A MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA

MARICOPA COUNTY - ARIZONA

Wilbur Smith and Associates

A MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA

MARICOPA COUNTY

Prepared for the

ARIZONA STATE HIGHWAY COMMISSION

MARICOPA COUNTY CITY OF PHOENIX

In Cooperation with the

U.S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

Wilbur Smith and Associates
1960

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May 10, 1960

Mr. John W. Beatty, Chairman
Co-ordinating Committee
Phoenix-Maricopa County Area Study
827 East Jefferson Street
Phoenix, Arizona

Dear Mr. Beatty:

We are pleased to submit herewith a long-range major street and highway plan for the Phoenix Urban Area and Maricopa County. This plan is based on comprehensive technical studies in accordance with our agreement of November 13, 1958 with the State Highway Commission. Needs for all classes of major street and highway facilities were considered, based on traffic demands forecast for 1980 when about 1,440,000 persons are expected to reside in Maricopa County - about 2.7 times the 1957 population level.

A major phase of this study involved a thorough analysis of data collected in the Phoenix-Maricopa County Traffic Study of 1957. These data were used to establish the basic relationships between the motivations and characteristics of travel and land use in the Phoenix area. These relationships, which were established under the direction of our Mr. F.H. Wynn, were applied in the estimation of the volumes and patterns of the future traffic demands which the major street and highway plan was designed to serve. Future travel patterns were estimated for a 400 square mile study area which includes the Cities of Phoenix, Mesa, Tempe, Scottsdale and Glendale and contiguous unincorporated areas - a considerably larger area than that covered by the 1957 origin and destination study.

Analyses of existing traffic conditions and travel patterns projected to 1980 indicate that long range street and highway needs in Phoenix and Maricopa County are tremendous by all measures. The estimated costs to develop the freeways, expressways, and arterial streets which will be needed are great and many other problems will require practical solutions. It is, perhaps, easier to determine the nature and magnitude of the major street and highway needs than it is to effectuate feasible means of financing and administering the expanded traffic improvement program which will be required. Nevertheless, these means should be found and various possible approaches are outlined in this report.

We wish to acknowledge the assistance and co-operation received from each of the sponsoring agencies. Mr. G.L. Drake, project engineer for the study, and I are especially grateful to the members of the Phoenix-Maricopa County Traffic Co-ordinating Committee with whom we met at frequent intervals. We appreciate the importance of our assignment, and hope that our report will contribute to a better understanding of transportation problems in the Phoenix area.

Respectfully submitted,

Wilbur S. Smith
Professional Engineer
State of Arizona
Registration Number 4273

Wilbur S. Smith

GLD:pc

SUMMARY

This report presents a long range major street and highway plan for Phoenix and environs and Maricopa County and describes the comprehensive technical studies upon which the plan is based. The study was sponsored jointly by the City of Phoenix, Maricopa County and the Arizona State Highway Commission in co-operation with the U.S. Department of Commerce, Bureau of Public Roads.

Long range needs for all classes of facilities were determined in consideration of existing traffic conditions, desirable standards of major street and highway design, and traffic demands forecast for the year 1980 when the population of Maricopa County is expected to reach 1,440,000. In accordance with desirable urban objectives, the plan for major street and highway facilities has been correlated with land use plans and other major public works projects. Implementation of the recommendations will establish better relationships between major traffic flows and land use, provide roadway capacity balanced against future traffic demands, provide adequate access and egress to and from the downtown business district, and provide optimum traffic services to all classes of road users and to all parts of the future urban area.

EXISTING CONDITIONS

To provide a sound basis for objective analyses of street and highway needs, a detailed inventory of existing facilities and traffic conditions was made. A major portion of the required inventory data was collected by local agencies in 1957. These data were summarized, expanded and up-dated to reflect 1958 conditions on all streets and highways in the Phoenix area serving 1,000 vehicles per day or more.

Detailed analyses of the magnitudes and patterns of 1958 traffic flow, the quality of traffic services and physical conditions on major streets and highways indicated the following:

1) Average daily traffic volumes in excess of 20,000 vehicles per day are served at maximum locations by 10 streets in the Phoenix Urban Area. These are Central Avenue, Grand Avenue, Washington Street, Van Buren Street, McDowell Road, Indian School Road, Thomas Road, Camelback Road, 16th Street and Black Canyon Highway.

2) Typical daily traffic demands on critical sections of all east-west mile roads between downtown Phoenix and Camelback Road are already close to, or in excess of desirable limits for the existing facilities with prospects for tremendous growth ahead.

3) Increased roadway capacity for future traffic increases on congested east-west arterials in central Phoenix will be difficult and costly to achieve because:

a) These facilities are already operated with four or more traffic lanes;
b) Rights-of-way of only 66 to 80 feet are available in most cases; and
c) Traffic engineering measures to improve the efficiency of traffic operations have already been effected.

4) Central Avenue is serving extremely heavy traffic - over 30,000 vehicles per day at the maximum location - because it is ideally located with respect to major north-south traffic desires, because it has been improved to relatively high standards and because of the inadequate status of development of 7th Avenue and 7th Street.

5) Capacity limitations on existing mile roads, which function as the arterial street system, are causing the following undesirable conditions:

(a) Excessive traffic delays, particularly at principal mile-road intersections;
(b) Excessive incidence of traffic accidents; and
(c) Diversion of arterial traffic flow to half-mile and quarter-mile streets in residential neighborhoods.

6) All primary state highway routes pass through the heart of the downtown business district, causing the undesirable intermingling of through traffic with heavy volumes of slow-moving local traffic.

7) No facilities exist in the Phoenix Urban Area to provide high-capacity, high-speed (40 to 60 miles per hour), safe traffic operations for major traffic movements. Black Canyon Highway, now under construction, will provide traffic services of this type in its tributary area when completed.

8) Many miles of the existing network of major streets and highways in the urban area are physically deficient. Principal deficiencies include pavements too narrow for adequate traffic lane widths, turn lanes and border areas; rough or obsolete roadways originally constructed for rural traffic needs; and inadequate drainage facilities.

9) Only 7 of the 68 railroad crossings of significance in the Phoenix Urban Area are provided with grade separations. Traffic delays and hazards have increased to the point where the construction of additional grade separations and the provision of additional modern warning devices at principal grade crossings are needed.

10) Traffic controls and regulations have been widely and effectively applied in the Phoenix Urban Area to "make-the-most" of existing facilities. Large capacity increases for future traffic needs in critical corridors of traffic flow will require major physical improvements including the construction of new facilities as well as the widening of existing streets.

FUTURE TRAVEL PATTERNS

A major phase of this study involved a thorough analysis of data collected in

the Phoenix-Maricopa County Traffic Study of 1957. These data were used to establish the basic relationships between the motivations and characteristics of travel and land use in the Phoenix area. These relationships were applied in the estimation of the volumes and patterns of 1980 traffic demands which the proposed major street and highway network was designed to serve.

The 1957 traffic study provided factual data concerning travel desires and trip generation characteristics for a 225 square mile area extending from the Salt River Mountains to Peoria Avenue and Shea Boulevard, and from 51st Avenue to Pima Road. The Cities of Mesa, Tempe and Glendale were excluded from this study area. Origin and destination data collected by home interviews determined that the 397,395 residents of the 225 square mile study area made about 909,978 person trips per day in 1957. Over-all rates of trip production were found to be 2.29 trips per person and 6.84 trips per dwelling unit. These rates are relatively high in comparison with those found in other urban areas.

The 1957 study also determined that of a total of 805,011 vehicle trips per day made within and from outside the study area on an average weekday, about 89.5 percent are made entirely within the limits of the study area; only about 10.5 percent of all trips have termini outside the area. Through trips - trips which passed through the study area without a stop - comprised 8.3 percent of the total traffic entering and leaving the area, or only about 0.9 percent of all vehicle trips.

For adequate analyses of major street and highway needs, future travel patterns were estimated for a 400 square mile area which includes the entire future Phoenix Urban Area as defined by local planning agencies. This expanded study area includes Mesa, Tempe and Glendale as well as Phoenix, Scottsdale and contiguous unincorporated sections of Maricopa County. Since traffic generation in urban areas is closely related to the characteristics of land use, the dominant uses of land in each of 135 zones in the study area were expressed statistically to provide a sound basis for estimates of future trip production. The significance of residential use in each zone was shown by the relative number of homes and residents. (The dwelling unit is an origin or destination for about 85 percent of all daily travel.) The number of jobs in each zone was used to identify the commercial and industrial importance of the zones, which is a useful index of the generation of work trips. Experience has shown that the generation of social travel is directly related to the resident population in each zone, while the amount of commercial activity in each zone is, in general, related to the volumes and distribution of retail sales in the area. In addition, direct relationships were established between trip production and median family incomes, automobile ownership and the decentralization of zones measured in minutes of driving time from the central business district. Therefore, statistical estimates of population, employment, median family income, automobile ownership and retail sales were prepared for each zone in the enlarged 1980 Study Area. Statistical projections to 1980 were based on a preliminary plan for future land use and population projections for the Phoenix Urban Area prepared by the Phoenix-Maricopa County Advance Planning Task Force. Based on these projections, it is estimated that the estimated 1,250,000 residents of the 1980 Phoenix Urban Area will generate about 2,838,000 person trips. The total daily volume of vehicle trips will approximate 2,524,000, of which 2,338,000 will be internal trips and 186,000 will be external or through trips.

THE RECOMMENDED PLAN

In order to provide adequate services for traffic demands of the magnitude expected by 1980, the master transportation plan for the Phoenix Urban Area should be a practical combination of the following:

1) Existing arterials and other major streets, widened and otherwise improved where necessary to adequate standards for urban traffic needs;

2) Traffic controls and regulations to achieve maximum utility of existing facilities;

3) New primary highway facilities constructed with modern design features including access control, grade separations and medians;

4) An attractive public transit service; and

5) Adequate off-street parking facilities.

The proposed major street and highway plan for the Phoenix Urban Area has been designed to include each of the different types of facilities needed to provide high-quality traffic services to all classes of users. This plan, which is shown in Figure A, includes a 140.6 mile system of freeways and expressways of which 59.2 miles are routes of state-wide interest; integrated with a 375 mile arterial street system. About 124 miles of the proposed arterial street system for the future urban area have been designated as major arterials, indicating that these routes should be improved to high standards on 100 to 140-foot rights-of-way for service to heavy volumes of traffic between various sections of the area. Other arterials, termed "secondary arterials" for the purposes of this report, would be developed on rights-of-way of at least 80 feet in accordance with present practice in Phoenix.

A generalized county-wide plan for major arterials and regional highways was also prepared to assure major route continuity and co-ordination between plans for rural and urban traffic demands in Maricopa County. The county-wide plan includes a 442 mile freeway-expressway system and about 598 miles of major urban arterials and major non-limited access rural roads. The generalized county-wide plan, shown in Figure B, was designed to provide adequate services to major traffic desires throughout the county without regard for corporate limits or political jurisdictions.

The total estimated cost of the proposed improvements for 1980 needs is $357,400,000 of which about $228,500,000 represents the needs of the Phoenix Urban Area. The estimated cost to complete the construction of the proposed urban area freeway-expressway system is $126,500,000. Major street improvements, including critical railroad grade separation projects and other special structures, would cost about $102,000,000. These projected needs are tremendous by all measures - especially when related to current rates of expenditures for street and highway construction. Relatively, however, they are comparable to those faced by other large and rapidly growing metropolitan areas. The projected needs are realistic and in keeping with the anticipated size and character of the future urban area.

BENEFITS

Although the cost of the necessary expanded street and highway programs for the Phoenix Urban Area and Maricopa County are of staggering proportions, the benefits to be derived from the proposed improvements are also great. Tangible economic benefits to potential users of the improved facilities would more than justify the construction costs. Important intangible benefits would also be derived which must not be overlooked. These include:

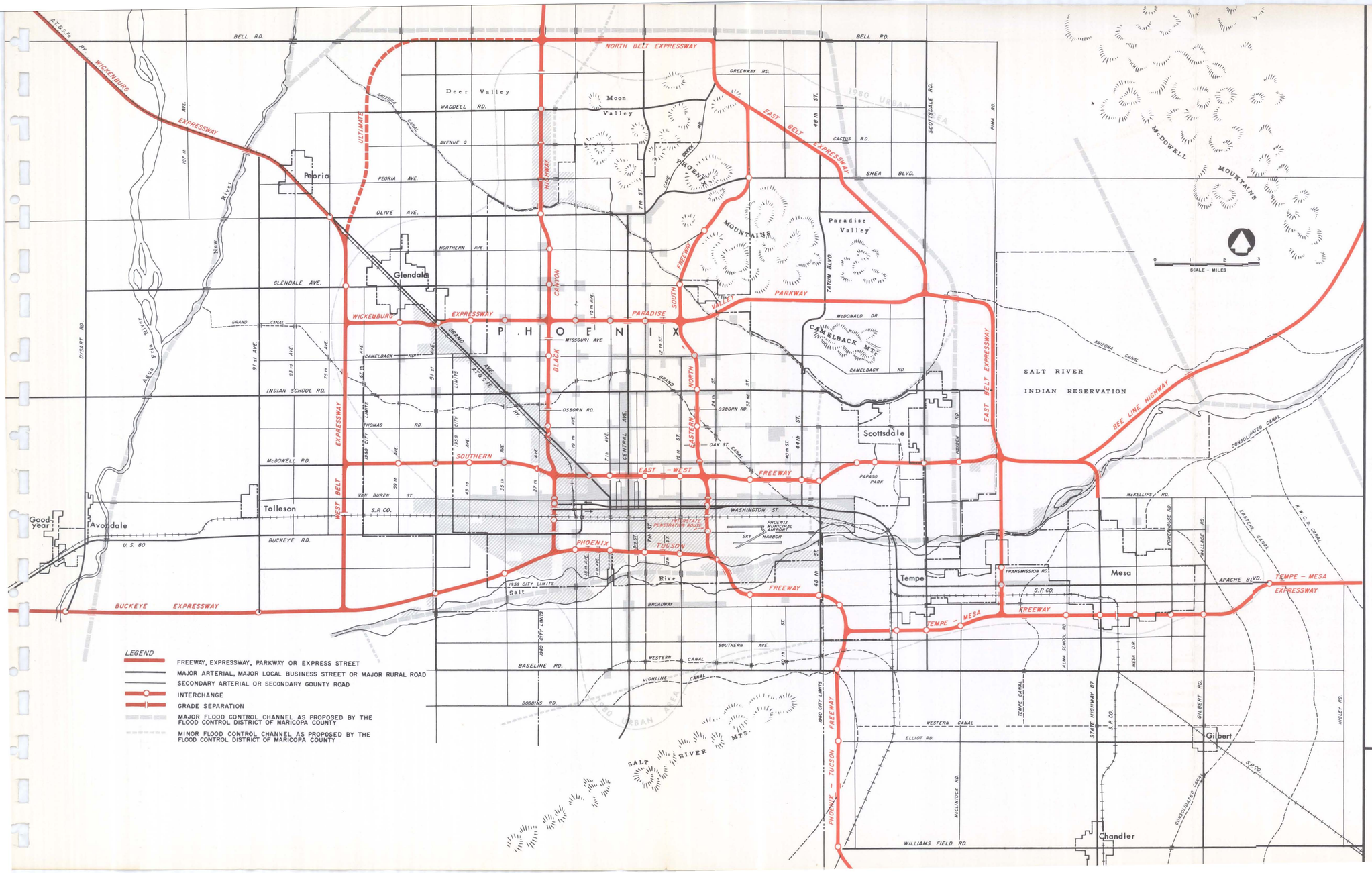
1) The reduction of traffic delays and congestion;
2) Accident reduction;
3) The removal of through traffic from local and collector streets in residential neighborhoods;
4) Efficient service to all parts of the urban area and rural sections of the county;
5) The provision of adequate roadway capacity balanced against projected traffic demands;
6) Improved access and egress to and from the central business district:
7) Increased convenience of travel; and
8) Reduced travel times.

The proposed major street and highway plan will serve as an essential guide for the logical and orderly development of the urban area and provide for the logical and economical expenditure of public funds for improvements most needed and consistent with long range objectives. Its implementation will preserve desirable community values in many ways. Equally significant, it is unlikely that growth of the proportions expected for the Phoenix Urban Area by local officials can be realized without a greatly improved street and highway network.

ADMINISTRATION AND FINANCE

Of major concern will be the effectuation of feasible means of financing the proposed long range program of major street and highway improvements. This will not be possible without co-operative efforts and changed policies at all levels of government. Effective implementation of the plan will require integrated area-wide administration, with the division of responsibility for various elements of the total plan clearly established. No existing unit of government has the necessary authority or financial resources to undertake the entire job alone. A new administrative approach, which will assure co-ordination of the development of major transportation facilities, will be essential. A major part of this new approach should be the establishment of a Regional Transportation Co-ordinating Committee with appropriate representation from all jurisdictions in the future urban area. This committee should be representative of regional interests. The calibre of its membership will determine its effectiveness - particularly in the early phases of the program when basic policy decisions must be made and legal actions must be taken to provide necessary financing and technical machinery for implementation of the plan.

Financial policies related to major street and highway construction will also require changes if the proposed plan is to be implemented. Revenues for future major



RECOMMENDED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA, MARICOPA COUNTY

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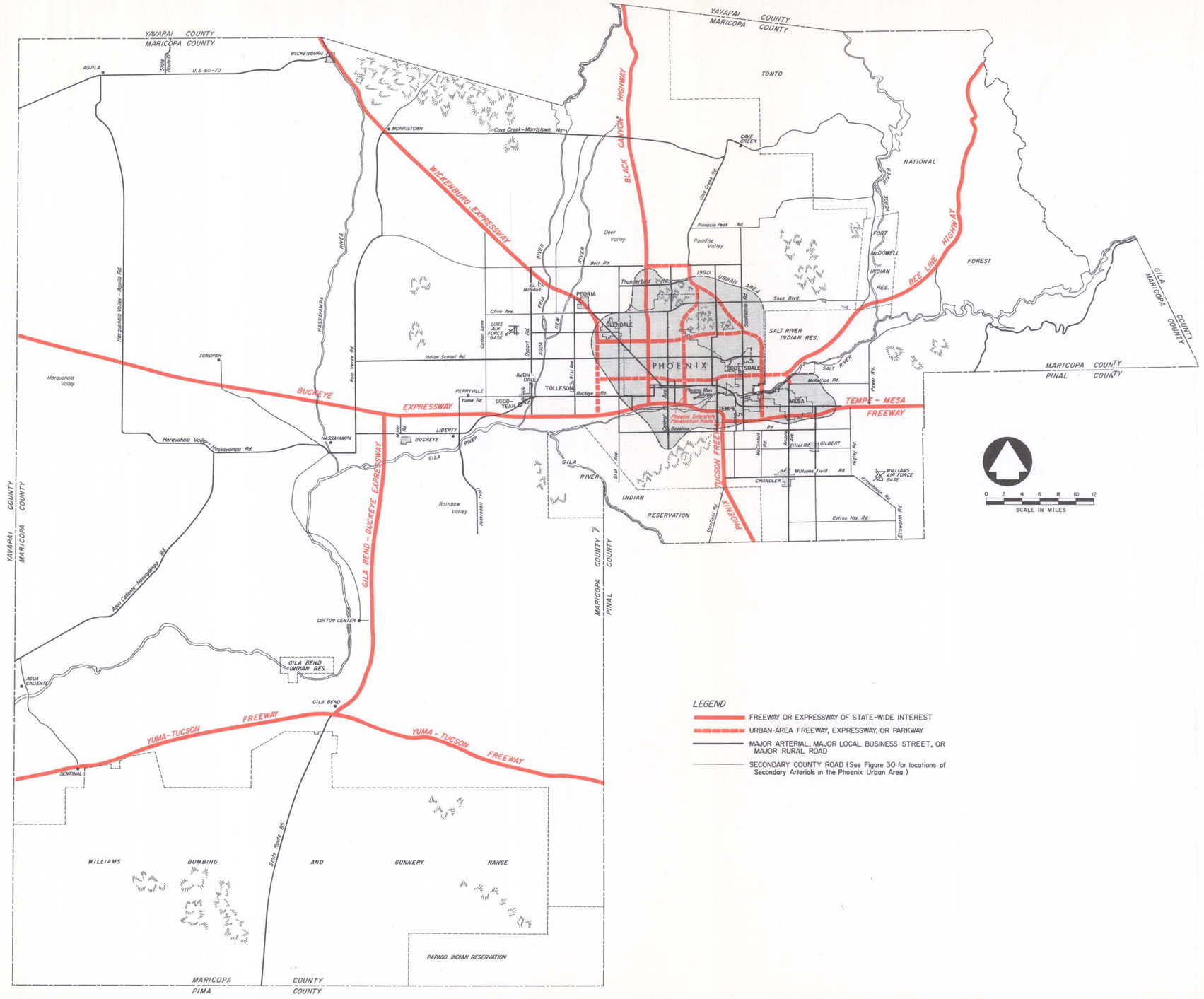
(A)



LEGEND

- FREEWAY OR EXPRESSWAY OF STATE-WIDE INTEREST
- URBAN-AREA FREEWAY, EXPRESSWAY, OR PARKWAY
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET, OR MAJOR RURAL ROAD
- SECONDARY COUNTY ROAD (See Figure 30 for locations of Secondary Arterials in the Phoenix Urban Area.)

RECOMMENDED COUNTY-WIDE FREEWAY-EXPRESSWAY SYSTEM AND MAJOR COUNTY ROADS

PHOENIX URBAN AREA - MARICOPA COUNTY

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B

street and highway needs in both the Phoenix Urban Area and rural sections of Maricopa County will be grossly inadequate if present policies are continued. Increased road user and/or general tax rate increases for transportation improvements will probably be needed. However, tax increases should be accompanied or preceded by a comprehensive reappraisal of present formulae governing the distribution of funds from these sources. Greater consideration should be given, in future financial planning, to the relative magnitudes of the transportation needs of the various road systems in various parts of the county and state.

Finally, little success in the implementation of the major street and highway plan will be achieved without public support. A general understanding by residents of the area of the need for a long range transportation improvement program, and the great benefits to be derived from it, will be essential.

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DEFINITIONS

Freeways are divided highways with full control of access and grade separations at all intersecting traffic flows. Freeways are located in major corridors of traffic flow and are designed to provide for the rapid movement of large volumes of traffic over relatively long distances with safety. There are no intersections at grade, stop lights, pedestrians or parking on freeways to interfere with the continuity of high speed travel.

Expressways are partially developed freeways on which some intersections are at grade. Expressways may also provide only partial control of access although the frequency of direct access to private properties is limited. Major intersecting traffic flows are separated in grade where warranted.

Parkways are arterial highways for non-commercial traffic, usually located within a park or ribbon of park-like development.

Express Streets are major arterials with grade separations at principal intersections but without access control They have been employed in large urban areas where high traffic capacity is needed but where the acquisition of adequate right-of-way for freeway construction is not justified or not desired.

Major Arterials, with the freeways, expressways, parkways and express streets which may be needed, provide the principal network for through traffic flow in urban areas. The primary function of major arterials is to provide for traffic movement; service to abutting property is secondary. Continuity and co-ordination with freeways, expressways and other major highways in the area are of paramount importance. Major arterials are generally spaced about midway between parallel freeways or expressways to provide a high capacity route for through traffic at two to three mile intervals.

Major Rural Roads perform the same traffic service functions in rural areas as major arterials do in urban areas. Traffic operating characteristics and

design standards for major rural roads and major arterials differ because of the different characteristics and needs of rural and urban areas. Major rural roads would be developed on rights-of-way of 100 to 140 feet.

Major Local Business Streets, as the name implies, are urban streets which serve heavy volumes of local traffic generated by business and commercial areas. The principal difference from major arterials is the character of traffic served. The primary function of major local business streets is to provide for local traffic movement and land access - not through traffic; physical standards and regulations for traffic operations may differ, therefore, from those applied to major arterials.

Secondary Arterials perform the same functions as those described above for major arterials with less emphasis on service to long distance through traffic. Secondary arterials, located at about one mile intervals, connect collector and local streets with the freeway-expressway system, serve moderately heavy volumes of trips between different sections of the urban area and provide access to abutting properties. As applied in this study, secondary arterials would be developed on rights-of-way of at least 80 feet, while major arterials would be developed on rights-of-way of at least 100 feet.

Secondary County Roads perform the same traffic service functions in rural areas as secondary arterials do in urban areas. As applied in this study, secondary county roads would be developed on rights-of-way of 80 feet.

Collector Streets connect residential neighborhoods and other areas of homogenous land use, with the arterials and major arterials, and provide for access to abutting property. Collector streets are generally spaced at intervals of about one-half mile in urban areas. Continuity is required only to the extent necessary to connect adjacent neighborhoods and to connect these neighborhoods with the arterials. Collector streets should be planned so that they do not attract heavy volumes of through traffic flow.

INTRODUCTION

The Phoenix Urban Area of Maricopa County, Arizona, is experiencing rapidly increasing traffic volumes and congestion on major streets and highways resulting from tremendous population growth and area expansion. In 1950, the City of Phoenix included only about 17 square miles and about 106,800 residents. Phoenix now includes about 185 square miles and over 400,000 residents. The total population of Maricopa County has almost doubled in the last ten years.

Prospects are for even greater growth and expansion in the next two decades. Over half of the expected "total development" of the Phoenix Urban Area lies ahead. These prospects have prompted local officials to seek long-range solutions to problems of providing adequate facilities for future traffic needs. This dynamic area is challenged with a great opportunity to benefit from the experiences of other large metropolitan areas closer to maturity and already plagued with chronic traffic congestion.

CHARACTERISTICS OF THE AREA

The 1958 population of Maricopa County has been estimated at 560,000 - almost half of the total population of Arizona. About 90 percent of this population is located in a 400 square mile area of the Salt River Valley which is substantially urban in character, including the Cities of Phoenix, Glendale, Scottsdale, Tempe and Mesa. Agriculture in Maricopa County, which accounts for about 40 percent of the state total, is also concentrated in this valley. Long famous as a winter resort area, the valley has become an important industrial center in recent years. The electronic industry, in particular, has assumed a place of major importance in its economy.

As shown in Figure 1, six regional highway routes serve the Phoenix Urban Area and Maricopa County. These are U. S. Routes 60, 70, 80, and 89 and State Routes 69 and 87. State Routes 71, 84, 85 and 88 also serve rural sections of the county. Both north-south and east-west regional traffic corridors through the urban area have been designated as parts of the National System of Interstate and Defense Highways. Freeways, which will be constructed to serve these two important corridors of inter-city traffic flow, will provide the backbone of a major street and highway system needed to serve the future urban area. However, these two freeways, important as they are, will not provide the total solution to the over-all transportation problem. Adequate feeders to the Interstate freeways will be needed, and several major traffic corridors within the urban area will not be served at all by them. To provide adequate traffic services for future needs, an integrated network of major streets and highways, with traffic capacity balanced as nearly as possible against traffic demands, will be essential.

BACKGROUND OF TRANSPORTATION STUDY

The costs of providing adequate transportation facilities have become so great that every possible advantage must be taken of existing facilities and the portions of the financial resources of the area which can be made available for im-

provements. This cannot be done by guesswork. In recognition of this, a carefully planned program of data collection in the Phoenix Urban Area was initiated by state and local officials in 1956. A comprehensive origin and destination study was conducted to determine present travel patterns and basic characteristics of trip generation for the area. In addition to information concerning trip origins, destinations and purposes, the distribution of resident population, dwelling units and auto ownership in a 224 square mile "study area" were also determined. This study was sponsored by the City of Phoenix, Maricopa County and the Arizona Highway Department in co-operation with the U. S. Bureau of Public Roads. A report summarizing the results of the origin and destination study was published in the fall of 1958.[1]

Valuable basic data concerning traffic volumes, travel speeds, accident rates, intersection capacities, street widths, the locations of traffic control devices, and other existing conditions were also collected as part of a co-operative program for the measurement of existing street services. These data, and the results of the origin and destination study, provide a sound basis for analyses of transportation needs in the area.

INITIATION OF STUDY

By Agreement PMS-1 of November 13, 1958 between the State of Arizona, acting by and through the State Highway Commission, and Wilbur Smith and Associates, this firm was assigned the task of preparing a comprehensive and long-range street and highway plan for Phoenix and environs and Maricopa County. The following report presents the plan, which was developed pursuant to this agreement, and describes the comprehensive technical studies upon which the plan is based.

As in previous projects described above, this study was sponsored jointly by the City of Phoenix, Maricopa County and the Arizona Highway Department in cooperation with the U.S. Bureau of Public Roads. The consultant worked closely, and held frequent conferences with the Phoenix-Maricopa County Traffic Co-ordinating Committee which includes representatives from each of the participating agencies.

SCOPE AND OBJECTIVES OF STUDY

As previously noted, the origin and destination study and other data collection projects undertaken prior to this study provided facts concerning present travel characteristics, traffic desires and existing street conditions for a 225 square mile study area. As shown in Figure 2, the 1956-57 study area extended from the Salt River Mountains on the south to Peoria Avenue on the north, and from 51st Avenue on the west to Pima Road on the east. The cities of Mesa, Tempe and Glendale were excluded.

For the purposes of the study described in this report, detailed analyses were made for a larger area including the entire future Phoenix Urban Area as defined by

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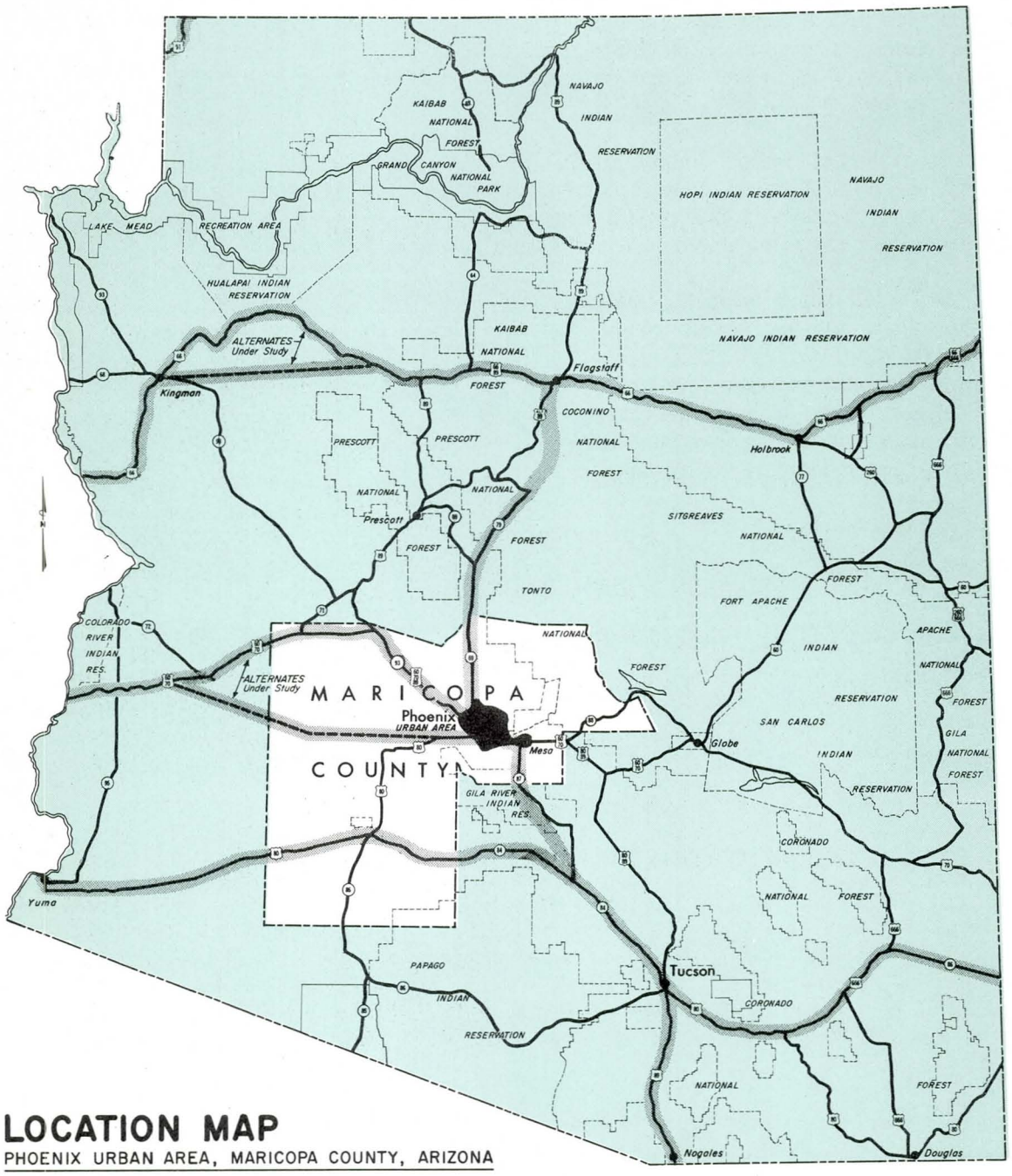
1. "Traffic Study, Phoenix-Maricopa County, 1956-57," sponsored by the City of Phoenix, Maricopa County and the Arizona Highway Department in cooperation with the U.S. Department of Commerce, Bureau of Public Roads.



LOCATION MAP

PHOENIX URBAN AREA, MARICOPA COUNTY, ARIZONA

GENERAL CORRIDOR LOCATIONS OF NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS

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local planning agencies. Needs for freeways, expressways, arterials and collector streets were determined in consideration of the adequacy of existing facilities, preliminary plans for future land use, future traffic volumes and traffic service needs, desirable standards of major street and highway design, construction costs and other factors affecting comprehensive transportation plans. Consideration has also been given to the future role of public transit in the urban area, and the probable effect of transit riding on major street and highway needs. Basic financial and administrative policies related to urban street and highway construction in Maricopa County were also evaluated.

In addition, major county roads and highways in rural sections of Maricopa County were designated based on available data. The plan for the development of major rural roads was integrated with the plan for the urban area to provide route continuity and adequate services for major regional traffic desires.

In accordance with the fundamental objective of this study, a *generalized* master plan for the development of major street and highway facilities has been prepared. Also included, although of secondary importance at this time, are more detailed recommendations regarding specific improvements which conform to the generalized plan. Minor modifications in the functional plans and route locations recommended in this report may be necessary as land use plans become crystalized and more detailed engineering studies are undertaken.

ORGANIZATION OF REPORT

The following report is presented in five principal parts:

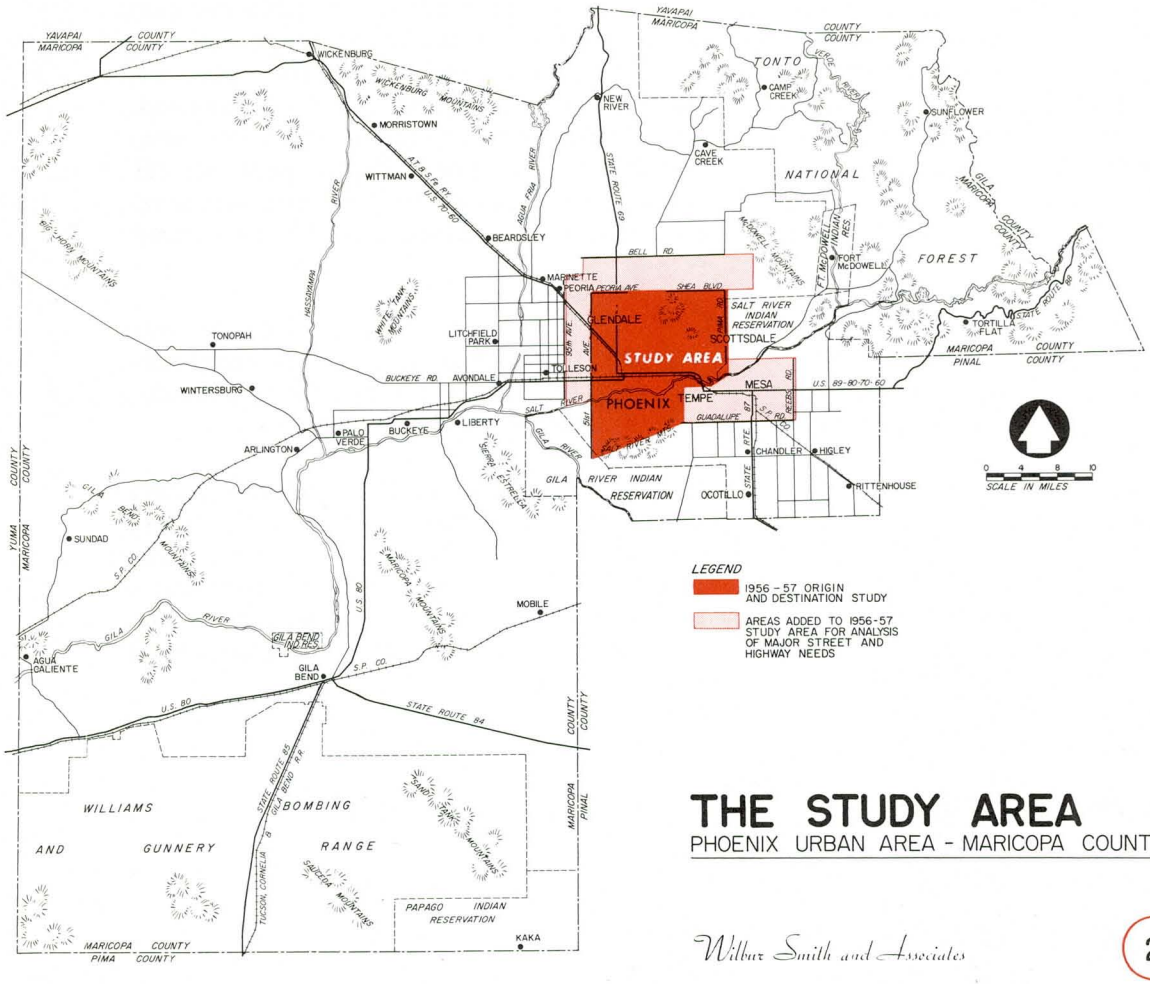
I EXISTING CONDITIONS

II FUTURE TRAVEL PATTERNS

III FUTURE TRAFFIC SERVICE NEEDS

IV THE MAJOR STREET AND HIGHWAY PLAN

V IMPLEMENTATION OF THE PLAN



THE STUDY AREA

PHOENIX URBAN AREA - MARICOPA COUNTY

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For simplicity of presentation, lengthy tabulations and other technical materials have been condensed and included in the appendix, or eliminated entirely.

Chapter I
EXISTING CONDITIONS

Figure 3 indicates the existing network of major streets and highways in the Phoenix Urban Area. Nearly all of these facilities follow north-south or east-west directions and conform to a basic rectangular grid system. The principal exception is Grand Avenue, which extends northwesterly from the intersection of 7th Avenue and Van Buren Street in downtown Phoenix.

When originally surveyed, the Phoenix Urban Area was divided into sections having an area equal to one square mile. Property owners were required to dedicate land along the section lines for the road system. These section-line roads have served as an arterial street system. As the urban area grew, the one-mile sections were subdivided; half-mile, quarter-mile and other streets were constructed to provide local traffic services.

Figure 3 also indicates the locations of the primary state highway routes which serve Phoenix and vicinity. U.S. Routes 60 and 70, the principal routes between Phoenix and the Los Angeles area of southern California, and U.S. Route 89 follow Grand Avenue and Van Buren Street through Phoenix and Apache Boulevard through Tempe and Mesa. U.S. Route 80, connecting Phoenix with Yuma and the San Diego area of southern California, follows Buckeye Road and 17th Avenue to a junction with U.S. Routes 60, 70 and 89 at Van Buren Street. The other two regional highways in the area, State Routes 69 and 87, are served by Black Canyon Highway in Phoenix and Arizona Avenue south of Mesa, respectively.

THE MAJOR STREET INVENTORY

A detailed inventory of major street and highway facilities in the 225 square mile area of the 1956-57 study was made by local public works agencies. Data were collected concerning the following physical and usage characteristics:

1) Average daily traffic volumes,
2) Peak hour traffic volumes and characteristics,
3) Traffic composition,
4) Right-of-way and pavement widths,
5) The number and width of travel lanes,
6) The condition and width of shoulders or curb parking lanes,
7) Pavement condition and riding quality,
8) Median widths, if existing,
9) Street lighting conditions, and
10) Drainage conditions.

The inventory data had been coded for summarization by business machine methods. The tabulations necessary for effective use of the data were prepared as part of this study. Additional data were collected for sections of the future urban area not surveyed previously. The expanded area of the inventory study is shown in Figure 3. All data were up-dated to reflect 1958 conditions based on reconnaissance

studies and limited field measurements. Upon completion of the major street inventory, detailed information was available in summarized form for homogeneous sections of over 500 miles of roadway. The surveyed facilities range from high-volume, divided arterials improved to good standards to lightly traveled, unimproved county roads. Local streets were not included in the inventory studies.

EXISTING TRAFFIC CONDITIONS

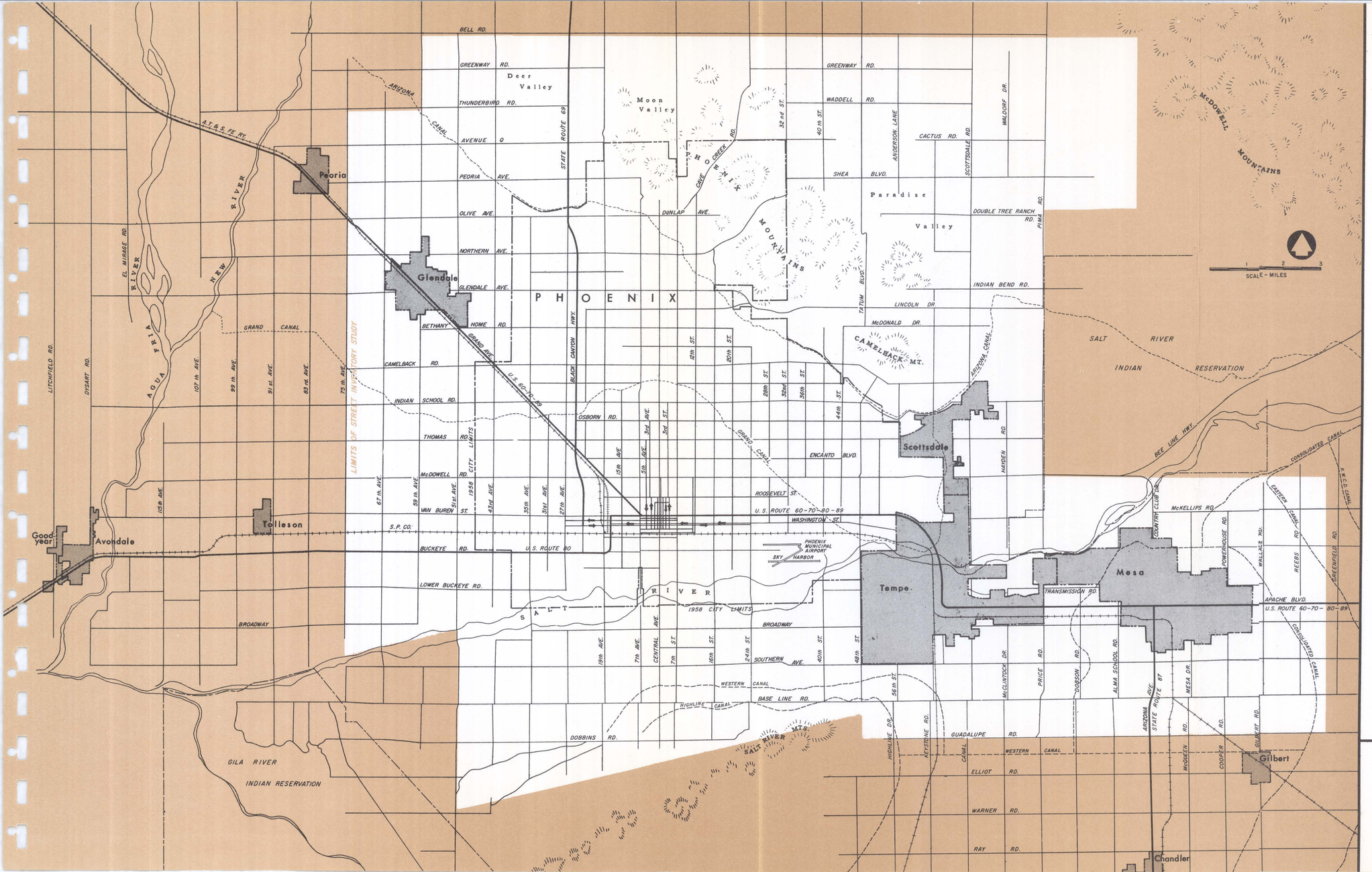
TRAFFIC VOLUMES

Figures 4 and 5 illustrate the pattern of 1958 annual average daily traffic flow on major streets and highways serving 1,000 vehicles per day, or more, in the Phoenix Urban Area. The pattern of heavy traffic volumes on the mile roads reflects the past history of urban development along the basic one-mile grid. The mile roads, generally constructed first, have been the locations for major commercial and residential developments, and have been widened in many instances to accommodate increasing traffic volumes.

Heavy traffic volumes generated by the downtown business district of Phoenix, where principal north-south and east-west traffic corridors intersect, are evident in Figure 4. The critical central north-south corridor, including all streets in the mile between 7th Avenue and 7th Street, serves over 80,000 vehicles per day between the downtown business district and Indian School Road. Van Buren, Washington and Jefferson Streets, east-west arterials, serve a combined volume of over 60,000 vehicles per day just east of 7th Street and about 36,000 vehicles per day just west of 7th Avenue.

All primary state highway routes in Phoenix pass through the heart of the downtown business district. It is important to note that most of the traffic served by these primary state highways is generated within the urban area. Grand Avenue, which serves U.S. Routes 60, 70, and 89, carries only 6,500 vehicles per day at the northwest limit of the urban area, in comparison with volumes exceeding 20,000 vehicles per day between the downtown business district and Black Canyon Highway. Black Canyon Highway (State Route 69) carries more than 20,000 vehicles per day south of Indian School Road in comparison with only about 5,400 vehicles per day north of Olive Avenue. Volumes on Buckeye Road (U.S. Route 80) range from about 4,200 vehicles per day west of Avondale to about 14,900 vehicles per day at 17th Avenue near the downtown area. About 20,000 vehicles per day use U.S. Route 60-70-80-89 between Phoenix and Tempe in comparison with about 8,500 vehicles per day east of Mesa. An important objective of the master plan for future major streets and highways in the urban area should be the removal of inter-city traffic and long distance urban-area trips from overloaded downtown streets which are needed to provide local circulatory traffic service functions.

The heaviest traveled street in the urban area is Central Avenue which serves maximum average daily volumes in excess of 30,000 vehicles. Because of its continuity for the 15 miles between Sunnyslope and the Salt River Mountains, and its high standard of development, Central Avenue provides arterial functions as well as local traffic services to major shopping, business and residential developments along it. Average traffic volumes on Central Avenue range between 9,000 and 33,000



EXISTING MAJOR STREETS AND HIGHWAYS

PHOENIX URBAN AREA, MARICOPA COUNTY

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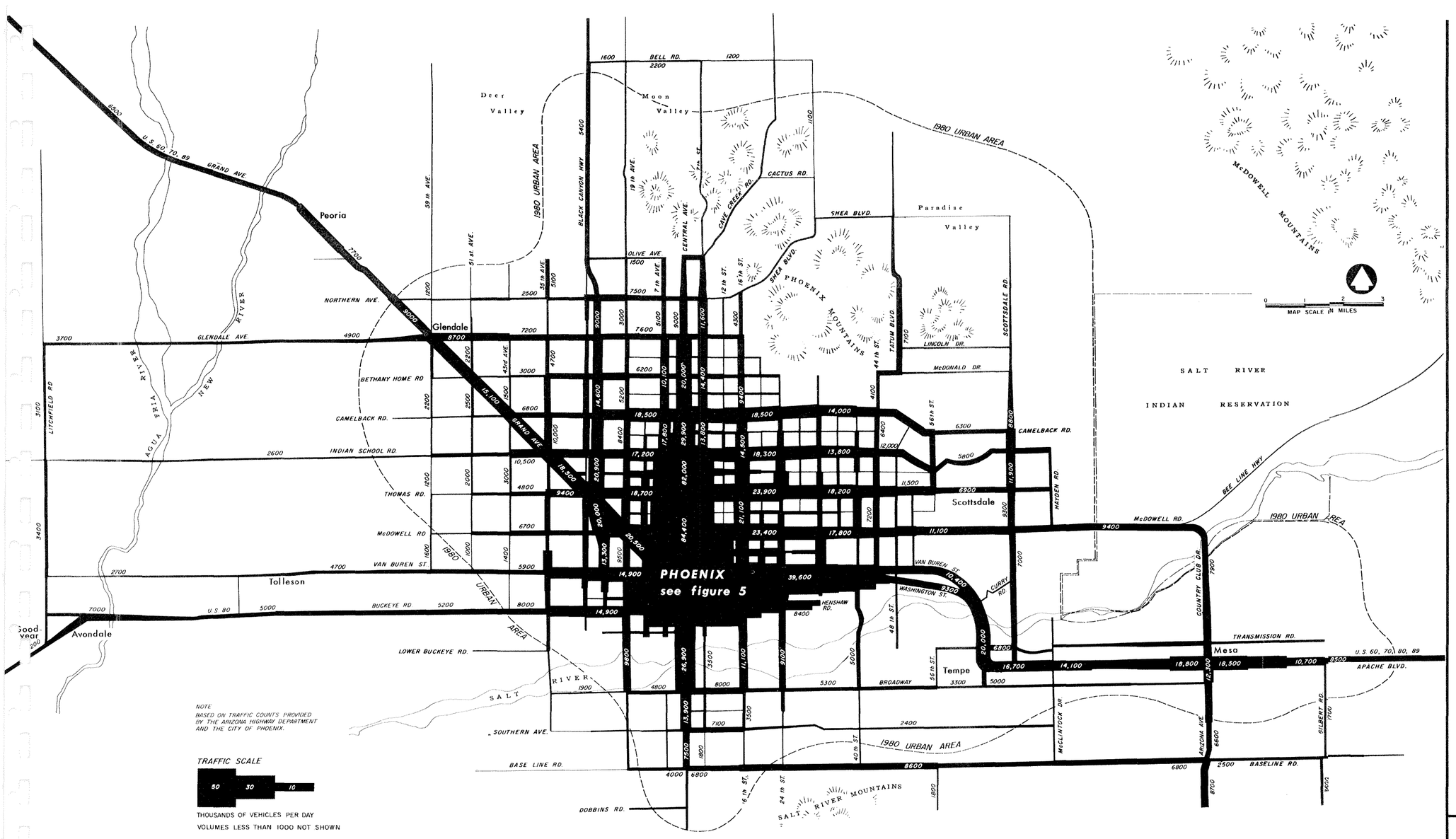

1958
AVERAGE DAILY TRAFFIC FLOW

PHOENIX URBAN AREA, MARICOPA COUNTY

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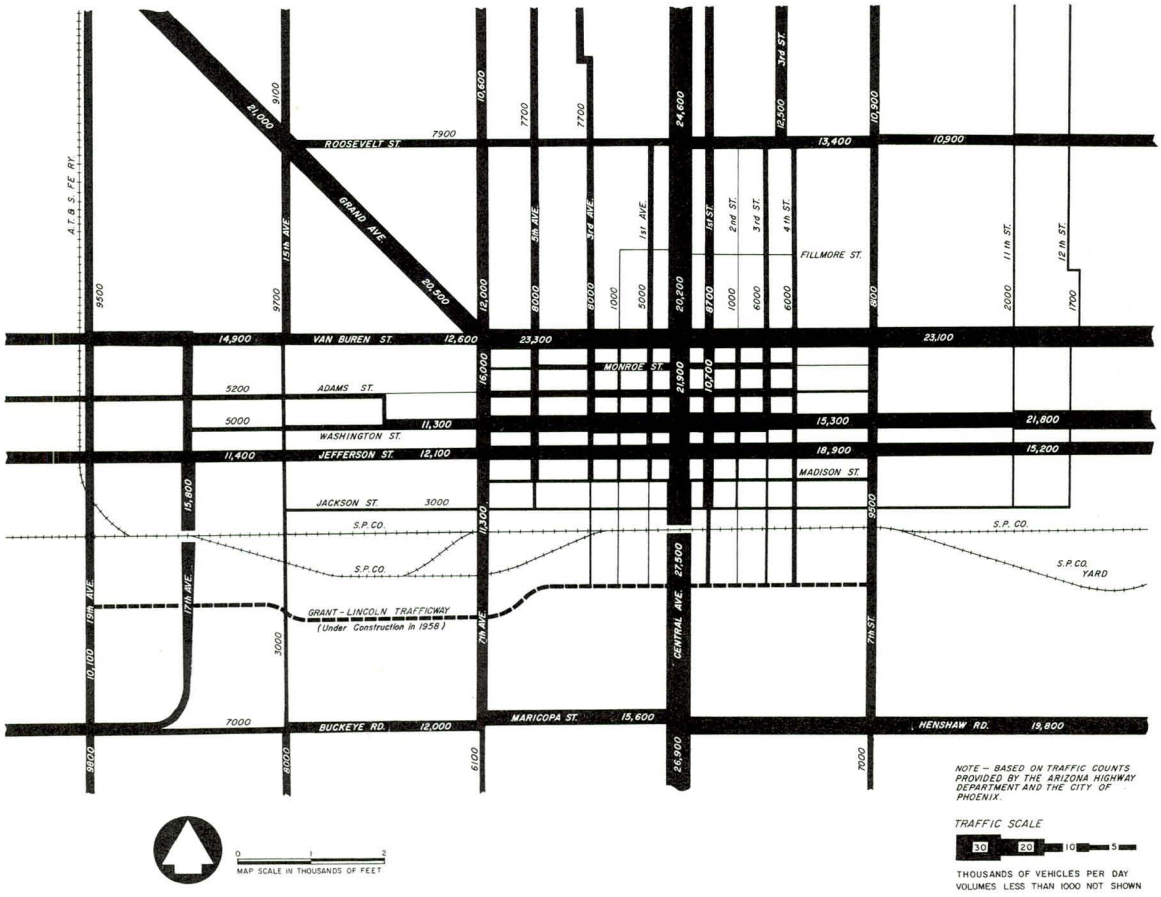
vehicles per day north of downtown Phoenix, between 7,000 and 27,000 vehicles per day between Baseline Road and downtown Phoenix, and between 20,000 and 22,000 vehicles per day in the downtown area itself. Peak demands equal to about 40,000 vehicles per day have been served by this important facility between the downtown area and Indian School Road.

Other streets serving 1958 average daily traffic in excess of 20,000 vehicles per day at maximum locations include Grand Avenue (21,000), Washington Street (22,000), Van Buren Street (23,000), McDowell Road (25,000), Thomas Road (24,000), Indian School Road (23,000), Camelback Road (22,000), 16th Street (21,000), and the Black Canyon Highway frontage roads (21,000 combined). Washington and Jefferson Streets, which operate as a one-way couplet through the downtwon area, serve combined volumes ranging between 33,000 and 40,000 vehicles per day. Capacity limita-



1958 AVERAGE DAILY TRAFFIC FLOW

DOWNTOWN PHOENIX

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tions on CentralAvenue south of McDowell Road have also required the conversion of 3rd and 4th Streets and 3rd and 5th Avenues to one-way operation. These streets each serve 6,000 to 8,000 vehicles per day between Roosevelt and Van Buren Streets (see Figure 5).

Analyses of the traffic flow patterns shown in Figures 4 and 5 are basic to the evaluation of major street and highway needs. In these analyses, it must be recognized that flow patterns are directly affected by the adequacy of existing street facilities. The overloading of one major facility may be indicative of inadequacies of adjacent facilities or the need for new facilities, rather than the need for improvement of the overloaded facility. Thus, the overloading of Central Avenue in central Phoenix reflects, in part, the inadequate status of development of 7th Avenue and 7th Street. The importance of improving these centrally located arterials to desirable standards, and developing other major north-south facilities sufficiently attractive to relieve them of long distance urban-area trips is apparent.

Analyses of 1958 traffic flow patterns also indicate an "overflowing" of arterial traffic flow to several half-mile roads because of capacity deficiences on the mile roads. Average daily traffic volumes on Osborn Road, Roosevelt Street, 15th Avenue, and 3rd Street already equal or exceed 10,000 vehicles per day; sections of 12th Street, 20th Street and Missouri Avenue are also serving appreciable through traffic - traffic which should generally be served by the mile roads.

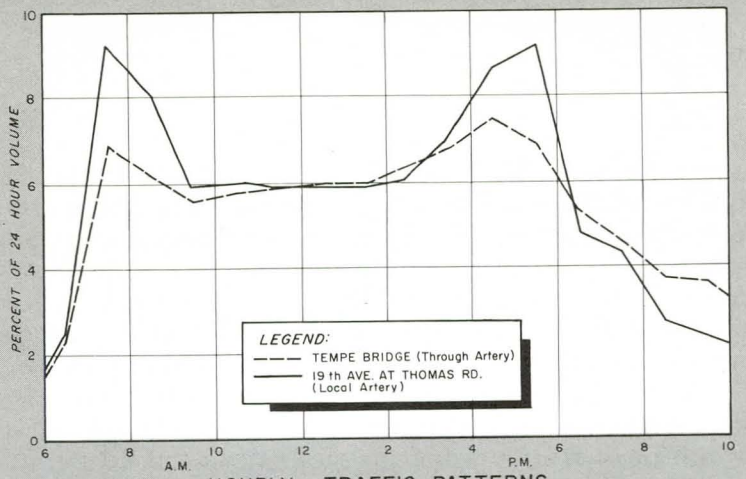
Average traffic volumes on major streets west of Black Canyon Highway were moderate in 1958 except for Grand Avenue and sections of Van Buren Street, 35th Avenue and Buckeye Road as shown in Figure 4. However, this portion of the urban area is being rapidly developed in residential subdivisions. Greatly increased traffic demands will develop during the next few years requiring replacement of existing two-lane county roads with adequate urban arterial streets.

TRAFFIC FLOW CHARACTERISTICS

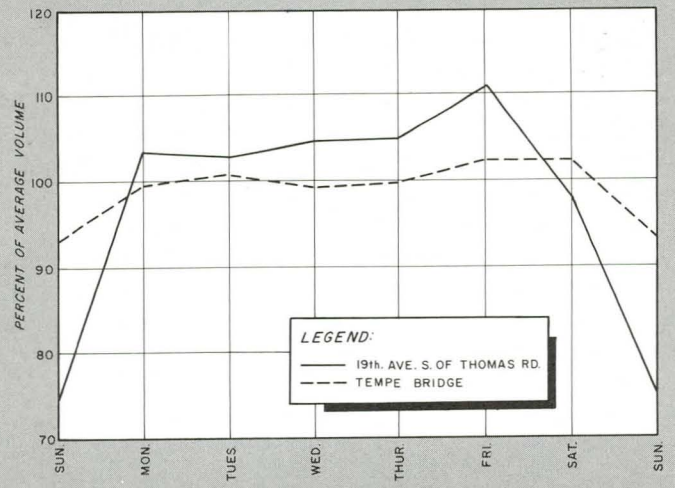
Major street and highway facilities must be designed to accommodate the frequent peak periods of traffic demand - not just the annual average daily volumes shown in Figures 4 and 5. Knowledge of the characteristics of traffic served by particular facilities is important to the determination of practical roadway capacities and future lane requirements. Traffic flow characteristics in the Phoenix Urban Area were found to be similar in most respects to those found in other large urban areas. The principal difference is the season for peak traffic demands.

A study of peak hour traffic characteristics at about 70 representative locations indicated that 7 to 13 percent of the total daily traffic on major streets and highways in the urban area occurs during the peak hour of demand; the weighted average for all locations was about nine percent. Lower-than-average values occur on arterial streets which carry heavy traffic throughout most of the day, such as Central Avenue, Van Buren Street, or the Tempe Bridge (see Figure 6), while the higher-than-average values occur on arterials serving commuter traffic in residential suburbs.

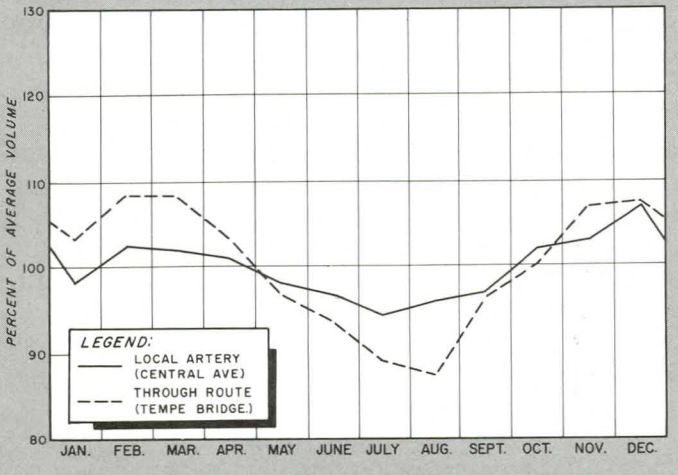
A study of the directional distribution of traffic during the peak hour showed that between 55 and 76 percent of peak hour traffic moves in the major direction of



HOURLY TRAFFIC PATTERNS



DAILY TRAFFIC PATTERNS



SEASONAL TRAFFIC PATTERNS

TYPICAL PATTERNS OF TRAFFIC VARIATION

PHOENIX URBAN AREA, MARICOPA COUNTY

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flow. The average for 58 representative locations was 64 percent. The lower values are found close to the center of the city where a sizable amount of "cross-town" traffic occurs, while the higher values occur in the outlying areas. Peak one-direction volumes as a percent of average 24-hour, two-way traffic equal about 5.8 to 5.9 percent in the Phoenix Urban Area. Peak hour directional volumes along one-way streets in and near downtown Phoenix comprise 10 to 11 percent of the 24-hour traffic.

Daily traffic variations are more pronounced on arterials than through routes in urban areas, with peak traffic occurring on Fridays and light traffic demands on Sundays. Friday traffic volumes during the winter season are generally 15 to 20 percent greater than the annual average daily volumes.

As shown in Figure 6, studies of the seasonal patterns of traffic variation in Phoenix indicate that traffic from November to March is generally eight to nine percent higher than the annual average volume for through routes. The April-May and September-October periods are most representative of average traffic volumes. Seasonal traffic variations on most arterials are less pronounced than on primary highways.

Commercial traffic volumes vary widely between locations. Medium and heavy truck traffic constitutes 4.0 to 7.5 percent of total traffic on major north-south streets in central Phoenix as recorded on north-south mile and half-mile roads between 19th Avenue and 16th Street at the Grand Canal.

QUALITY OF TRAFFIC FLOW

The quality of traffic service provided by existing street and highway facilities may be determined by studies of vehicle travel speeds, delays and accident frequency. Speed and delay studies were made during off-peak periods on more than 200 miles of major streets and highways in the urban area. Peak hour travel speeds are also available from the Phoenix-Maricopa County Pilot Study.[2] Accident records are readily available from files maintained by city, county and state agencies.

Travel Speeds and Delays - Traffic engineering measures have been very effective in maintaining a relatively high standard of traffic service on most streets and highways in the urban area, despite mounting traffic demands and major street deficiencies. The average driving speed during the evening peak hour on arterials outside the downtown area was reported in the Pilot Study report to be 28.6 miles per hour in 1957 compared with 24.8 miles per hour in 1947. This 15 percent increase was achieved during a period of tremendous traffic growth. The average peak hour driving speed for all arterials in the City of Phoenix, including the downtown area, was found to be a respectable 26.9 miles per hour.

The average over-all driving speed during off-peak periods on about 200 miles of heavily traveled roads in the area was found in this study to be about 28 miles per hour. As summarized in Table 1, over-all speeds on most streets serving heavy

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2. "Travel Time Study;" Phoenix-Maricopa County Pilot Study, Section V, Measurement of Existing Street Services; February 17, 1958.

traffic range between 25 miles per hour and 30 miles per hour, which is satisfactory. However, travel speed deficiencies were found on critical sections of Grand Avenue, Central Avenue, 16th Street, 19th Avenue, Van Buren Street, McDowell Road and Scottsdale Road. Off-peak speeds in excess of 40 miles per hour were found only on Black Canyon Highway north of Camelback Road. (See Appendix Table A for typical travel speeds and delays by significant roadway sections.)

Traffic congestion during peak hours of traffic demand has reached undesirable levels on most of the major streets in central Phoenix. The quality of traffic flow is deficient during peak hours on about 50 miles of the existing street system. Figure 7 indicates the deficient roadway sections. Peak hour travel speeds are deficient and traffic delays are excessive on Grand Avenue, where six-legged intersections at the mile road crossings require multi-phase traffic signal controls, and on central sections of all east-west mile roads between the downtown area and Camelback Road. Even more serious congestion on these east-west facilities is impending with rapid growth in suburbs just west of Phoenix, and construction of Black Canyon Highway to freeway standards with interchanges at the mile roads. The quality of peak hour traffic flow is also deficient on Central Avenue, where average speeds range between 10 and 17 miles per hour for most of the five miles between Henshaw Road and Camelback Road, as well as on other north-south major streets as shown in Figure 7.

Figure 8 indicates that about 14 percent of the over-all travel time on major arterials in the Phoenix Urban Area is in traffic delay. In many other large urban areas where major street and highway improvements have lagged behind traffic demands, delays have been shown to account for as much as one-fourth of the over-all travel time. This condition will confront the Phoenix Urban Area unless action is taken to provide additional capacity in critical traffic corridors.

Figure 8 also shows that most of the delays are caused at intersections; mid-block delays actually accounted for only about two percent of all delays. This fact is indicative of the type of improvement needed - major high-capacity facilities designed to remove intersection delays by separating high-volume intersecting traffic flows. Safe speeds in excess of 35 miles per hour in the urban area are not possible on conventional urban arterial streets with frequent intersections at grade.

Accidents - High incidence of accidents may be another indication of a deficiency in the quality of traffic services provided by existing facilities, although some accidents must be expected even on facilities of the best design because of driver failures.

Of a total of 2,662 motor vehicle accidents at intersections responsible for five or more accidents in 1958, 2,248 occurred within the 1958 Phoenix city limits while 414 occurred in areas under county jurisdiction.

Table 2 lists the 28 intersections in the urban area at which 20 or more accients occurred in 1958. All of these intersections are at high-volume intersections in the City of Phoenix. Of the 28 intersections with the highest incidence of motor vehicle accidents, eight are located on McDowell Road, six on Van Buren Street, five on Thomas Road, and three on Grand Avenue, suggesting serious functional deficiencies. New facilities developed to high standards of design are needed to provide

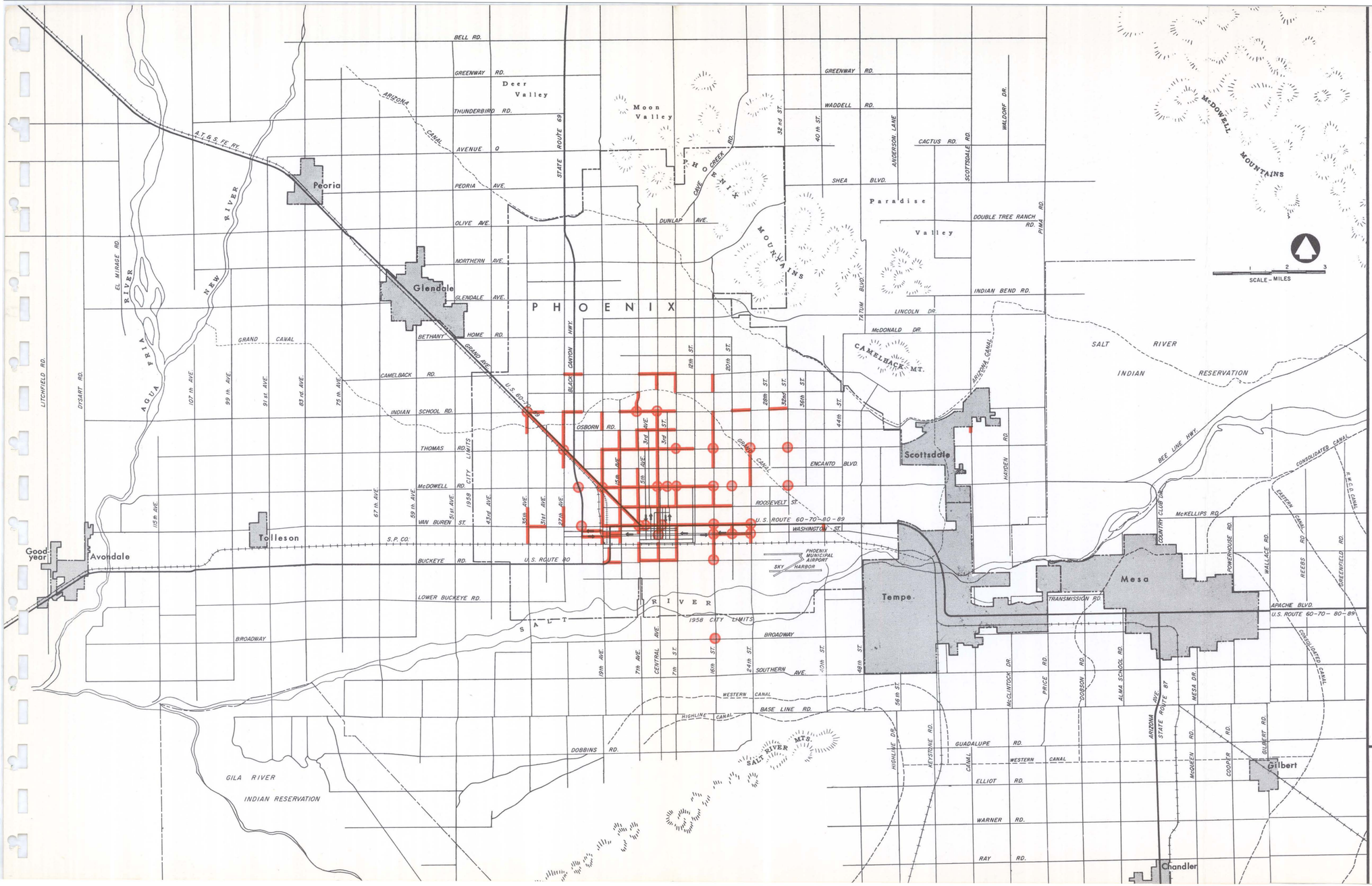
Table 1

SUMMARY OF TYPICAL OFF-PEAK TRAVEL SPEEDS AND DELAYS (February 1959)

Phoenix Urban Area

Major Street	Street Section	Miles	Time (Min:Sec)	Delays (Min:Sec)	Average Speed (m.p.h.)
Central Avenue	Baseline Road to Dunlap Avenue	13.0	31:59	7:36	24.4
Black Canyon Highway	Van Buren Road to Dunlap Avenue	8.0	12:24	1:05	38.5
7th Avenue	Van Buren Road to Olive Avenue	8.0	17:25	2:06	27.6
7th Street	Baseline Road to Dunlap Avenue	13.0	32:09	3:57	24.2
19th Avenue	Baseline Road to Olive Avenue	13.0	25:40	2:39	30.4
16th Street	Baseline Road to Glendale Avenue	11.0	25:09	4:47	26.3
24th Street	Baseline Road to Camelback Road	9.0	20:06	2:57	26.8
35th Avenue	Broadway to Olive Avenue	11.0	21:10	1:37	31.2
Scottsdale Road	Baseline Road to McDonald Drive	10.0	20:01	2:09	30.0
Grand Avenue	7th Avenue to 43rd Avenue	5.6	12:46	2:53	26.4
Van Buren Street	43rd Avenue to 40th Street	9.0	24:14	6:23	22.1
Jefferson Street	Black Canyon Highway to 16th St.	3.5	8:16	0:34	25.3
Buckeye-Maricopa-Henshaw	43rd Avenue to 16th Street	5.5	12:15	1:50	26.9
Baseline Road	19th Avenue to 40th Street	6.0	9:00	0:35	40.0
McDowell Road	43rd Avenue to Scottsdale Road	13.0	29:10	5:48	26.8
Thomas Road	43rd Avenue to Scottsdale Road	13.0	28:02	2:59	27.9
Indian School Road	43rd Avenue to Scottsdale Road	13.0	26:44	2:50	29.2
Bethany Home Road	43rd Avenue to 16th Street	6.0	13:12	1:50	27.3
Glendale Avenue	43rd Avenue to 16th Street	6.0	11:05	1:54	32.4
Northern Avenue	43rd Avenue to 16th Street	6.0	10:40	1:23	33.8

Note: Refer to Appendix Table A for details concerning individual roadway sections.



TRAFFIC SERVICE DEFICIENCIES

PHOENIX URBAN AREA - MARICOPA COUNTY

LEGEND

- INTERSECTION WITH 20 OR MORE ACCIDENTS IN 1958. *(Based on accident data provided by the City of Phoenix, Maricopa County, and the Arizona Highway Department.)*
- EXCESSIVE PEAK HOUR CONGESTION AND SLOW RUNNING SPEEDS. *(Based in part on peak hour speed and delay data collected by the Traffic Engineering Division, City of Phoenix.)*

for safety of traffic operations in major traffic corridors as well as to provide adequate roadway capacity and travel speeds.

Table 2

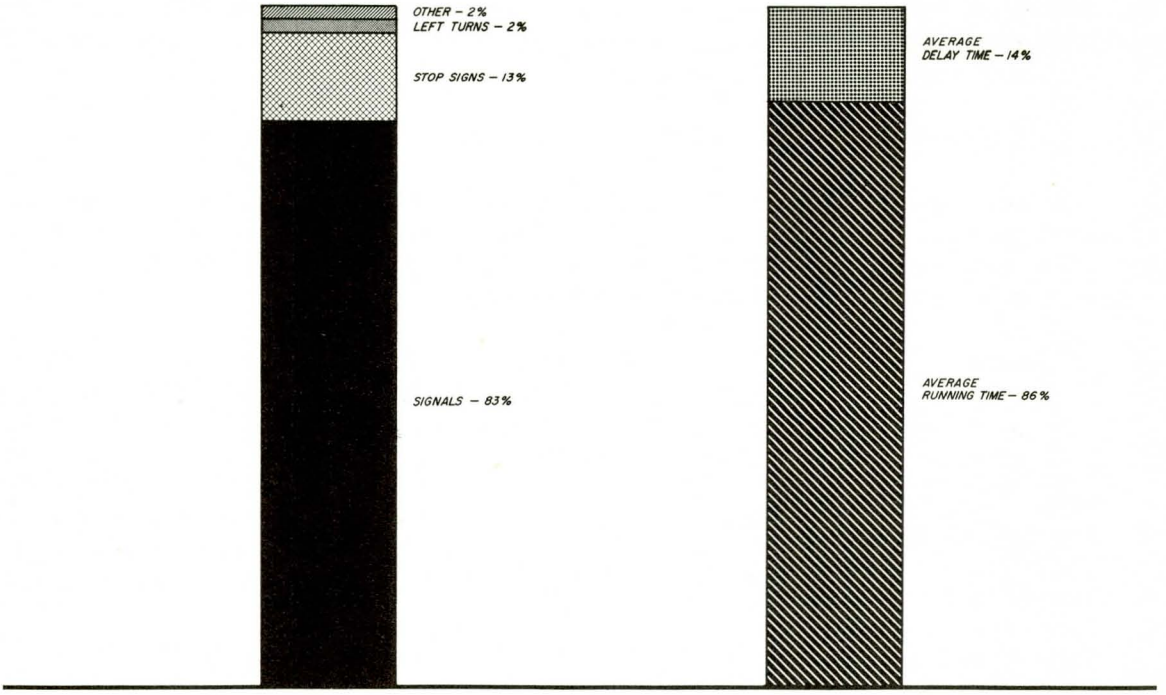
INTERSECTIONS EXPERIENCING
20 OR MORE REPORTED ACCIDENTS IN 1958
Phoenix Urban Area

Intersection	Number of Accidents			
	Total	Fatals	Injury	P.D.O.*
16th Street & McDowell Road	33	-	9	24
19th Avenue & Grand Avenue	31	-	6	25
7th Avenue & Van Buren Street	29	-	4	25
32nd Street & McDowell Road	28	-	5	23
Indian School Road & Central Avenue	26	-	5	21
16th Street & Van Buren Street	24	1	4	19
7th Street & Thomas Road	24	-	2	22
24th Street & Washington Street	23	-	10	13
20th Street & McDowell Road	23	-	3	20
7th Avenue & Indian School Road	23	-	1	22
24th Street & Thomas Road	22	-	4	18
Black Canyon Highway & McDowell Road	22	-	6	16
16th Street & Washington Street	21	-	6	15
Black Canyon Highway & Van Buren St.	21	-	3	18
24th Street & Van Buren Street	21	-	7	14
32nd Street & Thomas Road	21	-	6	15
16th Street & Thomas Road	21	-	9	12
35th Avenue & Indian School Road	21	1	5	15
5th Avenue & Van Buren Street	20	-	3	17
1st Street & Van Buren Street	20	-	3	17
7th Street & McDowell Road	20	-	6	14
3rd Street & McDowell Road	20	-	2	18
20th Street & Jefferson Street	20	-	3	17
27th Avenue & Grand Avenue	20	-	1	19
McDowell Road & Central Avenue	20	-	3	17
Jefferson Street & Central Avenue	20	-	3	17
16th Street & Broadway	20	-	7	13
16th Street & Henshaw Road	20	-	9	11
Total	634	2	135	497

* Property Damage Only

Source: Department of Police, City of Phoenix.

Note: No intersections in areas under the jurisdiction of Maricopa County experienced 20 or more accidents in 1958.



CHARACTERISTICS OF TRAFFIC DELAYS
PHOENIX URBAN AREA, MARICOPA COUNTY

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TRAFFIC VOLUME–CAPACITY RELATIONSHIPS

Undesirable levels of traffic congestion develop when the practical capacity of a roadway is exceeded. Traffic demands on critical sections of all east-west major streets between the downtown area and Camelback Road in central Phoenix are approaching, or have already reached the practical capacities of the existing roadways. Traffic control measures to increase capacity have been effected; despite these operational improvements, traffic redistribution to half-mile roads has taken place because of capacity deficiencies on the mile roads, and the peak period of congestion on the mile roads is extended beyond desirable limits.

Present traffic demands for major north-south facilities between Black Canyon Highway and 24th Street are also approaching or already exceed practical capacity limits. Completion of Black Canyon Highway as a six-lane freeway during the next few years will triple the capacity in this important corridor of traffic flow, and pro-

vide traffic relief to other congested north-south streets. Nevertheless, the need for additional capacity in the central north-south corridor (between 7th Avenue and 7th Street), and north-south corridors east of 7th Street is indicated.

EXISTING TRAFFIC CONTROLS AND REGULATIONS

Many traffic control measures have been applied in the Phoenix Urban Area to attain maximum utility from existing street facilities. These include the use of traffic signals, stop signs, turn prohibitions, curb parking restrictions, one-way streets, lane markings, median islands and channelization.

Traffic signals have been installed at most of the heavily traveled intersections in Phoenix, including nearly all mile-road intersections between 27th Avenue and 40th Street, and between the downtown business district and Camelback Road. Many of the intersections between the mile and half-mile roads in this central area are also signalized. Most of these installations include fixed-time signal equipment although traffic actuated signals are in use at various locations along Van Buren Street and on several other arterials. All signalized intersections in Phoenix are provided with at least two signal indications for each direction of travel in accordance with desirable standards.

The need for additional signalization along Scottsdale Road and in areas north of the 1958 corporate limits of Phoenix was indicated in field studies of traffic operations made for this report. Some of these installations have already been made. The City of Phoenix, Division of Traffic Engineering, is engaged in a continuing program of signalization and modernization of traffic control systems.

Several thousand stop signs have been installed throughout the urban area, including several "four-way stop" installations (most of which are outside the 1958 corporate limits of Phoenix) which should be replaced eventually with traffic signals. Left turn prohibitions are in effect at critical intersections along Central Avenue, Van Buren Street, Roosevelt Street, McDowell Road, Thomas Road, 16th Street, and Grand Avenue.

One-way traffic operations have been established on several streets in and near downtown Phoenix (see Figure 3). Major streets paired for one-way traffic include Washington and Jefferson Streets between 17th Avenue and 16th Street; Adams and Jefferson Streets between Black Canyon Highway and 17th Avenue; Adams and Monroe Streets between 5th Avenue and 7th Street; 3rd and 5th Avenues between Madison Street and Thomas Road; and 3rd and 4th Streets between Jackson Street and Roosevelt Street.

Curb parking restrictions have been applied at numerous locations in central Phoenix to improve roadway capacity and the quality of traffic flow. It is of importance to this analysis of major street needs to note that curb parking has been removed from long sections of Central Avenue, Van Buren Street, Roosevelt Street, McDowell Road and Thomas Road.

A landscaped median was recently constructed along a short section of Central Avenue. This was the first application of this highly desirable traffic control measure in Phoenix. The use of medians, which can increase intersection capacity and provide

important safety benefits, should be greatly expanded. Channelizing islands, left-turn lanes established through pavement markings and narrow raised center strips to eliminate left-turns and U-turns have also been provided at various locations.

A general review of existing traffic conditions in the Phoenix Urban Area, made primarily to establish the character and magnitude of major street and highway needs, revealed that the ability of existing arterials to accommodate current traffic demands has been improved substantially by traffic engineering. Potential capacity increases on critical sections of the existing street system in Phoenix have already been achieved through the traffic control measures cited above. The provision of additional capacity for future needs in these critical areas must involve physical improvements including street widening projects, more extensive use of medians and the construction of new and modern major street and highway facilities.

PHYSICAL STREET CONDITIONS

Comprehensive information concerning physical street conditions in the Phoenix Urban Area was also essential to this study. As previously indicated, a major street inventory was made by local public works agencies as part of the 1956-57 data collection program. These data, which were summarized and up-dated to reflect 1958 conditions, provided the basis for preliminary cost estimates to establish the general magnitude of the necessary street improvement program. Existing physical conditions were also major considerations in the determination of the types, locations and design standards of recommended improvements.

PAVEMENT WIDTHS

Figure 9 illustrates the general pattern of 1958 major street widths in the Phoenix Urban Area. With few exceptions, at least four traffic lanes have been provided between 35th Avenue and 48th Street on heavily traveled sections of the east-west mile roads in central Phoenix. Principal exceptions include McDowell Road between 3rd and 7th Avenues; Indian School Road between Grand Avenue and 15th Avenue; Thomas Road and Van Buren Street for several blocks east of 35th Avenue; and the connection between Buckeye and Henshaw Roads (Maricopa Street). Washington and Jefferson Streets each serve one-way traffic in four to five lanes between the downtown area and 16th Street; east of 16th Street, Jefferson Street is an inadequate two-lane facility in need of reconstruction. Van Buren Street, Washington Street, Apache Boulevard and McDowell Road also serve four-lane traffic east of Phoenix.

North-south streets with four or more traffic lanes include Central Avenue from Broadway to Olive Avenue; 16th Street south of Camelback Road, and some sections of 19th Avenue, 7th Avenue and 7th Street. Critical sections of Central Avenue are operated with six lanes for traffic with curb parking restrictions. Four lanes are also provided on Grand Avenue, Black Canyon Highway (frontage roads), Arizona Avenue, and sections of Scottsdale Road between McDowell and Camelback Roads.

Few sections of the existing street system in west Phoenix, which is growing rapidly, are provided with four traffic lanes. In many areas, old 16 to 18-foot pavements are in use, constructed in the early period of road development in Maricopa

County when the accent was on getting the greatest possible mileage of all-weather, hard surfacing. These roads may be adequate for rural farm-to-market needs, but they do not provide the quality of service required by urban traffic demands. As new subdivisions are developed, the old "section-line" rural roads are being replaced with modern arterial streets.

Many sections of the existing arterial street system in central Phoenix include 40 to 42-foot pavements which were originally intended as two-lane roads with shoulders but which actually operate as four-lane roads without shoulders because of the pressures of traffic demands or the lack of pavement delineation. Thus, although four traffic lanes are provided on most of the heavily traveled streets in Phoenix, in many cases pavement widths are inadequate for adequate lane widths, curb parking lanes or special turn lanes.

Table 3 summarizes the 1958 status of streets and highways serving 8,500 vehicles per day or more. (This is the maximum volume which two-lane streets can normally be expected to accommodate without undesirable congestion during peak hours.) About 165 miles of the existing major street and highway system served 8,500 vehicles per day or more in 1958. About one-third of this important mileage consists of two-lane streets and pavement widths are deficient on most of the mileage of four-lane streets. It is evident that an extensive program of major street widenings is urgently needed.

Several new streets are also needed, or soon will be needed as a result of the expansion of the urban area. The principal among these is the extension of 7th Avenue across the Salt River.[3] Sections of other mile roads in the future urban area not yet constructed include Olive Avenue between 7th Avenue and Central Avenue; 35th Avenue north of Olive Avenue; Thunderbird Road east of Black Canyon Highway; and various sections of the mile road network in Paradise Valley. In addition, 7th Street north of Sunnyslope, Southern Avenue south of Tempe and Mesa and various other roads at the fringes of the future urban area have been graded but not paved.

EXISTING MAJOR STREET RIGHTS-OF-WAY

The widths of existing major street rights-of-way are even more important than existing pavement widths in developing plans for future facilities in built-up sections of the urban area. As shown schematically in Figure 9, rights-of-way equal to 100 feet or more for an appreciable distance are available along few streets in the Phoenix Urban Area. Most of these streets are those serving primary state highway routes such as Grand Avenue, 17th Avenue, and some sections of Van Buren Street and Apache Boulevard. Black Canyon Highway is now being improved to the high standards of the Interstate system on rights-of-way exceeding 200 feet in width. Other than these facilities, only Central Avenue, sections of Washington Street, and downtown sections of First and Second Avenues and First and Second Streets are provided with the 100-foot right-of-way normally recommended as a minimum for major arterials.

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3. Since the physical inventory studies were completed, the Maricopa County Highway Department has constructed 7th Avenue across the Salt River and completed several other important street improvement projects.

Table 3

1958 STATUS OF STREETS
WITH 1958 AVERAGE DAILY TRAFFIC OF 8,500 VEHICLES OR MORE

Street Name	Limits of Critical Section	Existing Conditions				
		No. Miles	No. Lanes	Pavt. Width*	Right-Of-Way*	1958 Average Daily Traffic
Baseline Road	16th Street to 56th Street	5.0	2	34	66	8,600
Bethany Home Road	35th Avenue to 19th Avenue	2.0	4	64	80	8,800- 9,700
Buckeye Road	35th Avenue to 17th Avenue	2.3	4	56	66	13,600-14,900
Buckeye Road	15th Avenue to 7th Avenue	0.5	2	24-34	66	10,800-12,000
Camelback Road	Black Canyon Hwy. to 16th Street	3.8	4	40	66	14,000-22,200
Camelback Road	16th Street to Arcadia Drive	4.5	4	40-48	66	10,000-16,900
Camelback Road	Arcadia Drive to 56th Street	0.5	2	20-22	66	8,500-10,000
Central Avenue	Southern Avenue to Salt River	2.0	4	48-56	66	13,900-26,900
Central Avenue	Salt River to McDowell Road	3.0	4	52-56	66- 79	24,600-27,500
Central Avenue	McDowell Road to Northern Avenue	6.0	4,6	56-62	93-104	9,000-33,000
Grand Avenue	67th Avenue to 27th Avenue	7.0	4	40	100-109	9,000-18,500
Grand Avenue	27th Avenue to 7th Avenue	2.8	4	56-64	80-100	18,500-20,500
Henshaw Road	Central Avenue to 24th Street	2.5	4	42-52	66	14,800-19,800
Indian School Rd.	43rd Avenue to Grand Avenue	1.0	4	40	66	10,500
Indian School Rd.	Grand Avenue to 7th Avenue	3.0	2,4	38-47	66- 80	10,500-17,200
Indian School Rd.	7th Avenue to 16th Street	2.0	4	60-64	80	18,300-23,300
Indian School Rd.	16th Street - 48th Street	4.0	4	40	66	12,000-18,300
Indian School Rd.	48th Street to 56th Street	1.0	2	20-28	66	12,000
Jefferson Street	17th Avenue to 16th Street	2.8	5	64-65	93- 94	11,400-18,900
Jefferson Street	16th Street to 20th Street	0.5	2	36	96	10,000-11,000
Maricopa Street	7th Avenue to Central Avenue	0.5	2	24	66	15,600
McDowell Road	27th Avenue to Central Avenue	2.5	3,4	36-43	66	11,100-18,600
McDowell Road	Central Avenue to 32nd Street	3.5	4	40-64	80	17,800-23,400
McDowell Road	32nd St. - Scottsdale Rd.	5.0	4	40	66	11,100-17,800
McDowell Road	Scottsdale Rd.-N.Country Club Dr.	6.0	4	40-48	80	8,800- 9,400
Arizona Avenue	Broadway - Transmission Road	1.0	4	40-64	66- 80	12,300
Northern Avenue	27th Avenue to 19th Avenue	1.0	4	40	80	8,500- 8,700
Scottsdale Road	Camelback Road - McDowell Road	2.5	4	38-48	66- 80	8,800-11,900
Thomas Road	35th Ave.- Black Canyon Hwy.	1.2	3,4	28-40	66-100	9,400-11,600
Thomas Road	Black Canyon Hwy.- 16th St.	3.8	4	40-52	66- 73	18,700-23,000
Thomas Road	16th Street - 48th Street	4.0	4	48-64	80	18,200-23,900
Thomas Road	48th Street - 56th Street	1.0	2	34	80	11,500

Table 3 (Continued)

1958 STATUS OF STREETS
WITH 1958 AVERAGE DAILY TRAFFIC OF 8,500 VEHICLES OR MORE

Street Name	Limits of Critical Section	Existing Conditions				
		No. Miles	No. Lanes	Pavt. Width*	Right-Of-Way*	1958 Average Daily Traffic
Van Buren Street	35th Avenue - Black Canyon Highway	1.5	2,4	32-42	66- 80	14,900-16,200
Van Buren Street	Black Canyon Highway - 7th Street	2.5	4,6	53-60	80	12,600-14,900
Van Buren Street	7th Street - 48th Street	5.0	4	56	80	14,600-23,000
Van Buren Street	48th Street - Washington Street	2.0	4	56	80	10,400-12,100
Washington Street	17th Avenue - 16th Street	2.8	4,5	62-64	100	11,400-18,900
Washington Street	16th Street - Van Buren Street	6.0	4	48-60	84-100	9,300-15,200
7th Avenue	Buckeye Road - Camelback Road	5.0	3,4	35-57	66	10,600-17,800
7th Avenue	Camelback Road - Glendale Road	2.0	2	34	66	10,100-14,100
19th Avenue	Broadway - Van Buren	3.0	2	32-40	66	9,800-10,100
19th Avenue	Van Buren - Osborn Road	2.5	3,4	30-46	66- 80	9,400- 9,500
19th Avenue	Osborn Road - Indian School Road	0.5	2	24	66	8,500- 9,400
27th Avenue	Bethany Home Rd. - Indian School Rd.	2.0	2	16-24	66	8,700- 9,000
35th Avenue	Camelback Rd. - Indian School Rd.	1.0	2	20-40	66	10,100
35th Avenue	Roosevelt Street - S.P. Co. Tracks	1.0	2	24-32	66- 80	9,400-12,000
7th Street	Henshaw Road - Van Buren Street	1.0	2,3	28-32	66- 73	8,600-10,300
7th Street	Van Buren Street - Grand Canal	3.5	4	33-40	66- 80	8,600-13,800
7th Street	Grand Canal - Orangewood Road	3.0	2	34	66	11,600-13,800
16th Street	Broadway - Washington Street	2.8	2	34-34	66	11,100
16th Street	Washington Street - Thomas Road	2.2	4	40-56	66	21,100
16th Street	Thomas Road - Camelback Road	2.0	4	40-56	80	14,500
16th Street	Camelback Road - Glendale Avenue	2.0	2	34-36	66	9,400-11,600
24th Street	Broadway - Henshaw Road	2.0	2	22-24	66	9,100
24th Street	Henshaw Road - Van Buren Street	1.0	3,4	34-40	66- 80	10,900-18,600
24th Street	Van Buren Street - Indian School Rd.	3.0	2	22-40	66	8,800-12,000
32nd Street	Washington Street - McDowell Road	1.2	2	28	66- 68	9,800-14,200
40th Street	Osborn Road - McDowell Road	1.5	2	24-26	66- 73	11,400-13,900
Apache Boulevard	Washington Street - Arizona Avenue	7.7	4	40-64	100	14,100-20,000
Apache Boulevard	Arizona Avenue - Reebs Road	5.0	4	80-99	88-130	8,500-18,500
Black Canyon Hwy.	Jefferson Street - Northern Avenue	7.3	4	2@32	Varies	9,000-20,900
Total Miles		170.2				

Many of the existing major streets in Phoenix, and most of the rural roads in undeveloped sections of the urban area were originally constructed on 66-foot rights-of-way. The inadequacy of 66 feet for the construction of adequate four-lane major streets in urban areas has long been recognized by local officials. The present zoning ordinance of the City of Phoenix establishes the future widths of most mile and half-mile roads by assuring 80 feet of undeveloped right-of-way. In areas of new subdivisions, 80-foot rights-of-way are established on major streets by subdivision regulations. Maricopa County recently adopted a policy whereby subdividers must dedicate 65 feet along both sides of the centerline of mile roads for a total 130-foot right-of-way, and 40 feet along both sides of the centerline of half-mile roads for a total 80-foot right-of-way. These wider dedications, which exist only where subdivisions have been developed in recent years, and the numerous street widening projects necessitated by increasing traffic demands, have resulted in disorderly and unbalanced patterns of major street widths and roadway capacities.

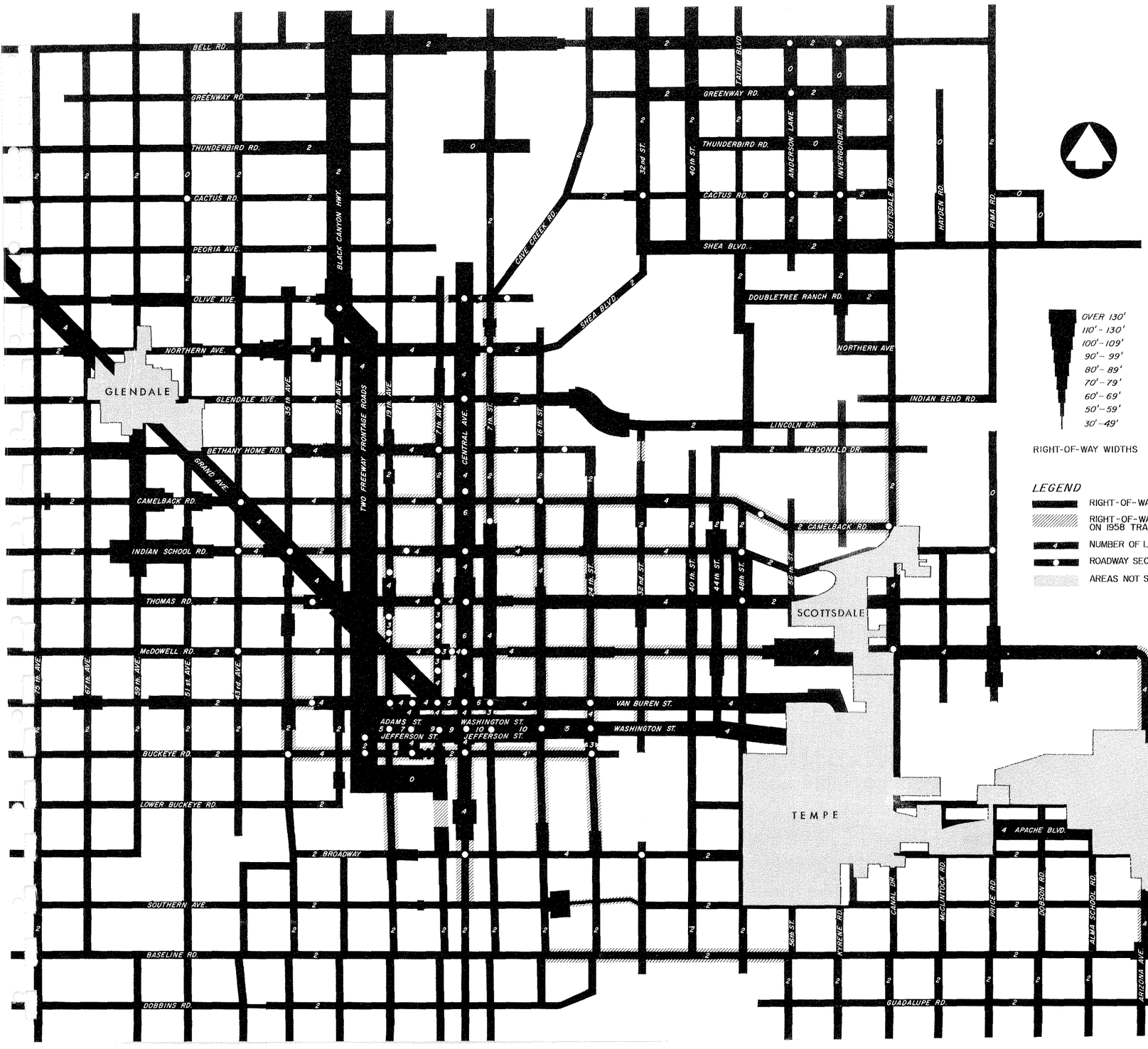
Existing right-of-way widths on most of the heavily traveled major streets range between 66 and 80 feet. About half of the mileage of streets serving 8,500 vehicles per day or more, listed in Table 3, is developed on rights-of-way less than 80 feet wide. These deficiencies in right-of-way for present traffic needs will be costly to eliminate since most of them are located in central areas of Phoenix which have already been developed. Thus, major expenditures of public funds will be required to improve existing arterials to adequate standards. Large capacity increases for future traffic needs will require the construction of new facilities on wider rights-of-way than available on most of the critical sections of the existing major street system.

OTHER PHYSICAL STREET CONDITIONS

In addition to adequate roadway widths for necessary traffic lanes, modern urban arterials should include curb parking lanes, special turn lanes where required, adequate border widths for sidewalks and plantings, curbs and gutters for drainage, street lighting and smooth riding pavement. Many miles of roadway in areas recently annexed by Phoenix, originally constructed to serve rural traffic, do not include these features and are now obsolete. As previously noted, existing mile roads serving four-lane traffic on 66-foot rights-of-way in central Phoenix are also obsolete with narrow lanes, the lack of curbs and gutters and inadequate widths for turn lanes. In addition, open irrigation ditches closely parallel the roadway along many streets in the urban area. These ditches constitute a traffic hazard.

Mercury vapor lighting has been or soon will be installed on many heavily traveled arterials in Phoenix where trafffic and pedestrian volumes warrant it. The central business district has incandescent lighting. Incandescent lighting has also been installed in most residential areas at street intersections. Except for outlying portions of the urban area, existing conditions of major street lighting are good.

Finally, there are only two bridge crossings of the Salt River in the urban area. These bridges are located on Central Avenue and U.S. Route 60-70-80 at Tempe. It is sometimes necessary to close other crossings because of flood conditions, or the possibility of a flash flood. Flood control needs in the urban area are under separate study; additional bridge crossings of future flood canals will be necessary.



1958 MAJOR STREET WIDTHS

PHOENIX URBAN AREA, MARICOPA COUNTY

NOTE — BASED ON DATA COLLECTED IN THE 1956 - 57 PILOT STUDY BY THE CITY OF PHOENIX, MARICOPA COUNTY AND THE ARIZONA HIGHWAY DEPARTMENT IN COOPERATION WITH THE U.S. BUREAU OF PUBLIC ROADS, AND UP-DATED BY WILBUR SMITH AND ASSOCIATES TO REFLECT 1958 CONDITIONS.

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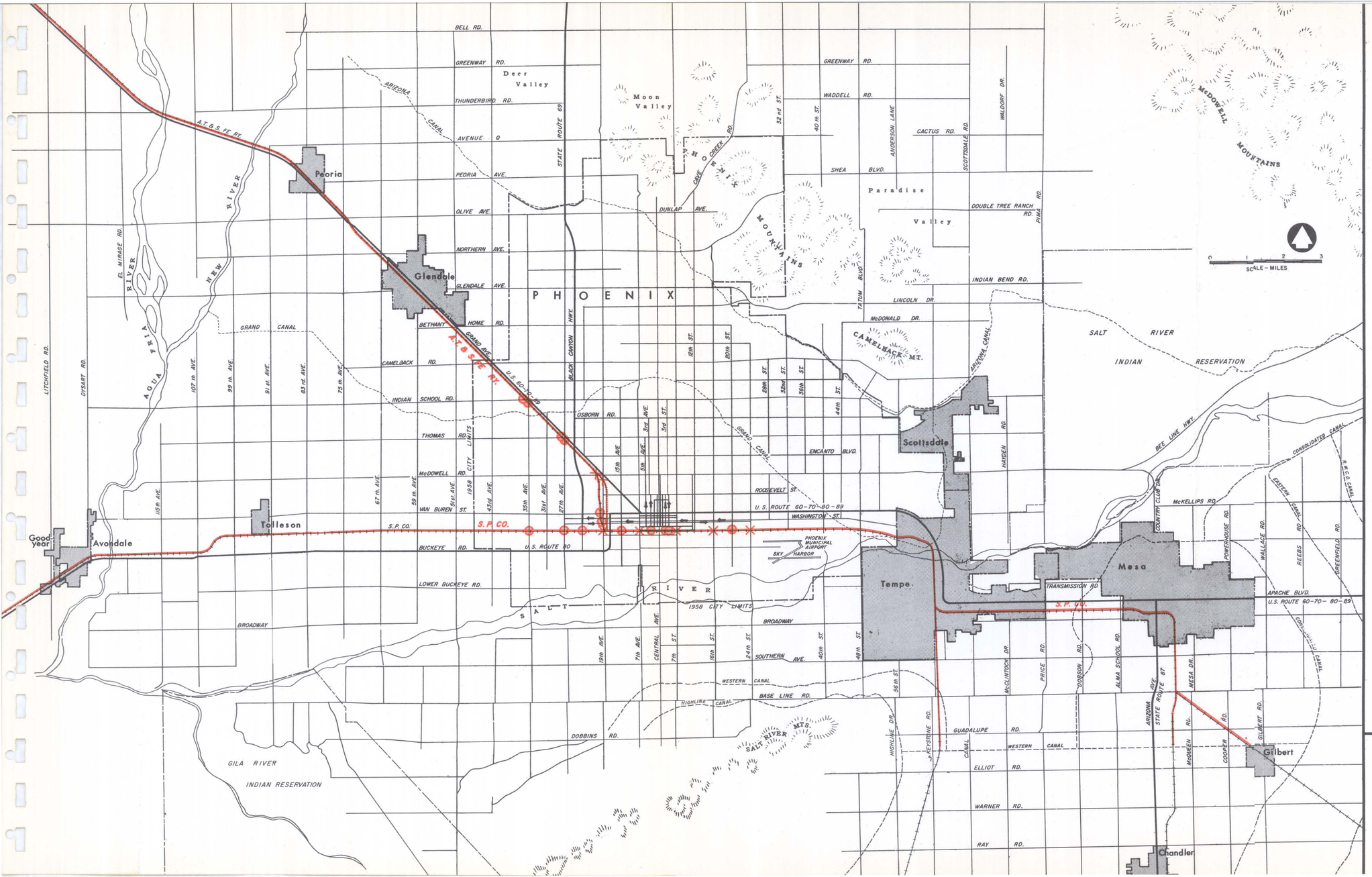

PRINCIPAL LOCATIONS OF RAILROAD-MOTOR VEHICLE CONFLICTS

PHOENIX URBAN AREA - MARICOPA COUNTY

LEGEND

× GRADE CROSSING AT WHICH THE PRODUCT OF 1958 AVERAGE DAILY TRAFFIC AND THE NUMBER OF TRAINS PER DAY (Potential railroad-motor vehicle conflicts) EXCEEDS 200,000 PER DAY

● GRADE CROSSING AT WHICH THE PRODUCT OF 1958 AVERAGE DAILY TRAFFIC AND THE NUMBER OF TRAINS PER DAY (Potential railroad-motor vehicle conflicts) EXCEEDS 100,000 PER DAY

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RAILROAD—MOTOR VEHICLE CONFLICTS

The Phoenix Urban Area is served by two railroads - the Atchison, Topeka and Santa Fe Railway and the Southern Pacific Company. The locations of these railroads are shown in Figure 10. The Southern Pacific maintains yard facilities just south of Jackson Street near downtown Phoenix. Except for underpasses at Central Avenue, Black Canyon Highway and 17th Avenue in Phoenix, Grand Avenue northwest of Glendale, Mill Avenue and McClintock Drive in Tempe, and Arizona Avenue in Mesa, all railroad crossings in the urban area are at grade with intersecting streets.

Appendix Table B summarizes the results of an inventory of 1958 traffic and physical conditions at 68 railroad crossings in the urban area. Physical conditions shown include the number of main-line and spur tracks, and the present protective devices used at each crossing. Traffic conditions at each crossing are indicated by the 1958 average daily vehicular traffic volume, the number of motor vehicle-train accidents during the last two years and the number of train movements per day classified by type. Also shown are the products of the number of trains per day and 1958 average daily traffic - a relative measure of potential railroad-motor vehicle conflicts.

Tables 4 and 5 indicate the principal locations of accidents and potential conflicts between motor vehicles and railroad traffic. The worst location is the 16th Street crossing of the Southern Pacific tracks where 17 accidents have taken place in the last two years and where about 1,695,000 potential conflicts occur each day - more than at any other location in the area. Over 100 switching movements are made across 16th Street by Southern Pacific trains on a typical day.

As shown in Table 5, potential conflicts between railroad traffic and motor vehicles exceed 200,000 per day at seven locations; they exceed 100,000 per day at 15 locations. These conditions indicate the desirability of including railroad grade

Table 4

PRINCIPAL LOCATIONS OF RAILROAD GRADE CROSSING ACCIDENTS
Phoenix Urban Area

Crossing	Railroad	Total Accidents Last 2 Years
16th Street	SP	17
7th Avenue	AT & SF & SP	10
McDowell Road	AT & SF	8
35th Avenue	AT & SF	4
19th Avenue (Near McDowell Rd.)	AT & SF	4
3rd Avenue	AT & SF & SP	4
All Crossings-Phoenix Urban Area		79
All Crossings-Maricopa County		106

separation projects in the major street and highway improvement program. Railroad warning devices are also deficient at many crossings; automatic gates are not used at all, and flashing lights are not provided at numerous locations where warranted by existing traffic conditions.

Table 5

PRINCIPAL LOCATIONS OF POTENTIAL RAILROAD-MOTOR VEHICLE CONFLICTS
Phoenix Urban Area

Crossing	Railroad	Potential 1958 Daily Motor Vehicle-Train Conflicts
16th Street	SP	1,695,800
7th Street	AT & SF & SP	684,000
7th Avenue	AT & SF & SP	519,800
McDowell Road	AT & SF	268,800
19th Avenue near McDowell Road	AT & SF	228,000
24th Street	SP	223,200
19th Avenue	SP	222,200
Indian School Road	AT & SF	199,800
3rd Avenue	AT & SF & SP	198,900
Van Buren Street	AT & SF	191,800
20th Street	SP	184,800
Thomas Road	AT & SF	178,200
4th Street	AT & SF & SP	156,400
23rd Avenue	SP	145,200
27th Avenue	AT & SF	142,200
19th Avenue near Jackson Street	AT & SF	141,400
Glendale Avenue	AT & SF	138,000
35th Avenue	AT & SF	135,000
35th Avenue	SP	109,800
15th Avenue	AT & SF & SP	108,000
Broadway	SP	108,000
3rd Street	AT & SF & SP	101,200
27th Avenue	SP	98,000

Note: Refer to Appendix Table B for additional details concerning existing conditions at principal railroad crossings.

SUMMARY AND CONCLUSIONS

Detailed analyses of the magnitudes and patterns of traffic flow, the quality of traffic services and physical conditions on existing major streets and highways in the Phoenix Urban Area indicate that:

1) Average daily traffic volumes in excess of 20,000 vehicles per day are served at maximum locations by 10 streets in the Phoenix Urban Area. These are Central Avenue, Grand Avenue, Washington Street, Van Buren Street, McDowell Road, Indian School Road, Camelback Road, 16th Street, Thomas Road and Black Canyon Highway.

2) Typical daily traffic demands on critical sections of all east-west mile roads between downtown Phoenix and Camelback Road are already close to, or in excess of desirable limits for the existing facilities with prospects for tremendous growth ahead.

3) Increased roadway capacity for future traffic increases on congested east-west arterials in central Phoenix will be difficult and costly to achieve because:

   (a) These facilities are already operated with four or more traffic lanes;

   (b) Rights-of-way of only 66 to 80 feet are available in most cases; and

   (c) Traffic engineering measures to improve the efficiency of traffic operations have already been effected.

4) Central Avenue is serving extremely heavy traffic - over 30,000 vehicles per day at the maximum location - because it is ideally located with respect to major north-south traffic desires, because it has been improved to relatively high standards and because of the inadequate status of development of 7th Avenue and 7th Street.

5) Capacity limitations on existing mile roads, which function as the arterial street system, are causing the following undesirable conditions:

   (a) Excessive traffic delays, particularly at principal mile-road intersections;

   (b) Excessive incidence of traffic accidents; and

   (c) Diversion of arterial traffic flow to half-mile and quarter-mile streets in residential neighborhoods.

6) All primary state highway routes pass through the heart of the downtown business district, causing the undesirable intermingling of through traffic with heavy volumes of slow-moving local traffic.

7) No facilities exist in the Phoenix Urban Area to provide high-capacity, high-speed (40 to 60 miles per hour), safe traffic operations for major traffic movements. Black Canyon Highway, now under construction, will provide traffic services of this type in its tributary area when completed.

8) Many miles of the existing network of major streets and highways in the urban area are physically deficient. Principal deficiencies include pavements too narrow for adequate traffic lane widths, turn lanes and border areas; rough or obsolete roadways originally constructed for rural traffic needs; and inadequate drainage facilities.

9) Only 7 of the 68 railroad crossings of significance in the Phoenix Urban Area are provided with grade separations. Traffic delays and hazards have increased to the point where the construction of additional grade separations and the provision of additional modern warning devices at principal grade crossings are needed.

10) Traffic controls and regulations have been widely and effectively applied in the Phoenix Urban Area to "make-the-most" of existing facilities. Large capacity increases for future traffic needs in critical corridors of traffic flow will require major physical improvements including the construction of new facilities as well as the widening of existing streets.

Chapter II
FUTURE TRAVEL PATTERNS

As described in Chapter I, the existing network of major streets and highways in the Phoenix Urban Area is physically and functionally deficient for service to present-day traffic demands. Plans for the removal of these deficiencies should be developed in consideration of future traffic demands and the official major street and highway plan designed to accommodate these future demands. Current street improvement programs should be consistent with long range objectives.

The year 1980 has been selected as the design year for the development of the long-range major street and highway plan. Accordingly, traffic patterns have been projected to 1980 levels based on the probable size and character of the urban area at that time. Since it is very unlikely that the growth and expansion of the Phoenix Urban Area will end by 1980, general consideration has also been given to the eventual generation of even greater traffic demands than those predicted for the design year.

FUTURE POPULATION

Studies made by the Phoenix-Maricopa County Advance Planning Task Force[4] indicate that the population of Maricopa County is expected to increase to about 1,440,000 persons by 1980 - about 2.7 times the 1957 level of 520,000 persons (see Figure 11). There are indications that this projection, which represents a tremendous growth, may even be conservative, in which case the 1,440,000 population level will be attained before 1980. Regardless of the specific future year at which this level will be reached, it is considered to be a reasonable and realistic basis for long range street and highway planning at the present time.

Growth of this magnitude will be accompanied by rapid expansion of the urban area. The Advance Planning Task Force indicates in its report that the future Phoenix Urban Area will include about 226 square miles and an estimated 1980 population of about 1,000,000 persons (exclusive of Mesa, Tempe, Glendale and Scottsdale) in comparison with the 144 square mile urban area of 1958 with its 400,000 persons. The total 1980 population of the area of this study, including Mesa, Tempe, Glendale and Scottsdale, is estimated as 1,250,000.

FUTURE LAND USE

Studies of traffic generation in other urban areas have shown that trips made by residents are closely related to the characteristics of land use in these areas. Knowledge of the probable pattern of future land use is basic to the estimation of future travel patterns.

4. "Population Growth of the Phoenix Urban Area"; Advance Planning Task Force, City of Phoenix and Maricopa County; April 1959

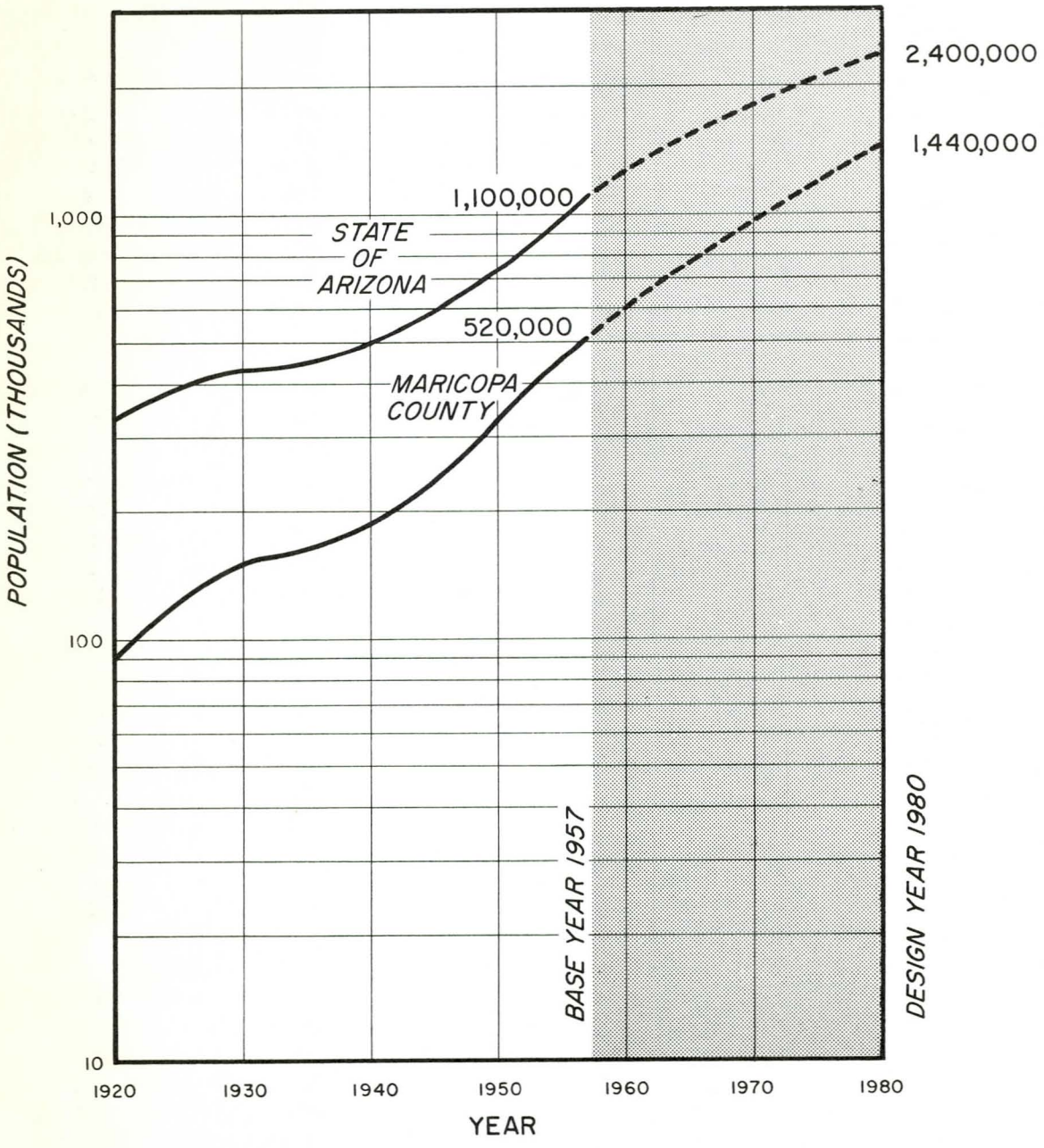
Figure 12 illustrates the preliminary diagrammatic plan for future land uses in the Phoenix Urban Area upon which the traffic projections have been based. This plan, prepared by the Advance Planning Task Force, is designed to accommodate the population expected by 1980. The following remarks regarding the future land use plan are taken from the report of the Advance Planning Task Force:[5]

"The land use-population ratio for the City of Phoenix in 1958 was 9.88 acres per 100 persons, while in the fringe areas the ratio was 15.4 acres per 100 persons. Since the latter ratio is characteristic of the most recent development, it is probably more characteristic of development which will occur in the next 20 years than that which occurred in the older portions of the city. Since the development which is expected to occur in the next two decades will be double in amount that which has occurred to 1958, the future total urban ratio of land area to people would be somewhere near 14 acres per 100 persons, an average of the ratios given above, but heavily weighted toward the fringe characteristic.

"The plan shown on plate 7 (Figure 12) embraces an area of approximately 226 square miles excluding Glendale, Scottsdale, Tempe and Mesa. Based on the aforementioned population-land use ratios, about 143,300 acres or 203 square miles would be needed for all urban purposes by 1980. However, for various reasons certain areas will remain vacant as in all cities. Thus, the future urban area shown diagrammatically here should be more than ample for future urban needs as foreseen at this time. *This is the area for which physical plans should be prepared now.* Such plans should then be reviewed and revised periodically as warranted by changing conditions or unforeseen needs.

"On the basis of past trends, the Diagrammatic Land Use Plan reflects the allocation of adequate space for all foreseeable urban uses. Most areas of the plan propose retention of the existing physical structures since it is recognized that they will probably continue into the future. Quite often overlooked in future plans is the fact that when a street is constructed or buildings, such as homes, plants, stores, etc., are erected they become, for all practical purposes, permanent features of the landscape influencing the city's land use pattern for generations. However, in some cases a community need in one particular area or another demands action which can make a drastic change in the land use pattern. For example, the area west of Sky Harbor Airport extending to Central Avenue is in an area of adverse residential influence as a result of the runway locations of the Sky Harbor Airport, so the plan proposes a complete elimination of residential uses. In another area, immediately to the southwest of the central business district, about 323 acres of land have been designated as an urban redevelopment project. The Future Land Use Plan reflects the community's decision that this land will be renewed for residential purposes, with elimination, where possible, of those non-residential uses which would not be compatible nor conducive to a healthy residential area.

5. Page 14, "Population Growth of the Phoenix Urban Area"; Advance Planning Task Force, City of Phoenix and Maricopa County; April 1959



POPULATION TRENDS

MARICOPA COUNTY, STATE OF ARIZONA

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11

"The future urban pattern of population distribution and population density are intended only as guides for the future physical growth of the Phoenix Urban Area and show what would result if the plans were developed as suggested. These plans have considered and are in scale with the population expectations of the area and as far as is known the future economic prospects of the community.

"With understanding and applied technical interpretations, the Phoenix Urban Area of 1980 can be developed along sound economic and social principles which will inspire the citizens of today and the future to take further pride in their community.

"Recognizing that unforeseen developments can occur, it is assumed that changes and revisions will be applied to the plan. It is important to recognize, however, that these changes should not impair the broad general principles and objectives of the plan.

"The proposed plan can be carried out by the proper use of aids of land planning - zoning regulations, subdivision regulations, urban renewal programs and capital budgeting."

FUTURE POPULATION DISTRIBUTION

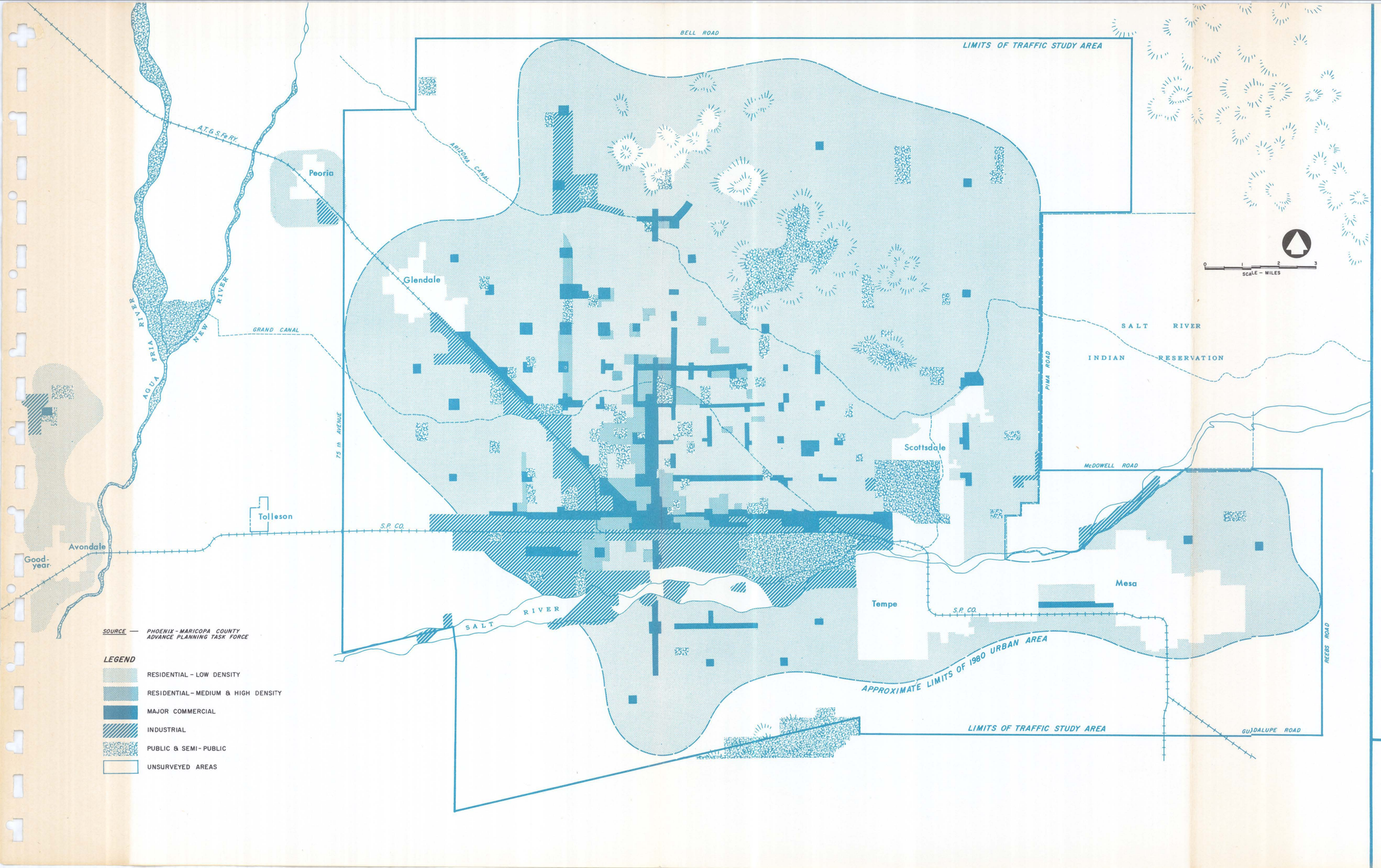
Since about 85 percent of all trips generated by an urban area have dwelling units as origins or destinations, the estimation of the future distribution of population in the Phoenix Urban Area was of prime importance to this study. Figure 13 illustrates the probable distribution of the estimated 1980 population of the study area based on estimates for the future urban area developed by the Advance Planning Task Force. The locations of the future population are related to the residential areas identified on the future land use plan.

About 82 percent of the 1980 population in the future Phoenix Urban Area is to be located in low density areas (areas with less than 80 persons per acre). The most significant population shift, noted by the Advance Planning Task Force, is in the area bounded by Central Avenue on the west, Sky Harbor Airport on the east, the Salt River on the south and the Southern Pacific Company tracks on the north. The people now residing in this area are to be relocated to other residential areas by 1980.

THE ORIGIN AND DESTINATION STUDY

The comprehensive home interview origin and destination study conducted by local agencies in 1956 and 1957 provides factual data concerning travel desires and basic traffic generation characteristics for a 225-square mile area of Phoenix and vicinity. The limits of this study area, and the zone plan used for the summarization of the interview data, are shown in Figure 14. The 1956-57 Study Area extended from the Salt River Mountains on the south to Peoria Avenue and Shea Boulevard on the north, and from 51st Avenue on the west to Pima Road on the east. The incorporated cities of Mesa, Tempe and Glendale are outside the limits of this area.

The 1956-57 Study Area was divided into 37 districts which were subdivided



PRELIMINARY PLAN OF FUTURE LAND USE

PHOENIX URBAN AREA, MARICOPA COUNTY

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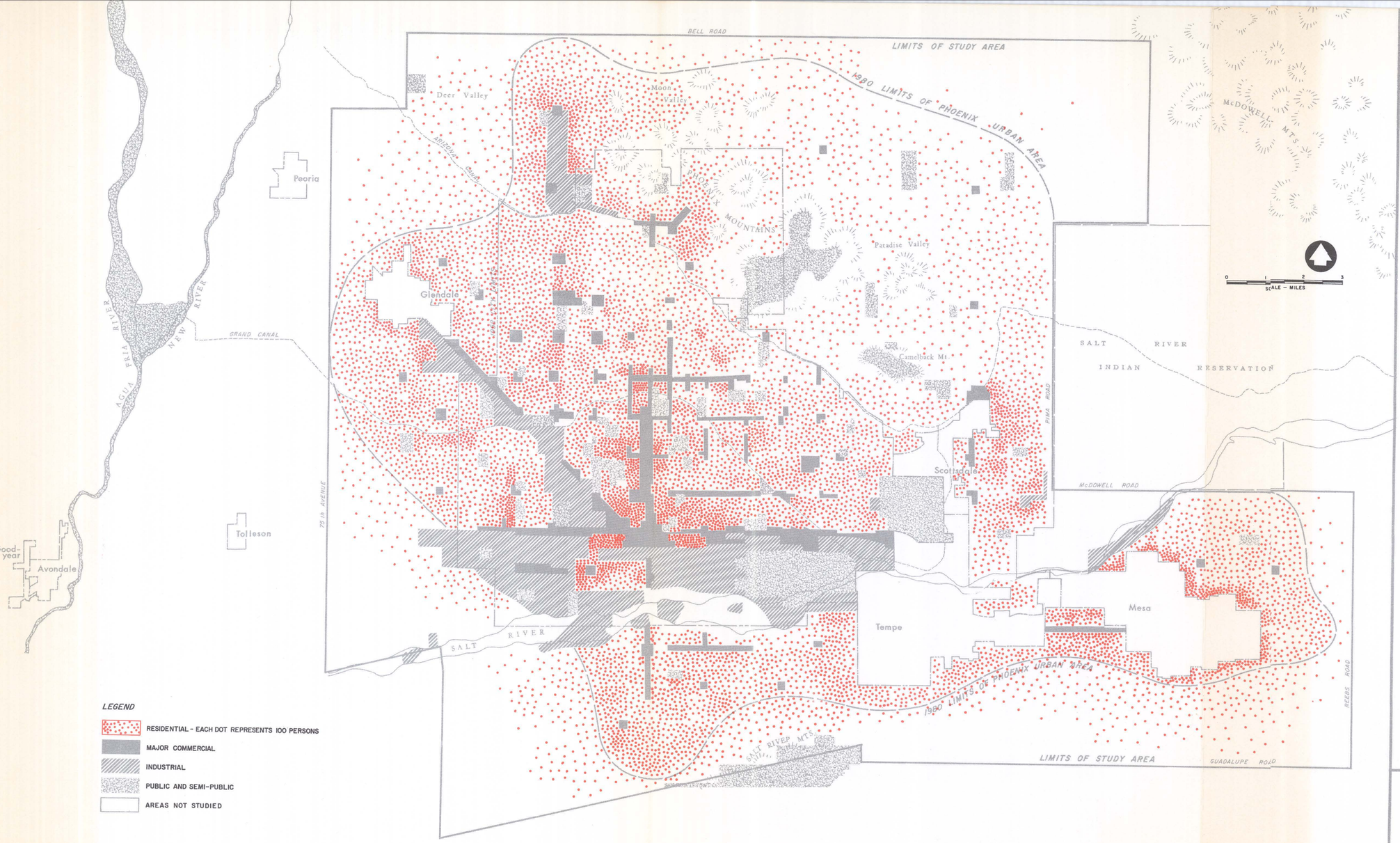

FUTURE - 1980 POPULATION DISTRIBUTION

PHOENIX URBAN AREA, MARICOPA COUNTY

ESTIMATED 1980 POPULATION

PHOENIX URBAN AREA	- 1,000,000
TOTAL STUDY AREA	- 1,250,000
MARICOPA COUNTY	- 1,440,000

NOTE: ESTIMATES OF THE PROBABLE FUTURE POPULATION DISTRIBUTION IN THE 1980 PHOENIX URBAN AREA (excluding Mesa, Tempe, Scottsdale and Glendale) AS SHOWN IN THIS ILLUSTRATION, WERE PREPARED BY THE PHOENIX - MARICOPA COUNTY ADVANCE PLANNING TASK FORCE BASED ON A TOTAL 1980 POPULATION OF THIS AREA EQUAL TO 1,000,000. ABOUT 1,250,000 PERSONS ARE EXPECTED TO RESIDE WITHIN THE LIMITS OF THE STUDY AREA SELECTED FOR ANALYSES OF MAJOR STREET AND HIGHWAY NEEDS.

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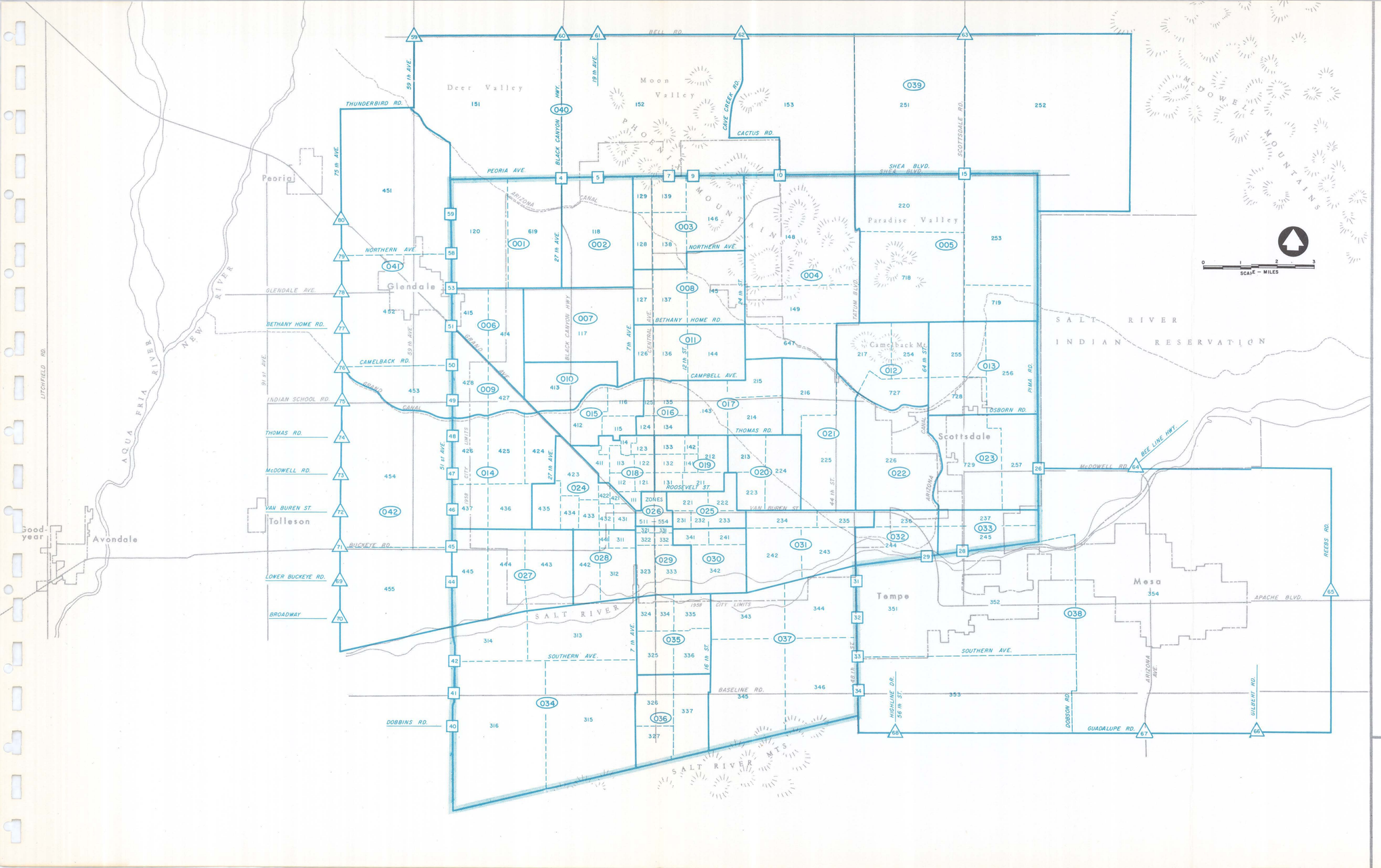

TRAFFIC STUDY ZONE PLAN

PHOENIX AND VICINITY, MARICOPA COUNTY

LEGEND

- 42 — 1957 EXTERNAL STATION
- 60 — 1980 EXTERNAL STATION
- DISTRICT BOUNDARY
- ZONE BOUNDARIES
- STUDY AREA, 1957 TRAFFIC STUDY
- 334 — ZONE NUMBER
- (025) — DISTRICT NUMBER

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into 135 zones as shown in Figure 14. Tabulations of traffic movements between these zones and districts were prepared representing typical daily travel as expanded from an interview sample of 1 in 15 dwelling units. Travel patterns into and out of the study area were determined at 27 roadside interview stations located on all major routes at the limits of the study area.

TRIP GENERATION IN THE PHOENIX URBAN AREA

The 397,395 residents of the 1956-57 Study Area made 909,978 persons trips per day in 1957 based on the expanded home interview sample.[6] Over-all rates of trip production were found to be 2.29 trips per person and 6.84 trips per dwelling unit. As shown in Table 6, these rates are high in comparison with those found in other urban areas.

Table 6

TRIP GENERATION BY PHOENIX URBAN AREA
COMPARED WITH OTHER URBAN AREAS*

Urban Area	Year of Survey	Study Area Population	Trips Per Person	Trips Per Dwelling Unit	Persons Per Car	Persons Per Dwelling Unit
Detroit, Mich.	1953	2,968,875	1.86	6.17	3.61	3.31
Washington, D.C.	1955	1,568,522	1.76	5.30	3.74	3.01
St. Louis, Mo.	1957	1,275,454	1.94	6.05	3.48	3.12
Houston, Texas	1953	878,629	2.22	7.16	3.41	3.22
Kansas City, Mo.	1957	857,550	2.18	6.67	3.24	3.06
Dallas, Texas	1951	533,606	2.04	6.47	3.47	3.17
PHOENIX, ARIZONA	1957	397.395	2.29	6.84	2.87	3.01
Madison, Wis.	1951	104,074	2.06	6.44	4.12	3.12
Racine, Wis.	1951	78,033	2.07	6.92	4.22	3.34

* All trips by residents.

Consistent with the high rates of trip production in the Phoenix Urban Area is the finding that the level of automobile ownership is relatively high. There were only about 2.87 persons per auto owned in the study area in 1957 - about 1.1 autos per dwelling unit.

The majority of all trips in the urban area consist of trips by automobile drivers and passengers. Only about 57,000 trips per day were served by public transit in 1957 - about 6.9 percent of the total trip production. Less than 10 percent of the trips generated by downtown Phoenix were made by transit riders.

6. Appendix Table 2, Phoenix-Maricopa County Traffic Study; 1956-57

BASE—YEAR ORIGIN AND DESTINATION PATTERNS

Table 7 summarizes the vehicle trips made in 1957 by principal origin and destination classes. Of a total of 805,011 trips per day made within and from outside the study area on an average weekday, about 89.5 percent are *internal* trips - trips made entirely within the study area - and about 9.6 percent are *external* trips - trips with one end inside and one end outside the study area. Less than one percent of the total generation of vehicle trips consists of *through* trips.

The 7,088 trips per day made through the area without a stop represent 8.3 percent of the total traffic at the external stations. This proportion of through traffic is relatively high for the size and character of the urban area and surrounding territory. The principal reason for this is that the cities of Mesa, Tempe and Glendale were outside the 1957 Study Area; if these cities had been included in the study area, the proportion of through trips to the total traffic at the external cordon would probably have been lower.

Table 7

SUMMARY OF 1957 TRIP GENERATION
BY PRINCIPAL ORIGIN AND DESTINATION CLASSES

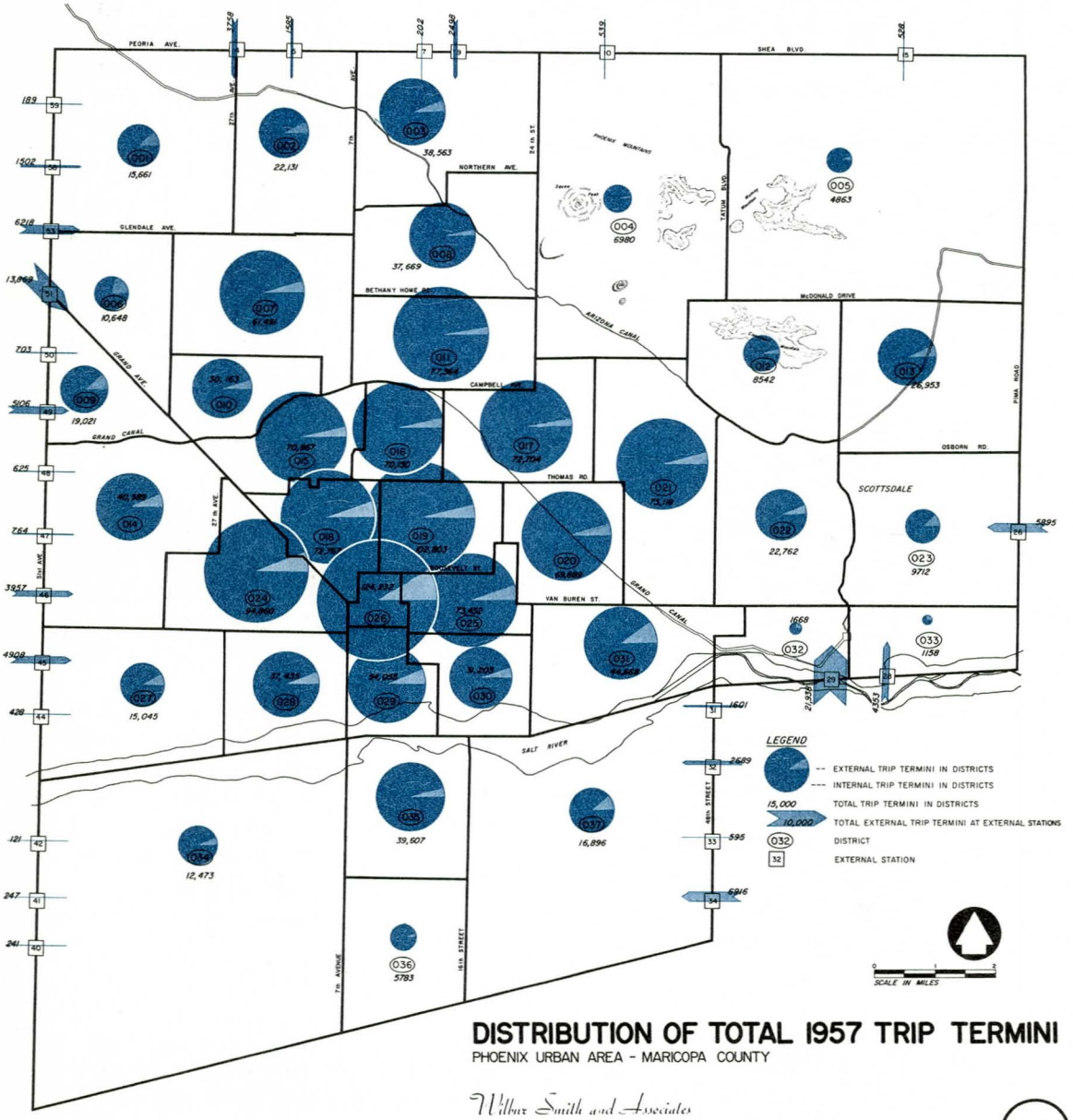
Class of Trips	Average Daily Volume	Percent of Total
Inter-District	467,530	58.1
District - CBD	46,723	5.8
Intra-District	205,871	25.6
Total Internal Trips	720,124	89.5
Station-District	69,445	8.6
Station - CBD	8,354	1.0
Total External Trips	77,799	9.6
Total Through Trips	7,088	0.9
Grand Total Vehicle Trips	805,011	100.0

Source: Figure 23, Phoenix-Maricopa County Traffic Study; 1956-57.

About 55,077 trips per day were made in 1957 to and from the Phoenix central business district (indicated in Table 7 as CBD). This represents 6.8 percent of all vehicle trips. The central business district includes only about 0.65 square miles,

extending generally from Jackson Street to Roosevelt Street, and from Seventh Avenue to Seventh Street as shown in Figure 14.

The distribution of the total 1957 generation of vehicle trips in the study area is shown graphically in Figure 15. The relative importance of the central business district and other central areas in terms of present-day trip production is indicated



DISTRICT OF TOTAL 1957 TRIP TERMINI

PHOENIX URBAN AREA - MARICOPA COUNTY

Wilbur Smith and Associates

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by the relative size of the circles. The proportion of the total trip production which consists of internal trips vs. external trips is also shown for each district.

Figure 16 is a tabulation of the distribution of the 805,011 daily vehicle trips between the 37 districts and 27 internal stations in the 225-square mile study area. About 26 percent of all trips are short *intra-district* trips, many of which will be served by local streets. *Inter-district* movements in excess of 5,000 trips per day are made between District 011 and Districts 016 and 017; between Districts 014 and 024; between Districts 015 and 016; between District 016 and Districts 017 and 019; between District 018 and Districts 019, 024 and 026 (CBD); between District 019 and Districts 020, 025 and 026 (CBD); between Districts 020 and 021; and between Districts 024, 025 and 029 and District 026 (CBD). Most of these heavy movements are between neighboring districts. Movements between the central business district and 19 of the other districts exceed 1,000 vehicles per day with major traffic desires radiating in north, northeast and northwest directions.

APPLICATIONS OF THE ORIGIN AND DESTINATION DATA

Analyses of origin and destination data collected in other urban areas have shown that the generation of trips in an urban community can be directly related to the number of people in the community and the needs and desires which prompt them to move about. The number and type of vehicle trips which the individual makes each day is modified by the density of development in the area in which he lives, the relative availability of private and public transportation, and other considerations related to land use. Trip production can be correlated with such variable factors as the number and density of residential population; automobile ownership; average levels of family income; the number and character of the labor force and available jobs; and the volume of retail sales activity.

The patterns of traffic movements between zones in an urban area can also be related to land use characteristics being dependent on the proximity of residences to trip generators such as employment centers, retail stores, schools, parks and other residential areas. These relationships can be described by "interactance" curves or formulae developed by complex analyses of current travel patterns using electronic data-processing equipment.

It was necessary to establish correlations between trip generation in the Phoenix Urban Area and the variable factors cited above, requiring complex analytical procedures, because mere projections of existing travel patterns would not be valid. New and different travel patterns will emerge as areas now in agricultural use are subdivided for residential developments, and as new schools, parks, shopping centers and employment centers are developed to serve the increasing population. Accordingly, the data collected in the 1956-57 origin and destination traffic study were used primarily to determine:

1) The number of trips and rate of trips produced each day by residents according to each of their principal purposes for travel, and by mode of transportation; and

ESTIMATED BASE YEAR - 1957
ORIGIN AND DESTINATION PATTERN
AVERAGE DAILY MOTOR VEHICLE TRIPS
PHOENIX URBAN AREA, MARICOPA COUNTY

Zone Number	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031	032	033	034	035	036	037	4	5	7	9	10	15	26	28	29	31	32	33	34	40	41	42	44	45	46	47	48	49	50	51	53	58	59
001	2,637																																																																				
002	1,787	2,467																																																																								
003	348	2,639	9,655																																																																						
004	30	12	27	400																																																																				
005	0	27	63	96	187																																																																				
006	159	262	96	0	30	496																																																																		
007	1,368	1,985	1,122	174	69	898	10,340																																																																
008	219	1,013	2,149	162	27	216	1,864	6,247																																																														
009	165	162	174	48	30	517	673	165	3,166																																																														
010	275	372	252	0	0	784	4,500	367	994	3,560																																																												
011	428	736	1,439	975	133	219	3,550	4,942	325	1,124	11,894																																																									
012	12	39	81	108	241	12	90	147	12	45	867	493																																																							
013	12	63	242	599	1,716	36	166	300	54	114	1,026	1,010	4,534																																																					
014	84	216	210	30	15	300	475	282	1,011	984	358	39	126	6,622																																																				
015	162	592	787	43	45	302	4,027	1,144	656	3,070	3,157	126	271	2,153	10,989																																																				
016	246	663	1,146	253	168	349	2,354	1,644	366	1,012	6,439	177	653	712	5,239	6,332																																																		
017	87	400	318	291	114	147	1,001	1,044	333	603	5,160	275	1,135	588	1,651	5,023	10,829																																																		
018	207	414	538	186	156	366	2,221	835	543	999	2,040	111	433	1,771	5,865	4,307	1,809	8,265																																																		
019	394	558	910	325	99	196	1,396	1,956	385	819	3,923	342	447	698	2,972	6,231	6,001	5,799	13,098																																																	
020	150	144	273	151	210	141	541	588	279	295	1,191	132	398	531	1,012	2,122	4,343	1,256	6,622	10,509																																																	
021	99	112	219	884	280	87	351	348	120	285	2,786	1,249	1,539	357	585	2,380	5,088	1,120	3,567	6,209	12,843																																																	
022	15	156	192	96	48	0	209	90	72	87	456	507	1,582	45	315	496	720	133	966	1,437	3,453	3,051																																																	
023	42	24	60	15	133	0	42	48	69	15	111	150	1,903	45	57	96	291	180	179	314	543	1,071	857																																																
024	628	531	552	172	42	681	2,151	647	822	1,510	1,488	250	168	5,418	3,367	1,968	1,728	5,938	3,526	1,767	1,086	429	132	13,274																																																
025	138	357	309	212	45	108	763	324	314	372	1,062	106	236	841	1,167	1,843	1,947	1,888	7,389	4,511	1,766	524	141	3,761	9,285																																															
026	531	1,056	1,156	310	151	510	3,191	1,920	964	1,241	3,938	363	953	1,756	4,570	4,963	3,936	7,605	9,463	4,432	3,309	725	177	8,795	8,015	11,203																																															
027	135	57	120	30	0	123	234	30	252	117	171	24	0	1,362	101	216	120	294	282	231	141	15	0	2,168	481	660	1,606																																									
028	108	408	393	30	0	60	691	117	204	240	333	45	57	1,009	695	731	522	1,050	1,037	621	270	24	96	4,129	1,431	3,156	1,500	5,094																																									
029	339	213	579	207	84	372	777	465	240	496	919	117	177	1,183	1,211	1,175	1,333	2,019	2,375	949	1,042	195	75	3,367	3,230	6,039	462	2,853	5,223																																									
030	42	78	108	60	0	84	234	129	132	138	336	24	66	465	199	293	547	539	729	801	564	60	72	1,350	2,309	2,220	267	793	2,557	5,231																																								
031	114	217	312	214	175	108	567	596	196	236	1,271	459	634	456	464	1,088	1,701	911	1,858	3,603	3,872	814	252	1,607	3,510	2,630	158	572	1,170	1,557	3,584																																							
032	0	51	0	0	15	24	24	0	0	0	54	0	17	42	0	30	12	81	107	52	99	42	0	69	36	83	0	51	36	24	144	24																																						
033	0	0	0	0	15	0	0	0	0	45	0	126	15	0	30	66	15	0	30	15	30	105	12	15	60	15	0	0	0	0	72	0	66																																						
034	30	30	12	30	12	0	186	45	0	0	121	24	39	426	126	75	27	318	127	135	60	30	12	735	282	866	321	674	678	183	315	45	24	1,266																																						
035	147	198	252	30	0	129	114	189	114	162	301	24	12	627	327	370	270	462	919	306	327	207	174	1,422	1,035	2,260	276	706	2,217	1,159	704	15	0	2,417	8,373																																						
036	12	12	72	30	0	36	36	24	30	15	102	0	15	183	31	174	126	105	221	30	45	27	12	142	201	464	75	161	358	111	159	36	0	689	1,446	189																																						
037	0	0	69	24	15	54	120	30	108	39	204	78	45	135	129	255	162	180	390	195	336	132	231	552	798	1,099	156	459	1,035	906	738	39	0	213	2,003	139	1,982																																						
Sta. 4	111	310	156	5	4	43	136	55	28	101	82	9	11	67	115	60	87	256	104	86	59	9	4	216	71	242	36	57	71	29	73	1	0	15	27	8	15	1																																						
5	65	189	271	6	2	14	69	36	8	36	43	3	11	19	74	21	23	137	32	25	12	3	0	61	38	70	4	29	40	11	28	2	0	11	10	17	2	33	1																																					
7	3	24	58	0	0	1	5	8	1	0	4	0	1	1	1	5	6	3	9	11	1	3	0	7	12	8	1	1	0	0	1	1	2	0	2	3																																						
9	12	85	754	13	4	5	71	77	5	34	118	4	9	36	41	121	71	61	125	40	24	5	2	96	81	212	14	17	61	20	59	9	0	7	18	0	2	14	10	2	0																																					
10	5	1	32	42	34	5	2	12	0	0	12	17	54	3	3	13	17	4	4	17	35	26	33	9	13	15	0	4	4	3	28	0	0	0	2	0	0	1	0	3	3	0																																				
15	2	1	3	3	27	1	6	6	0	3	8	4	130	2	3	18	9	7	8	17	27	11	13	4	15	34	1	1	4	1	9	2	2	0	4	0	1	1	0	1	3	12	0																																				
26	14	58	103	42	42	27	118	119	38	60	268	68	471	68	182	311	341	262	456	301	422	268	424	150	131	367	20	28	49	28	66	2	22	17	10	9	17	51	10	2	17	39	44	4																																				
28	9	38	53	47	92	12	94	59	19	32	160	85	707	29	101	180	190	101	248	169	314	204	578	39	42	110	1	3	19	9	31	5	291	2	7	3	4	25	7	1	9	18	47	97	0																																				
29	50	64	135	49	5	49	292	164	94	157	401	52	9	322	403	507	647	772	1,136	1,249	1,264	539	21	1,224	1,421	3,124	76	249	620	349	2,042	303	10	40	92	16	61	330	17	0	21	12	14	3	0	0																																				
31	3	3	4	3	0	3	3	3	0	4	11	1	4	18	18	20	21	32	56	67	69	28	0	57	77	138	7	22	67	36	426	14	0	6	24	7	311	1	0	0	0	0	1	0	0	3																																				
32	3	5	1	1	0	4	5	2	6	7	11	1	0	77	9	15	15	55	36	34	17	3	1	153	87	141	96	179	315	211	157	5	0	78	391	26	340	4	1	0	0	0	0	1	0	0	2	0	1																																				
33	1	3	1	0	0	0	3	2	0	0	0	0	0	1	1	1	3	6	5	4	7	1	0	6	18	13	3	6	28	23	12	0	0	13	116	13	236	0	0	0	0	0	0	0	0	0	0	1	0																																				
34	19	36	15	10	0	26	99	62	27	53	85	4	2	136	130	85	105	198	164	127	103	8	5	562	325	770	123	347	571	348	327	4	1	136	346	112	601	48	6	0	0	1	2	6																																				
40	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	4	0	8	1	15	0	0	0	5	2	7	2	17	3	12	0	0	0	73	12	2	5	0	0	0	0	0	0	0	0	1	1	1	2	21	0																																				
41	0	0	0	0	0	0	6	1	3	0	0	0	0	3	4	3	6	12	1	1	2	0	0	2	2	7	3	19	8	4	3	1	0	52	9	3	10	1	0	0	0	0	0	0	0	12	0	1	0	27	19	3																																				
42	1	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	4	4	1	1	0	0	3	4	7	6	1	4	3	2	0	0	44	10	0	2	1	0	0	0	0	0	0	0	0	0	2	2	1	4	0																																				
44	3	0	0	1	1	2	3	3	2	4	2	0	1	7	3	1	1	6	6	1	0	0	0	16	15	17	106	36	10	7	9	0	0	52	18	11	27	0	0	0	0	0	0	0	0	4	4	4	5	18	6	2	0	1																																				
45	6	13	11	2	1	7	27	18	14	14	24	2	8	93	41	40	29	109	85	90	30	12	7	335	223	425	378	489	440	188	139	7	0	130	210	18	121	53	2	0	8	0	2	18	3	568	11	121	48	214	10	3	2	2	2	0																																				
46	16	19	11	7	2	15	44	19	41	27	35	5	11	445	121	76	44	247	186	113	71	23	2	643	184	571	112	95	134	69	151	3	1	17	39	2	16	27	5	2	6	0	0	9	1	170	3	16	1	43	1	3	1	0	2	0																																				
47	5	6	2	0	1	3	12	1	11	4	13	2	1	204	27	4	8	82	57	28	14	1	2	123	18	44	9	7	12	5	4	1	0	3	3	0	0	1	0	0	0	0	0	8	0	18	0	0	0	1	1	0	0	0	0	2	2																																				
48	9	3	3	0	0	3	7	2	64	7	6	3	2	121	78	28	28	37	23	22	12	4	1	37	12	24	13	5	6	0	6	0	0	1	8	1	0	7	1	0	0	0	0	6	0	12	0	3	0	0	0	0	0	0	1	0	0																																				
49	57	73	52	6	5	109	300	75	950	281	153	10	22	228	317	215	187	221	170	76	95	27	6	253	92	320	34	63	104	25	70	3	8	36	29	5	13	24	7	0	17	0	0	48	6	62	3	13	0	67	1	0	0	3	3	3	1	5	0																																				
50	13	10	10	3	1	40	60	5	311	31	23	0	1	16	10	6	5	4	7	1	5	0	2	10	6	19	3	3	9	8	5	0	0	1	4	1	4	4	4	0	1	0	0	3	0	10	0	0	0	3	0	0	0	0	0	1	5	0																																				
51	19	17	15	45	11	774	470	52	481	481	199	10	32	426	526	340	177	781	371	316	168	60	23	1,036	451	1,438	174	302	418	173	334	22	1	85	131	26	85	69	2	0	6	0	3	76	23	2,520	5	26	7	344	3	4	6	7	46	39	9	17	131	30	6																																				
53	986	451	218	36	3	1,064	758	296	61	130	161	8	23	69	131	113	85	115	132	42	69	21	5	128	64	193	12	32	44	24	49	5	0	13	17	4	6	187	38	3	33	1	4	78	13	106	3	4	1	5	1	0	0	0	6	2	1	2	14	2	27	40																																				
58	421	195	115	4	0	41	52	31	14	15	26	2	4	10	28	11	22	23	24	15	17	4	4	26	10	35	5	8	22	19	14	3	0	1	1	1	3	70	7	0	34	2	8	3	2	28	0	1	0	4	0	0	0	0	0	3	1	0	3	1	7	23	27	
59	41	8	1	0	0	2	4	0	2	0	0	0	0	3	0	0	2	1	3	1	0	0	0	3	0	1	0	0	2	1	1	0	0	1	1	0	0	45	9	1	0	0	1	0	1	2	0	0	0	4	0	0	0	0	0	0	0	0	16	25	1	
Total	15,661	22,131	38,563	6,980	4,863	10,648	61,491	37,669	19,021	30,163	77,364	8,542	26,953	40,589	70,967	70,150	72,704	72,767	102,803	69,889	73,118	22,762	9,712	94,860	73,452	124,232	15,045	37,435	54,055	31,205	44,668	1,668	1,158	12,473	39,607	5,783	16,896	3,758	1,585	202	2,498	539	528	5,895	4,353	21,938	1,601	2,689	595	6,916	241	247	121	428	4,908	3,957	764	625	5,106	703	13,869	6,218	1,502	189

SUMMARY OF TOTAL VEHICLE TRIPS ALL MODES OF TRAVEL

INTERNAL	720,124
EXTERNAL	77,799
THROUGH	7,088
TOTAL	805,011

2) The factors which govern or reflect the patterns of trip distribution between zones.

TRIP PURPOSES

Since the production of trips in an urban area and the distribution of trips between zones in the area are directly related to the needs and desires which prompt people to move about, it was important to summarize the available origin and destination data by major trip-purpose categories for analyses. Previous studies have shown that many classes of trips can be combined for these analyses. Two main classes have been recognized in this study - *"home-based"* trips which have either origin or destination at the place of residence, and which account for more than 85 percent of all trips made by residents of the Phoenix Urban Area; and *"miscellaneous"* trips which have neither end at home and account for the remainder of the trips.

All principal purposes have been recognized in home-based travel as follows:

1) Work trips to and from home;
2) Business trips (business, medical-dental, and eat-meal) to and from home;
3) Shopping trips to and from home;
4) Social-recreational trips to and from home; and
5) School trips to and from home.

Other minor trip-purpose categories have been classed as work, business or shopping trips to and from home.[7] In addition to the five basic purpose classifications, miscellaneous trips - identified as travel from work to work; business to business; shopping to shopping; or movements between work, business and shopping - have been recognized.

As in most urban areas, it was found that about 40 percent of all trips in the Phoenix Urban Area are trips destined for home. The most important non-home motive for travel is work which constitutes about 18 percent of travel by Phoenix residents, which is slightly less than usually found. On the other hand, the proportion of business and shopping trips is somewhat higher than average in Phoenix (see Table 8).

Some of the movements reported in the home interviews represent only parts of *interrupted* trips - trips identified as *change travel mode*. These movements include trips which made use of both a car and a transit vehicle to move between trip origin and destination, and other trips reported by auto drivers which represented only incidental stops to *"serve passengers."* Such trip interruptions do not properly interpret the primary motive for making a trip. The interruptions were eliminated by "linking" the two or more parts of the basic trip and replacing these analytically

7. See Table A-5 in the Phoenix-Maricopa County Traffic Survey Report, 1956-57 for a detailed classification of trips in each possible category by purpose.

with a single trip representing true origin, destination, and purpose of trip. About half of the *"serve passenger"* trips represent travel which does not fall in the class of *"interrupted trips."* Examples are a mother driving children to or from school, or a wife taking her husband to work and returning home with the car. These trips have not been combined, but each segment has been re-identified with the purpose of the passenger.

Consolidation of all trips generated by residents of the Phoenix Urban Area by eliminating *"change travel mode"* trips and *"serve passenger"* trips reduces the total volume of generation for 1957 to 836,229 person trips per day.

Table 8

TRIP PURPOSE IN PHOENIX URBAN AREA
COMPARED WITH OTHER URBAN AREAS

Urban Area	Year of Survey	Percentage of Total Trips in Each Purpose Category						
		To Home	To Work	Business, Shopping	Work, Bus. & Shopping	Social & Recreat.	Other	Total
Detroit, Mich.	1953	39.5	23.5	13.3	(36.8)	12.1	11.6	100.0
Washington, D.C.	1955	41.7	23.4	14.8	(38.2)	7.1	13.0	100.0
St. Louis, Mo.	1957	40.6	20.7	15.1	(35.8)	12.4	11.2	100.0
Houston, Texas	1953	40.4	18.9	15.4	(34.3)	10.8	14.5	100.0
Kansas City, Mo.	1957	38.5	20.6	15.4	(36.0)	12.9	13.6	100.0
Dallas, Texas	1951	40.3	20.9	13.9	(34.8)	11.6	13.3	100.0
PHOENIX, ARIZ.	1957	37.6	18.2	16.5	(34.7)	11.2	16.4	100.0
Madison, Wis.	1951	36.2	20.6	12.1	(32.7)	14.2	16.9	100.0
Racine, Wis.	1951	35.7	22.0	12.6	(34.6)	15.1	14.6	100.0

Table 9 summarizes the internal trips by residents of the Phoenix Urban Area by seven principal purposes, with interrupted trips removed and work trips divided into two classes. Of the total 836,229 trips made by the 397,395 residents of the area, over one-fourth were made between home and work (10.6 percent for "white collar" work; 14.7 percent for "blue-collar" work); more than 10 percent between home and places of business; nearly 18 percent between home and retail establishments; and over 20 percent for social or recreational purposes. Nearly 15 percent were classed as miscellaneous trips, while the remainder (11.7 percent) represent travel to and from school (see Figure 17).

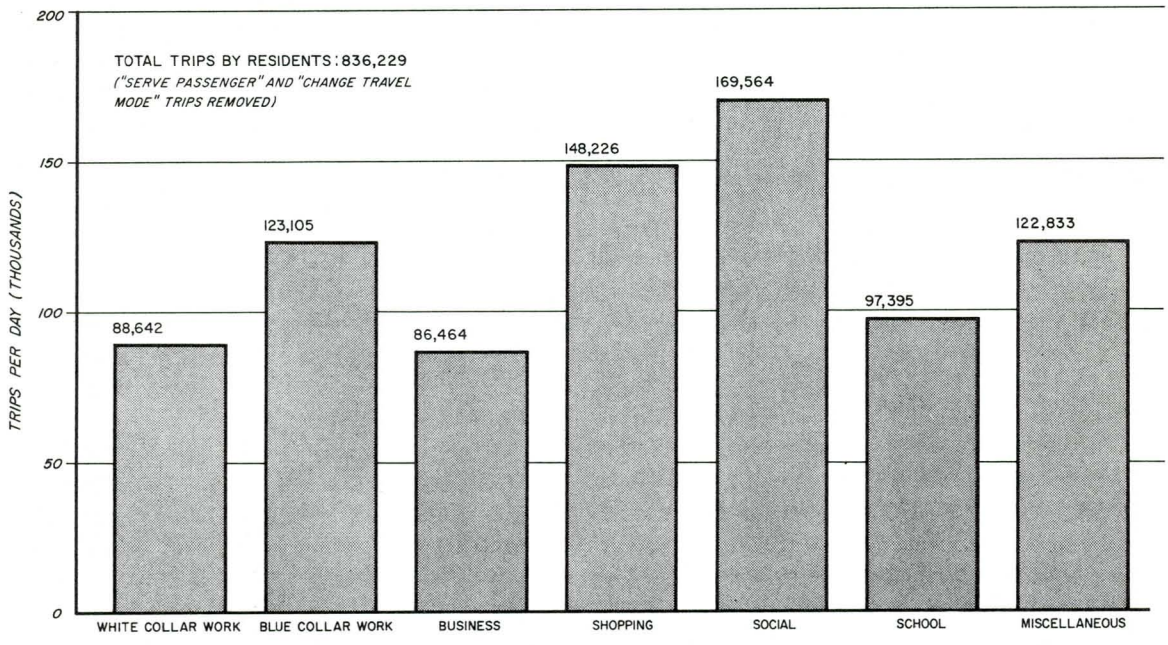
Appendix Table C summarizes the distribution of 1957 trip termini by zones and by trip purposes. Trip termini at residences are distinguished from termini at the "purpose" end of trips. A more detailed listing of trips between each pair of zones and between the zones and external stations, classified by trip purpose, was also prepared. This tabulation is too lengthy for inclusion in this report, but is available for review.

Table 9

TOTAL INTERNAL PERSON TRIPS BY PURPOSE
Phoenix Urban Area

Purpose Classification	Consolidated Number of Person Trips	Percentage of Total Person Trips
"White Collar" Work	88,642	10.6
"Blue Collar" Work	123,105	14.7
Business	86,464	10.3
Shopping	148,226	17.7
Social	169,564	20.3
School	97,395	11.7
Miscellaneous	122,833	14.7
Total	836,229	100.0

* "Serve passenger" and "change travel mode" trips removed.



1957 TRAFFIC GENERATION
PHOENIX URBAN AREA - MARICOPA COUNTY

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STATISTICAL ESTIMATES AND PROJECTIONS

The dominant uses of land in each zone were expressed statistically for analyses of trip generation characteristics. The significance of residential use in each zone is shown by the relative number of homes and residents. As previously noted, the dwelling unit is an origin or destination for about 85 percent of all daily travel. The number of jobs in each zone identifies the commercial and industrial importance of the zones, and is a useful index of the generation of work trips. Experience has shown that the generation of social travel is directly related to the resident population in each zone, while the amount of commercial activity in each zone is, in general, related to the volumes and distribution of retail sales in the area.

In addition, direct relationship can be established between trip production and median family incomes, automobile ownership and the decentralization of zones measured in minutes of driving time from the central business district. Zones near the center of the city were part of the earliest urban development, contain some of the oldest and least attractive dwellings, and are more densely occupied than zones in the suburbs. Public transit provides its most efficient service to these central zones. Toward the periphery of the urban area, trip production is influenced by the relative isolation of zone residents and the general lack of transit service.

Statistical estimates and projections of population, employment, median family income, automobile ownership and retail sales were prepared for the enlarged 1980 Study Area shown in Figure 14. These statistics, tabulated in Appendix Tables D and E by zones, were based on data collected in the 1956-57 home interview origin and destination study; records of the Arizona State Employment Security Commission and State Tax Commission; data in the report "Inside Phoenix" by the Phoenix Republic and Gazette; various statistical reports published by the Valley National Bank of Phoenix; data included the report "Population Growth of the Phoenix Urban Area" by the Phoenix-Maricopa County Advance Planning Task Force, and related economic investigations made by Western Business Consultants of Phoenix, Arizona.

POPULATION

As previously noted, the design year population of the future Phoenix Urban Area, exclusive of the cities of Mesa, Tempe, Scottsdale and Glendale, has been taken as 1,000,000 persons in accordance with estimates prepared by local planning agencies. This figure is based on a total 1980 population of Maricopa County equal to 1,440,000. For the purposes of this study, it was assumed that the 1980 population of the enlarged 1980 Study Area, which includes Mesa, Tempe, Scottsdale and Glendale, will be about 1,250,000 or about 90 percent of the estimated 1980 population of the county. The 1957 population of this 414 square mile area was about 466,200, based on the results of the home interview study and other available estimates. (See Appendix Table E for the zonal distributions of 1957 and 1980 population estimates.)

EMPLOYMENT

Records maintained by the State Employment Security Commission indicate that non-agricultural wage and salary earners in Maricopa County averaged about 140,613 in 1957 of which about 122,760 were employed in the 1980 Study Area. Table

10 summarizes these 1957 employment statistics and the projections to 1980 developed for this report. Non-agricultural, wage and salary employment (excluding agricultural workers and self-employed) has been projected to a level of 310,000 jobs in the study area - about 2.5 times the present level of employment. Employment in the Phoenix downtown area (CBD) has been projected from a level of about 21,000 jobs to 43,000 jobs. This projection is based on tentative conclusions regarding future office employment in private industry, and employment in retail trade in this area, reported by Western Business Consultants.[8] Based on these conclusions, office employment in the central business district can be expected to more than double between 1958 and 1980 if sufficient competitive prime office space will be available; employment in retail trade in the central business district can be expected to increase to 1.6 to 2.9 times the 1958 level by 1980, the amount depending on what steps are taken to increase the shopping appeal of this district. Zone by zone estimates of 1957 and 1980 employment in the study area are listed in Appendix Table E.

Table 10

ESTIMATED AND PROJECTED EMPLOYMENT BY CLASSIFICATION*
Phoenix-Maricopa County Urban Area

Employment Classification	Average No. 1957 Employed			Average No. 1980 Employed		
	County	Study Area	CBD	County	Study Area	CBD
Natural Resources	14,743	13,500	430	37,000	32,000	1,500
Manufacturing	23,268	20,700	1,532	98,000	86,000	3,500
Transp.-Utilities	11,243	10,500	2,313	90,000	25,000	6,000
Wholesale, Retail Trade	34,792	32,300	6,761	82,000	71,000	12,000
Fin., Insur., Real Estate	7,946	7,500	3,682	19,000	18,000	8,000
Services	9,316	8,800	2,213	26,000	21,000	5,000
Professional	12,760	11,300	837	35,000	28,000	2,000
Government	21,521	13,160	2,917	35,000	29,000	5,000
Adjustment**	5,024	5,000	414	---	---	---
Total County	140,613	122,760	21,099	362,000	310,000	43,000

* Non-agricultural wage and salary earners covered by unemployment compensation. See Appendix Table F for detailed summary by zones.

** Seasonal adjustment to average employment level.

8. Central Business District Report No. 3 "Growth Potential of the Phoenix Central Business District," by Western Business Consultants; Phoenix, Arizona, July 14, 1959.

RETAIL TRADE

Retail sales volumes for the study area were projected in proportion to expected population growth. The present distribution of retail sales was estimated by coding actual sales tax records maintained by the State Tax Commission. On the basis of these data, it appears that about 22 percent of the total retail sales of the study area (18 percent of the total in the county) take place in the Phoenix downtown area. It does not appear likely that this area will maintain its present share of the total retail trade volume in 1980. Western Business Consultants report the following:[9]

> "In light of recent trends in retailing, the shopping preferences of consumers, the probable growth of competing regional shopping centers, and other considerations, it hardly seems realistic to assume that growth of retail trade in the central business district will keep pace with that in the county as a whole. Yet it may be possible that the retail business of the central business district could grow at a very substantial rate if improvements were made in the district and surrounding area that would cause consumers to regard the district as an outstanding shopping center. What such improvements might be, how much business they might attract, and whether the additional business would be worth the cost and effort involved is beyond the scope of this report.
>
> "If major improvements are not made that will increase the shopping appeal of the central business district, it would seem probable that the retail market of the district would be made up of:
>
> (1) consumers living nearby for which the district was a convenient shopping center;
> (2) persons working in the district;
> (3) some shoppers living beyond the 'convenience limit' who would continue to prefer downtown stores; and
> (4) other shoppers who could be induced occasionally to come past the outlying regional shopping centers because of something special that was offered downtown.
>
> "A very rough estimate of this composite market suggests that it might provide retail sales of around $200 million for the central business district in 1980 at current prices, if county sales were to reach the already mentioned figure of $2 billion, assuming that major improvements were not made within the central business district and that accessibility to the district from outlying residential areas was not substantially improved.
>
> "If retail sales in the central business district were $200 million in 1980, it is

9 Central Business District Report No. 1, "The Retail Growth Potential of the Phoenix Business District," by Western Business Consultants, Phoenix, June 26, 1959.

estimated that about 3.6 million square feet of gross floor space would be required as compared with 2.35 million square feet in 1958 (a 55 percent increase)."

The projected distribution of retail trade in the study area, shown in Appendix Table E, includes a 60 percent increase in the downtown area. This estimate is based on the preliminary conclusions reached by Western Business Consultants regarding the growth potential of the Phoenix downtown area adjusted in consideration of improved access to this area which can be expected with the development of a modern major street and highway system as proposed in this report. The distribution of retail trade in other areas was based on a study of the sizes and locations of all known shopping centers present and planned, the 1957 distribution of retail trade, and the future distribution of population with respect to major shopping areas.

MEDIAN FAMILY INCOME

Previous studies have shown that relative family income is an important factor in predicting the volume of trip generation in residential zones. Estimates of median family income levels by zones, shown in Appendix Table E, are based on family income statistics published by the Phoenix Republic and Gazette,[10] the 1950 U.S. Census of Housing, and judgment with the assistance of the Advance Planning Task Force. Median family incomes for each zone were classified in ascending order as follows:

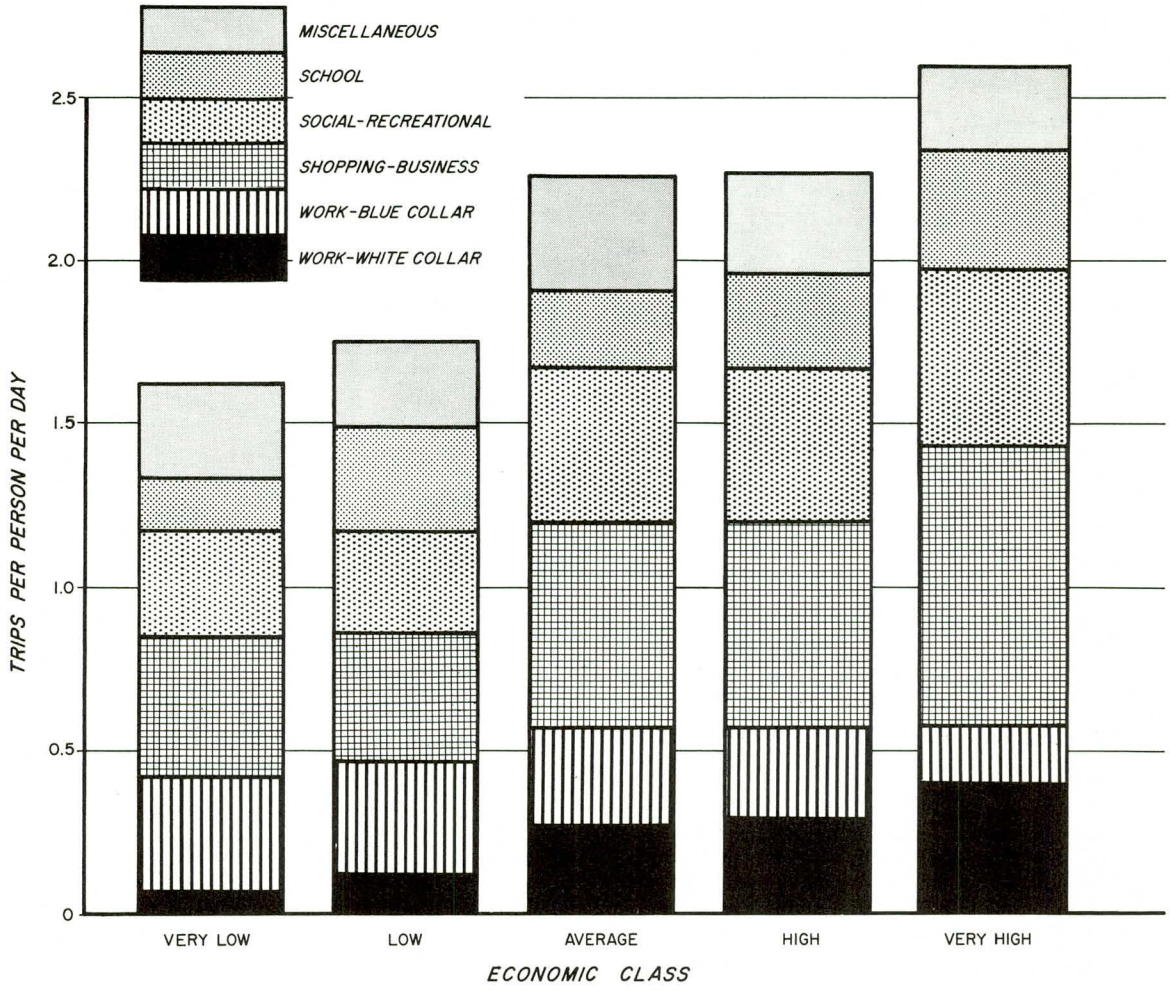
Economic Class	Median Annual Family Income	General Description
A	Less than $3,000	Very low
B	$3,000 to $5,000	Low
C	$5,000 to $7,000	Average
D	$7,000 to $10,000	High
E	Over $10,000	Very high

As shown in Figure 18, the rate of trip production in the Phoenix Urban Area tends to increase with increases in family income. The rate of business and shopping trips by residents in class E (high income) zones is very much greater than for the lower income classes. Persons in the lowest economic group average 1.2 non-work trips per person per day while those in the highest economic group average more than 2.0 non-work trips per person per day. Differences in work trip production are not so great, although the difference between the rate of generation by white and blue collar employment is very pronounced.

AUTO OWNERSHIP

In 1957, there were 201,517 private automobiles registered in Maricopa County; there were about 2.6 persons per registered auto. (The 1957 origin and destination

10. "Inside Phoenix", Sixth Annual Report; published by the Phoenix Republic and Gazette; 1959.



EFFECT OF FAMILY INCOME ON TRIP GENERATION

PHOENIX URBAN AREA, MARICOPA COUNTY

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survey determined that there were about 2.82 persons per auto *owned* in the Phoenix Urban Area.) The number of persons per registered auto in Maricopa County has been decreasing for many years. Future decreases are expected to be moderate since the level of ownership is already high and since there appears to be a practical or saturation limit to auto ownership. Since the number of persons eligible to drive is generally less than two-thirds of the resident population, and since some drivers share their cars with others, it is not reasonable to expect car ownership to exceed a ratio of one car for two drivers in any but the most exclusive neighborhoods. It is estimated that the over-all ratio of persons to registered autos for Maricopa County will decrease to about 2.3 by 1980. This ownership level will result in about 610,000 registered autos in the county in 1980 compared with about 201,000 in 1957 (see Figure 19). Auto ownership in the 1980 Study Area is expected to increase from about 164,700 in 1957 to about 500,000 by 1980.

The distribution of the estimated and projected automobile ownership in the study area is shown in Appendix Table E. These estimates are based on existing ownership ratios and known relationships between car ownership and the relative economic levels of residents of various zones. Ownership ratios in the Phoenix Urban Area decrease from an average of about 4.0 persons per car in zones of economic class A (low income) to about 2.2 persons per car for zones in economic class E (high income).

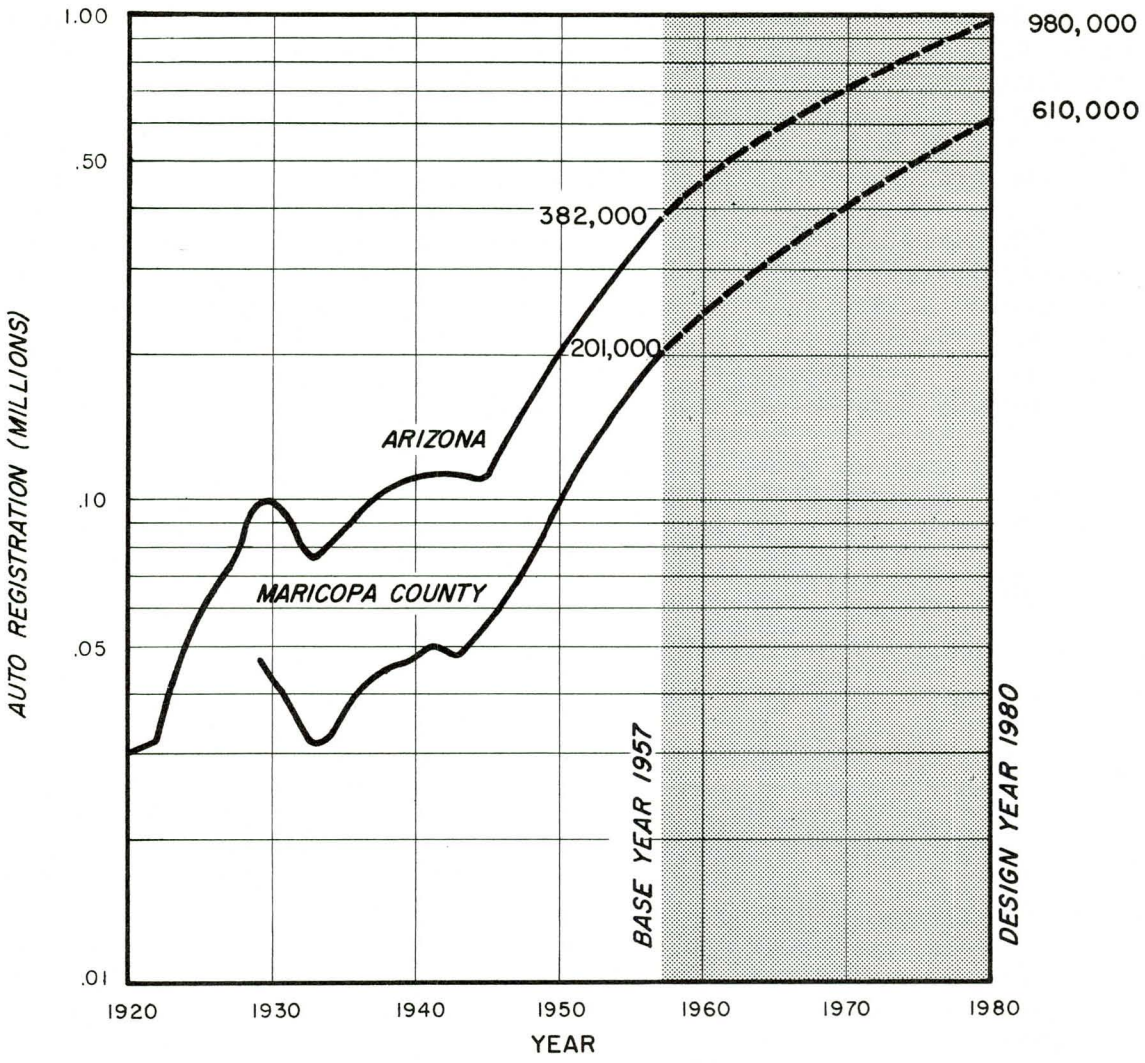
TRAVEL TIMES

Previous studies have shown that the pattern of trip distribution between zones is directly proportional to the number of trip attractions in the zones, and inversely related to the travel time between zones. Estimates of auto driving time between every possible pair of zones were prepared for off-peak conditions in the 1980 Study Area. Data obtained in the speed-delay studies, described in Part I of this report, were used in these computations for typical major street travel. Travel time on major streets in 1980 were estimated based on the 1957 speeds with adjustments where appropriate to account for the effects of major street and highway improvements. Speeds on a modern, high-speed primary highway network proposed in this report were assumed to range between 40 and 60 miles per hour in accordance with actual operations on similar facilities already constructed in other areas.

For the rapid summarization of these estimates, a series of "control points" were established throughout the study area. Direct routings were determined, and estimated travel times recorded, for travel between each zone centroid and these control points and between each pair of control points. Total travel times between each pair of zone centroids were compiled mechanically.

ESTIMATED 1980 TRAFFIC GENERATION

Many of the zones in the urban area are *stable*; that is, the pattern of land use and trip generation are well established. Most of the unmeasured forces which have contributed to unique patterns of trip production in these stable zones would continue to exert their influence in future years. By assuming that the 1957 rates of trip production are normal for stable zones, and making modifications in projection to account for such basic changes as increased auto ownership, different levels of



AUTO REGISTRATION TRENDS

MARICOPA COUNTY, STATE OF ARIZONA

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income, or other predictable conditions, the resulting estimates of 1980 travel will be weighted for the special unmeasured conditions.

Note that this approach is considered to be valid for stable zones. Zones which undergo much change are another case. The unique character of rapidly growing

zones tends to be lost while a new set of characteristics develops, so that the advantage of analogy with current conditions is lost. The application of formulae derived from relationships between trip production and land use statistics in stable zones is more reliable under these condtions.

CORRELATION ANALYSES

A series of correlation analyses have been made which relate the number of trips made by residents of each zone to the combined influences of the factors enumerated above. An estimate of trips per day per person, according to trip purpose and income group, can be developed from the several equations thus prepared. Typical of these formulae is the equation for work trips produced by "white collar" workers in zones of economic class C.

$$X = 0.482 + 1.516\,C - 0.056\,M - 0.036\,P$$

Where X = work trips per day per resident worker in zone

C = car ownership (average number of cars per dwelling)

M = driving time to central business district (minutes)

P = population density (persons per square mile)

For purposes other than work, the trip rates developed from the equations have been expressed in trips per person, rather than trips per worker.

Although the trip estimating formulae do not purport to produce perfect trip generation estimates, statistical tests of the reliability of the values made by applying these formulae to 1957 land use data and comparing the travel thus determined with actual 1957 travel, produce satisfactory results.

ESTIMATING 1980 INTERNAL TRIPS "AT RESIDENCE"

Estimates of 1980 trip production in each zone have been made according to the reasoning outlined above. Stable zones were defined as those in which the resident population did not increase by more than 100 percent or decrease to less than 50 percent of 1957 levels. Trip projections in zones which meet this criteria were based on 1957 trip rates found in each zone, modified by changes in vehicle ownership. Trips made by the populations of all other zones were produced by applying the regression equations described above. All zones located in the area between the 1957 and 1980 cordon lines were included in the latter category.

The total number of projected (1980) trips by future residents of the urban area, according to purpose, are listed in Table 11, By 1980, about 2,838,000 trips by residents must be served in comparison with about 836,000 trips in the 1957 urban area. Figure 20 illustrates the tremendous growth expected for each trip purpose.

Table 11

COMPARISON OF TRIPS BY RESIDENTS, 1957 AND 1980
Phoenix Urban Area

Purpose	Number of Person Trips - 1957*	Number of Person Trips - 1980**
Work (white collar)	88,642	664,537
Work (blue Collar)	123,105	
Commercial, Business	86,464	761,189
Commercial, Shopping	148,226	
Social	169,564	624,656
School	97,395	263,892
Miscellaneous	122,833	523,846
Total	836,229	2,838,120

* 1957 Study Area (225 square miles)
** 1980 Study Area (414 square miles)

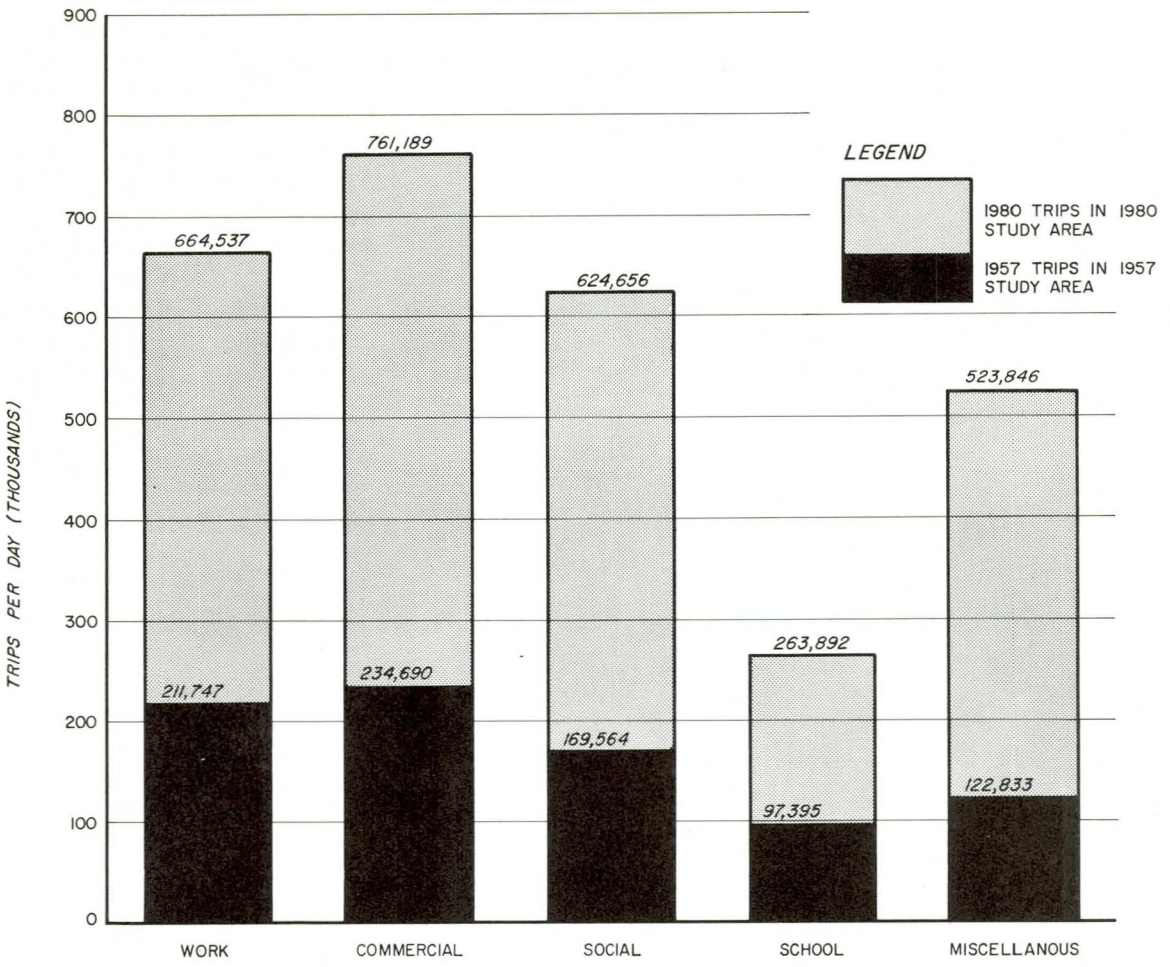
ESTIMATING 1980 INTERNAL TRIPS "AT PURPOSES"

Most of the trips made by the residents of each zone begin or end at the home. The only exceptions are "miscellaneous" trips which, by definition, have neither end at home. All of the "home-based" trips must have their non-home ends at the generating purposes.

Termini at the purpose end of trips have been estimated largely by analogy techniques. Growth factors have been developed from the statistical forecasts, based on the changes from 1957 conditions. The procedure for estimating 1980 trips at purposes may be described as follows:

Work Trips to and from places of employment have been developed in two categories, for (a) "white collar" and (b) "blue collar" jobs. In stable zones (those with projected employment more than half but less than two times the 1957 level) the 1957 ratio of trips per job has been applied to 1980 jobs. In zones where 1980 employment has been projected at less than half or more than twice the 1957 level, the average rate (trips per job) prescribed by the 1957 regression equations have been applied to 1980 employment figures. The total number of home-based trips at employment has been set equal to internal work trips generated at home, plus non-resident work trips which cross the external cordon line. "White collar" and "blue collar" trips were handled separately throughout this procedure.

Commercial Trips (shopping and business travel) were processed very much like work trips. Dollar volumes of retail sales (computed from sales tax data) were the criteria against which trip-generation characteristics were measured, except in those zones where a considerable proportion of the 1957 trips were generated by business uses rather than at retail centers. An area-wide growth factor, based on



INTERNAL TRIPS BY PURPOSE 1957-1980

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the percentage change in over-all population, 1957 to 1980, was applied to 1957 commercial trips in these latter zones. Trip totals for commercial purposes were then balanced against the trips generated at home and by non-residents at the external cordon.

Social Trips consist of two major classes of trips, (a) the "social" travel from one dwelling to another, and (b) the "recreational" travel between homes and theatres, parks, and other recreational attractions. Zones in which recreational travel was an important consideration were identified by the disproportionately large number of trips per household reported in the social category. In such zones, one or more recreational facilities was identified as the special trip generator. Trips in these zones were projected by applying the over-all social trip growth factor to the number of trips reported in the 1957 study. Social trips generated in other zones were related directly to zone populations, following the procedures described for work trips. The over-all number of non-home social trip-ends were then balanced to the total volume of social trips generated in the homes and those by non-residents at the cordon.

School Trips were handled much like social trips, with special consideration given to the relatively few high schools and colleges in the study area.

Miscellaneous Trips were estimated as a proportion of the work and commercial trips generated at those purposes. The total number of miscellaneous trips was determined in the estimates of trips by residents. Trip-ends equal to twice the number of trips have been distributed to the zones.

The distribution of the estimated 1980 internal trip production by future residents of the 1980 Study Area is shown in Appendix Table G. Trip ends "at residences" and "at purposes" are listed separately.

ESTIMATING INTERNAL TRUCK TRIPS

Estimates of 1980 truck trips in zones have been prepared by analogy with 1957 truck information. A 1957 truck-trip index was prepared for each zone, much as was done for work trips at places of employment in the stable zones. The 1957 index value for each zone was then modified to take into account the land use changes and over-all growth expected in the study area by 1980. The 1980 components of the index - percentages of population, employment, and retail sales - were expressed in terms of 1957 values, automatically compensating for over-all metropolitan area growth. The 1957 trip rate in each zone was computed by adding together the percentages of total population, employment, and retail sales accounted for in the zone and dividing the resulting value into the truck trip-ends generated in the zone. This rate was applied to the 1980 index value to derive the estimate of 1980 truck trip-ends in the zone.

The preparation of 1980 trip-ends in this manner assumes that the future trip-generating qualities in each zone will remain substantially as they are at present. Zones in which very large changes are expected, and all zones between the 1957 and 1980 cordon lines, were evaluated by analogy with more intensively developed zones of similar characteristics; i.e., trip rates typical of well-established zones were assumed to apply to the areas of new trip generation.

Internal truck trips are expected to comprise about 22 percent of all vehicle trips in 1980.

PUBLIC TRANSIT

It was not within the scope of this study to prepare recommendations concerning public transit services. It was, however, essential to the estimation of future patterns of vehicular travel to reach general conclusions regarding the role of transit in the future urban area.

Public transit has been recognized in this study as a highly desirable, if not essential, element in the over-all plan for moving people and goods in the Phoenix Urban Area. It is a matter of sound economics to strive for a practical balance between private and public transportation. The greater efficiency of the motor bus in comparison with private automobiles in the utilization of city streets - especially in peak hours of traffic demand - has been proven. In a study published in 1957 by the U. S. Bureau of Public Roads,[11] it was determined that buses are more than seven times more efficient than automobiles on freeways in terms of utilizing roadway space and transporting people. It was further determined that buses are almost four times as efficient as automobiles on downtown streets and over twice as efficient in outlying areas.

In addition to efficient street utilization, public transit is needed to serve "necessity-riders" - people who cannot afford an automobile, cannot drive or do not have the use of an automobile for other reasons. There are also people who prefer to take advantage of public transit service if the over-all patronage supports a reasonably frequent schedule, if transit trip travel times are kept within reasonable limits in comparison with typical travel times for similar trips by private automobiles, if transit stops are conveniently located, and if the buses are kept clean and attractive.

If public transit can be made attractive to a substantial segment of the traveling public, a better balance will be obtained in the transportation program of the urban area. However, the use of public transit in Phoenix has experienced a large decline during the last decade, while the number of persons utilizing private automobiles has greatly increased. The use of transit in the Phoenix Urban Area in 1957 was 20 percent less than in 1947. During this 10 year period, the population of the surveyed areas increased by more than 145 percent. All transit trips, except those to and from school, decreased from 53,981 to 19,535 per day. Thus, non-school transit trips declined by 36 percent between 1947 and 1957. School trips, on the other hand, increased from 17,337 per day in 1947 to 38,042 per day in 1957.[12]

In 1957, transit services in Phoenix were provided by two transit systems - the Phoenix Transportation System (municipally owned) and the Valley Transit Lines (privately owned). The Phoenix Transit System served 74.65 square miles of the urban area, while the Valley Transit System served 83.70 square miles with about 20 square miles of duplicating services.

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11. "The Efficiency of Public Transit Operation in the Utilization of City Streets," by the Division of Highway Transport Research, Bureau of Public Roads; October, 1957

12. These values are as reported by the home interviews with "interrupted" trips removed.

The Phoenix Transit System produced $725,030 in revenue in 1958 which was $101,974 short of meeting its expenses, resulting in an operating ratio of 114 percent. The average fare per revenue passenger on the city lines was only 19.8 cents. Patronage failed to adequately support even a few of the lines so that most of them were quite consistently in deficit operation throughout the year. Like most transit systems throughout the country, this system lost more than fifty percent of its riders since 1950 at the same time that unit costs increased. Fare increases and reductions in service failed to off-set the patronage decline and the over-all rise in operating costs, resulting in deficit operation.

The Valley Transit Lines produced revenue of $742,627 in 1958 while operating 2,046,843 miles. Data are not available on the individual route performance for 1958, but the 1959 history of the Valley Transit Lines has shown that some lines operated at a profit, which enabled the system as a whole to show a profit. However, the patronage on some routes in the sparsely settled areas was too low for efficient operation.

A 1957 study of the scope and quality of transit service in the Phoenix Urban Area made by local agencies determined the following:

1) Existing transit routes were as direct between the principal residential areas and the Phoenix downtown area as existing streets permit.

2) Service to the industrial areas was poor but little need exists for such service.

3) Cross-town service between secondary business centers was poor.

4) Service to and from schools was good.

5) Route duplication was excessive between the two companies.

6) No feeder routes were used by either company.

7) Walks to the transit line varied from one-quarter mile to one mile, depending on the population density and income level of the area.

8) Convenient transit routing was impossible in some areas because of poor subdivision planning.

9) Express routing was not practical or efficient at that time.

10) Areas with high family income, high home valuation and high auto ownership produced little transit riding, whereas areas with low family income, low home valuation and low auto ownership produced frequent transit trips.

11) The percentage of seating capacity was low for both the rush and non-rush periods as compared to the accepted standard.

12) The standard for frequency of service at maximum load points was in excess of maximum requirements.

13) Conditions justifying no frequency of service at all were found to exist prior to 6:00 a.m. and after 9:00 p.m.

14) The number of passenger stops in residential and commercial areas was in excess of the accepted standard.

15) Transit speeds were as high as practical consistent with existing traffic conditions.

16) Schedule adherence was found to be good.

17) Transit would be benefited by bus " turnouts " for passenger loading on primary transit routes.

The merging of the former competing companies into a unified system in April 1959 has permitted the establishment of improved efficiency of transit operations. The elimination of duplication of service and unnecessary transferring will in itself be of great benefit to both the operating company and the riding public.

The decline in transit patronage in the Phoenix Urban Area in recent years is consistent with a national trend. However, despite adverse trends, it is not reasonable to expect that the decline in the absolute volume of transit patronage in the Phoenix Urban Area will continue. The number of non-school transit trips is already close to the practical minimum; these trips can be expected to increase as the city grows if adequate services are provided. The development of modern major street and highway facilities will permit significant reductions in transit travel times and operating costs, resulting in a more efficient transit operation and increased patronage. The establishment of express routings will become practical with population growth and the construction of freeways. It can also be expected that increased business activity and employment in the downtown area, coupled with possible limitations on available parking space near major traffic generators, will result in increased transit riding. Accordingly, traffic projections have been based on the assumption that adequate public transit facilities will be provided to serve about 75,000 trips per day by 1980. This estimate represents a substantial increase over the 1957 absolute volume of transit use, but a moderate decline in the proportion of the total trip production served by transit. The existing and planned low densities of land use development, anticipated high levels of automobile ownership, and trends in transit use do not support optimism regarding a greatly expanded role for public transit in Phoenix.

SUMMARY OF 1980 INTERNAL TRIP GENERATION BY MODE OF TRAVEL

As summarized in Table 12, about 2,338,000 internal vehicle trips per day are expected in the Phoenix Urban Area by 1980. Of this total, about 1,818,000 trips per day will be made by auto drivers with 520,000 trips per day by trucks. These estimates

are based on typical vehicle occupancy ratios for various trip purposes determined in the 1956-57 traffic study.[13]

Table 12

SUMMARY OF 1980 INTERNAL TRIP GENERATION
BY MODE OF TRAVEL

Mode of Travel	Average Daily Trips
Auto Driver Trips	1,818,530
Truck Driver Trips	519,288
Total Driver Trips	2,337,818
Auto Passengers	831,318
Transit Trips	76,656
Total Person Trips	2,726,504*

*Excludes truck driver trips.

EXTERNAL AND THROUGH TRIPS

External and through trips accounted for about 9.5 percent of the total generation of vehicle trips in the 1957 Study Area (about 84,900 trips per day, of which about 8.3 percent were through trips). Total traffic at the 1957 external cordon was about 92,000 vehicles per day (through trips are measured twice at the external cordon). As shown in Table 13, the estimated 1957 traffic at the cordon of the expanded study area is 58,500 vehicles per day.

External and through traffic volumes are not expected to increase uniformly on all facilities which cross the 1980 cordon line. New highways, particularly proposed freeway and expressway routes, will alter the pattern of traffic distribution at the external stations by diverting traffic from less attractive roads. Urbanization will also be more rapid in some areas than others. It is estimated that traffic at the 1980 cordon will increase from about 58,500 trips per day in 1957 to about 200,000 vehicles per day by 1980. About 12,000 trips per day of this total will consist of through trips, while about 176,000 trips per day will have a terminal in the Phoenix Urban Area.

Through trips will represent only about six percent of the total traffic at the external cordon in 1980 - a lower proportion than in 1957 because the 1980 Study Area includes the urbanized areas adjacent to Phoenix which were outside the 1957 Area.

ESTIMATED TRAVEL BETWEEN ZONES

Analysis of trip distribution between zones is a distinctly different problem from the analysis of trip production within the zones. The estimating of trip *quantity*, described above, is a quite straight-forward procedure. Trip distribution on the other hand, reflects the *quality* of access between trip termini and competing trip attractions.

13. Tables 6A and 6B; Average Automobile Occupancy by Trip Purpose; Phoenix-Maricopa County Traffic Study; 1956-57.

Table 13

ESTIMATED AVERAGE DAILY TRAFFIC AT
1980 EXTERNAL STATIONS; 1957-1980

Station	Street or Highway[1]	Average Daily Traffic 1957	1980
40	Dobbins Road	200	500
41	Baseline Road	300	1,500
42	Southern Avenue	100	4,200
	Subtotal	600	6,200
59	59th Avenue - 35th Avenue	0	2,500
60	Black Canyon Highway[2]	4,200	16,200
61	19th Avenue - 7th Street	100	3,500
62	Cave Creek Road - Tatum Blvd.	1,600	4,700
63	Scottsdale Road - Pima Road	100	1,500
	Subtotal	6,000	28,400
64	Bee Line Highway	500	1,500
65	Apache Boulevard[2]	8,500	26,800
	Subtotal	9,000	28,300
66	Gilbert Road	3,600	9,000
67	Arizona Avenue	8,700	15,700
68	McClintock Road - Highline Drive[2]	2,200	23,400
	Subtotal	14,500	48,100
69	Lower Buckeye Road	400	1,000
70	Broadway[2]	0	18,100
71	Buckeye Road	4,900	8,400
72	Van Buren Street	3,900	7,700
73	McDowell Road[2]	800	11,700
74	Thomas Road	600	2,000
75	Indian School Road	2,600	9,800
76	Camelback Road	700	2,000
77	Bethany Home Road	600	4,000
78	Glendale Avenue	4,900	7,700
79	Northern Avenue	500	1,000
80	Grand Avenue - Peoria Avenue	8,500	15,600
	Subtotal	28,400	89,000
	Total Volume at all External Stations	58,500	200,000

1. At 1980 External Cordon - See Figure 14 for locations of these stations.

2. Location of proposed Freeway route.

Patterns of trip distribution lack the stable characteristics of trip production. While the number of trips to be distributed between one zone and all others may be readily predicted, the pattern of distribution is highly variable. Populations in a particular zone may produce trips at substantially the same rate, day after day, year after year. But, as the community grows, as new concentrations of employment arise, as new shopping centers are built, as other changes in land use develop, and as new high-speed highways are constructed, the patterns of travel must be expected to undergo radical change.

Trip patterns are dynamic in character; they respond to competition, changes in the direction of urban growth, and the transition from public to private transportation. Thus, it is imperative that the forces which create change be recognized and that means of evaluating them be found.

DEVELOPMENT OF "INTERACTANCE" CURVES FOR INTER–ZONAL TRAVEL

Previous studies have shown that trip distribution between zones may be described by *interactance* or *gravity* curves which express the basic characteristics of urban traffic patterns. The pattern of trip distribution between one zone and all others is directly proportional to the number of trip attractions in each other zone and inversely related to the travel time between zones.

In practical application of these principles, it is found that most urban travel consists of a very large number of small inter-zonal movements, with relatively few movements of very large magnitude, and even fewer when the movements are further subdivided by trip purpose. Therefore, rather than considering each zone-to-zone movement individually, the entire study area was divided into five "'rings" established at three-minute increments of driving time from the central business district. The number of trips for each purpose made by residents of each zone to all other zones within each ring was accumulated; the rates of travel between the dwellings in each zone and the trip attractions in each ring were then computed. The required interactance curves were developed by plotting these trip generation rates against off-peak driving time between zones on semi-logarithmic paper. The grouping of trips from each zone to all other zones within three minutes of driving time affords much greater statistical stability than would be obtained by consideration of each individual inter-zonal movement.

Interactance curves for the distribution of trips at *"purpose generators"* back to places of residence were also prepared following procedures similar to those described above for trips generated at the home. These curves for the Phoenix Urban Area are very similar to those developed for other large urban areas. It can, therefore, be assumed that the basic relationships they describe can be applied with confidence to predict the trip distribution pattern of the future urban area.

INTRA–ZONE TRIPS

A modification of the interactance method was applied to derive the number of intra-zone trips by purpose in each zone. The number of intra-zone trips is a function of both the number of trips made by residents and those with "purpose" destinations in the zone under consideration. Thus, although many work trips may be made

by the residents of a particular zone, few or no intra-zone trips will result unless there is a considerable amount of employment in the zone. Likewise, a zone which consists entirely of a major shopping center will attract many commercial trips to it, but there will be few or no intra-zone trips because of the lack of resident population within the zone. Zones with mixed land uses, having considerable residential development as well as employment or shopping attractions, generally develop the greatest proportions of intra-zone trips. The number of intra-zone trips is also indirectly proportional to the area of the zone, in that larger areas are more likely to include a greater variety and amount of mixed land uses.

The 1980 volumes of intra-zone trips were estimated by analogy with the 1957 data. A somewhat smaller proportion of the total trips are expected to fall in the intra-zone category in 1980 due to longer average trip lengths throughout the urban area of the future.

1980 INTER–ZONAL TRAVEL PATTERNS

Intra-zone trips and transit trips were subtracted from the estimates of total trip ends for the application of "interactance" curves to establish inter-zonal travel patterns. Rates of trip interchange between zones were taken from the "interactance" curves and applied by the use of high-speed electronic computers. For example, the relative rate of travel for home-based work trips (taken from the interactance curves for this type of trips) was multiplied by the number of inter-zonal work trips made by residents of zone A and by the number of work trips generated by employment in Zone B. A similar computation was made with the curves for work-based trips, applying values from them to the number of trips generated by employment in Zone A and multiplying by work trips made by residents of Zone B. Thus, two sets of estimates were developed for work travel between the two zones: work trips made by Zone A residents and work trips generated by Zone B jobs. Similar pairs of estimates were developed for trips of each purpose category between each other pair of zones. When this was done, pairs of estimates had been produced for each class of work travel between each pair of zones as follows:

1) Trips between the residents of Zone A and work trip generators in each other zone, and trips between work trip generators in each zone and residents of Zone A; and

2) Trips between jobs in Zone A and residents of each other zone, and trips between residents of each other zone and jobs in Zone A.

These pairs of estimates were averaged to produce a first approximation of work trips generated by residents and jobs throughout the area. The total number of trip ends for individual zones, resulting from this first approximation, required adjustments to maintain the estimates of total trip ends by purpose which were previously established as discussed in foregoing paragraphs. These adjustments were made mechanically by a series of successive approximations to produce a well-balanced estimate of travel in which the total trips attributed to each zone were in consonance with the number and character of trip generators in the zone.

Appendix Table H summarizes the resulting estimates of 1980 internal travel

between zones by mode of travel.

EXTERNAL TRIP DISTRIBUTION

The distribution pattern for the projected external trips in the future urban area was estimated by analogy with the 1957 patterns with appropriate modifications for major land use changes and probable traffic diversion to new highway routes. Appendix Table I summarizes the estimated 1980 external traffic pattern by mode of travel. The heaviest volumes of 1980 external trips are shown for stations which are located on future primary highway routes which are proposed for development to freeway or expressway standards by 1980.

THROUGH TRIPS

The future pattern of through trips was also estimated by analogy but with the 1957 pattern with major adjustments to account for the development of new regional highways as proposed in the report. Most of the 1980 trips passing through the future urban area without a stop would be located on the proposed county-wide freeway-expressway system which will be described in detail in subsequent chapters. Through trips between many of the external stations at the periphery of the 1980 Study Area will be negligible in volume.

1980 ORIGIN AND DESTINATION PATTERN — TOTAL VEHICLE TRIPS

Figure 21 indicates the projected pattern of total vehicle trips between zones in the 1980 Study Area. About 92.6 percent of these trips are internal trips, about 6.9 percent are external trips, and about 0.5 percent are through trips.

ESTIMATED DESIGN YEAR - 1980
ORIGIN AND DESTINATION PATTERN

AVERAGE DAILY MOTOR VEHICLE TRIPS

PHOENIX URBAN AREA, MARICOPA COUNTY

Zone Number	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017	018	019	020	021	022	023	024	025	026	027	028	029	030	031	032	033	034	035	036	037	038	039	040	041	042	40	41	42	59	60	61	62	63	64	65	66	67	68
001	12,863																																																					
002	9,568	18,030																																																					
003	1,496	8,012	13,671																																																		
004	281	1,216	1,830	3,023																																																	
005	373	680	558	1,214	8,591																																																
006	3,375	2,283	584	168	175	6,559																																															
007	12,902	17,802	4,379	818	415	10,339	20,843																																														
008	1,179	3,576	3,943	1,071	390	242	7,810	7,356																																												
009	500	602	145	84	100	2,242	2,975	128	2,851																																											
010	997	1,771	553	182	195	1,966	8,745	414	2,077	2,771																																										
011	1,056	3,673	3,481	2,737	966	1,436	13,136	7,195	719	2,147	18,961																																									
012	84	160	138	677	632	48	154	205	35	38	841	1,855																																							
013	270	285	257	756	4,993	144	286	244	93	118	667	3,644	13,831																																						
014	2,994	3,204	1,274	996	1,016	4,845	10,789	1,602	5,784	4,244	7,076	318	918	20,206																																						
015	136	830	200	111	95	1,333	3,393	291	1,492	4,891	1,017	17	61	7,014	7,403																																						
016	1,385	1,734	1,878	1,942	859	1,087	4,158	2,552	866	2,789	12,638	472	644	10,104	1,772	8,229																																					
017	539	1,013	979	1,735	862	386	1,773	2,190	313	1,001	11,339	731	617	4,137	602	7,201	8,855																																					
018	964	1,405	782	618	593	953	4,361	895	879	2,689	3,527	223	450	8,940	5,573	7,976	2,414	11,899																																				
019	936	1,203	956	1,199	838	708	2,067	1,693	524	1,305	6,702	375	702	6,445	1,373	9,483	7,512	10,319	15,322																																				
020	431	650	534	899	487	282	653	692	163	423	2,486	484	552	2,700	322	2,408	5,351	1,961	8,310	6,763																																		
021	363	677	561	2,384	1,226	225	866	897	208	486	4,417	2,778	1,826	2,959	366	3,304	7,574	1,728	5,773	12,715	14,092																																		
022	359	331	278	446	708	179	424	284	112	228	1,014	2,316	7,446	1,297	166	787	1,104	641	1,179	2,474	10,392	11,384																																	
023	586	638	544	965	3,681	268	570	430	157	272	1,047	2,680	27,345	1,397	743	908	1,156	1,096	1,887	2,585	4,320	10,065	41,453																															
024	1,511	2,114	497	632	696	1,472	6,003	617	1,196	3,130	1,693	285	649	11,765	4,845	1,997	1,667	9,482	3,080	1,599	1,662	728	1,294	13,725																															
025	661	846	656	675	592	454	1,111	787	280	653	2,862	323	625	2,695	2,209	3,075	3,776	3,606	12,072	5,289	3,056	839	1,417	2,821	8,560																														
026	3,082	2,923	2,183	1,576	1,575	2,159	5,480	2,254	1,352	3,041	9,202	748	1,707	8,690	6,631	6,285	4,628	13,736	12,741	4,808	5,056	2,202	4,572	11,223	14,488	16,449																														
027	251	288	135	101	111	503	600	104	568	344	285	31	121	5,704	481	347	245	691	324	250	248	114	212	1,863	450	1,337	2,317																														
028	1,005	1,242	584	431	509	752	2,624	463	678	1,370	1,359	165	528	6,221	2,562	2,158	1,182	3,780	2,302	1,462	1,288	669	1,161	12,128	2,462	11,237	5,821	13,123																														
029	586	530	403	328	334	381	848	366	207	484	797	183	364	2,283	302	764	904	1,752	1,640	871	831	357	681	1,884	2,701	6,818	602	5,435	3,393																														
030	242	176	215	199	182	159	313	210	80	179	445	85	198	813	112	410	558	517	1,115	941	599	222	383	487	1,358	1,275	141	1,444	1,200	1,338																														
031	605	637	528	581	619	341	657	582	174	460	1,398	317	682	2,193	247	929	1,583	1,270	2,472	3,761	4,410	1,074	1,795	927	2,597	1,918	132	1,449	754	929	2,305																														
032	131	140	113	113	162	84	155	101	31	77	219	149	294	436	53	160	297	221	380	625	1,411	417	2,326	202	365	381	30	216	87	52	505	1,061																														
033	103	131	108	118	283	60	110	65	37	58	206	101	1,102	427	65	247	240	262	429	538	1,116	897	5,249	346	373	874	34	238	229	124	423	384	2,017																														
034	308	507	242	213	293	205	796	155	201	561	559	89	234	2,904	515	729	467	1,473	1,383	802	495	411	641	3,673	1,360	5,548	1,318	5,937	2,457	708	1,583	333	125	8,607																														
035	157	188	145	153	164	94	307	124	80	201	371	62	161	1,008	152	446	390	862	1,277	783	460	232	426	1,230	994	4,075	386	2,320	2,053	643	1,023	110	86	7,175	4,892																														
036	142	208	150	149	206	61	205	105	65	127	343	62	166	811	127	436	365	586	802	662	391	273	454	961	933	3,055	337	1,756	1,440	932	1,364	138	79	12,157	5,397	5,238																														
037	325	518	388	428	495	158	517	391	163	329	1,286	209	502	2,283	321	1,504	1,316	1,513	3,239	4,077	4,082	1,132	1,563	2,302	3,529	18,433	557	2,562	2,325	1,962	6,426	962	327	7,248	5,741	10,324	19,506																														
038	1,603	2,345	1,749	1,504	2,837	889	2,158	969	674	989	3,185	935	4,846	5,988	729	3,453	2,849	3,062	5,596	4,327	5,144	3,219	19,125	4,567	4,203	11,729	938	4,524	3,049	1,694	4,428	6,602	6,682	2,122	2,012	2,082	17,182	236,194																														
039	466	1,019	1,082	4,274	4,706	250	478	565	145	222	1,118	123	1,001	1,047	191	1,031	760	523	958	587	640	307	1,883	560	572	1,646	109	497	274	162	428	124	162	247	157	179	436	2,172	8,185																														
040	5,961	6,441	16,213	891	994	878	3,369	3,007	450	847	2,989	275	814	2,556	1,572	2,500	1,607	1,570	2,365	1,394	1,520	825	1,644	2,200	1,627	5,109	519	1,653	971	436	1,599	279	294	752	435	407	1,066	3,718	1,402	25,607																														
041	6,313	5,486	1,506	558	771	15,170	10,878	723	5,882	2,203	3,173	207	614	9,107	3,191	2,756	1,288	2,297	2,362	993	982	749	1,312	3,576	1,693	6,616	843	2,557	1,230	478	1,250	238	234	911	423	419	925	3,301	719	12,818	37,960																														
042	242	489	222	168	242	682	923	178	1,164	666	619	61	228	8,824	1,627	1,454	346	1,790	1,940	513	429	299	515	3,627	1,154	5,184	823	2,208	824	293	645	120	100	570	222	188	437	1,473	236	830	4,386	7,374																														
40	5	6	1	0	0	5	8	2	5	4	8	0	3	23	8	9	5	10	8	5	6	3	8	17	6	32	5	14	6	2	7	0	0	37	5	12	12	22	1	6	13	5	-																														
41	17	25	10	2	2	21	35	10	17	19	31	0	12	100	31	40	21	44	33	19	27	15	27	81	31	137	31	67	31	15	27	4	0	189	31	54	50	89	6	25	48	29	-	-	-																														
42	43	64	30	10	14	50	85	24	45	42	76	6	30	315	74	93	48	123	87	50	62	31	69	217	77	351	141	198	82	33	68	10	8	360	54	88	96	216	17	55	116	69	-	-	-	-																														
59	82	133	51	16	19	42	101	33	24	36	70	5	34	84	54	81	45	69	53	33	48	21	64	92	43	193	12	59	31	15	37	6	5	26	16	14	38	143	229	257	110	24	-	-	-	-	-																														
60	378	736	247	66	83	185	442	162	104	163	306	25	140	378	245	370	199	308	231	125	201	83	258	410	183	870	59	253	142	63	154	24	22	112	69	62	170	590	138	2,824	498	103	-	-	-	40	-	-																														
61	112	187	71	22	27	58	143	45	33	49	96	7	47	117	75	113	62	95	73	45	66	29	88	125	59	269	17	81	42	21	50	8	7	35	22	19	52	200	320	360	154	33	-	-	-	-	-	-	-																														
62	88	129	91	40	44	53	124	64	29	46	147	13	72	123	75	149	100	107	101	66	99	43	130	135	82	320	22	88	51	29	77	11	11	34	28	27	76	285	276	531	149	39	-	-	-	-	-	-	-	-																														
63	23	35	23	11	27	14	33	16	8	12	39	5	40	32	21	42	27	100	27	19	36	17	70	35	23	90	6	23	14	8	23	5	6	10	8	9	23	139	39	54	40	9	-	-	-	-	-	-	-	-	-																														
64	6	9	6	3	7	6	11	6	4	5	16	1	28	16	10	17	12	15	17	14	22	18	92	19	15	57	2	14	8	5	16	4	9	6	4	4	16	930	8	12	13	5	-	-	-	-	-	-	-	-	-	-																														
65	74	116	86	50	83	73	149	68	50	69	196	26	217	218	126	215	147	216	197	149	240	136	495	265	186	714	44	199	135	77	199	38	73	95	74	72	269	16,030	90	139	173	67	-	-	-	40	-	600	-	30	-	-	-																														
66	68	108	80	44	75	67	144	62	47	63	173	28	203	203	112	202	131	197	186	137	222	137	459	247	174	670	40	163	124	72	182	36	50	88	66	63	254	3,252	83	130	161	65	-	-	-	-	-	-	-	-	-	-	-																														
67	118	171	124	71	122	106	216	95	70	97	285	41	144	909	186	311	211	320	294	211	344	193	687	387	274	667	66	294	193	113	287	56	92	139	106	104	397	6,325	129	197	256	96	-	-	-	10	-	100	-	10	-	340	-	-	-	
68	155	233	171	74	94	146	301	141	102	145	427	48	270	458	269	451	300	470	443	329	490	275	629	582	427	1,591	96	446	300	183	481	110	100	208	249	274	1,710	4,053	113	292	349	141	-	-	-	40	-	650	-	90	-	50	-	-	-	
69	11	16	7	2	3	10	22	6	8	11	19	1	8	45	18	23	13	28	21	12	16	8	18	38	14	78	12	29	14	6	16	2	2	60	14	19	25	56	4	14	28	13	-	-	-	-	-	-	-	-	-	-	-																														
70	235	297	156	55	57	275	394	113	180	185	355	28	141	1,008	325	425	215	510	390	200	287	147	316	721	279	1,470	297	475	270	122	260	39	36	246	134	112	295	929	76	341	848	810	-	-	-	40	-	550	-	60	-	470	-	80	900	
71	119	140	74	25	27	136	185	54	93	87	169	12	69	633	157	208	105	249	183	104	137	68	154	353	135	720	188	240	123	59	128	18	19	124	65	53	143	442	38	164	477	956	-	-	-	-	-	60	-	-	-	110	-	40	190	
72	108	130	68	24	25	134	172	50	111	83	156	13	62	911	149	191	98	235	172	95	126	62	140	356	142	675	100	198	108	44	101	17	17	90	53	44	116	354	34	150	512	941	-	-	-	-	-	40	-	-	-	50	-	20	90	
73	167	199	105	35	39	193	261	76	203	123	239	18	97	921	222	294	150	350	261	165	192	96	218	492	215	1,007	112	296	166	68	155	26	26	136	83	70	182	546	52	231	917	1,991	-	-	-	-	-	40	-	-	-	50	-	20	90	
74	31	35	19	7	6	38	49	14	38	23	43	2	12	183	32	44	19	49	38	20	28	14	31	72	30	144	20	43	23	11	25	3	3	19	12	11	25	81	9	36	255	236	-	-	-	-	-	-	-	-	-	-	-																														
75	154	170	86	29	32	210	230	65	202	107	203	14	58	482	156	209	82	236	176	95	122	65	142	322	145	677	64	201	108	49	118	17	17	87	52	44	115	363	42	189	2,668	678	-	-	-	10	-	50	-	-	-	80	-	40	120	
76	49	37	20	8	7	78	49	15	40	22	44	3	15	84	35	48	27	52	39	19	29	13	28	74	26	152	13	45	24	11	23	3	3	20	12	10	27	85	10	44	674	105	-	-	-	-	-	-	-	-	-	-	-																														
77	95	66	37	12	12	259	89	25	47	41	78	5	27	130	64	93	48	77	59	30	48	22	40	104	46	219	19	64	35	15	39	6	5	29	17	15	39	125	17	77	1,648	59	-	-	-	-	-	-	-	-	-	-	-																														
78	261	190	91	29	36	261	223	60	75	113	191	13	64	334	159	229	117	189	142	75	118	54	87	255	114	536	44	158	86	39	94	13	13	70	43	36	95	301	42	199	1,816	156	-	-	-	-	-	20	-	-	-	60	-	30	90	
79	38	27	14	5	5	28	32	9	10	15	29	2	9	48	23	33	17	29	21	11	18	8	13	37	17	79	7	26	13	5	14	2	2	12	6	5	15	45	6	34	357	22	-	-	-	-	-	-	-	-	-	-	-																														
80	576	418	198	58	55	431	384	126	141	181	352	25	118	603	285	414	212	347	258	142	217	98	165	463	211	984	83	294	156	72	175	26	25	131	78	66	180	578	92	516	4,086	243	-	-	-	20	-	50	-	10	-	400	-	30	90	

SUMMARY OF TOTAL VEHICLE TRIPS ALL MODES OF TRAVEL

INTERNAL	2,338,000
EXTERNAL	176,000
THROUGH	12,000
TOTAL	2,526,000

Note: Through trips between Stations 69 through 80 are not shown; the estimated 1980 daily volume of these movements is negligible.

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Chapter III
FUTURE TRAFFIC SERVICE NEEDS

As the population of the Phoenix Urban Area has increased, traffic volumes have increased, distances between principal trip origins and trip destinations have become greater, and traffic delays and congestion have become widespread - particularly on the mile roads in central Phoenix. As described at length in Chapter I, these mile roads, which function as an arterial street system, are deficient in terms of standards of physical development and quality of traffic operations.

There are essentially four ways to improve existing traffic conditions and to provide for future traffic service needs:

1. Apply traffic controls and regulations to achieve maximum utility of existing facilities;

2. Widen existing arterials and other major streets;

3. Construct new major street and highway facilities; and

4. Improve the attractiveness of public transit.

The master transportation plan for the Phoenix Urban Area should be a practical combination of these four approaches. Provision should be made for each of several different types of major street and highway facilities needed for high-quality traffic services to all classes of users. Consideration should be given to the development of a county-wide freeway-expressway system as well as to the improvement and extension of existing major streets. Plans for the development of all traffic facilities should be integrated to form a "total plan" with traffic capacities balanced against traffic demands and with proper relationships between land uses and major traffic flows. The major street and highway plan must be designed without regard for boundaries of political jurisdiction since traffic needs have no regard for corporate limits.

NEED FOR A NEW APPROACH

There is need for a new approach to transportation planning in the Phoenix Urban Area. In the past, attention has been focused on making the most of existing streets and highways in Phoenix through traffic engineering and much has been accomplished. The ability of existing facilities to accommodate increasing traffic demands has been improved substantially by the extensive use of traffic signals and the timing of these signals for progressive movement; by the establishment of one-way streets in and near the downtown area; by the establishment of through streets for arterial traffic flow; by the installation of stop signs on minor cross streets where signals are not warranted; by the use of channelizing islands and left-turn lanes; by curb parking and left-turn restrictions; and by pavement striping and other traffic control measures. These measures have been effective and their use should be continued and expanded.

Recognition has also been given to the needs for better standards of major street construction and wider rights-of-way. Requirements for right-of-way dedications for street purposes have been improved by both the City of Phoenix and Maricopa County. At present, the City is securing 80 foot rights-of-way on all mile and half-mile roads as new areas are developed, while the County requires 130 foot dedications on mile roads and 80 foot dedications on half-mile roads - a considerable improvement over the typical 66 foot dedications of the past.

Realizing the need for better major streets and other public works facilities, the City of Phoenix has approved a bond program; the amount of $6,000,000 has been authorized for street improvement bonds. Most of these funds are planned for arterial street widening projects. Because of high costs, the current street improvement program will only be sufficient to meet the most pressing needs.

Local traffic engineering, planning and public works officials should be commended for their excellent achievements in providing traffic services with limited financial resources. However, regardless of past accomplishments, the urban area is faced now with mounting traffic congestion. It is clear that a greatly expanded major street improvement program is urgently needed.

There is also an obvious need for the construction of new facilities. As indicated in Chapter II, future major streets and highways in the Phoenix Urban Area will be required to accommodate more than three times as many vehicle trips as served by present facilities. Analyses of anticipated 1980 traffic demands indicate that additional traffic operational improvements and major street widenings which may be economically feasible cannot, in themselves, provide adequate capacity and efficiency of traffic flow for long-range needs.

Higher standards of design will be needed in the construction of new facilities and the improvement of existing ones. Typical arterial streets with curb parking, frequent grade intersections and slow-moving local traffic cannot provide satisfactory services to the increasing volumes of relatively long trips in Phoenix. New facilities for high-speed service to large volumes of traffic should be planned, incorporating the following modern design features:

1. Grade separations for principal intersecting traffic flows;

2. Access control for the removal of marginal friction and separation of high speed through traffic from low speed local traffic; and

3. Medians for the separation of opposing lanes of traffic and elimination of cross traffic at minor cross streets.

Integrated route planning will also be required in the development of new facilities. Requirements of the City of Phoenix and Maricopa County for right-of-way dedications along major routes are not consistent. Existing and planned roadway capacities are not balanced against projected traffic demands; in many cases, considerably more capacity is being provided in sections of major traffic corridors in outlying areas than is planned for these same corridors in the highly developed central portions of the urban areas where traffic demands are greatest. An inte-

grated area-wide approach to transportation planning in the Phoenix Urban Area, regardless of corporate boundaries or political jurisdictions over particular facilities, can:

1. Assure the maximum utilization of existing facilities;

2. Guide the development of new facilities to complement existing ones;

3. Obviate the need for undesirable widenings of local and collector streets through residential areas;

4. Assure the provision of capacity balanced against future traffic demands;

5. Guide the logical and economical expenditure of available public funds;

6. Assure major route continuity regardless of corporate limits;

7. Provide for the most expeditious, efficient and safe movement of people and goods; and

8. Provide an effective guide and stimulus for the orderly growth and development of various sections of the urban area.

CLASSIFICATION OF FACILITIES

Street and highway facilities needed to serve any large metropolitan area's traffic needs may be classified as follows:

1. Freeways and expressways
2. Parkways
3. Arterials
4. Major local business streets
5. Collector streets
6. Local streets

Each of these six types of facilities are needed in the Phoenix Urban Area to provide separate and distinct traffic service functions. Standards of design of the various classes of facilities differ in accordance with the different characteristics of the traffic to be served. The functions of each type of facility are generally described below:

Freeways are divided highways with full control of access and grade separations at all intersecting traffic flows. There are no intersections at grade, traffic signals, pedestrians or parking on freeways to interfere with the continuity of high speed travel. *Expressways* are partially developed freeways on which some intersections are not grade separated.

An extensive system of freeways and expressways is needed in the Phoenix Urban Area and Maricopa County to provide for the rapid and safe movement of large volumes of traffic over relatively long distances. Freeways or expressways should be constructed to serve major rural traffic corridors throughout Maricopa

County including all Interstate and state primary routes. Freeway and expressway routes of nation-wide and state-wide interest should be supplemented and complemented by other routes in major traffic corridors as necessary to form a complete and integrated freeway-expressway network in the Phoenix Urban Area. The location of these urban facilities will be dictated largely by existing and planned patterns of land use, topography and other physical conditions, as well as traffic desires.

Parkways are arterial highways for non-commercial traffic, usually located within a park or ribbon of park-like development. The desirability of designating as parkways several sections of the proposed network of limited-access highways for the Phoenix Urban Area was indicated in consideration of existing land use characteristics.

Arterials are the major streets which will serve large volumes of traffic between different sections of the urban area and provide access and egress to the freeway-expressway system. While arterial streets may serve abutting properties, their primary function is to provide for through traffic movement. Arterials should be located with regard to areas of homogeneous land use; they should define the limits of neighborhoods, industrial sites and major commercial areas - not sever these areas. Arterials should be located and designed with sufficient capacity to prevent the undesirable diversion of through traffic to local and collector streets. Because of the character of land use and major street conditions in Phoenix, two classes of arterials were included in the proposed major street and highway plan - major arterials and secondary arterials.

Major Arterials, with the proposed freeway-expressway system, would provide the principal routes for heavy volumes of through traffic flow in the urban area; route continuity and location with respect to the freeway-expressway system are of paramount importance. Major arterials were generally located about midway between parallel freeway routes to provide a major facility for through traffic flow at two to three mile intervals.

Secondary Arterials, located at one mile intervals, would perform the same functions as major arterials but with less emphasis on service to long-distance through traffic; service to abutting commercial, industrial and service facilities would be an important function of the secondary arterials which would, in many cases, be the existing mile roads in Phoenix. As applied in this study, major arterials would be developed on rights-of-way of at least 100 feet, whereas secondary arterials would be developed on rights-of-way of at least 80 feet in accordance with present practice.

Major Local Business Streets as the name implies, are streets which serve heavy volumes of local traffic generated by business and commercial establishments. The principal difference from major arterials is the character of traffic served. The primary function of a major local business street is to provide for local traffic movement and land access - not through traffic; physical standards and regulations for traffic operations may differ, therefore, from those applied to major arterials, Central Avenue is a prime example of a major street in Phoenix which should function and be classified as a major local business street.

Collector Streets connect residential neighborhoods and other areas of homogeneous land use. Collector streets are generally spaced at intervals of about one-half mile in urban areas. Continuity is generally required only to the extent necessary to connect adjacent neighborhoods and to connect neighborhoods with arterials. The design of collector streets is properly a part of good neighborhood planning. Desirably, neighborhood traffic should flow from local street to collector street to arterial street. Collector streets in residential areas should be planned so that they do not attract large volumes of through traffic flow.

Local Streets, not a part of this study, are minor streets which provide primarily for local traffic circulation and land access.

RECENT MAJOR STREET AND HIGHWAY CONSTRUCTION PROJECTS

The proposed master plan for major streets and highways has been designed to take maximum advantage of existing facilities and construction projects which have been completed in recent years or soon will be completed. During the last ten years, the City of Phoenix has widened and otherwise reconstructed about 12 miles of the existing major street system, involving a total cost of about $2,500,000. These projects are listed in Table 14. Almost half of the total cost of these completed projects was paid for by the owners of properties abutting the improvements. The widenings along McDowell Road and Seventh Street, indicated in Table 14, were completed since the physical inventory studies upon which plans and estimates included in this report are based.

The Black Canyon Highway in the Phoenix Urban Area has been under construction for several years. This route is being improved to freeway standards as part of the National System of Interstate and Defense Highways. The right-of-way has been acquired, frontage roads have been constructed to serve existing traffic, and several miles of the main roadways are now under contract. In addition, local agencies recently participated in the construction of a new two-mile connection between the Black Canyon Highway and industrial areas south of downtown Phoenix via Grant and Lincoln Streets. This project, completed in 1959, cost a total of about $711,000 of which about $314,000 was provided by property owners.

Although relatively little of the Phoenix Urban Area is now under county jurisdiction, numerous major street improvement projects were completed by the Maricopa County Highway Department prior to recent annexations by Phoenix, and other projects are under way in outlying areas which have not been annexed. The locations of completed county projects, and those undertaken by the State Highway Department and City of Phoenix, are shown on Figure 22. The locations of major street improvement projects included in budget programs for the current fiscal year are also shown.

OTHER MAJOR URBAN IMPROVEMENT PROJECTS

Several other major improvement projects, which affect long range plans for major streets and highways in the Phoenix Urban Area, are in various stages of planning or development. Principal among these are plans for flood control facilities, expanded facilities at Phoenix Municipal Airport, urban renewal and downtown devel-

Table 14

COMPLETED ARTERIAL STREET CONSTRUCTION PROJECTS
1950-1959
City of Phoenix

Street	Length (Miles)	Construction Cost: Federal Aid	Construction Cost: City Aid	Construction Cost: Prop.Owner, All Others	Right-of Way Cost	Total Cost	Completion Date
16th St., Pinchot Avenue to the Grand Canal	0.78	$ 78,877	$ 1,107	$ 90,256	$ 2,139	$172,379	Dec. 1953
McDowell Rd., 20th Street to 28th Street	1.00	97,539	16,302	130,439	19,685	263,965	Aug. 1959
Indian School Rd., 16th Street to 7th Avenue	2.00	218,465	13,056	204,690	80,134	516,345	May 1955
Thomas Rd., 16th Street to 24th Street	1.00	77,687	51,879	80,577	39,344	250,487	Oct. 1955
S. Central Ave., Watkins St. to Maricopa Street	0.78	111,862	304	83,498	130,381	326,045	May 1957
7th St., McDowell Road to Thomas Road	1.00	130,000*	10,000*	115,000*	90,188	345,188	Feb. 1960

* Estimated

Table 14 (Continued)

COMPLETED ARTERIAL STREET CONSTRUCTION PROJECTS
1950-1959
City of Phoenix

Street	Length (Miles)	Construction Cost: Federal Aid	Construction Cost: City Aid	Construction Cost: Prop. Owner, All Others	Right-of Way Cost	Total Cost	Completion Date
Osborn Rd., Central Avenue to 19th Avenue	1.50	--	$ 22,208	$112,814	--	$135,022	May 1951
16th St., Villa to Pinchot Avenue; Thomas Road, 12th Street to 16th Street	2.44	--	84,015	247,643	$ 413	332,071	Mar. 1952
1st St., Roosevelt to McDowell Road	0.47	--	13,430	69,429	2,631	85,490	Aug. 1955
1st Ave., Fillmore to Roosevelt Street	0.27	--	3,845	43,818	--	47,663	Oct. 1956
3rd Ave., Indian School Road to Glenrosa	0.23	--	4,719	16,754	--	21,473	July 1958
Total	11.47	$714,430	$220,865	$1,194,918	$364,915	$2,496,128	

Source: Public Works Department, City of Phoenix, Arizona.

opment. These important projects were considered in the development of plans for major streets and highways to the extent possible considering the information available at the time the route studies were undertaken; each project is still under study or in formulative stages of development.

Flood Control Facilities. A Flood Control District was established in 1959 by legislative act for the purpose of "acquiring, constructing, improving, extending, maintaining, and operating flood control facilities"[14] throughout Maricopa County regardless of existing political boundaries. Various preliminary studies have indicated the need for protection of the Phoenix Urban Area from floods from the Salt River, Cave Creek, mountains northeast of Mesa, Indian Bend wash and the McDowell Mountains, and mountain washes north and south of Phoenix. Figure 23 indicates preliminary recommendations of the Flood Control District of Maricopa County for the development of channels in and near Phoenix to control floods from these sources.

Since acquisition and hauling of adequate fill material for the construction of the major highways may be a serious problem, it may be desirable to relate excavation work for flood control facilities with the future highway construction program. It will also be necessary to construct bridges across future flood control channels for the major street and highway system. At present, storms of moderate size frequently create flood damage to road crossings of the Salt River and other natural drainage ways, and hazards to motorists.

Airport Expansion. Facilities at Phoenix Municipal Airport are to be expanded, including the extension of east-west runways. These runway extensions will require the closure of 40th Street through the airport property. Principal access to the terminal building may be via a new extension of Henshaw Road or via existing Sky Harbor Boulevard. In either case, improved access to the airport will be essential including a grade separation and interchange ramps at the intersection of the airport access road and the principal north-south highway west of the airport.

Urban Renewal. An area including about 50 acres east of 7th Street near downtown Phoenix has been designated for redevelopment. The major street and highway plan should be planned to serve this area - not to sever it or to require extensive acquisition of right-of-way for highway purposes within the urban renewal area. This was a special problem in this study because of the proposed location of an Interstate "penetration route" along 7th Street. Various alternate locations for this penetration route were studied with emphasis on integrating this route into the network of regional freeways and expressways with minimum adverse effects on the proposed urban renewal project and other land uses, while still providing for the principapl traffic service functions which the Interstate penetration route was designated to serve.

Downtown Development. Since the development of the recommended major street and highway plan, the Planning Department of the City of Phoenix has undertaken a study to prepare a development plan for downtown Phoenix. This study is

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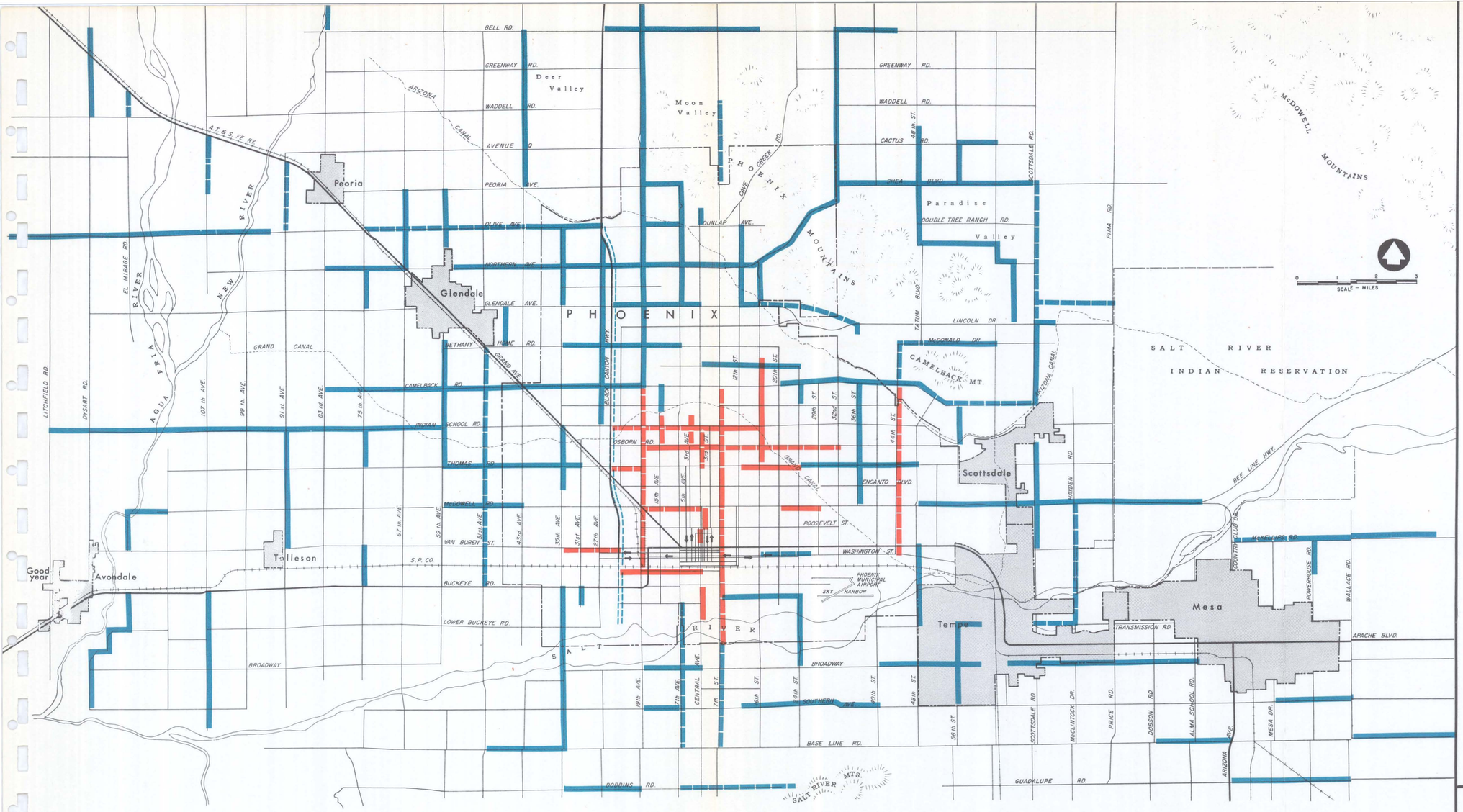
14. Senate Bill 204, Arizona State Legislature, signed by the Governor on March 23, 1959, permits any county to establish a flood control district. The Flood Control District of Maricopa County was formally established in August of 1959.

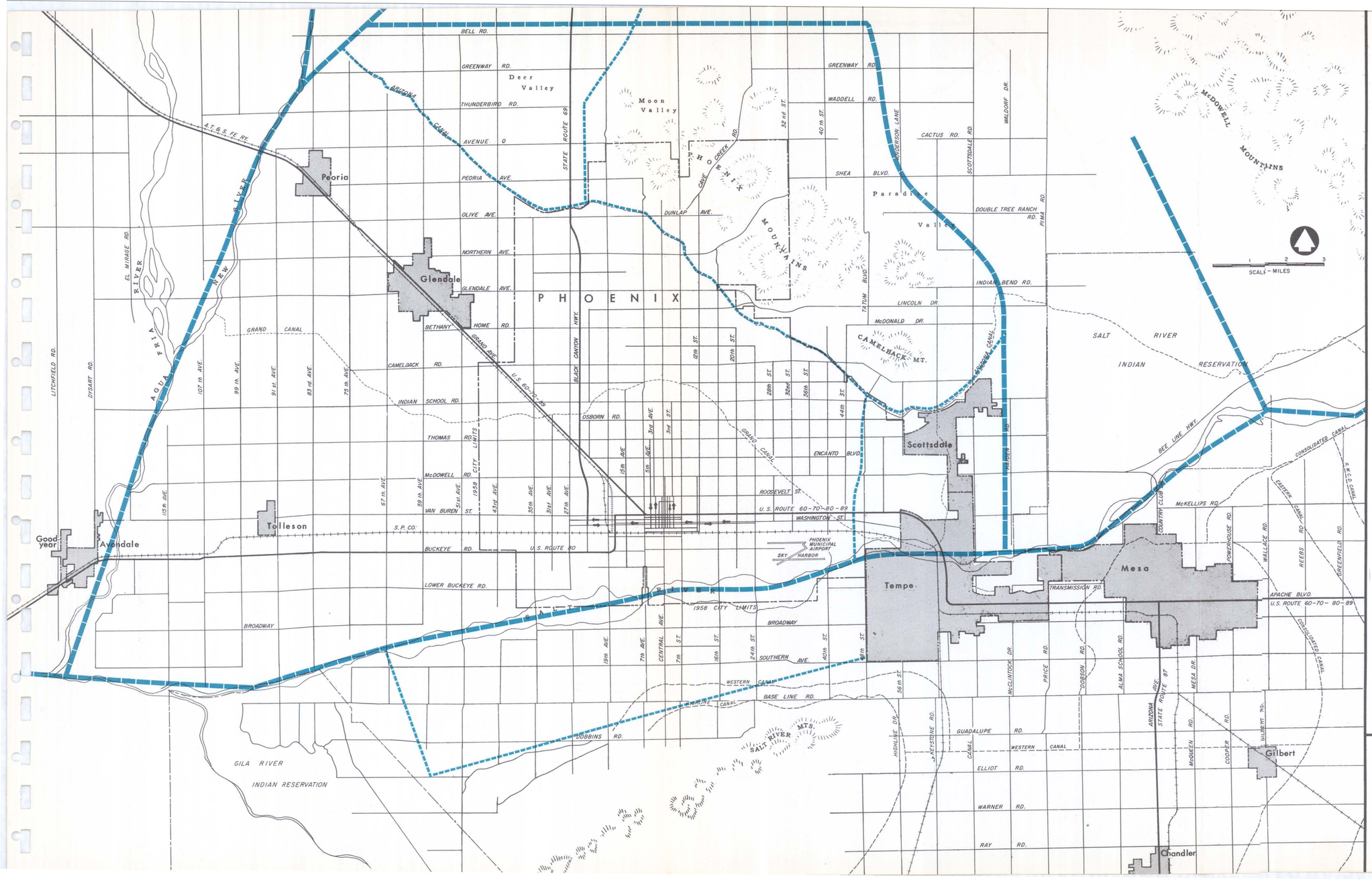


CURRENT MAJOR STREET AND HIGHWAY IMPROVEMENT PROJECTS

PHOENIX URBAN AREA – MARICOPA COUNTY

LEGEND

- COMPLETED COUNTY PROJECTS (1953-1959)
- COMPLETED CITY PROJECTS (1951-1959)
- 1959-1960 COUNTY ROAD PROGRAM
- 1959-1960 CITY STREET PROGRAM
- INTERSTATE FREEWAY UNDER CONSTRUCTION



FLOOD CONTROL CHANNELS

PROPOSED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

LEGEND

- MAJOR FLOOD CONTROL CHANNEL
- MINOR FLOOD CONTROL CHANNEL

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still in process. The recommended major street and highway plan should be reappraised upon completion of the downtown development plan. Losses in traffic capacity through major street closures (if any) in the downtown development plan should be replaced through the addition or redesign of other major streets.

1980 CAPACITY NEEDS — CRITICAL TRAFFIC CORRIDORS

Broad indications of the magnitudes of needs for new facilities, or major improvements to existing facilities are provided by studies of projected traffic demands in critical traffic corridors. Corridors of traffic are not well defined in the Phoenix Urban Area because of the regularity of the street pattern and the general absence of major topographic obstacles to traffic flow. Nevertheless, the logical grouping of parallel arterials in arbitrarily selected corridors provides the basis for significant conclusions regarding general capacity needs.

Base-year (1957) and design-year (1980) traffic demands were determined at five screen lines in critical traffic corridors as shown in Table 15 and Figure 24. The five screen lines were located:

1. At the Salt River (east-west);
2. Near the east limits of Phoenix at 48th Street (north-south);
3. West of Black Canyon Highway (north-south);
4. Between Camelback Road and Missouri Avenue (east-west); and
5. Between 7th and 12th Streets (north-south).

Major traffic desires across screen lines 1, 2 and 3 are illustrated in Figures 25, 26, and 27. Total 1980 screen line volumes are expected to range from 2.03 to 3.22 times base-year levels.

It is particularly significant to note the tremendous growth in east-west traffic expected across screen line No. 3 which parallels the Black Canyon Highway, and across screen line No. 5 near 7th Street in central Phoenix. Major east-west streets and highways between Roosevelt Street and Camelback Road in central Phoenix should be designed to serve about 190,000 vehicles per day; existing streets in this traffic corridor are adequate for service to only about 100,000 vehicles per day. If all mile and half-mile roads in this traffic corridor were to be widened to four-lane standards, there still would be a serious capacity deficiency; freeway construction is clearly needed.

Similarly, traffic growth between Phoenix and the Tempe-Mesa area will require capacity increases which could best be provided by freeway construction. North-south capacity at the Salt River should be more than doubled to provide for future needs; future Interstate freeway construction between Phoenix and Tucson will provide much of this capacity need. Finally, future traffic demands indicate the need for greater capacity on major routes between Phoenix and Paradise Valley, and

Table 15

TRAFFIC VOLUME - CAPACITY RELATIONSHIPS
Critical Traffic Corridors

	Base-Year (1957) Conditions					Design Year (1980) Needs		
	Avg.Daily Traffic*	Peak Hour Volumes	No.** Lanes	Pract.Capy (Veh/Hour)	Vol-Capy Ratio	Capacity Deficiency	Avg.Daily Traffic	Design Hr/Vol.
SCREEN LINE NO. 1 - SALT RIVER								
51st Avenue-7th Street	44,000	3,900	12	4,800	0.82	2,200	84,000	7,000
12th Street-48th Street	29,000	2,700	8	2,900	0.93	5,100	95,000	8,000
East of 48th Street	35,000	3,200	8	3,800	0.84	4,200	96,000	8,000
Total	108,000	9,800	28	11,500	0.85	11,500	275,000	23,000
SCREEN LINE NO. 2 - EAST PHOENIX								
South of Salt River	17,000	1,600	8	2,700	0.60	3,300	66,000	6,000
Salt River-Van Buren Street	24,000	2,000	8	3,400	0.59	(400)	32,000	3,000
McDowell Rd-Camelback Road	42,000	3,600	10	3,600	1.00	5,400	104,000	9,000
North of Camelback Road	14,000	1,500	8	2,000	0.75	6,000	78,000	8,000
Total	97,000	8,700	34	11,700	0.69	14,300	280,000	26,000
SCREEN LINE NO. 3 - BLACK CANYON HIGHWAY								
South of Salt River	4,000	500	8	2,000	0.25	(500)	14,000	1,500
Salt River-Van Buren Street	29,000	2,500	8	3,400	0.74	600	49,000	4,000
McDowell Rd-Indian School Rd	49,000	4,200	12	4,800	0.88	9,200	156,000	14,000
Camelback Road-Northern Avenue	27,000	2,500	16	6,800	0.37	4,200	120,000	11,000
North of Northern Avenue	1,000	100	12	3,000	0.03	(1,500)	16,000	1,500
Total	110,000	9,800	56	20,000	0.49	12,000	355,000	32,000

Table 15 (Continued)

TRAFFIC VOLUME - CAPACITY RELATIONSHIPS
Critical Traffic Corridors

	Base-Year (1957) Conditions					Design Year (1980) Needs		
	Avg.Daily Traffic*	Peak Hour Volumes	No.** Lanes	Pract.Capy (Veh/Hour)	Vol-Capy Ratio	Capacity Deficiency	Avg.Daily Traffic	Design Hr/Vol.
SCREEN LINE NO. 4 - CAMELBACK ROAD								
59th Avenue-35th Avenue	29,000	2,700	12	4,600	0.59	4,400	95,000	9,000
27th Avenue-19th Avenue	28,000	3,100	8	3,400	0.92	4,600	86,000	8,000
15th Avenue-12th Street	46,000	4,200	10	4,000	1.02	3,000	80,000	7,000
16th Street-Scottsdale Road	33,000	3,000	14	4,500	0.67	6,500	119,000	11,000
Total	136,000	13,000	44	16,500	0.79	18,500	380,000	35,000
SCREEN LINE NO. 5 - 7th STREET								
South of Salt River	23,000	2,100	8	3,200	0.66	1,800	57,000	5,000
Salt River-Van Buren Street	75,000	7,500	18	8,000	0.94	4,000	135,000	12,000
Roosevelt Street-Camelback Road	111,000	9,400	24	10,400	0.91	6,600	190,000	17,000
North of Camelback Road	23,000	2,000	14	5,800	0.35	2,200	88,000	8,000
Total	232,000	21,000	64	27,400	0.76	14,600	470,000	42,000

* Includes all major streets

** Number of lanes serving indicated 1957 traffic

between Paradise Valley and highly urbanized areas to the south including Scottsdale, Tempe, and Mesa.

SELECTION OF A TENTATIVE PLAN

As an early phase of this study, a tentative freeway-expressway system for the urban area was developed, based on preliminary studies of traffic needs, field reconnaissance, studies of available topographic and land use maps and the use of aerial photography. Current aerial photographs, covering about 1,200 square miles of the Phoenix Urban Area and contiguous rural sections of Maricopa County, were secured specifically for this project.

In the development of the tentative freeway-expressway routes, consideration was given to the relative merits of a grid system vs. a system of radials and circular circumferential routes. It soon became evident that a radical departure from the established grid pattern of land development in the urban area would cause undue disruption to residents and excessively high construction costs. The development of true radial freeway routes emanating from downtown Phoenix in northwest and north-east directions would sever countless neighborhood units which local planners indicated should not be severed by major thoroughfares . In addition, the concentration of the heavy traffic on several radial freeways, at or near, the same point would create intolerable congestion and defeat the purpose of establishing a *system* of major highways, individual sections of which will *complement* one another. Essential traffic service needs in the urban area can be effectively provided by a system of freeways and expressways which generally conforms with the existing grid street system. The grid system is also more readily adaptable to stage construction programs - an important factor in consideration of the tremendous costs of freeways.

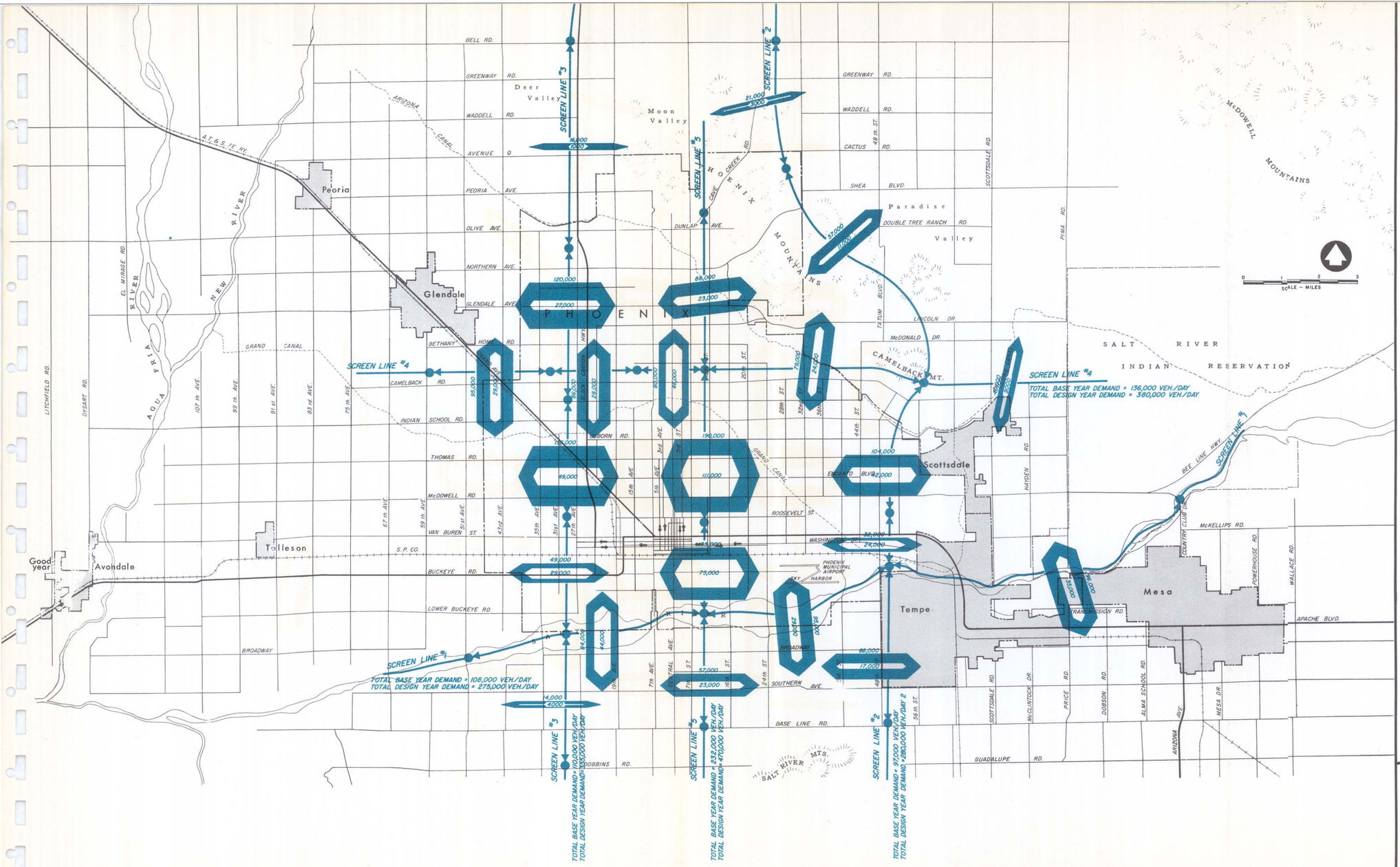
The various routes which were included in the tentative freeway-expressway system, and other routes which were developed as the analyses progressed, are shown in Figure 28. This system for the Phoenix Urban Area was designed to be integrated with principal rural highways serving the area; to complement, not duplicate, the traffic services to be provided by the Black Canyon Highway and other planned Interstate routes; to provide express service between large residential areas, employment centers and downtown Phoenix; to provide for through traffic, and to serve principal high-volume traffic corridors. The tentative system included:

1) The Black Canyon Highway (Interstate 17);

2) The Phoenix-Tucson Freeway (Interstate 10), from the Durango Street interchange with the Black Canyon Highway to the south limits of the urban area via the City of Tempe;

3) An east-west route to link Tempe and Mesa with each other and with Phoenix via the Phoenix-Tucson Freeway;

4) Routes in both the U.S. Route 80 and U.S. Route 60-70-89 traffic corridors west of Phoenix;



AVERAGE DAILY TRAFFIC DEMANDS 1957 - 1980 MAJOR TRAFFIC CORRIDORS

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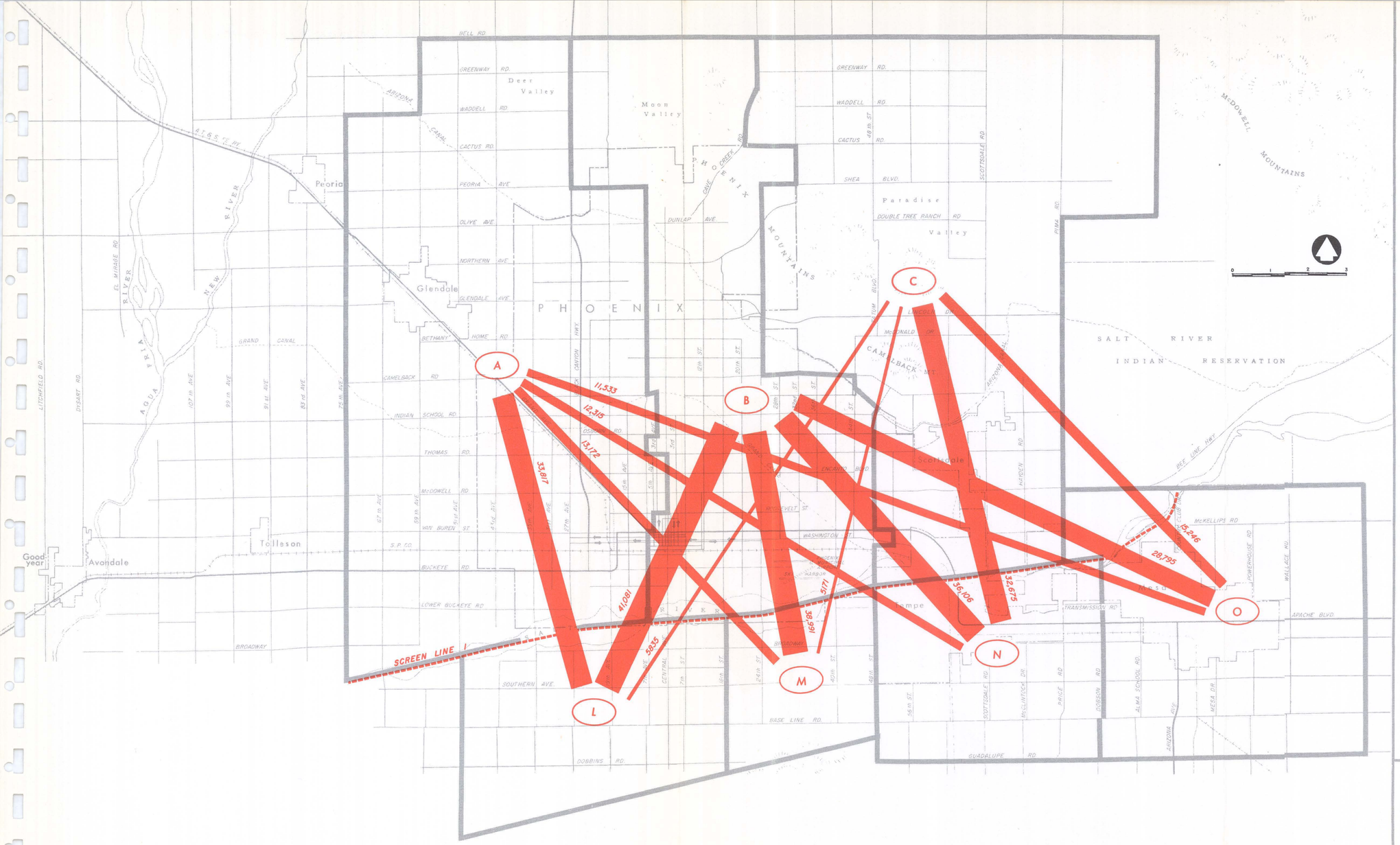


1980
MAJOR TRAFFIC DESIRES
SCREEN LINE I

SALT RIVER

LEGEND

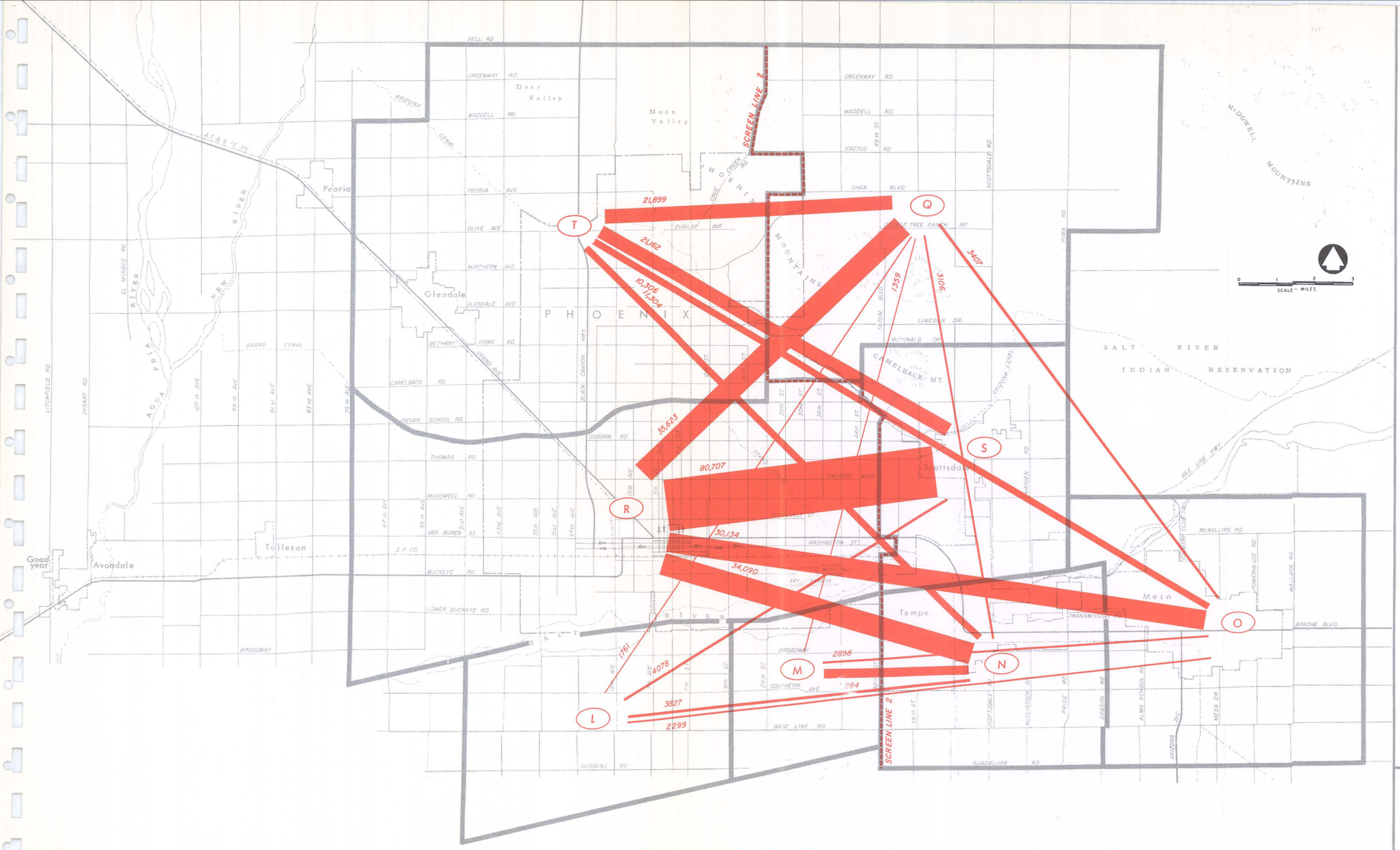
N — ANALYSIS AREA

BOUNDARY OF ANALYSIS AREA

TRAFFIC SCALE

60 40 20

THOUSANDS OF TRIPS PER DAY



1980
MAJOR TRAFFIC DESIRES
SCREEN LINE 2

EAST PHOENIX

LEGEND

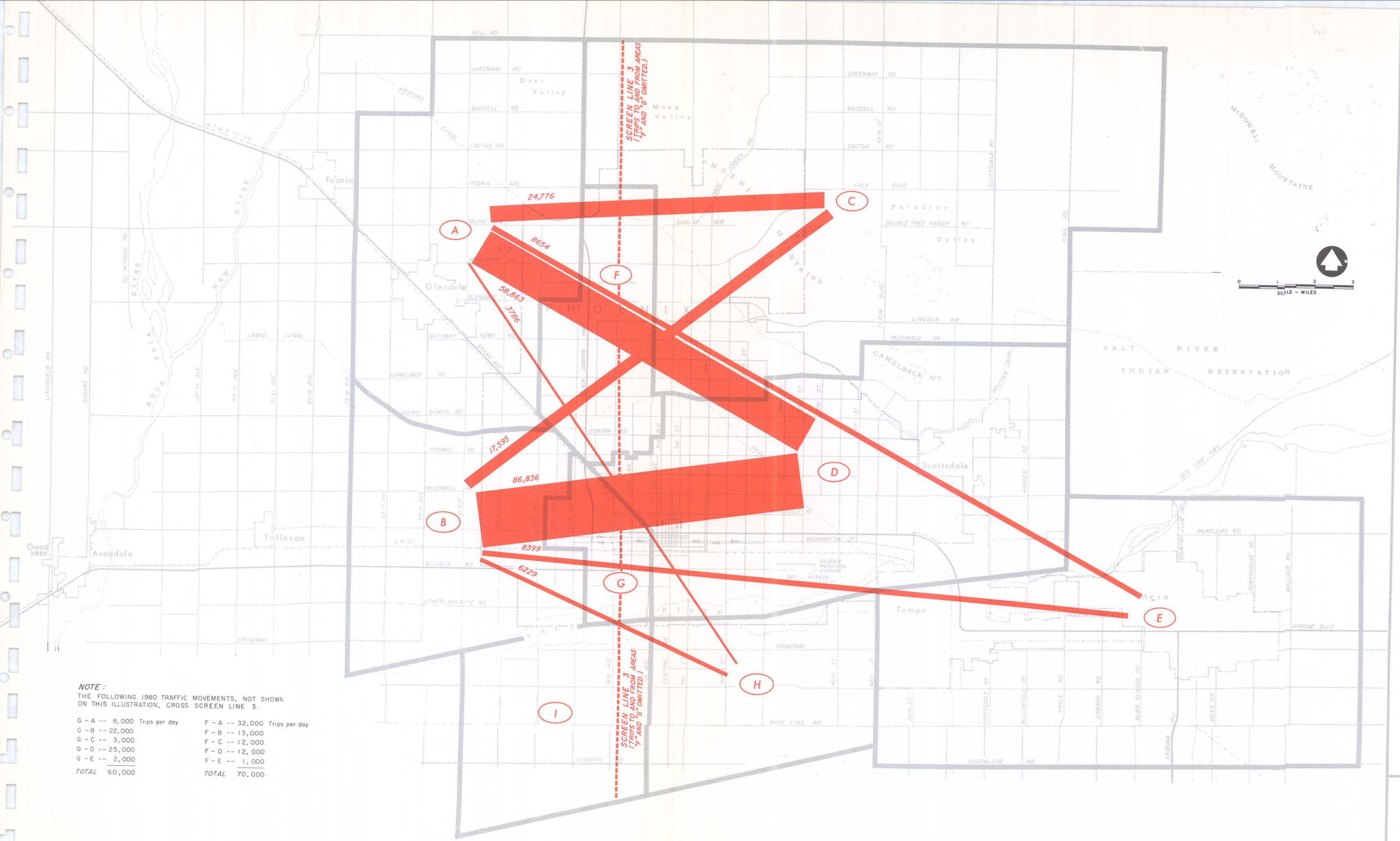
R — ANALYSIS AREA

BOUNDARY OF ANALYSIS AREA

TRAFFIC SCALE

60 40 20

THOUSANDS OF TRIPS PER DAY



NOTE :
THE FOLLOWING 1980 TRAFFIC MOVEMENTS, NOT SHOWN ON THIS ILLUSTRATION, CROSS SCREEN LINE 3.

G – A	8,000	F – A	32,000
G – B	22,000	F – B	13,000
G – C	3,000	F – C	12,000
G – D	25,000	F – D	12,000
G – E	2,000	F – E	1,000
TOTAL	60,000	TOTAL	70,000

Trips per day

1980
MAJOR TRAFFIC DESIRES
SCREEN LINE 3
BLACK CANYON HIGHWAY

LEGEND

E — ANALYSIS AREA

BOUNDARY OF ANALYSIS AREA

TRAFFIC SCALE

60 40 20

THOUSANDS OF TRIPS PER DAY

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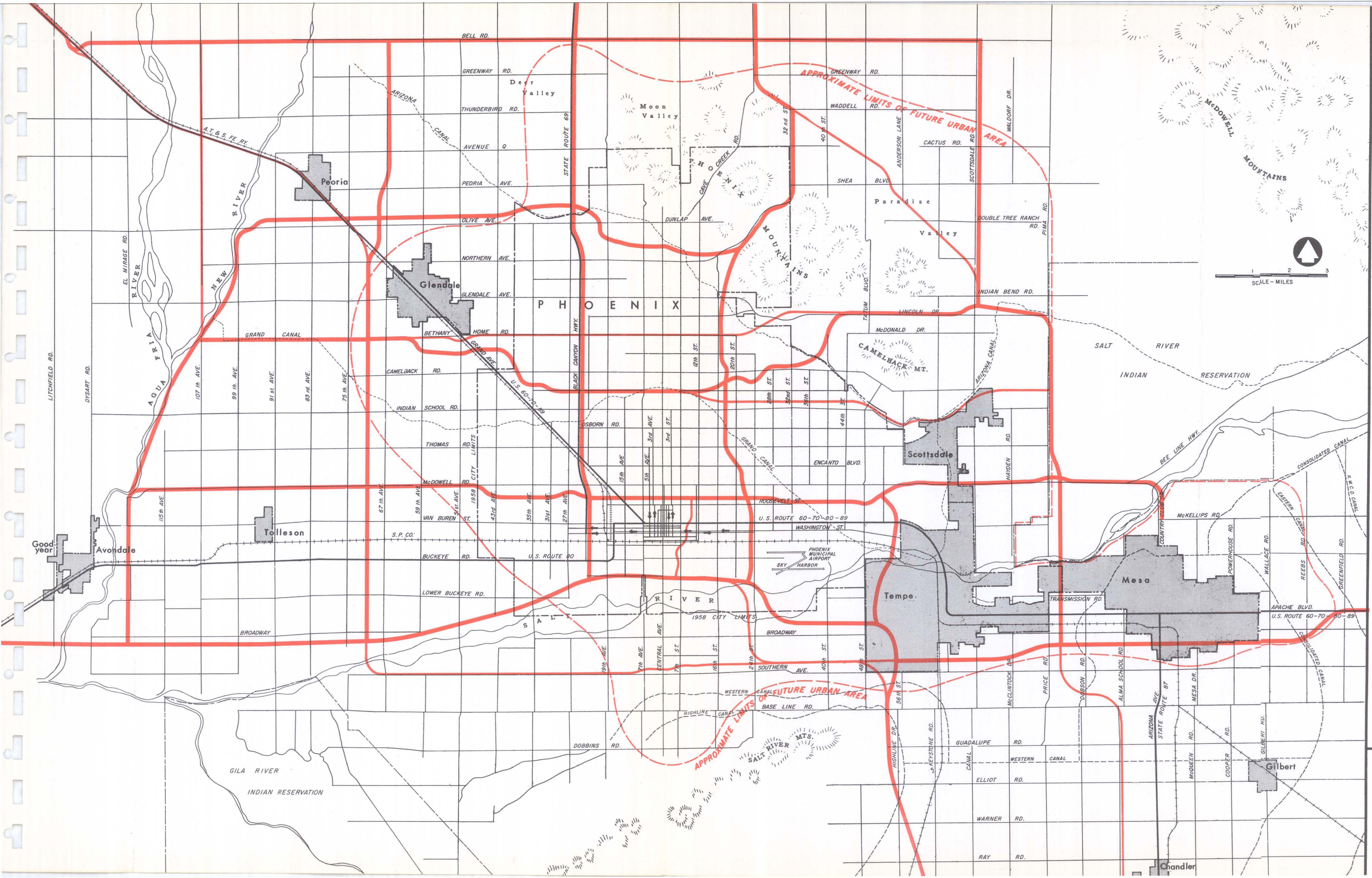

TENTATIVE FREEWAY - EXPRESSWAY SYSTEM AND ALTERNATE ROUTES STUDIED

PHOENIX URBAN AREA - MARICOPA COUNTY

LEGEND

- TENTATIVE FREEWAY SYSTEM
- ALTERNATE ROUTES STUDIED

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5) East-west routes through the central portion of the urban area to provide needed traffic capacity and quality traffic operations in critical east-west traffic corridors. (As shown in Figure 28, three central east-west routes were included in the tentative plan spaced at about three-mile intervals.)

6) An "east-side" north-south route located east of Central Avenue but west of the Municipal Airport and 24th Street;

7) A north-south route between Paradise Valley and the Tempe-Mesa area via Scottsdale;

8) An outer circumferential, or belt route around the 1980 urban area to collect and distribute external traffic between the other elements of the system;

9) Routes to serve areas west of the 1980 urban area; and

10) The designated Interstate "penetration" route to connect the Phoenix-Tucson Interstate freeway with principal areas of Phoenix providing services to the Interstate traveler; locations for this route near 7th, 24th and 52nd Streets were studied.

The basic pattern of arterial street connections to the tentative freeway-expressway system selected for further study included the mile roads and other major streets which now serve arterial traffic flow. The existing spacing of arterials generally conforms with desirable standards; there is little need or opportunity to depart from this established pattern.

TRAFFIC ASSIGNMENTS

Assignments of 1980 traffic to the tentative freeway-expressway system were made to test the adequacy of this system to serve future traffic needs. Traffic assignments are useful in the determination of lane requirements, in the determination of locations which may become overloaded indicating the need for additional capacity, and in the determination of sections of the tentative system which do not warrant expressway or freeway-type construction by 1980.

The basis for assignments of traffic to any roadway system is a comparison of relative time savings, trip lengths, directness of routing and availability of ingress and egress via alternate routes. Figure 29 shows the traffic diversion curve based on time ratios which has been developed from studies of traffic diversion to limited access highways by the Bureau of Public Roads and others. This diversion curve was applied in this study with adjustments for intangible or psychological values demonstrated by measured practices and reflecting the desires of motorists to travel on limited access highways.

The assignment procedure involved the following basic procedures:

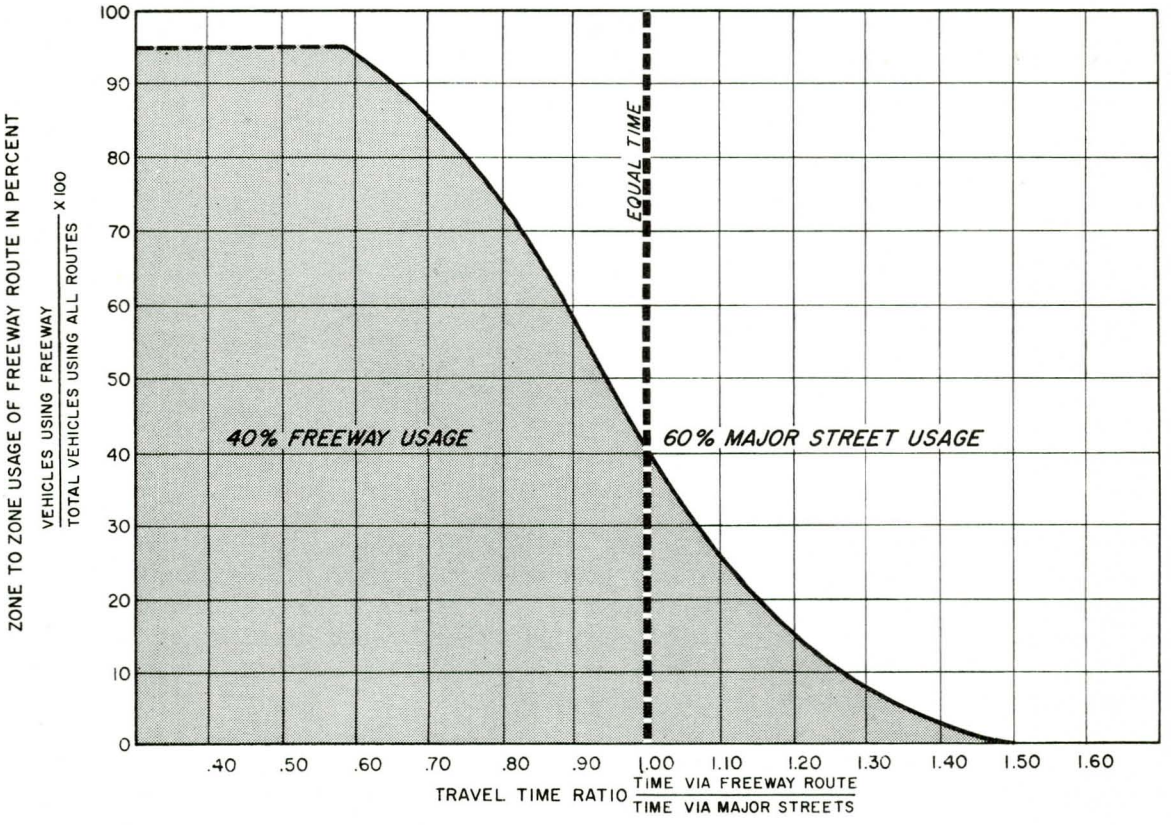
1) Selecting the shortest and most convenient route (and a second best or alternate route) via major streets between each pair of the 157 zones and 33 external stations in the 1980 study area;

2) Recording these major street routings using a numerical code;

3) Measuring and recording the estimated travel times via the selected major street routings;

4), 5) and 6) Same as steps 1), 2) and 3) for the freeway-expressway system;

7) Comparison of the route measurements obtained for the major street routes with those for the freeway-expressway routes by calculating time ratios, and from these ratios determining the allocation of trips to the freeway-expressway system by application of the diversion curve shown in Figure 29.



TRAFFIC DIVERSION CURVE

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29

The actual assignments were accomplished by mechanical methods which have been developed with the advent of electronic data-processing equipment. These methods are described in great detail in nationally accepted technical publications[15] and there is little need for a detailed explanation in this report.

MODIFICATIONS TO THE TENTATIVE PLAN

After the initial assignments of traffic to the tentative plan, the desirability of modifying the plan was indicated. Several sections of the tentative system could not be justified by the anticipated 1980 traffic volumes. The feasibility and desirability of replacing two of the three east-west routes through the central portion of the urban area with a single route located about midway between those replaced were also indicated. Otherwise, the traffic assignments substantiated the need for the freeway-expressway system and the desirability of the general locations selected for the individual routes. The results of these assignments, with respect to the recommended plan, are discussed in the following section.

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15. Bulletin 130, "Traffic Assignment by Mechanical Methods, Highway Research Board; 1956.

Chapter IV
THE MAJOR STREET AND HIGHWAY PLAN

The major street and highway plan recommended for the Phoenix Urban Area is shown in Figure 30. This plan, which evolved from the comprehensive studies of existing traffic and physical conditions, land use characteristics, and future traffic needs described in previous sections of this report, includes the combination of facilities which was found to be most desirable and practical. The road network for the 1980 Phoenix Urban Area, as defined by local planning agencies, would include an extensive system of controlled-access highways (freeways, expressways and parkways) integrated with a carefully planned system of urban arterials. The proposed arterial street plan conforms with the established grid pattern and consists, in general, of existing mile roads. About one-third of the proposed arterial streets have been designated as *major arterials* indicating that these streets should be developed to higher standards than other arterials for service to heavy volumes of relatively long trips. Routes included in the urban major street and highway plan, and the recommended standards for their development, are presented in this chapter.

Also described herein is a county-wide plan for major highway routes which has been prepared to assure integration between plans for the urban and rural sections of the county. This plan includes a county-wide system of rural freeways and expressways which has been integrated with a vast network of non-limited access rural highways and county roads.

THE URBAN FREEWAY—EXPRESSWAY SYSTEM

The proposed plan for controlled-access highways (freeways, expressways and parkways) in the future Phoenix Urban Area includes about 59.2 miles of routes which are of state-wide interest, and about 81.4 miles of other routes required to develop an integrated system for 1980 urban traffic demands. These routes are briefly described as follows:

BLACK CANYON HIGHWAY (Interstate Route 17; 14.6 miles)

As discussed previously, this route is now being constructed to freeway standards in Phoenix as part of the Interstate highway system. With other planned Interstate routes, the Black Canyon Highway constitutes the "back-bone" of the proposed freeway-expressway system. Black Canyon Highway will provide high quality access to downtown Phoenix from rapidly growing residential suburbs to the north and northwest, and will serve heavy volumes of urban area trips as well as interstate traffic movements.

The planned locations of interchanges along the Black Canyon Highway were major factors in the determination of the recommended locations of east-west arterials in the Phoenix Urban Area. Current plans of the Arizona Highway Department call for interchange ramps at nearly all east-west mile roads and at Grant Street, Adams Street and Grand Avenue, as well as the Durango Street interchange with the Phoenix-Tucson Freeway (Interstate Route 10). It is recommended that plans for the

construction of Black Canyon Highway be modified to include provisions for future interchanges with east-west freeway routes proposed in this report.

PHOENIX–TUCSON FREEWAY (Interstate Route 10; 24.1 miles)

The location of this freeway has also been established within general limits by the Arizona Highway Department; right-of-way has been acquired for some sections. As shown in Figure 31, the Phoenix-Tucson Freeway will be located north of the Salt River between Black Canyon Highway and a point east of 24th Street, where the route will cross the river and pass to the north of Bell Butte (east of 48th Street at Broadway). At Bell Butte, this freeway will turn to the south as shown. The Phoenix-Tucson Freeway will provide traffic relief to congested east-west streets between Henshaw Road and Van Buren Street through the removal of through traffic and service to trips between downtown Phoenix and the Tempe-Mesa area.

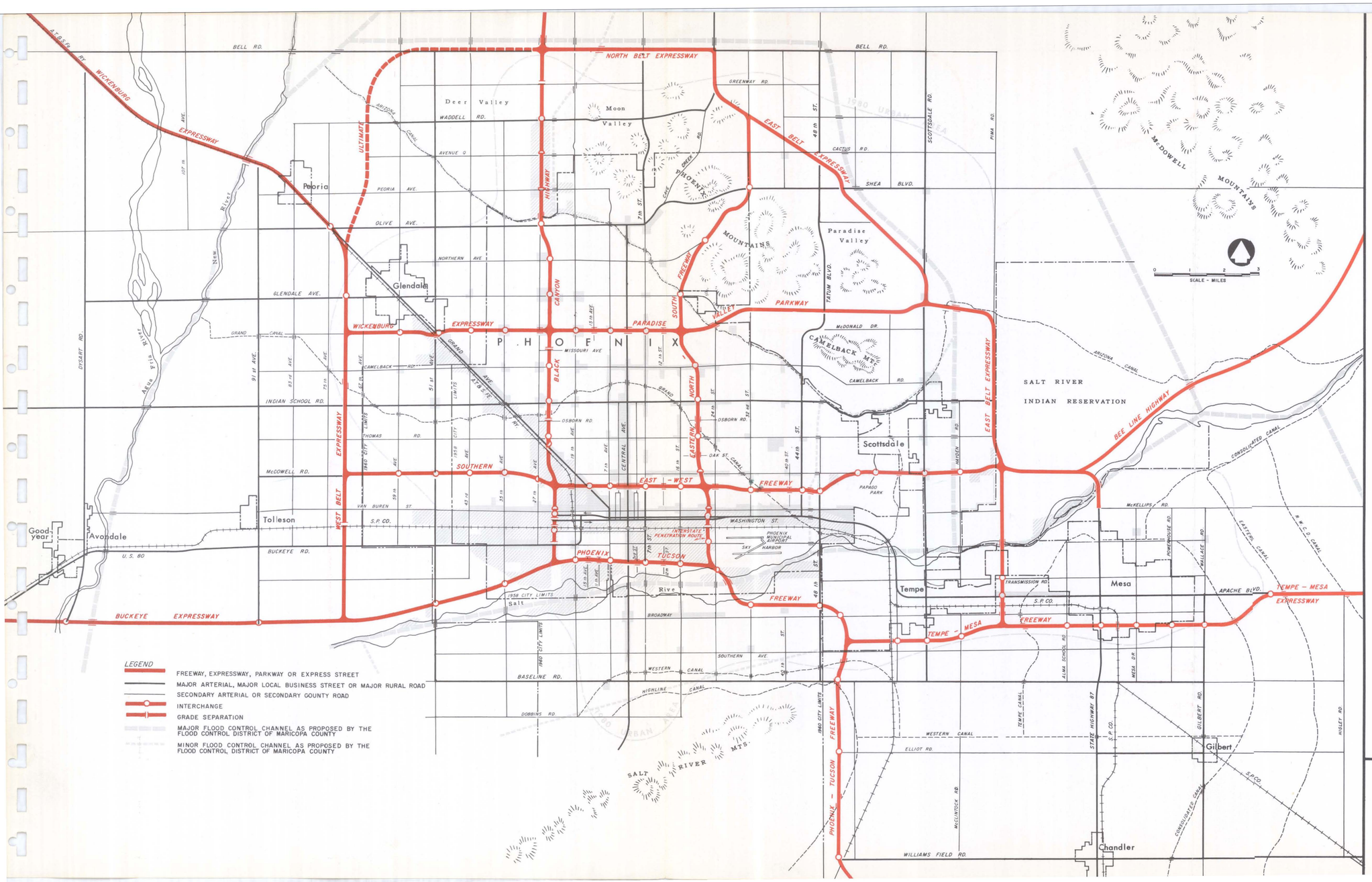
TEMPE–MESA FREEWAY (13.0 miles)

This route, which constitutes a limited-access highway relocation of U.S. Routes 60-70-80-89, would serve important regional traffic movements between the Phoenix Urban Area and points east, and would connect Tempe and Mesa with Phoenix via the Phoenix-Tucson Freeway. It would be developed to freeway standards along the southern limits of urbanization at or near Southern Avenue as shown in Figure 32. The Tempe-Mesa Freeway would provide necessary capacity and high-quality traffic services in a major traffic corridor, remove through traffic from major east-west streets which will be needed to serve local traffic between Tempe and Mesa, and serve as a buffer between conflicting land uses. Right-of-way for the future development of this route should be secured at the earliest possible date.

SOUTHERN EAST–WEST FREEWAY (22.7 miles)

As shown in Figure 30, it is proposed that two east-west controlled-access highway routes be developed through central portions of the urban area. The Southern East-West Freeway would be located along or near McDowell Road; a location in the vicinity of Portland Street in central Phoenix seems most feasible, based on preliminary route locations studies. (See Figure 33).

The Southern East-West Freeway is needed for present-day traffic demands, let alone those projected for 1980. This route would provide vitally needed traffic capacity, would constitute part of an inner circumferential around the downtown area, would greatly improve access to the downtown area from both areas east and west of central Phoenix, would provide a much needed high-speed east-west route through the area, would connect Mesa and Scottsdale with major business centers of Phoenix, and would provide many other traffic benefits. The great benefits to be derived from this facility would more than offset the high costs of its construction. It must be emphasized that the development of this route should not be deferred; preliminary design studies and acquisition or control of key land parcels should begin soon if the Southern East-West Freeway is to be in operation by 1970 as recommended.



LEGEND

- FREEWAY, EXPRESSWAY, PARKWAY OR EXPRESS STREET
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET OR MAJOR RURAL ROAD
- SECONDARY ARTERIAL OR SECONDARY COUNTY ROAD
- INTERCHANGE
- GRADE SEPARATION
- MAJOR FLOOD CONTROL CHANNEL AS PROPOSED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
- MINOR FLOOD CONTROL CHANNEL AS PROPOSED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA, MARICOPA COUNTY

Wilbur Smith and Associates

WICKENBURG EXPRESSWAY (18.0 miles)

The Wickenburg Expressway would consist of a relocation of U.S. Routes 60-70-89 in the Phoenix Urban Area. As shown in Figure 34, this route would be connected with Black Canyon Highway (Interstate Route 17) east of Glendale. Preliminary route location studies, and the objective of developing a continuous east-west route across this portion of the urban area, indicate the desirability of by-passing the City of Glendale to the south and connecting with Black Canyon Highway at or near Bethany Home Road. Early action to protect right-of-way required for the urban sections of this route will be essential.

PARADISE VALLEY PARKWAY (11.1 miles)

This route would constitute part of the northern east-west route through the urban area. It would extend from the Wickenburg Expressway at Black Canyon Highway to the east limits of the urban area as shown in Figure 35. Because of the nature of the areas traversed (desirable residential areas, de luxe resort hotels, etc.) it would be desirable to develop this route as a parkway (restrict its use to passenger cars and light trucks with local deliveries).

Access control along this route should be secured, as much as possible, through neighborhood planning to minimize right-of-way requirements. In critical areas in central Phoenix, the route could be developed initially as an express street; i.e., grade separations would be constructed at major intersecting north-south streets, but extensive right-of-way acquisitions to provide access control would be deferred.

The Paradise Valley Parkway would provide a needed high-speed, high-capacity route across north Phoenix between the Glendale area and the rapidly expanding Paradise Valley and Scottsdale areas. It would remove through traffic from congested Camelback Road and Grand Avenue, reserving these facilities for services to the major commercial and service establishments along them.

EASTERN NORTH–SOUTH FREEWAY (15.2 miles)

This route would provide needed high-quality, high-speed traffic services in a major north-south traffic corridor in the eastern half of the urban area, extending from the northern end of the Interstate Penetration Route at Van Buren Street to the northern limits of the urban area. Preliminary studies indicate that a location along or near 20th Street north of McDowell Road, shown in Figure 36, would be most desirable. The Eastern North-South Freeway would improve access to the downtown area and the municipal airport from east Phoenix and the Paradise Valley. Also, it would connect the latter areas with the interstate routes, remove many long-distance north-south trips from 16th and 7th Streets and Central Avenue, and complete the integrated *system* of high-speed routes in the highly developed sections of the urban area, thereby increasing the effectiveness of the other elements of this system.

INTERSTATE PENETRATION ROUTE (Interstate Route 510; 1.7 miles)

The Interstate highway system includes a short route in the Phoenix Urban Area, bearing north from Interstate Route 10 (Phoenix-Tucson Freeway), which has

been designated as an urban penetration route. Several possible locations for this penetration route were studied, including those at or near 7th Street, 24th Street, and 52nd Street. Based on studies of traffic services and construction costs for each of these possible locations, it is recommended that the Interstate Penetration Route be developed just west of Phoenix Municipal Airport between 20th and 24th Streets, as shown in Figure 36. Local officials of the Federal Aviation Agency indicate that a major highway route in this area would not interfere with future airport operations, either depressed or at grade level. The 20th-24th Street location for the Interstate Penetration Route is recommended for the following principal reasons:

1) A freeway between 20th and 24th Streets would cost only about half as much to construct as a 7th Street location.

2) The 20th-24th Street location could be integrated into the needed freeway-expressway system as a key section of a continuous north-south route through the eastern half of the Phoenix Urban Area. This could not be done with either the 7th Street or 52nd Street locations without excessive property damages and disruption of established land use patterns.

3) The 20th-24th Street location would provide the needed high-quality direct access to Phoenix Municipal Airport.

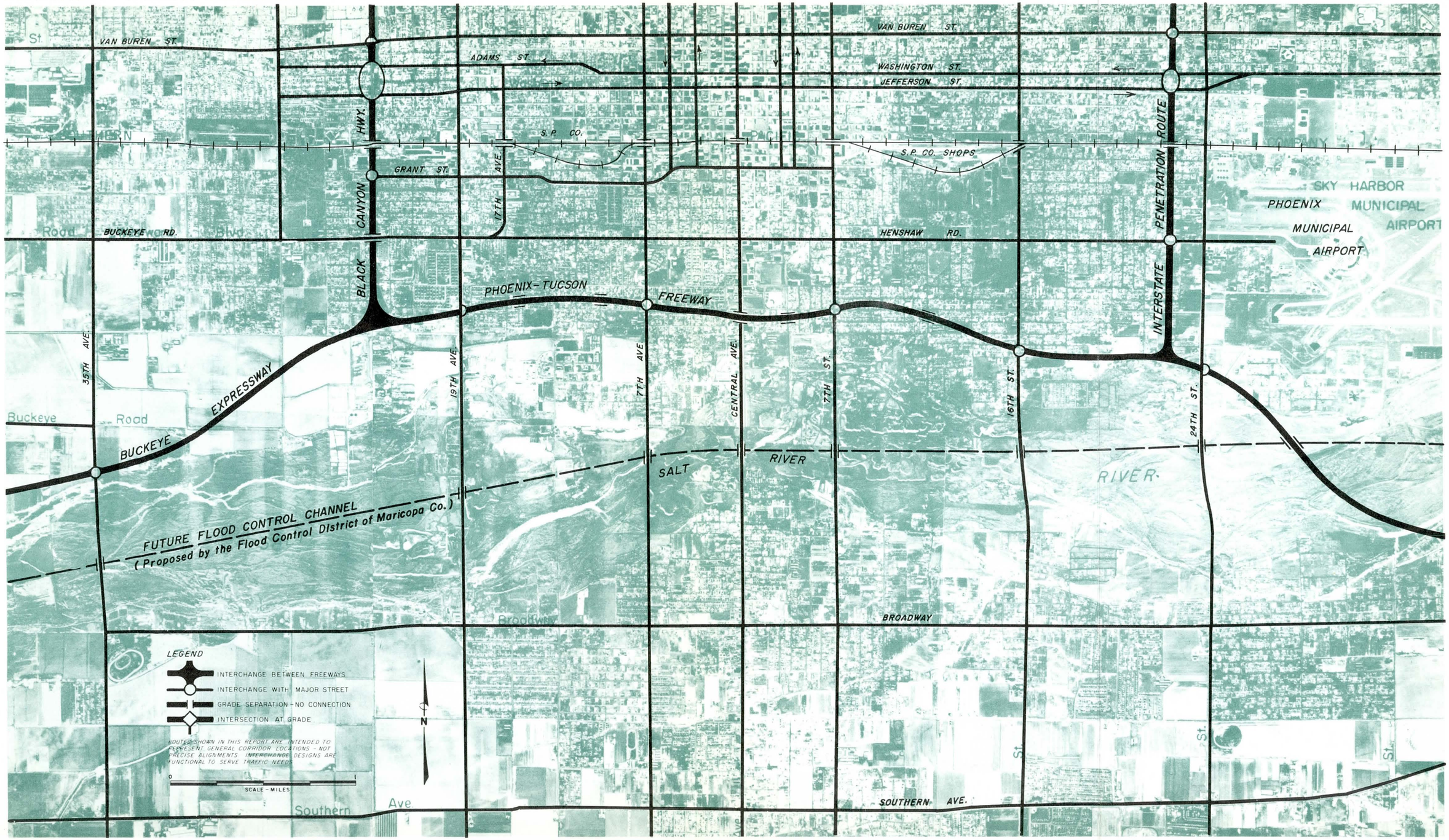
4) The 20th-24th Street route would provide a more direct connection from the Interstate system to a major strip of motels and other establishments along Van Buren Street which cater to the interstate traveler. High quality access to the Phoenix central business district could be provided from the 20th-24th Street Penetration Route via the Washington-Jefferson one-way couplet (Jefferson Street would be extended) and from Interstate Route 10 via 7th Street developed to standards of a major arterial.

5) The 20th-24th Street location would serve 38,000 to 50,000 vehicles per day in 1980, if part of a continuous "east-side" north-south freeway. This volume is considerably more than would be served by a route located at 52nd Street. It is approximately the same volume which would be served by a route at 7th Street if the latter route were to be terminated at Van Buren Street as shown on preliminary route plans prepared by the Arizona Highway Department.

6) An elevated freeway along 7th Street would cause much greater disruption to land use, including a future redevelopment area, than a freeway along or near 24th Street. The area west of the airport is undesirable for residential use and has been designated as an airport "clear zone" in which no large structures can be built.

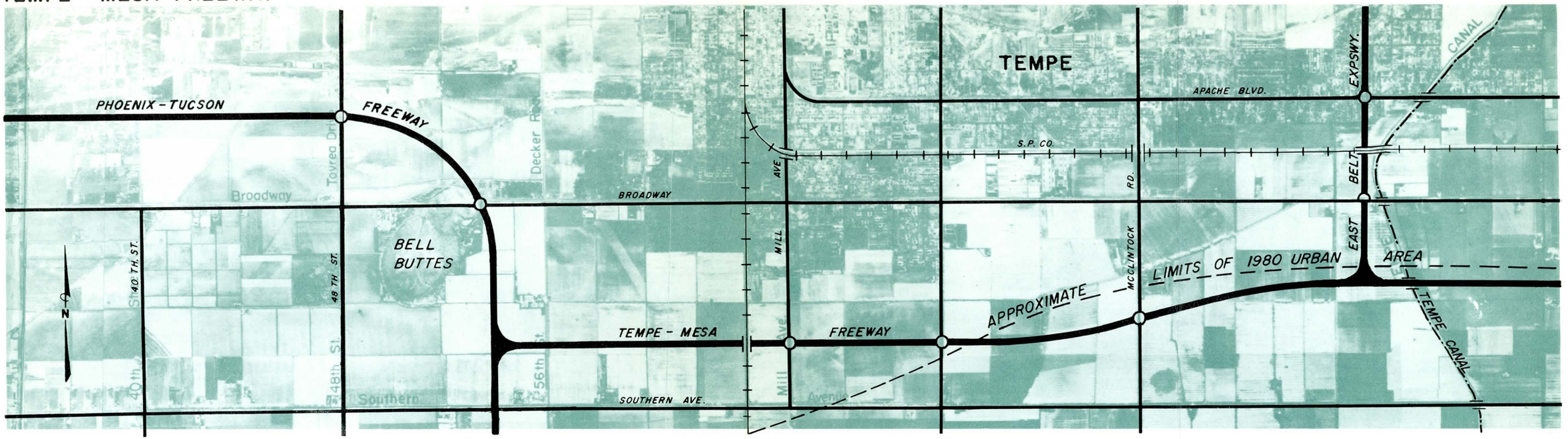
7) Relationships between over-all benefits and costs indicate the superiority of constructing a freeway near 24th Street with major arterials at 7th and 48th Streets, as proposed herein, over constructing a freeway penetration route at 7th Street with major improvements to 24th Street and other north-south arterials in east Phoenix.

PHOENIX-TUCSON FREEWAY



TEMPE — MESA FREEWAY

SHEET 1



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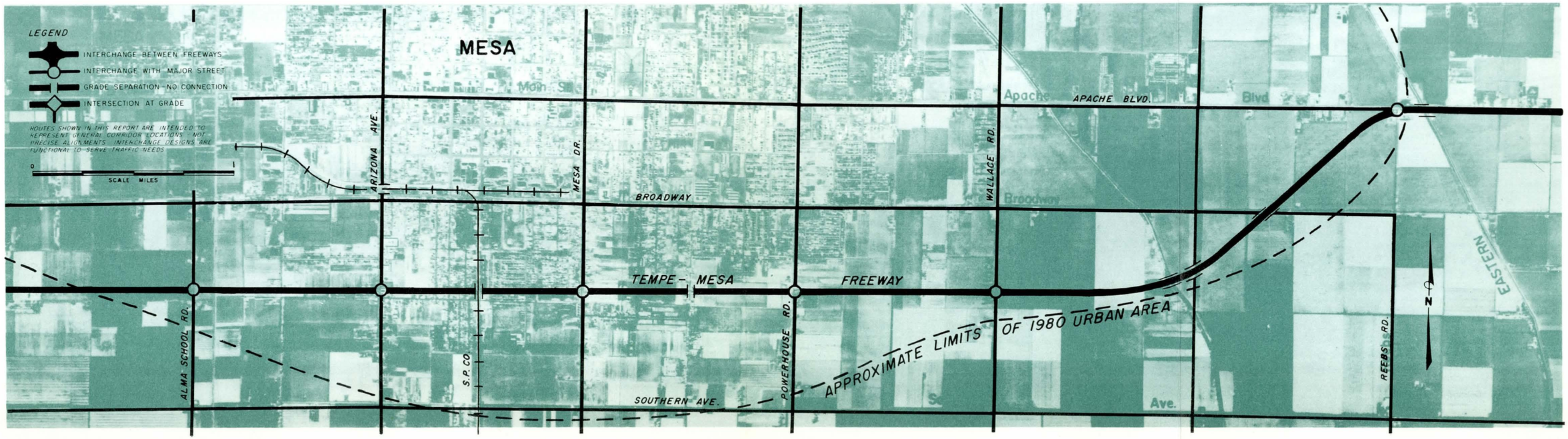
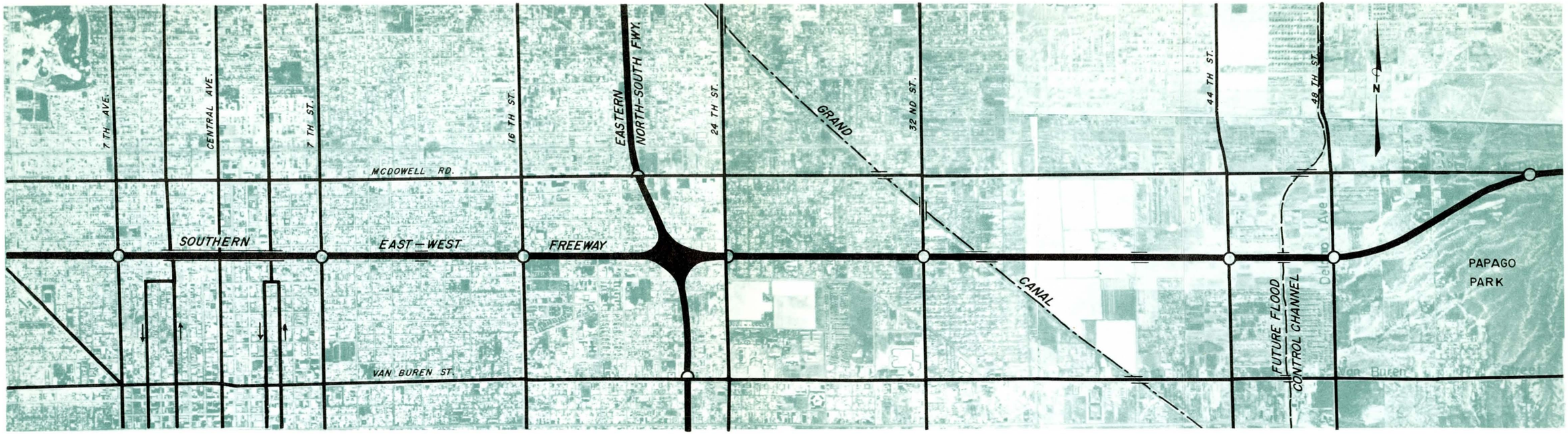


SOUTHERN EAST-WEST FREEWAY

SOUTHERN EAST-WEST FREEWAY

SHEET 2



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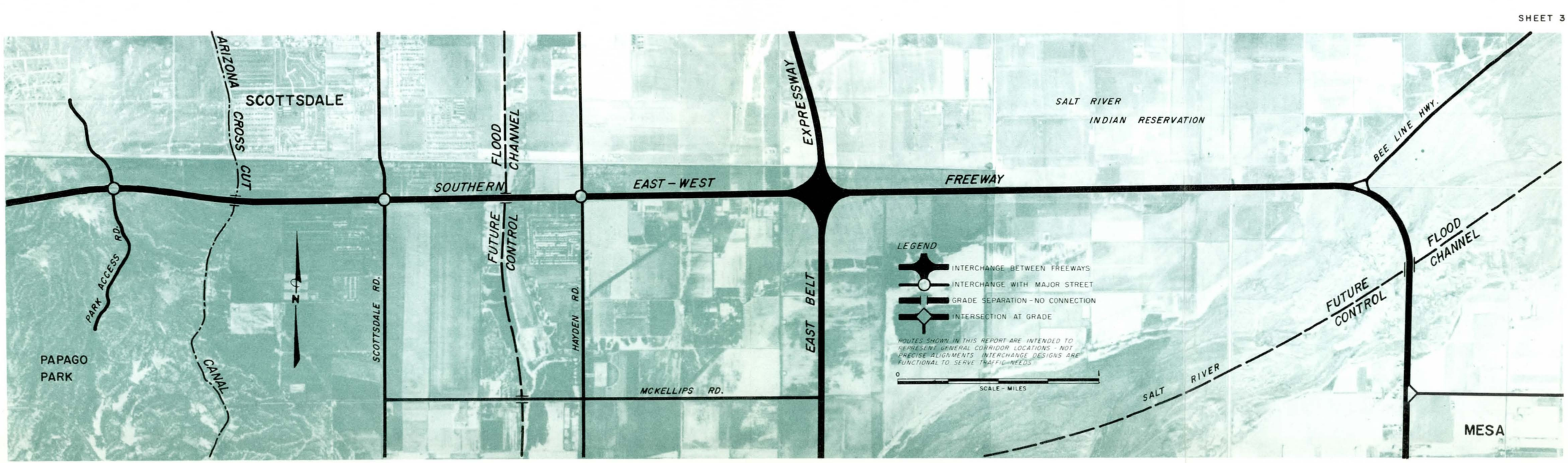
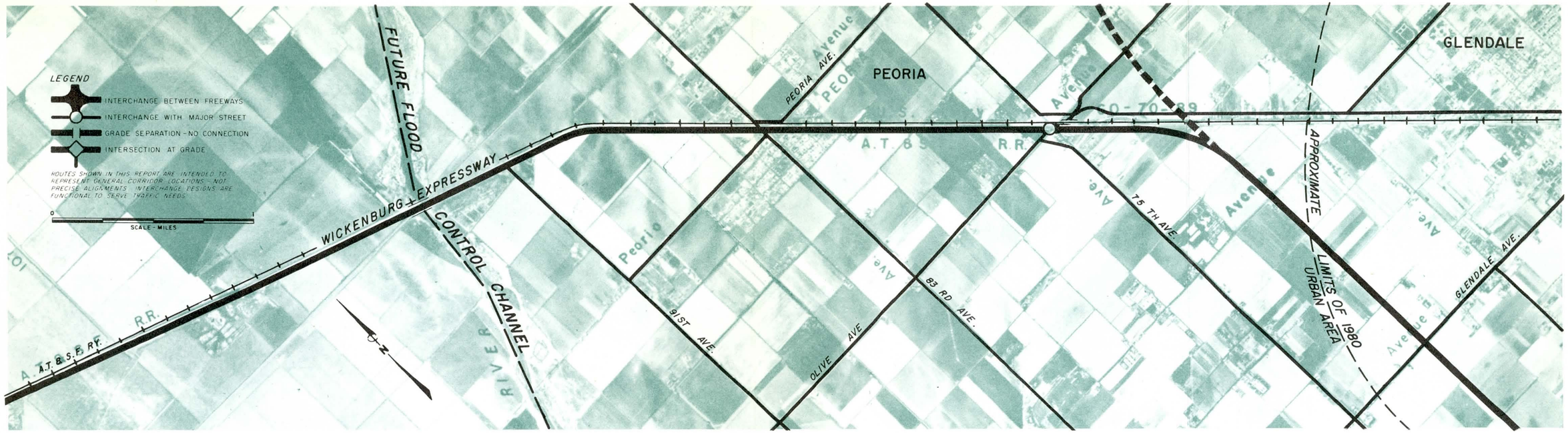


WICKENBURG EXPRESSWAY

SHEET 1



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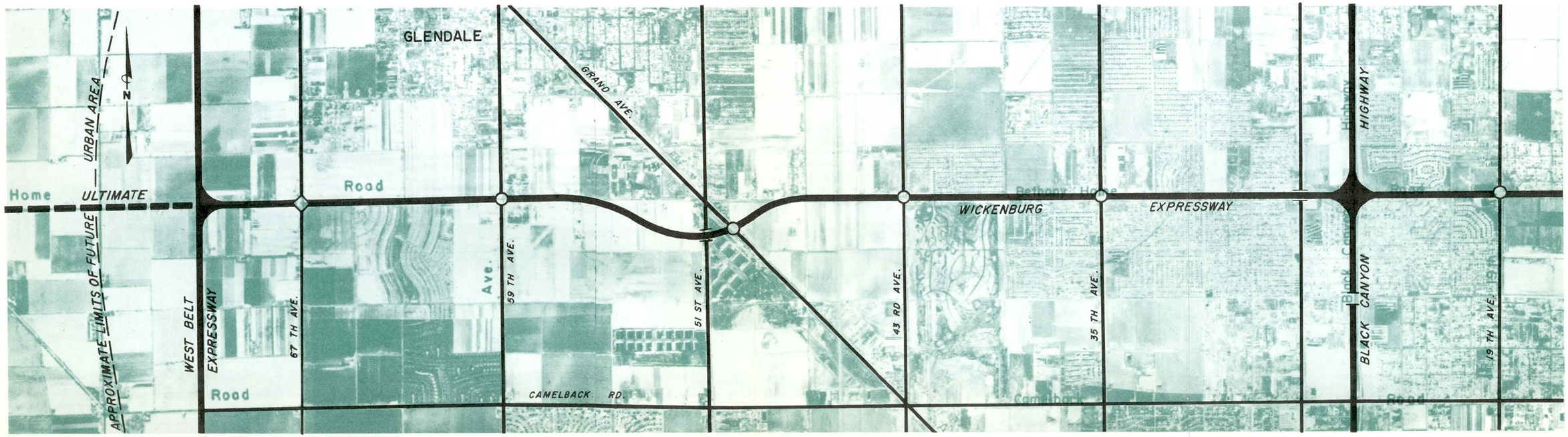
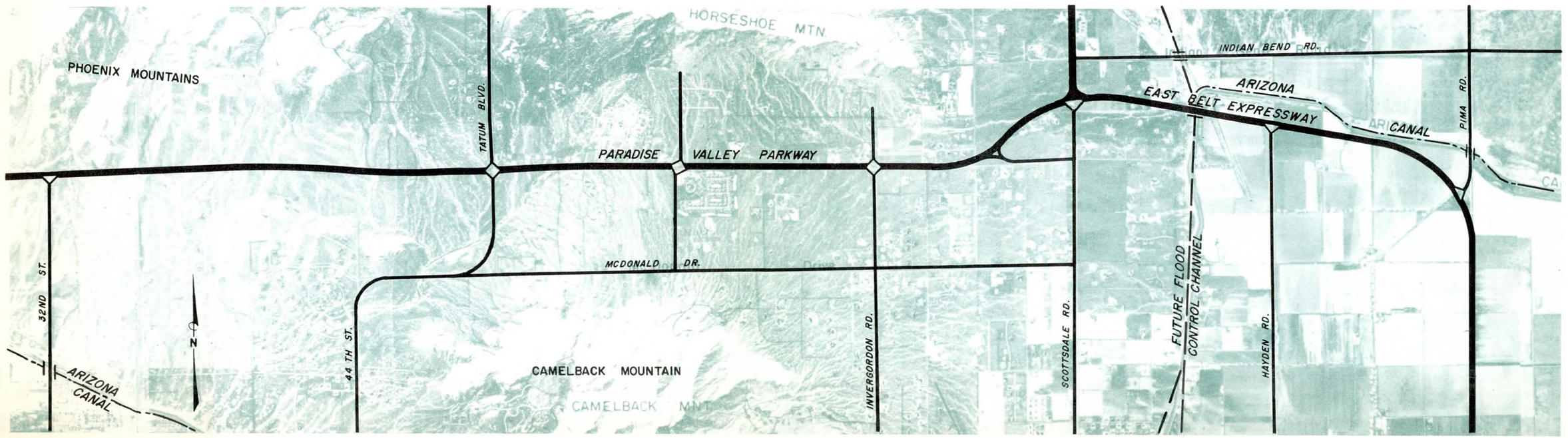


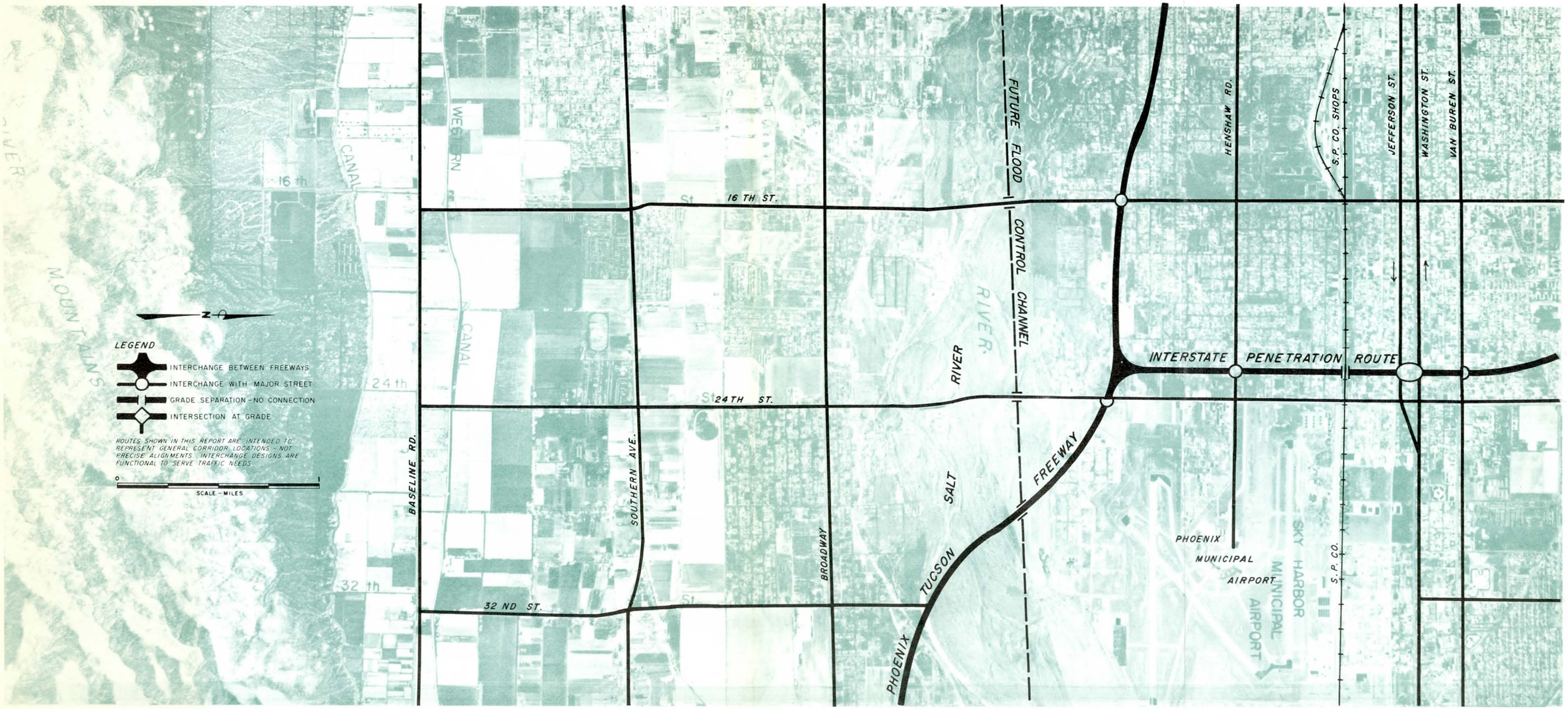
NORTHERN EAST-WEST THRU ROUTE

SHEET 1

SHEET 2



EASTERN NORTH-SOUTH FREEWAY



EASTERN NORTH-SOUTH FREEWAY

SHEET 2

EASTERN NORTH-SOUTH FREEWAY

SUNNYSLOPE

NORTHERN AVE.

CAVE CREEK RD.

SUNNYSLOPE

7 TH ST.

WADDELL RD.

LOOKOUT MTN.

NORTH BELT EXPRESSWAY

(GENERAL LOCATION)

16TH ST.

CONTROL CHANNEL

FUTURE FLOOD

EASTERN NORTH-SOUTH FREEWAY

SHEA BLVD.

CACTUS RD.

EAST BELT EXPRESSWAY

GREENWAY AVE.

BELL RD.

32ND ST.

N

LEGEND

- INTERCHANGE BETWEEN FREEWAYS
- INTERCHANGE WITH MAJOR STREET
- GRADE SEPARATION - NO CONNECTION
- INTERSECTION AT GRADE

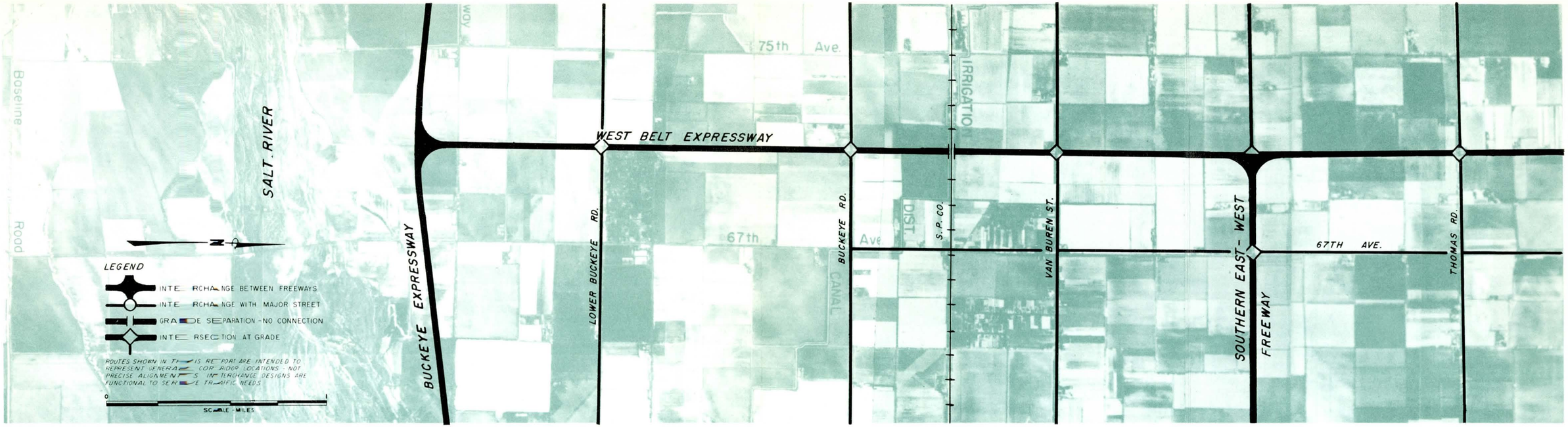
ROUTES SHOWN IN THIS REPORT ARE INTENDED TO REPRESENT GENERAL CORRIDOR LOCATIONS - NOT PRECISE ALIGNMENTS. INTERCHANGE DESIGNS ARE FUNCTIONAL TO SERVE TRAFFIC NEEDS.

0 1

SCALE - MILES

WEST BELT EXPRESSWAY

SHEET 1



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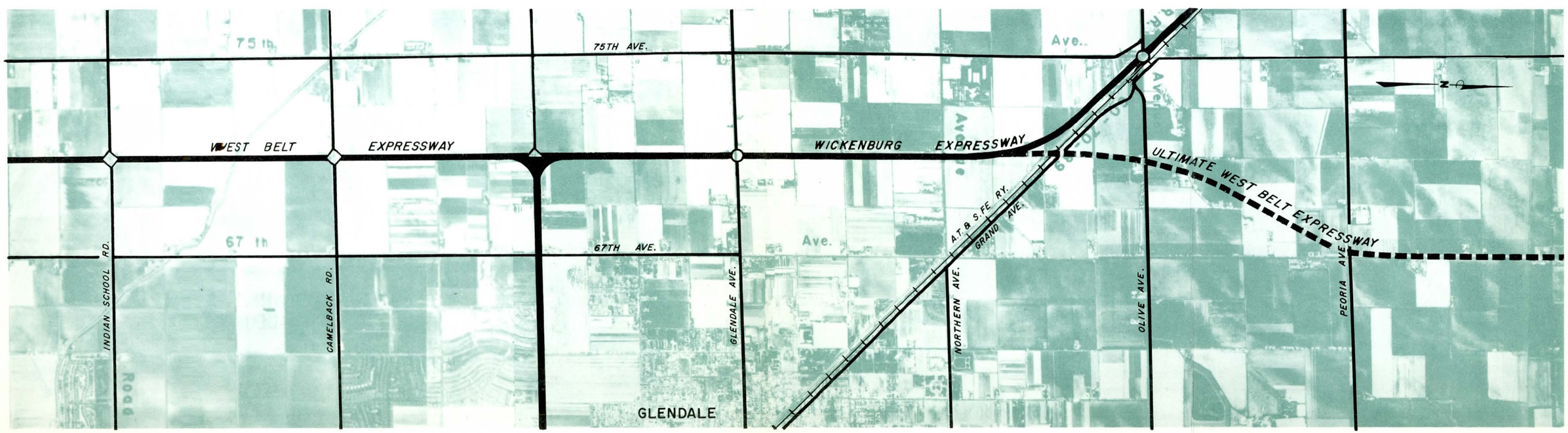
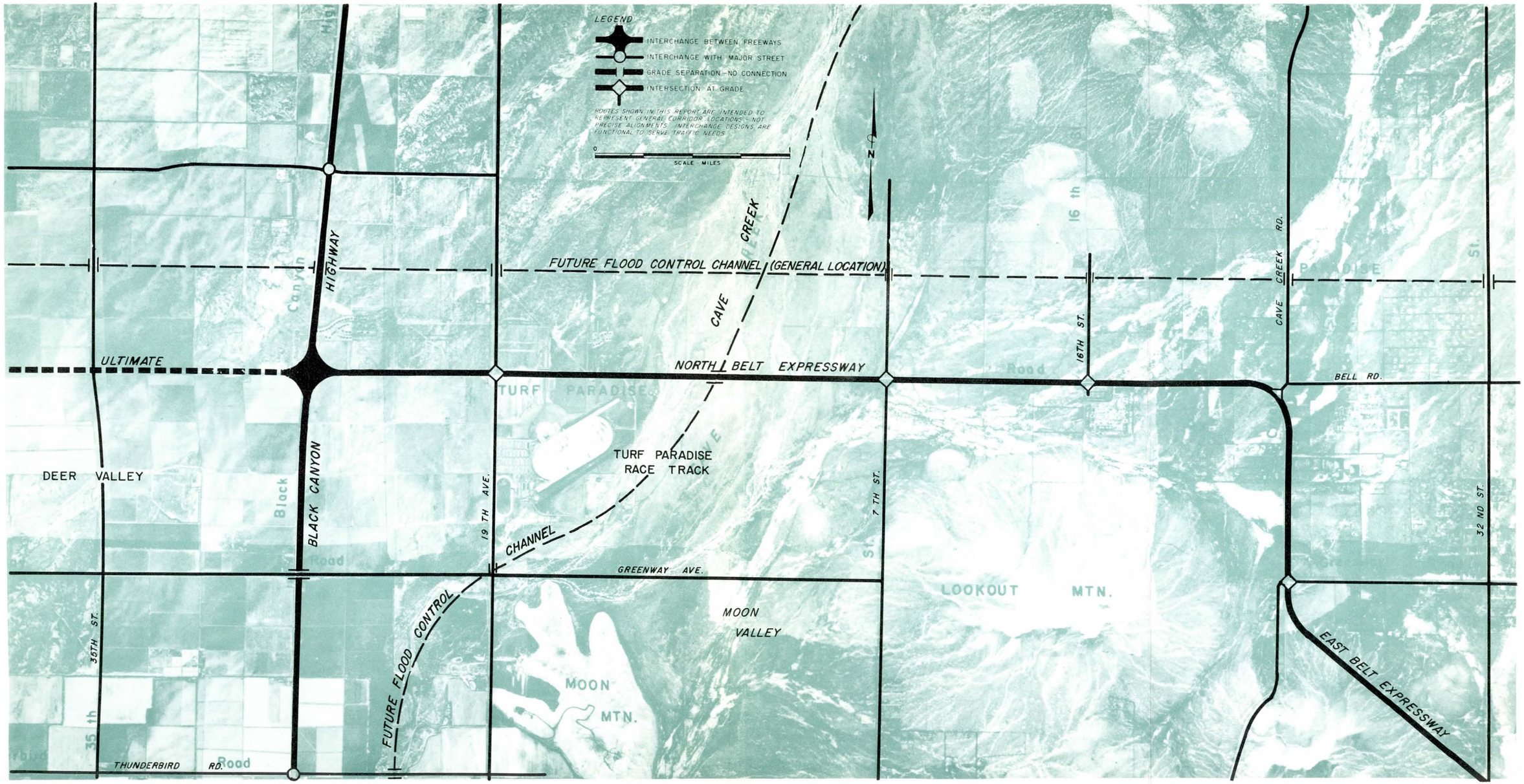
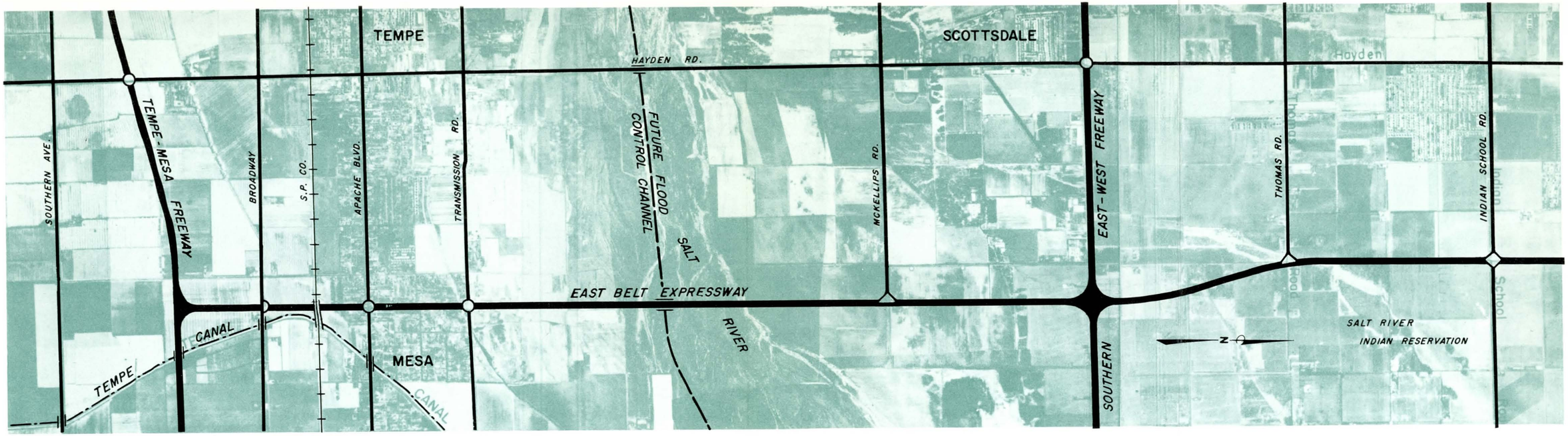
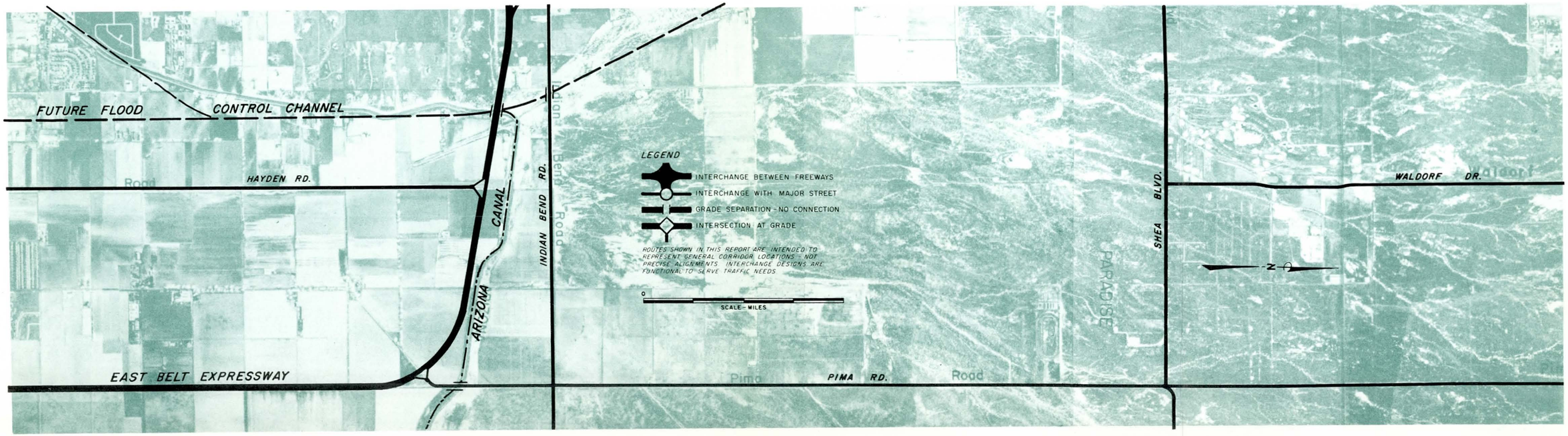


NORTH BELT EXPRESSWAY



EAST BELT EXPRESSWAY

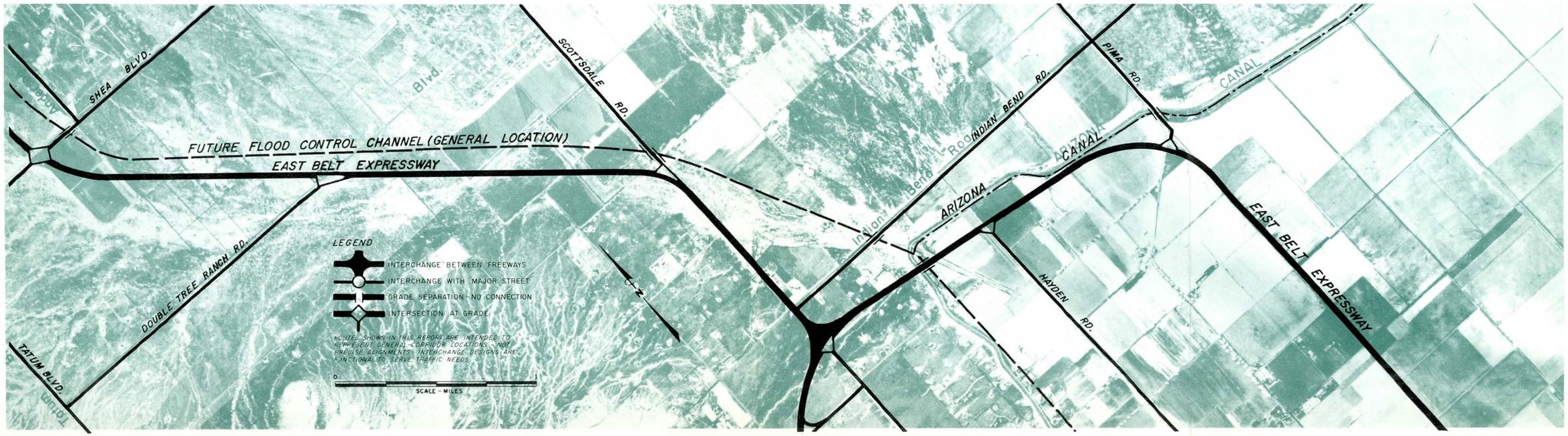




EAST BELT EXPRESSWAY

SHEET 3

SHEET 4



8) The 20th-24th Street location fits the desirable pattern for an over-all system of major highway routes in the urban area better than any other location studied.

WEST BELT EXPRESSWAY (8.4 miles)

This route is recommended as a lateral connection between the Wickenburg and Buckeye Expressways and as part of an outer circumferential of the 1980 urban area, located as shown in Figure 37. Highway grade separations will not be needed along this route for 1980 traffic unless the urban area expands substantially beyond the 1980 urban limits established for planning purposes in this study. The West Belt Expressway will collect and distribute high speed external traffic leaving and approaching the urban area to and from the west and will connect northwestern sections of the urban area with areas southwest of Phoenix.

NORTH BELT EXPRESSWAY

Construction of an expressway around the north limits of the 1980 urban area as shown in Figure 38 is also recommended. Although the limits of the future urban area have been established by the Phoenix-Maricopa County Advance Planning Task Force at about Bell Road, (See Figure 12), important land developments can be expected north of Bell Road, including major employment centers. Within the indicated limits of the urban area, the North Belt Expressway will provide important traffic services to Moon Valley, with an estimated 1980 population of about 40,000 persons, Deer Valley, the Paradise Race Track (19th Avenue and Bell Road), and portions of Paradise Valley.

EAST BELT EXPRESSWAY (18.9 miles)

The recommended outer circumferential for the Phoenix Urban Area also includes an East Belt Expressway. This route would connect Paradise Valley with the Mesa-Tempe area via Scottsdale as shown in Figure 39, providing high-quality traffic services in a major corridor of traffic demand. Consideration should be given to the possibility of developing this route as part of a flood control project in Paradise Valley and in areas east of Scottsdale.

Future traffic usage of the southern half of this route is largely contingent on future developments in the Salt River Indian Reservation. Traffic estimates included in this report are not based on expansion of the urban area into the reservation. The precise location of this route should be established by more detailed studies of flood control needs, land use, and topographic factors.

THE ARTERIAL STREET SYSTEM

The major street and highway plan for the Phoenix Urban Area, shown in Figure 30, also includes a 375 mile network of arterial streets. Of this total network, about 124 miles have been designated as major arterials, including the following:

51ST AVENUE

This major arterial is desirably spaced between the Black Canyon Highway and the proposed West Belt Expressway and would serve heavy volumes of traffic generated by the newly annexed Maryvale section of Phoenix, the Glendale area and Deer Valley. It would constitute one of the major feeder routes to the proposed Southern East-West Freeway and other east-west regional highways. It would be the principal route between west Phoenix and westerly sections of south Phoenix. Recently constructed sections of 51st Avenue have been developed on adequate 130-foot rights-of-way; older sections will require widening.

GRAND AVENUE

This existing arterial highway route would function as a major local business street upon completion of the proposed freeway-expressway system. Widening within the existing 100-foot right-of-way is recommended for service to heavy volumes of local traffic generated by abutting industrial and commercial establishments. Six-legged intersections at each mile road crossing prevent this facility from providing satisfactory service to heavy volumes of relatively long trips - an important reason for the development of proposed freeway routes in west Phoenix. The planned widening of the principal approaches to these intersections to provide turn lanes and adequate channelization is strongly endorsed.

CENTRAL AVENUE

This important facility should also function as a major local business street. Central avenue is located in the center of one of the heaviest traveled traffic corridors in the area and must be expected to serve very heavy volumes with periodic congestion even when the Black Canyon Highway, Eastern North-South Freeway and north-south arterial street improvements are completed. It is recommended that Central Avenue be widened where necessary to provide six lanes for traffic flow with curb parking restrictions between the downtown area and Indian School Road. Other sections of Central Avenue should be provided with four through traffic lanes with left-turn lanes at principal intersections and median islands to limit cross traffic to major intersecting streets.

44TH STREET – TATUM BOULEVARD

These streets would constitute the principal north-south route between Paradise Valley and east Phoenix. They would also be major feeders to the east-west routes in the proposed freeway-expressway system. Existing right-of-way widths along this important route are inadequate for desirable major arterial standards. A right-of-way width of at least 100 feet should be reserved along Tatum Boulevard in Paradise Valley. While it will be desirable to secure a similar width along 44th Street in Phoenix, it may be necessary to develop a "restricted" major arterial section on only 80 feet right-of-way. In either case, a four lane divided roadway should be constructed by 1980.

48TH STREET

This major arterial would constitute the principal north-south route in Phoenix east of the airport, connecting east Phoenix with south Phoenix and the Interstate route to Tucson.

7TH STREET (Interstate 10 to Southern East-West Freeway)

As shown in Figure 30, interchange connections on the Phoenix-Tucson Freeway (Interstate 10) and the Southern East-West Freeway would not be provided at Central Avenue. The downtown connections to these routes would be via 7th Avenue and 7th Street. The latter route has been designated for development as a major arterial.

The 7th Street major arterial will constitute the principal feeder route for downtown trips generated in eastern sections of the urban area and using the east-west freeway routes. It will also supplement Central Avenue for service to major north-south traffic demands in and near the downtown area; directly serve the future urban renewal area; connect the major industrial area southwest of the downtown area with the Interstate system; and serve through traffic between south Phoenix and central Phoenix enabling Central Avenue to provide better service to local traffic in the downtown area.

7TH STREET (Olive Avenue to Bell Road)

This section of 7th Street has also been designated as a major arterial to connect Moon Valley, which is expected to include thousands of homes in future years, with north Phoenix. Since this route passes through an area which is virtually undeveloped, the opportunity exists to develop a high-capacity route without great cost or right-of-way damages.

SCOTTSDALE ROAD

This important facility will function as a major local business street between Scottsdale and Tempe. It will also provide the principal connection between Paradise Valley and Scottsdale, Tempe and Mesa until the East Belt Expressway is constructed. Because Scottsdale Road passes through downtown Scottsdale, and will be required to serve heavy volumes of local traffic, the early development of the East Belt Expressway will be desirable for through traffic service.

NORTH COUNTRY CLUB DRIVE – ARIZONA AVENUE

These streets will provide the major north-south route through Mesa, constituting the extension of the eastern sections of the Southern East-West Freeway. This route will also be a major connection between Mesa and the proposed Tempe-Mesa Freeway; a grade separation has already been provided at the crossing of the Southern Pacific Company tracks. Arizona Avenue also serves as the principal route between Mesa and Chandler, Gilbert and other sections of southeastern Maricopa County.

BASELINE ROAD

An east-west freeway through south Phoenix, constituting an extension of the proposed Tempe-Mesa Freeway, was tested for need in these studies. It was found that the improvement of existing arterials, including the development of Baseline Road as a major arterial, would be sufficient for anticipated 1980 traffic in the corridor. Baseline Road will constitute the principal route between south Phoenix and Tempe, will connect south Phoenix with the Interstate route to Tucson, will connect south Phoenix with Mesa until the Tempe-Mesa Freeway is constructed and will serve as an outer circumferential route around the southern section of the urban area.

THE ADAMS—JEFFERSON AND WASHINGTON—JEFFERSON ONE—WAY COUPLET

One of the principal connections between the downtown area and the Black Canyon Highway will be the existing one-way couplet which includes Adams Street (westbound) and Jefferson Street (eastbound). These streets should be developed to provide three effective lanes for traffic flow. Through the downtown area, and east of this area to 16th Street, Washington Street is paired with Jefferson Street as a high-capacity one-way couplet which is operating very effectively. It is recommended that Adams Street be connected more directly to Washington Street in the vicinity of 10th Avenue and that the one-way couplet be extended to about 26th Street where Jefferson Street would be connected to Washington Street by a minor street extension.

WASHINGTON STREET — APACHE BOULEVARD

These streets would constitute the principal east-west major street route between areas east of downtown Phoenix and the cities of Tempe and Mesa. Washington Street (as well as 44th and 48th Streets) would connect a major strip of motels with the freeway-expressway system and would serve a major industrial area of Phoenix, reserving Van Buren Street for more localized traffic service functions. Apache Boulevard will be, as today, the principal route between Tempe and Mesa, serving very heavy volumes of trips of moderate length.

INDIAN SCHOOL ROAD

This facility has been designated for improvement to the standards of a major arterial because it is desirably located between the proposed east-west freeways in central Phoenix and with respect to major east-west traffic desires. Major improvements will be needed to increase its capacity. Projected traffic demands along this route indicate the future need for six traffic lanes in central Phoenix. The primary function of Indian School Road would be to serve major east-west long distance traffic movements not served by the freeway-expressway system, thereby removing trips of this type from Camelback and Thomas Roads where capacity is needed for service to major commercial, service and industrial developments. Indian School Road would also be one of the principal east-west routes between the urban area and rural sections of Maricopa County west of Phoenix.

OLIVE AVENUE — SHEA BOULEVARD

Olive Avenue has been included in the major arterial system to provide import-

ant traffic services between the Glendale area and north Phoenix. This route would also be a major feeder to the Black Canyon Highway. Shea Boulevard would be connected with Olive Avenue to serve Paradise Valley. (The desired traffic service function could also be provided by use of Cactus Road and Cave Creek Road; Shea Boulevard was selected because a wider right-of-way has been secured along this route, and because it would provide a superior connection between the Paradise Valley and the Eastern North-South Freeway.)

BELL ROAD

Sections of Bell Road, not included in the freeway-expressway system, would be developed to the standards of a major arterial. Bell Road should be developed to 51st Avenue in the near future, and eventually extended west to the Wickenburg Expressway. If the future urban area expands beyond the northern limit established for this study, which is quite possible considering the land available and existing developments, Bell Road will serve very substantial traffic volumes.

SECONDARY ARTERIALS

The recommended major street and highway plan also includes about 250 miles of secondary arterials in the Phoenix Urban Area. The locations of these arterials, which are, in general, the mile roads which have not been designated as major arterials, are also shown in Figure 30.

Use of the term secondary arterial is not intended to imply that these streets are less important than major arterials. Secondary arterials will also serve heavy traffic volumes 1980, including traffic between major residential, commercial and industrial centers and the freeway and expressway routes. The secondary arterials will provide important services to abutting properties as well as service to through traffic, whereas the major arterials will be planned to serve through traffic primarily. This difference in traffic service functions does not now exist on these streets but would be established by the development of major arterials to higher standards for traffic movement.

THE COUNTY—WIDE PLAN

Figure 40 indicates a master plan for the development of major highway routes in Maricopa County which would result in an integrated county-wide transportation system including major streets and highways in the Phoenix Urban Area. The county-wide plan includes a 442 mile freeway-expressway system, and about 598 miles of major urban arterials and major non-limited access rural roads. About 496 miles of important secondary county roads are also included; this mileage includes the rural roads which will be serving more than 1,000 vehicles per day in 1980 and which are necessary to provide service to all developed areas of the county. The rural road network, shown in Figure 40, was developed to assure major route continuity and integration with the major street and highway plan for the urban area. This plan should be reappraised when adequate land use data are available on a county-wide basis.

RURAL FREEWAYS AND EXPRESSWAYS

About 301 miles of the county-wide freeway-expressway system consists of rural sections of the Interstate system or important regional routes of state-wide interest in Maricopa County. These include Black Canyon Highway from Bell Road to the north county line (28.5 miles); the Phoenix-Tucson Freeway from Guadalupe Road to the south county line (12.2 miles); the Tempe-Mesa Expressway from Reebs Road to the east county line (10.0 miles); and the Wickenburg Expressway from Bell Road to the north county line (35.1 miles).

The county-wide freeway-expressway plan also includes the following routes:

BUCKEYE EXPRESSWAY (65.6 miles)

The proposed Buckeye Expressway would extend from the west county line to the Black Canyon Highway, serving Buckeye, Goodyear, Avondale, Tolleson and unincorporated areas west of the Phoenix Urban Area. From Buckeye to the Black Canyon Highway, this route would function as a limited-access highway relocation of U.S. Route 80. The entire length of the Buckeye Expressway is now under study by the Arizona Highway Department as a possible route for Interstate 10 west of Phoenix. If this route is selected for the Interstate system, it will be developed to rural freeway standards.

Even if this route via Buckeye (commonly referred to as the "Brenda cut-off") is selected for the Interstate system, the Wickenburg Expressway should be developed as part of the county-wide network of major regional routes. The Wickenburg Expressway would serve important intercity traffic movements in Maricopa County and Arizona, and would constitute part of a direct connection between the Phoenix Urban Area and southern Nevada. If the Wickenburg Expressway is selected as the Interstate route, the Buckeye Expressway would be constructed to a junction with U.S. Route 80 near Buckeye.

YUMA—TUCSON FREEWAY (Interstate Route 8; 67.1 miles)

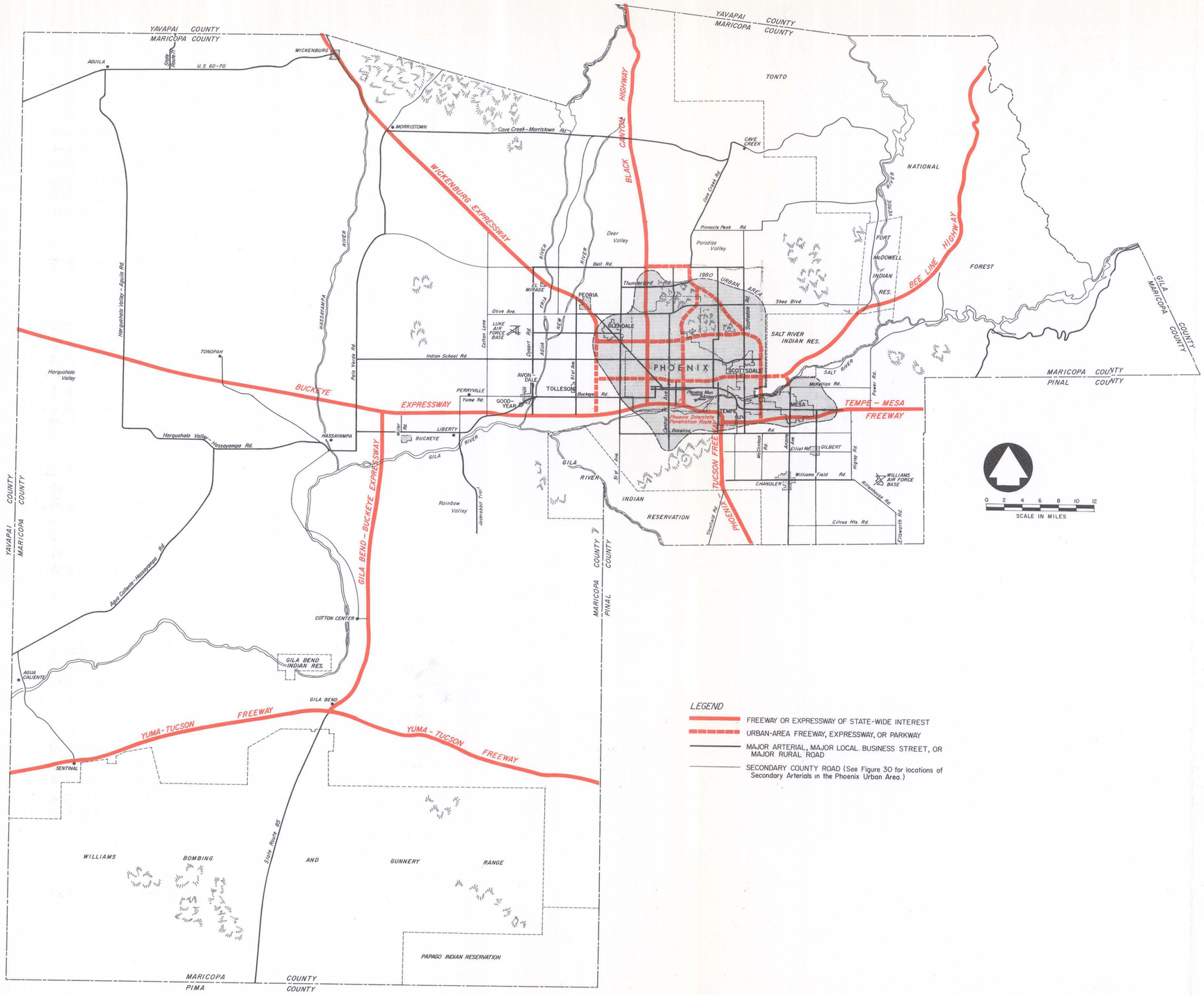
This regional route is to be developed to freeway standards across the southern section of Maricopa County via Gila Bend as part of the Interstate system. It will be the southernmost east-west Interstate route in Arizona, connecting Yuma with Tucson.

GILA BEND—BUCKEYE EXPRESSWAY (34.0 miles)

This rural route constitutes the development of U.S. Route 80 to limited access standards between Gila Bend and Buckeye; it has been included in the county-wide master plan primarily as a lateral connection between the Buckeye Expressway and the Yuma-Tucson Freeway. Thus, the Gila Bend-Buckeye Expressway would provide a major part of an important connection between the Phoenix Urban Area and Yuma and southern California.

BEE LINE HIGHWAY (48.5 miles)

This highway, which is scheduled for improvement by the Arizona Highway



LEGEND

- FREEWAY OR EXPRESSWAY OF STATE-WIDE INTEREST
- URBAN-AREA FREEWAY, EXPRESSWAY, OR PARKWAY
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET, OR MAJOR RURAL ROAD
- SECONDARY COUNTY ROAD (See Figure 30 for locations of Secondary Arterials in the Phoenix Urban Area.)

RECOMMENDED COUNTY-WIDE FREEWAY-EXPRESSWAY SYSTEM AND MAJOR COUNTY ROADS

PHOENIX URBAN AREA - MARICOPA COUNTY

Department, provides regional traffic services between the Phoenix Urban Area and Winslow and passes through national forest areas of Arizona. Although projected traffic demands for this route are moderate, topographic conditions and the character of the area through which it passes indicate access could be controlled with comparative ease. It is recommended that the Bee Line Highway be developed as a two-lane rural expressway.

MAJOR RURAL ROADS

The rural extensions of the major arterials in the Phoenix Urban Area and other major rural roads in Maricopa county are also shown in Figure 40. Major rural routes in the Salt River Valley include Dysart Road, 91st Avenue, Buckeye Road, Glendale Avenue, Indian School Road, Arizona Avenue, Williams Field Road, sections of Gilbert Road north of Williams Field Road, and sections of Baseline Road west of Phoenix and south of Tempe and Mesa. Other major rural routes would include Cave Creek Road; existing U.S. Route 60-70 between the west county line and Wickenburg (if not added to the Interstate system); a new east-west route between Cave Creek Road and the Wickenburg Expressway at about Morristown; State Route 84 south of Gila Bend; State Route 71 north of Aquila; and regional routes connecting the Harquahala Valley with other major rural roads.

Figure 40 also indicates the locations of principal secondary county roads which have been included in the county-wide plan for major rural roads. These routes, which include virtually all secondary roads serving appreciable traffic at present, total about 496 miles in length. They will provide the principal tributaries to the proposed regional highway network, providing for "farm-to-market" needs.

SPECIAL STRUCTURES

Several bridge projects have been included in the general plan for major street and highway development which warrant special mention. These include flood control channel crossings, collector street freeway crossings, and principal railroad grade separations.

FLOOD CONTROL CHANNEL CROSSINGS

As previously indicated, the development of flood control facilities in the Phoenix Urban Area will create the need for major street bridge crossings of the future drainage channels. The design and location of these bridges will depend upon the widths and locations of the channels. Figure 30 indicates the probable locations of these bridges based on preliminary plans for major flood control channels proposed by the Flood Control District of Maricopa County. Additional crossings of Grand Canal, Arizona Canal and other canals in the urban area will also be required as shown.

COLLECTOR STREET FREEWAY CROSSINGS

The future need for collector street crossings of freeways in the urban area was also considered. Crossings of this type will be desirable in some areas. The

network of controlled access highways and arterials described above should be designed with sufficient capacity to serve major traffic movements across the urban area. As previously noted, the development of collector streets in residential areas to such high standards of design and continuity that they attract heavy volumes of through traffic should be avoided. Wherever possible, collector streets, which are generally the half-mile roads in Phoenix, should be planned to function primarily as feeder routes between neighborhoods and the arterial system.

The provision of collector street crossings of Black Canyon Highway is a special problem since this facility is already under construction. Analyses of needs for crossings of this type primarily involve the half-mile roads between Thomas Road and Glendale Avenue. Present plans include intermediate grade separations at Grant, Jefferson and Adams Streets between Buckeye Road and Van Buren Street. The proposed Southern East-West Freeway would constitute a major crossing of Black Canyon Highway between Van Buren Street and McDowell Road. Between McDowell Road and Thomas Road, a grade separation is already provided at Grand Avenue; it will not be either desirable, or necessary to extend Encanto Boulevard across the freeway because through traffic should not be introduced into the fine residential area served by this street, and since east-west capacity needs would be provided by the Southern East-West Freeway. North of Glendale, adequate east-west traffic capacity can be provided by existing arterials, because of the moderate densities of existing and planned land use developments and the fact that the Phoenix Mountains restrict the length of east-west streets in north Phoenix.

The need for additional half-mile crossings of Black Canyon Highway in central Phoenix will depend on the standard of development of other east-west facilities. If present street improvement policies are continued, whereby all mile roads are widened to only four lane standards, and if the two proposed east-west controlled access routes are not constructed, capacity needs will require the construction of several half-mile road crossings. Even with these half-mile crossings, sufficient capacity for 1980 needs would not be provided unless the proposed controlled access routes are also developed.

Because of the urgent need for additional east-west capacity and the time which will be required to construct the Southern East-West Freeway and to improve Grand Avenue and Indian School Road to the standards of major arterials, it will be desirable to extend Osborn Road across the freeway during the next few years. This street has already been programmed for future widening by local authorities. Similarly, a freeway crossing at Missouri Avenue would serve to relieve Camelback Road and provide necessary east-west capacity until the Paradise Valley Parkway is developed. Implementation of the recommended major street and highway plan will preclude the need for other collector street crossings of Black Canyon Highway.

Preliminary plans for the Phoenix-Tucson Freeway in the Phoenix Urban Area, prepared by the Arizona Highway Department, include collector street crossings at 15th Avenue, 11th Avenue, 3rd Street and 12th Street. These crossings are adequate for the projected 1980 traffic needs. A preliminary plan for the Southern East-West Freeway, developed for this study, includes collector street freeway crossings at 3rd Avenue, 3rd Street, 12th Street, and 40th Street. The Eastern North-South Freeway preliminary plan includes collector street crossings at Oak Street and Osborn

Road. Crossings at 15th Avenue and 12th Street are included in the preliminary plans for the Paradise Valley Parkway.

RAILROAD GRADE SEPARATIONS

Conflicts between railroad and vehicular traffic have already reached undesirable levels at various grade crossings in the Phoenix Urban Area. The estimates of future traffic demands developed for this report emphasize the desirability of including railroad grade separation projects in the major street and highway improvement program for reasons of safety as well as for the elimination of traffic delays.

It would be desirable to develop a complete separation of railroad and motor vehicle traffic in urban areas. However, the costs and practical problems involved in railroad grade separation projects are extremely great. The prospective benefits from each improvement must be carefully weighed against the costs and possible adverse effects on railroad operations and existing properties. Where traffic delays are not critical, less costly protective devices may provide adequate safety.

The proposed freeway-expressway system includes railroad grade separations of the Southern Pacific tracks at Black Canyon Highway, the Eastern North-South Freeway, the East Belt Expressway, the West Belt Expressway and the Tempe-Mesa Freeway. Separations at crossings of the Santa Fe would be provided by the Black Canyon Highway, the Wickenburg Expressway and the Southern East-West Freeway (south of McDowell Road). The costs of these separations have been included in the estimates prepared for the freeway-expressway system.

Priorities for other railroad grade separation projects should be established in consideration of the relative magnitudes of traffic delays and hazards which already exist at critical grade crossings, but they should also be consistent with long-range objectives for the development of major routes. Thus, although the McDowell Road crossing of the Santa Fe tracks is high on the list of critical grade crossings based on existing traffic delays and hazards, this report recommends against the construction of a costly grade separation at this location because the proposed Southern East-West Freeway will provide the necessary separation and other high quality services in this traffic corridor.

General standards have been established for use as guides for the determination of needs for railroad protective devices at grade crossings and for grade separations.[16] These standards call for:

A) *Flashing Lights* where the product of number of trains per day and the average daily traffic in 1971 is between 1,500 and 5,000 (minimum improvement).

16. Instruction Manual for Estimating Needs of Various Road Systems for use in investigations under Section 210 of the Highway Revenue Act of 1956; by U.S. Department of Commerce, Bureau of Public Roads; March 1957.

B) *Automatic Gates and Flashing Lights* where the average daily traffic in 1971 exceeds 2,000; where product of number of trains per day and average daily traffic in 1971 exceeds 5,000 for normal single-track lines; or where the product exceeds 3,000 for double-track main lines or high speed single lines.

C) *Grade Separations:*

1. On rural highways where 1971 average daily traffic exceeds 20,000.

2. On multi-lane rural or urban highways where there are single or multiple main line tracks.

3. Where the product of the number of trains per day and the 1971 average daily traffic exceeds 100,000 in rural areas and 200,000 in urban areas.

4. On new construction where the product of the number of trains per day and the 1971 average daily traffic exceeds 50,000.

The standards cited above have been applied in the determination of priorities of needs for railroad grade crossings in the Phoenix Urban Area except that the design year for this study (1980) was substituted for the year 1971 used for the previous deficiency surveys.

Eventually, principal grade crossings on the recommended major arterial system in the Phoenix Urban Area should be eliminated. These include crossings on 51st Avenue, Indian School Road, Adams and Jefferson Streets, 7th Street, 48th Street amd Scottsdale Road. Grade separations are already provided on the major arterial system at Central Avenue and 17th Avenue in Phoenix and Arizona Avenue in Mesa. Secondary arterial grade separation projects should also be included in the program where the needs are particularly great.

Table 16 lists the railroad grade separation projects which these studies determined to be most needed, which can be justified on the basis of the general standards cited above and which have been included in he recommended major street and highway plan. Most urgently needed are separations at 16th Street, 7th Street and 7th Avenue. In addition, better protective devices, including automatic gates and/or flashing lights, should be installed at other principal railroad crossings in the urban area. At present, automatic gates are not used at all and flashing lights (the minimum desirable protection) have not been installed at many locations.

The magnitude of the needs for future railroad grade separations and protective devices at grade crossings in the Phoenix Urban Area indicates the need for detailed engineering, financial and legal studies beyond the scope of this report. These studies should be undertaken jointly by the City of Phoenix, Maricopa County, the Arizona Highway Department, and the railroad companies involved. A successful program for railroad crossing improvements will require a co-operative approach in the necessary planning and construction, with joint participation in project costs.

Table 16

RECOMMENDED SCHEDULE OF PRIORITIES
RAILROAD GRADE SEPARATION IMPROVEMENTS

Priority	Street	Classification	R.R.	Number of Tracks	Avg.No. Trains Per Day	Number of Accidents 1957-1959	Potential Daily Conflicts 1958	Potential Daily Conflicts 1980
1	16th Street	Sec. Arterial	SP	5	122	17	1,695,800	2,200,000
2	7th Street	Major Arterial	SP	11	72	3	684,000	1,800,000
3	7th Avenue	Sec. Arterial	SP	21	46	10	519,800	830,000
4	Adams Street	Major Arterial	ATSF	1	14	0	74,200	210,000
5	Jefferson St.	Major Arterial	ATSF	1	14	0	75,600	210,000
6	Van Buren St.	Sec. Arterial	ATSF	1	14	1	191,800	310,000
7	19th Avenue	Sec. Arterial	SP	1	14	0	141,400	252,000
8	Indian Sch.Rd.	Major Arterial	ATSF	3	18	0	199,800	450,000

PROJECTED TRAFFIC VOLUMES AND CAPACITY STANDARDS

Estimates of 1980 traffic at critical screen lines, and the probable area-wide pattern of future traffic flow, were related to general standards of traffic capacity to determine desirable standards of physical development and lane requirements.

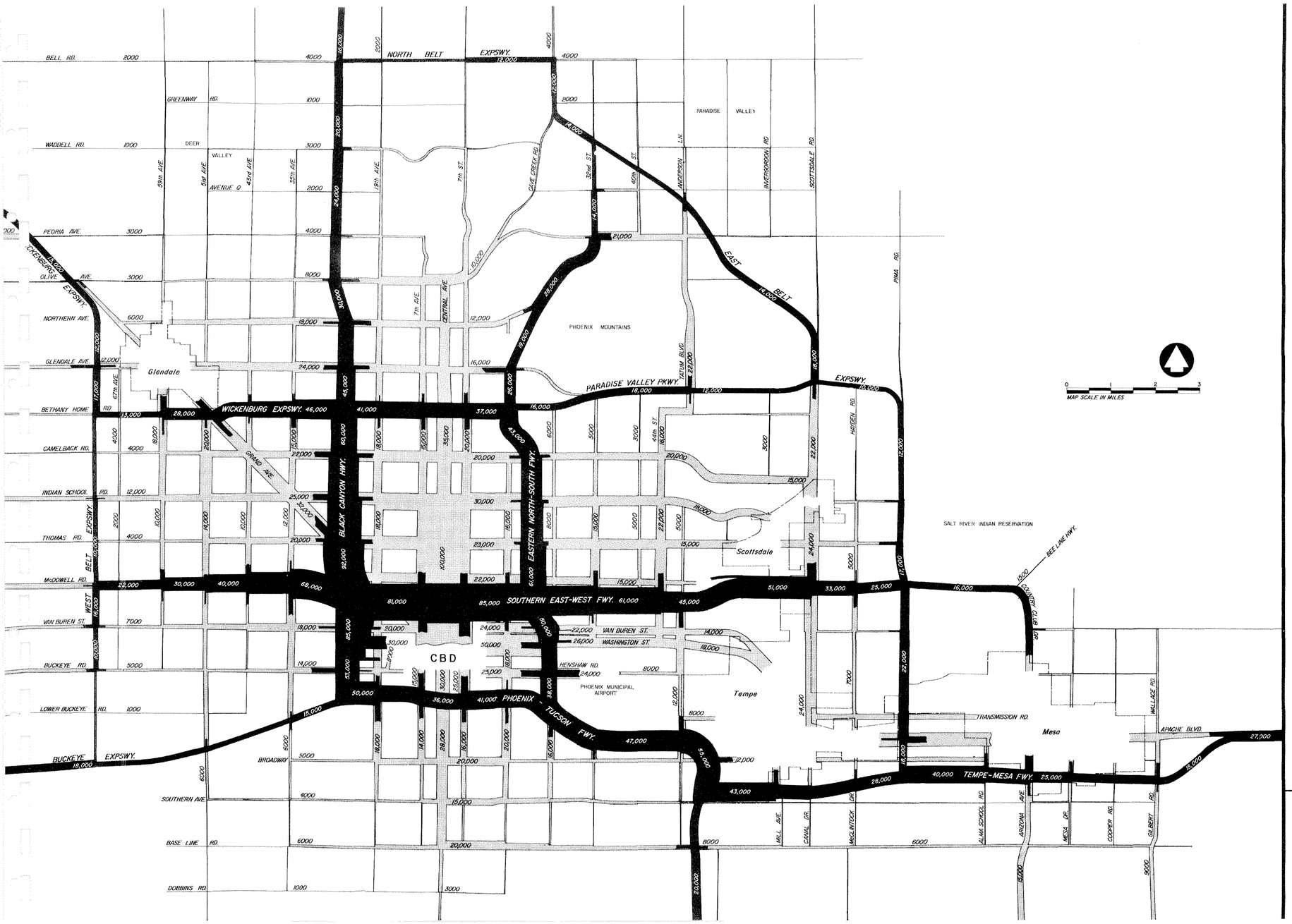
ESTIMATED 1980 TRAFFIC FLOW

Figure 41 illustrates the estimated pattern of 1980 average daily traffic flow on the recommended major street and highway system for the Phoenix Urban Area. The estimates shown in this illustration are based on assignments of inter-zonal traffic movements, using methods described in Chapter III of this report, and analyses of traffic volume-capacity relationships at screen lines in the critical corridors of flow.

Typical daily traffic volumes in excess of 50,000 vehicles per day are expected on all sections of Black Canyon Highway south of Bethany Home Road, on the proposed Southern East-West Freeway from west of Black Canyon Highway to Scottsdale, on the Phoenix-Tucson Freeway between the Interstate Penetration Route and Tempe, and on some sections of the Eastern North-South Freeway. Critical sections of both Black Canyon Highway and the Southern East-West Freeway should be planned to serve over 80,000 vehicles per day. Heavy traffic demands are also expected on Black Canyon Highway north of Bethany Home Road (20,000 to 43,000 vehicles per day); the Wickenburg Expressway from west of Grand Avenue to Black Canyon Highway (28,000 to 46,000 vehicles per day); the Paradise Valley Parkway between Black Canyon Highway and the Eastern North-South Freeway (35,000 to 41,000 vehicles per day); the Tempe-Mesa Freeway from the Phoenix-Tucson Freeway to Mesa (30,000 to 43,000 vehicles per day); the Interstate Penetration Route (38,000 to 50,000 vehicles per day); and the Phoenix-Tucson Freeway (18,000 to 51,000 vehicles per day).

These estimates of typical daily traffic volumes on the proposed freeway-expressway system may seem high in relation to present traffic volumes on major routes in the Phoenix Urban Area. The highest average daily volume at present is found on Central Avenue between Thomas and Indian School Roads where about 33,000 vehicles per day are served, and no other existing facility serves as much as 30,000 vehicles per day. However, the estimated values are consistent with volumes now using completed freeways in other urban areas of comparable size. They are the result of the application of known relationships between route selection behavior by average motorists and relative travel times, determined by empirical studies of freeway use in other cities, with appropriate adjustments for intangible values and local conditions. They were also developed in consideration of the major improvements which should be made to the major street system; without these improvements, demands for the freeway routes would be even greater.

In the development of the estimated 1980 traffic volumes shown in Figure 41, it was necessary to make certain assumptions which are conducive to high traffic potentials tothe major routes. These include the following:



ESTIMATED 1980 TRAFFIC FLOW
RECOMMENDED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA – MARICOPA COUNTY

TRAFFIC SCALE

50 40 30 20 10

THOUSANDS OF VEHICLES

LEGEND

- 1980 AVERAGE DAILY TRAFFIC ON FREEWAY-EXPRESSWAY SYSTEM
- 1980 AVERAGE DAILY TRAFFIC ON MAJOR STREETS

Wilbur Smith and Associates

1) The entire major street and highway system will be completed by the design year as proposed in this report. Each individual route will, therefore, serve every other route as a system;

2) There will be no impedance on the freeways, even during peak hours. Typical driving speeds on the freeway-expressway routes were assumed to range between 40 and 60 miles per hour, the lower value applicable only to critical sections near the downtown area where lane densities will be exceedingly great and distances between interchange ramps will be short;

3) There will be no restrictions on the ability of arterial feeder streets to serve the anticipated freeway traffic at and near proposed interchanges;

4) The population growth and land use pattern projected for the area will be realized by the design year. As previously described, if they are realized, more than three times as many vehicle trips per day will be made in the Phoenix Urban Area as were made in 1957.

Even with the proposed freeway-expressway system, transportation planning should anticipate heavy traffic volumes on the major street system. Although temporary traffic relief will be provided arterials which closely parallel newly constructed freeways, 1980 traffic volumes on most arterials will equal or exceed present volumes. As shown in Figure 41, analyses of the projected traffic pattern indicate that virtually all arterials in central Phoenix should be planned to serve 20,000 vehicles per day or more. The actual future volumes on particular sections of these arterials will depend largely on comparative roadway capacities and standards of physical development as well as traffic desires.

TRAFFIC CAPACITY STANDARDS

Many factors affect roadway capacity. The principal of these in urban areas are the number and width of effective moving lanes, and the degree of marginal and intersectional interferences or friction. Capacity standards were based on practical capacity volumes observed on existing facilities, which represent the maximum loadings at which a desirable level of traffic performance can be attained. In the development of these standards for general application, it was recognized that practical capacity is a variable concept; the practical capacity of a particular roadway depends on physical and traffic operational conditions, traffic composition and characteristics of traffic flow at the particular location.

A typical urban arterial serving traffic with about 8 percent trucks and about 20 percent left-turn movements at principal intersections can be expected to satisfactorily accommodate between 400 and 600 vehicles per lane per hour. It is desirable to plan urban freeways for lane volumes of 1,200 to 1,500 vehicles per hour, although freeway lanes can accommodate volumes in excess of 1,800 vehicles per hour. Thus, freeway lanes can serve about three times as much traffic as typical arterial street lanes.

Table 17 summarizes the practical capacity standards which were applied in this study. Typical two-lane streets generally can be expected to accommodate satisfactorily up to about 8,500 vehicles per day. A typical four-lane major street with curb parking can serve about 18,000 vehicles per day without congestion; the provision of a median, left-turn restrictions or other traffic control measures may permit satisfactory operations under daily loadings as high as about 25,000 vehicles. These values are applicable to most of the major streets now under development by the City of Phoenix and Maricopa County. Based on comparable traffic characteristics, four-lane urban freeways can serve over 40,000 vehicles per day and six-lane freeways can serve 60,000 to 80,000 vehicles per day without congestion or significant reductions in over-all travel speeds.

Table 17

RECOMMENDED DESIGN CAPACITY STANDARDS

Type Facility	Recommended Design Capacity: Peak Hour - Both Directions	Recommended Design Capacity: Average Daily Traffic
2 lane Urban Street		
2-way (curb parking)	600-750	6,500-8,500
1-way (curb parking)	900-1,100	10,000-12,000
3 lane Urban Street		
1-way (curb parking one side)	1,300-1,800	14,000-20,000
4 lane Urban Street		
2-way (curb parking)	1,100-1,600	12,000-18,000
2-way (special controls)*	1,600-2,200	18,000-25,000
4 lane Urban Expressway	1,800-2,600	20,000-30,000
4 lane Urban Freeway	3,600-4,500	40,000-50,000
4 lane Urban Street	2,200-3,200	25,000-35,000
6 lane Urban Freeway	5,400-7,000	60,000-80,000

* Median, progressive signalization, parking restrictions, turn controls, widenings at intersections, or green signal time in excess of 50 percent.

Note: These capacities are based on typical traffic flow characteristics; i.e., 9 percent of total daily traffic in peak hour, 60-65 percent of peak hour traffic in predominant direction of flow, 20 percent turning movements, 10 percent trucks, and 50 percent green signal time except for expressways where 60 percent was used.

The typical design capacity values shown in Table 17 are based on typical traffic flow characteristics in Phoenix. They are also based on desirable lane loadings. Relatively slight differences in lane loadings or differences in the percentage of the average daily traffic in the peak hour, can greatly affect the actual operating volume which a facility can serve as contrasted with the indicated design volume. For example, it is desirable to plan six-lane freeways to serve moderate average lane volumes equal to 1,500 vehicles in the predominant direction of flow in the peak hour; with nine percent of the total daily traffic in the peak hour, the total daily volume would be about 80,000 vehicles. However, under operating conditions where lane loadings average 1,800 vehicles per hour with only eight percent of the total daily traffic in the peak hour, which are common conditions on existing freeways in large urban areas, the same freeways can serve over 100,000 vehicles per day. Where major highways are particularly well located with regard to major traffic desires, it may not be desirable or economically feasible to provide sufficient capacity to maintain desirable lane loadings during peak periods of demand. Therefore, the design capacity values shown in Table 22 have been used as a general guide in the determination of capacity needs in critical traffic corridors; they have not been rigidly applied to all sections of the recommended major street and highway network.

FUNCTIONAL DESIGN STANDARDS

Geometric design standards for each type of facility included in the recommended plan have been prepared which conform with the policies of the American Association of State Highway Officials and/or the National Committee on Urban Transportation. In many respects, the recommended standards are consistent with standards already in use by local agencies. However, the desirability of certain important changes is indicated.

THE FREEWAY–EXPRESSWAY SYSTEM

The design of the recommended freeways should include complete control of access and grade separations at all intersecting traffic flows. For the purposes of this report, expressways are partially developed freeways with some grade intersections. In addition to these important design features, the freeways and expressways should include the following:

1) *Medians* - Opposing directions of flow should be separated by a median strip to eliminate all cross traffic except at designated locations, to minimize the hazard of head-on collisions and to shield left-turning vehicles and cross traffic at grade intersections on expressways. Medians on freeways and expressways should be at least 16 feet wide; 22-foot medians are desirable and are recommended for expressways.

2) *Shoulders* - Paved shoulders are provided for emergency use by disabled vehicles and to minimize maintenance of the main roadways. They should be at least 8 feet wide; 10-foot shoulders are desirable.

3) *Wide Lanes* - Traffic lanes on freeways and expressways should be wide - not less than 12 feet in width.

4) *High Design Speed* - Horizontal alignment, vertical curvature, super-elevation, sight distances, gradients and other freeway design values are planned for speeds of 50 to 70 miles per hour. (Actual operating speeds will be somewhat lower than design speeds.)

5) *Wide Rights-of-Way* - Right-of-way widths for freeways and expressways must be adequate for the necessary cross section elements described above, for side slopes in areas of cut or fill and for frontage roads where required. All freeway and expressway routes in the Phoenix Urban Area should be constructed with sufficient rights-of-way to provide for at least six lanes ultimately. Right-of-way widths for elevated freeways (on fill) with frontage roads should be at least 300 feet; 220 to 250 feet should be provided for freeways to be constructed at grade level.

Figure 42 indicates the typical cross sections developed for the planning of freeway and expressway routes recommended in this report. Where four lanes will be adequate for 1980 traffic needs, provision has been made for the ultimate construction of two additional lanes within the median. Right-of-way requirements for routes in presently undeveloped areas can be greatly reduced by eliminating the need for frontage roads through subdivision design (backing the subdivision to the freeway or expressway).

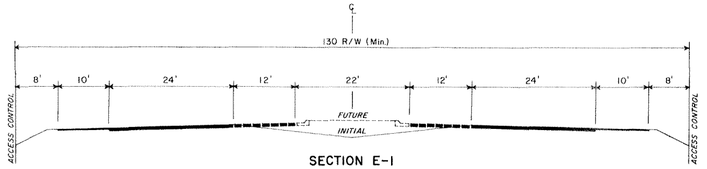
THE MAJOR STREET SYSTEMS

Table 18 summarizes proposed standards for major streets which were used in the development of typical cross sections shown in Figure 43. Collector streets in low density residential areas where two lanes will be sufficient for future traffic needs may be developed on 60-foot, or the originally dedicated 66-foot rights-of-way as shown by Section A-1. Other collector streets should be developed on 80-foot rights-of-way as shown by Section B-1. These sections are in general accordance with standards now in effect in Phoenix for two-lane collector streets and four-lane "mid-section line" roads.

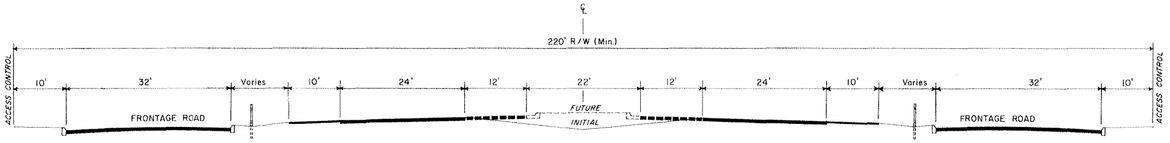
Table 18

PROPOSED MINIMUM MAJOR STREET DESIGN STANDARDS

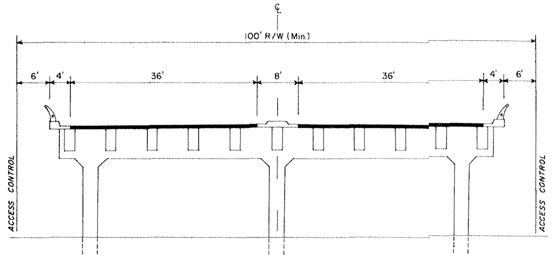
Design Elements (All Widths in Feet)	Major Arterial	Collectors - Low Density Resid. Areas	Other Major Streets
Width of Right-of-Way	100	60	80
Number of Traffic Lanes	4	2	4
Width of Traffic Lanes	12	10	11
Width of Shoulder or Curb Parking Lanes	10	8	10
Median Width	12	-	4
Width of Border Areas	8	10	8



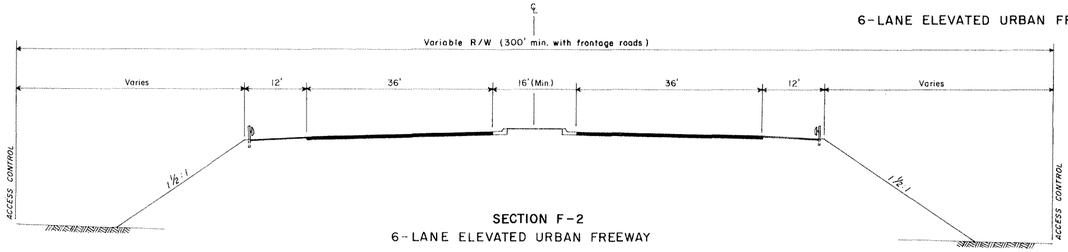
SECTION E-1
4 OR 6 - LANE EXPRESSWAY OR FREEWAY - NO FRONTAGE ROADS



SECTION E-2
4 OR 6 - LANE EXPRESSWAY OR FREEWAY AT GRADE WITH FRONTAGE ROADS



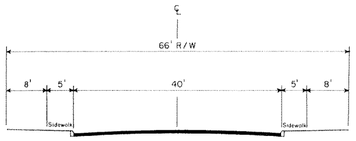
SECTION F-1
6-LANE ELEVATED URBAN FREEWAY - NO FRONTAGE ROADS - RESTRICTED R/W



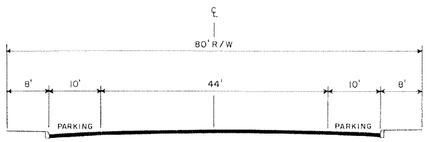
SECTION F-2
6-LANE ELEVATED URBAN FREEWAY

TYPICAL CROSS-SECTIONS

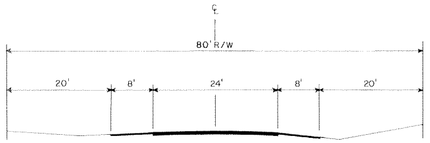
FREEWAY - EXPRESSWAY SYSTEM



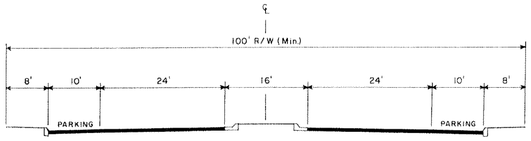
SECTION A-1
2-LANE COLLECTOR



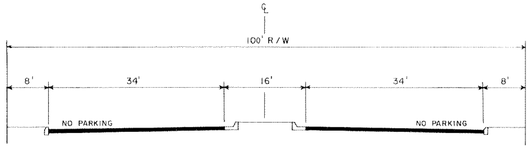
SECTION B-1
4-LANE COLLECTOR OR SECONDARY ARTERIAL - MINIMUM R/W



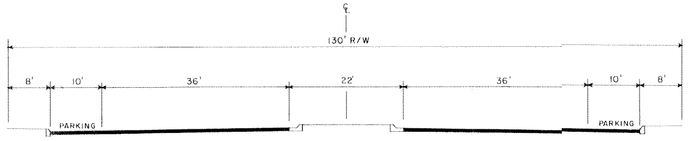
SECTION B-2
2-LANE SECONDARY COUNTY ROAD
(1000 - 3000 VEHICLES PER DAY)



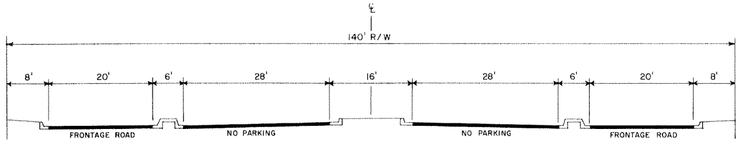
SECTION C-1
4-LANE MAJOR ARTERIAL - MINIMUM R/W



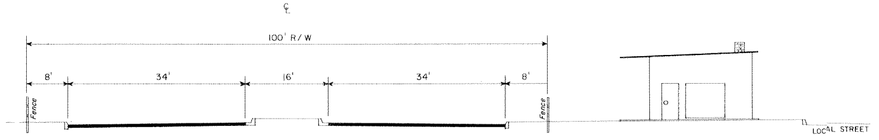
SECTION C-2
6-LANE MAJOR ARTERIAL - RESTRICTED R/W



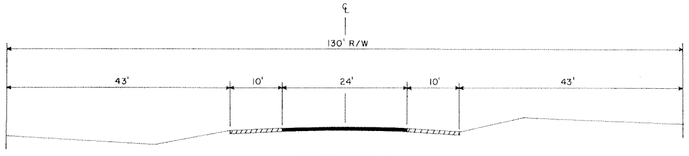
SECTION D-1
6-LANE MAJOR ARTERIAL ON 130' R/W - NO FRONTAGE ROADS



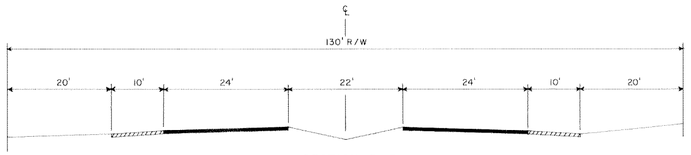
SECTION D-2
4-LANE MAJOR ARTERIAL WITH FRONTAGE ROADS



SECTION D-3
4-LANE MAJOR ARTERIAL WITH ACCESS CONTROL THROUGH SUBDIVISION DESIGN



SECTION D-4
2-LANE MAJOR RURAL ROAD



SECTION D-5
4-LANE MAJOR RURAL ROAD

TYPICAL CROSS-SECTIONS

MAJOR URBAN STREETS
AND MAJOR RURAL ROADS

As discussed in Chapter I, rights-of-way of only 66 feet are available along many of the existing arterials (mile roads) in built-up areas of Phoenix, although these arterials are operated as four lane streets. Present practice is to widen these arterials in accordance with Section B-1. This section involves the minimum width of right-of-way for the development of four-lane streets with adequate lane widths and curb parking lanes.

There is need for greater use of medians in the development of arterials in the Phoenix Urban Area. The minimum acceptable median width is four feet. The construction of 4-foot medians on arterials will be desirable for the elimination of cross traffic at minor streets where the available right-of-way must be limited to only 80 or 84 feet. Curb parking should be eliminated near intersections to permit the establishment of a left turn lane on arterials of this minimum standard.

More important advantages can be gained by the construction of wide medians. Medians on major arterials should be at least 12 feet wide, and preferably 16 feet wide wherever possible. These wider medians can significantly increase intersection capacity, provide important safety advantages for both pedestrian and vehicular traffic and provide space for landscaping and traffic control devices as well as eliminate minor street cross traffic. Openings in medians on major arterials should be limited to principal cross streets at which traffic signals should be provided, timed for progressive movement of through traffic.

In order to provide for medians of the desired 16-foot width, 100-foot rights-of-way are necessary. Sections C-1 and C-2 indicate the recommended standards for major arterials on minimum right-of-way. Section C-1 should also be used for secondary arterials where 100 feet can be secured at reasonable cost for an appreciable distance.

In areas of new subdivisions under county jurisdiction, 130-foot rights-of-way have been secured along the mile roads. This width is adequate for the construction of a six-lane, divided arterial with a 22-foot median (see Section D-1). However, in actual practice narrow frontage roads for local service to abutting properties have been constructed by the subdividers, leaving a main roadway of restricted width to be provided by the public agency. The frontage roads are useful in establishing a measure of access control along major arterials and they are desired for aesthetic reasons by the owners of abutting properties. On the other hand, they create undesirable traffic conflicts at intersections and their construction within 130-foot right-of-way leaves inadequate width for the construction of the main roadway to desirable standards. Since the primary function of major arterials is service to traffic movement, it is recommended that major arterials be constructed without the frontage roads, (Section D-1), or with frontage roads on wider rights-of-way as shown in Section D-2. It is also recommended that neighborhood values be protected against the adverse effects of heavy arterial traffic through subdivision planning rather than by providing frontage roads; subdividers should be encouraged to plan abutting properties to back against major arterials where feasible (see Section D-3).

Sections D-4 and D-5 indicate recommended cross sections for major rural roads. Wide medians should be provided on all rural roads serving traffic requiring four lanes. Right-of-way requirements should be at least equal to those established

for major arterials in the urban area. Secondary county roads should be developed on rights-of-way of at least 80 feet as shown by Section B-2.

Appendix Table J summarizes the estimated 1980 design traffic volumes, required number of lanes, and recommended cross sections for all routes included in the major street and highway plan. Existing traffic volumes and roadway widths are also shown where applicable.

ESTIMATED COSTS

Estimates of the costs of the recommended freeways and expressways were computed based on typical unit prices for principal construction items. Quantities for excavation, paving, fencing, drainage, structures, etc. were computed based on preliminary functional plans prepared at large scale on aerial photographs and topographic maps where available. The costs of principal structures were estimated on a "square foot" basis using approximate span arrangements and typical unit prices for similar structures previously constructed. Right-of-way costs were computed using average land values for the district in which the facility is located, giving consideration to building types and conditions, severance damages and the cost of securing access rights. Cost estimates shown herein also include an amount for contingencies computed as 10 percent of the construction costs.

Table 19 summarizes the estimated costs of the proposed county-wide freeway-expressway system. The total 441.6 mile system would cost about $204,800,000 at present unit cost levels. Of this total, the cost of about 360.2 miles of Interstate freeways and other routes of state-wide interest would be about $128,100,000. Routes added to these Interstate and "state" routes to form an integrated freeway-expressway network for the Phoenix Urban Area would cost about $76,700,000. A major part of this is the cost to construct the proposed Southern East-West Freeway.

The costs of major street widenings and street extension projects were estimated using typical "per mile" values based on similar projects recently completed in the Phoenix area. These values ranged from a low of $25,000 per mile for low volume county secondary roads to $250,000 per mile for major urban arterials. These values are exclusive of the costs of right-of-way, major irrigation tiling or frontage roads. Right-of-way costs, ranging from $50,000 per mile to $250,000 per mile, were included only for roadway widenings in presently developed areas. It was assumed that adequate rights-of-way will be secured in undeveloped areas through dedications by subdividers. It was also assumed that frontage roads on arterial street projects would be constructed by private land developers. Although no attempt was made to prepare detailed construction cost estimates or right-of-way appraisals for individual projects, the estimates developed on the basis of typical unit values based on recent experience in the Phoenix area are adequate to establish the "order of magnitude" of the required capital improvement program.

Table 20 summarizes the total cost of the recommended major street and highway plan including the costs to bring major streets and rural roads up to the standards required for 1980 traffic demands (see Appendix Table J for a summary of these standards). The total cost of all recommended improvements is estimated at $357,400,000 of which $228,500,000 represents the approximate magnitude of needs

Table 19

SUMMARY OF RECOMMENDED STANDARDS AND DEVELOPMENT COSTS
PROPOSED FREEWAY-EXPRESSWAY SYSTEM

Name of Route	Miles	1980 ADT	Type Facility	Required No. of Lanes	Estimated Cost
1. Black Canyon Highway (Interstate 17)					
Interstate 10 to Wickenburg Expressway	6.6	53,000-92,000	Urban Freeway	6	$ 12,200,000
Wickenburg Expressway to North Belt Expressway	8.0	15,000-43,000	Urban Freeway	4	
North Belt Expressway to North County Line	28.5	10,000-15,000	Rural Freeway	4	14,700,000
	43.1				26,900,000
2. Buckeye Expressway*					
West County Line to Black Canyon Highway	65.6	8,000-15,000	Rural Freeway-Expressway	4	24,500,000
3. Phoenix-Tucson Freeway (Interstate 10)					
Black Canyon Highway to Eastern North-South Freeway	4.8	36,000-50,000	Urban Freeway	4	
Eastern North-South Freeway to Tempe-Mesa Freeway	5.1	47,000-55,000	Urban Freeway	6	15,300,000
Tempe Mesa Freeway to Guadalupe Road	2.0	18,000-20,000	Rural Freeway	4	
Guadalupe Road to South County Line	12.2	15,000-18,000	Rural Freeway	4	3,900,000
	24.1				19,200,000
4. Tempe-Mesa Freeway					
Interstate 10 to Arizona Avenue, Mesa	8.0	28,000-43,000	Urban Freeway	4	
Arizona Avenue, Mesa to Reebs Road	5.0	15,000-25,000	Urban Freeway	4	8,900,000
Reebs Road to East County Line	10.0	18,000-25,000	Rural Freeway-Expressway	4	4,000,000
	23.0				12,900,000
5. Wickenburg Expressway*					
North County Line to Bell Road	35.1	5,000-10,000	Rural Freeway-Expressway	2,4	5,600,000
Bell Road to South of Glendale	14.0	12,000-15,000	Rural Freeway-Expressway	4	9,600,000
South of Glendale to Interstate 17	4.0	28,000-46,000	Urban Freeway	4	
	53.1				15,200,000
6. Yuma-Tucson Freeway (Interstate 8)					
West County Line to East County Line	67.1	8,000-12,000	Rural Freeway	2,4	17,600,000
7. Gila Bend-Buckeye Expressway					
Yuma-Tucson Freeway to Buckeye Expressway	34.0	5,000- 6,000	Rural Expressway	2	3,000,000
8. Bee Line Highway					
Tempe-Mesa Freeway to North County Line	48.5	1,000- 3,000	Rural Expressway	2	5,000,000
9. Penetration Route (Interstate 510)					
Phoenix-Tucson Freeway to Van Buren Street	1.7	38,000-50,000	Urban Freeway	4	3,800,000
SUBTOTAL - Interstate and State Routes	360.2				$128,100,000

* Either Buckeye Expressway or Wickenburg Expressway will be part of Interstate Route 10.

Table 19 (Continued)

SUMMARY OF RECOMMENDED STANDARDS AND DEVELOPMENT COSTS
PROPOSED FREEWAY-EXPRESSWAY SYSTEM

	Name of Route	Miles	1980 ADT	Type Facility	Required No. of Lanes	Estimated Cost
10.	Southern East-West Freeway					
	West Belt Expressway to 51st Avenue	2.5	22,000-30,000	Urban Expressway	4	
	51st Avenue to Interstate 17	3.5	40,000-68,000	Urban Freeway	6	3,600,000
	Interstate 17 to Eastern North-South Freeway	4.0	81,000-88,000	Urban Freeway	6	21,900,000
	Eastern North-South Freeway to Scottsdale Road	9.5	51,000-67,000	Urban Freeway	6	
	Scottsdale Road to Mesa	3.2	16,000-33,000	Urban Freeway	4	9,200,000
		22.7				34,700,000
11.	Paradise Valley Parkway					
	Interstate 17 to Eastern North-South Freeway	3.8	35,000-41,000	Urban Parkway	6	
	Eastern North-South Freeway to E. Belt Expressway	7.3	12,000-18,000	Urban Parkway	4	9,100,000
		11.1				
12.	Eastern North-South Freeway					
	Penetration Route to Paradise Valley Parkway	5.0	43,000-61,000	Urban Freeway	6	
	Paradise Valley Parkway to No. Belt Expressway	10.2	8,000-26,000	Urban Expressway	4	13,400,000
		15.2				
13.	West Belt Expressway					
	Interstate 10 to Wickenburg Expressway	8.4	8,000-16,000	Urban Expressway	4	4,200,000
14.	North Belt Expressway					
	Interstate 17 to East Belt Expressway	5.1	8,000-12,000	Urban Expressway	4	2,600,000
15.	East Belt Expressway					
	Tempe-Mesa Freeway to North Belt Expressway	18.9	10,000-22,000	Urban Expressway	4	12,700,000
	SUBTOTAL - Urban Area Routes	81.4				$ 76,700,000
	GRAND TOTAL - Freeway-Expressway System	441.6				$204,800,000

Table 20

ESTIMATED DEVELOPMENT COSTS
MAJOR STREET AND HIGHWAY IMPROVEMENTS
Phoenix and Vicinity and Maricopa County

	Estimated Costs	Miles
URBAN AREA		
State Freeways-Expressways	$ 49,800,000	59.2
Other Freeways-Expressways	76,700,000	81.4
Major Arterials	33,400,000	124.4
Secondary Arterials	50,400,000	250.4
Collector Streets	9,900,000	56.5
Special Structures*	8,300,000	--
Subtotal - Urban Area	$ 228,500,000	571.9
RURAL AREAS		
State Freeways-Expressways	$ 78,300,000	301.0
Major Rural Roads	36,400,000	473.5
Secondary County Roads	14,200,000	496.1
Subtotal - Rural Areas	$ 128,900,000	1,270.6
Total - State Projects	128,100,000	360.2
Total - Non-State Urban Area Projects	178,700,000	512.7
Total - Rural Road Projects	50,600,000	969.6
Grand Total	$ 357,400,000	1,842.5

* Includes railroad grade separations listed in Table 16 and collector street crossings of Black Canyon Highway as recommended in this report.

in the Phoenix Urban Area and $128,900,000 represents rural road needs of Maricopa County. If the cost of the Interstate and "state" freeways and expressways are excluded, recommended improvements in the Phoenix Urban Area total $178,700,000 while the cost of improvements to major non-limited access rural roads would be about $50,600,000.

STAGE CONSTRUCTION

The magnitude of the proposed freeway-expressway system and other major street and highway improvements, and the availability of funds, will necessitate a stage construction program. A general program for the Phoenix Urban Area has been prepared with three stages:

Stage I - 1958-1965 (Recommended improvements and estimated costs included in this report are based on 1958 conditions. Some of the necessary improvements have been accomplished in recent construction programs as noted in Chapter III of this report.)

Stage II - 1965-1970

Stage III - 1970-1980

In developing the stage construction program, priorities were governed by the following criteria:

1) Highest priorities were given to improvements which will provide the greatest service for present traffic demands.

2) Roadway sections must be usable by traffic upon completion.

3) Right-of-way acquisitions for major projects should commence as soon as possible to minimize costs and permit actual construction to begin on schedule.

4) The cost of the total program was distributed among the three phases in consideration of the present availability of funds, the time required to modify basic policies to establish an expanded road program, the magnitude and directions of urban growth and expansion, and the proportion of the total needs which will exist by 1970.

5) Expenditures allocated to Stages I and II should result in an effective major street and highway system for needs which will exist at that time.

Table 21 summarizes the suggested general stage construction program for urban area projects other than Interstate or state primary routes. Slightly less than half of the total $178,700,000 program would be completed by 1970. Expenditures totalling $80,000,000 are indicated for Stages I and II, including $40,900,000 for freeways and expressways, $35,600,000 for major streets and $3,500,000 for top-priority railroad grade separations and other special structures. (See Figure 44 for the locations of freeway-expressway projects to be completed by 1970.)

Table 21 - Sheet 1
RECOMMENDED STAGE CONSTRUCTION PROGRAM
PHASING OF MAJOR STREET IMPROVEMENTS
Phoenix-Maricopa County Urban Area

Stage 1

Project	Limits	Miles	Remarks
A. Freeways			
1. South East-West Freeway	35th Avenue-56th Street	10.0	Right-of-way Acquisition
2. Eastern North-South Freeway	Van Buren Street-Southern East-West Freeway	0.6	Right-of-way Acquisition
3. Paradise Valley Parkway	Interstate 17-Tatum Boulevard	7.8	Right-of-way Acquisition
4. West Belt Expressway	--	-	--
5. North Belt Expressway	Interstate 17-Cave Creek Road	5.0	Right-of-way Acquisition
6. East Belt Expressway	North Belt Expressway-Lincoln Drive	10.2	Construct Recommended Section
B. Major Arterials			
1. Central Avenue	Van Buren Street-Indian School Road	3.0	Widen to 6 lanes
Central Avenue	Indian School Road-Dunlap Avenue	5.0	Construct Recommended Section
2. Jefferson Street	Interstate 17-17th Avenue	0.7	Construct Recommended Section
3. Adams Street	24th Street-26th Street	0.3	Construct Recommended Section
4. Washington Street	Interstate 17-10th Avenue	1.2	Construct Recommended Section
5. Grand Avenue	24th Street-26th Street	0.3	6-leg Intersectional Treatment
6. Indian School Road	19th Avenue-43rd Street	-	Construct Recommended Section
7. 44th Street	35th Avenue-7th Avenue	3.0	Construct Recommended Section
8. Shea Boulevard	32nd Street-Scottsdale Road	5.0	Completed to Recommended Standards
C. Secondary Arterials			
1. 7th Street	Southern Avenue-Broadway	1.0	Initial Construction-4 Lane County Road
7th Street	Broadway-Dunlap Avenue	11.0	Construct Recommended Section
7th Street	Dunlap Avenue-Bell Road	5.0	Initial Construction-2 Lane County Road
2. McDowell Road	Interstate 17-44th Street	7.2	Construct Recommended Section
McDowell Road	56th Street-Mesa	8.0	Existing 4 lane arterial
3. Thomas Road	Interstate 17-24th Street	4.7	Construct Recommended Section
4. 16th Street	Jefferson Street-Camelback Road	4.3	Construct Recommended Section
5. 7th Avenue	Baseline Road-1958 City Limits	3.0	Initial Construction-4 Lane County Road
6. Camelback Road	35th Avenue-24th Street	6.0	Construct Recommended Section
Camelback Road	44th Street-Scottsdale Road	3.5	Construct Recommended Section
7. 35th Avenue	Van Buren Street-Camelback Road	4.0	Construct Recommended Section
8. Van Buren Street	35th Avenue-Interstate 17	1.5	Construct Recommended Section
9. 51st Avenue	Buckeye Road-Grand Avenue	6.0	Initial Construction-4 Lane County Road
10. Glendale Avenue	Interstate 17-Lincoln Road	6.2	Construct Recommended Section
11. Grant-Lincoln Trafficway	Interstate 17-7th Street	2.5	Completed 1960
12. Northern Avenue	Glendale Avenue-32nd Street	10.7	Initial Construction-4 Lane County Road
D. Collector Streets			
1. 15th Avenue	Osborn Road-Grand Canal	0.8	Construct Recommended Section
2. 3rd Avenue	Roosevelt Street-McDowell Road	0.5	Construct Recommended Section
3rd Avenue	Osborn Road-Indian School Road	0.5	Construct Recommended Section
3. Osborn Road	7th Street-16th Street	1.0	Construct Recommended Section
4. 40th Street	Washington Street-Camelback Road	4.5	Construct Recommended Section
E. Special Structures			
1. 16th Street	--	-	Railroad Crossing
2. Osborn Road	--	-	Overpass of Interstate 17

Stage 2

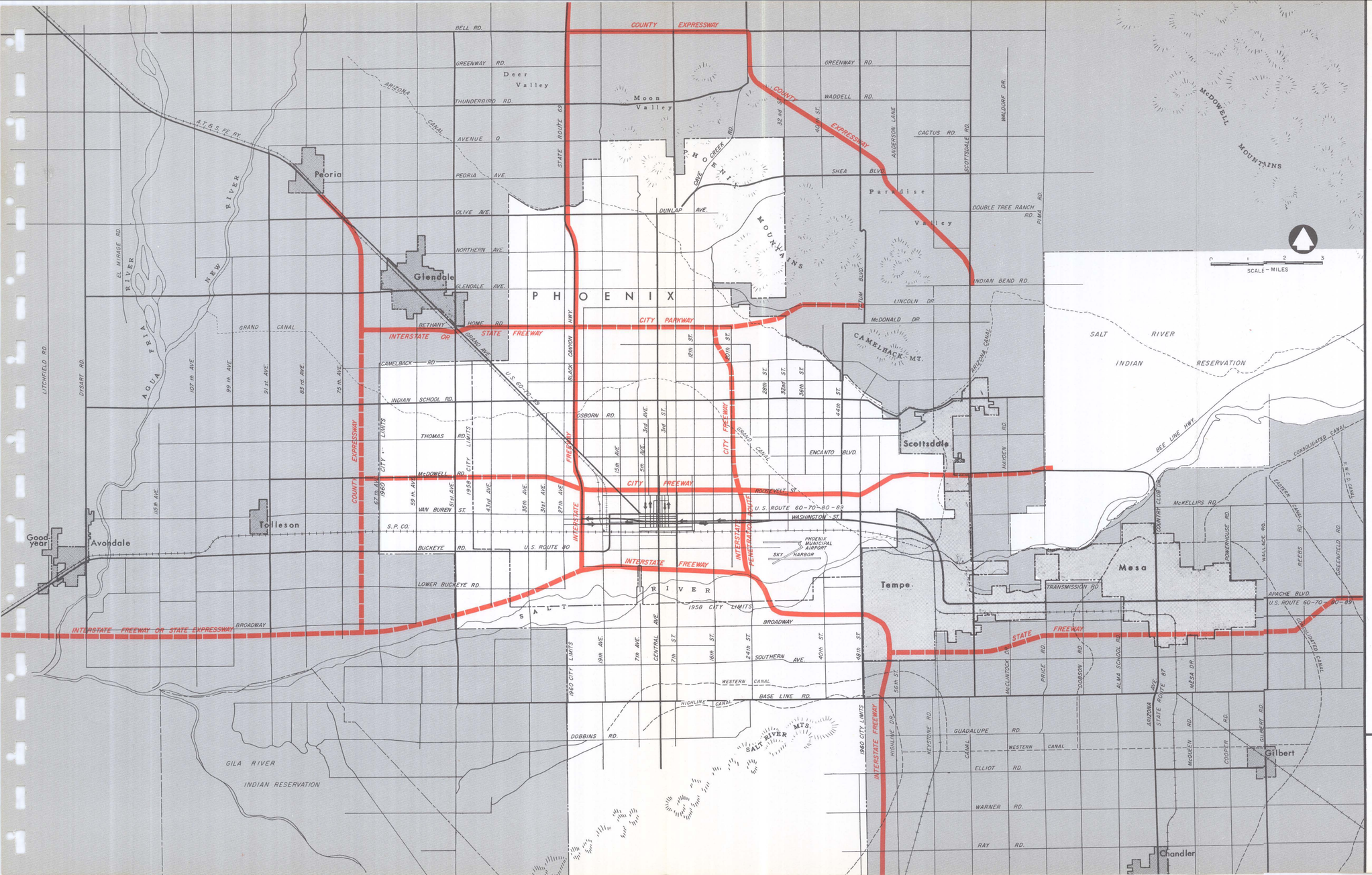
Project	Limits	Miles	Remarks
A. Freeways			
1. South East-West Freeway	35th Avenue-56th Street	10.0	Construct Recommended Section
2. Eastern North-South Freeway	Van Buren Street-South East-West Freeway	0.6	Construct from Penetration Route to South East-West Freeway
3. Paradise Valley Parkway	Interstate 17-Tatum Boulevard	7.8	Right-of-way Acquisition
4. West Belt Expressway	Interstate 10-Wickenburg Expressway	8.4	Right-of-way Acquisition
5. North Belt Expressway	Interstate 17-Cave Creek Road	5.0	Construct Recommended Section
6. East Belt Expressway	--	-	--
B. Major Arterials			
1. Indian School Road	51st Avenue-35th Avenue	2.0	Construct Recommended Section
2. Tatum Boulevard	McDonald Drive-East Belt Expressway	5.5	Construct Recommended Section
3. Scottsdale Road	Tempe-Mesa Freeway-Scottsdale	9.5	Construct Recommended Section
Scottsdale Road	Camelback Road-Lincoln Drive	2.0	Initial Construction-4 Lane County Road
4. 51st Avenue	Glendale Road-Northern Avenue	1.0	Construct Recommended Section
5. Apache Boulevard	Tempe-Mesa	2.0	Construct Recommended Section
6. Olive Avenue	Interstate 17-7th Street	3.0	Construct Recommended Section
C. Secondary Arterials			
1. 24th Street	Van Buren Street-Camelback Road	4.0	Construct Recommended Section
2. 7th Avenue	1958 City Limits-Glendale Road	8.0	Construct Recommended Section
3. Broadway	19th Avenue-24th Street	4.0	Construct Recommended Section
4. Thomas Road	35th Avenue-Interstate 17	1.3	Construct Recommended Section
Thomas Road	24th Street-44th Street	2.5	Construct Recommended Section
5. Camelback Road	51st Avenue-35th Avenue	2.0	Construct Recommended Section
Camelback Road	24th Street-44th Street	2.5	Construct Recommended Section
D. Collector Streets			
1. Oak Street	7th Avenue-24th Street	3.0	Construct Recommended Section
2. Osborn Road	Central Avenue-3rd Street	0.3	Construct Recommended Section
Osborn Road	16th Street-24th Street	1.0	Construct Recommended Section
3. 12th Street	Jefferson Street-Thomas Road	2.3	Construct Recommended Section
4. 3rd Street	Oak Street-Indian School Road	1.5	Construct Recommended Section
E. Special Structures			
1. 7th Street	--	-	Railroad Crossing
2. 7th Avenue	--	-	Railroad Crossing
3. Missouri Avenue	--	-	Overpass of Interstate 17

Table 21 - Sheet 2

RECOMMENDED STAGE CONSTRUCTION PROGRAM
NON-STATE URBAN AREA PROJECTS
Phoenix-Maricopa County Urban Area

	Stage I 1958-1965	Stage II 1965-1970	Stage III 1970-1980
A. Freeways and Expressways[1]			
Southern East-West Freeway	$ 6,800,000	$21,400,000	$ 6,500,000
Eastern North-South Freeway	1,600,000	2,400,000	9,400,000
Paradise Valley Parkway	700,000	1,300,000	7,100,000
West Belt Expressway[2]	--	400,000	3,800,000
North Belt Expressway[2]	200,000	2,400,000	--
East Belt Expressway[2]	3,700,000	--	9,000,000
Subtotal	13,000,000	27,900,000	35,800,000
B. Major Arterials	5,500,000	6,000,000	21,900,000
C. Secondary Arterials	13,600,000	6,600,000	30,200,000
D. Collector Streets	1,900,000	2,000,000	6,000,000
E. Special Structures	1,200,000	2,300,000	4,800,000
Total	$35,200,000	$44,800,000	$98,700,000

1 See Figure 44 for recommended status of freeway-expressway system by 1970.
2 Assumed Maricopa County Highway Department projects.



RECOMMENDED STAGE CONSTRUCTION PROGRAM FREEWAY AND EXPRESSWAY PROJECTS TO BE COMPLETED BY 1970

PHOENIX URBAN AREA – MARICOPA COUNTY

- FREEWAY CONSTRUCTION COMPLETED
- FREEWAY, EXPRESSWAY OR PARKWAY RIGHT-OF-WAY ACQUIRED
- AREAS NOW UNDER COUNTY JURISDICTION
- INCORPORATED AREAS (OR INDIAN RESERVATION)

Wilbur Smith and Associates

BUSINESS DISTRICT PARKING NEEDS

Transportation plans for the future Phoenix Urban Area should include an off-street parking program. As the need for roadway capacity increases with traffic growth, it will be necessary to remove curb parking to provide additional lanes for moving traffic on critical sections of the arterial street system. Curb parking restrictions, already in effect along some sections of Central Avenue, Van Buren Street, Thomas Road and McDowell Road, will have to be applied to other high-volume roadway sections in central Phoenix. It is recommended that curb parking be eliminated near each of the mile road intersections to permit the establishment of vitally needed left-turn lanes. Development of critical sections of Central Avenue and Indian School Road to six-lane standards will require continuous curb parking restrictions for several miles. Curb parking should also be removed from 7th Street south of the proposed Southern East-West Freeway, where six lanes will be required for adequate freeway access and egress, and from many other arterials near freeway interchanges.

Although decreases in available curb parking spaces are inevitable, the need for greater parking capacity in principal business districts will be greater. If the downtown business district is to share in the future growth of the area, if the estimates of 1980 traffic to this area (based on improved access through the construction of freeways) are to be realized, additional off-street parking will be essential. From the practical standpoint, it will be important that plans for the removal of curb parking be coupled with plans for off-street parking.

Compulsory provision of off-street parking for new building construction and renovations of existing buildings through zoning ordinances or building codes can be effective in providing for parking needs outside the downtown area. New parking generators should be required to provide for their own parking needs in off-street spaces. Developers should not be permitted to construct buildings which will create parking problems on adjacent residential streets or which will interfere with traffic flow. Table 22 indicates general requirements for off-street parking related to principal classes of generators of parking demand. The requirements shown are general recommendations based on studies of parking demands in other areas; minor modifications for the Phoenix Urban Area may be desirable.

Parking needs in the downtown business district usually cannot be provided for by zoning ordinance requirements for new construction alone. Although a detailed parking study is not within the scope of this study, long range parking needs in this critical area were generally reviewed. Figure 45 indicates the results of an inventory of both curb and off-street spaces in a designated study area which conforms to the study area used in a 1953 study by the City of Phoenix.[17] As summarized in Table 23, there are now about two percent more total spaces in this area than in 1949 but there are 37 percent less curb spaces. About 2,800 additional off-street spaces have been provided since 1949.

Parking space usage in the Phoenix downtown area has been analysed by means of hourly accumulation checks. Figure 46 illustrates the accumulation of 1959 demand

17. Traffic Engineering, Phoenix, Arizona; 1950-55

Table 22

GENERAL REQUIREMENTS FOR OFF-STREET PARKING
Phoenix-Maricopa County Urban Area

Type Buildings	General Requirements
Business, Commercial, Office Buildings other than below	3-4 spaces per 1,000 sq. ft.
Professional, Public and Utility Offices	5-7 spaces per 1,000 sq. ft.
Neighborhood Shopping Center	5-10 spaces per 1,000 sq. ft.
Industrial Buildings	1-3 spaces per 1,000 sq. ft.
Hospitals	1-2 spaces per bed
Places of Assembly	1 space per 5 seats
Residence Hotel	1 space per 2 units
Motel	1 space per unit
School or College	1 space per staff member plus 1/2 space per student

Table 23

DOWNTOWN PARKING INVENTORY
City of Phoenix

Spaces	1949	1953	1959	Loss or Gain	Pct. Loss or Gain
Curb	4,559	3,136	2,886	-1,673	-37%
Off-Street					
Commercial	4,016	5,777	6,823	+2,807	+70%
Customer	1,349	1,077	1,238	- 111	- 8%
Restricted	2,688	2,086	1,877	- 811	-30%
Total	12,612	12,076	12,824	+ 212	+ 2%

for curb and off-street parking facilities in the downtown area on a July weekday as compared to an October weekday in 1953. Accumulation curves indicate a substantial decrease in curb parking and a substantial increase in off-street parking within the designated survey area since 1953. The peak weekday accumulation of curb parking in July, 1959, equal to 2,023 parkers (70 percent of the existing curb spaces), occurred at about 11:00 a.m. Peak parking accumulation, including both curb and off-street facilities, equalled about 8,000 parkers or only about two-thirds of all parking spaces in the survey area as a whole.

Although there are more total parking spaces in the survey area than present parking demands, parking spaces must be properly located to be effective. In the downtown area of every city there exists a central group of blocks representing the largest generators of parking demand and highest land values. Parking supply must be within a reasonable walking distance of major generators in this so-called "core

LEGEND

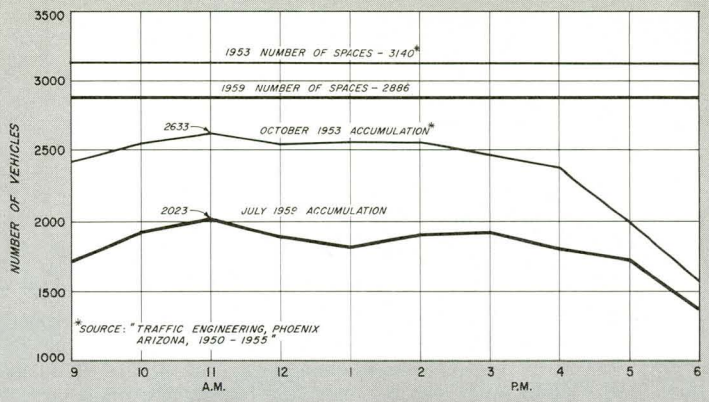
- 12 — NUMBER OF CURB SPACES
- (75) — NUMBER OF OFF STREET SPACES
- PARKING LOTS
- PARKING GARAGES
- PRINCIPAL BUILDINGS
- (156) — BLOCK NUMBER

PARKING INVENTORY

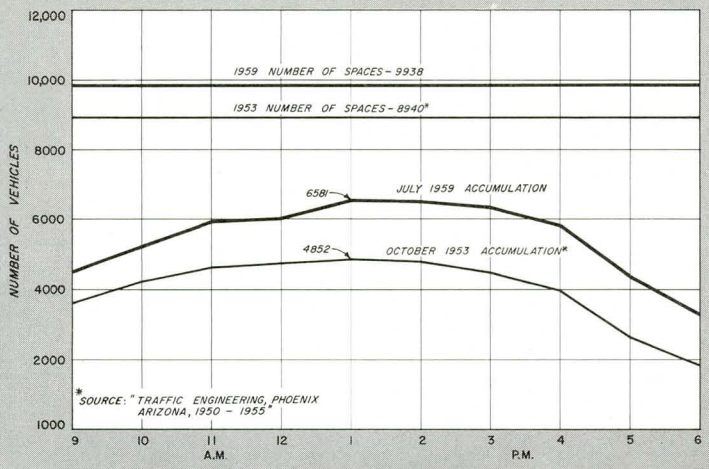
DOWNTOWN PHOENIX

Wilbur Smith and Associates

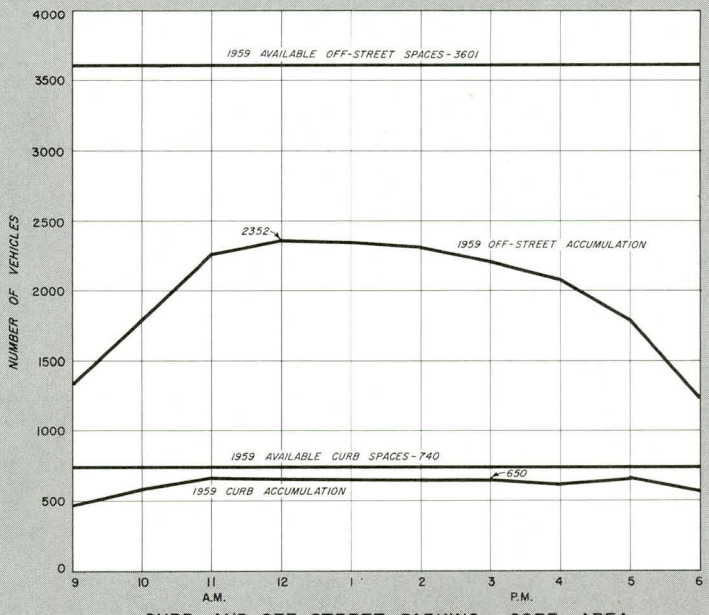
(45)



CURB PARKING - 1953 SURVEY AREA



OFF-STREET PARKING - 1953 SURVEY AREA



CURB AND OFF-STREET PARKING - CORE AREA

WEEKDAY PARKING ACCUMULATION

DOWNTOWN PHOENIX

Wilbur Smith and Associates

(46)

are." Studies of parking accumulation in the core area of the Phoenix downtown area indicate that available curb spaces in this area are used to capacity[18] throughout the day but that the peak accumulation of off-street parking is only about two-thirds of capacity (see Figure 46). Significant parking deficiencies exist in several blocks within the core area as shown in Table 24.

Table 24
CORE AREA PARKING SPACE USAGE BY BLOCKS
Downtown Phoenix

	Curb Parking		Off-Street Parking	
Block No.	No. of Spaces	Maximum Usage	No. of Spaces	Maximum Usage
5	19	15	60	22
6	12	12*	385	197
7	5	5*	30	23
8	17	17*	100	47
9	25	23*	60	48
10	34	32*	283	193
19	21	15	70	38
20	34	33*	0	0
21	21	21*	0	0
22	19	19*	110	101*
23	19	19*	400	237
24	41	39*	10	6
33	31	23	48	43*
34	25	16	215	133
35	18	13	305	115
64	17	17*	400	258
65	31	26	212	128
66	33	13	132	59
75	32	26	230	139
76	36	35*	90	67
77	27	26*	0	0
78	7	7*	0	0
79	24	23*	65	49
80	31	30*	0	0
89	31	29*	190	135
90	39	37*	0	0
91	31	29*	0	0
92	9	8*	0	0
93	30	23	40	29
94	21	19*	166	155*
Total	740	650	3,601	2,222

* An asterisk denotes a block where maximum usage equals or exceeds capacity (90 percent of available curb spaces and 85 percent of available off-street spaces)

18. Capacity is considered to be 90 percent of available spaces for curb parking and 85 percent of available spaces for off-street parking.

As discussed in Chapter II, preliminary studies of future employment and retail trade in the downtown business district by Western Business Consultants indicate that it is reasonable to expect substantial increases in the traffic generated by this key area although downtown traffic growth will probably not keep pace with that anticipated for the urban area as a whole. Transportation plans for the future urban area should be based on an average weekday demand equal to about 18,000 parkers in the downtown area. Spaces for about 12,000 parkers should be provided in the core area. The design, location and rates for the required spaces should be established in consideration of the differing needs and characteristics of both short-term and long-term parkers. About 40 percent of the 1980 parking demand will be created by long-term parkers (over three hours), a higher proportion of the total demand than at present. The nature of the downtown development plan[19] now in preparation by the Planning Department of the City of Phoenix will have a great bearing on the specific magnitude and character of parking needs. The future development of new buildings on properties now used to provide off-street parking will require that parking demands be related to available spaces periodically and that long range planning include allowances for future losses in both curb and off-street spaces.

19. It is understood that the Planning Director of the City of Phoenix has been requested to prepare a development plan for downtown Phoenix.

Chapter V
IMPLEMENTATION OF THE PLAN

The design of a master plan for major streets and highways to serve long-range traffic needs is only the beginning; adequate administrative organization and financing are also essential. The generalized plan must be adopted by official technical agencies and "sold" to the residents of the area as a desirable and necessary part of over-all plans for public improvements. Implementation of the major street and highway plan will require the active support of legislators, executive officials, organized civic groups, and in the final analyses, the general public.

PROJECTED NEEDS ARE REALISTIC

Long-range street and highway needs in the Phoenix Urban Area and Maricopa County are tremendous by all measures. The total cost to construct freeways, expressways, arterials and other major streets to meet the traffic needs forecast for the next 20 years poses a great problem, especially when related to current magnitudes of expenditures for streets and highways. Relatively, however, these needs are no greater than those faced by all rapidly growing metropolitan areas. Although the absolute magnitude of the recommended improvement program is large, the projected needs are realistic and in keeping with the anticipated size and character of the future urban area. The staggering proportions of all modern highway programs are in evidence everywhere.

Of major concern in the future will be effectuation of feasible means of financing and administering the necessary expanded road program. There is not even assurance that this can be done through conventional processes. Drastic actions will be necessary and the need for some deviations from past practices is indicated. While it is beyond the scope of this engineering study to undertake a complete analysis of governmental structures, administrative organizations and financial needs in the study area, it is pertinent to review the adequacy of present policies as they relate to major street and highway construction in order that deficiencies in these policies may be put in proper perspective by official agencies.

THE INTERACTANCE BETWEEN URBAN GROWTH AND TRAFFIC NEEDS

The master plan for major streets and highways is properly an integral part of the over-all community development plan. The major street and highway plan recommended in this report has been based on the preliminary plan for future land use in the Phoenix Urban Area, prepared by the Advance Planning Task Force of the City of Phoenix and Maricopa County (see Figure 12). The degree to which future land developments actually follow this land use plan will determine, to some degree, the adequacy of the major street and highway plan. Also, the rate of attainment of various portions of the land use plan will affect priorities of future transportation needs.

It is conversely true that the adequacy of the transportation system will greatly affect and influence the potential growth of the area. This intimate "interaction" between growth and traffic movement in social dimensions must be recognized. This

report is concerned with one of these physical dimensions, the transportation plan. Unless this functional element of the total community plan is advanced and realized it is unlikely that the other side of the coin, growth, will occur in proportions indicated in the preliminary land use plan.

ADMINISTRATION

One of the most startling developments of today is the suburbanization and metropolitanization of cities. Like many other cities, Phoenix is exploding in all directions. An area equal in size to that previously incorporated was only recently annexed to the City. Nevertheless, the future Phoenix Urban Area will include several cities and unincorporated areas as well as the City of Phoenix.

Highway transportation and highway development problems have no regard for corporate boundaries. Again, this poses a difficult problem for public services which are desired and which must be furnished by cities, counties, and states. Metropolitan areas are just one geographic, economic, and social unit. They must be so treated. The central city, like Phoenix, is called upon to provide principal services for the whole area. One jurisdiction generates traffic problems for another. The "free" flow of commerce is the essential.

NEED FOR AN AREA—WIDE APPROACH

Although it will be necessary for various public agencies to assume responsibility for various elements of the total plan, to be most effective the traffic improvement program for the Phoenix Urban Area and Maricopa County will require an integrated area-wide approach. Roadway needs are inter-related with so little consideration given in traffic usage to corporate or political boundaries that the job of implementing the program must be looked upon as much as possible as a "total job" rather than as one which can be factored according to political jurisdictions. The development of the individual components of the total plan should not be handled in separate unco-ordinated actions of the several agencies which may be involved. The division of responsibility for various parts of the plan must be clearly established, with over-all co-ordination by a single administrative authority.

The importance of effective administration and co-ordinated effort to the implementation of the recommended plan is obvious when it is realized that numerous official agencies of government now have responsibilities for the planning, construction and operation of major street and highway facilities in the Phoenix Urban Area. These include the U.S. Bureau of Public Roads; the Arizona Highway Department; the Maricopa County Engineer; the City Engineers of Phoenix, Mesa, Tempe, Scottsdale and Glendale; the City Planning Department and City Planning Commission of Phoenix; the Maricopa County Planning Department and County Planning Commission; the Traffic Engineer of Phoenix; the Safety Engineer of Maricopa County, and others. City, county and state police agencies also provide traffic enforcement and other services related to transportation. Local transit services and off-street facilities are operated by private organizations. Various unofficial groups perform related functions. It has been proven through experience elsewhere that effective urban transportation programs require comprehensive administration with relation to area, political jurisdiction and all components of the total plan.

POSSIBLE ADMINISTRATIVE APPROACHES

An administrative mechanism, at least as broad in area as the future urban area, seems to be desirable for the development of major highway routes in Phoenix and vicinity. Although rural road needs are vastly different in character and magnitude than urban transportation needs, the administrative mechanism could also be county-wide in scope. However, no existing organization has all the necessary powers and financial resources to undertake the entire job alone. Jurisdiction would be divided along individual routes under present laws.

There are at least three feasible administrative approaches to the implementation of the proposed plan for major highway routes. With increased funds and legislative action, the entire freeway-expressway system could be administered by the *Arizona Highway Department;* routes not now on the state federal-aid primary highway system would have to be added to this system. With this administrative approach, the entire freeway-expressway system would be constructed by a single agency and co-ordination in its development would be assured. This is the approach to be used in the development of a state-wide freeway-expressway system in California; this state-wide system includes integrated networks of freeways in each large urban area.

The *Maricopa County Highway Department* could also administer the development of the county-wide system of major highways including urban "extensions" if additional funds and authority were to be provided. Presumably, the construction of Interstate routes and primary state highway routes would remain under state jurisdiction. Close co-ordination between the two agencies in planning, design, programming and construction would be essential.

Thirdly, in some other areas it has proven desirable to establish a *new organization* with legislative authority and special financing to undertake the development of major routes on a regional basis. This is the approach to the administration of a large-scale transportation program being used in Dade County, Florida and Toronto, Canada. Several other large urban areas such as Seattle, Washington, have established new units of government, with powers that transcend corporate limits, for the development of various public works facilities. It must also be noted, however, that proposed regional governments for many other urban areas have been turned down, including those recently proposed for Cleveland, Ohio; St. Louis, Missouri; Albuquerque, New Mexico; and Knoxville, Tennessee.

Although an urban area-wide or county-wide approach to transportation problems is highly desirable, the need for new regional governmental structure is not great in the Phoenix Urban Area. This is because existing highway departments are competent and because regional government in the Phoenix Urban Area will be approached upon completion of the City of Phoenix annexation program. Phoenix already includes about 185 square miles - a large part of the future urban area.

ESTABLISHMENT OF A REGIONAL TRANSPORTATION CO—ORDINATING COMMITTEE

Regardless of which administrative approach is used, various public agencies will still be concerned with different aspects of the total program and co-ordination will be essential. One practical administrative device for this purpose is a Regional

Transportation Co-ordinating Committee. It is recomended that a committee of responsible civic leaders, with appropriate representation from all jurisdictions in the future urban area, be established. It must be emphasized that the effective implementation of the total transportation plan will require that this committee be representative of *regional* interests. Representatives from the Cities of Mesa, Tempe, Scottsdale and Glendale should be included as well as representation from Phoenix, Maricopa County and the State of Arizona.

The caliber of the membership of the proposed Regional Transportation Co-ordinating Committee will determine its effectiveness - particularly in the early phases of the program when basic policy decisions must be made and legal actions taken to provide necessary financing and technical machinery for implementation of the plan.

NECESSARY ADMINISTRATIVE TOOLS

Four basic legal tools of the land planner are essential for the effective implementation of an urban transportation plan. These are:

1. An adopted General Plan,
2. A Zoning Ordinance,
3. Subdivision Regulations, and
4. Building Line or Set-Back Controls

The *General Plan* can be a very effective legal tool of the administrator in controlling the development of land uses to assure the integration of adequate transportation facilities with other urban improvements. In order to be effective the General Plan must be:

1. Realistic,
2. Comprehensive, and
3. Understood

The General Plan must be *realistic*. In many instances, financially possible plans have been discarded because of the inability of the community to muster the resources or support necessary for their realization. The transportation plan proposed in this report is realistic and is considered to be within the scope of the potential financial resources of the area. The unit costs of the recommended improvements, in terms of annual costs per resident and costs per vehicle mile of usage, are relatively small.

The General Plan must be *comprehensive*. It should indicate the generalized plan for land use development and the major street and highway plan. The plan should encompass an area at least as broad as the future urban area, and should be adopted by legal action subsequent to public hearings.

The various types of facilities needed for 1980 traffic demands should be classified on the General Plan. These classifications should be based on traffic service functions - not traffic volumes - as described in Chapter III of this report. By the classification of traffic facilities on the General Plan and reference to the same in subdivision regulations, zoning and other legal documents, minimum standards of

design including ultimate right-of-way requirements may be specified for practical applications. Detailed design standards for individual street sections should not be indicated on the plan itself to avoid frequent changes. The General Plan should be sufficiently generalized to permit flexibility in its implementation and yet remain an accurate reflection of transportation objectives.

Finally, the General Plan must be *understood;* understood by administrative officials to assure consistent application, and by the public at large to assure acceptance of restrictions which may be imposed by attention to the plan.

Zoning can assure the logical and orderly development of the urban area in accordance with desirable planning objectives. Zoning can establish better relationships between major traffic flows and land use; assure that planned roadway capacities will not be exceeded through control of land use densities and the locations of major traffic generators; assure the provision of adequate right-of-way for major streets and highways by establishing future width lines; reduce future development costs and otherwise facilitate major street and highway construction; and assure integration between land use and trafficways plans. Essential elements of adequate zoning laws include:

1) Authority to control the character and density of land use development;

2) Provisions for the establishment of building lines for the major streets and highways shown on the General Plan;

3) Requirements for off-street parking facilities;

4) Requirements governing building set-backs and other details concerning front, side, and back yards; and others.

It is important that a co-operative zoning program be established including all jurisdictions in the urban area. Zoning laws are now in effect in Phoenix and Maricopa County; modifications in these present laws will be desirable as a result of the findings of this study regarding major street and highway needs. The major street and highway plan proposed in this report has been designed with sufficient capacity to serve the land use densities indicated on the future land use plan prepared by the official planning agencies. Future width lines for arterials should be established in accordance with adopted portions of this plan - not by arbitrary relationships between zoning classifications for particular properties and street widths. On the other hand, if the land use densities indicated on the future land use plan are subsequently modified, a re-evaluation of major street design capacities indicated in this report may be required.

Subdivision regulations are necessary to assure conformity of new land developments with the planned major street and highway system, and to establish adequate standards of design for facilities constructed by private land developers. These regulations should include the following essential elements related to major street improvements:

1) Authority of the official planning agency to control the subdivision of land through approval of tentative maps of proposed developments.

2) Authority to co-ordinate the development of collector streets and local streets within new subdivisions with the major street and highway plan.

3) Provide for adequate standards of street improvements.

4) Authority to control points of access to the major street and highway system.

5) Provide for conformity with the General Plan for the area through direct reference to the General Plan and other duly adopted legal documents related to plans for major street and highway development.

Subdivision regulations are in effect in the City of Phoenix but not in Maricopa County. The Advance Planning Task Force of the City of Phoenix and Maricopa County has prepared a recommended uniform subdivision ordinance.[20] This proposed ordinance includes provisions for the five elements listed above and is generally well prepared with respect to the administration of the major street and highway plan. However, it is recommended that section 102.17, which defines various types of major streets and highways, be modified in accordance with definitions included in this report. Of particular importance is the need for differentiation between freeways and arterial streets.

Building Line or Set-Back Controls - Planners have long been concerned with the problem of how they can control the building of structures in the beds of proposed streets prior to the time that the city is in a position to acquire the rights-of-way. If such controls cannot be established, the cost of future developments may be prohibitive. One of the most successful devices for accomplishing this purpose has been the official map ordinance. Under this type of ordinance, projected future streets or other public areas are designated on an *Official Map* which is recorded.

A number of states have enacted official map and building permit acts which contain detailed legislation enabling the legislative authority of municipalities to adopt official maps establishing the location and widths of streets. It is common for such acts to provide that no permit shall be issued for any building or structure in the bed of any street shown on the official map. The function of the official map is not to compel a dedication of land for streets without payment of compensation, but rather to prevent the owner from building on the areas which the city proposes to acquire at some future date. The primary purpose of the restriction upon use is to keep the municipality from having to pay excessively high acquisition costs for the land or rights-of-way when the city is in a position to acquire them.[21]

The preparation of the Official Map is a responsibility that usually devolves

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20. Proposed Subdivision Regulations, Phoenix, Arizona. Draft No. 3, June, 1959; prepared by Phoenix-Maricopa County Advance Planning Task Force.

21. Kenneth T. Leque, "Advantages of Official Map," The Municipality, Volume 50, No. 3, page 49, March, 1955.

upon the engineering department. The map should be prepared after careful engineering surveys have been made, and should show not only the street plan but also the recorded land subdivision plans and the planned and existing public open spaces. During preparation of the map, it is important that the planning agency work closely with the engineering department in order to insure that the official map will be in conformity with the comprehensive plan. It should be submitted to the legislative body for adoption only after it has been carefully checked in every detail. The legislative authority, from time to time, may make additions to, or modifications of, the official map by designating thereon the lines of new streets or street extensions, widenings, or vacations. Such action should be preceded by public hearings held after due notice as provided by law. The ordinance should make it clear that the effect of the adoption of the map does not constitute the opening of a street or acceptance of any land for street purposes.[22]

It is possible and in many cases desirable to establish set-back lines by zoning rather than by official map since the zoning test for variance requires a showing that the landowner's particular situation is unique; the official map "variance" does not.[23]

As in the case of the Official Map, the nature and purpose of set-back control is the same. The preparation and adoption of set-back controls within the scope of zoning authority require individual strip maps, metes and bounds descriptions, or dimensions from reference lines (usually center lines) with specific names of streets involved and the limits of the additional set-back controls. After adoption, the set-backs are administered in the same fashion as other zoning set-backs. Compensation to affected property owners may be made at the time of application of this set-back restriction or when the widening project is actually accomplished.

Both methods of set-back control, "official map" or "set-back by zoning," are effective, assuming that the administration of either is consistent. It is imperative that the set-back regulations are enforced after having been established. Once established, the responsibility of providing funds for protective purchases of right-of-way, often years in advance of need, must be realized and met. Great pressures will be brought to bear on the various jurisdictions to relax the restrictions or yield in favor of promised "tax-producing" improvements to substandard widths and inferior alignments. Yielding to such pressures jeopardizes not only the eventual proper development of the traffic facility and the efficiency of adjacent arterials, but the integrity and success of the entire building line program.

In summation, the proper implementation of the proposed major street and highway plan will require the adoption of an area-wide General Plan, enforced by uniform zoning, subdivision, and building line or set-back controls. Standard planning enabling acts, published by the federal government and various states, are available as guides for the establishment of necessary powers and procedures.[24]

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22. "Urban Planning and Municipal Public Policy," 1958.

23. "Local Planning Administration," 3rd Edition, 1959; International City Managers Association, Appendix: Legislative Bases for Local Parking: I) Municipal Planning Enabling Act; II) Municipal Subdivision Regulation Act

24. U.S. Department of Commerce, Advisory Committee on City Planning and Zoning, "A Standard City Planning Enabling Act," Government Printing Office, 1928; and "Local Planning and Zoning," A Manual of Powers and Procedures for Citizens and Government Officials; State of New York.

FINANCE

In all major programs of public improvements, means must be found for financing. The needs for highways become even more important because traffic demands already exceed the capacity afforded by many roadway facilities. The public demands good auto transportation. The automobile is inter-dependent with most public activities; it is considered an essential. The automobile is not necessarily used in accord with sound economic principles, but it is none-the-less desired and it is directly related to the livelihoods of many. The very best combination of financial approaches will obviously be required to produce the traffic facilities which are sorely needed in the Phoenix Urban Area and Maricopa County.

PRESENT FUNDS AND REVENUE SOURCES

At present, separate funds for major street and highway construction in the Phoenix Urban Area and Maricopa County are administered by the Arizona Highway Department, Maricopa County Highway Department, and public works agencies of each incorporated area in the county. These funds are derived from various sources as described below:

Arizona Highway Department - Revenues for road construction administered by the Arizona Highway Department are derived from the state tax on gasoline, motor vehicle registration fees, other road user taxes (title fees, fines, weight fees, etc.) and federal-aid.

As shown in Table 25 total annual revenues for state highway purposes have increased from about $21,000,000 to about $69,000,000 since 1952. About $40,000,000 of the total consisted of federal-aid in 1959. Revenues from the state tax on motor fuel have increased with traffic growth to about $16,000,000 per year. Registration fees and other road user taxes total an additional $12,000,000 per year.

Table 25

ANNUAL REVENUES FOR STATE HIGHWAY PURPOSES
State of Arizona
(thousands of dollars)

Fiscal Year	Motor Fuel Tax	Registr. Fees	Other Road User Taxes	General Fund	Other	Federal Aid	Total
1952	$ 9,482	$3,781	$1,840	$ -	$ -	$ 6,036	$21,139
1953	10,472	4,475	2,192	-	-	6,009	23,148
1954	10,842	4,684	2,263	15	118	7,035	24,957
1955	11,479	4,439	2,417	-	165	7,090	25,590
1956	13.091	6,091	2,798	-	140	10,580	32,700
1957	13,745	6,493	3,497	-	148	23,588	47,471
1958	15,016	6,953	3,790	-	246	29,671	55,676
1959 Est.	16,000	7,100	4,900	-	300	40,405	68,705

Source: Arizona Highway Department

Federal-aid funds can only be used for street and highway facilities on several officially designated highway systems including the National System of Interstate and Defense Highways, the federal-aid primary highway system, the federal-aid secondary highway system and urban extensions of the federal-aid secondary system. Figure 47 indicates the locations of these federal-aid highway systems in the Phoenix Urban Area in relation to the recommended freeway-expressway system and major arterials.

Table 26 summarizes the annual amount of federal funds apportioned to Arizona for each of the designated federal-aid highway systems. The bulk of the available federal-aid is used for construction of the Interstate highways. About $6,000,000 per year is used on federal-aid primary highways throughout the state. It should be noted that federal-aid funds for primary and secondary routes and urban extensions to the secondary system have remained fairly constant, whereas needs have greatly increased.

The annual allocation of federal-aid secondary funds in Arizona has been about $4,000,000 per year. Unprogrammed balances at the end of the current year may be carried forward and added to the following year. In accordance with the Federal Highway Act of 1950 and subsequent Amendments, 50 percent of the federal-aid secondary funds are re-allocated to the counties (after relatively small deductions for the State Highway Planning Survey). Thus, as shown in Table 26, about $2,000,000 per year have been allocated for county federal-aid secondary projects. The distribution of the county portion of these funds is based on a formula in which rural population (20 percent), daily traffic on federal-aid secondary routes (20 percent), vehicle registration (20 percent), area (10 percent), rural mileage (10 percent), mileage of federal-aid secondary routes)10 percent) and unimproved county federal-aid secondary mileage (10 percent) are the factors. The "tentative share" of Maricopa County is about 40 percent of this total.[25] It is important to note that county federal-aid secondary funds cannot be used in incorporated areas.

Only about $900,000 per year of the total federal-aid has been allocated for extensions of approved federal-aid secondary routes in cities over 5,000 in population at the time of the last official census. This small amount must be shared by Phoenix, Tucson, Mesa, Glendale, Tempe, Prescott, Yuma and several other cities in Arizona. Federal-aid funds for major streets in incorporated areas are obviously insufficient in themselves to provide for present needs - let alone those of the future.

To use the apportioned federal-aid, local agencies must provide matching funds and conform with methods and standards of construction approved by the U.S. Bureau of Public Roads. Up to 72 percent of the approved construction costs of projects on the accepted federal-aid primary and secondary systems can be secured from federal-aid. In practical application, federa-aid usually amounts to about two-thirds of the total costs of road development if costs not covered by federal-aid are included.

The theoretical matching ratio for Interstate projects in Arizona is about 94

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25. Outline of Policies and Procedures, Federal-Aid Secondary County Highways, Arizona Highway Department in co-operation with U.S. Department of Commerce, Bureau of Public Roads; March, 1959.

Table 26

FEDERAL-AID APPORTIONMENTS
State of Arizona

Federal-Aid System	Miles	1956-1957	1957-1958	1958-1959	1959-1960**	1960-1961**
Interstate	1,164	$13,435,534	$19,482,364	$22,843,956	$33,979,250	$24,342,120
Primary	1,209	5,564,756	5,564,327	5,714,323	5,996,337	5,981,431
State - FAS	1,707	1,895,028	1,896,520	1,947,666	2,041,747	2,038,747
State - non-FAS	146	--	--	--	--	--
County - FAS	2,155	1,895,028	1,896,521	1,947,667	2,041,748	2,038,747
City - FA Urban	123	796,865	831,380	851,554	875,884	895,690
Emergency Funds 1958 Highway Act*		--	--	7,100,000	--	--
Total		$23,587,211	$29,671,112	$40,405,166	$44,934,966	$35,296,735

* Emergency Funds include $2, 300, 000 for Interstate, and $4, 800, 000 for other state systems.
** Estimates based upon past formulas.
Source: U.S. Bureau of Public Roads.

EXISTING FEDERAL-AID HIGHWAY SYSTEMS AND PROPOSED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA – MARICOPA COUNTY

LEGEND

EXISTING

- FEDERAL AID SECONDARY SYSTEM
- FEDERAL AID PRIMARY SYSTEM
- FEDERAL AID INTERSTATE SYSTEM

PROPOSED

- FREEWAY, EXPRESSWAY, PARKWAY OR EXPRESS STREET
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET OR MAJOR COUNTY ROAD
- SECONDARY ARTERIAL OR SECONDARY COUNTY ROAD

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percent federal funds to 6 percent state funds. The practical ratio (including costs not subject to federal-aid) is about 85 percent federal funds to 15 percent state funds.

State funds for highway purposes, summarized in Table 25, are used to match federal-aid apportionments for Interstate, primary and state secondary projects. About $10,000,000 to $12,000,000 per year is assigned to the Motor Vehicle Department, the State Police, various overhead funds including funds for social security and retirement, and to state highway maintenance and highway department administration. In addition, the counties share road user revenues to the extent of 30 percent of the state gasoline tax.

Table 27 summarizes the actual expenditures for construction by the Arizona Highway Department in Maricopa County during the last few years. The average annual rate of state-wide expenditure over the last ten years has been $19,654,000, of which about 13.5 percent was spent in Maricopa County. State-wide construction expenditures have exceeded $30,000,000 over the last two years with about 17 percent spent in Maricopa County. The largest expenditure in the Phoenix Urban Area has been for the improvement of Black Canyon Highway to freeway standards as part of the Interstate system.

Maricopa County Highway Department - The Maricopa County road improvement program is based primarily on the county share of the state gasoline tax, and a public works fund derived from property taxes. The 30 percent "county share" of the state gasoline tax is divided into two parts - 20 percent is retained for county road purposes and 10 percent is distributed to all incorporated areas on the basis of population. Maricopa County gasoline tax revenues, which amounted to about $1,836,000 in 1958 (fiscal year), are used for non-federal-aid projects. The public works fund is used to match federal-aid allocated for approved county secondary road projects. Transfers from the public works fund for road purposes amounted to about $998,000 in fiscal year 1958.

As shown in Table 28, the Maricopa County Highway Department has had an average of less than $3,000,000 per year over the last three years to match federal-aid on approved secondary road projects, to construct major non-federal-aid roads, and to administer and maintain its vast county road network. About two-thirds of recent expenditures of county road funds has been for improvements in the Phoenix Urban Area, much of which has been in areas recently annexed by the City of Phoenix.

Public Works - Incorporated Areas - Major street improvements in incorporated areas of Maricopa County are financed primarily by gasoline tax revenues, assessments against property owners, special assessments against improvement districts, and transfers from the general, sales tax and public works funds. A total of only about $2,160,000 was spent for street construction in all the incorporated places in Maricopa County in fiscal year 1958. (See Table 29) Phoenix, Mesa, Glendale, Tempe and Scottsdale - all in the designated Phoenix Urban Area - spent a combined total of less than $2,000,000. Funds for new construction in the incorporated areas have been used almost entirely as matching money for federal-aid projects; as noted earlier, federal-aid for urban projects has been relatively small.

During fiscal year 1958, the City of Phoenix expended only about $1,100,000

Table 27

CONSTRUCTION EXPENDITURES BY ARIZONA HIGHWAY DEPARTMENT
Maricopa County
(Thousands)

Route	Limit	1950-54	5-Year An.Avg.	1955-59	5-Year An.Avg.	1958	1959	1950-59	10-Year An.Avg.
U.S.Route 60	Ehrenburg-Wickenburg	$930	$186	$1,432	$286	$793	$ 59	$2,362	$236
	Wickenburg-Phoenix	366	73	567	113	13	18	933	93
	Phoenix-Globe	1,499	300	28	6	3	12	1,527	153
State Route 69	Casa Grande-Phoenix	0	0	239	48	230	9	239	24
	Phoenix-Prescott	1,850	370	5,250	1,050	870	1,905	7,100	710
State Route 71	Aquila-Congress Jct.	85	17	0	0	0	0	85	9
U.S.Route 80	Yuma-Phoenix	1,423	285	5,801	1,160	916	1,175	7,224	722
State Route 84	Gila Bend-Tucson	98	20	5,212	1,042	1,402	3,700	5,310	531
State Route 85	Gila Bend-Ajo	18	4	189	38	19	145	207	20
State Route 87	Pecacho-Mesa	667	133	295	59	0	8	962	96
State Route 88	Apache Trail	254	51	77	15	8	10	331	33
State Route 89	Wickenburg-Prescott	0	0	332	66	189	127	332	33
Washington St.	Phoenix	15	3	0	0	0	0	15	2
Total Maricopa County		7,203	1,441	19,424	3,885	4,443	7,168	26,627	2,663
Total State of Arizona		68,835	13,767	127,706	25,541	30,305	37,555	196,541	19,654

Table 28

MARICOPA COUNTY HIGHWAY DEPARTMENT PROJECTS
July, 1953 Thru July, 1959

Project Category	1953-1954	1954-1955	1955-1956	1956-1957	1957-1958	1958-1959	Average Annual Cost
County Contract Construction	$ --	$ --	$ 60,842	$ 811,569	$ 623,025	$ 452,681	$ 324,686
Federal-Aid Constr. and Paving	706,132	342,928	1,400,337	1,768,592	1,100,488	2,443,083	1,293,593
County Forces Constr. (Roadway)	552,825	745,449	1,566	76,684	26,907	106,817	251,375
County Forces Constr. (Bridges)	18,263	3,316	--	--	--	--	3,596
Bridges-County Contract	--	--	--	188,174	31,002	225,779	74,159
Bridges-Federal-Aid	--	40,761	146,174	24,256	--	43,735	42,488
Betterments	122,866	78,513	135,760	142,435	221,056	461,666	193,716
Total	$1,400,086	$1,210,967	$1,744,679	$3,009,710	$2,002,478	$3,733,761	$2,183,613

Source: Maricopa County Highway Department

Table 29

DIRECT EXPENDITURES FOR STREET CONSTRUCTION
Incorporated Areas of Maricopa County
(Fiscal Year 1958)

City	Expenditure
Avondale	$ 5,287
Buckeye	-
Chandler	36,000
El Mirage	-
Gilbert	237,168
Glendale	13,162
Goodyear	-
Mesa	412,436
Peoria	-
Phoenix	1,105,080
Scottsdale	199,635
Tempe	144,395
Tolleson	9,000
Wickenburg	269
Total	$2,162,432

Source: Annual Road Finance Report of the 54 Incorporated Places in Arizona, Arizona Highway Department; June 1959.

for street construction. Realizing the inadequacy of this rate of expenditure, the City has approved a bond program. As previously noted, $6,000,000 has been authorized for street improvement bonds. Although this is a step in the right direction, the authorized amount will be sufficient for only the most pressing needs of today.

Summary - In summation, 1958 construction expenditures in Maricopa County by the Arizona Highway Department equalled about $4,443,000 - about 15 percent of the total state-wide highway construction program. In 1959, about $7,168,000 was spent in Maricopa County. Recent state expenditures, and those projected for the near future, largely involve the construction of Interstate highways.

The Maricopa County road construction program has been based, in large part, on the county share of the state gasoline tax (20 percent), and federal-aid for federal-aid secondary county roads. These county funds cannot be used in incorporated areas. In past years, virtually all major street construction by the City of Phoenix has been financed with federal-aid for urban extensions of the secondary road system, matched by the city share (10 percent) of the state gasoline tax. Since federal-aid for urban extensions has averaged less than $900,000 per year for the entire state, very few miles of the arterial street system in Phoenix have been widened or otherwise reconstructed to modern standards for urban traffic needs.

FINANCIAL RESPONSIBILITY

The division of responsibility for various elements of the master plan must be established to determine future financial requirements because of the regulations which govern the distribution of available funds. As previously discussed, facilities included in the recommended plan have been classified according to *traffic service functions* - not according to traffic volumes, lines of political jurisdiction, or previously established route designations. Through this system of classification, the principal responsibility for the financing and administration of the construction of various parts of the plan is inferred.

The Interstate highway system is of nation-wide importance. In recognition of this, the federal government has assumed responsibility for financing the construction of this system to the extent of about 90 percent of the costs.[26] The Black Canyon Highway (Interstate 17), the Phoenix-Tucson Freeway (Interstate 10), the Yuma-Tucson Freeway (Interstate 8) and either the Buckeye Expressway or the Wickenburg Expressway would constitute the Interstate system in Maricopa County, Arizona. The urban penetration route in Phoenix is also included in this nation-wide system of controlled-access highways.

Several important highway routes in Maricopa County, not on the Interstate system, but included in the recommended freeway-expressway system for Maricopa County, are of state-wide importance. These routes, which include the Tempe-Mesa Freeway, the Gila Bend-Buckeye Expressway, and either the Buckeye Expressway or the Wickenburg Expressway (whichever route is not selected for the Interstate system), would be financed with state and federal funds for federal-aid primary state highways. It is also recommended that Bee Line Highway be developed with state and federal funds.

Other freeways and expressways which would supplement the routes of state-wide interest to form an integrated system in the future Phoenix Urban Area, are of primary concern to the urban area as a whole and to Maricopa County. These routes should be financed by a co-ordinated capital improvement program which takes into account the capital requirements and capital limitations of each public agency with responsibilities for their construction. As previously noted, it may prove desirable, as it has in other states, to assign the responsibility for the construction of the entire freeway-expressway system to the State Highway Department, or to assign the responsibility for all routes not already on the designated state highway system to one other governmental agency such as the County Highway Department. Whichever approach is used, the freeway-expressway system should be financed with public funds on an area-wide basis; the financing of individual routes should not be assigned to the owners of properties abutting the routes, or accomplished by local benefit assessment districts.

At present, arterial construction projects in Phoenix are financed by federal-aid urban funds administered by the State Highway Department and matched by city

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26. This percentage varies from state to state, depending upon the amount of federal ownership of land. About 94 percent of the approved costs of constructing Interstate highways in Arizona are provided by federal government.

funds. Property owners generally pay for curbs, gutters, sidewalks and a portion of the paved surface. (In the county, the property owners often pay for the curbs, gutters and sidewalks where required, but the County Highway Department pays for the entire paved surface.) As indicated in Table 14 of Chapter III, property owner contributions have constituted a large portion of the funds used for arterial widening projects completed during the last ten years in Phoenix. Benefit assessment districts have been established to secure property owner contributions where the consent of a majority of the property owners could be secured.

It will not be possible to effectively implement the necessary expanded major street improvement program, with higher design standards for major arterials, with the present degree of reliance on benefit district assessments. In addition, although it is now recognized that local benefit assessments should not be applied for the total costs of arterial improvements, there is a serious question as to whether or not they should be applied for any of the costs of arterial widening projects, especially in residential areas. Arterial routes, which are primarily for service to through traffic (traffic between different sections of the urban area), with relatively little land service functions, are of regional concern and should be financed primarily with public funds. Collector streets, on the other hand, are of more localized interest and should generally be responsibilities of land developers and other local property owners benefited directly by the improvements.

SPECIAL NEED IN FINANCING

On any arterial in which federal funds are to be used, the incorporated area must obtain the right-of-way and present a clear right-of-way affidavit to the state before necessary action can be taken by the state to acquire federal-aid urban funds. The state does not participate in any arterial costs but acts only as the agent for the federal government. The federal government has participated in right-of-way costs but only on special occasions. Right-of-way costs are eligible for federal funds, but since the funds are limited it usually is determined that the funds can be used to better advantage on construction. On the state primary system which passes through incorporated areas, the state pays for all costs, including right-of-way.

Recent policy on right-of-way acquisition for street widening projects in Phoenix has been to enter into agreement wherever possible with property owners to pay $4.50 per front foot upon completion of construction, and using condemnation procedures where agreement cannot be reached. This policy has not been entirely effective; purchase of right-of-way at appraised value would be desirable to facilitate acquisition. Limited funds for an effective and equitable right-of-way acquisition program have not been available.

A special financing need for the long range capital improvement program is the establishement of a revolving fund for acquisition of right-of-way in advance of need. In addition to conventional land use controls, which can be exercised by city and county planning agencies, key land parcels should be purchased where developments are proposed which will be detrimental to the future construction of planned major highways. Although state and local money may be required for the necessary revolving fund, a portion of the costs may be recovered by application for federal-aid at the time of construction (for approved federal-aid projects).

FUTURE FUNDS VERSUS NEEDS

For the purposes of this study, it has been assumed that the Interstate and state highway routes included in the recommended plan for Maricopa County will be constructed with federal-aid funds matched by state road user tax funds as required. Although an evaluation of state-wide highway needs would be required to establish with accuracy the financial capabilities of the Arizona Highway Department with respect to Maricopa County needs, and is obviously beyond the scope of this study, it seems reasonable to assume that the proposed state highway routes could be financed by 1980. Thus, the 20-year capital improvement program for major streets and highways in the Phoenix Urban Area should be based on needs totalling about $178,700,000, including $76,700,000 for urban freeways and expressways. Major rural road needs in Maricopa County, excluding state freeways and expressways, will approximate $50,600,000. Thus, it is recommended that present financial planning in Maricopa County be based on total expenditures averaging $10,000,000 per year over the next 20 years, exclusive of state freeway-expressway construction.

It would appear that the major portion of future revenues for major street and highway purposes will come from increases in road user tax revenues; these revenues have almost doubled since 1952 and should continue to increase at about the same rate as increases in motor vehicle ownership and usage, assuming no increases in present tax rates. Auto registrations in Maricopa County are expected to increase from about 201,000 vehicles to about 610,000 vehicles by 1980.

Maricopa County's share of the state gasoline tax, equal to $1,800,000 in 1958, will increase to over $5,000,000 per year by 1980 assuming no increase in the tax rate, and total about $75,000,000 over the next 20 years based on a conservative projection of motor vehicle registrations and use. If annual amounts averaging $1,500,000 are transferred from the County Public Works Fund (considerably more than the present rate of such transfers) annual funds ranging from about $3,000,000 to $7,000,000 would be available for county road construction, totaling about $100,000,000 over 20 years. From $60,000,000 to $70,000,000 would be required for maintenance, operation and other financial obligations of the County Highway Department. County construction projects totaling $30,000,000 to $40,000,000 could therefore be financed on a pay-as-you-go basis. It is important to note that these funds will not be available for use in incorporated areas under present policies, and they will be available in relatively small annual amounts over a 20-year period, whereas road needs are already urgent.

The City of Phoenix now includes about 185 square miles. Considering possible expansions by Mesa, Tempe, Scottsdale and Glendale, it must be assumed that very little of the long range major street and highway needs in the Phoenix Urban Area could be financed with county revenues under present policies. At present, the West Belt, North Belt and East Belt Expressways would be under county jurisdiction. These three routes, included in the urban cost summary, could be constructed for about $20,000,000 if adequate rights-of-way are reserved and advantage is taken of future flood control channel construction. Major streets in Moon Valley and sections of Paradise Valley in the designated future urban area, are also under county jurisdiction. Projected needs in the future urban area, within the present city limits of Phoenix, total about $135,000,000. This amount is far in excess of future revenues

which can be expected under present policies and tax rates.

Annual revenues from the city share of the state gasoline tax in Maricopa County will probably average about $1,500,000 per year over the next 20 years if present policies are continued. Small annual amounts of federal-aid for urban extensions can also be expected. Some of the projected road user revenues are already earmarked as collateral for the $6,000,000 street improvement bonds. Recent street construction programs have been geared to available road user revenues; unless means are found to increase the road user revenues available for use in the urban areas, continuation of this policy will result in serious major street and highway deficiencies.

POSSIBLE SOURCES OF ADDITIONAL FUNDS

While this report is concerned only with road needs and highway transportation, it is well known that somewhat comparable needs prevail in other public activities. It is proper, therefore, to think of the experiences and practices in highway finance that have been applied, or which are being considered, in other areas. Also, the demands on all public coffers must be recognized.

There are several possible approaches to securing additional funds for urban transportation programs, each of which should be thoroughly investigated subsequent to this study.

First, the total state gasoline tax rate in Arizona is five cents per gallon. The tax rate in several other states is already seven cents per gallon; thus, there is precedent for higher gasoline taxes than now in effect in Arizona. It would be possible to increase the state gasoline tax, without changing the combined federal-state tax, if the federal rate reverts to three cents per gallon in 1961.[27] Whether or not the federal tax is reduced, an increase in the state tax should be considered.

An increase in the state gasoline tax should be accompanied by changes in present policies governing its distribution. At present, less than 10 percent of the gasoline tax revenues collected in Maricopa County, which amounted to about $9,000,000 in 1958, is returned to Phoenix for local use. If the state gasoline tax rate is increased in future years, at least part of the increase should be ear-marked for use on approved major street and highway systems in urban areas (other than the federal-aid primary and Interstate systems). This is already being done in California where a major program of state-wide freeway construction is under way. If an additional one cent per gallon were levied, and the revenues therefrom apportioned among all cities with 5,000 population or more, and ear-marked for construction of major streets, annual amounts ranging from about $1,500,000 to $4,000,000 would be developed for cities in Maricopa County.

In the future allocation of road user funds, greater consideration should be given to the magnitudes of urban transportation needs as determined by objective

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27. The federal tax on gasoline was increased from three to four cents in 1959 to solve a temporary fiscal problem with respect to the Interstate system. The law by which this tax was increased expires in 1961.

studies, in comparison with the needs of the several rural road systems. Certainly, future revenue distributions should account for the shifts in population from rural areas to urban areas, and from central cities to suburbs of urban areas. As outlying sections of the future urban area are annexed by Phoenix and other cities, which is highly desirable from the standpoint of over-all administration, state and county secondary road funds will no longer be available for these areas although the needs will be increased by the development of these areas for residential use. The distribution of available funds should be adjusted to account for the effects of urbanization when it occurs. These adjustments should not necessarily be in direct proportion to changes in *area*, but rather in accordance with changed *needs*.

Local responsibility for local problems must also be assumed if the major street and highway plan is to be implemented. Future gasoline tax revenues available for local street and highway purposes should be used for building new facilities - not to shift the burden of maintenance from general taxpayers to road users, the effect of which is merely to substitute state taxes for local taxes. To provide adequate funds for future maintenance costs and other expanded public activities, it may be essential to tap local general revenue sources to a greater extent than at present.

It has already been recognized by the City of Phoenix that the large-scale program of major street and highway improvements contemplated for the area cannot proceed effectively on a strict "pay-as-you-go" basis. Credit financing will be essential if major improvements are to be provided at an early date - when they are needed. Legislation has already been secured which permits the use of gasoline tax revenues for the retirement of local bonds for street improvements. Use of this financing method, which permits the capital improvement program to get under way at an early date by taking advantage of the tremendous growth predicted for the state, should be expanded consistent with sound financial practice.

Urban redevelopment and urban renewal are providing some assistance in major highway development in some cities. Its potentials should be exercised in Maricopa County. When areas are cleared for redevelopment, it is easier to lay out proper road facilities than otherwise. Reduced land prices that can be obtained through redevelopment make possible road projects which would have to be deferred otherwise for many years. This can especially be true in the cases of several projects in the Phoenix Urban Area.

BENEFITS

The recommended major street and highway plan for the Phoenix Urban Area and Maricopa County has been designed to:

1) Provide an essential guide for the logical and orderly development of the urban area;

2) Provide for high quality traffic services for anticipated 1980 traffic demands;

3) Provide for the logical and economical expenditure of public funds for improvements most needed and consistent with long range needs.

In accordance with desirable urban development objectives, major arterials and primary highways have been located to preserve and enhance community values. Implementation of the recommended plan will establish better relationships between major traffic flows and land use by the removal of through trafffic from neighborhoods; by the logical separation of incompatible land uses with major street and highway facilities with wide rights-of-way, medians, and other modern design features; and by minimizing severance of integral planning areas, or groups of related land uses such as residential neighborhoods and unified commercial and industrial districts.

By correlating the major street and highway plan with the planning of other land uses, quality traffic services are assured to the future benefit of all residents of the area. The recommended plan includes major street and highway facilities of various types to provide for the various traffic service needs of the area and with roadway capacities balanced against future traffic demands. Desirable operating conditions in 1980, even under traffic loadings which will be more than three times present levels, will be possible if the total plan is implemented. The speed, convenience and safety of travel will be improved, whereas these conditions will deteriorate as traffic demands increase unless effective action is taken to develop improved traffic facilities.

BENEFITS FROM MAJOR STREET AND HIGHWAY IMPROVEMENTS

The urgent need for improvements to arterial streets in the Phoenix Urban Area is generally recognized. The recent sale of street improvement bonds for critical arterial widening projects is evidence to this. However, the importance of establishing higher design standards for the development of major arterial routes may not be readily understood. This is partially due to the fact that local agencies have been reasonably successful in providing traffic services to date. Serious problems of traffic congestion, commanding public attention, have developed only recently. Because such a large proportion of the total development of the area lies ahead with expansion occurring at a very rapid rate, now is the best time for making provisions for adequate roadway capacity for future traffic requirements.

The mere widening of mile roads to 64-foot widths will not result in a high type transportation system. As the population increases to more than 1,000,000 persons during the next two decades, the urban area will expand. Thus, in addition to about three times as many vehicle trips to be served, distances between principal trip origins and destinations will increase. High-capacity streets and highways will be required as recommended in this report. As previously suggested, the future growth and areal expansion predicted for the urban area cannot be achieved without a high-standard major arterial system and controlled access highways.

Other benefits to be realized from the improvement of major arterials as recommended in this report include:

1) The reduction of traffic delays and congestion;

2) The reduction of the incidence and traffic accidents;

3) The removal of arterial traffic from local and collector streets in residential neighborhoods;

4) Efficient service to through traffic - traffic between various sections of the urban area;

5) Improved access to the downtown area and other principal business and commercial areas; and

6) The provision of adequate capacity balanced against projected traffic demands.

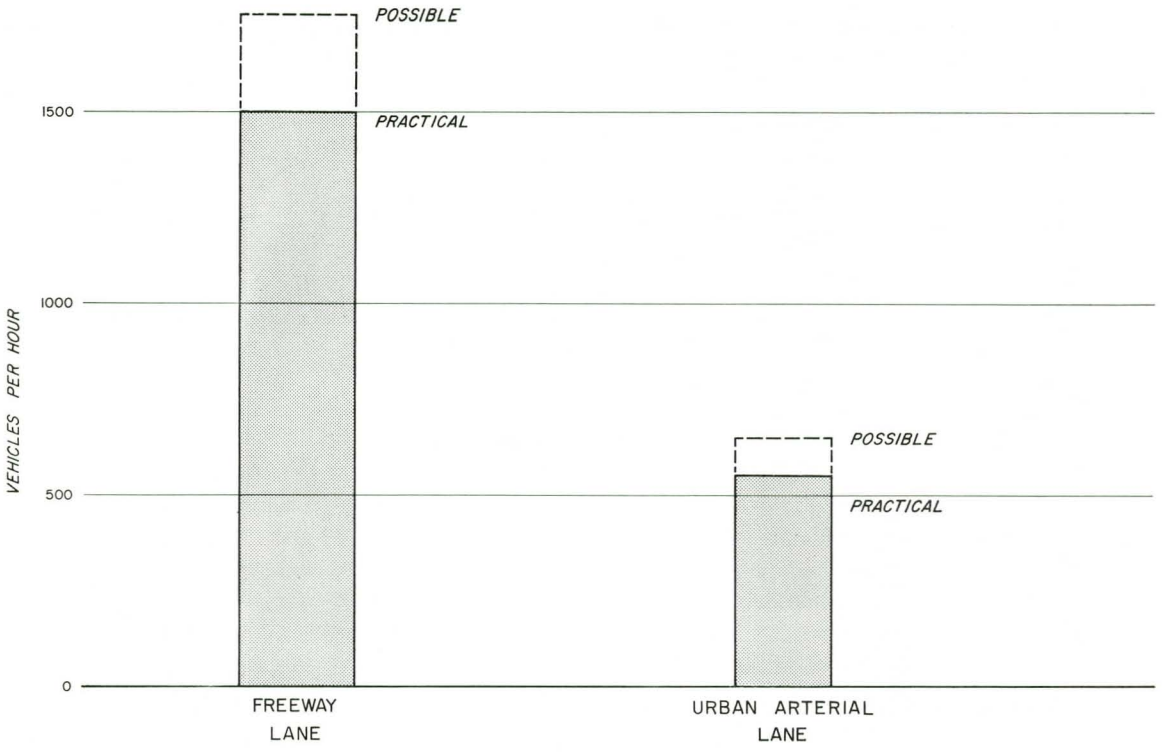
FREEWAY—EXPRESSWAY BENEFITS

The costly freeway-expressway system described in this report has been recommended because of the many benefits which this system would provide to road users, property owners, and all residents of the area. Part of the cost of this system would be off-set by the cost of major street widenings which would otherwise be required. These street widenings would be considerably more disruptive to established land uses in the area than construction of the recommended freeways or expressways, and they would not provide for important traffic service needs provided by freeways. Tangible economic benefits to motorists, and intangible values to particular classes of residents and the community in general, will more than justify the construction costs.

Freeways Provide Greater Traffic Capacity - Urban freeways can serve about three times as much traffic as comparable arterials. As shown in Figure 48, modern freeways can accommodate 1,200 to 1,500 vehicles per lane per hour with reasonable facility of flow, the specific volume depending on the characteristics of traffic served, frequency of interchanges and other design features. Individual lanes of multi-lane facilities can attain even higher peak hour totals - 1,800 vehicles per lane per hour under favorable conditions. In comparison, an urban arterial can satisfactorily accommodate only 400 to 600 vehicles per lane per hour, about one-third the volume of a freeway lane.

Freeways Reduce Travel Times - Freeways reduce average travel times for long urban area trips. Freeway speeds in urban areas usually range between 40 and 60 miles per hour while arterial speeds range between 25 and 30 miles per hour except during the height of the evening peak period of demand. This speed advantage for freeways is largely due to the elimination of intersecting traffic flows. Indirect benefits from freeways related to travel time reductions include traffic relief to parallel streets which may obviate or defer the need for disruptive widenings; increased land values in the central business district through improved access; and stimulated land development in fringe areas. It may not be desirable to maintain the low land-use densities planned for the Phoenix Urban Area unless the freeway-expressway system is developed to maintain adequate service between outlying residential areas and central areas of business and employment.

Freeways are Safer - Freeways are much safer than typical heavily traveled major streets. The present high incidence of motor vehicle accidents at many inter-



COMPARATIVE LANE TRAFFIC CAPACITIES

FREEWAYS VERSUS ARTERIAL STREETS

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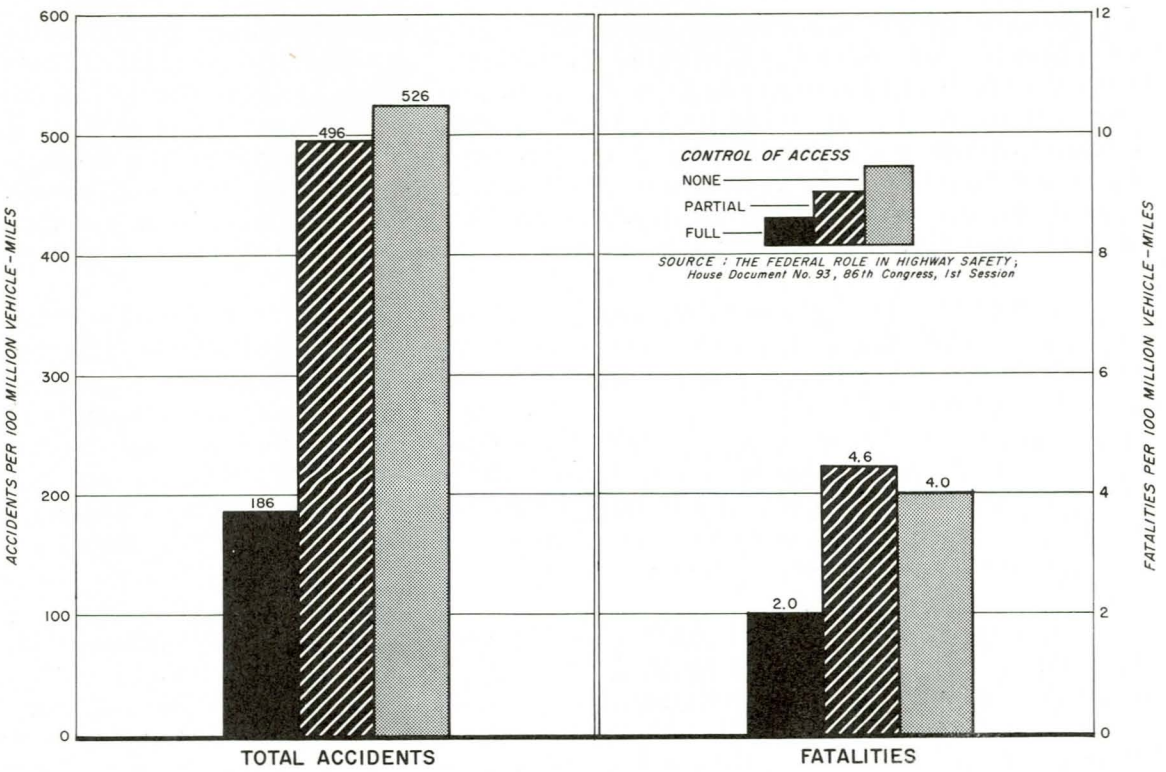
sections on the existing arterial system is indication of the need for safer primary routes. Recent studies of accident records for highway facilities in 30 states by the U.S. Bureau of Public Roads have shown that about one-third as many accidents and half as many fatalities occur on urban highways with full control of access (freeways) as occur on highways with no access control[28] (see Figure 49). Nation-wide accident statistics indicate that about 15 lives per year would be saved in Maricopa County if the improved freeways and expressways were available during the next few years; the annual saving in traffic fatalities would probably exceed 40 by 1980.

28. Federal Role in Highway Safety, House Document 93, 86th Congress; 1st Session.



EFFECT OF CONTROL OF ACCESS ON ACCIDENTS
URBAN AREAS

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Freeways are Convenient - Freeway travel is convenient travel. Most trips are free-flow or continuous, without the inconvenience and delay of stop-and-go driving, if the total transportation plan is designed and developed with capacity balanced against demands. Benefits will also be derived from the urban freeways and expressways operating as an integrated system as opposed to individual routes; to some extent traffic flow will tend to redistribute in accordance with current operating conditions during peak periods.

Freeways will Improve Access to the Downtown Business District - Economic studies by Western Business Consultants indicate that the role of downtown Phoenix in future business and commercial activities of the urban area is related to the adequacy of access and egress from this area. In developing the major street and high-

way plan, particular attention was given to improving downtown access and egress by including freeway routes in both east-west and north-south traffic corridors. These routes were located close enough to the downtown area to provide effective access and egress via proposed major arterial connections, and yet far enough away to assure efficient traffic operations on the freeways and room for downtown development and expansion. The downtown area will also benefit from the proposed freeway system by the elimination of non-productive through traffic from local downtown streets, reserving these streets for shopper access and other local business traffic.

Freeways may Cost Less for Capacity Gained - The total cost of widening mile roads in central Phoenix to adequate four-lane standards has ranged between $250,000 to $500,00 per mile. The increase in peak hour roadway capacity gained by widening from two lanes to four lanes is about 1,000 vehicles per hour. In comparison, new freeways in the Phoenix Urban Area will provide capacity for up to 7,000 vehicles per hour at an average cost of between $1,000,000 and $2,000,000. Thus, the cost per unit capacity gained is generally less for freeways than typical mile road widenings in central Phoenix. Both freeways and major street widenings are needed to provide for different traffic service functions.

Freeways Serve Heavy Traffic - The freeway-expressway system proposed for Maricopa County would serve about 2,358,000,000 vehicle miles of travel in 1980 - about half of the total travel anticipated in Maricopa County. Table 30 lists the estimated 1980 vehicle miles of travel for each route in the county-wide system. The freeway-expressway system will cost less than one-half cent per vehicle-mile of use over the life of the facilities.

Freeways Provide Economic Benefits to Users - Direct economic benefits to potential freeway users can be estimated based on empirical studies of freeway operations elsewhere. Tangible economic savings stem from reductions in accident costs, lower motor vehicle operating costs and time savings. Other advantages derived from a freeway system are not so readily evaluated in economic terms but are nonethe-less very real.

Empirical studies of freeway benefits by the U.S. Bureau of Public Roads indicate that "accident costs on highways having full control of access are about 0.3 cents per vehicle-mile of travel compared to at least 1.0 cent per vehicle-mile for conventional highways." This finding confirms the results of a previous study of freeway system benefits in Los Angeles where it was found that accident costs on freeways averaged 0.56 less than on existing major streets and highways without access control. Based on an average value of 0.6 cents per vehicle mile, the proposed freeway-expressway system in Maricopa County would provide annual accident savings totaling $14,200,000 in 1980.

Savings in vehicle operating costs on urban freeways from the elimination of stop-and-go driving have been shown to average about 0.5 cents per vehicle mile. This is attributed to reduced fuel consumption and vehicle maintenance when vehicles are operated on freeways. Tremendous savings in vehicle operating costs on several of the rural freeways in the plan will be provided by reductions in travel distances between principal points of origin and destination. Annual savings in vehicle operating costs, based on anticipated 1980 traffic, will be about $9,500,000.

Table 30

ESTIMATED 1980 VEHICLE MILES OF TRAVEL
RECOMMENDED FREEWAY-EXPRESSWAY SYSTEM

Name of Route	Miles	1980 Vehicle Miles Per Day	1980 Vehicle Miles Per Year	Total Cost	Annual Cost*	Cost Veh/Mile
Black Canyon Highway	43.1	737,000	268,000,000	$ 26,900,000	$1,260,000	$.0047
Buckeye Expressway	65.6	656,000	239,000,000	24,500,000	1,150,000	.0048
Phoenix-Tucson Freeway	24.1	685,000	250,000,000	19,200,000	900,000	.0036
Tempe-Mesa Freeway	23.0	586,000	214,000,000	12,900,000	610,000	.0029
Wickenburg Expressway	53.1	550,000	201,000,000	15,200,000	710,000	.0035
Yuma-Tucson Freeway	67.1	670,000	245,000,000	17,600,000	830,000	.0034
Gila Bend-Buckeye Expwy	34.0	190,000	69,000,000	3,000,000	140,000	.0020
Bee Line Highway	48.5	95,000	36,000,000	5,000,000	230,000	.0064
Penetration Route	1.7	65,000	24,000,000	3,800,000	180,000	.0075
Southern East-West Fwy	22.7	1,095,000	398,000,000	34,700,000	1,620,000	.0041
Paradise Valley Parkway	11.1	255,000	93,000,000	9,100,000	420,000	.0045
Eastern North-South Fwy	15.2	463,000	169,000,000	13,400,000	630,000	.0037
West Belt Expressway	8.4	84,000	31,000,000	4,200,000	200,000	.0105
North Belt Expressway	5.1	51,000	19,000,000	2,600,000	120,000	.0063
East Belt Expressway	18.9	278,000	102,000,000	12,700,000	590,000	.0058
Total	441.6	6,460,000	2,358,000,000	$204,800,000	$9,590,000	$.0041

* Annual cost computed on the basis of $3\frac{1}{2}$ percent, 40-year amortization.

It is largely the time savings factor which makes freeways attractive to motorists. The evaluation of the economic value of time savings has assumed great importance in analyses of highway benefits and their relationships with development cost. Certainly, motorists have shown a willingness to pay for time saved. Travel speeds on the freeway-expressway system in the Phoenix Urban Area will average about twice the average speed on parallel arterials. Based on average value for time savings equal to one cent per vehicle minute, the total value of time savings for freeway-expressway users will be about $23,600,00 in 1980.

Thus, the total economic value to potential users of the freeway-expressway system would be about $47,300,000 per year based on 1980 traffic estimates. Road user benefits in years after 1980 would be even greater. Thus, the $205,000,000 freeway-expressway system proposed for Maricopa County is justified many times over by road user benefits alone. It would appear that the Phoenix Urban Area and Maricopa County cannot afford not to develop a comprehensive freeway-expressway system over the next 20 years.

NEED FOR CONTINUING STUDY

The major street and highway plan has been designed for the needs expected by 1980 when the population of Maricopa County is expected to reach 1,440,000. However, growth will not end abruptly in 1980 and needs for greater traffic services will probably continue to exist beyond the design period for this study. Plans of the type included in this report should not be considered final or static. Conditions are constantly changing, and the plan must be continually reviewed and if necessary, modified to fit the changes without impairing the broad objectives of the plan.

The need for continuing study has been recognized by local planners. The preliminary plan for future land use in the urban area, upon which the major street and highway plan is based, was developed as a guide for future growth of the magnitude now expected. If growth takes place more or less rapidly than expected, the capital improvement program must be adjusted accordingly.

Departures from the projected growth trend will not necessarily require changes in the basic major street and highway plan, although they will require adjustments of priorities for construction. The plan has been developed with emphasis on flexibility; it may be expanded or contracted with ease, as future conditions may dictate.

WHAT OTHER URBAN AREAS ARE DOING

Many urban areas across the country have already adopted, or are now considering the adoption, of major street and highway plans similar in nature and magnitude to that recommended in this report. Virtually all of these plans include freeway-expressway systems integrated with modern arterial street networks. Best known, perhaps, is the state-wide freeway-expressway plan for California which includes urban routes in each large metropolitan area. Table 31 lists the mileages and estimated freeway-expressway costs for several California counties with large urban areas.

Table 31

THE CALIFORNIA FREEWAY SYSTEM
MILEAGES AND ESTIMATED COSTS

Counties	Miles	Estimated Cost	1957 Population
Alameda	227.0	$449,797,000	874,000
Contra Costa	183.4	200,045,000	357,000
Fresno	363.5	230,406,000	337,000
Kern	664.5	246,634,000	273,000
Orange	250.0	696,092,000	511,000
Sacramento	258.9	358,507,000	427,000
San Bernardino	968.6	450,174,000	436,000
San Diego	513.3	589,158,000	900,000
Santa Clara	193.2	202,162,000	528,000

Many other urban areas in other states are developing comprehensive transportation plans, and proceeding with their construction, without total reliance on state highway departments. In the Detroit area, for example, the current construction program includes about 42 miles of freeways, costing over $300,000,000. The ultimate plan will include about 200 miles of freeways and expressways. Michigan state law requires the state to pay 75 percent of the cost of freeways in cities. The Detroit freeway program has been effectively engineered, financed and supervised jointly by city, county, state and federal agencies, proving that this approach can be successful.

Metropolitan Miami, which is nearing the one million mark in population, is using a county-wide approach to financing a $180,000,000 freeway-expressway program. A new "angle" has been suggested for the early financing of critically needed sections of this system which may prove feasible elsewhere as well. Dade County would advance $40,000,000 to the State Road Board for five years, the money to be raised by a general obligation bond issue and repaid in time from road user funds. Property owners would be asked to approve the bond issue, which would require the addition of only about 1.5 mils to the county tax bills. There is assurance that future road user funds will be available to repay the $40,000,000 loan, and make this amount available for use as a revolving fund for local road improvements.

Although the approaches to implementing long range major street and highway plans differ greatly, virtually all large metropolitan areas are looking ahead to greatly expanded construction programs including the development of freeway-expressway systems as recommended in this report for the Phoenix Urban Area and Maricopa County.

PUBLIC SUPPORT

Little success in the construction of the needed transportation facilities will be achieved without public support. Groups of civic minded citizens, already organized in the area, should be encouraged to review the technical recommendations and assist in the formulation of plans for implementing the transportation plan. The active support and assistance of news media will also be important. General understanding by residents of the area of the need for a long range program of major street and highway improvements, and the great benefits to be derived from them, will be essential.

APPENDIX

Table A

TYPICAL ARTERIAL TRAVEL SPEEDS AND DELAYS (OFF-PEAK)
Phoenix Urban Area

Street and Section	Miles	Average Time (Min:Sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
CENTRAL AVENUE					
Baseline Rd. to Broadway	2.0	4:02	0:18	29.7	30
Broadway to Buckeye Rd.	2.0	4:30	0:39	26.7	25
Buckeye Rd. to Van Buren St.	1.0	5:43	3:02	10.5*	20
Van Buren St. to McDowell Rd.	1.0	3:10	1:03	19.0	20
McDowell Rd. to Camelback Rd.	3.0	7:24	0:42	24.3	25
Camelback Rd. to Dunlap Ave.	4.0	7:10	0:42	33.4	30
Total	13.0	31:59	7:36	24.4	--
BLACK CANYON HIGHWAY (Frontage Roads)					
Van Buren St. to McDowell Rd.	1.0	1:51	0:21	32.4*	50
McDowell Rd. to Camelback Rd.	3.0	4:40	0:19	38.4*	50
Camelback Rd. to Dunlap Ave.	4.0	5:53	0:25	40.9*	50
Total	8.0	12:24	1:05	38.5	--
7th AVENUE					
Van Buren St. to McDowell Rd.	1.0	2:45	0:11	21.8*	25
McDowell Rd. to Camelback Rd.	3.0	6:30	0:44	27.7	25
Camelback Rd. to Olive Ave.	4.0	8:10	1:11	29.3	30
Total	8.0	17:25	2:06	27.6	--

Table A (Continued)

Street and Section	Miles	Average Time (Min:Sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
7th STREET					
Baseline Rd. to Broadway	2.0	5:25	0:18	22.2*	30
Broadway to Buckeye Rd.	2.0	4:17	0:00	28.0	30
Buckeye Rd. to Van Buren St.	1.0	3:47	1:10	15.8	20
Van Buren St. to Camelback Rd.	4.0	9:35	1:40	25.0	25
Camelback Rd. to Dunlap Ave.	4.0	9:05	0:49	26.3	30
Total	13.0	32:09	3:57	24.2	--
19th AVENUE					
Baseline Rd. to Broadway	2.0	3:11	0:12	37.7	35
Broadway to Buckeye Rd.	2.0	3:34	0:07	33.6	30
Buckeye Rd. to McDowell Rd.	2.0	5:18	0:45	21.8*	25
McDowell Rd. to Camelback Rd.	3.0	6:45	0:52	26.6	25
Camelback Rd. to Olive Ave.	4.0	6:52	0:43	34.8	30
Total	13.0	25:40	2:39	30.4	--
16th STREET					
Baseline Rd. to Broadway	2.0	3:45	0:14	32.0*	35
Broadway to Henshaw Rd.	2.0	4:34	0:49	26.3*	30
Henshaw Rd. to McDowell Rd.	2.0	6:54	3:18	17.4*	25
McDowell Rd. to Camelback Rd.	3.0	5:50	0:11	30.8	25
Camelback Rd. to Glendale Ave.	2.0	4:05	0:15	29.4	30
Total	11.0	25:09	4:47	26.3	--

Table A (Continued)

Street and Section	Miles	Average Time (Min:sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
24th STREET					
Baseline Rd. to Broadway	2.0	3:29	0:19	34.5	35
Broadway to Henshaw Rd.	2.0	3:50	0:38	31.3	30
Henshaw Rd. to McDowell Rd.	2.0	4:49	1:04	24.9	25
McDowell Rd. to Camelback Rd.	3.0	7:58	0:56	22.6	25
Total	9.0	20:06	2:57	26.8	--
35th AVENUE					
Broadway to Buckeye Rd.	2.0	3:25	0:20	35.1	35
Buckeye Rd. to McDowell Rd.	2.0	4:01	0:22	29.4	30
McDowell Rd. to Camelback Rd.	3.0	6:04	0:06	29.7	30
Camelback Rd. to Olive Ave.	4.0	7:40	0:49	31.3	30
Total	11.0	21:10	1:37	31.2	--
SCOTTSDALE ROAD					
Baseline Rd. to Broadway	2.0	4:07	0:18	29.2	30
Broadway to McDowell Rd.	4.0	7:20	0:33	32.8	35
McDowell Rd. to Camelback Rd.	2.0	6:27	1:24	18.6*	25
Camelback Rd. to McDonald Dr.	2.0	2:18	0:06	52.2	35
Total	10.0	20:01	2:09	30.0	--
GRAND AVENUE					
7th Ave. to Black Canyon Hwy.	2.4	6:11	1:42	23.4	25
Black Canyon Hwy. to 43rd Ave.	3.2	6:35	1:11	29.2	30
Total	5.6	12:46	2:53	26.4	--

Table A (Continued)

Street and Section	Miles	Average Time (Min:Sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
VAN BUREN STREET					
43rd Ave. to Black Canyon Hwy.	2.5	5:00	0:26	30.0	30
Black Canyon Hwy. to Central Ave.	2.0	7:24	3:03	16.2*	20
Central Ave. to 16th St.	1.5	4:31	1:53	19.9	20
16th St. to 40th St.	3.0	7:19	2:01	24.5	25
Total	9.0	24:14	6:23	22.1	--
JEFFERSON STREET					
Black Canyon Hwy. to Central Ave.	2.0	5:08	0:34	23.4	25
Central Ave. to 16th St.	1.5	3:08	0:00	28.8	25
Total	3.5	8:16	0:34	25.3	--
BUCKEYE-MARICOPA-HENSHAW					
43rd Ave. to Black Canyon Hwy.	2.5	4:13	0:07	35.7	35
Black Canyon Hwy. to Central Ave.	1.5	4:34	1:19	20.7*	25
Central Ave. to 16th St.	1.5	3:28	0:24	26.0	25
Total	5.5	12:15	1:50	26.9	--
BASELINE ROAD					
19th Ave.-Central Ave.	1.5	2:18	0:00	39.1	35
Central Ave.-16th St.	1.5	2:37	0:35	34.4	35
16th St.-40th St.	3.0	4:05	0:00	44.2	35
Total	6.0	9:00	0:35	40.0	--

Table A (Continued)

Street and Section	Miles	Average Time (Min:Sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
McDOWELL ROAD					
43rd Ave.-Black Canyon Hwy.	2.3	5:10	0:33	26.8*	30
Black Canyon Hwy. to Central Ave.	2.2	5:47	1:19	22.8*	25
Central Ave. to 16th St.	1.5	4:39	1:37	19.3*	25
16th St. to 40th St.	3.0	6:59	1:15	25.7*	30
40th St. to Scottsdale Rd.	4.0	6:35	1:04	36.5	35
Total	13.0	29:10	5:48	26.8	--
THOMAS ROAD					
43rd Ave.-Black Canyon Hwy.	2.3	5:05	0:41	27.3	30
Black Canyon Hwy. to Central Ave.	2.2	5:50	1:01	22.5*	25
Central Ave. to 16th St.	1.5	3:52	0:49	23.3*	25
16th St. to 40th St.	3.0	6:23	0:00	28.2	30
40th St. to Scottsdale Rd.	4.0	6:52	0:28	35.0	35
Total	13.0	28:02	2:59	27.9	--
INDIAN SCHOOL ROAD					
43rd Ave. to Black Canyon Hwy.	2.3	4:42	0:48	29.3	30
Black Canyon Hwy. to Central Ave.	2.2	5:17	0:57	25.1	25
Central Ave. to 16th St.	1.5	2:56	0:05	30.6	25
16th St. to 40th St.	3.0	5:16	0:35	34.1	30
40th St. to Scottsdale Rd.	4.0	8:33	0:25	28.1	30
Total	13.0	26:44	2:50	29.2	--

Table A (Continued)

Street and Section	Miles	Average Time (Min:Sec)	Average Delays (Min:Sec)	Average Overall Speed Existing (m.p.h.)	Average Overall Speed Desirable (m.p.h.)
CAMELBACK ROAD					
43rd Ave. to Black Canyon Hwy.	2.3	4:31	0:50	30.7	30
Black Canyon Hwy. to Central Ave.	2.2	5:11	1:20	25.6	25
Central Ave. to 16th St.	1.5	3:37	0:28	24.9	25
16th St. to 40th St.	3.0	5:27	0:35	33.0	30
40th St. to Scottsdale Rd.	4.0	8:15	0:25	29.0	30
Total	13.0	27:01	3:38	28.9	--
BETHANY HOME ROAD					
43rd Ave. to Black Canyon Hwy.	2.3	5:07	0:24	27.1	30
Black Canyon Hwy. to Central Ave.	2.2	4:26	0:54	29.8	25
Central Ave. to 16th St.	1.5	3:39	0:32	24.7	25
Total	6.0	13:12	1:50	27.3	--
GLENDALE AVENUE					
43rd Ave. to Black Canyon Hwy.	2.3	3:40	0:35	37.5	30
Black Canyon Hwy. to Central Ave.	2.2	3:55	0:30	33.8	25
Central Ave. to 16th St.	1.5	3:30	0:49	25.8	25
Total	6.0	11:05	1:54	32.4	--
NORTHERN AVENUE					
43rd Ave. to Black Canyon Hwy.	2.3	3:35	0:12	36.8	30
Black Canyon Hwy. to Central Ave.	2.2	4:05	0:37	32.5	25
Central Ave. to 16th St.	1.5	3:00	0:34	30.0	25
Total	6.0	10:40	1:23	33.8	--

* Significant deficiency

TABLE B
RAILROAD CROSSINGS INVENTORY
Phoenix-Maricopa County Urban Area

Street	Railroad	Number of Tracks: Main-line	Siding & Spur	Total Tracks	1958 A.D.T*	Accidents Last 2 yrs (1957-8): No.	Killed	Protective Devices	No. Train Movements Per Day: Passenger	Freight	Switch	Potential Conflicts
75th Ave.	SP	1	0	1	300	0	0	signs	6	6	0	3,600
67th Ave.	SP	1	0	1	600	0	0	signs	6	6	0	7,200
59th Ave.	SP	1	0	1	900	2	2	signs	6	6	0	10,800
43rd Ave.	SP	1	0	1	700	0	0	signs	6	6	4	11,200
35th Ave.	SP	1	0	1	6,100	2	2	flashers	6	6	6	109,800
31st Ave.	SP	1	1	2	300	0	0	signs	6	6	6	5,400
27th Ave.	SP	1	1	2	4,900	0	0	signs	6	6	8	98,000
23rd Ave.	SP	1	0	1	6,600	0	0	signs	6	6	10	145,200
19th Ave.	SP	1	1	2	10,100	0	0	wigwags	6	6	10	222,200
75th & Olive Ave.	AT & SF	1	0	1	1,000	1	0	signs	2	6	4	12,000
Grand Ave.	AT & SF	1	0	1	7,700	-	-	underpass	2	6	4	-
67th & Northern Ave.	AT & SF	1	0	1	2,800	2	0	signs	2	6	4	33,600
Bethany Home Rd.	AT & SF	1	7	8	1,500	0	0	flashers	2	6	10	27,000
51st Ave.	AT & SF	1	6	7	1,100	0	0	flashers	2	6	10	19,800
Camelback Rd.	AT & SF	1	0	1	2,800	3	0	signs	2	6	10	50,400
43rd Ave.	AT & SF	1	0	1	2,200	0	0	signs	2	6	10	39,600
Indian School Rd.	AT & SF	1	2	3	11,100	0	0	flashers	2	6	10	199,800
35th Ave.	AT & SF	1	4	5	7,500	4	0	flashers	2	6	10	135,000
Thomas Rd.	AT & SF	1	1	2	9,900	0	0	flashers	2	6	10	178,200
27th Ave.	AT & SF	1	0	1	7,900	0	0	flashing signal	2	6	10	142,200
Encanto Blvd.	AT & SF	1	1	2	-	-	-	no crossing	2	6	0	-
23rd Ave.	AT & SF	1	1	2	50	0	0	signs	2	6	0	400
McDowell Rd.	AT & SF	1	10	11	11,200	8	0	flashers	2	6	16	268,800
19th Ave. (nr McDowell Rd.)	AT & SF	0	3	3	9,500	4	0	signs	2	6	16	228,000
Fillmore St.	AT & SF	1	3	4	3,300	2	0	signs	2	0	20	72,600
Van Buren St.	AT & SF	1	0	1	13,700	1	0	flashers	2	0	12	191,800
Monroe St.	AT & SF	1	0	1	600	0	0	signs	2	0	12	8,400
Adams St.	AT & SF	1	0	1	5,300	0	0	wigwags	2	0	12	74,200
Washington St.	AT & SF	1	0	1	1,000	2	0	signs	2	0	12	14,000
Jefferson St.	AT & SF	1	0	1	5,400	0	0	wigwags	2	0	12	75,600
Madison St.	AT & SF	1	0	1	1,500	0	0	signs	2	0	12	21,000
19th Ave. (nr Madison)	AT & SF	1	0	1	10,100	0	0	signs	2	0	12	141,400
Jackson St.	AT & SF	1	0	1	500	0	0	wigwags	2	0	12	7,000
18th Ave.	AT & SF & SP	2	1	3	500	0	0	signs	8	6	22	18,000

TABLE B Con'd
RAILROAD CROSSINGS INVENTORY
Phoenix-Maricopa County Urban Area

Street	Railroad	Number of Tracks: Main-line	Siding & Spur	Total Tracks	1958 A.D.T*	Accidents Last 2 yrs (1957-8): No.	Killed	Protective Devices	No. Train Movements Per Day: Passenger	Freight	Switch	Potential Conflicts
17th Ave.	AT & SF & SP	2	2	4	15,800	-	-	underpass	8	6	22	-
16th Ave.	AT & SF & SP	2	9	11	500	0	0	signs	8	6	22	18,000
15th Ave.	AT & SF & SP	2	7	9	3,000	0	0	signs	8	6	22	108,000
9th Ave.	AT & SF & SP	3	7	10	700	0	0	signs	8	6	26	28,000
7th Ave.	AT & SF & SP	3	18	21	11,300	10	0	wigwags, signs	8	6	32	519,800
3rd Ave.	AT & SF & SP	2	11	13	3,900	4	0	flashers, signs	6	6	39	198,900
2nd Ave.	AT & SF & SP	2	6	8	2,000	1	0	flashers, signs	6	6	34	92,000
1st Ave.	AT & SF & SP	2	4	6	2,000	0	0	flashers, signs	6	6	34	92,000
Central Ave.	AT & SF & SP	2	5	7	27,500	-	-	underpass	6	6	34	-
1st St.	AT & SF & SP	2	10	12	2,000	1	0	flashers, signs	6	6	34	92,000
2nd St.	AT & SF & SP	2	10	12	2,000	0	0	flashers, signs	6	6	34	92,000
3rd St.	AT & SF & SP	2	11	13	2,200	0	0	wigwags, signs	6	6	34	101,200
4th St.	AT & SF & SP	2	11	13	3,400	0	0	wigwags, signs	6	6	34	156,400
5th St.	AT & SF & SP	2	14	16	1,500	0	0	wigwags, signs	6	6	34	69,000
7th St.	AT & SF & SP	2	9	11	9,500	3	0	wigwags	6	6	60	684,000
16th St.	SP	1	4	5	13,900	17	0	signs	6	6	110	1,695,800
17th St.	SP	1	3	4	0	0	0	no crossing	6	6	0	-
18th St.	SP	1	2	3	0	0	0	no crossing	6	6	0	-
20th St.	SP	1	2	3	6,600	1	0	signs	6	6	16	184,800
24th St.	SP	1	1	2	18,600	1	0	flashers	6	6	0	223,200
36th St.	SP	1	1	2	3,000	0	0	signs	6	6	0	36,000
40th St.	SP	1	1	2	6,300	1	0	signs	6	6	0	75,600
48th St.	SP	1	0	1	2,100	1	1	signs	6	6	0	25,200
Price Rd.	SP	1	0	1	50	0	0	x-signs	6	7	0	700
Dobson Rd.	SP	1	0	1	50	0	0	x-signs	6	7	0	700
Alma School Rd.	SP	1	0	1	1,400	0	0	flashers	6	7	0	18,200
Southern Ave.	SP	1	0	1	400	0	0	x-signs	6	7	0	5,200
Baseline Rd.	SP	2	0	2	2,500	0	0	flashers	6	7	0	32,500
Guadalupe Rd.	SP	1	0	1	50	0	0	flashers	6	5	0	600
McQueen Rd. (Branch)	SP	INCLUDED IN BASELINE CROSSING										
Guadalupe Rd. (Branch)	SP	1	0	1	50	0	0	flashers	0	2	0	100
Southern Ave. (Branch)	SP	1	0	1	3,000	0	0	x-signs	0	2	0	6,000
Baseline Rd. (Branch)	SP	1	0	1	6,400	0	0	x-signs	0	2	0	12,800
Guadalupe Rd. (Branch)	SP	1	0	1	50	0	0	x-signs	0	2	0	100

* Average Daily Traffic

DISTRIBUTION OF 1957 TRIP ENDS BY PURPOSE OF TRIP
Phoenix Urban Area

TABLE C

SUMMARY OF TRIPS AT RESIDENCE

Origin Zone	White Collar Work	Blue Collar Work	Business	Shopping	Social	School	Miscellaneous
111	407	523	285	795	615	120	1,081
112	1,002	760	435	960	1,020	585	646
113	1,332	759	870	1,035	2,147	600	437
114	195	105	315	495	405	75	315
115	1,263	1,049	1,390	1,320	2,314	943	1,432
116	2,593	1,371	1,237	2,895	3,959	1,520	1,246
117	5,356	6,165	4,848	9,004	10,713	7,714	3,669
118	2,601	1,907	1,200	3,154	4,219	2,659	1,185
119	1,448	1,763	1,050	1,985	3,681	2,840	1,294
121	494	627	540	690	884	315	1,217
122	585	510	705	930	990	345	829
123	824	357	1,050	946	1,080	750	615
124	405	148	390	495	495	120	2,765
125	315	419	315	405	135	270	2,198
126	1,019	1,001	706	1,111	990	1,050	1,142
127	1,003	59	840	1,080	570	1,156	375
128	598	178	435	570	915	810	75
129	494	300	330	465	1,125	195	345
131	480	1,076	1,170	676	1,095	705	2,646
132	510	479	525	1,305	990	300	1,214
133	598	835	735	1,170	960	555	842
134	570	520	465	1,170	1,005	585	1,002
135	2,390	2,070	1,395	2,116	2,294	1,275	1,906
136	1,458	1,904	1,519	1,902	2,168	1,667	4,329
137	1,600	1,240	780	2,195	1,980	2,073	1,126
138	1,019	1,222	810	1,911	1,545	885	434
139	405	1,030	600	1,490	1,455	315	1,232
141	583	660	465	870	540	420	899
142	389	791	375	615	600	570	150
143	2,517	3,676	1,757	4,419	3,660	2,251	2,573
144	1,989	1,415	2,087	2,948	2,671	1,740	2,480
145	1,078	1,150	555	1,428	1,710	1,171	554
146	269	537	480	615	855	450	135
147	808	148	900	887	1,185	660	225
148	0	30	60	60	90	0	15
153	0	0	15	0	0	0	0
193	0	0	0	15	0	0	0
199	15	0	0	0	0	0	0
211	1,435	1,735	1,212	1,851	2,610	574	1,819
212	1,406	1,629	2,100	1,981	2,490	1,081	2,253
213	1,840	2,031	1,365	2,103	2,430	1,440	991
214	2,526	1,924	1,230	1,969	2,701	1,485	1,774
215	1,633	1,229	855	2,431	2,265	1,442	824
216	3,349	2,571	2,130	4,619	5,614	3,425	2,073
217	300	164	315	645	465	330	225
218	435	164	827	481	600	255	285
219	60	0	45	90	60	150	15
221	1,109	2,074	1,637	2,391	2,142	995	1,140
222	733	1,521	1,005	1,905	1,934	435	1,311
223	838	1,011	855	2,041	1,545	570	1,219
224	3,723	3,677	2,160	5,837	7,353	2,310	2,855
225	4,183	4,394	3,465	8,040	8,138	3,903	2,524
226	1,419	1,896	1,335	2,644	3,331	1,980	1,591
227	344	194	600	360	930	676	404
228	1,528	895	1,850	1,534	2,235	1,051	2,768
229	867	1,152	767	1,037	1,546	1,201	465
231	165	538	405	285	540	15	1,382
232	15	583	225	285	315	75	1,337
233	180	1,700	630	1,365	1,695	616	2,031
234	523	1,191	1,695	2,553	3,736	1,186	1,456
235	30	375	150	135	120	60	600
236	0	30	0	0	0	30	75
237	0	30	0	30	30	0	15
241	120	2,243	420	1,127	1,185	1,381	573
242	90	268	360	180	510	15	915
243	165	403	255	150	270	225	270
244	30	0	0	45	0	60	60
245	135	284	165	165	150	526	30
262	0	0	0	15	15	0	0
311	150	1,003	255	1,080	1,350	195	738
312	135	2,139	945	990	1,050	540	1,640
313	540	1,656	750	676	1,080	1,172	345
314	60	89	60	60	150	90	0
315	315	210	105	435	120	240	150
316	134	225	165	90	240	255	105
321	15	15	15	0	90	0	1,052
322	120	689	120	270	180	105	390
323	45	1,273	720	855	885	450	615
324	60	433	330	585	525	555	480
325	974	1,524	615	1,338	1,500	885	931
326	329	375	315	300	375	586	149
327	360	165	105	360	375	540	30
331	0	0	0	60	0	105	540
332	0	614	255	90	195	1,008	961

SUMMARY OF TRIPS AT PURPOSE

Dest'n Zone	White Collar Work	Blue Collar Work	Business	Shopping	Social	School	Miscellaneous
111	434	1,035	330	285	707	15	1,110
112	345	164	300	526	735	285	495
113	60	148	270	105	741	0	452
114	212	359	420	500	1,744	0	165
115	628	625	652	3,410	1,345	2,841	1,130
116	420	958	906	1,645	2,348	1,181	1,159
117	1,150	1,908	1,215	4,532	6,878	6,796	3,081
118	597	848	405	390	2,542	3,697	990
119	179	478	540	2,017	1,577	90	1,414
121	628	661	1,069	1,038	1,112	540	1,320
122	1,288	418	578	360	705	420	857
123	285	299	1,036	285	1,730	165	585
124	1,747	1,611	3,722	3,837	2,565	165	3,111
125	1,199	1,177	1,939	2,349	735	450	2,043
126	328	999	962	1,010	1,021	90	1,275
127	90	492	165	1,370	795	15	225
128	120	165	45	45	390	390	150
129	0	164	195	450	495	0	225
131	1,198	1,572	2,588	1,635	1,844	210	2,883
132	879	682	2,148	1,022	2,657	495	1,292
133	329	494	495	796	1,324	315	872
134	330	741	3,353	420	1,653	30	1,020
135	1,749	1,454	1,896	1,817	2,520	962	2,150
136	1,344	1,982	2,195	6,284	4,420	2,782	4,453
137	254	536	405	3,083	2,254	2,766	931
138	44	237	405	210	1,710	525	390
139	434	608	1,125	3,657	1,440	555	1,202
141	523	570	1,396	603	570	30	902
142	409	252	120	30	915	3,619	180
143	1,050	1,529	856	3,160	2,569	1,456	2,335
144	1,000	1,310	1,157	3,690	2,752	3,536	2,406
145	164	297	300	135	930	0	540
146	15	45	45	75	195	0	135
147	255	540	315	0	930	0	240
148	0	0	0	0	0	0	15
153	0	0	0	0	0	0	0
193	0	0	0	0	0	0	0
199	0	0	0	0	15	0	0
211	1,340	1,306	1,367	2,769	3,576	931	1,970
212	914	1,189	1,745	2,183	1,682	211	2,148
213	311	640	735	1,336	2,794	1,156	841
214	867	846	660	3,293	2,195	720	1,532
215	493	727	555	630	1,877	2,507	749
216	611	1,044	795	4,699	3,126	2,178	1,743
217	44	210	180	0	810	0	240
218	150	372	315	30	945	270	270
219	30	90	60	0	60	0	15
221	1,091	1,168	600	901	2,665	7,969	1,472
222	420	716	735	828	1,605	75	1,295
223	839	463	330	2,162	735	30	1,308
224	690	1,479	1,861	5,892	4,310	705	2,437
225	983	1,369	1,410	4,653	3,800	2,823	2,103
226	2,114	1,879	585	1,458	2,522	1,066	1,579
227	90	269	225	15	600	0	345
228	1,732	2,297	4,269	3,954	3,647	3,047	2,418
229	539	389	90	300	1,350	195	450
231	765	1,753	667	465	570	1,428	1,323
232	602	971	285	392	735	105	1,262
233	767	1,737	390	1,983	811	90	1,702
234	766	1,282	1,050	585	2,070	15	1,412
235	735	1,287	647	120	375	30	750
236	30	135	30	90	60	0	90
237	0	0	0	0	0	0	15
241	286	539	60	225	600	90	572
242	3,736	4,310	690	15	1,546	1,908	1,062
243	45	163	105	0	195	0	315
244	30	180	0	0	45	0	90
245	15	30	0	30	0	0	15
291	0	0	0	0	0	60	0
311	270	615	60	180	315	75	692
312	645	1,286	165	630	720	15	1,699
313	105	195	120	135	540	15	330
314	0	0	0	0	150	0	0
315	30	165	0	0	90	811	165
316	59	135	15	60	45	195	105
321	2,326	1,723	255	15	480	15	1,169
322	315	943	150	330	390	60	435
323	692	1,013	270	630	825	60	540
324	240	553	525	1,216	600	0	285
325	524	700	555	1,953	1,665	3,786	856
326	45	30	45	150	885	0	150
327	0	30	0	0	660	0	30
331	615	1,187	0	15	120	30	735
332	524	1,046	390	270	556	30	960

DISTRIBUTION OF 1957 TRIP ENDS BY PURPOSE OF TRIP
Phoenix Urban Area

TABLE C (Cont'd)

SUMMARY OF TRIPS AT RESIDENCE

Origin Zone	White Collar Work	Blue Collar Work	Business	Shopping	Social	School	Miscellaneous
333	150	1,553	645	870	795	480	616
334	255	580	330	645	780	405	450
335	75	779	300	300	300	917	285
336	210	913	390	525	810	872	165
337	30	60	165	60	90	60	45
341	60	643	60	360	255	150	481
342	567	2,477	1,170	1,384	3,171	931	912
343	75	3,147	570	855	330	1,277	376
344	45	330	105	135	315	690	225
345	373	1,045	315	540	1,125	675	180
346	0	179	105	150	345	330	90
411	135	525	450	675	825	405	1,161
412	3,157	2,015	2,240	4,757	3,541	2,281	1,637
413	2,720	4,144	2,192	4,786	5,316	2,686	1,545
414	568	1,344	540	1,006	1,200	661	375
415	434	792	255	555	660	902	45
421	331	571	407	255	541	150	795
422	105	269	390	315	210	270	302
423	120	269	270	135	330	90	1,443
424	659	1,642	735	1,968	2,388	795	465
425	1,258	1,612	720	1,579	1,680	1,335	585
426	60	30	30	60	150	60	105
427	0	240	135	106	165	60	315
428	1,559	2,398	945	2,532	3,379	1,772	601
431	390	883	915	615	615	135	1,876
432	165	659	315	810	885	45	1,743
433	465	820	675	1,245	1,065	405	510
434	420	1,285	285	900	1,245	826	719
435	1,020	2,371	1,065	2,872	2,355	1,095	702
436	285	1,450	255	1,156	765	255	840
437	0	30	0	0	0	0	45
439	0	0	0	0	0	0	0
441	90	360	165	510	420	225	405
442	329	1,389	870	1,501	1,290	1,365	902
443	165	972	705	1,080	1,260	1,036	464
444	165	715	315	930	735	1,487	75
445	60	0	0	0	30	30	0
511	30	0	30	0	30	0	120
512	45	0	75	60	60	0	345
513	105	105	465	105	390	0	1,609
514	75	105	15	0	60	0	661
521	135	193	543	180	405	30	2,223
522	15	0	45	60	120	15	195
523	15	0	0	0	0	0	30
524	0	45	0	0	0	0	150
525	0	30	105	60	60	0	1,322
531	30	90	75	0	525	0	870
532	0	0	0	0	210	0	406
533	30	0	15	0	15	0	45
541	0	0	0	0	15	0	165
542	0	0	0	0	0	0	135
543	0	120	0	15	30	0	270
551	105	135	285	150	120	0	271
552	135	225	285	225	615	60	854
553	60	166	165	285	450	105	2,594
554	75	45	150	210	225	0	1,004
700	0	0	0	0	0	0	0
701	0	0	0	0	0	0	0
702	0	0	0	0	0	0	15
703	0	0	0	15	0	0	0
704	0	0	0	0	0	0	0
705	0	0	0	0	0	0	0
706	0	0	0	0	0	0	0
707	0	0	0	0	0	0	0
714	0	0	0	0	0	0	0
737	0	0	30	0	0	0	0
810	15	0	0	15	0	0	0
911	0	0	15	75	15	0	45
912	0	0	120	45	60	0	60
913	0	0	0	0	30	0	75
914	0	0	30	0	15	0	165
921	0	0	15	60	60	0	60
922	0	0	0	45	15	0	75
923	0	0	0	0	0	15	150
924	150	225	255	285	333	45	1,212
931	0	0	60	90	15	15	240
932	45	15	15	15	0	15	45
933	0	0	0	0	0	0	60
934	0	0	0	0	0	0	60
941	0	0	0	0	0	0	30
942	15	15	90	15	15	0	302
943	32	0	0	120	45	30	376
944	0	0	105	315	135	0	1,080
TOTAL	88,642	123,105	86,464	148,226	169,564	97,395	122,833

SUMMARY OF TRIPS AT PURPOSE

Dest'n Zone	White Collar Work	Blue Collar Work	Business	Shopping	Social	School	Miscellaneous
333	674	1,135	180	420	1,440	405	781
334	269	329	585	240	405	240	509
335	0	208	45	360	525	30	285
336	225	178	75	90	240	1,875	135
337	0	0	15	0	195	0	30
341	134	940	45	315	405	30	601
342	327	386	405	3,081	3,546	420	674
343	105	284	120	540	330	932	421
344	15	135	45	90	240	210	210
345	90	75	15	180	510	75	270
346	0	59	60	135	510	0	15
411	614	902	663	361	1,170	225	1,293
412	983	1,161	1,490	4,684	4,185	6,990	1,442
413	747	1,071	1,082	5,094	4,236	1,141	1,095
414	195	477	75	165	630	1,141	330
415	0	60	45	15	240	0	75
421	165	676	212	60	331	0	659
422	210	313	75	120	390	0	408
423	1,575	3,015	285	165	150	15	1,743
424	465	1,355	405	646	1,443	885	510
425	285	415	315	2,542	825	120	390
426	30	0	0	0	120	0	105
427	240	836	180	135	901	0	330
428	184	450	435	2,487	1,201	240	572
431	1,425	2,136	1,125	960	1,396	60	2,084
432	2,830	973	1,440	360	711	30	2,132
433	286	493	90	45	842	630	556
434	404	628	270	1,620	945	15	510
435	254	179	270	2,571	1,425	1,051	480
436	1,064	1,112	450	1,096	1,532	30	809
437	30	30	15	0	0	0	30
439	0	30	0	0	0	0	0
441	120	345	135	45	165	0	345
442	559	1,720	390	1,036	600	420	1,035
443	794	764	675	690	1,035	1,487	556
444	105	569	30	270	301	0	75
445	0	240	0	60	0	0	0
511	60	150	45	45	180	0	150
512	719	285	586	210	240	15	556
513	4,231	2,466	1,995	1,410	1,290	60	2,178
514	767	930	1,455	225	360	0	765
521	3,487	3,974	2,915	7,461	1,909	375	2,554
522	0	120	30	195	635	1,187	150
523	0	60	60	15	45	30	15
524	255	240	120	45	75	0	165
525	750	1,125	257	6,950	360	30	1,652
531	1,144	1,126	555	512	375	45	959
532	241	494	360	480	120	0	495
533	90	30	0	0	0	0	45
541	60	300	120	30	0	75	210
542	165	630	120	105	60	0	315
543	780	285	75	150	15	0	225
551	300	105	300	45	286	0	301
552	706	1,229	797	375	1,035	60	1,051
553	4,352	2,766	2,886	990	1,622	1,065	3,151
554	1,303	746	542	571	855	60	1,140
700	15	0	15	0	346	0	0
701	0	0	0	0	30	0	0
702	0	0	0	0	195	0	0
703	0	15	90	0	450	30	15
704	0	0	15	0	0	0	0
705	0	0	0	0	30	0	0
706	15	15	15	0	15	0	0
707	0	0	0	0	90	0	0
714	0	0	15	0	45	0	0
737	0	0	0	0	0	0	0
810	0	30	0	0	225	0	0
911	60	254	30	0	495	30	30
912	358	373	60	0	1,517	0	60
913	60	165	135	0	450	15	60
914	60	122	75	45	720	0	135
921	45	60	30	0	465	75	30
922	74	75	30	0	585	0	120
923	165	269	15	0	525	0	150
924	1,429	2,836	1,650	465	4,661	5,058	1,141
931	299	793	195	0	960	30	180
932	256	195	180	0	526	45	45
933	45	240	45	0	0	0	45
934	75	194	90	0	90	0	45
941	120	75	0	0	0	511	15
942	1,558	4,071	525	15	975	150	359
943	1,185	3,958	405	210	932	902	463
944	898	2,806	1,350	1,636	2,445	1,728	961
TOTAL	88,642	123,105	86,464	148,226	169,564	97,395	122,833

TABLE D (SHEET 1)
1957 LAND USE STATISTICS
Phoenix Urban Area

Zone	Zone Size in Sq. Mi.	Zone Size in Acres	Number of Dwelling Units	Dwelling Units Per Acre	Population	Population Per Acre	Population per Dwelling Unit	Employment		Retail Sales Tax	Auto Registration	Autos Per Dwelling Unit	Persons Per Auto	Median Income Level*
								No. of Jobs	Percent of Total					
111	0.21	134.4	861	6.41	1,842	13.71	2.14	1,119	0.8	$ 18,207.14	634	0.74	2.90	B
112	0.57	365.0	997	2.73	2,401	6.58	2.40	207	0.1	1,921.86	906	0.91	2.65	C
113	0.38	243.2	936	3.85	2,688	11.05	2.87	70	0.1	7,947.59	1,344	1.44	2.00	E
114	0.44	281.9	151	0.54	332	1.18	2.20	240	0.2	590.35	242	1.60	1.37	E
115	0.49	313.9	1,201	3.83	3,429	10.93	2.86	673	0.5	2,892.43	1,580	1.32	2.17	D
116	0.85	544.0	2,052	3.77	6,126	11.25	2.98	824	0.6	6,333.99	2,569	1.25	2.38	D
117	6.35	4,064.0	6,840	1.47	23,828	5.87	3.48	1,356	1.0	20,071.95	8,169	1.19	2.92	D
118	6.00	3,840.0	2,944	0.77	9,271	2.41	3.15	735	0.5	1,820.43	3,473	1.18	2.67	D
120	4.50	2,880.0	356	0.12	1,375	0.48	3.85	26	0.0	250.00	426	1.23	3.12	C
121	0.29	185.5	936	5.05	1,706	9.20	1.82	571	0.4	5,013.51	695	0.74	2.45	D
122	0.25	160.0	634	3.96	1,570	9.82	2.48	1,191	0.8	872.55	785	1.24	2.00	D
123	0.28	179.1	664	3.71	1,646	9.18	2.48	453	0.3	3,074.93	770	1.16	2.14	D
124	0.24	153.6	362	2.36	710	4.62	1.96	2,109	1.3	78,349.71	362	1.00	1.96	C
125	0.28	179.1	423	2.36	1,314	7.32	3.11	1,564	1.1	6,126.12	619	1.46	2.12	D
126	0.70	447.0	1,012	2.26	2,718	6.07	2.68	765	0.5	3,635.59	1,223	1.21	2.22	E
127	0.75	480.0	589	1.23	2,069	4.31	3.51	167	0.1	3,250.93	800	1.36	2.59	E
128	0.75	480.0	423	0.88	1,540	3.21	3.64	36	0.0	5.52	544	1.29	2.83	E
129	0.50	320.0	468	1.46	1,480	4.62	3.16	153	0.1	1,750.66	574	1.23	2.58	C
131	0.35	224.0	997	4.45	2,416	10.80	2.42	2,412	1.7	6,789.02	679	0.68	3.56	C
132	0.38	243.2	785	3.23	1,752	7.20	2.23	494	0.4	6,740.89	695	0.88	2.52	D
133	0.38	243.2	997	4.10	2,174	8.93	2.18	582	0.4	1,488.41	951	0.95	2.29	C
134	0.50	320.0	604	1.89	1,782	5.57	2.95	620	0.4	6,259.38	815	1.35	2.19	E
135	1.10	704.0	2,476	3.52	6,493	9.22	2.62	1,996	1.4	8,263.83	2.612	1.05	2.48	C
136	1.40	896.0	2,218	2.47	6,191	6.90	2.79	1,964	1.3	15,532.31	2,572	1.16	2.41	D
137	1.50	960.0	1,465	1.53	4,907	5.11	3.35	509	0.4	7,574.44	1,963	1.34	2.50	D
138	1.50	960.0	1,389	1.45	3,971	4.14	2.86	164	0.1	2,348.83	1,601	1.15	2.48	D
139	1.00	640.0	1,102	1.72	2,718	4.24	2.47	390	0.3	6,713.48	1,027	0.93	2.65	C
141	0.25	160.0	710	4.44	2,084	13.04	2.94	297	0.2	1,904.71	830	1.04	2.51	C
142	0.25	160.0	559	3.50	1,752	10.96	3.13	192	0.1	166.52	649	1.16	2.70	C
143	1.50	960.0	2,929	3.05	8,275	8.70	2.82	1,382	1.0	9,679.90	3,548	1.21	2.33	C
144	2.25	1,440.0	2,054	1.43	6,357	4.42	3.09	1,249	0.9	40,541.50	2,658	1.29	2.39	D
145	3.00	1,920.0	1,208	0.63	3,657	1.80	3.02	283	0.2	1,123.14	1,676	1.39	2.18	D
146	3.00	1,920.0	589	0.31	1,601	0.83	2.72	22	0.0	244.65	634	1.08	2.52	C
148	9.00	5,760.0	60	0.01	91	0.02	1.52	5	0.0	146.74	60	1.00	1.52	E
149	3.05	1,962.0	72	0.04	199	0.10	2.78	0	0.0	0.00	91	1.30	2.14	E
151	14.28	9,145.0	43	0.00	150	0.02	3.49	3	0.0	19.40	57	1.33	2.63	C
152	19.92	12,260.0	419	0.03	1,257	0.12	3.00	0	0.0	11.29	557	1.33	2.26	D
153	11.29	7,225.0	345	0.05	1,120	0.15	3.25	53	0.0	593.17	460	1.33	2.43	E
211	0.60	384.0	1,817	4.73	4,451	11.61	2.45	1,236	0.9	10,965.41	1,602	0.88	2.78	B
212	0.73	467.0	1,631	3.50	4,711	10.10	2.89	932	0.7	4,494.39	1,963	1.20	2.40	C
213	1.00	640.0	2,038	3.18	5,919	9.26	2.90	496	0.4	4,077.60	2,537	1.24	2.33	C
214	1.50	960.0	2,144	2.21	6,629	6.91	3.09	833	0.6	11,276.92	2,673	1.25	2.48	C
215	1.25	800.0	1,691	2.11	5,587	6.98	3.30	486	0.3	3,606.38	2,099	1.24	2.66	C
216	2.50	1,600.0	2,899	1.81	9,815	6.14	3.38	1,022	0.7	10,619.70	3,986	1.37	2.46	D
217	2.21	1,415.0	377	0.27	981	0.69	2.60	87	0.0	54.61	468	1.24	2.10	E
220	5.16	3,304.0	44	0.01	94	0.03	2.15	0	0.0	52.06	55	1.24	1.72	E
221	0.55	352.0	2,264	6.44	5,559	15.97	2.46	761	0.5	5,376.46	1,971	0.87	2.82	C
222	0.54	345.6	1,797	5.21	4,998	14.45	2.78	567	0.4	9,861.09	1.344	0.75	3.72	A
223	0.73	467.5	1,510	3.23	3,397	7.26	2.25	763	0.5	3,524.79	1,510	1.00	2.25	B
224	2.00	1,280.0	4,183	3.27	13,514	10.56	3.23	1,128	0.8	11,555.40	4.575	1.09	2.95	C
225	4.11	2,632.0	4,545	1.72	15,507	5.90	3.41	1,175	0.8	13,336.55	5,799	1.28	2.67	C
226	6.95	4,450.0	1,857	0.42	5,783	1.30	3.11	1,423	1.0	3,862.18	2,340	1.26	2.47	D
231	0.26	166.4	981	5.90	2,295	13.80	2.34	1,536	1.1	6,508.48	393	0.40	5.84	A
232	0.25	160.0	664	4.15	1,344	8.40	2.02	696	0.5	5,163.61	317	0.48	4.24	B
233	0.50	320.0	1,661	5.20	5,149	16.08	3.10	1,263	0.9	6,333.69	1,404	0.84	3.67	A
234	1.00	640.0	2,295	3.58	5,754	9.00	2.50	1,574	1.1	14,928.80	2,220	0.97	2.59	A
235	0.75	480.0	211	0.44	513	1.07	2.43	1,383	1.0	4,987.72	196	0.93	2.62	A
236	0.99	634.0	106	0.17	196	0.31	1.85	697	0.5	1,019.00	60	0.57	3.27	B
237	1.15	736.0	30	0.04	91	0.12	3.03	2	0.0	5.59	30	1.00	3.03	B
241	0.50	320.0	1,299	4.05	5,043	15.75	3.88	651	0.5	2,353.26	921	0.71	5.48	A
242	1.73	1,107.0	317	0.29	695	0.63	2.19	5,072	3.7	1,550.85	211	0.66	3.29	A
243	1.54	985.6	438	0.46	1,102	1.13	2.52	172	0.1	1,157.90	347	0.79	3.18	A
244	2.23	1,429.5	15	0.01	91	0.06	6.07	114	0.1	0	30	2.00	3.03	B
245	0.85	544.0	181	0.33	846	1.57	4.67	3	0.0	25.45	272	1.50	3.11	B
251	11.85	7,590.0	62	0.01	186	0.02	3.00	0	0.0	0	83	1.33	2.24	E
252	20.50	13,120.0	73	0.01	231	0.02	3.17	28	0.0	0	97	1.33	2.38	E
253	6.00	3,840.0	54	0.01	106	0.03	1.97	0	0.0	4.80	68	1.28	1.55	E
254	1.50	960.0	49	0.05	163	0.17	3.34	0	0.0	0	74	1.50	2.22	E
255	2.40	1,536.0	329	0.21	952	0.62	2.89	180	0.1	4,454.58	428	1.30	2.22	C
256	3.50	2,240.0	611	0.27	1,766	0.79	2.89	90	0.1	0	794	1.30	2.22	C
257	2.69	1,721.0	664	0.39	2,195	1.27	3.30	1,250	0.9	50.00	741	1.12	2.96	C
311	0.75	480.0	1,193	2.49	4,107	8.70	3.44	648	0.5	5,261.58	800	0.67	5.13	B
312	1.00	640.0	1,344	2.10	4,545	8.50	3.38	1,807	1.3	9,145.09	966	0.72	4.70	A
313	3.87	2,479.0	1,012	0.41	4,198	1.77	4.15	73	0.1	1,380.88	1,434	1.12	2.93	B
314	0.86	550.4	45	0.08	151	0.27	3.36	51	0.0	88.05	45	1.00	3.36	B
315	9.21	5,900.0	242	0.04	921	0.16	3.80	23	0.0	0	423	1.75	2.18	C
316	10.17	6,510.0	181	0.03	589	0.09	3.25	24	0.0	0	302	1.67	1.95	C
321	0.12	76.8	30	0.39	15	0.19	0.50	2,079	1.5	13,746.45	15	0.50	1.00	A
322	0.18	115.2	544	4.72	1,631	14.16	3.00	1,003	0.7	3,576.13	287	0.53	5.68	A
323	0.50	320.0	1,042	3.26	4,016	12.55	3.86	1,014	0.7	2,058.11	544	0.52	7.38	B
324	0.61	390.1	559	1.43	1,404	3.59	2.51	242	0.2	3,312.91	468	0.84	3.00	B
325	1.27	812.5	1,419	1.74	4,847	5.96	3.42	392	0.3	5,879.71	1,676	1.18	2.89	C
326	1.25	800.0	347	0.43	1,283	1.60	3.70	105	0.1	428.89	559	1.61	2.30	D

TABLE D (SHEET 2)
1957 LAND USE STATISTICS
Phoenix Urban Area

Zone	Zone Size in Sq. Mi.	Zone Size in Acres	Number of Dwelling Units	Dwelling Units Per Acre	Population	Population Per Acre	Population Per Dwelling Unit	Employment		Retail Sales Tax	Auto Registration	Autos Per Dwelling Unit	Persons Per Auto	Median Income Level*
								No. of Jobs	Percent of Total					
327	1.51	966.4	317	0.33	997	1.03	3.14	49	0.0	50.60	408	1.29	2.44	D
331	0.21	134.5	75	0.56	211	1.57	2.81	1,370	1.0	2,135.08	30	0.40	7.03	B
332	0.22	140.9	544	3.86	1,722	12.25	3.16	823	0.6	2,025.17	211	0.39	8.16	A
333	1.01	646.4	1,148	1.77	4,062	6.30	3.54	1,184	0.8	9,420.04	831	0.72	4.89	A
334	0.62	397.0	664	1.67	2,114	5.32	3.18	319	0.2	2,486.18	695	1.05	3.04	B
335	1.24	793.6	589	0.74	2,144	2.70	3.64	96	0.1	679.17	634	1.08	3.38	B
336	1.27	812.8	800	0.98	2,748	3.38	3.44	154	0.1	230.96	861	1.08	3.19	C
337	2.62	1,676.0	91	0.05	302	0.18	3.32	50	0.0	12.63	75	0.82	4.03	D
341	0.46	294.4	393	1.35	1,450	4.92	3.69	1,255	0.9	2,447.53	257	0.65	5.64	A
342	1.42	908.0	1,978	2.17	7,082	7.80	3.58	818	0.6	17,008.86	1,812	0.92	3.91	A
343	3.03	1,940.0	1,842	0.95	6,282	3.24	3.41	267	0.2	1,931.76	1,465	0.80	4.29	B
344	3.54	2,265.0	604	0.27	1,661	0.73	2.75	135	0.1	401.06	317	0.52	5.24	A
345	6.54	4,180.0	800	0.19	3,080	0.74	3.85	79	0.1	74.95	936	1.17	3.29	C
346	5.72	3,660.0	196	0.05	679	0.19	3.46	10	0.0	445.27	211	1.08	3.22	C
351	5.23	3,350.0	940	0.28	3,290	0.98	3.50	272	0.2	75.00	1,250	1.33	2.63	C
352	10.22	6,550.0	3,620	0.55	10,140	1.55	2.71	2,443	1.7	16,741.81	4,340	1.20	2.34	C
353	11.65	7,451.0	487	0.07	1,461	0.20	3.00	365	0.3	25.00	647	1.33	2.26	C
354	35.20	22,510.0	9,385	0.42	30,433	1.35	3.24	5,250	3.7	50,952.79	11,250	1.20	2.71	C
411	0.50	320.0	634	1.98	1,691	5.29	2.67	822	0.6	5,608.87	528	0.83	3.20	B
412	1.53	979.2	2,461	2.51	7,580	7.76	3.08	1,297	0.9	24,123.22	3,156	1.28	2.40	C
413	2.57	1,644.0	3,322	2.02	11,400	0.69	3.43	817	0.6	6,871.89	3,881	1.17	2.94	C
414	2.50	1,600.0	1,193	0.75	4,077	2.55	3.42	324	0.2	7,353.00	1,329	1.11	3.07	C
415	1.50	960.0	649	0.68	1,963	2.45	3.02	27	0.0	7,689.72	634	0.98	3.10	C
421	0.38	243.2	755	3.11	1,694	6.97	2.24	462	0.3	3,013.17	447	0.59	3.79	B
422	0.16	102.5	347	3.39	1,087	10.59	3.13	844	0.6	1,968.29	332	0.96	3.29	B
423	1.29	825.6	211	0.26	559	0.68	2.65	3,130	2.2	20,951.05	196	0.93	2.85	B
424	1.70	1,088.0	1,359	1.25	4,047	3.73	2.98	1,014	0.7	2,832.75	1,374	1.01	2.94	C
425	3.70	2,370.0	1,178	0.50	4,666	1.97	3.96	245	0.2	5,531.29	1,419	1.20	3.29	C
426	1.80	1,152.0	60	0.05	226	0.20	3.77	3	0.0	0	106	1.77	2.13	C
427	0.81	518.0	106	0.20	377	0.73	3.56	511	0.3	15,504.30	75	0.71	5.03	C
428	2.71	1,734.0	1,827	1.05	6,961	4.02	3.81	187	0.1	1,930.08	2,038	1.12	3.42	C
431	0.39	249.5	1,314	5.27	2,658	10.65	2.02	2,751	2.1	11,794.85	876	0.67	3.03	C
432	0.24	153.6	695	4.52	1,721	11.20	2.48	3,320	2.4	1,236.24	559	0.80	3.08	C
433	0.37	236.8	1,193	5.04	2,839	11.98	2.38	449	0.3	4,757.41	891	0.75	3.19	C
434	0.54	345.6	846	2.45	2,642	7.64	3.12	763	0.5	9,674.65	997	1.18	2.65	B
435	0.84	537.6	1,842	3.43	6,055	11.30	3.29	245	0.2	5,887.27	2,084	1.13	2.90	B
436	1.57	1,004.8	1,193	1.19	3,428	3.40	2.87	2,582	1.8	1,173.05	951	0.80	3.60	B
437	1.28	819.2	15	0.02	15	0.02	1.00	133	0.1	15.57	0	0	0	C
441	0.13	83.2	468	5.62	1,434	17.20	3.06	216	0.2	1,011.84	408	0.87	3.51	A
442	0.61	391.0	1,465	3.74	4,877	12.45	3.33	1,608	1.1	7,503.32	1,208	0.82	4.04	B
443	2.62	1,676.0	1,102	0.66	3,397	2.03	3.08	862	0.6	2,228.93	951	0.86	3.57	B
444	2.14	1,370.0	589	0.43	2,416	1.77	4.10	379	0.3	505.22	589	1.00	4.10	B
445	2.18	1,395.0	30	0.02	91	0.07	3.03	104	0.1	63.55	30	1.00	3.00	C
451	11.33	7,251.2	285	0.04	998	0.14	3.50	127	0.1	98.22	379	1.33	2.63	C
452	9.00	5,760.0	2,695	0.47	11,700	2.03	4.33	2,948	2.1	18,717.52	3,230	1.20	3.62	B
453	2.84	1,816.0	1,837	1.01	5,060	2.79	2.75	42	0.0	25.00	2,440	1.33	2.07	C
454	12.16	7,782.4	895	0.12	2,460	0.32	2.75	109	0.1	1,000.00	1,190	1.33	2.07	C
455	7.54	4,830.0	123	0.03	338	0.07	2.75	38	0.0	0	163	1.33	2.07	C
511	0.02	12.8	0	-	0	-	0	71	0.1	576.37	0	0	0	B
512	0.02	12.8	121	9.45	151	11.80	1.25	931	0.7	1,739.54	60	0.50	2.52	B
513	0.03	19.2	181	9.45	211	11.00	1.16	4,366	3.1	18,957.31	45	0.25	4.69	B
514	0.03	19.2	166	8.68	181	9.45	1.09	1,123	0.8	12,949.31	15	0.09	1.21	B
521	0.03	19.2	544	28.35	695	36.20	1.28	4,145	3.0	74,522.68	211	0.39	3.29	B
522	0.01	6.4	45	7.03	45	7.04	1.00	12	0.0	52.65	0	0	0	B
523	0.01	6.4	45	7.03	91	14.20	2.02	5	0.0	.51	15	0.33	6.07	B
524	0.02	12.8	91	7.10	121	9.48	1.33	244	0.2	82.46	45	0.49	2.67	B
525	0.03	19.2	226	11.80	257	13.40	1.14	628	0.4	61,020.44	30	0.13	8.57	B
531	0.02	12.8	513	40.20	695	54.30	1.35	1,395	1.0	4,295.65	196	0.38	3.54	B
532	0.03	19.2	121	6.31	166	8.66	1.37	316	0.2	2,719.80	45	0.37	3.69	B
533	0.02	12.8	60	4.69	106	8.28	1.77	134	0.1	425.07	15	0.25	7.07	B
541	0.02	12.8	0	-	0	-	0	232	0.2	962.68	0	0	0	B
542	0.02	12.8	15	1.17	30	2.34	2.00	423	0.3	929.13	15	1.00	2.00	B
543	0.02	12.8	136	10.60	136	10.60	1.00	446	0.3	1,110.13	15	0.11	9.07	B
551	0.07	44.8	438	9.78	830	18.50	1.89	152	0.1	465.26	242	0.55	3.43	C
552	0.09	57.6	740	12.85	1,117	19.40	1.51	900	0.3	9,255.54	302	0.41	3.70	C
553	0.09	57.6	423	7.38	604	10.50	1.43	4,942	3.6	23,881.26	242	0.57	2.50	C
554	0.07	44.8	528	11.75	755	16.90	1.43	634	0.5	3,858.84	242	0.46	3.12	C
619	4.50	2,880.0	1,607	0.56	6,175	2.14	3.85	275	0.2	4,410.30	1,990	1.23	3.12	C
647	2.45	1,569.0	683	0.44	1,900	1.21	2.78	218	0.2	43.05	890	1.30	2.14	E
718	6.84	5,375.0	575	0.11	1,235	0.23	2.15	143	0.1	550.00	715	1.24	1.72	E
719	2.00	1,280.0	52	0.04	105	0.08	2.02	2	0.0	4.80	68	1.28	1.55	E
727	1.45	928.0	313	0.34	1,045	1.13	3.34	67	0.1	585.57	470	1.50	2.22	E
728	1.60	1,024.0	570	0.56	1,646	1.62	2.89	1,527	1.1	12,000.00	741	1.30	2.22	C
729	6.04	3,865.6	378	0.10	1,248	0.32	3.30	178	0.1	2,807.96	422	1.12	2.96	C
Total Study Area	413.71	264,774.4	153,398	0.59	466,222	1.78	3.04	122,764	96.0	$ 978,763.38	164,699	1.07	2.82	-
Total Maricopa Co.	9226	5,900,000	167,219	0.03	520,000	0.09	3.12	140,613	100.0	$1,200,000.00	179,827	1.07	2.89	-

* Median Income Levels

A Very Low
B Low
C Medium
D High
E Very High

TABLE E (SHEET 1)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population 1957	Population 1980	Auto Ownership 1957	Auto Ownership 1980	Employment* 1957	Employment* 1980	Retail Sales Tax 1957	Retail Sales Tax 1980	Median Income Level 1957	Median Income Level 1980
120	1,375	17,780	426	6,480	19	300	$ 250	$ 10,000	C	C
619	6,175	24,310	1,990	8,180	205	900	4,410	30,000	C	C
Subtotal	7,550	42,090	2,416	14,660	224	1,200	$ 4,660	$ 40,000	-	-
118	9,271	28,130	3,473	11,240	512	3,250	$ 1,820	$ 100,000	D	D
Subtotal	9,271	28,130	3,473	11,240	512	3,250	$ 1,820	$ 100,000	-	-
414	4,077	13,140	1,329	4,940	118	450	$ 7,353	$ 29,200	C	C
415	1,963	10,000	634	3,550	10	50	7,690	30,800	C	C
Subtotal	6,040	23,140	1,963	8,490	128	500	$ 15,043	$ 60,000	-	-
117	23,828	37,600	8,169	13,400	995	4,300	$ 20,072	$ 130,000	D	D
Subtotal	23,828	37,600	8,169	13,400	995	4,300	$ 20,072	$ 130,000	-	-
413	11,400	15,840	3,881	5,700	630	2,100	$ 6,872	$ 35,000	C	C
Subtotal	11,400	15,840	3,881	5,700	630	2,100	$ 6,872	$ 35,000	-	-
427	377	800	75	232	400	1,000	$ 15,504	$ 35,600	C	C
428	6,961	9,420	2,038	3,240	146	400	$ 1,930	$ 4,400	C	C
Subtotal	7,338	10,220	2,113	3,472	546	1,400	$ 17,434	$ 40,000	-	-
128	1,540	2,300	544	876	31	200	$ 5	$ 100	E	E
129	1,480	2,400	574	1,012	130	400	1,751	7,900	C	C
138	3,971	7,120	1,601	3,030	140	400	2,349	10,600	D	D
139	2,718	4,600	1,027	1,925	332	900	6,713	30,400	C	C
146	1,601	8,840	634	3,740	19	150	245	1,000	C	C
Subtotal	11,310	25,260	4,380	10,583	652	2,050	$ 11,063	$ 50,000	-	-
127	2,069	3,150	800	1,320	129	250	$ 3,251	$ 8,200	E	E
137	4,907	5,200	1,963	2,200	392	800	7,574	19,000	D	D
145	3,657	10,710	1,676	5,150	217	400	1,123	2,800	D	D
Subtotal	10,633	19,060	4,439	8,670	738	1,450	$ 11,948	$ 30,000	-	-

TABLE E (SHEET 2)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population		Auto Ownership		Employment*		Retail Sales Tax		Median Income Level	
	1957	1980	1957	1980	1957	1980	1957	1980	1957	1980
126	2,718	8,270	1,223	4,030	550	1,100	$ 3,636	$ 7,900	E	E
136	6,191	5,150	2,572	2,250	1,413	2,800	15,532	33,800	D	D
144	6,357	10,820	2,658	4,950	900	1,700	40,542	88,300	D	D
Subtotal	15,266	24,240	6,453	11,230	2,863	5,600	$ 59,710	$ 130,000	-	-
148	91	5,300	60	2,650	3	50	$ 147	$ 11,600	E	E
149	199	5,100	91	2,510	0	0	0	0	E	E
647	1,900	4,020	890	1,870	130	300	43	3,400	E	E
Subtotal	2,190	14,420	1,041	7,030	133	350	$ 190	$ 15,000	-	-
217	981	2,200	468	1,090	57	100	$ 55	$ 450	E	E
254	163	1,100	74	525	0	25	0	0	E	E
727	1,045	4,320	470	2,105	43	75	586	4,550	D	D
Subtotal	2,189	7,620	1,012	3,720	100	200	$ 641	$ 5,000	-	-
220	94	4,300	55	2,150	0	25	$ 52	$ 1,300	E	E
253	106	9,840	68	4,920	0	25	5	100	E	E
718	1,235	6,060	715	3,030	117	500	550	13,500	E	E
719	105	4,300	68	2,150	2	50	5	100	E	E
Subtotal	1,540	24,500	906	12,250	119	600	$ 612	$ 15,000	-	-
255	952	2,100	428	1,000	153	450	$ 4,455	$ 13,500	D	D
256	1,766	17,000	794	8,100	76	250	0	0	D	D
728	1,646	7,260	741	3,540	1,290	3,600	12,000	36,500	D	D
Subtotal	4,364	26,360	1,963	12,640	1,519	4,300	$ 16,455	$ 50,000	-	-
257	2,195	20,140	741	7,310	1,161	7,900	$ 50	$ 2,000	D	D
729	1,248	24,270	422	8,490	165	1,150	2,808	$ 98,000	D	D
Subtotal	3,443	44,410	1,163	15,800	1,326	9,050	$ 2,858	$ 100,000	-	-
226	5,783	22,080	2,340	9,250	1,380	5,500	$ 3,862	$ 20,000	D	D
Subtotal	5,783	22,080	2,340	9,250	1,380	5,500	$ 3,862	$ 20,000	-	-

TABLE E (SHEET 3)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population		Auto Ownership		Employment*		Retail Sales Tax		Median Income Level	
	1957	1980	1957	1980	1957	1980	1957	1980	1957	1980
216	9,815	11,340	3,986	4,950	746	2,200	$ 10,620	$ 44,500	D	D
225	15,507	19,030	5,799	7,650	860	2,500	13,337	55,500	D	D
Subtotal	25,322	30,370	9,785	12,600	1,606	4,700	$ 23,957	$ 100,000	-	-
143	8,275	7,790	3,548	3,570	1,065	2,150	$ 9,680	$ 29,500	C	C
214	6,629	9,370	2,673	4,070	642	1,300	11,277	34,400	C	C
215	5,587	6,240	2,099	2,510	374	750	3,606	11,100	C	C
Subtotal	20,491	23,400	8,320	10,150	2,081	4,200	$ 24,563	$ 75,000	-	-
213	5,919	6,200	2,537	2,840	378	700	$ 4,078	$ 9,600	C	C
223	3,397	3,560	1,510	1,730	580	1,000	3,525	8,300	B	B
224	13,514	11,180	4,575	3,950	859	1,950	11,555	27,100	C	C
Subtotal	22,830	20,940	8,622	8,520	1,817	3,650	$ 19,158	$ 45,000	-	-
141	2,084	1,000	830	424	242	450	$ 1,905	$ 3,500	C	C
142	1,752	870	649	362	157	300	167	300	C	C
131	2,416	4,950	679	1,710	1,970	3,600	6,789	12,500	C	C
132	1,752	2,550	695	1,080	403	750	6,741	12,500	D	D
133	2,174	3,470	951	1,600	475	900	1,488	2,700	C	C
211	4,451	5,750	1,602	2,220	1,008	1,800	10,965	20,200	B	B
212	4,711	4,450	1,963	1,950	753	1,400	4,494	8,300	C	C
Subtotal	19,340	23,040	7,369	9,346	5,008	9,200	$ 32,549	$ 60,000	-	-
111	1,842	800	634	302	1,050	2,050	$ 18,207	$ 33,600	B	B
112	2,401	8,300	906	3,220	194	350	1,922	3,600	C	C
113	2,688	3,700	1,344	1,850	66	150	7,948	14,700	E	E
114	332	1,240	242	620	225	450	590	1,100	E	E
121	1,706	1,970	695	895	535	1,000	5,014	9,300	D	D
122	1,570	1,000	785	500	1,115	2,200	873	1,600	D	D
123	1,646	5,200	770	2,560	425	900	3,075	5,700	D	D
411	1,691	1,370	528	472	770	1,500	5,609	10,400	B	B
Subtotal	13,876	23,580	5,904	10,419	4,380	8,600	$ 43,238	$ 80,000	-	-

TABLE E (SHEET 4)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population 1957	Population 1980	Auto Ownership 1957	Auto Ownership 1980	Employment* 1957	Employment* 1980	Retail Sales Tax 1957	Retail Sales Tax 1980	Median Income Level 1957	Median Income Level 1980
221	5,559	5,760	1,971	2,200	695	1,350	$ 5,376	$ 7,300	C	C
222	4,998	5,450	1,344	1,817	518	1,000	9,861	13,300	A	A
231	2,295	4,700	393	1,253	1,400	2,800	6,508	8,700	A	A
232	1,344	4,980	317	1,660	640	1,250	5,164	7,000	B	B
233	5,149	0	1,404	0	1,150	2,300	6,334	8,700	A	-
Subtotal	19,345	20,890	5,429	6,930	4,403	8,700	$ 33,243	$ 45,000	-	-
124	710	1,600	362	800	2,000	3,300	$ 78,350	$ 118,800	C	C
125	1,314	900	619	445	1,486	2,500	6,126	9,300	D	D
134	1,782	3,000	815	1,470	589	1,000	6,259	9,500	D	D
135	6,493	6,050	2,612	2,630	1,899	3,200	8,264	12,400	C	D
Subtotal	10,299	11,550	4,408	5,345	5,974	10,000	$ 98,999	$ 150,000	-	-
421	1,694	0	447	0	427	850	$ 3,013	$ 3,300	B	-
422	1,087	0	332	0	779	1,550	1,968	2,150	B	-
423	559	340	196	130	2,890	5,800	20,951	23,000	B	B
431	2,658	6,080	876	2,260	2,540	5,000	11,795	12,900	C	C
432	1,721	2,200	559	811	3,046	6,100	1,236	1,400	C	C
433	2,839	340	891	124	415	800	4,757	5,200	B	B
434	2,642	0	997	0	705	1,400	9,675	10,600	B	-
435	6,055	3,420	2,084	1,300	226	400	5,887	6,450	B	B
Subtotal	19,255	12,380	6,382	4,625	11,028	21,900	$ 59,282	$ 65,000	-	-
424	4,047	6,040	1,374	2,280	883	3,600	$ 2,833	$ 19,300	C	C
425	4,666	11,850	1,419	3,820	216	850	5,531	37,500	C	C
426	226	11,600	106	5,715	3	100	0	100	C	C
436	3,428	10,210	951	3,490	2,288	9,000	1,173	8,000	B	B
437	15	4,100	0	1,745	117	450	16	100	C	C
Subtotal	12,382	43,800	3,850	17,050	3,507	14,000	$ 9,553	$ 65,000	-	-
443	3,397	0	951	0	837	3,000	$ 2,229	$ 3,200	A	A
444	2,416	1,600	589	506	368	1,200	505	700	A	A
445	91	2,400	30	900	99	300	64	100	B	B
Subtotal	5,904	4,000	1,570	1,406	1,304	4,500	$ 2,798	$ 4,000	-	-

TABLE E (SHEET 5)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population 1957	Population 1980	Auto Ownership 1957	Auto Ownership 1980	Employment* 1957	Employment* 1980	Retail Sales Tax 1957	Retail Sales Tax 1980	Median Income Level 1957	Median Income Level 1980
311	4,107	4,270	800	1,353	547	1,700	$ 5,262	$ 10,300	B	B
312	4,545	4,500	966	1,437	1,523	4,800	9,145	17,900	A	A
441	1,434	3,950	408	1,362	182	600	1,012	2,000	A	A
442	4,877	13,410	1,208	3,950	1,359	4,200	7,503	14,800	B	B
Subtotal	14,963	26,130	3,382	8,102	3,611	11,300	$ 22,922	$ 45,000	-	-
115	3,429	8,730	1,580	4,280	555	1,050	$ 2,892	$ 5,600	D	D
116	6,126	6,650	2,569	3,030	680	1,200	6,334	12,300	D	D
412	7,580	6,440	3,156	2,860	1,072	2,300	24,123	47,100	C	C
Subtotal	17,135	21,820	7,305	10,170	2,307	4,550	$ 33,349	$ 65,000	-	-
321	15	0	15	0	2,001	2,900	$ 13,746	$ 10,400	A	-
322	1,631	600	287	177	960	1,400	3,576	2,700	A	A
323	4,016	2,450	544	564	974	1,400	2,058	1,550	A	A
331	211	0	30	0	1,314	2,000	2,135	1,650	A	-
332	1,722	0	211	0	789	1,150	2,025	1,500	A	-
333	4,062	0	831	0	1,136	1,600	9,420	7,200	A	-
Subtotal	11,657	3,050	1,918	741	7,174	10,450	$ 32,960	$ 25,000	-	-
241	5,043	0	921	0	535	1,250	$ 2,353	$ 1,600	A	-
341	1,450	0	257	0	1,030	2,500	2,448	1,700	A	-
342	7,082	0	1,812	0	674	1,550	17,009	11,700	A	-
Subtotal	13,575	0	2,990	0	2,239	5,300	$ 21,810	$ 15,000	-	-
234	5,754	0	2,220	0	1,464	3,000	$ 14,929	$ 9,900	A	-
235	513	0	196	0	1,287	2,600	4,988	3,300	A	-
242	695	0	211	0	4,725	10,000	1,551	1,000	A	-
243	1,102	0	347	0	160	300	1,158	800	A	-
Subtotal	8,064	0	2,974	0	7,636	15,900	$ 22,626	$ 15,000	-	-
236	196	0	60	0	685	2,600	$ 1,019	$ 1,000	C	-
244	91	0	30	0	111	400	0	0	C	-
Subtotal	287	0	90	0	796	3,000	$ 1,019	$ 1,000	-	-

TABLE E (SHEET 6)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population 1957	Population 1980	Auto Ownership 1957	Auto Ownership 1980	Employment* 1957	Employment* 1980	Retail Sales Tax 1957	Retail Sales Tax 1980	Median Income Level 1957	Median Income Level 1980
511	0	0	0	0	70	200	$ 576	$ 900	A	-
512	151	0	60	0	912	1,800	1,739	2,800	A	-
513	211	0	45	0	4,273	8,550	18,957	30,400	A	-
514	181	0	15	0	1,098	2,200	12,949	20,800	A	-
521	695	0	211	0	4,057	8,150	74,523	119,400	A	-
522	45	0	0	0	12	100	53	100	A	-
523	91	0	15	0	5	100	1	100	A	-
524	121	0	45	0	239	400	82	150	A	-
525	257	0	30	0	615	1,200	61,020	98,000	A	-
531	695	0	196	0	1,268	2,550	4,296	6,900	A	-
532	166	0	45	0	309	600	2,720	4,350	A	-
533	106	0	15	0	131	300	425	700	A	-
541	0	0	0	0	227	400	963	1,550	A	-
542	30	0	15	0	414	800	929	1,500	A	-
543	136	0	15	0	437	900	1,110	1,800	A	-
551	830	600	242	212	149	300	465	750	B	B
552	1,117	900	302	312	881	1,800	9,255	14,900	B	B
553	604	0	242	0	4,952	9,950	23,881	38,400	B	-
554	755	200	242	68	620	1,200	3,859	6,500	B	B
Subtotal 500's	6,191	1,700	1,735	592	20,669	41,500	$217,803	$ 350,000	-	-
237	91	4,960	30	1,823	2	400	$ 6	$ 2,200	B	C
245	846	5,300	272	1,920	3	450	25	2,800	B	C
Subtotal	937	10,260	302	3,743	5	850	$ 31	$ 5,000	-	-
313	4,198	10,800	1,434	4,050	56	550	$ 1,381	$ 10,000	B	B
314	151	500	45	170	39	300	88	500	B	B
315	921	19,940	423	9,500	18	150	0	18,000	C	C
316	589	2,200	302	1,100	18	100	0	1,500	C	C
Subtotal	5,859	33,440	2,204	14,820	131	1,100	$ 1,469	$ 30,000	-	-
326	1,283	7,440	559	3,420	53	450	$ 429	$ 6,000	D	D
327	997	5,400	408	2,400	24	200	51	3,000	D	D
337	302	10,500	75	3,330	25	200	13	11,000	D	D
Subtotal	2,582	23,340	1,042	9,150	102	850	$ 493	$ 20,000	-	-

TABLE E (SHEET 7)
ESTIMATED (1957) AND PROJECTED (1980) LAND USE STATISTICS
Phoenix-Maricopa County Urban Area

Zone	Population 1957	Population 1980	Auto Ownership 1957	Auto Ownership 1980	Employment* 1957	Employment* 1980	Retail Sales Tax 1957	Retail Sales Tax 1980	Median Income Level 1957	Median Income Level 1980
343	6,282	7,700	1,465	2,480	201	900	$ 1,932	$ 6,000	B	B
344	1,661	13,960	317	3,820	102	700	401	13,000	A	C
345	3,080	21,660	936	7,100	60	300	75	18,000	C	C
346	679	15,400	211	5,460	8	150	445	13,000	C	C
Subtotal	11,702	58,720	2,929	18,860	371	2,050	$ 2,853	$ 50,000	-	-
334	2,114	1,200	695	440	264	550	$ 2,486	$ 3,950	B	A
335	2,144	2,800	634	975	79	200	679	1,100	B	B
336	2,748	6,900	861	2,600	127	300	231	350	C	C
324	1,404	990	468	364	200	450	3,313	5,300	B	A
325	4,847	5,620	1,676	2,120	323	500	5,879	9,300	C	C
Subtotal	13,257	17,510	4,334	6,499	993	2,000	$ 12,588	$ 20,000	-	-
151	150	29,260	57	11,670	3	2,050	$ 19	$ 20,000	C	C
152	1,257	42,500	557	19,550	0	3,500	11	30,000	D	D
153	1,120	14,300	460	6,090	47	1,200	593	10,000	E	E
251	186	5,500	83	2,550	0	1,000	0	4,000	E	E
252	231	1,800	97	807	25	300	0	500	E	E
451	998	16,840	379	6,760	113	1,300	98	10,000	C	C
452	11,700	48,030	3,230	13,700	2,634	4,000	18,717	60,000	C	C
453	5,060	17,370	2,440	8,600	38	1,200	25	10,000	C	C
454	2,460	26,400	1,190	13,075	97	2,000	1,000	15,000	C	C
455	338	1,000	163	495	34	200	0	500	C	C
351	3,290	37,430	1,250	14,730	243	4,000	75	35,000	C	C
352	10,140	66,080	4,340	29,700	2,159	10,500	16,742	80,000	C	C
353	1,461	10,100	647	4,770	326	1,600	25	10,000	C	C
354	30,433	158,500	11,250	60,300	4,690	15,000	50,953	265,000	C	C
Subtotal Area Added	68,824	475,110	26,143	192,797	10,409	47,850	$ 88,258	$ 550,000	-	-
Subtotal Old Study Area	397,398	774,890	138,556	307,203	99,007	230,150	$890,503	$2,150,000	-	-
Total New Study Area	466,222	1,250,000	164,699	500,000	109,416	278,000	$978,761	$2,700,000	-	-
Job Class 0-18					13,348	32,000				
Grand Total Including Job Class 0-18					122,764	310,000				

* Excluding Job Classification 0-18 (Construction Workers, etc.)

DISTRIBUTION OF 1957 EMPLOYMENT
Phoenix-Maricopa County Urban Area

TABLE F

Job Code Number[1] Zone Group	0-18 Natural Resources	19-30's Manufac-turing	40's Communication Utilities Etc.	50's Wholesale Retail	60's Finance Etc.	70's Ser-vices	80's Profes-sional	90's Govern-ment	Adjust-ment	Total
111-114,121-123,411	293	130	942	1,434	215	601	171	687	200	4,673
124-125,134-135	315	104	251	2,294	962	463	1,103	590	207	6,289
115-116,412	487	286	17	761	179	223	642	19	180	2,794
117	361	31	13	454	1	42	418	-	36	1,356
118	223	115	-	112	-	-	264	-	21	735
120,619	77	-	9	145	12	17	27	4	10	301
126,136,144	1,115	50	15	1,524	196	316	521	27	214	3,978
127,137,145	221	14	77	222	30	68	183	15	129	959
128,129,138,139,146	113	35	29	184	59	34	243	32	36	765
131-133,141-142,211-212	1,137	372	199	1,500	574	736	1,135	304	188	6,145
148,149,647	90	-	-	16	6	69	30	-	12	223
213,223,224	570	67	21	562	58	244	677	19	169	2,387
216,225	591	312	72	461	38	186	443	32	62	2,197
214,215,143	620	148	94	628	148	251	407	327	78	2,701
217,254,727	54	-	-	5	-	90	-	-	5	154
414,415	223	-	-	36	7	2	68	-	15	351
427,428	152	62	132	258	17	29	26	-	22	698
220,718,719,253	26	-	-	-	-	95	15	-	9	145
255,256,728	278	56	56	-	724	109	285	42	247	1,797
257,729	102	1,239	-	14	-	-	50	-	23	1,428
221,222,231-233	420	719	197	1,486	130	410	584	518	359	4,823
241,341,342	485	395	936	532	1	50	222	26	77	2,724
311,312,441,442	668	1,516	108	1,175	9	150	68	456	129	4,279
321-323,331-333	299	750	2,488	2,828	45	293	598	14	158	7,473
236,244	15	-	610	91	-	-	-	81	14	811
234,235,242,243	565	4,910	299	1,003	34	663	104	225	398	8,201
237,245	-	-	-	-	-	-	-	-	5	5
313-316	40	52	-	18	-	-	26	16	19	171
326,327,337	102	-	9	30	3	25	20	0	15	204
343-346	120	141	-	103	-	4	104	-	19	491
334-336,324,325	210	215	16	311	32	55	245	77	42	1,203
421-423,431-435	936	1,701	839	3,367	166	669	163	3,459	664	11,964
424-426,436,437	470	2,673	25	402	-	133	207	-	67	3,977
443-445	41	171	130	71	10	6	-	795	121	1,345
CBD	430	1,532	2,313	6,761	3,682	2,213	837	2,917	414	21,099
226	43	850	141	122	-	10	118	96	43	1,423
413	187	2	84	248	-	36	191	46	23	817
TOTAL 225 sq. mile area	12,079	18,648	10,122	29,158	7,338	8,292	10,195	10,824	4,430	111,086
Total 414 sq. mile urban area[2]	13,500	20,700	10,500	32,300	7,500	8,800	11,300	13,160	5,000	122,760
Total County	14,743	23,268	11,243	34,792	7,946	9,316	12,760	21,521	5,024	140,613

[1] Social Security Board, Industrial Classification Code, Vol I, Description of Industries; 1942.
Manufacturing Codes are based on "Standard Industrial Classification Manual, Vol I, Manufacturing Industries," 1945

[2] Estimated

DISTRIBUTION OF 1980 TRIP ENDS BY PURPOSE OF TRIP
Phoenix Urban Area

TABLE G

SUMMARY OF TRIPS AT RESIDENCE

Origin	Work	Commercial	Social	School
111	224	405	86	185
112	5,099	6,561	4,024	923
113	2,700	2,727	2,493	728
114	748	936	805	467
115	4,970	5,623	5,926	1,574
116	4,245	4,402	4,682	1,714
117	20,709	24,484	17,202	12,183
118	14,036	13,686	12,039	6,274
120	8,473	10,016	8,878	2,908
121	726	1,400	826	354
122	569	1,110	567	214
123	2,957	3,418	3,461	934
124	1,158	930	603	371
125	515	379	68	186
126	7,677	5,531	4,695	2,186
127	1,782	2,550	774	1,612
128	1,232	1,492	1,221	957
129	1,310	1,393	1,845	268
131	2,795	3,826	2,278	551
132	1,023	1,880	1,111	436
133	1,604	2,928	1,311	891
134	1,780	2,550	1,684	954
135	3,627	3,843	2,485	1,715
136	2,462	2,447	1,658	1,361
137	3,288	3,341	1,983	2,172
138	3,593	4,619	2,540	1,376
139	1,849	3,141	2,260	479
141	727	498	288	265
142	620	420	256	238
143	5,363	6,132	3,395	2,075
144	5,770	8,855	4,401	2,860
145	6,043	5,759	4,160	2,707
146	5,291	4,678	4,064	1,840
148	2,432	4,071	3,361	2,049
149	2,581	3,787	3,072	1,820
151	14,757	15,735	14,842	5,438
152	22,771	19,226	17,180	10,743
153	6,310	10,131	6,347	4,678
211	3,556	4,188	3,261	885
212	2,710	4,220	2,499	1,070
213	3,832	3,328	2,339	1,491
214	6,203	4,610	3,377	2,013
215	3,377	3,734	2,485	1,649
216	7,668	7,983	6,629	3,868
217	1,048	1,672	1,360	802
220	1,999	3,340	2,726	1,694
221	2,561	3,888	1,751	986
222	2,640	4,309	2,463	560
223	1,616	3,535	1,760	703
224	6,352	7,201	6,184	1,921
225	11,756	15,406	10,157	4,706
226	12,018	11,497	8,575	5,581
231	1,711	3,214	1,969	80
232	3,359	5,529	3,110	213
233	0	0	0	0
234	0	0	0	0
235	0	0	0	0
236	0	0	0	0
237	2,666	2,879	2,555	885
241	0	0	0	0
242	0	0	0	0
243	0	0	0	0
244	0	0	0	0
245	2,747	3,302	2,856	827
251	2,298	4,084	2,877	2,045
252	730	1,383	1,013	723
253	4,834	7,643	6,240	3,878
254	492	807	584	384
255	1,148	968	783	562
256	8,916	7,546	7,950	4,044
257	8,965	8,424	10,535	3,744
311	1,521	1,669	1,439	256
312	2,892	2,438	1,368	693
313	6,464	6,376	4,164	4,082
314	374	286	271	235
315	13,404	9,651	7,602	5,441
316	1,519	939	767	572
321	0	0	0	0
322	399	336	212	0

SUMMARY OF TRIPS AT PURPOSE

Destination	Work	Commercial	Social	School	Miscellaneous
111	3,399	1,392	3,119	6	5,172
112	719	527	3,616	1,488	1,313
113	308	1,436	1,709	659	2,089
114	924	351	7,696	226	1,277
115	2,810	7,477	3,595	6,825	6,877
116	2,877	5,302	2,682	1,212	4,638
117	12,755	31,178	12,222	9,562	36,469
118	9,448	29,478	9,245	3,976	33,964
120	872	2,926	5,713	2,515	3,328
121	2,859	4,691	1,341	585	6,041
122	3,988	2,215	473	253	3,851
123	1,847	1,026	2,317	933	2,960
124	6,574	11,448	6,049	350	13,217
125	4,737	8,584	3,243	288	8,456
126	3,149	4,616	3,254	258	8,599
127	742	1,946	1,059	801	2,242
128	581	197	786	330	576
129	1,163	2,451	776	339	3,078
131	6,014	9,967	3,962	406	14,697
132	1,540	1,570	11,715	452	3,366
133	1,845	2,640	2,220	475	4,183
134	2,207	2,209	7,294	622	3,062
135	6,423	7,744	11,120	843	8,193
136	7,813	17,906	19,505	2,175	20,629
137	2,373	4,724	1,688	1,319	5,811
138	1,163	3,171	2,337	1,008	3,752
139	2,616	8,886	1,478	650	10,084
141	924	572	2,516	179	1,554
142	662	264	4,039	10,228	598
143	4,745	6,168	2,998	1,611	7,724
144	5,180	10,137	4,903	5,663	13,519
145	1,163	1,088	3,522	1,517	1,801
146	437	395	2,841	1,253	663
148	146	3,140	1,803	754	3,043
149	0	0	1,740	725	0
151	5,960	7,087	9,402	4,136	10,638
152	10,174	10,994	13,962	6,010	17,123
153	3,488	3,692	4,874	2,025	5,800
211	5,619	8,237	4,835	1,131	8,911
212	4,642	8,426	7,422	187	8,360
213	1,545	2,006	12,330	1,281	2,513
214	2,869	6,315	3,616	1,941	6,762
215	2,225	3,035	1,981	7,085	4,186
216	6,526	11,382	3,690	2,883	14,525
217	291	204	755	311	386
220	72	369	1,467	612	395
221	5,199	2,758	2,906	7,808	5,446
222	2,053	1,781	2,390	980	4,095
223	2,657	5,253	809	30	5,556
224	5,842	17,074	3,749	551	9,552
225	7,416	13,957	6,184	4,842	17,430
226	18,903	8,080	10,098	3,836	17,658
231	5,975	2,439	1,225	2,757	6,600
232	2,566	1,341	2,191	895	4,005
233	5,942	3,421	0	0	4,991
234	4,981	3,336	9,135	0	3,561
235	4,846	1,921	1,655	0	3,125
236	7,558	2,481	251	0	7,390
237	1,163	928	1,593	697	1,650
241	2,291	302	0	0	1,129
242	20,239	1,985	6,823	0	5,822
243	890	458	0	0	990
244	1,163	340	0	0	1,099
245	1,309	1,131	1,698	754	1,938
251	2,907	1,920	1,876	782	3,747
252	872	389	618	254	948
253	72	48	3,354	1,394	93
254	72	21	377	160	69
255	1,309	3,989	692	301	4,616
256	727	212	5,587	2,402	688
257	22,965	7,263	6,614	2,845	22,194
311	3,489	1,896	1,876	763	5,534
312	9,853	4,324	1,971	810	14,330
313	1,214	1,961	4,193	2,242	2,286
314	890	395	157	132	935
315	445	3,882	6,342	5,068	3,802
316	291	485	702	311	650
321	6,966	739	0	0	3,684
322	2,164	642	151	21	1,264

SUMMARY OF TRIPS AT RESIDENCE

Origin	Work	Commercial	Social	School
323	1,237	1,218	845	64
324	625	806	589	0
325	3,154	2,472	1,523	1,006
326	4,292	4,321	3,341	2,030
327	3,031	2,996	2,055	1,365
331	0	0	0	0
332	0	0	0	0
333	0	0	0	0
334	725	923	673	0
335	1,527	876	399	1,419
336	4,207	3,886	2,806	1,530
337	5,171	5,821	4,270	2,596
341	0	0	0	0
342	0	0	0	0
343	4,812	1,897	326	1,838
344	6,441	7,494	5,441	2,738
345	12,339	11,245	8,441	4,987
346	8,919	7,756	6,347	3,206
351	18,877	24,282	19,580	5,288
352	34,241	41,175	37,187	10,318
353	5,933	5,000	4,803	2,253
354	66,319	97,411	106,004	23,568
411	537	1,047	653	387
412	4,376	5,473	2,645	1,825
413	10,378	10,454	7,783	3,782
414	6,625	7,747	6,234	2,465
415	5,404	6,146	4,993	1,562
421	0	0	0	0
422	0	0	0	0
423	133	149	59	116
424	3,431	4,593	3,392	1,193
425	7,392	5,944	4,317	2,930
426	7,500	7,043	5,602	2,472
427	437	359	271	197
428	6,239	5,307	4,405	2,101
431	3,557	4,969	2,998	572
432	805	1,739	1,121	37
433	122	148	54	107
434	0	0	0	0
435	2,308	2,540	1,405	734
436	7,375	7,580	5,563	3,421
437	2,441	2,093	1,598	979
441	603	3,825	2,401	237
442	10,792	16,074	10,564	460
443	0	0	0	0
444	883	1,027	651	1,269
445	1,747	1,415	1,240	1,105
451	9,566	8,768	8,543	3,505
452	20,497	29,108	25,126	6,785
453	13,396	10,675	8,949	2,970
454	17,410	12,845	10,672	6,281
455	674	435	365	260
511	0	0	0	0
512	0	0	0	0
513	0	0	0	0
514	0	0	0	0
521	0	0	0	0
522	0	0	0	0
523	0	0	0	0
524	0	0	0	0
525	0	0	0	0
531	0	0	0	0
532	0	0	0	0
533	0	0	0	0
541	0	0	0	0
542	0	0	0	0
543	0	0	0	0
551	238	450	162	108
552	158	522	585	63
553	0	0	0	0
554	40	88	8	44
619	10,980	14,525	12,138	3,615
647	1,916	2,848	1,944	1,255
718	2,870	4,656	3,843	2,342
719	2,227	3,267	2,726	1,631
727	2,450	2,212	1,712	1,124
728	3,993	3,471	3,222	1,782
729	10,596	10,773	11,350	4,691
Total	664,537	761,189	624,656	263,892

SUMMARY OF TRIPS AT PURPOSE

Destination	Work	Commercial	Social	School	Miscellaneous
323	2,913	1,175	527	35	1,480
324	993	1,154	377	207	1,508
325	1,483	2,418	1,782	10,700	3,149
326	1,335	1,685	2,421	1,894	2,387
327	581	971	1,771	763	1,299
331	3,250	10	0	0	2,741
332	2,719	1,287	0	0	2,448
333	3,027	785	6,354	0	1,628
334	1,214	1,016	461	245	1,524
335	441	316	1,090	584	513
336	890	365	2,191	1,752	907
337	593	2,479	3,417	2,676	2,626
341	3,097	312	0	0	2,703
342	1,946	2,963	15,649	0	1,255
343	2,670	2,123	2,463	1,960	3,648
344	2,076	3,380	4,434	3,552	4,402
345	890	4,028	6,887	5,511	4,221
346	437	3,600	4,948	2,176	3,667
351	11,628	12,756	12,023	5,285	19,746
352	30,523	30,311	21,226	9,336	48,864
353	4,651	4,033	3,249	1,432	6,896
354	43,604	83,566	81,686	22,403	107,551
411	3,507	2,466	994	171	5,918
412	5,470	12,015	3,728	5,598	6,441
413	6,229	9,312	5,031	4,032	12,458
414	1,335	6,500	4,172	3,344	6,746
415	146	8,269	3,207	1,413	7,850
421	1,745	774	0	0	2,552
422	1,235	326	0	0	1,598
423	10,947	970	662	8	7,502
424	7,945	3,625	2,327	1,253	9,136
425	2,521	8,613	3,763	3,015	9,426
426	297	117	3,690	2,949	299
427	2,966	8,365	252	207	9,489
428	1,163	1,515	3,029	1,328	2,201
431	8,323	4,111	3,351	129	10,054
432	9,025	4,471	954	36	11,043
433	1,642	925	147	57	2,645
434	2,437	2,285	0	0	1,510
435	883	1,296	1,331	707	1,560
436	19,862	7,779	3,962	2,120	17,759
437	1,335	459	1,300	1,046	1,280
441	1,232	518	1,730	707	1,762
442	9,269	5,358	5,199	2,779	9,684
443	6,621	2,675	0	0	5,986
444	3,560	1,315	514	405	3,492
445	890	312	765	612	858
451	3,779	3,778	5,409	2,383	6,074
452	11,628	19,433	15,430	6,783	26,007
453	3,488	3,692	5,576	2,459	5,800
454	5,814	5,710	8,480	3,731	9,248
455	581	304	325	141	674
511	418	177	795	0	230
512	2,347	1,966	1,059	0	2,820
513	16,210	7,630	5,693	0	11,224
514	4,027	4,477	1,589	0	3,670
521	17,332	14,582	8,424	0	8,895
522	209	61	2,802	3,355	101
523	209	61	198	0	101
524	835	226	331	0	400
525	4,338	10,224	1,589	0	7,382
531	5,522	2,289	1,655	0	4,627
532	1,253	659	529	0	754
533	626	215	0	0	321
541	835	334	0	0	452
542	1,671	545	265	0	844
543	1,879	622	66	0	954
551	626	219	943	273	323
552	4,683	2,796	878	46	4,868
553	17,229	9,623	7,158	3,010	15,977
554	4,716	2,366	3,774	15	3,593
619	2,616	8,779	7,809	3,439	9,983
647	872	1,163	1,373	565	1,675
718	1,453	4,031	2,065	857	4,753
719	146	69	1,467	612	162
727	218	1,278	1,415	612	1,346
728	10,465	12,816	2,390	1,027	19,025
729	3,344	27,155	7,977	3,429	27,695
Total	664,558	761,102	624,665	263,887	1,047,692

1980 INTERNAL ORIGIN AND DESTINATION PATTERN
BY MODE OF TRAVEL
PHOENIX URBAN AREA

TABLE H (Sheet 1)

District	Auto Drivers	Truck Drivers	Total Drivers	Auto Passengers	Transit	Total Persons
001 001	10517	2346	12863	5728		16245
001 002	7629	1939	9568	3803	1080	12512
001 003	1066	403	1469	646	36	1748
001 004	141	140	281	114		255
001 005	218	155	373	207		425
001 006	2911	464	3375	1826		4737
001 007	11195	1707	12902	5882	354	17431
001 008	929	250	1179	495		1424
001 009	429	71	500	198		627
001 010	880	117	997	458		1338
001 011	873	183	1056	450	14	1337
001 012	44	40	84	42		86
001 013	232	38	270	138		370
001 014	2512	482	2994	1244	25	3781
001 015	95	41	136	45	7	147
001 016	1229	156	1385	588		1817
001 017	403	136	539	191		594
001 018	763	201	964	409		1172
001 019	781	155	936	414		1195
001 020	364	67	431	209		573
001 021	286	77	363	135		421
001 022	319	40	359	143		462
001 023	471	115	586	241		712
001 024	1186	325	1511	338		1524
001 025	518	143	661	183		701
001 026	2790	292	3082	985	14	3789
001 027	211	40	251	57		268
001 028	830	175	1005	351		1181
001 029	474	112	586	135		609
001 030	214	28	242	118		332
001 031	547	58	605	191		738
001 032	112	19	131	25		137
001 033	72	31	103	62		134
001 034	170	138	308	141		311
001 035	99	58	157	56		155
001 036	88	54	142	77		165
001 037	198	127	325	170		368
001 038	1289	314	1603	984		2273
001 039	374	72	446	213		587
001 040	4697	1264	5961	3076		7773
001 041	4843	1470	6313	3145		7988
001 042	196	46	242	129		325
002 002	12996	5034	18030	6116	2350	21462
002 003	5972	2040	8012	2438	920	9330
002 004	612	604	1216	304		916
002 005	300	380	680	176		476
002 006	1754	529	2283	771		2525
002 007	13801	4001	17802	5157	270	19228
002 008	2476	1100	3576	1050		3526
002 009	499	103	602	154		653
002 010	1386	385	1771	553		1939
002 011	2701	972	3673	1037		3738
002 012	51	109	160	30		81
002 013	209	76	285	91		300
002 014	2228	976	3204	840		3068
002 015	597	233	830	245		842
002 016	1324	410	1734	497	131	1952
002 017	619	394	1013	239		858
002 018	882	523	1405	358		1240
002 019	873	330	1203	345		1218
002 020	466	184	650	206		672
002 021	490	187	677	173		663
002 022	251	80	331	98		349
002 023	424	214	638	165		589
002 024	1278	836	2114	314		1592
002 025	556	290	846	159	138	853
002 026	2361	562	2923	690	248	3299
002 027	199	89	288	52		251
002 028	865	377	1242	303		1168
002 029	325	205	530	80	57	462
002 030	129	47	176	62		191
002 031	492	145	637	161		653
002 032	108	32	140	22		130
002 033	68	63	131	39		107
002 034	247	260	507	113		360
002 035	94	94	188	36		130
002 036	105	103	208	56		161
002 037	274	244	518	137	68	479
002 038	1691	654	2345	765		2456
002 039	766	253	1019	340		1106
002 040	4664	1777	6441	2044		6708
002 041	3988	1498	5486	1751		5739
002 042	333	156	489	141		474
003 003	8517	5154	13671	4006	1289	13812
003 004	1042	788	1830	689		1731
003 005	281	277	558	204		485
003 006	442	142	584	241		683
003 007	3442	937	4379	1521	28	4991
003 008	3083	860	3943	1510	357	4950
003 009	116	29	145	55		171
003 010	442	111	553	188		630
003 011	2788	693	3481	1272	59	4119
003 012	53	85	138	42		95
003 013	201	56	257	107		308
003 014	945	329	1274	423		1368
003 015	143	57	200	61		204
003 016	1587	291	1878	673	87	2347
003 017	661	318	979	297		958
003 018	554	228	782	279		833
003 019	730	226	956	376		1106
003 020	396	138	534	204		600
003 021	422	139	561	175		597
003 022	224	54	278	105		329
003 023	389	155	544	185		574
003 024	338	159	497	95		433
003 025	458	198	656	154	24	636
003 026	1879	304	2183	579	284	2742
003 027	103	32	135	19		122
003 028	446	138	584	166		612
003 029	280	123	403	80	44	404
003 030	174	41	215	94		268
003 031	424	104	528	155		579
003 032	88	25	113	18		106
003 033	61	47	108	42		103
003 034	119	123	242	76		195
003 035	73	72	145	39		112
003 036	74	76	150	52		126
003 037	217	171	388	133	24	374
003 038	1297	452	1749	733		2030
003 039	871	211	1082	453		1324
003 040	13323	2890	16213	6842		20165
003 041	1097	409	1506	588		1685
003 042	168	54	222	93		261
004 004	1797	1226	3023	1087		2884
004 005	408	806	1214	366		774
004 006	87	81	168	66		153
004 007	506	312	818	242		748
004 008	583	488	1071	446		1029
004 009	54	30	84	30		84
004 010	105	77	182	57		162
004 011	1957	780	2737	1099		3056
004 012	266	411	677	277		543
004 013	521	235	756	308		829
004 014	595	401	996	329		924
004 015	56	55	111	29		85
004 016	1472	470	1942	838		2310
004 017	1101	634	1735	719		1820
004 018	336	282	618	194		530
004 019	818	381	1199	505		1323
004 020	645	254	899	400		1045
004 021	1848	536	2384	1114		2962
004 022	306	140	446	155		461
004 023	562	403	965	289		851
004 024	310	322	632	106		416
004 025	372	303	675	145		517
004 026	1124	452	1576	405		1529
004 027	54	47	101	11		65
004 028	236	195	431	119		355
004 029	160	168	328	61		221
004 030	138	61	199	87		225
004 031	419	162	581	158		577
004 032	76	37	113	16		92
004 033	36	82	118	30		66
004 034	58	155	213	52		110
004 035	44	109	153	36		80
004 036	46	103	149	40		86
004 037	162	266	428	128		290
004 038	714	790	1504	510		1224
004 039	3256	1018	4274	2255		5511
004 040	439	452	891	293		732
004 041	292	266	558	202		494
004 042	91	77	168	64		155
005 005	4730	3861	8591	3047		7777
005 006	111	64	175	91		202
005 007	229	186	415	139		368
005 008	201	189	390	128		329
005 009	73	27	100	47		120
005 010	122	73	195	70		192
005 011	657	309	966	361		1018
005 012	301	331	632	254		555
005 013	4462	531	4993	3085		7547
005 014	667	349	1016	360		1027
005 015	53	42	95	24		77
005 016	641	218	859	346		987
005 017	477	385	862	272		749
005 018	355	238	593	228		583
005 019	564	274	838	365		929
005 020	335	152	487	222		557
005 021	955	271	1226	458		1413
005 022	528	180	708	252		780
005 023	2678	1003	3681	1309		3987
005 024	381	315	696	120		501
005 025	329	263	592	146		475
005 026	1180	395	1575	436		1616
005 027	56	55	111	13		69
005 028	305	204	509	170		475
005 029	153	181	334	61		214
005 030	133	49	182	105		238
005 031	485	134	619	199		684
005 032	113	49	162	25		138
005 033	126	157	283	102		228
005 034	117	176	293	115		232
005 035	60	104	164	47		107
005 036	90	116	206	87		177
005 037	219	276	495	188		407
005 038	1618	1219	2837	1145		2763
005 039	3700	1006	4706	3035		6735
005 040	589	405	994	421		1010
005 041	497	274	771	406		903
005 042	173	69	242	120		293
006 006	5650	909	6559	2791	1644	10085
006 007	8970	1369	10339	4236		13206
006 008	178	64	242	92		270
006 009	2098	144	2242	987	161	3246
006 010	1775	191	1966	915	361	3051
006 011	1225	211	1436	587		1812
006 012	22	26	48	18		40
006 013	122	22	144	53		175
006 014	4173	672	4845	2138	1946	8257
006 015	1169	164	1333	614	217	2000
006 016	972	115	1087	433		1405
006 017	293	93	386	127		420
006 018	759	194	953	379		1138
006 019	611	97	708	289		900
006 020	236	46	282	115		351
006 021	180	45	225	81		261
006 022	158	21	179	64		222
006 023	211	57	268	96		307
006 024	1147	325	1472	317		1464
006 025	366	88	454	121		487
006 026	1987	172	2159	621	64	2672
006 027	429	74	503	145		574
006 028	634	118	752	262		896
006 029	311	70	381	88		399
006 030	141	18	159	71		212
006 031	306	35	341	100		406
006 032	74	10	84	17		91
006 033	40	20	60	24		64
006 034	119	86	205	88		207
006 035	55	39	94	21	65	141
006 036	31	30	61	20		51
006 037	91	67	158	54		145
006 038	701	188	889	459		1160
006 039	221	29	250	109		330
006 040	718	160	878	378		1096
006 041	13435	1735	15170	6876		20311
006 042	546	136	682	334		880
007 007	11800	9043	20843	5553	3780	21133
007 008	6281	1529	7810	3117		9398
007 009	2693	282	2975	1020		3713
007 010	7635	1110	8745	3555	279	11469
007 011	11071	2065	13136	4790	357	16218
007 012	68	86	154	36		104
007 013	234	52	286	87		321
007 014	8855	1934	10789	3906	179	12940
007 015	2890	503	3393	1391	457	4738
007 016	3615	543	4158	1456	161	5232
007 017	1318	455	1773	539		1857
007 018	3338	1023	4361	1546	133	5017
007 019	1687	380	2067	745	128	2560
007 020	517	136	653	219		736
007 021	708	158	866	234		942
007 022	350	74	424	126		476
007 023	420	150	570	148		568
007 024	4363	1640	6003	1225		5588
007 025	843	268	1111	257	71	1171
007 026	4797	683	5480	1461	430	6688
007 027	477	123	600	126		603
007 028	1916	508	2424	721	39	2676
007 029	614	234	848	169	135	918
007 030	262	51	313	126	24	412
007 031	550	107	657	174		724
007 032	128	27	155	28		156
007 033	61	49	110	33		94
007 034	504	292	796	237		741
007 035	196	111	307	63		259
007 036	121	84	205	43		164
007 037	333	184	517	124		457
007 038	1641	517	2158	712		2353
007 039	397	81	478	171		568
007 040	2645	724	3369	1098		3743
007 041	8706	2172	10878	3755		12461
007 042	768	155	923	337		1105
008 008	2506	4850	7356	1256	1950	5712
008 009	103	25	128	42		145
008 010	334	80	414	148		482
008 011	5972	1223	7195	2865	597	9434
008 012	90	115	205	65		155
008 013	190	54	244	84		274
008 014	1258	344	1602	624	18	1900
008 015	227	64	291	94		321
008 016	2171	381	2552	993	33	3197
008 017	1641	549	2190	880		2521
008 018	654	241	895	319		973
008 019	1400	293	1693	753	331	2484
008 020	553	139	692	293		846
008 021	732	165	897	335		1067
008 022	230	54	284	89		319
008 023	312	118	430	120		432
008 024	428	189	617	113	34	575
008 025	579	208	787	226	52	857
008 026	1957	297	2254	598	131	2686
008 027	76	28	104	20		96
008 028	344	119	463	122	51	517
008 029	263	103	366	76	25	364
008 030	173	37	210	88	38	299
008 031	483	99	582	170		653
008 032	78	23	101	19		97
008 033	31	34	65	21		52
008 034	67	88	155	38		105
008 035	67	57	124	33		100
008 036	50	55	105	34		84
008 037	238	153	391	124	144	506
008 038	622	347	969	381		1003
008 039	457	108	565	266		723
008 040	2275	732	3007	1160		3435
008 041	508	215	723	272		780
008 042	130	48	178	68		198
009 009	2272	579	2851	985		3257
009 010	1946	131	2077	823	66	2835
009 011	641	78	719	228		869
009 012	23	12	35	11		34
009 013	84	9	93	36		120
009 014	5292	492	5784	2372		7664
009 015	1373	119	1492	596	105	2074
009 016	796	70	866	287	49	1132
009 017	257	56	313	85		342
009 018	746	133	879	291		1037
009 019	463	61	524	176	18	657
009 020	142	21	163	58		200
009 021	184	24	208	56		240
009 022	102	10	112	43		145
009 023	132	25	157	52		184
009 024	990	206	1196	236		1226
009 025	234	46	280	69	101	404
009 026	1245	107	1352	334		1579
009 027	508	60	568	170		678
009 028	597	81	678	207		804
009 029	168	39	207	39	27	234
009 030	70	10	80	31		101
009 031	155	19	174	54		209
009 032	27	4	31	6		33
009 033	29	8	37	17		46
009 034	155	46	201	74		229
009 035	59	21	80	21		80
009 036	48	17	65	23		71
009 037	130	33	163	53		183
009 038	584	90	674	265		849
009 039	130	15	145	56		186
009 040	395	55	450	167		562
009 041	5365	517	5882	2948		8313
009 042	1063	101	1164	503		1566
010 010	2312	459	2771	1088	188	3588
010 011	1875	272	2147	852		2727
010 012	17	21	38	10		27
010 013	103	15	118	41		144
010 014	3571	673	4244	1659		5230
010 015	4404	487	4891	2291	852	7547
010 016	2554	235	2789	1135		3689
010 017	818	183	1001	367		1185
010 018	2248	441	2689	1159	40	3447
010 019	1138	167	1305	565	50	1753
010 020	365	58	423	160		525
010 021	422	64	486	156		578
010 022	202	26	228	69		271
010 023	217	55	272	79		296
010 024	2464	666	3130	792	96	3352
010 025	531	122	653	188	108	827
010 026	2749	292	3041	920	159	3828
010 027	294	50	344	88		382
010 028	1163	207	1370	493		1656
010 029	387	97	484	111		498
010 030	158	21	179	81		239
010 031	411	49	460	134		545
010 032	66	11	77	16		82
010 033	38	20	58	17		55
010 034	424	137	561	212		636
010 035	149	52	201	64		213
010 036	92	35	127	41		133
010 037	252	77	329	108		360
010 038	816	173	989	345		1161
010 039	193	29	222	85		278
010 040	716	131	847	302		1018
010 041	1856	347	2203	858		2714
010 042	559	107	666	276		835
011 011	11957	7004	18961	5430	1875	19262
011 012	514	327	841	309		823
011 013	554	113	667	232		786
011 014	5957	1119	7076	2852	16	8825
011 015	832	185	1017	366	33	1231
011 016	10887	1551	12438	5121	88	16096
011 017	9295	2044	11339	4423	1487	15205
011 018	2809	718	3527	1391	49	4249
011 019	5757	945	6702	2939	375	9071
011 020	2102	384	2486	1103		3205
011 021	3859	558	4417	1605		5464
011 022	835	179	1014	342		1177
011 023	780	267	1047	312		1092
011 024	1190	503	1693	295	67	1552
011 025	2226	636	2862	904		3130
011 026	7607	1595	9202	2722	343	10672
011 027	216	69	285	52		268
011 028	1088	271	1359	416	17	1521
011 029	560	237	797	161	100	821
011 030	363	82	445	214	14	591
011 031	1135	263	1398	428		1563
011 032	171	48	219	36		207
011 033	136	70	206	55		191
011 034	370	189	559	158		528
011 035	250	121	371	94		344
011 036	232	111	343	97		329
011 037	957	329	1286	410		1367
011 038	2491	694	3185	1133		3624
011 039	958	160	1118	430		1388
011 040	2456	533	2989	1071		3527
011 041	2594	579	3173	1167		3761
011 042	505	114	619	233		738
012 012	590	1265	1855	370		960
012 013	2907	737	3644	1433		4340
012 014	158	160	318	89		247
012 015	6	11	17	4		10
012 016	297	175	472	175		472
012 017	381	350	731	255		636
012 018	101	122	223	64		165
012 019	217	158	375	134		351
012 020	319	165	484	182		501
012 021	1934	844	2778	1187		3121
012 022	1560	756	2316	890		2450
012 023	1217	1463	2680	805		2022
012 024	147	138	285	44		191
012 025	160	163	323	65		225
012 026	532	216	748	187		719
012 027	10	21	31	2		12
012 028	81	84	165	30		111
012 029	102	81	183	23		125
012 030	57	28	85	27		84
012 031	197	120	317	79		276
012 032	88	61	149	21		109
012 033	37	64	101	30		67
012 034	25	64	89	20		45
012 035	16	46	62	9		25
012 036	16	46	62	13		29
012 037	72	137	209	49		121
012 038	369	566	935	260		629
012 039	66	57	123	48		114
012 040	132	143	275	92		224
012 041	110	97	207	78		188
012 042	34	27	61	21		55
013 013	12131	1700	13831	5608	353	18092
013 014	795	123	918	278	8	1081
013 015	50	11	61	18		68
013 016	561	83	644	228		789
013 017	494	123	617	198	15	707
013 018	362	88	450	155		517
013 019	599	103	702	270		869
013 020	477	75	552	196	26	699
013 021	1614	212	1826	623	199	2436
013 022	6867	597	7464	2534	772	10173
013 023	24141	3204	27345	9567		33708
013 024	524	125	649	139		663
013 025	514	111	625	163	25	702
013 026	1549	158	1707	443	12	2004
013 027	101	20	121	21		122
013 028	453	75	528	158		611
013 029	291	73	364	82		373
013 030	175	23	198	90		265
013 031	593	89	682	206		799
013 032	247	47	294	51		298
013 033	787	315	1102	452		1239
013 034	171	63	234	81		252
013 035	117	44	161	44		161
013 036	122	44	166	59		181
013 037	383	119	502	186		569
013 038	3911	935	4846	1775		5686
013 039	882	119	1001	428		1310
013 040	706	108	814	335		1041
013 041	527	87	614	281		808
013 042	196	32	228	97		293

1980 INTERNAL ORIGIN AND DESTINATION PATTERN
BY MODE OF TRAVEL
PHOENIX URBAN AREA

TABLE H (Sheet 2)

District	Auto Drivers	Truck Drivers	Total Drivers	Auto Passengers	Transit	Total Persons
014 014	14809	5397	20206	7116	549	22474
014 015	5839	1175	7014	2769	389	8997
014 016	9085	1019	10104	4161	121	13367
014 017	3264	873	4137	1513		4777
014 018	7061	1879	8940	3331	205	10597
014 019	5494	951	6445	2888	81	8463
014 020	2273	427	2700	1066	63	3402
014 021	2531	428	2959	987	96	3614
014 022	1116	181	1297	397		1513
014 023	1058	339	1397	353		1411
014 024	8633	3132	11765	2927	275	11835
014 025	2023	672	2695	659	120	2802
014 026	7226	1464	8690	2249	342	9817
014 027	4824	880	5704	1951	141	6916
014 028	5020	1201	6221	2128		7148
014 029	1630	653	2283	490	87	2207
014 030	664	149	813	351	57	1072
014 031	1852	341	2193	643		2495
014 032	356	80	436	78		434
014 033	308	119	427	118		426
014 034	2060	844	2904	929		2989
014 035	682	326	1008	270	35	987
014 036	578	233	811	217		795
014 037	1738	545	2283	713	13	2464
014 038	4816	1172	5988	1941		6757
014 039	899	148	1047	390		1289
014 040	2101	455	2556	772		2873
014 041	7539	1568	9107	3690		11229
014 042	7611	1213	8824	4669		12280
015 015	4592	2811	7403	2409	676	7677
015 016	1570	202	1772	712		2282
015 017	455	147	602	200		655
015 018	4706	867	5573	2874	427	8007
015 019	1146	227	1373	628	37	1811
015 020	258	64	322	116	33	407
015 021	296	70	366	107		403
015 022	122	24	146	44		166
015 023	586	157	743	247		833
015 024	3608	1237	4845	1343	80	5031
015 025	1821	388	2209	900	135	2856
015 026	5609	1022	6631	2292	672	8573
015 027	392	89	481	112		504
015 028	2192	370	2562	1025	87	3304
015 029	190	112	302	64		254
015 030	87	25	112	50		137
015 031	194	53	247	63		257
015 032	40	13	53	9		49
015 033	47	18	65	20		67
015 034	365	150	515	171		536
015 035	96	56	152	39		135
015 036	87	40	127	34		121
015 037	233	88	321	88		321
015 038	575	154	729	252		827
015 039	165	26	191	66		231
015 040	1334	238	1572	575		1909
015 041	2654	537	3191	1305		3959
015 042	1401	226	1627	725		2126
016 016	6083	2146	8229	2830	196	9109
016 017	5999	1202	7201	2722	206	8927
016 018	7008	968	7976	3337	271	10616
016 019	8505	978	9483	4389	148	13042
016 020	2121	287	2408	1117	19	3257
016 021	2947	357	3304	1223		4170
016 022	665	122	787	282		947
016 023	706	202	908	308		1014
016 024	1539	458	1997	424	8	1971
016 025	2537	538	3075	1137	125	3799
016 026	5275	1010	6285	1950	795	8020
016 027	279	68	347	69		348
016 028	1888	270	2158	788	52	2728
016 029	502	262	764	172	23	697
016 030	339	71	410	235	24	598
016 031	752	177	929	367	27	1146
016 032	119	41	160	24		143
016 033	190	57	247	95		285
016 034	565	164	729	247		812
016 035	334	112	446	145		479
016 036	349	87	436	162		511
016 037	1232	272	1504	543		1775
016 038	2958	495	3453	1292		4250
016 039	915	116	1031	430		1345
016 040	2167	333	2500	942		3109
016 041	2329	427	2756	1011		3340
016 042	1319	135	1454	567		1886
017 017	4497	4358	8855	2372	734	7603
017 018	1749	665	2414	830		2579
017 019	6085	1427	7512	3065	219	9369
017 020	4450	901	5351	2423	110	6983
017 021	6482	1092	7574	3163	405	10050
017 022	877	227	1104	395		1272
017 023	771	385	1156	294		1065
017 024	1123	544	1667	292		1415
017 025	2784	992	3776	1240	172	4196
017 026	3727	901	4628	1190	386	5303
017 027	186	59	245	40		226
017 028	884	298	1182	306	34	1224
017 029	609	295	904	175	64	848
017 030	425	133	558	212		637
017 031	1242	341	1583	429	48	1719
017 032	212	85	297	47		259
017 033	128	112	240	62		190
017 034	255	212	467	114		369
017 035	233	157	390	98	8	339
017 036	222	143	365	99		321
017 037	882	434	1316	400		1282
017 038	2107	742	2849	838		2945
017 039	605	155	760	267		872
017 040	1225	382	1607	509		1734
017 041	965	323	1288	383		1348
017 042	265	81	346	107		372
018 018	7498	4401	11899	3757	47	11302
018 019	8759	1560	10319	4687	52	13498
018 020	1560	401	1961	850	102	2512
018 021	1358	370	1728	601	59	2018
018 022	493	148	641	207		700
018 023	735	361	1096	306		1041
018 024	6147	3335	9482	2234	61	8442
018 025	2527	1079	3606	1176	566	4269
018 026	9860	3876	13736	4056	1112	15028
018 027	495	196	691	173		668
018 028	2831	949	3780	1472	17	4320
018 029	985	767	1752	315	118	1418
018 030	387	130	517	214		601
018 031	960	310	1270	421		1381
018 032	153	68	221	34		187
018 033	160	102	262	91		251
018 034	940	533	1473	520		1460
018 035	559	283	842	270	29	858
018 036	389	197	586	183		572
018 037	1049	464	1513	493	86	1628
018 038	2152	910	3062	1105		3257
018 039	409	114	523	204		613
018 040	1214	356	1570	551		1765
018 041	1735	562	2297	804		2539
018 042	1351	439	1790	692		2043
019 019	11519	3803	15322	6166	142	17827
019 020	7437	873	8310	4055	539	12031
019 021	5088	685	5773	2377	88	7553
019 022	976	203	1179	453		1429
019 023	1414	473	1887	612		2026
019 024	2150	930	3080	704		2854
019 025	10121	1951	12072	4923	354	15398
019 026	10220	2521	12741	4075	1928	16223
019 027	239	85	324	68	23	330
019 028	2033	469	2502	963	139	3135
019 029	1071	569	1640	405	182	1658
019 030	927	188	1115	632	246	1805
019 031	2015	457	2472	1011		3026
019 032	279	101	380	59		338
019 033	300	129	429	153		453
019 034	1005	378	1383	504		1509
019 035	977	300	1277	488		1465
019 036	600	202	802	297		897
019 037	2596	643	3239	1279	38	3913
019 038	4523	1073	5596	2082		6605
019 039	826	132	958	419		1245
019 040	1983	382	2365	909		2892
019 041	1947	415	2362	901		2848
019 042	1647	293	1940	808		2455
020 020	4451	2312	6763	2244	308	7003
020 021	11507	1208	12715	5540	71	17118
020 022	2165	309	2474	981		3146
020 023	2014	571	2585	905		2919
020 024	1156	443	1599	370	15	1541
020 025	4452	837	5289	2077	473	7002
020 026	4085	723	4808	1597	611	6293
020 027	194	56	250	50		244
020 028	1192	270	1462	503	32	1727
020 029	622	249	871	244		866
020 030	796	145	941	525		1321
020 031	3111	650	3761	1465	29	4605
020 032	472	153	625	101		573
020 033	399	139	538	219		618
020 034	580	222	802	306		886
020 035	611	172	783	317		928
020 036	500	162	662	269		769
020 037	3460	617	4077	1715	54	5229
020 038	3579	748	4327	1711		5290
020 039	501	77	587	246		747
020 040	1168	226	1394	559		1727
020 041	827	166	993	407		1234
020 042	420	93	513	215		635
021 021	9611	4481	14092	4429	1804	15844
021 022	9198	1194	10392	4068	721	13987
021 023	3292	1028	4320	1362		4654
021 024	1279	383	1662	325	22	1626
021 025	2472	584	3056	955	335	3762
021 026	4462	594	5056	1362	417	6241
021 027	198	50	248	45		243
021 028	1058	230	1288	354	37	1449
021 029	630	201	831	179		809
021 030	501	98	599	260	21	782
021 031	3639	771	4410	1379	221	5239
021 032	1117	294	1411	255	21	1393
021 033	782	334	1116	420		1202
021 034	318	177	495	132		450
021 035	326	134	460	135		461
021 036	274	117	391	117		391
021 037	3182	900	4082	1554		4736
021 038	4114	1030	5144	1758		5872
021 039	552	88	640	235		787
021 040	1268	252	1520	506		1774
021 041	798	184	982	325		1123
021 042	351	78	429	149		500
022 022	6390	4994	11384	3007	1052	10449
022 023	7811	2254	10065	3445		11256
022 024	541	187	728	151		692
022 025	637	182	819	224	95	956
022 026	1911	291	2202	673	351	2935
022 027	90	24	114	20		110
022 028	558	111	669	187		745
022 029	260	97	357	83		343
022 030	183	39	222	116		299
022 031	869	205	1074	329		1198
022 032	331	86	417	72	75	478
022 033	660	237	897	319		979
022 034	325	86	411	124		449
022 035	175	57	232	63		238
022 036	216	57	273	89		305
022 037	868	264	1132	351		1219
022 038	2659	560	3219	1150		3809
022 039	268	39	307	119		387
022 040	719	106	825	305		1024
022 041	651	98	749	288		939
022 042	262	37	299	109		371
023 023	35234	6219	41453	15480		50714
023 024	818	476	1294	230		1048
023 025	963	454	1417	313		1276
023 026	3648	924	4572	1222		4870
023 027	143	69	212	30		173
023 028	866	295	1161	303		1169
023 029	418	263	681	133		551
023 030	286	97	383	171		457
023 031	1277	518	1795	473		1750
023 032	1864	462	2326	402		2266
023 033	3539	1710	5249	1847		5386
023 034	406	235	641	171		577
023 035	267	157	424	100		367
023 036	302	152	454	131		433
023 037	1010	553	1563	428		1438
023 038	14043	5082	19125	5837		19880
023 039	1617	266	1883	695		2312
023 040	1324	320	1644	581		1905
023 041	1049	263	1312	500		1549
023 042	412	103	515	182		594
024 024	7402	6323	13725	2411	193	10006
024 025	1689	1132	2821	515	560	2764
024 026	7021	4202	11223	2138	714	9873
024 027	1311	552	1863	371	36	1718
024 028	9246	2882	12128	3260	210	12716
024 029	881	1003	1884	225	37	1143
024 030	301	186	487	142		443
024 031	546	381	927	170		716
024 032	116	86	202	17		133
024 033	221	125	346	70		291
024 034	2469	1204	3673	821		3290
024 035	788	442	1230	234	32	1054
024 036	655	306	961	188		843
024 037	1650	652	2302	469	150	2269
024 038	3235	1312	4547	902		4137
024 039	419	141	560	120		539
024 040	1672	528	2200	457		2129
024 041	2670	906	3576	724		3394
024 042	2797	830	3627	866		3663
025 025	5470	3090	8560	2433	469	8372
025 026	9686	4802	14488	3775	1587	15048
025 027	312	138	450	80	454	846
025 028	1740	702	2442	645	976	3361
025 029	1375	1326	2701	424	1578	3377
025 030	927	431	1358	486	332	1745
025 031	1832	765	2597	748	211	2791
025 032	216	149	365	43		259
025 033	252	121	373	86		338
025 034	894	466	1360	321		1215
025 035	653	341	994	255	65	973
025 036	643	290	933	230		873
025 037	2618	911	3529	999	256	3873
025 038	2993	1210	4203	997		3990
025 039	450	122	572	172		622
025 040	1256	371	1627	422		1678
025 041	1295	398	1693	437		1732
025 042	882	272	1154	334		1216
026 026	7713	8736	16449	2646	72	10431
026 027	1034	303	1337	246	91	1371
026 028	9099	2138	11237	3169	758	13026
026 029	3102	3716	6818	873	336	4311
026 030	878	397	1275	515	196	1589
026 031	1274	644	1918	594	128	1996
026 032	236	145	381	34		270
026 033	697	177	874	229		926
026 034	4599	949	5548	1541	176	6316
026 035	3308	767	4075	1138	183	4629
026 036	2572	483	3055	845		3417
026 037	6004	12429	18433	1955	246	8025
026 038	10016	1713	11729	3215		13231
026 039	1464	182	1646	492		1956
026 040	4529	580	5109	1471		6000
026 041	5853	763	6616	1865		7718
026 042	4597	587	5184	1565		6162
027 027	1295	1022	2317	515	157	1967
027 028	4875	946	5821	1809	141	6825
027 029	361	241	602	97		458
027 030	89	52	141	29	15	133
027 031	75	57	132	19		94
027 032	19	11	30	4		23
027 033	14	20	34	4		18
027 034	1017	301	1318	360		1377
027 035	280	106	386	75		355
027 036	258	79	337	72		330
027 037	439	118	557	110		549
027 038	691	247	938	184		875
027 039	87	22	109	23		110
027 040	433	86	519	112		545
027 041	689	154	843	211		900
027 042	682	141	823	259		941
028 028	9572	3551	13123	4378	328	14278
028 029	3662	1773	5435	1308	82	5052
028 030	1132	312	1444	641		1773
028 031	1153	296	1449	419	16	1588
028 032	157	57	214	30		187
028 033	158	80	238	68	16	242
028 034	4527	1410	5937	2444		6971
028 035	1709	611	2320	778		2487
028 036	1295	461	1756	542		1837
028 037	1954	608	2562	757	142	2853
028 038	3464	1060	4524	1281		4745
028 039	407	90	497	166		573
028 040	1337	316	1653	496		1833
028 041	2048	509	2557	815		2863
028 042	1801	407	2208	844		2645
029 029	1359	2034	3393	496	33	1888
029 030	744	456	1200	534	8	1286
029 031	401	353	754	201		602
029 032	31	56	87	4		35
029 033	152	77	229	52		204
029 034	1589	868	2457	576	32	2197
029 035	1318	735	2053	511	65	1894
029 036	977	463	1440	332		1309
029 037	1664	661	2325	541	29	2234
029 038	2064	985	3049	652		2716
029 039	193	81	274	61		254
029 040	726	245	971	221		947
029 041	929	301	1230	275		1204
029 042	637	187	824	179		816
030 030	285	1053	1338	119		404
030 031	694	235	929	620		1314
030 032	23	29	52	3		26
030 033	98	26	124	59		157
030 034	547	161	708	282	55	884
030 035	501	142	643	303		804
030 036	798	134	932	484		1282
030 037	1641	321	1962	955		2596
030 038	1384	310	1694	820		2204
030 039	135	27	162	88		223
030 040	369	67	436	206		575
030 041	408	70	478	235		643
030 042	254	39	293	120		374
031 031	1017	1288	2305	518		1535
031 032	248	257	505	39		287
031 033	321	102	423	114		435
031 034	1285	298	1583	417		1702
031 035	809	214	1023	286		1095
031 036	1138	226	1364	391		1529
031 037	5188	1238	6426	1951	118	7257
031 038	3700	728	4428	1326		5026
031 039	367	61	428	160		527
031 040	1425	174	1599	470		1895
031 041	1104	146	1250	392		1496
031 042	569	76	645	187		756
032 032	930	131	1061	402		1332
032 033	310	74	384	86		396
032 034	194	139	333	46		240
032 035	77	33	110	16		93
032 036	104	34	138	25		129
032 037	590	372	962	135		725
032 038	5262	1340	6602	1304		6566
032 039	106	18	124	22		128
032 040	231	48	279	55		286
032 041	192	46	238	43		235
032 042	103	17	120	22		125
033 033	1237	780	2017	672		1909
033 034	51	74	125	32		83
033 035	38	46	84	22		60
033 036	32	47	79	26		58
033 037	165	162	327	101		266
033 038	4507	2175	6682	2536		7043
033 039	107	55	162	62		169
033 040	199	95	294	124		323
033 041	156	78	234	118		274
033 042	73	27	100	43		116
034 034	4326	4281	8607	2648	544	7518
034 035	5007	2168	7175	3325	2277	10609
034 036	8089	4068	12157	5535	3165	16789
034 037	4523	2725	7248	3222		7745
034 038	1217	905	2122	705		1922
034 039	164	83	247	101		265
034 040	475	277	752	277		752
034 041	565	346	911	321		886
034 042	366	204	570	219		585
035 035	2758	2134	4892	1515	1992	6265
035 036	4099	1298	5397	2664	320	7083
035 037	4321	1420	5741	2790	2225	9336
035 038	1386	626	2012	708		2094
035 039	110	47	157	55		165
035 040	300	135	435	148		448
035 041	272	151	423	137		409
035 042	139	83	222	73		212
036 036	3873	1365	5238	2301		6174
036 037	7618	2706	10324	5204		12822
036 038	1368	714	2082	810		2178
036 039	129	50	179	76		205
036 040	279	128	407	171		450
036 041	268	151	419	171		439
036 042	123	65	188	72		195
037 037	14096	5404	19500	8274	3686	26056
037 038	12206	4976	17182	6839		19045
037 039	321	115	436	178		499
037 040	725	341	1066	422		1147
037 041	627	298	925	388		1015
037 042	305	132	437	163		468
038 038	217073	19121	236194	102151		319224
038 039	1736	436	2172	905		2641
038 040	2851	867	3718	1566		4417
038 041	2574	727	3301	1683		4257
038 042	1183	290	1473	681		1864
039 039	6880	1305	8185	3930		10810
039 040	1145	257	1402	596		1741
039 041	596	123	719	338		934
039 042	201	35	236	107		308
040 040	21761	3846	25607	10266		32027
040 041	10787	2031	12818	6492		17279
040 042	672	158	830	341		1013
041 041	32616	5344	37960	15965		48581
041 042	3611	775	4386	2196		5807
042 042	5964	1410	7374	2846		8810
000 000	1818530	519288	2337818	831318	76656	2726324*

* Excludes Truck Driver Trips

1980 EXTERNAL ORIGIN AND DESTINATION PATTERN
BY MODE OF TRAVEL
PHOENIX URBAN AREA

TABLE I (Sheet 1)

External Station	Internal District	Auto Drivers	Truck Drivers	Total Drivers
40	001	3	2	5
40	002	4	2	6
40	003	1		1
40	004			
40	005			
40	006	3	2	5
40	007	5	3	8
40	008	2		2
40	009	3	2	5
40	010	3	1	4
40	011	6	2	8
40	012			
40	013	2	1	3
40	014	14	9	23
40	015	5	3	8
40	016	6	3	9
40	017	3	2	5
40	018	8	2	10
40	019	6	2	8
40	020	4	1	5
40	021	4	2	6
40	022	2	1	3
40	023	5	3	8
40	024	12	5	17
40	025	5	1	6
40	026	26	12	38
40	027	3	2	5
40	028	9	5	14
40	029	5	1	6
40	030	2		2
40	031	5	2	7
40	032			
40	033			
40	034	24	13	37
40	035	4	1	5
40	036	7	5	12
40	037	7	5	12
40	038	14	8	22
40	039	1		1
40	040	4	2	6
40	041	8	3	11
40	042	3	2	5
41	001	11	6	17
41	002	15	10	25
41	003	6	4	10
41	004	2	0	2
41	005	2	0	2
41	006	13	8	21
41	007	20	15	35
41	008	6	4	10
41	009	11	6	17
41	010	11	8	19
41	011	19	12	31
41	012	0	0	0
41	013	8	4	12
41	014	60	40	100
41	015	19	12	31
41	016	23	17	40
41	017	13	8	21
41	018	25	19	44
41	019	18	15	33
41	020	11	8	19
41	021	17	10	27
41	022	9	6	15
41	023	17	10	27
41	024	50	31	81
41	025	19	12	31
41	026	83	54	137
41	027	29	22	51
41	028	38	29	67
41	029	19	12	31
41	030	11	4	15
41	031	17	10	27
41	032	2	2	4
41	033	0	0	0
41	034	112	77	189
41	035	19	12	31
41	036	31	23	54
41	037	29	21	50
41	038	52	37	89
41	039	4	2	6
41	040	15	10	25
41	041	27	21	48
41	042	17	12	29
42	001	22	21	43
42	002	33	31	64
42	003	15	15	30
42	004	5	5	10
42	005	7	7	14
42	006	26	24	50
42	007	43	43	86
42	008	12	12	24
42	009	23	22	45
42	010	21	21	42
42	011	38	38	76
42	012	3	3	6
42	013	15	15	30
42	014	159	156	315
42	015	37	37	74
42	016	47	46	93
42	017	24	24	48
42	018	62	61	123
42	019	44	43	87
42	020	25	25	50
42	021	31	31	62
42	022	16	15	31
42	023	35	34	69
42	024	110	107	217
42	025	39	38	77
42	026	176	175	351
42	027	71	70	141
42	028	100	98	198
42	029	41	41	82
42	030	17	16	33
42	031	34	34	68
42	032	5	5	10
42	033	4	4	8
42	034	182	178	360
42	035	37	37	74
42	036	45	43	88
42	037	48	48	96
42	038	109	107	216
42	039	9	8	17
42	040	28	27	55
42	041	58	58	116
42	042	35	34	69
59	001	61	21	82
59	002	108	33	141
59	003	38	13	51
59	004	12	4	16
59	005	14	5	19
59	006	31	11	42
59	007	76	25	101
59	008	25	8	33
59	009	18	6	24
59	010	27	9	36
59	011	52	18	70
59	012	1	1	2
59	013	25	9	34
59	014	63	21	84
59	015	40	14	54
59	016	61	20	81
59	017	34	11	45
59	018	53	16	69
59	019	40	13	53
59	020	25	8	33
59	021	36	12	48
59	022	16	5	21
59	023	46	16	62
59	024	69	23	92
59	025	32	11	43
59	026	145	48	193
59	027	9	3	12
59	028	44	15	59
59	029	23	8	31
59	030	11	4	15
59	031	28	9	37
59	032	4	2	6
59	033	4	1	5
59	034	19	7	26
59	035	12	4	16
59	036	10	4	14
59	037	28	10	38
59	038	107	36	143
59	039	172	57	229
59	040	193	64	257
59	041	82	28	110
59	042	18	6	24
60	001	272	106	378
60	002	528	206	734
60	003	178	69	247
60	004	48	18	66
60	005	59	24	83
60	006	133	52	185
60	007	318	124	442
60	008	102	40	142
60	009	75	29	104
60	010	117	46	163
60	011	220	86	306
60	012	18	7	25
60	013	101	39	140
60	014	272	106	378
60	015	175	69	244
60	016	267	103	370
60	017	143	56	199
60	018	221	87	308
60	019	166	65	231
60	020	90	35	125
60	021	145	56	201
60	022	60	23	83
60	023	186	72	258
60	024	295	115	410
60	025	131	52	183
60	026	627	243	870
60	027	42	17	59
60	028	182	71	253
60	029	102	40	142
60	030	45	18	63
60	031	110	44	154
60	032	17	7	24
60	033	16	6	22
60	034	83	31	114
60	035	50	19	69
60	036	44	18	62
60	037	122	48	170
60	038	425	165	590
60	039	99	39	138
60	040	3032	792	3824
60	041	352	139	491
60	042	74	29	103
61	001	66	46	112
61	002	110	77	187
61	003	42	29	71
61	004	13	9	22
61	005	16	11	27
61	006	34	24	58
61	007	84	59	143
61	008	27	18	45
61	009	19	14	33
61	010	29	20	49
61	011	57	39	96
61	012	4	3	7
61	013	27	20	47
61	014	69	48	117
61	015	44	31	75
61	016	67	46	113
61	017	37	25	62
61	018	56	39	95
61	019	43	30	73
61	020	26	45	71
61	021	39	27	66
61	022	17	12	29
61	023	52	36	88
61	024	74	51	125
61	025	35	24	59
61	026	158	111	269
61	027	10	7	17
61	028	47	34	81
61	029	24	18	42
61	030	13	8	21
61	031	30	20	50
61	032	5	3	8
61	033	4	3	7
61	034	20	15	35
61	035	13	9	22
61	036	11	8	19
61	037	31	21	52
61	038	117	83	200
61	039	189	131	320
61	040	212	148	360
61	041	91	63	154
61	042	19	14	33
62	001	69	19	88
62	002	101	28	129
62	003	71	20	91
62	004	32	8	40
62	005	34	10	44
62	006	41	12	53
62	007	97	27	124
62	008	50	14	64
62	009	23	6	29
62	010	34	10	44
62	011	115	32	147
62	012	10	3	13
62	013	56	16	72
62	014	97	26	123
62	015	59	16	75
62	016	117	32	149
62	017	78	22	100
62	018	83	24	107
62	019	78	23	101
62	020	51	15	66
62	021	78	21	99
62	022	34	9	43
62	023	102	28	130
62	024	105	30	135
62	025	64	18	82
62	026	252	68	320
62	027	17	5	22
62	028	68	20	88
62	029	40	11	51
62	030	23	6	29
62	031	60	17	77
62	032	8	3	11
62	033	9	2	11
62	034	27	7	34
62	035	22	6	28
62	036	21	6	27
62	037	59	17	76
62	038	222	63	285
62	039	216	60	276
62	040	415	116	531
62	041	117	32	149
62	042	31	8	39
63	001	17	6	23
63	002	26	9	35
63	003	18	6	24
63	004	9	2	11
63	005	20	7	27
63	006	11	4	14
63	007	25	9	33
63	008	12	5	16
63	009	6	2	8
63	010	9	3	12
63	011	29	10	39
63	012	4	1	5
63	013	29	11	40
63	014	24	8	32
63	015	16	5	21
63	016	31	11	42
63	017	20	7	27
63	018	74	27	100
63	019	21	7	27
63	020	13	5	18
63	021	26	10	36
63	022	12	4	16
63	023	51	19	70
63	024	25	10	35
63	025	16	6	22
63	026	68	29	90
63	027	4	1	5
63	028	17	6	23
63	029	11	3	14
63	030	6	2	8
63	031	16	5	21
63	032	3	1	4
63	033	5	2	7
63	034	8	2	10
63	035	7	2	9
63	036	6	2	8
63	037	18	6	24
63	038	102	36	138
63	039	38	11	49
63	040	40	14	54
63	041	29	11	40
63	042	6	2	8
64	001	5	1	6
64	002	7	2	9
64	003	5	1	6
64	004	3	1	4
64	005	6	2	8
64	006	4	2	6
64	007	9	2	11
64	008	5	1	6
64	009	3	1	4
64	010	4	1	5
64	011	13	3	16
64	012	1		1
64	013	22	6	28
64	014	13	3	16
64	015	8	2	10
64	016	14	3	17
64	017	10	2	12
64	018	13	2	15
64	019	14	3	17
64	020	10	4	14
64	021	17	5	22
64	022	14	4	18
64	023	72	20	92
64	024	15	4	19
64	025	11	4	15
64	026	45	12	57
64	027	2		2
64	028	11	3	14
64	029	7	1	8
64	030	5		5
64	031	12	4	16
64	032	3	1	4
64	033	7	2	9
64	034	5	1	6
64	035	4		4
64	036	4		4
64	037	12	4	16
64	038	734	196	930
64	039	6	2	8
64	040	9	3	12
64	041	10	3	13
64	042	4	1	5
65	001	61	13	74
65	002	97	19	116
65	003	72	14	86
65	004	41	9	50
65	005	69	14	83
65	006	62	11	73
65	007	125	24	149
65	008	57	11	68
65	009	42	8	50
65	010	58	11	69
65	011	165	31	196
65	012	22	4	26
65	013	182	35	217
65	014	183	35	218
65	015	106	20	126
65	016	180	35	215
65	017	123	24	147
65	018	180	36	216
65	019	166	31	197
65	020	125	24	149
65	021	201	39	240
65	022	111	23	134
65	023	416	79	495
65	024	221	44	265
65	025	156	30	186
65	026	600	114	714
65	027	36	8	44
65	028	166	33	199
65	029	112	23	135
65	030	64	13	77
65	031	166	33	199
65	032	32	6	38
65	033	62	11	73
65	034	80	15	95
65	035	63	11	74
65	036	61	11	72
65	037	226	43	269
65	038	13445	2585	16030
65	039	775	155	930
65	040	136	23	159
65	041	145	28	173
65	042	57	10	67
66	001	53	15	68
66	002	35	9	44
66	003	62	18	80
66	004	35	9	44
66	005	58	17	75
66	006	53	15	67
66	007	111	33	144
66	008	48	14	62
66	009	36	11	47
66	010	49	14	63
66	011	133	40	173
66	012	22	6	28
66	013	157	46	203
66	014	157	46	203
66	015	87	25	112
66	016	156	46	202
66	017	102	29	131
66	018	153	44	197
66	019	144	42	186
66	020	106	31	137
66	021	172	50	222
66	022	106	31	137
66	023	355	104	459
66	024	191	56	247
66	025	134	40	174
66	026	517	153	670
66	027	31	9	40
66	028	126	37	163
66	029	96	28	124
66	030	56	16	72
66	031	141	41	182
66	032	28	8	36
66	033	39	11	50
66	034	68	20	88
66	035	51	15	66
66	036	49	14	63
66	037	197	57	254
66	038	2513	739	3252
66	039	64	19	83
66	040	100	30	130
66	041	124	37	161
66	042	50	15	65
67	001	91	27	118
67	002	132	39	171
67	003	95	29	124
67	004	55	16	71
67	005	75	23	98
67	006	82	24	106
67	007	167	49	216
67	008	74	21	95
67	009	54	16	70
67	010	76	22	98
67	011	220	65	285
67	012	32	9	41
67	013	111	33	144
67	014	219	65	284
67	015	142	42	184
67	016	240	71	311
67	017	163	48	211
67	018	248	72	320
67	019	227	67	294
67	020	163	48	211
67	021	266	78	344
67	022	149	44	193
67	023	531	156	687
67	024	299	88	387
67	025	211	63	274
67	026	515	152	667
67	027	51	15	66
67	028	227	67	294
67	029	149	44	193
67	030	87	26	113
67	031	222	65	287
67	032	43	13	56
67	033	71	21	92
67	034	107	32	139
67	035	82	24	106
67	036	80	24	104
67	037	306	91	397
67	038	4883	1443	6326
67	039	100	29	129
67	040	152	45	197
67	041	198	58	256
67	042	74	22	96
68	001	120	35	155
68	002	180	53	233
68	003	132	39	171
68	004	57	17	74
68	005	73	21	94
68	006	113	33	146
68	007	213	68	281
68	008	109	32	141
68	009	79	23	102
68	010	112	33	145
68	011	330	97	427
68	012	87	11	98
68	013	208	62	270
68	014	354	104	458
68	015	208	61	269
68	016	348	103	451
68	017	232	68	300
68	018	364	106	470
68	019	344	99	443
68	020	254	75	329
68	021	379	111	490
68	022	213	62	275
68	023	487	142	629
68	024	451	131	582
68	025	330	97	427
68	026	1239	362	1591

1980 EXTERNAL ORIGIN AND DESTINATION PATTERN
BY MODE OF TRAVEL
PHOENIX URBAN AREA

TABLE I (Sheet 2)

External Station	Internal District	Auto Drivers	Truck Drivers	Total Drivers
68	027	74	22	96
68	028	344	102	446
68	029	232	68	300
68	030	143	41	184
68	031	372	109	481
68	032	85	25	110
68	033	77	23	100
68	034	160	48	208
68	035	192	57	249
68	036	213	63	276
68	037	1,293	387	1,680
68	038	3,135	918	4,053
68	039	87	26	113
68	040	296	66	362
68	041	220	73	293
68	042	109	32	141
69	001	7	4	11
69	002	10	6	16
69	003	5	2	7
69	004	2		2
69	005	2	1	3
69	006	6	4	10
69	007	14	8	22
69	008	4	2	6
69	009	5	3	8
69	010	7	4	11
69	011	12	7	19
69	012	1		1
69	013	5	3	8
69	014	29	16	45
69	015	12	6	18
69	016	15	8	23
69	017	9	4	13
69	018	19	9	28
69	019	14	7	21
69	020	8	4	12
69	021	10	6	16
69	022	5	3	8
69	023	12	6	18
69	024	24	14	38
69	025	9	5	14
69	026	51	27	78
69	027	8	4	12
69	028	18	11	29
69	029	9	5	14
69	030	4	2	6
69	031	10	6	16
69	032	1	1	2
69	033	2		2
69	034	39	21	60
69	035	9	5	14
69	036	12	7	19
69	037	16	9	25
69	038	36	20	56
69	039	3	1	4
69	040	9	5	14
69	041	18	10	28
69	042	8	5	13
70	001	150	85	235
70	002	189	108	297
70	003	99	57	156
70	004	35	20	55
70	005	37	20	57
70	006	175	100	275
70	007	251	143	394
70	008	72	41	113
70	009	114	66	180
70	010	118	67	185
70	011	327	128	455
70	012	18	10	28
70	013	90	51	141
70	014	643	365	1,008
70	015	207	118	325
70	016	271	154	425
70	017	137	78	215
70	018	325	185	510
70	019	248	142	390
70	020	127	73	200
70	021	183	104	287
70	022	94	53	147
70	023	200	114	314
70	024	459	262	721
70	025	197	102	299
70	026	937	533	1,470
70	027	189	108	297
70	028	303	172	475
70	029	172	98	270
70	030	78	44	122
70	031	166	94	260
70	032	25	14	39
70	033	23	13	36
70	034	157	89	246
70	035	85	49	134
70	036	71	41	112
70	037	188	107	295
70	038	592	339	931
70	039	48	28	76
70	040	217	124	341
70	041	540	308	848
70	042	516	294	810
71	001	82	37	119
71	002	97	43	140
71	003	51	23	74
71	004	17	8	25
71	005	19	8	27
71	006	94	42	136
71	007	128	57	185
71	008	303	143	446
71	009	71	29	100
71	010	64	27	91
71	011	1,177	522	1,699
71	012	6	3	9
71	013	48	21	69
71	014	438	195	633
71	015	109	48	157
71	016	143	65	208
71	017	53	23	76
71	018	193	77	270
71	019	127	56	183
71	020	92	42	134
71	021	54	23	77
71	022	47	21	68
71	023	107	47	154
71	024	248	108	356
71	025	64	41	105
71	026	499	221	720
71	027	150	59	209
71	028	166	74	240
71	029	85	38	123
71	030	41	18	59
71	031	88	40	128
71	032	12	6	18
71	033	13	6	19
71	034	85	39	124
71	035	46	19	65
71	036	37	16	53
71	037	69	44	143
71	038	366	136	442
71	039	56	19	38
71	040	113	51	164
71	041	330	147	477
71	042	661	295	956
72	001	85	23	108
72	002	103	27	130
72	003	53	15	68
72	004	19	5	24
72	005	20	5	25
72	006	106	28	134
72	007	136	36	172
72	008	39	11	50
72	009	88	23	111
72	010	66	17	83
72	011	124	32	156
72	012	30	3	33
72	013	49	13	62
72	014	720	181	901
72	015	117	32	149
72	016	151	40	191
72	017	77	21	98
72	018	185	50	235
72	019	136	36	172
72	020	75	20	95
72	021	100	26	126
72	022	49	13	62
72	023	111	29	140
72	024	202	74	276
72	025	112	30	142
72	026	534	141	675
72	027	79	21	100
72	028	157	41	198
72	029	85	23	108
72	030	35	9	44
72	031	79	22	101
72	032	14	3	17
72	033	13	4	17
72	034	71	19	90
72	035	40	11	51
72	036	35	9	44
72	037	93	23	116
72	038	280	74	354
72	039	77	21	98
72	040	119	31	150
72	041	405	107	512
72	042	744	197	941
73	001	122	45	167
73	002	145	49	194
73	003	77	28	105
73	004	26	9	35
73	005	27	12	39
73	006	141	52	193
73	007	191	70	261
73	008	55	21	76
73	009	148	55	203
73	010	90	33	123
73	011	174	65	239
73	012	13	5	18
73	013	71	26	97
73	014	672	249	921
73	015	162	60	222
73	016	214	80	294
73	017	109	41	150
73	018	256	94	350
73	019	190	71	261
73	020	106	39	145
73	021	140	52	192
73	022	70	26	96
73	023	159	59	218
73	024	359	133	492
73	025	157	58	215
73	026	737	270	1,007
73	027	81	31	112
73	028	216	80	296
73	029	1,20	44	164
73	030	50	18	68
73	031	113	42	155
73	032	19	7	26
73	033	19	7	26
73	034	98	38	136
73	035	60	23	83
73	036	51	19	70
73	037	111	40	151
73	038	390	147	546
73	039	38	14	52
73	040	169	65	234
73	041	669	248	917
73	042	1,464	537	1,991
74	001	23	8	31
74	002	25	10	35
74	003	14	5	19
74	004	5	2	7
74	005	5	1	6
74	006	27	11	38
74	007	35	14	49
74	008	10	4	14
74	009	27	11	38
74	010	17	6	23
74	011	31	12	43
74	012	2		2
74	013	9	3	12
74	014	132	51	183
74	015	33	9	42
74	016	33	12	44
74	017	14	5	19
74	018	27	12	39
74	019	28	10	38
74	020	15	5	20
74	021	20	8	28
74	022	10	4	14
74	023	22	9	31
74	024	52	20	72
74	025	22	8	30
74	026	103	41	144
74	027	14	6	20
74	028	31	12	43
74	029	16	7	23
74	030	8	3	11
74	031	18	7	25
74	032	2	1	3
74	033	2	1	3
74	034	14	5	19
74	035	8	4	12
74	036	8	3	11
74	037	18	7	25
74	038	59	22	81
74	039	6	3	9
74	040	26	10	36
74	041	184	71	255
74	042	170	66	236
75	001	123	31	154
75	003	136	34	170
75	003	69	17	86
75	004	24	5	29
75	005	25	7	32
75	006	167	43	210
75	007	183	47	230
75	008	52	13	65
75	009	161	41	202
75	010	85	22	107
75	011	162	41	203
75	012	11	3	14
75	013	46	12	58
75	014	385	97	482
75	015	124	32	156
75	016	166	43	209
75	017	65	17	82
75	018	188	48	236
75	019	140	36	176
75	020	75	20	95
75	021	97	25	122
75	022	52	13	65
75	023	113	29	142
75	024	257	65	322
75	025	115	30	145
75	026	537	140	677
75	027	51	13	64
75	028	161	40	201
75	029	85	23	108
75	030	39	10	49
75	031	94	24	118
75	032	14	3	17
75	033	13	4	17
75	034	70	17	87
75	035	42	10	52
75	036	35	9	44
75	037	92	23	115
75	038	289	74	363
75	039	34	8	42
75	040	151	38	189
75	041	2,128	540	2,668
75	042	540	138	678
76	001	28	21	49
76	002	21	16	37
76	003	12	8	20
76	004	4	3	8
76	005	5	4	9
76	006	45	34	79
76	007	28	21	49
76	008	9	6	15
76	009	93	17	40
76	010	13	16	29
76	011	25	19	44
76	012	2	1	3
76	013	8	6	14
76	014	47	36	84
76	015	20	15	35
76	016	27	20	47
76	017	16	13	29
76	018	29	23	52
76	019	22	15	37
76	020	11	8	19
76	021	16	13	29
76	022	4	3	7
76	023	16	12	28
76	024	40	34	74
76	025	16	11	27
76	026	87	66	153
76	027	7	6	13
76	028	25	20	45
76	029	14	11	25
76	030	6	5	11
76	031	12	10	23
76	032	2	1	3
76	033	2	1	3
76	034	12	10	22
76	035	6	5	11
76	036	5	5	10
76	037	15	12	27
76	038	49	37	85
76	039	6	4	10
76	040	25	19	44
76	041	392	291	683
77	001	50	46	96
77	002	76	19	95
77	003	53	13	66
77	004	30	7	37
77	005	9	3	12
77	006	207	52	259
77	007	71	18	89
77	008	20	5	25
77	009	38	9	47
77	010	33	8	41
77	011	62	16	78
77	012	4	1	5
77	013	21	6	27
77	014	104	26	130
77	015	51	13	64
77	016	76	19	95
77	017	38	10	48
77	018	61	16	77
77	019	47	12	59
77	020	24	6	30
77	021	39	9	48
77	022	18	4	22
77	023	32	8	40
77	024	83	21	104
77	025	17	9	26
77	026	175	44	219
77	027	15	4	19
77	028	51	13	64
77	029	28	7	35
77	030	12	3	15
77	031	31	8	39
77	032	5	1	6
77	033	4	1	5
77	034	23	6	29
77	035	14	3	17
77	036	12	3	15
77	037	31	8	39
77	038	100	25	125
77	039	14	3	17
77	040	61	16	77
77	041	1,315	333	1,648
77	042	227	57	284
78	001	217	44	261
78	002	153	33	190
78	003	76	15	91
78	004	24	5	29
78	005	25	5	30
78	006	218	43	261
78	007	196	37	233
78	008	50	10	60
78	009	62	13	75
78	010	94	19	113
78	011	159	32	191
78	012	11	2	13
78	013	53	11	64
78	014	279	55	334
78	015	132	27	159
78	016	191	38	229
78	017	98	19	117
78	018	159	30	189
78	019	119	23	142
78	020	62	13	75
78	021	98	20	118
78	022	45	9	54
78	023	73	14	87
78	024	214	41	255
78	025	95	19	114
78	026	448	88	536
78	027	37	7	44
78	028	132	26	158
78	029	72	14	86
78	030	32	7	39
78	031	79	15	94
78	032	11	2	13
78	033	11	2	13
78	034	59	12	71
78	035	36	7	43
78	036	30	6	36
78	037	78	17	95
78	038	250	51	301
78	039	35	7	42
78	040	166	33	199
78	041	1,612	404	1,016
78	042	130	26	156
79	001	32	6	38
79	002	14	3	17
79	003	8	6	14
79	004	3	2	5
79	005	2	3	5
79	006	16	13	29
79	007	11	4	15
79	008	5	4	9
79	009	6	5	11
79	010	9	6	15
79	011	17	13	29
79	013	1	1	2
79	013	5	4	9
79	014	27	21	48
79	015	13	10	23
79	016	10	8	18
79	017	10	7	17
79	018	18	11	29
79	019	13	8	21
79	020	7	5	12
79	021	17	12	29
79	022	1	1	2
79	023	2	2	4
79	024	3	2	5
79	025	4	3	7
79	026	4	3	7
79	027	3	2	5
79	028	1	1	2
79	029	7	5	12
79	030	3	2	5
79	031	8	6	14
79	032	1	1	2
79	033	2	2	4
79	034	5	4	9
79	035	4	3	7
79	036	3	3	6
79	037	8	6	14
79	038	25	20	45
79	039	3	3	6
79	040	145	109	254
79	041	204	153	357
79	042	12	9	22
80	001	445	131	576
80	002	323	95	418
80	003	153	45	198
80	004	45	13	58
80	005	43	13	56
80	006	333	98	431
80	007	297	87	384
80	008	98	28	126
80	009	109	32	141
80	010	140	41	181
80	011	272	80	352
80	012	19	6	25
80	013	92	26	118
80	014	466	137	603
80	015	220	65	285
80	016	330	94	424
80	017	164	48	212
80	018	268	79	347
80	019	199	59	258
80	020	110	32	142
80	021	168	49	217
80	022	76	22	98
80	023	128	37	165
80	024	357	106	463
80	025	163	48	211
80	026	761	223	984
80	027	64	19	83
80	028	226	68	294
80	029	120	36	156
80	030	56	16	72
80	031	135	40	175
80	032	20	6	26
80	033	19	6	25
80	034	101	30	131
80	035	68	18	86
80	036	51	15	66
80	037	139	41	180
80	038	446	132	578
80	039	71	21	92
80	040	399	117	516
80	041	3157	929	4086
80	042	188	55	243
		132044	44170	176206

TABLE J (SHEET 1)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Adams Street;								
Interstate 17-Washington Street at 10th Avenue	1.2	3,000-5,000	60-100	27-49	15,000	3	U	Special*
Aqua Caliente-Hassayampa Road	33.0	< 1,000	NA	NA	2,000	2	R	D-4
Aqua Caliente-Sentinel Road	15.0	< 1,000	NA	NA	1,000	2	R	B-2
Alma School Road;								
Baseline Road to Apache Boulevard	2.5	< 1,000	66	20-22	5,000	2	U	B-2
Apache Boulevard;								
Tempe to Mesa	2.0	14,000-16,000	100	40-64	30,000	6	U	C-2
Mesa to Tempe-Mesa Freeway	2.0	8,000-10,000	88	80	12,000	4	U	C-1
Arizona Avenue;								
Pinal County Line to Chandler	6.0	5,000-7,000	66-80	32-58	8,000	2	R	D-4
Chandler to Baseline Road	4.0	7,000	66	52-60	15,000	4	R	D-5
Baseline Road to Mesa	1.2	10,000	66-100	52-60	15,000	4	U	C-1 or D-2
Baseline Road;								
Palo Verde Road to Jackrabbit Trail	11.5	1,000-3,000	66	26-40	5,000	2	R	D-4
51st Avenue to Central Avenue	5.5	1,000-4,000	66	20-22	8,000	2	R	D-4
Central Avenue to Interstate 10	6.0	6,000-8,000	66	34	20,000	4	U	C-1
Interstate 10 to Gilbert Road	10.5	6,000-7,000	66	34	8,000	2	R	D-4
Gilbert Road to Higley Road	4.0	2,000-3,000	66	26-28	4,000	2	R	B-2
Bell Road;								
Palo Verde Road to Wickenburg Expressway	18.5	---	--	--	1,000	2	R	B-2
Wickenburg Expressway to Interstate 17	13.0	< 1,000	0-66	0-20	4,000	2	R	D-4
Cave Creek Road to Scottsdale Road	6.0	< 1,000	66	16-20	4,000	2	R	D-4
Bethany Home Road;								
91st Avenue to West Belt Expressway	2.5	< 1,000	66	16-20	4,000	2	R	B-2
Broadway;								
35th Avenue to 19th Avenue	2.0	1,000-2,000	66	22	5,000	2	U	B-2
19th Avenue to Tempe	7.0	4,000-8,000	66-80	34-42	20,000	4	U	B-1
Tempe to Mesa	4.0	3,000-4,000	66	20-44	10,000	4	U	B-1
Buckeye Road;								
Baseline Road to Goodyear	7.0	< 4,000	66	40	3,000	2	R	D-4
Avondale to 51st Avenue	10.0	< 6,000	66	22-40	5,000	2	R	D-4
51st Avenue to 17th Avenue	4.2	10,000-14,000	66	56	12,000	4	U	C-1
Cactus Road;								
51st Avenue to 19th Avenue	4.0	< 1,000	66	16-22	2,000	2	R	B-2
Cave Creek Road to East Belt Expressway	3.0	1,000	66-73	24-26	6,000	2	U	B-2
East Belt Expressway to Scottsdale Road	3.3	---	--	--	2,000	2	R	B-2

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* One-way

TABLE J (SHEET 2)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Camelback Road;								
91st Avenue to West Belt Expressway	2.5	---	--	--	2,000	2	R	B-2
West Belt Expressway to 51st Avenue	2.5	< 1,000	66-130	22-34	5,000	2	U	B-2
51st Avenue to Interstate 17	3.2	2,000-7,000	66	24-40	22,000	4	U	B-1
Interstate 17 to Scottsdale Road	10.8	6,000-22,000	66-80	22-48	20,000	4	U	B-1
Cave Creek Road;								
Shea Boulevard to East Belt Expressway	4.0	1,000-2,000	66	20-24	4,000	2	U	B-2
North Belt Expressway to Cave Creek	15.0	NA	NA	NA	1,000	2	R	D-4
Cave Creek to Pinnacle Peak Road	27.5	NA	NA	NA	1,000	2	R	B-2
Central Avenue;								
South Mountain Park to Baseline Road	2.0	< 2,000	66	20-22	5,000	2	R	D-4
Baseline Road to Broadway	2.0	8,000-14,000	66	20-57	20,000	4	U	C-1
Broadway to Van Buren Street	3.0	22,000-26,000	79-100	49-56	30,000	4	U	Special*
Van Buren Street to Paradise Valley Parkway	5.0	20,000-36,000	93-100	50-60	40,000	6	U	C-2**
Paradise Valley Parkway to Olive Avenue	3.0	9,000-20,000	95-100	40	28,000	4	U	C-1
Citrus Heights Road;								
Arizona Avenue to Ellsworth Road	12.0	< 1,000	66	16-20	2,000	2	R	B-2
Cotton Center-Hassayampa Road	24.0	< 1,000	NA	NA	1,000	2	R	B-2
Cotton Lane;								
Buckeye Road to Wickenburg Expressway	20.0	< 1,000	66	18-20	3,000	2	R	B-2
Dobbins Road;								
51st Avenue to 19th Avenue	4.0	< 1,000	66	16-26	1,000	2	R	B-2
19th Avenue to 16th Street	3.0	1,000-2,000	66	18-37	3,000	2	U	B-2
Dysart Road;								
Buckeye Expressway to Wickenburg Expressway	15.7	< 1,000	NA	NA	5,000	2	R	D-4
Elliot Road;								
Interstate 10 to Arizona Avenue	7.0	< 1,000	66	16-20	2,000	2	R	B-2
Arizona Avenue to Gilbert Road	3.0	< 1,000	66	16-20	4,000	2	R	D-4
Gilbert Road to Higley Road	4.0	< 1,000	66	16-20	2,000	2	R	B-2
Ellsworth Road;								
Rittenhouse Road to County Line	3.4	< 1,000	66	22	3,000	2	R	B-2
Fort McDowell Road;								
Bee Line Highway to Pinnacle Peak Road	12.0	NA	NA	NA	1,000	2	R	B-2
Gilbert Road-Wallace Road								
Pinal County Line to Williams Field Road	7.0	1,000-2,000	66	20-22	3,000	2	R	B-2
Williams Field Road to Gilbert	4.0	2,000-3,000	66	20-22	6,000	2	R	D-4
Gilbert to Tempe-Mesa Freeway	3.5	3,000-4,000	66	16-34	9,000	4	R	D-5

* One-way ** Curb parking restrictions

TABLE J (SHEET 3)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Gilbert Road-Wallace Road (continued)								
Tempe-Mesa Freeway to Apache Boulevard	1.0	4,000	66	34	9,000	4	U	C-1 or D-2
Apache Boulevard to McKellips Road	2.5	< 1,000	66	16	2,000	2	U	B-2
Glendale Avenue;								
Dysart Road to Wickenburg Expressway	7.0	4,000	66	24-28	8,000	2	R	D-4
Wickenburg Expressway to Glendale	1.3	4,000-5,000	66	24-28	12,000	4	U	C-1
Glendale to Eastern North-South Freeway	7.0	5,000-9,000	66-80	22-40	24,000	4	U	B-1
Eastern North-South Freeway to Paradise Valley Parkway	2.0	---	80-130	--	4,000	2	U	B-2, D-2
Grand Avenue;								
7th Avenue to Glendale	7.0	15,000-22,000	80-100	40-60	32,000	6	U	C-2
Glendale to Olive Avenue	2.0	9,000-10,000	100-109	38-64	10,000	4	U	C-1
Grant-Lincoln Trafficway;								
Interstate 17 to 7th Street	2.5	---	80	64	15,000	4	U	B-1
Greenway Road;								
51st Avenue to 7th Street	7.0	< 1,000	66	20-26	2,000	2	U	B-2
Cave Creek Road to Tatum Boulevard	3.0	< 1,000	66-80	20-26	2,000	2	R	B-2
Harquahala Valley-Aquila Road	38.0	---	--	--	2,000	2	R	D-4
Harquahala Valley-Hassayampa Road	26.0	< 1,000	NA	NA	2,000	2	R	D-4
Hayden Road-McClintock Road;								
Baseline Road to Tempe	2.0	1,000	66	16-24	5,000	2	U	B-2
Tempe to East Belt Expressway	7.7	1,000-3,000	66	21-22	7,000	2	U	B-2
Highline Road;								
Baseline Road to Williams Field Road	5.0	1,000-2,000	66	20-26	3,000	2	R	B-2
Higley Road;								
Williams Field Road to Apache Boulevard	7.5	1,000-2,000	66	24-28	5,000	2	R	B-2
Indian School Road;								
Palo Verde Road to West Belt Expressway	26.0	< 3,000	66	24-34	8,000	2	R	D-4
West Belt Expressway to Interstate 17	5.7	4,000-11,000	66-130	36-40	25,000	4	U	C-1, D-2
Interstate 17 to Eastern North-South Freeway	4.2	17,000-23,000	66-80	38-64	30,000	6	U	C-2**
Eastern North-South Freeway to Scottsdale Road	6.5	5,000-20,000	66	20-52	20,000	4	U	C-1
Scottsdale Road to East Belt Expressway	2.0	1,000-2,000	66	20-24	8,000	4	U	C-1
Invergorden Road;								
Indian School Road to Paradise Valley Parkway	2.0	< 1,000	66	12-22	3,000	2	U	B-2
Shea Boulevard to Bell Road	4.0	< 1,000	80	0-26	2,000	2	R	B-2
Jackrabbit Trail;								
Rainbow Valley to Yuma Road	19.0	< 2,000	66	16-26	4,000	2	R	B-2

** Curb parking restrictions

TABLE J (SHEET 4)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Jefferson Street;								
Interstate 17 to 17th Avenue	0.7	2,000-4,000	60-94	32-63	15,000	3	U	Special*
17th Avenue to 24th Street	3.3	11,000-19,000	93-96	24-64	25,000	5	U	Special*
24th Street to 26th Street	0.3	---	--	--	15,000	3	U	Special*
Lower Buckeye Road;								
91st Avenue to 43rd Avenue	6.0	< 1,000	66	22-28	1,000	2	R	B-2
McClintock Drive;								
Williams Field Road to Baseline Road	5.0	1,000-2,000	66	16-24	2,000	2	R	B-2
McDonald Drive;								
Tatum Boulevard to Scottsdale Road	2.8	1,000	66	22	3,000	2	U	B-2
McDowell Road;								
91st Avenue to West Belt Expressway	2.5	< 1,000	66	16-18	12,000	4	R	D-5
Grand Avenue to Southern East-West Freeway	8.0	17,000-25,000	66-80	40-64	22,000	4	U	B-1
McKellips Road;								
North Country Club Drive to Power Road	9.0	< 1,000	66	16-36	3,000	2	R	B-2
Maricopa Street-Henshaw Road;								
17th Avenue to Central Avenue	1.3	10,000-12,000	66-72	24-34	12,000	4	U	B-1
Mesa Drive;								
Baseline Road to Mesa	1.4	< 1,000	66	20-22	4,000	2	U	B-2
Mesa to McKellips Road	1.8	1,000-2,000	66	20-22	6,000	2	U	B-2
Miller Road;								
Baseline Road to Buckeye Expressway	2.5	< 2,000	66	24-28	3,000	2	R	B-2
Morristown-Castle Hot Springs Road	9.0	< 1,000	NA	NA	1,000	2	R	B-2
Morristown-Cave Creek Road	38.0	---	--	--	3,000	2	R	D-4
North Country Club Drive;								
Mesa to Southern East-West Freeway	0.8	8,000-9,000	66	40	16,000	4	U	C-1 or D-2
Northern Avenue;								
Grand Avenue to 51st Avenue	2.0	2,000-3,000	66	16	8,000	2	U	B-2
51st Avenue to Eastern North-South Expressway	8.0	4,000-8,000	66-105	20-40	18,000	4	U	B-1
Olive Avenue;								
Cotton Lane to 91st Avenue	10.0	< 1,000	66	24-26	3,000	2	R	B-2
91st Avenue to 51st Avenue	5.0	< 1,000	66	20-28	4,000	2	R	D-4
51st Avenue to 7th Street	6.0	2,000-6,000	66-80	0-64	12,000	4	U	C-1
Palo Verde Road;								
Hassayampa to Morristown	34.0	< 1,000	NA	NA	2,000	2	R	D-4
Peoria Avenue;								
Wickenburg Expressway to 51st Avenue	4.0	< 1,000	66	16-22	3,000	2	R	B-2

* One-way

TABLE J (SHEET 5)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Peoria Avenue (continued);								
51st Avenue to 7th Avenue	5.0	< 1,000	66	22-24	5,000	2	R	B-2
Pima Road;								
East Belt Expressway to Shea Boulevard	3.5	< 1,000	66	18	1,000	2	R	B-2
Pinnacle Peak Road;								
Cave Creek Road to Fort McDowell Road	22.0	NA	NA	NA	1,000	2	R	B-2
Powerhouse Road-Cooper Road;								
Baseline Road to McKellips Road	3.5	< 1,000	66	26	2,000	2	U	B-2
Power Road-Bee Line Highway;								
Tempe-Mesa Freeway to Bee Line Highway	21.0	< 1,000	NA	14-32	1,000	2	R	B-2
Rittenhouse Road;								
Ellsworth Road to Williams Field Road	5.8	< 1,000	66	22	3,000	2	R	B-2
Roosevelt Dam Road;								
Pinal County Line to Gila County Line	28.0	NA	NA	15-24	1,000	2	R	D-4
Scottsdale Road-Canal Drive;								
Baseline Road to Tempe-Mesa Freeway	1.2	< 1,000	66	20-22	3,000	2	U	D-4
Tempe-Mesa Freeway to Southern East-West Freeway	4.8	1,000-7,000	66-80	20-32	24,000	4	U	C-1 or D-2
Southern East-West Freeway to Paradise Valley Parkway	4.7	8,000-14,000	66-80	20-48	24,000	4	U	C-1 or D-2
Paradise Valley Parkway to Pinnacle Peak Road	11.5	1,000	66	20-28	3,000	2	R	B-2
Shea Boulevard;								
7th Street to Eastern North-South Expressway	3.4	---	--	--	10,000	4	U	C-1 or D-2
Eastern North-South Expressway to East Belt Expressway	2.5	1,000-2,000	80	26	21,000	4	U	C-1 or D-2
East Belt Expressway to Scottsdale Road	2.5	1,000-2,000	66-80	22-26	3,000	2	R	D-4
Scottsdale Road to Fort McDowell Indian Res.	13.0	< 1,000	66	16-22	1,000	2	R	B-2
Southern Avenue;								
51st Avenue to 7th Avenue	4.0	1,000-2,000	66	16-20	4,000	2	R	B-2
7th Avenue to Interstate 10	6.5	3,000-7,000	66	26-51	15,000	4	U	B-1
Interstate 10 to Gilbert Road	10.5	1,000-3,000	66	16-34	3,000	2	U	B-2
Stanfield Road;								
Williams Field Road to County Line	7.2	< 1,000	66	24	3,000	2	R	B-2
State Route 71;								
US 60-70 to Yavapai County Line	4.5	1,000	NA	28	2,000	2	R	D-4
State Route 85;								
Pima County Line to Gila Bend	31.0	< 1,000	NA	20-34	3,000	2	R	D-4

TABLE J (SHEET 6)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
Tatum Boulevard;								
44th Street at McDonald Drive to East Belt Expressway	5.5	3,000-7,000	66-80	20-64	22,000	4	U	C-1 or D-2
East Belt Expressway to Bell Road	3.2	1,000-2,000	66	30	6,000	2	R	D-4
Bell Road to Pinnacle Peak Road	4.0	---	--	--	2,000	2	R	B-2
Thomas Road;								
91st Avenue to West Belt Expressway	2.5	< 1,000	66	24	2,000	2	R	B-2
West Belt Expressway to 51st Avenue	2.5	1,000-2,000	66	24	5,000	2	U	B-2
51st Avenue to Interstate 17	3.2	4,000-12,000	66-100	24-60	20,000	4	U	B-1
Interstate 17 to Scottsdale Road	10.8	11,000-24,000	66-80	30-64	23,000	4	U	B-1
Scottsdale Road to East Belt Expressway	2.0	---	--	--	5,000	2	U	B-2
Tonopah-Hassayampa Road	17.0	< 1,000	NA	NA	1,000	2	R	B-2
Transmission Road;								
Tempe to Mesa	3.5	6,000-8,000	66	16-20	12,000	4	U	B-1
U. S. Route 60-70;								
Yavapai County Line to Wickenburg Expressway	36.0	3,000-4,000	NA	20-34	3,000	2	R	D-4
Van Buren Street;								
Litchfield Road to West Belt Expressway	8.5	3,000-5,000	66	22-34	6,000	2	R	B-2
West Belt Expressway to Interstate 17	6.0	6,000-12,000	66-80	32-43	18,000	4	U	B-1
Interstate 17 to Tempe	8.5	14,000-24,000	80	56-60	24,000	4	U	B-1
Waddell Road-Thunderbird Road;								
67th Avenue to Interstate 17	5.0	< 1,000	66	16-22	3,000	2	R	D-4
Interstate 17 to 7th Street	3.0	---	--	--	8,000	4	U	C-1 or D-2
7th Street to Cave Creek Road	1.8	---	--	--	3,000	2	U	B-2
40th Street to Scottsdale Road	4.0	---	--	--	2,000	2	R	B-2
Washington Street;								
10th Avenue to 24th Street	3.3	11,000-22,000	100	62-64	25,000	5	U	Special*
24th Street to 26th Street	0.3	18,000-20,000	84-92	60	15,000	3	U	Special*
26th Street to 48th Street	2.7	12,000-20,000	84-92	48-60	30,000	6	U	C-2
48th Street to Tempe	2.0	9,000-10,000	66-92	48	25,000	4	U	C-1
Williams Field Road;								
Interstate 10 to Chandler	6.5	< 1,000	66	16-20	3,000	2	R	D-4
Chandler to Gilbert Road	2.6	3,000-4,000	66	40	10,000	4	R	D-5
Gilbert Road to Higley Road	4.0	1,000-2,000	66	40	5,000	2	R	D-4
Yuma Road;								
Jackrabbit Trail to Goodyear	7.0	< 1,000	66	16	3,000	2	R	B-2

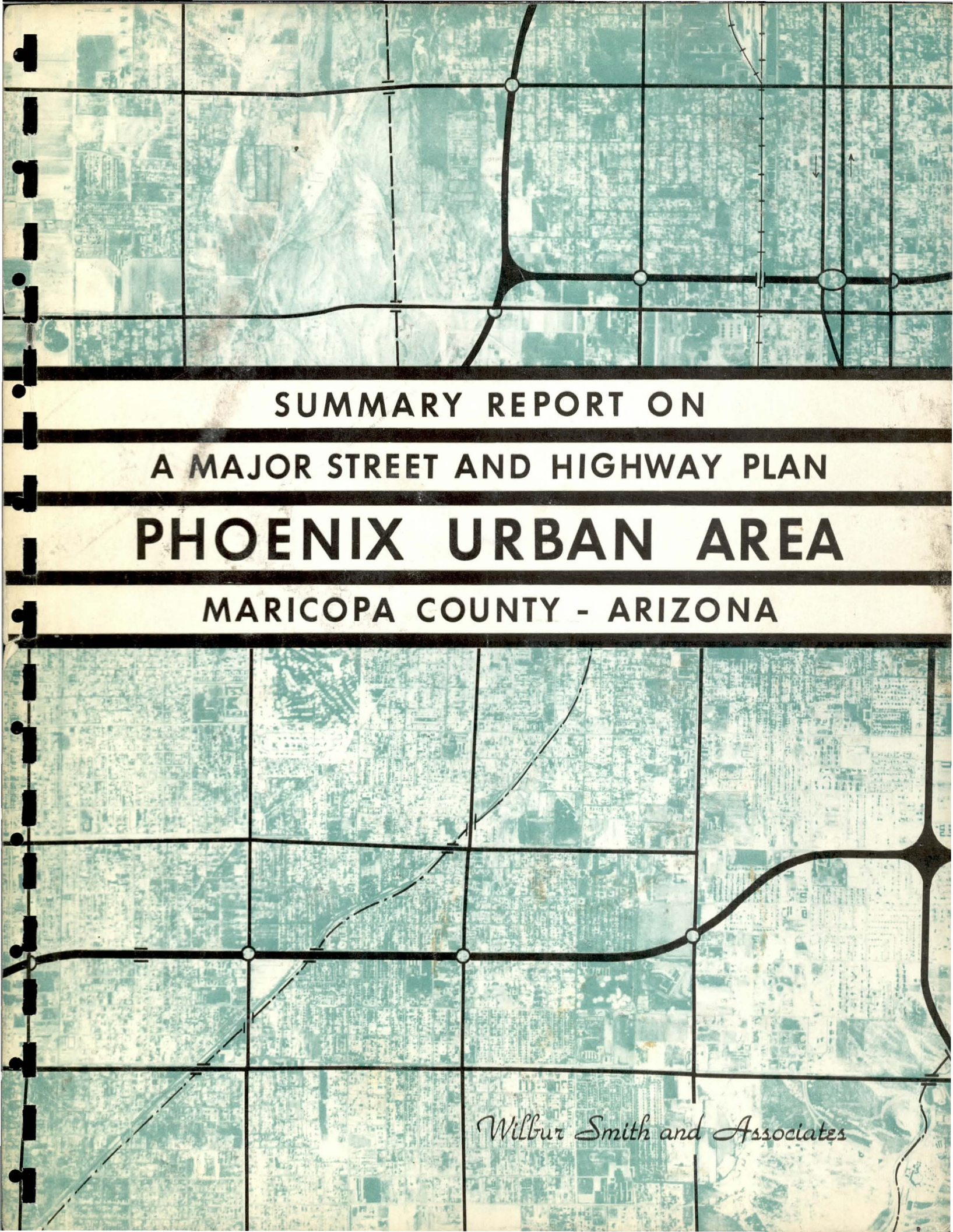
TABLE J (SHEET 7)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
7th Street;								
Baseline Road to Phoenix-Tucson Freeway	3.3	1,000-4,000	66	20-24	16,000	4	U	B-1
Phoenix-Tucson Freeway to Southern East-West Freeway	2.4	7,000-12,000	66-73	22-43	30,000	6	U	C-2**
Southern East-West Freeway to Dunlap Avenue	7.3	10,000-14,000	66-80	20-52	20,000	4	U	B-1
Dunlap Avenue to Bell Road	5.0	1,000-2,000	66	20-38	10,000	4	U	C-1 or D-2
12th Street;								
Mesa to Wallace Road	2.5	---	--	--	2,000	2	R	B-2
16th Street;								
Dobbins Road to Baseline Road	1.0	< 1,000	66	22-34	3,000	2	R	B-2
Southern Avenue to Indian School Road	9.0	3,000-14,000	66-80	30-57	20,000	4	U	B-1
24th Street;								
Baseline Road to Broadway	2.0	1,000-3,000	66	22	10,000	4	U	B-1
Broadway to Phoenix-Tucson Freeway	1.5	8,000-9,000	66	22-24	16,000	4	U	B-1
Phoenix-Tucson Freeway to Paradise Valley Parkway	6.5	8,000-20,000	66	22-40	8,000	4	U	B-1
32nd Street;								
Baseline Road to Phoenix-Tucson Freeway	2.2	< 1,000	66	18-24	4,000	2	U	B-2
Washington Street to Paradise Valley Parkway	5.4	2,000-8,000	66	20-40	15,000	4	U	B-1
East Belt Expressway to Bell Road	2.0	< 1,000	80	26	3,000	2	R	B-2
40th Street;								
Shea Boulevard to Bell Road	4.0	1,000-2,000	80	22	4,000	2	R	B-2
44th Street;								
Washington Street to McDonald Drive	5.3	4,000-8,000	66-80	20-64	22,000	4	U	C-1 or B-1
48th Street;								
Baseline Road to Broadway	2.0	1,000	66	16-36	6,000	2	U	D-4
Broadway to Southern East-West Freeway	3.2	3,000-5,000	66	16-36	20,000	4	U	C-1
Southern East-West Freeway to Indian School Road	2.5	3,000-4,000	66-100	18-24	5,000	2	U	B-2
7th Avenue;								
Baseline Road to Phoenix-Tucson Freeway	3.5	1,000-2,000	66-80	18-32	14,000	4	U	B-1
Phoenix-Tucson Freeway to Paradise Valley Parkway	6.5	5,000-18,000	66-80	22-57	20,000	4	U	B-1
Paradise Valley Parkway to Olive Avenue	3.0	2,000-6,000	66-73	26-34	12,000	4	U	B-1
17th Avenue;								
Buckeye Road to Adams Street	0.8	15,000-16,000	100	56-62	15,000	4	U	Existing
19th Avenue;								
Dobbins Road to Broadway	3.0	1,000-3,000	66	16-28	6,000	2	R	B-2
Broadway to Olive Avenue	11.0	5,000-10,000	66-80	22-57	18,000	4	U	B-1

** Curb parking restrictions

TABLE J (SHEET 8)
SUMMARY OF EXISTING CONDITIONS AND RECOMMENDED STANDARDS OF DEVELOPMENT
MAJOR STREETS AND RURAL ROADS

Name of Route	Miles	Existing Conditions			Recommended Standards			
		1958 ADT	Predominating Right-of-Way	Pavement Width	Design ADT	No. Lanes for Design ADT	Land Use Class.	Design Section
19th Avenue (continued);								
Olive Avenue to Bell Road	5.0	1,000-2,000	66-73	20-51	6,000	4	U	B-1
27th Avenue;								
Buckeye Road to Interstate 17	9.0	5,000-9,000	66-80	20-34	12,000	4	U	B-1
35th Avenue;								
Dobbins Road to Broadway	3.0	< 1,000	66	16-20	3,000	2	R	B-2
Broadway to Olive Avenue	9.0	< 10,000	66-80	20-30	15,000	4	U	B-1
Olive Avenue to Bell Road	5.0	---	--	--	3,000	2	R	B-2
43rd Avenue;								
Buckeye Road to Southern East-West Freeway	2.0	1,000-2,000	66	18-22	5,000	2	R	B-2
Southern East-West Freeway to Olive Avenue	7.0	1,000-4,000	66	20-24	12,000	4	U	B-1
Olive Avenue to Bell Road	5.0	< 1,000	66	16-24	3,000	2	R	B-2
51st Avenue;								
Gila River Indian Reservation to Baseline Road	7.0	< 1,000	66	18-20	< 1,000	2	R	B-2
Baseline Road to Southern East-West Freeway	6.0	< 4,000	66	18-20	8,000	2	R	D-4
Southern East-West Freeway to Olive Avenue	7.0	2,000-4,000	66-130	20-41	18,000	4	U	C-1 or D-2
Olive Avenue to Bell Road	5.0	< 1,000	66	20-22	4,000	2	R	D-4
59th Avenue;								
Buckeye Road to Southern East-West Freeway	2.0	1,000	66	22-34	3,000	2	R	B-2
Southern East-West Freeway to Glendale	4.2	2,000-4,000	66-130	22-34	18,000	4	U	B-1, D-1 or D-2
Glendale Road to Bell Road	6.0	< 1,000	66	16-24	3,000	2	R	B-2 or D-4
67th Avenue;								
Buckeye Road to Southern East-West Freeway	2.0	< 1,000	66	22-26	2,000	2	R	B-2 or D-4
Southern East-West Freeway to Glendale Avenue	5.0	1,000-2,000	66	22	6,000	4	U	B-2 or D-2
75th Avenue;								
Buckeye Road to Waddell Road	12.0	< 1,000	66	16-24	4,000	2	R	B-2 or D-4
83rd Avenue;								
Buckeye Road to Waddell Road	12.0	< 1,000	66	16-24	3,000	2	R	B-2 or D-4
91st Avenue;								
Buckeye Expressway to Wickenburg Expressway	13.0	< 1,000	66	18-20	5,000	2	R	D-4
107th Avenue;								
Olive Avenue to Cave Creek-Morristown Road	18.0	< 1,000	66	24-32	2,000	2	R	B-2



SUMMARY REPORT ON

A MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA

MARICOPA COUNTY - ARIZONA

Wilbur Smith and Associates

A MAJOR STREET AND HIGHWAY PLAN
for the
PHOENIX URBAN AREA AND MARICOPA COUNTY

Prepared for the

ARIZONA STATE HIGHWAY COMMISSION

MARICOPA COUNTY CITY OF PHOENIX

In co-operation with the

U.S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

by

Wilbur Smith and Associates

1960

A MAJOR STREET AND HIGHWAY PLAN
for the
PHOENIX URBAN AREA AND MARICOPA COUNTY

A long range master plan for the development of major street and highway facilities in the Phoenix Urban Area and Maricopa County has been prepared by Wilbur Smith and Associates, Consulting Engineers, based on a comprehensive 18-month study of traffic needs. This study was authorized and sponsored jointly by the Arizona State Highway Commission, the Phoenix City Council, and Maricopa County Board of Supervisors in co-operation with the U.S. Department of Commerce, Bureau of Public Roads.

Long range needs for all classes of facilities were determined in consideration of:

a) Existing traffic conditions;
b) Desirable standards of major street and highway design; and
c) Traffic demands forecast for the year 1980 when the population of Maricopa County is expected to reach about 1,440,000 persons.

The major street and highway plan has been correlated with existing and planned land uses in the urban area in order to preserve and enhance desirable community values. The recommended improvements have been planned to:

- Guide the logical and orderly development of the urban area;
- Provide for safe and convenient traffic movement in future years;
- Establish better relationships between major traffic flows and residential land use;
- Provide adequate roadway capacity balanced against future traffic demands;
- Provide adequate access and egress to and from the Phoenix downtown business district and other major centers of business activity and employment;
- Provide optimum traffic services to each of the several different classes of road users, and to all parts of the future urban area, and rural sections of Maricopa County; and
- Provide a guide for the logical and economical expenditure of public funds for improvements most needed and consistent with long range objectives.

EXISTING CONDITIONS

To provide a sound basis for objective analyses of street and highway needs, a detailed inventory of existing facilities and traffic conditions was made. A major portion of the required inventory data was collected by local agencies in 1957. These

data were summarized, expanded and up-dated to reflect 1958 conditions on all streets and highways serving 1,000 vehicles per day or more in the Phoenix area .

Detailed analyses of the magnitudes and patterns of 1958 traffic flow, the quality of traffic services afforded by existing facilities and physical conditions on major streets and highways in the Phoenix area indicated the following:

1) Average daily traffic volumes in excess of 20,000 vehicles per day are served at maximum locations by 10 streets in the Phoenix Urban Area. These are Central Avenue, Grand Avenue, Washington Street, Van Buren Street, McDowell Road, Indian School Road, Thomas Road, Camelback Road, 16th Street and Black Canyon Highway.

2) Typical daily traffic demands on critical sections of all east-west mile roads between downtown Phoenix and Camelback Road are already close to, or in excess of desirable limits for the existing facilities with prospects for tremendous growth ahead.

3) Increased roadway capacity for future traffic increases on congested east-west arterials in central Phoenix will be difficult and costly to achieve because:

   a) These facilities are already operated with four or more traffic lanes;
   b) Rights-of-way of only 66 to 80 feet are available in most cases; and
   c) Traffic engineering measures to improve the efficiency of traffic operations have already been effected.

4) Central Avenue is serving extremely heavy traffic - over 30,000 vehicles per day at the maximum location - because it is ideally located with respect to major north-south traffic desires, because it has been improved to relatively high standards and because of the inadequate status of development of 7th Avenue and 7th Street.

5) Capacity limitations on existing mile roads, which function as the arterial street system, are causing the following undesirable conditions:

   a) Excessive traffic delays, particularly at principal mile-road intersections;
   b) Excessive incidence of traffic accidents; and
   c) Diversion of arterial traffic flow to half-mile and quarter-mile streets in residential neighborhoods.

6) All primary state highway routes pass through the heart of the downtown business district, causing the undesirable intermingling of through traffic with heavy volumes of slow-moving local traffic.

7) No facilities exist in the Phoenix Urban Area to provide high-capacity, high-speed (40 to 60 miles per hour), safe traffic operations for major traffic movements. Black Canyon Highway, now under construction, will

provide traffic services of this type in its tributary area when completed.

8) Many miles of the existing network of major streets and highways in the urban area are physically deficient. Principal deficiencies include pavements too narrow for adequate traffic lanes, turn lanes and border areas; rough or obsolete roadways originally constructed for rural traffic needs; and inadequate drainage facilites.

9) Only 7 of the 68 railroad crossings of significance in the Phoenix Urban Area are provided with grade separations. Traffic delays and hazards have increased to the point where the construction of additional grade separations and the provision of additional modern warning devices at principal grade crossings are needed.

10) Traffic controls and regulations have been widely and effectively applied in the Phoenix Urban Area to "make-the-most" of existing facilities. Large capacity increases for future traffic needs in critical corridors of traffic flow will require major physical improvements including the construction of new facilities as well as the widening of existing streets.

FUTURE TRAFFIC DEMANDS

The year 1980 has been selected as the design year for the development of the major street and highway plan. Accordingly, traffic demands have been projected to 1980 levels based on the probable size and character of the urban area at that time. Studies made by the Advance Planning Task Force of the City of Phoenix and Maricopa County indicate that the Phoenix Urban Area of 1980 will include about 226 square miles and about 1,000,000 residents, exclusive of Mesa, Tempe, Scottsdale and Glendale, in comparison with the 144 square mile urban area of 1958 with its 400,000 residents. The total 1980 population of the future urban area, including Phoenix, Mesa, Tempe, Scottsdale, Glendale and contiguous areas of Maricopa County which are now unincorporated but which will be urbanized, has been estimated as 1,250,000 persons. Thus, a tremendous growth over the next 20 years is anticipated.

Basic to the estimation of the future magnitude and pattern of vehicular traffic movement in the Phoenix Urban Area are data collected in the Phoenix-Maricopa County Traffic Study conducted in 1956 and 1957 by local public agencies. This study, which included home interviews of a substantial portion of the 397,395 residents of a 225 square mile area, determined that a total of about 805,011 vehicle trips per day were made in the study area on a typical weekday in 1957. The vast majority of these trips (89.5 percent) were made entirely within the limits of the study area. Thus, most of the traffic in the Phoenix Urban Area is generated locally. Only about 10.5 percent of all trips in the area had termini outside the limits of the traffic study. Less than one percent of all trips consisted of through traffic - trips which pass through the area without a stop.

Analyses of origin and destination data have revealed the existence of basic relationships between traffic generation and land use. The volumes and patterns of trips in the area were found to be related to the density of urban development; the relative availability of private vs. public transportation; the proximity of residences

to major trip generators; and certain variables related to land use such as residential population, the number and character of available jobs, retail sales volumes and median family income levels. These relationships were established for the Phoenix Urban Area by complex technical procedures using electronic data-processing equipment.

Application of the traffic generation characteristics, thus determined, to statistics describing the size and character of the future Phoenix Urban Area determined that the major street and highway plan must be designed to accommodate about 2,526,000 trips per day - about three times as much traffic as now served by existing facilities. As shown in Table 1, about 92 percent of the future trip production will consist of internal trips - trips with both ends in the urban area.

Table 1

COMPARISON OF DAILY TRIP PRODUCTION; 1957-1980
Phoenix Urban Area

Classification	1957 Trips per Day in 225 sq. mile Urban Area	1980 Trips per Day in 400 sq. mile Urban Area
Internal Trips	720,124	2,338,000
External Trips	77,799	176,000
Through Trips	7,088	12,000
Total Trips	805,011	2,526,000

THE RECOMMENDED PLAN

Figures A and B indicate the major street and highway plan which has been recommended for the Phoenix Urban Area and Maricopa County. The recommended county-wide plan for major traffic facilities includes:

- A 442-mile network of freeway and expressway routes;
- A 598-mile network of major urban arterials and major rural roads;
- A 746-mile network of secondary urban arterials and secondary county roads.

The county-wide freeway-expressway system would include:

1) *The Black Canyon Highway* - the backbone of the proposed major street and highway system and part of the National System of Interstate and Defense Highways.

2) *The Phoenix-Tucson Freeway* - another Interstate route which will extend from the Durango Street interchange with the Black Canyon Highway to the south county line via the City of Tempe.

3) *The Tempe-Mesa Freeway* - an east-west facility to link Tempe and Mesa with each other and with Phoenix via the Phoenix-Tucson Freeway.

4) *The Buckeye Expressway* (or freeway if selected as an Interstate route) - an east-west rural route to serve the U.S. Route 80 regional traffic corridor.

5) *The Wickenburg Expressway* - an east-west rural route to serve the U.S. Route 60-70 regional traffic corridor between Phoenix and Wickenburg.

6) *The Yuma-Tucson Freeway* - an east-west Interstate route traversing the southern portion of Maricopa County.

7) *The Gila Bend-Buckeye Expressway* - a lateral connection between the Yuma-Tucson Freeway and the Buckeye Expressway for regional traffic movements between the Phoenix Urban Area and Yuma and southern California.

8) *The Southern East-West Freeway* - an east-west freeway through the Phoenix Urban Area passing just north of the downtown business district to serve extremely heavy traffic in a critical corridor of demand, and to provide high quality access to the downtown business district and other commercial and industrial centers of central Phoenix.

9) *The Paradise Valley Parkway* - an east-west route through the Phoenix Urban Area constituting an extension of the Wickenburg Expressway and connecting the Glendale area with the northeast section of the urban area including Paradise Valley.

10) *The West Belt Expressway* - a north-south connection between the Wickenburg and Buckeye Expressways, constituting part of an outer circumferential route around the designated 1980 Urban Area.

11) *The North and East Belt Expressways* - part of the outer circumferential route around the future urban area, connecting Paradise Valley with the Interstate system and with Scottsdale, Tempe and Mesa.

12) *Bee Line Highway* - a rural highway to provide regional traffic services between the Phoenix Urban Area and areas to the northeast.

An extensive network of urban arterials and rural roads, shown in Figures A and B, has been integrated with the proposed freeway-expressway system to provide optimum traffic services to all parts of the county. Major arterials have been spaced about midway between parallel freeways or expressways to provide a high-capacity facility at two to three mile intervals in the Phoenix Urban Area. These major urban routes have been extended into rural sections of the county, as shown in Figure B, assuring co-ordination between plans for urban and rural sections of the county. Major arterials and major rural roads would be developed on rights-of-way of 100 to 140 feet. Secondary arterials and secondary county roads would be developed on

rights-of-way of at least 80 feet.

ESTIMATED COSTS

As summarized in Table 2, the total estimated cost of the proposed improvements for 1980 traffic needs is $357,400,000, of which $228,500,000 represents the needs of the Phoenix Urban Area. The total estimated cost of the proposed 140.6-mile freeway-expressway system for the urban area is $126,500,000, which includes about $49,800,000 for routes which are of state-wide interest. Proposed major street improvements and railroad grade separation projects in the urban area would cost

Table 2

SUMMARY OF ESTIMATED DEVELOPMENT COSTS
RECOMMENDED MAJOR STREET AND HIGHWAY PLAN
Phoenix Urban Area and Maricopa County

	Estimated Costs	Miles
Phoenix Urban Area		
Freeways and Expressways	$126,500,000	140.6
Major Arterials	33,400,000	124.4
Secondary Arterials	50,400,000	250.4
Collector Street Widenings	9,900,000	56.5
Special Structures*	8,300,000	---
Subtotal	$228,500,000	571.9
Rural Areas of Maricopa County		
Freeways and Expressways	$ 78,300,000	301.0
Major Rural Roads	36,400,000	473.5
Secondary County Roads	14,200,000	496.1
Subtotal	$128,900,000	1,270.6
Total Maricopa County		
Freeways and Expressways	$204,800,000	441.6
Major Arterials and Rural Roads	69,800,000	597.9
Secondary Arterials and Rural Roads	64,600,000	746.5
Other	18,200,000	56.5
Total	$357,400,000	1,842.5

* Includes railroad grade separations and collector street bridge crossings of Black Canyon Highway.

about $102,000,000. These projected needs are tremendous by all measures - especially when related to current rates of expenditures for street and highway construction. Relatively, however, they are comparable to those faced by other large and rapidly growing metropolitan areas. The projected needs are considered to be realistic and in keeping with the anticipated size and character of the future urban area and the traffic demands forecast for Maricopa County.

BENEFITS

Although the cost of the necessary expanded street and highway programs for the Phoenix Urban Area and Maricopa County are of staggering proportions, the benefits to be derived from the proposed improvements are also great. These benefits include the following:

- *Accident Reduction* - About one-third as many accidents and half as many fatalities occur on urban freeways in comparison with typical urban arterials. Accident reductions would also be achieved on the arterial street system through the provision of adequate traffic capacity.

- *Time Savings* - Freeway travel speeds in urban areas are about double average speeds via typical arterial streets.

- *Convenience of Travel* - Traffic delays and congestion would be reduced and efficient service to all classes of users and all parts of the county would be afforded.

- *Improved Access to Commercial Centers* - Access to the downtown business districts and other major commercial areas would be improved and non-productive through traffic will be diverted to the freeway-expressway system.

- *Enhanced Community Values* - Better relationships between traffic flow and land use would be established to the lasting benefit of all residents.

- *Facilitate Area Expansion* - It is doubtful that the growth and expansion predicted for the Phoenix Urban Area and Maricopa County can be achieved without a modern major street and highway system.

- *Economic Savings to Road Users* - The economic value of reductions in accidents, vehicle operating costs and travel time to potential users of the recommended freeway-expressway system would average about two cents per vehicle mile.

- *Efficient Service for Future Traffic* - It is estimated that the proposed county-wide freeway-expressway system would serve about 2,358,000,000 vehicle miles of travel in 1980 - about half of the total travel anticipated in Maricopa County. Thus, major street facilities and county roads would be required to serve only about half of the total traffic demand, thereby minimizing required street widening projects, which are extremely disruptive to established land uses. As shown in Figure 41, major traffic

flows in the urban area would be served by the proposed network of freeways, expressways and major arterials.

ADMINISTRATION AND FINANCE

Of major concern will be the effectuation of feasible means of financing the proposed long range program of major street and highway improvements. This will not be possible without co-operative efforts and changed policies at all levels of government. Effective implementation of the plan will require integrated area-wide administration, with the division of responsibility for various elements of the total plan clearly established. No existing unit of government has the necessary authority or financial resources to undertake the entire job alone. A new administrative approach, which will assure co-ordination of the development of major transportation facilities, will be essential. A major part of this new approach should be the establishment of a Regional Transportation Co-ordinating Committee with appropriate representation from all jurisdictions in the future urban area. This committee should be representative of regional interests. The calibre of its membership will determine its effectiveness - particularly in the early phases of the program when basic policy decisions must be made and legal actions must be taken to provide necessary financing and technical machinery for implementation of the plan.

Financial policies related to major street and highway construction will also require changes if the proposed plan is to be implemented. Revenues for future major street and highway needs in both the Phoenix Urban Area and rural sections of Maricopa County will be grossly inadequate if present policies are continued. Increased road user and/or general tax increases for transportation improvements will probably be needed. However, tax increases should be accompanied or preceded by a comprehensive reappraisal of present formulae governing the distribution of funds from these sources. Greater consideration should be given, in future financial planning, to the relative magnitudes of the needs of the various road systems in the county and state with less emphasis on arbitrary formulae.

Finally, little success in the implementation of the major street and highway plan will be achieved without public support. A general understanding by residents of the area of the need for a long range transportation improvement program, and the great benefits to be derived from it, will be essential.

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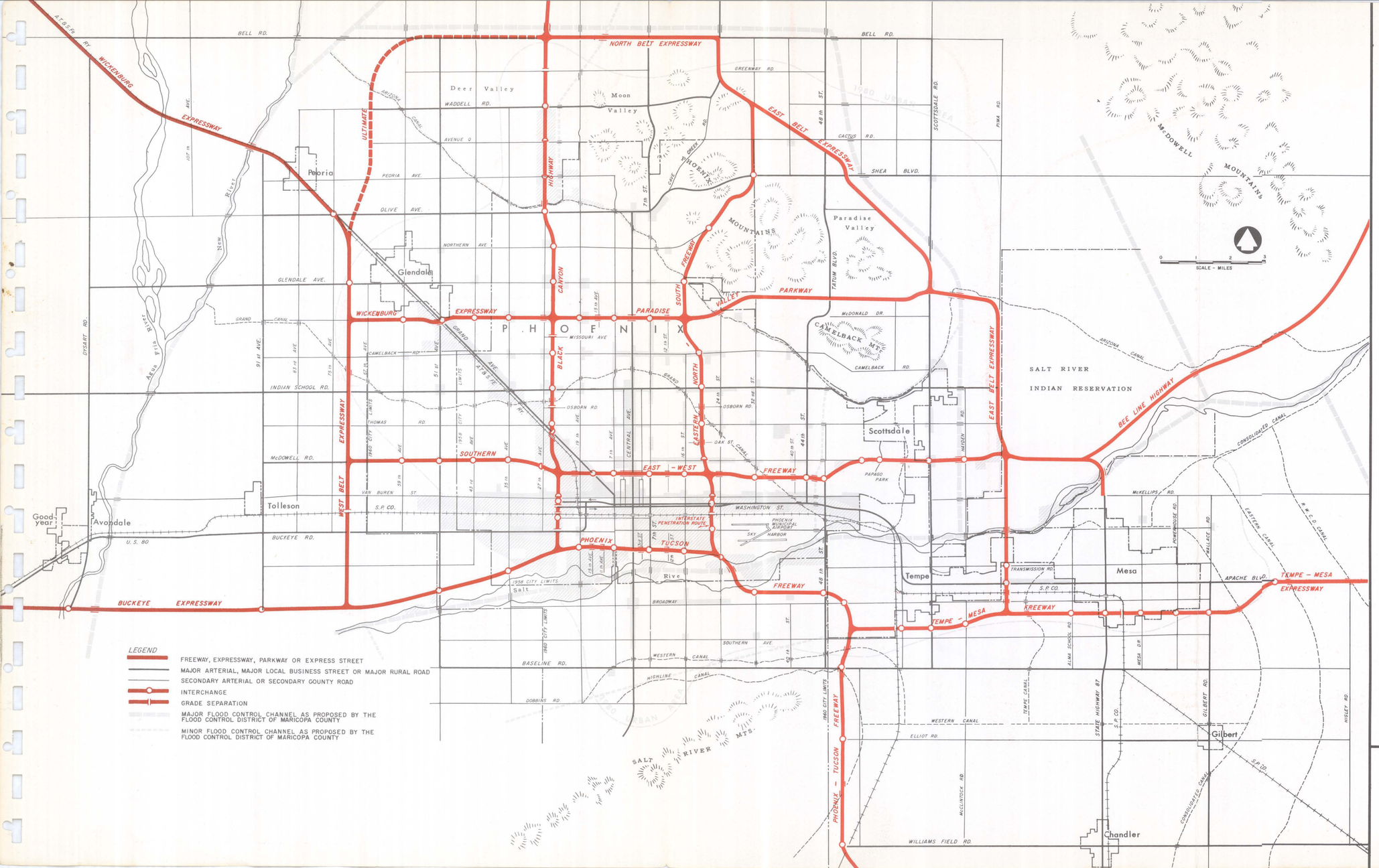
Information in this brochure constitutes a brief summary of a 126-page report prepared by Wilbur Smith and Associates for the sponsoring public agencies. Descriptions of the technical studies upon which the recommended major street and highway plan is based and substantiating data are included in the basic report.



LEGEND

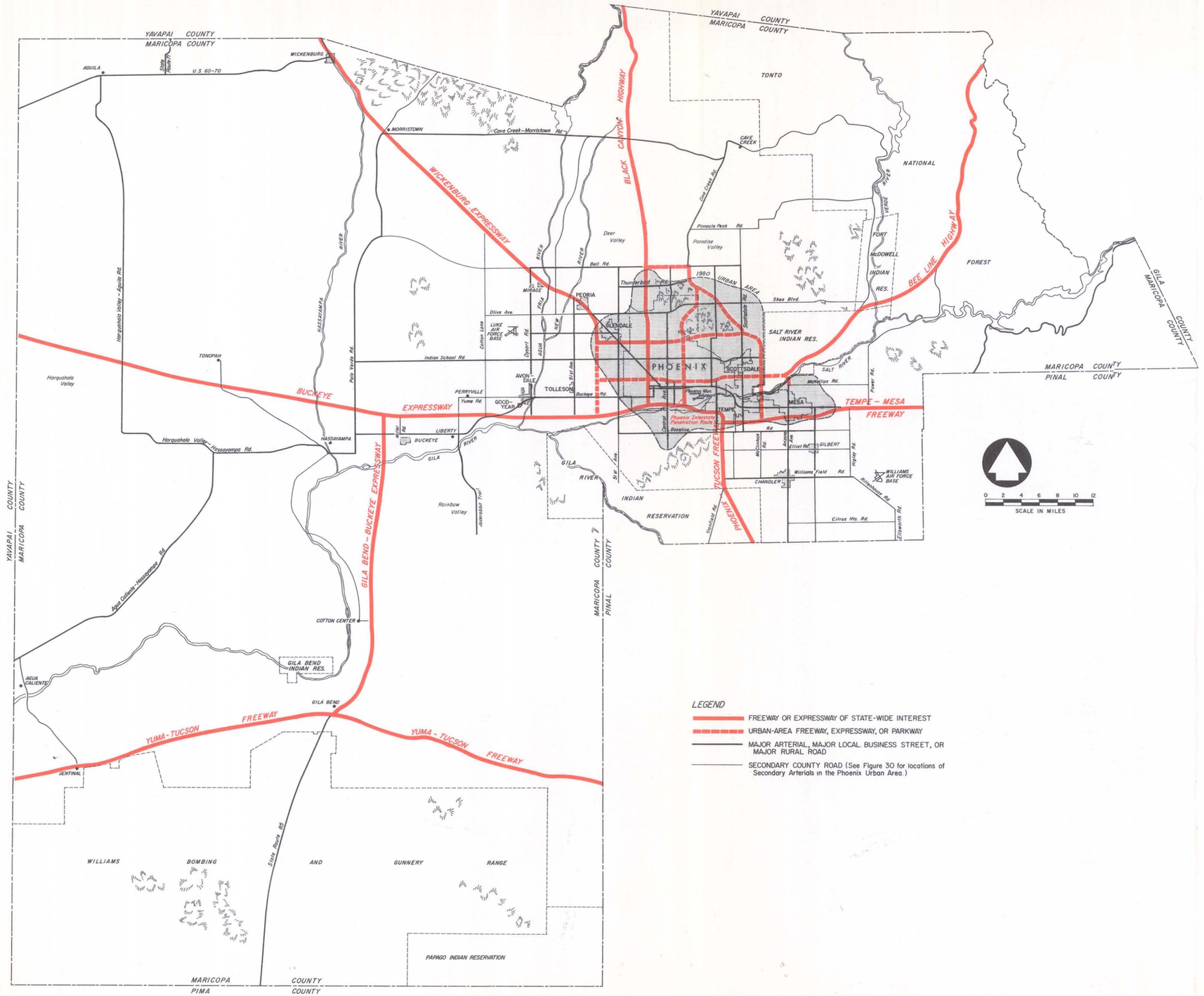
- FREEWAY, EXPRESSWAY, PARKWAY OR EXPRESS STREET
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET OR MAJOR RURAL ROAD
- SECONDARY ARTERIAL OR SECONDARY COUNTY ROAD
- INTERCHANGE
- GRADE SEPARATION
- MAJOR FLOOD CONTROL CHANNEL AS PROPOSED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
- MINOR FLOOD CONTROL CHANNEL AS PROPOSED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA, MARICOPA COUNTY

Wilbur Smith and Associates

(A)



LEGEND

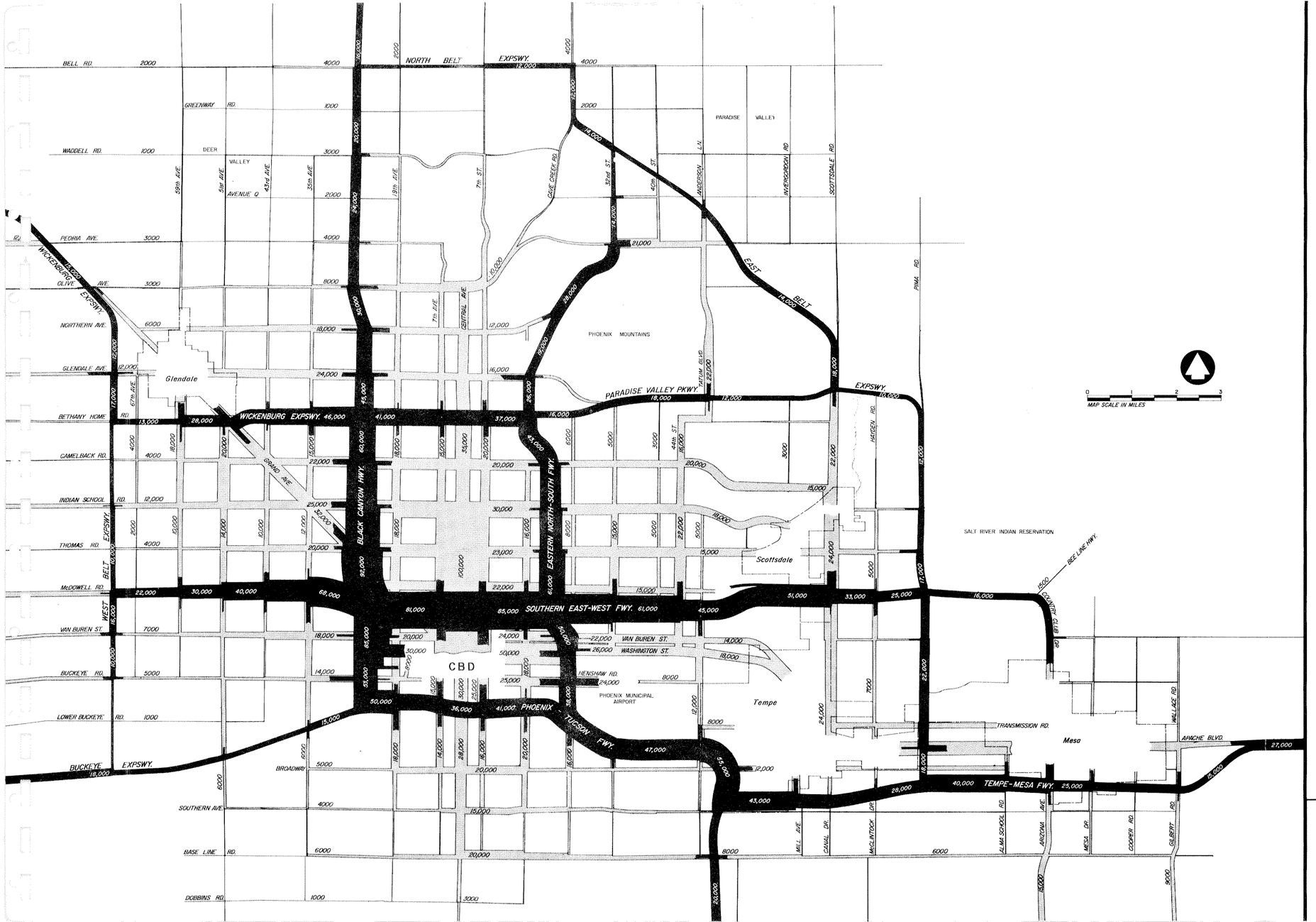
- FREEWAY OR EXPRESSWAY OF STATE-WIDE INTEREST
- URBAN-AREA FREEWAY, EXPRESSWAY, OR PARKWAY
- MAJOR ARTERIAL, MAJOR LOCAL BUSINESS STREET, OR MAJOR RURAL ROAD
- SECONDARY COUNTY ROAD (See Figure 30 for locations of Secondary Arterials in the Phoenix Urban Area.)

RECOMMENDED COUNTY-WIDE FREEWAY-EXPRESSWAY SYSTEM AND MAJOR COUNTY ROADS

PHOENIX URBAN AREA - MARICOPA COUNTY

Wilbur Smith and Associates

B



ESTIMATED 1980 TRAFFIC FLOW
RECOMMENDED MAJOR STREET AND HIGHWAY PLAN

PHOENIX URBAN AREA - MARICOPA COUNTY

TRAFFIC SCALE

50 40 30 20 10

THOUSANDS OF VEHICLES

LEGEND

1980 AVERAGE DAILY TRAFFIC ON FREEWAY-EXPRESSWAY SYSTEM

1980 AVERAGE DAILY TRAFFIC ON MAJOR STREETS

Wilbur Smith and Associates