

# **REVIEW OF HURRICANE EVACUATION MODEL INPUTS FOR THE FLORIDA KEYS ACSC**

Hurricane Evacuation Work Group  
January 30, 2012



# Florida Keys

## Area of Critical State Concern

- ▶ Area of Critical State Concern (ACSC)
- ▶ **Permit Allocation System** developed to distribute the **Future Growth Capacity** within the Florida Keys ACSC
- ▶ Based on:
  - hurricane evacuation,
  - public safety, and
  - environmental needs including water quality and habitat protection

# Hurricane Evacuation Modeling:

- ▶ **1989:** PBS&J, retained by ACOE, to perform a transportation analysis of evacuation travel movements and clearance times. The analysis was released in 1991.
  - Lower Southeast Florida Hurricane Evacuation Study
  - 1990 Census baseline for the model
- ▶ **2000:** FDOT contracts with Miller Consulting, Inc., to develop an evacuation model that measures and analyzes the unique characteristics of the Florida Keys
  - Miller Report completed in 2001
  - 1990 Census data + number of certificates of occupancy issued through 1999, after 1999 add max number of ROGO allocations
- ▶ **2004:** 2000 Census info is incorporated in the Miller model by DCA
- ▶ **2005:** DCA contracts with the SFRPC to develop regional hurricane evacuation study (Broward, Miami-Dade and Monroe Counties)
  - South Florida Regional Hurricane Evacuation Traffic Study Technical Support Document is finalized in 2006

# Hurricane Evacuation Modeling:

- ▶ **2009-2010:** Monroe County contracts with University of Utah (Reid Ewing, Ph.D.) to update the Miller model for phased evacuations, update the model based on 2000 Census data, recent building permit data, the best available tourist data, etc.
- ▶ **2010:** Statewide Regional Evacuation Study Program (SRESP) by the Florida Division of Emergency Management and Regional Planning Councils and Wilbur Smith Associates is released.
  - Data were developed for three analysis years: 2006, 2010, and 2015.
  - All data are based off of mid-census estimates and future year projections based off of Census 2000 data.
  - Census 2010 data were not available at the time that the evacuation model was developed.

# Hurricane Evacuation Model Inputs

## ► Number of People per Unit

	PBS&J Hurricane Evacuation Analysis Dec. 1991 (1990 Census)	2000 Miller Model (1990 Census & PSC) Final Report in 2001	2004 Miller Update (2000 Census)	2006 South Florida Regional Hurricane Evacuation Traffic Study (SFRPC)	SRESP / Base Scenarios		SRESP / Operational Scenarios	
					2010	2015	2010	2015
	7 evac zones	7 evac zones	7 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones
<b>Number of People per M.H. Unit</b>	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 = 2.62 Zone 2 = 1.95 Zone 3 = 1.98 Zone 4 = 2.02 Zone 5 = 2.03	Aggregated for 98 census block groups Zone 1 = 2.41 Zone 2 = 2.02 Zone 3 = 2.03 Zone 4 = 1.99 Zone 5 = 2.00	Aggregated for 98 census block groups Zone 1 = 2.41 Zone 2 = 2.02 Zone 3 = 2.03 Zone 4 = 1.99 Zone 5 = 2.00		
<b>Number of People per Permanent Unit</b>	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 - 2.44 2 - 2.31 3 - 2.25 4 - 1.97 5 - 2.27 6 - 2.27 7 - 2.11	Zone 1 = 2.24 Zone 2 = 2.31 Zone 3 = 2.22 Zone 4 = 2.25 Zone 5 = 1.85	Aggregated for 98 census block groups Zone 1 = 2.27 Zone 2 = 2.32 Zone 3 = 2.22 Zone 4 = 2.29 Zone 5 = 1.81	Aggregated for 98 census block groups Zone 1 = 2.27 Zone 2 = 2.32 Zone 3 = 2.22 Zone 4 = 2.29 Zone 5 = 1.81		

# Hurricane Evacuation Model Inputs

## ▶ Number of Vehicles per Unit

	PBS&J Hurricane Evacuation Analysis Dec. 1991 (1990 Census)	2000 Miller Model (1990 Census & PSC) Final Report in 2001	2004 Miller Update (2000 Census)	2006 South Florida Regional Hurricane Evacuation Traffic Study (SFRPC)	SRESP / Base Scenarios		SRESP / Operational Scenarios	
					2010	2015	2010	2015
	7 evac zones	7 evac zones	7 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones
<b>Number of Vehicles per Occupied Permanent Unit</b>	Zone 1 - 1.80 2 - 1.80 3 - 1.82 4 - 2.00 5 - 2.00 6 - 2.00 7 - 2.00	1 - 1.35 2 - 1.76 3 - 1.39 4 - 1.65 5 - 1.76 6 - 1.61 7 - 1.58	1 - 1.36 2 - 1.74 3 - 1.56 4 - 1.65 5 - 1.71 6 - 1.83 7 - 1.43	Zone 1 = 1.34 Zone 2 = 1.73 Zone 3 = 1.56 Zone 4 = 1.74 Zone 5 = 1.69	Aggregated for 98 census block groups Zone 1 = 1.33 Zone 2 = 1.74 Zone 3 = 1.58 Zone 4 = 1.79 Zone 5 = 1.51			
<b>Number of Vehicles per Occupied Mobile Home Unit</b>	Zone 1 - 1.80 2 - 1.80 3 - 1.82 4 - 2.00 5 - 2.00 6 - 2.00 7 - 2.00	1 - 1.35 2 - 1.76 3 - 1.39 4 - 1.65 5 - 1.76 6 - 1.61 7 - 1.58	1 - 1.36 2 - 1.74 3 - 1.56 4 - 1.65 5 - 1.71 6 - 1.83 7 - 1.43	Zone 1 = 1.34 Zone 2 = 1.73 Zone 3 = 1.56 Zone 4 = 1.74 Zone 5 = 1.69	Aggregated for 98 census block groups Zone 1 = 1.34 Zone 2 = 1.68 Zone 3 = 1.49 Zone 4 = 1.65 Zone 5 = 1.50			
<b>Number of Vehicles per Tourist Unit</b>	Zone 1 - 1.04 2 - 1.04 3 - 1.05 4 - 1.10 5 - 1.10 6 - 1.10 7 - 1.10	1 - 1.04 2 - 1.04 3 - 1.05 4 - 1.10 5 - 1.10 6 - 1.10 7 - 1.10	1 - 1.04 2 - 1.04 3 - 1.05 4 - 1.10 5 - 1.10 6 - 1.10 7 - 1.10	Zone 1 = 1.10 Zone 2 = 1.10 Zone 3 = 1.10 Zone 4 = 1.10 Zone 5 = 1.10	1.10 for all 98 census block groups			

# Hurricane Evacuation Model Inputs

## ▶ Vehicle Usage

	PBS&J Hurricane Evacuation Analysis Dec. 1991 (1990 Census)	2000 Miller Model (1990 Census & PSC) Final Report in 2001	2004 Miller Update (2000 Census)	2006 South Florida Regional Hurricane Evacuation Traffic Study (SFRPC)	SRESP / Base Scenarios		SRESP / Operational Scenarios											
					2010	2015	2010	2015										
	7 evac zones	7 evac zones	7 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones										
<b>Vehicle Usage %</b>	Zone 1 - 69% 2 - 69% 3 - 70% 4 - 71% 5 - 71% 6 - 71% 7 - 71%	Zone 1 - 69% 2 - 69% 3 - 70% 4 - 71% 5 - 71% 6 - 71% 7 - 71%	Zone 1 - 69% 2 - 69% 3 - 70% 4 - 71% 5 - 71% 6 - 71% 7 - 71%	80% vehicle usage of permanent occupied units, including mobile homes (page 13)	<p style="text-align: center;"><b>Ranges from 75% to 90%</b> (see Volume 2-11 Behavioral Analysis) For example:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">Site-Built homes - Cat 3</td> <td style="width: 50%; text-align: center;">Mobile homes - Cat 3</td> </tr> <tr> <td style="text-align: center;">Upper Keys - 75%</td> <td style="text-align: center;">Upper Keys - 80%</td> </tr> <tr> <td style="text-align: center;">Middle Keys - 75%</td> <td style="text-align: center;">Middle Keys - 80%</td> </tr> <tr> <td style="text-align: center;">Lower Keys - 75%</td> <td style="text-align: center;">Lower Keys - 80%</td> </tr> <tr> <td style="text-align: center;">Key West - 80%</td> <td style="text-align: center;">Key West - 85%</td> </tr> </table>				Site-Built homes - Cat 3	Mobile homes - Cat 3	Upper Keys - 75%	Upper Keys - 80%	Middle Keys - 75%	Middle Keys - 80%	Lower Keys - 75%	Lower Keys - 80%	Key West - 80%	Key West - 85%
Site-Built homes - Cat 3	Mobile homes - Cat 3																	
Upper Keys - 75%	Upper Keys - 80%																	
Middle Keys - 75%	Middle Keys - 80%																	
Lower Keys - 75%	Lower Keys - 80%																	
Key West - 80%	Key West - 85%																	
<b>Tourist Vehicle Usage %</b>		100%	100%	100%	<p style="text-align: center;"><b>100% of available vehicles</b> (i.e., the estimated number of vehicles reflects the use of other means of transportation that tourists use to come and go from the Florida Keys)</p>													

# Hurricane Evacuation Model Inputs

## ► Participation Rates

	PBS&J Hurricane Evacuation Analysis Dec. 1991 (1990 Census)	2000 Miller Model (1990 Census & PSC) Final Report in 2001	2004 Miller Update (2000 Census)	2006 South Florida Regional Hurricane Evacuation Traffic Study (SFRPC)	SRESP / Base Scenarios		SRESP / Operational Scenarios	
					2010	2015	2010	2015
	7 evac zones	7 evac zones	7 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones
% Participation of M.H. Units	95%	95%	95%	100%	100%	100%	Level A = 65% Level B = 75% Level C = 85% Level D = 90% Level E = 95%	Level A = 65% Level B = 75% Level C = 85% Level D = 90% Level E = 95%
% Participation of Other Units	60% lower keys (1 & 2) 80% middle keys (3) 85% upper keys (4-7)	Zone 1 - 60% 2 - 60% 3 - 80% 4 - 85% 5 - 85% 6 - 85% 7 - 85%	Zone 1 - 60% 2 - 60% 3 - 80% 4 - 85% 5 - 85% 6 - 85% 7 - 85%	62% participation rate of permanent occupied units for categories 1-2; 100% participation rate of permanent occupied units for categories 3-5	100%	100%	Level A = 35-40% Level B = 40-50% Level C = 70% Level D = 80% Level E = 90%	Level A = 35-40% Level B = 40-50% Level C = 70% Level D = 80% Level E = 90%
% Participation by Tourists Units at Risk	95%	100%	100%	100%	100% (1 <sup>st</sup> phase for a Level C storm or higher)	100% (1 <sup>st</sup> phase for a Level C storm or higher)	100% (1 <sup>st</sup> phase for a Level C storm or higher)	100% (1 <sup>st</sup> phase for a Level C storm or higher)



# Hurricane Evacuation Model Inputs

## ► Occupancy Rates

	PBS&J Hurricane Evacuation Analysis Dec. 1991 (1990 Census)	2000 Miller Model (1990 Census & PSC) Final Report in 2001	2004 Miller Update (2000 Census)	2006 South Florida Regional Hurricane Evacuation Traffic Study (SFRPC)	SRESP / Base Scenarios		SRESP / Operational Scenarios	
					2010	2015	2010	2015
	7 evac zones	7 evac zones	7 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones	5 evac zones
% Occupancy of Permanent Dwelling Units		Zone 1 - 86% 2 - 71% 3 - 69% 4 - 57% 5 - 66% 6 - 65% 7 - 42%	Zone 1 - 84.10% 2 - 66.85% 3 - 58.95% 4 - 45.43% 5 - 57.99% 6 - 66.37% 7 - 32.84%	Zone 1 = 84.1% Zone 2 = 72.1% Zone 3 = 60.9% Zone 4 = 61.8% Zone 5 = 38.5%	Aggregated for 98 census block groups			
					Zone 1 = 83.8% Zone 2 = 72.1% Zone 3 = 57.7% Zone 4 = 61.4% Zone 5 = 34.5%	Zone 1 = 83.9% Zone 2 = 72.1% Zone 3 = 57.8% Zone 4 = 61.5% Zone 5 = 34.4%	Zone 1 = 83.8% Zone 2 = 72.1% Zone 3 = 57.7% Zone 4 = 61.4% Zone 5 = 34.5%	Zone 1 = 83.9% Zone 2 = 72.1% Zone 3 = 57.8% Zone 4 = 61.5% Zone 5 = 34.4%
% Occupancy of Tourist Units	45 % low occupancy 75% high occupancy	Zone 1 - 72% 2 - 64% 3 - 64% 4 - 70% 5 - 70% 6 - 70% 7 - 70%	45% low occupancy	45 % low occupancy 85% high occupancy	Defaults to 85% for all 98 census block groups, but can be adjusted as a scenario parameter			

# Hurricane Evacuation Model Inputs

- ▶ Estimated clearance time will vary with the assumptions made in the model.
  - ▶ Model outputs are only as accurate as the input assumptions.
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