

Residential Capacity Analysis Automation for an Urban Service Area

Tracy Toutant, GISP

And

Tamara Schells

Abstract

During Sarasota County's updating of its Comprehensive Plan, a model was developed to automate the process of determining Residential Capacity for the Urban Service Area. The Capacity Analysis Model involves a set of GIS processes which first selects the study area and then, using cadastral and other local data sources, assigns spatial attributes that affect the existing and potential capacity. The database component of the resulting shapefile integrates into Microsoft Access allowing for sets of macros to run. A formatted Access report is produced containing itemized calculations of the existing and potential units by type. The results are also stored in a table that allows for comparisons between model runs. The automation of this complicated analysis assures consistency between model runs, in both data and calculations and allows for detailed documentation of the methodology for analysis validation.

Introduction

Florida Statutes require local governments calculate the amount of land needed to accommodate their projected populations. In Sarasota County the analysis consists of three distinct components: (1) a housing demand forecast, (2) residential capacity calculations and, (3) an economically feasible infrastructure plan. This analysis is typically prepared every seven years during the state mandated Evaluation and Appraisal Report (EAR) and subsequent major update to the Comprehensive Plan. The analysis seeks to determine the unincorporated County's ability to accommodate an increase in housing demand over the next 10-year planning period. For the purpose discussed here, capacity analysis will refer to the calculation of existing and potential housing units at the analysis date.

Previous analyses by Sarasota County indicate that the projected population growth is causing a severe tightening of the land supply in the Unincorporated Urban Service Area. Therefore, The County initiated a program that continuously monitors residential capacity, rather than on the state mandated seven-year cycle. This allows the County Commissioners to respond more quickly and accurately to growth policy decisions.

Calculating the residential capacity was historically a very time and labor-intensive process for County planning staff. Staff determined that to meet the time demands of an annual monitoring program, they must leverage the recent availability of electronic and GIS data. Relying on new tools and data allowed staff to create a model that automates the residential capacity analysis, reducing a process that once required weeks to one which now requires just a few hours.

The analysis process combines data from 4 different County departments. The County maintains an Enterprise GIS system, with ArcSDE that allows access to all the data in a single source. The steps involved in assigning the attributes to the individual parcels are repetitive and requires the analyst to understand the GIS processes involved,

to insure consistency. Calculating the existing and potential units requires formatting complex queries in a database program.

Creating a model in GIS and combining it with Access macros, allows running a long series of processes in two steps. The analyst should be familiar with the underlying concepts, but can run the models without intense training in GIS or macros. Since the steps are all predetermined, creating the model, in effect, helps to generate documentation of the steps used in the analysis and insures that the analysis will be done consistently each time. The general analysis follows the steps in Figure 1.



Figure 1. General workflow for the Capacity Analysis

GIS Model

The GIS model was created with ESRI's Model Builder for ArcGIS 9.1 and later updated for ArcGIS 9.2. The GIS model covers the first two steps of the Capacity Analysis: determining the area of interest (AOI) and assigning the relevant attributes to the parcels that fall within the AOI. The resulting output is a shapefile, whose .dbf component is later used in the Access portion of the model.

The original design of the analysis focused on calculating residential capacity for the municipalities but within the Urban Service Area (USA). This accounts for approximately 25% of the total area of the County and represents the initial AOI. This area serves as the AOI for the model and is determined at the beginning of the analysis. The AOI is calculated each time the model is run, to account for annexations and changes to the USA.

The USA is selected from the Urban Service Area polygon layer, and the unincorporated county is selected from the Sarasota County Boundary layer. These two selected areas are then intersected to generate the AOI layer. The county parcel layer is converted to point centroids then clipped to the AOI so the only parcels being used in the model are within the AOI. The AOI centroid file is then run through a series of identity tools to assign attributes of 5 GIS files that influence the number of units that can be built on a parcel. Four of these files will determine "special areas" and they will be used in the Access queries to help include or exclude parcels from a query.

The first attribute assigned to the AOI parcels shows if they are located in an area designated as part of the County Environmentally Sensitive Lands Purchase Program (ESLPP). Lands designated in this program are purchased by the County to become public conservation lands, rendering them ineligible for development. The County Natural Resources Department maintains the ESLPP GIS file.

Parcels that are within a mobile home park are also tagged for exclusion in the analysis. The Property Appraiser tracks mobile homes different ways, based on if they are real or tangible property. The Planning Department keeps a GIS layer of the Mobile Home/RV Parks containing the number of units. Parcels that fall in the parks will be excluded from most of the queries.

Developments of Regional Impact (DRI) and Developments of Critical Concern (DOCC) are large projects that require additional State review and are granted a set number of allowable units. Parcels that fall within the boundaries of an active DRI/DOCC will be tagged for exclusion. The unit counts will come from the Planning Department DRI GIS file that includes the allowable units built and remaining.

The last special consideration is the South Venice Community Area. Parcels in this area are tagged so that they can be queried and calculated separately in the access model. The GIS file of Community Plans, maintained by the Planning Department is used to select and attribute parcels in this area.

Finally, all the parcel centroids are assigned the zoning designation from the Planning Department Zoning GIS layer. The zoning is used to query for residential vs. non-residential parcels, query for multi- vs. single-family and to calculate allowable units.

The model puts the final output shapefile in a folder and names it "AOICtrds.shp". The Access database links to the .dbf table from this shapefile and uses it as the starting point for the unit analysis. The output name and location should not be changed, unless the location of the linked table is also updated in Access.

Access Model

The portion of the Capacity Analysis that is handled in Access serves two major functions. The first is that the units are calculated based on predetermined queries and displayed for the user in a report. The second is that the results of previous analysis runs are available to the user in the same report format to allow for comparisons over time. The Access framework also allows for a simple, form-based user interface to be developed and macros to link to the form and automate the calculation of units.

The initial opening of the Access project opens a form that asks the user to select if they wish to run a new model or view results of a previous run. When the user selects the option to create a new model run, a macro takes care of running all the queries and opening the report at the end of all the info being written to the master unit table. Append queries are used to put the unit counts into the master unit table. In addition to appending the unit count to the master table, the record will include the type of housing being calculated, whether the unit count is for existing or potential units and the analysis date. The automation of the query process is a tremendous time saver, and allows less experienced Access users to still do the analysis.

The first step of most of the main macro queries, involves the table containing the AOI centroids. Since the GIS part of the analysis is automated, we can assure that the output has the proper name and is stored in the proper location. An initial select query is used to insure that there are no duplicate Parcel Id Numbers (PID), such as from exploded multipart shapes. Where they are found, the shape area is summed to give the total area of the parcel.

A second select query (AOICtrdsFINAL) joins the initial select query results to the Property Appraiser Database by the PID. Using large parcel based files, in conjunction with the property data often leads to poor performance, especially across the network. Doing the join and queries in Access greatly improves the time taken in processing the queries. Some of the housing categories use a select query that is later used in the append query that will put the unit count into the master unit table.

The categories of residential units are broken into two main components, Existing Units and Potential Units. Total Existing Units are calculated with the formula: TOTAL EXISTING UNITS = Existing (appraised) Single Family and Multi Family Units + Existing Mobile Home and RV Units + New Units (not yet appraised).

Single and Multi Family units are calculated using an append query. The AOICtrdsFINAL query result is joined to a table containing the FL Dept. of Revenue Use Code (STCD), for residential properties. The query also stipulates that the results, in addition to being residential, should not fall in a Mobile Home Park, or in a Vacant Tract. The sum of the Unit field of these records (from the property data) is then appended to the master unit table.

Leveraging the data stored on the SDE server, the Access program uses an ODBC connection to directly get the Mobile Home Park layer table. This layer stores the number of units in each park, regardless of if the lots are owned or rented. This bypasses the problem of real vs. tangible property inherent in the property data. The query finds the first record in the centroid file for each park name and joins it to the table on SDE. The query can then append the sum of the units into the master unit table.

The New Units can be queried out because they appear in the property data, but they have not yet had an assessed value entered. If there is no value and the property has a residential zoning designation, the record is considered a New Unit. The query joins to a table containing the desired zoning categories and looks for records with null values in the assessed value field. One unit per record is assumed in the calculation.

The other major analysis component is potential dwelling units. Potential Units are calculated with the formula: TOTAL POTENTIAL UNITS= DRI/DOCCs (remaining) + Vacant Platted (condo) + Vacant Platted Multi Family + Vacant Platted Single Family + Vacant Tracts (≥ 10 ac).

The DRI/DOCC units are calculated similar to the Mobile Home Park units. The Planning department layer for DRI/DOCC contains the count of the allowable units remaining to be built in each development. The query takes the first instance of the DRI/DOCC name and joins directly to the SDE feature class to sum the units directly from the GIS layer.

Condominiums that have plats filed, but are not yet constructed are calculated separately. A select query is used to initially determine which parcels contain the STCD value for vacant condo (0400), excluding “special areas”, meet a minimum lot size and have a code listed in the property subdivision field (platted). An append query then takes the count of the number for records returned in this query and uses this value in the unit table. The majority of selected records represent new individual dwelling units within a condominium development and each record was therefore counted as one unit.

Vacant Platted Multi Family parcels were queried based on a minimum 10-acre lot size. (Input from developers recommended a 10-acre minimum size for feasible multi-family development.) The parcels needed to have a vacant/multifamily residential STCD value, not be in a “special area” and contain a subdivision code. The resulting records were joined to a table containing the density for the residential zoning designations. The number of units was calculated using the parcel size and zoning density.

Vacant Platted Single Family parcels also needed to be a minimum lot size and have a vacant STCD and a subdivision code. They also needed to not fall within a “special

area” and have a residential zoning designation. The count of the records returned was used as the unit count for this category.

Vacant Platted South Venice was a unique case within the area of interest. Deed restrictions in the South Venice subdivision prevented using the assumption of one potential dwelling unit per parcel. Drainfield setbacks established by the Sarasota County Health Department require two adjacent lots for construction of a new housing unit. An analysis conducted in 2004 showed that only 25.6% of the vacant platted lots are developable based on the adjacency criteria. When the query returns the number of records that fall within the South Venice area, the number of units appended to the master table is multiplied by 0.256 to accommodate the strict criteria.

Vacant Tracts are monitored by the Planning Department as part of potential multi-family developments. The potential units are pulled from this GIS file because it takes into account more data than is available in the property database. Information such as stipulations regarding allowable units imposed during rezones, average platted density from planning studies and variations in densities that relate to Critical Area Plans, or the Future Land Use designation.

The custom report opens as the last action of the main macro running all the queries. The report is date based and breaks the unit counts into the categories described above. The report subtotals by existing and potential units and provides a total unit count.

The initial startup form allows the user to view previous model runs. When the user selects this option, a form pops up with a pick list of run dates that are pulled from the master unit table. A report is generated using the data from the master unit table that corresponds to that run date. This allows for very easy comparisons over time. The data is all stored in the same table and the report generation allows for consistent formatting.

Discussion

The original design of both the GIS and Access parts of the model were based on the unincorporated urban service area. This proved to be somewhat short sighted, but the necessary assumption inherent in the analysis discouraged using it for small area analysis. By not allowing the user to change the input parameters, the model was running the same process that the assumptions were geared toward. Using the models allows the software to help generate documentation about the processes, so the technical aspects can be verified.

Using the data from the SDE server does not guarantee the most accurate, up to date information. Some of the layers used in the analysis are updated very infrequently, or are not on the SDE server. No assumptions about the data in the analysis should be assumed. Metadata for the layers should always be checked and confirmations about data should be obtained from the responsible departments.

This model was updated and customized to assist with generating numbers for the Wastewater Master Plan process. Instead of using the unincorporated, urban service area, the model was run for each of the Wastewater Treatment Plant Service Areas. Because these areas extended past the USA boundary, it required extra attention to additional potential units that fall under the purview of the long range-planning department.

Summary

This approach to Capacity Analysis utilizes and combines different, but related technologies in a practical approach to a complex analysis. The Model presented uses the GIS data whenever it is the best available data, even outside of the GIS software. The automation of a complex task, combined with the assurance of consistency was a dual benefit to the two different departments who have been able to use the model. As the model continues to evolve and improve, the advantages to its use will increase and its availability for similar tasks will emerge.

Tracy Toutant, GISP
GIS Developer, Sarasota County Water Core Services
1001 Sarasota Center Blvd., Sarasota, FL 34240
ttoutant@scgov.net

Tamara Schells
GIS Research Analyst, Richardson Kleiber Walter
2055 Wood St, Ex Suite 202, Sarasota FL 34237
Tamara@rkwrealestate.com