Goal: To provide emergency management officials sound data that will inform them in hurricane evacuation planning and decision-making.
Roles and Responsibilities

- Coordination
  - Subject Matter Expertise
  - Training

- Project Management
  - Training
  - Tech Support

- SLOSH Basin Development
  - Tech Support

- Data Collection
  - Local Coordination
  - User needs

- Data Collection
  - Local Agency Coordination
  - User needs

Local EMA

HES

Local Hurricane Plans

State Evac and Support plans

Regional Ops and Support plans

National planning and Ops
NC Hurricane Evacuation Study (HES)

Hazards Analysis
- SLOSH Model development
- Surge MOMS
- Surge Maps
- Evacuation Zones

Vulnerability Analysis
- Identify at risk populations
- Infrastructure
- Critical facilities
- Local Planning data

Behavioral Analysis
- Public Survey
- Analysis of Survey responses
- Results for input into shelter and trans analysis

Shelter Analysis
- Determining the shelter need
- Estimate number of shelter spaces
- Potential vulnerability

Transportation Analysis
- Analysis of traffic volumes, evacuation routes, and destinations
- Traffic patterns
- Evacuation Clearance Times
Transportation Analysis

The transportation analysis addressed five primary steps:

- Developing of evacuation zones and scenarios
- Establishing of an evacuation roadway network
- Calculating the number of evacuees and vehicles
- Conducting evacuee trip generation and assigning destinations
- Routing evacuees along the evacuation roadway network
Transportation Analysis

The Transportation Analysis utilizes data produced by the other analysis to determine traffic congestion and clearance times.

- **Inputs**
  - Demographics
  - Behavioral Assumptions
  - Evacuation Routes
  - Levels of Service (Roadway Capacities)
  - Travel Destinations
  - Evacuation Scenarios

Analysis: Hazard Vulnerability Behavioral Shelter Transportation
Products: Surge Maps Evacuation Zones Planning Data Clearance times
Primary Evacuation Areas

Upper Coastal / Albemarle Sound

Example: Currituck County
Regional Evacuation Road Network: Upper Coastal / Albemarle Sound Counties
## ATM Socioeconomic Data Sheet

### Example – Currituck County

#### Socioeconomic Data

<table>
<thead>
<tr>
<th>Traffic Modeling Evacuation Area</th>
<th>2010 Population</th>
<th>2010 Perm Occ Dwelling Units</th>
<th>2014 ACS Population</th>
<th>2014 Perm Occ Dwelling Units</th>
<th>Growth Factor (2010 vs 2014) Population</th>
<th>Perm Occ Dwelling Units</th>
<th>Mobile Homes</th>
<th>H Motel + Seasonal Units</th>
<th>% Seasonal Occupancy</th>
<th>People Per Perm Occ Dwelling Unit</th>
<th>People Per Seasonal Unit</th>
<th>Vehicles Per Perm Occ Dwelling Unit</th>
<th>Vehicles Per Seasonal Unit</th>
<th>Perm Occ Dwelling Unit Vehicle Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currituck 1 - Roanoke Island</td>
<td>92</td>
<td>50</td>
<td>98</td>
<td>53</td>
<td>6%</td>
<td>6%</td>
<td>13</td>
<td>171</td>
<td>90%</td>
<td>2.84</td>
<td>5.00</td>
<td>3.00</td>
<td>1.80</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 2 - Knotts Island</td>
<td>1,545</td>
<td>628</td>
<td>1,639</td>
<td>666</td>
<td>6%</td>
<td>6%</td>
<td>168</td>
<td>199</td>
<td>90%</td>
<td>2.46</td>
<td>5.00</td>
<td>2.92</td>
<td>1.80</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 3 - Corolla area</td>
<td>450</td>
<td>234</td>
<td>477</td>
<td>248</td>
<td>6%</td>
<td>6%</td>
<td>62</td>
<td>3,596</td>
<td>90%</td>
<td>1.92</td>
<td>5.00</td>
<td>2.98</td>
<td>1.80</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 4 - Jarvisburg golf courses</td>
<td>2,887</td>
<td>1,157</td>
<td>3,041</td>
<td>1,227</td>
<td>6%</td>
<td>6%</td>
<td>176</td>
<td>132</td>
<td>90%</td>
<td>2.48</td>
<td>3.00</td>
<td>2.93</td>
<td>1.05</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 5 - Poplar Beach-Grandy area</td>
<td>4,506</td>
<td>1,834</td>
<td>4,780</td>
<td>1,924</td>
<td>6%</td>
<td>6%</td>
<td>468</td>
<td>304</td>
<td>90%</td>
<td>2.48</td>
<td>3.00</td>
<td>1.93</td>
<td>1.05</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 6 - Currituck Tull Creek Rd area</td>
<td>4,243</td>
<td>1,561</td>
<td>4,501</td>
<td>1,656</td>
<td>6%</td>
<td>6%</td>
<td>357</td>
<td>130</td>
<td>90%</td>
<td>2.72</td>
<td>3.00</td>
<td>2.39</td>
<td>1.05</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 7 - Barco/Shawboro area</td>
<td>2,065</td>
<td>1,082</td>
<td>3,145</td>
<td>1,148</td>
<td>6%</td>
<td>6%</td>
<td>432</td>
<td>26</td>
<td>90%</td>
<td>2.74</td>
<td>3.00</td>
<td>1.95</td>
<td>1.05</td>
<td>75%</td>
</tr>
<tr>
<td>Currituck 8 - Moyock area</td>
<td>6,879</td>
<td>2,354</td>
<td>7,297</td>
<td>2,497</td>
<td>6%</td>
<td>6%</td>
<td>455</td>
<td>38</td>
<td>90%</td>
<td>2.92</td>
<td>3.00</td>
<td>2.31</td>
<td>1.05</td>
<td>75%</td>
</tr>
</tbody>
</table>

#### Demographic

#### Special Social Factors

<table>
<thead>
<tr>
<th>Traffic Modeling Evacuation Area</th>
<th>Average Income</th>
<th>HH w/o Vehicles</th>
<th>% of Population over 75</th>
<th>% of Population</th>
<th>Drive %</th>
<th>Walk/Bike %</th>
<th>Bus %</th>
<th>Evac Mode Assumption Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currituck 1 - Roanoke Island</td>
<td>$91,210</td>
<td>2%</td>
<td>4%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 2 - Knotts Island</td>
<td>$49,390</td>
<td>2%</td>
<td>4%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 3 - Corolla area</td>
<td>$77,663</td>
<td>3%</td>
<td>7%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 4 - Jarvisburg golf courses</td>
<td>$51,472</td>
<td>3%</td>
<td>6%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 5 - Poplar Beach-Grandy area</td>
<td>$48,300</td>
<td>2%</td>
<td>6%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 6 - Currituck Tull Creek Rd area</td>
<td>$66,663</td>
<td>2%</td>
<td>4%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 7 - Barco/Shawboro area</td>
<td>$57,262</td>
<td>9%</td>
<td>7%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
<tr>
<td>Currituck 8 - Moyock area</td>
<td>$62,430</td>
<td>2%</td>
<td>3%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Transportation Analysis
Helping coastal decision makers understand traffic congestion potential based upon evacuation decisions

Products of the Transportation Analysis

- Traffic Patterns (bottle necks)
- Evacuating Vehicles
- Clearance Time tables
- Variables of:
  - Response
  - Population
  - Evacuation Scenarios (one way, Multi state)
Evacuation Clearance Times

**Definition**

Begins when the **first evacuating vehicle enters** the road network, ends when the **last vehicle reaches an assumed point of safety**

- Includes travel time and waiting in traffic congestion (does not relate to any one particular vehicle)

- Driven by bottlenecks
Evacuation Clearance Times

Timeline

L = -48  L = -36  L = -24  L = -18  L = -12  L = -6  L = 0  L = +6  L = +12  L = +18  L = +26

Evacuation Decision Time

Clearance Time = 48hrs

Mobilization Time

Travel Time

Queuing Delay Time (traffic)

Forecasted Landfall of TS winds or Hazards

Hazards

Analysis: Hazard Vulnerability Behavioral Shelter Transportation
Products: Surge Maps Evacuation Zones Planning Data
Clearance Times
## Clearance Times

– DRAFT Upper Coastal / Albemarle Sound Counties:

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>Public Response Quickness 2</th>
<th>Regional Out of County Clearance Times (in hours) 4</th>
<th>Local In County Movement Times (in hours) 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low Occ 3 Med Occ 3 High Occ 3 Max Occ 3</td>
<td>Low Occ 3 Med Occ 3 High Occ 3 Max Occ 3</td>
</tr>
<tr>
<td>Weak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario A</td>
<td>e.g. Probable Category 1/2</td>
<td>Immediate 4.8 6.1 7.5 8.9</td>
<td>2.1 2.6 2.8 2.9</td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td>6.1 7.4 8.8 10.2</td>
<td>3.1 3.6 3.8 3.9</td>
</tr>
<tr>
<td></td>
<td>Medium 5</td>
<td>7.3 8.6 10.0 11.4</td>
<td>4.8 5.3 5.5 5.6</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>9.3 10.6 12.0 13.4</td>
<td>8.1 8.6 8.8 8.9</td>
</tr>
<tr>
<td>Scenario A</td>
<td>e.g. Worst Case Category 1/2</td>
<td>Immediate 11.1 13.7 16.2 18.7</td>
<td>2.3 2.8 3.0 3.1</td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td>12.4 15.0 17.5 20.0</td>
<td>3.3 3.8 4.0 4.1</td>
</tr>
<tr>
<td></td>
<td>Medium 5</td>
<td>13.6 16.2 18.7 21.2</td>
<td>5.3 5.8 6.0 6.1</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>15.6 18.2 20.7 23.2</td>
<td>8.3 8.8 9.0 9.1</td>
</tr>
<tr>
<td>Scenario B</td>
<td>e.g. Worst Case Category 3</td>
<td>Immediate 19.5 22.0 25.3 28.5</td>
<td>3.3 3.8 4.0 4.1</td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td>20.8 23.3 26.6 29.8</td>
<td>4.3 4.8 5.0 5.1</td>
</tr>
<tr>
<td></td>
<td>Medium 5</td>
<td>22.0 24.5 27.8 31.0</td>
<td>6.3 6.8 7.0 7.1</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>24.0 26.5 29.8 33.0</td>
<td>9.3 9.8 10.0 10.1</td>
</tr>
<tr>
<td>Scenario C+</td>
<td>e.g. Worst Case Category 4/5</td>
<td>Immediate 23.3 25.7 29.3 32.9</td>
<td>3.8 4.3 4.5 4.6</td>
</tr>
<tr>
<td></td>
<td>Fast</td>
<td>24.6 27.0 30.6 34.2</td>
<td>4.8 5.3 5.5 5.6</td>
</tr>
<tr>
<td></td>
<td>Medium 5</td>
<td>25.8 28.2 31.8 35.4</td>
<td>7.3 7.8 8.0 8.1</td>
</tr>
<tr>
<td></td>
<td>Slow</td>
<td>27.8 30.2 33.8 37.4</td>
<td>10.3 10.8 11.0 11.1</td>
</tr>
</tbody>
</table>

Critically Important Notes:

1. Weak Scenario A – typically a direct threat from a minimal Category 1 that has virtually no chance of strengthening
2. Scenario A – direct threat from a strong Category 1 or 2 hurricane
3. Scenario B – direct threat from a Category 3 hurricane
4. Scenario C+ – direct threat from a bonafide Category 4 or 5 hurricane
5. Public Response Quickness – how quickly the public mobilizes and enters the road network
6. Tourist Seasonal Occupancy – the percent of tourist units occupied at the start of the official evacuation
7. Regional Times vs. Local Times – times for those going to out of county destinations vs. in county shelter
8. Yellow Highlighted Times – recommended for state/local decision making and coordination
Technical Data Reports

Detailed reports of the following analyses:

- Hazards Analysis
- Vulnerability Analysis
- Behavioral Surveys
- Shelter Analysis
- Transportation Analysis
NC HES contains valuable information for planning purposes:

- Technical Data Report
  - **Hazards Analysis**: Wind, Surge, Flooding
  - **Vulnerability Analysis**: Who is at risk? What is at risk?
  - **Behavioral Analysis**: What do residents do? Where do they go?
  - **Shelter Analysis**: Capacity, Anticipated Use
  - **Transportation Analysis**: Roadway network

- Surge Atlases & Evacuation Zones
- Evacuation Clearance Times
Questions Regarding the NC HES?

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Meteorologist/Branch Manager
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