Planning for the Threat
Hurricane Evacuation Decision Making

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Decision Making in the Face of Uncertainty

Key Questions:

Will we be impacted by the storm, and if so when? For how long?

How much coastal flooding and where?

What about wind and inland flooding from rain?

Who do we need to evacuate?

When does the evacuation need to start and how long will it take?

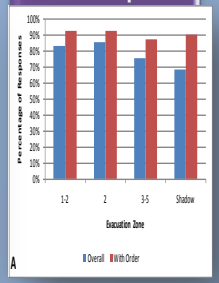
HES and NHC/NWS products assist/support you with evacuation decision making

Hurricane Evacuation Studies (HES)

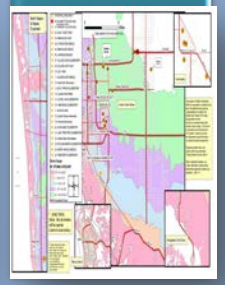
Hazards Analysis
- SLOSH Model Development
- Surge MOMS

Vulnerability Analysis
- **Identify at Risk:**
- Populations
- Infrastructure
- Critical Facilities

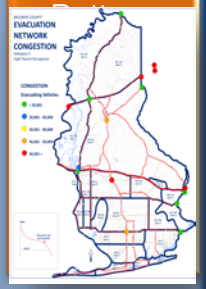
Behavioral Analysis
- Public Survey
- Analysis of Survey Responses
- Results for Input



Shelter Analysis
- Determining the Shelter Need
- Estimate Number of Shelter Spaces
- Potential



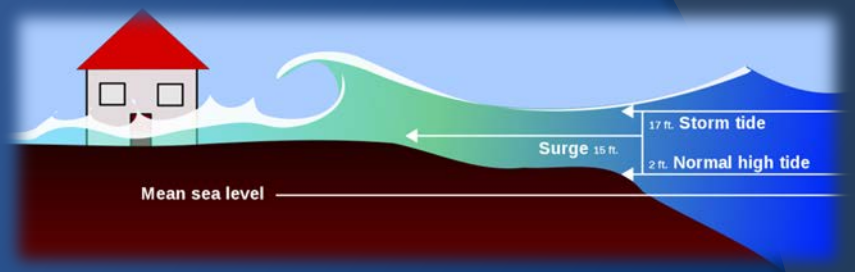
Transportation Analysis
- Analysis of Traffic Volumes, Evac. Routes, and Destinations
- Traffic



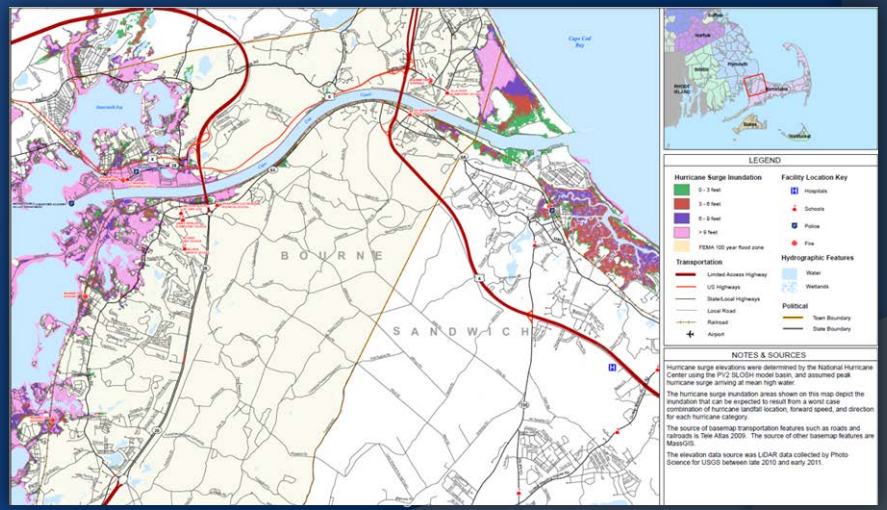
Critical Information for Planning and Response…

Hazards Analysis

Understanding Storm Surge Potential



- Storm surge has the highest potential for death and damage
- Storm surge is the main reason we evacuate the coast
- Worst Case Scenario Surge Maps used to assess risk in your community

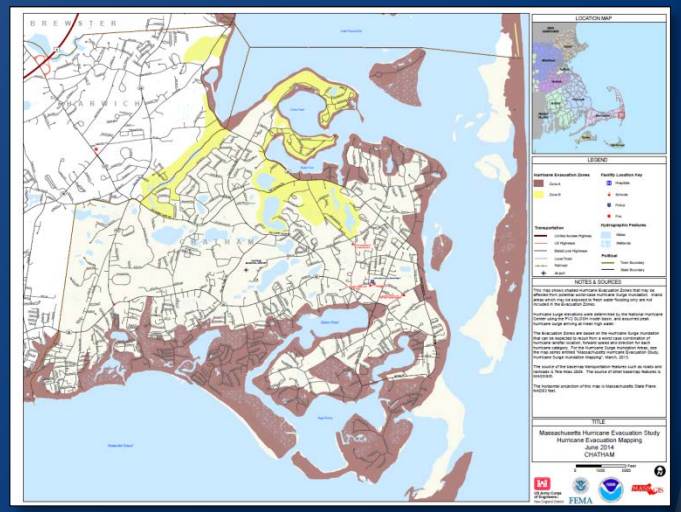


Analysis: **Hazard** Vulnerability Behavioral Shelter Transportation
Products: Surge Maps Evacuation Zones Planning Data Clearance times

Evacuation Zones

"Know Your Zone"

- Communicate risk to the public
- Communicate evacuation orders by zone
- Must use evacuation zones from HES or clearance times will not be valid!



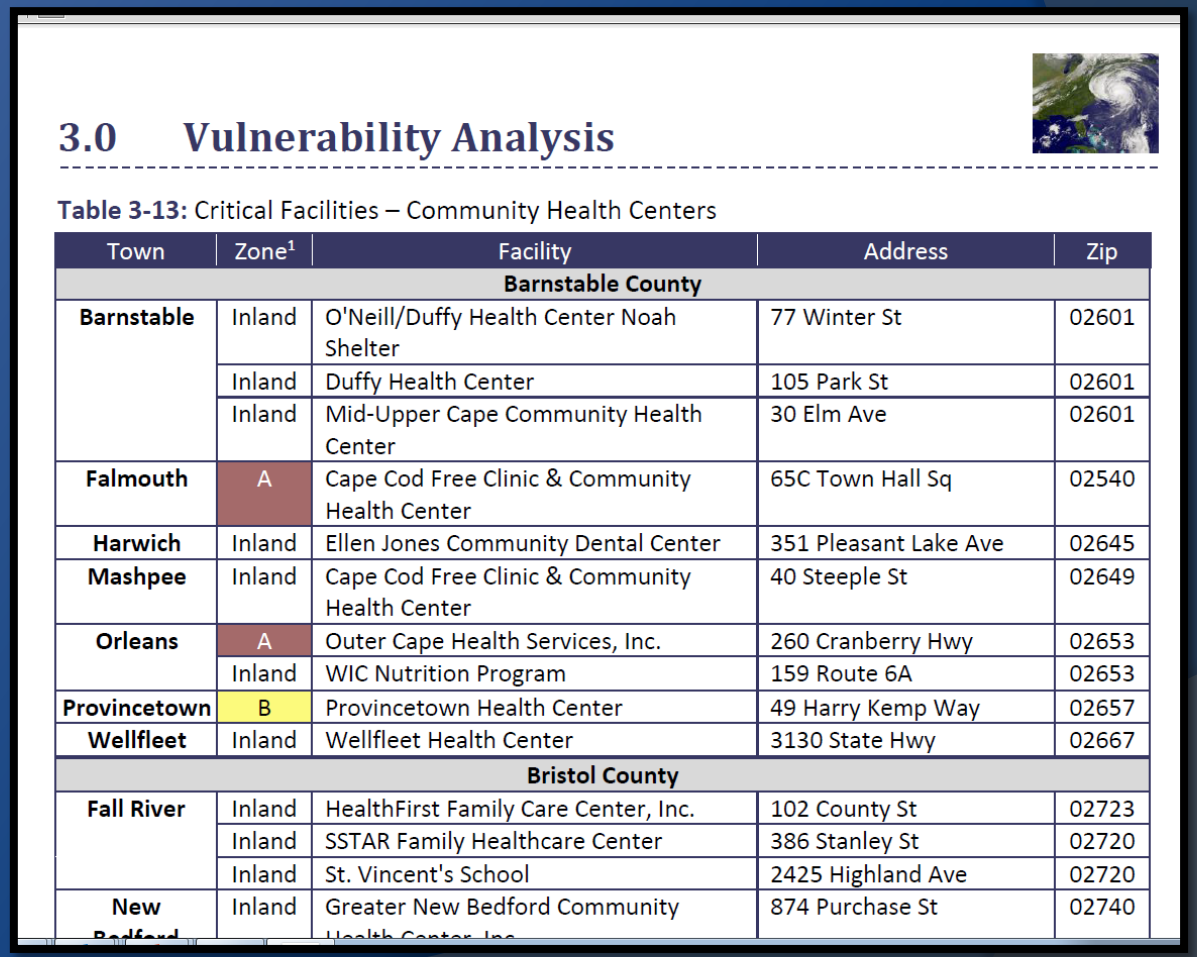
Analysis: Hazard Vulnerability Behavioral Shelter Transportation

Products: Surge Maps **Evacuation Zones** Planning Data Clearance times

Vulnerability Analysis

Who may need to evacuate and What is at risk

- Citizens residing in surge prone areas
- Critical facilities
- Mobile/Manufactured home communities
- Vulnerable shelters
- Colleges/Universities



3.0 Vulnerability Analysis

Table 3-13: Critical Facilities – Community Health Centers

Town	Zone[1]	Facility	Address	Zip
Barnstable County				
Barnstable	Inland	O'Neill/Duffy Health Center Noah Shelter	77 Winter St	02601
	Inland	Duffy Health Center	105 Park St	02601
	Inland	Mid-Upper Cape Community Health Center	30 Elm Ave	02601
Falmouth	A	Cape Cod Free Clinic & Community Health Center	65C Town Hall Sq	02540
Harwich	Inland	Ellen Jones Community Dental Center	351 Pleasant Lake Ave	02645
Mashpee	Inland	Cape Cod Free Clinic & Community Health Center	40 Steeple St	02649
Orleans	A	Outer Cape Health Services, Inc.	260 Cranberry Hwy	02653
	Inland	WIC Nutrition Program	159 Route 6A	02653
Provincetown	B	Provincetown Health Center	49 Harry Kemp Way	02657
Wellfleet	Inland	Wellfleet Health Center	3130 State Hwy	02667
Bristol County				
Fall River	Inland	HealthFirst Family Care Center, Inc.	102 County St	02723
	Inland	SSTAR Family Healthcare Center	386 Stanley St	02720
	Inland	St. Vincent's School	2425 Highland Ave	02720
New Bedford	Inland	Greater New Bedford Community Health Center, Inc.	874 Purchase St	02740

Hurricane Behavioral Analysis

- Attitudes about risk from hurricane hazards – Primarily storm surge
- Evacuation intentions and past experiences
- Evacuation destinations
- Evacuation routes
- Sources of forecast information

Table 4-2: Perceived Vulnerability of Home – Believe Home would Flood Dangerously

Category 2			Category 3			Category 4		
A / 1-2	B / 3-4	Non-Surge	A / 1-2	B / 3-4	Non-Surge	A / 1-2	B / 3-4	Non-Surge
28%	18%	15%	46%	33%	25%	67%	54%	37%

Shelter Analysis

Understanding Shelter Need

Key Sheltering Information:

- Location/Identification
- Potential Shelter Demand
- Flood Risk
- Capacity
- ARC vs. Local Shelter
- Pet Friendly

Table 5-8: Public Sheltering Demand and Sheltering Capacity – Plymouth County

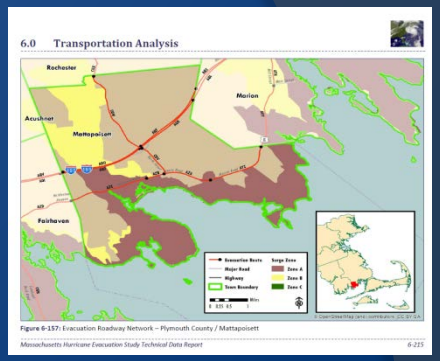
Community	Scenario A Low Occ	Scenario A High Occ	Scenario B Low Occ	Scenario B High Occ	Shelter Capacities*
Duxbury	203	216	331	347	0
Hingham	334	339	542	549	230
Hull	531	561	531	561	0
Kingston	178	183	304	311	2,910
Marion	215	231	233	249	0
Marshfield	799	839	915	956	0
Mattapoisett	169	193	214	239	0
Plymouth	531	629	1,178	1,341	2,918
Rochester	8	10	56	59	0
Scituate	393	424	518	553	0
Wareham	974	1060	1,070	1,163	0
Totals	**4,335**	**4685**	**5,892**	**6,328**	**6,058**

* Based on American Red Cross National Shelter Survey (NSS) database shelter capacities.

Transportation Analysis

Understand traffic congestion potential based upon evacuation decisions

- Traffic Patterns (bottle necks)
- Evacuating Vehicles



Clearance Time tables

Variables of:

- Response
- Population
- Evacuation Scenarios (one way, Multi state)
- Storm Category

Evacuation Clearance Times

Timeline

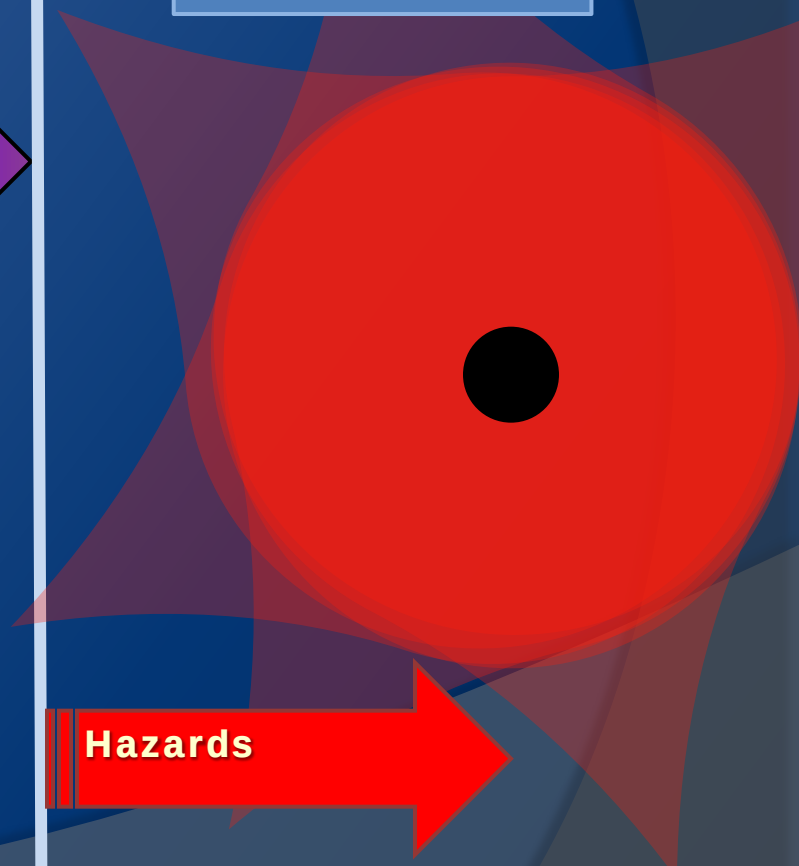
H= -48 H= -36 H= -24 H= -18 H= -12 H= -6 H=0 H=+6 H=+12 H=+18 H=+26

Evacuation Start Time

Forecasted Onset of TS winds or surge

Clearance Time = 48hrs

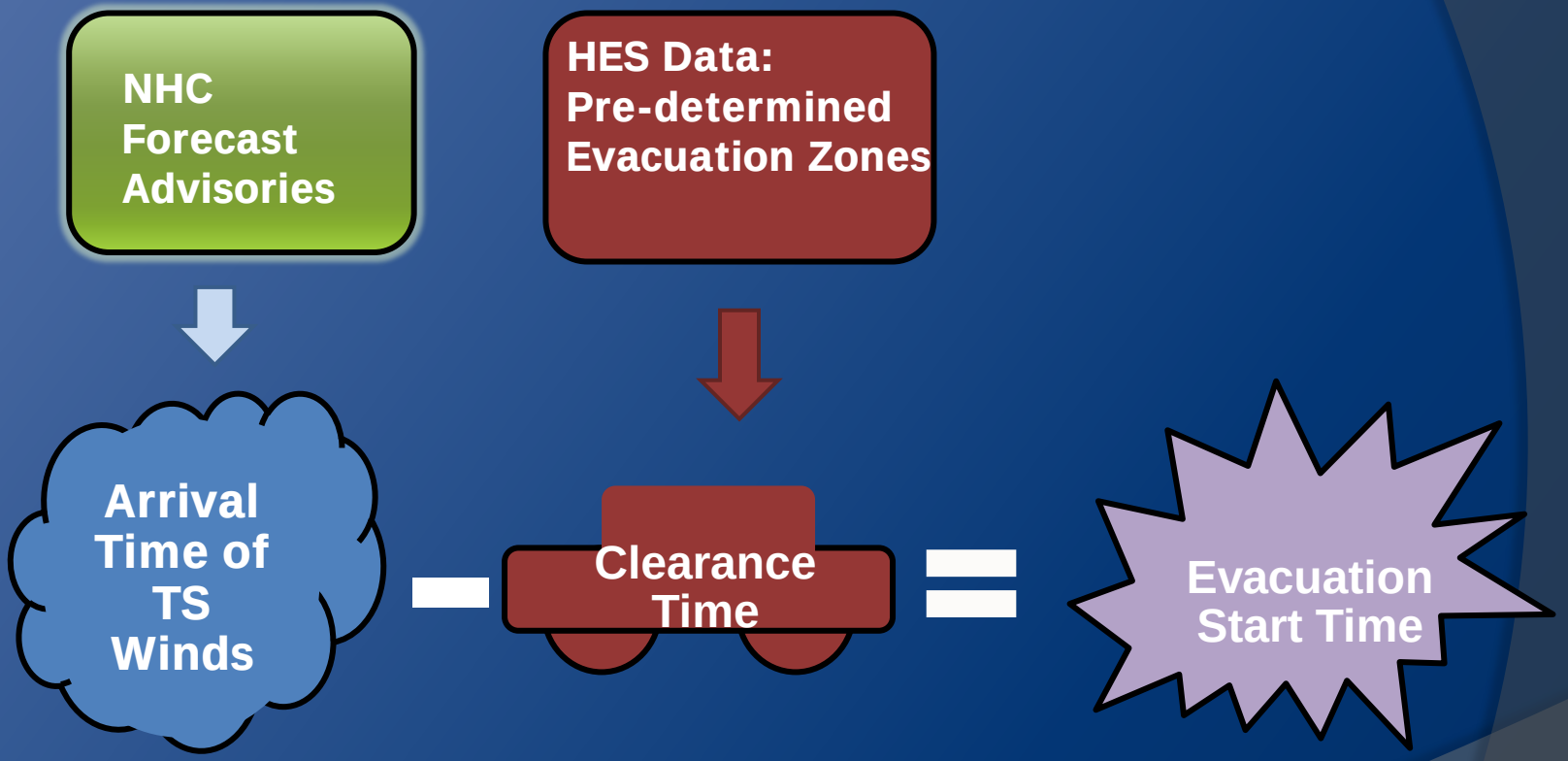
Begins when the first evacuating vehicle enters the road network, ends when the last vehicle reaches an assumed point of safety



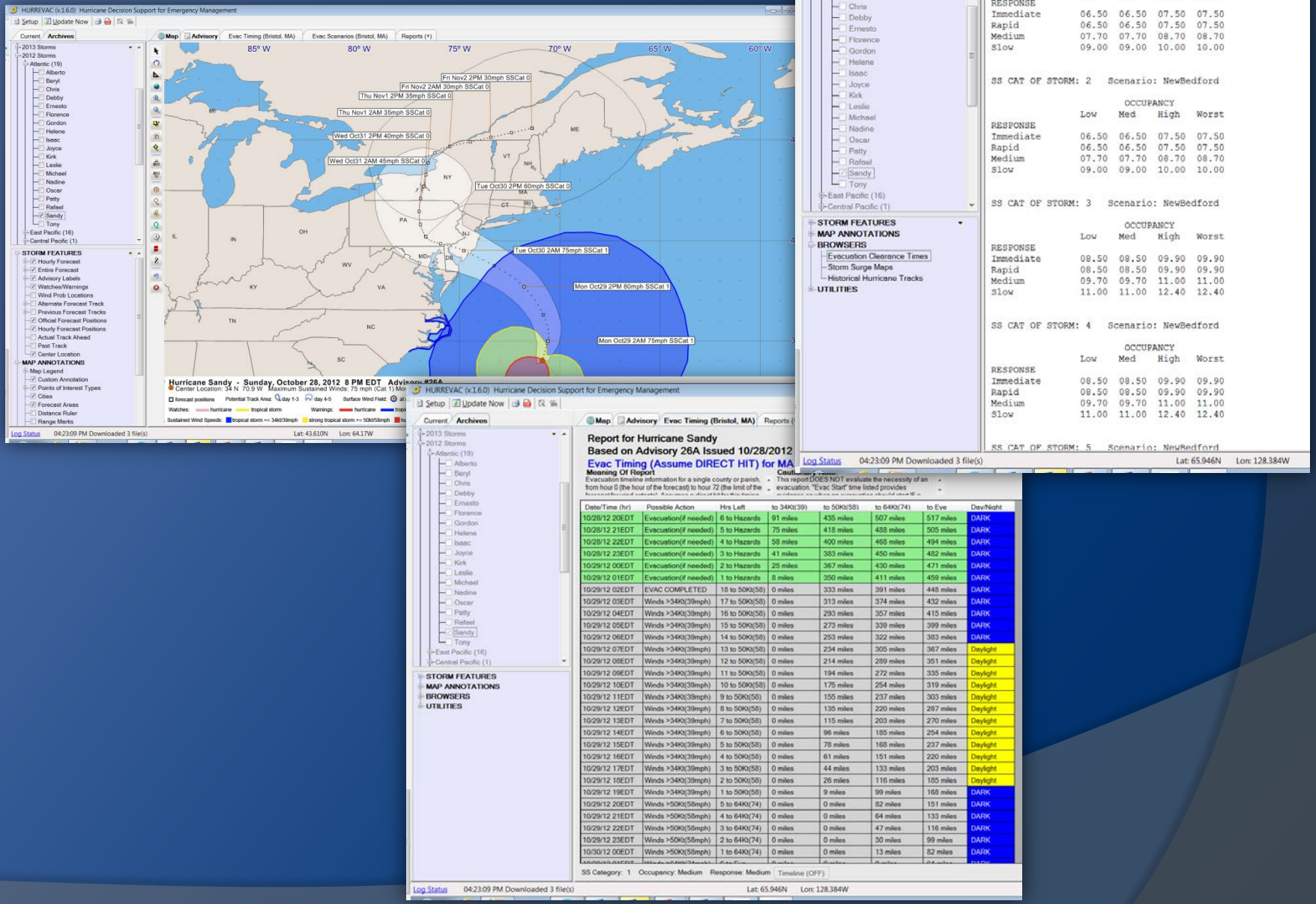
Analysis: Hazard Vulnerability Behavioral Shelter **Transportation**

Products: Surge Maps Evacuation Zones Planning Data Clearance times

Evacuation Decision Calculation



HES in HURREVAC



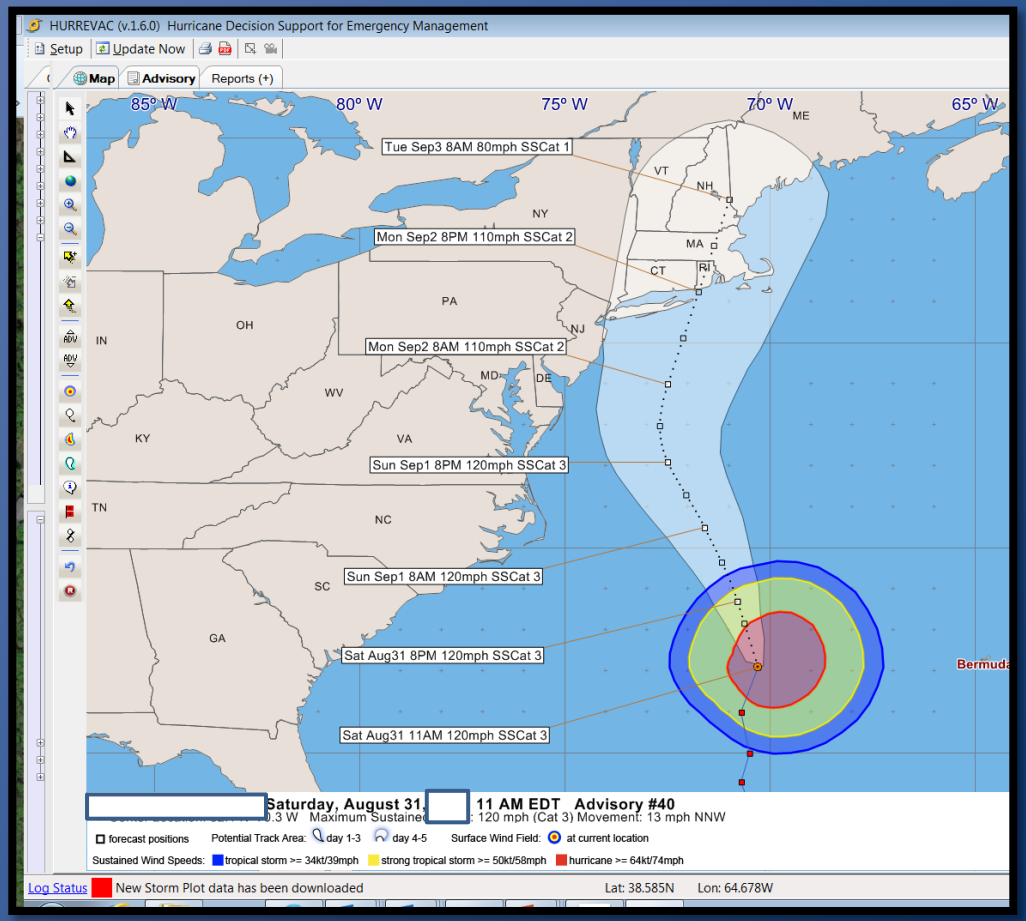
The Hurricane Evacuation Study:

Informs your plans with data from the 5 analysis

Supports your response operations by providing:

- **Information on which populations and facilities to evacuate**
- **Information on shelter risk capacity and demand**
- **Timing guidance in HURREVAC**
- **Clearance Times for specific storm scenarios**
- **Information on critical traffic bottlenecks and suggested traffic control points**

Hurricane Scenario



Advisory 40

Issued at 11AM

Saturday August 31st

Cat 3

Moving 13mph

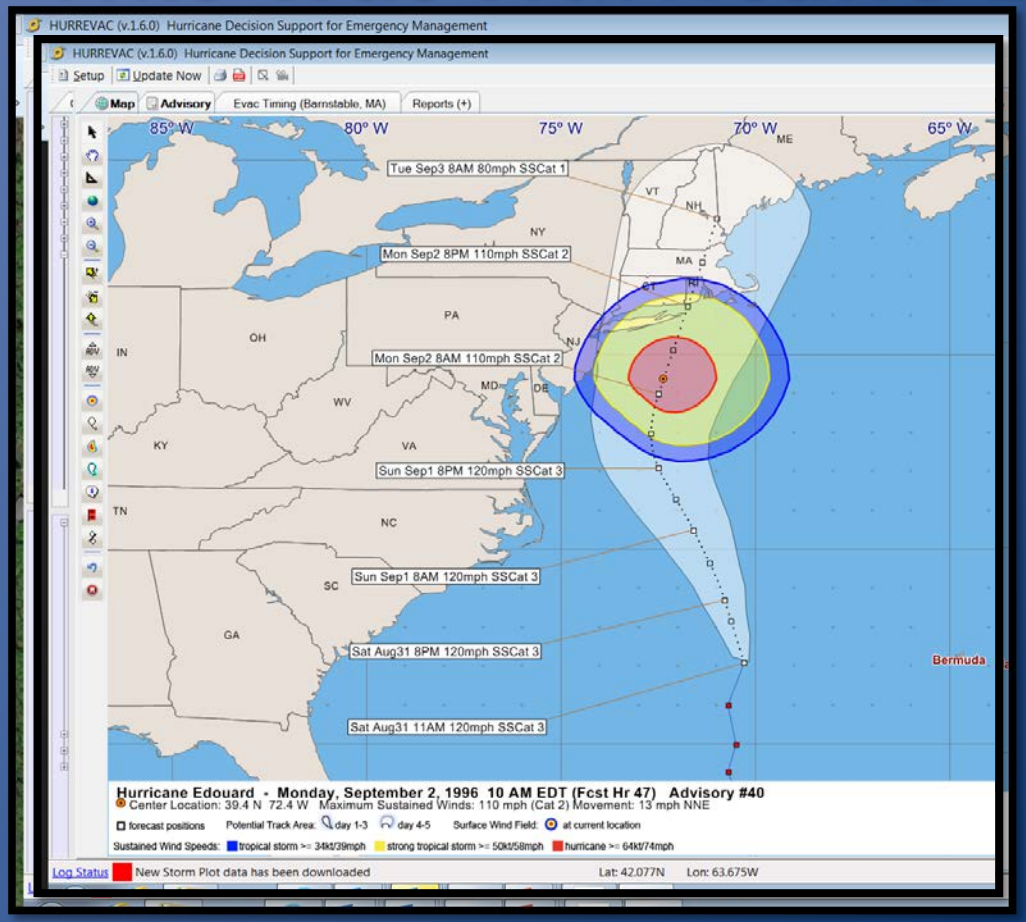
Center located off the coast of GA/SC

Assume a 24 hour CT

Lower/Outer Cape community

Mobilize response assets? Call for an evacuation? When do you take action?

This was Hurricane Edouard 1996

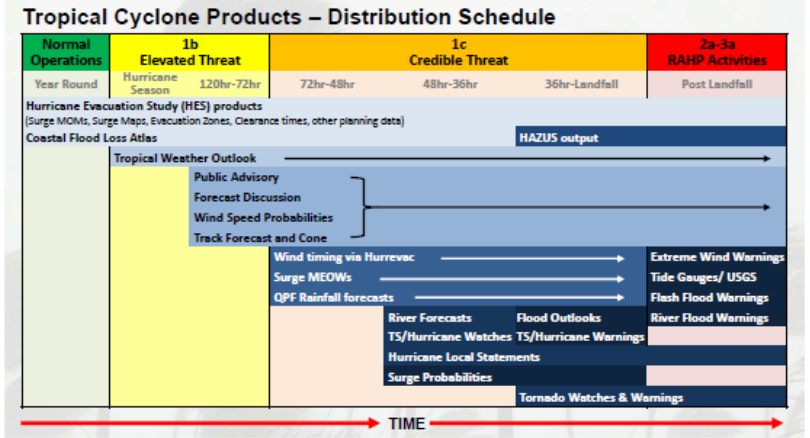


In this scenario, given a 24 hour Clearance Time, evacuations would have to begin early Sunday AM in order to be complete before the onset of TS force winds.

This would leave 24 hours from the issuance of this advisory to make an evacuation decision, notify the public, and mobilize response assets.

Key forecast products, clearance times and local planning factors guide Evacuation Decision Making and other Response Actions

Product Timelines
When is key information available?

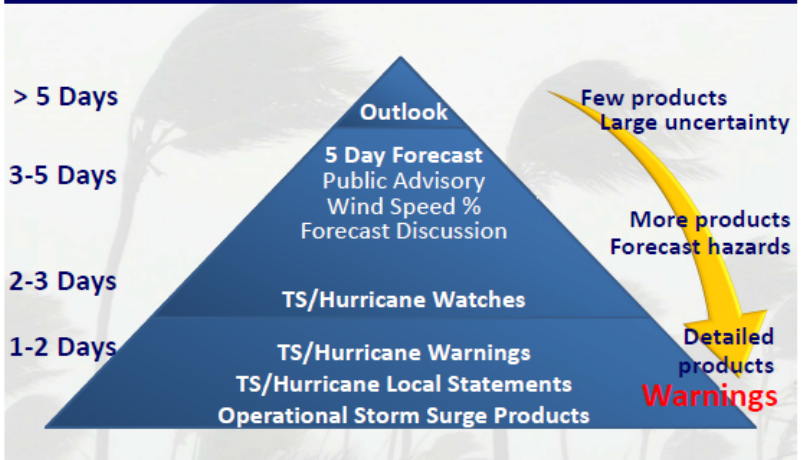


Activate EOC

Establish TCPs

CT from HES Begin Evacuation

National Weather Service
Tropical Cyclone Products



Cape Cod Emergency Traffic Plan Implementation and Stages…

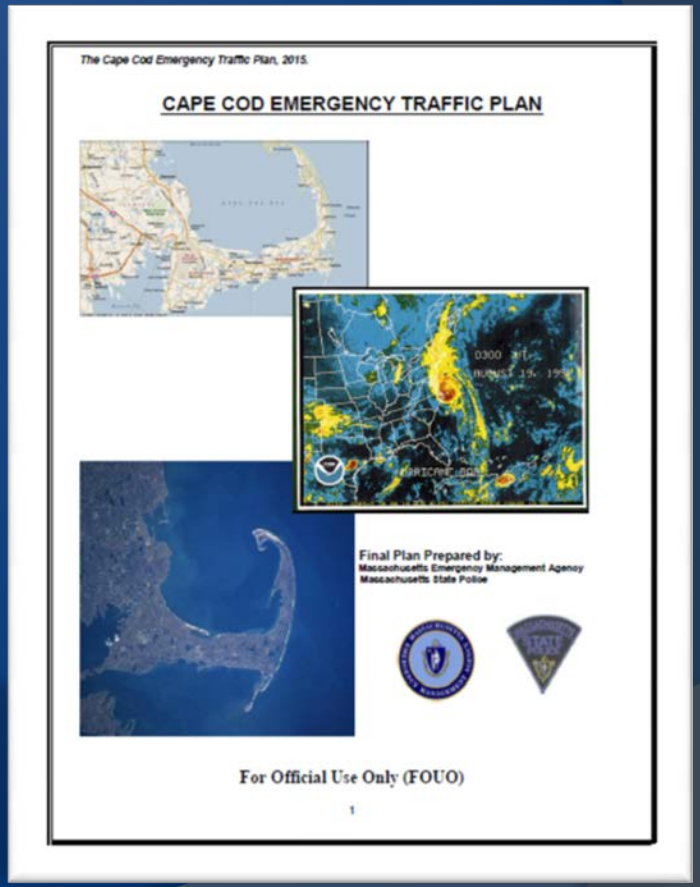
Cape Cod Emergency Traffic Plan (CCETP)

Multi-Jurisdictional Evacuation Procedure

Developed Following Hurricane Edouard

Primary Tasks

- **Evacuation on Route 6 and 28**
- **Shelter-of-Last Resort at JBCC**



CCETP Update - Purpose and Scope

Validate and update all traffic and traffic management related components of the Commonwealth of Massachusetts Cape Cod Emergency Traffic Plan (CCETP).”

Incorporate New Emergency Traffic Projections

- **Cape Cod Traffic Study (Pilgrim Nuclear) – Evacuation Time Estimates**
- **Hurricane Evacuation Study (FEMA and US Army Corp) – Evacuation Clearance Estimates**

Project Management Team

- **State Agencies, US Army Corp, National Guard, and Local Jurisdictions**

Emergency Traffic Management

There Is No Trick of Engineering or Traffic Management That Will Ease Traffic on The Cape During An Emergency Response

The Solution Lays with:

- **Understanding the Scope of the Response**
- **Executing Your Plan as Smoothly as Possible**
- **Giving Yourselves As Much of a Lead as Possible**
  - **Coordination**
  - **Communication**
  - **Staffing Up**
  - **Pre-Staging**

Understanding The Timeline you are Working Within

Cape Cod Emergency Traffic Plan

Informed and Efficient Emergency Traffic Management should also include:

- **Time Management**
- **Communication – Internal/Public**
- **Resource Staging and Logistics**
- **Coordination/ Response Integration**
- **Situational Awareness**
- **Flexibility and Scalability**

Using the Hurricane Evacuation Study

	Scenario A – Cat 1-2	Scenario B – Cat 3-4
Peak Season	22.1	31.7
Off-Peak Season	12.2	18.1

(Assumes "Medium" Response)

What the Numbers Tell Us:

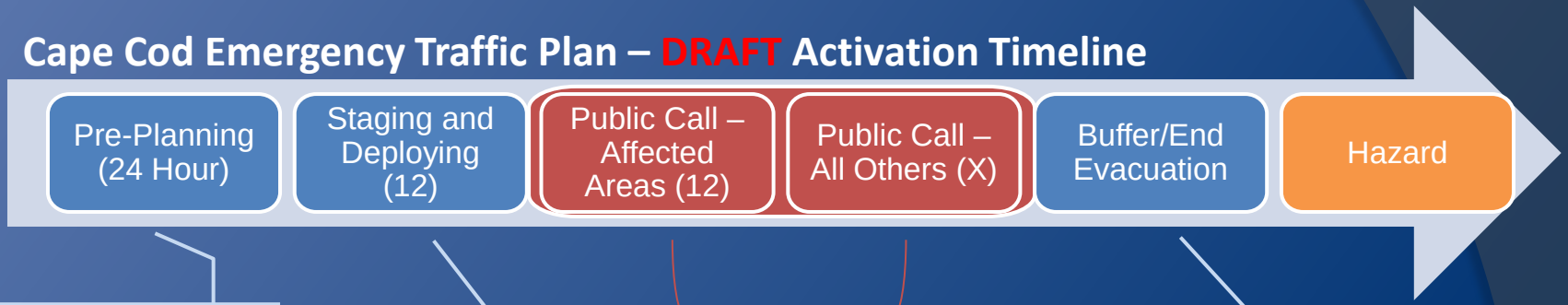
- Provides an estimated time that it will take for every resident and visitor that is likely (and able) to self evacuate the Cape to do so, following a public advisory.

What the Numbers DON'T Tell Us:

- Preparation time to support self evacuation
- Impact of roadway "failure"
- Impacts of time of day* and weather conditions
- Imperfect notification

* Partially taken into account by estimates

Cape Cod Emergency Traffic Plan – DRAFT Activation Timeline



- Weather and Situational Assessment
- Resource and Personnel Identification
- Personnel Activation

Source: Hurricane Checklist, MSP Personnel Activation, Past Events

Put personnel and equipment in place to control and manage emergency traffic

Source: Hurricane Checklist, MSP, MassDOT, Past Event

Phased Public Advisory

- "Areas of highest impact"
- "Regional advisory"

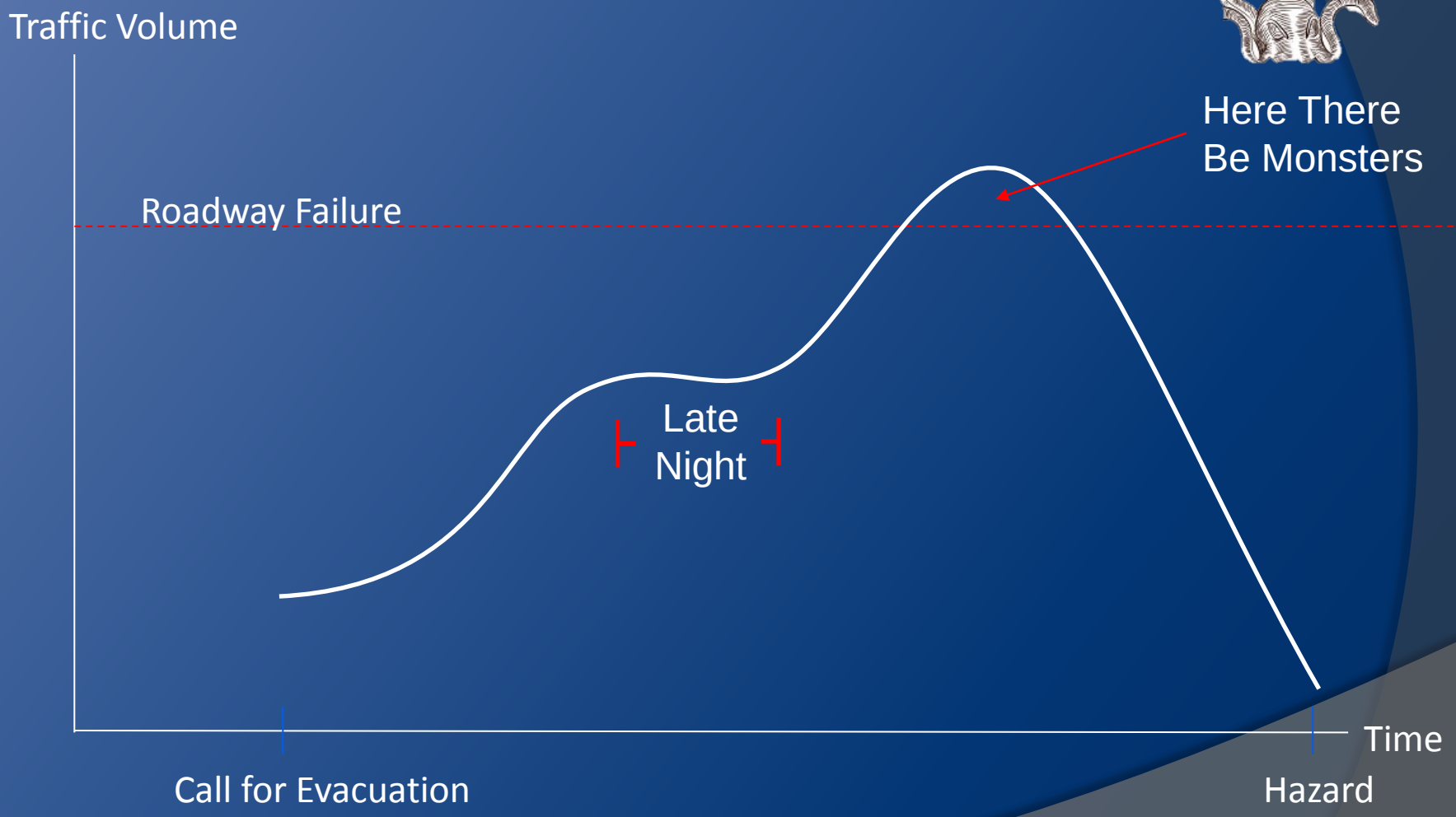
Source: HES, Traffic Management, Past Events

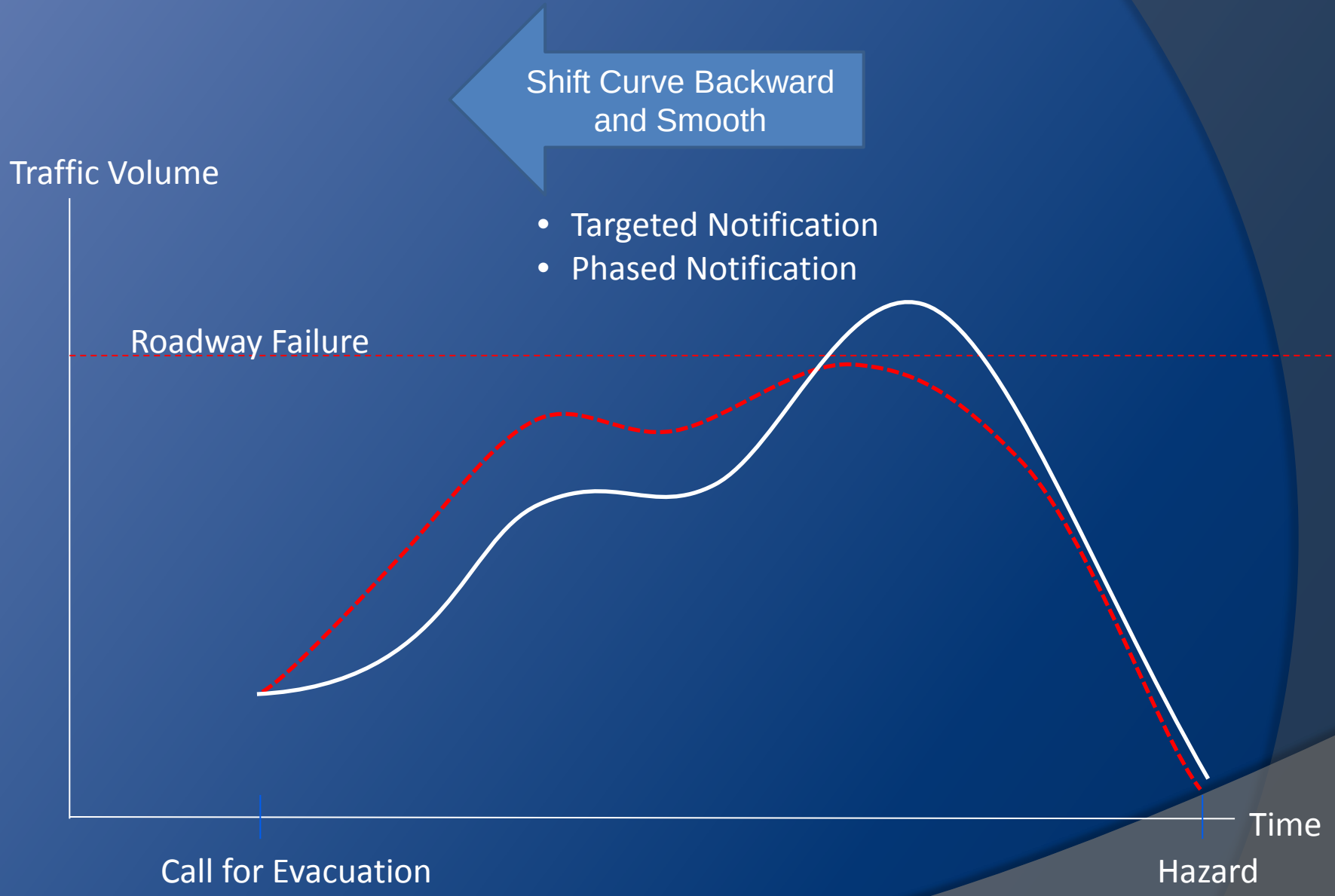
Buffer Period

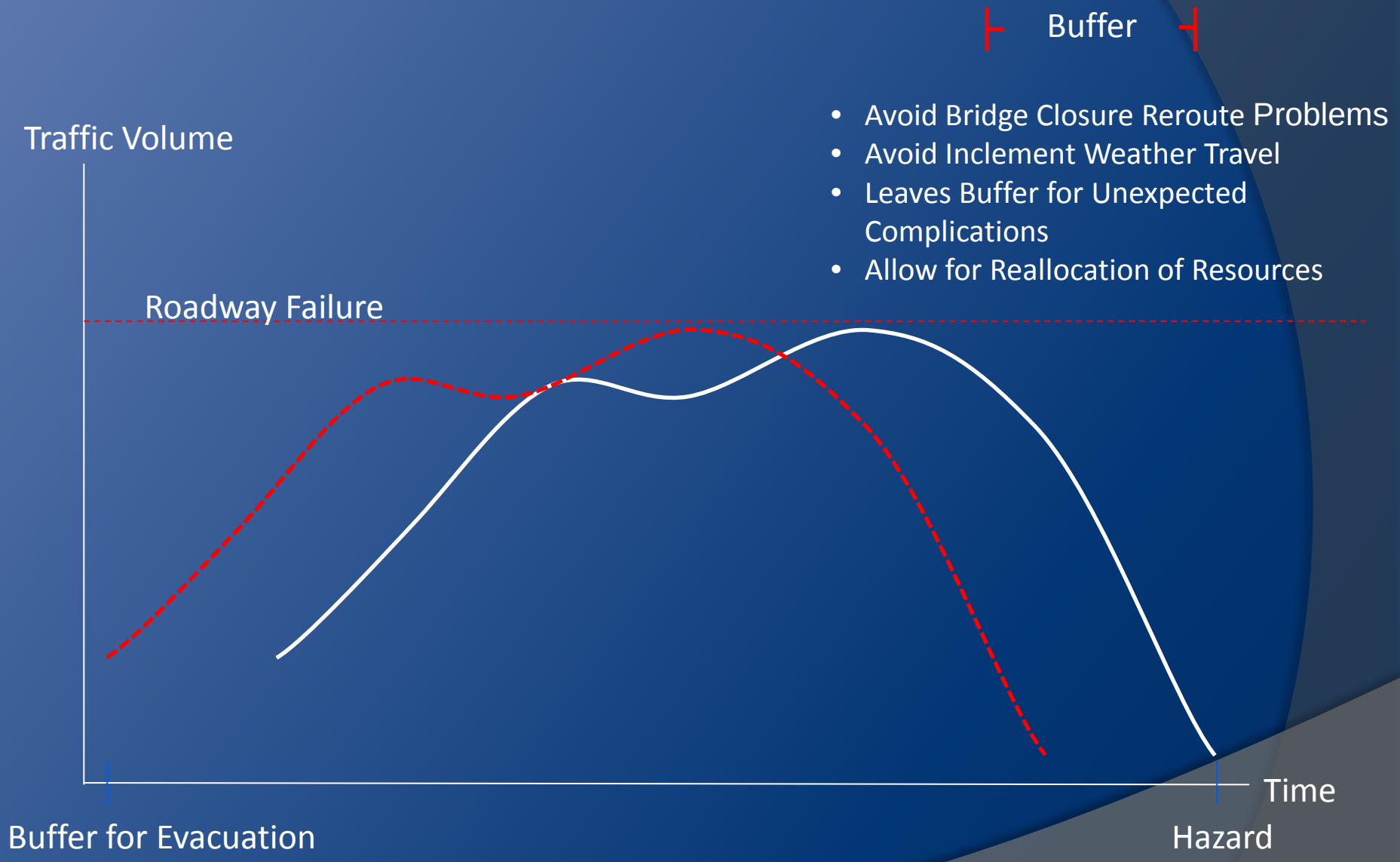
- buffer for unexpected complications
- Avoid bridge closure reroute problems
- Avoid inclement weather travel
- Allow for reallocation of resources

Source: HES, Past Events

Expected Self Evacuation Curve

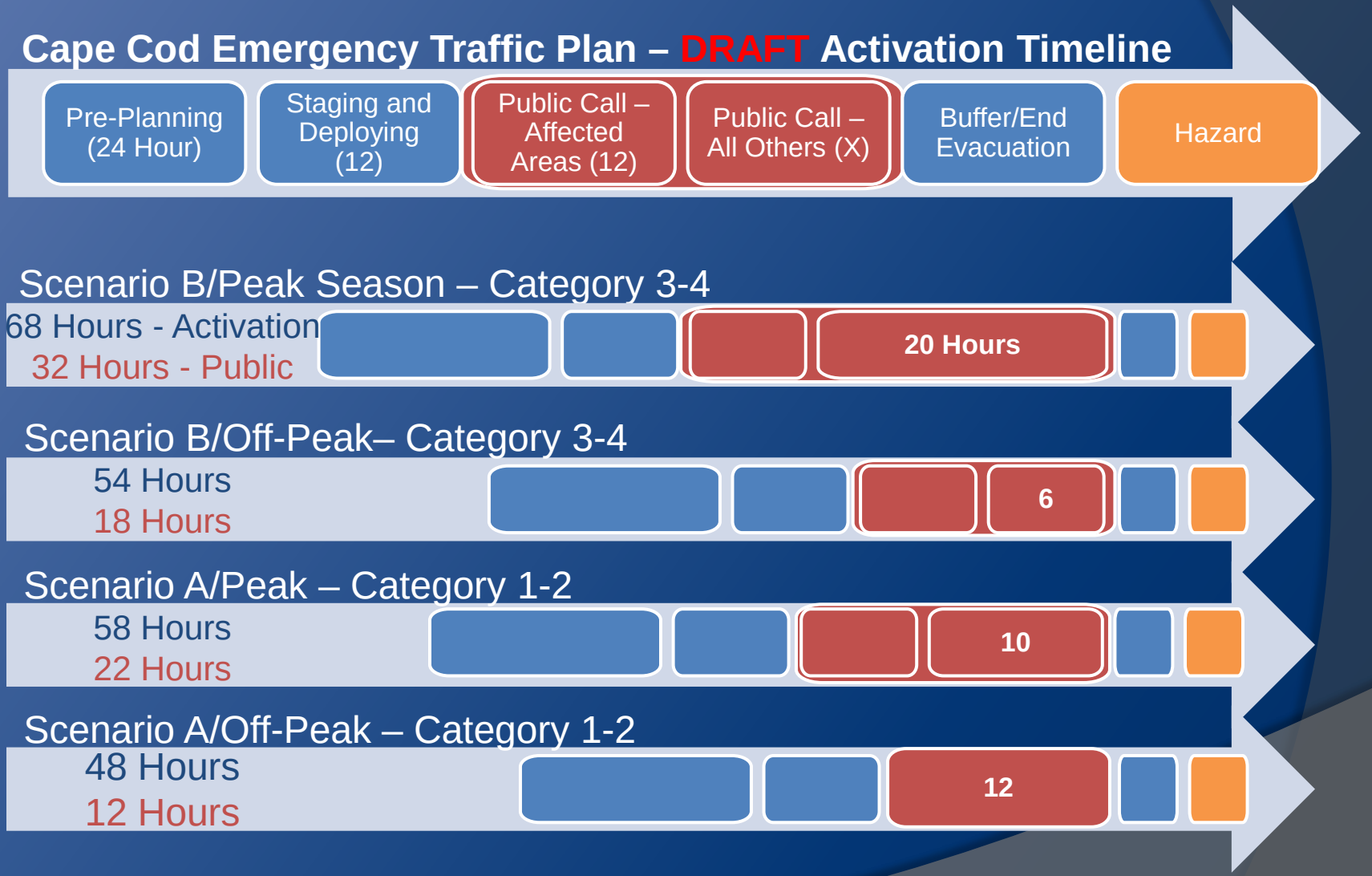



Shift Curve Backward and Smooth
Traffic Volume
• Targeted Notification
• Phased Notification
Roadway Failure
Time
Call for Evacuation
Hazard



- Avoid Bridge Closure Reroute Problems
- Avoid Inclement Weather Travel
- Leaves Buffer for Unexpected Complications
- Allow for Reallocation of Resources

Cape Cod Emergency Traffic Plan – DRAFT Activation Timeline



Positioning for Success Beyond the Estimates

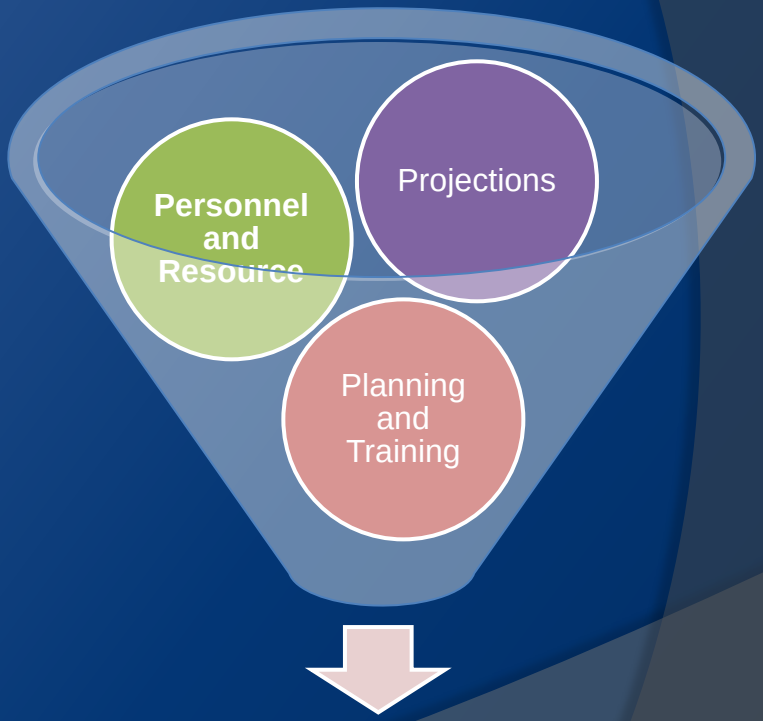
Develop Realistic Lead Time Estimates for Assessing, Staging, and Deploying Resources

- Personnel
- Equipment
- Signage

Develop Effective and Targeted Communication

- Permanent Residents
- Vacationers
- Motorists

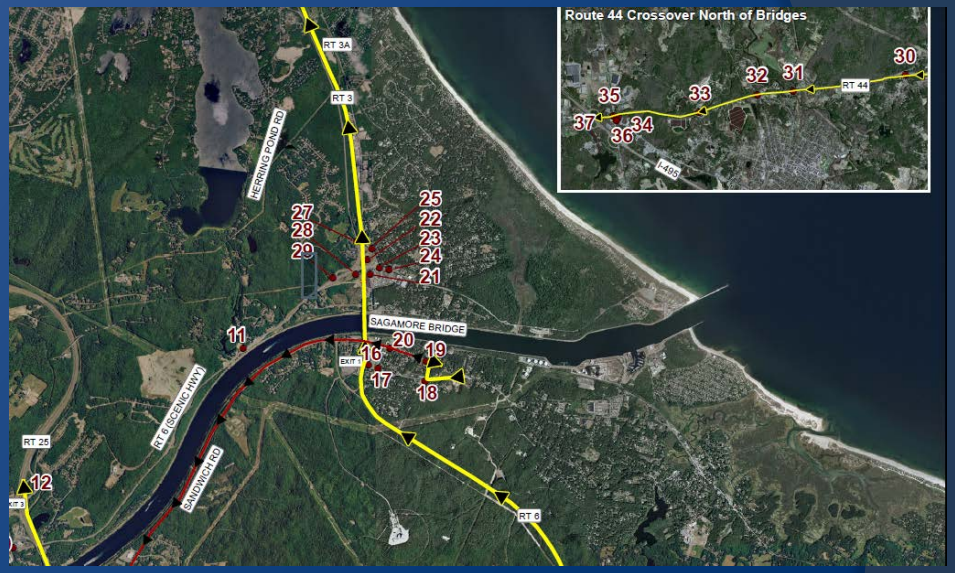
Training and Coordination Among Response Partners



Review of Traffic Control Points

Full Review of State Police Traffic Control Points

- **Resource Requirements and Lead Time**
- **Identify and Prioritize Choke Points**
- **Increase Flexibility**



	Per 12 Hour Shift	Backstop
State Police	~40 vehicles	
Bourne	14 vehicles	MSP
Sandwich	15 vehicles	MSP

Traffic Control Point Flexibility

- Include Current TCPs
- Change Language To “May Activate”
- Prioritize TCPs
  - Roadway Closers/Redirects
  - Choke Points (Prior to Bridges)

- Develop Standardized MSP TCP Post Order Form
  - Identify Active TCPS, Responsibilities, Communication
  - Provide Consistent Information for All Partners
    - Which TCPs are Active
    - How are They Directing Traffic

Public Notification

- Reaching Permanent Residents
- Reaching Non-Resident
  - CC Chamber of Commerce
  - State and National Parks/Beaches

- Communication with Motorists
  - Traffic Control Points
  - Fixed Message Signs
  - Variable Messaging Signs
  - Mobile Public Address

CCETP Project Next Steps

- Education and Coordination of Stakeholders
- Access to Resources and Personnel
- Training and Exercises
- Annual Review and Updates

Questions?

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