

**Response to Florida Department of Community Affairs Rulemaking  
Workshop**

**Conducted at Tampa Bay Regional Planning Council, Pinellas Park**

**April 23, 2010**

**Methodologies for:**

**Rule 9J-5.005 General Requirements (Population Forecasting Method)  
Rule 9J-5.006 Future Land Use Element (Land Use Needs Analysis)**

**Prepared by Van Buskirk, Ryffel and Associates, Inc.  
100 Estero Boulevard, Suite 434  
Fort Myers Beach, Florida 33931  
Phone: 239-281-6312  
Email: [cryffel@interactivegrowthmodel.com](mailto:cryffel@interactivegrowthmodel.com)  
Web Site: [www.interactivegrowthmodel.com](http://www.interactivegrowthmodel.com)**

**9J-5.005(2)(e)1. General Requirements**  
(Methodology for Projecting Population of an Area)

**9J-5.006 (2)(c) Land Use Element Analysis Requirements**  
(Methodology to Determine the Amount of Land Required to Accommodate Anticipated Growth)

**Purpose and Subject:** Statutory requirements that the future land use element be based upon, inter alia, the amount of land required to accommodate anticipated growth and the projected population of an area. This workshop focuses specifically on the methodologies of projecting the population of an area.

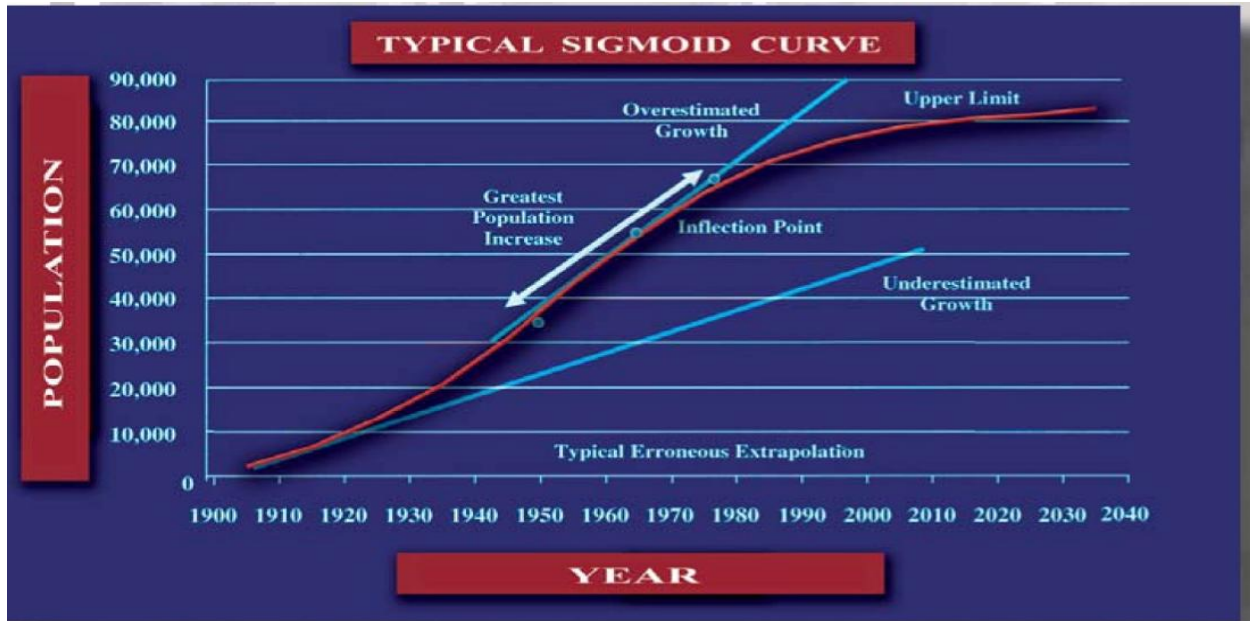
Accurate population forecasts by local governments are necessary in order to obtain the optimal return on public and private capital investments in infrastructure. Population projections determine when infrastructure such as roads, utilities, schools, parks, fire stations, commercial centers and industrial parks are needed to meet the demands of the population over time.

The underlying key to reliable and efficient short and long range planning for these needs is accurate population forecasting so that infrastructure is neither prematurely advanced nor allowed to fall behind population demand. The cost to “catch up” far exceeds the cost of being proactive to accurately meet the demands as they occur.

Investing public capital to replace infrastructure before the term of its useful life (i.e. 20 years) due to over-utilization, can result in negative returns on public investment. Likewise, over-estimating population could result in large-scale capital investment expenditures that are underutilized with few beneficial returns. Perhaps this is why the Florida Department of Community Affairs, as part of their Comprehensive Plan amendment reviews, now poses the question of demonstrating the need for land use changes.

To forecast aggregate growth, there are many more accurate applications and methodologies than the typical linear extrapolation. Unfortunately, typical linear population extrapolation has historically underestimated or overestimated population growth in Florida.

Based on our experiences and extensive research, a growing community’s population growth is best described as a sigmoid curve (see Typical Sigmoid Curve below). Many biological populations (including cities) tend to grow at a rate over time that simulates a logistic or Sigmoid Curve. Population growth increases at an increasing rate over time until it reaches an inflection point, then the population growth increases at a decreasing rate until it reaches its upper growth limit. One of the key variables in this growth equation is its upper growth limit (build-out). The upper limit can be precisely defined by calculating the total number of housing units that can be built based on zoning or alternatively by the future land use plan of the community. The housing units can then be translated into population.



Richard P. Mignogna of Technology/Engineering Management, Inc. (Science & Technology Forecasting and Intelligence) recently stated in one of his published technical reports on the application of the logistic curves:

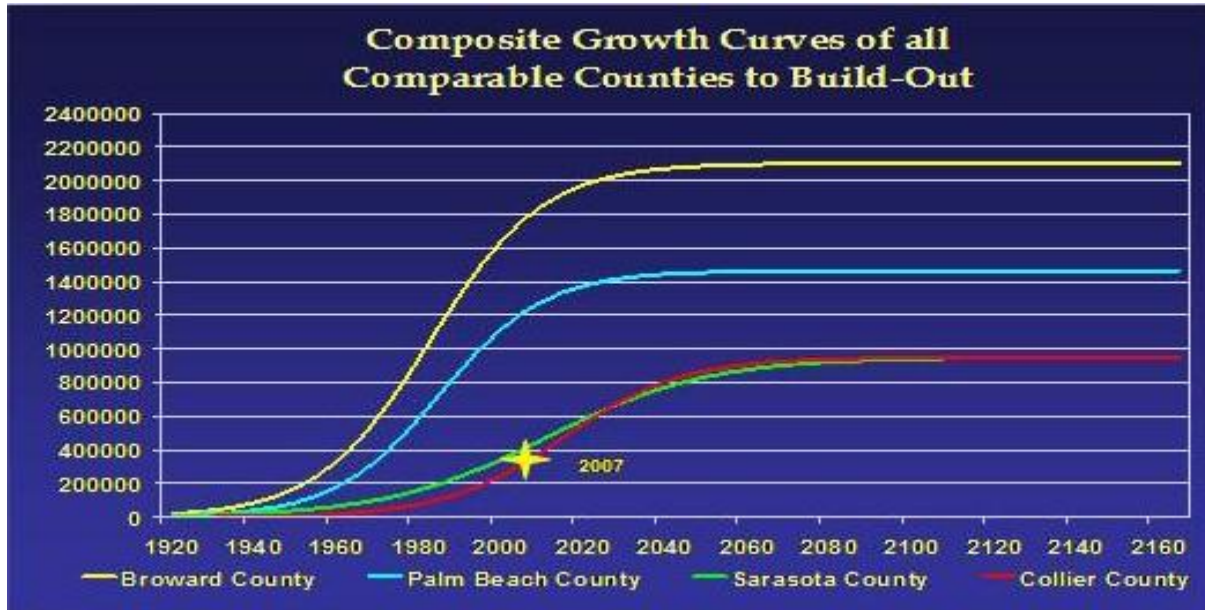
*“And, while it is tempting to attempt to estimate L (upper limit) based on data acquired to date, this is absolutely the wrong thing to do. L must be determined exogenously from the data base.....”*

He further states in another technical report that the logistic function requires an upper limit be specified. An infinite number of solutions can result if the upper limit is not determined exogenously from the data base. Typically the Future Land Use Plan and Element are used to determine build out population.

Previous studies in Florida have demonstrated the accuracy of logistic forecasting. One study in 1980 forecasted that the population of for the city of Palm Bay in 2000 would be 82,331 and the census count was 79,413. In a study for Lee County, a logistic model forecasted from 1990 data that the population of Lehigh Acres would be 33,098 in 2000 and the census count was 33,430.

Research has demonstrated that for fast growing areas, as our state as a whole has been, the Sigmoid (S-Shaped) Curve is a more accurate representation. As we study the historic data and the statistical analysis of the growth curves of the essentially built-out cities of St. Petersburg (see Exhibit A), Miami and Tampa whose history is over 100 years, they are all statistically significant sigmoid curves and support this hypothesis. St Pete has a  $R^2$  value of 0.9382 at a confidence interval of 95% which means that 93.8% of the variance in population is accounted for by the variance of the predictor variable. (See attachment)

## Exhibit A



There are essentially two models; the population forecasting model that forecast for a large study area in the aggregate and the Interactive Growth Model™ (hereafter IGM) that distributes the population over time into disaggregated zones such as TAZs (Traffic Analysis Zones) and Census Block Groups. The IGM can interface with any population model forecast.

The IGM, a copyrighted population-driven software program, has been created that can be used to forecast the disaggregated and spatial distribution of population, in five-year increments to build-out along with the timing, apportionment, distribution and optimal location of support land uses, both public and private, for that population. For planning purposes, build-out” is assumed to be 90% of the ultimate population of a study area.

The model has been applied to study areas of various sizes, from TAZs, clusters and other disaggregated areas up to 1900 square miles, with the latter being an area slightly larger than the State of Delaware. To address the huge amount of data in the model, study areas need to be disaggregated into subareas, usually TAZs or Census Block Groups, with each method having their own advantages. Disaggregation provides greater levels of detail, over manageable areas that are then combined into a whole.

This growth model applies a series of algorithms to determine the optimal solution for the location and timing of various land uses. For example, some of the parameters for the algorithms could include the location and timing of development, the proximity of existing development, propensity to aggregate land parcels and the transportation network. The model is also interactive and therefore dynamic because through its software, an element, parameter or standard can be changed to reflect changing times, priorities, policies, zoning or land use. Those changes are then processed through its software and the outputs adjusted and reallocated. It also presents the opportunity to demonstrate alternative “What-if” growth management

scenarios valuable to community planning and budgetary purposes, meaning an idea of the potential magnitude of the costs associated with support public facilities, which includes infrastructure.

There are also myriad sub-models of the growth model that are of importance to an individual community. Some of these include commercial land use allocations and commercial corridors, school plant allocations, industrial parks, parks, recreation and open space, fire/ems allocations, etc. Further, the data from the model can be used to update transportation plans, including MPO transportation models, water/sewer master plans, economic development, comprehensive plans, annexation impact analysis and others.

There are several examples of the application of the IGM to forecast population for areas (i.e.TAZs) within a future land use plan. One example is the use by MPO's of IGM data for more accurate forecasting of demographic and economic data to produce more accurate trip data.

Research has demonstrated that traffic forecasting models for regions undergoing growth have been historically inaccurate. This is due to the method of extrapolating demographic and socio-economic data by TAZs within the study area. A research report for the Jacksonville, Florida Region entitled "Comparing Short Term Traffic Projections With Traffic Counts-The JUATS 2015 Model" prepared for FDOT (Florida Department of Transportation), concluded that having forecasted 2000 demographic and socioeconomic data from a 1990 baseline and then comparing the 2000 Census data that:

*" For a fast growing urban area in Florida like Jacksonville, the transportation demand models in the past are likely to underestimate the overall number of trips produced since socioeconomic, demographic and employment data may be underestimated.... The difference between the estimated and observed at the zonal level were significant."*

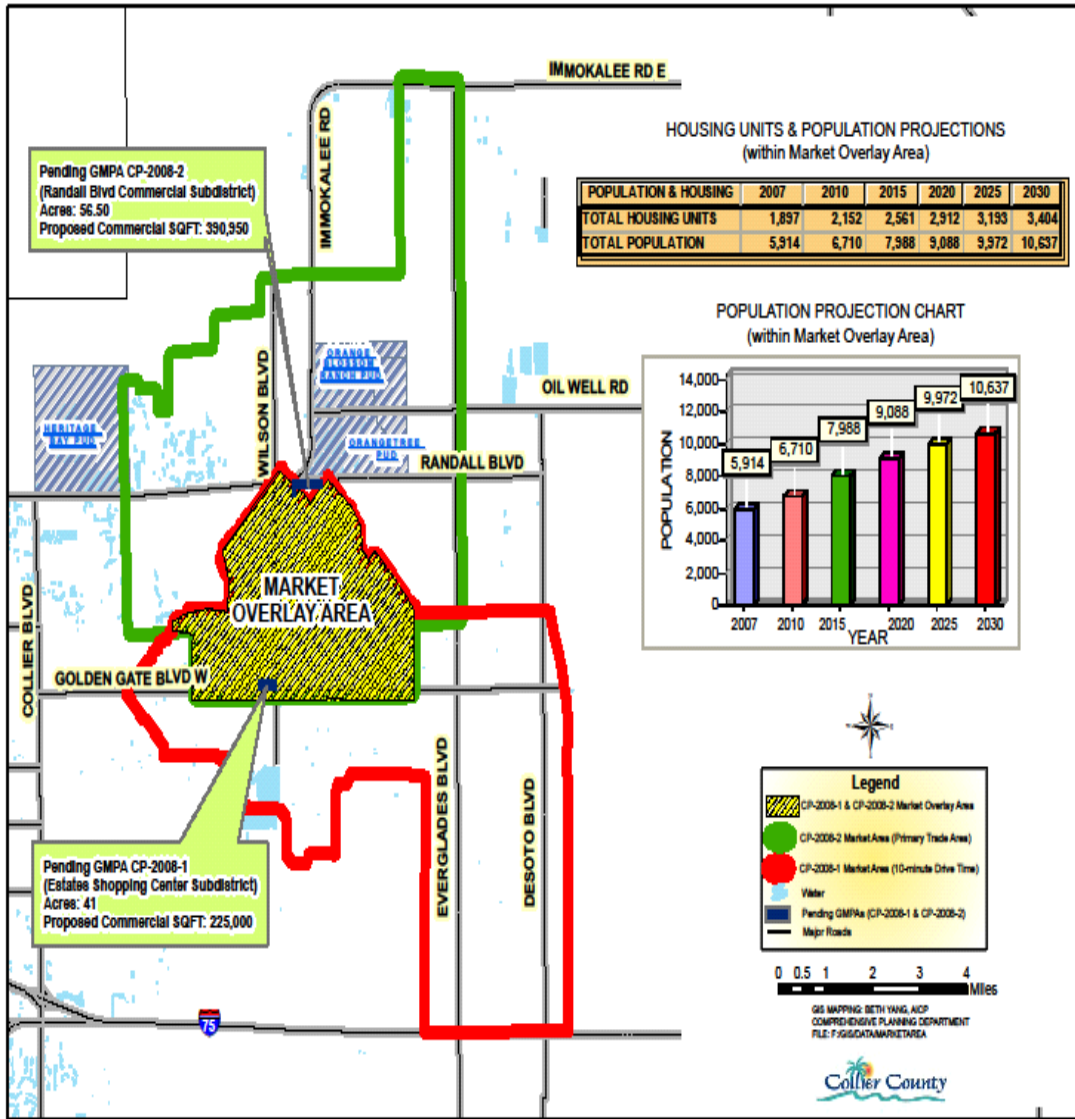
They found that those TAZs that were approaching built-out were overestimated and those that were developing were underestimated an average of a 25% variance for a 10-year projection. The report further stated that the Census Transportation Planning Package (CTPP) does not segregate dwelling units into single-family and multi-family.

The IGM addresses and solves these issues that results in more accurate forecasted demographic and socio-economic attributes at the zonal level and then for forecasting accurate trip productions.

Other examples include the City of Cape Coral and Collier County who have used the IGM's data to forecast the location and timing of commercial centers to meet the needs of future populations, to reduce trip lengths and forecast the market needed to support the commercial centers. (See Exhibit B)

## Exhibit B

### CP-2008-1 & CP-2008-2 MARKET OVERLAY AREA POPULATION PROJECTION & HOUSING UNITS USING CIGM



Collier County needed to forecast the timing and distribution of development as well as the forecasted acres to be preserved under its Rural Lands Stewardship Areas. The model forecasted the needed data to plan for future infrastructure.

The City of Auburn, Alabama used the model to forecast the timing and distribution of development for annexations and it is currently being used for the development of its Comprehensive Plan.

In summary, accurate population forecasting and its distribution are key ingredients and the basis of any long range planning efforts. From that point of departure, land uses and their distribution can be determined that support the forecasted population over time by the use of algorithms and parameters. The land uses and their distribution also provide the opportunity for local governments to gain an insight of the fiscal implications of providing necessary support infrastructure associated with the land uses over the time frame of their Comprehensive Plan, its goals, objectives and policies and associated Future Land Use Map.

Authors: Dr. Paul Van Buskirk, AICP, P.E. and Carleton Ryffel, AICP

## Attachment

BCRI tf.Innovate v4.03					
st_pete_pop					
Pearl-Reed		Min.SSE	95	% Conf Interval	
<b>R-Squared:</b>		0.9382			
<b>Sum-of-Squares Error:</b>		628386968			
<b>Standard 'a' Error:</b>		1.9181381			
		<b>a =</b>	1951.891		
		<b>b =</b>	0.0962045		
		<b>L =</b>	250000.00		
Observed Data		Fitted Value		Confedence Range	
x	y	x	y	Upper	Lower
1900	1575	1900	1686.3111	2025.286	1403.75
1910	4127	1905	2716.6729	3260.047	2263.036
1920	14237	1910	4365.5334	5231.727	3640.619
1930	40425	1915	6986.8791	8355.498	5837.023
1940	60812	1920	11111.049	13243.5	9308.461
1950	96738	1925	17494.357	20745.52	14719.99
1960	181298	1930	27128.429	31924.16	22977.22
1970	216232	1935	41129.432	47868.64	35173.91
1980	238647	1940	60398.139	69247.86	52351.83
1990	238629	1945	85019.567	95656.8	74990.49
2000	248232	1950	113661.08	125163.2	102349.4
		1955	143555.62	154651.4	132152.6
		1960	171426.63	181013.3	161161.6
		1965	194805.8	202333.1	186463.1
		1970	212740.56	218221	206503.4
		1975	225578.2	229353.6	221199.1
		1980	234318.7	236821.8	231377.5
		1985	240068.72	241686.6	238151.5
		1990	243766.41	244795	242540.8
		1995	246109.66	246756.7	245336
		2000	247580.81	247985.2	247096.2
		2005	248499.03	248750.7	248197
		2010	249070.04	249226.3	248882.4
		2015	249424.33	249521.1	249308
		2020	249643.83	249703.8	249571.8
		2025	249779.72	249816.8	249735.1
		2030	249863.79	249886.7	249836.2
		2035	249915.78	249930	249898.7
		2040	249947.93	249956.7	249937.4
		2045	249967.81	249973.2	249961.3
		2050	249980.1	249983.5	249976.1

