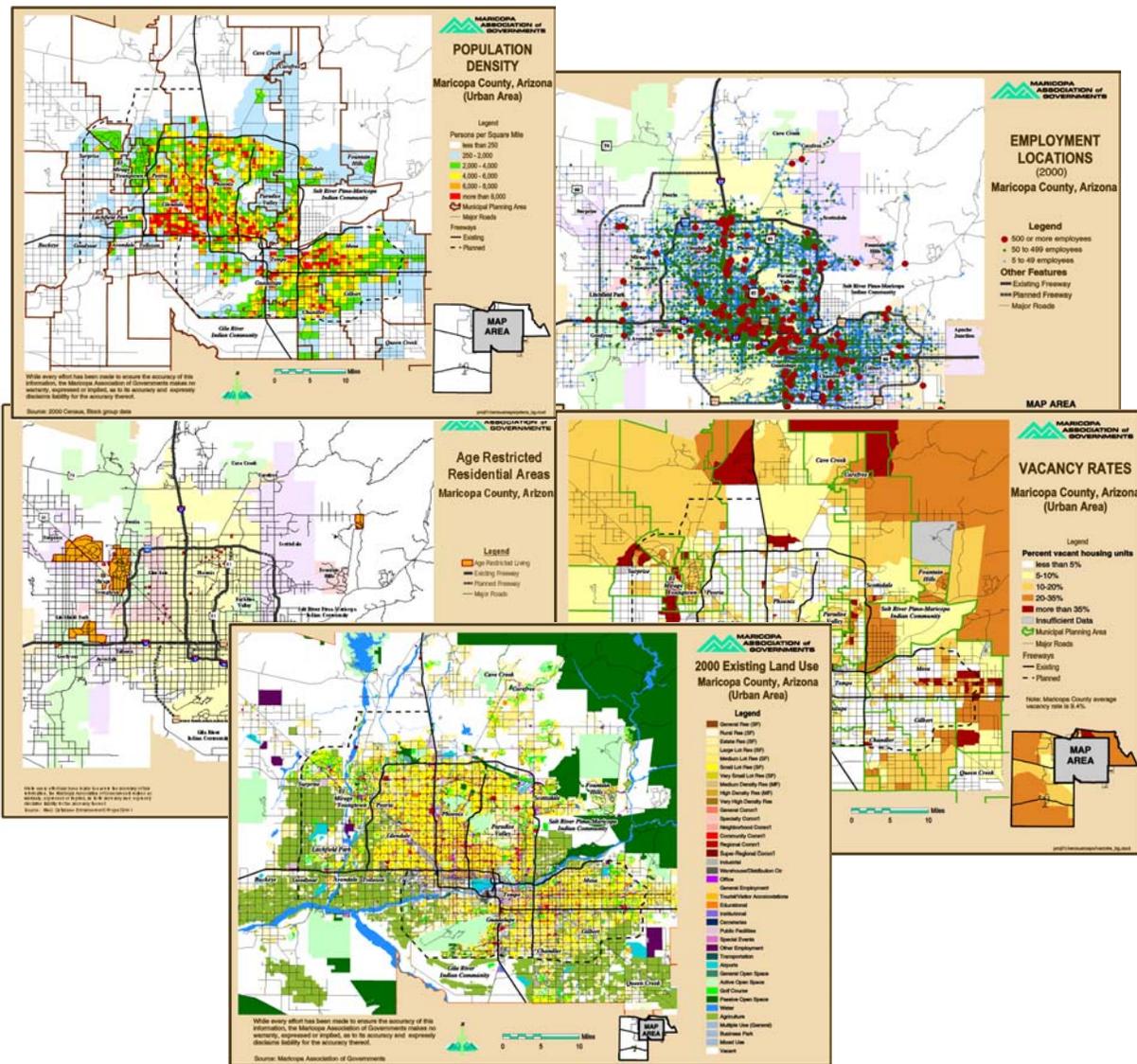




INTERIM SOCIOECONOMIC PROJECTIONS DOCUMENTATION

JULY 2003





**INTERIM SOCIOECONOMIC PROJECTIONS
DOCUMENTATION
JULY 2003**

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1. PURPOSE

The purpose of this document is to explain the socioeconomic projections process used to prepare interim socioeconomic projections by Municipal Planning Areas (MPA), Regional Analysis Zones (RAZs) and Socioeconomic Analysis Zones (SAZs) for population, housing and employment variables.

Executive Order 95-2 requires that the Arizona Department of Economic Security develop state and County population estimates and projections for 50 years for each city and town with a population greater than 1,000 people. It also authorizes Councils of Government to prepare subregional estimates and projections using the County population as a control total. In preparing these estimates and projections, MAG is required to follow standards established by DES.

Subregional projections are used:

- By MAG as input into the MAG transportation models to predict automobile traffic
- By MAG as input into the MAG air quality models to predict emissions and concentrations
- By local governments to evaluate infrastructure improvements
- For gauging regional development and land use plans
- By local governments to prepare general plans.
- By developers to identify sites for residential and commercial development
- By human services providers for planning
- By school districts for planning infrastructure.

2. BASE DATA

The development of population and socioeconomic projections requires the collection of a substantial amount of base data. These base data include, but are not limited to the following:

- Population and Housing: Census 2000 SF1 data
- Group Quarters (Institutional and Non-Institutional): Census 2000 SF1 data
- Employment: Employment July 1, 2000 Base
- Residential Completions: April 1, 2000 to June 30, 2000, submitted and reviewed by MAG member agencies
- Street Network: MAGNet is an electronic street network for Maricopa County and Apache Junction that is updated regularly based on the Residential Completions, reviewed by MAG POPTAC
- Existing Land use: Year 2000 land use current as of July 2000, reviewed by MAG Population Technical Advisory Committee (POPTAC)
- Future Plans: Future Plans current as of Dec. 2001 or later, reviewed by MAG POPTAC
- Development Data: Year 2000 data current as of July 2000, reviewed by MAG POPTAC
- SAZ system: SAZi03
- TAZ system: TAZi03

- Post High School Institutions: MAG GIS & Database Enhancement Project, July 2000
- Mobile home and RV Parks: MAG GIS & Database Enhancement Project, July 2000
- Airport 2000 and projected enplanements: Regional Aviation System Plan Update.
- Projected enplanements for Sky Harbor and Williams Gateway airports.
- Retirement Areas: MAG GIS & Database Enhancement Project, July 2000
- Hotels/Motels/Resorts: MAG GIS & Database Enhancement Project, July 2000

The method of deriving the base data is discussed in the following sections.

2.1 Census Data

The most recent Decennial or Special Census provides a good source of information for developing projections. Because the census is an actual population count as opposed to an estimate, it provides a more reliable base from which to prepare projections. The following variables were extracted from the Decennial Census and used as a part of the projections base: resident population in households, resident population in group quarters, total housing units, occupied housing units, vacant housing units, housing units held for occasional use, institutional and non-institutional group quarters and households by income range. Figure 2-1 shows the population density derived from the Census. Figures 2-2 and 2-3 show the vacancy rates and persons per household respectively.

Because the latest Decennial Census was conducted on April 1, 2000, it was necessary to adjust the database to July 1, 2000 to provide a mid-year benchmark for the projections series. This adjustment was carried out by adding the housing units constructed between April 1, 2000 and June 30, 2001 minus any demolitions. By applying Census occupancy rates and persons per occupied household to the July 1, 2000 housing stock, a July 1, 2000 population was derived.

Census information was collected by County, place, census tract, block group and block. However, because MAG prepares projections by different geographical areas, (Municipal Planning Area (MPA), Regional Analysis Zone (RAZ) and Traffic Analysis Zone (TAZ)) it was necessary to reallocate the census data to this MAG geography. This reallocation was accomplished by establishing a conversion table relating the Census Blocks to the Traffic Analysis Zones. Where Census Blocks crossed TAZ boundaries population was allocated to each based upon the 2000 land use coverage. TAZs were then summed to RAZ and MPA levels of geography.

2.2 2000 Employment Database

Total 2000 employment at the County level was derived from a population control total developed by the Arizona Department of Economic Security. Total employment includes self-employed as well as wage and salary workers.

Using the 2000 Maricopa County employment control total, 2000 subregional employment estimates were prepared. An employer database for Maricopa County containing approximately 37,000 employers was purchased from Dunn & Bradstreet.

This database was merged with other sources of employment data, verified through a telephone survey of the largest employers, subjected to quality control measures and reviewed by MAG member agencies.

The employment from the employer database was then benchmarked to the Arizona Department of Economic Security Standard Industrial Classification (SIC) county totals. A land use was assigned to each employer record based on industry, industry to land use relationships and Traffic Analysis Zone (TAZ) land use.

Each employer was geocoded and employment then summed by land use classification to Traffic Analysis Zones. These estimates were then adjusted to the county employment control total for employment not captured in the major employer database based on the underlying land use. This resulted in subregional employment estimates which in turn were summed to Regional Analysis Zone (RAZ) and Municipal Planning Area (MPA). Figure 2-4 shows the distribution of employment locations and the number of employees at each site.

2.3 Residential Building Completions

Since April 1990, MAG has collected residential building completions by unit type from MAG member agencies. The four unit types are single family, condo/townhouse, apartment and mobile home.

After initial collection efforts, the number of residential completions are summed by unit type and forwarded to MAG member agency for review and verification. Adjustments to the total residential completions by unit type require the submittal of documentation. Each completion is also geocoded, enabling MAG to aggregate new development by MAG geography.

2.4 Existing Land Use

The existing land use database identifies the current land use pattern in the urban area. MAG maintains a 49 land use category classification that was established by MAG in concert with its member agencies.

The existing land use database was digitized by MAG staff and MAG consultants based on input from MAG member agencies and then circulated to the agencies for review and verification. Changes were made based on comments provided. Figure 2-5 depicts the existing land use derived from this process.

The existing land use coverage is important to the projections process because it establishes areas that have already been developed or are not suitable for further development. The developed areas become ineligible for the allocation of population and employment growth, except where the area is planned for redevelopment. Nondevelopable areas include open space or environmentally sensitive lands, or areas where the relief makes construction infeasible.

2.5 Future Land Use

The Future Land Use Database is based upon the plans of MAG member agencies and identifies both the type of development that is anticipated to occur in the future and the density of that development. For example, rural residential land use allows for up to 1 unit per acre. In those areas designated rural residential, a maximum is established so that the projections model does not exceed the 1 unit per acre density authorized.

The Future Plan Land Use database also uses the standard MAG 49 land use categories that allows for a direct comparison between existing and planned land use. The difference between the existing and planned land use databases helps determine where development may take place. Figure 2-6 depicts the future land use derived from this process.

2.6 Large Scale Developments

A Large Scale Development Database was developed through a consultant study. Information was collected on major residential and non-residential developments including number of units or square footage by land use parcel. An estimated date for the initiation of the development was also determined. The Large Scale Development Database was used to calibrate the MAG projections model to ensure that it captured anticipated development. Figure 2-7 depicts the developments derived from this process.

2.7 MAG Subregional Geography

Maricopa County is subdivided into 27 Municipal Planning Areas (MPAs), 145 Regional Analysis Zones (RAZs) and 1864 Socioeconomic Analysis Zones (SAZs). Municipal Planning Areas include the corporate limits of a municipality plus any adjacent areas that are anticipated to become a part of those corporate limits in the future. Regional Analysis Zones are subunits of MPAs, and are the basic unit used by the spatial allocation model to prepare subregional projections. RAZs are further divided into Socioeconomic Analysis Zones. The SAZ is the smallest unit for which MAG prepares projections. Their boundaries are defined using major streets and landmarks. In addition, MAG also includes parts of Pinal County in its transportation modeling area, as transportation needs are partially dictated by the people living and working in Pinal County. The transportation model uses a geography called the Traffic Analysis Zone (TAZ). The TAZ is similar to the SAZ, but is only within the transportation modeling area and its numbering system is sequential.

The interim projections by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ) were prepared to be consistent with the April 1, 2000 Census and have been prepared for July 1 of the following years: 2010, 2020, 2025 and 2030. The projections by Socioeconomic Analysis Zone (SAZ) and Traffic Analysis Zone (TAZ) were prepared to be consistent with Interim Socioeconomic Projections by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ) accepted by MAG Regional Council on June 25, 2003. The projections by SAZ and TAZ have not been through any formal MAG approval process.

2.8 Other Data Collection Efforts

Other data needed by the modeling process include post high school institutions and enrollment, mobile home and recreational vehicle parks and number of residential and non-residential units, current and projected enplanements for Sky Harbor and Williams Gateway airports, current and projected retirement areas, and hotels, motels and resorts and number of beds and employees. The data on recreational vehicle parks, hotels, motels and resorts are used to develop estimates and projections of non-resident population. The majority of this information was collected by consultants for the MAG GIS and Database Enhancement Project during 2000 and 2001. The MAG Population Technical Advisory Committee (POPTAC) then reviewed this information and provided further comments. Figures 2-8 to 2-11 show some of the databases derived from this process.

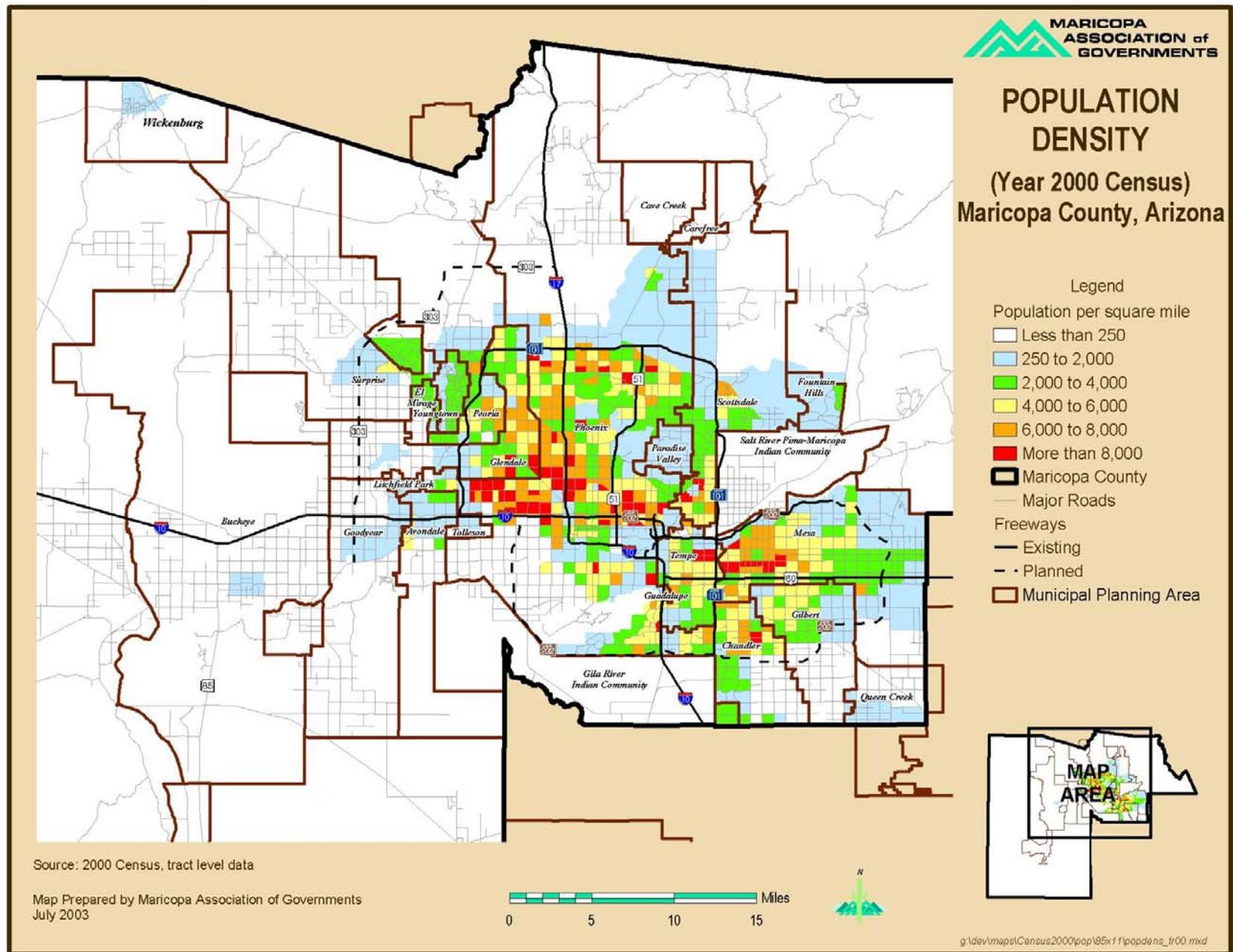


Figure 2-1: Population Density, 2000

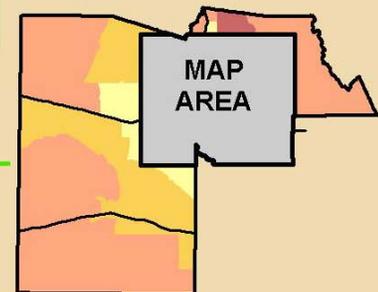
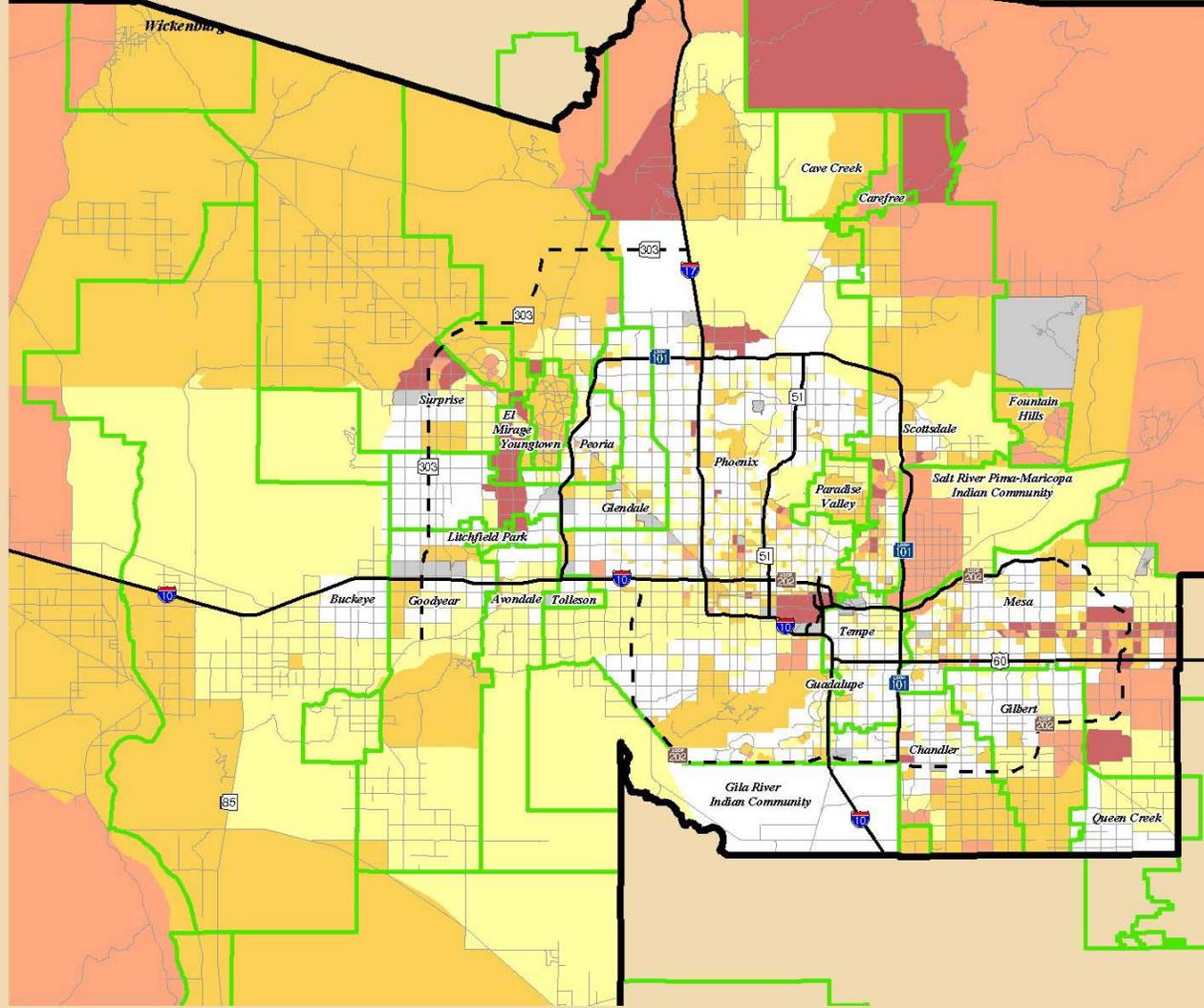
VACANCY RATES (Year 2000 Census) Maricopa County, Arizona

Legend

Percent Vacant Housing Units
(Maricopa County Average = 9.4%)

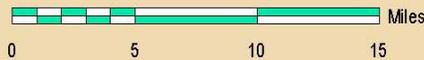
- less than 5%
- 5 to 10%
- 10 to 20%
- 20 to 35%
- more than 35%
- Insufficient Data

- Municipal Planning Area
- Maricopa County
- Major Roads
- Freeways
- Existing
- Planned



Source: 2000 Census, block group data

Map Prepared by Maricopa Association of Governments
November 2002



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Figure 2-2: Vacancy Rates, 2000

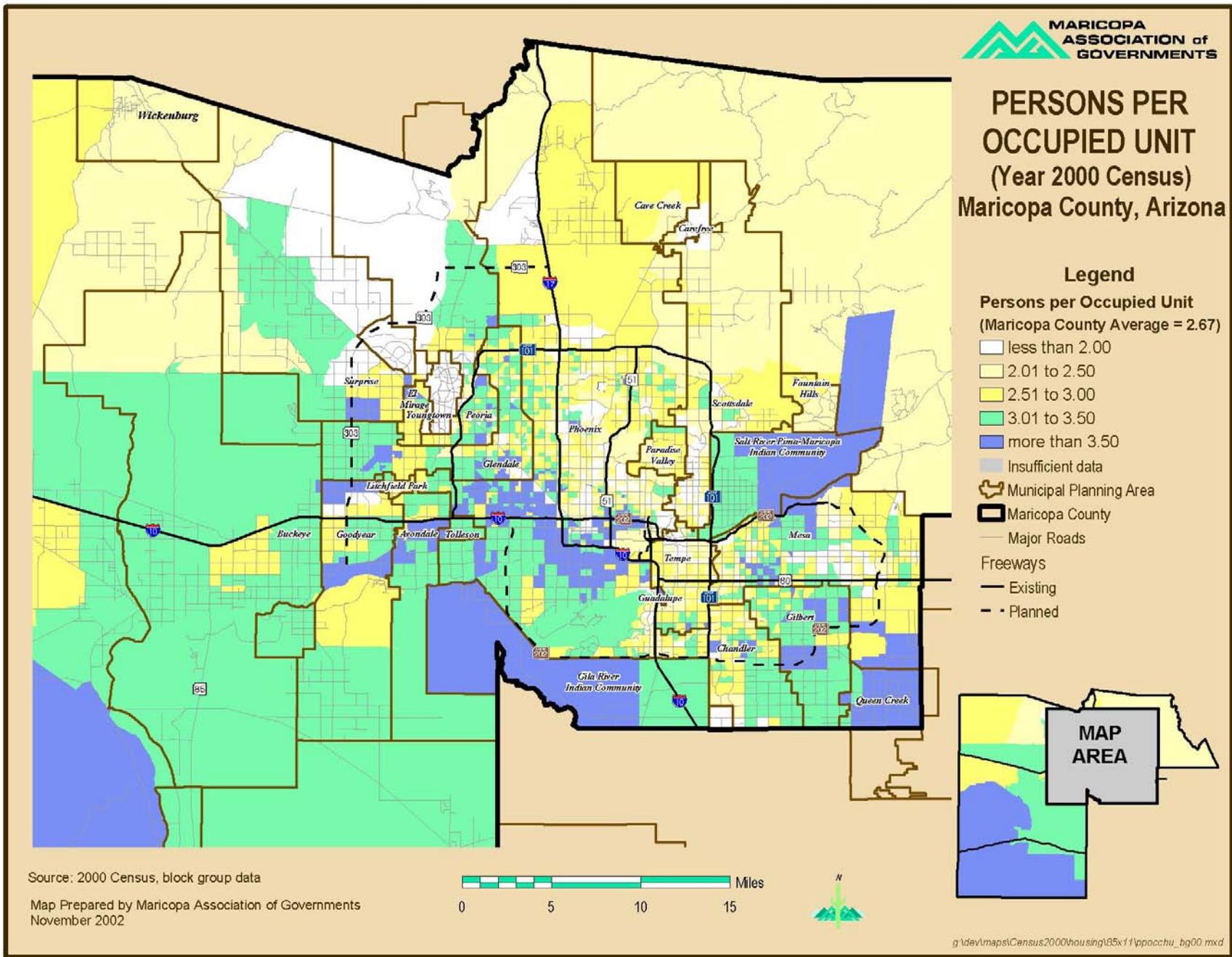


Figure 2-3: Persons Per Household, 2000

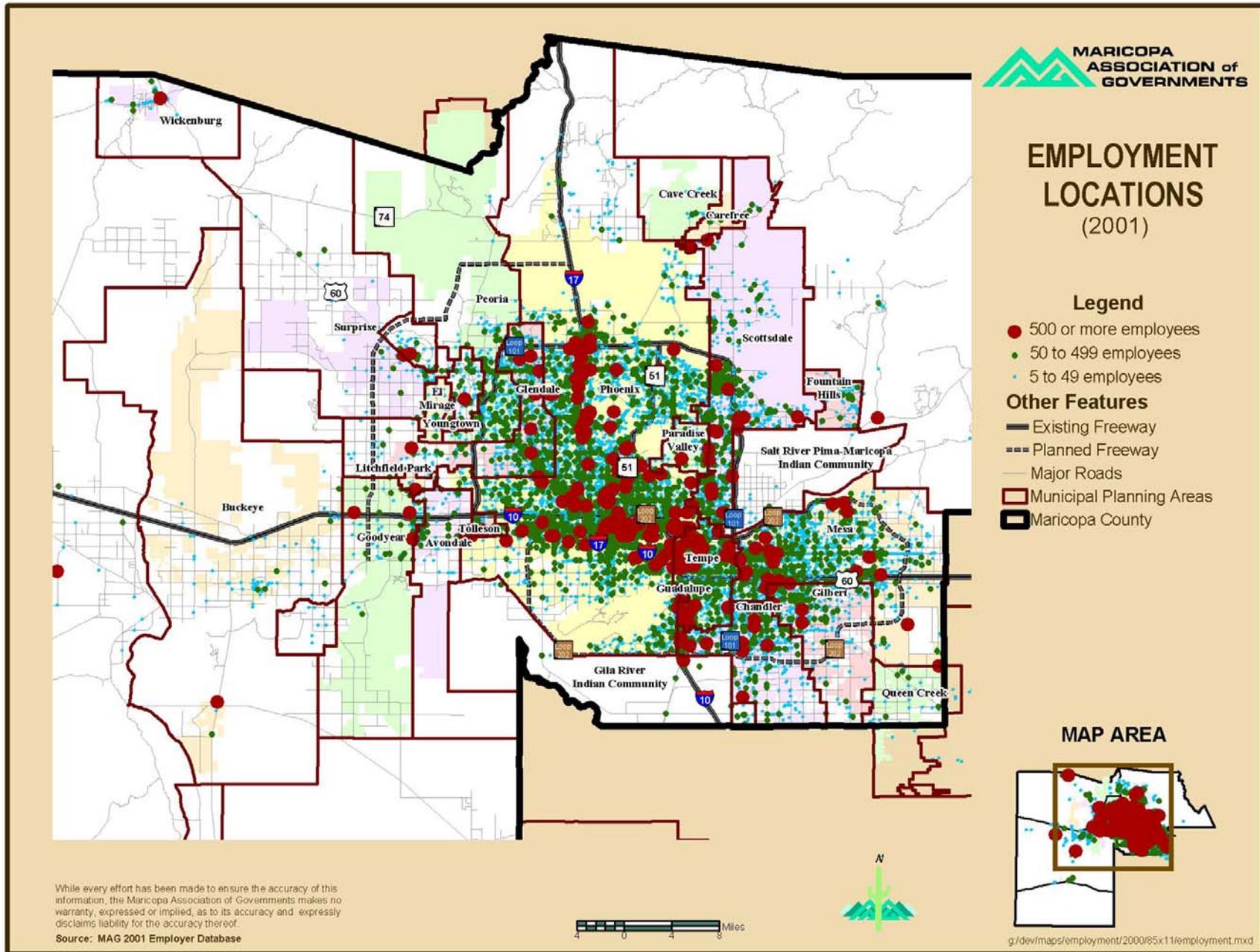


Figure 2-4: Employment Locations, 2000

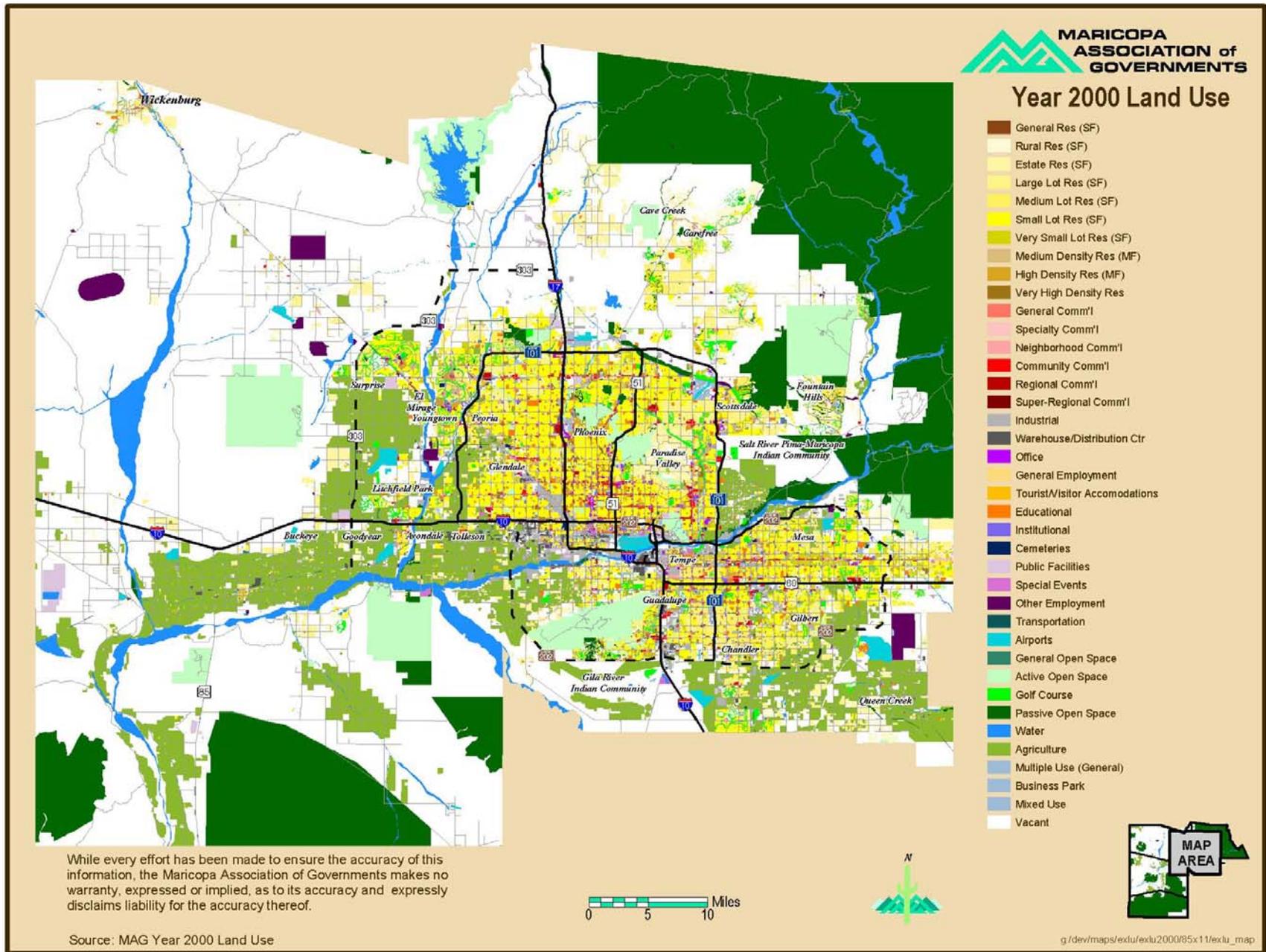


Figure 2-5: Existing Land Use, 2000

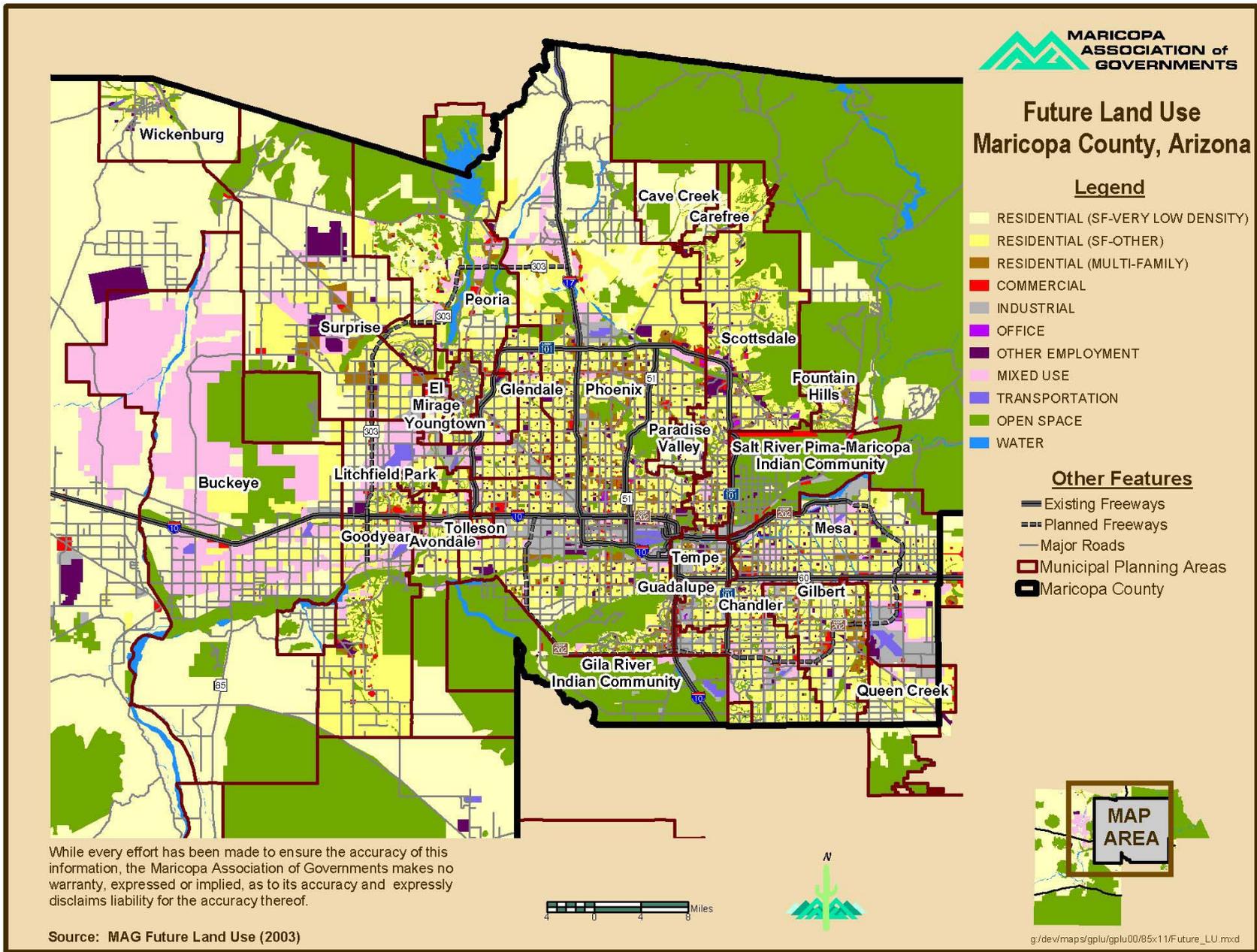


Figure 2-6: Future Land Use

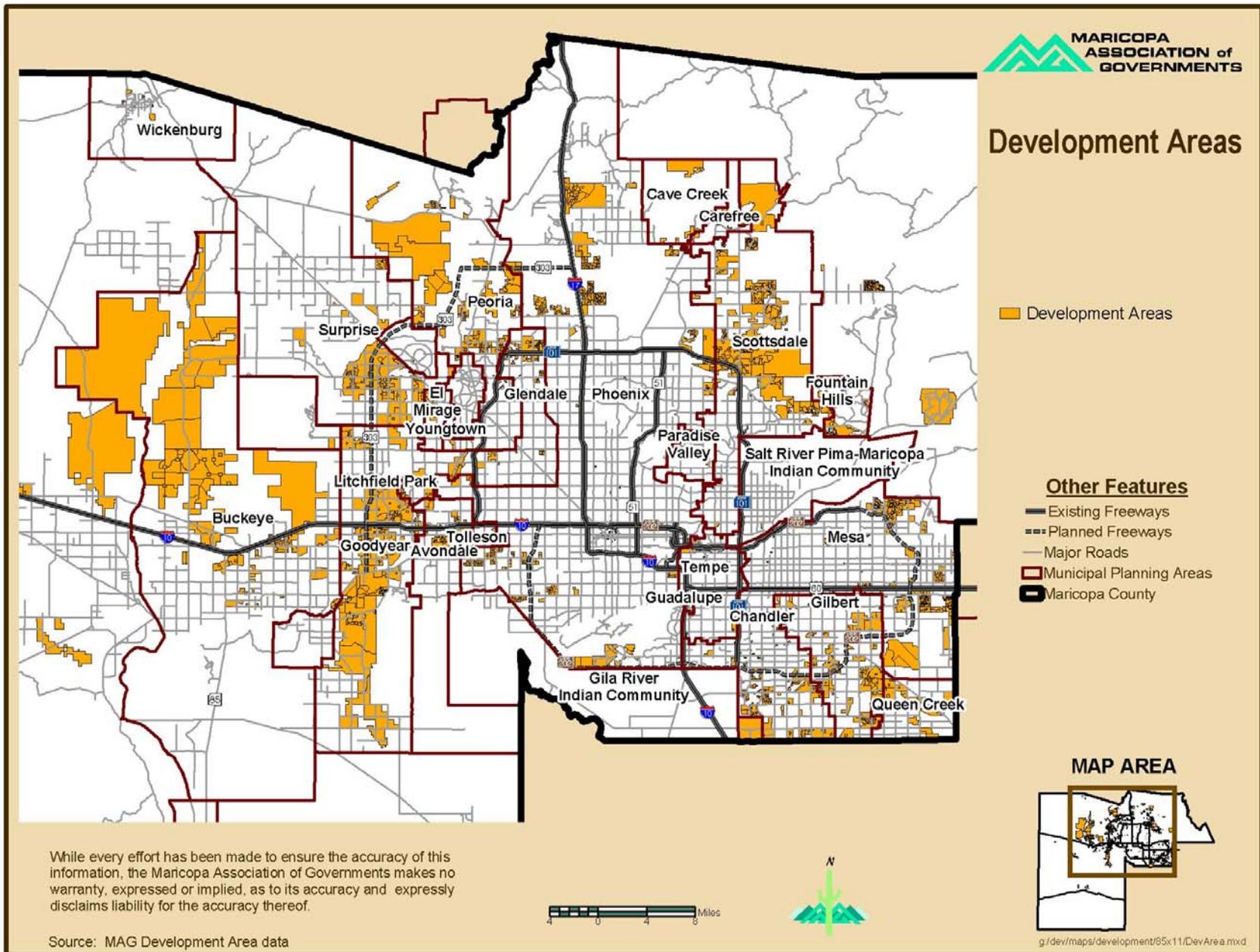


Figure 2-7: Large Scale Developments

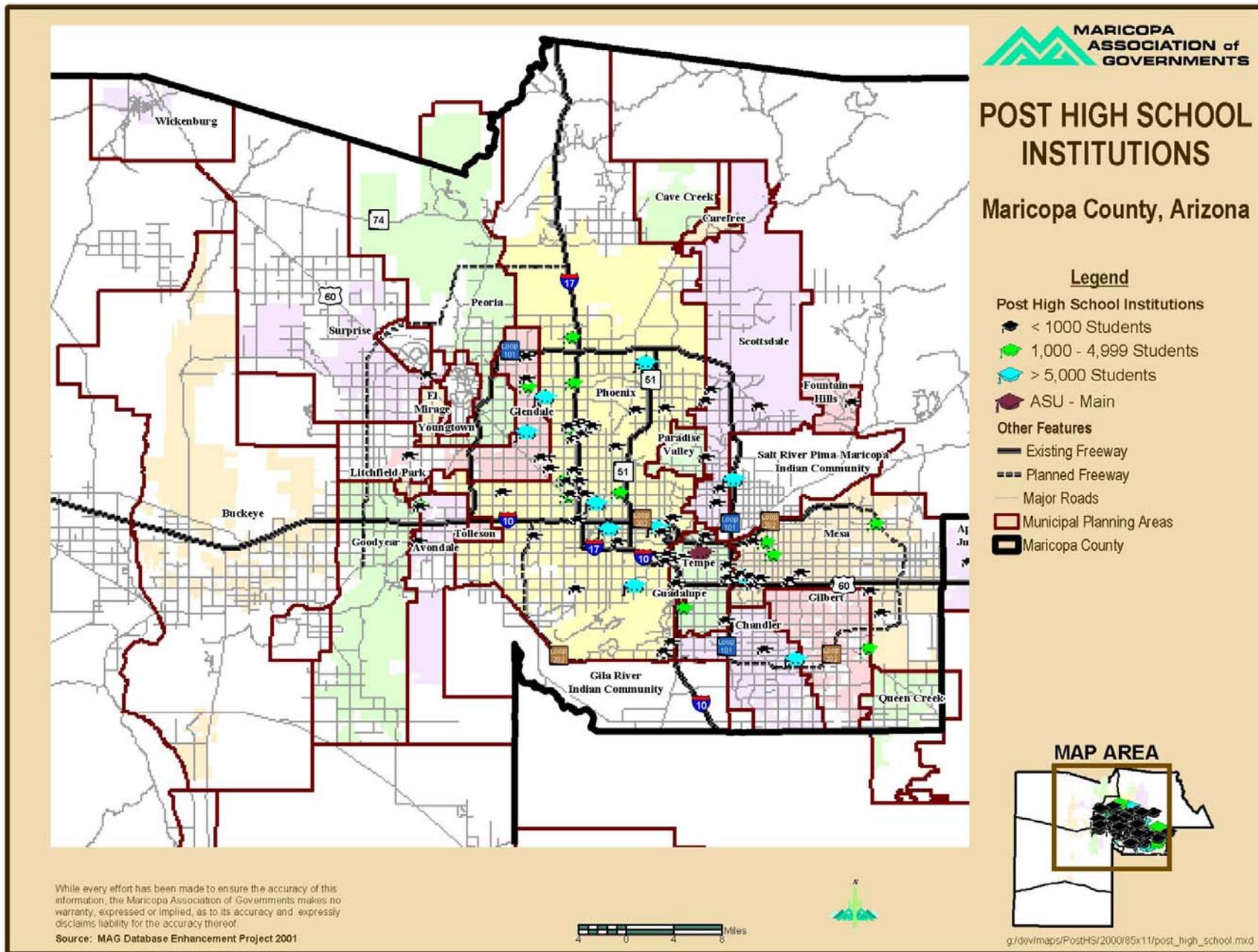


Figure 2-8: Post High School Institutions

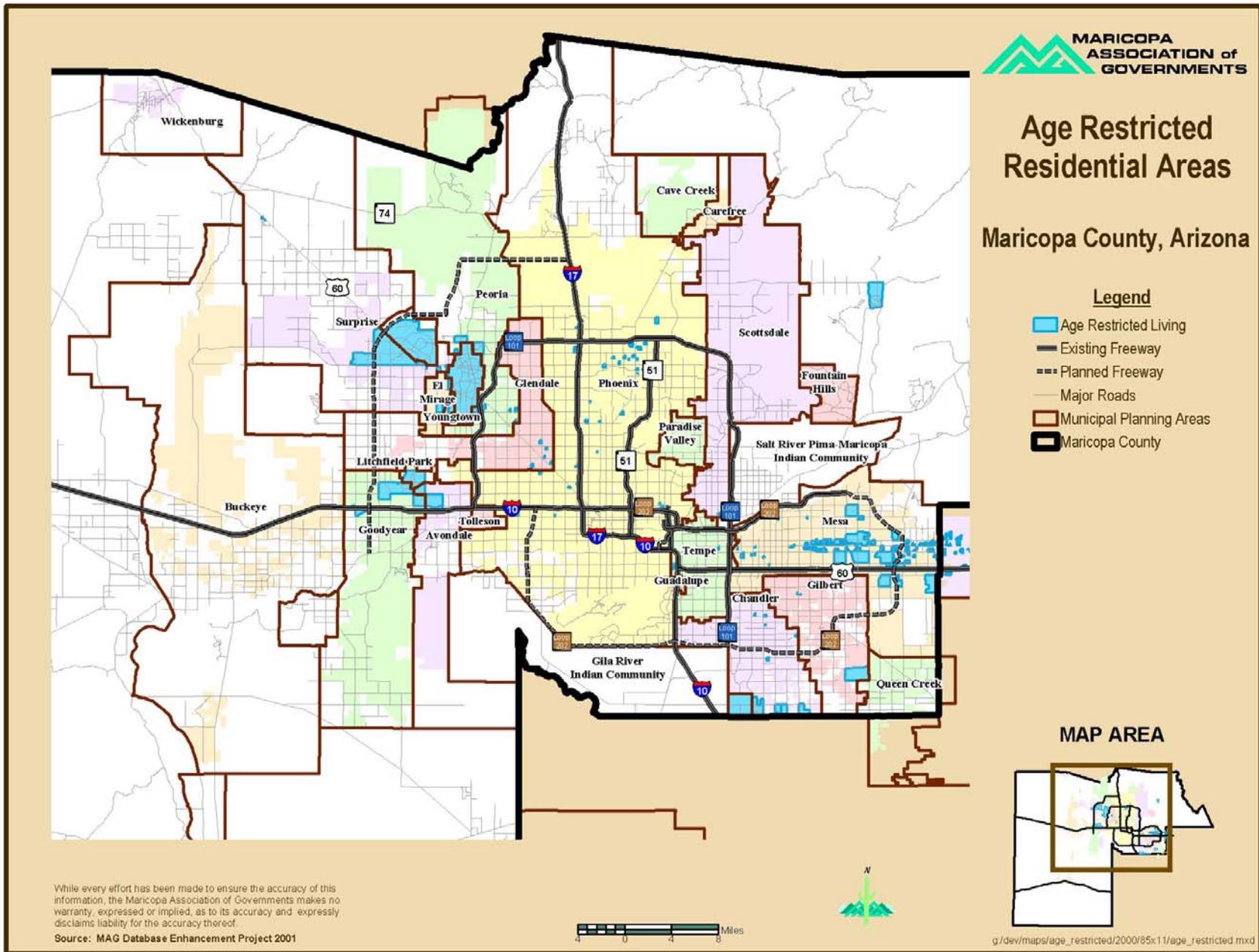


Figure 2-9: Age Restricted Residential Areas

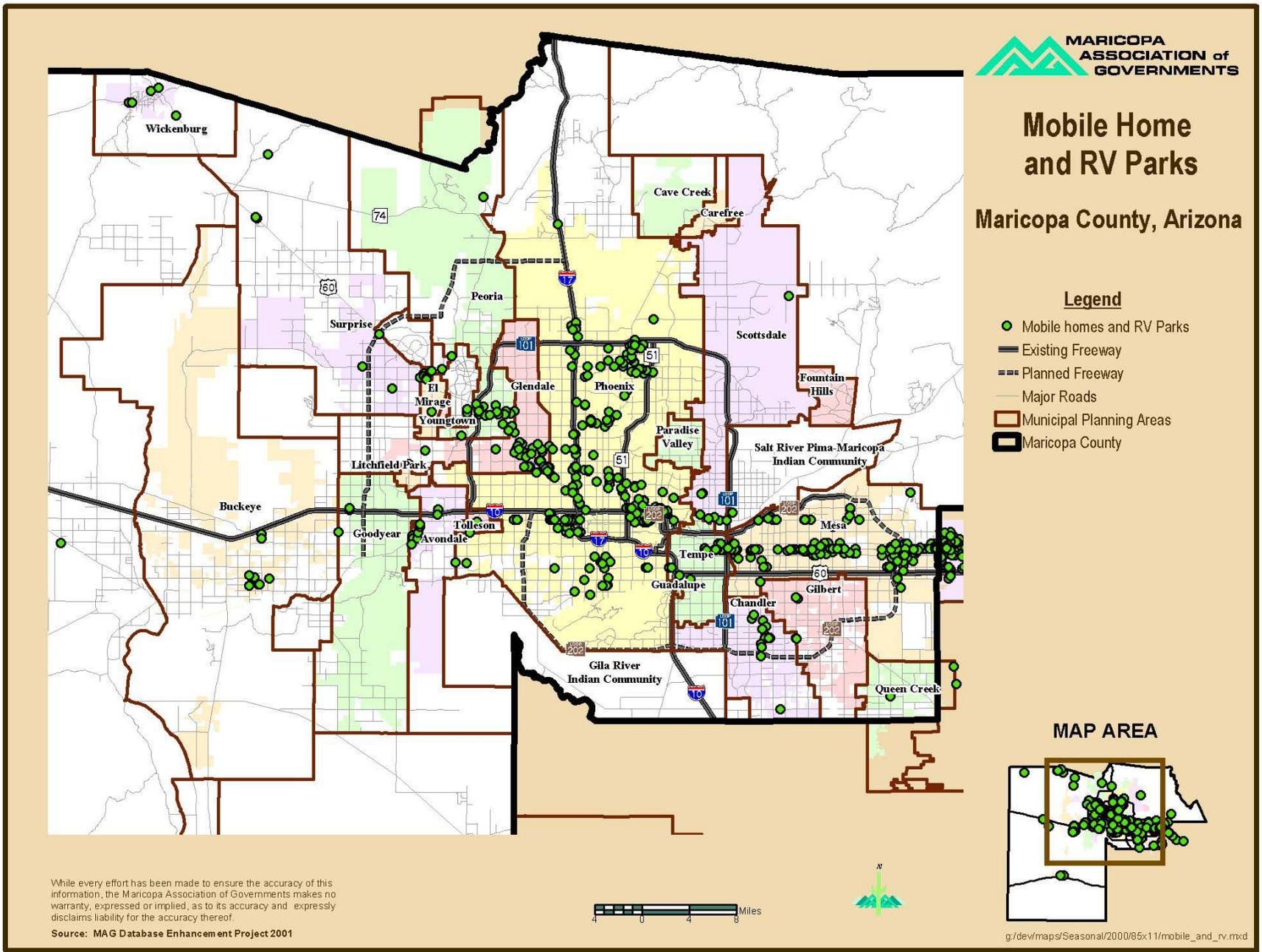


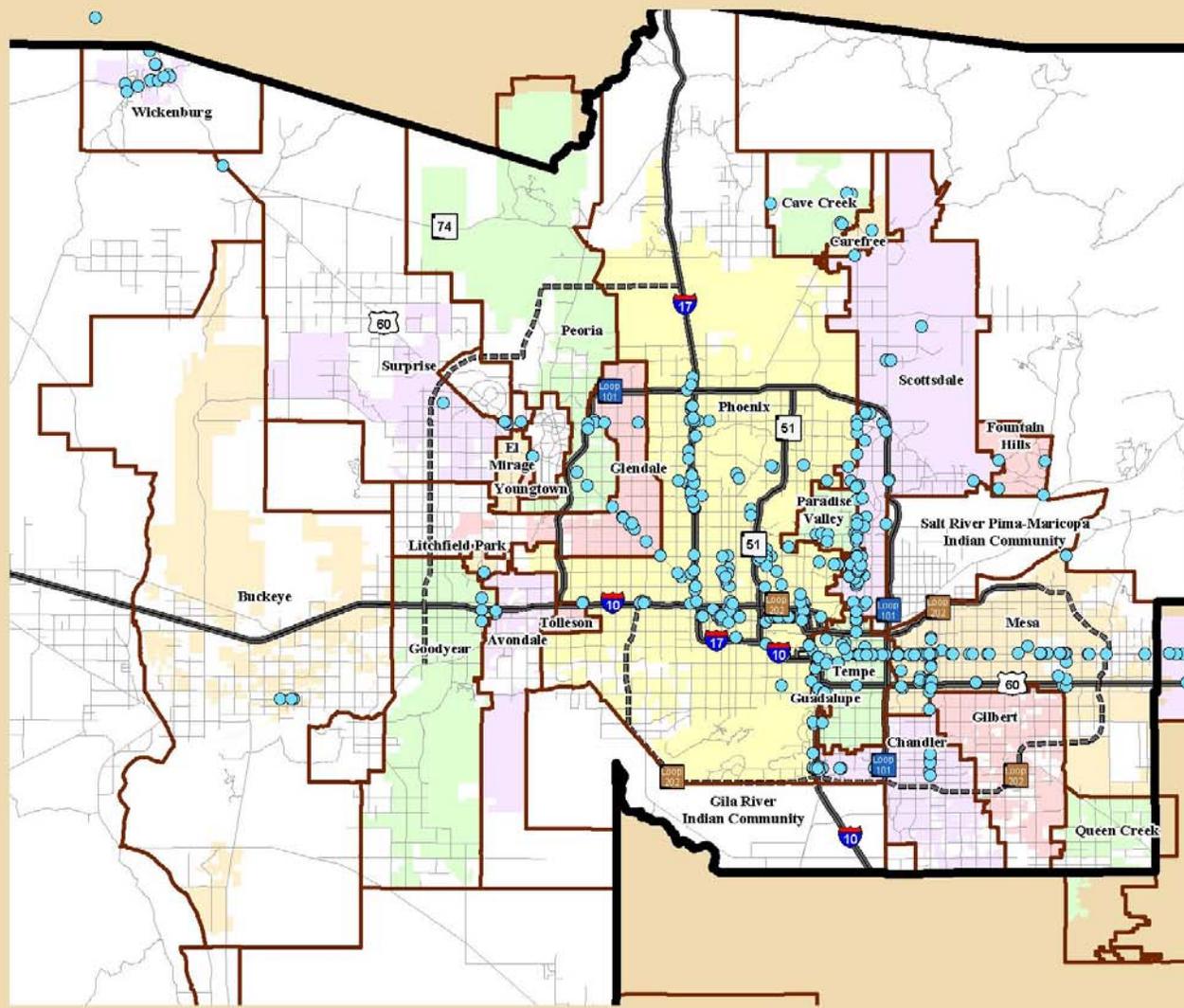
Figure 2-10: Mobile Home and RV Parks

Hotels and Motels

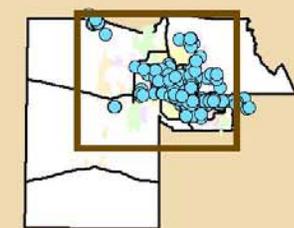
Maricopa County, Arizona

Legend

- Hotels and Motels
- Existing Freeway
- Planned Freeway
- Major Roads
- Municipal Planning Areas
- Maricopa County



MAP AREA



While every effort has been made to ensure the accuracy of this information, the Maricopa Association of Governments makes no warranty, expressed or implied, as to its accuracy and expressly disclaims liability for the accuracy thereof.
 Source: MAG Database Enhancement Project 2001



g:\dev\maps\Transient\2000\85x11\Hotel_Motel.mxd

Figure 2-11: Hotels and Motels

3. MODELS & MODELING PROCESS

The primary purpose of the population and socioeconomic projections developed by MAG is for input into the MAG transportation and air quality models. However, they are also used for a wide variety of regional planning programs such as human services, regional development and by MAG member agencies in developing their plans.

Important objectives of the modeling process are to:

- Establish a linkage between transportation, land use and air quality models. This linkage is depicted in Figure 3-1.
- Test various policy alternatives and land use scenarios.
- Incorporate a Geographic Information System (GIS) into the process for better data sharing and review with member agencies and for maintaining an innovative approach to land use planning.

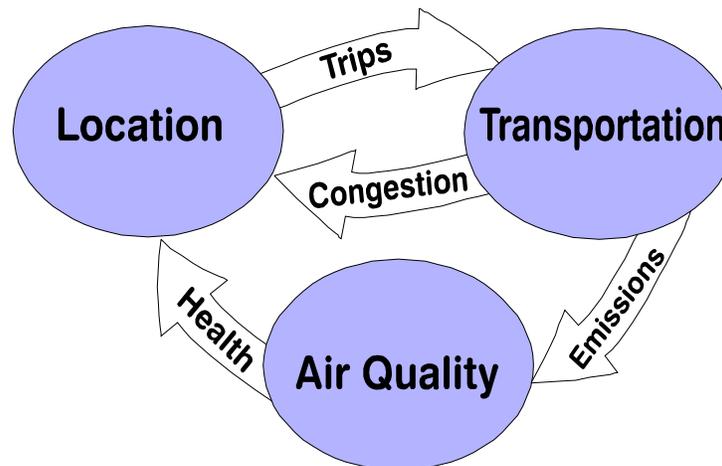


Figure 3-1: Modeling Relationships

3.1 Methodology for Preparing Projections

The land use, population and socioeconomic modeling is based on a three-tier modeling process as shown in Figure 3-2. The first tier is a demographic model that is used to produce county control totals. The second tier involves using a spatial interaction model to allocate the county control total population and employment to subregions. The third tier allows for the allocation of the subregional population to smaller areas drawing upon GIS representation of land use plans and local policies of MAG member agencies.

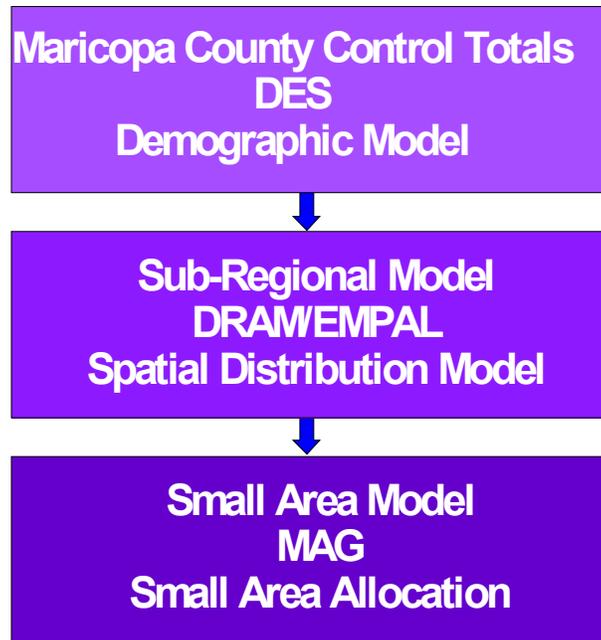


Figure 3-2: Three-Tier Modeling Process

3.2 County Level Model

The first tier model is a county level model. In accordance with Executive Order 95-2, the preparation of county and state level population projections is the responsibility of the Arizona Department of Economic Security (DES). This model is a demographic model, projecting births, deaths and net migration in each county for a fifty-year time horizon. This model incorporates population by age and sex, birth rates, death rates and net migration trends. The model takes into account short-term economic conditions, but not long-range employment trends.

The Arizona Department of Economic Security (DES) is responsible for preparing the official state and county control population control totals. However, DES has not yet prepared updated county control totals because of the unavailability of certain census data. DES developed the last set of official population projections in 1997. Because MAG needs to develop control totals for socioeconomic projections for the Regional Transportation Plan, MAG staff has developed an updated set of population and employment projections drawing upon work prepared by Arizona State University and the University of Arizona for the Department of Commerce State Economic Strategies Study, and the MAG REMI (Regional Economic Models, Inc.) model. See also, section 4.4 for further details on the method for County level projections.

3.3 The Sub-Regional Model

For the second tier process, MAG is using METROPILUS (DRAM/EMPAL). DRAM and EMPAL are registered trademarks of S.H. Putman Associates. The two models, DRAM (Disaggregated Residential Allocation Model) and EMPAL (EMPloyment Allocation Model), forecast household location, and employment location. These models are being used by a number of major metropolitan areas.

DRAM/EMPAL projects the spatial patterns of households and employment in the MAG region. The forecasting procedure starts with regional trends, transportation facility descriptions and data on the current location of employment by sector. This information is then used to project the future location of households. Figure 3-3 displays this process. The projections are done for five-year intervals.

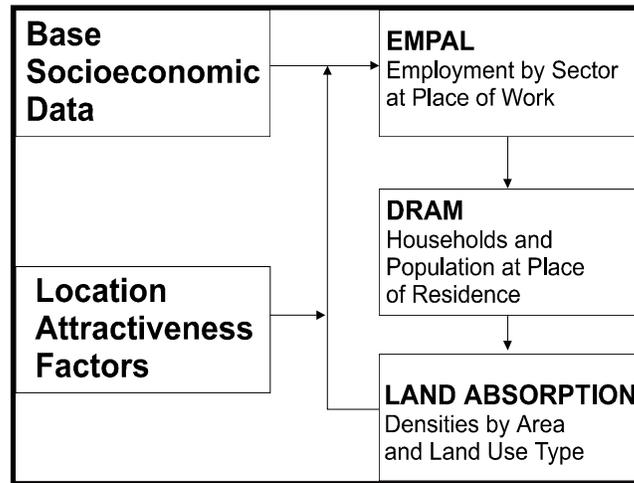


Figure 3-3: DRAM/EMPAL Spatial Distribution Model

Each five-year step begins with the EMPAL model to project employment by sector by zone. DRAM modeling to project households by income category follows the EMPAL run for that time period. The specific data that were input into the DRAM/EMPAL models are as follows:

EMPAL

- Employment by sector by zone for the previous time period.
- Population by income category by zone for the previous time period
- Total area of each zone
- PM peak hour travel times from each zone to every other zone
- Regional employment forecasts by sector for the time period.

DRAM

- Population by income category by zone for the previous time period
- Land used for residential purposes in each zone for the previous time period.
- The percentage of developable land in each zone which is already developed
- Vacant developable land in each zone
- PM peak hour travel times from each zone to every other zone
- Employment by sector by zone for this time period
- Regional population forecasts by sector for the time period.

Land consumption in each zone is performed after the DRAM model is run. Land consumption in this version of DRAM/EMPAL is derived from zone specific densities of housing and employment.

3.4 The Subarea Allocation Model (SAM-IM)

The third tier Subarea Allocation Model- Information Manager (SAM-IM) allocates population and employment from RAZs to one-acre grids that are then aggregated to TAZs.

The method for ranking one acre grids (220 feet on each side) which receive development are based on a number of factors:

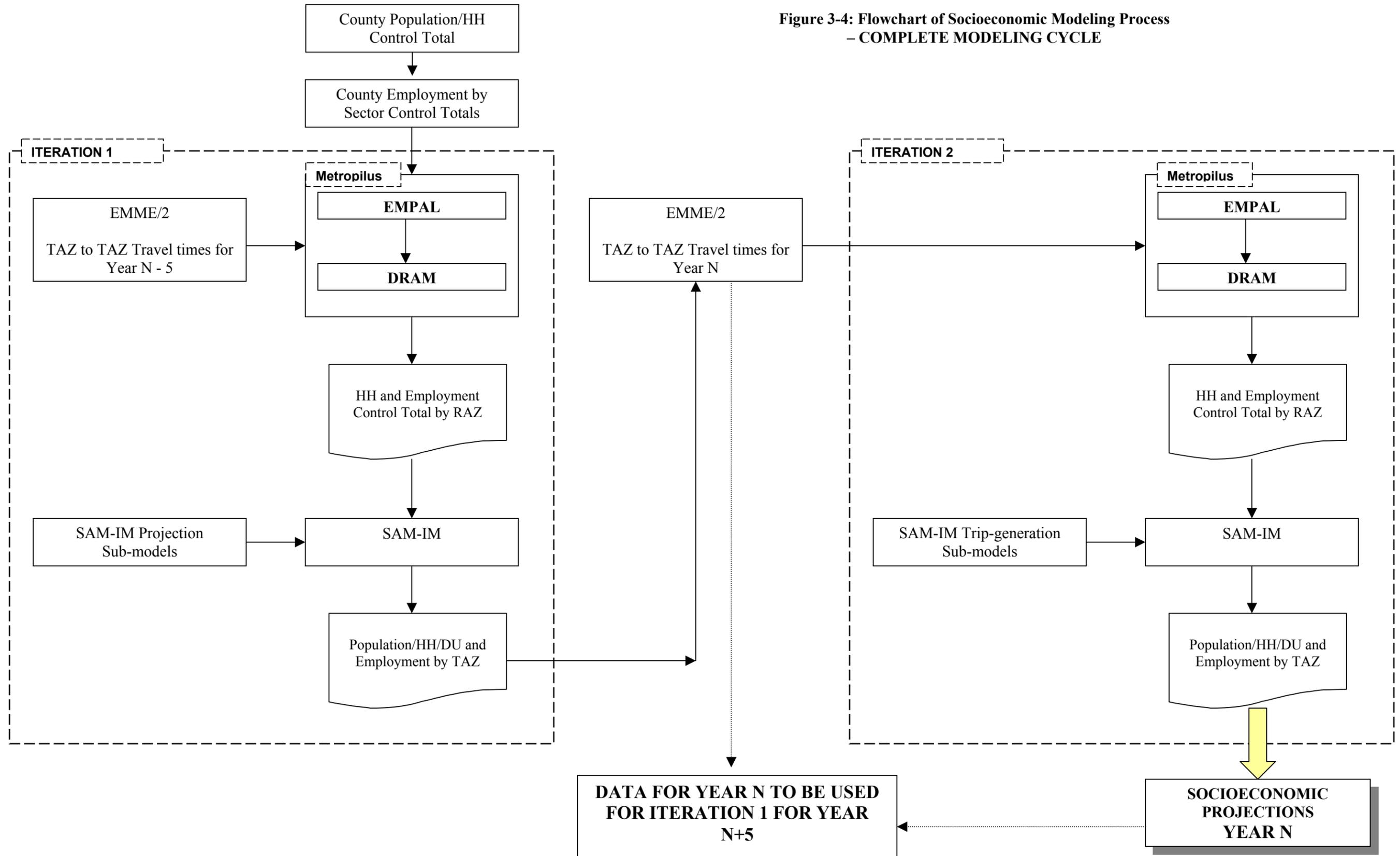
- Land use, to insure that the grid is vacant and eligible to receive either employment or population;
- Active and planned development, to include development underway, or anticipated initiation of development;
- Urbanization, to indicate the extent to which development occurs close to existing development;
- Highway access, to identify proximity to the nearest arterial; and
- Infill, to determine the extent to which a grid is surrounded by development.

The composite score derived from this ranking process is then used to determine the allocation of population and employment from each RAZ. Land uses are allocated separately, and build outs, floor area ratios and square feet per employee are all used to determine the final allocation to grids and then to TAZ.

3.5 Modeling Process

The following four figures (Figures 3-4 to 3-7) depict schematically the MAG socioeconomic modeling process.

**Figure 3-4: Flowchart of Socioeconomic Modeling Process
– COMPLETE MODELING CYCLE**



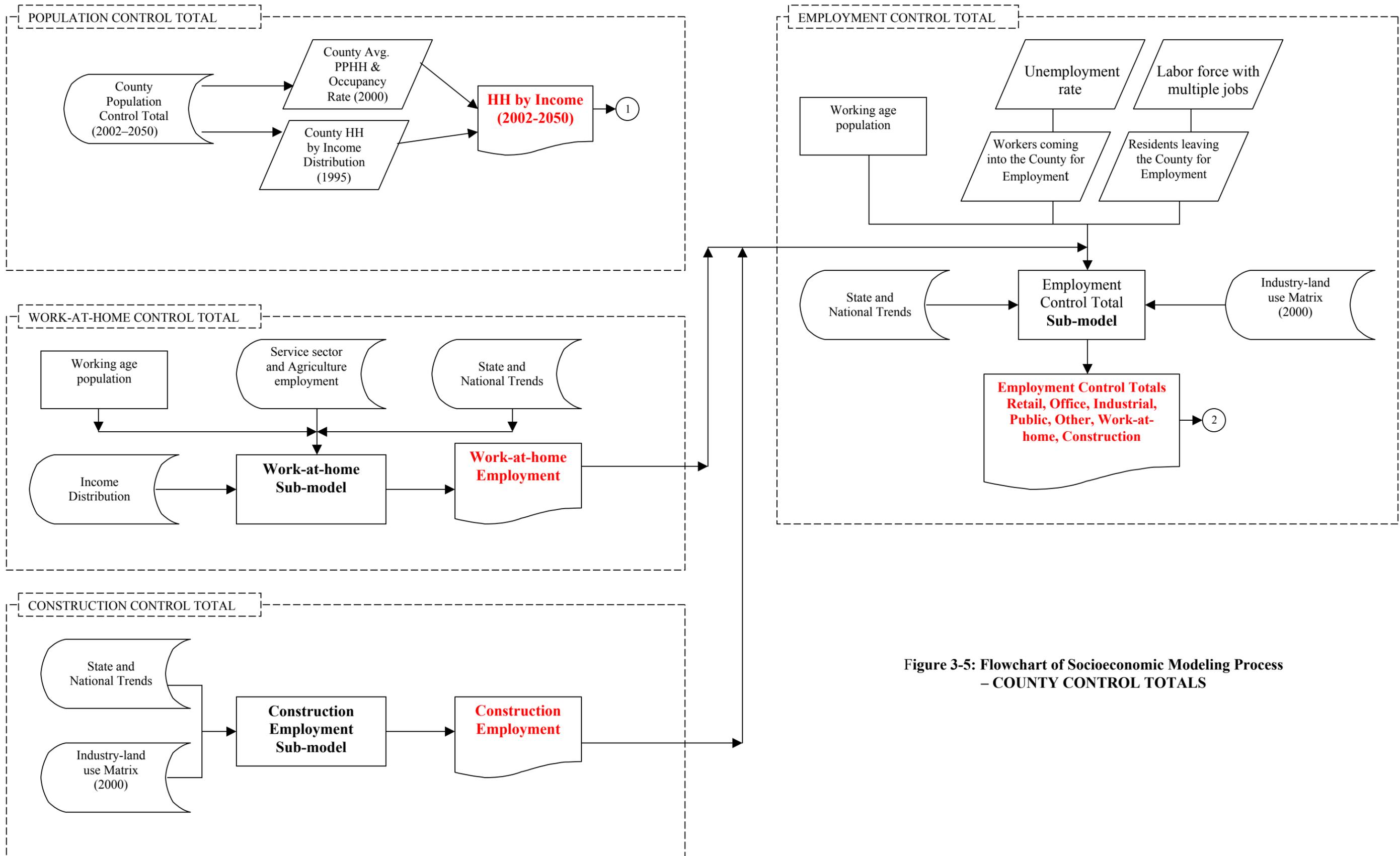
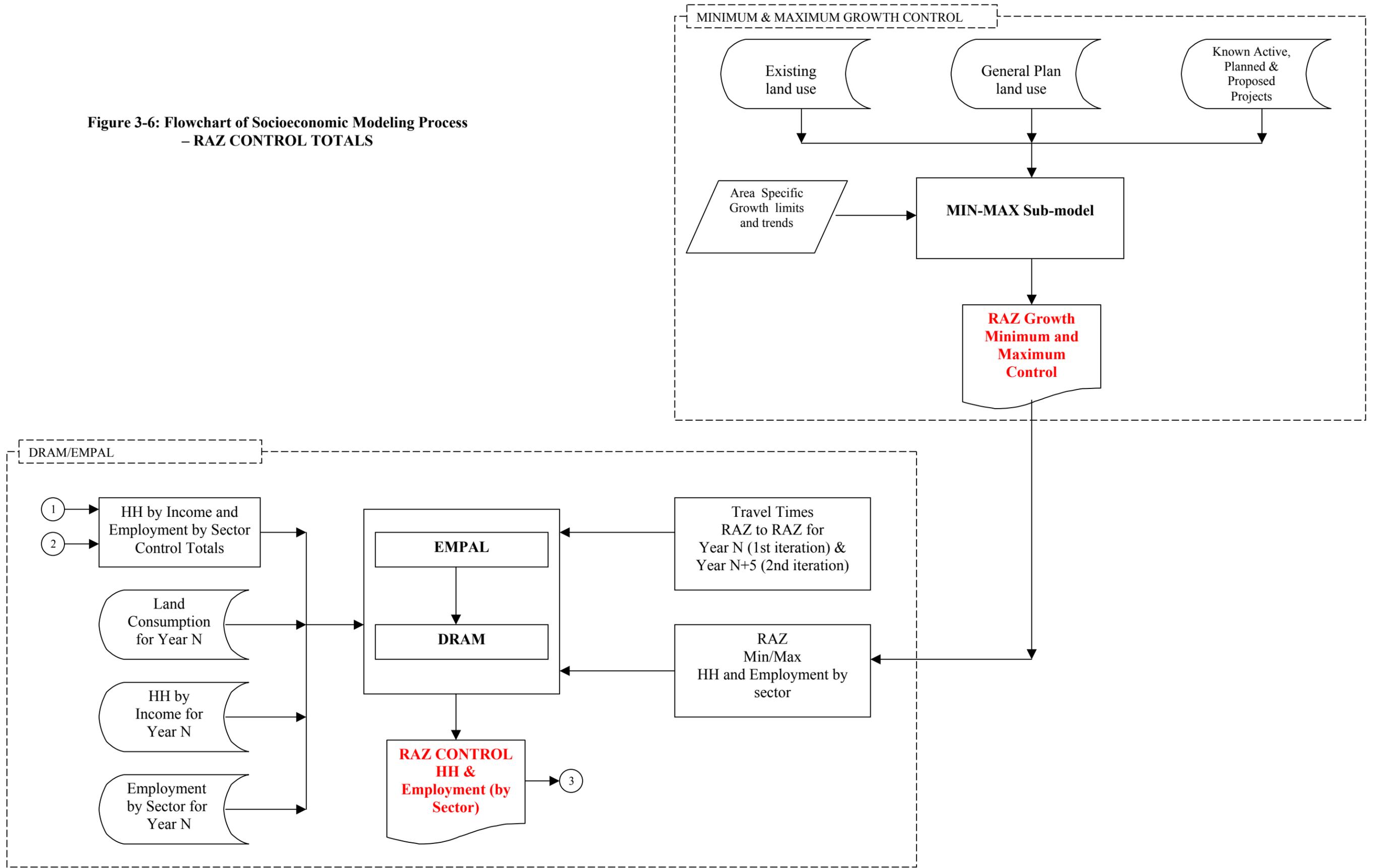


Figure 3-5: Flowchart of Socioeconomic Modeling Process
 – COUNTY CONTROL TOTALS

**Figure 3-6: Flowchart of Socioeconomic Modeling Process
– RAZ CONTROL TOTALS**



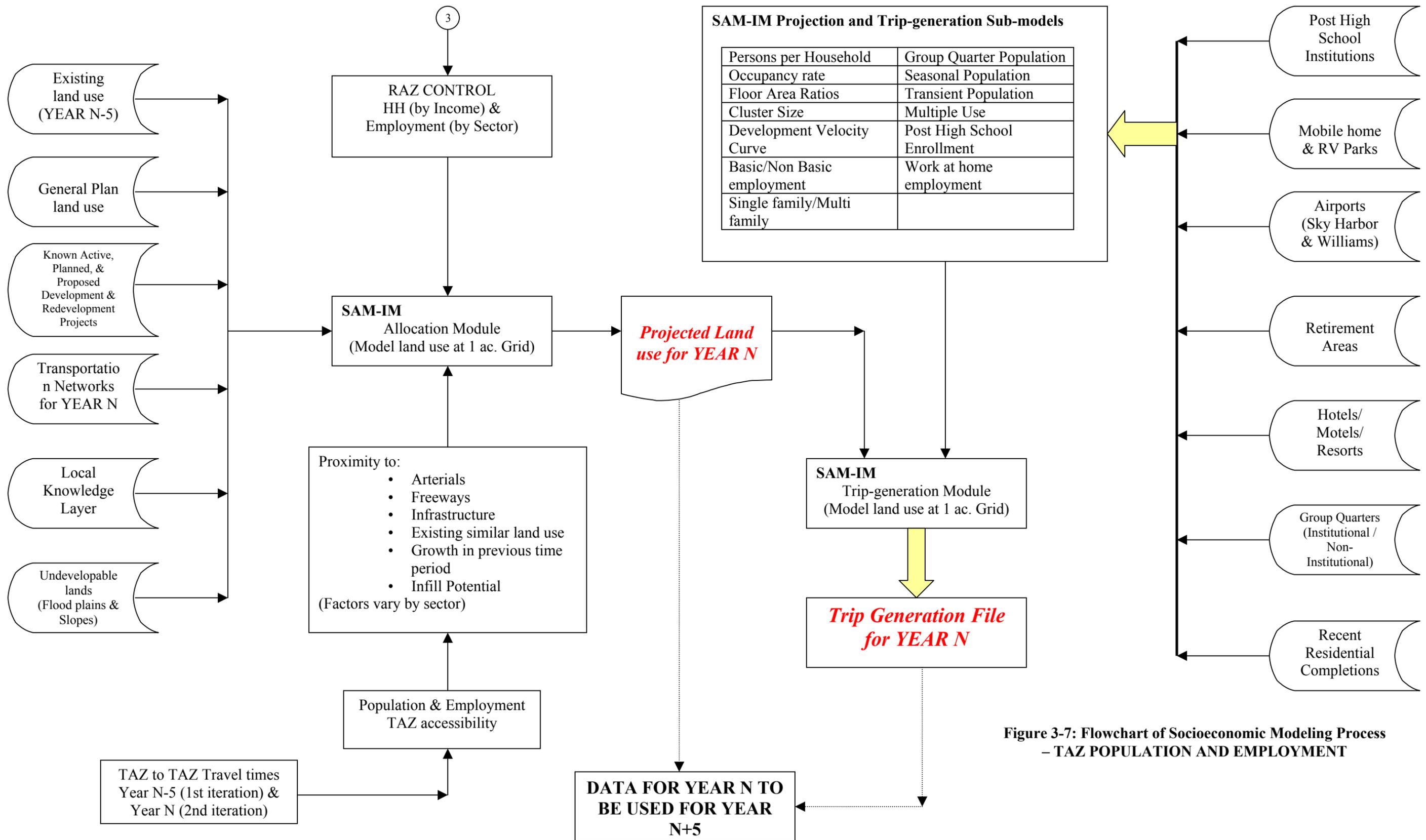


Figure 3-7: Flowchart of Socioeconomic Modeling Process – TAZ POPULATION AND EMPLOYMENT

4. ASSUMPTIONS & METHODS

The following is a list of assumptions and methods approved by the MAG Population Technical Advisory Committee (POPTAC) over the past two years.

4.1 MAG Geography

- Transportation Analysis Zones (TAZs) are required for transportation planning and are set by the MAG Street Committee with input from the MAG POPTAC.
- TAZs are modified as expected growth in a 30-year horizon expands geographically or densities in existing TAZs warrant TAZ splits.
- Each municipality has its own Municipal Planning Area (MPA), which delineates the area of planning concern for each jurisdiction. TAZs and Regional Analysis Zones (RAZs) fall completely within only one MPA, as TAZs add up to RAZs, and RAZs add up to MPAs.
- The metropolitan area is growing beyond the current modeling area. This includes not only areas further south and west in Maricopa County, but also areas beyond the physical boundaries of Maricopa County. Queen Creek, Peoria and the Gila River Indian Community already extend into other counties. Apache Junction has been included in the modeling area for many years. It was therefore necessary to extend the modeling area further south and west in Maricopa County and further into Pinal County.

4.2 Base July 1, 2000 Population and Housing Variables

- The MAG socioeconomic models require a base population, housing and households from which to begin its modeling process.
- A census in 2000 for April 1, 2000 population and housing determines the base at that time.
- Additional housing units, households, population in group quarters and population in households are derived from the Residential Completions submitted by each member agency. Residential Completions for April 1, 2000 to June 30, 2000 are extracted from the file to create the base July 1, 2000 numbers.
- These counts are then cumulated to TAZ2002.

POPTAC Recommendation:

- Use the method as described above for cumulating Base July 1, 2000 population and housing data to TAZ2002.

4.3 Base July 1, 2000 Employment by Sector

- The MAG transportation models require employment projections by 5 land use types, namely, Retail, Office, Public, Industrial, and Other, for July 1, 2000.
- For effective transportation modeling, the employment by sector must be identified by land use sector and not by SIC categories. Thus, if an office is in a retail center, and the underlying land use is “Retail,” then the office employees are in a Retail sector. Care must thus be taken to ensure proper interpretation of the results.
- The MAG socioeconomic models, therefore, require a base employment by the same 5 land use types, namely, Retail, Office, Public, Industrial, and Other, from which to begin its modeling process.
- A database of employment of 5 or more employees at any one site was collected by MAG/MAG consultants and reviewed by each MAG member agency. This database included, among other items, the name, address, SIC code and number of employees at the site. The information was collected from various private and public sources and enhanced by phone interviews. Changes were made to the database as identified by the member agencies.
- A coverage of existing land use as of July 1, 2000 was collected by MAG/MAG consultants and reviewed by each MAG member agency. This coverage was based on land use categories approved by POPTAC prior to beginning the creation of the coverage. Changes were made to the coverage as identified by the member agencies.
- The employment locations were address matched, compared to a database of employment-based buildings, and assigned to the underlying land use sector as identified in the existing land use database.
- Where employment appeared in incompatible land use sectors, such as residential, the land use code as derived from the SIC code was used. This was to account for possible issues with small parcels of employment-based land use not identified on the existing land use database.
- Where employment appeared in a multiple use land use sector, such as Business Park, the underlying base employment was derived from the SIC code.
- After all of the known employment was allocated, the residual employment was assumed to be the 1-4 employees per site that were not collected by MAG/MAG consultants. This employment was allocated to the employment-based land use sectors identified on the existing land use coverage with limited or no employment. The database of employment-based buildings was also used. This employment used Floor Area Ratios and Employment Density factors in order to allocate the remaining employment at the appropriate densities.
- The majority of construction employment is not located at the corporate offices of the company, but at construction sites across the region. Therefore, construction employment in the Industrial Sector using the above methodology was not assigned to the employment location. Construction employment was assigned spatially to where new construction was identified in the prior two years, using both the

Residential Completions database and the Development database. This employment is considered to be in the Other Sector.

- Work-at-Home employment was derived separately using the algorithm identified in 4.13.
- Non-Basic employment was derived separately as identified in 4.5.

POPTAC Recommendation:

- Use the method as described above for cumulating base employment to TAZ2002.

4.4 Population and Employment Control Totals for Interim Socioeconomic Projections Until DES Population Control Totals are Available

- MAG develops its resident population projections to be consistent with population control totals for Maricopa County developed by the Arizona Department of Economic Security.
- MAG develops its employment projections based on the population by age and sex control totals for Maricopa County developed by the Arizona Department of Economic Security.
- Delays to the development of DES population control totals means that no official control totals for population totals and for population by age and sex were available for the interim set of projections.
- MAG needs an interim set of projections for 2010, 2020, 2025, 2030 and 2040 for transportation analysis.
- In the absence of a DES population control, MAG needs to use an interim population projection and an interim employment projection as control totals for Maricopa County.
- The Arizona Department of Commerce has conducted a Statewide Economic Study (SES) to develop a long-range economic strategy for the State. As part of this study, a limited set of projections for Maricopa County based on the 2000 census results, and extending to 2020, has been produced by the Center for Business Research at Arizona State University. Similarly, a set of population and employment projections for the Phoenix-Mesa Metropolitan Area was produced by the Economic and Business Research, Eller College of Business and Public Administration at the University of Arizona. For more information see <http://www.azcommerce.com/prop/ses/SESreports.htm>.
- MAG has acquired a county-level projections model, REMI (Regional Economic Models Inc.) to provide input to the Maricopa County resident population control totals developed by DES and to prepare Maricopa County socioeconomic variables that are currently not available, but have important planning applications.

- The REMI projection model produces county-level population and employment projections for Maricopa County to 2035.

POPTAC Recommendation:

- Produce interim control totals for 2010, 2020, 2025, 2030 and 2040.
- Where possible, use the population control totals developed by the Center for Business Research at Arizona State University.
- Where possible, use the employment control totals for Maricopa County consistent with those produced by the Economic and Business Research, Eller College of Business and Public Administration at the University of Arizona.
- Apply the REMI model for the later years to produce population control totals consistent with those developed by the Center for Business Research at Arizona State University and employment control totals consistent with those developed by the Economic and Business Research, Eller College of Business and Public Administration at the University of Arizona.
- Apply trends consistent with REMI for 2040 population and employment control totals.

4.5 Basic/Non-Basic Employment

- The current MAG model assigns employment to areas based on land use designations.
- Many large tracts of residential land use will have some non-basic retail, public and other employment associated with them and should have some retail, public and other employment assigned to them as population growth occurs.

POPTAC Recommendation:

- In the current MAG model, hold back 10% of retail employment, 5% of public employment and 10% of other employment for non-basic employment and assign it to the Traffic Analysis Zones where large tracts of residential development exist and where population growth has occurred.

4.6 Build Out Population and Housing Variables

- The MAG socioeconomic models require a build out population, housing and households to identify the population and housing potential in an area for its modeling process.

- The build out analysis was performed for minimum, target and maximum densities as described in the accompanying paper (Paper 1), “Build Out Procedure for Population and Housing Variables.”

See also, attached paper (Paper 1) on Build Out Procedure for Population and Housing Variables

POPTAC Recommendation:

- Use the method for projecting and cumulating build out population and housing data to TAZ2002 as identified in the accompanying paper (Paper 1), “Build Out Procedure for Population and Housing Variables.”

4.7 Build Out Employment Variables

- The MAG socioeconomic models require a build out employment by land use sector to identify the employment potential in an area for its modeling process.
- The build out analysis was performed for minimum, target and maximum densities as described in the accompanying paper (Paper 2), “Build Out Procedure for Employment Variables.”

See also, attached paper (Paper 2) on Build Out Procedure for Employment Variables

POPTAC Recommendation:

- Use the method for projecting and cumulating build out employment data to TAZ2002 as identified in the accompanying paper (Paper 2), “Build Out Procedure for Employment Variables.”

4.8 Build Out and Net Capacity Definitions for Households and Housing Units

- The MAG socioeconomic model uses General Plans and known developments to determine a maximum number of housing units that may be built in an area.
- Build out has been defined as the potential of the area. This potential assumes that all houses are occupied, and therefore the occupancy rate is 100%. This is the gross build out.
- POPTAC members have indicated that this potential is very unlikely to occur in any year, and that the occupancy rates should be applied to build out units to derive households and population for the net capacity. This net capacity is more indicative of the maximum for socioeconomic modeling.

POPTAC Recommendation:

- The gross build out will assume that all houses are occupied, and therefore the occupancy rate is 100%.

- The net capacity will assume that not all houses are occupied, and therefore the occupancy rate is less than 100%. This **net capacity** will be used in all socioeconomic modeling.

4.9 Vacancy and Occupancy Rates

- Occupancy rates will be derived from the 2000 Census by dividing the total number of occupied housing units by the total number of housing units.
- Total housing units and total occupied housing units by block will be allocated to Traffic Analysis Zones, which in turn will be summed to Regional Analysis Zones and Municipal Planning Areas.
- The MAG models have been modified to be able to project both single family and multi-family households, using different occupancy rates.
- The 2000 Census occupancy rates by unit type became available in September 2002.
- Occupancy rates for TAZ zones must be derived from Census information by block.
- When there is not enough information at the TAZ zone level for projecting occupancy rates, the next level of geography (RAZ) is used.
- When there is not enough information at the RAZ zone level for projecting occupancy rates, the next level of geography (MPA) is used.
- There appear to be no adequate surveys of occupancy rates over time.

POPTAC Recommendation:

- Use 2000 occupancy rates for single family and multi-family units that bear the same relationship as the rates derived from the 1995 Special Census. This therefore assumes the same unit mix as identified in 1995. Use 2000 occupancy rates for single family and multi-family units from the 2000 Census when they become available.
- Maintain the derived occupancy rates over time with necessary modifications, as identified above, due to lack of data.

4.10 Persons per Household

- Persons per household will be derived from the 2000 Census by dividing the population in households by the number of occupied housing units.
- Total housing units, total occupied housing units and population in households will be identified by Census block.
- These variables will then be allocated to Traffic Analysis Zones, which in turn will be summed to Regional Analysis Zones and Municipal Planning Areas.
- The MAG models have been modified to be able to project population in both single family and multi-family households, using different persons per household.
- The 2000 Census information by unit type became available in September 2002.

- Persons per household for TAZ zones must be derived from Census information by block.
- When there is not enough information at the TAZ zone level for projecting persons per household, the next level of geography (RAZ) is used.
- When there is not enough information at the RAZ zone level for projecting persons per household, the next level of geography (MPA) is used.
- There are national and state surveys that review persons per household over time.

POPTAC Recommendation:

- Use year 2000 persons per household rates for single family and multi-family units that bear the same relationship as the rates derived from the 1995 Special Census. This therefore assumes the same unit-mix as identified in 1995. Use year 2000 persons per household rates for single family and multi-family units from the 2000 Census when they become available.
- Adjust the derived persons per household rates over time with necessary modifications in the rates due to lack of data.

4.11 Multiple Use Definitions by Geographic Location by Time

- The MAG projections are consistent with member agency General Plans and Planned Area Developments.
- Many of these plans, however, have areas defined as multiple use areas that can generate various types and densities of housing or employment.
- In order to use these designations in socioeconomic modeling, the multiple use categories must ultimately be converted to one or more of the standard land use categories.
- The MAG socioeconomic models have been enhanced to accommodate such multiple use categories. The models are flexible enough to allow for each individual area to have different proportions of standard land use categories.
- Default categories would assist member agencies to use categories that are consistent with past local multiple use development but can be modified, area by area, by the member agencies.
- The default categories and areas are defined in the accompanying paper (Paper 1), “Build Out Procedure for Population and Housing Variables.”

See also, attached paper (Paper 1) on Build Out Procedure for Population and Housing Variables

POPTAC Recommendation:

- Accept default land use proportions by area category, which may be modified by individual member agencies.
- Accept default land use proportions by MPA, which may be modified by individual member agencies.
- Maintain all land use proportions over time, unless modified by individual member agencies.

4.12 Single Family / Multi-family Split for Maricopa County by Time

- The MAG projections are consistent with member agency General Plans and Planned Area Developments.
- The data is then used in MAG transportation models to project future transportation behavior.
- The latest version of the model requires long-term projections of the distribution of future housing units into single family and multifamily types.
- MAG socioeconomic models can determine the distribution of housing provided a county-wide control total is known.
- Current inventory and previous census data give good unit type information.
- General Plans give good future projections of land for single family and multi-family units.
- A split between single family and multi-family units over time at the county level should be identified.

See also, attached paper (Paper 3) on Single Family / Multi-family Split

POPTAC Recommendation:

- Use single family/multi-family split over time as identified in the accompanying paper (Paper 3), “Single Family / Multi-family Split.”

4.13 Work at Home Employment Methodologies

- The number of workers in the work at home category is increasing, and constitutes an important variable in transportation models.
- The demographic characteristics of the work at home population from an extensive literature review can be directly incorporated as independent variables in the regression analyses used in the methodology described. Key characteristics include: workers over age 45, households with above average income levels, people with a college degree or higher level of education, people in “white collar” occupations – professional specialty or executive/managerial, service industry workers, and agricultural industry workers.
- The projections of work at home employment for Maricopa County will be those people who work at home 3 or more days per week. These projections may not be comparable to sources other than the Census.
- Methodologies need to be developed for county level and TAZ level data.

See also, attached paper (Paper 4) on Work at Home Employment Methodologies

POPTAC Recommendation:

- Accept county level methodology for projecting work at home employment as outlined in the working paper.

- Accept TAZ level methodology for projecting work at home employment as outlined in the accompanying paper (Paper 4), “Work at Home Employment Methodologies.”

4.14 Cluster Size, Floor Area Ratios (FAR) and Employment Density

- The MAG transportation models require employment projections by 5 land use types, namely, Retail, Office, Public, Industrial, and Other.
- Cluster Size represents the average parcel size of employment land use.
- FAR represents the ratio of the square footage of the building to the square footage of the parcel of land.
- Employment Density represents the floor space required by employees. This is calculated as Employees per 1000 square feet of floor space.
- The MAG models convert a parcel of land to the square feet of employment space and then to the number of employees on that parcel. This requires an understanding of average employment areas.
- Cluster Size, FAR and Employment Density differ for each non-residential land use type.
- It is likely that Cluster Size, FAR and Employment Density will not change appreciably over time.
- There appear to be no adequate surveys and methods for projecting Cluster Size for Employment over time.

See also, attached paper (Paper 5) on Cluster Size, FAR and Employment Density

POPTAC Recommendation:

- Accept the Cluster Size, FAR and Employment Density values by land use type as identified in Table 1 of the accompanying paper (Paper 5), “Cluster Size, FAR and Employment Density.”
- Maintain Cluster Size, FAR and Employment Density values over time for the employment projections.

4.15 Residential Development Density, Cluster size and Velocity Curves

- In developing TAZ population projections, the MAG socioeconomic models project residential dwelling units from parcels zoned for residential uses in the General Plans or areas anticipated to be residential in the Development database. Households and Population by TAZ are subsequently calculated from the dwelling unit projections.
- As part of the GIS and Database Enhancement Project, three General Plan Residential Density figures (dwelling units/acre) have been collected from the member agencies. These include the minimum, maximum and target residential density anticipated for each residential land use type in the General Plan. The models use Target Density as the base for new residential growth. The Maximum density set by the MPA caps the residential density. These densities may be changed, polygon-by-polygon by the member agencies if desired.

- Areas covered by the Development database have the number of dwelling units being built/planned and thus do not need to use the densities identified in the General Plan.
- Cluster Size represents the average parcel size of residential land use.
- Residential Density and Cluster Size differ for each residential land use type.
- It is likely that Residential Density and Cluster Size will not change appreciably over time.
- There appear to be no adequate surveys or methods for projecting Density and Cluster Size for Residential uses over time.
- Development Velocity Curves represent the life cycle of residential development projects. These are used to estimate the development trends of residential units coming into the market.
- The Development Velocity curves are based upon an analysis of the life cycles of projects over the 1979 to 1999 time period.
- The size of the development project (total number of units to be built) decides the development Velocity Curve to be used for the particular project. The percent of built units constructed is used as an indicator of the stage the development project is on the Velocity Curve. The total number of units built during a five-year time period shall not exceed the number indicated by the velocity curve by more than 10%.

See also, attached papers (Papers 6 & 7) on Residential Cluster Size and Residential Velocity Curves

POPTAC Recommendation:

- Accept the Residential density methodology as identified above.
- Accept the Cluster Size and Development Velocity Curves as identified in Table 1 of the accompanying paper (Paper 6), “Residential Cluster Sizes” and Figure 1 of the accompanying paper (Paper 7), “Residential Development Velocity Curves” respectively.
- Maintain the Residential Density, Cluster Size and Velocity Curve values over time for population projections.

4.16 Households by Age of Householder and Housing Units by Age of Unit

- The MAG transportation models require projections for the age of the head of householder by TAZ.
- If such data is not available, the MAG transportation models require projections for the number of housing units in each TAZ by four categories of housing unit age (less than 10, 10 to 19, 20 to 29, and 30 or more years old).
- A survey of the large-population Metropolitan Planning Organizations revealed that forecasts of the age of head of householder are not common.
- Census data for Maricopa County is the source of base data for the age of head of householder. This data for 2000 was collected as part of the long form and became available in September 2002.

- The current MAG methodology for calculating housing unit age ages the existing housing stock, adds new residential construction projected by SAM-IM, and assumes that demolitions occur among the oldest housing units.

POPTAC Recommendation:

- Do not develop projection by age of head of householder until after Census 2000 data is available.
- Prepare projections of housing units by age of unit as has been done previously. Use Census 1990 data brought forward to 2000 by aging the units by 10 years as the base for the projections. Add residential completions from 1990 to 2000 to create the 2000 base. This base may be updated once the Census 2000 information is available.
- Use the current MAG methodology for housing unit age. The current method ages the existing housing stock, adds new residential construction projected by SAM-IM, and assumes that demolitions occur among the oldest housing units.

4.17 Households by Income

- The MAG transportation models require projections for the number of households in each TAZ by five income quintiles.
- The most recent MAG socioeconomic projection series used the 1995 Special Census data for Maricopa County aggregated to RAZ as the base dataset for households by income group. This data for 2000 was collected as part of the Census long form and became available in September 2002.
- The current MAG methodology projects households by income group by RAZ using Metropilus, the new version of DRAM/EMPAL. The projected change in income distribution is assigned to each TAZ within the RAZ using SAM-IM.

POPTAC Recommendation:

- Use the Special Census 1995 data as the base for the projections. This base may be updated once the Census 2000 information is available.
- Continue to use the current MAG methodology for households by income group. The current MAG methodology projects households by income group by RAZ using Metropilus, the new version of DRAM/EMPAL. The projected change in income distribution is assigned to each TAZ within the RAZ using SAM-IM.

4.18 Post Secondary Enrollment

- Post-secondary enrollment projections are a component of socioeconomic projections used to drive the travel demand model.
- A phone survey of post-secondary education providers was conducted to gather information on current enrollment and expansion plans. Only

institutions that require a high school diploma for admission and have at least 100 students were included in the survey.

- Projections for Community Colleges are based upon the average of participation rates by age cohort for 1997 and 2000. The age specific participation rates are then applied to the projected population by MPA by age using the County age distribution.
- ASU provided its enrollment projections for 2000 through 2015. Distance learning students are not included in the projections. Projections for ASU beyond 2015 are based upon historical growth at each campus relative to countywide population growth.
- Based upon statewide findings, private colleges are projected to grow between 2 percent (traditional colleges) and 8 percent (non-traditional). The projected enrollment is capped at 25% increase over 2000 enrollment for tradition institutions, and a 50% increase over 2000 enrollment for non-traditional institutions.

See also, attached paper (Paper 8) on Post Secondary Enrollment

POPTAC Recommendation:

- Use the post-secondary enrollment projection methodology as identified in the accompanying paper (Paper 8), “Post-Secondary Enrollment.”

4.19 Seasonal Population

- Seasonal Population is defined as residents of the area for two weeks to six months and is a part of the socioeconomic projections required by MAG transportation models.
- As part of the MAG GIS and Database Enhancement Project, an inventory of Mobile Home parks and RV parks was created to gather information on location and characteristics of the parks, as well as the number and types of residents during peak and low seasons.
- Seasonal units and population for 2000 are estimated by TAZ using the inventory for population in RV and Mobile Homes parks from surveys conducted in January and July 2000, and Census 2000 information for the component of Seasonal Population residing in housing units.
- Seasonal residents are divided into two categories for projections, namely those residing in RV and Mobile Home parks and those residing in permanent housing units.
- The RV and Mobile Home parks component of Seasonal Population projection should remain constant at 2000 levels since expansions of existing facilities are not anticipated. The allocation of these to TAZs will thus also remain constant in the future.
- A ratio of 2000 “non-park mobile home” seasonal housing units by TAZ (calculated by subtracting the number of seasonal housing units in mobile home parks from the park survey from the total number of seasonally vacant units from Census 2000) to the 2000 total housing units (adjusted by deleting the seasonal units in mobile home parks) is used for projecting the seasonal population residing in other units.

- This ratio is not modified over time since no evidence is available on which to quantify any systematic change.
- Seasonal population is projected by multiplying the seasonal units with the 2000 estimate of seasonal persons per household. This estimate of seasonal persons per households is held constant over time.
- The Seasonal Population used for MAG Transportation models is the average of the High Season and the Low Season projections.
- When there is not enough information at the TAZ zone level for projecting Other Seasonal Population, the next level of geography (RAZ) is used.
- When there is not enough information at the RAZ zone level for projecting Other Seasonal Population, the next level of geography (MPA) is used.

POPTAC Recommendation:

- Accept the seasonal population projection methodology as identified above.

4.20 Transient Population

- Transient population, defined as residents of the area for two weeks or less, is a part of the socioeconomic projections required by MAG transportation models.
- As part of the MAG GIS and Database Enhancement Project, an inventory of hotels, motels, and resorts was created to gather information on their location and to estimate transient population.
- Transient population numbers for 2000 winter and summer seasons by TAZ were derived from the inventory and other data collected.
- Transient Population projections are based upon methodologies developed by MAG Consultants as part of the MAG GIS and Database Enhancement Project.
- Separate methodologies were developed to produce projections of the transient population traveling to the Phoenix area for business reasons and the transient population coming for non-business reasons. Projections of the hotel/motel/resort component and the other transient population component are derived from the total figures.
- Transient Population projections at the County level are distributed to TAZ zone level using the existing Hotel/Motel room share by TAZ, augmented by known future plans.
- The Transient Population used for MAG Transportation models is the average of the High and Low Transient Population Projections.

See also, attached paper (Paper 9) on Transient Population

POPTAC Recommendation:

- Accept the transient population projection methodology as described above and in the accompanying paper (Paper 9), “Transient Population projection methodology.”

4.21 Group Quarters

- All residents not living in households are classified as living in Group Quarters. Population in Group Quarters is a part of the socioeconomic projections required by MAG transportation models.
- Methods for projecting the different components of population in Group Quarters (military quarters, prisons and jails, college dormitories, nursing homes, and other group quarters) have been identified by MAG Consultants as part of the GIS and Database Enhancement Project.
- The Group Quarter Population by TAZ shall be based upon a 2000 share by Group Quarter type.
- The group quarters projections are calculated as follows:
 - i. Military quarters = 927 (held constant at the current population of Luke Air Force base).
 - ii. Prisons and jails = 1.128 percent of the Maricopa County population age 20 through 44.
 - iii. College dormitories = 8.951 percent of the Maricopa County population age 18 to 19.
 - iv. Nursing homes = 5.433 percent of the Maricopa County population age 75 or older.
 - v. Other group quarters = 0.417 percent of the entire Maricopa County population.

POPTAC Recommendation:

- Use the methodology for Group Quarter Population as identified above.

4.22 Age Restricted Communities

- MAG transportation models require TAZs to have identifiers for Age Restricted Areas.
- A survey of the existing Age Restricted Communities was conducted and a GIS coverage of the communities was created.

POPTAC Recommendation:

- Continue to use the current MAG methodology for Age Restricted flags. TAZs with fifty percent or more of the total land area under communities with deed restrictions on age of residents are flagged as Retirement Areas.

5. THE MAG REVIEW PROCESS

Preparation for the socioeconomic modeling needed to produce MAG projections has been very extensive. MAG staff reviewed each step of the process. In addition, the MAG Population Technical Advisory Committee (POPTAC) and MAG POPTAC Ad Hoc Subcommittee reviewed all data and GIS coverages, recommended specific assumptions to be incorporated into the models, and reviewed the results of the data modeling efforts. Figure 5-1 depicts the socioeconomic data and modeling review process.

After an 18-month review of base data, GIS coverages and assumptions, the MAG POPTAC reviewed the implications of the data collection efforts, in particular the base year 2000 population and employment and the build out population and employment. Following a review of the base and buildout population and employment, test model runs were performed for the early projection years, and MAG POPTAC reviewed and commented on these runs. The input received on these test runs were used to develop a more refined draft.

In the second half of 2002 and early 2003 three draft runs were performed. Comments on each of the drafts were solicited from member agency staff and incorporated into revisions as necessary. During this period to ensure an opportunity for thorough review, MAG staff met with member agencies 18 times, conducted 9 workshops, and made 17 presentations to MAG committees and other local agencies. Groups such as the MAG Planners Stakeholders, the MAG Street Committee and the Transportation Review Committee were kept informed of the progress of the projections process and encouraged to participate in the review process.

In addition to conveying the draft projections to member agencies through traditional means (spreadsheets and hard copy reports) MAG also provided the POPTAC with more innovative and effective ways to review the data. In the early stages of review, MAG staff provided every POPTAC member with Arc Explorer software to facilitate displaying projections graphically and reviewing their implications.

MAG staff also conveyed two draft sets of projections via the MAG website, through ArcIMS, eliminating the need for specialized software to analyze the data. Figure 5-2 shows the results of using ArcIMS to zoom into an area and select a series of TAZ zones. Numerous reports could also be created on the selected set for each of the review years. Additional capabilities include thematic mapping on any combination of variables, and for any number of computer or user generated intervals.

The results of the Interim Projections may be seen in Figures 5-3 to 5-7 for population concentrations in years 2010, 2020, 2025 and 2030. Similarly Figures 5-8 to 5-12 depict employment concentrations for the same years.

5.1 MAG Staff

MAG staff is charged with preparing subregional population projections by Municipal Planning Area, Regional Analysis Zone and smaller areas known as Socioeconomic Analysis Zones (SAZs). Staff also provides support to the Chairs of the MAG Population Technical Advisory Committee, and Ad Hoc Subcommittee, disseminates information to POPTAC members and representatives of member agencies on socioeconomic information, manages consultant contracts and represents the interests of MAG on the State Population Technical Advisory Committee.

5.2 MAG POPTAC

The MAG Population Technical Advisory Committee was created to provide technical input in the development of socioeconomic information for the region, including socioeconomic databases, GIS coverages, resident population estimates, and socioeconomic projections. The MAG POPTAC was also designated by the MAG Regional Council as the lead committee for coordinating preparations for the Census in Maricopa County.

The Committee is comprised of representatives of MAG's 25 cities and towns, two Indian Communities and Maricopa County. However, because of limited staff resources, some member agencies have chosen not to send an official representative to the meetings.

The MAG POPTAC meetings are held generally held on a monthly basis. Members may participate in the meetings either by attending in person, or via audio or videoconference. An agenda, minutes and attachments for the MAG POPTAC are generally sent out in electronic format via e-mail a week prior to the meeting. The meeting agenda and minutes are also posted on the MAG Website at <http://www.mag.maricopa.gov> under MAG POPTAC. On April 29, 2003, the MAG POPTAC recommended acceptance of the Interim Projections for July 1, 2010, 2020, 2025, 2030 and 2040 by MPA and RAZ.

5.3 MAG POPTAC Ad Hoc Subcommittee

The MAG POPTAC Ad Hoc Subcommittee was created to provide more in depth input on the development of socioeconomic information and to make technical recommendations to the members of the MAG POPTAC. Membership on the Subcommittee is open to all MAG member agencies, but generally the participants include the largest MAG member agencies with the greatest technical resources. This includes Phoenix, Mesa, Glendale, Scottsdale, Maricopa County, Tempe and Peoria. The MAG POPTAC Ad Hoc Subcommittee generally meets just prior to the scheduled meeting of the MAG POPTAC.

5.4 MAG Management Committee

The MAG Management Committee is comprised of the highest administrative officials of each of the member agencies as well as the Regional Public Transportation Authority and Arizona Department of Transportation. Recommendations made by the MAG POPTAC on estimates and projections are forwarded to members of the Management Committee

for consideration. The Management Committee will review the proposed estimates and projections and make a recommendation to the Regional Council for their approval. The Management Committee generally meets monthly. Meeting agendas and minutes are posted on the MAG Website.

At the May 2003 Management Committee meeting, the Draft Interim subregional projections of population, housing and employment by MPA and RAZ for July 1, 2010, 2020, 2025, 2030 and 2040 were reviewed. The MAG Population Technical Advisory Committee (POPTAC) had recommended these subregional projections for approval on April 29, 2003.

During the discussion on the projections, an issue raised was whether there was adequate water to support the future population. It was noted that the projections were based upon the General Plans of MAG member agencies, and unless a jurisdiction specifically noted a water constraint, it was assumed that the jurisdiction would be able to secure the water necessary to support the population identified in its General Plan.

Given the concern about whether there would be adequate water to support the projected population, it was proposed that the interim projections only be approved through 2030. A motion to approve the interim projections through 2030 was approved. In order to give additional attention to the issue of available water supply, on May 20, 2003, a memorandum was transmitted from the Chair of the MAG Management Committee to committee members, requesting one final review of the 2030 interim projections of population and employment.

It was requested these Interim projections be reviewed in terms of whether there would be adequate water available to support the interim population and employment projections. In response to that request, additional input was received from one member agency requesting that their interim population projections be reduced. No jurisdiction requested a change to employment projections.

The population projections were adjusted based on the comments received. The net effect of this adjustment was to decrease the population of the member agency's MPA by 101,000 in 2030. The Maricopa County projection, which was accepted by the Regional Council in April 2003, was reduced by an equivalent amount.

In June 2003, the MAG Management Committee recommended acceptance of these MAG Interim Socioeconomic Projections for July 1, 2010, 2020, 2025 and 2030 by Municipal Planning Area and Regional Analysis Zone.

5.5 MAG Regional Council

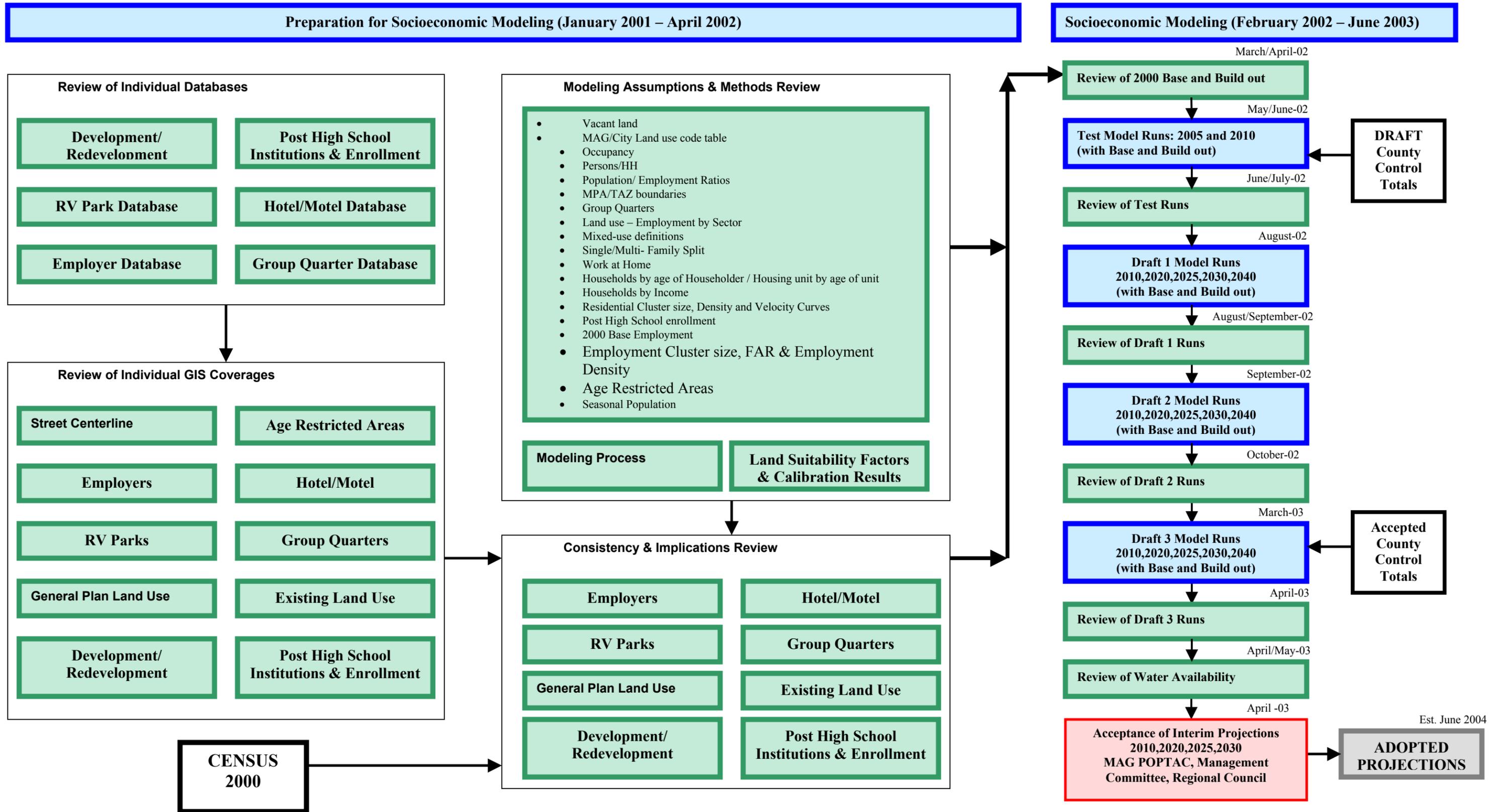
The MAG Regional Council is comprised of the highest elected official of each of MAG's member agencies as well as representatives from the Arizona Department of Transportation and the Citizens Transportation Oversight Committee. The Regional Council establishes MAG policy and direction and must approve MAG socioeconomic estimates and projections before they can be considered officially approved by MAG. The Regional Council generally meets monthly. Meeting agendas and minutes are posted on the MAG Website. The MAG Regional Council accepted the MAG Interim

Socioeconomic Projections for July 1, 2010, 2020, 2025 and 2030 by Municipal Planning Area and Regional Analysis Zone in June 2003.

5.6 State Population Technical Advisory Committee

The State Population Technical Advisory Committee was originally established in 1977 by a Governor's Executive Order to review and approve the official population projections for Arizona. In 1988, the Executive Order was revised. The revisions resulted in changes in the Committee membership, expansion of the committee's responsibilities to include both population estimates and projections, and a review and advisory recommendation on both population estimates and projections to the DES Director.

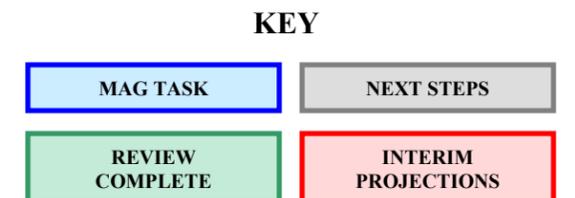
In 1995, the Executive Order was revised to the current version, Executive Order 95-2. The current Executive Order also changed the frequency of the preparation of official projections from an annual schedule to twice per decade: once after the decennial census and once after the mid-decade census. Meetings are held approximately six to eight times per year. The State POPTAC has not yet developed control totals for the official population projections.



SOCIOECONOMIC DATA & MODELING REVIEW PROCESS

FOR PREPARATION OF INTERIM SCOCIOECONOMIC PROJECTIONS BY THE MARICOPA ASSOCIATION OF GOVERNMENTS

Figure 5-1



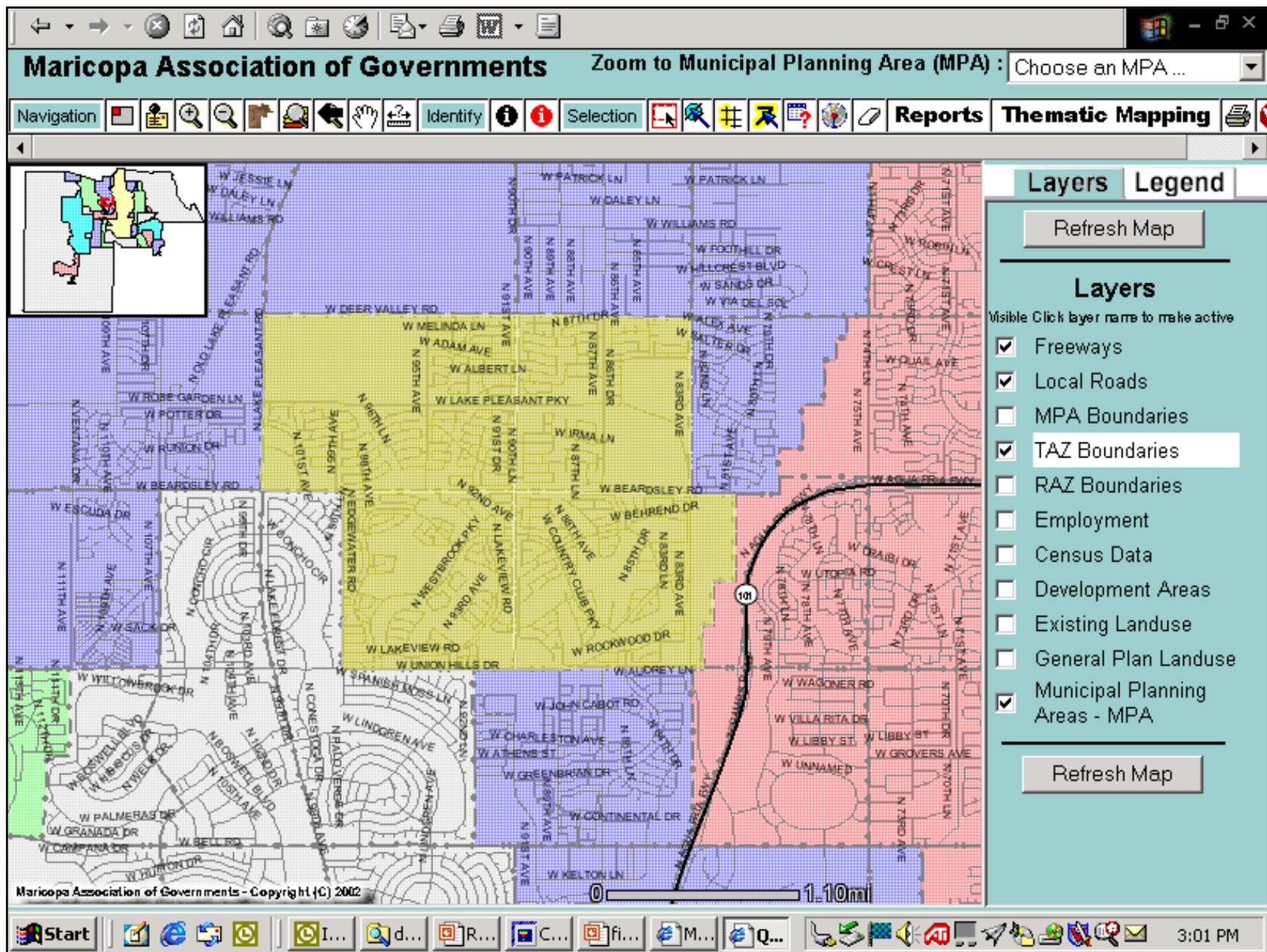


Figure 5-2: Data Review Using ArcIMS – Zoom to selected Traffic Analysis Zone

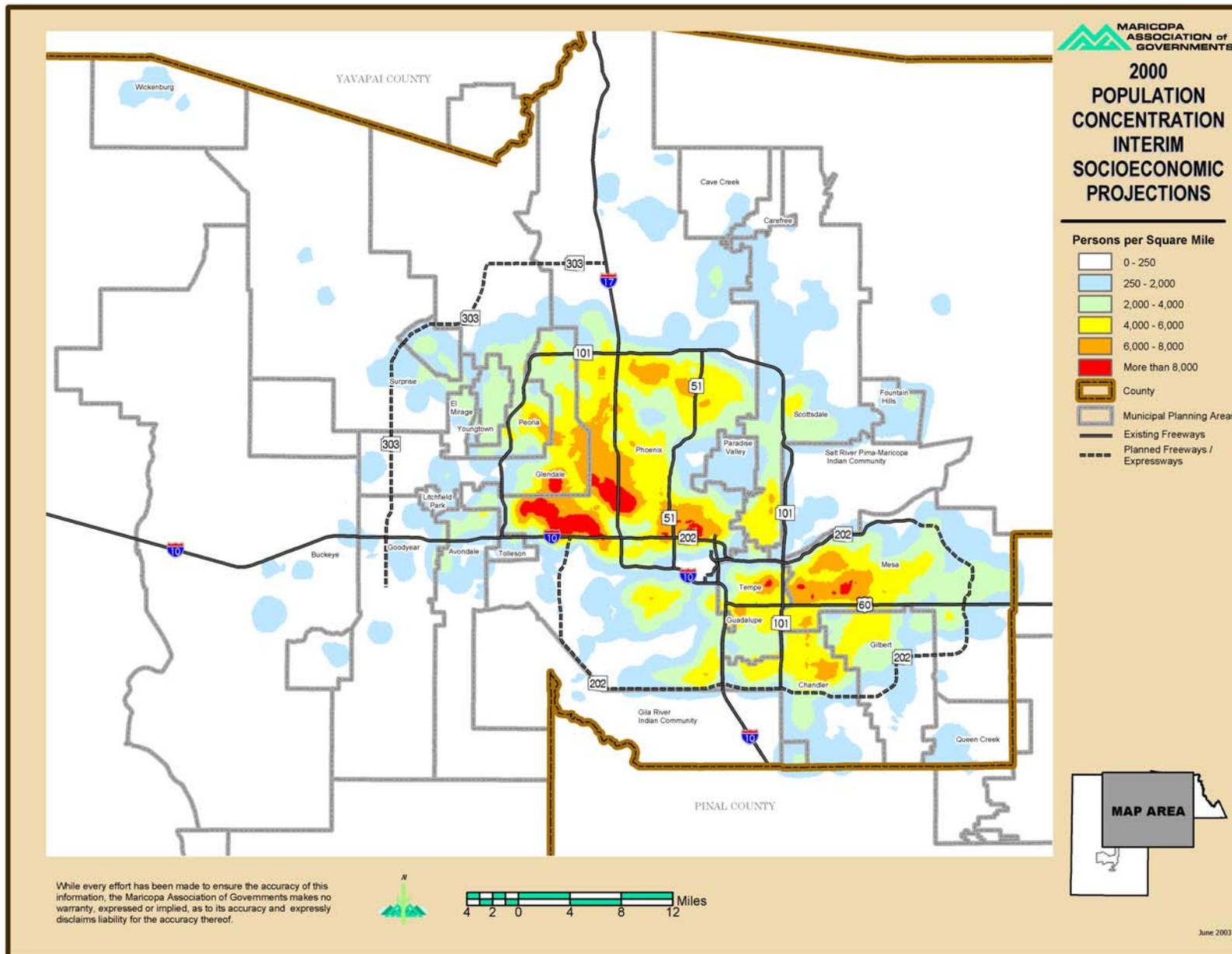


Figure 5-3: 2000 Population Concentration Interim Socioeconomic Projections

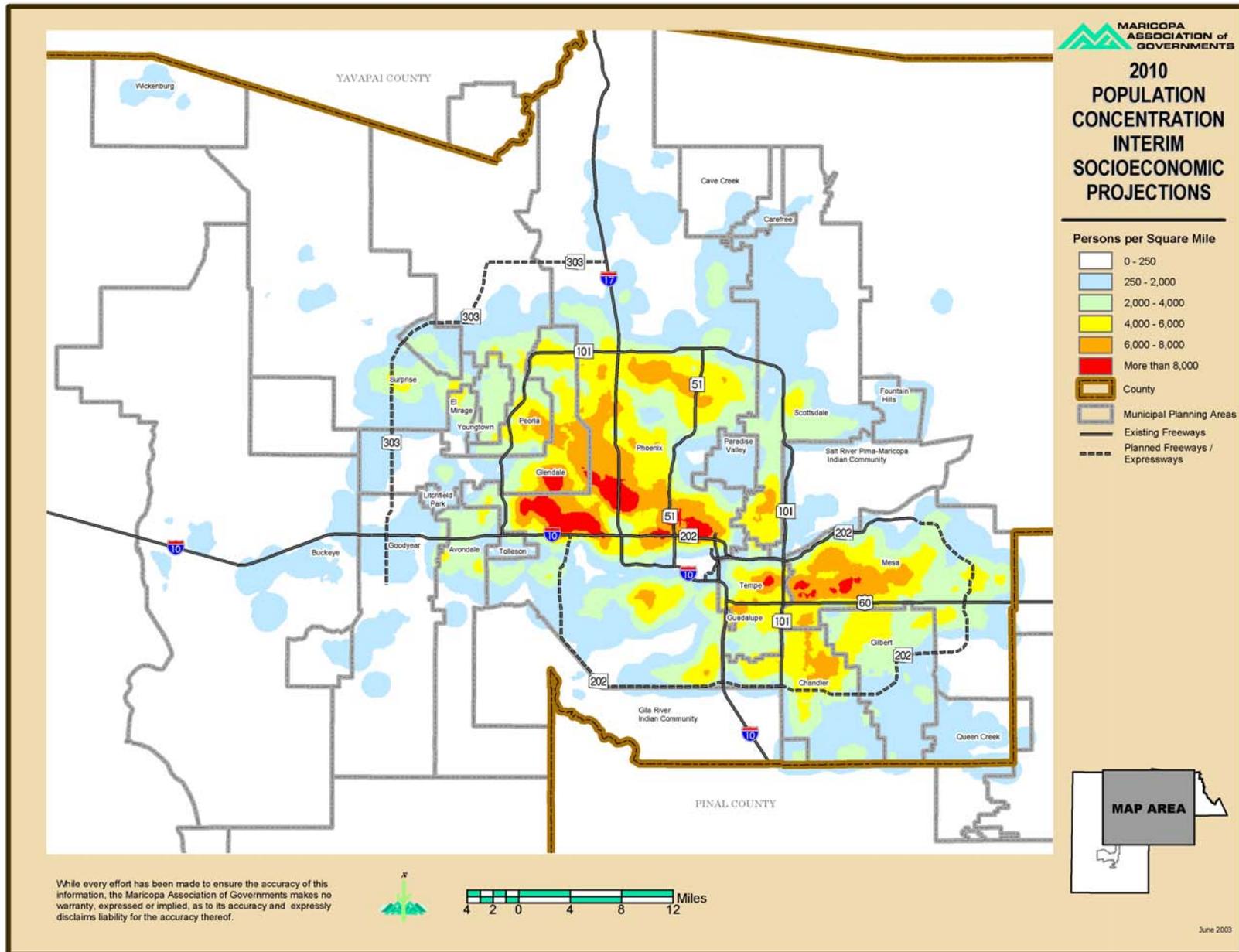


Figure 5-4: 2010 Population Concentration Interim Socioeconomic Projections

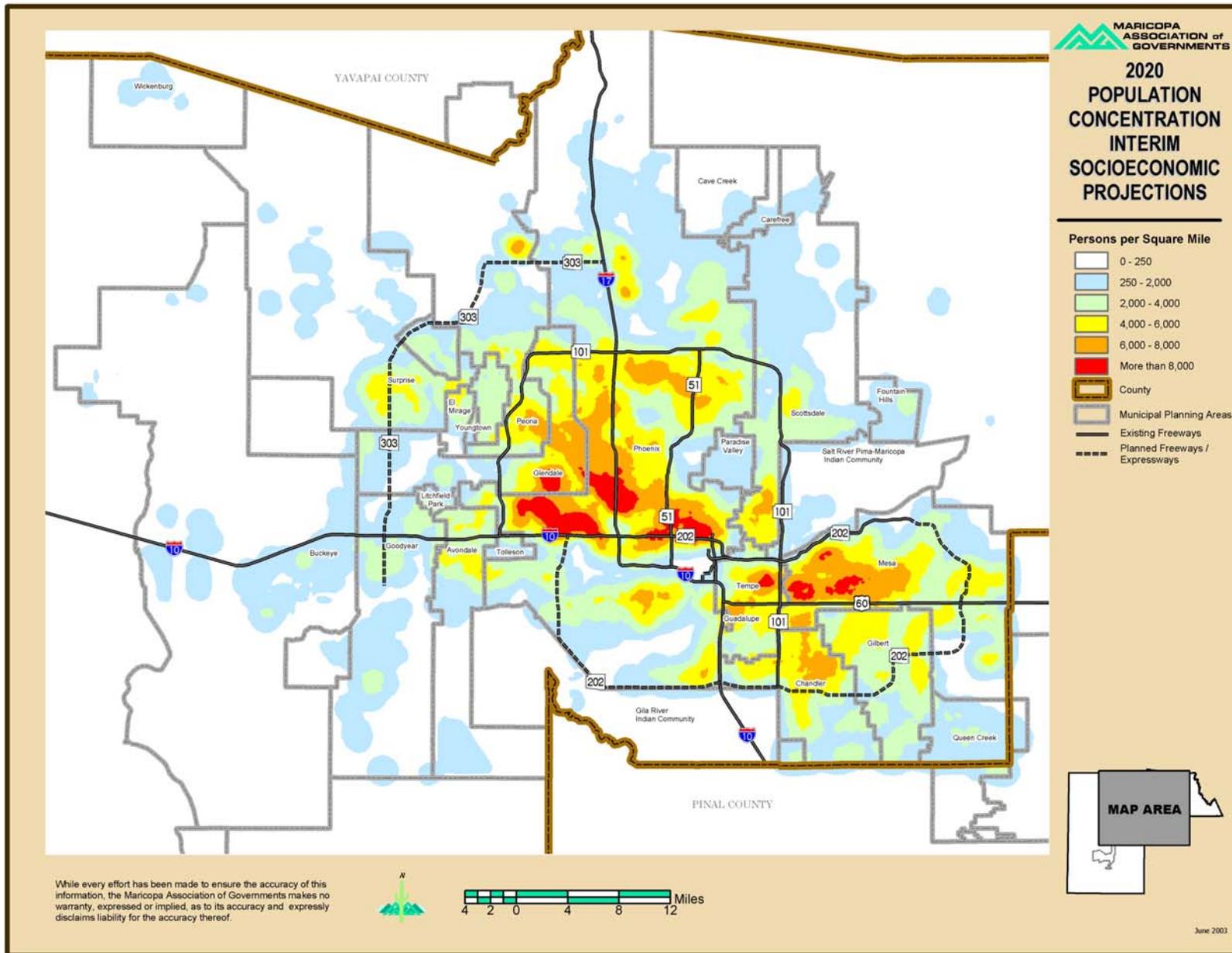


Figure 5-5: 2020 Population Concentration Interim Socioeconomic Projections

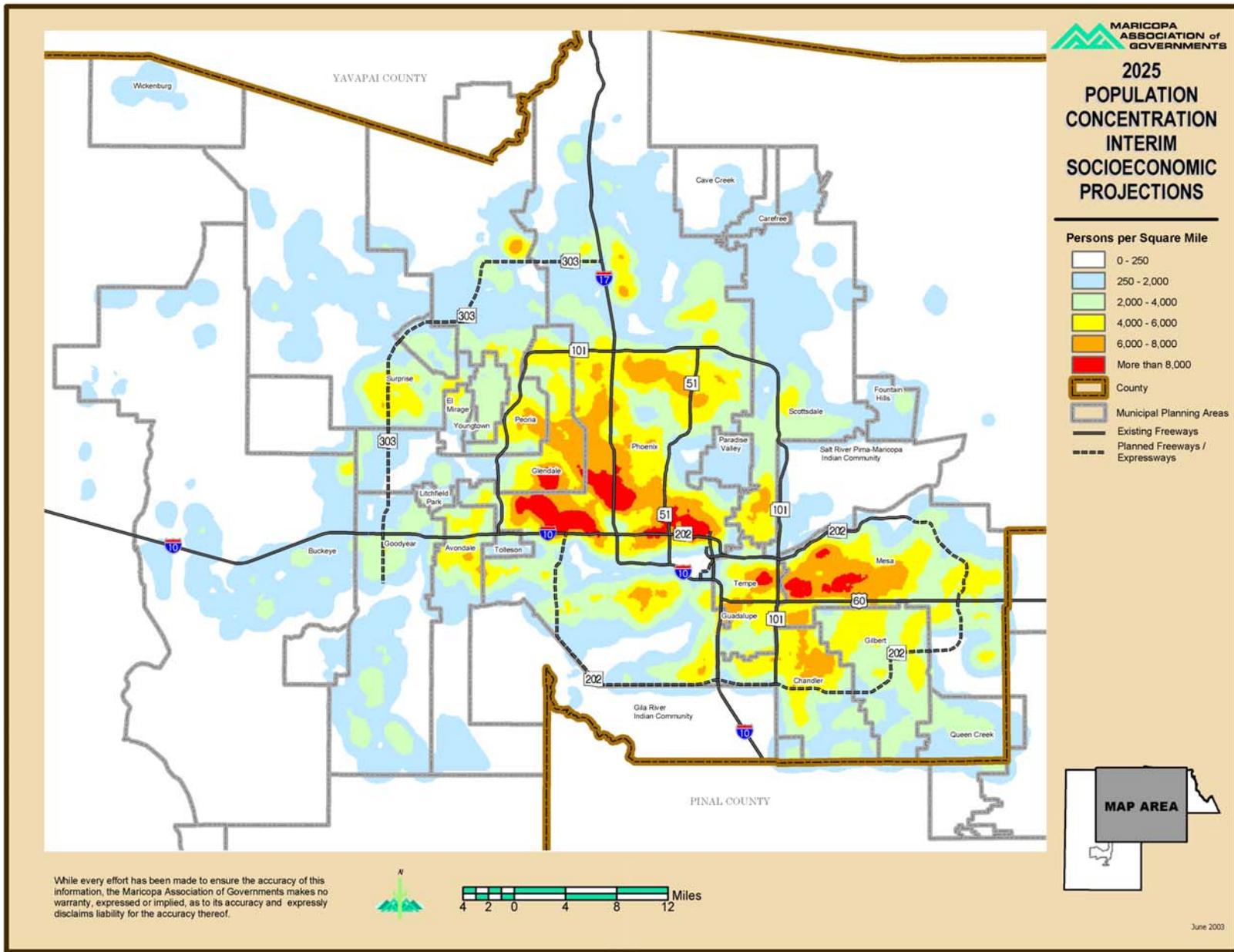


Figure 5-6: 2025 Population Concentration Interim Socioeconomic Projections

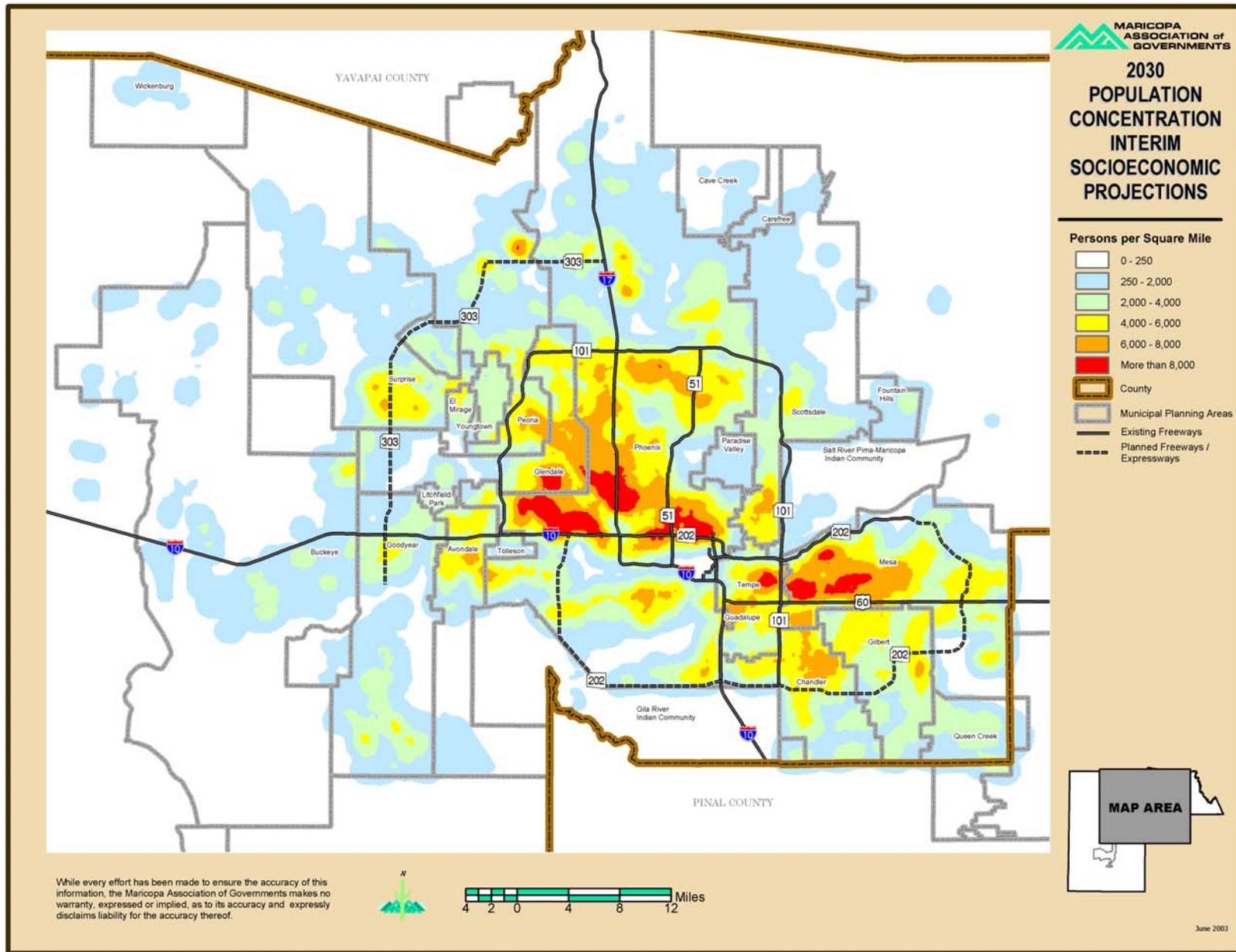


Figure 5-7: 2030 Population Concentration Interim Socioeconomic Projections

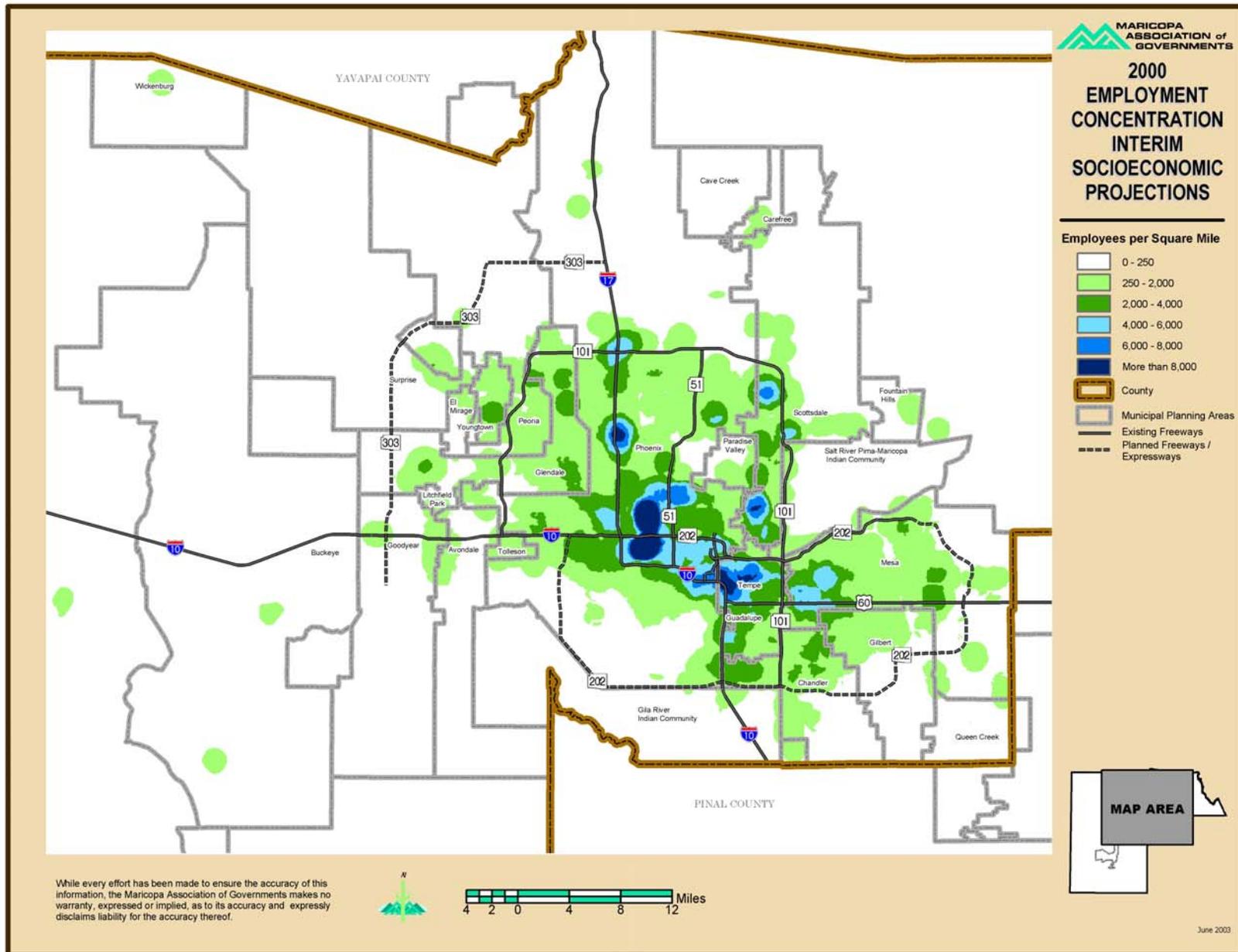


Figure 5-8: 2000 Employment Concentration Interim Socioeconomic Projections

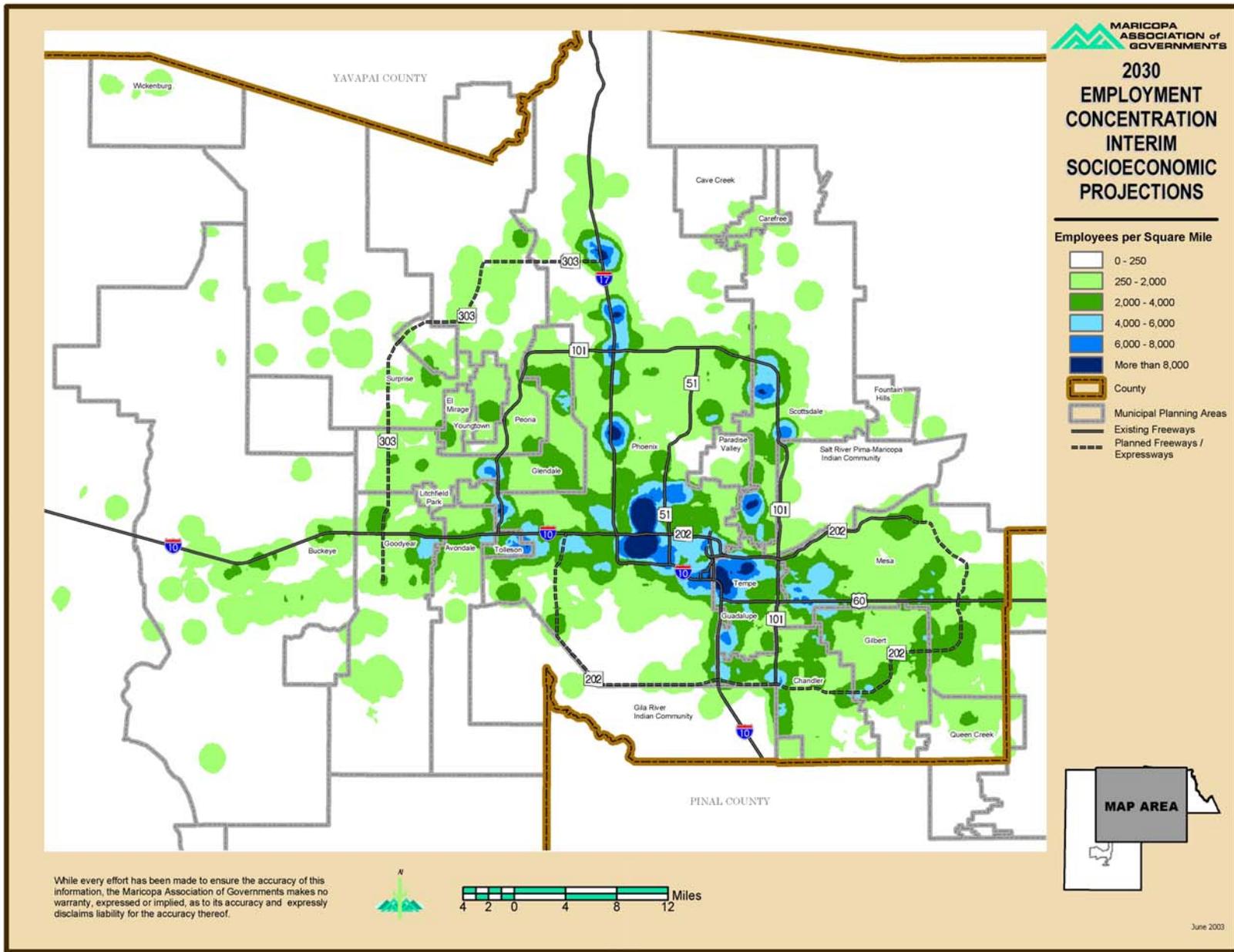


Figure 5-12: 2030 Employment Concentration Interim Socioeconomic Projections

6. NOTES AND CAVEATS FOR INTERIM PROJECTIONS

The Interim Projections were prepared and distributed with the following caveats:

1. These projections by Socioeconomic Analysis Zone (SAZ) were prepared to be consistent with Interim Socioeconomic Projections by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ) accepted by MAG Regional Council on June 25, 2003. The projections by SAZ have not been through any formal MAG approval process.
2. The interim projections by Municipal Planning Area (MPA) and Regional Analysis Zone (RAZ) were prepared to be consistent with the April 1, 2000 Census and have been prepared for July 1 of the following years: 2010, 2020, 2025 and 2030.
3. The interim population projections are for resident population only and do not include nonresident seasonal or transient population.
4. Because the Arizona Department of Economic Security has not yet developed or approved new county population control totals, MAG has developed these interim projections using interim Maricopa County population and employment control totals. These control totals are based upon work done by Arizona State University and the University of Arizona to develop a long-range economic strategy for the state, augmented by information from the regional model from Regional Economic Models, Inc. (REMI). These control totals were accepted by the MAG Population Technical Advisory Committee (POPTAC) in March 2003 and the Management Committee and Regional Council in April 2003. The control totals have been modified for these interim projections to reflect the reduction in population in one MPA based on water availability.
5. Official MAG population projections will be developed subsequent to DES approval of official population control totals.
6. The interim projections by MPA and RAZ were recommended for acceptance by the MAG POPTAC on April 29, 2003. The interim projections were recommended for acceptance by the Management Committee on June 11, 2003, and were accepted by the Regional Council on June 25, 2003.
7. The interim projections include the Maricopa County portion of Peoria, Queen Creek and the Gila River Indian Community only.
8. The interim projections were based upon each MAG member agency's latest version of its future land use plan. Where jurisdictions have not yet adopted their land use plan, or have amendments to their plan, changes may result in and require changes to the projections.
9. The databases and assumptions upon which the interim projections are based have been reviewed by MAG member agencies, revised by MAG staff based on input received and approved by members of the MAG POPTAC.
10. The interim projections are based upon previous review and local insight by members of the MAG POPTAC.

11. The “other” employment category includes work-at-home and construction employment. Because construction employment follows development, employment projections may show declines in future years.
12. The interim projections should be used with caution. They are subject to change as a result of fluctuation in economic and development conditions, local development policies and updated data.

PAPER 1

BUILD OUT PROCEDURE FOR POPULATION AND HOUSING VARIABLES

PURPOSE

To prepare minimum, target and maximum build out numbers by Traffic Analysis Zone for population and housing variables to be used to evaluate the population and housing potential for the next set of socioeconomic projections.

BASE DATA

- Population: Census 2000 SF1 data
- Residential Completions: April 1, 2000 to June 30, 2000, submitted and reviewed by MAG member agencies
- Existing Land use: Year 2000 land use current as of July 2000, reviewed by MAG POPTAC
- Future Plans: Future Plans current as of Dec. 2001 or later, reviewed by MAG POPTAC
- Development Data: Year 2000 data current as of July 2000, reviewed by MAG POPTAC
- TAZ system: TAZ2002

MODEL

SAM-IM version 3.1 was used for this build out analysis. The analysis was conducted with a Grid Cell size of 220 feet on each side.

ASSUMPTIONS

Minimum, Target and Maximum Densities: In developing TAZ build out projections, the MAG socioeconomic models project residential dwelling units from parcels identified as residential in the General Plans or areas anticipated to be residential in the Development database. Households and Population by TAZ are subsequently calculated from the dwelling unit projections.

As part of the GIS and Database Enhancement Project, three General Plan Residential Density figures (dwelling units/acre) have been collected from the member agencies, the minimum, maximum and target residential density anticipated for each residential land use type in the General Plan. Thus, three build out scenarios have been generated for the Minimum, Target, and Maximum densities. These densities may be changed, polygon-by-polygon by the member agencies if desired.

Those areas covered by the Development database that have the number of dwelling units being built/planned and thus do not need to use the densities identified in the General Plan.

Net Density: The density figures mentioned above for the residential areas in the General Plans have been assumed to be indicating the Gross residential density. As part of the MAG GIS and Database Enhancement Project, Arizona State University collected information on the Residential Cluster Sizes. This build out analysis uses the net residential density for General Plan

residential areas. Net density adjustment is not required in areas covered by the development areas since the total number of units is known. Table 1 indicates the gross and net acres by land use type used in the build out analysis.

**TABLE 1
NET RESIDENTIAL DENSITY**

LUCODE	Land Use	Description	Gross Acres	Net Acres
110	Rural Residential	<= 1/5 du per acre	50	50
120	Estate Residential	1/5 du per acre to 1 du per acre	46	46
130	Large Lot Residential (SF)	1 du per acre to 2 du per acre	45	45
140	Medium Lot Residential (SF)	2-4 du per acre	25	19
150	Small Lot Residential (SF)	4-6 du per acre	20	15
160	Very Small Lot Residential (SF)	>6 du per acre (includes mobile home parks)	20	15
170	Medium Density Residential (MF)	5-10 du per acre	26	20
180	High Density Residential (MF)	10-15 du per acre	17	14
190	Very High Density Residential (MF)	> 15 du per acre	18	13

Source: Arizona State University, 2001
MAG GIS and Database Enhancement Project

Persons per Household: Persons per household was derived from the 2000 Census by dividing the population in households by the number of occupied housing units. Total housing units, total occupied housing units and population in households was identified by Census block. These variables were then be allocated to Traffic Analysis Zones, which in turn was summed to Regional Analysis Zones and Municipal Planning Areas.

MAG derives persons per household at the lowest level of geography possible. For each Decennial Census year, this is the Census Block. For deriving a projection data set for the transportation models, MAG cumulates information to the Traffic Analysis Zone (TAZ). For this purpose, persons per household are refined as follows:

- For TAZs where the existing development in 2000 is less than fifty percent of build out, persons per household from the Regional Analysis Zone (RAZ) level will be utilized. This is essential since figures resulting from a sparsely developed TAZ may not adequately reflect future trends in the TAZ.
- Similarly, for RAZs where the existing development in 2000 is less than fifty percent of build out, persons per household from the Municipal Planning Area (MPA) will be used.
- A maximum persons per household at build out will be set at 5.0 persons per household.

It is important to note that the Census Bureau defines population as those people who are residents of the jurisdiction. If the individual reports himself/herself as usually housed

elsewhere, the Census Bureau will not count the population at that unit and will designate the unit as a vacant unit even though people reside in the unit. These individuals would be included in the MAG nonresident population projections.

Occupancy Rate: This build out analysis assumes a 100% occupancy rate.

Mixed Use : This build out analysis is consistent with member agency General Plans and Planned Area Developments. Many of these plans, however, have areas defined as multiple use areas that can generate various types and densities of housing or employment. In order to use these designations in socioeconomic modeling, the multiple use categories must ultimately be converted to one or more of the standard land use categories. The MAG socioeconomic models have been enhanced to accommodate such multiple use categories. The MAG GIS and Database Enhancement Project has identified default categories for member agencies to use that are consistent with past local multiple use development.

Some of the factors found to have the strongest influence on the type of development were regional planning issues/factors that are not adequately delineated by MPA boundaries. For these areas, a set of recommended land use proportions were developed based on the proximity of a property to urban core areas (downtowns), railroads, freeways and airports. The criteria used for these assignments were: location within a developed downtown area (currently Phoenix, Mesa, Tempe, and Scottsdale); location within approximately one mile of a freeway; location within approximately one mile of a rail line; location within approximately two miles of a commercial airport. Table 2 indicates the mixed-use proportions used for the four areas in order of dominance.

A priority system is used for areas that fell within more than one of the location types. The location types were therefore evaluated in the following order:

- 1 - Downtown
- 2 - Proximity to Railroad Corridors
- 3 - Proximity to Airports
- 4 - Proximity to Freeways

For those areas that did not fall within one of the defined special areas, the recommended land use proportions by MPA and General Plan land use category were used. These recommendations were derived from base data from field surveys, discussions with city planners, and further modifications to improve reasonableness for areas with a lack of data. These recommendations were then reviewed and modified by MAG POPTAC. Table 3 indicates the results of this analysis.

TABLE 2
LAND USE PROPORTIONS BY AREA CATEGORY

Area Category	Structure Code	Land Use	Acres	Percent of Area
Downtown Area	AP	Multifamily	3	18%
	OF	Office	7	43%
	RH	Resort/Hotel	1	6%
	RT	Retail	5	33%
			16	100%
Freeway Area	AP	Multifamily	114	7%
	IN	Industrial	873	54%
	OF	Office	257	16%
	PB	Public buildings	6	0%
	RH	Resort/Hotel	44	3%
	RT	Retail	309	19%
			1,602	100%
Airport Area	AP	Multifamily	9	1%
	IN	Industrial	466	46%
	OF	Office	452	45%
	RH	Resort/Hotel	15	1%
	RT	Retail	72	7%
			1,014	100%
Railroad Area	IN	Industrial	1,332	97%
	OF	Office	17	1%
	PB	Public buildings	20	1%
	RH	Resort/Hotel	1	0%
	RT	Retail	9	1%
			1,379	100%

Source: Applied Economics, 2001.

**TABLE 3
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Avondale</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Buckeye</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Carefree</u>	Business Park	Business Park	Retail	10
			Office	30
			Industrial	60
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Cave Creek</u>	Business Park	Business Park	Retail	10
			Office	30
			Industrial	60
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Chandler</u>	Business Park	Commercial/Office/ Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Employment	Multifamily	10
			Retail	5
			Office	20
			Industrial	65
<u>El Mirage</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Fountain Hills</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Gila Bend</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35

**TABLE 3
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Gila River</u>	Business Park	Business Park	Retail Office Industrial	10 10 80
	Mixed Use	Mixed Use	Multifamily Retail Office	30 35 35
<u>Gilbert</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Business Park	Regional Commercial	Hotel Retail Office	5 80 15
	Mixed Use	Village Center	Multifamily Hotel Retail Office	15 10 35 40
<u>Glendale</u>	Business Park	Business Park	Retail Office Industrial	5 15 80
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Goodyear</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Guadalupe</u>	Business Park	Commercial Mixed Use	Office Industrial Public	15 80 5
	Mixed Use	Mixed Use	Multifamily Retail Office	35 40 25
<u>Litchfield Park</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Maricopa County</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Mixed Use	Mixed Use	Multifamily Retail Office	25 35 40

**TABLE 3
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Mesa</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use/Employment	Multifamily	20
			Retail	25
			Office	30
			Industrial	25
<u>Paradise Valley</u>	Business Park	Business Park	Retail	10
			Office	70
			Industrial	20
	Mixed Use	Mixed Use	Multifamily	10
			Retail	40
			Office	50
<u>Peoria</u>	Business Park	Business Park	Retail	10
			Office	15
			Industrial	75
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Phoenix</u>	Business Park	Commerce Park	Retail	25
			Office	25
			Industrial	50
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Queen Creek</u>	Business Park	Employment - Type B	Office	20
			Industrial	80
	Mixed Use	Town Center	Multifamily	15
			Retail	35
			Office	40
			Public	10
<u>Scottsdale</u>	Business Park	General Employment (34)	Office	25
			Industrial	75
	Business Park	Minor Employment (33)	Office	20
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35

**TABLE 3
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Surprise</u>	Business Park	Employment	Office	50
			Manufacturing	38
			Hotel	12
	Mixed Use	Mixed Use Gateway	Single Family	5
			Townhouse	5
			Multifamily	20
			Retail	30
			Office	25
			Industrial	5
			Public	10
	Mixed Use	Surprise Center	Single Family	5
			Townhouse	5
			Multifamily	10
			Retail	30
			Office	40
			Public	10
<u>Tempe</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	35
			Retail	35
			Office	30
<u>Tolleson</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	35
			Retail	35
			Office	30
<u>Wickenburg</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Mixed Use	30
			Retail	45
			Office	25
<u>Youngtown</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	35
			Retail	40
			Office	25

Source: Applied Economics, 2001.

Maricopa Association of Governments GIS and Database Enhancement Project

METHOD

1. Use the TAZ allocation of housing units and population from the 2000 Census as the base (existing) data.
2. If the land is not identified as a Planned Area Development, determine additional housing units and population from the General Plan. Calculate developable residential acres by land use category (*land use codes 110 – 190 and 820*) by TAZ. For this scenario, acreage is considered developable residential if it meets all of the following criteria:
 - a) The 2000 land use was either agriculture or vacant.
 - b) The land use was not in a flood plain as defined by the MAG Desert Spaces Plan.
 - c) The General Plan land use was residential or mixed use - land use codes 110-190 and 820. In the case of mixed use, apply the percentages identified previously.

Calculate additional housing units by land use category as developable residential acres * net density (minimum/target/maximum) for the residential category. Sum categorized residential housing units to obtain total additional housing units by TAZ.

3. If the area is identified as a Planned Area Development, then allocate the new residential units from the development database to the parcel. Apply the mixed-use proportions in cases where the development is mixed use. Sum categorized residential housing units to obtain total additional housing units by TAZ.
4. Using TAZ persons per occupied housing unit from the 2000 Census, calculate additional population by TAZ as total additional housing units * TAZ occupancy rate * TAZ persons per occupied unit.
5. Add additional housing units and population to the 2000 base housing units and population to obtain total build out figures.
6. Although control totals for Group Quarter population will be generated for projection years, it is not possible to generate Group Quarter population control totals for build out. Build out population in Group Quarters by TAZ was determined by keeping the 2000 proportion of Group Quarter population to the Population resident in households constant by TAZ except for:
 - a) Military: The population was held constant at 2000 levels based upon recommendations from Arizona State University as part of the MAG GIS and Database Enhancement Project.
 - b) Prisons: The total Group Quarter population in prisons was determined by keeping the proportion of the prison population in 2000 to the total population in households constant by TAZ.

PAPER 2

BUILD OUT PROCEDURE FOR EMPLOYMENT VARIABLES

PURPOSE

To prepare minimum, target and maximum build out numbers by Traffic Analysis Zone for employment variables to be used to evaluate the employment potential for the next set of socioeconomic projections.

BASE DATA

- Employment: Employment July 1, 2000 Base
- Residential Completions: April 1, 2000 to June 30, 2000, submitted and reviewed by MAG member agencies
- Existing Land use: Year 2000 land use current as of July 2000, reviewed by MAG POPTAC
- Future Plans: Future Plans current as of Dec. 2001 or later, reviewed by MAG POPTAC
- Development Data: Year 2000 data current as of July 2000, reviewed by MAG POPTAC
- TAZ system: TAZ2002

MODEL

SAM-IM version 3.1 was used for this build out analysis. The analysis was conducted with a Grid Cell size of 220 feet on each side.

ASSUMPTIONS

Employment Densities: In developing TAZ build out projections, the MAG socioeconomic models project employment from parcels identified as employment-based in the General Plans or areas anticipated to be non-residential in the Development database.

As part of the GIS and Database Enhancement Project, Floor Area Ratios (FAR) and Employment Density (employees per 1000 square feet) factors were developed by Arizona State University (Table 1). Thus:

Total square feet of employment space = FAR * Area of polygon in square feet

Number of employees = Total square feet of employment space * Employees per 1000 square feet

Generally, areas covered by the Development database have the square feet of employment areas being built or planned. Thus to derive the employment only the Employees per 1000 square feet value need to be used. In cases where the planned square footage was not available, the FAR factors for the particular land use is used.

TABLE 1
FLOOR AREA RATIOS AND EMPLOYEES PER 1000 SQUARE FEET
2000

DESCRIPTION	FAR	EMPLOYEES/1000 SQFT
RETAIL		
Neighborhood	0.23	1.18
Community	0.23	.72
Regional	0.27	1.24
Strip	0.25	1.30
OFFICE		
Small	0.78	3.13
Large	3.36	3.08
INDUSTRIAL		
Warehouse	0.37	2.54
Manufacturing	0.34	2.82
PUBLIC		
Schools	0.21	1.21
Government	0.33	3.98
HOTEL/MOTEL/RESORT		
Hotel/motel	0.70	0.68
Resorts	0.62	0.45

Net Acres: The figures mentioned above for the employment areas indicate the gross density. In order to determine employment, a net density figure must be derived. This is due to the fact that the MAG existing land use database includes non-buildable land, such as roadways and right-of-ways. Therefore, an analysis was conducted to account for the percentage of the land use that is likely not to be developed in the future. The target future densities assumed this percentage continues in the future. The minimum densities assume the percentage is 25% higher in future development, and the maximum densities assume the percentage is only that area necessary for transportation needs. These results are shown in Table 2, which identifies net acres as a percentage of total acres for each of the major land use categories.

**TABLE 2
NET ACRES AS PERCENT OF TOTAL ACRES
FOR MINIMUM, TARGET AND MAXIMUM EMPLOYMENT BUILDOUT**

Code	Definition	Minimum	Target	Maximum
200s	Commercial	50%	60%	90%
300s	Industrial	50%	60%	90%
400s	Office	50%	60%	90%
500s	General & Public	60%	70%	95%

Spatial Multiplier Factor: To understand the variation of employment density spatially, an analysis was conducted on the existing employment and land uses in the entire metro area, as well as the following:

- a. Downtowns – Phoenix, Tempe, Scottsdale, Mesa
- b. Freeway corridors – 1 mile buffer around the freeways
- c. Airports – 2 mile buffer around the airports
- d. Rail roads – 1 mile buffer around the railroads
- e. None of the above (all other areas)

Table 3 summarizes the findings of the analysis. It was found that more than 70% of the total employment is located within these identified areas. Also the density variation indicates that the employment density on Retail, Office and Public land uses in downtown areas is generally double than other areas.

**TABLE 3
SPATIAL MULTIPLIER FACTORS
FOR EMPLOYMENT SECTORS**

Sector	Metro	Downtown	Freeway	Airport	Railroad	Other
Retail	1.0	2.0	1.0	1.0	1.0	1.0
Office	1.0	2.0	1.0	0.5	0.75	1.0
Industrial	1.0	1.0	1.0	1.0	1.0	0.5
Public	1.0	2.0	1.0	0.5	0.75	1.0
Other	1.0	2.0	2.0	1.5	1.5	0.5

Mixed Use: This build out analysis is consistent with member agency General Plans and Planned Area Developments. Many of these plans, however, have areas defined as multiple use areas that can generate various types and densities of housing or employment. In order to use these designations in socioeconomic modeling, the multiple use categories must ultimately be converted to one or more of the standard land use categories. The MAG socioeconomic models have been enhanced to accommodate such multiple use categories. The MAG GIS and Database Enhancement Project has identified default categories for member agencies to use that are consistent with past local multiple use development.

Some of the factors found to have the strongest influence on the type of development were regional planning issues/factors that are not adequately delineated by MPA boundaries. For these areas, a set of recommended land use proportions were developed based on the proximity of a property to urban core areas (downtowns), railroads, freeways and airports. The criteria used for these assignments were: location within a developed downtown area (currently Phoenix, Mesa, Tempe, and Scottsdale); location within approximately one mile of a freeway; location within approximately one mile of a rail line; location within approximately two miles of a commercial airport. Table 4 indicates the mixed-use proportions used for the four areas in order of dominance.

A priority system is used for areas that fell within more than one of the location types. The location types were therefore evaluated in the following order:

- 1 - Downtown
- 2 - Proximity to Railroad Corridors
- 3 - Proximity to Airports
- 4 - Proximity to Freeways

For those areas that did not fall within one of the defined special areas, the recommended land use proportions by MPA and General Plan land use category were used. These recommendations were derived from base data from field surveys, discussions with city planners, and further modifications to improve reasonableness for areas with a lack of data. Table 5 indicates the results of this analysis.

TABLE 4
LAND USE PROPORTIONS BY AREA CATEGORY

Area Category	Structure Code	Land Use	Acres	Percent of Area
Downtown Area	AP	Multifamily	3	18%
	OF	Office	7	43%
	RH	Resort/Hotel	1	6%
	RT	Retail	5	33%
			16	100%
Freeway Area	AP	Multifamily	114	7%
	IN	Industrial	873	54%
	OF	Office	257	16%
	PB	Public buildings	6	0%
	RH	Resort/Hotel	44	3%
	RT	Retail	309	19%
			1,602	100%
Airport Area	AP	Multifamily	9	1%
	IN	Industrial	466	46%
	OF	Office	452	45%
	RH	Resort/Hotel	15	1%
	RT	Retail	72	7%
			1,014	100%
Railroad Area	IN	Industrial	1,332	97%
	OF	Office	17	1%
	PB	Public buildings	20	1%
	RH	Resort/Hotel	1	0%
	RT	Retail	9	1%
			1,379	100%

Source: Applied Economics, 2001.

**TABLE 5
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Avondale</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Buckeye</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Carefree</u>	Business Park	Business Park	Retail	10
			Office	30
			Industrial	60
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Cave Creek</u>	Business Park	Business Park	Retail	10
			Office	30
			Industrial	60
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Chandler</u>	Business Park	Commercial/Office/ Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Employment	Multifamily	10
			Retail	5
			Office	20
			Industrial	65
<u>El Mirage</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35
<u>Fountain Hills</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35

**TABLE 5
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Gila River</u>	Business Park	Business Park	Retail Office Industrial	10 10 80
	Mixed Use	Mixed Use	Multifamily Retail Office	30 35 35
<u>Gilbert</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Business Park	Regional Commercial	Hotel Retail Office	5 80 15
	Mixed Use	Village Center	Multifamily Hotel Retail Office	15 10 35 40
<u>Glendale</u>	Business Park	Business Park	Retail Office Industrial	5 15 80
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Goodyear</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Guadalupe</u>	Business Park	Commercial Mixed Use	Office Industrial Public	15 80 5
	Mixed Use	Mixed Use	Multifamily Retail Office	35 40 25
<u>Litchfield Park</u>	Business Park	Business Park	Retail Office Industrial	10 20 70
	Mixed Use	Mixed Use	Multifamily Retail Office	20 35 45
<u>Maricopa County</u>	Business Park	Business Park	Retail Office Industrial	10 20 70

**TABLE 5
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Mesa</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use/Employment	Multifamily	20
			Retail	25
			Office	30
			Industrial	25
<u>Paradise Valley</u>	Business Park	Business Park	Retail	10
			Office	70
			Industrial	20
	Mixed Use	Mixed Use	Multifamily	10
			Retail	40
			Office	50
<u>Peoria</u>	Business Park	Business Park	Retail	10
			Office	15
			Industrial	75
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Phoenix</u>	Business Park	Commerce Park	Retail	25
			Office	25
			Industrial	50
	Mixed Use	Mixed Use	Multifamily	20
			Retail	35
			Office	45
<u>Queen Creek</u>	Business Park	Employment - Type B	Office	20
			Industrial	80
	Mixed Use	Town Center	Multifamily	15
			Retail	35
			Office	40
			Public	10
<u>Scottsdale</u>	Business Park	General Employment (34)	Office	25
			Industrial	75
	Business Park	Minor Employment (33)	Office	20
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	30
			Retail	35
			Office	35

**TABLE 5
LAND USE PROPORTIONS BY MPA**

MPA	Generic Category	General Plan Category	Land Use	Percentage
<u>Surprise</u>	Business Park	Employment	Office	50
			Manufacturing	38
			Hotel	12
	Mixed Use	Mixed Use Gateway	Single Family	5
			Townhouse	5
			Multifamily	20
			Retail	30
			Office	25
			Industrial	5
			Public	10
	Mixed Use	Surprise Center	Single Family	5
			Townhouse	5
			Multifamily	10
			Retail	30
			Office	40
			Public	10
<u>Tempe</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	35
			Retail	35
			Office	30
<u>Tolleson</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Multifamily	35
			Retail	35
			Office	30
<u>Wickenburg</u>	Business Park	Business Park	Retail	10
			Office	10
			Industrial	80
	Mixed Use	Mixed Use	Mixed Use	30
			Retail	45
			Office	25
<u>Youngtown</u>	Business Park	Business Park	Retail	10
			Office	20
			Industrial	70
	Mixed Use	Mixed Use	Multifamily	35
			Retail	40
			Office	25

Source: Applied Economics, 2001.

Maricopa Association of Governments GIS and Database Enhancement Project

METHOD

1. Use the TAZ allocation of employment by land use sector as the base (existing) data.
2. Determine additional employment from the General Plan and Development database. Calculate developable employment-based acres by land use category (*land use codes 200 - 820*) by TAZ. For these scenarios, acreage is considered developable for employment if it meets all of the following criteria:
 - c) The 2000 land use was either agriculture or vacant.
 - d) The land use was not in a flood plain as defined by the MAG Desert Spaces Plan.
 - e) The General Plan land use was employment use or mixed use - land use codes 200 – 820. In the case of mixed use, apply the percentages identified previously.

Calculate additional employment by land use category as developable employment use acres * net density factors (identified above) * Floor Area Ratio * Employment per 1000 square feet for the appropriate employment land use. Sum employment by sector by TAZ.

3. Add additional employment by sector to the 2000 base employment by sector to obtain total build out figures.

PAPER 3

SINGLE FAMILY / MULTI-FAMILY SPLIT

The MAG projections are consistent with member agency General Plans and Planned Area Developments. The data is then used in MAG transportation models to project future transportation behavior. The latest version of the model requires long-term projections of the distribution of future housing units into single family and multifamily types. MAG socioeconomic models can determine the distribution of housing provided a county-wide control total is known. This paper recommends a split between single family and multi-family units over time.

Before beginning to explore how residential units may be split between single family and multifamily types in the future, it is useful to understand how this distribution has changed in the relatively recent past. In order to analyze past trends, housing inventory information from several previous Censuses were compiled, along with estimates for 2000.

The results of the data collection for the historic inventory breakdown by unit type are shown in Table 1, below. Over the past thirty years the total housing inventory in Maricopa County has increased by 281 percent, from about 317,000 housing units in 1970 to more than 1.2 million units in 2000. Despite this incredible increase in housing inventory, the overall change in the breakdown of housing units by type has changed relatively little. In 1970 nearly 80 percent of the inventory was comprised of single family units, compared with about 73 percent in 2000. While these figures reflect a modest decrease in the single family share of housing inventory, the decline has been relatively small compared with the amount of urbanization that has taken place.

TABLE 1
RESIDENTIAL INVENTORY BY UNIT TYPE
MARICOPA COUNTY: 1970 – 2000

Year	Units		Single Family Share	
	Single Family	Multi-family	Percent of Total	Percent of Change
2000	883,380	325,122	73.10%	78.48%
1995	733,366	283,976	72.09%	97.37%
1990	669,781	282,260	70.35%	60.60%
1985	549,917	204,344	72.91%	64.27%
1980	450,591	149,135	75.13%	69.74%
1970	253,428	63,580	79.94%	

Sources:

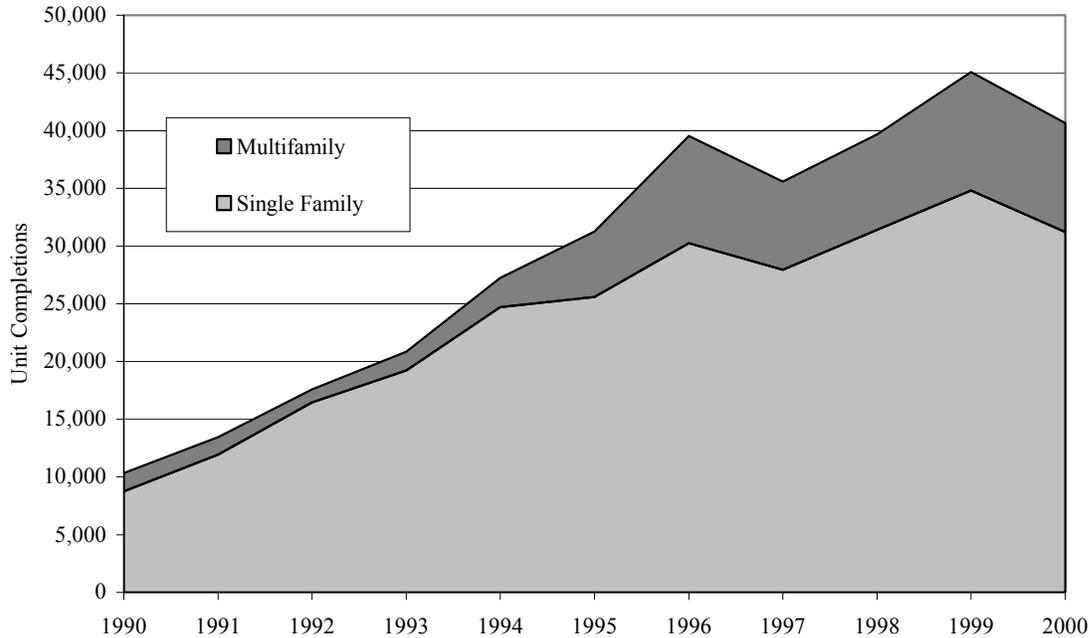
1970, 1980, 1990, 1995: U.S. Bureau of the Census.

1985: Estimate based on occupied units by type.

2000: Estimate based on 1995 Census plus building completions.

The current year estimate of housing units by type was based on 1995 Census inventory data, supplemented with MAG Building Permit Completion data for 1995 through 1999. The Building Permit Completion data supplied by MAG provided individual records of new single family and multifamily units, from 1990 through 2000. The total number of units by type by year is shown in Figure 1 below.

**FIGURE 1
UNIT TYPE BREAKDOWN OF RECENT HOUSING ADDITIONS**



Source: Maricopa Association of Governments, Building Permit Completions Database.

The housing unit completion information is added to the 1995 Census baseline housing unit information to estimate year 2000 housing inventory. This resulted in 733,366 single family units in 1995, representing 72.1% of the housing stock, 150,014 new units from 1995 to 1999, representing 78.5%, for a total of 883,380 units, or 73.1% of the total housing stock.

Based on the consistency of the 1995 Census unit-type split data with estimates developed based on existing land use data, and the reasonable and consistent share of single family units in the general plan land use data, it is reasonable to construct a time-series for the breakdown of units by type by interpolating between the current (2000) and future (general plan) levels. Table 2 shows the County-level results of performing this interpolation. Under that scenario, the single family share of housing inventory would fall from 73.1 percent currently, to 70.6 percent at 2050, a change of only 2.5 percent.

TABLE 2
SINGLE FAMILY SHARE OF INVENTORY BY
MARICOPA COUNTY: 1995 - 2050

Year	Single Family Share of Inventory
1995	72.1%
2000	73.1%
2005	72.8%
2010	72.6%
2015	72.3%
2020	72.1%
2025	71.8%
2030	71.6%
2035	71.3%
2040	71.1%
2045	70.8%
2050	70.6%
Build-out	70.6%

Sources:

1995: U.S. Bureau of the Census.

2000: Estimate based on 1995 Census plus building completions.

2005 - 2050: Projection based on General Plan Land Use interpolation.

PAPER 4

WORK AT HOME EMPLOYMENT METHODOLOGY

Introduction

The number of workers in the work at home category is increasing. The Census reported a 56 percent increase in work at home employment from 1980 to 1990. All newer estimates of the various work at home groups indicate continued increases during the 1990's.

The definitions of work at home employment range from people who telecommute, or who moonlight on a second job from home 1 or more days a month, to the much more limited Census definition of people who work at home 3 or more days per week. Of the 21.4 million people who reported at least one day per month of work at home time in the 1997 Bureau of Labor Statistics (BLS) Survey, only about 6.5 million (30 percent) were self-employed. An additional 17 percent were telecommuters, or wage and salary workers who were paid for work at home. The remaining 53 percent were wage and salary workers who were not paid for time worked at home, such as teachers preparing lesson plans at home in the evening.

Self-employed people who work at home would be included in the work-at-home methodology presented here. Only a portion of the telecommuters captured in the BLS survey would be included because some of these people may be working at telecenters rather than at home, and most telecommute less than 3 days a week. The remaining unpaid workers would be excluded from the work at home estimates for Maricopa County since they also commute to a regular job site during the day, and would be counted at their primary place of work.

The demographic characteristics of the work at home population from an extensive literature review can be directly incorporated as independent variables in the regression analyses used in the methodology described. Key characteristics include:

- Workers over age 45,
- Households with above average income levels,
- People with a college degree or higher level of education,
- People in "white collar" occupations – professional specialty or executive/managerial,
- Service industry workers, and
- Agricultural industry workers.

The projections of work at home employment for Maricopa County that will be used in this methodological approach will be those people who work at home 3 or more days per week. It will be important to keep in mind that these projections are most likely not comparable to sources other than the Census. The Census definition was adopted for this study because it is the only source for dependent variable data, on the share of people on a sub-county level who are working at home. It is also more consistent with the needs of the MAG transportation models.

Methodology

The methodology described here will produce estimates of work at home employment for 2000 through 2055. The methodology specifies a multi-variable regression equation to project the

level of work at home employment. These projections will be for the county as a whole, and for each TAZ in Maricopa County. The approach is similar for both geographies, but the general form of the equations varies in terms of the independent variables. Information from the literature review on the demographic and economic characteristics of people who work at home was incorporated into the regression analysis. However, the final results are limited by the availability of projections for the independent variables at both the county and TAZ levels. The current methodology uses data from the 1990 Census, however, the estimates will need to be updated when similar information is available from the 2000 Census.

Maricopa County Work At Home Estimates

The regression analysis for county level work at home estimates uses cross-sectional data for all counties in the United States (3,141 observations) to determine the factors that significantly influence the level of work at home employment. All cross-sectional data (data for multiple areas in the same time period) was abstracted from the 1990 Census.

The dependent variable in the equation is the percent of workers 16 and over who work at home. This percentage can be applied to county-level employment projections to produce the total number of people working at home.

The final results for the county level work at home regression are presented in the table below, where:

- **Older Workers** - Percent of population 45 to 65 divided by population 16 to 65
- **Agricultural Workers** – Percent of workers in the agriculture, fishing and forestry industry
- **Service/Information Workers** – Percent of workers in the finance, insurance, real estate, business and other service industries
- **Income Level** – Ratio of median household income in each county to national median household income

REGRESSION RESULTS COUNTY DATA

Variables	Coefficient
Constant	-0.0483
Older	0.0663***
Agricultural Industry	0.4165***
Service Industry	0.0507***
Income Ratio	0.0221***

*** Indicates significance at the 1 percent level

Using projections of the independent variables from Woods & Poole Economics for Maricopa County, the future Homeshare values were calculated. Woods & Poole Economics is a national vendor of economic and demographic projections. However, these projections are only available through 2025. From 2030 through 2055, the percentage change in the share of work at home employment was held constant at the 2025 to 2030 level. The resulting share of work at home percentages were then applied to MAG employment projections for the county. These

calculations, and the underlying data used for the independent variables are shown in the figure below.

**PROJECTED WORK AT HOME EMPLOYMENT
MARICOPA COUNTY**

Year	Older Workers	Ag Industry Share	Svc Industry Share	Income Ratio	Share of Work At Home	Total Employment	Work at Home Employment
2000	44.00%	1.70%	44.45%	93.84%	3.1185%	1,482,983	46,246
2005	47.13%	1.60%	45.90%	94.12%	3.3633%	1,678,093	56,439
2010	49.38%	1.49%	47.06%	94.60%	3.5381%	1,877,045	66,411
2015	50.14%	1.40%	48.02%	95.10%	3.6105%	2,042,684	73,751
2020	50.51%	1.33%	48.82%	95.58%	3.6566%	2,212,889	80,916
2025	50.97%	1.27%	49.50%	96.07%	3.7068%	na	na
2030	na	na	na	na	3.7577%	na	na
2035	na	na	na	na	3.8093%	na	na
2040	na	na	na	na	3.8615%	na	na
2045	na	na	na	na	3.9145%	na	na
2050	na	na	na	na	3.9683%	na	na
2055	na	na	na	na	4.0228%	na	na

Source: Applied Economics; Woods and Poole Economics, 2000 Complete Economic and Demographic Data Source; Maricopa Association of Governments Employment Projections.

The projections show work at home employment in the county increasing primarily due to the projected growth in employment. However, the share of work at home employment also increases steadily from 3.12 percent in 2000, to 4.02 in 2055. Although these values are lower than projected national levels from the Department of Transportation, it is important to remember that the projections above only include people who primarily work at home. If this same equation is applied to the independent variables listed above for the United States, the share of work at home employment is estimated at 2.95 percent for 2000, compared to 3.19 percent in Maricopa County. It is not surprising that Maricopa County is slightly above the national rate of work at home employment given the large number of information technology workers in the Valley.

The final projections of work at home employment for the county will be based on total employment as projected for each projection series. The above table simply illustrates how the methodology will be applied.

Small Area Work At Home Estimates

The regression analysis for the small area work at home estimates uses cross-sectional data for census tracts in Maricopa County (463 observations, excluding tracts with no population) to determine the factors that significantly influence the level of work at home employment. All cross-sectional data was abstracted from the 1990 and 1980 Censuses.

The dependent variable in the equation is the percent of population who work at home. This percentage can be applied to TAZ level population projections to produce the total number of people working at home. The dependent variable cannot be relative to employment as with the county estimates, since the employment estimates at the TAZ level will be based on place of work, not place of residence. Therefore, work at home employment must be estimated independently from all other employment, based on where workers live.

The following independent variables were chosen for the final regression:

- **At Home 80** – Percent of workers over 16 working at home in 1980
- **Agricultural Workers** – Percent of workers in the agriculture, fishing and forestry industry
- **Service/Information Workers** – Percent of workers in the finance, insurance, real estate, business and other service industries
- **Over 65** – Percent of the population that is over 65
- **Employment Accessibility** – Average peak travel time from each TAZ to employment centers

The final results for the TAZ level work at home regression are as presented in the table below.

REGRESSION RESULTS TAZ LEVEL

Variables	Coefficient
Constant	-0.0063
Employment Access	-0.0000004*
Service Industry	0.0507***
Agricultural	0.0366**
AtHome80	0.114***
Over 65	-0.0176***

* Indicates significance at the 10 percent level

** Indicates significance at the 5 percent level

*** Indicates significance at the 1 percent level

The final projections of work at home by TAZ will be based on the predicted percentage of work at home employment for each TAZ and each time period from the regression equation, multiplied by total projected population by TAZ. Employment Access projections will be available for each projection year. However, the other independent variables, which are all expressed as percentages, may need to be held constant at 2000 Census levels, due to the lack of available projections at the TAZ or Census Tract level.

PAPER 5

CLUSTER SIZE, FLOOR AREA RATIOS, AND EMPLOYMENT DENSITY

The MAG transportation models require projections of the number of employees in 5 different land use categories. The MAG socioeconomic models are land-use based and identify development by acres. It is therefore necessary to identify the number of acres in a typical development parcel (cluster size); the size of typical building on the parcel of land (floor area ratio) and the number of employees generated from the typical building (employees per 1000 square feet of building, or employment density). Table 1 presents the results of the most recent survey on cluster size, floor area ratio, employment density and compares the results to the previous survey in 1989.

Cluster Size: Cluster sizes are estimated in Table 1. Most cluster sizes have expanded due to larger buildings being built, especially in the retail sector. In the office sector, the cluster size grew more due to the concept of the phasing of new buildings. Phasing would allow the developer to buy a large parcel and build one building with a plan to add others as the market allows. The cluster size for the hotel/motel sector has declined because most of the present development has focused on the smaller motel with no amenities such as restaurants and conference centers. Thus, the buildings are smaller and the land need is less.

Floor Area Ratio (FAR): This concept represents the relationship between the structure and the land. Acquiring the land accounts for one of the largest costs associated with commercial development, frequently representing 25 to 30 percent of the final cost. Although the ratio measures the relation of the building to the land with a fairly typical ratio being around 25 percent, the building is not the only improvement on the land. The FAR does not include such land uses as the parking lot, landscaping, land use regulations creating open space between structures, and outlying structures such as PADs and parking structures in the determination of building square feet.

Table 1 indicates the Floor Area Ratios (FAR) for the various land use types and compares it to 1989 surveys. The greatest change was in large offices, which moved from 0.75 to 3.36. Some of this change is due to the fact that the larger buildings are frequently built on parking garages. But also, many of the sites examined for 1989 have added new buildings with no additional land. For example, there are now four buildings on the Esplanade site, not just two. The average FAR for a 1-story building is 0.40, .77 for 2-story building and 7.03 for 10 or more stories. Changing FARs represent differing intensity of land usage, which can be dictated by a wide-range of factors including market conditions, tenant requirements, land use regulations and market characteristics of the area.

Employment Density: In a very competitive economic environment, most companies are trying to improve the “bottom-line” by increasing the productivity of employees and space utilization. In order to enhance employee productivity, there is a greater use of technology and work scheduling. Thus, in the retail market the employment density has decreased, while in the office building market and the industrial market the employment density has increased. Table 1 indicates the employment per 1000 square feet that have been identified by the consultant for 2000.

FACTORS INFLUENCING CHANGE

FARs and employment densities are changing as firms work to gain efficiencies to improve their profitability. The following identify some of the forces that are changing the structure of commercial development.

Work schedule. Until the last ten years, it was fairly typical that most people worked 8 to 5 Monday thru Friday. In order to better serve customers and/or reduce personnel costs, companies are moving to different work schedules such as extended hours (6 AM to midnight for the entire week) or a 24/7 schedule. Thus, a company might employ three hundred people but they are spread though the week and over the day. For example, a typical Walgreens drug store employs 25 people at each store but a 24-hour drug store has nearly 40 people. Another example is the American West reservations center in Tempe. The employment density is 18.7 people per 1,000 square feet due to the 24/7 schedules and the use of part-time people.

Part time versus full time. In the past, most jobs were full-time (typically 40 hours with benefits). Now more jobs are considered part time (under 20 hours with limited benefits) and can found in most areas of employment, especially retailing and services. For example, only 4-6 people in a Walgreens out of a total workforce of 25-40 people are full-time and practically all of the 250 people at a Wal-Mart are part-time. The use of part-time people is frequently associated with changing concepts of the work schedule.

Services offered. The number of people employed at a site can be greatly influenced by the services being offered. For example, a grocery store typically employs fewer than 100 people but if a pharmacy is added then typically 6 people are added to the employment base. The number of services being offered also may increase the size of the store. Fry's stores frequently have pharmacies and banks and so are larger than Bashas, which frequently do not offer these services

Work location. People used to go to a site to work. Now, there are more options such as work-at-home, at the employer's site or at a client's site. Many supermarkets had on-site butchers, but now many are working from a central site and transporting the cut meat to site. This reduces the number and expense of on-site butchers. It is also difficult to identify the true employee density for such operations as delivery or construction workers.

Use of technology. Technology has a tremendous impact on location. For example, many grocery stores are introducing self-checkouts to reduce the number and/or hours worked of human checkers. The most typical use of technology is the increasing ability to work at home and communicate with the office site and/or clients.

Land use management. Many cities are implementing regulations that will influence FARs and employee densities. For example, cities are recommending more mixed-use projects that will draw residential and commercial usages to a single site.

Land usage. The drive to heighten efficiencies increases FARs as developers try to make the greatest economical use of a site. More and more stores are trying to combine uses. For example, Wal-Mart superstores combine a supermarket with a discount operation; developers are making more use of PADs where a restaurant such as McDonalds can share the land with the

shopping center. Thus, FARS may continue to increase but not at the rate evident in the last few years. Further, tenants will try to enhance the efficiency of their space to sure that most of the space is allocated to revenue generation. For example, the inclusion of a bank within a grocery store gains both market attraction (both uses bring customers) and space efficiencies.

Economy. Prior to the 2001 economic downturn, several firm such as Wells Fargo, American Express, and Charles Schwab were considering the development of corporate campuses, similar to the USAA campus in north Phoenix, which is over 700 acres. The idea of such a campus is to bring all workers to a single location with a set of office buildings and other features such as restaurants, day-care, and recreation facilities. The purpose was to create a corporate identity and a desirable place that would attract the needed skilled workers. However, as the economy slowed, many of the plans were shelved, and whether the concept will come back is largely unknown.

Table 1
FAR, Employment densities and Cluster
1989 and 2000

Description	1989		1989		2000	
	1989 FAR	Employees per 1000 SqFt	Cluster Size (Acres)	2000 FAR	Employees per 1000 SqFt	Cluster Size (Acres)
RETAIL						
Neighborhood	0.23	1.43	16	0.23	1.18	21
Community	0.23	1.84	48	0.23	.72	49
Regional	0.25	2.26	92	0.27	1.24	144
Strip	0.23	1.86	4	0.25	1.30	5
OFFICE						
Small	0.25	3.21	1.3	0.78	3.13	4.9
Large	0.75	2.50	3.3	3.36	3.08	4.8
INDUSTRIAL						
Warehouse	0.27	1.37	2.1	0.37	2.54	2.8
Manufacturing	0.27	2.23	6.1	0.34	2.82	10.7
PUBLIC						
Schools	0.25	1.44	8.3	0.21	1.21	20.3
Government	0.25	2.50	NA	0.33	3.98	NA
HOTEL/MOTEL/RESORT						
Hotel/motel	0.25	2.61	6.2	0.70	0.68	3.9
Resorts	0.25	1.96	18	0.62	0.45	NA

NA=sample too small—data not available

PAPER 6

RESIDENTIAL CLUSTER SIZES

Introduction

In analyzing subdivisions, the average size of subdivisions prior to 1985 was 280 lots. Since then, the average subdivision size has steadily declined from 129 during the 1985-89 time period to 103 lots in the 1990-94 time period to the current 98 lots. There are many reasons for the decline in size. Now, most subdivisions are part of a master planned community, which might encompass thousands of lots such as McDowell Mountain. Further, many subdivisions within a community might be started at the same time by different builders and for different market segments. Thus, the smaller size allows builders to adjudge market acceptance of specific plans. Land costs within a master planned community can be quite high in order to sustain the front costs of the amenity features such as lakes, golf courses and jogging trails. Thus, to keep capital costs low relative to expected returns, a builder might buy smaller parcels.

An additional reason is the local homebuilding industry has come to be dominated by national builders such as Pulte and KB Homes. These companies are basically production builders. They need to sustain a level of construction to support their corporate infrastructure and capital needs. Thus, they tend to build at all times, even in weak markets, with the idea of being able to attract a buyer through attractive financing, pricing arrangements or other marketing concessions. Given the large scale of these companies, local speculative products do not typically represent a large share of their national production. But to minimize risk, national builders do keep their current exposure low by building small subdivisions, which allow them to more quickly adjust to changing market conditions. Thus there really no reason to expect a sudden increase in subdivision sizes above the typical 100-lot subdivision.

The average lot size has not changed appreciably, with the average being 7,475 square feet for pre-1985; 7,525 for 1985-89; 7,984 for 1990-94; and 7,690 currently. The difference is that range of sizes appears to have become greater with more subdivisions moving into the 5,500 sq.ft. range or lower with cluster style housing. Thus, many builders, in order to maintain affordability of housing with higher land prices, are trying to get more homes in a subdivision by lowering lot sizes.

Based on average lots sizes, the typical subdivision has allocated 16 acres (net acres) for housing. The issue then becomes how much is being allocated for other uses such as streets and open space. Typically, about 25 percent of a subdivision is allocated for streets and other public access, although some subdivision are allocating another 10 to 15 percent for public open space such a trails and/or parks. This is especially evident where subdivisions are using a small lot concept.

Larger lots, with 2 units or fewer per acre, do not have a decrease in acres for usable acres. Similarly, the highest density units typically have about three acres of non-buildable space.

Based on an analysis of the development database and the Greater Phoenix Housing Study, Table 1 details the cluster sizes by residential land use type.

Table 1
Residential Cluster Sizes

Land Use Code	Density	Gross Acres	Net Acres*
Rural Residential (Limited Sample)	Under 1 DU/Acre	50	50
Estate Residential	DU/Acre	46	46
Large Lot Residential	1-2 DU/Acre	45	45
Medium Lot Residential	2-4 DU/Acre	25	19
Small Lot Residential	4-6 DU/Acre	20	15
Medium Density Residential	4-10 DU/ Acre	26	20
High Density Residential	10-15 DU/Acre	17	14
Very High Density Residential	More than 15DU/Acre	18	13

*Net acres based on the assumption that the proposed subdivision would lose a certain percentage of its gross acreage for streets right-of ways, etc.

PAPER 7

RESIDENTIAL DEVELOPMENT VELOCITY CURVES

Introduction

In forecasting residential activity, it is important to understand the development trends of units that come to market. Typically, growth is fairly slow in the beginning of a project, but beyond a certain point the continued growth accelerates until it reaches another point at which it begins to decrease and tails off towards its limits. Hence the curve typically takes on a “S” shape and is frequently referred to as Life Cycle Analysis.

A typical life cycle of a small area can be described as an “S-Curve” indicating that development of an area will start slowly, speeds up velocity and stops when all homes are absorbed. Based on an analysis of the Greater Phoenix Housing Study (The Meyers Group, Landiscor), a series of S-curves were developed and are presented in FIGURE 1. Subdivision sales activity is analyzed over the 1979 to 1999 time period.

Factors impacting Development Velocity:

Size of Subdivisions: On the metropolitan (Metro) level, over 90 percent of starts were sold by the end of year 5. Except for the 500+ housing units subdivisions, most subdivisions approached sell-out by the end of year 6. Most of the activity occurred in the first few years with the remaining activity being focused on probably less desirable lots and models. The 500+ projects tend to be very consistent over time with half of the project being started by the end of year 7. This scale of projects has always been relatively rare in the area and typically associated with active adult communities such as Sun City or Sun Lakes. Currently, most active adult communities are smaller subdivisions within master planned communities.

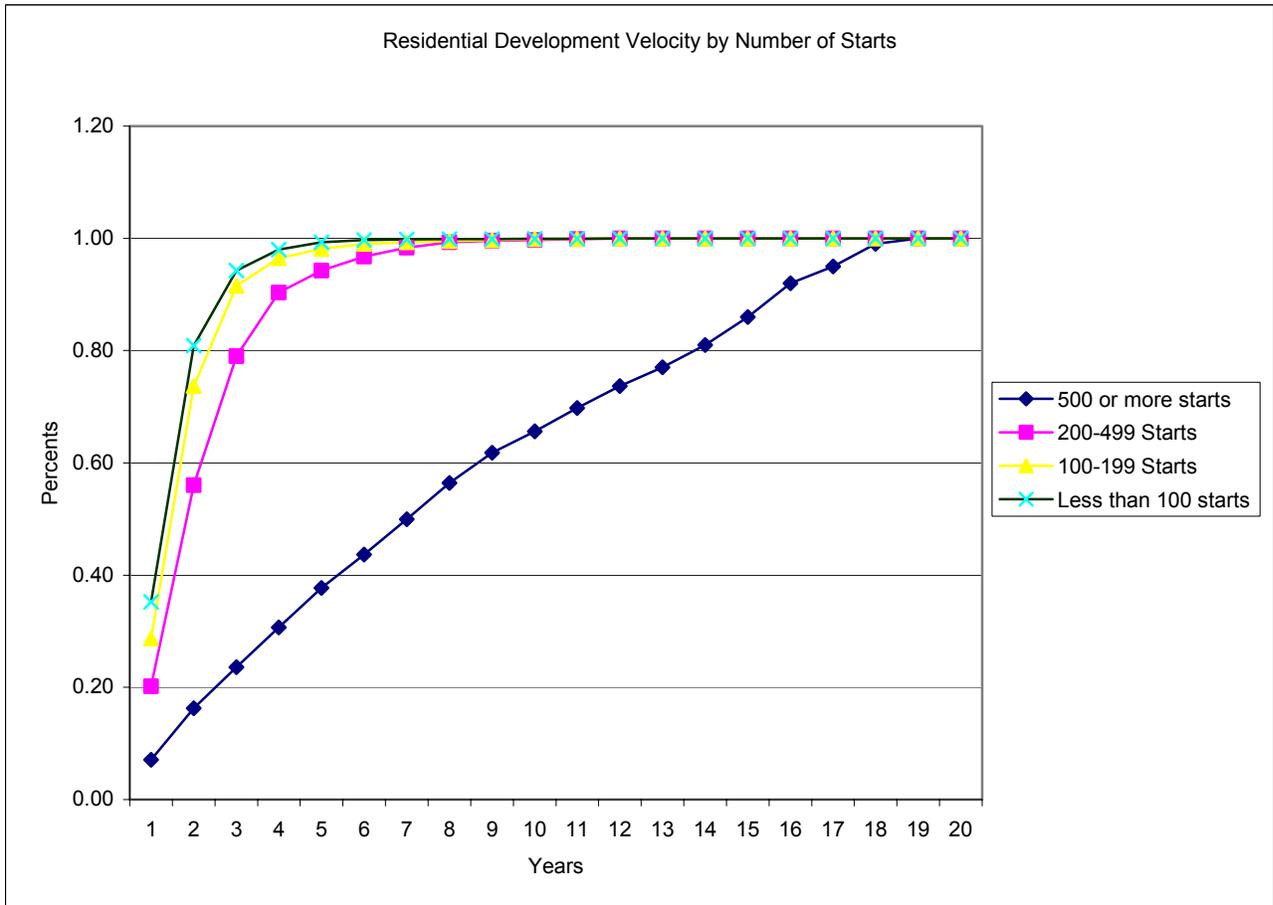
Time Dimension: The time dimension seems to show the greatest differences. In the 1980s, subdivisions tended to take longer time to sell out with nearly 20 percent of the lots remaining by year 12. The 1995-1999 time period is much quicker with a subdivision typically being sold out by the end of year 4. There are probably two key reasons for the difference. In the 1980s, subdivisions tended to be larger, which historically have longer sell-out periods. The other is the robust housing market of the 1990s, with low interest rates that drove sales at record paces.

Lot Size: Another dimension of sales activity is lot size. Basically, as lots get larger, which could well denote more expensive homes, the sales rate slows. This is especially evident in the early years, but all categories of lot sizes have over 90 percent of the homes sold at the end of year 4.

Market Conditions: Although the health of the housing market seems to be important, it is still true that the vast majority of developments sell out within five years and have less than 200 units.

Based on the analysis of the above parameters, it is recommended that the development velocity associated with 100-199 starts be used for projects with up to 200 units. FIGURE 1 details the velocity curves for various sized developments.

FIGURE 1: RESIDENTIAL VELOCITY CURVES



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POST-SECONDARY ENROLLMENT

Post-secondary enrollment projections are a component of socioeconomic projections required by the MAG travel demand model because of its potential impact on trip generation. This survey of post-secondary education providers was conducted to gather information on current enrollment and expansion plans. The methodology described here will produce estimates of post-secondary enrollment by institution for 2000 through 2055. The methodology used divides enrollment into four components—community colleges, public universities (ASU), traditional private colleges and non-traditional private colleges.

Institution Survey: As a first step in creating enrollment projections for Maricopa County, a phone survey of post-secondary education providers was conducted to gather information on enrollment and expansion plans. Ninety-one institutions of higher education in Maricopa County were identified. In order to be included, institutions must require a high school diploma for admission, and have at least 100 students. These standards are consistent with earlier MAG post-secondary enrollment projections.

Projections for Community Colleges: The methodology for projecting community college enrollment combines historical participation rates by age cohort with projected population by age. In addition, information from the Maricopa Community College District about future expansion plans is also incorporated.

For the eleven existing campuses, detailed historical information was available about student enrollment by age cohort. Using data on spring enrollment for 1997 and 2000, age-based participation rates were calculated. Spring enrollment was used as opposed to fall, since the survey data for current enrollment is for spring 2000.

The first step is to calculate participation rates by age for each campus. Since community colleges target students within approximately 10 miles from the campus, participation rates were calculated by dividing enrollment in each age cohort for a particular campus by population in that age cohort in the host MPA. In some cases, multiple smaller MPAs were combined.

Since MPA-level population is not projected by age, the county age distribution, which varies by year, was applied uniformly to all MPA-level population estimates for a given year. The results of this calculation yield a participation rate by age cohort by campus for 1997 and 2000. Participation rates for the two years were averaged and held constant over the projection period. These participation rates were then applied to projected population by MPA by age for the relevant geographic areas.

There are also several new community college sites that will come on line in the next 10 to 15 years. Information on projected enrollment and timing was obtained from the Facilities Department at the Maricopa Community Colleges District. Two sites are expected to reach 4,000 to 5,000 students by 2010. A third site is expected to build out between 2010 and 2020.

Projections for Arizona State University: The Office of Institutional Analysis at ASU was able to provide projected enrollment by campus for 2000 through 2015. Distance learning students were excluded from these enrollment figures.

The projections for 2015 to 2055 were based on historical enrollment growth at each campus, relative to countywide population growth. For ASU Main, historical absolute growth has been about 0.45 percent of absolute population growth in the County. Since ASU Main is essentially at capacity, future growth will not be significant. For the purpose of the model, the average relative growth rate of 0.45 percent was held constant from 2015 to 2055, resulting in annual enrollment growth at ASU Main of about 3 percent. ASU Downtown, which was included with ASU Main in projections from the university, was modeled similarly to ASU Main.

For ASU East and ASU West significant growth is projected through 2015, given that both campuses presently have significant available capacity. It is unlikely this rate of growth will be sustained through 2055. Therefore, the ratio of enrollment growth to county population growth was trended downward over time, based on the declining rate of growth from 2020 to 2055.

Projections for Private Colleges: In order to project enrollment at private two and four-year colleges in Maricopa County, the methodology used in the statewide projections prepared for the Governor's Task Force on Higher Education was adopted. To apply this methodology, private colleges in the survey were divided into traditional and non-traditional schools. Non-traditional schools can generally be described as those that aggressively market to working adults and provide flexible class schedules and compressed instructional formats.

Based on the statewide findings on growth rates at private colleges in Arizona, traditional colleges are projected to grow at 2 percent per year, while non-traditional colleges are expected to grow at 8 percent per year. A further breakdown was done to calculate the growth rates during each five year period, that decrease over time from 2 to 0.4 percent annually for traditional schools, and 9 to 1 percent annually for non-traditional schools. These rates were then applied to current enrollment by institution to calculate the projections. The rates were trended forward through 2055, based on projected growth rates through 2020. However, for multi-campus non-traditional schools it is likely that they will open new campuses in the future rather than continue to grow indefinitely at existing sites. For this reason projected enrollment is capped at a 25 percent increase over the 2000 enrollment number for traditional institutions, and a 50 percent increase over the 2000 enrollment number for non-traditional institutions.

Summary of Post-Secondary Enrollment Projection Methodology

Institution Type	Method
Community Colleges	<ol style="list-style-type: none"> 1. Calculate participation rates by age for each campus for 1997 and 2000 (divide enrollment in each age cohort for a campus by population in age cohort in host MPA or combined smaller MPAs). 2. Use county age-by-year distribution to estimate projected population by age by MPA. 3. Use the average (1997 and 2000) Participation rate for enrollment projection by campus.
Public Universities (ASU)	<ol style="list-style-type: none"> 1. Use the enrollment projections for 2000 through 2015 provided by ASU. 2. The 2015 to 2055 projections are based upon the historical enrollment growth at each campus, relative to county population growth. 3. For ASU Main and ASU Downtown, the average relative growth rate of 0.45 percent is held constant 4. For ASU East and ASU West the ratio of enrollment growth to county population growth is trended downward over time.
Private Colleges	<ol style="list-style-type: none"> 1. Methodology used from the statewide projections for Governor’s Task Force on Higher Education. 2. Traditional colleges are projected to grow at 2 percent per year. These are trended to decrease growth rate to 0.4 percent by 2055. 3. Non-traditional colleges are expected to grow at 8 percent per year and are trended to decrease growth rate to 1 percent by 2055. 4. Projected enrollment is capped at a 25 percent increase over the 2000 enrollment number for traditional institutions, and a 50 percent increase over the 2000 enrollment number for non-traditional institutions. 5. The difference between capped projected enrollment and total projected state enrollment is assigned to future facilities.

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TRANSIENT POPULATION PROJECTION METHODOLOGY

Separate methodologies were developed to produce projections of the transient population traveling to the Phoenix area for business reasons and the transient population coming for non-business reasons. Once these two sets of projections are prepared, separate projections of the hotel/motel/resort component and the other transient population component are derived from the total figures.

Projecting the Business-Related Transient Population

The county-level projections of business-related transient population for the 2005-2055 period are developed using the following procedures:

1. Taking a conservative approach, the average annual number of business travelers to the Phoenix area over the 1992-99 period was computed as a baseline level of business travel activity. While the transient population coming to the Metro Phoenix area has exhibited substantial growth, the travel industry can be significantly affected by economic and other factors causing wide swings in the volume of travel. Annual estimates of the total number of domestic business overnight travelers for the 1992–1999 period from the Phoenix and Valley of the Sun Convention and Visitor Bureau Statistical Reports show substantial but erratic growth over the decade of the 1990s. Although statistics are not available for 2000 or 2001, it is well known that business travel has been adversely impacted this year, and any statistical analysis based on the experience of the 1990s may not be an accurate forecast of the future.
2. The visitor volume for the peak quarter and the low quarter was calculated. The seasonality was estimated using information from an unpublished analysis of Sky Harbor Airport passenger data by Professor Lee McPheters of Arizona State University. Based upon these data, it was estimated that the volume of travel to Phoenix during the peak quarter was 30.5 percent of the total and only 18.6 percent during the low quarter.
3. Total visitor days during the peak quarter and the low quarter were computed using average length of stay data for business travelers from the 1995 Metro Phoenix Visitor Study.
4. The average number of business visitors per day for the peak and low periods was calculated by dividing the total visitor day figures by the number of days in a quarter.
5. The average daily business-related transient population figures from step #4 were split into shares coming from each region of the country (East, Midwest, South, West) based upon the regional shares reported in the 1995 Metro Phoenix Visitor Study.
6. The number of business-related transient residents per 1000 employees in each region was computed using 1995 total employment data from the U. S. Bureau of Economic

Analysis. (1995 employment figures were chosen as the midpoint of the 1990s decade – the visitor data was based upon the 1992-99 period.)

7. Projections of total employment for each region were multiplied by the ratios computed in step #6 to produce projections of the business-related transient population coming from each region. These regional estimates were summed to produce projections of the total business-related transient population. The regional employment projections were developed from the 1995 U.S. Bureau of Economic Analysis Regional Projections. They were extended from 2045 to 2055 by extrapolating by linear trends.

Projecting the Non-Business-Related Transient Population

1. The county-level projections of non-business-related transient population for the 2005-2055 period were developed using the following procedures:
2. Similar to the approach for business-related travel, the average annual number of non-business travelers to the Phoenix area over the 1992-99 period was computed as a baseline level of travel activity.
3. The visitor volume for the peak quarter and the low quarter was calculated. The seasonality was estimated with information using an unpublished analysis of Sky Harbor Airport passenger data by Professor Lee McPheters. Based upon these data, it was estimated that the share of travel to Phoenix was 30.5 percent during the peak quarter and only 18.6 percent during the low quarter.
4. Total visitor days during the peak quarter and the low quarter were computed using average length of stay data for leisure travelers from the 1995 Metro Phoenix Visitor Study.
5. Average number of non-business visitors per day for the peak and low periods were calculated by dividing the total visitor day figures by the number of days in a quarter.
6. The average daily non-business-related transient population figures from step #4 were split into shares coming from each region of the country (East, Midwest, South, West) based upon the regional shares reported in the 1995 Metro Phoenix Visitor Study.
7. The number of non-business-related transient residents per 1000 population in each region was computed using estimates of the 1995 population of each region from the U.S. Census Bureau.
8. Projections of total population for each region were multiplied by the ratios computed in step #6 to produce projections of the non-business-related transient population coming from each region. These regional estimates were summed to produce projections of the total non-business-related transient population. The U.S. regional projections were developed from the latest U.S. Census Bureau state projections and were extended to 2055 by linear extrapolation of the regional share and applying the resulting projected shares to the latest Census Bureau national projections.

Projecting the Foreign Transient Population

The factors affecting the flow of foreign visitors to the Phoenix area are even more complex than those affecting domestic travel. The projection methodology relied upon information on the origin of travelers to the area from the 1995 Metro Phoenix Visitor Study.

Two sets of projections are prepared based upon the assumption that the foreign transient population was a share of the total transient population. For the first alternative, it is assumed that the foreign component would remain 7.5 percent of the total. The second alternative assumes that the volume of foreign travel to the Phoenix area would grow faster than domestic travel, with the share of the total rising gradually from 7.5 percent in 2000 to 10 percent in 2055.

Projecting the Hotel/Motel/Resort and the Other Transient Populations

The business, leisure (non-business), and foreign transient population figures were split into hotel/motel/resort and other transient population components using information on the distribution of business and leisure visitors by type of accommodation from the 1995 Metro Phoenix Visitor Study. The overall distribution for all travelers was employed to split the foreign component.