Rick Scott
GOVERNOR

Cynthia R. Lorenzo
INTERIM EXECUTIVE DIRECTOR

FLORIDA DEPARTMENT of
ECONOMIC OPPORTUNITY

TO:	State Validation Team
FROM:	Jeannine Kelsick, Planning Analyst, Areas of Critical State Concern
DATE:	March 19, 2012
SUBJECT:	Proposed Methodology for TIME Model Update for Monroe County, Florida

1   Purpose

This document explains the methodology utilized to develop updates for the small area data found within the Transportation Interface for Modeling Evacuations (TIME) Model for Monroe County, Florida, using data from the 2010 Census and 2006-2010 American Community Survey.

The Department, pursuant to its role as the state land planning agency, has indicated the Statewide Regional Evacuation Study Program (SRESP) and the associated Transportation Interface for Modeling Evacuations (TIME) Model should be utilized for the purpose of conducting hurricane evacuation clearance time analysis that will guide the future allocation of building permits in the Florida Keys. In order to properly conduct an analysis acceptable to all the local governments in the Florida Keys and the state, the small area data within the TIME Model needs to be updated with the most recent U.S. Census data pursuant to Rules 28-18.400(5)(a)8., 28-19.310(5)(a)3., and 28-20.140(5)(a)13., Florida Administrative Code. When the SRESP and TIME Model were released in late 2010, they did not contain the latest Census data needed to indicate current trends of growth in the Florida Keys.

2   Background

Pursuant to Section 380.0552(2)(i), Florida Statutes, part of the Legislative intent for the designation of the Florida Keys as an Area of Critical State Concern was to "ensure that the population of the Florida Keys can be safely evacuated" before a hurricane event. The state and local governments of the Florida Keys have had a long history regarding hurricane evacuation modeling. In 1992, in response hurricane evacuation clearance times published in 1991 by Post, Buckley, Shuh and Jernigan, in coordination with the U.S. Army Corps of Engineers and the Florida Department of Community Affairs, Monroe County adopted a Rate of Growth Ordinance to limit permitting of additional development based upon the ability to evacuate the population during a hurricane event.

During the late 1990s, litigation over the Monroe County Comprehensive Plan led to an established hurricane evacuation clearance time of 24 hours as the level of service standard for the Florida Keys. However, in 2001, Miller Consulting, Inc., contracted through the Florida Department of Transportation, found that the hurricane evacuation clearance time for the Florida Keys surpassed 24 hours, using what would be known as the Miller Model. In response to these findings, the state land planning agency began multi-agency and local government meetings regarding hurricane evacuation of the Florida Keys' population given the many limitations such as their proximity to the Caribbean, the area's elongated configuration and single evacuation route (US Highway 1). Some of the methods utilized to ensure that the population could be safely evacuated were the adoption of a 48-hour phased evacuation and the continuance of a building permit allocation system for not just Monroe County, but also for the Cities of Marathon and Key West[1] and the Village of Islamorada. Under current state and local law, the permanent population must be able to evacuate within 24 hours. The 48-hour phased evacuation, as adopted by 2006 by various Keys' local governments, required that the transient population leave at the 48-hour mark and the mobile home population leave at the 36-hour mark (known as Phase or Day 1), with the site-built population leaving at the 30-hour mark (known as Phase or Day 2).

The number of building permit allocations for all of the Florida Keys is based upon the ability to safely evacuate the permanent population in 24 hours. In 2011, the Governor and Cabinet, seated as the Administration Commission, directed the Department of Economic Opportunity (Department), and the Florida Division of Emergency Management to enter into a Memorandum of Understanding (MOU) with Monroe County, Village of Islamorada, and the Cities of Marathon, Key West, Key Colony Beach, and Layton regarding hurricane evacuation modeling. The MOU will address the input variables and assumptions, including regional considerations, to depict hurricane evacuation clearance times for the population of the Florida Keys. The MOU will be the basis for an analysis of the maximum build-out capacity in the Florida Keys to revise (if necessary) the current building permit allocations, while maintaining the ability of the permanent population to evacuate within 24 hours.

3 Methodology

Below is an explanation of the methodology used to produce the updated inputs for Monroe County, Florida, including the reasons why this methodology was created, the steps taken and the results. The Department has developed this methodology in coordination with the South Florida Regional Planning Council and WilburSmith/CDM, and has conducted a series of analyses to produce updated inputs for the small area data based upon the 2010 Census and 2006-2010 American Community Survey. This update focused on non-transient revisions to the small area data. There were no updates to tourist and shelter capacity attributes that were part of the overall analysis.

---

[1] The City of Key West used all of the allocations in the early 2000's. Until the new allocation distributions for the local governments are finalized, the City currently does not have any building permit allocations available for them to use for residential development.

3.1 Data Sources

The South Florida Regional Planning Council developed the small area data that was included in the SRESP and the TIME Model for Monroe County, based upon the occupancy rates, as well as vehicles and persons per household data from the 2000 Census at the block group level. Dwelling unit estimates for 2010 (non-transient) for block groups were based on data from the 2000 Census, the 2006 Update to the Miller Model by the Florida Department of Community Affairs, and building permit data from each local government in the Florida Keys. Current ROGO allocations were used to make dwelling unit projections for 2015. With the availability of the most recent Census data, the general consensus among the committee members for the Florida Keys' MOU was to update the model with 2010 Census data. In order for the new inputs to be consistent and uniform with the overarching methodology of the TIME Model, the analysis used to produce the updated small area data utilized the 2010 Census Summary File 1 and 2006-2010 American Community Survey (ACS).

3.2 Changes between 2000 and 2010 US Census

The small area data used by the TIME Model is organized into geographic units called Traffic Evacuation Zones, or TEZs. In Monroe County, there are 40 TEZs. 2000 Census data from Summary File 1 (short-form, 100% count) and Summary File 3 (long-form, sample data) was used to prepare data for the TEZs. The importance of Summary File 3 (sample data) is that it included the housing and population characteristics necessary to understand the number of site-built and mobile home units, single- and multi-family site-built units, and the associated vehicles and persons per household and occupancy rates.

As the Department moved forward to revise the data and update the TIME Model with the 2010 Census results, it was identified that the US Census Bureau had made some changes in their practices that impacted the potential maintenance and update of the small area data in the Model. In 2005, the US Census Bureau introduced the American Community Survey (ACS), a continuous sample household survey, to replace the long-form (sample) used in the decennial census. Although the results of the ACS are published each year, small area data at the block group level is only published for a cumulative 5-year sample – the first release was from the 2005-2009 ACS. In response to these changes, block group level data from the 2006-2010 ACS was used to gain the general housing and population characteristics for Monroe County.

Also, as is usual with each decennial census, the boundary lines for blocks, block groups and census tracts were revised in the 2010 Census, which led to some differences with the boundary lines of the TEZs developed for Monroe County. Monroe County had 98 block groups and 3,173 blocks in the 2000 Census. By the 2010 Census, Monroe County lost 22 block groups and gained 1,422 blocks, causing the boundary lines of the block groups to be re-drawn in response. To identify how the data must be redistributed to fit within the boundaries of the established TEZs, an analysis of the land area was conducted through ArcGIS 10 and then small area data input analysis was conducted in 2007 Microsoft Excel, with all the data calculated for the update found in the Workbook entitled "MasterCensusUpdate.xlsx", which is located in the Appendix. Subsection 3.4 will go further into detail regarding the Workbook and its organization. Throughout the rest of

this white paper, the word "Sheet" will refer to the worksheets within the Workbook for reference.

3.3   Use of ArcGIS

The Department utilized ArcGIS 10 to conduct a land analysis to understand how the data from the US Census and ACS would be distributed. The data sources used in the ArcGIS analysis included:

- Census Block Group Data from 2010 Census Summary File 1 released in March 2011 (cenblkgrp2010_sf_mar11)[2]
- Census Block Group Data from 2000 Census Summary File 3 released in May 2009 (ETAT.BLKGRP2000_May09)[2]
- TEZ Boundary File from the TIME Model (SRESP_EM_GDB.mdb, TEZ database)
- County Boundary File for the State of Florida (ETAT.CNTBND_JUN11)[2]

The following were the steps taken to conduct the GIS land analysis:

Step 1
The analysis began by comparing the changes between the boundary lines between the Census Block Group Data files from the 2000 and 2010 Census; then, compared the changes in boundary lines between the 2010 Census with the TEZ Boundary File. These comparisons were done by overlaying the associated shapefiles in ArcGIS. This was done to visually understand the changes that had occurred and to create a list of specific characteristics of certain TEZs (See Sheets entitled "1-1 TEZs" and "Problem TEZ List"). There are 28 TEZs identified in "Problem TEZ List" Sheet, in which a block group(s) would intersect multiple TEZs. The other 12 TEZs that were identified through the visual analysis indicated no problems, as the block group boundary lines on which those TEZs were based on had not changed.

Please note that those TEZs identified under the "1-1 TEZs" Sheet are not precluded from being on "Problem TEZ List" Sheet. Those identified on the "1-1 TEZs" Sheet are those 12 TEZs that are only associated with one block group. Some of the TEZs identified on this list can have issues because the block group associated with that TEZ is so large that it intersects others. For example, TEZ 1246 is only associated with Block Group 1 of Tract 980000, but this block group also intersects TEZs 1245 and 1247.

Step 2
Using "Select Features", Monroe County's boundaries were selected from the County Boundary File and saved as a separate layer file. Following, under the ArcToolbox, the next step utilized the Clip tool located under Extract in Analysis Tools. Selecting the TEZ Boundary File as the input feature and the Monroe County Boundary layer file as a clip feature, a shapefile was created for the TEZs that were located within the boundaries of Monroe County. The same procedure was done for the Census Block Group Data file

---

[2] This data was retrieved using the Florida Geographic Library: Metadata Explorer, http://www.fgdl.org/metadataexplorer/explorer.jsp, and the files found within the scenario folders generated for the TIME Model.

from 2010 Census, creating a Monroe County specific version of the shapefile. These operations insure that the water portions found in the Census Block Group Data file from 2010 Census were not part of future analysis. The newly created Monroe County TEZ Boundary File and Monroe County 2010 Census Block Group Data file were used for the rest of the GIS analysis.

<u>Step 3</u>
Using Select Features, each of the 40 TEZs in the Monroe County TEZ Boundary File were made into individual boundary layer files and grouped underneath the Individual TEZ layer group. After this has been completed, the Monroe County 2010 US Census Block Group Data file is overlaid on top of the TEZs. For those TEZs that were not identified on the "Problem TEZ List" Sheet, shapefiles were not created since their boundaries did not change between 2000 and 2010. The process for those 28 TEZs identified on the "Problem TEZ List" Sheet made it necessary to create individual shapefiles for each of the identified 28 TEZs. In order to find the portions of the intersecting block groups as they relate to the established TEZ boundaries, a series of intersects were performed to find the size of the intersecting areas. Each of the 28 TEZs received a separate intersect analysis.

Under the ArcToolbox, the Intersect tool was utilized, located under Overlay in Analysis Tools. The input features for each intersect analysis included the individual TEZ boundary layer file for the affected TEZ and Monroe County 2010 Census Block Group Data file. This operation created a new, individualized shapefile for each of the 28 TEZs identified on the "Problem TEZ List" Sheet.

<u>Step 4</u>
After creating all 28 shapefiles for the affected TEZs, the next step included using the Identify tool and Measure a Feature function of the Measure tool, calibrated to give results in acres. The results from this operation were recorded under the Sheet entitled "Problem TEZ Intersects" of the Workbook. Overlaying the Monroe County 2010 Census Block Group Data file and Individual TEZ layer group as guides, the Identify tool was used to identify the Block Group and Tract Numbers for each block group portion which intersected into a specific TEZ boundary. After a block group portion was identified, the Measure tool was used to identify the amount of acreage that resided in each TEZ of a particular block group and recorded in Sheet "Problem TEZ Intersects".

3.4   Use of Microsoft Excel
As mentioned in Subsection 3.2, the results of the GIS analysis were recorded in the Workbook entitled "MasterCensusUpdate.xlsx", which is located in the Appendix. The Workbook is organized by the Sheets listed below:

- SRESP Inputs
- 1-1 TEZs
- Problem TEZ List
- Problem TEZ Intersects
- TEZ Totals

- Projection of Variables by TEZ
- New Database

The Workbook combined analysis of the 2010 Census and 2006-2010 ACS block group data with the analysis conducted using ArcGIS to calculate the inputs necessary to update the small area data attributes for Monroe County. The 2010 Census and 2006-2010 ACS data was compiled by the South Florida Regional Planning Council for use with this analysis. There are 28 attributes identified to be updated for Analysis Year Period 2010 in the small area data as listed below. Please note that the definitions for each attribute can be found in Volume 8 of the SRESP:

- DSSB_10
- DMSB_10
- DTSB_10
- PCSSO_10
- PCMSO_10
- PCTSO_10
- ODSSB_10

- ODMSB_10
- ODTSB_10
- PHSSB_10
- PHMSB_10
- PHTSB_10
- PSSB_10
- PMSB_10

- PTSB_10
- VHSSB_10
- VHMSB_10
- VHTSB_10
- VSSB_10
- VMSB_10
- VTSB_10

- D_MB_10
- PC_MO_10
- O_MB_10
- PH_MO_10
- P_MB_10
- VH_MB_10
- V_MB_10

The following will describe each Sheet. Most of the Sheets in this Workbook are linked together to ensure easy revisions and updates.

SRESP Inputs

SRESP Inputs refers to the data compiled and provided by the South Florida Regional Planning Council in coordination with the Department. This Sheet is organized into the 76 block groups (Column A is Tract, Column B is Block Group) as established by the US Census Bureau for Monroe County. As described above, with changes to how the US Census Bureau conducted its analysis of people and their living characteristics, data from the ACS is required to gain the specific details needed for the Model. The 2010 Census data was used as an anchor since it contains the official totals for units and population in the nation. The categories of data used from the US Census for this analysis are:

- Total Population (Pop100 - Column C)
- Total Housing Units (H0030001 – Column D)
- Occupied Housing Units (H0030002 – Column E)
- Vacant Housing Units (H0030003 – Column F)

The 2010 Census data, however, did not provide information regarding the proportion of single-family to multi-family dwelling unit types or site-built to mobile home unit types, as well as the number of vehicles that would be available to each type. This level of detail is found within the ACS. Since the ACS is a sample of the population to understand how residents generally live and not an official count, the ACS should only be used to derive these specific details to which can be applied to the official Census counts. The main categories of data used from the 2006-2010 ACS (as there are numerous subcategories under each) for this analysis are:

- Total Housing Units, by Units in Structure (Table B25024, Subcategories B25024_001-011 – Columns I-S)
- Occupied Housing Units, by Units in Structure (Table B25032, Subcategories B25032_001-023 – Columns V-AR)
- Residents by Tenure, by Units in Structure (Table B25033, Subcategories B25033_001-013 – Columns AW-BI)
- Aggregate Vehicles by Tenure (Table B25046, Subcategories B25046_001-003 – Columns – BL-BN)

Using these two main sources, the unit, population and vehicle data needed for the TIME Model small area data is calculated into two main groupings: Derivation of Main SRESP Inputs and Derivation of Additional SRESP Inputs.

Derivation of Main SRESP Inputs (Columns BQ-BX) are the main inputs which proportion out mobile home and site-built unit data from the overall unit data totals for the following attribute types:

- Total Housing Units
- Occupied Housing Units
- Residents in Occupied Housing Units
- Vehicles in Occupied Housing Units

Derivation of Additional SRESP Inputs (Columns BY-CF) are the secondary inputs which proportion out single-family and multi-family from the overall site-built units only. Single-family site-built units are defined in ACS data subcategory as "1, detached" dwelling unit, while multi-family site-built units are those dwelling units which are not defined as "1, detached", "Mobile home", or "Boat, RV, van, etc". The following attribute types for the secondary inputs are:

- Total Site-Built Units
- Occupied Site-Built Units
- Residents in Occupied Site-Built Units
- Vehicles in Occupied Site-Built Units

As will be elaborated under its own heading, the Sheet entitled "TEZ Totals" hosts the list of TEZs and their associated block group(s). If a TEZ did not appear on the "Problem TEZ List", then the data from Columns BQ-CF were linked to the sheet organized by TEZ and their associated Block Group and Tract Number. If a TEZ did appear on the "Problem TEZ List", then Columns BQ-CF were linked to the Sheet entitled "Problem TEZ Intersects" in order to redistribute the data in response to the aforementioned boundary issues.

<u>1-1 TEZs</u>
Some TEZs are a combination of multiple block groups. Some are not. During the GIS portion of the overall analysis, this table was created to understand which TEZs were bound by one block group only.

Problem TEZ List
This is the list created through GIS that indicates those block groups that intersect multiple TEZs, some of which as a result of changes to the boundaries at the block group level. For example, TEZ 1208 contains portions of Block Group 1 of Tract 972500 and Block Group 2 of Tract 972400. Previously, the TEZ 1208 contain approximately seven block groups, of which no portion of those block groups crossed into another TEZ.

Problem TEZ Intersects
Taking the acreage measurements found through the GIS analysis (refer to Steps 3-4 under Subsection 3.3), the Sheet is organized first by block group (Column A is Tract, Column B is Block Group). For each block group, those TEZs that contain a portion of that particular block group are listed (Column C). The measurements of proportions for the associated TEZ-block group are inserted into each block group by TEZ (Columns D-E) and summed to find the percentage share (proportion) of a specific TEZ within each of the block groups (Column F).

The data from Columns BQ-CF from "SRESP Inputs" was linked into this Sheet by the associated block group under Columns G-V of this Sheet. Then, by using the percentage proportion for each TEZ-block group portion, the "SRESP Inputs" Sheet data is redistributed into portions of the block group within an affected TEZ. For example, Block Group 1 of Tract 972500 intersects both TEZs 1208 and 1209. The portion that intersected TEZ 1208 was found to be 155.97 acres, while the portion that intersected TEZ 1209 is 230.81 acres, giving a total of 386.78 acres. That gives TEZ 1208 a proportion percentage of 40.33% of the unit, person and vehicle data from Columns BQ-CF for Block Group 1 of Tract 972500, while TEZ 1209 receives 59.67%. The reapportioned data for the 28 affected TEZs are calculated in Columns W-AL of this Sheet.

TEZ Totals
This Sheet combined the data from both "SRESP Inputs" and "Problem TEZ Intersects" Sheets, organized by TEZ (Column A). The block groups associated with each TEZ are listed with the TEZ (Columns B is Tract, Column C is Block Group). Column D indicates whether the block group listed had an intersection referenced in the "Problem TEZ Intersects" Sheet (Y) or not (N). If it was (Y), then the data from Columns W-AL from the "Problem TEZ Intersects" Sheet are linked to the block group for that TEZ. If it was not (N), then the data from Columns BQ-CF from the "SRESP Inputs" Sheet are linked.

For example, Row 4 is within TEZ 1208. Row 4 contains the data for Block Group 3 of Tract 972400. Column D is "N" for this Row, which means that the data from Columns BQ-CF from Row 75 (Block Group 3 of Tract 972400) of the "SRESP Inputs" Sheet is linked to Row 4 for Columns E-T. For an example with a "Y", look at Row 5 for TEZ 1208 which contains the data for Block Group 1 of Tract 972500. For Row 5, data from Columns W-AL from the "Problem TEZ Intersects" Sheet are linked from Row 3 on that Sheet to Row 5.

The block group data for Columns E-T of this Sheet are summed. The Summed (Total) Row of Columns E-T for each TEZ is linked to the "Projection of Variables by TEZ"

Sheet. The Summed Row contains all the unit, person and vehicle data for a particular TEZ.

Projection of Variables by TEZ
This Sheet contains all of the Summed Rows for Columns E-T from the "TEZ Totals" Sheet. This Sheet was created to have an uncluttered view of the results of combining the "SRESP Inputs" and "Problem TEZ Intersects" Sheets for all of the TEZs. This Sheet is also used for linked data for TEZs for the "New Database" Sheet.

New Database
Columns from the "Projection of Variables by TEZ" Sheet are linked to this Sheet with their associated attribute as defined by Volume 8 of the SRESP for the South Florida Region. For example, Column B (Total Mobile Homes) of the "Projection of Variables by TEZ" Sheet is linked to the Column W for attribute "D_MB_10". Like the previous Sheet, this is also organized by TEZ (Column A). However, there are more calculations in this Sheet for occupancy rates. Because of the need to distribute the unit, person and vehicle data from block groups to TEZ, the following data had to be calculated at the end so it would be TEZ-specific:

- Occupancy Rates for:
    - All Site-Built (Column G)
    - Single-Family Site-Built (Column E)
    - Multi-Family Site-Built (Column F)
    - Mobile Home (Column X)
- Persons per Occupied:
    - All Site-Built (Column M)
    - Single-Family Site-Built (Column K)
    - Multi-Family Site-Built (Column L)
    - Mobile Home (Column Z)
- Vehicles per Occupied:
    - All Site-Built (Column S)
    - Single-Family Site-Built (Column Q)
    - Multi-Family Site-Built (Column R)
    - Mobile Home (Column AB)

4   Conclusion

The "New Database" Sheet was created to contain the updated inputs for the small area data attributes to be included in Analysis Year Period 2010 for Monroe County. This Sheet is formatted and organized identically to the data found in the geodatabase, "SRESP_EM_GDB.mdb", which is used to populate the small area data of the TIME Model for an evacuation scenario. The methodology above explained the steps which took place to create the "New Database" Sheet. Overall, this methodology and associated Workbook were created in a fashion so anyone could replicate this work as need be. The Workbook was set up so that revisions to the "SRESP Inputs" Sheet will update the rest of the Sheets in the Workbook including the "New Database" Sheet.

We hope this exercise was clear and concise to those who are interested and that it would be helpful to others in the future. If anyone has questions or concerns regarding this white paper, please contact Jeannine Kelsick, Planning Analyst for the Areas of Critical State Concern Program, at (850) 717-8495, or Jeannine.Kelsick@deo.myflorida.com.

5   Appendix

Attached to the email that was sent out for this methodology, there is a Microsoft 2007 Excel Workbook entitled "MasterCensusUpdate.xlsx". If your computer has an earlier version of Excel installed, please contact Jeannine Kelsick in order to get a compatible version for review.