7 GENERAL POPULATION EVACUATION TIME ESTIMATES (ETE)

This section presents the ETE results of the computer analyses using the DYNEV II System described in Appendices B, C and D. These results cover 22 regions within the CGS EPZ and the 14 Evacuation Scenarios discussed in Section 6.

The ETE for all Evacuation Cases are presented in Table 7-1 and Table 7-2. These tables present the estimated times to clear the indicated population percentages from the Evacuation Regions for all Evacuation Scenarios. The ETE for the 2-mile Region in both staged and un-staged regions are presented in Table 7-3 and Table 7-4. Table 7-5 defines the Evacuation Regions considered. The tabulated values of ETE are obtained from the DYNEV II System outputs which are generated at 5-minute intervals.

7.1 Voluntary Evacuation and Shadow Evacuation

"Voluntary evacuees" are people within the EPZ in sections for which an Advisory to Evacuate has not been issued, yet who elect to evacuate. "Shadow evacuation" is the voluntary outward movement of some people from the Shadow Region (outside the EPZ) for whom no protective action recommendation has been issued. Both voluntary and shadow evacuations are assumed to take place over the same time frame as the evacuation from within the impacted Evacuation Region.

The ETE for the CGS EPZ addresses the issue of voluntary evacuees in the manner shown in Figure 7-1. Within the EPZ, 20 percent of people located in sections outside of the evacuation region who are not advised to evacuate, are assumed to elect to evacuate. Similarly, it is assumed that 20 percent of those people in the Shadow Region will choose to leave the area.

Figure 7-2 presents the area identified as the Shadow Region. This region extends radially from the plant to cover a region between the EPZ boundary and approximately 15 miles. The population and number of evacuating vehicles in the Shadow Region were estimated using the same methodology that was used for permanent residents within the EPZ (see Section 3.1). As discussed in Section 3.2, it is estimated that a total of 55,700 people reside in the Shadow Region; 20 percent of them would evacuate. See Table 6-4 for the number of evacuating vehicles from the Shadow Region.

Traffic generated within the Shadow Region, traveling away from the CGS location, has the potential for impeding evacuating vehicles from within the Evacuation Region. All ETE calculations include this shadow traffic movement.

7.2 Staged Evacuation

As defined in NUREG/CR-7002, staged evacuation consists of the following:

1. Sections comprising the 2 mile region are advised to evacuate immediately.
2. Sections comprising regions extending from 2 to 5 miles downwind are advised to shelter in-place while the two mile region is cleared.

3. As vehicles evacuate the 2 mile region, people from 2 to 5 miles downwind continue preparation for evacuation while they shelter.
4. The population sheltering in the 2 to 5 mile region is advised to evacuate when approximately 90% of the 2 mile region evacuating traffic crosses the 2 mile region boundary.
5. Non-compliance with the shelter recommendation is the same as the shadow evacuation percentage of 20%.

See Section 5.4.2 for additional information on staged evacuation.

7.3 Patterns of Traffic Congestion during Evacuation

Figure 7-3 through Figure 7-6 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ (Region R03) is advised to evacuate during the summer, midweek, midday period under good weather conditions (Scenario 1).

Traffic congestion, as the term is used here, is defined as Level of Service (LOS) F. LOS F is defined as follows (HCM 2010, page 5-5):

> The HCM uses LOS F to define operations that have either broken down (i.e., demand exceeds capacity) or have exceeded a specified service measure value, or combination of service measure values, that most users would consider unsatisfactory. However, particularly for planning applications where different alternatives may be compared, analysts may be interested in knowing just how bad the LOS F condition is. Several measures are available to describe individually, or in combination, the severity of a LOS F condition:
>
> • *Demand-to-capacity ratios* describe the extent to which capacity is exceeded during the analysis period (e.g., by 1%, 15%, etc.);
>
> • *Duration of LOS F* describes how long the condition persists (e.g., 15 min, 1 h, 3 h); and
>
> • *Spatial extent measures* describe the areas affected by LOS F conditions. These include measures such as the back of queue, and the identification of the specific intersection approaches or system elements experiencing LOS F conditions.

All highway "links" which experience LOS F are delineated in these figures by a thick red line; all others are lightly indicated. Figure 7-3 displays the developing congestion within the population center of Richland (in the Shadow Region), just 30 minutes after the Advisory to Evacuate (ATE). Congestion (LOS F) is exhibited on the approaches to State Highway 240, on Stevens Dr southbound, George Washington Way southbound, and Horn Rapids Rd eastbound within the EPZ. Most of this congestion is caused by spillback from congestion in the Shadow Region.

At 1 hour after the ATE, Figure 7-4 displays fully-developed congestion within Richland, especially along George Washington Way and Thayer Dr southbound, providing access to I-182. Congestion persists in the EPZ on the approaches to State Highway 240, Stevens Rd

southbound, George Washington Way southbound, and Horn Rapids Rd eastbound. There is no congestion elsewhere in the EPZ.

At 1 hour and 30 minutes after the ATE, Figure 7-5 shows that congestion has cleared within Section 3A as southbound traffic along Stevens Drive and George Washington Way is beginning to dissipate. Pronounced congestion persists in Richland in Section 3C and in the Shadow Region. All southbound routes out of Richland traveling toward I-182 are congested, including George Washington Way, Jadwin Ave, Thayer Dr and State Highway 240. Evacuees traveling eastbound on I-182, toward the reception centers, experience moderate congestion.

At 2 hours and 30 minutes after the ETE, as shown in Figure 7-6, the study area is clear of congestion (LOS F). More than 90 percent of the general population has mobilized and begun their evacuate trip at this time. The traffic congestion within Richland has dissipated. There is some residual traffic volume (LOS C) along State Highway 240, exiting Section 3C, which clears shortly thereafter. I-82 is also clear of congestion.

The evacuation routes remain free of congestion for the next 2 hours and 30 minutes while the last 10 percent of evacuees are mobilizing.

7.4 Evacuation Rates

Evacuation is a continuous process, as implied by Figure 7-7 through Figure 7-20. These figures indicate the rate at which traffic flows out of the indicated areas for the case of an evacuation of the full EPZ (Region R03) under the indicated conditions. One figure is presented for each scenario considered.

As indicated in Figure 7-7, there is typically a long "tail" to these distributions. Vehicles begin to evacuate an area slowly at first, as people respond to the ATE at different rates. Then traffic demand builds rapidly (slopes of curves increase). When the system becomes congested, traffic exits the EPZ at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the aggregate rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, relatively few evacuation routes service the remaining demand.

This decline in aggregate flow rate, towards the end of the process, is characterized by these curves flattening and gradually becoming horizontal. Ideally, it would be desirable to fully saturate all evacuation routes equally so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would retain the same slope until the end – thus minimizing evacuation time. In reality, this ideal is generally unattainable reflecting the spatial variation in population density, mobilization rates and in highway capacity over the EPZ.

7.5 Evacuation Time Estimate (ETE) Results

Table 7-1 and Table 7-2 present the ETE values for all 22 Evacuation Regions and all 14 Evacuation Scenarios. Table 7-3 and Table 7-4 present the ETE values for the 2-mile region for both staged and un-staged keyhole regions downwind to 5 miles. They are organized as

follows:

Table	Contents
7-1	ETE represents the elapsed time required for 90 percent of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-2	ETE represents the elapsed time required for 100 percent of the population within a Region, to evacuate from that Region. All Scenarios are considered, as well as Staged Evacuation scenarios.
7-3	ETE represents the elapsed time required for 90 percent of the population within the 2-mile Region, to evacuate from that Region with both Concurrent and Staged Evacuations.
7-4	ETE represents the elapsed time required for 100 percent of the population within the 2-mile Region, to evacuate from that Region with both Concurrent and Staged Evacuations.

The animation snapshots described above reflect the ETE statistics for the concurrent (un-staged) evacuation scenarios and regions, which are displayed in Figure 7-3 through Figure 7-6. Most of the congestion is located in Sections 3A, 3C and the Shadow Region, which are well beyond the 5-mile radius; this is reflected in the ETE statistics:

- The 90th percentile ETE for Region R01 is about 30 minutes less (on average) than for Region R02, primarily because all evacuees from Region R01 are employees at CGS. Employees mobilize much quicker than residents (see Figure 5-4).
- The 90th percentile ETE for midweek, midday scenarios are 15 to 45 minutes longer for Region R03 (full EPZ) than for Region R02 (5-Mile Region). The 90th percentile ETE is similar for these two regions for all other scenarios. Midweek, midday scenarios include the evacuation of a significant number of employees in Sections 3A and 3C beyond the 5 mile radius, which causes the congestion shown in Figure 7-3 through Figure 7-6 and prolongs ETE for the full EPZ.

The 100th percentile ETE for all Regions and for all Scenarios are the same values as the mobilization times. This fact implies that the congestion within the EPZ dissipates prior to the end of mobilization, as is displayed in Figure 7-6.

Comparison of Scenarios 9 and 13 in Table 7-1 indicates that the Special Event – Motor Sports event at Horn Rapids ORV Park – has a material impact on the ETE for the 90th percentile. The event increases the 90th percentile ETE for a Region R03 (full EPZ) evacuation by 30 minutes, and increases ETE for Regions R12 through R14 by 35 to 45 minutes. The additional 1,597 vehicles present for the special event increase congestion along State Highway 240, which is the last roadway in the EPZ to clear of congestion. The event is located beyond the 5-Mile Region, which is why the ETE for Regions extending to 5 miles or less are unaffected. The 100th

percentile ETE remains unaffected by the special event, as congestion within the EPZ clears well before the general population has completely mobilized, as shown in Figure 7-6.

Comparison of Scenarios 1 and 14 in Table 7-1 indicates that the roadway closure – one lane eastbound on I-182 from the interchange with State Route 240 (Exit 5) to the interchange with US-395 (Exit 12) – does not have a material impact on 90th percentile ETE. The interstate never experiences sustained traffic congestion (LOS F), which means it has excess capacity to service the evacuating traffic demand. The interstate is also located far enough from the EPZ boundary that any increased congestion does not spill back far enough into the EPZ to affect ETE.

The results of the roadway impact scenario indicate that events such as adverse weather or traffic accidents which close a lane on I-182, would not materially impact ETE.

7.6 Staged Evacuation Results

Table 7-3 and Table 7-4 present a comparison of the ETE compiled for the concurrent (un-staged) and staged evacuation studies. Note that Regions R15 through R22 are the same geographic areas as Regions R04 through R11, respectively.

To determine whether the staged evacuation strategy is worthy of consideration, one must show that the ETE for the 2-mile Region can be reduced without significantly affecting the people evacuating from the region between 2 miles and 5 miles. In all cases, as shown in these tables, the ETE for the 2-mile Region is unchanged when a staged evacuation is implemented. The reason for this is that there is no traffic congestion within the 5-mile Region of CGS. All congestion is concentrated in Richland, well beyond the 5-mile Region, as discussed in Section 7.3. Consequently, there is no impedance to evacuees from within the 2-mile Region.

While failing to provide assistance to evacuees from within 2 miles of the CGS, staging produces a negative impact on the ETE for those evacuating from within the 5-mile Region. A comparison of ETE between Regions R15 through R22 to Regions R04 through R11 reveals that staging retards the 90th percentile evacuation time for those in the 2 to 5-mile area by 5 minutes (see Table 7-1) for some Regions and Scenarios. This slight increase in ETE is due to the delay in beginning the evacuation trip, experienced by those who shelter, plus the effect of the trip-generation "spike" (significant volume of traffic beginning the evacuation trip at the same time) that follows their eventual ATE, in creating congestion within the EPZ area beyond 2 miles.

In summary, the staged evacuation option provides no benefits to evacuees from the 2-mile Region, and adversely impacts some evacuees located beyond 2 miles from the CGS.

7.7 Guidance on Using ETE Tables

The user first determines the percentile of population for which the ETE is sought (The NRC guidance calls for the 90th percentile). The applicable value of ETE within the chosen Table may then be identified using the following procedure:

1. Identify the applicable **Scenario**:
   - Season

    - Summer
    - Winter (also Autumn and Spring)
- Day of Week
    - Midweek
    - Weekend
- Time of Day
    - Midday
    - Evening
- Weather Condition
    - Good Weather
    - Rain
    - Snow
- Special Event
    - Motor Sports event at Horn Rapids ORV Park
    - Road Closure (A lane on I-182 EB is closed)
- Evacuation Staging
    - No, Staged Evacuation is not considered
    - Yes, Staged Evacuation is considered

While these Scenarios are designed, in aggregate, to represent conditions throughout the year, some further clarification is warranted:

- The conditions of a summer evening (either midweek or weekend) and rain are not explicitly identified in the Tables. For these conditions, Scenarios (2) and (4) apply.
- The conditions of a winter evening (either midweek or weekend) and rain are not explicitly identified in the Tables. For these conditions, Scenarios (7) and (10) for rain apply.
- The conditions of a winter evening (either midweek or weekend) and snow are not explicitly identified in the Tables. For these conditions, Scenarios (8) and (11) for snow apply.
- The seasons are defined as follows:
    - Summer assumes that public schools are not in session.
    - Winter (includes Spring and Autumn) considers that public schools are in session.
- Time of Day: Midday implies the time over which most commuters are at work or are travelling to/from work.

2. With the desired percentile ETE and Scenario identified, now identify the **Evacuation Region**:
    - Determine the projected azimuth direction of the plume (coincident with the wind direction). This direction is expressed in terms of compass orientation: from N, NNE, NE, ...
    - Determine the distance that the Evacuation Region will extend from the nuclear power plant. The applicable distances and their associated candidate Regions are given below:
        - 2 Miles (Region R01)

    - To 5 Miles (Region R02, R04 through R11)
    - To EPZ Boundary (Regions R03, R12 through R14)
  - Enter Table 7-5 and identify the applicable group of candidate Regions based on the distance that the selected Region extends from the CGS. Select the Evacuation Region identifier in that row, based on the azimuth direction of the plume, from the first column of the Table.
3. Determine the **ETE Table** based on the **percentile** selected. Then, for the **Scenario** identified in Step 1 and the **Region** identified in Step 2, proceed as follows:
  - The columns of Table 7-1 are labeled with the Scenario numbers. Identify the proper column in the selected Table using the Scenario number defined in Step 1.
  - Identify the row in this table that provides ETE values for the Region identified in Step 2.
  - The unique data cell defined by the column and row so determined contains the desired value of ETE expressed in Hours:Minutes.

Example

It is desired to identify the ETE for the following conditions:

- Sunday, August 10th at 4:00 AM.
- It is raining.
- Wind direction is from the northeast (NE).
- Wind speed is such that the distance to be evacuated is judged to be a 2-mile radius and downwind to 10 miles (EPZ Boundary).
- The desired ETE is that value needed to evacuate 90 percent of the population from within the impacted Region.
- A staged evacuation is not desired.

Table 7-1 is applicable because the 90th percentile ETE is desired. Proceed as follows:

1. Identify the Scenario as summer, weekend, evening and raining. Entering Table 7-1, it is seen that there is no match for these descriptors. However, the clarification given above assigns this combination of circumstances to Scenario 4.
2. Enter Table 7-5 and locate the Region described as "Evacuate 2-Mile Radius and Downwind to the EPZ Boundary" for wind direction from the NE and read Region R13 in the first column of that row.
3. Enter Table 7-1 to locate the data cell containing the value of ETE for Scenario 4 and Region R13. This data cell is in column (4) and in the row for Region R13; it contains the ETE value of **1:45**.

Table 7-1. Time to Clear the Indicated Area of *90* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Winter	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R02	1:25	1:25	1:30	1:30	1:40	1:30	1:30	1:40	1:35	1:35	2:05	1:45	1:35	1:25
R03	1:50	2:05	1:40	1:45	1:35	1:50	2:00	2:05	1:30	1:30	1:50	1:35	2:00	1:55
2-Mile Ring and Keyhole to 5 Miles														
R04	1:40	1:40	1:30	1:35	1:45	1:40	1:40	2:00	1:40	1:40	2:05	1:45	1:40	1:40
R05	1:40	1:40	1:30	1:35	1:45	1:40	1:40	2:00	1:40	1:40	2:05	1:45	1:40	1:40
R06	1:45	1:50	1:35	1:40	1:45	1:50	1:50	2:15	1:45	1:45	2:15	1:50	1:45	1:45
R07	1:45	1:45	1:45	1:45	1:50	1:50	1:50	2:15	1:50	1:50	2:15	1:55	1:50	1:45
R08	1:25	1:25	1:35	1:35	1:40	1:25	1:25	1:35	1:35	1:35	2:05	1:40	1:35	1:25
R09	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:10	1:05	1:05	1:05	1:05	1:05	1:05
R10	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:10	1:05	1:05	1:05	1:05	1:05	1:05
R11	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
2-Mile Ring and Keyhole to EPZ Boundary														
R12	1:50	2:10	1:40	1:45	1:30	1:50	2:00	2:05	1:25	1:30	1:45	1:35	2:00	1:55
R13	1:50	2:10	1:40	1:45	1:25	1:50	2:00	2:05	1:20	1:25	1:35	1:25	2:05	1:50
R14	1:50	2:10	1:40	1:45	1:25	1:50	2:00	2:05	1:20	1:25	1:35	1:25	2:05	1:50
Staged Evacuation - 2-Mile Ring and Keyhole to 5 Miles														
R15	1:40	1:40	1:35	1:35	1:45	1:40	1:40	2:00	1:40	1:40	2:05	1:45	1:40	1:40
R16	1:40	1:40	1:35	1:35	1:45	1:40	1:45	2:05	1:40	1:40	2:05	1:45	1:40	1:40
R17	1:45	1:50	1:40	1:40	1:50	1:50	1:50	2:15	1:45	1:45	2:15	1:50	1:45	1:45
R18	1:45	1:45	1:45	1:45	1:50	1:50	1:50	2:15	1:50	1:50	2:15	1:55	1:50	1:45
R19	1:25	1:25	1:35	1:35	1:40	1:25	1:25	1:35	1:35	1:40	2:05	1:45	1:35	1:25
R20	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:10	1:05	1:05	1:05	1:05	1:05	1:05
R21	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:10	1:05	1:05	1:05	1:05	1:05	1:05
R22	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05

Table 7-2. Time to Clear the Indicated Area of *100* Percent of the Affected Population

	Summer		Summer		Summer	Winter			Winter			Winter	Winter	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Entire 2-Mile Region, 5-Mile Region, and EPZ														
R01	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R02	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R03	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10
2-Mile Ring and Keyhole to 5 Miles														
R04	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R06	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R07	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R08	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R09	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R10	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R11	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
2-Mile Ring and Keyhole to EPZ Boundary														
R12	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10
R13	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10
R14	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10	5:10
Staged Evacuation - 2-Mile Ring and Keyhole to 5 Miles														
R15	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R16	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R17	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R18	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R19	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R20	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R21	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05
R22	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05	5:05

Table 7-3. Time to Clear *90* Percent of the 2-Mile Area within the Indicated Region

	Summer		Summer		Summer	Winter			Winter			Winter	Winter	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Un-staged Evacuation - 2-Mile Ring and Keyhole to 5-Miles														
R01	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R04	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R06	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R07	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R08	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R09	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R10	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R11	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
Staged Evacuation - 2-Mile Ring and Keyhole to 5-Miles														
R15	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R16	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R17	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R18	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R19	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R20	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R21	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05
R22	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05	1:05

Table 7-4. Time to Clear *100* Percent of the 2-Mile Area within the Indicated Region

	Summer		Summer		Summer	Winter			Winter			Winter	Winter	Summer
	Midweek		Weekend		Midweek Weekend	Midweek			Weekend			Midweek Weekend	Weekend	Midweek
Scenario:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Region	Midday		Midday		Evening	Midday			Midday			Evening	Midday	Midday
	Good Weather	Rain	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Rain	Snow	Good Weather	Special Event	Roadway Impact
Un-staged Evacuation - 2-Mile Ring and Keyhole to 5-Miles														
R01	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R04	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R05	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R06	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R07	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R08	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R09	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R10	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R11	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
Staged Evacuation - 2-Mile Ring and Keyhole to 5-Miles														
R15	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R16	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R17	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R18	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R19	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R20	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R21	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55
R22	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55	1:55

Table 7-5. Description of Evacuation Regions

Region	Description	Section						
		CGS	1	2	3A	3B	3C	4
R01	2-Mile Radius	x						
R02	5-Mile Radius	x	x	x	x			x
R03	Full EPZ	x	x	x	x	x	x	x
Evacuate 2-Mile Radius and Downwind to 5 Miles								
Region	Wind Direction From:	Section						
		CGS	1	2	3A	3B	3C	4
R04	SSE, S, SSW	x	x					x
R05	SW, WSW	x	x					
R06	W, WNW	x	x	x				
R07	NW	x		x				
R08	NNW, N, NNE	x		x	x			
R09	NE	x			x			
R10	ENE, E, ESE	x			x			x
R11	SE	x						x
Evacuate 2-Mile Radius and Downwind to the EPZ Boundary								
Region	Wind Direction From:	Section						
		CGS	1	2	3A	3B	3C	4
N/A	SSE, S, SSW	Refer to Region R04						
N/A	SW, WSW	Refer to Region R05						
N/A	W, WNW	Refer to Region R06						
N/A	NW	Refer to Region R07						
R12	NNW, N	x		x	x	x	x	
R13	NNE, NE, ENE	x			x	x	x	
R14	E, ESE	x			x	x	x	x
N/A	SE	Refer to Region R11						
Staged Evacuation - 2-Mile Radius Evacuates, then Evacuate Downwind to 5 Miles								
Region	Wind Direction From:	Section						
		CGS	1	2	3A	3B	3C	4
R15	SSE, S, SSW	x	x					x
R16	SW	x	x					
R17	WSW, W, WNW	x	x	x				
R18	NW	x		x				
R19	NNW, N, NNE	x		x	x			
R20	NE	x			x			
R21	ENE, E, ESE	x			x			x
R22	SE	x						x
Shelter-in-Place until 90% ETE for R01, then Evacuate		Section(s) Shelter-in-Place				Section(s) Evacuate		

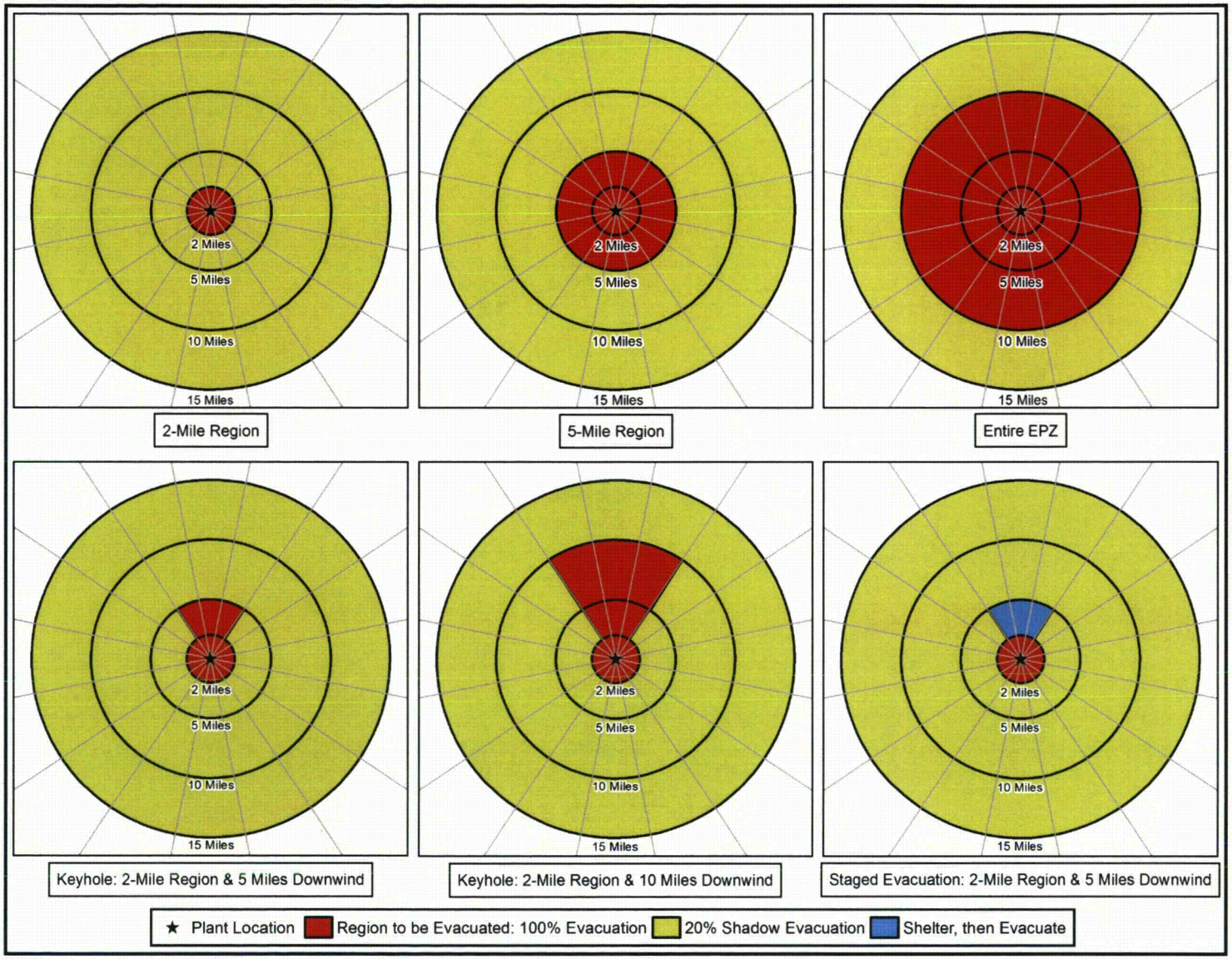

Figure 7-1. Voluntary Evacuation Methodology

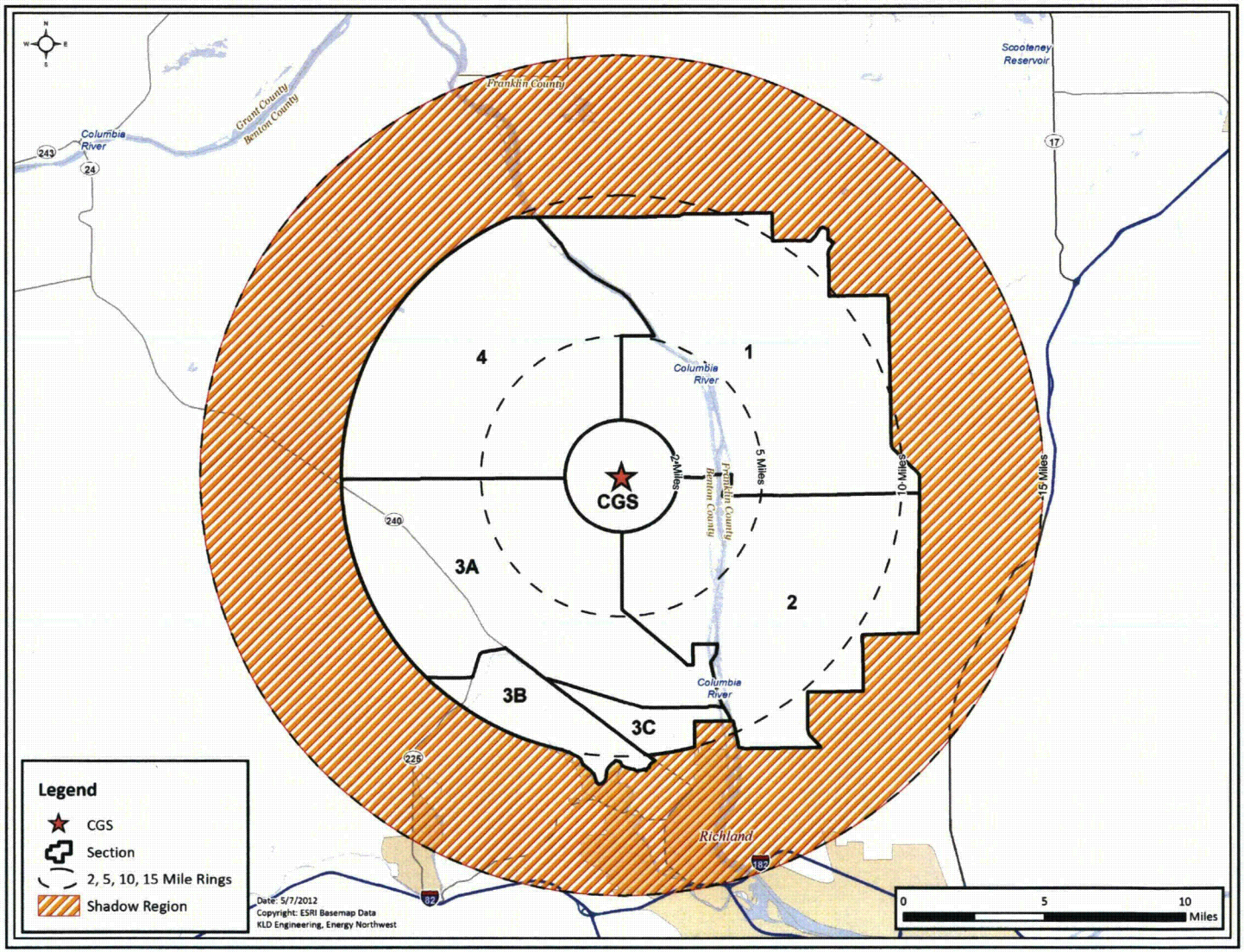

Figure 7-2. Columbia Generating Station Shadow Region

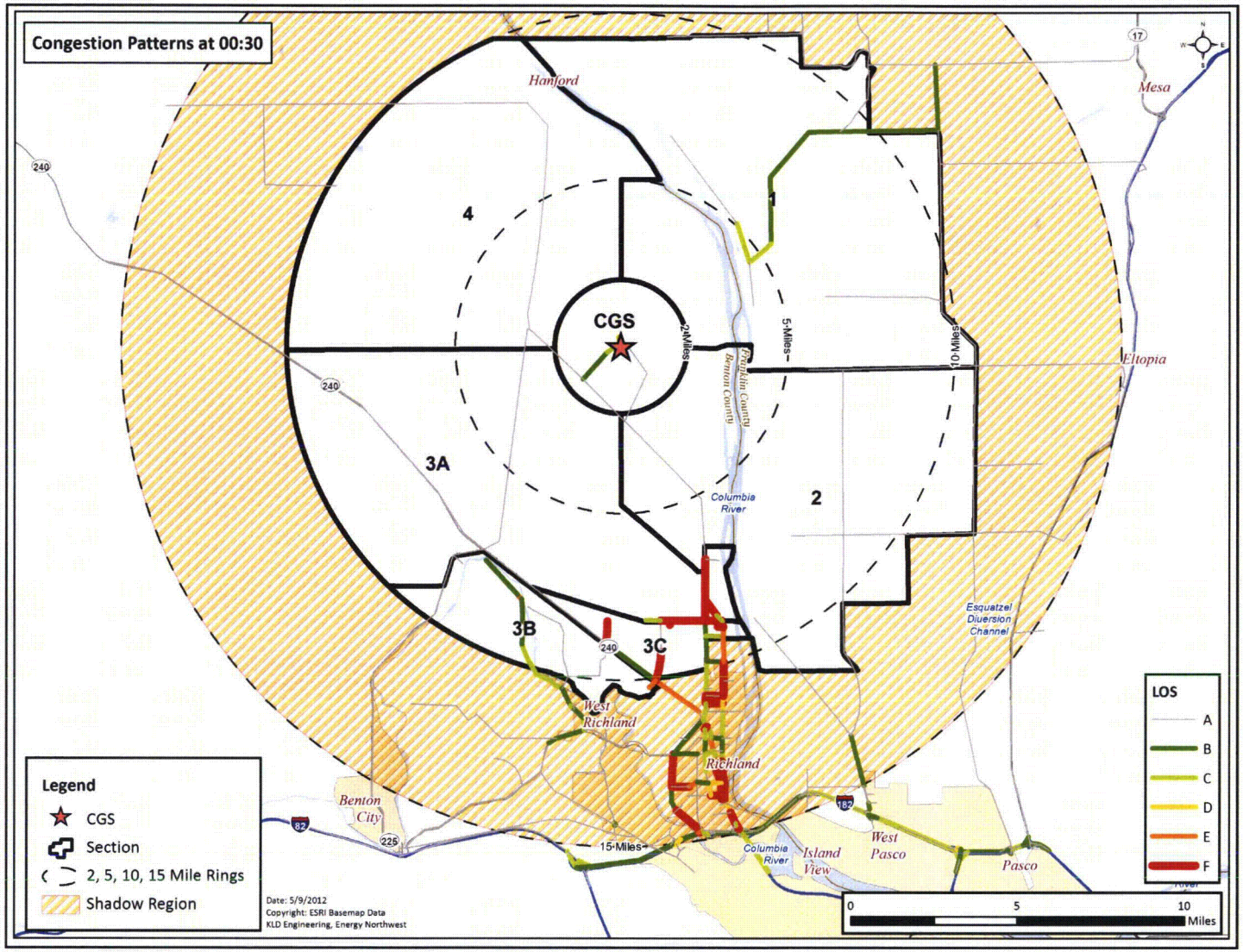

Figure 7-3. Congestion Patterns at 30 Minutes after the Advisory to Evacuate

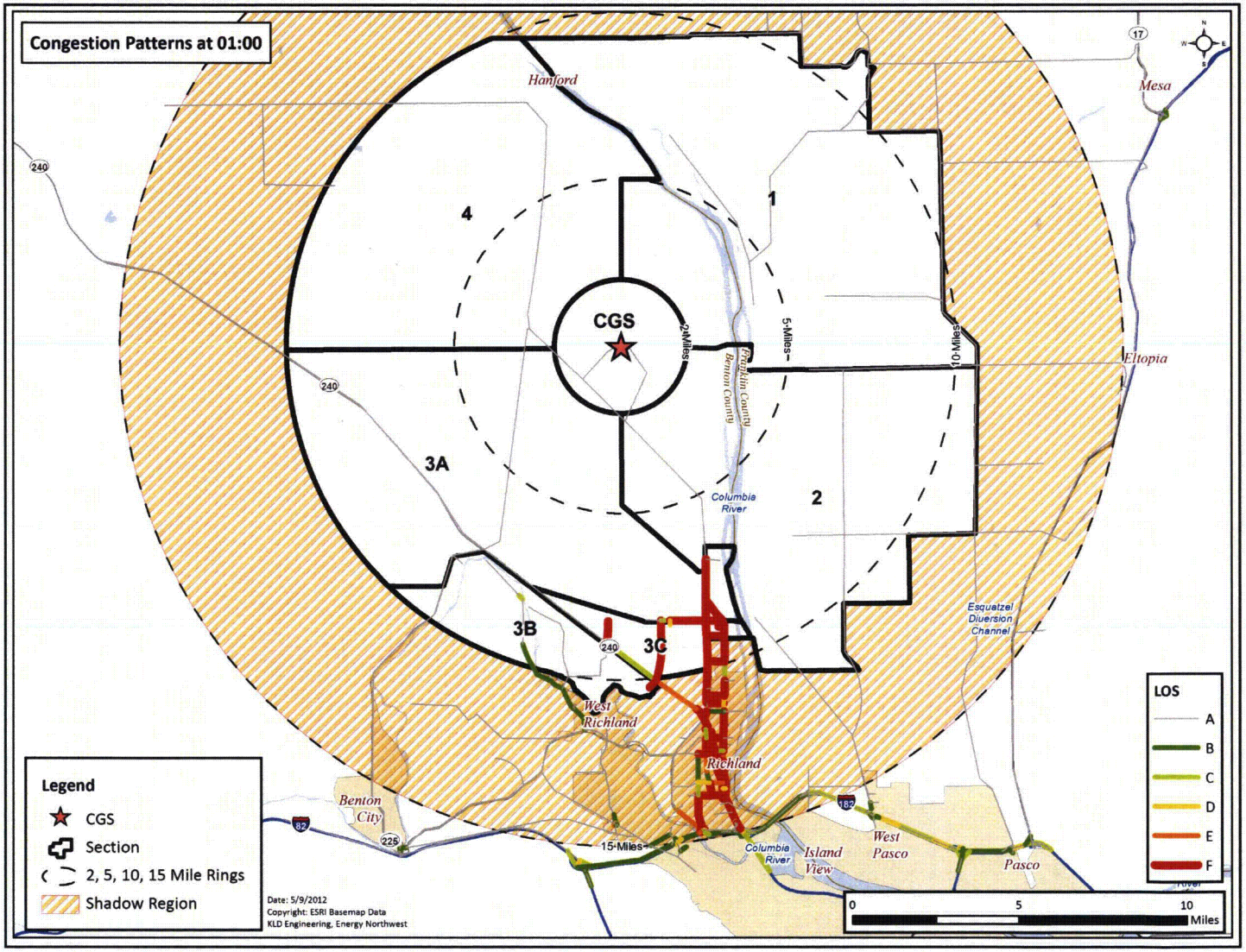

Figure 7-4. Congestion Patterns at 1 Hour after the Advisory to Evacuate

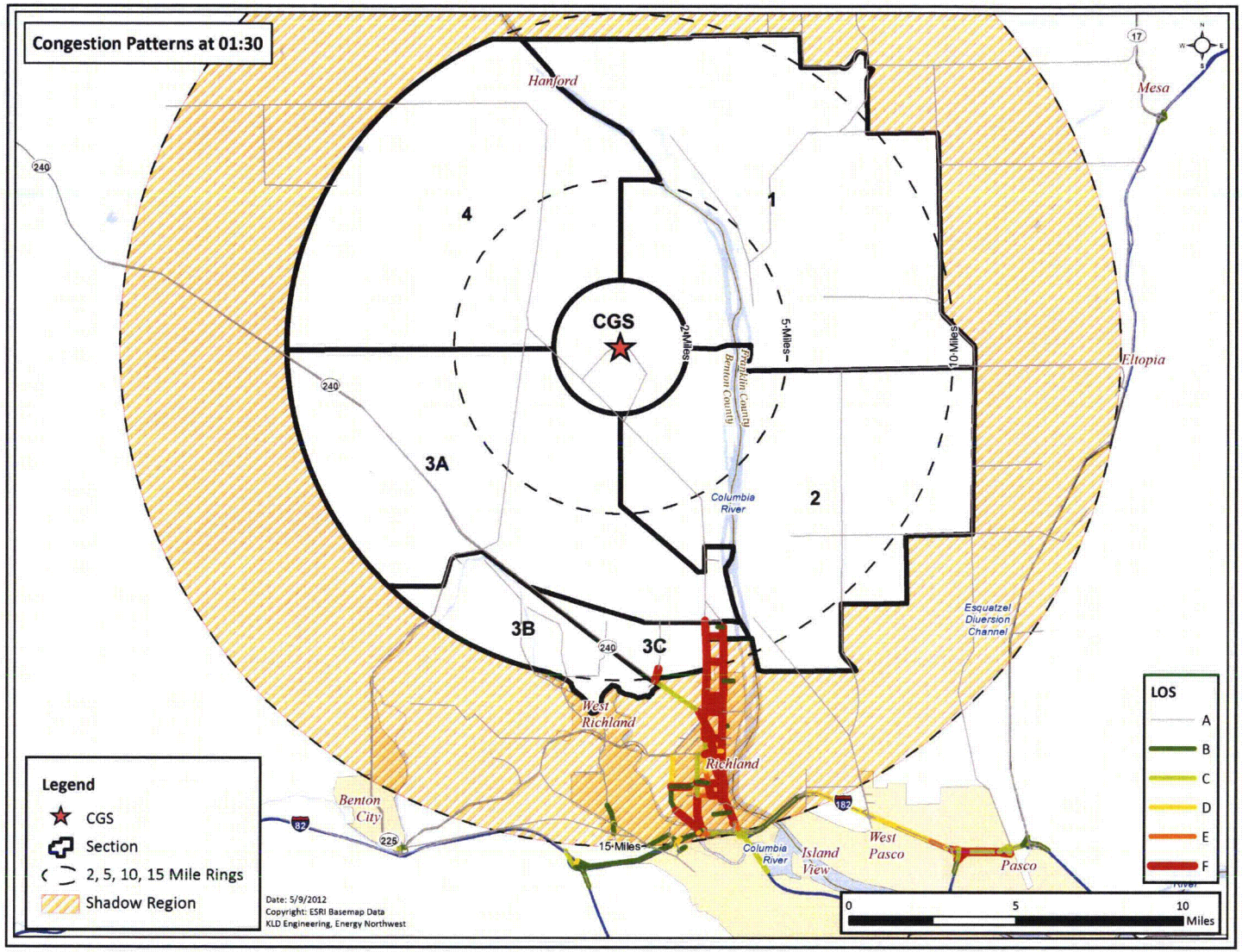

Figure 7-5. Congestion Patterns at 1 Hour and 30 minutes after the Advisory to Evacuate

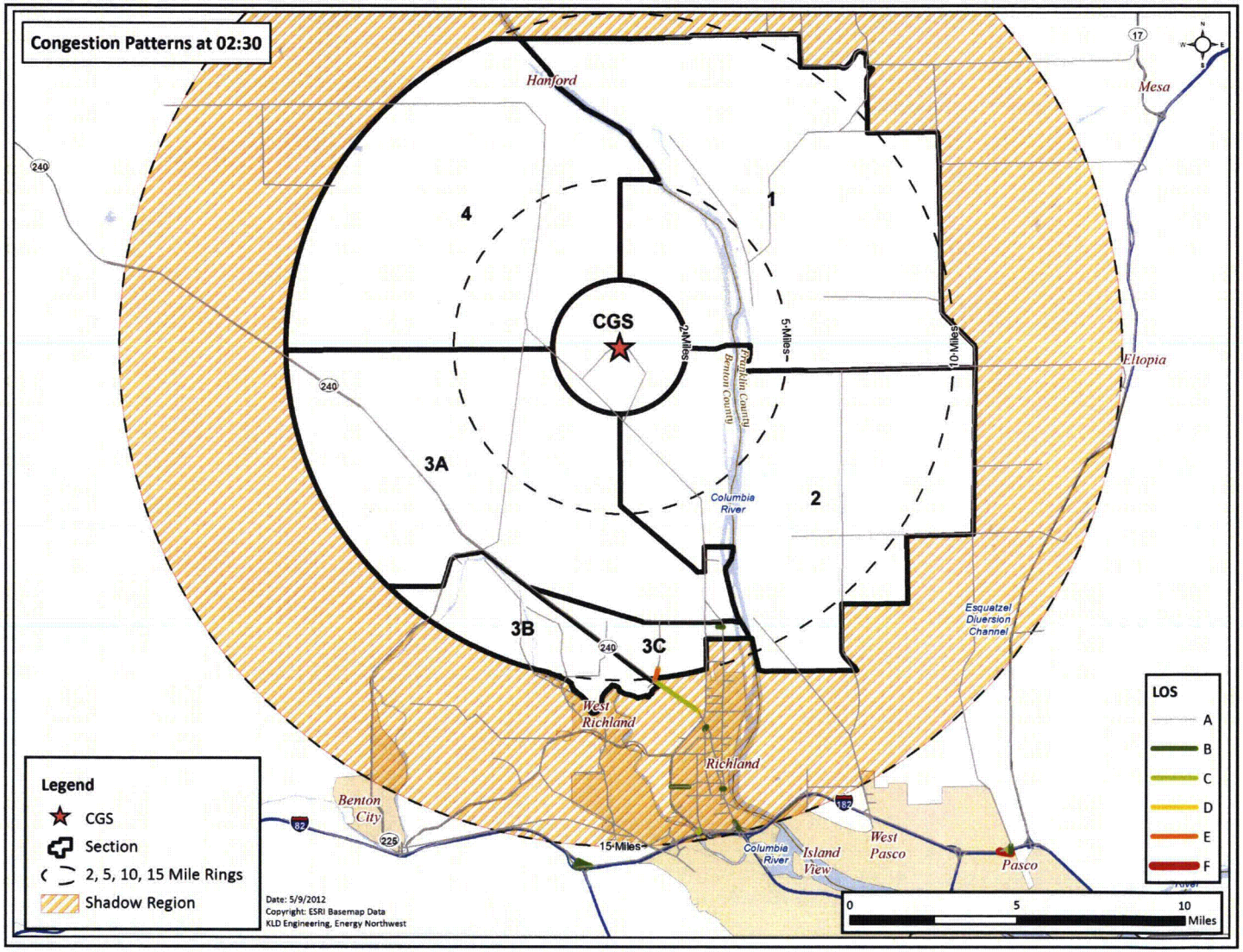

Figure 7-6. Congestion Patterns at 2 Hours and 30 Minutes after the Advisory to Evacuate

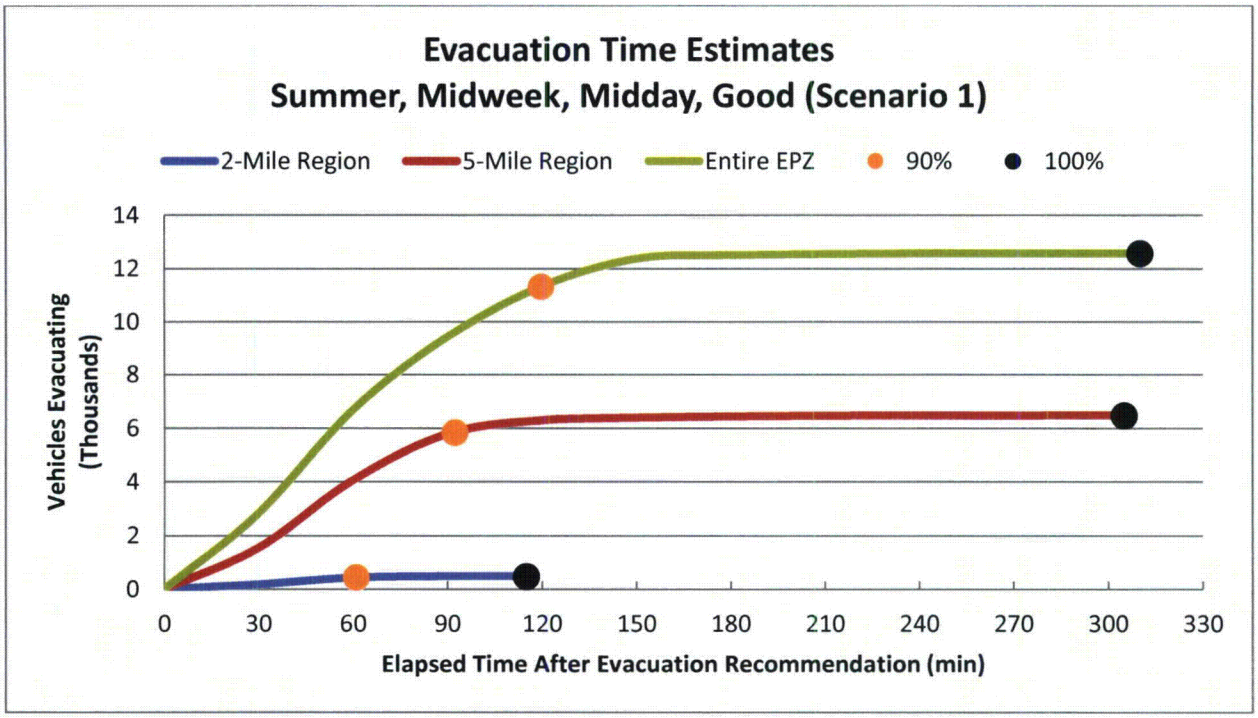

Figure 7-7. Evacuation Time Estimates - Scenario 1 for Region R03

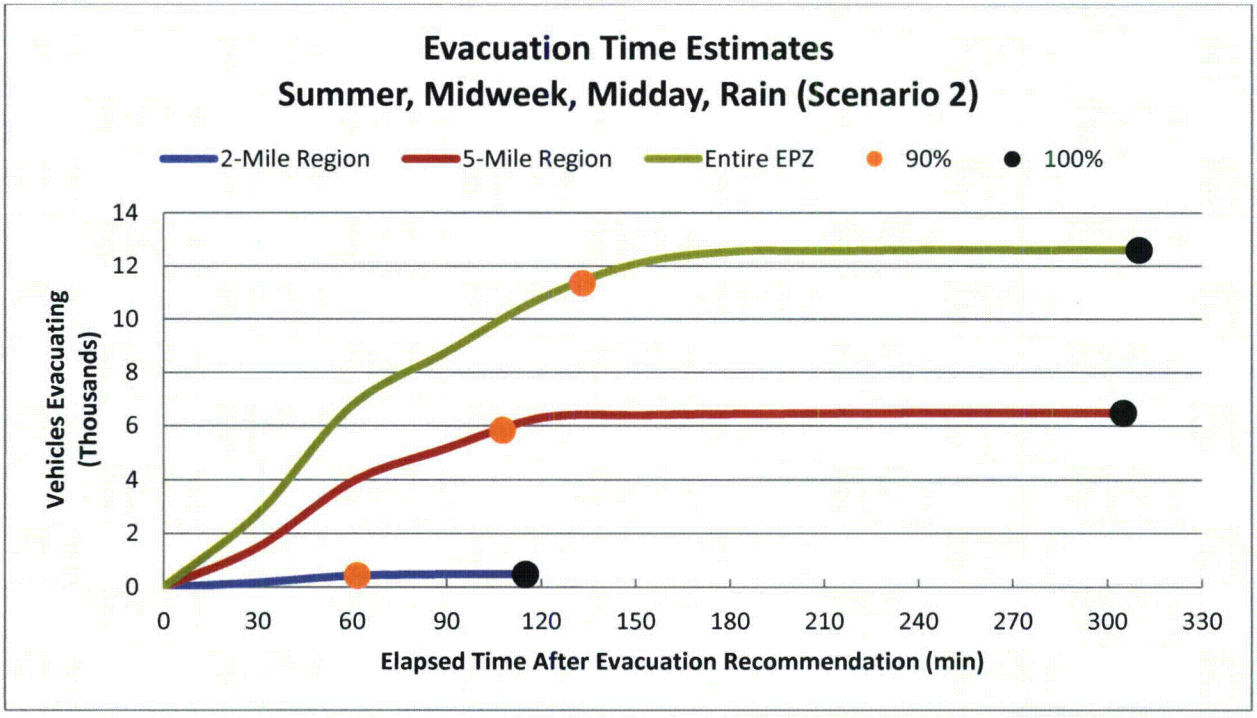

Figure 7-8. Evacuation Time Estimates - Scenario 2 for Region R03

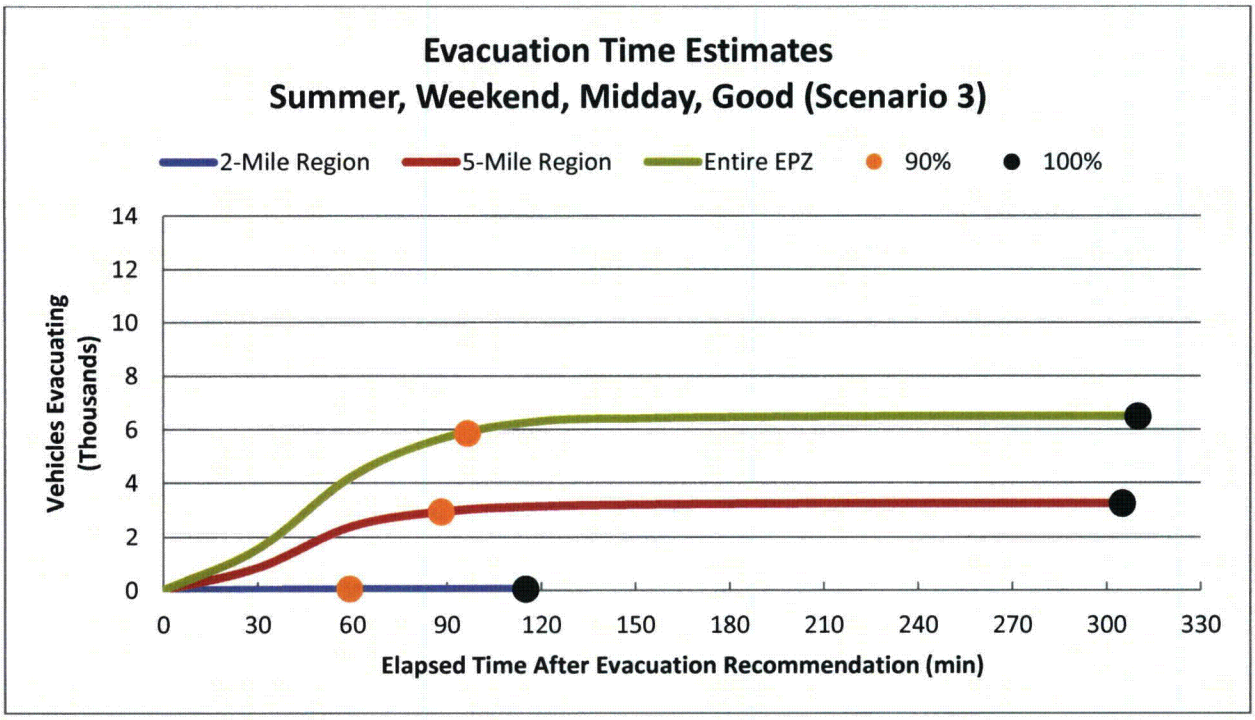

Figure 7-9. Evacuation Time Estimates - Scenario 3 for Region R03

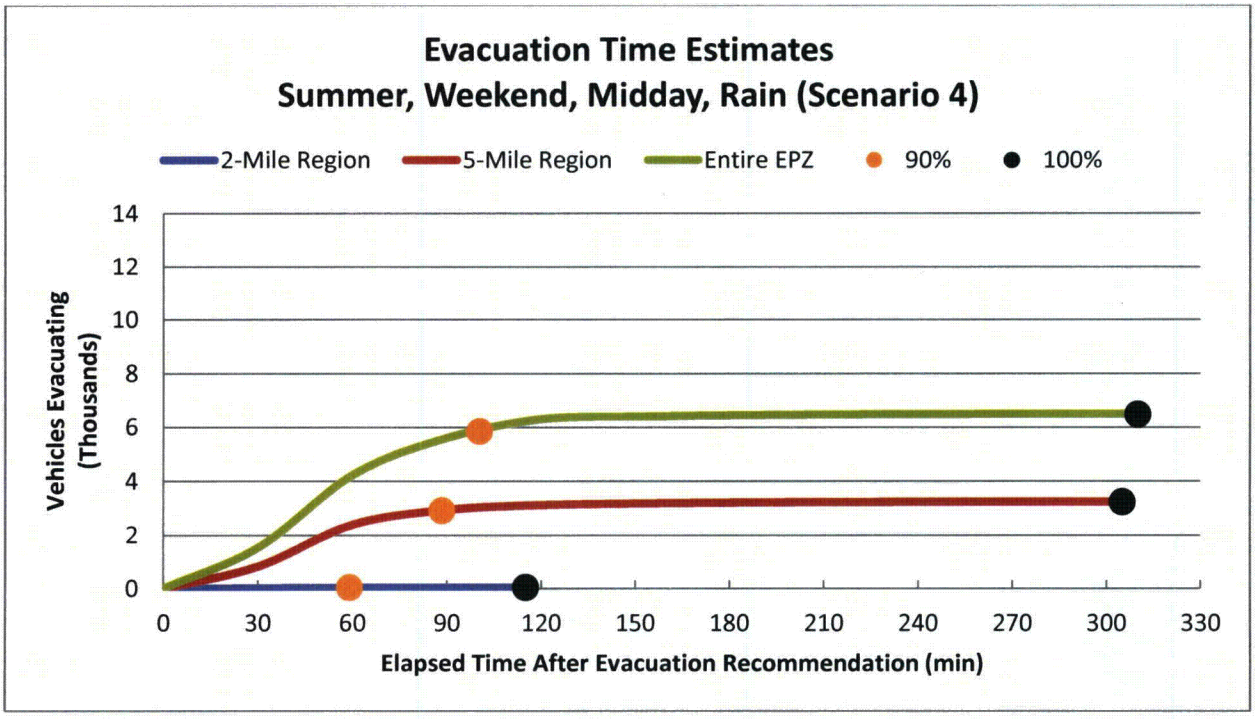

Figure 7-10. Evacuation Time Estimates - Scenario 4 for Region R03

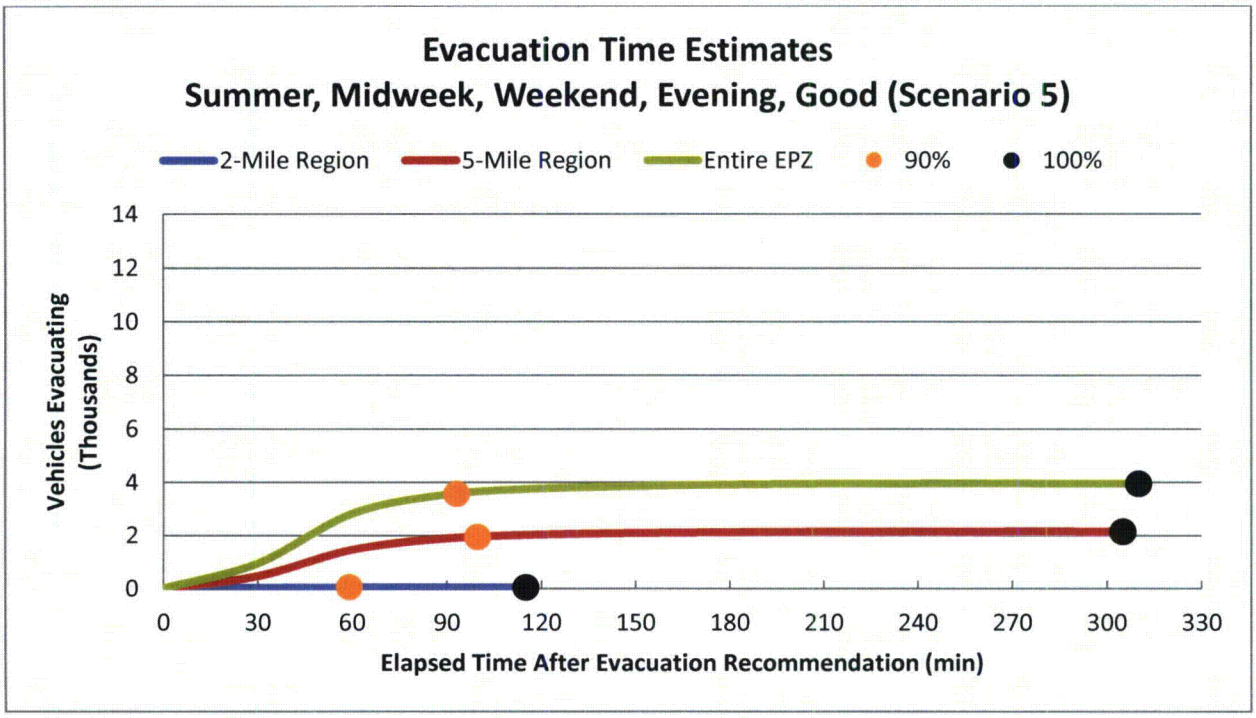

Figure 7-11. Evacuation Time Estimates - Scenario 5 for Region R03

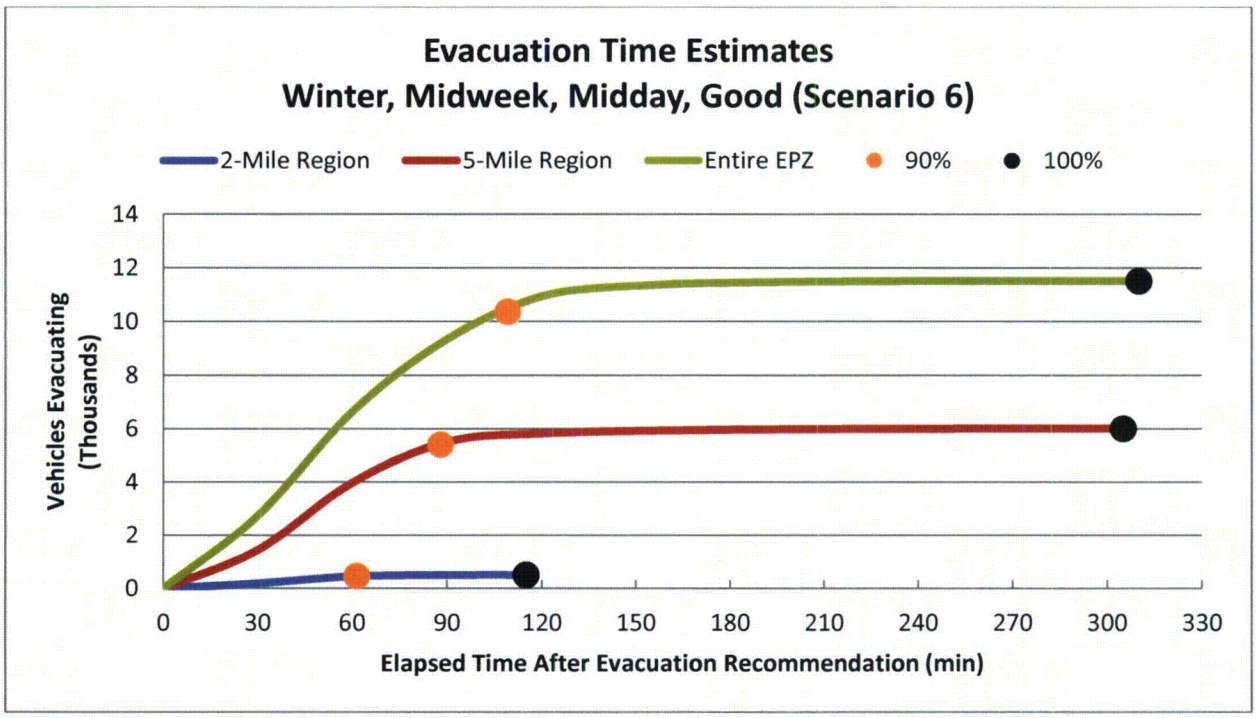

Figure 7-12. Evacuation Time Estimates - Scenario 6 for Region R03

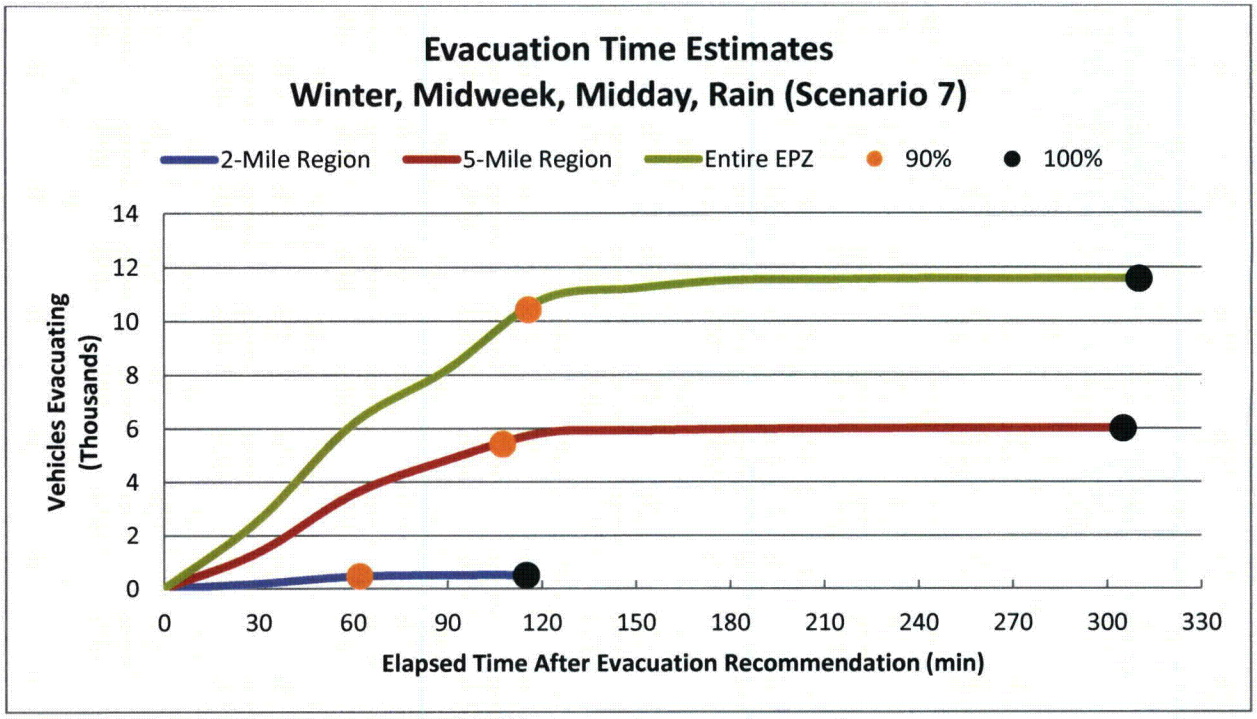

Figure 7-13. Evacuation Time Estimates - Scenario 7 for Region R03

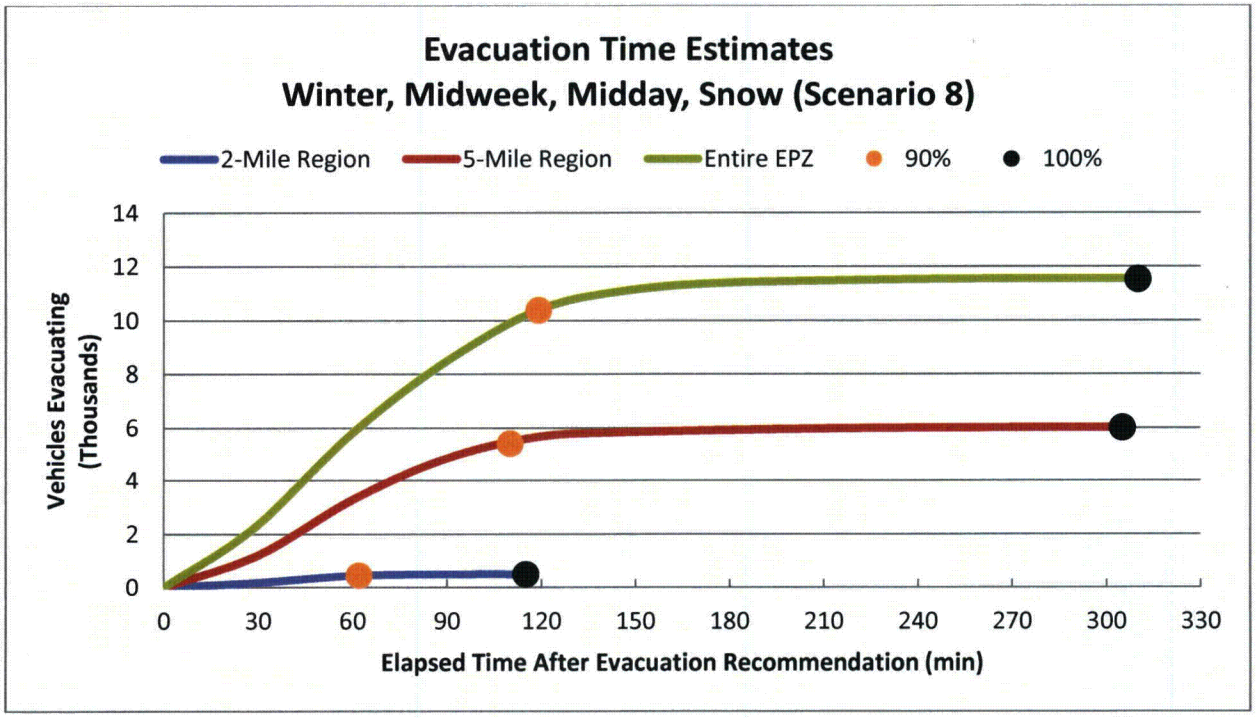

Figure 7-14. Evacuation Time Estimates - Scenario 8 for Region R03

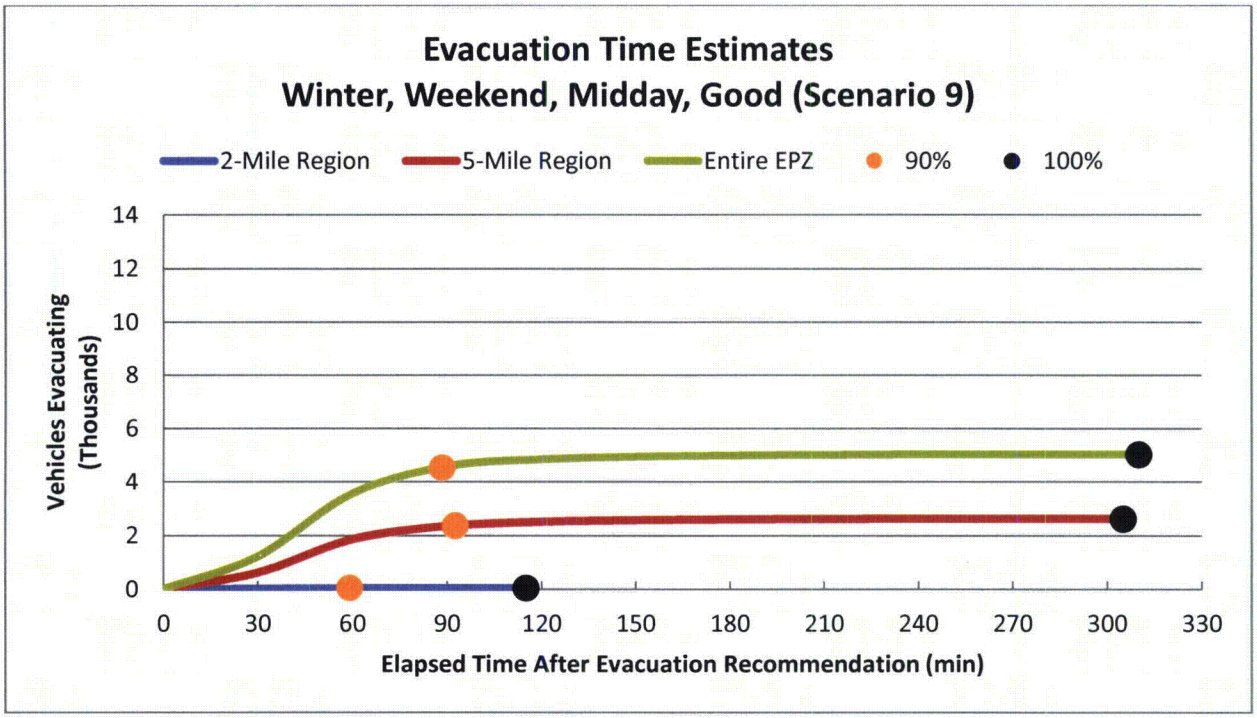

Figure 7-15. Evacuation Time Estimates - Scenario 9 for Region R03

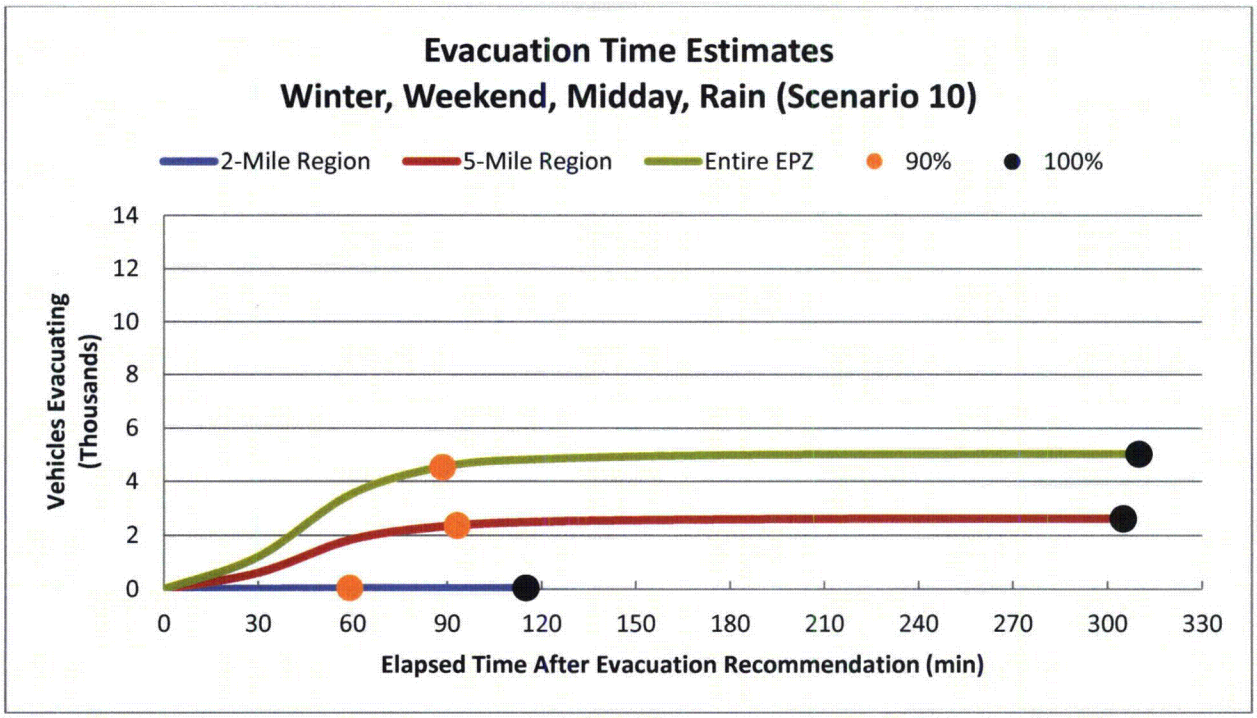

Figure 7-16. Evacuation Time Estimates - Scenario 10 for Region R03

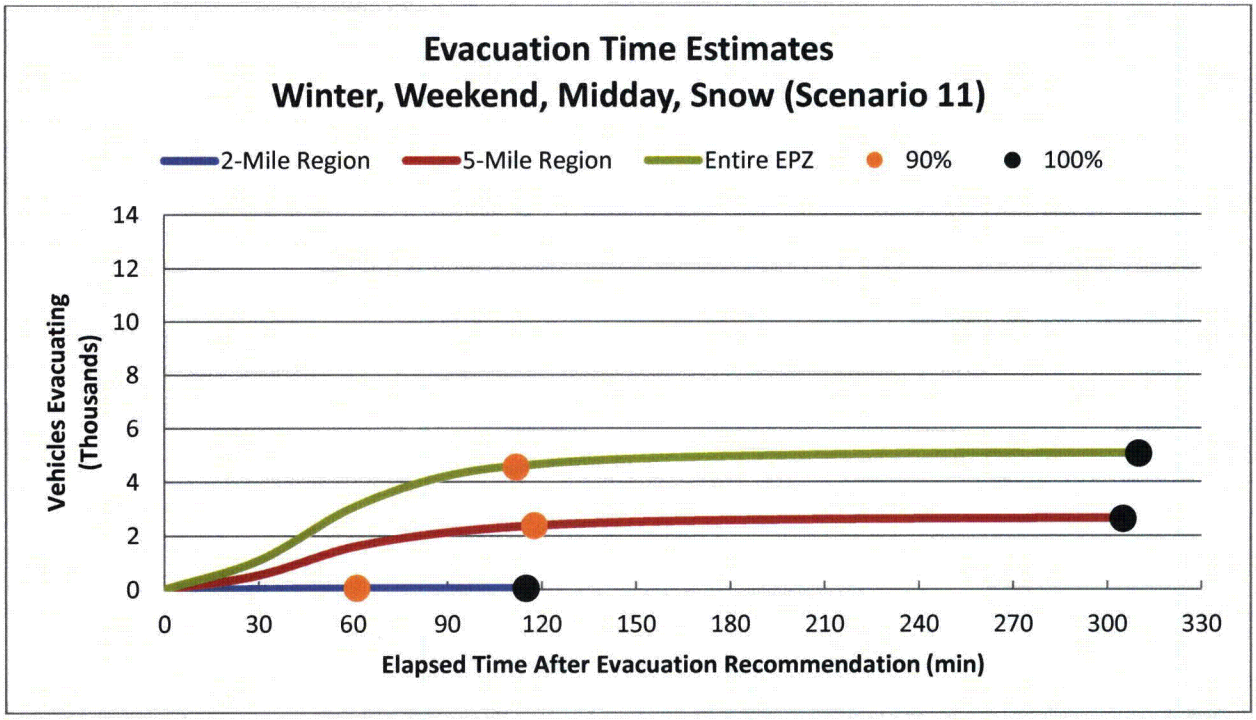

Figure 7-17. Evacuation Time Estimates - Scenario 11 for Region R03

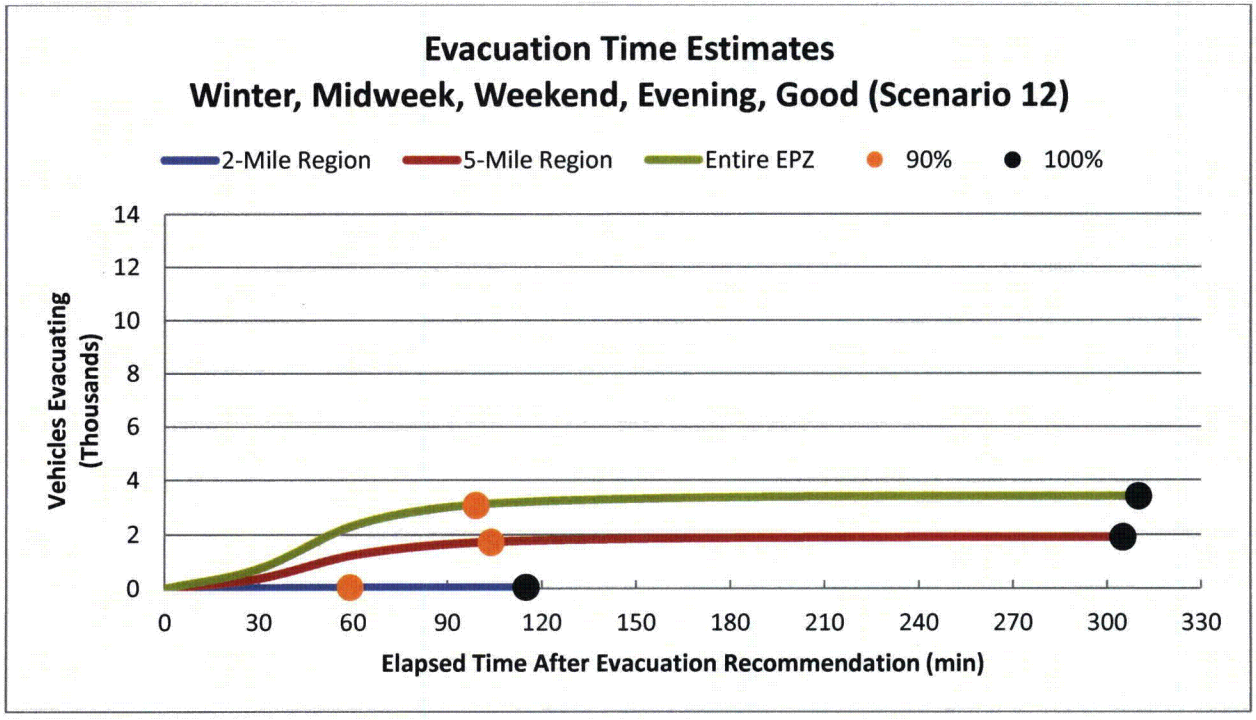

Figure 7-18. Evacuation Time Estimates - Scenario 12 for Region R03

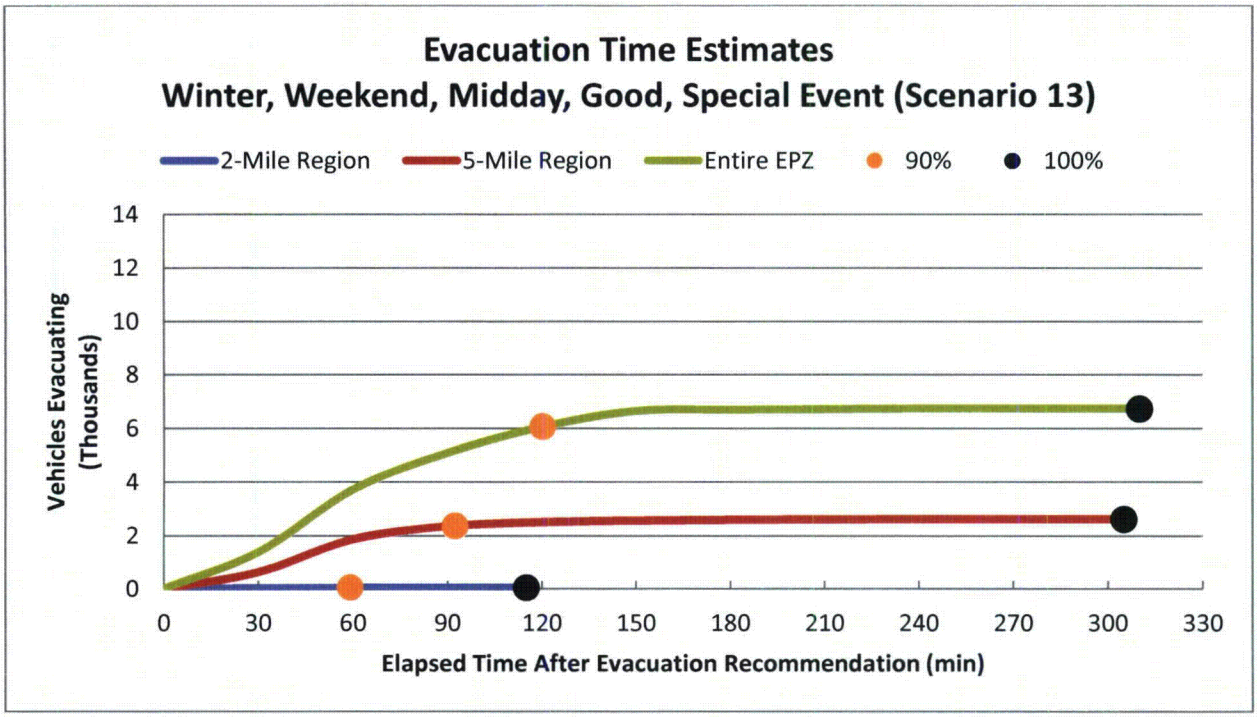

Figure 7-19. Evacuation Time Estimates - Scenario 13 for Region R03

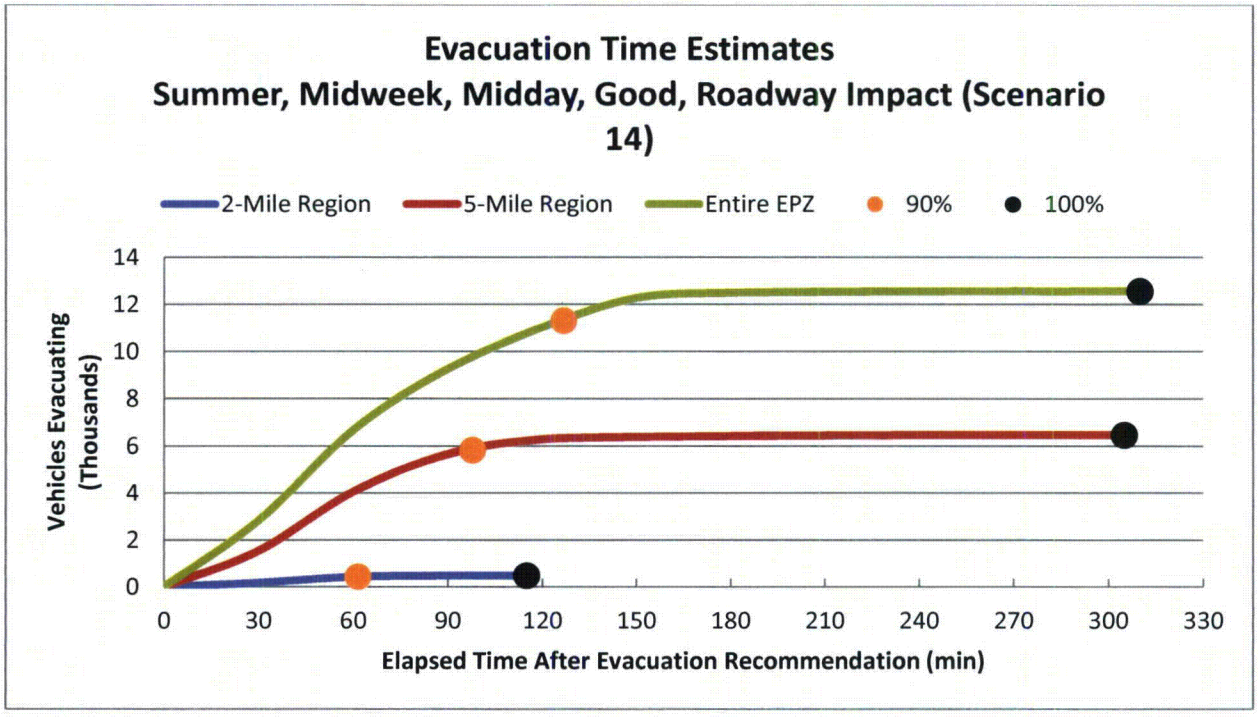

Figure 7-20. Evacuation Time Estimates - Scenario 14 for Region R03