RHODE ISLAND HURRICANE EVACUATION STUDY

TRANSPORTATION ANALYSIS SUPPORT DOCUMENTATION

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Prepared For:

US Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

COMMONWEALTH OF MASSACHUSETTS
NICHOLAS G.
RUBINO
CIVIL
No. 32629
REGISTERED
PROFESSIONAL ENGINEER

4.19.95

Submitted By:

HMM Associates, Inc.
Three Executive Park Drive
Bedford, NH 03110
(603)-647-1010

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SECTION ONE

INTRODUCTION

1.1 PURPOSE

The purpose of the Transportation Analysis is to estimate roadway clearance times for coastal Rhode Island communities and affected coastal communities in Bristol County, Massachusetts[1] under a variety of hurricane evacuation scenarios. Clearance time is defined as the amount of time required for all vehicles to clear the roadways after a regional or state level hurricane evacuation recommendation is disseminated to the public. During an evacuation, a large number of vehicles have to travel on a road system in a relatively short period of time. A number of different vehicle trips are possible, varying by trip origination, time of departure, and trip destination. The number of vehicle trips becomes particularly significant for an area such as Rhode Island's coast because its land areas are highly urbanized with many residents living near the immediate shore. The number of evacuating vehicles varies depending upon the intensity of the hurricane, actions taken by local authorities, and certain human behavioral response characteristics of the area's population. Motorists evacuating their homes and intermixing with traffic from people leaving work or traveling for other trip purposes can lead to significant traffic congestion and backups, ultimately delaying the evacuation.

The Transportation Analysis is one element of a much broader study entitled the Rhode Island Hurricane Evacuation Study (HES). The Rhode Island HES Technical Data Report presents the results of several technical analyses to provide emergency management officials with realistic data quantifying the major factors involved in hurricane evacuation decision-making. The technical data presented in the Study is not intended to replace the detailed operations plans developed by the State and communities. Rather, the data is intended to provide a framework within which each jurisdiction can update and revise hurricane evacuation plans and from which operation procedures and guides can be developed for future hurricane threats. Because the Transportation Analysis builds upon results from other analyses of the Study, in this report, reference is frequently made to information that is presented in the Technical Data Report (TDR).

A transportation modeling methodology and a roadway representation were developed for all coastal communities in Rhode Island and southeastern Massachusetts within the study area to conduct the analysis and estimate clearance times. This analysis establishes the clearance time portions of evacuation times. Clearance time is one component of the total time required for a regional hurricane evacuation to be completed. An additional time component, which considers the amount of time necessary for public officials to notify people to evacuate, must be combined with clearance time to determine the total evacuation time. More information on how decision-makers can use the results of this analysis is discussed in detail in Chapter Eight, Decision Analysis, of the TDR.

1.2 STUDY AREA

The study area for the Transportation Analysis includes the entire State of Rhode Island and Bristol County, Massachusetts as illustrated in Figure 1-1. Bristol County, Massachusetts is included as part of

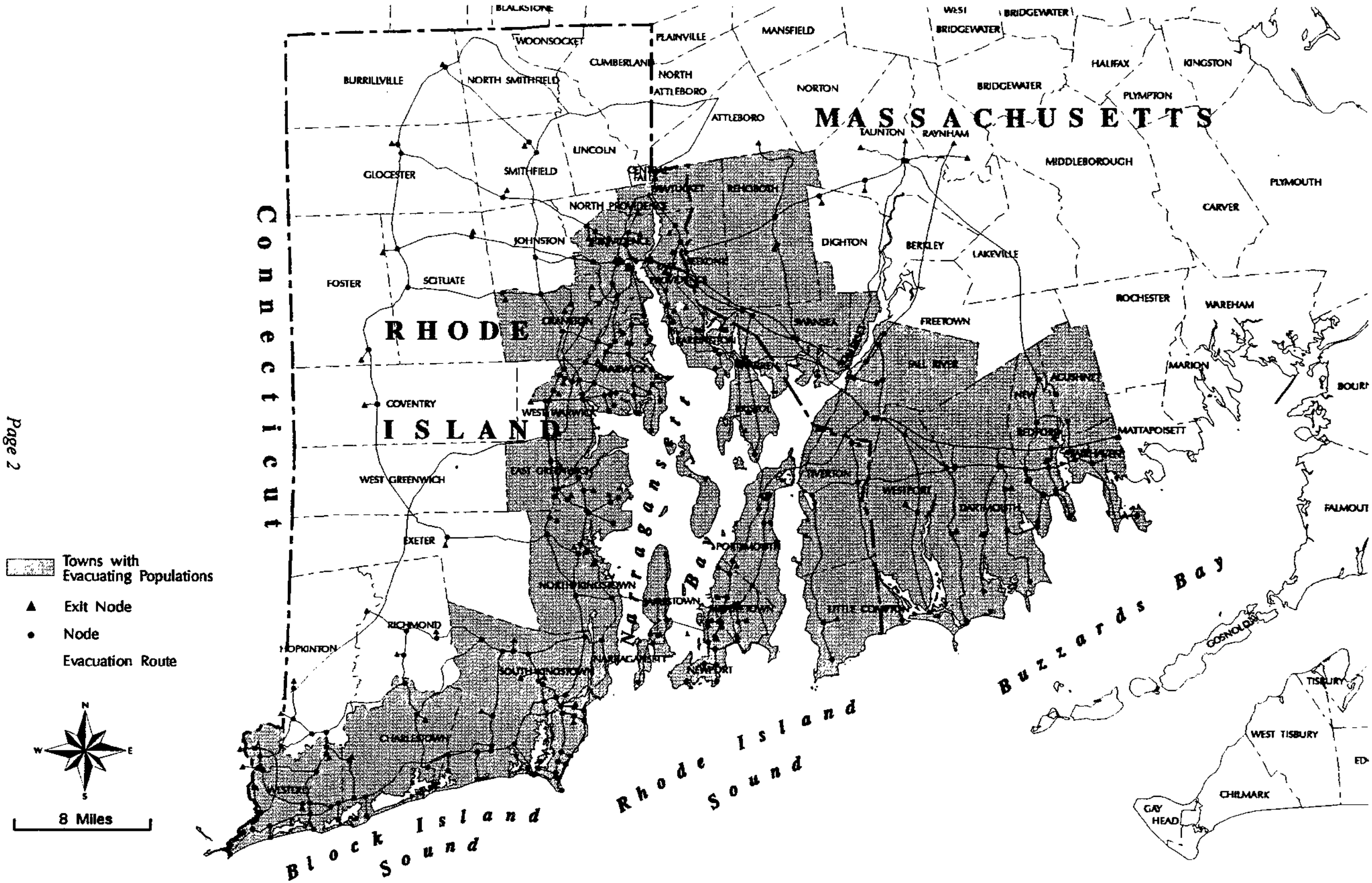


FIGURE 1-1: STUDY AREA

the Rhode Island Transportation Analysis because of the interdependence and inseparability of the eastern Rhode Island and southern Massachusetts roadway systems. The vastness of the Rhode Island and Bristol County, Massachusetts study area required that the region be divided into two approximately equal sized areas and analyzed individually. The two networks were defined as the "West Bay/Rhode Island Network" and the "East Bay/Massachusetts Network". The West Bay/Rhode Island Network extends from approximately the Connecticut-Rhode Island State Line eastward to Narragansett Bay. The East Bay/Massachusetts Network extends from approximately the Fairhaven-Mattapoisett, Massachusetts town line westward to Narragansett Bay.

The study area does not include the community of New Shoreham (Block Island) and Prudence Island. It is the intention of the community of New Shoreham and the Rhode Island Emergency Management Agency to evacuate all non-permanent residents from Block Island by ferry boat or other means possible in response to a hurricane threat. Currently, the Rhode Island Emergency Management Agency, in conjunction with the community of New Shoreham, is developing an Emergency Operations Plan which will include provisions for evacuating non-permanent residents from the Island. Shelter space will be provided on the island for permanent residents at an ARC Mass Care Facility located at the New Shoreham High School. No permanent residents live on Prudence Island.

The road system under examination includes major State maintained highways from the Connecticut state line to the Fairhaven-Mattapoisett, Massachusetts town line, extending approximately 15 miles inland from the coast. The analysis assumes evacuees originate from the various coastal communities and safe destinations include locations within coastal communities as well as locations farther inland, or in adjacent States. The Transportation Analysis was done at a state level, or macro scale, rather than at a community level because the intermixing of traffic from one community to the next was considered perhaps a leading contributor to delays in evacuations.

1.3 METHODOLOGY

The Behavioral Analysis discussed in Chapter Four of the TDR presents information about which destination types evacuees are most likely to choose during an evacuation in Rhode Island. The analysis concludes that people who evacuate surge areas are most likely to seek safe destinations at public shelters, friends'/relatives' homes, or hotels/motels. Although behavioral data provided in Chapter Four can give some guidance in predicting the actual geographic areas people will evacuate to and the evacuation routes people may use to reach their destinations, assumptions of this nature tend to be subjective. This is caused by the vast number of possible destinations and routes available to evacuees in highly populated areas. Clearance time calculations are further complicated by the affects of significant and varying amounts of "background" traffic that will be present on roadways as an evacuation progresses ("background" traffic refers to vehicle trips by people who leave work early and return home, people who travel through the region, and trips made by people preparing for the arrival of hurricane conditions or engaged in normal activities).

The study considered several approaches to estimate clearance times for the Rhode Island study area. The first approach considered was the one used by the Corps of Engineers and the FEMA to complete hurricane evacuation studies in the Gulf and southern Atlantic coast states. This approach assigns destinations and evacuation routes for the evacuating population by matching probable evacuee destinations (determined by a behavioral analysis) with the land uses known for the region. A mathematical model of the study area's roadway system is then used to calculate clearance times based on the trip distributions assumed for the evacuation. The time required for all evacuees to reach their predetermined destination is considered the clearance time. As reported in a post-hurricane assessment of Hurricane Hugo in 1989, the transportation analyses conducted for the North Carolina and South Carolina Hurricane Evacuation Studies were found to be very accurate in that the clearance times experienced during evacuations were very near predicted times. These results give evidence that this approach is accurate for study areas with limited alternative roadway systems and where adequate behavioral data and landuse information is suitable to identify evacuation routes and predict the destinations of evacuees. The following paragraphs explain some differences in the Rhode Island study area in comparison to other areas, and give the reasons why the Corps of Engineers employed an alternative transportation modeling approach for Rhode Island and Bristol County, Massachusetts.

One concern in using the transportation modeling approach discussed above for the Rhode Island study area was the appropriateness of assuming specific zonal evacuee destinations and evacuation routes. Inundation areas in Rhode Island and Bristol County, Massachusetts are relatively narrow, but densely populated. The complex system of interconnecting freeways, undivided state routes, and numerous local streets offer evacuees, and others on the roadways, many possible travel routes to reach their destinations. The region is generally characterized by diverse land uses in small geographic areas. Hotels and motels are sporadically located in most communities, friends' and relatives' homes could well be distributed over the entire area, and Rhode Island communities tend to open public shelters to accommodate their individual demands. The Study concluded that it was not practical to use the behavioral information developed for Rhode Island and Bristol County, Massachusetts to derive specific assumptions about evacuee destinations and evacuation routes. The study did conclude that the behavioral response curves presented in the Behavioral Analysis, and used in other hurricane evacuation studies, are useful when estimating the general response and destinations sought by residents who live in surge vulnerable areas.

The second concern in using the modeling approach used in other studies was the representation of the relationship between the number of people evacuating from vulnerable areas in comparison to the number of background vehicles that would be on the roadways during evacuations. Although surge areas are densely populated, the relatively small land areas that they encompass include only a fraction of the region's total population. When viewing the region's roadways as an entire transportation system, most of the traffic on roadways during initial and mid stages of an evacuation is likely to be from people leaving work early and from daily vehicles passing through the region. The problem during evacuations is that evacuating vehicles are forced to compete for roadway capacity with a larger amount of background traffic. This can cause increased congestion, potentially delaying the overall evacuation. Because background traffic will travel in both directions on nearly all roadways during evacuations, the Study determined that the transportation methodology for Rhode Island should not focus on assuming assigned evacuation routes as has been done in other study areas. Instead, the methodology should focus on analyzing the influence that background traffic can have on the overall evacuation.

To address the unique behavioral and transportation issues of the Rhode Island study area, an alternative modeling strategy was used. A mathematical model of the road system was developed and calibrated to simulate the traffic flows of a normal week day. Empirical traffic engineering studies and local traffic count data from the State's Department of Transportation (DOT) were used to establish various existing traffic flow conditions within the study area. The transportation modeling methodology used for this study assumes that the preferences of evacuees to travel on given routes are related to the traffic patterns of a normal day, except where it is clear that evacuees will travel directly to public shelters. The large portion of vehicles associated with background traffic enables the methodology to neglect assigning specific destinations and evacuation routes to evacuees traveling to hotels/motels and friends'/relatives' homes. Large business districts and confined hurricane surge areas in most coastal communities in Rhode Island and Bristol County, Massachusetts will give rise to evacuations involving mostly traffic generated by people leaving work rather than people evacuating surge areas. Analysis of traffic data collected on the days of Hurricanes Gloria and Bob further support this assumption. Accordingly, the modeling strategy used in the Rhode Island study focuses on estimating clearance times which qualitatively measure how competition by evacuating traffic may affect, and possibly delay, the movement of all traffic during an evacuation.

1.4 NETVAC2 TRAFFIC SIMULATION SOFTWARE

The NETVAC2 evacuation simulation software was used to create a mathematical model representing the study area's road system. NETVAC2 is a special purpose, network evacuation computer model designed by the Massachusetts Institute of Technology in cooperation with HMM Associates, Incorporated (now EARTH TECH). It was specifically designed to represent traffic flows over a transportation system during an emergency evacuation. This particular model was selected from several available models because it can be easily applied to model hurricane evacuations conducted in areas with complex roadway systems such as that in coastal Rhode Island and Bristol County, Massachusetts.

NETVAC2 represents roadways as links and intersections connecting two or more roadways as nodes. Physical characteristics about representative links and nodes, and the logic connecting them are inputs to the model used in computing vehicle capacity constraints and legal turning movements. Traffic flows at nodes are subject to intersection approach capacity constraints, whereas traffic flow assignments on outbound links are subject to the volume capacities of the modeled roads. Capacities are based on the Highway Capacity Manual (Highway Research Board) and Interim Material on Highway Capacity (Transportation Research Board).

A complementary program for use with NETVAC2, entitled POPDIS, converts the population that is assigned to enter onto roadways to an equivalent number of vehicles. The user enters the vehicle occupancy rates and the number of people assigned to enter the network at each node. As many as five different population types can be specified. POPDIS aggregates the population input for each entry node and in turn computes the effective average vehicle loading rate per minute at each node.

As vehicles are modeled to move throughout the road networks, NETVAC2 utilizes dynamic programming theory to update vehicle densities, speeds, flows, queues, spillbacks and other relevant traffic information at a fixed time step prescribed by the user. Traffic assignments from links entering and emanating nodes are made with each time step. One main feature of the model is that link assignments are made based upon the relative combinations of route preferences input for each node. The model also uses dynamic route selection such that route preferences are modified if significant backups exist at one or more emanating links. Vehicles preferring to travel on links undergoing heavy flows or large queues will be rerouted to another link of second preference. This is an important consideration when simulating hurricane evacuations because evacuees are not likely to wait in traffic for long periods of time if less restrictive, alternate routes are available to them.

Simulations terminate after vehicles exit the road system. NETVAC2 model results include computer print files of node and link time history flow and queue data, departing vehicle summaries, total simulation time, and total vehicles on the road system at specified report intervals.

SECTION TWO

MODEL DEVELOPMENT

2.1 GENERAL

The following sections discuss the coding assumptions made in applying NETVAC2 for modeling the hurricane evacuations in Rhode Island. The NETVAC2 User's Manual[2] gives specific data format instructions and a complete description of all parameters required by the model.

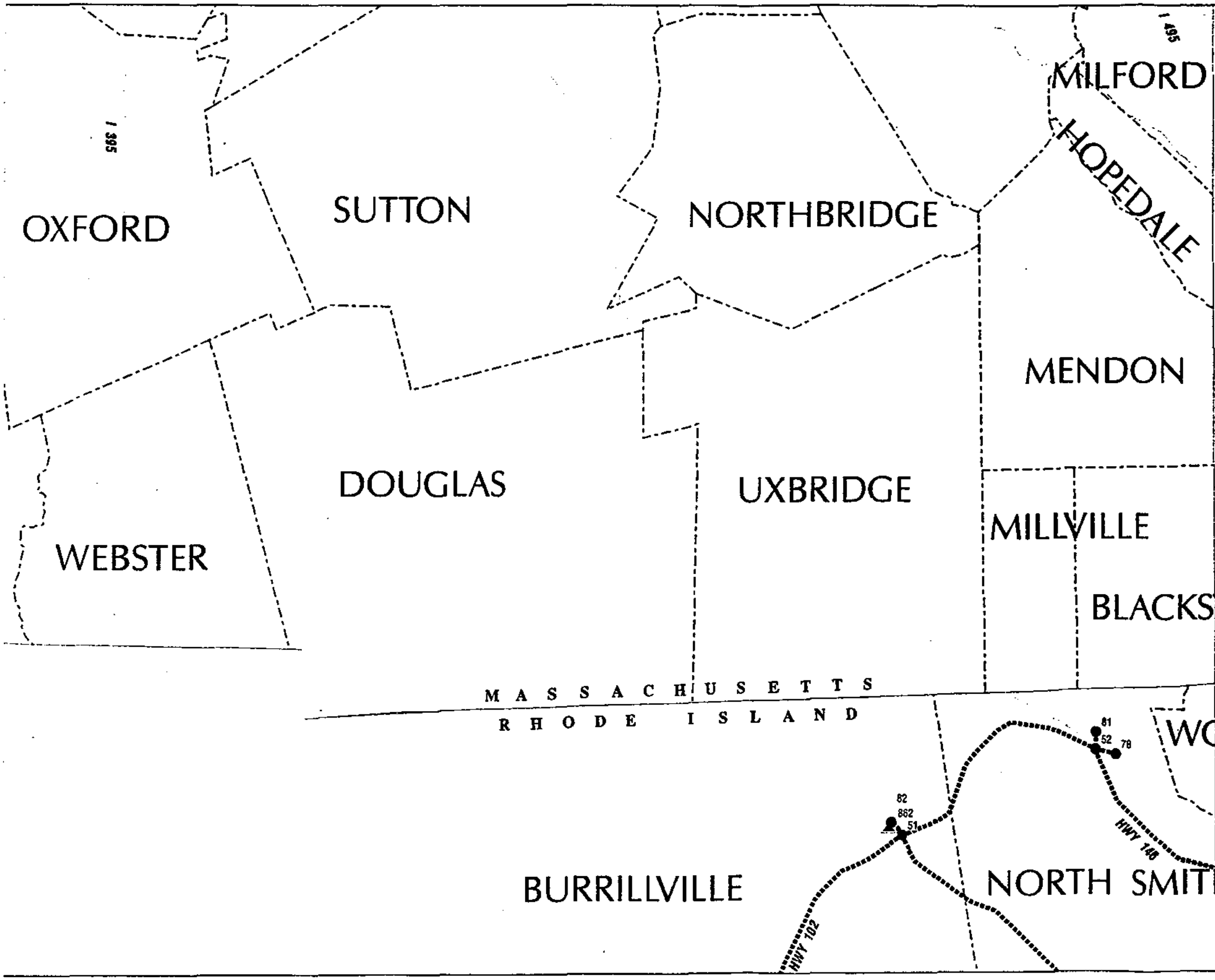
The Rhode Island DOT provided information for the roadway and intersection data used for model development. Roadway and intersection data was retrieved from printouts of state routes extracted from a study by Louis Berger Associates provided by the RI DOT[7]. The study contained detailed information such as the number of travel lanes and auxiliary lanes, lane widths, and intersection approach widths. The total length of each road segment was measured from a scaled map of the roadway network. Functional classification of routes and land use information are also listed. As networks were created, field surveys conducted at several locations verified that the modeling strategy and data input in the models were consistent with physical conditions.

2.2 ROAD NETWORKS

The NETVAC2 program allows networks with up to 500 links and 1000 nodes to be constructed. The vastness of the Rhode Island and Bristol County, Massachusetts study area required that the region be divided into two approximately equal sized areas and analyzed individually. The two networks were defined as the "West Bay/Rhode Island Network" and the "East Bay/Massachusetts Network". The West Bay/Rhode Island Network extends from approximately the Connecticut-Rhode Island state line eastward to Narragansett Bay. The East Bay/Massachusetts Network extends from approximately the Fairhaven-Mattapoisett, Massachusetts town line westward to Narragansett Bay. In the NETVAC2 model, roadways and intersections in the study area are represented by a link-node network as shown in Figures 2-1 through 2-9.

For each link, the actual number of lanes, lane widths, total roadway length in feet, roadway type, surrounding land use, and lateral clearances from roadside obstructions were entered into a computer link file. Values for roadway lateral clearances were input such that link capacities were not influenced by roadside obstructions except in cases where a particular link represented a highway bridge with a restrictive road shoulder. The logical turning movements from one link to the next and route preferences controlling traffic flow onto each link were also specified.

Single nodes were used to identify intersections of two or more undivided state roads, or to represent significant changes in roadway characteristics. Traffic flowing through intersections modeled using single nodes is forced to compete for the right of way with opposing traffic from other approaches. Major interchanges connecting divided and undivided highways, or connecting two undivided highways were modeled with four nodes per interchange. A greater number of nodes at these interchanges were needed to replicate non-opposing continuous traffic flow characteristic of highway on-ramps and off-ramps.



Key Map

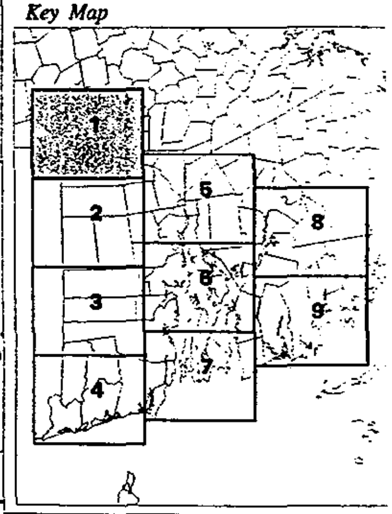


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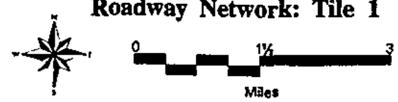
Figure 2-1
Roadway Network: Tile 1



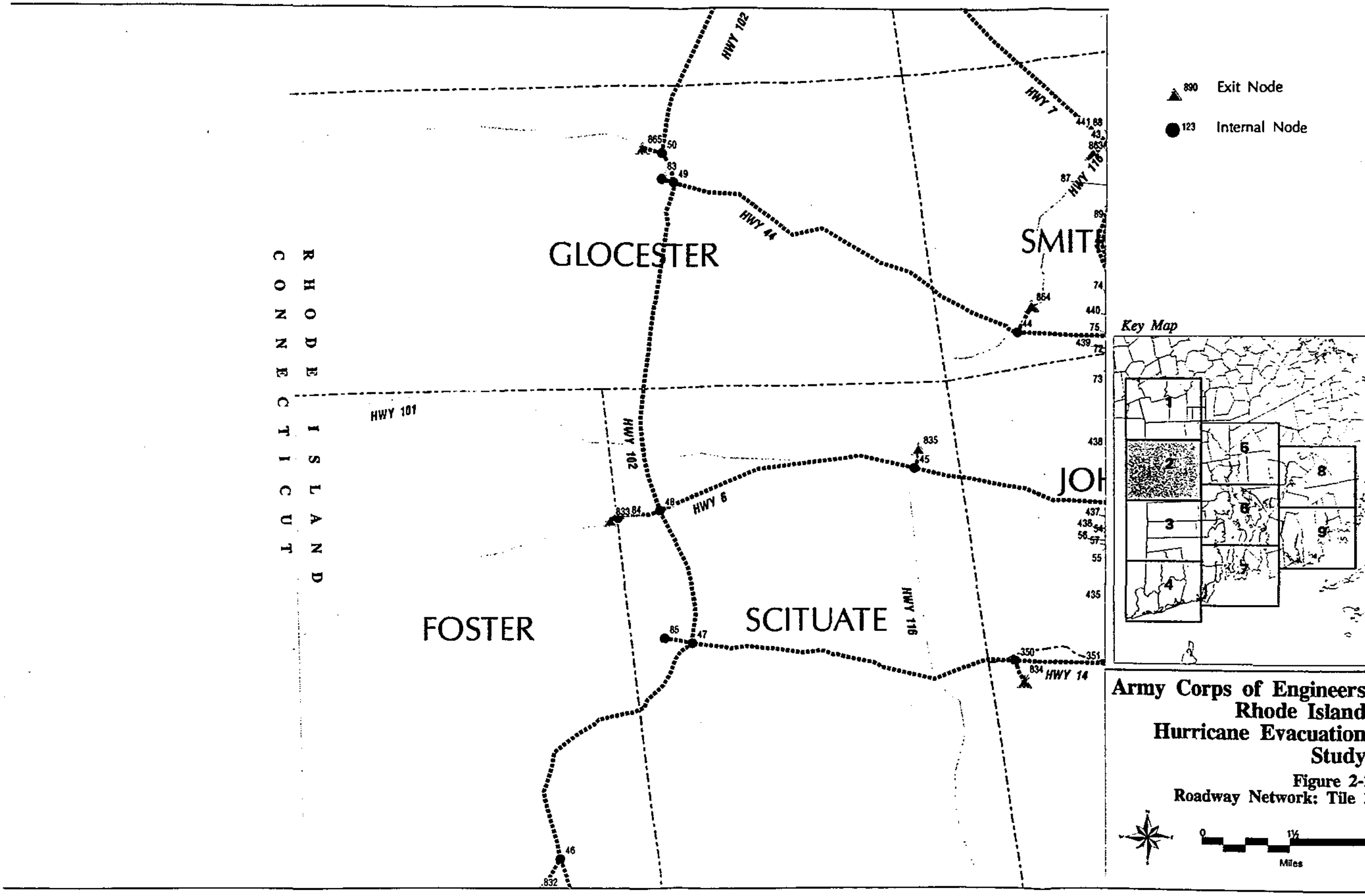


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Figure 2-2
Roadway Network: Tile 2

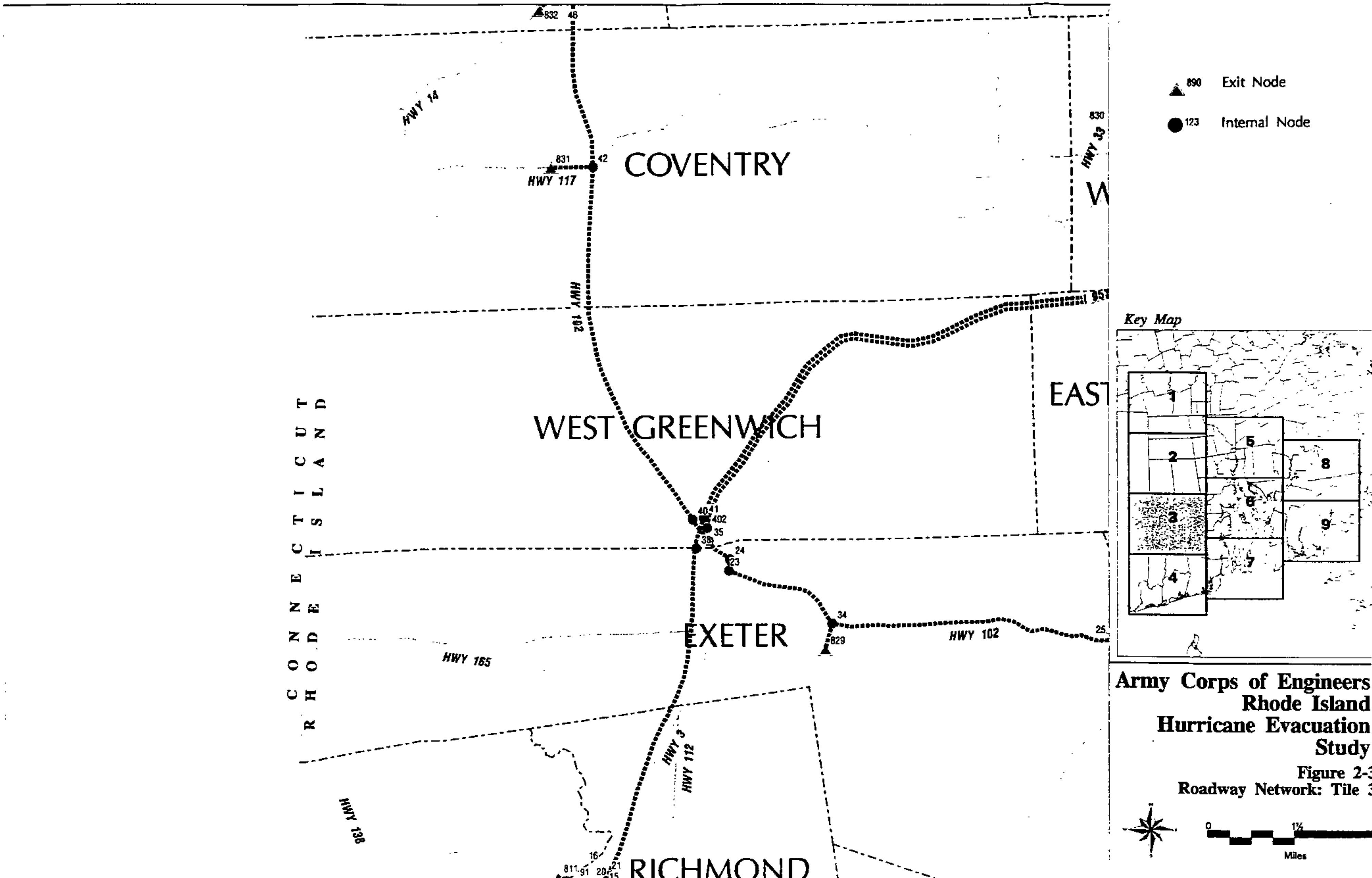

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Figure 2-3
Roadway Network: Tile 3

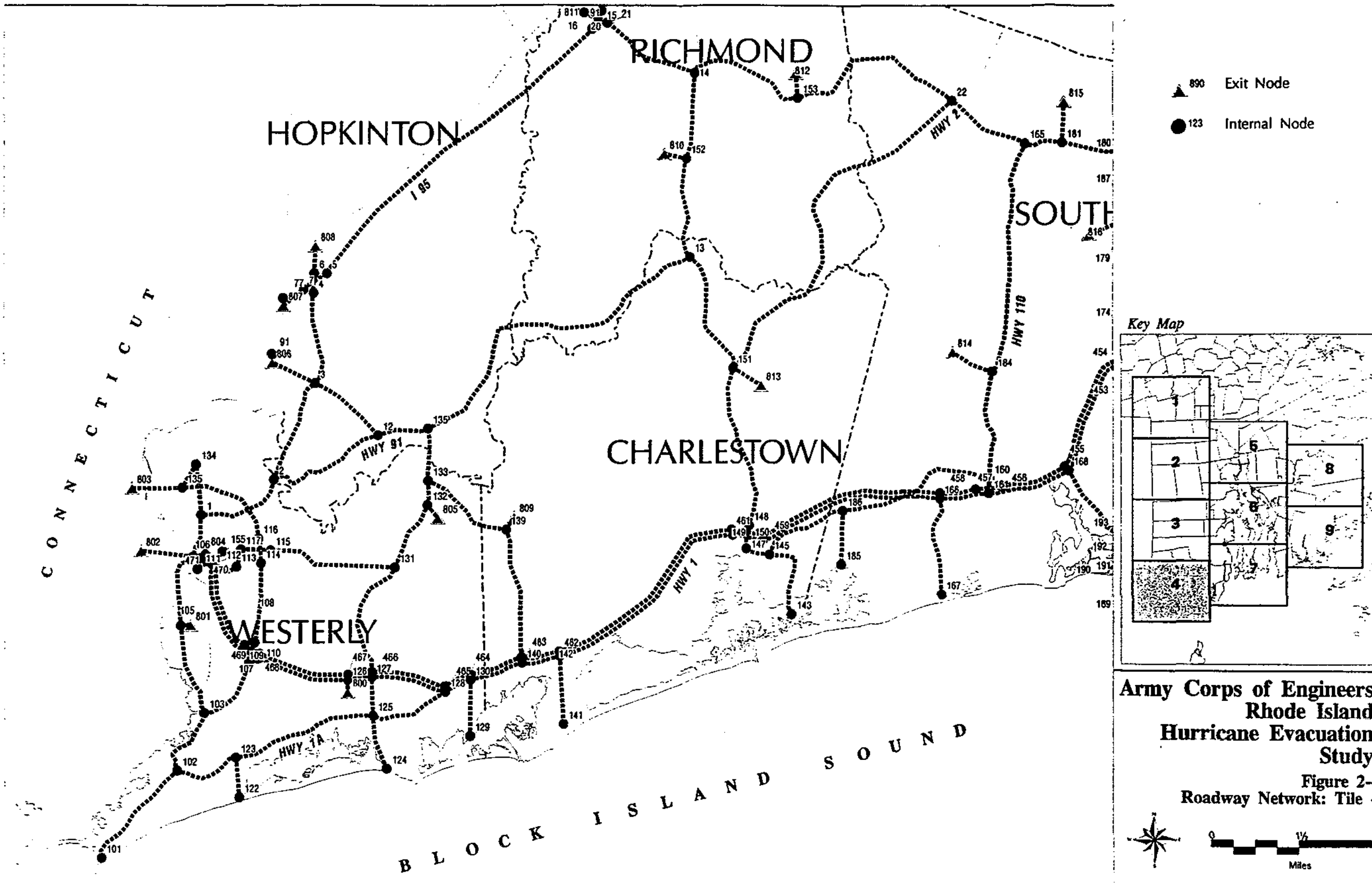

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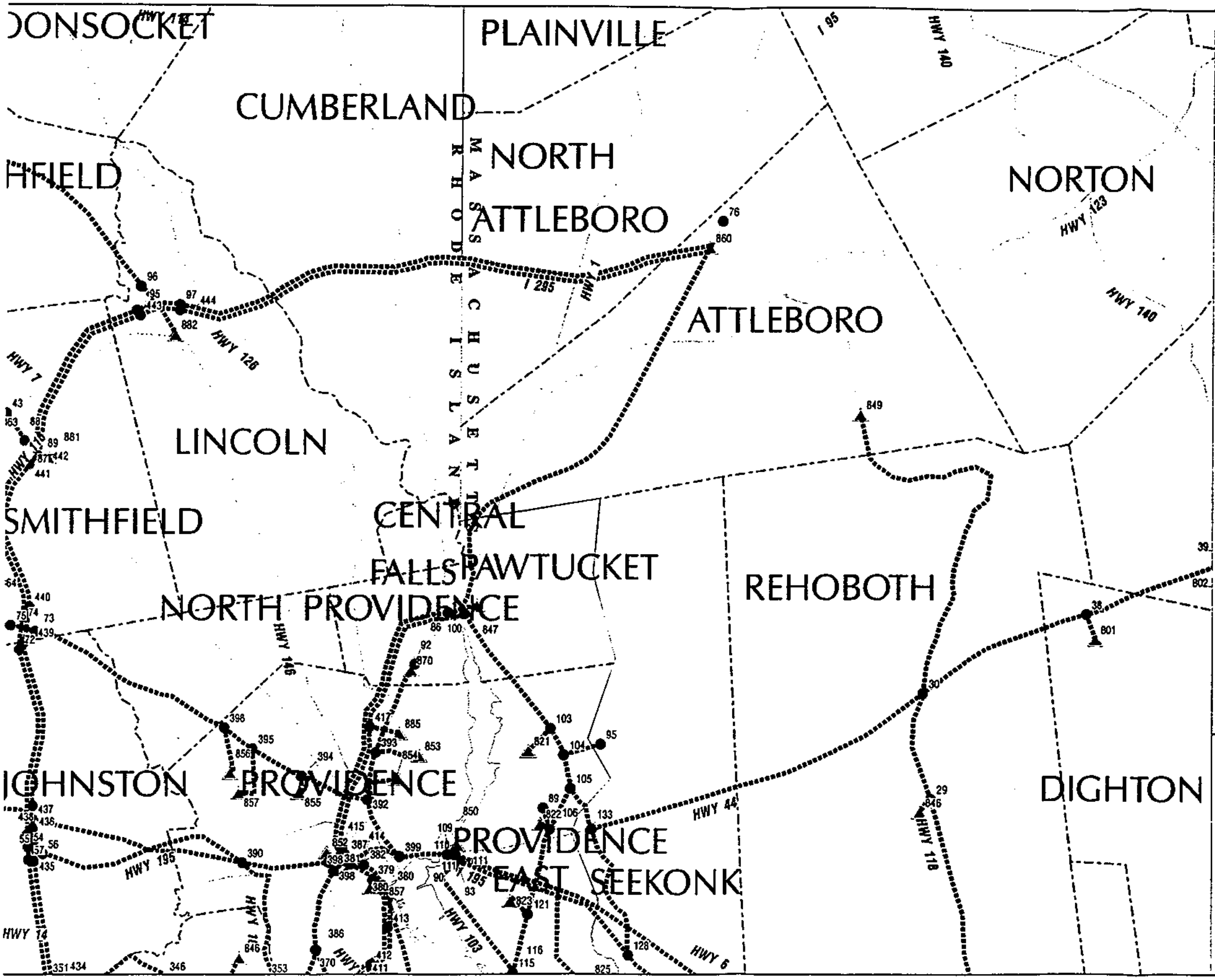
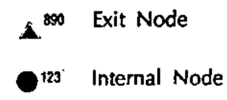
Figure 2-4
Roadway Network: Tile 4





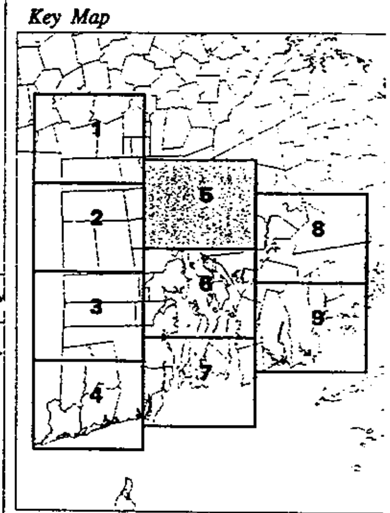


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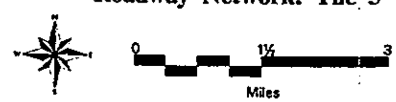
Figure 2-5
Roadway Network: Tile 5



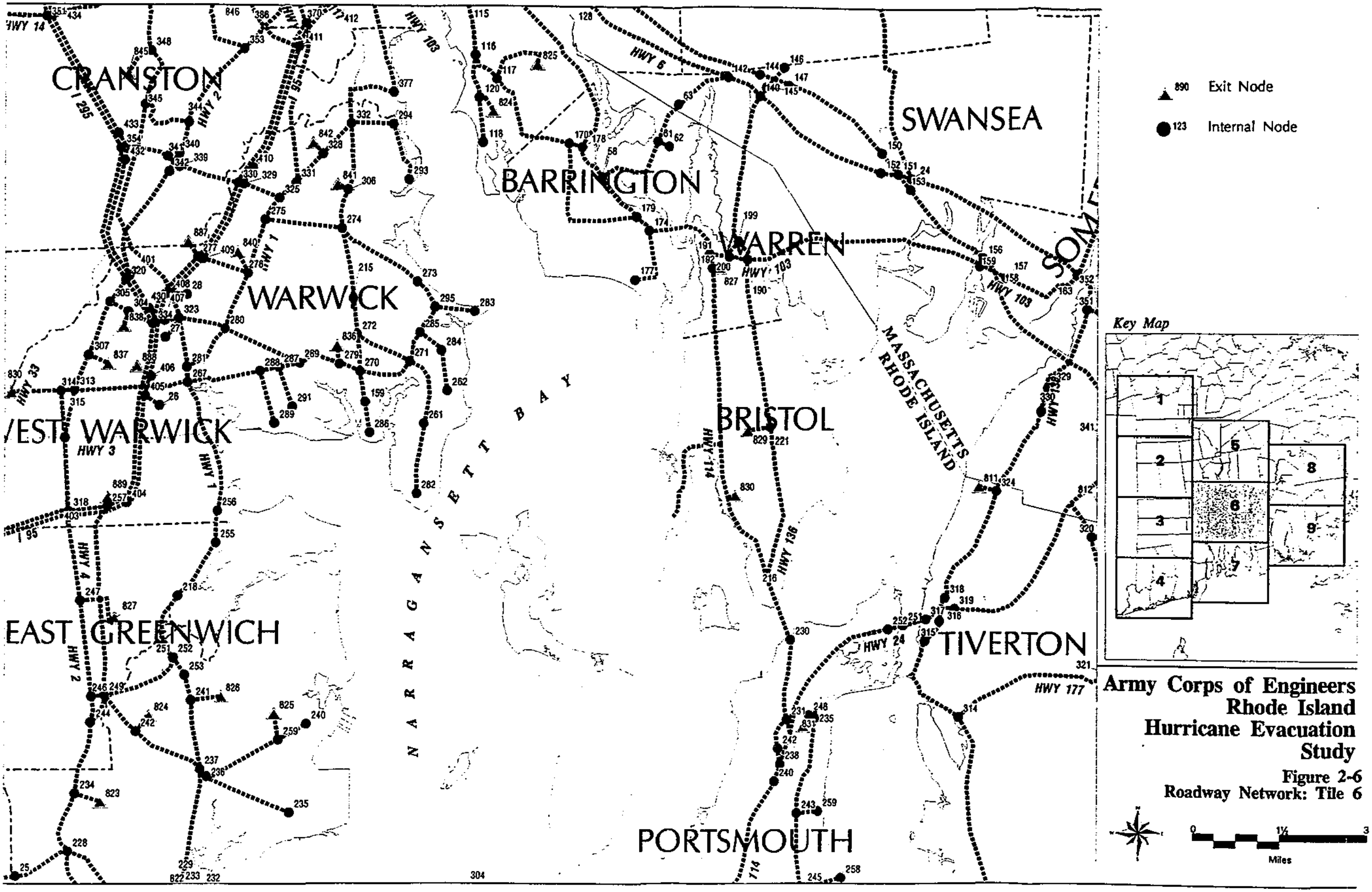


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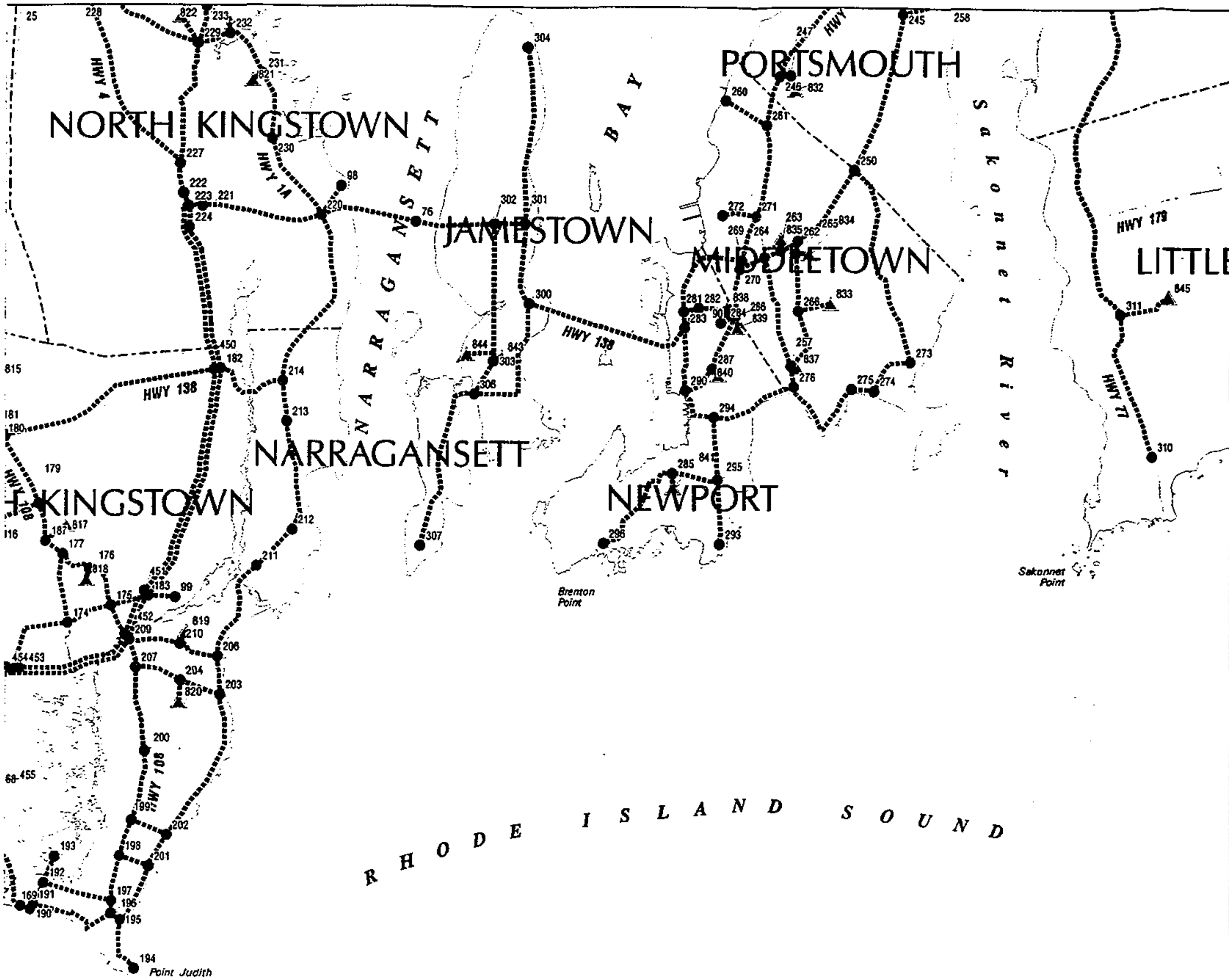
Figure 2-6
Roadway Network: Tile 6



▲ 890 Exit Node

● 123 Internal Node

Key Map

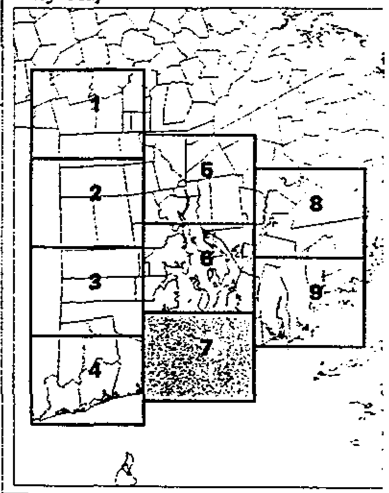


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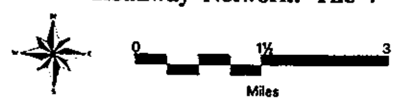
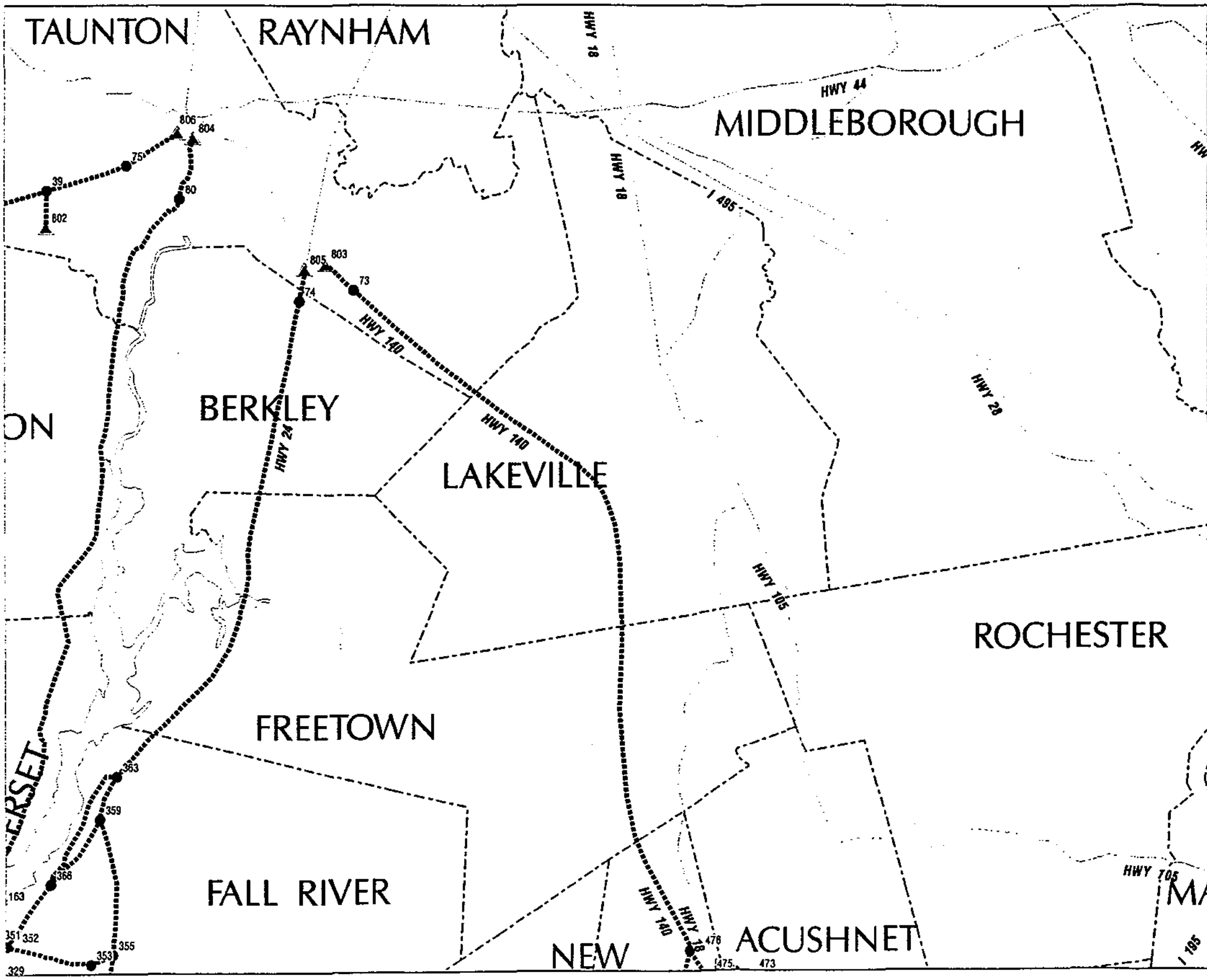
Figure 2-7
Roadway Network: Tile 7





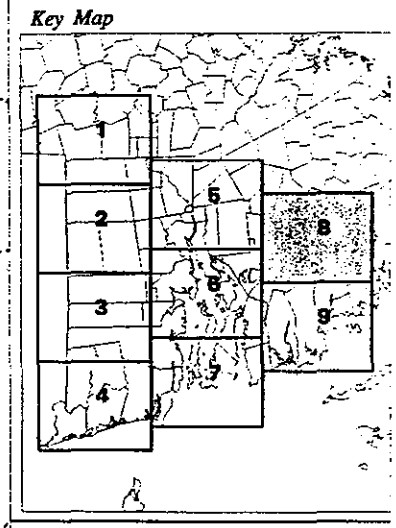


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Figure 2-8
Roadway Network: Tile 8

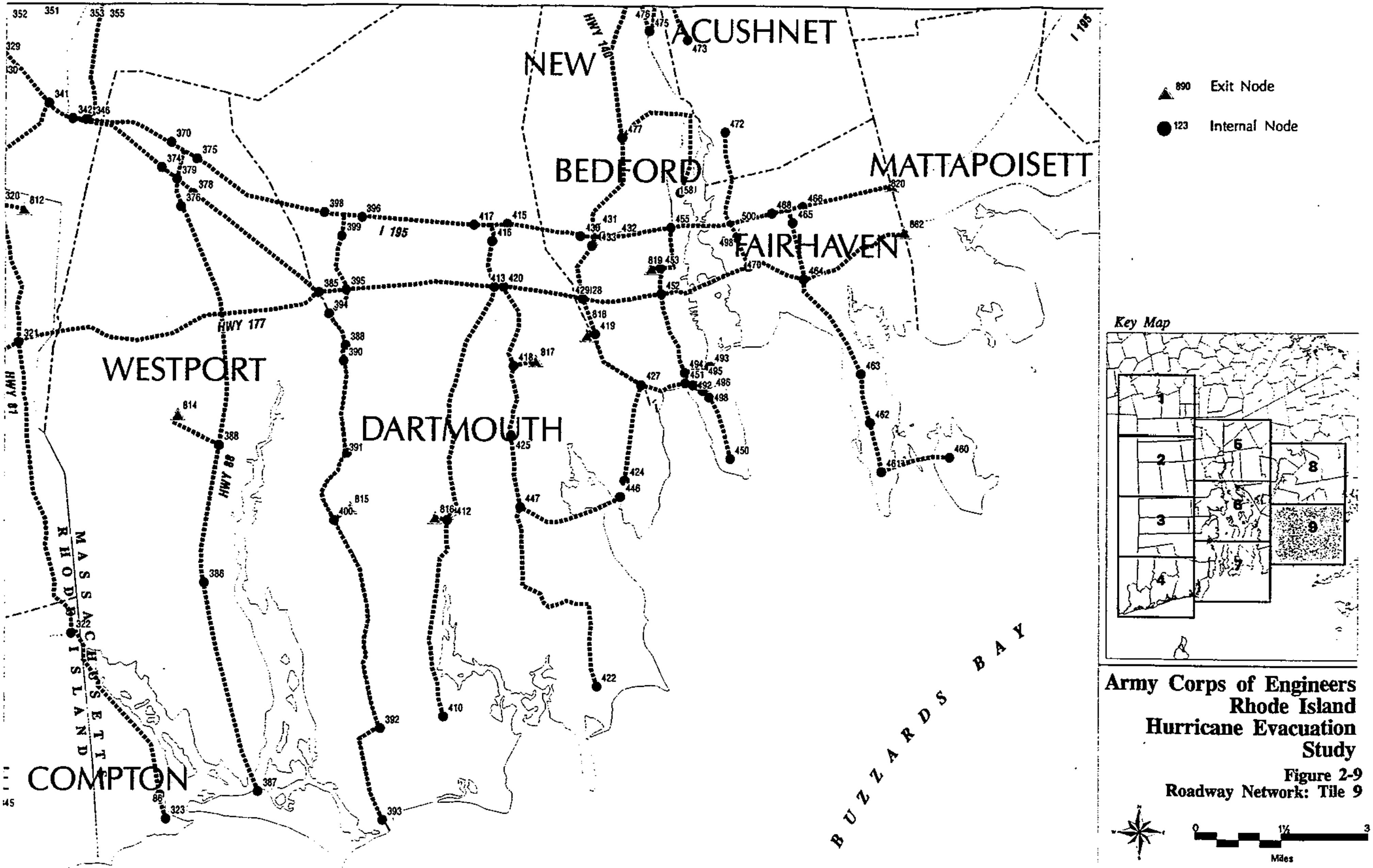

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Figure 2-9
Roadway Network: Tile 9

Because areas along the immediate coast lack direct access to state routes, evacuees leaving these areas would first travel on local streets before entering onto state routes. Therefore, areas immediately along the coast, which do not have state routes passing nearby, were provided network access by links representing local streets. The information entered for these links idealized the capacities of several local streets rather than any particular street. The majority of evacuees were programmed to enter networks from local streets extending into coastal areas. However, some evacuees were assigned to enter directly onto the networks at nodes positioned along state routes near the coast.

As a starting point, intersection approaches were all initially coded as equal priority. Coding the model in this manner assumes that at signalized intersections the green time for a particular intersection approach is directly proportional to the relative amount of traffic volume from its approach, relative to the cumulative volume of traffic from all other approaches. In turn, this forces vehicles to compete for the right of way which is typical of normal traffic conditions. Accordingly, more green time is allotted to approaches with the highest volumes.

NETVAC2 allows vehicles to exit networks at specified nodes, designated as sink nodes. Exits were created within each study area's interior to represent locations of available public shelters (locations are illustrated by the squares in Figures 2-1 through 2-9).

The following presents the rationale used to develop an estimate of the general destinations of evacuees from study area communities. The report entitled Hurricane Evacuation Behavior in the Middle Atlantic and Northeast States (HEB Report) indicated the following:

- In the northeast, 55 to 79% of the evacuating population stay within their local town.
- In the northeast, between 83 and 100% of the evacuating population reach their destination in approximately 30 minutes.
- In the northeast between 3 and 23% of the evacuating population uses public shelters.

A second source, the Federal Emergency Management Agency (FEMA), has a standard for public sheltering capacity of 20%. A third source in determining the approach for this study was the actual shelter capacities in the affected communities. It was calculated that the vulnerable communities in total have capacity to shelter approximately 50 to 60% of the total evacuating population. Based on the above, the following approach for determining which exit nodes are assigned priorities was used:

- Assign 15% of the evacuating population to exit nodes corresponding to public shelters within the community (this is slightly higher than would be expected in the northeast but in line with the FEMA 20% planning basis).
- Assign an additional 40% of the evacuating population to exit nodes within the community from which they evacuate. Many of these exit nodes will be the same location as the public shelters. This brings the total evacuating population which stays within their

community up to 55% between public shelters and other destinations (consistent with the 55-79% which stay within their town).

- Assign 25% of the evacuating population to interior exit nodes outside the affected communities but within 15 miles of the coast (corresponding to 30 minute travel time). This brings the total within 30 minutes travel time up to 80% (slightly lower than with the 83-100% anticipated in the northeast but tends to be conservative).

- Assign 20% of the evacuating population to exterior exit nodes, roughly 15 miles or more from the inundation areas.

2.3 MODEL CALIBRATION

Before evacuation simulations were run, each network was first calibrated for its study area. Calibration is performed for two primary reasons. First, it establishes the route preferences that will be used by all vehicles during an evacuation simulation. Route preferences control the numbers of vehicles assigned to travel on each road. Second, calibration determines how many vehicles must be loaded at a given loading rate to achieve traffic patterns typical of a normal day. Before an evacuation takes place, the modeling methodology assumes traffic patterns of a normal day occur. Therefore, NETVAC2 was programmed to simulate normal traffic patterns at peak, mid-peak, and off peak conditions at the start of all model runs. Only after a hurricane threat becomes imminent, and people begin responding to warnings, are changes in normal day traffic anticipated. The following paragraphs describe how traffic counts recorded for average daily periods were used to calibrate each study area network.

Average Daily Traffic (ADT) volume data (i.e., 24-hour period) are collected along most state and interstate roadways in Rhode Island, by the Rhode Island Department of Transportation, and in Massachusetts by the Massachusetts Highway Department. In addition to the 24-hour counts, detailed hourly counts are conducted on a continuous basis at central stations in both Rhode Island[5] and Massachusetts[6].

The following sources of data were used to develop estimates of the existing, typical traffic volume levels along the study area roadways:

- "State Highway Map of Rhode Island, Traffic Flow Map", Rhode Island Department of Transportation, 1994 (showing 1993 Annual 24-hour Average Daily Traffic)

- "1993 Traffic Volumes for the Commonwealth of Massachusetts", Massachusetts Highway Department, 1994

- Automatic Traffic Counter Records (hourly summaries) for the following locations, from the Rhode Island Department of Transportation:

  - I-295 Southbound, Johnston
  - I-295 Northbound, Cumberland

- I-95 Northbound, Exeter
- I-95 Southbound, Exeter

- Route 1 Northbound, South Kingstown
- Route 1 Southbound, South Kingstown

- I-195 Eastbound, East Providence
- I-195 Westbound, East Providence

Hourly counts for I-195 in Dartmouth, MA were also obtained from the Massachusetts Highway Department[6].

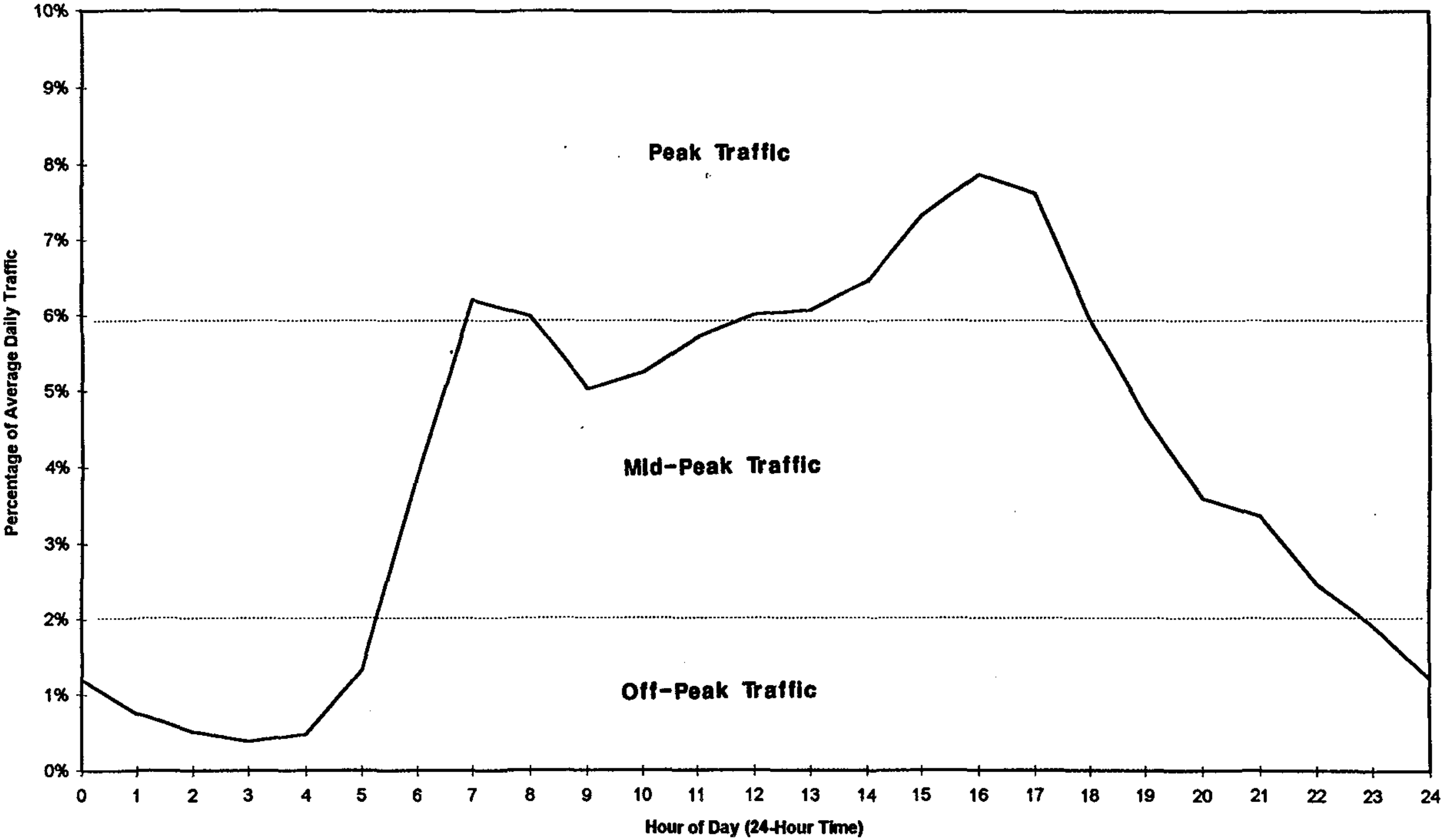
The distribution of ADT over a 24-hour period varies with each hour and day of the week. In general, the percentage of ADT is usually many times greater during peak traffic periods compared with times of off-peak traffic. Figure 2-10 plots weighted averages of the hourly weekday ADT volume recorded at traffic monitoring stations in Johnston, RI; Exeter, RI; South Kingstown, RI; East Providence, RI; and Dartmouth, MA. The distribution of hourly ADT at each location was found to vary in terms of magnitude, but overall trends and variations are generally similar.

In Figure 2-10, dashed lines delineate approximate levels of ADT corresponding to off-peak, mid-peak, and peak traffic. For the most part, off-peak traffic refers to light traffic volumes that typically occur late at night or in the early morning. Mid-peak traffic refers to moderate traffic conditions similar to that generally experienced in the late morning or early afternoon on weekdays, or on weekend days. Peak traffic represents the volume of traffic that is typical during weekday afternoon rush hour.

Although the distribution of ADT in Figure 2-10 may not reflect all of the local traffic patterns for each road in the study area, it does however provide a reasonable representation of how most of the vehicle trips in Rhode Island and Bristol County, Massachusetts are distributed over a normal day. Therefore, Figure 2-10 was used as a basis by which all the roadways within networks were calibrated.

For the final calibration tests, focus was placed on 31 key roadway links in Rhode Island and Southeastern Massachusetts to evaluate overall results. The actual unidirectional ADT at exterior nodes was entered as vehicles, and programmed to flow throughout each system. As simulation progressed, printouts every hour of simulation time reported the cumulative link departures and link speeds, as well as any spill backs and queues found at nodes. Calibration was accomplished using an iterative process of running NETVAC2, comparing modeled two-way ADTs to actual two-way ADTs for the 31 links, then adjusting link preference factors and adding traffic onto the network where appropriate before rerunning the model. During this process, a loading distribution that approximated average actual conditions was developed. The entire portion of major corridors such as I-95, I-195 and Route 1 were also reviewed in detail to ensure that the identified "check" locations were not isolated spots where ADT was correlated. The transportation methodology assumed calibration was complete when the volume of vehicles on each of the 31 links matched its corresponding actual two-way ADT by ±10% for Principal Arterials and 15% for Major Collectors[8], and the distribution of hourly traffic approximated actual conditions.

FIGURE 2-10: AVERAGE OF HOURLY ADT ALONG MAJOR ROUTES IN RHODE ISLAND AND BRISTOL COUNTY, MASSACHUSETTS



The results of the calibrated network analyses for these key links are represented in Tables 2-1 and 2-2, for the West Bay/Rhode Island and East Bay/Massachusetts networks.

TABLE 2-1: WEST BAY/RHODE ISLAND NETWORK CALIBRATION ANALYSIS

RHODE ISLAND NETWORK CHECKPOINTS

ROUTE	TOWN	ACTUAL ADT	MODELED ADT	% DIFFERENCE
14	Scituate	2,400	2,316	-4%
102	W. Greenwich/Coventry	4,100	4,633	+13%
2	Charlestown	4,300	4,482	+4%
6	Scituate	5,200	4,810	-8%
7	Smithfield	6,400	6,710	+5%
1	Charlestown	10,600	12,059	+14%
44	Glocester	10,800	12,446	+15%
1	East Greenwich/Warwick	16,100	17,246	+7%
1	South Kingstown	18,600	20,341	+9%
1	Westerly	20,600	17,831	-13%
295	Cumberland/N. Attleboro	29,600	27,690	-6%
95	Richmond/Exeter	34,100	37,504	+10%
295	Cranston	44,200	48,236	+9%
295	Johnston	51,400	48,132	-6%
195	Providence	60,300	58,066	-3%
95	Providence/N. Providence	120,600	112,231	-7%
95	Cranston/Providence	159,000	153,978	-3%

TABLE 2-2: EAST BAY/MASSACHUSETTS NETWORK CALIBRATION ANALYSES

SOUTHEASTERN MASSACHUSETTS NETWORK CHECKPOINTS

ROUTE	TOWN	ACTUAL ADT	MODELED ADT	% DIFFERENCE
114	Portsmouth	13,600	12,477	-8%
24	Portsmouth	19,600	19,769	+1%
77	Little Compton	2,800	2,795	0%
87	Tiverton	3,200	3,056	-4%
177	Westport	5,000	4,708	-6%
88	Westport	7,200	7,294	+1%
6	Dartmouth	16,000	14,462	-10%
195	Dartmouth	50,000	51,602	+3%
6	Fairhaven	28,000	28,640	+2%
195	Fairhaven	33,400	35,982	+8%
24	Berkley	30,000	32,088	+1%
138	Dighton	11,300	11,074	-2%
44	Taunton	16,000	15,320	-4%
195	East Providence	60,300	64,481	+7%

SECTION THREE

DEVELOPMENT OF TRAFFIC DATA

3.1 CLASSIFICATION OF MOTORISTS

After road networks were developed, the next steps of the analysis were to estimate the total number of vehicles that will load onto roadways, and determine the rates at which vehicles will load onto roadways over the course of an evacuation. To facilitate the development of this information, vehicles were classified as belonging to one of four major categories listed below:

(1) Surge Vulnerable Evacuees: Permanent and seasonal residents living in evacuation zones who evacuate when directed to do so by authorities.

(2) Non-Surge Vulnerable Evacuees: Permanent and seasonal residents, excluding mobile home residents, living outside evacuation zones who choose to evacuate. Most of the evacuees of this category leave their homes because of perceived dangers and not necessarily because of real flooding threats. However, in some cases, officials may deem it necessary to evacuate small groups of people who live in substandard housing units particularly vulnerable to hurricane winds, or those who live in or near areas that may be exposed to freshwater flooding.

(3) Mobile Home Evacuees: All permanent and seasonal mobile home residents of coastal communities. The analysis assumes all mobile home residents will be told to evacuate by local officials due of their high risk to strong winds from storms of even modest intensities.

(4) Background Vehicles: The population associated with all remaining vehicle trip purposes. Examples are: Trips made by people who leave work early and return home, people who travel through the region, and trips made by persons preparing for the arrival of hurricane conditions or engaged in normal activities. This traffic can also include transit vehicles (vans/buses) used to pick up evacuees without personal transportation.

The number of vehicles assumed to participate during an evacuation from each group listed is an important factor in estimating clearance times. Human behavioral information developed in Chapter Four, Behavioral Analysis, in the TDR, gives clear estimates of the participation that can be expected from the first three groups. The fourth group, Background Vehicles, is not addressed by the Behavioral Analysis. However, motorists belonging to this group mostly comprise of people making shopping trips or commuting, which is related to the ADT distribution shown in Figure 2-10.

For Rhode Island, Tables 3-1 and 3-2 list estimates made of the numbers of permanent and seasonal people who were assumed to evacuate their homes by population type for two levels of hurricane threat. Table 3-1 refers to evacuations for a weak hurricane scenario, and Table 3-2 gives similar estimates for a severe hurricane scenario. The same information for Bristol County, Massachusetts is provided in Tables 3-3 and 3-4. Estimates were made by applying evacuation participation behavioral assumptions to community population data (see TDR).

TABLE 3-1:
RHODE ISLAND EVACUATING POPULATION FOR A WEAK HURRICANE SCENARIO

Community	Permanent Population	Seasonal Population	Population Evacuating Mobile Homes	Population Evacuation Surge Areas	Population Evacuating Non-Surge Areas	Total Evacuating Population
Barrington	15,850	180	0	8,970	40	9,010
Bristol	21,630	400	20	2,980	330	3,330
Charlestown	6,480	4,010	330	1,330	160	1,820
Cranston	76,060	200	50	1,600	1,480	3,130
East Greenwich	11,870	60	110	720	210	1,040
East Providence	50,380	110	170	4,740	860	5,770
Jamestown	5,000	1,070	10	1,640	70	1,720
Little Compton	3,340	920	190	650	60	900
Middletown	19,460	240	450	840	350	1,640
Narragansett	14,990	4,850	10	6,080	220	6,310
New Shoreham	840	1,880	0	670	40	710
Newport	28,230	1,640	0	7,300	390	7,690
North Kingstown	23,790	630	540	5,240	330	6,110
Pawtucket	72,640	70	880	540	1,420	2,840
Portsmouth	16,860	1,380	1,080	4,280	230	5,590
Providence	160,730	330	90	490	3,200	3,780
South Kingstown	24,630	6,610	460	3,850	510	4,820
Tiverton	14,310	450	720	1,670	230	2,620
Warren	11,390	270	10	4,650	80	4,740
Warwick	85,430	900	210	17,840	1,150	19,200
Westerly	21,610	3,570	210	4,150	380	4,740
TOTALS	685,520	29,770	5,540	80,230	11,740	97,510

TABLE 3-2:
RHODE ISLAND EVACUATING POPULATION FOR A SEVERE HURRICANE SCENARIO

Community	Permanent Population	Seasonal Population	Population Evacuating Mobile Homes	Population Evacuating Surge Areas	Population Evacuating Non-Surge Areas	Total Evacuating Population
Barrington	15,850	180	0	12,500	110	12,610
Bristol	21,630	400	20	4,780	840	5,640
Charlestown	6,480	4,010	330	1,960	400	2,690
Cranston	76,060	200	50	2,050	3,700	5,800
East Greenwich	11,870	60	110	1,010	540	1,660
East Providence	50,380	110	170	6,530	2,150	8,850
Jamestown	5,000	1,070	10	2,130	190	2,330
Little Compton	3,340	920	190	870	160	1,220
Middletown	19,460	240	450	1,420	880	2,750
Narragansett	14,990	4,850	10	8,110	540	8,660
New Shoreham	840	1,880	0	760	90	850
Newport	28,230	1,640	0	9,530	960	10,490
North Kingstown	23,790	630	540	6,540	830	7,910
Pawtucket	72,640	70	880	600	3,560	5,040
Portsmouth	16,860	1,380	1,080	4,910	590	6,580
Providence	160,730	330	90	910	8,000	9,000
South Kingstown	24,630	6,610	460	4,970	1,260	6,690
Tiverton	14,310	450	720	2,130	580	3,430
Warren	11,390	270	10	6,760	210	6,980
Warwick	85,430	900	210	25,700	2,880	28,790
Westerly	21,610	3,570	210	5,960	960	7,130
TOTALS	685,520	29,770	5,540	110,130	29,430	145,100

TABLE 3-3
BRISTOL COUNTY, MASSACHUSETTS EVACUATING POPULATION FOR A WEAK HURRICANE SCENARIO

Community	Permanent Population	Seasonal Population	Population Evacuating Mobile Homes	Population Evacuating Surge Areas	Population Evacuating Non-Surge Areas	Total Evacuating Population
Acushnet	9,550	30	570	0	160	730
Dartmouth	27,240	1,130	130	2,700	490	3,320
Fairhaven	16,130	1,150	50	3,850	100	4,000
Fall River	92,700	150	90	2,520	1,760	4,370
New Bedford	99,920	140	170	1,680	1,600	3,450
Rehoboth	8,660	50	10	410	160	580
Seekonk	13,050	50	0	330	250	580
Somerset	17,660	50	10	2,960	280	3,250
Swansea	15,410	170	10	4,270	210	4,490
Westport	13,850	1,830	90	1,550	270	1,910
	314,170	4,750	1,130	20,270	5,280	26,680

TABLE 3-4
BRISTOL COUNTY, MASSACHUSETTS EVACUATING POPULATION FOR A SEVERE HURRICANE SCENARIO

Community	Permanent Population	Seasonal Population	Population Evacuating Mobile Homes	Population Evacuating Surge Areas	Population Evacuating Non-Surge Areas	Total Evacuating Population
Acushnet	9,550	30	570	820	410	1,800
Dartmouth	27,240	1,130	130	3,200	1,230	4,560
Fairhaven	16,130	1,150	50	11,100	250	11,400
Fall River	92,700	150	90	4,370	4,400	8,860
New Bedford	99,920	140	170	17,710	4,010	21,890
Rehoboth	8,660	50	10	580	400	990
Seekonk	13,050	50	0	480	630	1,110
Somerset	17,660	50	10	3,320	700	4,030
Swansea	15,410	170	10	4,810	510	5,330
Westport	13,850	1,830	90	1,740	680	2,510
TOTALS	314,170	4,750	1,130	48,130	13,220	62,480

3.2 BEHAVIORAL RESPONSE OF MOTORISTS

Perhaps one of the most critical assumptions that must be considered when estimating clearance times is the timing at which evacuees load onto roadways. Behavioral data from research obtained from past hurricane evacuations show that mobilization and actual departures of the evacuating population occur over a period of many hours and sometimes several days[3]. For Rhode Island, evacuation simulations were tested for three evacuation rates that are summarized by the response curves in Figure 3-1. Behavioral response curves describe the percentages of the evacuating population who leave their homes and load onto roadways at hourly intervals relative to when an evacuation recommendation is disseminated to the public.

The behavioral response curves are intended to include the most probable range of public responses that will be experienced in a future hurricane evacuation. The rapid response curve depicts the quickest mobilization response by evacuating households. For analysis purposes, the rapid response curve includes two hours of response time occurring before the evacuation recommendation is disseminated to the public and four hours after it is disseminated. For the moderate response curve, three hours of response time is assumed before dissemination of the evacuation recommendation, and six hours after. The slow response curve includes four hours of response time before notification of the evacuation recommendation, and eight hours after. The public's response before evacuation accounts for people who choose to evacuate their homes before being directed to do so by authorities. Regardless of the behavioral response curve used, 85 percent of all people who will eventually leave their homes are assumed to leave after being directed to do so by officials. This is an important point because people's timeliness in responding to a hurricane evacuation is extremely dependent upon the aggressiveness of authorities to encourage them to leave[4].

3.3 VEHICLE USAGE

The behavioral analysis conducted for Rhode Island estimated that approximately 75 percent of the vehicles available to evacuees will be used during future evacuations[4]. For the most part, families usually evacuate using one vehicle for fear of separation, but some households evacuate using two or more vehicles depending upon how many are available to them. Differences in vehicle ownership may vary with variations in access to public transportation, household income, and other socio-economic characteristics of the region.

The first column of Table 3-5 list permanent population by community. The second and third columns list the numbers of available vehicles per owner and renter - occupied housing units, respectively. This information was obtained from socio-economic data reported in the 1980 census[9]. The fourth column of the Table gives the number of available vehicles per person, and the fifth column gives the calculated average numbers of people that will travel in each evacuating vehicle, assuming 75 percent of the available vehicles are used. Similar information for Bristol County, Massachusetts is provided in Table 3-6. A sample calculation of the assumed persons per evacuating vehicle for Westerly, Rhode Island is shown below.

FIGURE 3-1: BEHAVIORAL RESPONSE CURVES

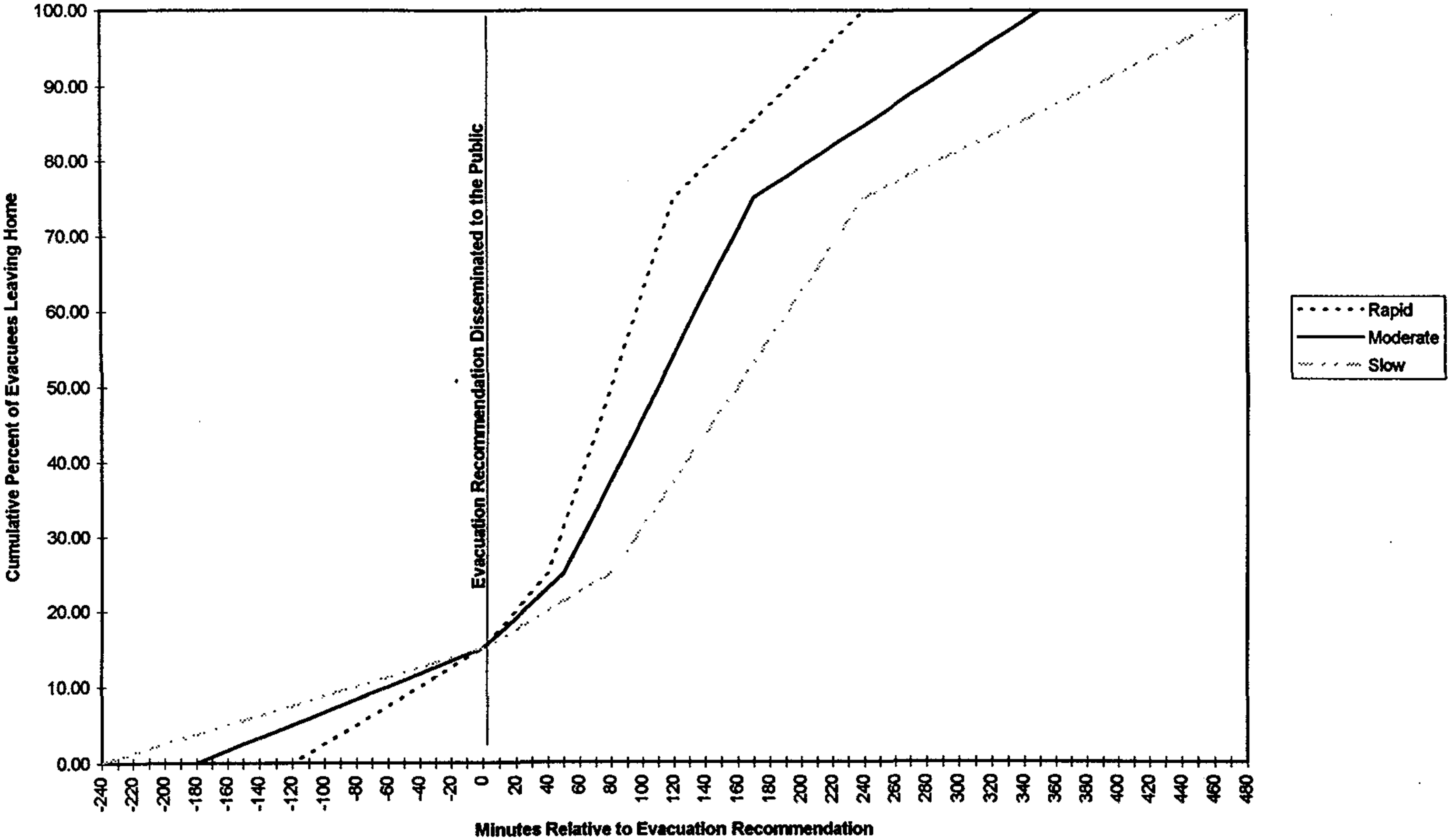


TABLE 3-5:
ASSUMED VEHICLE USAGE RATES BY COMMUNITY (RHODE ISLAND)

Community	Permanent Population	Available Vehicles in Owner Occupied Housing Units	Available Vehicles in Renter Occupied Housing Units	Vehicles Per Person	Persons per Evacuating Vehicle (75% Usage)
Barrington	15,850	10,400	890	0.71	1.88
Bristol	21,630	9,970	3,670	0.63	2.12
Charlestown	6,480	3,790	1,020	0.74	1.80
Cranston	76,060	37,370	12,210	0.65	2.05
East Greenwich	11,870	7,300	1,230	0.72	1.85
East Providence	50,380	22,500	9,240	0.63	2.12
Jamestown	5,000	3,240	730	0.79	1.69
Little Compton	3,340	2,250	490	0.82	1.63
Middleton	19,460	6,220	5,060	0.58	2.30
Narragansett	14,990	7,010	4,520	0.77	1.73
New Shoreham	840	540	240	0.93	1.43
Newport	28,230	8,140	8,020	0.57	2.34
North Kingstown	23,790	13,560	3,690	0.73	1.83
Pawtucket	72,640	24,430	18,410	0.59	2.26
Portsmouth	16,860	9,290	2,850	0.72	1.85
Providence	160,730	35,470	37,140	0.45	2.96
South Kingstown	24,630	10,900	3,380	0.58	2.30
Tiverton	14,310	9,230	1,360	0.74	1.80
Warren	11,390	5,080	2,390	0.66	2.02
Warwick	85,430	49,670	10,760	0.71	1.88
Westerly	21,610	10,500	4,530	0.70	1.90

TABLE 3-6
ASSUMED VEHICLE USAGE RATES BY COMMUNITY (MASSACHUSETTS)

Community	Permanent Population	Available Vehicles in Owner Occupied Housing Units	Available Vehicles in Renter Occupied Housing Units	Vehicles Per Person	Persons per Evacuating Vehicle (75% Usage)
Acushnet	9,550	5,820	690	0.68	1.96
Dartmouth	27,240	13,970	2,180	0.59	2.26
Fairhaven	16,130	7,840	2,290	0.63	2.12
Fall River	92,700	20,450	24,590	0.49	2.72
New Bedford	99,920	27,130	19,430	0.47	2.84
Rehoboth	8,660	5,730	520	0.72	1.85
Seekonk	13,050	8,730	820	0.73	1.83
Somerset	17,660	10,800	1,540	0.70	1.90
Swansea	15,410	9,930	800	0.70	1.90
Westport	13,850	8,510	1,480	0.72	1.85

Permanent Population = 21,610 people

Available vehicles = 10,500 + 4,500 = 15,030 vehicles

$$\text{Vehicles per person} = \frac{15{,}030 \text{ vehicles}}{21{,}610 \text{ person}} = 0.70 \ \frac{\text{vehicles}}{\text{person}}$$

$$\text{Persons per evacuating vehicle, assuming 75\% usage} \quad \frac{1}{0.70 \text{ vehicles/person} \times 0.75}$$

$$= 1.90 \text{ persons per vehicle}$$

The transportation methodology used the information in Table 3-5 and 3-6 to determine the vehicles that would load onto roadways during evacuations. The user enters the vehicle occupancy rates and the number of people assigned to enter the network at each node. NETVAC2's complimentary program, POPDIS, aggregates the population input for each entry node and in turn computes the effective average vehicle loading rates per minute to be input into NETVAC2 at network entry locations.

SECTION FOUR

EVACUATION SCENARIOS

Since all hurricanes differ from one another in some respect, it becomes necessary to set forth clear assumptions about storm characteristics and evacuees' expected response before transportation modeling can begin. Not only does a storm vary in its track, intensity and size, but also in the way it is perceived by residents in potentially vulnerable areas. These factors cause a wide variance in the behavior of the vulnerable population. Even the time of day at which a storm makes landfall influences the time parameters of an evacuation response. The transportation analysis computes clearance times based on sets of assumed conditions and behavioral responses. It is likely that an actual storm will differ from a simulated storm for which clearance times are calculated in this report. Therefore, key input parameters were varied to derive a range of evacuation scenarios idealizing many possible situations officials may have to contend with. The three major parameters that were varied with each simulation are described below.

(1) Hurricane Severity: Storms are classified as either weak or severe hurricanes. Evacuating population estimates (see Tables 3-1 through 3-4) are significantly greater (approximately double) for an evacuation due to severe hurricanes when compared with that for weak hurricanes. Category 5 hurricanes were not considered because the cooler waters of the Northeast can not sustain hurricanes of this intensity.

(2) Behavioral Response: The time in which evacuees mobilize to leave their homes and enter onto the roadway system is characterized by the behavioral response curves shown in Figure 3-1. Behavioral response curves are defined for rapid, moderate, and slow responses.

(3) Background Traffic Condition: The traffic condition at the start of an evacuation will depend upon the time of day the evacuation begins as well as other factors that may influence initial traffic conditions. As the NETVAC2 models were run, initial traffic conditions corresponding to off-peak, mid-peak, and peak ADT levels were analyzed. Figures 4-1a through 4-1c illustrate background vehicle distributions assumed for the following three conditions.

a. **Off-peak**: The off-peak traffic condition refers to light traffic volumes that typically occur late at night or in the early morning.

b. **Mid-peak**: The mid-peak traffic condition refers to moderate traffic conditions similar to that generally experienced in the two hour period occurring before and after the AM and PM peak conditions.

c. **Peak**: The peak traffic condition replicates the "rush hour" volume of traffic that is typical of the two hour period from 4:00 - 6:00 PM.

As noted above, background vehicles refer to motorists who travel roadways during an evacuation with trip purposes other than for evacuating their homes. At the start of an evacuation, the number of background

Figure 4-1a: Off-Peak Background Traffic Distribution

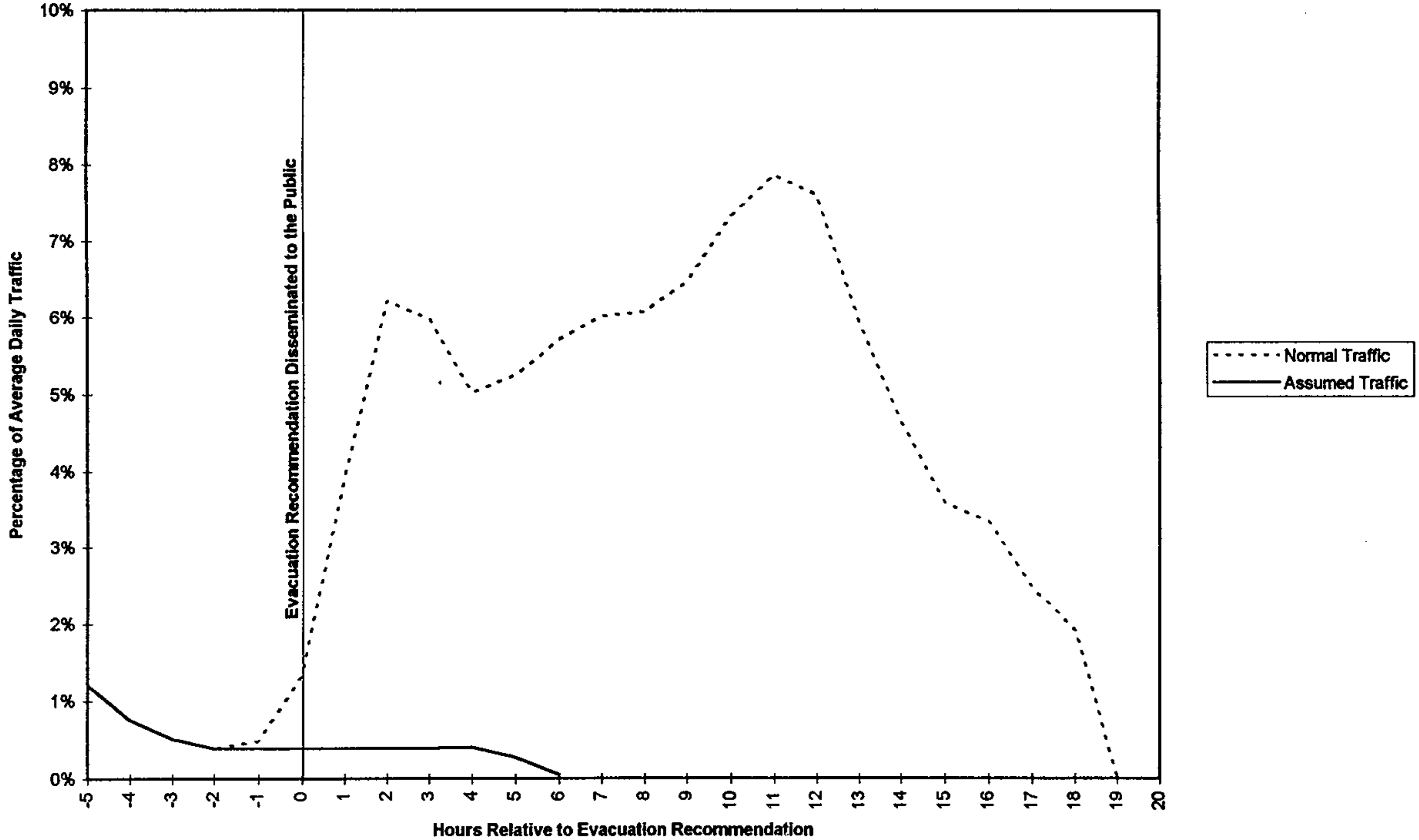


Figure 4-1b: Mid-Peak Background Distribution

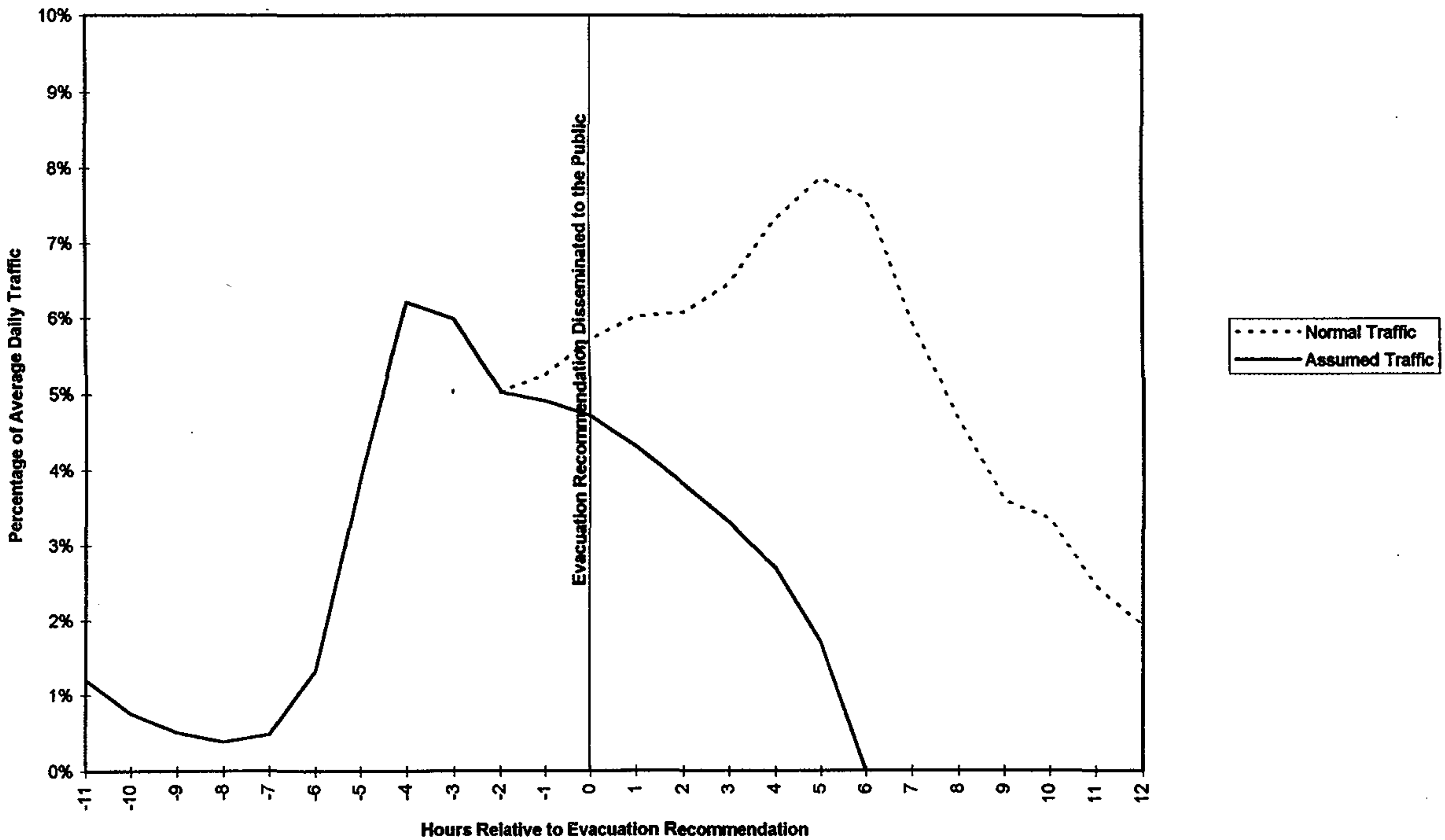
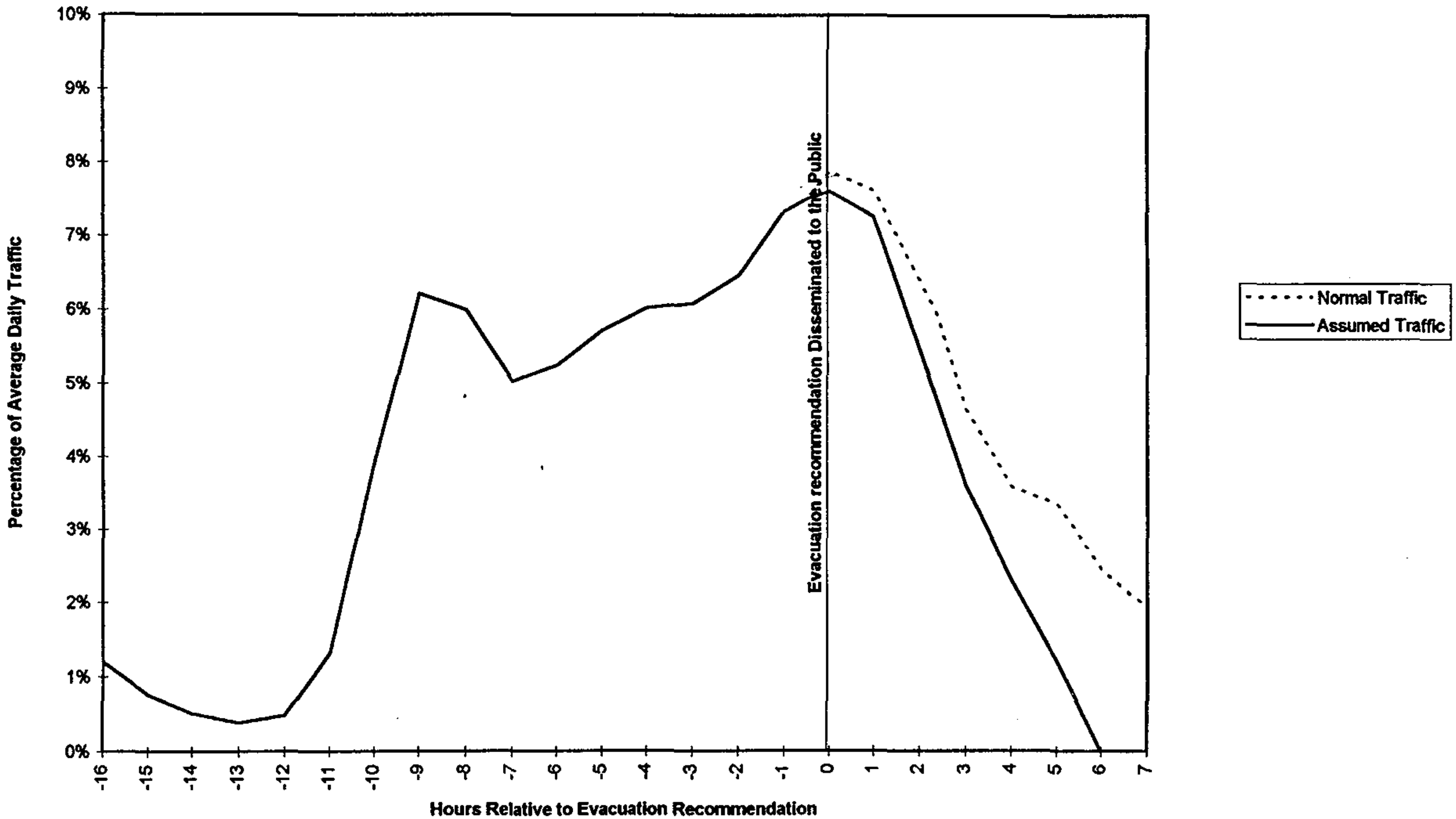


Figure 4-1c: Peak Background Distribution



vehicles assumed to exist on a particular road was taken as the ADT for that road on a normal day. As an evacuation progressed, the initial ADT assumed was slowly decreased until approximately zero background vehicles were on the roads at the completion of the evacuation.

Referring to the ADT distribution shown in Figure 2-10, the Transportation Analysis simulated evacuations occurring coincident with rush hour by programming evacuees to load onto roadways that were initially set at peak ADT volumes. Conversely, an evacuation occurring at times of light traffic, such as late at night or in the early morning, was modeled by running the model with background vehicles initially set at off-peak ADT volumes. Simulations run with background traffic at mid-peak ADT volumes represented moderate traffic volumes typical of mid-morning and mid-afternoon on weekdays or weekends.

The Transportation Analysis assumed the background traffic distributions shown in Figures 4-1a through 4-1c to apply to evacuations assuming a moderate behavioral response by evacuees. Background traffic distributions used for evacuations assuming a rapid or a slow behavioral response (not shown) follow the same curves shown in Figures 4-1a through 4-1c. The only exception is that evacuees are programmed to load onto roadways slightly before or after background traffic starts its decline. The number of background vehicles on any roadway during a a model run will vary depending upon each road's particular ADT and the hourly percentage of ADT assumed for the traffic condition modeled. A key point in using Figure 2-10 to derive background traffic conditions is that all traffic conditions are derived from actual traffic patterns observed for Rhode Island and Bristol County, Massachusetts rather than assumed hypothetical conditions.

Combinations of these key input parameters were used in developing 18 possible scenarios. For each of the networks, simulations were run for evacuations assuming weak hurricanes and severe hurricanes. Initial traffic conditions imparted on the road network followed the background distributions for off-peak, mid-peak, and peak traffic. Evacuees entered road networks at prescribed time intervals defined by the rapid, moderate, and slow behavioral responses.

Seasonal resident population and transient population visiting the area (i.e., tourism) varies widely in the study area, based upon the time of year, weather conditions, etc. The evacuating population used during simulations included seasonal residents as estimated from the 1990 census[10] from seasonal housing unit information. Coastal Rhode Island's seasonal population was found to be less than 12 percent of its permanent population. Although the varying transient conditions were not specifically evaluated for all scenarios, they were inherently addressed in a sensitivity analysis which focused on an evaluation of varying increases in study area population (refer to Section 5.3).

SECTION FIVE

ANALYSIS

5.1 GENERAL

Clearance time and dissemination time are two major considerations in deciding when an evacuation recommendation should be issued. The combination of these times defines a region's total evacuation time. Clearance time begins when an evacuation recommendation is clearly disseminated to the threatened public, and ends when the last evacuees clear the road system. This time includes the time required by evacuees to secure their homes and prepare to leave (mobilization time), the time spent by evacuees traveling along the road network (travel time), and the time lost due to traffic congestion (queuing delay time). Clearance time *does not relate solely to the time any one vehicle spends traveling on the road system.*

Dissemination time is the amount of time required by officials to notify the public to evacuate after the decision has been made. These values may differ by region depending on the communication and warning procedures utilized by State and local officials in their areas, and can best be estimated by the responsible state and local officials. The times calculated by the Transportation Analysis include only the clearance time component of evacuation time, and officials using this information must determine the dissemination time appropriate for their areas. Failure to add dissemination time to clearance time will underestimate total evacuation time, which could result in insufficient time for all evacuees to safely clear the hazard area.

Evacuations should be completed before the arrival of gale force winds (34 knot/39 mph) and/or storm surge. Vehicle accidents and reduced travel speeds from inclement weather can impede traffic flows, and potentially disrupt the evacuation. Therefore, the transportation modeling assumes that evacuations will occur well enough before a hurricane to preclude possible delays caused by significant weather. Moreover, the analysis assumes that provisions would be made for removal of vehicles in distress during the evacuation. The Decision Arc Method, outlined in Chapter Eight of the TDR, explains how the clearance times, used in conjunction with the dissemination times specified by officials, can provide guidance in hurricane evacuation decision-making. The time at which gale force winds arrive has been incorporated into the decision-making process of the Decision Arc Method and, therefore, does not need to be factored into the calculation of clearance time.

Evacuations for 18 combinations of storm strength, background traffic conditions, and evacuee response were simulated using the NETVAC2 computer model for both the West Bay/Rhode Island and the East Bay/Massachusetts networks. The simulated evacuations were reviewed to identify locations and duration of vehicle queuing delays (congestion), as well as to determine clearance times. The results of the simulated evacuations are presented below.

5.2 RESULTS

The NETVAC2 program presents information on traffic operations throughout the course of the simulated evacuation, including reports on vehicle arrivals and departures, roadway link speeds, and the total number of vehicles on the network for each reporting interval specified by the user. The total number of vehicles on a network can be plotted versus time to display graphically how quickly vehicles evacuate the roadway network. Figures 5-1 through 5-4 are such graphs, plotted from analysis results for the West Bay/Rhode Island and East Bay/Massachusetts networks under weak and severe hurricane evacuation scenarios, respectively. A moderate behavioral response curve was assumed for all scenarios presented in these figures. In each graph, the curves depict the numbers of vehicles remaining on a network, throughout the course of the evacuation, for evacuations starting with off-peak, mid-peak, and peak background traffic conditions.

For modeling purposes, evacuations were considered complete when the evacuating vehicles reached safe destinations. One limitation when calibrating networks to traffic patterns of a normal day is that near the completion of simulations, when most of the vehicles on the network are from evacuees rather than background traffic, vehicles adhere to turning movements of a normal day instead of seeking the most logical exit nodes. The remaining percentage on the network (2 percent) accounts for this difference. It is expected that evacuees leaving homes immediately before storm arrival will seek safe destinations of the shortest travel time. Free flow conditions are verified up to one hour before model termination to ensure the last evacuees experience light traffic free from queuing.

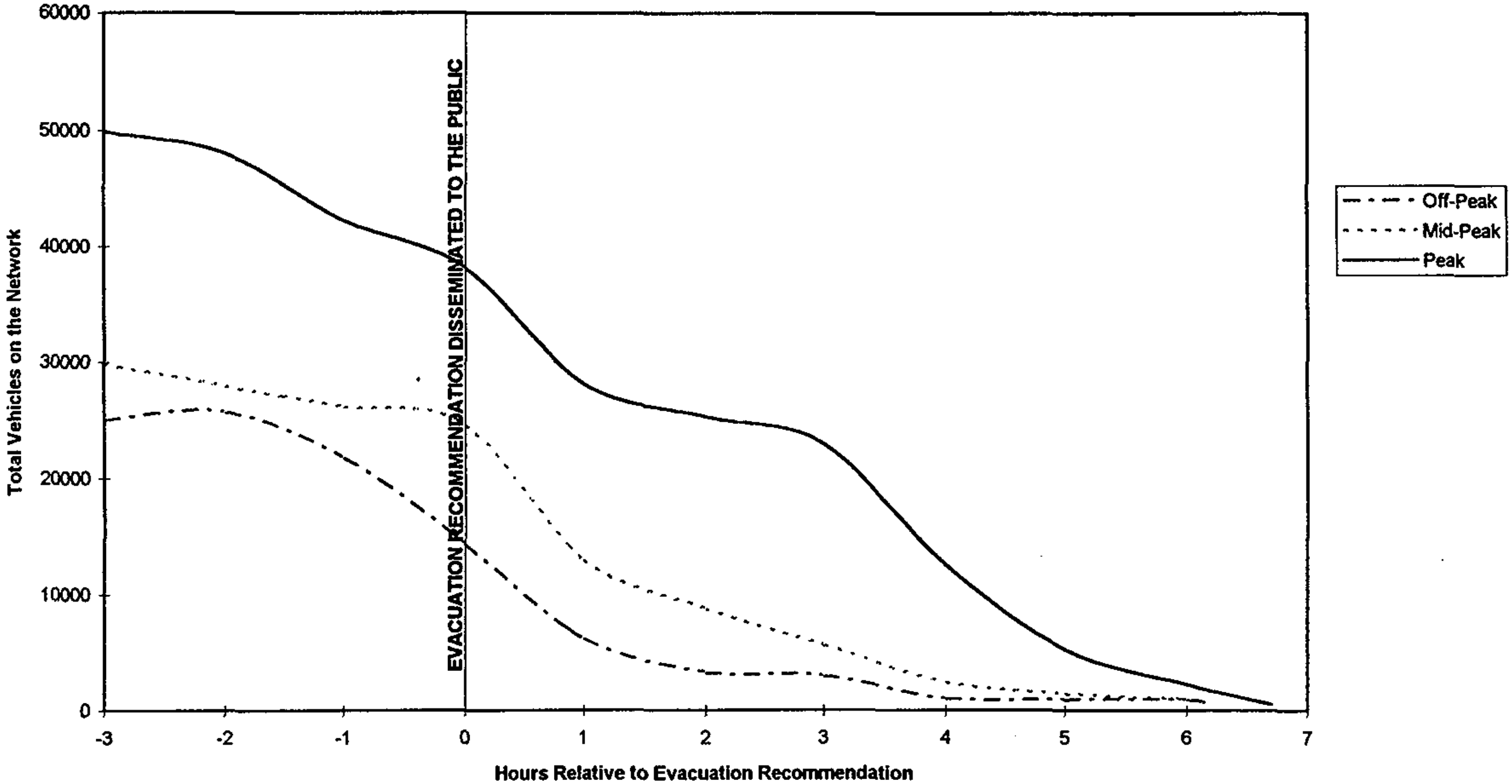
Tables 5-1 and 5-2 present the clearance times estimated for the West Bay/Rhode Island and East Bay/Massachusetts networks for weak and severe hurricane scenarios, respectively. Times are organized by intensity of hurricane, by the rate of response of the evacuating population, and by the level of background traffic at the start of the evacuation.

The clearance times were calculated assuming that each community is capable of sheltering their individual demands. The Transportation Analysis assessed how inadequate shelter capacity might influence clearance times, through sensitivity testing discussed in Section 5.3. Results showed that deficiencies in shelter capacity have a minimal affect on clearance time. This point is explained by the fact that the number of vehicles determined to travel to public shelters is very small in comparison to all vehicles on roadways. Consequently, the clearance times provided in Tables 5-1 and 5-2 are considered valid for the existing condition of deficient community shelter capacities and in the future if community sheltering capabilities improve.

Clearance times ranged from a minimum of approximately 4 hours and 15 minutes for an off-peak traffic condition under a weak hurricane scenario, to a maximum of about 9 hours and 35 minutes for a peak traffic condition under a severe hurricane scenario. The longer clearance times for the West Bay/Rhode Island network can be attributed to queuing along Route 1 from Providence to North Kingstown, as well as congestion on roads feeding into Route 1 along this same roadway section.

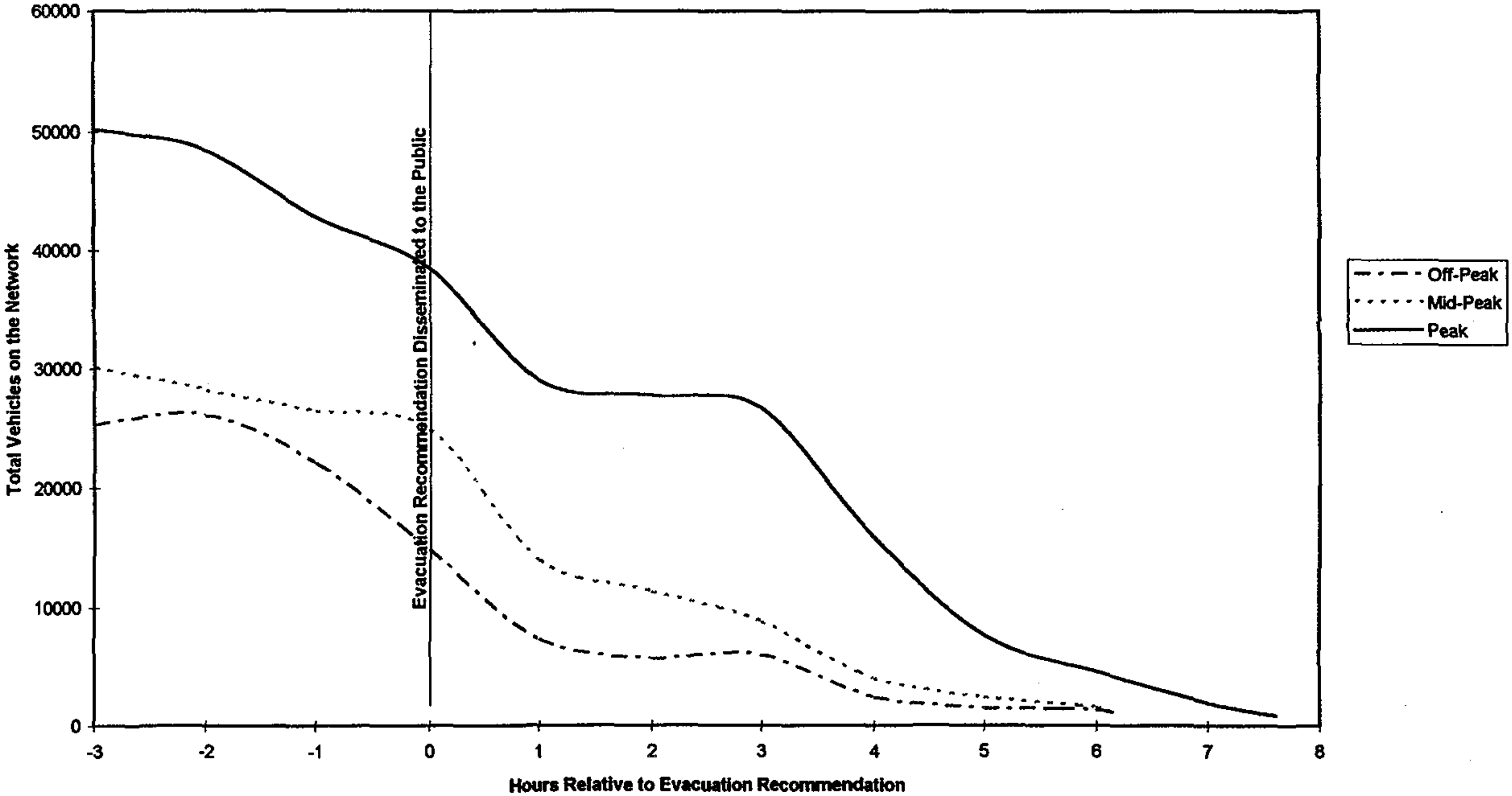
A summary of the evacuation clearance times for the West Bay/Rhode Island and East Bay/Massachusetts networks is presented in Tables 5-1 and 5-2.

FIGURE 5-1:
WEST BAY/RHODE ISLAND NETWORK PLOTTED RESULTS
FOR MODERATE BEHAVIORAL RESPONSE (WEAK HURRICANE)



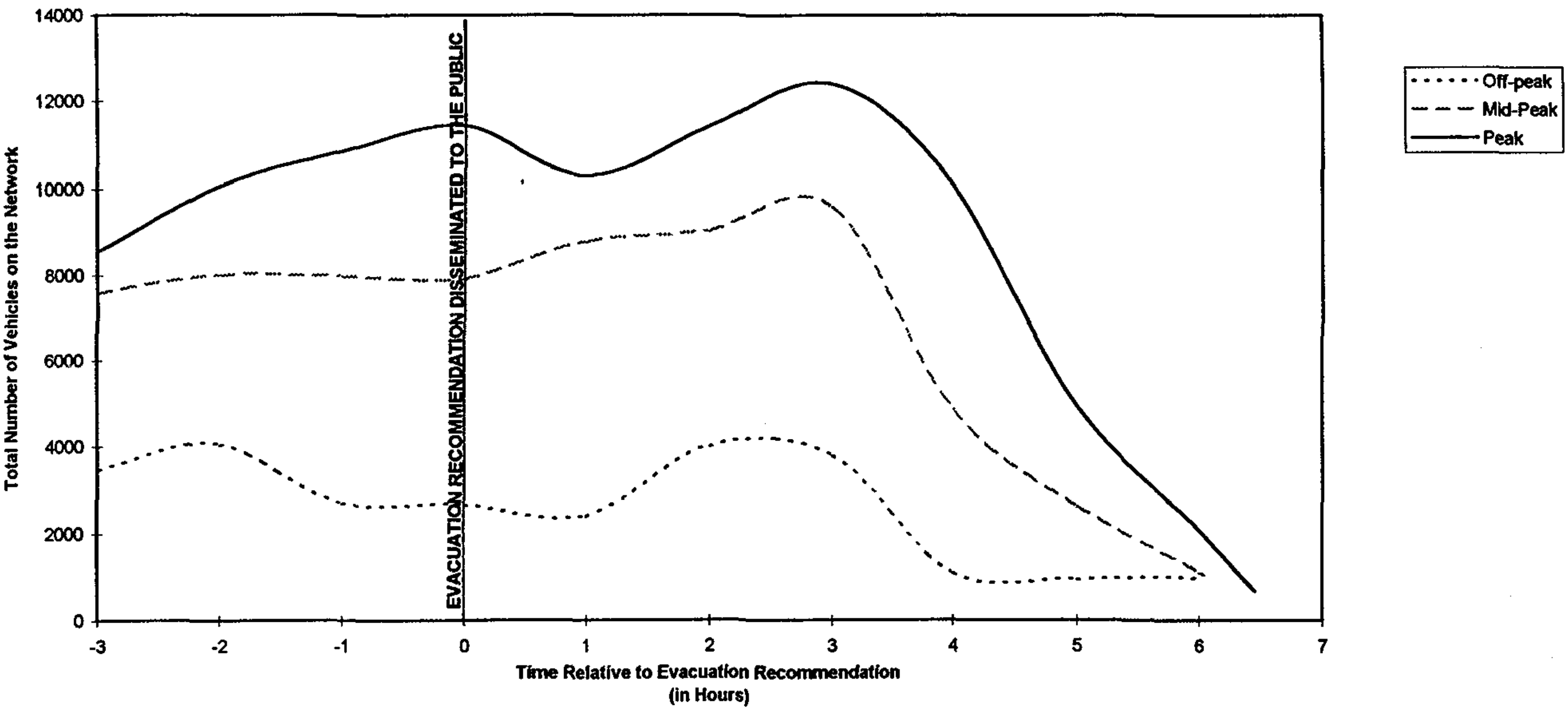
Note: **About 540 vehicles were on the network at the end of simulation *for all background runs.***

FIGURE 5-2:
WEST BAY/RHODE ISLAND NETWORK PLOTTED RESULTS
FOR MODERATE BEHAVIORAL RESPONSE (SEVERE HURRICANE)



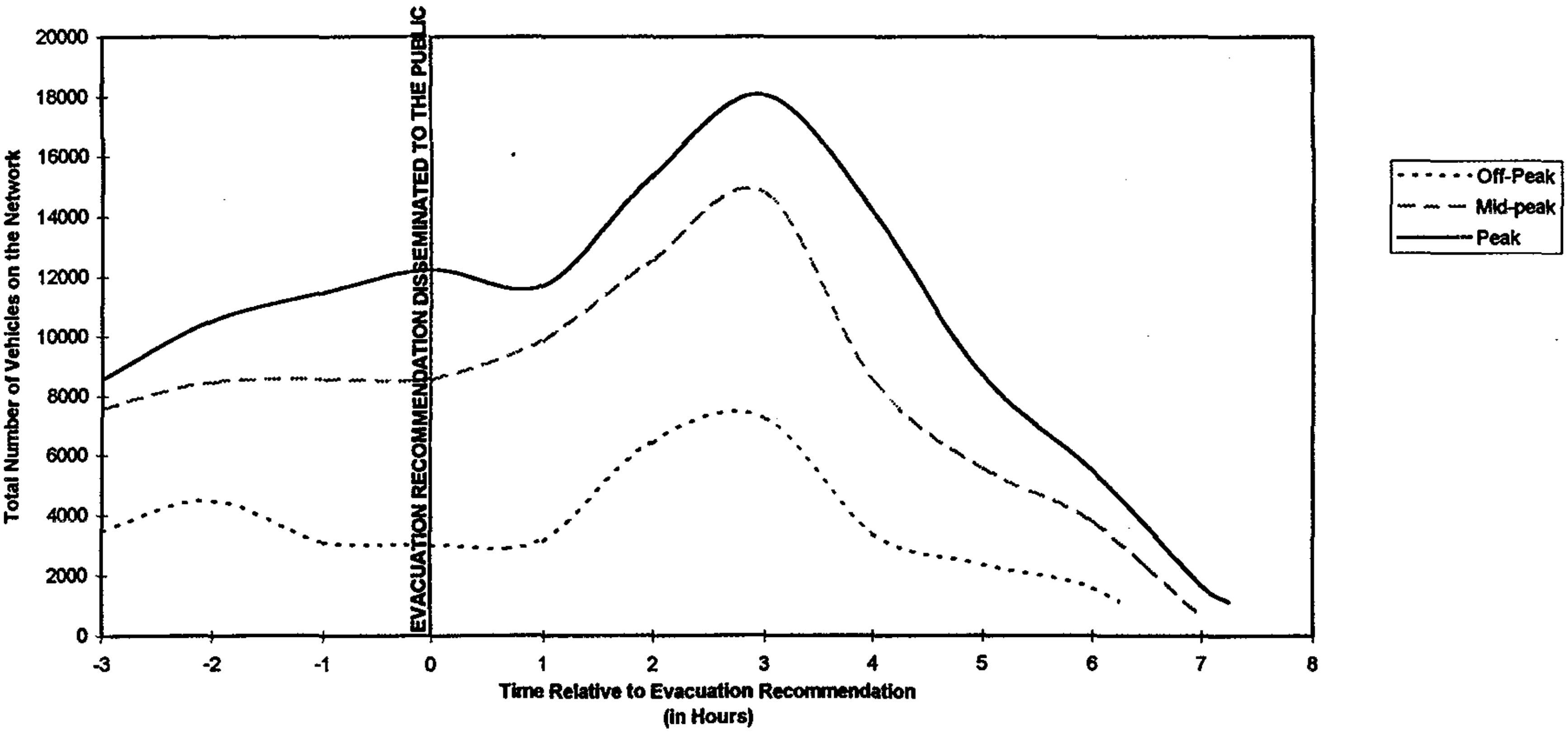
Note: **About 860 vehicles were on the network at the end of simulation for all background traffic conditions.**

FIGURE 5-3:
EAST BAY/MASSACHUSETTS NETWORK PLOTTED RESULTS
FOR MODERATE BEHAVIORAL RESPONSE (WEAK HURRICANE)



Note: **About 690 vehicles were on the network at the end of simulation for all background runs.**

FIGURE 5-4:
EAST BAY/MASSACHUSETTS NETWORK PLOTTED RESULTS
FOR MODERATE BEHAVIORAL RESPONSE (SEVERE HURRICANE)



Note: About 1140 vehicles were on the network at the end of simulation for all background runs.

TABLE 5-1
SUMMARY OF CLEARANCE TIMES (Weak Hurricane Scenario)

	BACKGROUND TRAFFIC CONDITION		
	Off-peak	Mid-peak	Peak
<u>WEST BAY/RHODE ISLAND NETWORK</u>	Hrs:Min		
Rapid Response	4:21	4:24	4:42
Moderate Response	6:10	6:11	6:43
Slow Response	8:04	8:04	8:38
<u>EAST BAY/MASSACHUSETTS NETWORK</u>			
Rapid Response	4:15	4:41	5:08
Moderate Response	6:06	6:10	6:28
Slow Response	8:01	8:02	8:22

TABLE 5-2
SUMMARY OF CLEARANCE TIMES (Severe Hurricane Scenario)

	BACKGROUND TRAFFIC CONDITION		
	Off-peak	Mid-peak	Peak
<u>WEST BAY/RHODE ISLAND NETWORK</u>	Hrs:Min		
Rapid Response	4:35	4:42	5:33
Moderate Response	6:10	6:13	7:37
Slow Response	8:04	8:04	9:36
<u>EAST BAY/MASSACHUSETTS NETWORK</u>			
Rapid Response	5:07	5:33	5:44
Moderate Response	6:06	6:47	7:15
Slow Response	8:03	8:11	8:36

West Bay/Rhode Island Network

For the West Bay/Rhode Island network, clearance times ranged from a minimum of approximately 4 hours and 20 minutes to a maximum of approximately 9 hours and 35 minutes. For this network, the evacuation clearance times for off-peak and mid-peak conditions under both weak and severe hurricane scenarios are only slightly higher than the response times, indicating that the response times are the primary factor influencing the total clearance times for these conditions. For the off-peak and mid-peak conditions under both the weak and severe hurricane scenarios, simulated traffic conditions are mostly free flow, with no long-term congestion along the network. For these conditions, some intermittent queuing occurs along Route 2 in East Greenwich; Route 1 in North Kingstown and Warwick and along Route 117 and 117A in Warwick; as well as some off ramps to I-95 in Warwick and Providence. The simulations for the off peak conditions showed limited congestion along I-95 and Route 1 north of Warwick.

West Bay/Rhode Island Network clearance times for all of the peak conditions reflect more congestion and lower travel speeds in numerous areas, compared to the off-peak and mid-peak conditions. Extended queuing is predicted to occur along Route 1, from Providence to North Kingstown, along I-95 in Warwick and Providence, as well as along most ramps accessing I-95 in these communities for extended periods during the evacuation. A moderate amount of congestion is also expected to occur along Route 138, between Route 102 and the Jamestown Bridge, as well as along Routes 2 and 4 in East Greenwich. Intermittent vehicle queuing and congestion would also occur along Routes 110 and 108 in South Kingstown, and Routes 117 and 117A in Warwick. For the peak conditions, Route 1 in Warwick is the one link expected to experience the highest level of overall congestion. Route I-95 in Warwick is also expected to experience prolonged delays during portions of the evacuation, with travel speeds lowering to 25-40 miles per hour. Along Route 1, travel speeds are predicted to decrease to 15 to 25 miles per hour for much of the time after the evacuation recommendation is disseminated.

In summary, the controlling factor for clearance of the West Bay/Rhode Island network is evacuee response time for off-peak and mid-peak conditions, while increased congestion in the peak case has an impact on extending the evacuation time, over the response time, by up to approximately 1 hour and 30 minutes. The difference in clearance times between the weak hurricane and severe hurricane storm scenarios are generally less than 1 hour, indicating that the number of evacuees and available roadway capacities are not the major influence on the clearance time for the West Bay/Rhode Island network.

East Bay/Massachusetts Network

For the East Bay/Massachusetts network, clearance times range from a minimum of 4 hours and 15 minutes, to a maximum of approximately 8 hours and 35 minutes. The evacuation clearance times for off-peak and mid-peak conditions under the weak hurricane scenario are only slightly higher than the response times, indicating that the background traffic conditions are the primary factor influencing total clearance times for these conditions.

Evacuation traffic conditions for off-peak, mid-peak, and peak rapid response conditions under the weak hurricane scenario generally result in free flow conditions, except for portions of Route 6 in Swansea, and Fall River, MA, and sections of Route 114 through Portsmouth and Middleton, RI and sections of 103 through Barrington and Warren. The level of congestion however, is more prominent for the mid-peak and peak rapid response scenarios. In these locations, intermittent vehicle queuing temporarily slows travel speeds to approximately 20 to 25% of the posted travel speeds. However, for these conditions, the intermittent congestion corresponds to the loading intervals for evacuating traffic. This indicates that the intermittent congestion and reductions in travel speeds are directly related to the assumed rate at which evacuees load onto roadways.

Evacuation traffic conditions for off-peak, mid-peak, and peak rapid response conditions under the severe hurricane scenarios has greater congestion problems along Route 6 in East Providence, Swansea and Fall River; Route 103 in Barrington and Warren and sections of Route 114 through Portsmouth and Middleton, RI, particularly during the rapid response condition. This intermittent congestion also corresponds to the loading intervals for evacuating traffic.

For peak conditions under the weak hurricane scenario, and most conditions under the severe hurricane scenario, increased vehicle queuing and congestion is expected along portions of Routes 6 in Swansea, MA, and sections of Route 114 through Portsmouth and Middleton, RI. Congestion is also predicted around the major urban centers subsequent to the evacuation recommendation, including key connectors such as Routes 6, 103 and 138 in the vicinities of East Providence, RI, Fall River, MA, Somerset, MA, Swansea, MA, Bristol, RI, and Barrington, RI. The roadways which will experience the most significant vehicle queuing are Route 6, between Fall River, MA and East Providence, and Route 114, between the Mount Hope Bridge and Route 6 in East Providence, RI. Congestion is also expected along Route 103 in Barrington and Warren.

In summary, evacuation clearance times for the East Bay/Massachusetts network, for the off-peak and mid-peak, moderate and slow response conditions under the weak and severe hurricane scenarios are generally defined by the response time. Although some intermittent queuing is expected, the major factor influencing these clearance times are the times associated with behavioral response. Simulations of most of the remaining weak storm and severe storm conditions indicate that prolonged vehicle queuing and congestion will have more of an impact in defining the overall clearance time. Specifically, congestion and vehicle queuing are predicted along major arterials, such as Route 6 in New Bedford, MA, and urban roadways such as Routes 114 and 24, and 103 in the bay communities, adding up to 1 hour and 45 minutes over the response time to the rapid response scenario.

A comparison of the clearance times for the East Bay/Massachusetts network indicates that the difference in evacuating population between a weak and severe storm would generally add an hour or less to the total clearance time. This indicates that even for the mid-peak and off-peak conditions, the response time is a substantial component of the overall clearance time.

5.3 SENSITIVITY ANALYSIS

5.3.1 Overview

The purpose of the sensitivity analysis was to evaluate the impact of simulated clearance times to key parameters that may vary from the base conditions discussed earlier. The key parameters considered in this analysis are:

- Population - to evaluate the impact of increased levels of the evacuating population on simulated clearance times
- Response Time - to access the sensitivity of a reduced response time for the rapid response condition
- Evacuation Shelter Use - to see how a reduction in community shelter use would impact simulated clearance times

The intent of the sensitivity analysis was not to simulate all cases and scenarios, but rather to evaluate a range of conditions which would define appropriate bounds from which conclusions for all conditions could be drawn.

Simulations for these three sensitivity analysis conditions were evaluated first for the severe hurricane scenario. If appropriate, for cases where a significant impact was found, the weak hurricane scenario would be considered. To limit the number of simulations, only scenarios that could be considered as defining the "upper" and "lower" bounds of clearance time were considered. From the base condition results, these scenarios were determined to be rapid and slow evacuee conditions during off-peak and peak background scenarios.

5.3.2 Sensitivity to Population Increases

The effect of population increases of up to 20% on clearance times were evaluated for the conditions outlined above. The simulated results for the cases analyzed are presented in Annex C, Table AC-1.

The results indicate that, for the severe hurricane scenario, several analysis conditions are sensitive to population increases of this magnitude. The most significant increases would be associated with the peak conditions (up to an 80 minute increase for the West Bay/Rhode Island network, and up to a 60 minute increase for the East Bay/Massachusetts network).

For the off-peak slow response scenario, the 20% increase in population had little effect on the clearance time for both networks. The 20% increase in population for the off-peak rapid response condition added up to 40 minutes to the clearance time.

In summary, an increase of total evacuating population of 20% for the severe hurricane scenario would have an appreciable effect on clearance times for the peak conditions. For the West Bay/Rhode Island network the most significant increase in clearance time would occur during the rapid response condition, whereas for the East Bay/Massachusetts network the most significant increase would occur for the slow response condition. Increases for the moderate response condition would be expected to be appreciable for both networks. These differences (i.e., between the East Bay/Massachusetts, and West Bay/Rhode Island network results) are associated with differences in the ability of the networks to accommodate the added traffic under the various loading scenarios.

Overall, it can be stated that for the defining cases, a 20% increase in population will result in an increase of clearance times of up to 80 minutes (up to 1 hour with a 10% increase).

5.3.3 Sensitivity to Shorter Rapid Response Time

A shorter rapid response time was evaluated to determine how sensitive the assumptions on rapid response were to clearance times. A 2-hour decrease in rapid response time (or a total response time of 2 hours) was used for the sensitivity analysis, for the severe hurricane scenario. The results of the sensitivity analysis simulations are presented in Annex C, Table AC-2.

The results indicate that, under the severe hurricane scenario, for both the West Bay/Rhode Island and East Bay/Massachusetts network, reduced rapid response assumptions have little effect on overall clearance times. For both off-peak and peak conditions, the shorter response times produced results within approximately 50 minutes of the base condition results.

It can be concluded that for the West Bay/Rhode Island and East Bay/Massachusetts networks, a reduction in the assumed rapid response time will have little effect on the overall clearance times. When the response time is reduced to 2 hours, the roadway network and capacity constraints become more of a constraining factor influencing the total clearance time.

5.3.4 Sensitivity to a Reduction in Community Shelter Use

An analysis was also performed to determine if the assumption on the number of persons expected to use community shelters could have an appreciable effect on the clearance times. Specifically, the intent was to determine if less evacuees used the shelters than predicted, would the additional traffic on the evacuating roadways have a significant effect on the clearance times.

The analysis was conducted for the severe hurricane scenario, assuming that only half of the evacuees assumed to use shelters under the base condition would actually use the shelters. The results, presented in Annex C, Table AC-3, indicate that for this condition, the impact would be nominal for most scenarios. The greatest increase in clearance time would be approximately 35 minutes for the West Bay/Rhode Island network, and 20 minutes for the East Bay/Massachusetts network. For most other conditions, the increased times resulting from decreased shelter use was about 10 minutes or less. Accordingly, it can be concluded that for most conditions under the severe hurricane scenario, the impact of a 50% reduction in community shelter use will not have an appreciable impact on clearance times.

It can also be concluded that for the weak hurricane scenario conditions, a reduction in community shelter use would generally have a nominal impact on clearance times.

SECTION SIX

SUMMARY

The Rhode Island Transportation Analysis is one element of a more comprehensive study entitled the Rhode Island Hurricane Evacuation Study. Two major considerations in hurricane evacuation planning are: 1) how much time will it take to notify people that they must leave their homes after authorities have determined an evacuation is necessary (dissemination time), and 2) how much time will it take for people who evacuate their homes to travel roadways and reach safe destinations (clearance time). Evacuation time is defined as the combination of these two times. The overall objective of the Transportation Analysis is to develop estimates of clearance times under a variety of hurricane evacuation scenarios for coastal Rhode Island. Clearance times and the results from other technical analyses are compiled in the Technical Data Report of the Rhode Island Hurricane Evacuation Study offering State and local officials state-of-the-art information for which hurricane preparedness plans can be updated.

An evacuation simulation computer model entitled NETVAC2 was used to create a mathematical representation of the road system in Rhode Island and Bristol County, Massachusetts. The model was calibrated to the traffic patterns of a normal day (a day for which no hurricanes are forecasted) using traffic and roadway data obtained from the Rhode Island Department of Transportation and Massachusetts Highway Department. Estimates of the numbers of seasonal and permanent residents that would evacuate prior to future hurricanes were made using estimates of the total vulnerable population and application of human behavioral characteristics assumed for the study area. During evacuation simulations, evacuating vehicles were programmed to enter roadways at prescribed loading rates and compete for roadway and intersection capacities with other vehicles of different trip purposes.

Evacuation scenarios, idealizing some of the possible situations officials may be faced with while contending with the decision to issue an evacuation, were outlined. Key parameters of evacuation scenarios include the intensity or severity of the hurricane, the behavioral response of evacuees to mobilize and leave their homes, and the time of day an evacuation takes place. Because Rhode Island and Bristol County, Massachusetts support an industrial and commercial base employing many people in and near inundation areas, evacuations are complicated by the presence of commuter traffic which varies at different times of the day. A total of 18 different scenarios formulated from combinations of key parameters were analyzed using the NETVAC2 model.

For the West Bay/Rhode Island network, results showed that in situations where people left their homes over a moderate to long period of time (6 to 8 hours after being told to do so by authorities), the density and capacity of the roadway system are such that evacuating traffic clears the network in slightly greater time than response times. For the rapid response condition (where people leave their homes within 4 hours of being told to do so by authorities) during peak background traffic, vehicle queuing and congestion can add up to 1 hour and 45 minutes to the clearance time.

For off-peak and mid-peak conditions under both weak and severe hurricane scenarios, simulated traffic conditions are mostly free flow with no long-term congestion throughout the network. However, clearance times for all of the peak conditions reflect greater congestion and lower travel speeds in Providence, Warwick, East Greenwich, and North Kingstown. However, the congestion does clear soon after the loading period.

The lowest clearance time calculated was approximately 4 hours and 30 minutes for the weak hurricane scenario assuming rapid response and off-peak background traffic in the West Bay/Rhode Island and East Bay/Massachusetts networks. The highest clearance time of about 9 hours and 35 minutes was calculated for the West Bay/Rhode Island network, for the severe hurricane scenario assuming slow evacuee response during peak background traffic conditions.

All scenarios assuming slow evacuee response resulted in clearance times ranging from approximately 8 hours to 9 hours and 35 minutes in both networks, independent of the severity of the hurricane or background traffic conditions.

A sensitivity analysis has been performed to evaluate the impact of key assumptions and parameters to evacuation clearance times. This analysis has indicated the following:

- An increase of total evacuating population of 20% for the severe hurricane scenario would add up to about 80 minutes for the West Bay/Rhode Island network and up to about 60 minutes for the East Bay/Massachusetts network. For the majority of cases, the increase in clearance times associated with a 20% increase in population results in a predicted increase in clearance times of less than 10%.

- Reductions in the assumed rapid response times will have little effect on the overall clearance times, for all conditions. When the response times are reduced to 2 hours, the roadway network and capacity constraints become more of a constraining factor influencing the total clearance time.

- A reduction in the assumed use of community shelters will generally have little effect on clearance times for most conditions. The greatest increase in clearance times for both the West Bay/Rhode Island and East Bay/Massachusetts network would be about 35 minutes for the peak condition. For most other conditions, the increased times resulting from decreased shelter use would be 10 minutes or less.

As stated before, the clearance times calculated in the analysis comprise only a portion of total evacuation times. An additional time component is required for officials to effectively disseminate evacuation recommendations to the public. Dissemination time may differ by region depending on communication and warning procedures utilized by State and local officials in a particular area, and can best be estimated by the responsible state and local officials. Failure to add this component to clearance times will underestimate evacuation times which could result in insufficient time for all evacuees to safely clear the hazard area. Evacuation times can be determined by adding an appropriate amount of time for dissemination to the clearance times estimated for Rhode Island in this analysis. This topic is discussed more fully in Chapter Seven, Evacuation Times, of the Technical Data Report.

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ANNEX A:
RHODE ISLAND NETWORK COMPUTER INPUT FILES

101	10211246		11	11	2	1	1	7	4	30	100	103	123		
102	103	6283	11	11	2	1	1	7	4	30	75	105	107		
102	123	5385	10	10	2	1	1	7	4	30	25	125			
103	105	7800	11	11	2	1	1	7	4	30	80	106	801		
103	107	6600	11	11	2	1	1	7	3	50	20	108	110		
104	803	6000	11	11	2	1	1	7	3	50	100				
105	801	1000	11	11	2	1	1	3	3	20	40				
105	106	4963	11	11	2	1	1	4	1	30	80	001	111	802	
106	001	6000	11	11	2	1	1	4	1	40	1	134	002		
106	802	1000	22	11	6	2	1	5	3	40	99				
106	111	3009	22	11	6	2	1	5	3	40	100	112			
107	108	1000	22	11	2	2	1	8	3	50	90	114			
107	110	1000	11	11	2	1	1	1	3	30	10	126			
108	11414520		22	11	2	2	1	8	3	50	90	116	115		
108	469	1000	11	11	2	1	1	1	3	30	10	470			
469	470	6600	22	11	6	2	1	5	3	40	100			471	
109	110	1000	22	11	6	2	1	5	3	40	100	126	126		
468	108	1000	22	11	2	2	1	1	3	25	1	114			
468	469	1000	22	11	6	2	1	5	3	40	99	470			
110	126	9750	22	11	2	2	1	8	3	40	100	127	800		
111	112	500	22	11	6	2	1	5	3	40	100	113	109		
111	106	3000	22	11	6	2	1	5	3	40	99	802	001		
471	804	500	11	11	2	1	1	5	1	25	1				
112	113	4500	22	11	6	2	1	5	3	40	1	117	880		
470	471	500	22	11	6	2	1	5	3	40	1		804		
112	109	6600	22	11	6	2	1	5	3	40	99	110			
113	117	2690	11	11	2	1	1	4	3	30	80	115			
113	880	1000	11	11	2	1	1	5	3	25	20				
113	470	4500	11	11	2	1	1	5	1	30	10	471			
114	115	1000	11	11	2	1	1	4	3	35	20	131		117	
114	116	1500	22	11	2	2	1	5	2	50	80	104			
115	116	1000	11	11	2	1	1	8	2	50	50	104			
115	117	750	11	11	2	1	1	4	2	30	25	113			
115	13112000		11	11	2	1	1	4	4	35	25			132	
116	104	9000	22	11	2	2	1	8	2	50	20	803			
117	113	2690	11	11	2	1	1	4	3	30	80	470		880	
117	115	1000	11	11	2	1	1	4	3	30	20	131	116		
122	123	3748	11	11	2	1	1	1	4	30	100		125	102	
123	102	5390	10	10	2	1	1	7	4	30	80		103		
123	12512620		11	11	2	1	1	4	4	35	95	128		127	
124	125	6000	10	10	2	1	1	7	4	50	100	127	128		
125	127	3170	11	11	2	1	1	7	4	50	80	131	128		
125	128	6450	11	11	2	1	1	8	4	35	20	130			
126	127	1480	22	11	6	2	1	8	4	40	75	128		131	
126	800	1000	11	11	2	1	1	5	1	25	25				
467	468	9750	22	11	6	2	1	8	4	50	100	469	108		
466	467	1480	22	11	2	2	1	8	4	50	100	468			
127	13110830		11	11	2	1	1	4	4	50	40	132		115	
127	128	7180	22	11	2	2	1	8	4	40	60			130	
128	130	3000	22	11	2	2	1	8	4	40	50	140			
465	466	7180	22	11	2	2	1	8	4	50	100	467	131		
129	130	2965	10	10	2	1	1	7	4	50	100		140		
464	465	3000	22	11	2	2	1	8	4	50	10		466		
130	140	4490	22	11	2	2	1	8	4	40	90	142		139	
131	11512000		11	11	2	1	1	4	4	35	50	117	116		
131	132	7500	11	11	2	1	1	4	4	35	50		805		
132	805	1000	11	11	2	1	1	5	1	25	40				
132	133	1000	11	11	2	1	1	4	4	35	90	135	139		
133	135	6000	22	11	4	2	1	6	4	35	90		013	012	
134	104	1000	22	11	2	2	1	8	1	35	50	803			
134	001	3000	22	11	2	2	1	8	1	35	50			002	
135	012	3900	11	11	4	1	1	7	4	30	50	002			
135	01330000		11	11	4	1	1	7	4	30	50			152	
139	133	8250	11	11	2	1	1	7	4	40	50		135	132	
133	139	8250	11	11	2	1	1	7	4	40	50	140			809
133	132	1000	11	11	2	1	1	7	4	35	10			805	
139	14010500		11	11	2	1	1	7	4	35	40			142	
139	809	1000	11	11	2	1	1	5	4	25	60				
140	13910500		11	11	2	1	1	7	4	35	50	133	809		
140	142	4225	22	11	6	2	1	8	4	40	50	149			
141	142	4800	10	10	2	1	1	7	4	50	100		149		
462	463	4225	22	11	6	2	1	8	4	50	50	464	139		
142	14920275		22	11	6	2	1	8	4	40	50	147			
143	144	4065	11	11	4	1	1	5	2	30	100	145			
144	145	3000	11	11	4	1	1	5	2	30	100	146	186		

145	146	3000	11	11	4	1	1	5	2	30	80	147			
145	186	8250	11	11	4	1	1	7	4	30	20	160			
146	147	500	11	11	4	1	1	5	2	30	100		150		
147	150	3000	22	11	6	2	1	8	4	40	15	166			
148	150	1000	22	11	6	2	1	8	4	40	50	166			
460	461	1000	22	11	6	2	1	8	4	50	90	462			
149	147	1500	22	11	6	2	1	8	4	40	50	150	151		
461	46220275		22	11	6	2	1	8	4	50	50	463			
147	15115000		12	12	4	1	1	7	4	40	9	013	813		022
459	460	1500	22	11	6	2	1	8	4	50	75	461			
459	151	1000	11	11	2	1	1	5	4	25	25	013	022		
150	16616000		22	11	6	2	1	8	4	40	50	162			
151	813	1000	11	11	2	1	1	5	4	25	60				
151	01312000		11	11	4	1	1	7	4	30	5		152	135	
151	02234500		12	12	4	1	1	7	4	40	5			153	
151	14815000		12	12	4	1	1	7	4	40	90		150		
152	014	7500	11	11	4	1	1	7	4	30	49		153		
152	810	1000	11	11	2	1	1	5	4	25	20				
152	013	9000	11	11	4	1	1	7	4	30	49		135		
153	812	1000	11	11	2	1	1	5	4	25	05				
153	01410500		12	12	4	1	1	7	4	40	75	021			
153	02217400		12	12	4	1	1	7	4	40	23	165			
155	112	3000	22	11	4	1	1	5	4	40	100	109			
159	270	3000	10	10	2	1	1	4	4	35	100	272		279	
160	161	500	11	11	4	1	1	7	4	35	20	162			
457	458	4500	22	11	6	2	1	8	4	50	95	459			
160	184	9000	11	11	4	1	1	7	4	35	80	165		814	
161	162	250	22	11	4	2	1	7	4	40	50	168			
162	168	7500	22	11	6	2	1	8	4	40	50	170			
455	456	7500	22	11	6	2	1	8	4	50	50	457	160		
165	181	3000	11	11	2	1	1	7	4	35	50	180		815	
165	022	7500	11	11	2	1	1	7	4	35	50	153			
166	162	3900	22	11	6	2	1	8	4	40	90	168			
458	45918000		22	11	6	2	1	8	4	50	10	460	151		
456	457	250	11	11	4	1	1	8	4	50	65	458			
167	166	9000	10	10	2	1	1	7	4	50	100		162		
168	170	9900	22	11	6	2	1	8	4	40	50	172			
169	189	6300	11	11	2	1	1	7	4	40	100	188			
170	171	750	11	11	2	1	1	5	2	40	10	173			
170	172	750	22	11	2	2	1	8	2	40	90	209			
454	455	9900	22	11	6	2	1	8	4	50	100	456			
171	172	750	11	11	2	1	1	4	4	40	95	209			
171	173	3000	11	11	2	1	1	4	4	40	75	174			
171	454	750	11	11	2	1	1	4	4	40	5	455			
172	20911250		22	11	6	2	1	8	2	40	100	183		175	210
453	454	1000	22	11	6	2	1	8	2	50	100	455	897		
173	174	4500	11	11	2	1	1	7	4	40	100	175		177	
174	175	3900	11	11	2	1	1	7	4	40	50	183		176	
174	177	5250	10	10	2	1	1	5	3	30	50		176	187	
175	176	1500	11	11	2	1	1	5	3	35	50	177		818	
175	183	3000	11	11	2	1	1	5	3	40	50	182			
176	818	1000	11	11	2	1	1	5	4	25	20				
176	177	3000	11	11	2	1	1	5	1	35	40		187		
176	175	1500	11	11	2	1	1	5	1	35	40			183	
177	187	750	11	11	2	1	1	5	1	30	70	179	817		
177	176	3000	11	11	2	1	1	5	1	35	30	175	818		
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179	816	1000	11	11	2	1	1	5	2	25	20				
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275	276	1800	22	11	6	2	1	5	2	40	100	280	840	278
276	275	2100	22	11	6	2	1	5	2	40	90	325		
276	278	9000	24	12	6	2	1	8	2	20	10	302		
276	280	6000	22	11	6	2	1	5	2	40	90	281	300	
276	840	1000	11	11	2	1	1	5	4	25	1			
278	302	6000	48	12	6	4	1	8	3	55	70	309		
409	410	9000	48	12	6	4	1	8	3	50	100	411		
278	302	5700	48	12	6	4	1	8	3	50	100	309		
279	269	4500	22	11	2	2	1	4	2	35	80	287	280	
276	409	7500	11	11	2	1	1	1	4	25	9	410		
279	836	1000	11	11	2	1	1	5	4	25	20			

280	276	6300	22	11	6	2	1	5	1	40	90	275	278	840		
280	300	6300	22	11	2	2	1	4	2	35	10	301	408			
281	322	4500	24	12	6	2	1	8	3	40	5	323		839		
281	280	5250	22	11	6	2	1	5	3	40	95	276		300		
282	261	3000	10	10	2	1	1	5	4	40	100	271				
283	295	2700	10	10	2	1	1	5	4	40	100		273	285		
284	285	2250	10	10	2	1	1	5	4	40	100		295			
286	159	3000	22	11	2	2	1	4	2	35	100	270				
285	295	3750	11	11	2	1	1	5	2	35	50			273		
285	271	4000	11	11	2	1	1	5	2	35	100	270				
287	288	2700	22	11	2	2	1	4	2	35	100	268				
288	268	3000	22	11	2	2	1	4	2	35	100	267				
289	288	2250	10	10	2	1	1	5	4	30	100			268		
290	291	1800	10	10	2	1	1	5	4	30	100	287				
291	287	2700	10	10	2	1	1	5	4	30	100			288		
293	294	5400	24	12	6	2	1	8	4	50	100			332		
294	332	3900	24	12	6	2	1	8	4	50	100	328				
295	273	3000	22	11	2	2	1	4	2	35	50	274				
300	408	1000	11	11	2	1	1	1	4	25	100	409				
300	301	1000	11	11	2	1	1	1	4	25	100		302			
301	302	1000	11	11	2	1	1	1	4	25	100	309				
408	409	5250	48	12	6	4	1	1	2	55	100	410				
302	309	9300	48	12	6	4	1	1	2	50	100	311	310		888	
304	333	1000	22	11	2	2	1	6	1	40	100	324				
304	838	1800	11	11	2	1	1	5	4	25	20					
304	305	2250	22	11	2	2	1	6	1	40	80		319	307		
305	319	2100	22	11	2	2	1	6	1	40	100	335				
305	304	2250	22	11	2	1	1	6	1	40	20	333	838			
305	307	5250	22	11	2	1	1	6	1	40	80	312		837		
306	841	1000	11	11	2	1	1	5	4	25	20					
306	332	6000	10	10	2	1	1	5	3	30	80			328		
306	274	3900	10	10	2	1	1	5	3	30	80		275			
307	837	1000	11	11	2	1	1	5	4	25	20					
307	312	2400	22	11	2	1	1	1	4	40	80		313			
307	305	5250	22	11	2	1	1	5	4	25	100	319	304			
308	406	1000	11	11	2	1	1	1	4	25	50	407				
308	310	1800	22	11	2	2	1	4	2	35	50	313				
309	310	1000	11	11	2	1	1	5	2	35	10	313				
406	407	2250	48	12	6	4	1	8	2	55	100	408		430		
309	311	6000	48	12	6	4	1	8	2	55	60	257				
310	313	5250	22	11	2	2	1	4	2	35	100	314				
310	311	1000	11	11	2	1	1	5	2	25	100	318				
405	406	2250	48	12	6	4	1	8	2	55	100	407				
311	31815000		36	12	6	3	1	8	2	55	100	041				
311	257	6000	48	12	6	4	1	8	2	55	100	318	889	250		
312	313	1000	11	11	2	1	1	1	4	25	100	314				
295	285	3000	10	10	2	1	1	7	2	30	50	271				
313	310	6000	22	11	2	2	1	4	2	35	20		311			
313	314	1000	22	11	2	2	1	4	2	35	100	830				
314	830	4500	11	11	2	1	1	5	2	25	20					
314	313	1000	22	11	2	2	1	4	2	35	80	310				
315	307	6000	22	11	2	2	1	6	3	40	80	305	837			
315	314	2400	11	11	2	1	1	5	3	40	20			830		
317	315	5000	11	11	2	1	1	5	3	40	50	314	307			
317	318	1000	11	11	2	1	1	1	4	25	100	041				
318	04149500		36	12	6	3	1	8	2	55	100	038	040			
403	40449500		36	12	6	3	1	8	2	55	100	405				
319	335	5250	24	12	6	2	1	8	2	55	25	337		336		
320	321	7200	11	11	2	1	1	1	2	25	100	309				
407	408	4500	48	12	6	4	1	8	4	55	75	409				
407	430	7200	24	12	6	2	1	8	4	55	25	431	890			
321	309	2250	24	12	6	2	1	8	2	55	100		310			
322	839	1000	11	11	2	1	1	5	4	25	20					
322	323	1000	11	11	2	1	1	4	4	40	80	336				
323	33611400		24	12	6	2	1	6	4	40	25	345				
323	324	1000	11	11	2	1	1	1	4	25	75	300				
324	300	1000	22	11	2	1	1	6	1	40	100		408			
324	280	1000	22	11	2	1	1	6	1	40	10	276				
325	326	3000	11	11	2	1	1	1	4	25	5	329				
325	327	1800	22	11	6	2	1	5	4	40	95	331				
326	329	1800	24	12	6	2	1	6	4	50	100	339		410		
327	331	3000	22	11	6	2	1	5	4	40	100			370		
327	326	1000	11	11	2	1	1	1	4	25	50	329				
328	842	1000	11	11	2	1	1	5	4	25	20					
328	331	2700	24	12	6	2	1	8	4	50	80	327	370			

329	410	1000	11	11	2	1	1	1	4	25	75	411		
329	339	6900	24	12	6	2	1	6	4	50	25	341		
410	411	11250	48	12	6	4	1	8	2	50	100	412		
330	278	12000	48	12	6	4	1	8	2	55	75	302	887	
331	370	9000	22	11	6	2	1	5	2	40	50	386		
331	327	2400	22	11	6	2	1	5	2	50	100	325	326	
332	328	3000	11	11	2	1	1	5	2	50	100		842	
332	376	7000	11	11	2	1	1	5	2	50	100	377		
333	324	3000	11	11	2	1	1	5	2	25	100	280		
334	309	6000	24	12	6	2	1	8	4	55	100	311		
335	337	3000	22	11	6	2	1	1	2	40	50	338		
336	345	9600	11	11	2	1	1	5	3	35	100	346		
337	338	2700	24	12	6	2	1	6	2	45	100	340		
338	340	1000	24	12	6	2	1	6	2	45	100	344		
339	341	1500	24	12	6	2	1	6	2	45	100	354		
340	341	1000	11	11	2	1	1	1	2	25	100		354	
341	354	2700	24	12	6	2	1	6	2	50	100		433	
344	353	7500	22	11	2	2	1	6	3	40	100	386		846
344	340	3600	24	12	6	2	1	6	2	50	25		341	
340	344	3600	24	12	6	2	1	6	2	50	75	353		
344	345	6000	22	11	2	2	1	5	2	35	75		346	
345	344	6000	22	11	2	2	1	5	2	35	100	353		
346	347	5000	22	11	2	2	1	5	2	35	80	348		
335	336	1000	11	11	2	1	1	1	2	25	50	345		
315	317	5000	22	11	2	2	1	6	3	40	50		318	
345	346	5250	22	11	2	2	1	5	2	35	100	347		845
346	845	3000	11	11	2	1	1	5	3	35	20			
346	345	5250	22	11	2	2	1	5	2	35	80	344		
347	348	3000	22	11	2	2	1	5	2	35	100	349		
347	346	5000	22	11	2	2	1	5	2	35	100	345	845	
348	349	6750	22	11	2	2	1	5	2	35	100	350		351
349	348	6750	22	11	2	2	1	5	2	35	80	347		
348	347	3000	22	11	2	2	1	5	2	35	100	346		
349	351	1000	11	11	2	1	1	6	4	25	50			355
349	434	1000	11	11	2	1	1	6	4	25	20		435	
349	350	13500	22	11	2	2	1	5	2	35	50	047		834
350	349	13500	22	11	2	2	1	5	2	35	80	348	434	
350	834	1000	11	11	2	1	1	5	4	35	15			
350	047	28500	12	12	6	1	1	7	4	40	85		048	046
353	846	8250	11	11	2	1	1	5	3	35	20			
353	344	7500	22	11	2	2	1	6	3	40	80	340	345	
353	386	6750	22	11	2	2	1	6	3	40	80	358		
354	433	1500	11	11	2	1	1	1	3	25	100	434		
351	355	12000	24	12	6	2	1	8	4	55	100	357		
355	357	12000	24	12	6	2	1	8	4	55	100	320		
357	320	12000	24	12	6	2	1	8	4	55	100	334		
320	334	4500	24	12	6	2	1	8	4	55	100	309		
358	850	1000	11	11	2	1	1	4	1	30	20			
238	233	11100	22	11	6	2	1	5	4	50	100	229		
370	386	7500	22	11	2	2	1	5	1	40	20	358		
370	371	1000	11	11	2	1	1	1	1	25	80	843		372
370	331	9000	22	11	6	2	1	6	2	40	100		327	
371	372	2700	11	11	2	1	1	1	1	25	80	374	412	
372	374	1000	22	11	2	2	1	1	1	40	50	389		
412	413	9750	48	12	6	4	1	8	1	55	100	414		
374	375	1000	11	11	2	1	1	1	1	25	100	330		
375	330	11250	48	12	6	4	1	8	2	55	100	278	886	
411	412	1200	24	12	6	2	1	8	1	55	100	413		
376	332	6000	24	12	6	2	1	6	2	50	100		328	
376	377	1800	11	11	2	1	1	5	2	45	100			378
377	378	2100	11	11	2	1	1	5	2	45	100	379		
378	379	5400	24	12	6	2	1	6	2	50	100	413		851
379	851	2400	11	11	2	1	1	5	2	25	20			
379	413	1000	11	11	2	1	1	1	4	25	80	414		
413	414	5250	48	12	6	4	1	8	2	55	100	415	382	
414	382	2100	12	12	2	1	1	8	1	50	20		397	
414	415	1500	48	12	6	4	1	8	1	55	80	417		
383	381	1500	48	12	6	4	1	8	1	55	100	380		
382	397	2400	36	12	6	3	1	8	1	50	10	871		
382	415	1800	12	12	2	1	1	8	1	50	80		417	
383	870	25500	48	12	6	4	1	1	4	50	100			
359	383	25500	48	12	6	4	1	8	2	55	100	381		
416	872	1000	48	12	6	4	1	8	4	55	100			
381	380	5250	48	12	6	4	1	8	2	55	100	373		
380	373	9000	48	12	6	4	1	8	2	55	100	375	374	

373	375	1200	48	12	6	4	1	8	2	55	90	330		
373	374	1000	11	11	2	1	1	1	2	25	10		389	
387	398	1000	24	12	6	2	1	6	1	45	100	390	852	
389	374	13500	24	12	6	2	1	6	1	50	100		375	
389	391	2700	24	12	6	2	1	8	1	55	100	056		
390	061	15900	24	12	6	2	1	6	2	55	20	059		
391	056	15600	24	12	6	2	1	6	2	55	100	057		
389	056	18000	24	12	6	2	1	8	4	55	100		436	
392	397	3600	22	11	2	2	1	4	1	40	95	871		
392	854	3000	11	11	2	1	1	5	1	30	05			
358	392	9000	22	11	2	2	1	5	1	40	100	226		394
392	394	5250	22	11	2	2	1	5	3	40	35	395		855
393	853	3750	11	11	2	1	1	5	1	30	05			
393	870	9000	22	11	2	2	1	5	1	40	95			
393	226	1500	22	11	2	2	1	5	1	40	95	392		
394	392	5250	22	11	2	2	1	5	3	40	100	397		854
394	855	1000	11	11	2	1	1	5	4	30	20			
394	395	3900	22	11	2	2	1	5	3	40	80	396		857
395	394	3900	22	11	2	2	1	5	3	40	100	392	855	
395	857	4500	11	11	2	1	1	5	4	30	20			
395	396	5250	22	11	2	2	1	5	3	40	80	073		856
396	856	3000	11	11	2	1	1	5	4	30	20			
396	073	15000	22	11	2	2	1	5	4	40	80	075	440	
396	395	3000	22	11	2	2	1	5	4	40	80	394	857	
397	871	6000	36	12	6	3	1	8	1	50	100			
398	852	1000	11	11	2	1	1	5	1	10	20			
398	390	6750	24	12	6	2	1	6	1	45	80	061	391	
390	398	6750	24	12	6	2	1	6	1	45	80			852
390	391	1000	11	11	2	1	1	5	1	25	80		056	
386	358	2000	22	11	2	2	1	5	1	40	50	392		850
358	386	2000	22	11	2	2	1	5	1	40	80	370	353	
386	353	6750	11	11	2	1	1	5	1	30	10	344	846	
386	370	7500	22	11	6	2	1	5	1	40	90	331		
374	389	14000	22	11	2	2	1	1	1	40	100		056	
372	412	1000	11	11	2	1	1	1	1	25	50		413	
371	843	500	11	11	2	1	1	5	1	25	20			
054	056	1000	11	11	2	1	1	1	4	25	100	389		
226	870	1000	22	11	2	2	1	7	1	50	1			
337	325	1500	24	12	6	2	1	7	2	50	50	275		
325	275	1500	24	12	6	2	1	5	2	40	100	276		
280	281	5250	22	11	6	2	1	5	3	40	4			266
281	266	9000	22	11	6	2	1	5	3	40	95	265		
253	241	6000	22	11	6	2	1	5	3	40	100	238		826
241	238	6500	22	11	6	2	1	5	4	40	90	233		
233	229	3000	22	11	6	2	1	7	4	40	100	227		
229	227	9000	22	11	6	2	1	5	4	50	100	222		
227	222	4500	22	11	6	2	1	7	4	40	100	224		
222	224	1500	22	11	6	2	1	8	4	50	50	450		
224	450	12000	22	11	6	2	1	8	4	50	100	451	180	
463	464	6000	22	11	6	2	1	8	4	50	100	465		
238	241	6500	22	11	6	2	1	5	4	40	85	253		
266	281	9000	22	11	6	2	1	5	3	40	100		280	
327	325	1000	22	11	6	2	1	7	3	40	50	275		
392	226	1500	22	11	6	2	1	7	3	40	100	393		
392	358	9000	22	11	6	2	1	7	3	40	100	386		
382	381	1500	22	11	2	2	1	4	3	35	10	380		
383	382	1500	22	11	2	2	1	4	3	35	100	397		
397	392	6000	22	11	2	2	1	5	3	40	100	394		
397	382	6000	36	12	6	3	1	8	1	50	100		415	381
398	387	1500	24	12	6	2	1	6	1	45	90	382		
387	382	1500	24	12	6	2	1	8	4	55	100	397		
226	392	1500	22	11	6	2	1	5	1	40	99	358		
026	405	6000	24	12	2	2	1	4	2	40	100	406		
027	407	6000	24	12	2	2	1	4	2	40	100	408		
028	408	6000	24	12	2	2	1	4	2	40	100	409		
029	409	6000	24	12	2	2	1	4	2	40	100	410		
415	417	12000	48	12	6	4	1	4	2	55	100	416	885	
417	416	12000	48	12	6	4	1	4	2	55	70	872		
417	885	3000	24	12	2	2	1	4	2	45	30			
430	431	3000	24	12	6	2	1	8	4	55	80	432	891	
431	432	12000	24	12	6	2	1	8	4	55	80	433		
432	433	1500	24	12	6	2	1	8	4	55	100	434		
433	434	13500	24	12	6	2	1	8	4	55	100	435	349	
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434	349	1000	11	11	2	1	1	1	4	25	4		350	

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 435 436 3000 24 12  6 2 1 8 4 55    100 437
 436 437 1500 24 12  6 2 1 8 4 55    100 438      061
 437 061 1000 11 11  2 1 1 1 4 25     15 390
 437 438 1500 24 12  6 2 1 8 4 55     85 439
 438 43915000 24 12  6 2 1 8 4 55    100 440
 439 440 1000 24 12  6 2 1 8 4 55     90 441      075
 439 073 1000 11 11  2 1 1 1 4 25     10 396
 440 44113500 24 12  6 2 1 8 4 55     85 442      881     088
 440 075 1000 11 11  2 1 1 5 1 25     15 044
 441 881 1000 11 11  2 1 1 5 1 25     40
 441 442 1000 24 12  6 2 1 8 4 55     40 443
 441 088 1000 11 11  2 1 1 5 1 25     10
 442 44315000 24 12  6 2 1 8 4 55    100 444      882
 443 882 1000 11 11  2 1 1 5 1 25     40
 443 444 1000 24 12  6 2 1 8 3 55    100 860
 444 86042000 24 12  6 2 1 8 3 55    100
 278 887 3000 24 12  6 2 1 8 3 55     30
 330 886 3000 24 12  6 2 1 8 3 55     20
 309 888 3000 24 12  6 2 1 8 3 55     25
 257 889 3000 24 12  6 2 1 8 3 55     46
 030 386 8300 22 11  2 2 1 5 1 40    100 370
 450 18018510 11 11  2 1 1 4 4 40      5 181
 167 458 9000 10 10  2 1 1 7 4 50    100 459
 463 13910500 11 11  2 1 1 7 4 35     30 133
 141 462 4800 10 10  2 1 1 7 4 50    100                  463
 466 13110830 11 11  2 1 1 4 4 50     40 132              115
 250 245 5250 24 12  6 2 1 8 4 50    100 244
 245 244 3000 24 12  6 2 1 8 4 50    100 243
 244 243 1000 24 12  6 2 1 8 4 50    100 234
 243 234 1000 24 12  6 2 1 8 4 50    100 228              823
 129 464 6000 24 12  6 2 1 5 4 30    100                  465
 456 160 1000 11 11  4 1 1 7 4 35     35 184
 430 890 3000 24 12  6 2 1 8 2 55     20
 431 891 3000 24 12  6 2 1 8 2 55     25
 452 175 3000 24 12  6 2 1 5 2 35     25 176
 227 895 3000 24 12  6 2 1 5 2 35     75
 454 897 3000 24 12  6 2 1 5 2 40     20
 093 090 3000 36 12  6 3 1 8 4 55    100 397
99999
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POPOTP1 Rhode Island Strong Storm Off-Peak Traffic, Rapid Response

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&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout1.dat'
outprint='popout1.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=270.0 int1(2)=390.0 int1(3)=400.0 int1(4)=510.0 int1(5)=630.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
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POPOPT2 Rhode Island Strong Storm Off-Peak Traffic, Moderate Response

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&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout2.dat'
outprint='popout2.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=120.0 int1(2)=300.0 int1(3)=360.0 int1(4)=480.0 int1(5)=660.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT3 Rhode Island Strong Storm Off-Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout3.dat'
outprint='popout3.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=0.0 int1(2)=240.0 int1(3)=320.0 int1(4)=480.0 int1(5)=720.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT4 Rhode Island Strong Storm Mid-Peak Traffic, Rapid Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout4.dat'
outprint='popout4.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=840.0 int1(2)=960.0 int1(3)=1000.0 int1(4)=1080.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT5 Rhode Island Strong Storm Mid-Peak Traffic, Moderate Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout5.dat'
outprint='popout5.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=660.0 int1(2)=840.0 int1(3)=900.0 int1(4)=1020.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT6 Rhode Island Strong Storm Mid-Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout6.dat'
outprint='popout6.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=480.0 int1(2)=720.0 int1(3)=800.0 int1(4)=960.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT7 Rhode Island Strong Storm Peak Traffic, Rapid Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout7.dat'
outprint='popout7.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=870.0 int1(2)=990.0 int1(3)=1030.0 int1(4)=1110.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT8 Rhode Island Strong Storm Peak Traffic, Moderate Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout8.dat'
outprint='popout8.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=690.0 int1(2)=870.0 int1(3)=930.0 int1(4)=1050.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT9 Rhode Island Strong Storm Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout9.dat'
outprint='popout9.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=510.0 int1(2)=750.0 int1(3)=830.0 int1(4)=990.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT10 Rhode Island Weak Storm Off-Peak Traffic, Rapid Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout10.dat'
outprint='popout10.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=270.0 int1(2)=390.0 int1(3)=430.0 int1(4)=510.0 int1(5)=630.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT11 Rhode Island Weak Storm Off-Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout11.dat'
outprint='popout11.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=120.0 int1(2)=300.0 int1(3)=360.0 int1(4)=480.0 int1(5)=660.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT12 Rhode Island Weak Storm Off-Peak Traffic, Slow Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout12.dat'
outprint='popout12.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=0.0 int1(2)=240.0 int1(3)=320.0 int1(4)=480.0 int1(5)=720.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT13 Rhode Island Weak Storm Mid-Peak Traffic, Rapid Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout13.dat'
outprint='popout13.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=840.0 int1(2)=960.0 int1(3)=1000.0 int1(4)=1080.0 int1(4)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT14 Rhode Island Weak Storm Mid-Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout14.dat'
outprint='popout14.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=660.0 int1(2)=840.0 int1(3)=900.0 int1(4)=1020.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT15 Rhode Island Weak Storm Mid-Peak Traffic, Slow Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout15.dat'
outprint='popout15.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=480.0 int1(2)=720.0 int1(3)=800.0 int1(4)=960.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT16 Rhode Island Weak Storm Peak Traffic, Rapid Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout16.dat'
outprint='popout16.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=870.0 int1(2)=990.0 int1(3)=1030.0 int1(4)=1110.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT17 Rhode Island Weak Storm Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout17.dat'
outprint='popout17.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=690.0 int1(2)=870.0 int1(3)=930.0 int1(4)=1050.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT18 Rhode Island Weak Storm Peak Traffic, Slow Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout18.dat'
outprint='popout18.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=510.0 int1(2)=750.0 int1(3)=830.0 int1(4)=990.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

Background Traffic

NR1ANB	3	2900	1.00	194	100							
WE1NB	3	10300	1.00	155	100							
WA1NB	3	4000	1.00	331	100							
WE1SB	3	3500	1.00	129	100							
WE1SB	3	3000	1.00	467	100							
PW1SB	3	5000	1.00	092	100							
WA1SB	3	10000	1.00	030	77	370	23					
WAAPR	3	2500	1.00	274	100							
HO95NB	3	17050	1.00	077	100							
PW95SB	3	86000	1.00	086	55	359	10	383	10	381	25	
BU102S	3	6300	1.00	078	100							
NK2NB	3	10000	1.00	079	100							
GL44EB	3	3500	1.00	083	100							
SC6EB	3	1000	1.00	084	100							
SC6WB	3	3600	1.00	387	100							
SC14EB	3	1200	1.00	085	100							
NA295S	3	17800	1.00	076	83	072	17					
CR295S	3	5000	1.00	057	100							
NS146S	3	6000	1.00	081	100							
BU7SB	3	1	1.00	082	100							
PR195W	3	30150	1.00	090	100							
RI138E	3	5900	1.00	091	100							
NR138W	3	8700	1.00	098	100							
NK1SB	3	1	1.00	099	100							
WEINB	3	10000	1.00	126	100							
CHRT1B	3	4000	1.00	185	100							
CHRT1B	3	2500	1.00	167	100							
SKRT1B	3	7000	1.00	209	100							
WART1B	3	4000	1.00	266	100							
WART1B	3	4000	1.00	281	100							
WART1B	3	4000	1.00	280	100							
WART1B	3	4000	1.00	276	100							
WART1B	3	8000	1.00	275	100							
WART1B	3	4000	1.00	325	100							
WART1B	3	4000	1.00	331	100							
CH2SB	3	3300	1.00	151	100							
EG4NB	3	35000	1.00	250	100							
EGQP	3	5000	1.00	235	100							
PR195W	3	20000	1.00	397	100							
SKETL	3	1000	1.00	169	100							
WA95NL	3	12000	1.00	026	100							
WA95NL	3	15000	1.00	027	100							
WA95NL	3	15000	1.00	028	100							
WA95NL	3	15000	1.00	029	100							
NK4NB	3	35000	1.00	242	50	250	50					

Severe Storm Surge Vulneralbe Population File

1	1	333	2.96	378	100		
7	1	4	2.96	379	100		
34	1	33	2.96	225	100		
35	1	166	2.96	093	100		
37	1	374	2.96	093	100		
134	1	1133	2.05	294	50	377	50
135	1	368	2.05	378	100		
136	1	409	2.05	371	100		
138	1	94	2.05	330	100		
139	1	47	2.05	330	100		
149	1	5	2.26	101	100		

Severe Storm Surge Vulneralbe Population File(con't.)

152	1	3	2.26	101	100								
153	1	54	2.26	393	100								
160	1	21	2.26	393	100								
165	1	2	2.26	393	100								
166	1	87	2.26	393	100								
167.97	1	264	2.26	101	100								
167.98	1	167	2.26	102	100								
209.01	1	1009	1.85	255	50	256	50						
210	1	1498	1.88	293	50	294	50						
211	1	204	1.88	330	100								
213	1	1888	1.88	306	50	293	50						
214.01	1	1288	1.88	215	80	306	20						
214.02	1	751	1.88	273	100								
215.01	1	2473	1.88	283	34	273	33	295	33				
215.02	1	3992	1.88	271	25	284	25	285	25	262	25		
216	1	1324	1.88	282	50	261	50						
217	1	3900	1.88	286	34	159	33	270	33				
218	1	1579	1.88	272	34	270	33	269	33				
219.01	1	230	1.88	268	100								
219.02	1	457	1.88	288	100								
219.03	1	1677	1.88	287	34	291	33	290	33				
220	1	1995	1.88	265	34	267	33	289	33				
221	1	738	1.88	322	100								
222.01	1	166	1.88	265	100								
223	1	230	1.88	279	100								
224	1	1308	1.88	216	50	217	50						
501.02	1	1052	1.83	238	50	236	50						
501.03	1	458	1.83	241	100								
501.04	1	1129	1.83	240	50	239	50						
502	1	623	1.83	240	50	236	50						
503.01	1	39	1.83	233	100								
503.02	1	1626	1.83	230	34	231	33	232	33				
504.02	1	1616	1.83	230	34	220	33	222	33				
508.01	1	1010	1.90	104	33	106	33	139	34				
508.02	1	970	1.90	103	50	105	50						
509	1	161	1.90	124	100								
510	1	3813	1.90	101	20	102	20	122	20	123	20	124	20
511.01	1	969	1.80	141	100								
511.02	1	990	1.80	143	100								
512	1	378	2.30	177	100								
513.01	1	418	2.30	160	100								
513.02	1	4170	2.30	166	34	188	33	189	33				
515.01	1	4556	1.73	190	20	191	20	193	20	201	20	203	20
515.02	1	3558	1.73	211	25	212	25	213	25	214	25		

Weak Storm Surge Vulnerable Population File

1	1	148	2.96	378	100		
7	1	2	2.96	379	100		
34	1	30	2.96	225	100		
35	1	147	2.96	093	100		
37	1	166	2.96	093	100		
134	1	952	2.05	294	50	377	50
135	1	267	2.05	378	100		
136	1	259	2.05	371	100		
138	1	83	2.05	330	100		
139	1	42	2.05	330	100		
149	1	4	2.26	101	100		
152	1	2	2.26	101	100		

Weak Storm Surge Vulnerable Population File(con't.)

153	1	48	2.26	393	100								
160	1	18	2.26	393	100								
165	1	2	2.26	393	100								
166	1	78	2.26	393	100								
167.97	1	234	2.26	101	100								
167.98	1	149	2.26	102	100								
209.01	1	720	1.85	255	50	256	50						
210	1	948	1.88	293	50	294	50						
211	1	97	1.88	330	100								
213	1	1388	1.88	306	50	293	50						
214.01	1	980	1.88	215	80	306	20						
214.02	1	406	1.88	273	100								
215.01	1	1757	1.88	283	34	273	33	295	33				
215.02	1	2469	1.88	271	25	284	25	285	25	262	25		
216	1	752	1.88	282	50	261	50						
217	1	3372	1.88	286	34	159	33	270	33				
218	1	1044	1.88	272	34	270	33	269	33				
219.01	1	182	1.88	268	100								
219.02	1	238	1.88	288	100								
219.03	1	1201	1.88	287	34	291	33	290	33				
220	1	1406	1.88	265	34	267	33	289	33				
221	1	328	1.88	281	50	322	50						
222.01	1	92	1.88	265	100								
223	1	102	1.88	279	100								
224	1	1082	1.88	216	50	217	50						
501.02	1	934	1.83	238	50	236	50						
501.03	1	262	1.83	241	100								
501.04	1	768	1.83	240	50	239	50						
502	1	552	1.83	240	50	236	50						
503.01	1	17	1.83	233	100								
503.02	1	1355	1.83	230	34	231	33	232	33				
504.02	1	1353	1.83	230	34	220	33	222	33				
508.01	1	610	1.90	104	33	106	33	139	34				
508.02	1	634	1.90	103	50	105	50						
509	1	132	1.90	124	100								
510	1	2775	1.90	101	20	102	20	122	20	123	20	124	20
511.01	1	690	1.80	141	100								
511.02	1	638	1.80	143	100								
512	1	302	2.30	177	100								
513.01	1	371	2.30	160	100								
513.02	1	3173	2.30	166	34	188	33	189	33				
515.01	1	3246	1.73	190	20	191	20	193	20	201	20	203	20
515.02	1	2834	1.73	211	25	212	25	213	25	214	25		

Severe Storm Mobile Home and Non-Surge Vulnerable Population File

WESTE	2	1170	1.90	107	20	131	20	113	20	132	20	127	20
CHARL	2	730	1.80	139	25	013	25	140	25	148	25		
S.KIN	2	1720	2.30	022	20	165	20	184	20	179	20	182	20
NARRA	2	550	1.73	198	20	199	20	200	20	204	20	207	20
N.KIN	2	1370	1.83	227	25	228	25	229	25	234	25		
E.GRE	2	650	1.85	244	25	246	25	247	25	403	25		
WARWI	2	3090	1.88	305	20	307	20	318	20	315	20	404	20
CRANS	2	3750	2.05	433	20	434	20	347	20	346	20	345	20
PROVI	2	8090	2.96	386	20	390	20	394	20	395	20	396	20
PAWTU	2	4440	2.26	392	50	416	50						

Weak Storm Mobile Home and Non-Surge Vulnerable Population File

WESTE	2	590	1.90	107	20	131	20	113	20	132	20	127	20
CHARL	2	490	1.80	139	25	013	25	140	25	148	25		
S.KIN	2	970	2.30	022	20	165	20	184	20	179	20	182	20
NARRA	2	230	1.73	198	20	199	20	200	20	204	20	207	20
N.KIN	2	870	1.83	227	25	228	25	229	25	234	25		
E.GRE	2	320	1.85	244	25	246	25	247	25	403	25		
WARWI	2	1360	1.88	305	20	307	20	318	20	315	20	404	20
CRANS	2	1530	2.05	433	20	434	20	347	20	346	20	345	20
PROVI	2	3290	2.96	386	20	390	20	394	20	395	20	396	20
PAWTU	2	2300	2.26	392	50	416	50						

ANNEX B:
EAST BAY/MASSACHUSETTS NETWORK COMPUTER INPUT FILES

```
001 848   600 11 11  2 1 1 5 2 25    15
070 00131150 24 12  6 2 1 8 2 55   100 100
100 001 2100 24 12  6 2 1 8 2 55    75 860               848
100 101   500 24 12  6 2 1 8 2 55    25 851               102
101 100   500 11 11  2 1 1 1 2 25    75 001
101 102   500 11 11  2 1 1 1 2 25    25 103               847
102 847 3600 11 11  2 1 1 5 2 25    20
102 10312000 11 11  2 1 1 5 2 30    25 104     821
102 101   500 11 11  2 1 1 5 2 25    55         100       851
103 10212000 11 11  2 1 1 5 2 30    55 101     847
103 821 3000 11 11  2 1 1 5 2 25    02
103 104 2700 11 11  2 1 1 5 2 30    25 105
104 103 3000 11 11  2 1 1 5 2 30    75 102               821
104 105 2700 11 11  2 1 1 5 2 30    25 133     106
105 106 5100 11 11  2 1 1 5 2 30    30 107     822
105 133 5400 11 11  2 1 1 5 2 30    30 131               030
106 105 5100 11 11  2 1 1 5 2 30    40         133       104
106 107 2100 11 11  2 1 1 5 2 30    40 108
106 822   300 11 11  2 1 1 5 2 25    15
107 106 2100 11 11  2 1 1 5 2 30    50 105     133       822
107 108 2100 11 11  2 1 1 5 2 30    50 121     113       124
108 124 2250 22 11  2 2 1 5 2 30    30 127
108 121 2100 11 11  2 1 1 5 2 30    20 122     823
108 113 1800 22 11  2 2 1 5 2 30    30 112
108 107 2100 11 11  2 1 1 5 2 30    20 106
124 127 6900 22 11  4 2 1 6 2 40    40 128
124 108 2250 22 11  2 2 1 5 2 30    40 113
131 129 2250 11 11  2 1 1 5 2 30    15 128
129 128 2250 11 11  2 1 1 5 2 30    50 127
129 131 2250 11 11  2 1 1 1 4 25    20 133               022
130 129 1000 11 11  2 1 1 1 4 25    20         128       131
022 02312000 36 12  6 3 1 8 2 55   100 031
021 022 1000 36 12  6 3 1 8 2 55    90 023
021 131 1000 11 11  2 1 1 5 2 25    10         133       129
130 132 1000 36 12  6 3 1 8 2 55    40 144
131 133 9000 11 11  2 1 1 5 2 30    05 105     030
131 022 1000 11 11  2 1 1 5 2 25    80 023
105 104 2700 11 11  2 1 1 5 2 30    40 103
106 133 5250 11 11  2 1 1 7 2 30    05 030     131
129 132 1000 11 11  2 1 1 1 2 25    30         144
109 002   750 11 11  5 2 1 5 2 30    75         852
109 11512000 11 11  2 1 1 5 2 30    25         116
110 114 8250 36 12  6 3 1 8 2 55   100 125
002 112 3000 22 11  2 2 1 5 2 30    50 113
112 002 3000 22 11  2 2 1 5 2 30    50 852
112 113 1500 22 11  2 2 1 5 2 30    50 108               114
113 112 1500 22 11  2 2 1 5 2 30    40 002
113 108 1800 22 11  2 2 1 5 2 30    40 124     121       107
114 125 6000 36 12  6 3 1 8 2 55    50 130     126
031 850 6000 36 12  6 3 1 8 2 55   100
115 116 3300 11 11  2 1 1 5 2 30    25 120               117
115 122 1800 11 11  2 1 1 5 2 30    75 121
116 115 3300 11 11  2 1 1 5 2 30    25 122
116 117 2700 11 11  2 1 1 5 2 30    75                   825
116 120 2100 11 11  2 1 1 5 2 30   100                   824
117 825 4500 11 11  2 1 1 5 2 25    02
117 116 2700 11 11  2 1 1 5 2 30    80         115
118 120 5250 11 11  2 1 1 5 2 30   100 116     824
119 117 7000 11 11  2 1 1 5 2 30   100         825       116
120 824 1000 11 11  2 1 1 5 2 30    03
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120	116	2100	11	11	2	1	1	5	2	30	80	115	117	
121	108	1800	11	11	2	1	1	5	2	30	40	107	124	113
121	823	1000	11	11	2	1	1	5	2	25	20			
121	122	2700	11	11	2	1	1	5	2	30	40	115		
122	115	1800	11	11	2	1	1	5	2	25	30	116		
122	121	2700	11	11	2	1	1	5	2	25	30	108		823
122	123	4500	11	11	2	1	1	5	2	30	40	178		
123	126	4500	11	11	2	1	1	1	4	25	100	023		
124	023	2000	11	11	2	1	1	5	2	25	20	031		
023	031	6000	36	12	6	3	1	8	2	55	100	850		
125	13012000		36	12	6	3	1	8	2	55	80	132	129	
126	023	3900	11	11	2	1	1	1	4	25	30	031		
127	128	2100	22	11	2	2	1	5	2	30	50	141		129
127	124	5400	22	11	2	2	1	5	2	30	50	108	023	
128	127	2100	22	11	2	2	1	5	2	30	40	124		
128	14112900		22	11	4	2	1	6	4	30	40	142		
132	14421000		36	12	6	3	1	8	2	55	100	147		
133	131	9000	11	11	2	1	1	5	2	30	10	129		
133	105	5400	11	11	2	1	1	5	2	30	10	104		106
133	03030000		12	12	6	1	1	7	4	50	40	039		849
133	106	5250	12	12	6	1	1	7	4	50	40	822	105	107
128	129	2000	12	12	6	1	1	7	4	40	20	131	132	
113	114	1000	11	11	2	1	1	1	2	25	20		125	
140	145	1000	11	11	4	1	1	4	2	35	10	146	147	
140	15215900		22	11	4	2	1	5	2	30	40	151	153	
140	142	3300	11	11	2	1	1	5	2	30	40	141		
141	12812900		22	11	2	2	1	5	2	30	50	127	129	
141	142	3750	22	11	2	2	1	5	2	30	50	140		
142	141	3750	22	11	2	2	1	5	2	30	50	128		
142	140	3300	22	11	2	2	1	5	2	30	50	152		145
144	147	1000	36	12	6	3	1	8	4	55	50	150		
145	146	1000	11	11	4	1	1	4	2	35	50	020		
146	020	1000	11	11	2	1	1	1	2	25	100	021		
145	147	1000	11	11	2	1	1	1	2	25	50	150		
020	02121000		36	12	6	3	1	8	2	55	100	022	131	
147	150	1000	36	12	6	3	1	8	2	55	50	153		
019	020	1000	36	12	6	3	1	8	2	55	90	021		
018	01914400		36	12	6	3	1	8	2	55	100	020		
150	153	1000	36	12	6	3	1	8	2	55	50	156		
151	018	1000	11	11	2	1	1	1	2	25	30	019		
151	152	1000	22	11	4	2	1	4	2	35	30	140		
152	153	1000	11	11	2	1	1	1	2	25	10	156		
152	14015900		22	11	4	2	1	5	2	30	45	142		
152	151	1000	22	11	4	2	1	4	2	35	45	024		018
153	15610000		36	12	6	3	1	8	2	55	50	158		
017	018	1000	36	12	6	3	1	8	2	55	90	019		
017	151	1000	11	11	2	1	1	1	2	30	10		024	152
143	159	2700	11	11	4	1	1	4	2	40	100	157	158	
156	158	1000	36	12	6	3	1	8	2	55	50	358		
157	162	7500	11	11	4	1	1	4	2	25	100			163
015	157	1000	11	11	2	1	1	1	2	30	10		162	
015	016	1000	36	12	6	3	1	8	2	55	90	017		
158	35824000		36	12	6	3	1	8	2	55	40	341		
159	157	1000	11	11	2	1	1	1	2	30	50	162		016
159	158	1000	11	11	2	1	1	1	2	25	50	358		
162	163	3000	11	11	4	1	1	4	4	25	100	164	350	024
163	024	8750	22	11	4	2	1	5	2	30	55	151	025	
163	16422500		12	12	6	1	1	6	4	45	20	036	810	
163	350	1000	24	12	6	2	1	6	2	40	25	351		
164	03613500		12	12	6	1	1	4	2	45	95	037		808

164	16322500		12	12	6	1	1	6	4	45	80		350	
151	024	1000	24	12	6	2	1	6	4	45	40	163		025
164	810	1000	11	11	2	1	1	5	4	25	05			
145	146	1000	11	11	4	1	1	4	2	50	80	020		
016	01710000		36	12	6	3	1	8	2	55	100	018	151	
170	171	3900	11	11	2	1	1	4	4	35	20			826
170	119	4500	11	11	2	1	1	4	4	35	80		117	
171	170	3900	11	11	2	1	1	4	4	35	80			119
171	826	1000	11	11	2	1	1	5	4	25	20			
172	171	3000	11	11	2	1	1	4	4	35	95	170		826
172	179	6750	11	11	2	1	1	4	4	35	5			058
173	172	3300	11	11	2	1	1	4	4	35	100	171		
174	179	1000	11	11	2	1	1	4	4	35	50			172
174	064	3000	10	10	4	1	1	4	4	30	50	191		
175	174	2250	11	11	2	1	1	4	4	35	100	179	064	
176	175	2100	11	11	2	1	1	4	4	35	100	174		
177	176	1800	11	11	2	1	1	4	4	35	100			175
178	170	1500	11	11	2	1	1	4	4	35	40	119		171
179	058	5400	11	11	2	1	1	4	4	35	50	178		
179	172	6750	11	11	2	1	1	4	4	35	50		171	
190	199	1500	11	11	4	1	1	4	4	35	50		057	
190	198	6000	11	11	4	1	1	4	4	35	50	143	853	
191	200	1000	11	11	4	1	1	4	4	40	40			199
192	191	1250	11	11	4	1	1	4	2	40	30		200	
192	193	3000	11	11	4	1	1	4	2	40	30	828	194	190
192	195	1500	11	11	4	1	1	4	2	40	40	197		827
193	190	1000	11	11	4	1	1	4	2	40	70		198	
193	194	1500	11	11	4	1	1	4	2	40	10	196		
194	193	1500	11	11	4	1	1	4	2	40	75	190	828	
194	19610500		11	11	4	1	1	4	2	40	25	221		
195	192	1500	11	11	4	1	1	4	2	40	40	191		
195	827	1000	11	11	2	1	1	5	2	25	20			
195	197	9900	11	11	4	1	1	4	2	40	40	383		
196	194	9600	11	11	2	1	1	4	2	35	80	193		
196	221	2100	11	11	2	1	1	4	2	35	20	210	829	
193	828	1000	11	11	2	1	1	5	2	25	50			
198	853	1000	11	11	2	1	1	4	2	35	50			
199	057	2250	11	11	4	1	1	4	2	35	60	140		
199	190	2000	11	11	4	1	1	4	2	25	20	198		
200	199	2000	11	11	4	1	1	4	2	45	70	057		
197	195	9900	11	11	4	1	1	5	4	35	50	192	827	
197	383	4500	11	11	4	1	1	5	4	35	50	211		
198	190	6000	11	11	2	1	1	5	4	35	5		199	
198	143	9900	11	11	4	1	1	5	4	40	80	159		
210	221	5100	11	11	2	1	1	5	2	35	75	196		829
210	212	3300	11	11	2	1	1	5	2	35	25	214		
211	383	3300	11	11	4	1	1	5	4	35	40	197		
211	215	5250	11	11	2	1	1	5	2	35	40	216		
211	830	1000	11	11	2	1	1	5	4	25	20			
212	210	3600	11	11	2	1	1	5	2	35	95	221		
212	214	1500	11	11	2	1	1	5	2	35	5	216		
214	212	1500	11	11	2	1	1	5	2	35	95	210		
214	216	3750	11	11	2	1	1	5	2	35	5	230		
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396 41711400 36 12  6 3 1 8 2 55    30 415
418 420 7500 11 11  4 1 1 7 4 35    80        428       413
418 817 1000 11 11  2 1 1 1 4 25    20
419 428 3300 10 10  4 1 1 4 2 30    80        429       420
419 818 1000 11 11  2 1 1 1 4 25    20
420 413 1000 22 11  6 2 1 6 2 35    40 395    416
420 428 3300 22 11  6 2 1 6 2 35    40 429
420 418 7500 11 11  4 1 1 7 4 35     5                  817
421 423 6000 11 11  4 1 1 7 4 35   100        447
422 421 7200 11 11  4 1 1 7 4 35   100                  423
423 447 6900 11 11  4 1 1 7 4 35   100 425
424 426 4500 10 10  4 1 1 4 2 30   100 427
426 427 4500 10 10  4 1 1 4 2 30   100        491       419
425 418 7800 11 11  4 1 1 7 4 35   100 420    817
412 411 1500 11 11  4 1 1 7 4 35    80                  413
427 419 6000 10 10  4 1 1 4 2 30    75 428              818
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427	491	1500	10	10	4	1	1	4	2	30	25	490			
428	429	1000	22	11	2	2	1	6	4	35	50	452			
428	420	3300	22	11	2	2	1	6	4	35	50	413	899		
429	428	1000	22	11	2	2	1	6	2	30	45	420			
429	433	2700	24	12	4	2	1	8	2	55	10	431	432		
429	452	7200	24	12	6	2	1	6	2	35	45	499		453	
430	432	2100	36	12	6	2	1	8	2	55	30	032		431	898
431	007	1000	11	11	2	1	1	1	4	25	50	008			
007	008	5100	36	12	6	3	1	8	2	55	70	009			
431	477	9750	24	12	6	2	1	1	2	55	50	476			
006	007	2100	36	12	6	3	1	1	4	50	90	008			
432	431	1000	11	11	2	1	1	1	4	25	5	477			
432	032	5000	36	12	6	3	1	8	2	55	40	455			
032	888	1000	24	12	6	2	1	8	2	55	20				
032	455	1000	36	12	6	3	1	8	2	55	100	467			
433	431	2100	24	12	6	2	1	8	2	55	75	477			
433	432	1000	11	11	2	1	1	1	4	25	25	032			
446	447	9900	10	10	4	1	1	4	4	30	100		425		
447	425	4500	10	10	4	1	1	4	4	30	100	418			
448	496	1000	10	10	4	1	1	4	2	30	100	495			
449	452	3600	10	10	4	1	1	4	2	30	100	453	499		
450	448	4500	10	10	4	1	1	4	2	30	100	496			
451	490	1000	10	10	4	1	1	4	2	30	50	491			
451	494	1000	10	10	4	1	1	4	2	30	50	459			
452	453	3300	10	10	4	1	1	4	2	30	20		480	819	
452	429	7200	22	11	2	2	1	6	2	30	40	428	433		
452	499	6750	22	11	2	2	1	6	2	30	40	470			
453	452	3300	10	10	4	1	1	4	2	30	30		429	499	
453	480	1800	10	10	4	1	1	4	2	30	50			454	
453	819	1000	11	11	2	1	1	5	2	25	20				
454	455	1000	11	11	2	1	1	1	2	25	100		467		
455	467	9600	36	12	6	3	1	8	2	55	40	466			
457	477	6900	12	12	4	1	1	5	2	30	100		476		
458	457	5700	12	12	4	1	1	5	2	30	100			477	
459	449	2250	10	10	4	1	1	4	2	30	100	452			
460	461	6000	10	10	2	1	1	4	2	30	100		462		
461	462	3900	10	10	2	1	1	4	2	30	100	463			
462	463	6000	10	10	2	1	1	4	2	30	100	464			
463	464	6000	10	10	2	1	1	4	2	30	100	465	469		
464	465	5250	10	10	2	1	1	4	2	30	10	004	466		
464	469	3300	22	11	4	2	1	6	4	35	90	862			
464	497	3300	22	11	4	2	1	6	2	35	55	470			
465	466	1000	11	11	2	1	1	1	4	25	40	820			
465	004	1000	12	12	6	1	1	1	4	25	50	005			
005	006	6000	36	12	6	3	1	8	4	50	100	007	431		
006	431	1000	12	12	6	1	1	1	4	25	20		477		
465	464	5250	10	10	2	1	1	4	2	30	10		497	469	
466	820	5400	24	12	6	2	1	8	4	50	40				
003	004	1000	36	12	6	3	1	8	4	50	90	005			
003	465	1000	12	12	6	1	1	1	4	25	10	464			
467	466	1000	36	12	6	3	1	8	4	50	60	820			
467	465	1000	12	12	6	2	1	1	4	25	10	464			
004	005	9000	36	12	6	3	1	8	4	50	100	006			
469	464	3300	22	11	2	2	1	6	4	35	100	497	465		
469	862	6300	22	11	2	2	1	6	4	35	100				
470	499	1500	22	11	4	2	1	6	2	35	50	452			
470	497	2100	22	11	4	2	1	6	2	35	50	464			
471	500	6000	10	10	2	1	1	4	4	30	100	470			
472	471	3900	10	10	2	1	1	4	2	30	100	500			
473	474	5400	11	11	4	1	1	4	4	30	100			475	

474	475 3000	11	11	4	1	1	4	4	30	100			476
475	476 3750	11	11	4	1	1	4	4	30	100	803		
476	80372000	24	12	6	2	1	8	4	50	50			
477	431 9750	24	12	6	2	1	8	2	50	50		007	
477	47612900	24	12	6	2	1	8	4	50	50	803		
480	454 1800	10	10	4	1	1	4	2	30	100		455	
483	485 1000	11	11	4	1	1	7	2	35	40	376	482	
483	484 1000	11	11	4	1	1	1	2	25	10	385		
484	485 1000	11	11	4	1	1	1	2	25	10	376		
485	37611000	11	11	4	1	1	7	2	35	50	379	378	
485	483 1000	11	11	4	1	1	7	2	35	40	388	484	
485	482 1000	11	11	4	1	1	1	2	25	10	321		
490	451 1200	10	10	4	1	1	4	2	30	50			494
490	491 3000	10	10	4	1	1	4	2	30	50	427		
491	427 1500	10	10	4	1	1	4	2	30	75	419		
491	490 1500	10	10	4	1	1	4	2	30	25	451		
492	451 1000	10	10	4	1	1	4	2	30	100	490	494	
493	494 2100	10	10	4	1	1	4	2	30	100		459	
494	459 1000	10	10	4	1	1	4	1	30	100	449		
495	492 1000	10	10	4	1	1	4	2	30	100	451		
496	495 1000	10	10	4	1	1	4	2	30	100	492		
497	470 2250	22	11	4	2	1	6	2	35	50	499		
497	464 3300	22	11	4	2	1	6	2	35	50	469		465
498	500 1000	10	10	2	1	1	4	4	30	100		470	
499	470 1500	22	11	4	2	1	6	2	35	50	497		
499	452 6750	22	11	4	2	1	6	1	30	50	429		
500	470 4500	10	10	2	1	1	4	4	30	100		499	497
071	003 7500	36	12	6	3	1	8	4	50	100	004	465	
072	46910000	22	11	4	2	1	6	4	35	100	464		
073	47672000	24	12	6	2	1	8	4	50	100	477		
074	03536750	24	12	6	2	1	8	4	35	100	363		809
075	03819500	12	12	6	1	1	7	2	50	100	039	802	
076	30220100	12	12	4	1	1	7	2	40	100	301		
001	86031150	11	11	2	1	1	5	4	25	60			
001	100 2100	24	12	6	2	1	8	2	55	25	101		
025	026 1000	11	11	2	1	1	5	2	35	75		027	
025	02410500	24	12	6	2	1	6	2	55	25		163	151
024	151 1000	12	12	6	1	1	6	2	40	45	152	018	
024	02510500	24	12	6	2	1	6	2	40	10			026
024	16318750	12	12	6	1	1	6	2	40	45	350		164
026	025 1000	11	11	2	1	1	4	4	35	25		024	
026	02713800	11	11	2	1	1	4	4	35	75			028
027	02613800	11	11	2	1	1	4	4	35	100			025
027	028 1000	11	11	2	1	1	4	4	35	100		029	
028	027 1000	11	11	2	1	1	4	4	35	100		026	
028	029 6900	11	11	2	1	1	4	4	35	100	030		846
029	028 6900	11	11	2	1	1	4	4	35	80			027
029	030 9900	11	11	2	1	1	4	4	35	80	849	039	133
030	03914250	12	12	6	1	1	7	4	50	40	038	801	
030	84935250	11	11	2	1	1	4	4	35	10			
030	13330000	12	12	6	1	1	7	4	50	40	106	105	
030	029 9900	11	11	2	1	1	4	4	35	10	028	846	
035	80536750	24	12	6	2	1	8	4	35	45			
035	809 1000	11	11	2	1	1	1	1	25	15			
035	363 9300	24	12	6	2	1	8	4	55	40	365		
036	03718900	12	12	6	1	1	4	4	45	40		807	
036	808 1000	11	11	2	1	1	4	4	25	20			
036	16413500	12	12	6	1	1	4	2	45	40	163		810
037	80415000	12	12	6	1	1	4	2	45	40			
037	03618900	12	12	6	1	1	4	4	45	40	164	808	

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037 807 1000 11 11  2 1 1 5 4 25     20
038 03911100 12 12  6 1 1 4 4 50     40 030                 801
038 802 1000 11 11  2 1 1 5 4 25     15
038 80619500 12 12  6 1 1 5 4 50     45
039 03014250 12 12  6 1 1 5 4 50     50 133       849       029
039 03811100 12 12  6 1 1 5 4 50     50 806       802
039 801 1000 11 11  2 1 1 5 4 25     15
029 846 1000 11 11  2 1 1 5 4 25     20
057 14012000 11 11  4 1 1 4 2 35     90 145       152       142
058 178 3300 11 11  4 1 1 4 2 35     40 123                 170
059 060 3000 11 11  4 1 1 4 2 35    100                     061
060 061 3000 11 11  4 1 1 4 2 35    100 063
062 061 2100 11 11  4 1 1 4 2 35    100           063
061 063 2250 11 11  4 1 1 4 2 35    100 142                 141
063 141 2000 11 11  4 1 1 4 2 35    25                      128
063 142 9000 11 11  4 1 1 4 2 35    75            140
064 174 2100 10 10  4 1 1 4 4 30    50            179
064 191 4500 11 11  4 1 1 4 4 40     50 192                 200
300 28315000 24 12  6 2 1 7 4 45     50 281       282
300 301 6000 24 12  4 2 1 7 4 45     50 302
300 305 6200 10 10  4 1 1 4 2 30     10           306
301 302 2200 11 11  4 1 1 7 4 45    100 863                 303
302 301 2200 11 11  4 1 1 7 4 45    40            300
302 86310000 11 11  4 1 1 7 4 45    40
303 30210000 10 10  4 1 1 4 4 30    40            301       863
304 30115000 11 11  4 1 1 7 4 45    100 300       302
305 300 6200 10 10  4 1 1 4 4 30    100 301       283
305 306 2800 10 10  4 1 1 4 4 30    50            303
306 305 2800 10 10  4 1 1 4 4 30    50                      300
307 30612000 10 10  4 1 1 4 4 30    100 305                 303
303 843 1000 11 11  2 1 1 5 4 25     20
303 844 1000 11 11  2 1 1 5 4 25     20
301 300 6000 24 12  4 2 1 7 4 45     50 283       305
302 30310000 10 10  4 1 1 4 4 30     20           844       843
306 303 2800 10 10  4 1 1 4 4 30     50 302       843       844
101 851  500 11 11  2 1 1 5 4 25    100
080 03715000 12 12  6 1 1 4 2 45    100 036                 807
088 133 3000 12 12  6 1 1 7 4 50    100 030
089 10610000 11 11  2 1 1 5 2 30    100 107
093 104 3000 11 11  2 1 1 5 2 30    100 105
090 28610000 11 11  2 1 1 5 4 30    100 270
091 239 3000 24 12  6 2 1 8 2 55    100 251
094 314 3000 11 11  4 1 1 5 4 35    100 380
095 484 3000 11 11  4 1 1 5 4 35    100 482
096 431 3000 24 12  6 2 1 8 2 55    100 477
178 058 4000 12 12  6 1 1 4 2 45     30 179       059
058 179 6000 12 12  6 1 1 4 2 45     40 174
058 059 1000 11 11  4 1 1 4 2 40     20 060
179 174 1000 11 11  2 1 1 4 4 35     20 064
191 192 1250 11 11  4 1 1 4 2 40     30 195                 193
178 12315000 11 11  4 1 1 4 2 40     20 126
126 123 6000 11 11  4 1 1 4 2 25     30 178
123 17815000 11 11  4 1 1 4 2 40     30 058
125 126 3900 11 11  2 1 1 1 4 25     20 123
353 34212000 11 11  4 1 1 4 2 40     40 343
357 355 3000 24 12  6 2 1 8 4 55     50 344
357 354 4000 11 11  2 1 1 1 4 25     50 353
319 317 1000 24 12  6 2 1 8 2 55     45 252
317 252 4800 24 12  6 2 1 6 4 55     30 251
092 340 3000 24 12  6 2 1 8 2 55    100 326
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 191 064 4500 11 11  4 1 1 4 4 40      30 174
 126 124 2500 11 11  2 1 1 1 4 30      40 023       127
 123 122 4500 11 11  2 1 1 5 2 30      40           121      115
 140 05712000 11 11  4 1 1 4 2 35      10 199
 057 199 2250 11 11  4 1 1 4 2 35      40           200      190
 199 200 2000 11 11  4 1 1 7 4 45      20 191
 200 191 1000 11 11  4 1 1 4 4 40      30           064      192
 109 11512000 11 11  2 1 1 5 2 30      50           116      122
 111 00210000 11 11  2 1 1 5 2 30     100 112       109
 002 109  750 11 11  5 2 1 5 2 30      10 115
 002 852 3000 11 11  2 1 1 5 2 30     100
 398 399 1000 11 11  2 1 1 1 4 25      15 395
 476 47712900 24 12  6 2 1 8 4 50      50 431
 399 395 6000 12 12  6 1 1 5 2 45      30           385      413
 097 357 3000 24 12  6 2 1 8 2 55     100 359
 098 234 3000 11 11  2 1 1 5 4 35     100 231
 099 197 3000 11 11  4 1 1 5 4 35     100 383
 234 231 6000 11 11  2 1 1 5 4 35      50 230
 081 327 6000 12 12  4 1 1 5 4 40     100 320
 082 413 3000 22 11  2 2 1 6 2 30     100 395
 083 385 3000 22 11  6 2 1 6 2 40     100 395
 084 452 3000 22 11  2 2 1 6 2 30     100 499
 420 899 3000 22 11  2 2 1 6 4 35      15
 430 433 1000 12 12  6 1 1 1 2 35      10 429
 433 429 2700 24 12  4 2 1 8 2 55      50                    452
 085 396 5000 36 12  6 3 1 8 2 55     100 417
 432 898 5000 36 12  6 3 1 8 2 55      15
 157 016 1000 11 11  2 1 1 1 2 30     100 017
 013 340 1000 11 11  2 1 1 1 2 25      20 326
 344 347 1000 36 12  6 3 1 8 2 55      40 370
 269 280 5000 24 12  2 2 1 5 4 40      50 281
 280 281 3000 24 12  2 2 1 5 4 40      50 283
 283 281 3000 24 12  2 2 1 5 4 40      60 280
 281 280 3000 24 12  2 2 1 5 4 40      50 269
 370 891 1000 24 12  6 2 1 8 2 55      30
 398 892 1000 24 12  6 2 1 8 2 55      34
99999
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POPOPT1 Rhode Island Strong Storm Off-Peak Traffic, Rapid Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout1.dat'
outprint='popout1.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=270.0 int1(2)=390.0 int1(3)=400.0 int1(4)=510.0 int1(5)=630.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
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POPOPT2 Rhode Island Strong Storm Off-Peak Traffic, Moderate Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout2.dat'
outprint='popout2.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=120.0 int1(2)=300.0 int1(3)=360.0 int1(4)=480.0 int1(5)=660.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
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POPOPT3 Rhode Island Strong Storm Off-Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout3.dat'
outprint='popout3.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=0.0 int1(2)=240.0 int1(3)=320.0 int1(4)=480.0 int1(5)=720.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT4 Rhode Island Strong Storm Mid-Peak Traffic, Rapid Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout4.dat'
outprint='popout4.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=840.0 int1(2)=960.0 int1(3)=1000.0 int1(4)=1080.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
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POPOPT5 Rhode Island Strong Storm Mid-Peak Traffic, Moderate Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout5.dat'
outprint='popout5.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=660.0 int1(2)=840.0 int1(3)=900.0 int1(4)=1020.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT6 Rhode Island Strong Storm Mid-Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout6.dat'
outprint='popout6.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=480.0 int1(2)=720.0 int1(3)=800.0 int1(4)=960.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT7 Rhode Island Strong Storm Peak Traffic, Rapid Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout7.dat'
outprint='popout7.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=870.0 int1(2)=990.0 int1(3)=1030.0 int1(4)=1110.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT8 Rhode Island Strong Storm Peak Traffic, Moderate Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout8.dat'
outprint='popout8.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=690.0 int1(2)=870.0 int1(3)=930.0 int1(4)=1050.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT9 Rhode Island Strong Storm Peak Traffic, Slow Response
&files
filename(1)='strong_w.dat'
filename(2)='mnsst_w.dat'
filename(3)='backgr_w.dat'
outfile='popout9.dat'
outprint='popout9.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=510.0 int1(2)=750.0 int1(3)=830.0 int1(4)=990.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT 10 Rhode Island Weak Storm Off-Peak Traffic, Rapid Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout10.dat'
outprint='popout10.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=270.0 int1(2)=390.0 int1(3)=430.0 int1(4)=510.0 int1(5)=630.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT 11 Rhode Island Weak Storm Off-Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout11.dat'
outprint='popout11.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=120.0 int1(2)=300.0 int1(3)=360.0 int1(4)=480.0 int1(5)=660.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT12 Rhode Island Weak Storm Off-Peak Traffic, Slow Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout12.dat'
outprint='popout12.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.09 frc(3,2)=0.09 frc(3,3)=0.06 frc(3,4)=0.02
/
&timeint
int1(2)=0.0 int1(2)=240.0 int1(3)=320.0 int1(4)=480.0 int1(5)=720.0
int2(1)=0.0 int2(2)=75.0 int2(3)=150.0 int2(4)=225.0 int2(5)=300.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT13 Rhode Island Weak Storm Mid-Peak Traffic, Rapid Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout13.dat'
outprint='popout13.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=840.0 int1(2)=960.0 int1(3)=1000.0 int1(4)=1080.0 int1(4)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072

POPOPT14 Rhode Island Weak Storm Mid-Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout14.dat'
outprint='popout14.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='backgrnd'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=660.0 int1(2)=840.0 int1(3)=900.0 int1(4)=1020.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

POPOPT15 Rhode Island Weak Storm Mid-Peak Traffic, Slow Response
```
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout15.dat'
outprint='popout15.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.34 frc(3,3)=0.13 frc(3,4)=0.10
/
&timeint
int1(2)=480.0 int1(2)=720.0 int1(3)=800.0 int1(4)=960.0 int1(5)=1200.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=690.0 int2(5)=840.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

POPOPT16 Rhode Island Weak Storm Peak Traffic, Rapid Response
```
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout16.dat'
outprint='popout16.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=870.0 int1(2)=990.0 int1(3)=1030.0 int1(4)=1110.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT17 Rhode Island Weak Storm Peak Traffic, Moderate Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout17.dat'
outprint='popout17.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=690.0 int1(2)=870.0 int1(3)=930.0 int1(4)=1050.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

```
POPOPT18 Rhode Island Weak Storm Peak Traffic, Slow Response
&files
filename(1)='weak_w.dat'
filename(2)='mnswk_w.dat'
filename(3)='backgr_w.dat'
outfile='popout18.dat'
outprint='popout18.prt'
/
&poptype
atype(1)='vulnerable'
atype(2)='nonvul+mob'
atype(3)='background'
/
&fraction
frc(1,1)=0.15 frc(1,2)=0.10 frc(1,3)=0.50 frc(1,4)=0.25
frc(2,1)=0.15 frc(2,2)=0.10 frc(2,3)=0.50 frc(2,4)=0.25
frc(3,1)=0.05 frc(3,2)=0.35 frc(3,3)=0.31 frc(3,4)=0.12
/
&timeint
int1(2)=510.0 int1(2)=750.0 int1(3)=830.0 int1(4)=990.0 int1(5)=1230.0
int2(1)=0.0 int2(2)=240.0 int2(3)=540.0 int2(4)=720.0 int2(5)=870.0
/
194,155,331,129,467,092,030,370,274,077,086,359,383,381,078,079,083,084,387,085,076,057,081,082,0
90,091,098,099,126,185,167,209,266,281,280,276,275,325,331,151,250,235,397,169,026,027,028,029,24
2,250,072
```

Background Traffic

114SOUTH	3	15000	1.00	089	15	093	45	099	40
114NORTH	3	12000	1.00	090	50	098	50		
24SOUTH	3	22500	1.00	074	70	092	30		
24NORTH	3	11500	1.00	091	71	097	29		
77SOUTH	3	300	1.00	315	100				
77NORTH	3	1600	1.00	310	100				
81NORTH	3	1600	1.00	086	100				
81SOUTH	3	2000	1.00	081	100				
88NORTH	3	3500	1.00	087	100				
88SOUTH	3	1000	1.00	376	100				
6EAST	3	31000	1.00	111	45	083	13	084	42
6WEST	3	17000	1.00	072	85	082	15		
195EAST	3	30150	1.00	110	99	085	01		
195WEST	3	16700	1.00	071	100				
140SOUTH	3	13000	1.00	073	100				
140NORTH	3	7000	1.00	096	100				
138NORTH	3	13500	1.00	076	64	164	36		
138SOUTH	3	7000	1.00	080	100				
44WEST	3	8000	1.00	075	100				
44EAST	3	5000	1.00	088	100				
177EAST	3	1000	1.00	094	100				
177WEST	3	2800	1.00	095	100				
95SOUTH	3	0	1.00	070	100				

Severe Storm Surge Vulnerable Population File

101.01	1	91	2.12	103	100										
101.02	1	149	2.12	103	100										
102	1	193	2.12	110	100										
103	1	795	2.12	105	50	125	50								
104	1	372	2.12	109	100										
105.01	1	611	2.12	124	50	126	50								
105.02	1	84	2.12	123	100										
106	1	2596	2.12	118	34	119	33	120	33						
107.01	1	144	2.12	117	100										
107.02	1	1492	2.12	119	100										
301	1	2267	1.88	170	25	171	25	172	25	173	25				
302	1	2685	1.88	178	34	179	33	058	33						
303	1	4127	1.88	059	16	060	16	061	17	062	17	063	17	064	17
304	1	3417	1.88	173	20	174	20	175	20	176	20	177	20		
305	1	3256	2.02	190	20	191	20	192	20	193	20	200	20		
306.01	1	2129	2.02	190	25	198	25	199	25	057	25				
306.02	1	1371	2.02	192	50	193	50								
307	1	941	2.12	112	100										
308	1	1439	2.12	215	100										
309.01	1	502	2.12	196	100										
309.02	1	1895	2.12	282	34	283	33	382	33						
401.01	1	3535	1.85	230	20	231	20	235	20	251	20	252	20		
401.02	1	1213	1.85	251	20	252	20	284	20	258	20	259	20		
401.03	1	158	1.85	230	100										
402	1	338	2.30	260	50	272	50								
403.02	1	291	2.30	267	100										
403.03	1	107	2.30	261	50	271	50								
404	1	680	2.30	274	25	275	25	276	25	273	25				
405	1	860	2.34	281	50	282	50								
406	1	156	2.34	287	100										
407	1	356	2.34	276	50	292	50								
408	1	81	2.34	292	100										
409	1	2909	2.34	294	25	295	25	296	25	293	25				

Severe Storm Surge Vulnerable Population File(con't.)

410	1	1562	2.34	290	50	291	50								
411	1	1795	2.34	283	34	288	33	289	33						
412	1	1809	2.34	280	34	281	33	283	33						
413	1	2131	1.69	304	20	301	20	300	20	305	20	307	20		
414	1	869	1.63	311	100										
416.01	1	337	1.80	324	100										
416.02	1	592	1.80	319	100										
417	1	1197	1.80	313	50	314	50								
6322	1	482	1.83	128	100										
6332	1	579	1.85	141	100										
6403	1	394	2.72	324	100										
6404	1	82	2.72	330	100										
6405	1	257	2.72	330	100										
6409	1	653	2.72	329	25	330	75								
6410	1	841	2.72	329	100										
6420	1	613	2.72	351	100										
6421	1	1392	2.72	366	34	367	33	350	33						
6422	1	138	2.72	366	100										
6441	1	3324	1.90	159	34	162	33	163	33						
6451	1	4807	1.90	142	20	140	20	198	20	153	20	133	20		
6461	1	1744	1.85	387	50	323	50								
6503	1	849	2.84	457	100										
6504	1	372	2.84	458	100										
6506	1	712	2.84	458	100										
6507	1	525	2.84	455	100										
6511	1	23	2.84	455	100										
6512	1	1053	2.84	454	50	455	50								
6513	1	37	2.84	453	100										
6518	1	314	2.84	452	100										
6519	1	1639	2.84	449	50	459	50								
6520	1	1618	2.84	449	50	459	50								
6521	1	100	2.84	449	100										
6524	1	1433	2.84	451	50	490	50								
6525	1	2661	2.84	427	34	490	33	491	33						
6526	1	3006	2.84	492	34	493	33	494	33						
6527	1	2176	2.84	495	34	496	33	448	33						
6528	1	1190	2.84	448	25	450	75								
6532	1	157	2.26	426	50	393	50								
6533	1	3043	2.26	421	16	422	16	423	17	410	17	424	17	446	17
6541	1	681	1.96	473	100										
6542	1	133	1.96	472	100										
6551	1	1161	2.12	465	50	470	50								
6552	1	2890	2.12	498	34	499	33	500	33						
6553	1	2627	2.12	464	25	497	25	499	25	470	25				
6554	1	4419	2.12	460	20	461	20	462	20	463	20	469	20		

Weak Storm Surge Vulnerable Population File

101.01	1	48	2.12	103	100						
101.02	1	66	2.12	103	100						
102	1	91	2.12	110	100						
103	1	353	2.12	105	50	125	50				
104	1	242	2.12	109	100						
105.01	1	470	2.12	124	50	126	50				
105.02	1	74	2.12	123	100						
106	1	2158	2.12	118	34	119	33	120	33		
107.01	1	110	2.12	117	100						
107.02	1	1128	2.12	119	100						
301	1	1270	1.88	170	25	171	25	172	25	173	25

Weak Storm Surge Vulnerable Population File(con't.)

302	1	1722	1.88	178	34	179	33	058	33						
303	1	3668	1.88	059	16	060	16	061	17	062	17	063	17	064	17
304	1	2305	1.88	173	20	174	20	175	20	176	20	177	20		
305	1	2210	2.02	190	20	191	20	192	20	193	20	200	20		
306.01	1	1569	2.02	190	25	198	25	199	25	057	25				
306.02	1	869	2.02	192	50	193	50								
307	1	429	2.12	112	100										
308	1	743	2.12	215	100										
309.01	1	400	2.12	196	100										
309.02	1	1410	2.12	282	34	283	33	382	33						
401.01	1	3088	1.85	230	20	231	20	235	20	251	20	252	20		
401.02	1	1078	1.85	251	20	252	20	284	20	258	20	259	20		
401.03	1	117	1.85	230	100										
402	1	226	2.30	260	50	272	50								
403.02	1	129	2.30	267	100										
403.03	1	48	2.30	261	50	271	50								
404	1	438	2.30	274	25	275	25	276	25	273	25				
405	1	714	2.34	281	50	282	50								
406	1	69	2.34	287	100										
407	1	233	2.34	276	50	292	50								
408	1	72	2.34	292	100										
409	1	2188	2.34	294	25	295	25	296	25	293	25				
410	1	962	2.34	290	50	291	50								
411	1	1595	2.34	283	34	288	33	289	33						
412	1	1469	2.34	280	34	281	33	283	33						
413	1	1636	1.69	304	20	301	20	300	20	305	20	307	20		
414	1	652	1.63	311	100										
416.01	1	174	1.80	324	100										
416.02	1	526	1.80	319	100										
417	1	974	1.80	313	50	314	50								
6322	1	328	1.83	128	100										
6332	1	408	1.85	141	100										
6403	1	253	2.72	324	100										
6404	1	46	2.72	330	100										
6405	1	182	2.72	330	100										
6409	1	293	2.72	329	25	330	75								
6410	1	554	2.72	329	100										
6420	1	273	2.72	351	100										
6421	1	855	2.72	366	34	367	33	350	33						
6422	1	61	2.72	366	100										
6441	1	2955	1.90	159	34	162	33	163	33						
6451	1	4273	1.90	142	20	140	20	198	20	153	20	133	20		
6461	1	1550	1.85	387	50	323	50								
6503	1	1	2.84	457	100										
6504	1	1	2.84	458	100										
6506	1	1	2.84	458	100										
6507	1	1	2.84	455	100										
6511	1	1	2.84	455	100										
6512	1	1	2.84	454	50	455	50								
6513	1	1	2.84	453	100										
6518	1	1	2.84	452	100										
6519	1	1	2.84	449	50	459	50								
6520	1	1	2.84	449	50	459	50								
6521	1	1	2.84	449	100										
6524	1	374	2.84	451	50	490	50								
6525	1	1	2.84	427	34	490	33	491	33						
6526	1	1	2.84	492	34	493	33	494	33						
6527	1	243	2.84	495	34	496	33	448	33						

Weak Storm Surge Vulnerable Population File(con't.)

6528	1	1058	2.84	448	25	450	75								
6533	1	2560	2.26	421	16	422	16	423	17	410	17	424	17	446	17
6541	1	1	1.96	473	100										
6542	1	1	1.96	472	100										
6551	1	1032	2.12	465	50	470	50								
6552	1	1	2.12	498	34	499	33	500	33						
6553	1	1	2.12	464	25	497	25	499	25	470	25				
6554	1	2815	2.12	460	20	461	20	462	20	463	20	469	20		

Severe Storm Mobile Home and Non-Surge Vulnerable Population File

ACUSHN	2	980	1.96	471	33	472	33	473	34	476			
DARTMH	2	1360	2.26	394	20	418	20	412	20	392	20	391	20
FAIRH	2	300	2.12	463	25	464	25	497	25	469	25		
FALLR	2	4490	2.72	344	20	352	20	035	20	012	20	013	20
NEWBED	2	4180	2.84	432	20	007	20	431	20	477	20	415	20
REHOB	2	410	1.85	030	25	029	25	028	25	027	25		
SEEK	2	630	1.83	133	50	128	50						
SOMER	2	750	1.90	164	33	163	33	162	34				
SWAN	2	680	1.90	142	33	025	33	156	34				
WEST	2	770	1.85	388	33	386	33	400	34				
BARR	2	110	1.88	170	20	172	20	176	20	060	20	063	20
BRIS	2	860	2.12	214	20	210	20	221	20	196	20	197	20
E.PROV	2	2320	2.12	023	20	021	20	122	20	130	20	125	20
JAMES	2	200	1.69	304	33	301	33	306	34				
L.COMP	2	340	1.63	311	50	312	50						
MIDDLE	2	1330	2.30	261	25	271	25	266	25	250	25		
NEWP	2	969	2.34	295	20	294	20	287	20	284	20	280	20
PORT	2	1670	1.85	244	20	247	20	245	20	243	20	230	20
TIVER	2	1300	1.80	321	33	319	33	320	34				
WAR	2	220	2.02	198	33	057	33	190	34				

Weak Storm Mobile Home and Non-Surge Vulnerable Population File

ACUSHN	2	830	1.96	471	33	472	33	473	34	476			
DARTMH	2	620	2.26	394	20	418	20	412	20	392	20	391	20
FAIRH	2	150	2.12	463	25	464	25	497	25	469	25		
FALLR	2	1850	2.72	344	20	352	20	035	20	012	20	013	20
NEWBED	2	1770	2.84	432	20	007	20	431	20	477	20	415	20
REHOB	2	170	1.85	030	25	029	25	028	25	027	25		
SEEK	2	250	1.83	133	50	128	50						
SOMER	2	290	1.90	164	33	163	33	162	34				
SWAN	2	220	1.90	142	33	025	33	156	34				
WEST	2	360	1.85	388	33	386	33	400	34				
BARR	2	40	1.88	170	20	172	20	176	20	060	20	063	20
BRIS	2	350	2.12	214	20	210	20	221	20	196	20	197	20
E.PROV	2	1330	2.12	023	20	021	20	122	20	130	20	125	20
JAMES	2	80	1.69	304	33	301	33	306	34				
L.COMP	2	250	1.63	311	50	312	50						
MIDDLE	2	800	2.30	261	25	271	25	266	25	250	25		
NEWP	2	390	2.34	295	20	294	20	287	20	284	20	280	20
PORT	2	1310	1.85	244	20	247	20	245	20	243	20	230	20
TIVER	2	950	1.80	321	33	319	33	320	34				
WAR	2	90	2.02	198	33	057	33	190	34				

ANNEX C:
WEST BAY/RHODE ISLAND AND EAST BAY/MASSACHUSETTS NETWORK SENSITIVITY ANALYSIS SUPPORT

TABLE AC-1:

SUMMARY OF CLEARANCE TIME SENSITIVITY TO A 20% INCREASE IN EVACUATING TRAFFIC (SEVERE HURRICANE SCENARIO)

	BACKGROUND TRAFFIC CONDITION					
	Off-peak		Mid-peak		Peak	
<u>WEST BAY/RHODE ISLAND NETWORK</u>	B.C.*	S.A.**	B.C.*	S.A.**	B.C.*	S.A.**
Rapid Response	4:35	5:15	4:42	***	5:33	6:57
Moderate Response	6:10	***	6:13	***	7:37	***
Slow Response	8:04	8:06	8:04	***	9:38	10:00
<u>EAST BAY/MASSACHUSETTS NETWORK</u>						
Rapid Response	5:07	5:45	5:33	***	5:44	6:20
Moderate Response	6:06	***	6:47	***	7:15	***
Slow Response	8:03	8:08	8:11	***	8:36	9:35

* B.C. = Base Condition
** S.A. = Sensitivity Analysis
*** = Scenario was not simulated

TABLE AC-2:

SUMMARY OF CLEARANCE TIME SENSITIVITY TO A 2-HOUR DECREASE IN EVACUEE RESPONSE TIME (SEVERE HURRICANE SCENARIO)

	BACKGROUND TRAFFIC CONDITION					
	Off-peak		Mid-peak		Peak	
WEST BAY/RHODE ISLAND NETWORK	B.C.*	S.A.**	B.C.*	S.A.**	B.C.*	S.A.**
2-Hour Decrease In Rapid Response Time	4:35	4:28	4:35	***	5:33	5:33
EAST BAY/MASSACHUSETTS NETWORK						
2-Hour Decrease In Response Time	5:07	4:21	4:26	***	5:44	5:16

* B.C. = Base Condition
** S.A. = Sensitivity Analysis
*** = Scenario was not simulated

TABLE AC-3:

SUMMARY OF CLEARANCE TIME SENSITIVITY TO A 50% REDUCTION IN COMMUNITY SHELTER USE (SEVERE HURRICANE SCENARIO)

	BACKGROUND TRAFFIC CONDITION					
	Off-peak		Mid-peak		Peak	
WEST BAY/RHODE ISLAND NETWORK	B.C.*	S.A.**	B.C.*	S.A.**	B.C.*	S.A.**
Rapid Response	4:35	4:39	4:42	***	5:33	6:09
Moderate Response	6:10	***	6:13	***	7:37	***
Slow Response	8:04	8:06	8:04	***	9:38	10:14
EAST BAY/MASSACHUSETTS NETWORK						
Rapid Response	5:07	5:10	5:33	***	5:44	6:04
Moderate Response	6:06	***	6:47	***	7:15	***
Slow Response	8:03	8:04	8:11	***	8:36	8:41

* B.C. = Base Condition
** S.A. = Sensitivity Analysis
*** = Scenario was not simulated