

NATIONAL HURRICANE PROGRAM

Maryland Western Shore Hurricane Evacuation Study Transportation Tools Workshop

Training Materials

April 2010



FEMA



**Maryland Western Shore
Hurricane Evacuation Study
Transportation Tools Workshop**

April 13, 2010

Morning Session 9:00 – 12:00

- Unit 1: Course Overview (30 minutes)
- Unit 2: Hurricane Evacuation Study Process (45 Minutes)
- Unit 3: Basic Features of the MD W Shore ATM (45 Minutes)
- Unit 4: Data Entry Modules / Demonstration I (1 Hour)

Afternoon Session 1:00 – 4:00

- Unit 5: Data Results Modules / Demonstration II / Exercise I (1 Hour, 15 Minutes)
- Unit 6: HURREVAC Integration / Exercise II (1 Hour, 15 Minutes)
- Unit 7: Course Summary / Evaluation Procedures (30 Minutes)

Breaks of 10 minutes will be provided after Unit 2 in the morning and Unit 5 in the afternoon.



National Hurricane Program

**Maryland Western Shore
Hurricane Evacuation Study
Transportation Tools Workshop**

April 2010



MARYLAND WESTERN SHORE



UNIT 1

Course Overview

Introduction to the MD Western Shore ATM

MARYLAND WESTERN SHORE

Visual 1.1



COURSE OBJECTIVES

Demonstrate a basic understanding of the use of the MD Western Shore ATM

Understand how model outputs or results may be used in HURREVAC

Upon course completion, participants should be able to train other users in the use of the ATM

MARYLAND WESTERN SHORE

Visual 1.2



STUDENT INTRODUCTIONS

Names, job titles, and organizations

Overall experiences with evacuation planning or emergency response

MARYLAND WESTERN SHORE

Visual 1.3



STUDENT EXPECTATIONS

What do you expect to gain from this course?

MARYLAND WESTERN SHORE

Visual 1.4



INSTRUCTOR EXPECTATIONS

Cooperate with the group

Be open minded to new ideas

Participate actively in all of the training activities and exercises

Return to class after breaks at the stated time

Use what you learn to support your organization's role in emergency management

MARYLAND WESTERN SHORE

Visual 1.5



COURSE STRUCTURE

Unit 1: Course Overview

Unit 2: Hurricane Evacuation Study Process

Unit 3: Basic Features of the MD Western Shore ATM

Unit 4: Data Entry Modules - *Demonstration I*

LUNCH BREAK

Unit 5: Data Results Modules - *Demonstration II*
Exercise I

Unit 6: HURREVAC Integration - *Exercise II*

Unit 7: Course Summary

MARYLAND WESTERN SHORE Visual 1.6



COURSE LOGISTICS

Course agenda

Sign in sheet

Housekeeping issues:

- Breaks
- Emergency exits / special access requirements
- Cell phone policy
- Facilities
- Other concerns

MARYLAND WESTERN SHORE Visual 1.7



COURSE COMPLETION

Participate in all unit activities / exercises

Complete unit capstone quizzes

Complete the end-of-course evaluation

STATE OF MARYLAND Visual 1.8



UNIT 2

The Hurricane Evacuation Study (HES) Process

STATE OF MARYLAND Visual 2.1



UNIT OBJECTIVES

Understand the background and components of the Maryland Western Shore Hurricane Evacuation Study

Identify the steps in the evacuation planning process

- Step 1: Establish Evacuation Zones
- Step 2: Establish Evacuation Roadway Network
- Step 3: Collect Demographic and Behavioral Data
- Step 4: Generate Evacuation Statistics (includes shelter demand and capacity)
- Step 5: Distribute Evacuation Trips
- Step 6: Identify Vehicles by Roadway Segment
- Step 7: Calculate Clearance Times

Define evacuation clearance time and understand its components

Definition, Tropical Storm Force Winds Trigger, Mobilization Time, Travel Time, Queuing Delay Time

MARYLAND WESTERN SHORE Visual 2.2



BACKGROUND AND COMPONENTS

Draft HES / Technical Data Report delivered in December 2009; represents the first study done for the Western Shore region of the State

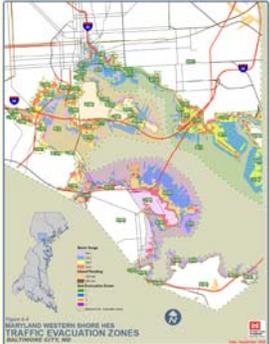
The MD Western Shore HES / TDR:

- Provides a calculation of clearance times by county for inclusion in HURREVAC
- ATM allows users to model different scenarios “on the fly”

MARYLAND WESTERN SHORE Visual 2.3

EVACUATION PLANNING PROCESS

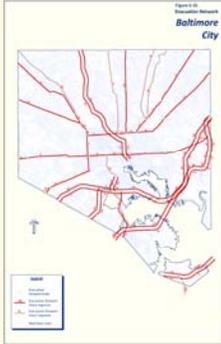
Establish Evacuation Zones



MARYLAND WESTERN SHORE Visual 2.4

EVACUATION PLANNING PROCESS

Establish Evacuation Roadway Network



MARYLAND WESTERN SHORE Visual 2.5

EVACUATION PLANNING PROCESS

Collect Demographic Data

- Population data was obtained from the US Census and Maryland Property View parcel data
- Tourist data was obtained by the Army Corps of Engineers in coordination with the State and local governments

Collect Behavioral Data

- A behavioral study was undertaken as part of the HES process

MARYLAND WESTERN SHORE Visual 2.6

EVACUATION PLANNING PROCESS

Generate Evacuation Statistics

Socioeconomic Information

- Permanent Occupied Dwelling Units
- Mobile Home Units
- Seasonal Tourist Units
- People per Each Unit Type
- Vehicles per Each Unit Type
- Low and High Tourist Occupancy

Behavioral Information

- Participation Rates
- Permanent Resident Local and Out of County Destination Percentages
- Vehicle Usage Percentages
- Tourist Local and Out of County Destination Percentages

Evacuation Statistics Information

- Evacuating Population
- Evacuating Vehicles
- Evacuating Vehicles to Local Destinations
- Evacuating Vehicles to Out of County Destinations
- Shelter Demand and Capacity

MARYLAND WESTERN SHORE Visual 2.7

EVACUATION PLANNING PROCESS

Distribute Evacuation Trips

- Destination routing informed by state tourist data

Identify Evacuating Vehicles By Roadway Segment

- Vehicles routed through to peripheral destinations

Calculate Clearance Times

- High / low tourist occupancy; fast, medium and slow response time

MARYLAND WESTERN SHORE Visual 2.8

EVACUATION PLANNING PROCESS

CLEARANCE TIMES

ISSUANCE OF LOCAL EVACUATION ADVISORY

MOBILIZATION TIME

TRAVEL TIME

QUEUING DELAY TIME

PRE-LANDFALL HAZARDS TIME

TROPICAL STORM WINDS TIME

SURGE ROADWAY INUNDATION TIME

HURRICANE EYE LANDFALL

MARYLAND WESTERN SHORE Visual 2.9

UNIT 2 – CAPSTONE QUIZ

Identify the main components of the Draft 2009 MD Western Shore HES

List the seven steps in the evacuation modeling process

Define clearance time

MARYLAND WESTERN SHORE Visual 2.10

UNIT 2 – SUMMARY

The Draft 2009 MD Western Shore HES / TDR provides estimates of clearance times and includes an ATM

The seven steps in the evacuation modeling process include;

- Step 1: Establish Evacuation Zones
- Step 2: Establish Evacuation Roadway Network
- Step 3: Collect Demographic and Behavioral Data
- Step 4: Generate Evacuation Statistics
- Step 5: Distribute Evacuation Trips
- Step 6: Identify Vehicles by Roadway Segment
- Step 7: Calculate Clearance Times

Clearance time is the time between when the first person leaves their home until the last person reaches their destination. It includes mobilization time, travel time and queuing time delay. Evacuations must be completed prior to tropical storm force (39 mph) winds.

MARYLAND WESTERN SHORE Visual 2.11

UNIT 3

Basic Features of the MD Western Shore ATM

MARYLAND WESTERN SHORE Visual 3.1

UNIT OBJECTIVES

Understand the structure and content of the ATM

- Microsoft Excel-based
- Includes 36 separate worksheets

Open the ATM and navigate through the spreadsheet modules

Understand how to interpret the clearance times worksheet

- Identifying focal points clearance times by scenario
- How county clearance times are determined

MARYLAND WESTERN SHORE Visual 3.2

ATM STRUCTURE

Microsoft Excel-based

- Accessible and easy to update
- Provides reliable results
- Allows testing of new scenarios “on the fly”

Includes 36 separate but integrated worksheets

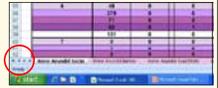
- Three primary input modules (socioeconomic data, behavioral data, out route assignment)
- Two primary output module (evacuation statistics, shelter demand and capacity)
- One module (evacuating vehicles) with inputs and outputs

MARYLAND WESTERN SHORE Visual 3.3

ATM CONTENT

Open the ATM by double clicking on the Excel file icon
Immediately save a copy as “MD ATM Navigation Test”

Use the arrows at the bottom of the screen to open the “Anne Arundel Socio” worksheet



Navigate to the upper right hand corner of the worksheet



Raise hands to ask questions during the navigation

The instructor-guided navigation will commence

MARYLAND WESTERN SHORE Visual 3.4

CLEARANCE TIME WORKSHEET

Using the worksheet tabs, navigate to the Clearance Times worksheet which is labeled, "Clearance Tms"

Navigate to the upper right hand corner of the worksheet



Background Traffic adjustment column inset for illustration purposes

MARYLAND WESTERN SHORE Visual 3.5

RESULTS WORKSHEET

The Clearance Times Table

| County | Speed of Traffic | Clearance Times WITHOUT DeMarVa Traffic | | | | | |
|------------------------|------------------|---|------|------|------|------|------|
| | | Low | High | Low | High | Low | High |
| Anne Arundel County | Slow | 18 | 28 | 84 | 88 | 88 | 101 |
| | Medium | 8.8 | 8.4 | 8.9 | 7.8 | 8.3 | 8.8 |
| | Fast | 4.8 | 4.7 | 5.0 | 4.8 | 5.0 | 5.1 |
| Baltimore County | Slow | 10.3 | 10.8 | 10.8 | 10.7 | 10.8 | 11.2 |
| | Medium | 8.7 | 8.3 | 8.3 | 8.8 | 8.7 | 8.8 |
| | Fast | 4.7 | 4.5 | 4.5 | 4.8 | 4.8 | 4.8 |
| Baltimore City | Slow | 8.7 | 7.8 | 8.9 | 8.8 | 8.8 | 10.1 |
| | Medium | 8.8 | 7.8 | 7.7 | 7.8 | 8.3 | 8.2 |
| | Fast | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| Calvert County | Slow | 8.8 | 7.8 | 7.8 | 8.8 | 8.8 | 8.8 |
| | Medium | 8.8 | 8.3 | 8.1 | 7.7 | 7.7 | 8.8 |
| | Fast | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| Charles County | Slow | 8.8 | 8.8 | 8.8 | 8.3 | 8.7 | 7.8 |
| | Medium | 8.8 | 8.8 | 8.3 | 8.3 | 8.3 | 8.7 |
| | Fast | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| Harford County | Slow | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 |
| | Medium | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 | 8.8 |
| | Fast | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 | 4.8 |
| Prince George's County | Slow | 8.7 | 10.2 | 10.8 | 10.8 | 10.8 | 10.2 |
| | Medium | 7.8 | 8.8 | 7.7 | 8.8 | 8.3 | 8.8 |
| | Fast | 4.7 | 4.8 | 4.8 | 4.8 | 4.7 | 4.8 |
| St. Mary's County | Slow | 4.8 | 4.8 | 4.8 | 4.8 | 4.7 | 4.8 |
| | Medium | 4.8 | 4.7 | 4.8 | 4.8 | 4.8 | 4.7 |
| | Fast | 4.8 | 4.7 | 4.8 | 4.8 | 4.8 | 4.7 |

MARYLAND WESTERN SHORE Visual 3.6

CLEARANCE TIME ESTIMATES

Comparing the Clearance Time and Results Worksheets

| Regional Bottlenecks | Bottleneck Location/ Critical Roadway Segment | Cat 1 | |
|--|---|------------------|----------------|
| | | Low Occupancy | High Occupancy |
| Anne Arundel County | 152-152 between Annapolis and I-97 | 3.8 | 4.1 |
| | 197 between SR 2 and I-95 | 3.8 | 4.0 |
| | SR 206 from I-95 to I-95 | 4.3 | 4.6 |
| | SR 10100 below SR 10 split | 4.3 | 4.6 |
| | SR 2 at intersection of SR 10 | 3.8 | 3.8 |
| Baltimore County | SR 2 from Stewart Center to Annapolis | 6.0 | 6.4 |
| | I-695 from Southwest Blvd to I-95 | 7.8 | 8.0 |
| | I-95 between I-695 and I-495 | 6.8 | 6.9 |
| | I-695 and I-495 interchange | 3.8 | 4.1 |
| | I-495 and I-70 interchange | 6.4 | 6.9 |
| <i>Results worksheet inset for illustration purposes</i> | | | |
| | | Speed of Traffic | Cat 1 |
| | | Low Occupancy | High Occupancy |
| Anne Arundel County | Slow | 7.8 | 7.8 |
| | Medium | 6.0 | 6.4 |
| | Fast | 4.3 | 4.7 |
| Baltimore County | Slow | 10.3 | 10.8 |
| | Medium | 8.1 | 8.3 |
| | Fast | 6.1 | 6.3 |

MARYLAND WESTERN SHORE Visual 3.7

UNIT 3 – CAPSTONE QUIZ

Lists four benefits of the Microsoft Excel platform

Identify the six functional modules or groupings of worksheets included in the MD Western Shore ATM

Explain how the clearance times generated for each bottleneck or critical roadway segment are used to establish county clearance time estimates

MARYLAND WESTERN SHORE Visual 3.8

UNIT 3 – SUMMARY

The Excel-based platform is assessable and easy to use. The model provides reliable results and allows users to test different scenarios.

The six functional groupings of worksheets or modules include;

- Demographic Data Module** (8 jurisdictional worksheets - 7 counties, 1 city)
- Behavioral Data Module** (8 worksheets)
- Out Route Assignment Module** (9 worksheets - 8 jurisdictions, 1 summary sheet)
- Shelter Demand and Capacity Module** (8 worksheets)
- Evacuation Statistics Module** (8 worksheets)
- Evacuating Vehicles Module** (Vehicles by Road, Clearance Times, Results)

The clearance time table is used to identify the regional bottlenecks with the worst clearance times. If a significant portion of a County's evacuating traffic passes through this bottleneck, based on the data in the Out Route Assignment Module, that governing bottleneck will determine the county clearance time.

MARYLAND WESTERN SHORE Visual 3.9

UNIT 4

Data Entry Modules

DEMONSTRATION I

MARYLAND WESTERN SHORE Visual 4.1

UNIT 4 – CAPSTONE QUIZ

Identify which of the three primary data entry modules would most commonly be used for updating data and testing new scenarios

Identify which two variables may be adjusted in the Evacuation Vehicles module / Clearance Time worksheet

MARYLAND WESTERN SHORE Visual 4.8

UNIT 4 – SUMMARY

While the three primary data entry modules; Socioeconomic, Behavioral, and Out Route Assignment, can all be modified by users, the Socioeconomic Data would most likely be accessed to adjust for common changes such as population growth

The Clearance Time worksheet may be adjusted to account for changes in service volumes on critical roadway segments as well as for anticipated background traffic

MARYLAND WESTERN SHORE Visual 4.9

UNIT 5

Data Results Modules

DEMONSTRATION II

EXERCISE I

MARYLAND WESTERN SHORE Visual 5.1

UNIT OBJECTIVES

Understand the structure of the three primary data results modules

- Evacuation Statistics module
- Shelter Demand and Capacity module
- Evacuating Vehicles module

Interpret the data results portion of the Out Route Assignments module

Understand the connection between the Clearance Times worksheet and the HES's Clearance Times table

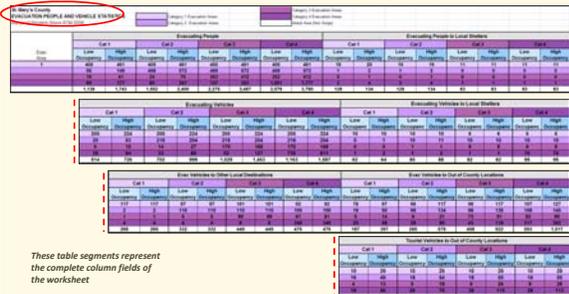
Demonstrate proficiency in using the full ATM in support of a facilitated table top exercise

MARYLAND WESTERN SHORE Visual 5.2

EVACUATION STATISTICS MODULE

Save a copy of the ATM as "MD ATM Demonstration II"

Navigate to "St. Mary's EvacStats" worksheet

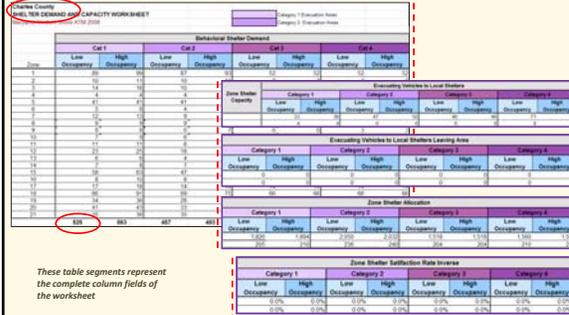


These table segments represent the complete column fields of the worksheet

MARYLAND WESTERN SHORE Visual 5.3

SHELTER MODULE

Navigate to "Charles Shelter" worksheet



These table segments represent the complete column fields of the worksheet

MARYLAND WESTERN SHORE Visual 5.4

UNIT 5 – CAPSTONE QUIZ

Identify which module includes information about the total number of evacuees or vehicles for a County

Identify which other worksheets are affected if changes are made in the Out Route Assignment Module

Explain how the clearance times at regional and local bottlenecks are used to determine a County clearance time

MARYLAND WESTERN SHORE Visual 5.11

UNIT 5 – SUMMARY

The Evacuation Statistics module includes summary information on the total number of evacuating people and vehicles for a County

Changes made in the Out Route Assignment Module also reflected in the three worksheet that make up the Evacuating Vehicles Module; the Evacuating Vehicles by Bottleneck/Critical Roadway Segment, the Clearance Time, and the Results worksheet.

The least efficient (worst) clearance time at regional or local bottlenecks along a county's primary evacuation routes determines its clearance time.

MARYLAND WESTERN SHORE Visual 5.12

UNIT 6

Using ATM clearance time results in HURREVAC

EXERCISE II

MARYLAND WESTERN SHORE Visual 6.1

DIRECT TO POINT

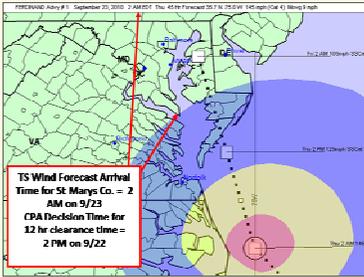
Direct to Point (DTP)
Evacuation Timing Assumptions



MARYLAND WESTERN SHORE Visual 6.2

CLOSEST POINT OF APPROACH

Closest Point of Approach (CPA)
Evacuation Timing Assumptions

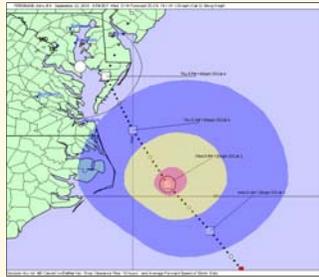


TS Wind Forecast Arrival Time for St. Marys Co. = 2 AM on 9/22
CPA Decision Time for 12 hr clearance time = 2 PM on 9/22

MARYLAND WESTERN SHORE Visual 6.3

DECISION ARC

Decision Arc
Evacuation Timing Assumptions



MARYLAND WESTERN SHORE Visual 6.4



EXERCISE II

This participant exercise should take 10 minutes to complete

Participants will be expected to navigate ATM and integrate its results into the HURREVAC

Participants will use the ATM data to determine the timing of initiating hurricane evacuations in relation to forecast tropical storm wind arrival times

Remember - Work from the copy of the ATM saved as "MD ATM Exercise II"

MARYLAND WESTERN SHORE Visual 6.5



UNIT 6 – CAPSTONE QUIZ

Identify the two major assumptions relative to evacuation decision timing and the approach of the storm

Use the tools in HURREVAC to determine when to start an evacuation based on the DTP assumption

Use the tools in HURREVAC to determine when to determine start an evacuation based on the CPA assumption

MARYLAND WESTERN SHORE Visual 6.6



UNIT 6 – SUMMARY

There are two methods to determining the evacuation decision time for a community based on the ATM clearance times.

The DTP assumption relative to the storm approach provides the safest results in calculating a decision time for a community, especially if it is in the average forecast error cone.

The CPA methodology for evacuation decision making assumes that a hurricane will follow along the forecast track in an advisory.

Many of the ATM clearance times are pre-loaded into HURREVAC for use in decision making by state and local emergency management staff.

Despite the pre-loaded clearance times in HURREVAC, there are tools within the program which allow specialized scenario results from the ATM to be used for decision making, including setting up a timeline and using the **Optional Safety Buffer** in the **Set Evac Options** function.

MARYLAND WESTERN SHORE Visual 6.7



UNIT 7

Course Summary

MARYLAND WESTERN SHORE Visual 7.1



REVIEW OF UNITS – UNIT 2

The Draft 2009 MD Western Shore HES / TDR provides estimates of clearance times and includes an ATM

The seven steps in the evacuation modeling process include;

- Step 1: Establish Evacuation Zones
- Step 2: Establish Evacuation Roadway Network
- Step 3: Collect Demographic and Behavioral Data
- Step 4: Generate Evacuation Statistics
- Step 5: Distribute Evacuation Trips
- Step 6: Identify Vehicles by Roadway Segment
- Step 7: Calculate Clearance Times

Clearance time is the time between when the first person leaves their home until the last person reaches their destination. It includes mobilization time, travel time and queuing time delay. Evacuations must be completed prior to tropical storm force (39 mph) winds

MARYLAND WESTERN SHORE Visual 7.2



REVIEW OF UNITS – UNIT 3

The Excel-based platform is assessable and easy to use. The model provides reliable results and allows users to test different scenarios.

The six functional groupings of worksheets or modules include;

- Demographic Data Module** (8 jurisdictional worksheets - 7 counties, 1 city)
- Behavioral Data Module** (8 worksheets)
- Out Route Assignment Module** (9 worksheets - 8 jurisdictions, 1 summary sheet)
- Shelter Demand and Capacity Module** (8 worksheets)
- Evacuation Statistics Module** (8 worksheets)
- Evacuating Vehicles Module** (Vehicles by Road, Clearance Times, Results)

The clearance time table is consulted to identify the regional bottlenecks with the worst clearance times. If a significant portion of a County's evacuating traffic passes through this bottleneck, based on the data in the Out Route Assignment Module, that governing bottleneck will determine the county clearance time

MARYLAND WESTERN SHORE Visual 7.3



REVIEW OF UNITS – UNIT 4

While the three primary data entry modules; Socioeconomic, Behavioral, and Out Route Assignment, can all be modified by users, the Socioeconomic Data would most likely be accessed to adjust for common changes such as population growth

The Clearance Time worksheet may be adjusted to account for changes in service volumes on critical roadway segments as well as for anticipated background traffic

MARYLAND WESTERN SHORE Visual 7.4



REVIEW OF UNITS – UNIT 5

The Evacuation Statistics module includes summary information on the total number of evacuating people and vehicles for a County

Changes made in the Out Route Assignment Module also reflected in the three worksheet that make up the Evacuating Vehicles Module; the Evacuating Vehicles by Bottleneck/Critical Roadway Segment, the Clearance Time, and the Results worksheet.

The least efficient (worst) clearance time at regional or local bottlenecks along a county’s primary evacuation routes determines its clearance time.

MARYLAND WESTERN SHORE Visual 7.5



REVIEW OF UNITS – UNIT 6

There are two methods to determining the evacuation decision time for a community based on the ATM clearance times.

The DTP assumption relative to the storm approach provides the safest results in calculating a decision time for a community, especially if it is in the average forecast error cone.

The CPA methodology for evacuation decision making assumes that a hurricane will follow along the forecast track in an advisory.

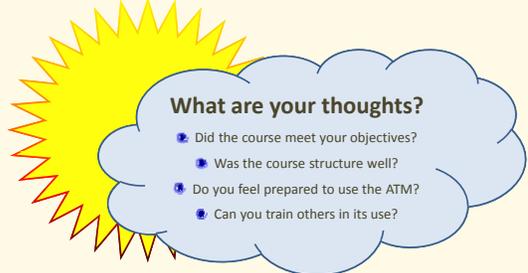
Many of the ATM clearance times are pre-loaded into HURREVAC for use in decision making by state and local emergency management staff.

Despite the pre-loaded clearance times in HURREVAC, there are tools within the program which allow specialized scenario results from the ATM to be used for decision making, including setting up a timeline and using the **Optional Safety Buffer** in the **Set Evac Options** function.

MARYLAND WESTERN SHORE Visual 7.6



PARTICIPANT OBSERVATIONS



What are your thoughts?

- Did the course meet your objectives?
- Was the course structure well?
- Do you feel prepared to use the ATM?
- Can you train others in its use?

MARYLAND WESTERN SHORE Visual 7.7



COURSE EVALUATION

Participant observations and feedback will be collected for inclusion in a Workshop Evaluation Report

The course will be evaluated using the web-based evaluation tool, Survey Monkey

Participants will be provided with a web link to complete the evaluation on line

Instructors will prepare an evaluation report including a list of attendees, description of obstacle, keys to success and a compilation of evaluation survey results

MARYLAND WESTERN SHORE Visual 7.8



CLOSING

Close out of the ATM application and HURREVAC

Ensure you were registered on the sign in sheet

Complete the web-based evaluation

Retain all participant course materials

Use the ATM in your emergency management planning and operations duties

Train others in its use

MARYLAND WESTERN SHORE Visual 7.9



DEMONSTRATION I:

You are an emergency manager interested in updating plans for Baltimore County, Maryland. Time has passed since the last time the ATM was used and you have concerns regarding changed local conditions. You understand that the County's critical roadway segment is at the Francis Scott Key Bridge Southbound. You are interested in whether these changing conditions may affect the clearance times.

Address the following by modifying your ATM.

- 1) In recent months there has been significant and marked increase in commercial development in your County. A series of convention-focused hotel units have been built. These buildings have contributed to additional units in the following zones:
 - a. 1000 additional tourist units in zone 4 in category 1
 - b. 1200 additional tourist units in zone 6 in category 1
- 2) Due to a new factory opening and resultant job opportunities, the following zones have seen growth in permanent dwelling units:
 - a. Zone 19, 300 new units in each of the category 1 - 4 and the inland areas
 - b. Zone 20, 500 new units in both the category 1 and 2 zones
- 3) You have obtained new data that suggests that the vehicle per tourist unit estimate of 1.05 is low. It should be changed to be 2.0 across the board.
- 4) Due to road construction, the directional service volume at I-70 Westbound from I-695 to the Howard County line has been reduced by half. Construction at the Francis Scott Key Bridge has also reduced the service volume there to 2830 vehicles.
- 5) Due to a major political convention, the background traffic levels need to be increased by 1,000 vehicles at all of the County's bottlenecks.

It is Wednesday, June 23. You are concerned primarily about what the impacts of a moderate level Category 2 storm might be. Based on these changes, answer the following questions:

Question 1: What is the new clearance time for this scenario at the Francis Scott Key Bridge? Has it gone up?

Question 2: How do things look at I-70 Westbound from I-695 to the Howard County line?

Question 3: Has the clearance time for the City of Baltimore been affected?

DEMONSTRATION II:

You are an emergency manager with responsibilities that include or extend to Charles County, Maryland. While you use HURREVAC, you are interested in checking some of your evacuation statistics as well as the anticipated traffic volumes along different evacuation routes that individuals departing from your county may use.

Answer the following question by navigating through and interpreting the data in your ATM.

Question 1: For evacuation zone 8 in a category 3 event;

- a. What is the default tourist occupancy rate in February?
- b. What is the default tourist occupancy rate in July?
- c. Which worksheet would need to be changed in order to adjust these defaults?

Question 2: In a category 3 storm, what is number of evacuating vehicles;

- a. Countywide, in February?
- b. Countywide, in July?
- c. That may be expected to evacuate to a local shelter in July?
- d. That may be expected to evacuate to another local destination in July?

Due to the limited number of southbound out-routes, evacuating traffic from Charles County must rely heavily on the use of the bridge at 301 Southbound over the Potomac. As part of a hazards analysis you are conducting, you have listed this bridge as a critical regional transportation facility. You would like to better understand how the bridge might influence your local evacuation planning.

Based on this description of events, answer the following questions:

Question 3: Identify the total number of evacuating vehicles expected to travel on through the listed bottleneck during a Category 3 storm occurring in July;

- a. At US 301 between SR 5 and Waldorf
- b. At the US 301 bridge over the Potomac river to VA

Question 4: In the same storm scenario (Category 3, high tourist occupancy) what is the clearance time;

- a. At US 301 between SR 5 and Waldorf
- b. At the US 301 bridge over the Potomac river to VA

Question 5: In the same storm scenario, understanding that the bottlenecks listed may not represent the final destinations of evacuees from Charles County,

- a. Which of these bottlenecks exhibits the highest clearance time?
- b. What is the estimated County clearance time, assuming a medium response rate, for Charles County?
- c. What is the estimated County clearance time, assuming a rapid response rate, for Charles County?

EXERCISE I:

You are an emergency manager with the Maryland Office of Emergency Management. It is August 1, 2010. While it has been a somewhat active season, with 5 named storms so far, none have actively threatened the Eastern United States. Your EOC has not been activated yet this hurricane season in response to any of these threats.

Part 1: This part of the exercise will test your ability to use the ATM to find and record data.

Inject: It is August 6. A wave that formed off of Africa at the beginning of the month has solidified and has reached tropical storm intensity. It has been named TS Ferdinand. Various early models show the storm track making landfall anywhere between Knott's Island, North Carolina and Sandy Hook, New Jersey.

In order to begin incident action planning, you have been asked to begin to compile some basic information about evacuees and routes.

Answer the following questions by navigating through and interpreting the data in your ATM.

Question 1.1:

What is the default rate for high tourist occupancy for Anne Arundel, Baltimore, Calvert and Charles counties?

Question 1.2:

What is the number of potential evacuees from each of those four counties?

| | <u>Cat 1</u> | <u>Cat 2</u> | <u>Cat 3</u> | <u>Cat 4</u> |
|--------------|--------------|--------------|--------------|--------------|
| Anne Arundel | | | | |
| Baltimore | | | | |
| Calvert | | | | |
| Charles | | | | |

Question 1.3:

In order to plan possible traffic diversion measures, what are the clearance times on I-95 at the following bottlenecks?

| | <u>Cat 1</u> | <u>Cat 2</u> | <u>Cat 3</u> | <u>Cat 4</u> |
|---|--------------|--------------|--------------|--------------|
| Between I-895 and I-695 | | | | |
| At the interchange of I-95 and I-895 at Exit 57 | | | | |
| I-95 N from SR 155 to Cecil Co. | | | | |
| I-95 at I-95/495 interchange | | | | |

Part 2: **This part of the exercise will test your ability to modify input data in the ATM and interpret the results.**

Inject: After providing the information to your superiors, you were alerted to some changed conditions. You are concerned that these conditions may impact the clearance time calculations and want to modify the ATM to quantify the impacts.

You will be asked to address the changed conditions by making specific changes in the ATM. Answer the following questions by navigating your ATM, modifying data as required, and interpreting the results.

Based on updated local tourism information, the average vehicles per unit for Calvert County should be 1.82 vehicles per unit.

Building official's data recorded several new developments in Charles County, (evacuation area 9). Based on your information, there should be an additional 500 permanent units in the category 1 zone, 100 units added in the category 2 zone and 1,000 units added to the category 3 zone.

Because so many evacuees will utilize I-95, you contacted your traffic operations specialists and found out that there is some minor construction at the bottleneck at I-95 between I-895 and I-695. You feel that to be prudent you should reflect that this facility is operating at a service volume of 4000 vehicles.

Question 2.1

What impact, if any, do these changes cause to clearance times at the following bottlenecks?

| | <u>Cat 1</u> | <u>Cat 2</u> | <u>Cat 3</u> | <u>Cat 4</u> |
|---|--------------|--------------|--------------|--------------|
| Between I-895 and I-695 | | | | |
| At the interchange of I-95 and I-895 at Exit 57 | | | | |
| I-95 N from SR 155 to Cecil Co. | | | | |
| I-95 at I-95/495 interchange | | | | |

Question 2.2

Which bottleneck demonstrates the greatest increase in clearance times as a result of these changes?

Question 2.3

What impacts would these changes have on the County Clearance times for Baltimore County? What about Charles County?

| | <u>Cat 1</u> | <u>Cat 2</u> | <u>Cat 3</u> | <u>Cat 4</u> |
|-------------|--------------|--------------|--------------|--------------|
| SR 5 at 301 | | | | |

Part 3: This part of the exercise will test your ability to find and interpret data in the ATM.

Inject: It is August 11. Ferdinand has maintained its storm track and has been consistently intensifying. The storm is now clocking 165 mph winds. While the models predict that the storm remains up to a week away from any potential landfall, your office is monitoring the storm closely.

Because this storm could result in a mandatory evacuation in your state, you are interested in finding out more information about route details and sheltering capacity along a potentially congested evacuation route.

Answer the following questions by navigating through and interpreting the data in your ATM.

Remember, these questions relate to a Category 4 intensity storm.

Question 3.1

What is the clearance time for Anne Arundel County, medium response?

What is the determining bottleneck?

Question 3.2

You anticipate that if your region calls an evacuation order, so will the Delmarva counties, which would add significant traffic into Anne Arundel County. What is the clearance time, medium response, for the County once Delmarva traffic impacts are factored in?

How does this compare to the clearance time without this additional traffic factored in?

With the Delmarva traffic factored in, what is the critical bottleneck for determining the County clearance time?

Part 4: This part of the exercise will test your ability to interpret the ATM results and its basic assumptions

Inject: It is August 15. Ferdinand has shifted slightly north-northwest and appears on track to make landfall in your state. While the storm has weakened to a category 4, it is still a very significant major hurricane. The models predict that the storm could make landfall in two to three days. Your EOC is fully activated.

It is likely that you Governor will call for a mandatory evacuation. You are concerned that the evacuation order may come late and that tourists may not comply since the weather at the shore has been perfect.

Answer the following questions by working with and interpreting the data in your ATM

Question 4.1

After consulting the ATM you noted that the total number of evacuating people from Anne Arundel County in this event would be approximately 139,000. The county has a population of over 510,000. Why is the evacuating population so much lower than the total population. In a Category 4 storm, shouldn't the entire population evacuate? Why or why not?

There are a number of bridges that will be shut down once surface winds reach 55 mph. How will this affect clearance times on routes that include these bridges?

Question 4.2

As you predicted, a mandatory evacuation was called. It appears as though the storm may make landfall within the next 24 hours. There has been considerable rainfall. Some planners have discussed using the SLOSH model output for a Category 4 hurricane to account for the rainfall associated with this expected Category 3.

Could the ATM be used to determine clearance times in this case? If so, how?

EXERCISE II:

Part 1: **This part of the exercise will test your ability to use HURREVAC to determine when your community must begin an evacuation in order to ensure all vehicles have cleared the most critical bottleneck before the forecast arrival of tropical storm force winds.**

Inject: It is September 21 at 11 PM and an advisory has just been issued. Hurricane Ferdinand is approaching the shores of the Mid-Atlantic States as a category 3 hurricane. The forecast has the hurricane intensifying to a category 4 before it makes landfall with sustained winds increasing from 120 to 145 MPH before landfall.

You are an emergency manager with the Maryland Emergency Management Agency. The entire Maryland coastline is in the average forecast error cone and some of your communities are getting close to having to make their decisions to initiate their evacuations.

In order to assist the communities along the coast with their evacuation decisions you have been asked to determine what time evacuations need to be started for all communities in the average forecast error cone.

Answer the following questions by navigating through the HURREVAC program and interpreting the results for the 11 PM, September 21st advisory.

Question 1.1:

Which county from the Western Shore will need to start their evacuation first, based on the default forecast intensity selected by HURREVAC for the DTP assumption, and at what time?

Question 1.2:

Based on the DTP clearance time table how much time does the ATM indicate will be needed to safely evacuate all the community's vulnerable residents, and at what date and time should the evacuation begin for that community?

Question 1.3:

What other county on the Maryland Western Shore is next in having to make its decision to evacuate, based on the ATM clearance times in HURREVAC, and at what time should they begin?

Part 2: **This part of the exercise will test your ability to modify input the clearance time data in HURREVAC in accordance with new data from the ATM and interpret the results.**

Inject: After providing the information to your superiors, you were informed that some construction issues on US 50 westbound will have a negative impact on the critical link for Anne Arundel County, and hence its clearance times. After running the ATM you discover that an additional 4 hours above the regular Cat 4 default clearance time will be needed to conduct the evacuation.

Question 2.1

Given the additional time needed to conduct the evacuation for Cape May County, at what time should the evacuation start?

Question 2.2

How many hours from the current advisory issuance period does Cape May County have to complete setting up and make the decision to evacuate?

Part 3: This part of the exercise will test your ability to use the HURREVAC Timeline function to determine evacuation start times from new clearance time data developed by the ATM, rather than pre-loaded clearance times.

Inject: As the emergency management director of Baltimore County, you are looking at the 5 AM Hurricane Ferdinand advisory issued on September 22nd. Using the ATM, you calculate that very low participation rates among your coastal and mobile residents will reduce your cat 4 clearance times in HURREVAC to 7 hours, rather than 10 hours.

Answer the following questions by navigating through and interpreting the data in HURREVAC using the DTP evacuation timing decision support tables.

Question 3

At what time should the evacuation begin for Baltimore County based on the current advisory and new evacuation scenario of 7 hours and is this a good time to initiate an evacuation?

Part 4: This part of the exercise will test your ability to conduct the same clearance time analysis for another advisory and using other evacuation scenarios.

Inject: At 5 PM on September 22nd the National Hurricane Center has just issued another advisory which includes further adjustments to the forecast track. While serving in the Maryland State EOC you receive a call from the Harford County emergency management director seeking advice on when they should consider starting their evacuations. The director also informs you that they are

considering evacuating to a category three because the storm would probably degrade as it traverses the DelMarVa Peninsula.

Answer the following questions by navigating through and interpreting the data in HURREVAC using the DTP evacuation timing decision support tables.

Question 4.1

At what time should the evacuation begin for Harford County based on the current advisory and a cat 3, medium response, medium tourist occupancy scenario and how many hours in the future should the evacuation begin?

Question 4.2

Would this be a good time to start an evacuation?

What would be your recommendation to the Hudson County EM director relative to when the community might consider issuing an evacuation order?

Part 5: **This part of the exercise will test your ability to use the CPA approach in HURREVAC to determine the forecast arrival time of tropical storm force winds for evacuation decision making.**

Inject: It is 11 PM on September 22nd and the outer bands of Ferdinand are just off the coast of Chincoteague, VA. The NHC is confident at this point that the storm will make landfall in the vicinity of Delaware Bay and will re-curve toward the northeast before it reaches the Chesapeake Bay. At that time the director of Charles County emergency management office calls to discuss his primary concerns regarding the protective actions for the mobile home population in his community and the fact that the participation rate in the category 1 evacuation areas could be very low.

He asks for your advice on when he should begin to conduct his evacuation in his county given the variables input into the ATM relative to the situation. Their new clearance time is only 4 hours, significantly less than their posted clearance times. He wants to know if he has enough time to conduct the evacuation between the 5 AM advisory the next morning and the forecast arrival of tropical storm force winds,

Answer the following questions by working with and interpreting the data in HURREVAC.

Question 5

With a newly computed 4 hour clearance time from the ATM, when should they begin their limited evacuation based on the forecast track of the storm?

Part 6: **This part of the exercise will test your ability to use the Decision Arc method in determining when to begin an evacuation based on a CPA assumption and clearance time data from the ATM.**

Inject: It is still just after the 11 PM on September 22nd and you have just hung up the phone with Charles County. Baltimore City, given the NHC confidence in the recurve track forecast, has decided to conduct a limited evacuation involving just the cat 2 evacuation zones and mobile homes. The Baltimore City emergency management director is seeking advice on when he can start a limited evacuation of the cat 2 zones.

This situation when plugged into the ATM revealed that the clearance time will be 8 hours or synonymous with a cat 2 scenario, medium tourist occupancy and public response.

Answer the following questions by working with and interpreting the data in HURREVAC.

Question 6

With newly computed data from the ATM which matches the clearance time for a category 2 scenario with medium tourist occupancy, as well as medium public response rates when should they begin their evacuation based on the forecast track of the storm?