Introduction

Arizona's Socioeconomic Modeling, Analysis and Reporting Toolbox (AZ-SMART) is a modeling suite that will support socioeconomic activities at the Maricopa Association of Governments (MAG), other Councils of Governments (COGs) and Metropolitan Planning Organizations (MPOs), and elsewhere throughout the State. This modeling suite is a platform on which to build, calibrate, run, and analyze socioeconomic projections and projection models and will seamlessly integrate with other third party models.

Background

Socioeconomic projections are essential to land use, transportation and air quality planning. The population and employment projections are used in modeling highway volumes, speeds and congestion, bus and rail ridership, and air pollution emissions and concentrations. The projections represent important underlying assumptions for COG and MPO programs and plans, including the five-year Transportation Improvement Program, the Long Range Transportation Plan, air quality conformity analyses, and air quality plans.

Socioeconomic projections at MAG address traditional population and employment as well as other measures of urban activity, such as land use, seasonal population, transient visitation, school campus populations, group quarters, and special generators, as dictated by transportation models and other analysis demands.

Rapid growth in population and employment in Arizona has led to a need for socioeconomic projections throughout the state. For example, MAG, by necessity, must understand transportation and growth impacts not only from Maricopa County, but also from Pinal and Yavapai Counties. Similarly, the Pima Association of Governments (PAG) needs to understand the impacts of Pinal County as well as portions of Santa Cruz and Cochise Counties.

This growth means that a consistent unified approach to socioeconomic projections, databases, inventories, and methodologies is needed.

Current Practice

MAG currently utilizes two land use models in performing projections of population and employment at the sub-county level. The first allocates County control totals for households and employment to approximately 150 districts known as Regional Analysis Zones (RAZs) using a variation of a gravity model. Using these RAZ numbers as controls, the second model, SAM-IM (Subarea Allocation Model and Information Manager) distributes RAZ-level households, resident population and employment to Transportation Analysis Zones (TAZs). It also uses county-level control totals for other socioeconomic variables, such as group quarters, transient, and seasonal population, to create information at the TAZ level. SAM-IM performs its modeling at a very small geographic level and cumulates the information to larger geographies such as TAZ, zipcode or census tract. SAM-IM is a GIS-based model that was originally developed for MAG in January 1996. Since then, SAM-IM has been enhanced a number of times. Since 2006, PAG has started using SAM-IM for some of its socioeconomic modeling needs.

It is intended that this project will update and refine the MAG socioeconomic models, creating a suite of tools that can be used over a wider geography and by other stakeholders in the State of Arizona.

AZ-SMART

The concept for AZ-SMART was developed in conjunction with all of the Councils of Governments and Metropolitan Planning Organizations in Arizona, as well as many other regional and state stakeholders. AZ-SMART was designed to be:

1. A data model and a common process for data collection that can be shared by all users to ensure consistent data for all areas;
2. A suite of models that together implements a projection and analysis system, including all of the component parts integral to it. The component parts include various submodels for managing and modeling regional and subarea activity;

3. A socioeconomic analysis framework on which to implement and run socioeconomic projection models and model procedures, with tools for the management, manipulation, and visualization of socioeconomic data;
4. A library of many different socioeconomic models, tools, and applications, all running on the AZ-SMART platform;
5. A completely programmable system using an application scripting language, calling on libraries of functions that perform relevant operations on model objects;
6. An extensible platform that can evolve over time; incorporating and integrating new software components, enhancements to procedures, and other advances as they become available.

AZ-SMART Progress to Date

The University of Washington, Center for Urban Simulation and Policy Analysis (CUSPA), was chosen to assist in the development of the first phase of AZ-SMART. This phase was funded jointly by MAG and PAG. CUSPA is the creator of UrbanSim, a software-based simulation model for integrated planning and analysis of urban development, incorporating the interactions between land use, transportation, and public policy. In 2005, the UrbanSim team did a complete re-design of UrbanSim and developed a new platform for it: the Open Platform for Urban Simulation (OPUS). The University of Washington chose to implement many of the AZ-SMART features directly into its OPUS platform, making significant portions of AZ-SMART part of a nationally recognized and well respected socioeconomic model.

The AZ-SMART/OPUS implementation key features to date:

- Simulate the key decisions and choices impacting urban development; in particular, the mobility and location choices of households and businesses, and the development choices of developers
- Explicitly account for land, structures (houses and commercial buildings), occupants (households and businesses), and developments
- Simulate urban development as a dynamic process over time and space
- Simulate the land market as the interaction of demand (locational preferences of businesses and households) and supply (existing vacant space, new construction, and redevelopment), with prices adjusting accordingly
- Incorporate governmental policy assumptions explicitly, and evaluate policy impacts by modeling market responses
- Are based on random utility theory and use logit models for the implementation of key demand components
- Are designed for high levels of spatial and activity disaggregation, that can be aggregated to any zonal system
- May be structured to use either parcels, polygons (aggregation of parcels) or grids as its building blocks
- Link to additional sub-models in spreadsheets, databases and applications to develop additional socioeconomic data needed to support transportation models and planning activities
- Utilize a graphical user interface to configure the model system, manage data, and run and evaluate scenarios. Inputs and results can be displayed using ArcGIS or other GIS.
- Create outputs of the model that includes:
    - Future year distributions of housing and population,
    - Households disaggregated by type, income, size, and housing type
    - Jobs by industry sector and land use sector
    - Square footage of nonresidential space by type
    - Densities of development by type of land use
    - Land use by type

MAG staff has been implementing and testing AZ-SMART using data for the MAG region. The MAG Socioeconomic Modeling Team has developed extensive user and in-depth technical knowledge of the model system. Due to this in-house expertise, MAG staff has made significant contributions to the OPUS code and major enhancements to both OPUS and AZ-SMART. The activities to date include work on:

- A polygon based model for Maricopa County;
- A parcel level model for areas of Maricopa County;

- A zonal model for areas of Maricopa County;
- Preparation of parcel level built space, households, jobs, and business datasets for use in the full County parcel model;
- Development and estimation of real estate price models, household location choice models, and jobs location choice models.
- Contribution of enhancements to OPUS model behaviors, and
- Enhanced data development and reporting tools for AZ-SMART.

As part of the hands-on experience with AZ-SMART, a number of short and long-term enhancements have also been identified. These enhancements will be incorporated into the model system for use in the official 2012 Projections.

Extension of AZ-SMART for Statewide Projections

One of the key design principles for AZ-SMART was the concept of extendibility to areas outside Maricopa County. The main idea behind this was to ensure the ability to model regions that may not have similar data or technical expertise as MAG. The system was designed and is being extended to be able to work with data sets and modeling demands from organizations of varying sizes and needs.

The design features that will ensure ease in extending the system to other regions include:

1. **Model geography**: AZ-SMART, using the OPUS model system, may be built for different levels of detail. Depending upon data availability and requirements the system may be configured to model:
   - Parcels – every parcel is explicitly identified including details of built space and occupants;
   - Polygons – akin to subdivisions. These are aggregations of individual parcels of a similar land use. The data needs are not as intensive as the parcel model;
   - Zones – or sub-regions. The model systems can be configured for Traffic Analysis Zones (TAZ), Census block groups, tracts, or places. This has the least intensive data needs, since most of the data sets can be developed using Census and QCEW data.

2. **Model stratification**: The OPUS model system is primarily comprised of four models:
   - Real estate price model
   - Real estate development model
   - Households location choice model
   - Jobs/Business location choice model

   Each of these model systems may be stratified into multiple levels, e.g. households may be classified by income, size, and tenure; by unit type (single family and multi-family), or just by total households. Similarly, the real estate price model may include equations for all 30 building types in the MAG model or just estimate equations for residential and non-residential built space types.

3. **Data needs**: Dependent upon the model system and the stratification of the individual models, the data needs for the implementation will be different. Minimum data needs for a zonal model include:
   - Zones – identification of the boundary system. This can be TAZ or Census geography such as place or tract;
   - Households and population – base year data on demographic characteristics may be completely derived from the Decennial Census;
   - Businesses and jobs – base year employment data may be derived from the Quarterly Census of Employment and Wages *(*QCEW*)* program;
   - Current built space information – may be synthesized using standard densities and floor area ratios or derived from Assessor or Arizona Department of Revenue information;
   - Capacity indicators by zone – should be available as general or comprehensive plans from the cities/towns and counties in the region. Standard densities may be used to develop the capacity of housing units, population, and jobs;
   - Known development projects – if available can provide the models with information on pipeline projects;

- Infrastructure and other location data – such as major roads, highways, protected areas, military, land ownership, etc. are available at the County and State level from such state agencies as the Arizona Department of Transportation and/or the Arizona Land Resource Information System (ALRIS).

4. **Local Knowledge**: The essential part of a good socioeconomic model is a high level of engagement with local planners and policy makers. This is essential to guide and train the model and also examine the outputs. The AZ-SMART model system is being designed to be flexible to accommodate local policy and planning information.

AZ-SMART could therefore be used to project population and employment for all cities and towns in Arizona with the following information:

- County control totals for population and employment from the Arizona Department of Commerce
- Base year housing and population information from the Decennial Census
- Base year employment information from QCEW or local databases
- General plans from the city or town with capacity information from local databases or standard assumptions
- Known current and future developments if known
- Infrastructure information from state agencies or local databases
- Built space information from state agencies, local databases or standard assumptions

As shown, the data required for AZ-SMART from cities and towns can be minimal. However, the support of the local planners and policy makers to help validate the assumptions and results is essential.

For Further Information Contact

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