. This was an average increase of 22.5 percent per year. Goodyear had 136,274 flight operations in 1999 and sold 446,000 gallons of aviation fuel in 1999. Goodyear is home to 197 aircraft. Improvements in 1999 included the construction of new terminal building and construction of 78 new T-hangars.

FUTURE ENVIRONMENTAL IMPACT

Future growth and construction will have an impact on the environment. The Airport commissioned an Environmental Impact Study in 1993 to access the issues and to look at possible alternatives. The study looked at various impact areas including:

- noise
- compatible land use
- social
- socioeconomic
- air quality
- hazardous materials
- water quality
- Department of Transportation
- endangered and threatened species of flora and fauna
- wetlands
- energy supply and natural resources
- light emissions
- solid waste
- construction

They looked at how each of these areas would be affected depending on how or if the airport expanded.

The noise analysis revealed that there are essentially no noise impacts as a result of any of the alternative development plans. Noise levels will not exceed the FAA's 1.5 dln threshold of significance in any noise sensitive location. Regardless of the alternative examined, the average noise levels and the number of people affected will be less in the future than the existing conditions. The decrease in noise in the future is attributed to the phase-out of all Stage 2 aircraft and subsequent increased utilization of quieter Stage 3 aircraft.

The proposed compatible land use analysis determined that proposed improvements on-airport will have only a minor effect upon off-airport land use. There will be some conversion of commercial property to airport use. Impact to businesses will occur during the relocation process but will be minimized through accepted federal relocation assistance policies.

The socioeconomic impacts were studied. The development alternatives will not cause shifts in patterns of population movement and growth, or result in changes in public service demands. Construction-related economic impact including jobs, income, and value added in the construction and construction-related industries would be generated by almost all of the development alternatives. The proposed improvements will have a minimal effect upon land use and will not substantially affect property values.

Air emissions associated with Phoenix Sky Harbor International Airport are expected to increase somewhat in the future as a result of the predicted increase in aircraft operations. However, total aircraft emissions are expected to be lower with the improvements than they would be without improvements. There will be reduced ground-based delay times. The average rate of emissions produced per aircraft is also expected to decrease due to the increased utilization of newer technology aircraft.

The most prominent source of air pollution at Sky Harbor is motor vehicle emissions. As passenger and employee numbers increase, the vehicle emissions increase. The Aviation Department authorized a vehicle utilization study to assist in long term planning. Various organizational changes will be implemented to reduce vehicle usage. In addition, the Aviation Department is committed to using alternative fuels in their vehicles. Currently, 159 vehicles have been converted to run on compressed

natural gas (CNG). Buses to transport passengers between terminals are dedicated CNG vehicles. The airport is purchasing alternative fuel vehicles whenever replacement vehicles are needed. Eventually all airport vehicles will be alternative fuel vehicles. Companies that have contracts with the airport are also encouraged to use alternative fuels. Off-site parking is encouraged.

There are several areas in and around Phoenix Sky Harbor International Airport that are known or suspected to contain hazardous substances from old industrial practices. Remedial action is being performed or plans are being developed for sites requiring cleanup.

Any increase in airport activities has the potential to degrade water quality. Potential impacts are reduced to insignificant levels through implementating a storm water pollution management plan. The airport has an Environmental Protection Agency permit that controls the quality of storm water runoff discharged to the Salt River and will develop a Storm Water Pollution Management Plan.

The Department of Transportation Act of 1966 provides for the protection of certain lands. None of the proposed improvements at Phoenix Sky Harbor International Airport will require the use of or adversely impact any publicly-owned land from a public park, recreation area, wildlife or waterfowl refuge or national, state or local significance. Archaeological resources are preserved in consultation with city and state archeologists.

Airport improvements require environmental analysis by the Federal Aviation Administration and local, state and public comment periods.

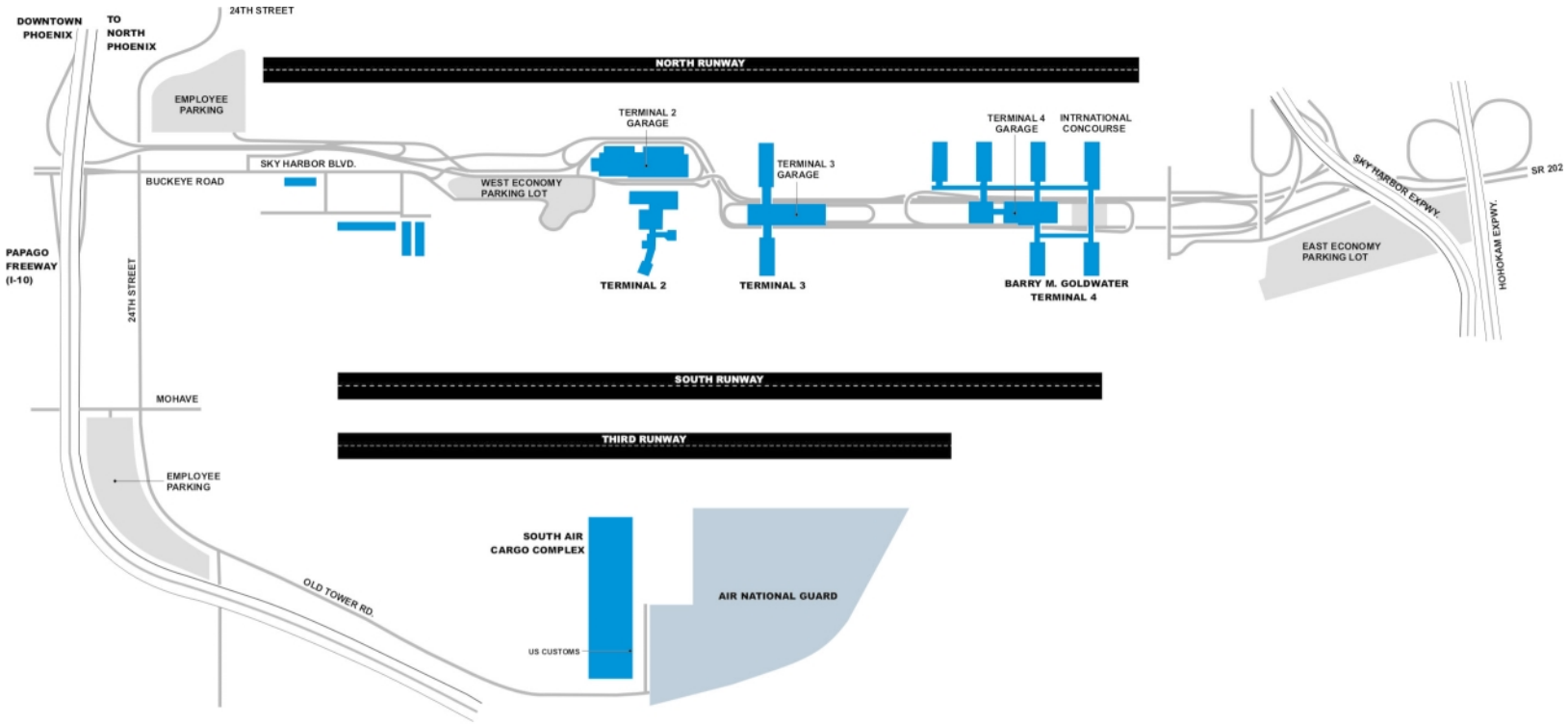

FIGURE 6

PHOENIX SKY HARBOR INTERNATIONAL AIRPORT LAYOUT MAP

NORTH

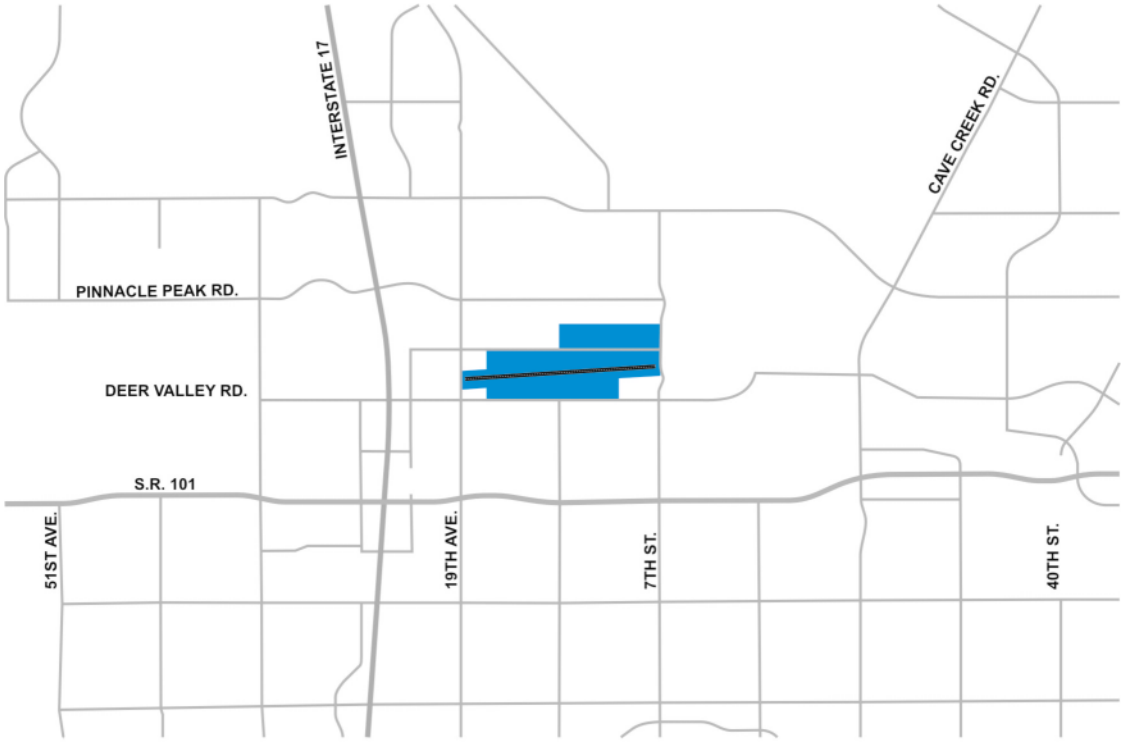

FIGURE 7

PHOENIX DEER VALLEY MUNICIPAL AIRPORT

FIGURE 8

ARIZONA RAIL SERVICE

MAJOR RAIL LINES

- BURLINGTON NORTHERN and SANTA FE
- UNION PACIFIC
- AMTRACK / BURLINGTON-NORTHERN and SANTA FE
- AMTRACK / UNION PACIFIC