9. TRAFFIC MANAGEMENT STRATEGY

This section presents the current traffic control and management strategy that is designed to expedite the movement of evacuating traffic. The resources required to implement this strategy include:

- Personnel with the capabilities of performing the planned control functions of traffic guides (preferably, not necessarily, law enforcement officers).
- Traffic Control Devices to assist these personnel in the performance of their tasks. These devices should comply with the guidance of the Manual of Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration (FHWA) of the U.S.D.O.T. All state and most county transportation agencies have access to the MUTCD (also available online). Applicable devices include, with reference to the MUTCD:
    - Traffic Barriers: Chapter 6F, section 6F.61, 62 and Figure 6F-4.
    - Traffic Cones: Chapter 3F and section 6F.56.
    - Signs: Chapter 2I
- A plan that defines all necessary details and is documented in a format that is readily understood by those assigned to perform traffic control.

The functions to be performed in the field are:

1. Facilitate evacuating traffic movements that serve to expedite travel out of the EPZ along routes that the analysis has found to be most effective.
2. Discourage traffic movements that permit evacuating vehicles to travel in a direction which takes them significantly closer to the power station, or which interferes with the efficient flow of other evacuees.

We employ the terms "facilitate" and "discourage" rather than "enforce" and "prohibit" to indicate the need for flexibility in performing the traffic control function. There are always legitimate reasons for a driver to prefer a direction other than that indicated. For example:

- A driver may be traveling home from work or from another location, to join other family members preliminary to evacuating.
- An evacuating driver may be taking a detour from the evacuation route in order to pick up a relative, or other evacuees.
- The driver may be an emergency worker en route to perform an important activity.

The implementation of a plan must also be flexible enough for the application of sound judgment by the traffic guide.

The traffic management strategy is the outcome of the following process:

1. A field survey of these critical locations.
   The schematics describing traffic control, which are presented in Appendix G, are based on data collected during field surveys, upon large-scale maps, and on overhead photos.
2. Computer analysis of the evacuation traffic flow environment.
   This analysis identifies the best routing and those locations that experience pronounced congestion.
3. Consultation with emergency management and enforcement personnel.
   Trained personnel who are experienced in controlling traffic and are aware of the likely evacuation traffic patterns have extensively reviewed these control tactics.
4. Prioritization of TCPs.
   Application of traffic control at some TCPs will have a more pronounced influence on expediting traffic movements than at other TCPs. For example, TCPs controlling traffic originating from areas in close proximity to the power plant could have a more beneficial effect on minimizing potential exposure to radioactivity than those TCPs located far from the power plant. Thus, during the mobilization of personnel to respond to the emergency situation, those TCPs which are assigned a higher priority should be manned earlier. These priorities have been developed in conjunction with county emergency management representatives and law enforcement personnel.

The control tactic at each TCP is presented in each schematic that appears in Appendix G.

Concern was expressed over manpower and equipment shortages at meetings with law enforcement personnel representing the police jurisdictions within the EPZ, especially those within Wake County, where the majority of the traffic congestion is expected based on the analysis presented in Section 7. A sensitivity study was performed to quantify the benefit of manning the traffic control points during the evacuation; the results of this study can be seen in Appendix I. Note that the manning of traffic control points can reduce the ETE by at most 20 minutes. Traffic control guides at key intersections throughout the EPZ serve as fixed point surveillance for accidents or other problems that may arise during the evacuation, which could reduce capacity and extend the ETE. Traffic control guides also provide needed route guidance to those evacuees who may not be familiar with the area and the roadway system (i.e. transients), and to those residents who are uncertain of the proper direction of travel.

Concern was also expressed over mobilization of equipment during an evacuation. Many of the police agencies do not have sufficient cones and barricades readily available to perform the recommended traffic control duties in the event of an emergency, and they would have to rely on the Department of Transportation (DOT) to provide assistance. It is recommended that the counties and the DOT develop joint emergency response implementation procedures to ensure that sufficient resources are available in a timely manner in the event of an emergency.

The use of Intelligent Transportation Systems (ITS) technologies can reduce manpower and equipment needs, while still facilitating the evacuation process. Dynamic Message Signs (DMS) can be placed within the EPZ to provide information to travelers regarding traffic conditions, route selection, and reception center information. DMS can also be placed outside of the EPZ to warn motorists to avoid using routes that may conflict with the flow of evacuees away from the nuclear power station. Highway Advisory Radio (HAR) can be used to broadcast information to evacuees en route through their vehicle stereo systems. Automated Traveler Information Systems (ATIS) can also be used to provide evacuees with information. Internet websites can provide traffic and evacuation route information before the evacuee begins his trip, while on board navigation systems (GPS units), cell phones, and pagers can be used to provide information en route. These are only several examples of how ITS technologies can benefit the evacuation process.

Chapter 2I of the MUTCD presents guidance on Emergency Management signing. Specifically, the Evacuation Route sign, EM-1 on page 2I-3, with the word “Hurricane” removed, could be installed selectively within the EPZ, if considered advisable by local and state authorities. Similar comments apply to sign EM-3 which identifies TCP locations.

Security Road Blocks (SRB) are deployed near the periphery of the EPZ to divert “through” trips. The ETE calculations reflect the assumption that all “external-external” trips are interdicted after 90 minutes have elapsed after the advisory to evacuate.

All transit trips and other responders entering the EPZ to support the evacuation are assumed to be unhindered by personnel manning TCP and SRB.

10. EVACUATION ROUTES

Evacuation routes are composed of two distinct components:

- Routing from a sub-zone being evacuated to the boundary of the Evacuation Region and thence out of the Emergency Planning Zone (EPZ).

- Routing of evacuees from the EPZ boundary to the reception centers.

Evacuees should be routed within the EPZ in such a way as to *minimize their exposure to risk*. This primary requirement is met by routing traffic to move *away* from the location of the Harris Nuclear Plant, to the extent practicable, and by delineating evacuation routes that expedite the movement of evacuating vehicles. This latter objective is addressed by developing evacuation routes to achieve a balancing of traffic demand relative to the available highway capacity to the extent possible, subject to satisfying the primary requirement noted above. This is achieved by carefully specifying candidate destinations for all origin centroids where evacuation trips are generated, and applying the TRAD model effectively. See Appendices A-D for further discussion.

The routing of evacuees from the EPZ boundary to the reception centers should be responsive to several considerations:

- Minimize the amount of travel outside the EPZ, from the points where these routes cross the EPZ boundary, to the reception centers.

- Relate the anticipated volume of traffic destined to the reception center, to the capacity of the reception center facility.

Figure 10-1 presents a map showing the general population reception centers. The major evacuation routes for the four counties within the EPZ are presented in Figures 10-2 through 10-5.

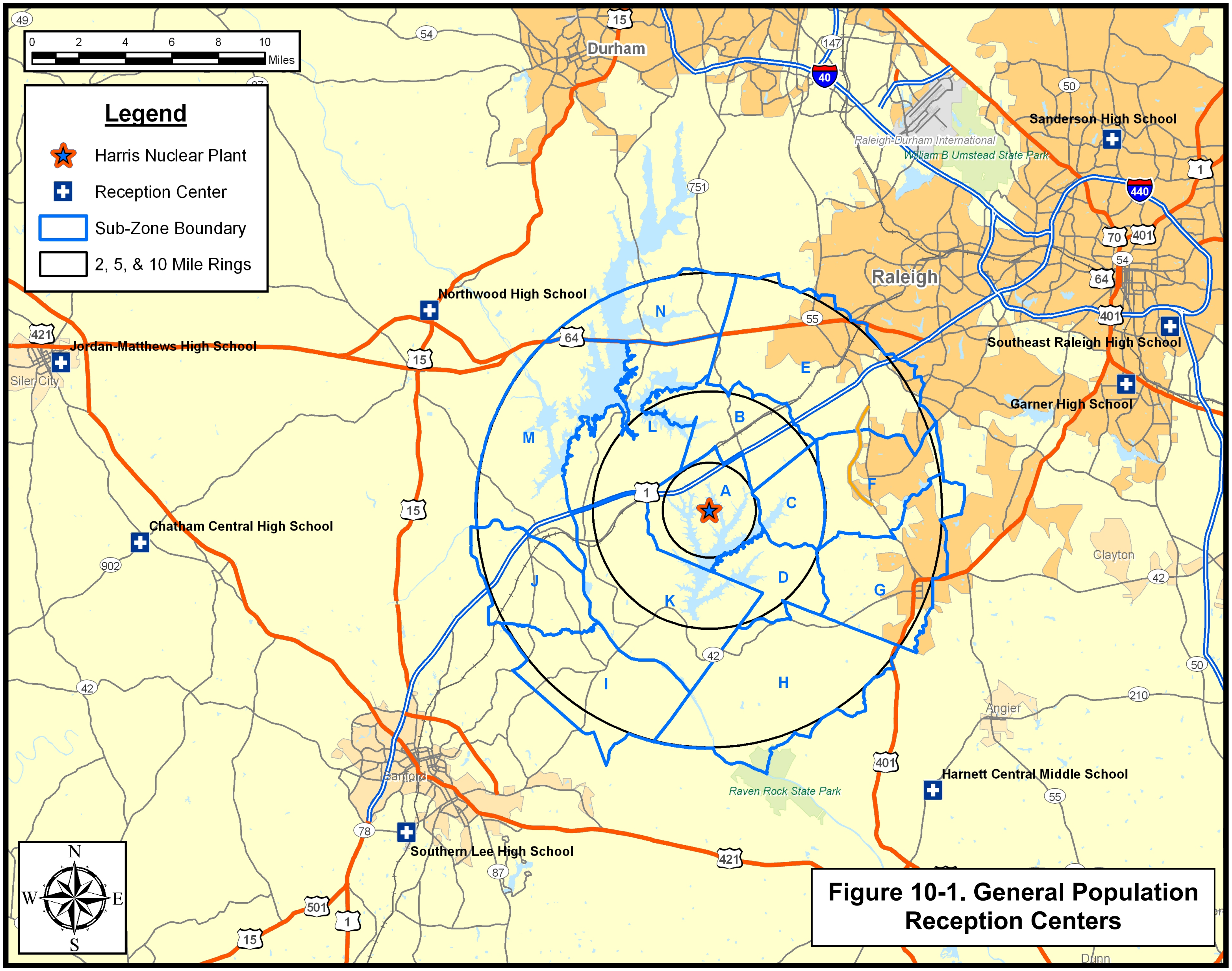


Figure 10-1. General Population Reception Centers

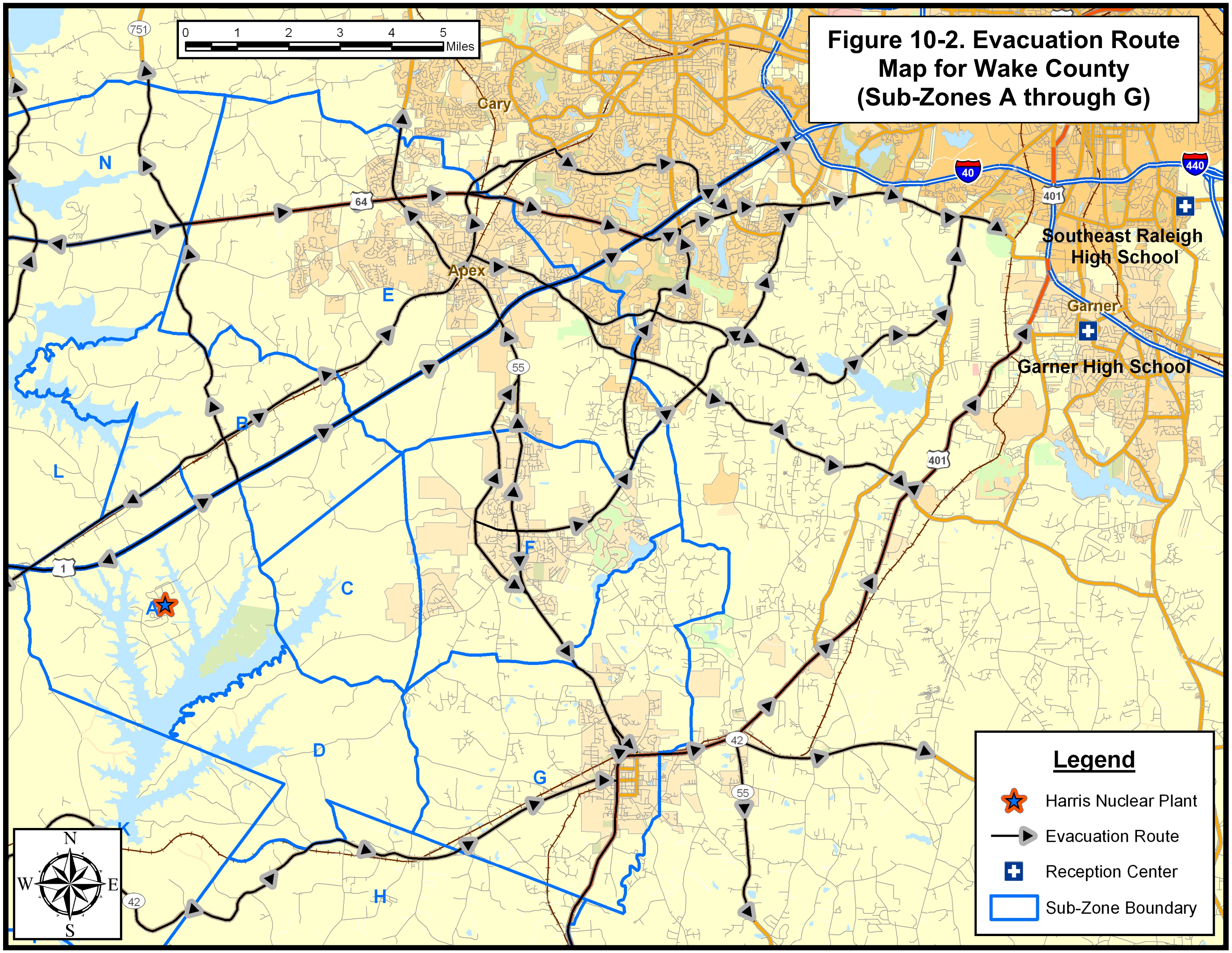


Figure 10-2. Evacuation Route Map for Wake County (Sub-Zones A through G)
0 1 2 3 4 5 Miles
Cary
Apex
Garner
Southeast Raleigh High School
Garner High School
N
E
B
L
A
C
F
D
G
K
H
Legend
Harris Nuclear Plant
Evacuation Route
Reception Center
Sub-Zone Boundary

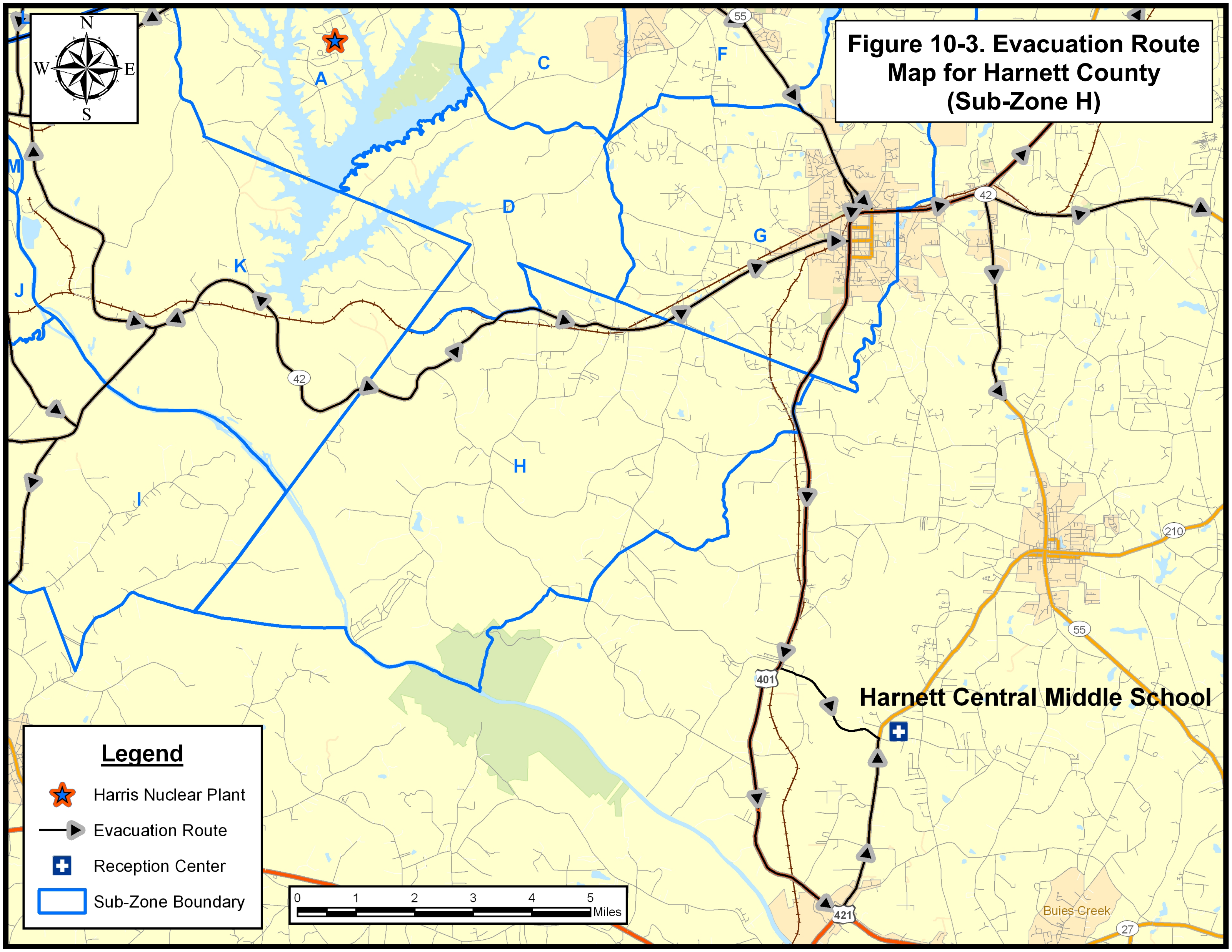


Figure 10-3. Evacuation Route Map for Harnett County (Sub-Zone H)
Harnett Central Middle School
Legend
Harris Nuclear Plant
Evacuation Route
Reception Center
Sub-Zone Boundary
0 1 2 3 4 5 Miles
N
S
E
W
A
C
D
F
G
H
I
J
K
M
55
42
210
401
421
27
Buies Creek

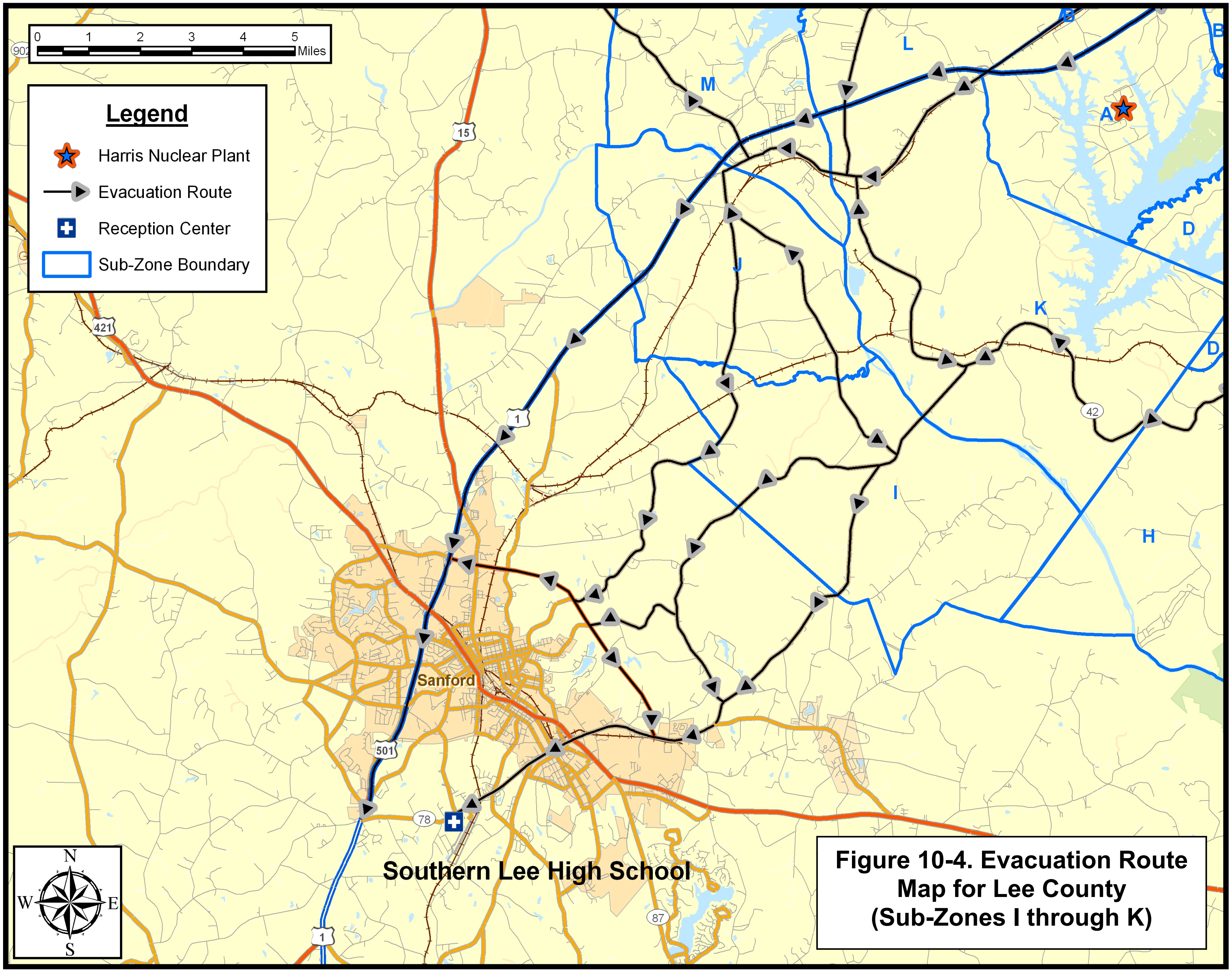


Figure 10-4. Evacuation Route Map for Lee County (Sub-Zones I through K)

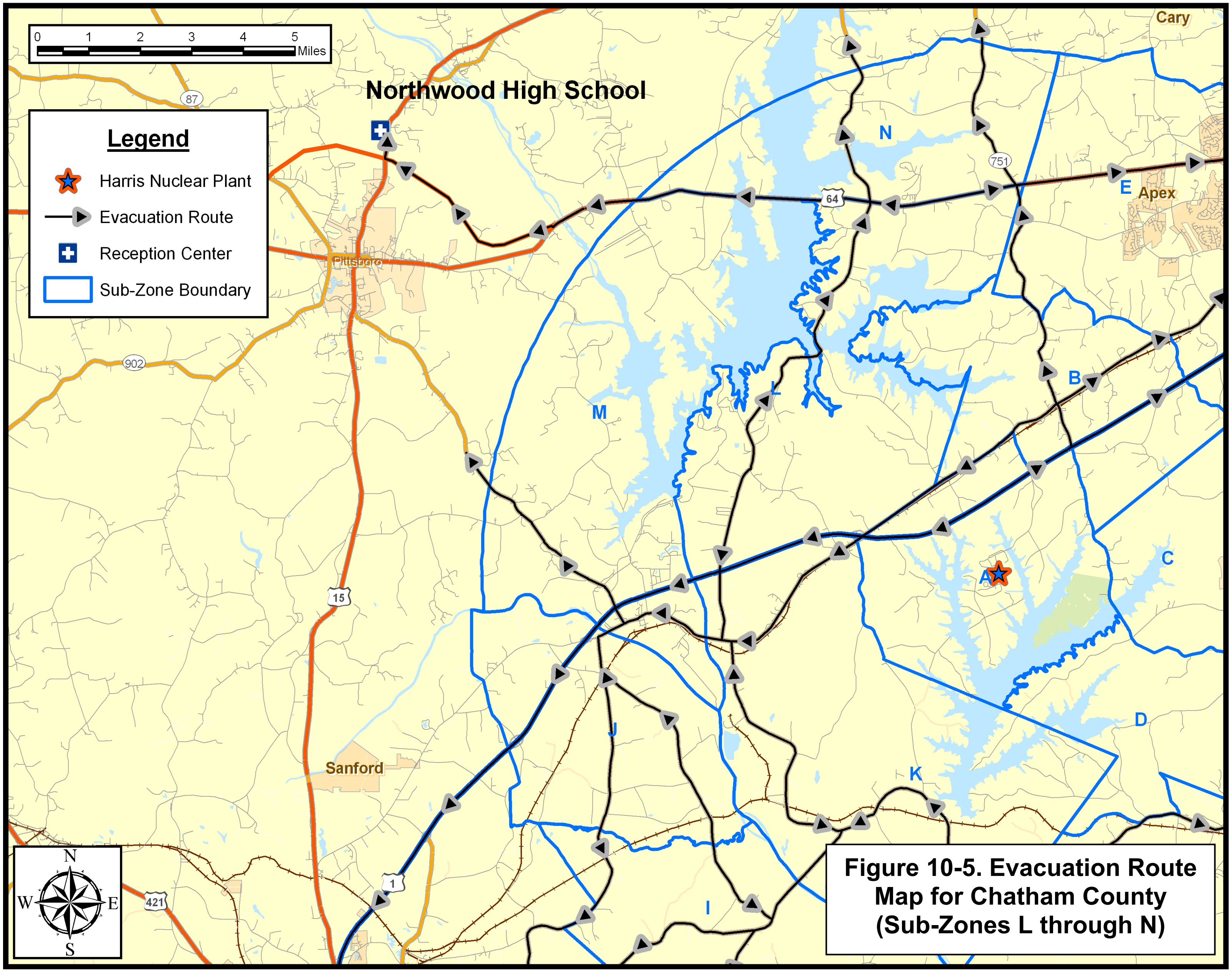


Figure 10-5. Evacuation Route Map for Chatham County (Sub-Zones L through N)

11. SURVEILLANCE OF EVACUATION OPERATIONS

There is a need for surveillance of traffic operations during the evacuation. There is also a need to clear any blockage of roadways arising from accidents or vehicle disablement. Surveillance can take several forms.

1. Traffic control personnel, located at Traffic Control and Access Control points, provide fixed-point surveillance.
2. Ground patrols may be undertaken along well-defined paths to ensure coverage of those highways that serve as major evacuation routes.
3. Aerial surveillance of evacuation operations may also be conducted using helicopter or fixed-wing aircraft.
4. Cellular phone calls (if cellular coverage exists) from motorists may also provide direct field reports of road blockages.

These concurrent surveillance procedures are designed to provide coverage of the entire EPZ as well as the area around its periphery. It is the responsibility of the Counties to support an emergency response system that can receive messages from the field and be in a position to respond to any reported problems in a timely manner. This coverage should quickly identify, and expedite the response to any blockage caused by a disabled vehicle.

Tow Vehicles

In a low-speed traffic environment, any vehicle disablement is likely to arise due to a low-speed collision, mechanical failure or the exhaustion of its fuel supply. In any case, the disabled vehicle can be pushed onto the shoulder, thereby restoring traffic flow. Past experience in other emergencies indicates that evacuees who are leaving an area often perform activities such as pushing a disabled vehicle to the side of the road without prompting.

While the need for tow vehicles is expected to be low under the circumstances described above, it is still prudent to be prepared for such a need. Tow trucks with a supply of gasoline may be deployed at strategic locations within, or just outside, the EPZ. These locations should be selected so that:

- They permit access to key, heavily loaded, evacuation routes.
- Responding tow trucks would most likely travel counter-flow relative to evacuating traffic.

12. CONFIRMATION TIME

It is necessary to confirm that the evacuation process is effective in the sense that the public is complying with the order to evacuate. Although Chatham County, Harnett County, Lee County and Wake County may use their own procedures for confirmation, we suggest an alternative or complementary approach.

The procedure we suggest employs a stratified random sample and a telephone survey. The size of the sample is dependent on the expected number of households that do not comply with the order to evacuate. We believe it is reasonable to assume, for the purpose of estimating sample size that at least 80 percent of the population within the EPZ will comply with the order to evacuate. On this basis, an analysis could be undertaken (see Table 12-1) to yield an estimated sample size of approximately 300.

The confirmation process should start at about 2½ hours after the Advisory to Evacuate, which is when 90 percent of evacuees have completed their mobilization activities (see Table 5-1). At this time, virtually all evacuees will have departed on their respective trips and the local telephone system will be largely free of traffic.

As indicated in Table 12-1, approximately 7-1/2 person hours are needed to complete the telephone survey. If six people are assigned to this task, each dialing a different set of telephone exchanges (e.g., each person can be assigned a different set of sub-zones), then the confirmation process will extend over a time frame of about 75 minutes. Thus, the confirmation should be completed well before the evacuated area is cleared. Of course, fewer people would be needed for this survey if the Evacuation Region were only a portion of the EPZ. Use of modern automated computer controlled dialing equipment can significantly reduce the manpower requirements and the time required to undertake this type of confirmation survey.

If this method is indeed used by the EPZ counties, it is recommended that a list of telephone numbers within the EPZ be available in the Emergency Operations Center (EOC) at all times. Such a list could be purchased from vendors and should be periodically updated. As indicated above, the confirmation process should not begin until 2½ hours after the Advisory to Evacuate, to ensure that households have had enough time to mobilize. This 2½ hour timeframe will enable telephone operators to arrive at their workplace, obtain a call list and prepare to make the necessary phone calls.

Should the number of telephone responses (i.e., people still at home) exceed 20 percent, then the telephone survey should be repeated after an hour's interval until the confirmation process is completed.

TABLE 12-1
ESTIMATED NUMBER OF TELEPHONE CALLS REQUIRED FOR CONFIRMATION OF EVACUATION

Problem Definition

Estimate number of phone calls, n, needed to ascertain the proportion, F of households that have not evacuated.

Reference: Burstein, H., Attribute Sampling, McGraw Hill, 1971

Given:

No. of households plus other facilities, N, within the EPZ (est.) = 24,500
Est. proportion, F, of households that have not evacuated = 0.20
Allowable error margin, e: 0.05
Confidence level, α: 0.95 (implies A = 1.96)

Applying Table 10 of cited reference,

$$p = F + e = 0.25;\ q = 1 - p = 0.75$$

$$n = \frac{A^2 pq + e}{e^2} = 308$$

Finite population correction:

$$n_F = \frac{nN}{n + N - 1} = 304$$

Thus, some 300 telephone calls will confirm that approximately 20 percent of the population has not evacuated. If only 10 percent of the population does not comply with the order to evacuate, then the required sample size, n_F = 214.

Est. Person Hours to complete 300 telephone calls

Assume: Time to dial using touch-tone (random selection of listed numbers): 30 seconds
Time for 6 rings (no answer): 36 seconds
Time for 4 rings plus short conversation: 60 sec.
Interval between calls: 20 sec.

Person Hours: 300[30+20+0.8(36)+0.2(60)]/3600 = 7.6

13. RECOMMENDATIONS

The following recommendations are offered:

1. Intelligent Transportation Systems (ITS) such as Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), Automated Traveler Information Systems (ATIS), etc. should be used to facilitate the evacuation process (See Section 9). The placement of additional signage should consider evacuation needs.
2. Counties should implement procedures whereby schools are contacted prior to dispatch of buses from the depots to obtain an accurate count of students needing transportation and the number of buses required (See Section 8).
3. Counties should work with the Department of Transportation to have equipment needed for traffic control duties mobilized in a timely manner should an evacuation be ordered (See Section 9).
4. Counties should establish strategic locations to position tow trucks in the event of a disabled vehicle during the evacuation process (See Section 11) and should encourage gas stations to remain open during the evacuation.
5. Counties should establish a system to confirm that the Evacuation Advisory is being adhered to (see the approach suggested by KLD in Section 12). Given the expansive recreational area within the EPZ, one or more helicopters equipped with loudspeakers should fly over these areas to alert all transients of the need to immediately evacuate.
6. Examination of the ETE in Appendix J shows that the ETE for 100 percent of the population is significantly longer than for 95 percent of the population. Specifically, the additional time needed for the last 5 percent of the population to evacuate can be as much as 40 percent longer than the time needed to evacuate 95 percent of the population. This non-linearity reflects the fact that these relatively few stragglers require significantly more time to mobilize (i.e. prepare for the evacuation trip) than their neighbors. This leads to two recommendations:
    - The public outreach (information) program should emphasize the need for evacuees to minimize the time needed to prepare to evacuate (secure the home, assemble needed clothes, medicines, etc.).
    - The decision makers should reference Table J-1C which lists the time needed to evacuate 95 percent of the population, when preparing recommended protective actions.

APPENDIX A

Glossary of Traffic Engineering Terms

APPENDIX A: GLOSSARY OF TRAFFIC ENGINEERING TERMS

Term	Definition
Link	A network link represents a specific, one-directional section of roadway. A link has both physical (length, number of lanes, topology, etc.) and operational (turn movement percentages, service rate, free-flow speed) characteristics.
Measures of Effectiveness	Statistics describing traffic operations on a roadway network
Node	A network node generally represents an intersection of network links. A node has control characteristics, i.e., the allocation of service time to each approach link.
Origin	A location attached to a network link, within the EPZ or shadow area, where trips are generated at a specified rate in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations.
Network	A graphical representation of the geometric topology of a physical roadway system, which is comprised of directional links and nodes.
Prevailing roadway and traffic conditions	Relates to the physical features of the roadway, the nature (e.g., composition) of traffic on the roadway and the ambient conditions (weather, visibility, pavement conditions, etc.)
Service Rate	Maximum rate at which vehicles, executing a specific turn maneuver, can be discharged from a section of roadway at the prevailing conditions, expressed in vehicles per second (vps) or vehicles per hour (vph).
Service Volume	Maximum number of vehicles which can pass over a section of roadway in one direction during a specified time period with operating conditions at a specified Level of Service. (The Service Volume at the upper bound of Level of Service, E, equals Capacity.) Service Volume is usually expressed as vehicles per hour (vph).
Signal Cycle Length	The total elapsed time to display all signal indications, in sequence. The cycle length is expressed in seconds.
Signal Interval	A single combination of signal indications. The interval duration is expressed in seconds. A signal phase is comprised of a sequence of signal intervals.
Signal Phase	A set of signal indications (and intervals) which services a particular combination of traffic movements on selected approaches to the intersection. The phase duration is expressed in seconds.

Term	Definition
Traffic (Trip) Assignment	A process of assigning traffic to paths of travel in such a way as to satisfy all trip objectives (i.e., the desire of each vehicle to travel from a specified origin in the network to a specified destination) and to optimize some stated objective or combination of objectives. In general, the objective is stated in terms of minimizing a generalized "cost". For example, "cost" may be expressed in terms of travel time.
Traffic Density	The number of vehicles that occupy one lane of a roadway section of specified length at a point of time, expressed as vehicles per mile (vpm).
Traffic (Trip) Distribution	A process for determining the destinations of all traffic generated at the origins. The result often takes the form of a Trip Table, which is a matrix of origin-destination traffic volumes.
Traffic Simulation	A computer model designed to replicate the real-world operation of vehicles on a roadway network, so as to provide statistics describing traffic performance. These statistics are called Measures of Effectiveness.
Traffic Volume	The number of vehicles that pass over a section of roadway in one direction, expressed in vehicles per hour (vph). Where applicable, traffic volume may be stratified by turn movement.
Travel Mode	Distinguishes between private auto, bus, rail, pedestrian and air travel modes.
Trip Table or Origin-Destination Matrix	A rectangular matrix or table, whose entries contain the number of trips generated at each specified origin, during a specified time period, that are attracted to (and travel toward) each of its specified destinations. These values are expressed in vehicles per hour (vph) or in vehicles.
Turning Capacity	The capacity associated with that component of the traffic stream which executes a specified turn maneuver from an approach at an intersection.

<u>APPENDIX B</u>

Traffic Assignment and Distribution Model

APPENDIX B: TRAFFIC ASSIGNMENT AND DISTRIBUTION MODEL

This section describes the integrated trip assignment and distribution model named TRAD that is expressly designed for use in analyzing evacuation scenarios. This model employs equilibrium traffic assignment principles and is one of the models of the I-DYNEV System.

To apply TRAD, the analyst must specify the highway network, link capacity information, the volume of traffic generated at all origin centroids, a set of accessible candidate destination nodes on the periphery of the EPZ for each origin, and the approach capacity to each destination node. TRAD calculates the optimal trip distribution and the optimal trip assignment (i.e., routing) of the traffic generated at each origin node, traveling to the associated set of candidate destination nodes, so as to minimize evacuee travel times.

Overview of Integrated Assignment and Distribution Model

The underlying premise is that the selection of destinations and routes is intrinsically coupled in an evacuation scenario. That is, people in vehicles seek to travel out of an area of potential risk as rapidly as possible by selecting the “best” route. The model is designed to identify these “best” routes in a manner that distributes vehicles from origins to destinations and routes them over the highway network, in a consistent and optimal manner.

The approach we adopt is to extend the basic equilibrium assignment methodology to embrace the distribution process, as well. That is, the selection of destination nodes by travelers from each origin node, and the selection of the connecting paths of travel, are both determined by the integrated model. This determination is subject to specified capacity constraints, so as to satisfy the stated objective function. This objective function is the statement of the User Optimization Principle by Wardrop.

To accomplish this integration, we leave the equilibrium assignment model intact, changing only the form of the objective function. It will also be necessary to create a "fictional" augmentation of the highway network. This augmentation will consist of Pseudo-Links and Pseudo-Nodes, so configured as to embed an equilibrium Distribution Model within the fabric of the Assignment Model.

Specification of TRAD Model Inputs

The user must specify, for each origin node, the average hourly traffic volume generated, as well as a set of candidate accessible destinations. A destination is “accessible” to traffic originating at an origin node if there is at least one path connecting the origin to the destination node. There must be at least one destination node specified for each origin centroid. The number of trips generated at the origin node, which are distributed to each specified, accessible destination node within this set, is determined by the model in a way as to satisfy the network-wide objective function (Wardrop's Principle).

The user must also specify the total number of trips which can be accommodated by each destination node. This value reflects the capacities of the road(s) immediately servicing the destination node. Clearly, we require that the total number of trips traveling to a destination, j, from all origin nodes, i, should not exceed the capacities of the approaches to destination node, j. By summing over all destination nodes, this constraint also states that the total trips generated at all origin nodes should not exceed the total capacity to accommodate these trips at all of the specified destinations.

In summary, the user must specify the total trips generated at each of the origin nodes, the maximum number of trips that can be accommodated by each of the specified destination nodes and the highway network attributes which include the traffic control tactics. The TRAD model includes a function which expresses travel time on each network link in terms of traffic volume and link capacity. This function drives the underlying trip distribution and trip assignment decision-making process. Thus, the TRAD model satisfies the objectives of evacuees to select destination nodes and travel paths to minimize evacuation travel time. As such, this integrated model is classified as a behavioral model.

At the outset, it may appear that we have an intractable problem:

- If TRAD retains the basic assignment algorithm, it must be provided a Trip Table as input.
- On the other hand, if the distribution model is embedded within the assignment model, rather than preceding it, a Trip Table is not available as input.

The resolution of this problem is as follows:

1. The software constructs an "augmentation" network that allows the user to specify the volume for each origin node and a set of candidate destinations on the periphery of the EPZ. The allocation of trips from the origin node to each candidate destination node is not specified and is determined internally by the model.
2. Each [real] link of the highway network is calibrated by relating speed to the volume:capacity (v/c) ratio.
3. The software constructs pseudo-links which service the assigned volumes, A_j, traveling to the destination nodes, j, in the augmented network.

This analysis network is comprised of three sub-networks:

1. The real highway sub-network, which consists of "Class I" Links and Nodes.
2. A sub-network of "Class II" Pseudo-Links which acts as an interface between the highway sub-network and the network augmentation.
3. The sub-network of "Class III" Pseudo-Links and Nodes which comprises the network augmentation described above.

The need for these Class II links will become clear later. The classifications are described below:

<u>Class I Links and Nodes</u>

These links and nodes represent the physical highway network: sections of highway and intersections. Trips generated at each Origin [Centroid] Node are assigned to a specified Class I link via a "connector" link. These connector links are transparent to the user and offer no impedance to the traveler; they represent the aggregation of local streets which service the centroidal generated trips and feed them onto the highway network. The real-world destination nodes are part of this network. The immediate approaches to these destination nodes are Class I links.

<u>Class II Links</u>

These pseudo-links are constructed so as to connect each specified destination node with its Class III Pseudo-Node (P-N) counterpart on a one-to-one basis. The capacities of these Class II links are set equal to the capacities at their respective destination nodes.

<u>Class III Links and Nodes</u>

Class III links and nodes form the augmentation to the basic network. These Pseudo-Links provide paths from the Class II links servicing traffic traveling from the specified [real] destination nodes, to the Super-Nodes which represent the user-specified set of destination nodes associated with each origin node.

Each Class of links provides a different function:

- Class I links represent the physical highway network. As such, each link has a finite capacity, a finite length and an estimated travel time for free-flowing vehicles. The nodes generally represent intersections, interchanges and, possibly, changes in link geometry. The topology of the Class I network represents that of the physical highway system.
- The Class II links represent the interface between the real highway sub-network and the augmentation sub-network. These pseudo-links are needed

to represent the specified maximum number of vehicles that can be accommodated by each destination node. Instead of explicitly assigning a capacity limitation to the destination nodes, we assign the capacity limitation of the Class II Pseudo-Links. This approach is much more suitable, computationally.

- The topology of the network augmentation (i.e., Class III Links and Nodes) is designed so that all traffic from an origin node can only travel to the single "Super-Node" by flowing through its set of real destination nodes, thence along the links of the augmented network.

The Class II Pseudo-Links and the network augmentation of Class III Pseudo-Nodes and Links represent logical constructs of fictitious links created internally by the model that allows the user to specify the identity of all destination nodes in each origin-based set, without specifying the distribution of traffic volumes from the origin to each destination node in that set.

Calculation of Capacities and Impedances

Each class of links exhibits different properties. Specifically, the relationship between travel impedance (which is expressed in terms of travel time) and both volume and capacity will differ:

- For Class I links, the capacity represents the physical limitation of the highway sections. Travel impedance is functionally expressed by relating travel time with respect to the traffic volume-link capacity relationship.
- For Class II links, link capacity represents the maximum number of vehicles that can be accommodated at the [real] destination nodes that form the upstream nodes of each Class II link. Since Class II links are Pseudo-Links, there should be virtually no difference in impedance to traffic along Class II links when the assigned traffic volume on these links is below their respective capacities. That is, the assignment of traffic should not be influenced by differences in travel impedance on those Class II links where the assigned volumes do not exceed their respective capacities.
- For Class III links, both capacity and impedance have no meaning. Since the Class II links limit the number of vehicles entering the Class III sub-network at all entry points (i.e., at the Class II Pseudo-Nodes) and since all these links are Pseudo-Links, it follows that the Class III network is, by definition, an un-capacitated network.

Specification of the Objective Function

It is computationally convenient to be able to specify a single impedance (or "cost") function relating the travel time on a link, to its capacity and assigned traffic volume, for all classes of links. To achieve this, we will adopt the following form based on the original "BPR Formula":

$$T = T_o\{\alpha[1 + a_1(\frac{v}{c})^{b_1}] + \beta[1 + a_2(\frac{v}{c})^{b_2}]\} + I$$

Where, as for the present traffic assignment model in TRAD,

T	=	Link travel time, sec.
T_o	=	Unimpeded link travel time, sec.
V	=	Traffic volume on the link, veh/hr
C	=	Link capacity, veh/hr
a_i, b_i	=	Calibration parameters
α, ß	=	Coefficients defined below
I	=	Impedance term, expressed in seconds, which could represent turning penalties or any other factor which is justified in the user's opinion

The assignment of coefficients varies according to the Class in which a link belongs:

Class	α	ß	T_o
I	1	0	L/U_f
II	0	1	W
III	0	0	1

Here, L is a highway link length and U_f is the free-flow speed of traffic on a highway link. The values of a_1 and b_1, which are applicable only for Class I links, are based on experimental data:

$a_1 = 0.8$ $b_1 = 5.0$

The values of a_2 and b_2, which are applicable for each Class II link, are based upon the absolute requirement that the upstream destination node can service no more traffic than the user-specified value of the maximum destination node “capacity.” In addition, these parameters must be chosen so that these Pseudo-Links all offer the same impedance to traffic when their assigned volumes are less than their respective specified maximum attractions. The weighting factor, W, is computed internally by the software.

Of course, it is still possible for the assignment algorithm within TRAD to distribute more traffic to a destination node than that node can accommodate. For emergency planning purposes, this is a desirable model feature. Such a result will be flagged by the model to alert the user to the fact that some factor is strongly motivating travelers to move to that destination node, despite its capacity limitations. This factor can take many forms: inadequate highway capacity to other destinations, improper specification of candidate destinations for some of the origins, or some other design inadequacy. The planner can respond by modifying the control tactics, changing the origin-destination distribution pattern, providing more capacity at the overloaded destinations, etc.

APPENDIX C

Traffic Simulation Model: PC-DYNEV

APPENDIX C: TRAFFIC SIMULATION MODEL: PC-DYNEV

A model, named PC-DYNEV, is an adaptation of the TRAFLO Level II simulation model, developed by KLD for the Federal Highway Administration (FHWA). Extensions in scope were introduced to expand the model's domain of application to include all types of highway facilities, to represent the evacuation traffic environment and to increase its computational efficiency. This model produces the extensive set of output Measures of Effectiveness (MOE) shown in Table C-1.

The traffic stream is described internally in the form of statistical flow profiles. These profiles, expressed internally as statistical histograms, describe the platoon structure of the traffic stream on each network link. The simulation logic identifies five types of histograms:

- The ENTRY histogram which describes the platoon flow at the upstream end of the subject link. This histogram is simply an aggregation of the appropriate OUTPUT turn-movement-specific histograms of all feeder links.
- The INPUT histograms which describe the platoon flow pattern arriving at the stop line. These are obtained by first disaggregating the ENTRY histogram into turn-movement-specific component ENTRY histograms. Each such component is modified to account for the platoon dispersion which results as traffic traverses the link. The resulting INPUT histograms reflect the specified turn percentages for the subject link.
- The SERVICE histogram which describes the service rates for each turn movement. These service rates reflect the type of control device servicing traffic on this approach; if it is a signal, then this histogram reflects the specified movement-specific signal phasing. A separate model estimates service rates for each turn movement, given that the control is GO.

These data are provided for each network link and are also aggregated over the entire network.

- The QUEUE histograms that describe the time-varying ebb and growth of the queue formation at the stop line. These histograms are derived from the interaction of the respective IN histograms with the SERVICE histograms.
- The OUT histograms that describe the pattern of traffic discharging from the subject link. Each of the IN histograms is transformed into an OUT histogram by the control applied to the subject link. Each of these OUT histograms is added into the (aggregate) ENTRY histogram of its receiving link. This approach provides the model with the ability to identify the characteristics of each turn-movement-specific component of the traffic stream. Each component is serviced at a different saturation flow rate as is the case in the real world. The logic recognizes when one component of the traffic flow encounters saturation conditions even if the others do not.

Algorithms provide estimates of delay and stops reflecting the interaction of the IN histograms with the SERVICE histograms. The logic also provides for properly treating spillback conditions reflecting queues extending from its host link, into its upstream feeder links.

A valuable feature is the ability to internally generate functions that relate mean speed to density on each link, given user-specified estimates of free-flow speed and saturation service rates for each link. Such relationships are essential in order to simulate traffic operations on freeways and rural roads, where signal control does not exist or where its effect is not the dominant factor in impeding traffic flow.

All traffic simulation models are data-intensive. Table C-2 outlines the input data elements. This input describes:

- Topology of the roadway system
- Geometrics of each roadway component
- Channelization of traffic on each roadway component
- Motorist behavior that, in aggregate, determines the operational performance of vehicles in the system
- Specification of the traffic control devices and their operational characteristics
- Traffic volumes entering and leaving the roadway system
- Traffic composition.

To provide an efficient framework for defining these specifications, the physical environment is represented as a network. The unidirectional links of the network generally represent roadway components: either urban streets or freeway segments. The nodes of the network generally represent urban intersections or points along the freeway where a geometric property changes (e.g. a lane drop, change in grade or ramp).

Figure C-1 is an example of a small network representation. The freeway is defined by the sequence of links, (20,21), (21,22), (22,23). Links (8001, 19) and (3, 8011) are Entry and Exit links, respectively. An arterial extends from node 3 to node 19 and is partially subsumed within a grid network. Note that links (21,22) and (17,19) are grade-separated.

Table C-1. Measures of Effectiveness Output by PC-DYNEV	
Measure	**Units**
Travel	Vehicle-Miles and Vehicle-Trips
Moving Time	Vehicle-Minutes
Delay Time	Vehicle-Minutes
Total Travel Time	Vehicle-Minutes
Efficiency: Moving Time/Total Travel Time	Percent
Mean Travel Time per Vehicle	Seconds
Mean Delay per Vehicle	Seconds
Mean Delay per Vehicle-Mile	Seconds/Mile
Mean Speed	Miles/Hour
Mean Occupancy	Vehicles
Mean Saturation	Percent
Vehicle Stops	Percent

Table C-2. Input Requirements for the PC-DYNEV Model

GEOMETRICS

- Links defined by upstream and downstream node numbers
- Link lengths
- Number of lanes (up to 6)
- Turn pockets
- Grade
- Network topology defined in terms of target nodes for each receiving link

TRAFFIC VOLUMES

- On all entry links and sink/source nodes stratified by vehicle type: auto, car pool, bus, truck
- Link-specific turn movements

TRAFFIC CONTROL SPECIFICATIONS

- Traffic signals: link-specific, turn movement specific
- Signal control treated as fixed time
- Stop and Yield signs
- Right-turn-on-red (RTOR)
- Route diversion specifications
- Turn restrictions
- Lane control (e.g. lane closure, movement-specific)

DRIVER'S AND OPERATIONS CHARACTERISTICS

- Drivers (vehicle-specific) response mechanisms: free-flow speed, aggressiveness, discharge headway
- Link-specific mean speed for free-flowing (unimpeded) traffic
- Vehicle-type operational characteristics: acceleration, deceleration
- Such factors as bus route designation, bus station location, dwell time, headway, etc.

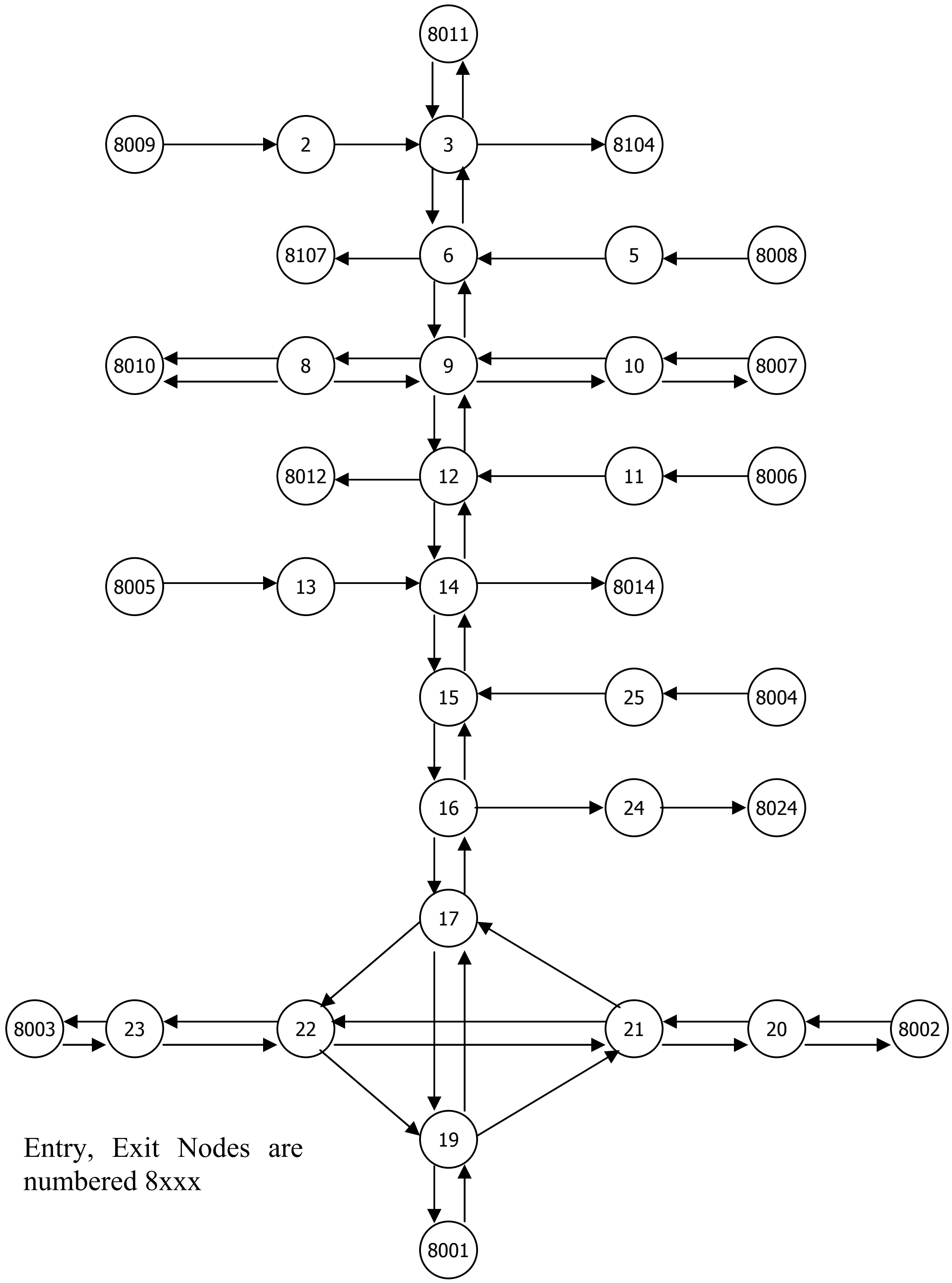


Figure C-1: Representative Analysis Network

APPENDIX D

Detailed Description of Study Procedure

APPENDIX D: DETAILED DESCRIPTION OF STUDY PROCEDURE

This appendix describes the activities that were performed to compute accurate Evacuation Time Estimates (ETE). The individual steps of this effort are represented as a flow diagram in Figure D-1. Each numbered step in the description that follows corresponds to the numbered element in this flow diagram.

Step 1.
The first activity is to obtain data defining the spatial distribution and demographic characteristics of the population within the Emergency Planning Zone (EPZ). These data were obtained from U.S. Census files and from results of a telephone survey conducted within the EPZ. Employee population data and transient population data were obtained from local sources of information and County Emergency Management Offices.

Step 2.
The next activity is to examine large-scale maps of the EPZ in both hard-copy form and using Geographical Information System (GIS) software. These maps were used to identify the analysis highway network and the access roads from each residential and employment development to the adjoining elements of this network. This information is used to plan a field survey of the highway system and later, to assign generated evacuation trips to the correct destinations at the periphery of the EPZ.

Step 3.
The next step is to conduct a physical survey of the roadway system. The purpose of this survey is to determine the geometric properties of the highway elements, the channelization of lanes on each section of roadway, whether there are any turn restrictions or special treatment of traffic at intersections, the type and functioning of traffic control devices and to make the necessary observations needed to estimate realistic values of roadway capacity.

Step 4.
With this information, develop the evacuation network representation of the physical roadway system.

Step 5.
With the network drawn, proceed to estimate the capacities of each link and to locate the origin centroids where trips would be generated during the evacuation process.

Step 6.
With this information at hand, the data were entered into the computer to create the input stream for the TRaffic Assignment and Distribution (TRAD) model. This model was designed to be compatible with the PC-DYNEV traffic simulation model used later in the project; the input stream required for one model is entirely compatible with the input stream

required by the other. Using a software system developed by KLD named UNITES, the data entry activity is performed interactively directly on the computer.

Step 7.
The TRAD model contains software that performs diagnostic testing of the input stream. These assist the user in identifying and correcting errors in the input stream

Step 8.
After creating the input stream, execute the TRAD model to compute evacuating traffic routing patterns consistent with the guidelines of NUREG 0654, Appendix 4. The TRAD model also provides estimates of traffic loading on each highway link as well as rough estimates of operational performance.

Step 9.
Critically examine the statistics produced by the TRAD model. This is a labor-intensive activity, requiring the direct participation of skilled engineers who possess the necessary practical experience to interpret the results and to determine the causes of any problems reflected in the results.

Essentially, the approach is to identify those "hot spots" in the network that represent locations where congested conditions are pronounced and to identify the cause of this congestion. This cause can take many forms, either as excess demand due to improper routing, as a shortfall of capacity, or as a quantitative error in the way the physical system was represented in the input stream. This examination leads to one of two conclusions:

- The results are as satisfactory as could be expected at this stage of the analysis process; or
- The input stream must be modified accordingly.

This decision requires, of course, the application of the user's judgment based upon the results obtained in previous applications of the TRAD model and a comparison of the results of this last case with the previous ones. If the results are satisfactory in the opinion of the user, then the process continues with Step 12. Otherwise, proceed to Step 10.

Step 10.
There are many "treatments" available to the user in resolving such problems. These treatments range from decisions to reroute the traffic by imposing turn restrictions where they can produce significant improvements in capacity, changing the control treatment at critical intersections so as to provide improved service for one or more movements, or in prescribing specific treatments for channelizing the flow so as to expedite the movement of traffic along major roadway systems or changing the trip table. Such "treatments" take the form of modifications to the original input stream.

Step 11.
As noted above, the changes to the input stream must be implemented to reflect the modifications undertaken in Step 10. At the completion of this activity, the process returns to Step 8 where the TRAD model is again executed.

Step 12.
The output of the TRAD model includes the computed turn movements for each link. These data are required – and – accessed by the PC-DYNEV simulation model. This step completes the specification of the PC-DYNEV input stream.

Step 13.
After the PC-DYNEV input stream has been debugged, the simulation model is executed to provide detailed estimates, expressed as statistical Measures of Effectiveness (MOE), which describe the detailed performance of traffic operations on each link of the network.

Step 14.
In this step, the detailed output of the simulation model is examined to identify whether problems exist on the network. The results of the simulation model are extremely detailed and far more accurately describe traffic operations than those provided by the TRAD model. Thus, it is possible to identify the cause of any problems by carefully studying the output.

Again, one can implement corrective treatments designed to expedite the flow of traffic on the network in the event that the results are considered to be less efficient than is possible to achieve. If input changes are needed, the analysis process proceeds to Step 15. On the other hand, if the results are satisfactory, then one can decide whether to return to Step 8 to again execute the TRAD model and repeat the whole process, or to accept the simulation results. If there were no changes indicated by the activities of Step 14, because the results were satisfactory, we can then proceed to document them in Step 17. Otherwise, return to Step 8 to determine the effects of the changes implemented in Step 14 on the optimal routing patterns over the network. This determination can be ascertained by executing the TRAD model.

Step 15.
This activity implements the changes in control treatments or in the assignment of destinations associated with one or more origins in order to improve the representation of traffic flow over the network. These treatments can also include the consideration of adding roadway segments to the existing analysis network to improve the representation of the physical system.

Step 16.
Once the treatments have been identified, it is necessary to modify the simulation model input stream accordingly. At the completion of this effort, the procedure returns to Step 13 to execute the simulation model again.

Step 17.
The simulation results are analyzed, tabulated and graphed. The results are then documented, as required.

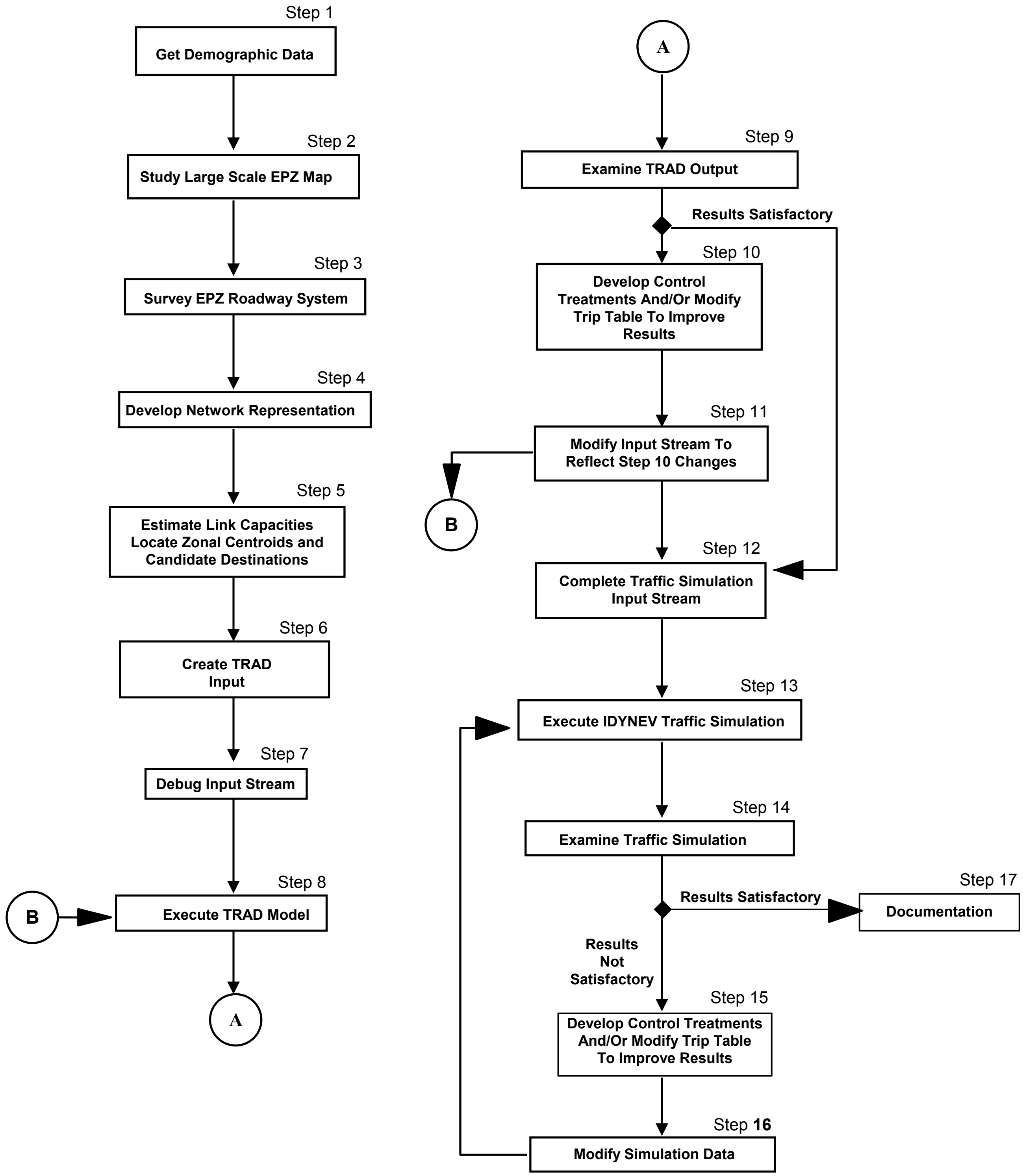


Figure D-1. Flow Diagram of Activities

APPENDIX E

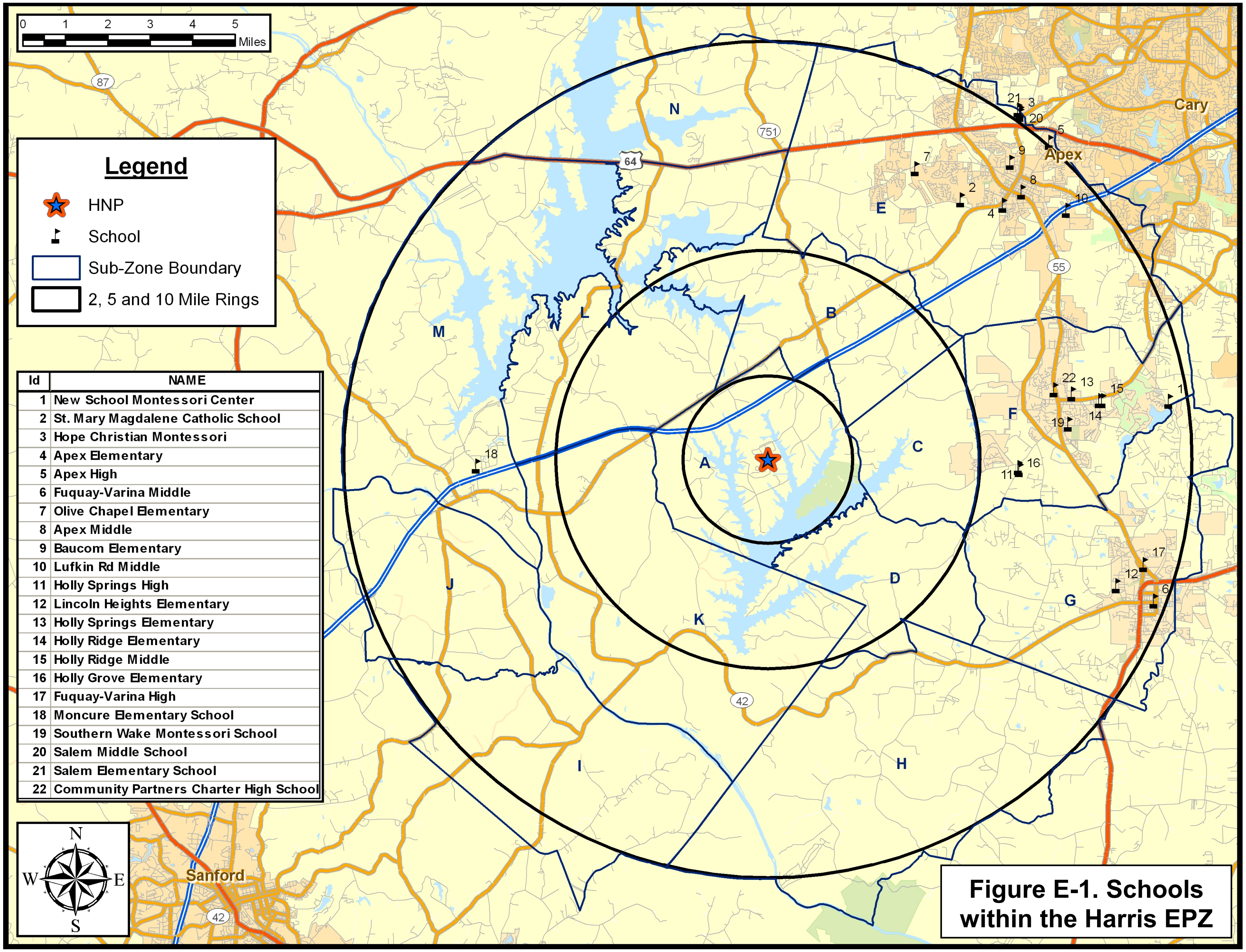
Special Facility Data

APPENDIX E: SPECIAL FACILITY DATA

The following tables list population information, as of June 2007, for special facilities that are located within the Harris Nuclear Plant EPZ. Special facilities are defined as schools, day care centers, hospitals and other medical care facilities, correctional institutions, and major employers. Transient population data is included in the tables for recreational areas and lodging facilities. Each table is grouped by county. The location of the facility is defined by its straight-line distance (miles) and direction (magnetic bearing) from the Harris Nuclear Plant.

Harris EPZ: Schools								
Sub - zone	Distance (miles)	Dire-ction	School Name	Street Address	Municipality	Phone	Enroll-ment	Staff
CHATHAM COUNTY								
M	6.9	W	Moncure Elementary School	Moncure School Rd	Moncure	(919) 542-3725	203	42
WAKE COUNTY								
E	8.3	NE	Apex Elementary School	700 Tingen Rd	Apex	(919) 387-2150	639	42
E	8.8	NE	Apex High School	1501 Laura Duncan Rd	Apex	(919) 387-2208	2,215	115
E	10.1	NE	Apex Middle School	400 E Moore St	Apex	(919) 387-2181	1,166	63
E	9.1	NE	Baucom Elementary School	400 Hunter St	Apex	(919) 387-2168	904	52
E	10.3	NE	Hope Montessori	6175 Old Jenks Rd	Apex	(919) 859-0008	44	4
E	9.3	NE	Lufkin Rd Middle School	1002 Lufkin Rd	Apex	(919) 387-4465	1,066	65
E	7.8	NE	Olive Chapel Elementary School	1751 Olive Chapel Rd	Apex	(919) 387-4440	925	62
E	10.3	NE	Salem Elementary School	6116 Old Jenks Rd	Apex	(919) 363-2865	757	45
E	10.3	NE	Salem Middle School	6150 Old Jenks Rd	Apex	(919) 363-1870	656	87
E	7.7	NE	St. Mary Magdalene Catholic School	625 Magdala Pl	Apex	(919) 657-4800	510	45
F	7.0	E	Community Partners Charter High School	116 Quantum St	Holly Springs	(919) 567-9955	115	12
F	6.0	E	Holly Grove Elementary School	1451 Avent Ferry Rd	Holly Springs	(919) 858-3166	462	82
F	8.0	E	Holly Ridge Elementary School	900 Holly Springs Rd	Holly Springs	(919) 577-1300	714	38
F	8.0	E	Holly Ridge Middle School	950 Holly Springs Rd	Holly Springs	(919) 577-1335	1,285	110
F	7.4	E	Holly Springs Elementary School	401 Holly Springs Rd	Holly Springs	(919) 557-2660	818	85
F	6.0	E	Holly Springs High School	5329 Cass Holt Rd	Holly Springs	(919) 463-8606	805	82
F	7.2	E	Southern Wake Montessori School	925 Avent Ferry Rd	Holly Springs	(919) 577-0081	100	N/A
F	9.6	E	The New School Montessori Center	5617 Sunset Lake Rd	Holly Springs	(919) 303-3636	117	13
G	9.2	E	Fuquay-Varina High School	201 Bengal Blvd	Fuquay-Varina	(919) 557-2511	1,730	97
G	9.7	SE	Fuquay-Varina Middle School	109 N Ennis St	Fuquay-Varina	(919) 557-2727	989	51
G	8.8	SE	Lincoln Heights Elementary School	307 Bridge St	Fuquay-Varina	(919) 557-2587	630	50
						Total:	16,850	1,242

N/A= Data not available



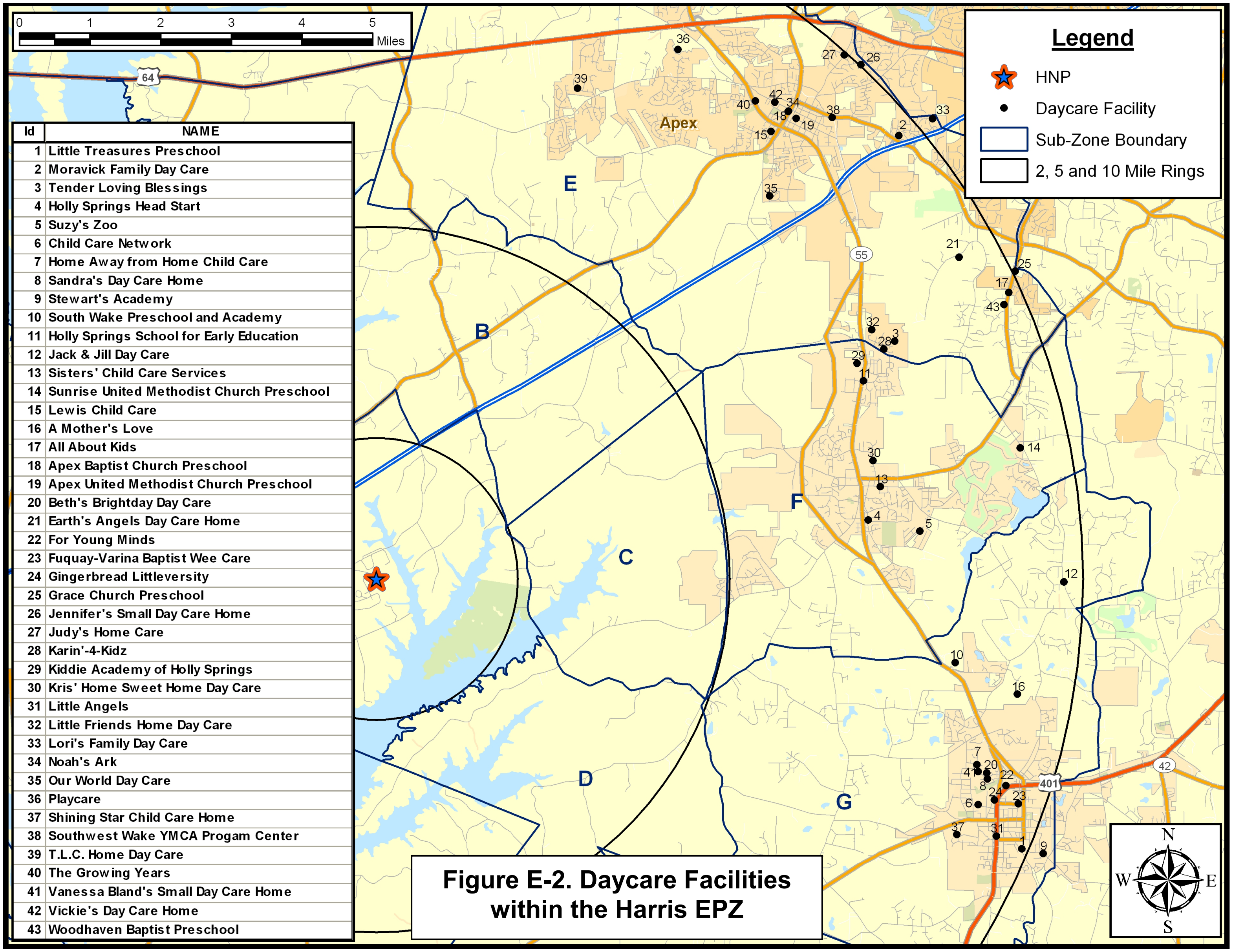
Id	NAME
1	New School Montessori Center
2	St. Mary Magdalene Catholic School
3	Hope Christian Montessori
4	Apex Elementary
5	Apex High
6	Fuquay-Varina Middle
7	Olive Chapel Elementary
8	Apex Middle
9	Baucom Elementary
10	Lufkin Rd Middle
11	Holly Springs High
12	Lincoln Heights Elementary
13	Holly Springs Elementary
14	Holly Ridge Elementary
15	Holly Ridge Middle
16	Holly Grove Elementary
17	Fuquay-Varina High
18	Moncure Elementary School
19	Southern Wake Montessori School
20	Salem Middle School
21	Salem Elementary School
22	Community Partners Charter High School

Figure E-1. Schools within the Harris EPZ

Harris EPZ: Day Care Facilities (Page 1 of 2)								
Sub - zone	Distance (miles)	Dir- ection	Name	Street Address	Municipality	Phone	Enroll- ment	Empl- oyees
WAKE COUNTY								
E	9.9	NE	All About Kids	3901 Kildaire Farm Rd.	Apex	(919) 303-7767	143	30
E	8.8	NE	Apex Baptist Church Preschool	110 South Salem St.	Apex	(919) 362-8988	170	22
E	8.9	NE	Apex United Methodist Church Preschool	100 South Hughes St.	Apex	(919) 362-7807	124	19
E	9.5	NE	Earth's Angel's Day Care Home	2909 Earth Drive	Apex	(919) 362-5166	8	1
E	10.0	NE	Grace Church Preschool	3725 Kildaire Farm Rd.	Apex	(919) 362-9355	82	13
E	10.0	NE	Jennifer's Small Day Care Home	1213 Apache Lane	Apex	(919) 387-8348	8	1
E	9.9	NE	Judy's Home Care	1300 Laura Duncan Rd.	Apex	(919) 362-5191	5	1
E	7.9	NE	Karin-4-Kidz	201 Ridge Lake Rd.	Apex	(919) 387-4915	8	2
E	8.5	NE	Lewis Child Care	202 Baucom St.	Apex	(919) 552-0706	8	2
E	7.9	NE	Little Friends Home Day Care	110 Spring Dove Ln.	Apex	(919) 363-8817	8	1
E	10.2	NE	Lori's Family Day Care	2610 Haventree Ct.	Apex	(919) 387-1419	8	1
E	9.7	NE	Moravick Family Day Care	1814 Misty Hollow Ln.	Apex	(919) 367-7579	8	1
E	8.8	NE	Noah's Ark	110 South Salem St.	Apex	(919) 367-9898	100	15
E	7.8	NE	Our World Day Care	1216 Shackleton Rd.	Apex	(919) 303-0181	8	1
E	8.7	NE	Playcare	1422 Fairfax Woods Dr.	Apex	(919) 303-9315	5	1
E	9.2	NE	Southwest Wake YMCA Program Center	1660 Center St.	Apex	(919) 657-9622	200	50
E	7.6	N	T.L.C Home Day Care	101 Checker Ct.	Apex	(919) 303-4680	2	1
E	8.1	ENE	Tender Loving Blessings	222 Hollyhock Ln.	Apex	(919) 363-2166	0	1
E	8.7	NE	The Growing Years	470 West Williams St.	Apex	(919) 387-8189	106	15
E	8.8	NE	Vickie's Day Care Home	410 East Chatham St.	Apex	(919) 362-7702	5	1
E	9.7	NE	Woodhaven Baptist Preschool	4000 Kildaire Farm Rd.	Apex	(919) 362-3909	102	18

Harris EPZ: Day Care Facilities (Page 2 of 2)								
Sub-zone	Distance (miles)	Dir-ection	Name	Street Address	Municipality	Phone	Enroll-ment	Empl-oyees
WAKE COUNTY								
F	7.0	E	Holly Springs Head Start	301 Stinson Ave.	Holly Springs	(919) 552-3717	N/A	N/A
F	7.5	NE	Holly Springs School for Early Education	101 Arbor Creek Dr.	Holly Springs	(919) 303-9009	110	21
F	7.5	ENE	Kiddie Academy of Holly Springs	150 Rosewood Centre Dr.	Holly Springs	(919) 367-0088	N/A	N/A
F	7.2	E	Kris' Home Sweet Home Day Care	420 Cayman Ave.	Holly Springs	(919) 552-4002	5	1
F	7.3	E	Sisters' Child Care Services	400 Earp St.	Holly Springs	(919) 552-9624	15	4
F	9.3	E	Sunrise United Methodist Church Preschool	5420 Sunset Lake Rd.	Holly Springs	(919) 303-3720	32	9
F	7.7	E	Suzy's Zoo	208 Crossfire Rd.	Holly Springs	(919) 523-6768	4	1
G	9.2	E	A Mother's Love	524 Dogwood Creek Place	Fuquay Varina	(919) 552-5448	5	1
G	9.1	E	Beth's Brightday Day Care	820 Hepplewhite Ct.	Fuquay Varina	(919) 557-6554	5	1
G	9.1	ESE	Child Care Network	350 West Jones St.	Fuquay Varina	(919) 557-1219	199	20
G	9.4	E	For Young Minds	523 N. Main St.	Fuquay Varina	(919) 552-8915	12	4
G	9.6	E	Fuquay-Varina Baptist Wee Care	3010 N. Woodrow St.	Fuquay Varina	(919) 552-9586	140	22
G	9.3	E	Gingerbread Littleversity	211 Railroad St.	Fuquay Varina	(919) 552-9525	99	15
G	8.9	ESE	Home Away from Home Child Care	901 Alderleaf Dr.	Fuquay Varina	(919) 557-1310	N/A	N/A
G	9.7	E	Jack and Jill Day Care	6225 Sunset Lake Rd.	Fuquay Varina	(919) 552-4325	N/A	N/A
G	9.5	ESE	Little Angels	334 S. Main St.	Fuquay Varina	(919) 552-0565	26	6
G	9.4	SE	Little Treasures Preschool	515 Angier Rd.	Fuquay Varina	(919) 557-3251	N/A	N/A
G	9.1	ESE	Sandra's Day Care Home	309 Seaton Dr.	Fuquay Varina	(919) 567-0973	N/A	N/A
G	9.0	SE	Shining Star Child Care Home	516 Nature Walk Rd.	Fuquay Varina	(919) 567-0738	2	1
G	8.3	E	South Wake Preschool and Academy	2275 N. Grassland Dr	Fuquay Varina	(919) 577-1144	N/A	N/A
G	10.2	ESE	Stewart's Academy	513 Creekway Dr.	Fuquay Varina	(919) 552-0257	N/A	N/A
G	8.9	E	Vanessa Bland's Small Day Care Home	829 Alderleaf Dr.	Fuquay Varina	(919) 552-0982	6	1
						Total:	2,393	344

N/A= Data not available

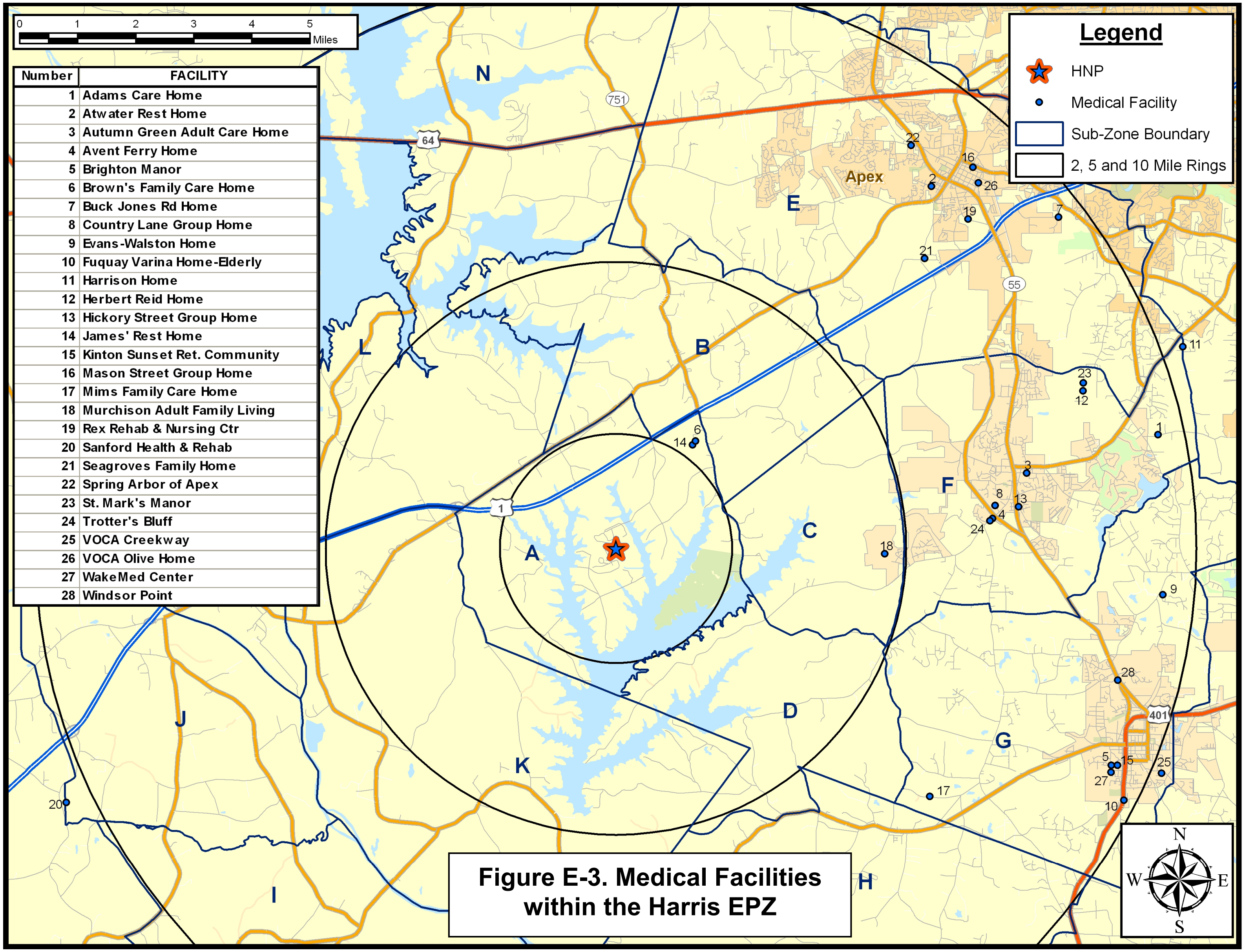


Id	NAME
1	Little Treasures Preschool
2	Moravick Family Day Care
3	Tender Loving Blessings
4	Holly Springs Head Start
5	Suzy's Zoo
6	Child Care Network
7	Home Away from Home Child Care
8	Sandra's Day Care Home
9	Stewart's Academy
10	South Wake Preschool and Academy
11	Holly Springs School for Early Education
12	Jack & Jill Day Care
13	Sisters' Child Care Services
14	Sunrise United Methodist Church Preschool
15	Lewis Child Care
16	A Mother's Love
17	All About Kids
18	Apex Baptist Church Preschool
19	Apex United Methodist Church Preschool
20	Beth's Brightday Day Care
21	Earth's Angels Day Care Home
22	For Young Minds
23	Fuquay-Varina Baptist Wee Care
24	Gingerbread Littleversity
25	Grace Church Preschool
26	Jennifer's Small Day Care Home
27	Judy's Home Care
28	Karin'-4-Kidz
29	Kiddie Academy of Holly Springs
30	Kris' Home Sweet Home Day Care
31	Little Angels
32	Little Friends Home Day Care
33	Lori's Family Day Care
34	Noah's Ark
35	Our World Day Care
36	Playcare
37	Shining Star Child Care Home
38	Southwest Wake YMCA Progam Center
39	T.L.C. Home Day Care
40	The Growing Years
41	Vanessa Bland's Small Day Care Home
42	Vickie's Day Care Home
43	Woodhaven Baptist Preschool

Figure E-2. Daycare Facilities within the Harris EPZ

Harris EPZ: Medical Facilities and Assisted Living Facilties									
Sub-Zone	Distance (miles)	Dir-ection	Name	Street Address	Municipality	Phone	Capacity	Employees (Max Shift)	Employees (Total)
WAKE COUNTY									
A	2.3	NE	Brown's Family Care Home	8416 James Rest Home Rd	New Hill	(919) 362-6686	6	2	5
A	2.3	NE	James Rest Home	8420 James Rest Home Rd	New Hill	(919) 362-8856	40	6	24
E	8.4	NE	Atwater Rest Home	312 Lynch St	Apex	(919) 362-6266	55	13	N/A
E	9.6	NE	Buck Jones Road Home	2420 Reliance Ave	Apex	(919) 854-1260	6	2	N/A
E	8.8	NE	Mason Street Home	306 N Mason St	Apex	(919) 387-1011	6	2	9
E	8.4	NE	Rex Rehab & Nursing Care	911 South Hughes St	Apex	(919) 363-6011	107	50	N/A
E	7.3	NE	Seagroves Family Home	1052 Irongate Dr	Apex	(919) 362-8556	6	2	3
E	8.7	NE	Spring Arbor of Apex	901 Spring Arbor Ct	Apex	(919) 303-9990	76	6	46
F	9.6	E	Adams Care Home	4825 Optimist Farm Rd	Apex	(919) 387-1600	5	2	N/A
F	7.2	E	Autumn Green Adult Care Home	312 Earp St	Holly Springs	(919) 552-4849	6	2	N/A
F	6.5	E	Avent Ferry House	904 Avent Ferry Rd	Holly Springs	(919) 557-6749	6	2	9
F	6.6	E	Country Lane Group Home	534 Country Ln	Holly Springs	(919) 552-5457	6	2	3
F	10.4	E	Harrison Home	8421 Pierce Olive Rd	Apex	(919) 303-4411	2	1	3
F	8.6	E	Herbert Reid Home	3733 Heritage Meadow Ln	Holly Springs	(919) 363-5311	3	2	N/A
F	6.9	E	Hickory Street Group Home	112 Hickory Avenue	Holly Springs	(919) 552-5407	6	3	12
F	4.7	E	Murchison Adult Family Living	533 Texanna Way	Holly Springs	(919) 557-6712	2	1	2
F	8.6	E	St. Mark's Manor	3735 Heritage Meadow Ln	Holly Springs	(919) 363-5311	9	4	7
F	6.5	E	Trotter's Bluff	912 Avent Ferry Rd	Holly Springs	(919) 557-6337	6	2	9
G	9.4	SE	Brighton Manor	415 Sunset Dr	Fuquay-Varina	(919) 552-5609	80	20	96
G	9.5	E	Evans-Walston Home	808 Hawks View Court	Fuquay-Varina	(919) 552-1312	3	1	1
G	9.8	SE	Fuquay-Varina Home for the Elderly	1012 S Main St	Fuquay-Varina	(919) 552-3671	60	2	2
G	9.5	SE	Kinton Sunset Retirement Community	301 Sunset Dr	Fuquay-Varina	(919) 552-6908	28	N/A	N/A
G	10.2	SE	VOCA Creekway	534 Creekway Dr	Fuquay-Varina	(919) 552-4359	6	3	7
G	10.1	SE	VOCA Olive Home	717 Olive Street	Apex	(919) 387-1011	6	2	8
G	9.4	SE	Wake Med Fuquay-Varina Outpatient and Skilled Nursing Facility	400 West Ransom St	Fuquay-Varina	(919) 350-4600	36	10	39
G	8.9	E	Windsor Point	1221 Broad St	Fuquay-Varina	(919) 552-4588	100	16	150
G	6.9	SE	Mims Family Care Home	6337 Mims Rd	Holly Springs	(919) 552-6455	6	1	2
LEE COUNTY									
J	10.5	SW	Sanford Health and Rehabilitation	2702 Farrell Rd	Sanford	(919) 776-9602	97	25	72
						Total:	**775**	**184**	**509**

N/A= Data not available



Number	FACILITY
1	Adams Care Home
2	Atwater Rest Home
3	Autumn Green Adult Care Home
4	Avent Ferry Home
5	Brighton Manor
6	Brown's Family Care Home
7	Buck Jones Rd Home
8	Country Lane Group Home
9	Evans-Walston Home
10	Fuquay Varina Home-Elderly
11	Harrison Home
12	Herbert Reid Home
13	Hickory Street Group Home
14	James' Rest Home
15	Kinton Sunset Ret. Community
16	Mason Street Group Home
17	Mims Family Care Home
18	Murchison Adult Family Living
19	Rex Rehab & Nursing Ctr
20	Sanford Health & Rehab
21	Seagroves Family Home
22	Spring Arbor of Apex
23	St. Mark's Manor
24	Trotter's Bluff
25	VOCA Creekway
26	VOCA Olive Home
27	WakeMed Center
28	Windsor Point

Figure E-3. Medical Facilities within the Harris EPZ

Harris EPZ: Correctional Facilities								
Sub - zone	Distance (miles)	Dir- ection	Name	Street Address	Municipality	Phone	Cap- acity	Current Census
There are no correctional facilties within the Harris EPZ								

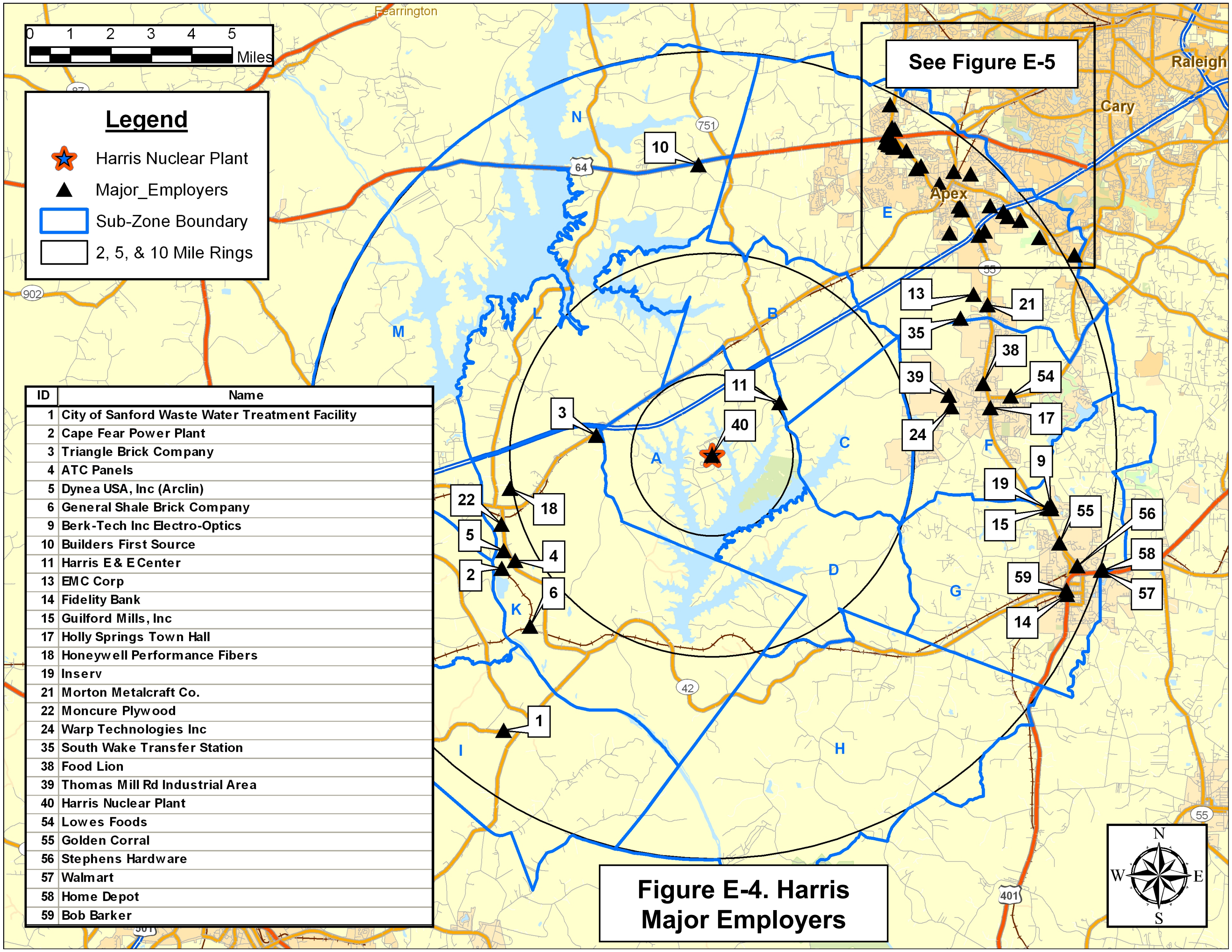
Harris EPZ: Major Employers (Page 1 of 3)									
Sub - zone	Distance (miles)	Dir- ection	Facility Name	Street Address	Municipality	Phone	Total Employees[2]	% Non-EPZ	Total Non-EPZ Employees
LEE COUNTY									
I	8.6	SW	Sanford Waste Water Treatment Facility	7441 Poplar Springs Church Rd	Sanford	(919) 775-1491	9	92%	8
CHATHAM COUNTY									
K	5.1	W	ATC Panels	985 Corinth Rd	Moncure	(919) 542-2128	50	75%	38
K	6.0	WSW	Cape Fear Power Plant	500 P.E. Rd (SR 1916)	Moncure	(919) 774-5245	61	75%	46
K	5.5	SW	Dynea USA, Inc (Arclin)	790 Corinth Rd	Moncure	(919) 542-2526	28	80%	22
K	6.1	SW	General Shale Brick Company	300 Brick Plant Rd	Moncure	(919) 777-6899	110	75%	83
K	5.5	W	Honeywell Performance Fibers[1]	338 Pea Ridge Rd	Moncure	(919) 542-2000	207	80%	166
K	5.6	SW	Moncure Plywood[1]	306 Corinth Rd	Moncure	(919) 542-2311	75	64%	48
K	2.9	W	Triangle Brick Company	294 King Rd	Moncure	(919) 624-9176	100	50%	50
WAKE COUNTY									
A	2.1	NE	Harris E&E Center[1]	3932 New Hill Holleman Rd	New Hill	(919) 362-3261	33	64%	21
A	0.0	----	Harris Nuclear Plant[1]	5421 Shearon Harris Rd	New Hill	(919) 363-0560	697	64%	446
E	8.2	NE	Apex Public Works[1]	105 Upchurch St	Apex	(919) 362-8166	50	64%	32
E	9.2	NE	Apex Town Hall[1]	73 Hunter St	Apex	(919) 249-3303	85	64%	54
E	8.9	NNE	Borders Bookstore	1541 Beaver Creek Commons Dr	Apex	(919) 363-8446	60	33%	20
E	8.9	NNE	Carrabbas Restaurant	1201 Hadden Hall Dr	Apex	(919) 387-6336	85	90%	77
E	8.9	NNE	Chili's Restaurant	1120 Beaver Creek Commons Dr	Apex	(919) 387-7701	65	40%	26
E	8.9	NNE	Circuit City	1591 Beaver Creek Commons Dr	Apex	(919) 367-8476	60	25%	15
E	8.7	NE	Cooper Tools Lufkin Division[1]	1000 Lufkin Rd	Apex	(919) 387-0099	450	64%	288
E	8.9	NNE	Dick's Sporting Goods	1531 Beaver Creek Commons Dr	Apex	(919) 367-0194	50	25%	13
E	9.6	NE	Educare of NC[1]	2420 Reliance Ave	Apex	(919) 387-1011	54	64%	35
E	7.6	NE	EMC Corp[1]	5800 Technology DR	Apex	(919) 362-4800	375	64%	240
E	8.7	NE	Family Dollar[1,3]	828 E Williams St	Apex	(919) 362-7883	25	64%	16
E	9.4	NE	Food Lion[1]	620 Laura Duncan Rd	Apex	(919) 362-3904	40	64%	26
E	9.5	NE	Food Lion[1]	1777 W Williams St	Apex	(919) 362-1986	75	64%	48
E	8.8	NE	Harris Teeter	750 West Williams St	Apex	(919) 362-3782	95	75%	71
E	8.6	NE	Henry Wurst Inc[1]	810 Lufkin Rd	Apex	(919) 362-8831	120	64%	77
E	9.3	NNE	Home Depot[1]	1100 Vision Drive	Apex	(919) 387-6554	130	64%	83

Harris EPZ: Major Employers (Page 2 of 3)									
Sub - zone	Distance (miles)	Dir- ection	Facility Name	Street Address	Municipality	Phone	Total Employees[2]	% Non-EPZ	Total Non-EPZ Employees
WAKE COUNTY (Continued)									
E	8.9	NNE	Homegoods	1571 Beaver Creek Commons Dr	Apex	(919) 363-3233	25	10%	3
E	9.7	ENE	Knights Play Golf Course[1,3]	2512 Ten Ten Rd	Apex	(919) 303-4653	25	64%	16
E	8.9	NNE	Longhorn Steakhouse	1411 Beaver Creek Commons Dr	Apex	(919) 303-4889	50	5%	3
E	8.9	NNE	Lowes	1101 Beaver Creek Commons Dr	Apex	(919) 303-4200	148	70%	104
E	8.7	NE	Lowes Foods	5400 Apex Parkway	Apex	(919) 363-5376	84	65%	55
E	9.3	NNE	Lowes Foods[1]	1405 W Williams St	Apex	(919) 363-7224	80	64%	51
E	10.2	ENE	Millpond Village Shopping Center[1,3]	3480 Kildaire Farm Rd	Apex	N/A	200	64%	128
E	7.8	NE	Morton Metalcraft Co.[1]	2080 E Williams St	Apex	(919) 363-1630	100	64%	64
E	8.1	NE	Perry Rd Industrial Area[1,3]	Perry Rd	Apex	N/A	50	64%	32
E	8.9	NNE	Red Robin Restaurant[1]	1431 Beaver Creek Commons Dr	Apex	(919) 363-8599	120	64%	77
E	9.4	NE	Reliance Ave Industrial Area[1,3]	Reliance Ave	Apex	N/A	100	64%	64
E	9.2	NE	Schieffelin Rd Industrial Area[1,3]	Schieffelin Rd	Apex	N/A	100	64%	64
E	8.7	NE	Shopping Center in Apex[1,3]	E Williams St & James St	Apex	N/A	100	64%	64
E	7.1	ENE	South Wake Transfer Station[1,3]	6025 Old Smithfield Rd	Apex	N/A	10	64%	6
E	9.1	NNE	Southern States Nissan	1405 Vision Drive	Apex	(919) 589-0029	50	50%	25
E	8.9	NNE	Target	1201 Beaver Creek Commons Dr	Apex	(919) 372-1405	80	65%	52
E	9.4	NE	Tipper Tie[1]	2000 Lufkin Rd	Apex	(919) 362-8811	150	64%	96
E	8.9	NNE	TJ Maxx[1]	1571 Beaver Creek Commons Dr	Apex	(919) 363-3233	36	64%	23
E	6.1	E	Warp Technologies Inc[1]	601 Irving Pkwy	Holly Springs	(919) 552-2311	50	64%	32
F	7.0	ENE	Food Lion	517 North Main St	Holly Springs	(919) 557-1175	75	50%	38
F	7.0	E	Holly Springs Town Hall[1]	128 S Main St	Holly Springs	(919) 552-6221	80	64%	51
F	7.5	E	Lowes Foods	550 Holly Springs Rd	Holly Springs	(919) 577-6971	102	80%	82
F	6.0	ENE	Thomas Mill Rd Industrial Area[1,3]	Thomas Mill Rd	Holly Springs	N/A	100	64%	64
G	8.5	E	Berk-Tech Inc Electro-Optics[1]	100 Technology Park Ln	Fuquay Varina	(919) 552-2061	55	64%	35
G	9.4	ESE	Bob Barker	134 N Main St	Fuquay Varina	(800) 334-9880	126	25%	32
G	9.4	SE	Fidelity Bank[1]	100 S Main St	Fuquay Varina	(919) 552-2242	90	64%	58
G	8.9	ESE	Golden Corral[1]	1420 E Broad St	Fuquay Varina	(919) 552-7604	67	64%	43
G	8.5	E	Guilford Mills, Inc[1]	200 Dickens Rd	Fuquay Varina	(919) 552-5667	150	64%	96

Harris EPZ: Major Employers (Page 3 of 3)									
Sub - zone	**Distance (miles)**	**Dir-ection**	**Facility Name**	**Street Address**	**Municipality**	**Phone**	**Total Employees[2]**	**% Non-EPZ**	**Total Non-EPZ Employees**
WAKE COUNTY (Continued)									
G	10.0	ESE	Home Depot[1]	901 E Broad St	Fuquay Varina	(919) 552-2881	135	64%	86
G	8.4	E	Inserv[1]	121 Dickens Rd	Fuquay Varina	(919) 552-6355	195	64%	125
G	9.4	ESE	Stephen's Hardware[1]	405 Broad St	Fuquay Varina	(919) 552-2200	90	64%	58
G	10.0	ESE	Walmart[1]	1051 E Broad St	Fuquay Varina	(919) 567-2350	100	64%	64
L	7.3	N	Builders First Source[1]	12816 US Hwy 64 W	Apex	(919) 363-4956	225	64%	144
						Total:	**6,337**		**3,984**

[1] An average of 64% non-EPZ employees (based on those facilities which did provide detailed data) was applied to those facilities which did not provide detailed data.
[2] Maximum Shift Employees were used for Total Employees if data was provided.
[3] Employment at these facilities was estimated based on overhead imagery of parking lots.

N/A = Data Not Available



ID	Name
1	City of Sanford Waste Water Treatment Facility
2	Cape Fear Power Plant
3	Triangle Brick Company
4	ATC Panels
5	Dynea USA, Inc (Arclin)
6	General Shale Brick Company
9	Berk-Tech Inc Electro-Optics
10	Builders First Source
11	Harris E & E Center
13	EMC Corp
14	Fidelity Bank
15	Guilford Mills, Inc
17	Holly Springs Town Hall
18	Honeywell Performance Fibers
19	Inserv
21	Morton Metalcraft Co.
22	Moncure Plywood
24	Warp Technologies Inc
35	South Wake Transfer Station
38	Food Lion
39	Thomas Mill Rd Industrial Area
40	Harris Nuclear Plant
54	Lowes Foods
55	Golden Corral
56	Stephens Hardware
57	Walmart
58	Home Depot
59	Bob Barker

Figure E-4. Harris Major Employers

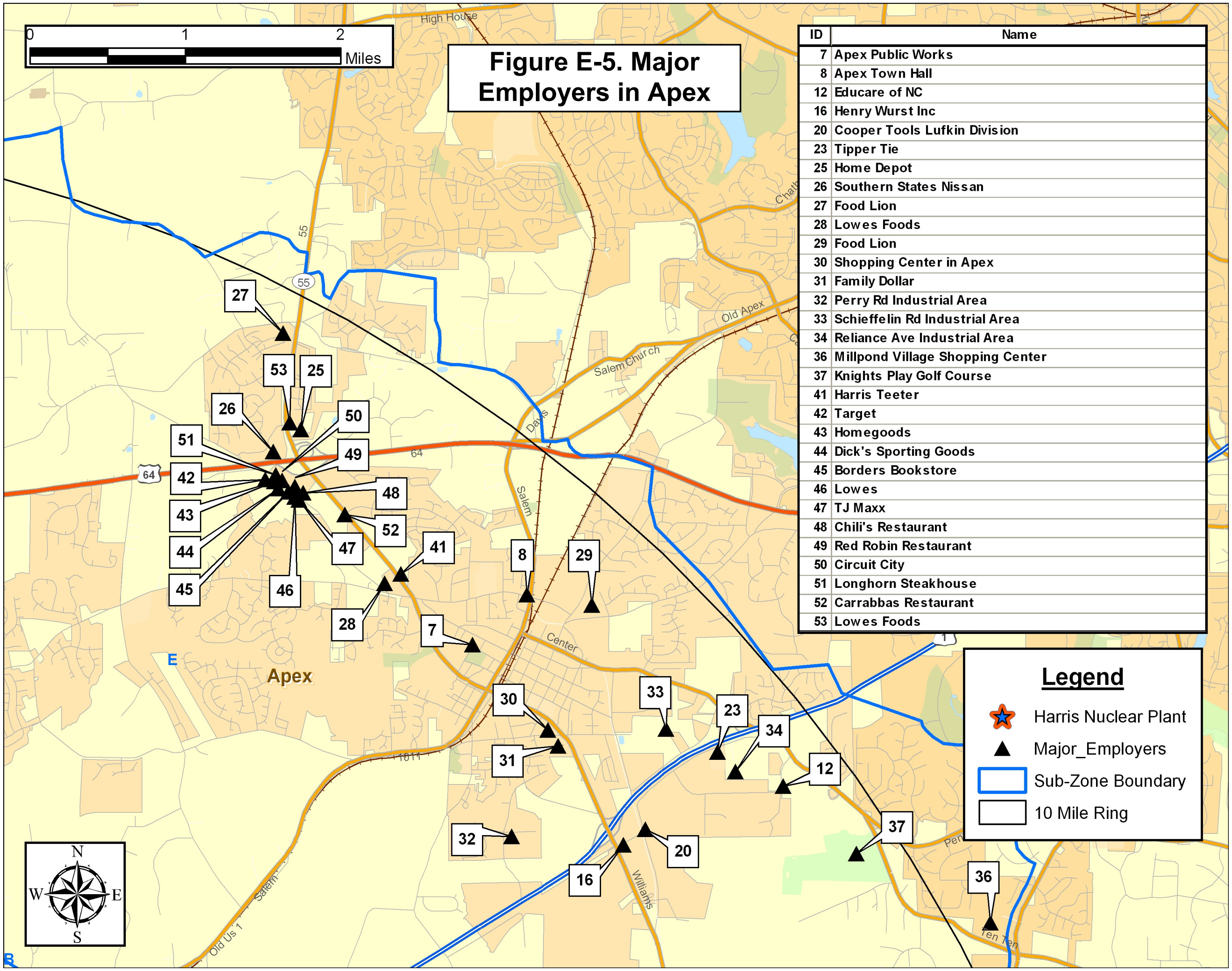


Figure E-5. Major Employers in Apex
0 1 2 Miles
ID Name
7 Apex Public Works
8 Apex Town Hall
12 Educare of NC
16 Henry Wurst Inc
20 Cooper Tools Lufkin Division
23 Tipper Tie
25 Home Depot
26 Southern States Nissan
27 Food Lion
28 Lowes Foods
29 Food Lion
30 Shopping Center in Apex
31 Family Dollar
32 Perry Rd Industrial Area
33 Schieffelin Rd Industrial Area
34 Reliance Ave Industrial Area
36 Millpond Village Shopping Center
37 Knights Play Golf Course
41 Harris Teeter
42 Target
43 Homegoods
44 Dick's Sporting Goods
45 Borders Bookstore
46 Lowes
47 TJ Maxx
48 Chili's Restaurant
49 Red Robin Restaurant
50 Circuit City
51 Longhorn Steakhouse
52 Carrabbas Restaurant
53 Lowes Foods
Legend
Harris Nuclear Plant
Major_Employers
Sub-Zone Boundary
10 Mile Ring
Apex
High House
Salem Church
Old Apex
Salem
Center
Williams
Old Us 1
N
S
E
W

Harris EPZ: Recreational Areas								
Sub - zone	Distance (miles)	Dir- ection	Facility Name	Street Address	Municipality	Phone	Per- sons	Total Vehicles
CHATHAM COUNTY								
L	7.2	NW	Ebenezer Church Recreation Area (Jordan Lake State Park)	SR 1008	NC State Parks	(919) 362-0586	1,297	575
L	6.3	NW	New Hope Overlook Recreation Area (Jordan Lake State Park)	Hidden Field Ln	NC State Parks	(919) 362-0586	610	400
L	6.8	NW	Poplar Point Recreation Area (Jordan Lake State Park)	Poplar Point Rd	NC State Parks	(919) 362-0586	3,718	1,238
M	7.3	W	Poe's Ridge Recreation Area (Jordan Lake State Park)	Moncure School Rd	NC State Parks	(919) 362-0586	250	164
M	9.5	WNW	Robeson Recreation Area (Jordan Lake State Park)	Hanks Chapel Rd	NC State Parks	(919) 362-0586	214	140
M	7.7	NW	Seaforth Recreation Area (Jordan Lake State Park)	U.S. Highway 64	NC State Parks	(919) 362-0586	1,602	700
M	7.3	NW	Vista Point Recreation Area (Jordan Lake State Park)	N Pea Ridge Rd	NC State Parks	(919) 362-0586	2,285	860
N	7.9	N	Crosswinds Campground & Marina (Jordan Lake State Park)	Campground Rd	NC State Parks	(919) 362-0586	1,265	520
N	8.0	NNW	White Oak Recreation Area (Jordan Lake State Park)	U.S. Highway 64	NC State Parks	(919) 362-0586	397	220
N	8.9	NW	Parkers Creek Recreation Area (Jordan Lake State Park)	Big Woods Rd	NC State Parks	(919) 362-0586	1,500	500
WAKE COUNTY								
A	1.9	E	Harris Lake County Park	2112 County Park Dr.	NC State Parks	(919) 387-4342	305	100
D	2.1	SSE	Harris Lake - SR 1130 Boat Access Point	SR 1130	NC State Parks	(919) 387-4342	458	300
K	4.3	SSW	Harris Lake - NC Hwy 42 Boat Access Point	NC Hwy 42	NC State Parks	(919) 387-4342	458	300
						Total:	**14,359**	**6,017**

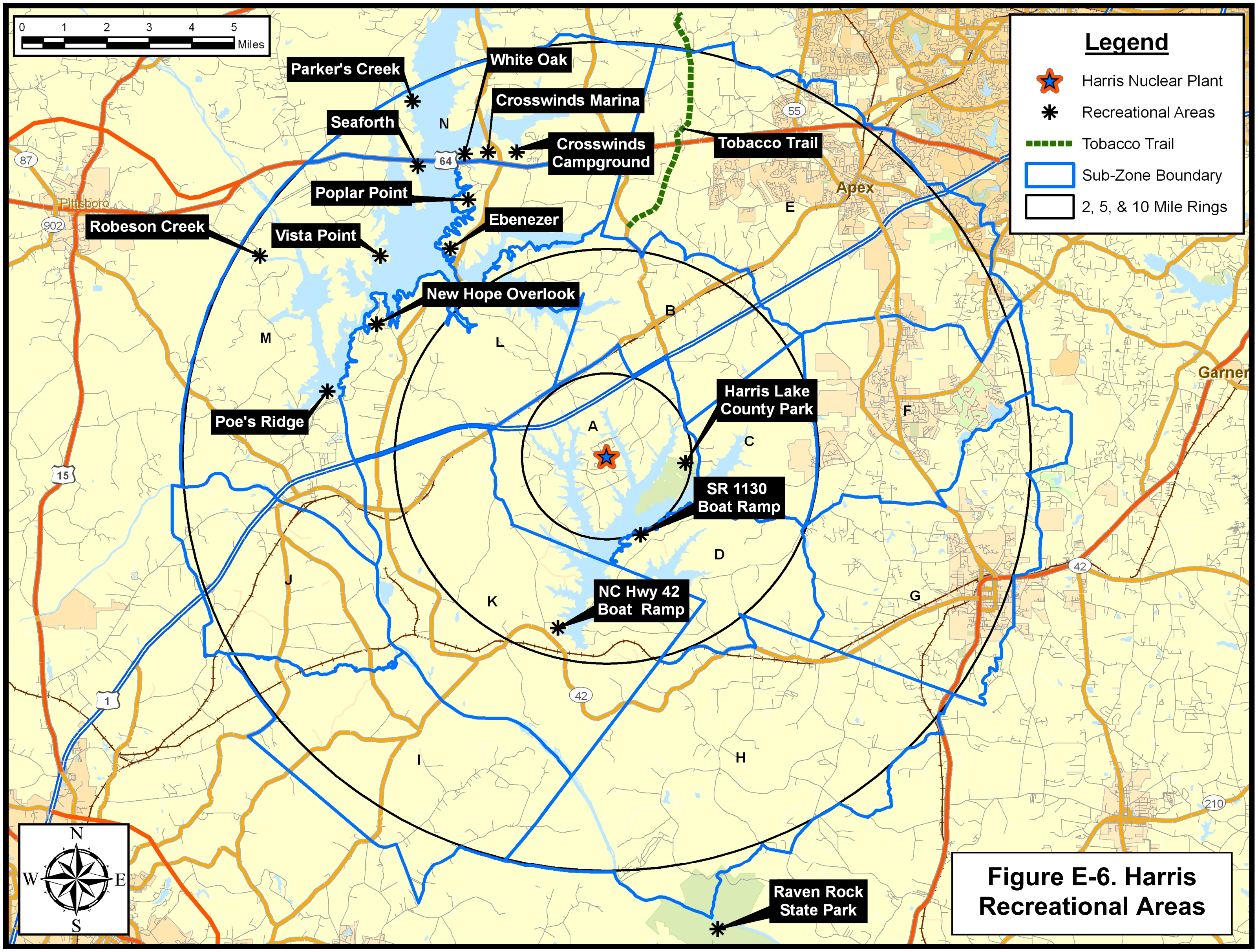


Figure E-6. Harris Recreational Areas

Harris EPZ: Lodging Facilities								
Sub - zone	**Distance (miles)**	**Dir- ection**	**Facility Name**	**Street Address**	**Municipality**	**Phone**	**Per- sons**	**Veh- icles**
				WAKE COUNTY				
E	8.9	NE	B & B Country Garden Inn	1041 Kelly Rd	Apex	(919) 303-8033	6	3
E	8.5	NE	Comfort Inn Apex	1411 E Williams St	Apex	(919) 387-4600	136	68
E	8.5	NE	Days Inn	1400 E Williams St	Apex	(919) 362-8621	184	92
E	8.6	NE	Holiday Inn Express	1006 Marco Dr	Apex	(919) 387-3636	128	64
G	10.2	E	Carambola Inn	7155 Sunset Lake Rd	Fuquay Varina	(919) 552-3091	8	4
G	9.0	ESE	Fuquay Mineral Spring Inn & Garden	333 S Main St	Fuquay Varina	(919) 552-3782	10	5
						Total:	**472**	**236**

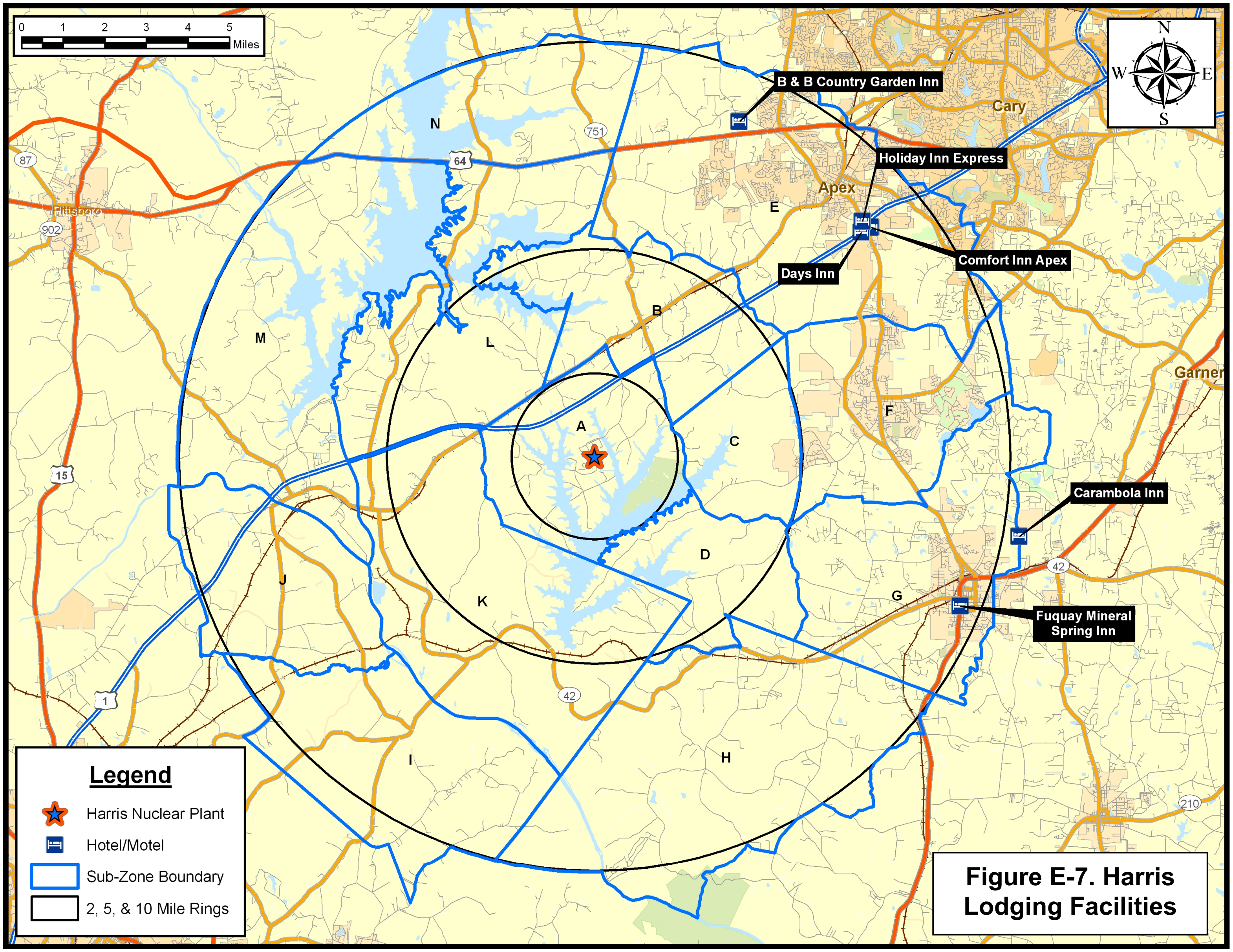


Figure E-7. Harris Lodging Facilities

APPENDIX F

Telephone Survey

APPENDIX F: TELEPHONE SURVEY

1. INTRODUCTION

The development of evacuation time estimates for the Emergency Planning Zone (EPZ) of the Harris Nuclear Plant requires the identification of travel patterns, car ownership and household size of the population within the EPZ. Demographic information is obtained from Census data. The use of this data has several limitations when applied to emergency planning. First, the Census data do not encompass the range of information needed to identify the time required for preliminary activities that must be undertaken prior to evacuating the area. Secondly, the Census data do not contain attitudinal responses needed from the population of the EPZ and consequently may not accurately represent the anticipated behavioral characteristics of the evacuating populace.

These concerns are addressed by a telephone survey. The survey is designed to elicit information from the public concerning family demographics and estimates of response times to well defined events. The design of the survey includes a limited number of questions of the form "What would you do if …?" and other questions regarding activities with which the respondent is familiar ("How long does it take you to …?")

2. SURVEY INSTRUMENT AND SAMPLING PLAN

Attachment A presents the final survey instrument. A draft of the instrument was submitted for comment. Comments were received and the survey instrument was modified appropriately.

Following the completion of the instrument, a sampling plan was developed. A sample size of approximately 600 completed survey forms yields results with an acceptable sampling error. The sample must be drawn from the EPZ population. Consequently, a list of EPZ zip codes was developed. This list is shown in Table F-1. Along with each zip code, an estimate of the population in each area was determined, based on average household size provided by Census data. The proportional number of the desired completed survey interviews for each area was identified, as shown in Table F-1. The completed survey adhered to the sampling plan.

Table F-1. Survey Sampling Plan

Harris Telephone Survey

Sampling Plan

Zip Code	EPZ Population in Zip Code (2000)	Households in EPZ	Required Sample
27312	472	190	5
27330	1,949	715	20
27502	16,437	5,875	162
27505	7	2	0
27511	2,060	601	17
27517	10	4	0
27519	24	10	0
27523	4,807	1,869	52
27526	12,660	4,745	131
27539	4,980	1,840	51
27540	12,728	4,627	128
27559	1,348	525	15
27562	1,803	693	19
Total	**59,285**	**21,696**	**600**
Average Household Size		**2.73**	
Total Sample Required		**600**	

3. SURVEY RESULTS

The results of the survey fall into two categories. First, the household demographics of the area can be identified. Demographic information includes such factors as household size, automobile ownership, and automobile availability. The distributions of the time to perform certain pre-evacuation activities are the second category of survey results. These data are processed to develop the trip generation distributions used in the evacuation modeling effort.

A review of the survey instrument reveals that several questions have a "don't know" (DK) entry for a response. It is accepted practice in conducting surveys of this type to accept the answers of a respondent who offers a DK response for a few questions or who refuses to answer a few questions. To address the issue of occasional DK/refused responses from a large sample, the practice is to assume that the distribution of these responses is the same as the underlying distribution of the positive responses. In effect, the DK/refused responses are ignored and the distributions are based upon the positive data that is acquired.

Household Demographic Results

Household Size

Figure F-1 presents the distribution of household size within the EPZ. The average household contains 3.05 people. The estimated household size (2.73 persons) used to determine the survey sample (Table F-1) was drawn from Census data.

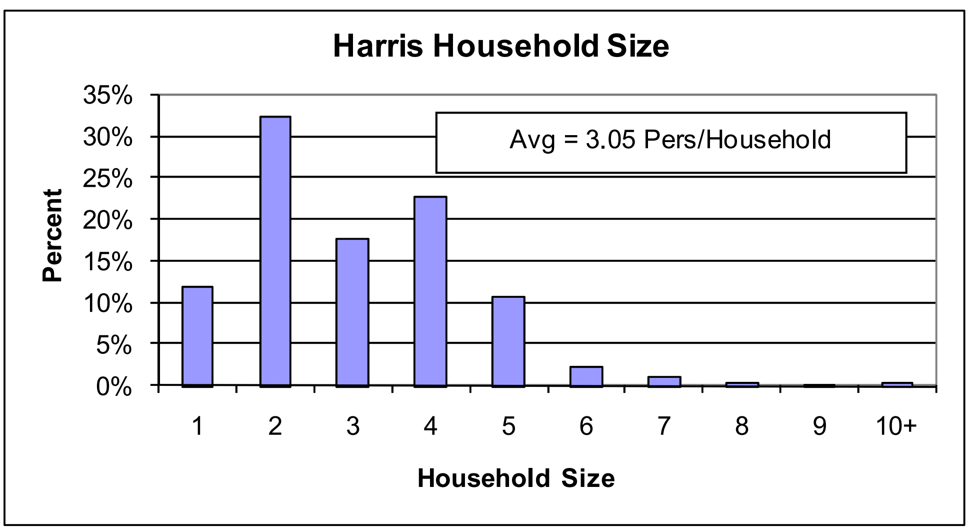


Figure F-1. Household Size in the EPZ

Automobile Ownership

The average number of automobiles per household in the EPZ is 2.20. The distribution of automobile ownership is presented in Figure F-2. Figures F-3 and F-4 present the automobile availability by household size; approximately 1.7 percent of households do not have access to an automobile. The majority of households without access to a car are single person households (see Figure F-3); nearly all households of 2 or more people have access to at least one vehicle.

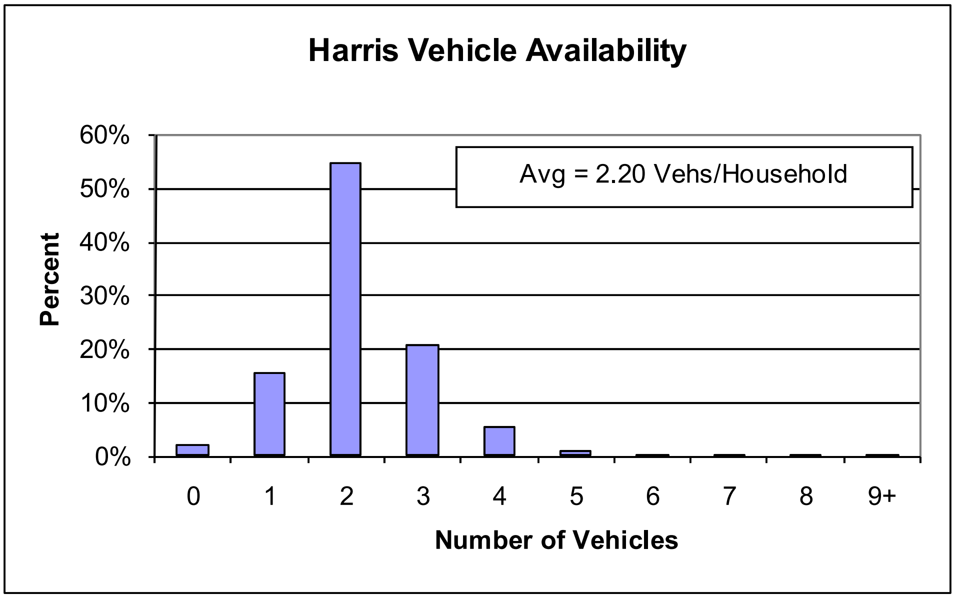


Figure F-2. Household Vehicle Availability

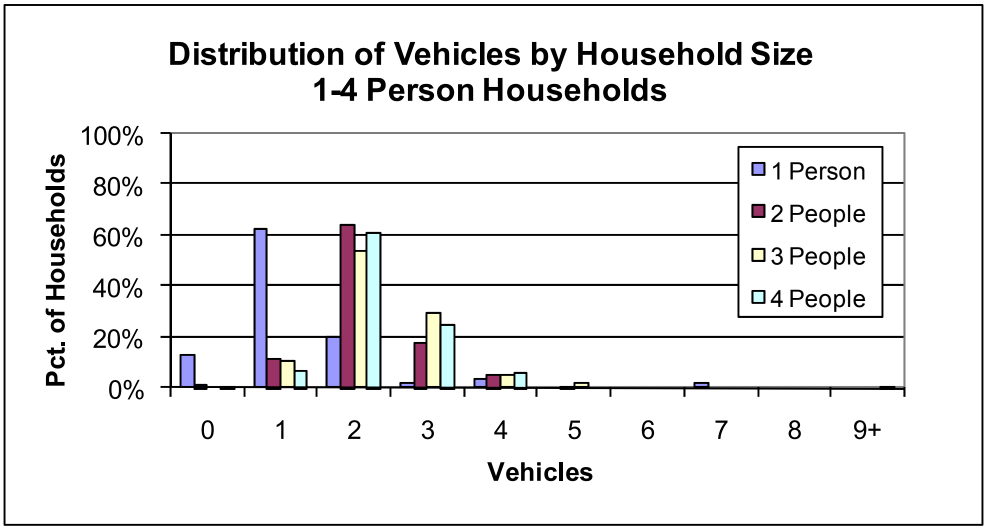


Figure F-3. Vehicle Availability – 1 to 4 Person Households

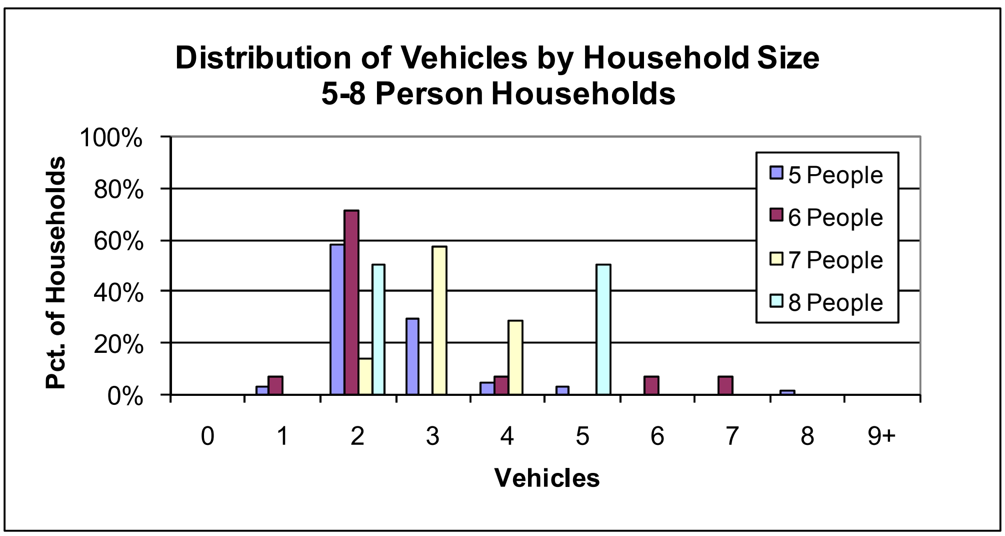


Figure F-4. Vehicle Availability – 5 to 8 Person Households

School Children

The average number of school children per household identified by the survey is 0.94. Figure F-5 presents the distribution of school children.

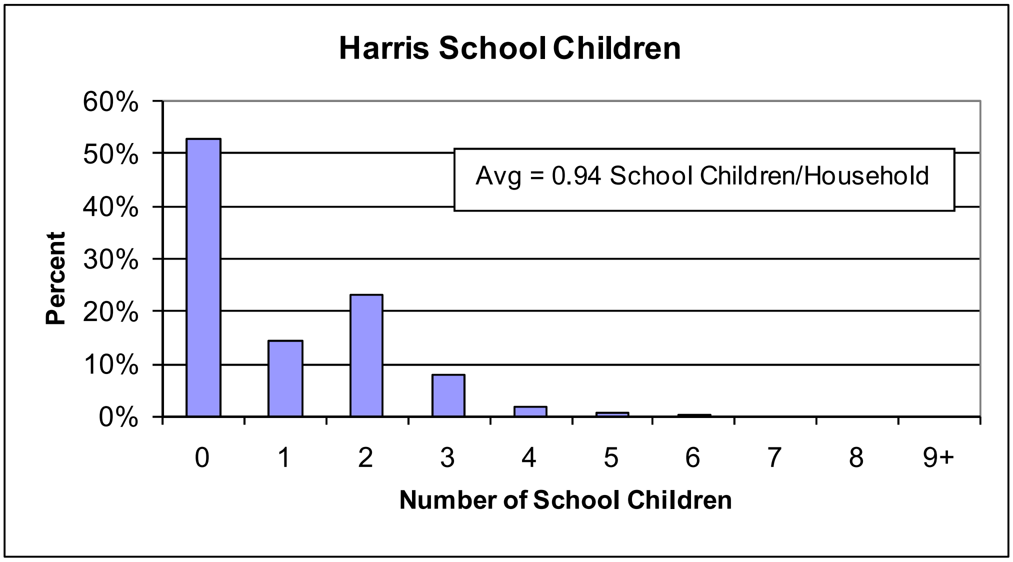


Figure F-5. School Children in Households

Commuters

Figure F-6 presents the distribution of the number of commuters in each household. The data shows an average of 1.15 commuters in each household in the EPZ.

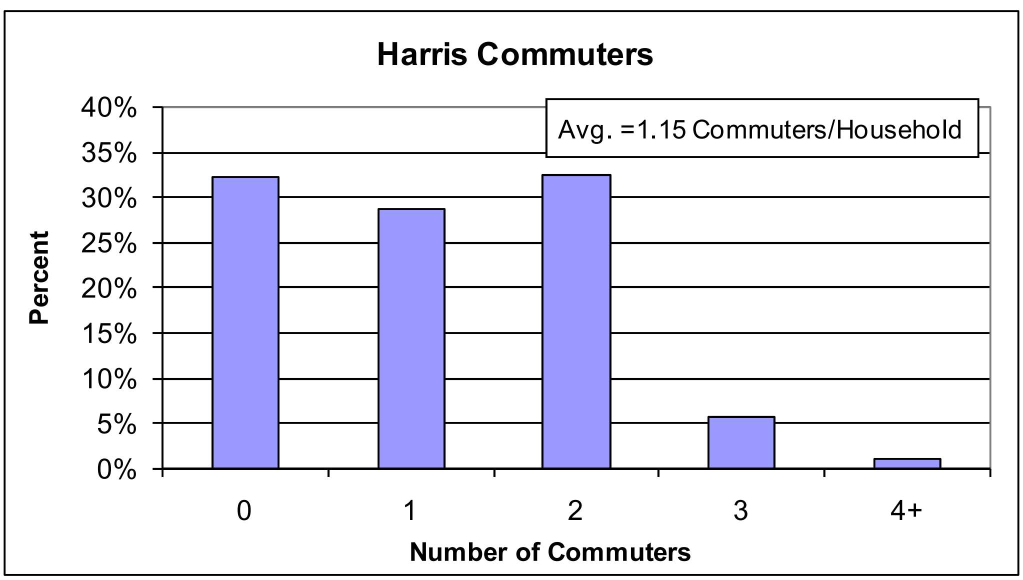


Figure F-6. Commuters in Households in the EPZ

Commuter Travel Modes

Figure F-7 presents the mode of travel that commuters use on a daily basis. The vast majority of commuters use their private automobiles to travel to work or school.

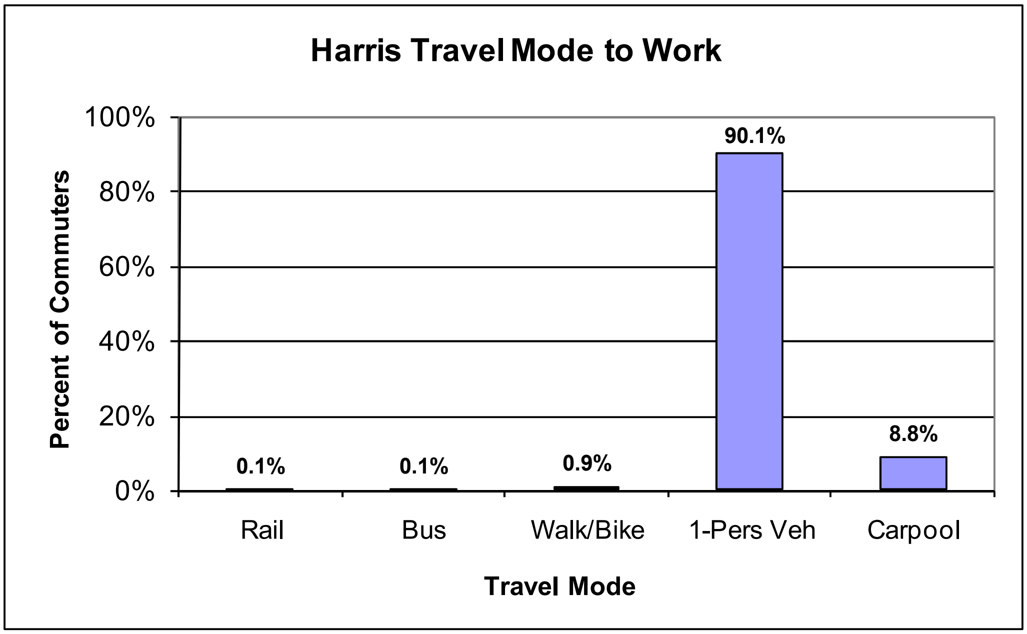


Figure F-7. Modes of Travel to Work by EPZ Residents

Evacuation Response

Several questions were asked which are used to gauge the population's response to an emergency. The first of these asked "How many of the vehicles that are usually available to the household would your family use during an evacuation?" The response is shown in Figure F-8. On average, 1.33 vehicles per household would be used for evacuation purposes.

The second evacuation response question asked was "When the commuters are away from home, is there a vehicle at home that is available for evacuation during an emergency?" Of the survey participants who responded, 62 percent said that there was another vehicle available to evacuate, while 38 percent answered that there would be no vehicle available for evacuation.

The third evacuation response question was "Would your family await the return of other family members prior to evacuating the area?" Of the survey participants who responded, 57 percent said they would await the return of other family members before evacuating and 43 percent indicated that they would not await the return of other family members.

The fourth evacuation response question was “Would you take household pets with you if you were asked to evacuate the area?” As shown in Figure F-9, 56 percent of respondents said they would take their pets; 23 percent would not. The remaining 21 percent either did not have a pet, or did not give a definitive answer.

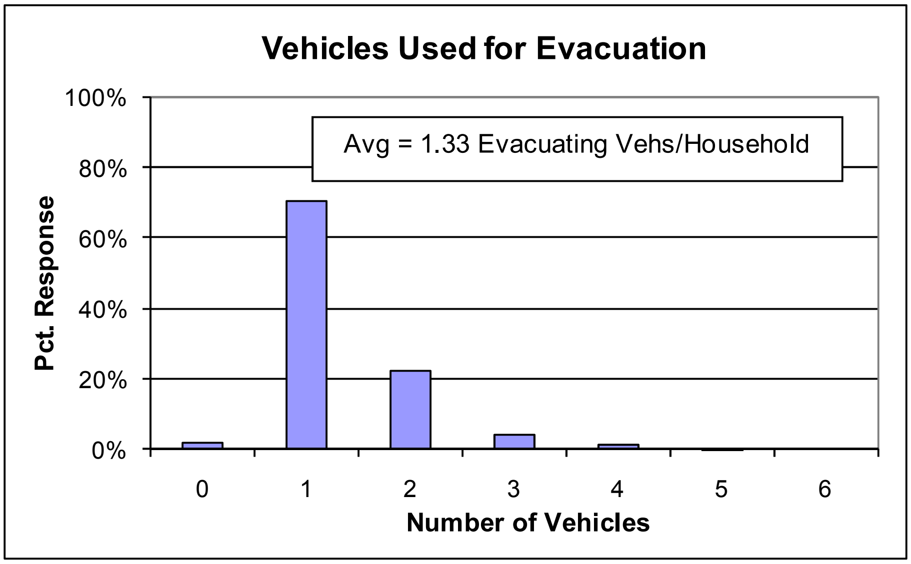


Figure F-8. Number of Vehicles Used for Evacuation

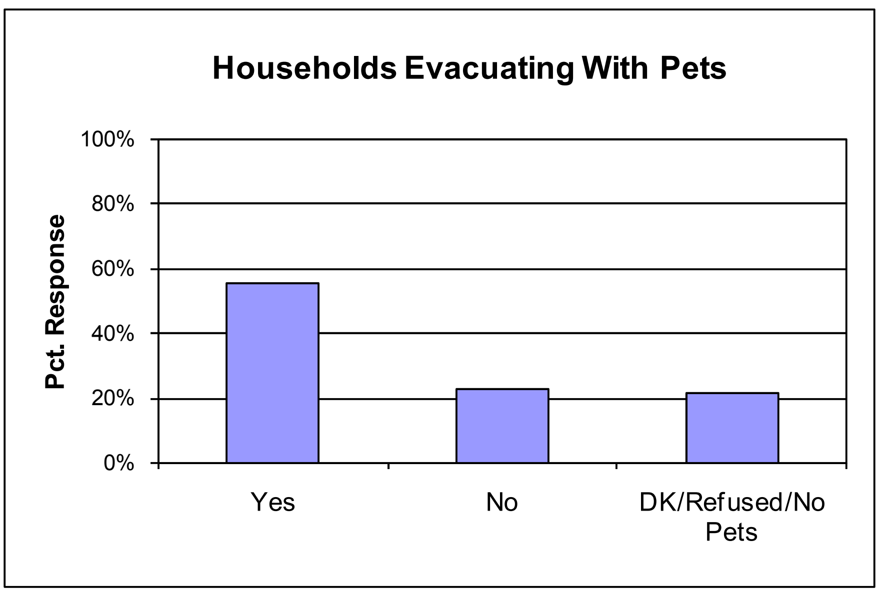


Figure F-9. Households Evacuating With Pets

Time Distribution Results

The survey asked several questions about the amount of time it takes to perform certain pre-evacuation activities. These activities involve actions taken by residents during the course of their day-to-day lives. Thus, the answers fall within the realm of the responder's experience.

How long does it take the commuter to complete preparation for leaving work? Figure F-10 presents the cumulative distribution; the activity is completed by about 90 minutes. Fifty seven percent can leave within 15 minutes.

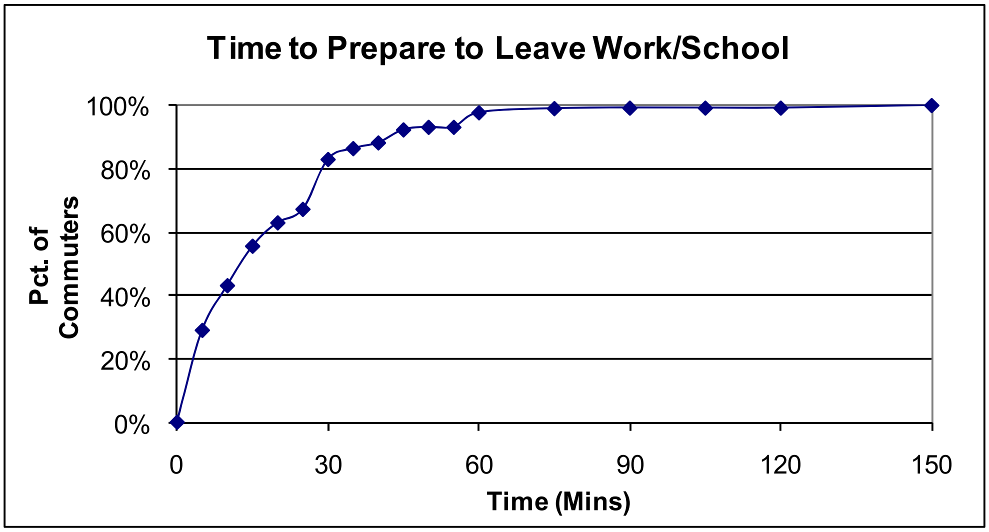


Figure F-10. Time Required to Prepare to Leave Work/School

How long would it take the commuter to travel home?
Figure F-11 presents the work to home travel time. In all cases, over 80 percent of commuters can arrive home within about 35 minutes of leaving work; nearly all within 60 minutes.

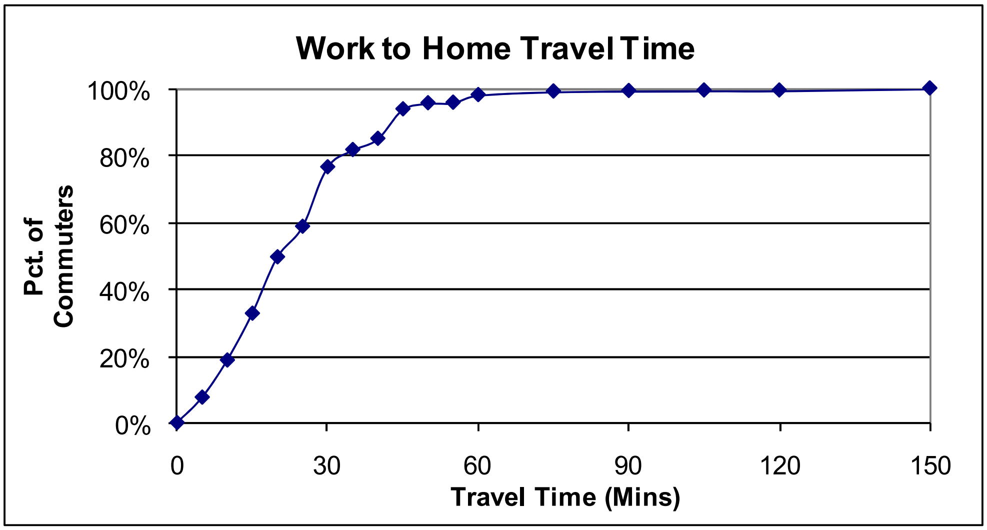


Figure F-11. Work to Home Travel Time

How long would it take the family to pack clothing, secure the house, and load the car?

Figure F-12 presents the time required to prepare for leaving on an evacuation trip. In many ways this activity mimics a family's preparation for a short holiday or weekend away from home. Hence, the responses represent the experience of the responder in performing similar activities.

The distribution shown in Figure F-12 has a long "tail." Approximately 95 percent of households can be ready to leave home within 2 hours; the remaining 5 percent of households require an additional 4 hours to prepare to evacuate.

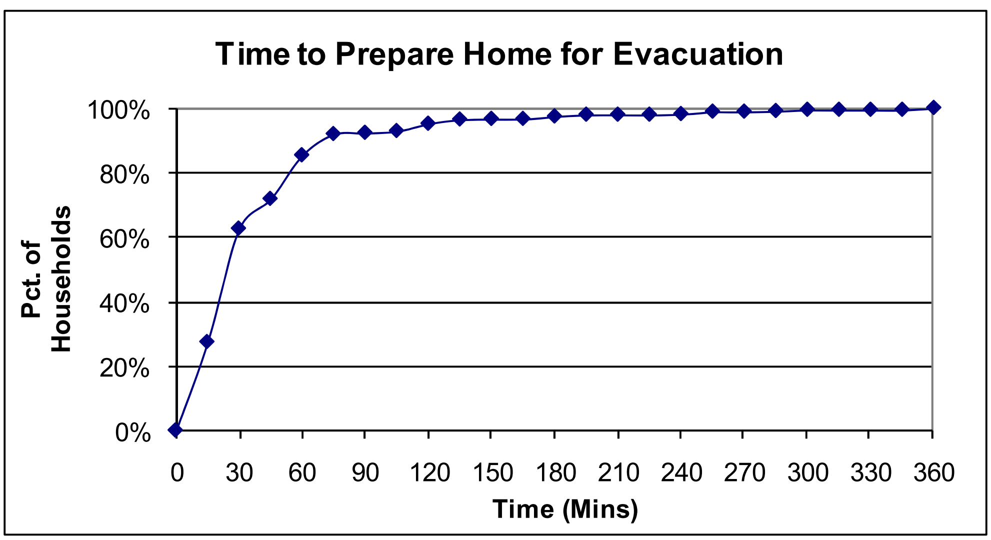


Figure F-12. Time to Prepare Home for Evacuation

4. CONCLUSIONS

The telephone survey provides valuable, relevant data that have been used to quantify "mobilization time" which can influence evacuation time estimates.