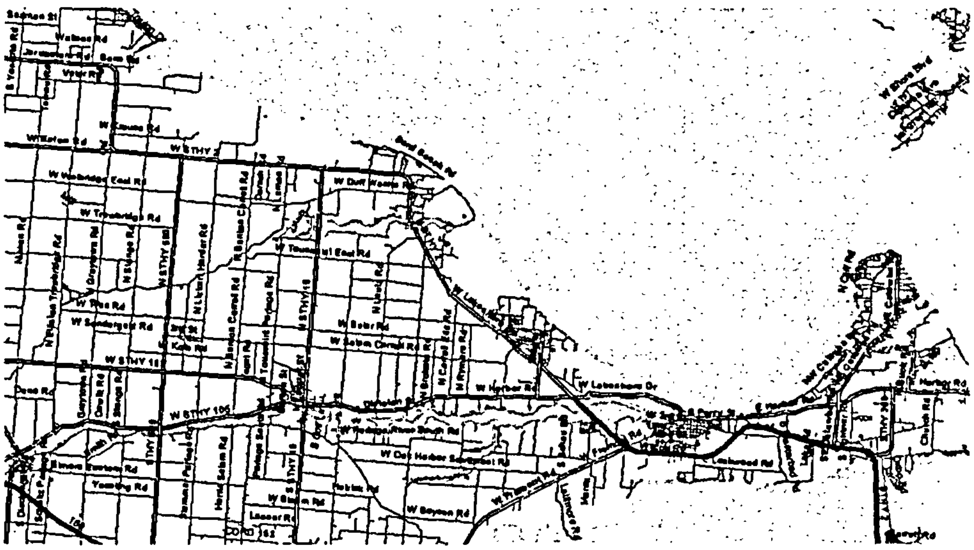
Davis Besse Nuclear Power Station
Development of Evacuation Time Estimates



prepared for:

First Energy Corporation
Davis Besse Nuclear Power Station
Emergency Planning Group
Mail Stop 3060
5501 N. State Route 2
Oak Harbor, OH 43449

by:

KLD Associates, Inc.
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New York 11746

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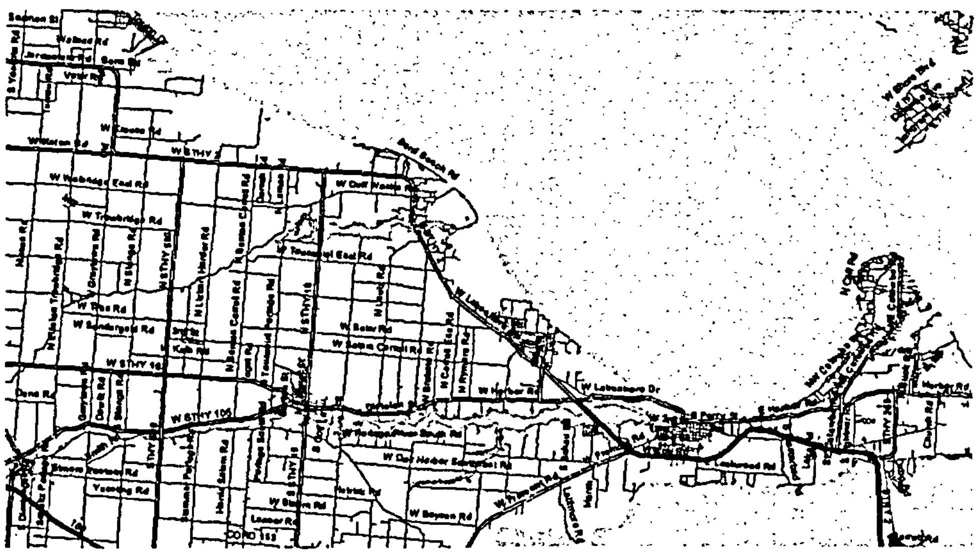

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1. INTRODUCTION

This report describes the analyses undertaken, and the results obtained, in a study to update the existing Evacuation Plan for Davis Besse Station, located in Ottawa County, Ohio. This plan is designed to protect the health and safety of the public in the event that an evacuation is ordered as a protective action in response to an accident at Davis Besse Station.

In the performance of this effort, all available prior documentation relevant to Evacuation Planning was reviewed. In addition, work products developed by previous consultants were incorporated, where appropriate. We wish to express our appreciation to all the directors and staff members of the Ottawa and Lucas County Offices of Emergency Preparedness and the various law enforcement agencies who provided valued guidance.

Other guidance is provided by documents published by Federal Government agencies. Most important of these are:

Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG 0654/FEMA-REP-1, Rev. 1, November 1980.

Analysis of Techniques for Estimating Evacuation Times for Emergency Planning Zones, NUREG/CR-1745, November 1980.

1.1 Overview of the Plan Update Process

The following outline presents a brief description of the work effort in chronological sequence:

1. The initial effort consisted of gathering information:

- Initial meeting with representatives of the Davis Besse Station, Ottawa County, Port Clinton, Lucas County and the State of Ohio to define the scope of work.
- Review of existing reports describing past evacuation studies.
- Conducted a field survey of the EPZ highway system and of area traffic conditions.
- Attended meetings and briefings with State and Local officials.
- Obtained demographic data from State Planning offices.

2. After reviewing and analyzing this information, it was decided to proceed with the task of preparing the preliminary input stream for the IDYNEV model.

- Estimated the traffic demand based on the available information derived from Census data, from prior studies, and from data provided by local and State agencies and from the telephone survey.
- Employed the procedures specified in the 2000 Highway Capacity Manual (HCM) and the data acquired during the field survey, to estimate the capacity of all highway segments comprising the evacuation routes.
- Developed the link-node representation of the evacuation network, which is used as the basis for computer analysis that calculates the Evacuation Time Estimates (ETE). The IDYNEV System, developed by KLD for FEMA, was used to perform these calculations.
- Prepared the input stream for the IDYNEV System.
- Executed IDYNEV to provide the initial estimates of evacuation routing and Evacuation Time Estimates (ETE) for a single scenario.

3. Distributions of Trip Generation times were estimated for the various population segments: permanent residents and transients (i.e. tourists and employees), seasonal residents and

boaters on Lake Erie. These estimates were primarily based upon the telephone survey performed previously.

4. Evacuation scenarios were defined. These scenarios reflect the variation in demand, trip generation distribution and in highway capacity, associated with different seasons, day of week, time of day and weather conditions.

5. Updated the demand estimation of employees who work within the EPZ, based on more recent information obtained from major employers in the area.

6. Defined a preliminary set of traffic management tactics to be applied at specified Traffic Control Posts (TCP), for subsequent review by local and State police personnel.

7. Updated and expanded the preliminary ETE results to reflect the recent information quantifying the current employment estimates.

8. Partitioned the EPZ into subareas, then defined "Regions", where each region consists of a grouping of contiguous subareas. Each region, other than those which approximate circular areas, approximates a quadrant within the EPZ as required by NUREG 0654.

9. Assigned Host Communities to each community within the EPZ and developed traffic routing patterns for evacuating vehicles.

10. Conducted a survey of sheriffs, local police chiefs and State Police within the EPZ to solicit their opinions and recommendations on traffic routing, control and management.

11. Using the traffic management policies derived in step 10, a complete set of ETE was computed. This set consists of over 90 distinct cases; each case corresponds to the evacuation of a

specified region for a specified evacuation scenario. A total of 10 regions and 9 scenarios were considered. In addition, several special studies were conducted.

12. Documented the results of these studies in formats responsive to NUREG 0654.

13. Estimated demand for transit services for persons at home. Determined the number of bus trips and buses required for each route within each community. These estimates were based on the census data base and on an analysis of route travel times.

14. Determined the ETE for all transit activities.

1.2 Description of the Emergency Planning Zone (EPZ)

The Davis Besse site is located on the south shore of Lake Erie, in Ottawa County, Ohio. The site is situated approximately 25 miles east of the City of Toledo, Ohio and 10 miles west of the City of Port Clinton, Ohio at longitude 83° 05' W and latitude 41° 36'N.

The area encompassing the EPZ includes part or all of the following communities:

Ottawa County

City of Port Clinton
Carroll Township
Erie Township
Bay Township
Benton Township
Harris Township
Salem Township

Lucas County

Jerusalem Township (Bono)

Figure 1-1 present the general site area surrounding the Davis Besse Nuclear Power Station (DBNPS). This map identifies both the communities in the area and the major roads.

The lakeshore, within the EPZ, with the exception of the plant site, is primarily devoted to recreational activities. The area is home to many marinas serving Lake Erie boaters and has significant amounts of land reserved for public use in the form of parks and wildlife refuges.

Areas away from the lakefront are primarily agricultural in nature. Commercial centers exist in Oak Harbor and Port Clinton. Industrial activity can be found east of DBNPS along State Route 2 (Erie Industrial Park) and on the outskirts of Port Clinton.

1.3 Preliminary Activities

Since this plan constitutes an update of prior work, it was necessary to become familiar with the existing plan. These activities are described below.

Literature Review

KLD Associates was provided with copies of documents describing past studies and analyses leading to the development of evacuation plans and of ETE. We also obtained supporting documents from a variety of sources, which contained information needed to form the data base used for conducting evacuation analyses.

Field Surveys

Senior KLD personnel drove the entire highway system within the EPZ and for some distance outside. The characteristics of each section of highway were recorded. These characteristics include:

Figure 1-1. General Site Area

C01

Number of lanes	Posted speed
Pavement width	Actual free speed
Shoulder type & width	Abutting land use
Intersection configuration	Control devices
Lane channelization	Interchange geometries
Unusual characteristics:	Geometries: curves, grades

Narrow bridges, sharp curves, poor pavement, flood warning signs, inadequate delineations, etc.

The data were then transcribed; this information was referenced while preparing the input stream for the IDYNEV model. In addition, photographs were taken of key highway features.

Telephone Survey

A telephone survey was undertaken in order to gather information needed for the evacuation study. Appendix F exhibits the survey instrument. Appendix G contains tabulations of some of the data compiled from the survey returns.

This data was utilized to develop estimates of vehicle occupancy during an evacuation and to estimate elapsed times between the issuance of an evacuation order and the start of evacuation trips. This database was also referenced to estimate the number of transit-dependent residents.

Developing the Evacuation Plan

The overall study procedure is outlined in Appendix D. Demographic data was obtained from several sources, as detailed later in this report. This data was analyzed and converted into vehicle demand data.

Highway capacity was estimated for each highway segment based on the field surveys and on the principles specified in the 2000 Highway Capacity Manual (HCM). The link-node representation of the physical highway network was developed using large-scale maps and the observations obtained from the field survey. This network is shown in Figure 1-2.

Analytical Tools

A variety of analytical tools was employed for this study. The most prominent of these is the IDYNEV (Interactive DYnamic Network EVacuation) computer system that was developed by KLD under contract with the Federal Emergency Management Agency (FEMA).

IDYNEV consists of three submodels:

- An equilibrium traffic assignment model (for details, see Appendix B).
- A macroscopic traffic simulation model (for details, see Appendix C);
- An intersection capacity model (for details, see Highway Research Record No. 772, Transportation Research Board, 1980, papers by Lieberman and McShane & Lieberman).

The procedure for applying IDYNEV within the framework of developing an update to the Davis Besse Evacuation Plan is outlined in Appendix D. Appendix A is a glossary of terms used in Traffic Engineering.

The evacuation analysis procedures are based upon the need to:

- Route traffic along paths of travel that will

-expedite their travel from their respective points of origin to points outside the EPZ

-restrict movement toward Davis Besse Station to the extent practicable

-disperse traffic demand so as to avoid focusing demand on a limited number of highways

- Satisfy, to the extent possible under emergency conditions, perceived "best" paths out of the EPZ

- Move traffic in directions that are generally radial, relative to the location of Davis Besse Station.

A Trip Table[1] is specified which satisfies the specified linkage between communities within the EPZ and host communities outside the EPZ. The IDYNEV Traffic Assignment model is executed to produce output which identifies the "best" traffic routing, subject to the design conditions outlined above. In addition to this information, [very] rough estimates of travel time are provided, together with turn-movement data required by the IDYNEV simulation model.

The simulation model is then executed to provide a detailed description of traffic operations on the evacuation network. This description enables the analyst to identify bottlenecks and to develop countermeasures that are designed to expedite the movement of vehicles.

As outlined in Appendix D, this procedure consists of an iterative design-analysis-redesign sequence of activities. If properly done, this procedure converges to yield an Evacuation Plan which best services the evacuating public.

[1]A trip table is defined as a matrix of origin-destination demand volumes.

Figure 1-2. Link-Node Map

1.4 Comparison of Revision 5 with Revision 4

The major change between Revision 4 and Revision 5 entails the utilization of Census 2000 information to the maximum extent possible. Specifically, the total resident population was determined using Geographic Information System techniques and "Census Block Points" containing the block centroid and the block population for all census blocks in Ohio. The earlier efforts were predicated on 1990 census data and manual population centroid placement.

The definition of the seasonal population group was changed. Revision 4 contained estimates of the seasonal population group based upon the amount of new construction in the area between the mid 1980s and 1990. Revision 5 uses seasonal housing data directly from Ottawa and Lucas Counties to identify seasonal housing. To the extent that the population in the newly built condominiums is included in the estimate, it is incorporated into the permanent resident population. We now believe that the previous estimate of seasonal population includes a significant amount of double counting with the transient population.

Vehicle occupancy assumptions were also modified in Revision 5. Previously, an estimate of 2.6 persons per vehicle was used for the permanent residents. Revision 5 utilizes the census-derived value of average household size and a factor of 1.25 evacuating vehicles per household to achieve an estimate of 2.0 persons per vehicle. Thus, although the number of permanent residents in the EPZ did not change significantly, they will generate approximately 3000 additional vehicles during an evacuation.

Similarly, the vehicle occupancy for employees was changed from 1.28 persons per vehicle to a more conservative estimate of 1 person per vehicle to account for the small amount of car-pooling in the area.

The net effect of these changes is that although the peak population estimate (the sum of all population presented later, in Table 2-7) has declined by about 7% between Revision 4 and Revision 5, the estimated number of vehicles has increased by about 9%.

No changes in trip generation, traffic routing, or traffic control plans were required for Revision 5

The ETE for transit-dependents and for schools and special facilities now reflect the current implementation plan. Fixed bus pick-up points, contained in Revision 4 are no longer used. The estimates now reflect similar transit operations in Port Clinton as is planned for the other areas of the EPZ.

2. DEMAND ESTIMATION

The estimates of demand constitute a critical element in developing an evacuation plan. This estimate consists of three components:

1. An estimate of population, stratified into groups, in communities within the EPZ.
2. An estimate, for each population grouping, of mean occupancy per evacuating vehicle. This estimate is used to determine the number of evacuating vehicles.
3. An estimate of potential double-counting of vehicles.

Appendix E presents much of the source material for the population estimates. A variation of the approach defined above was used to estimate park area traffic. This change in approach was necessary since the majority of park traffic consists of transients, most of whom enter the EPZ from locations outside.

As a result, we relied on empirical observation of the number of vehicles that can physically be accommodated within park areas. This technique is valid since discussions with public officials confirmed that, with few exceptions, people at the park have access to a vehicle. Thus, the evacuation of people from the park area will be primarily reflected in the number of evacuating private vehicles.

By accurately estimating the number of vehicles at park areas, we have satisfied the input requirements for an evacuation plan. Estimates of population can be based on accurate estimates of per-vehicle person occupancy. Thus, for the park area, more reliable estimates are forthcoming if we reverse the sequence of steps 1 and 2, above, by first estimating the number of evacuating vehicles, then using the vehicle-occupancy figure to estimate population.

During the summer season, vacationers and tourists enter the EPZ. These non-residents may dwell within the EPZ for the entire season, for a short period (e.g. one or two weeks), for a weekend, overnight, or may enter and leave within one day. Estimates of the size of these population components must be obtained, so that the associated number of vehicles can be ascertained.

The spectre of double-counting of people and vehicles must be addressed: a vehicle and its occupants cannot occupy two disparate locations at the same time. Consider a vacationing family that registers at a motel, travels to a park in the morning, then does some shopping, away from the park, in the evening before returning to the motel. If we consider a scenario where the accident occurs at about 2:00 PM when the parks are most crowded, then this family, and its vehicle, would most likely be at the park. If an evening scenario is being studied, then the vehicle would be at a retail parking lot, or perhaps, back at the motel.

Clearly, since this vehicle cannot be at all 3 locations simultaneously, its location at the instant an order to evacuate is announced, depends on the scenario being studied.

It is seen that the number of vehicles at each location depends on time of day. It is clearly <u>wrong</u> to estimate counts of vehicles by simply adding up the capacities of different types of parking facilities, without considering the whereabouts of the vehicles. For example, motel parking lots, which are full at dawn, may be almost empty at noon. Similarly, parking lots at area parks, which are full at noon, may be almost empty at dawn.

Another element that must be considered in an evacuation plan is the need to provide for transit-dependent people. These people may be youngsters in school, persons in institutions without access to private vehicles or who cannot provide for themselves, as well as residents and tourists who do not have access to a private vehicle.

Analysis of the population characteristics of the Davis Besse EPZ indicates the need to identify five distinct groups:

- Permanent residents - people who are year round residents of the EPZ.
- Seasonal residents - people who reside in the EPZ for a portion of the year, generally the peak summer season.
- Transients - people who reside outside of the EPZ who enter the area for a specific purpose (shopping, recreation) and then leave the area.
- Employees - people who reside outside of the EPZ and commute to business within the EPZ on a daily basis.
- Boaters on Lake Erie who use marinas within the EPZ.

Estimates of the population and numbers of vehicles to be expected for each of the population groups will now be presented. Estimates will be presented by evacuation subarea and by polar coordinate representation (population rose).

The Davis Besse EPZ have been subdivided into 12 subareas. These areas are shown in Figure 2-1.

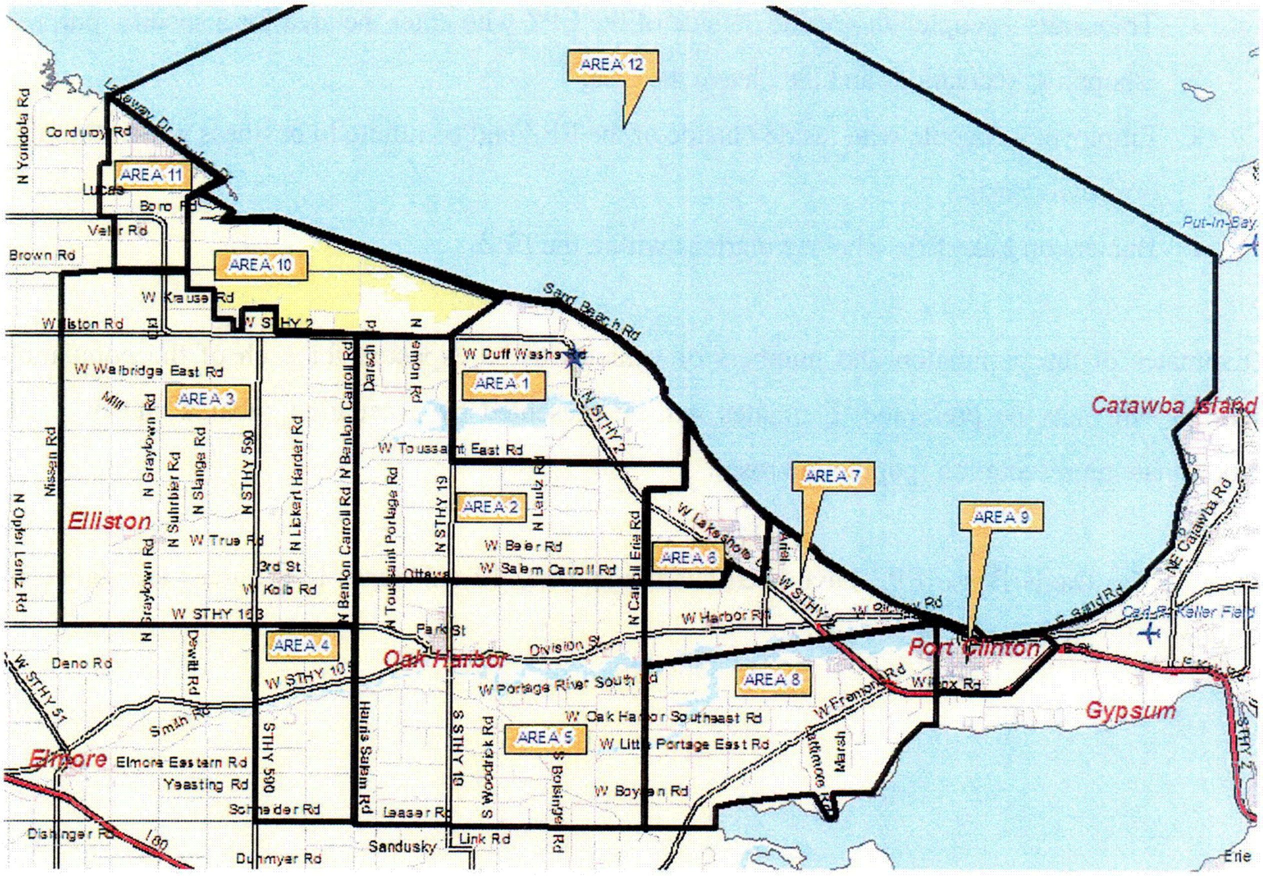


Figure 2-1 Davis Besse EPZ Subareas

CO3

Permanent Residents

The starting point for the estimates of permanent population must be based upon the latest U.S. Census data. Comparing census information, it is possible to estimate population changes and project the current resident population to a 2003 base year. Table 2-1presents these estimates.

Table 2-1 EPZ Population Growth

	Population		Growth Rate	Population
Subdivision	1990	2000	2000-2003	2003
Bay Twp.	1,276	1,294	0.423%	1,299
Benton Twp.	2,046	2,232	2.727%	2,293
Carroll Twp.	1,735	1,931	3.389%	1,996
Erie Twp.	1,454	1,328	-2.600%	1,293
Portage Twp.	1,600	1,634	0.638%	1,644
Port Clinton	7,106	6,391	-3.019%	6,198
Ottawa County	40,029	40,985	0.716%	41,279
Lucas County	1,375	1,365	-0.218%	1,365

Table 2-1 shows the population for the EPZ has remained stable over the last 10-year period. The growth in population of the rural areas of the county is more than compensated for with the loss of population in Port Clinton.

The second step of the estimation process is the estimation of the average number of people who may be expected to occupy each evacuating vehicle. Using the 2000 Census, the average household size in Ottawa County is approximately 2.48 persons. It is reasonable to assume that some families will choose to utilize more than one vehicle to evacuate. Work on other evacuation studies have indicated that a number in the range of 1.1 to 1.2 evacuating vehicles per household is reasonable. We will use the figure of 1.2 evacuating vehicles per household for this study. Consequently, the average number of persons per evacuating vehicle can be computed:

2.48 persons per household / 1.2 vehicles per household
= 2.1 persons per evacuating vehicle

Permanent population and vehicle estimates for 2003 are presented in Figures 2-2 and 2-3. Data in these figures are displayed as totals within each subarea. A total of 12 subareas are defined for the Davis Besse EPZ. Figures 2-4 and 2-5 presents the resident population and resident vehicle estimates by sector and distance from DBNPS.

It can be argued that accepting this estimate of permanent residents serves to overstate, somewhat, the number of evacuating vehicles, especially during the summer. It is certainly reasonable to assert that some portion of the population would be on vacation during the summer and would travel elsewhere. A rough estimate of this reduction can be obtained as follows:

1. Assume 60 percent of households vacation over the summer, for a two-week period.
2. Assume these vacations, in aggregate, are uniformly dispersed over 10 weeks, i.e. 12 percent of the population is on vacation during each two-week interval.
3. Assume half of these vacationers leave the area.

On this basis, the resident population would be reduced by 6 percent in the summer and by a lesser amount in the off-season. The same rationale will lead to the conclusion that the number of employees who work within the EPZ on a full-time (i.e. non-seasonal) basis would also be reduced by that percentage over the summer. This six percent reduction translates into about 600 vehicles.

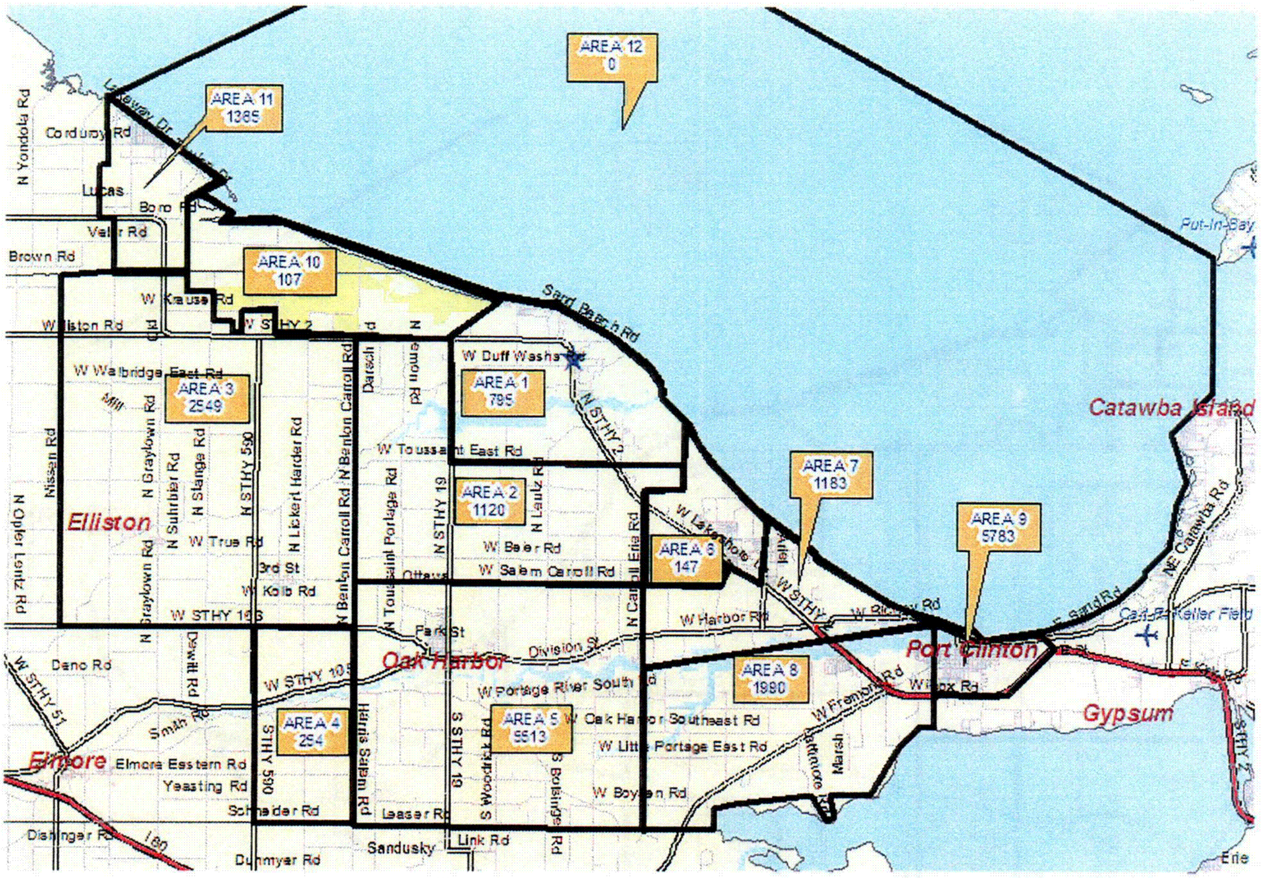


Figure 2-2. Permanent Resident Population by Subarea

C 04

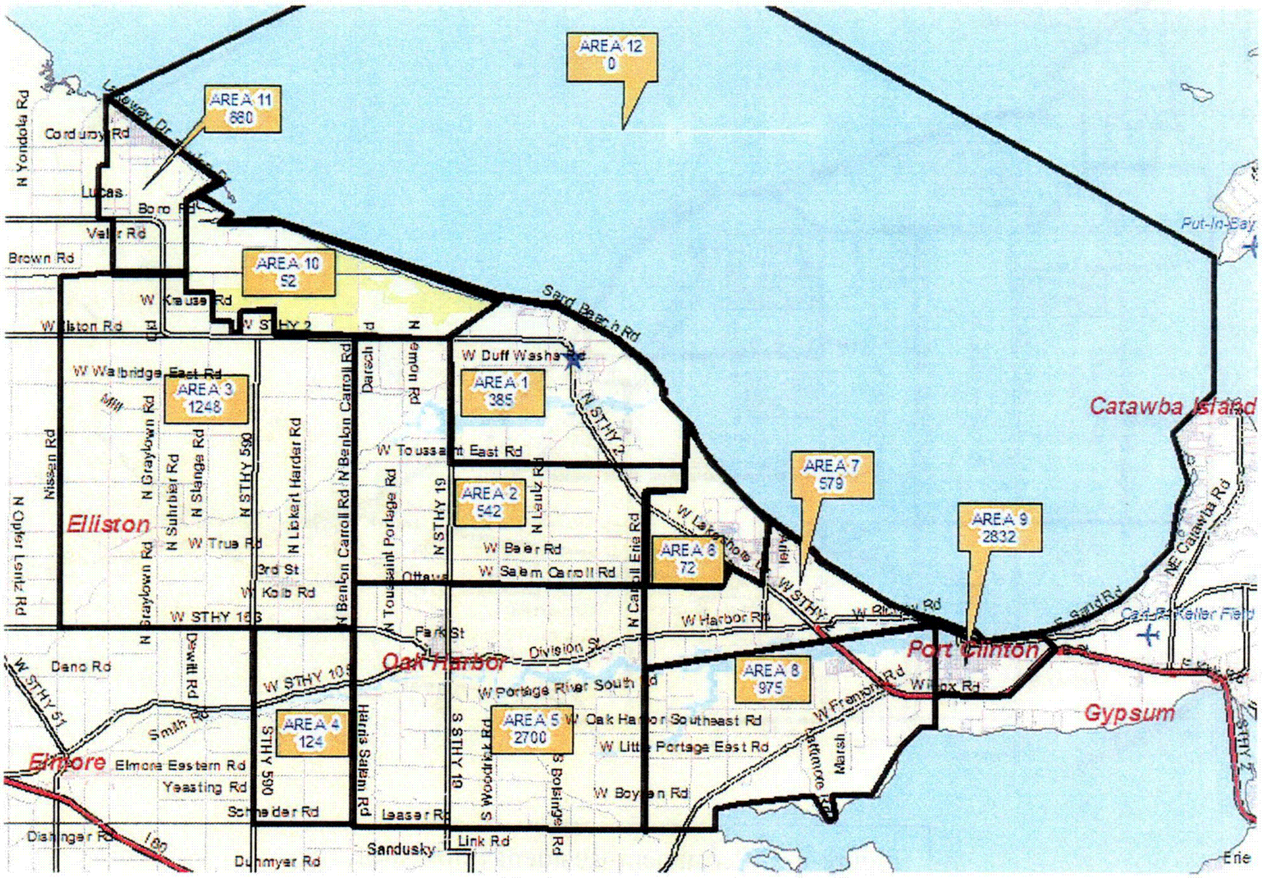
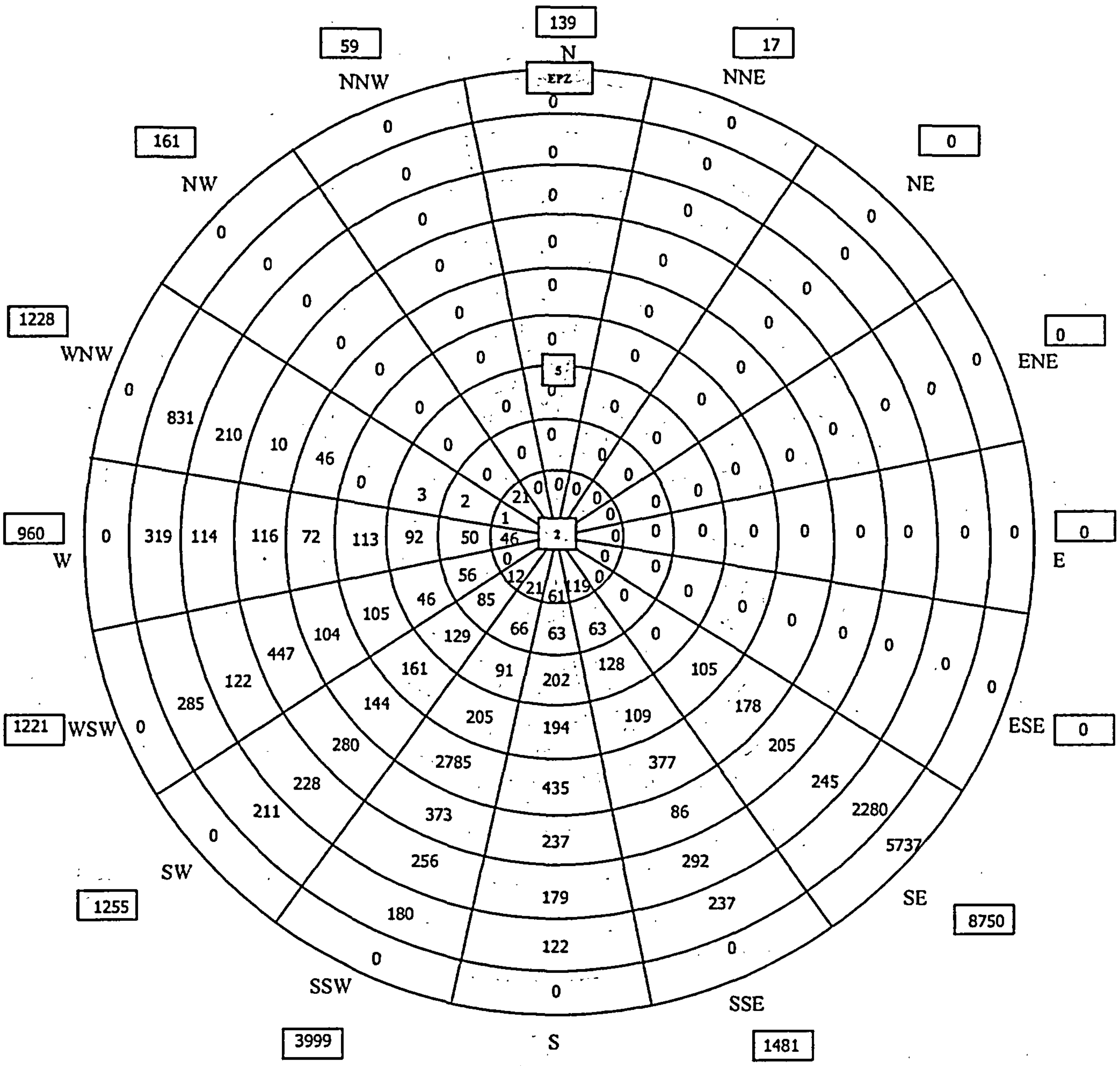


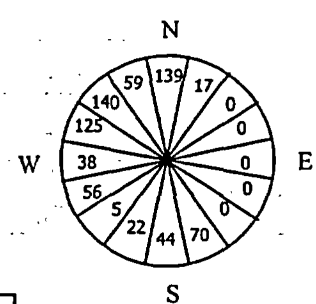
Figure 2-3. Permanent Resident Vehicles by Subarea

C05



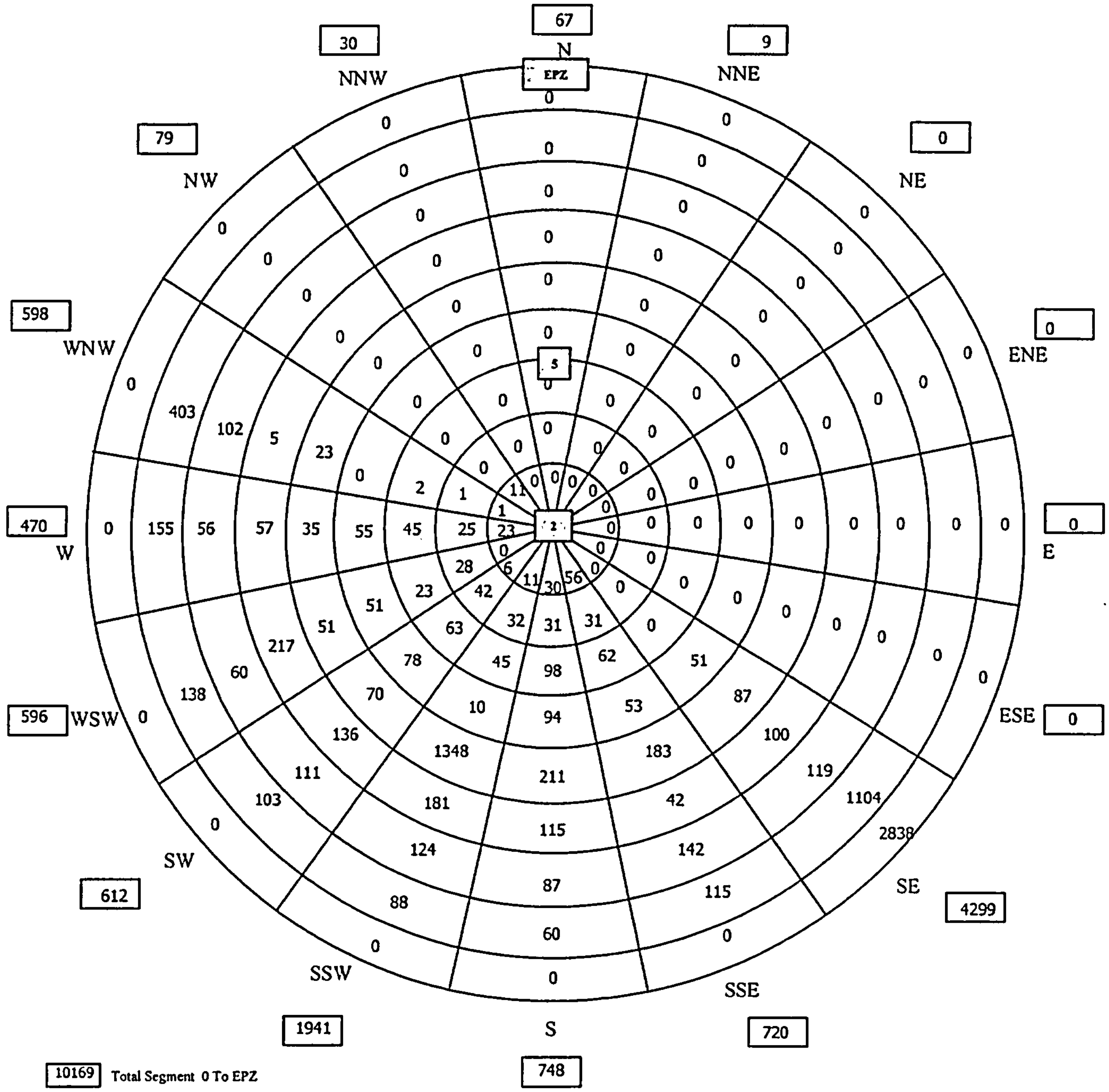
20807 Total Segment 0 To EPZ

Permanent Residents			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	715	0-2	715
2-5	1357	0-5	2072
5-10	12998	0-10	15070
10-EPZ	5737	0-EPZ	20807

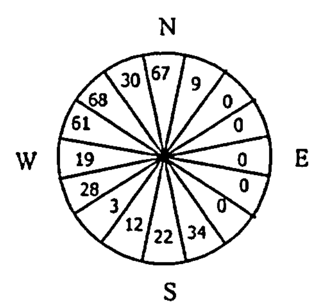


DETAIL OF 2 MILE RING

Figure 2-4. Permanent Resident Population



Resident Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	353	0-2	353
2-5	668	0-5	1021
5-10	6310	0-10	7331
10-EPZ	2838	0-EPZ	10169



DETAIL OF 2 MILE RING

Figure 2-5. Permanent Resident Vehicles

Seasonal Population

The seasonal population estimates were based upon the 2000 estimates developed with the assistance of the Ottawa County Planning. There are few seasonal housing units in the Lucas County portion of the EPZ, with the exception of some migrant labor housing. Vehicular estimates for seasonal housing assume 1.0 vehicle per housing unit and an average family size of 2.48 persons per housing unit. Table 2-2 presents the data available.

Estimates of seasonal population in Revision 4 were based upon the extensive condominium construction of the mid 1980's. At that time we estimated the growth as increases in seasonal population. With the 2000 census, much of that condominium development has been folded into the permanent population estimates. Seasonal housing was obtained from County estimates of housing occupied only during periods of the year.

Table 2-2. Seasonal Housing Units

Locality	Units	Persons	Vehicles
Bay Twp.	231	573	231
Benton Twp	2	5	2
Carroll Twp.	614	1523	614
Erie Twp.	274	680	274
Salem Twp	18	45	18
Port Clinton	470	1166	470
Totals	**1609**	**3992**	**1609**

Figures 2-6 and 2-7 presents the seasonal population distributions (both people and vehicles) by subarea. Figures 2-8 and 2-9 present the same data in Polar Sector format.

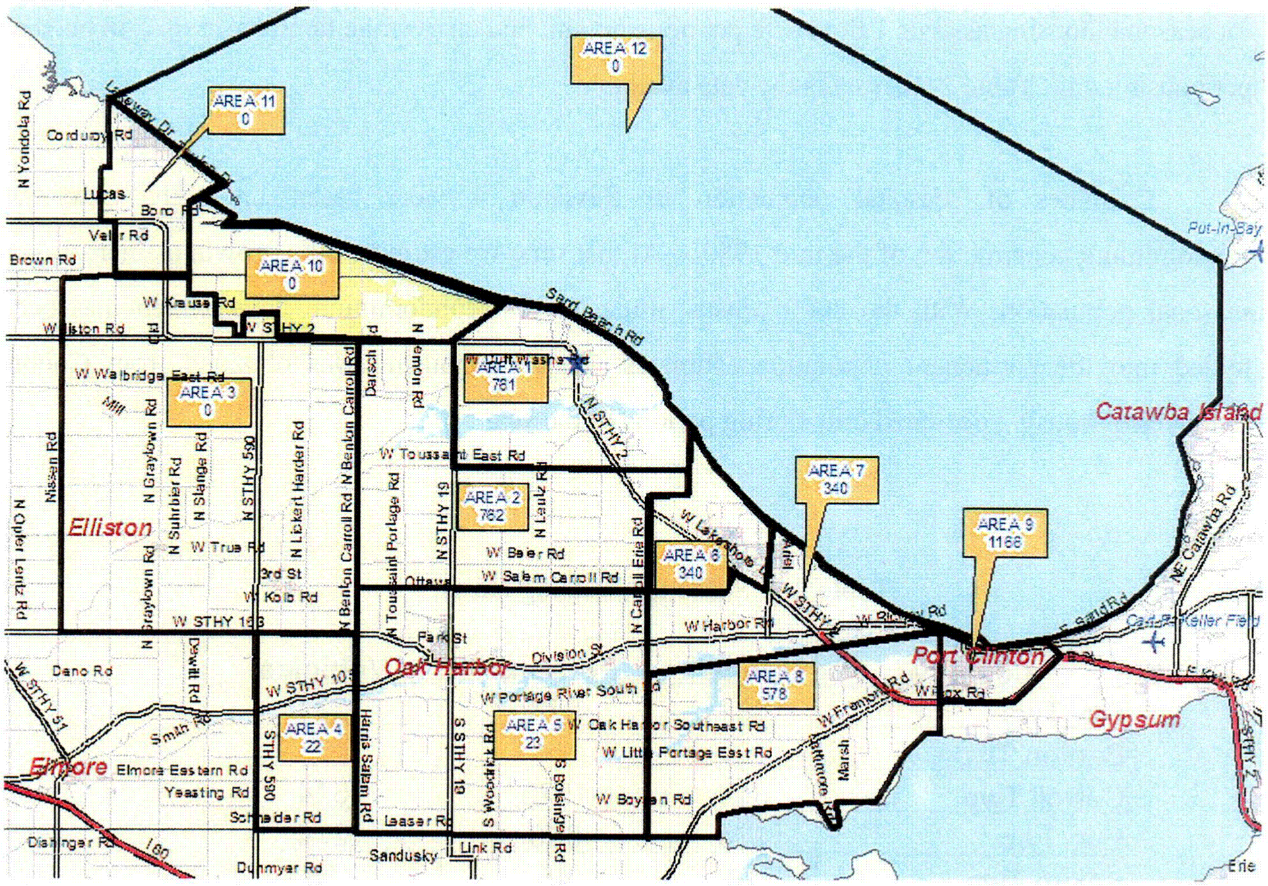


Figure 2-6. Seasonal Residents
by Subarea

C06

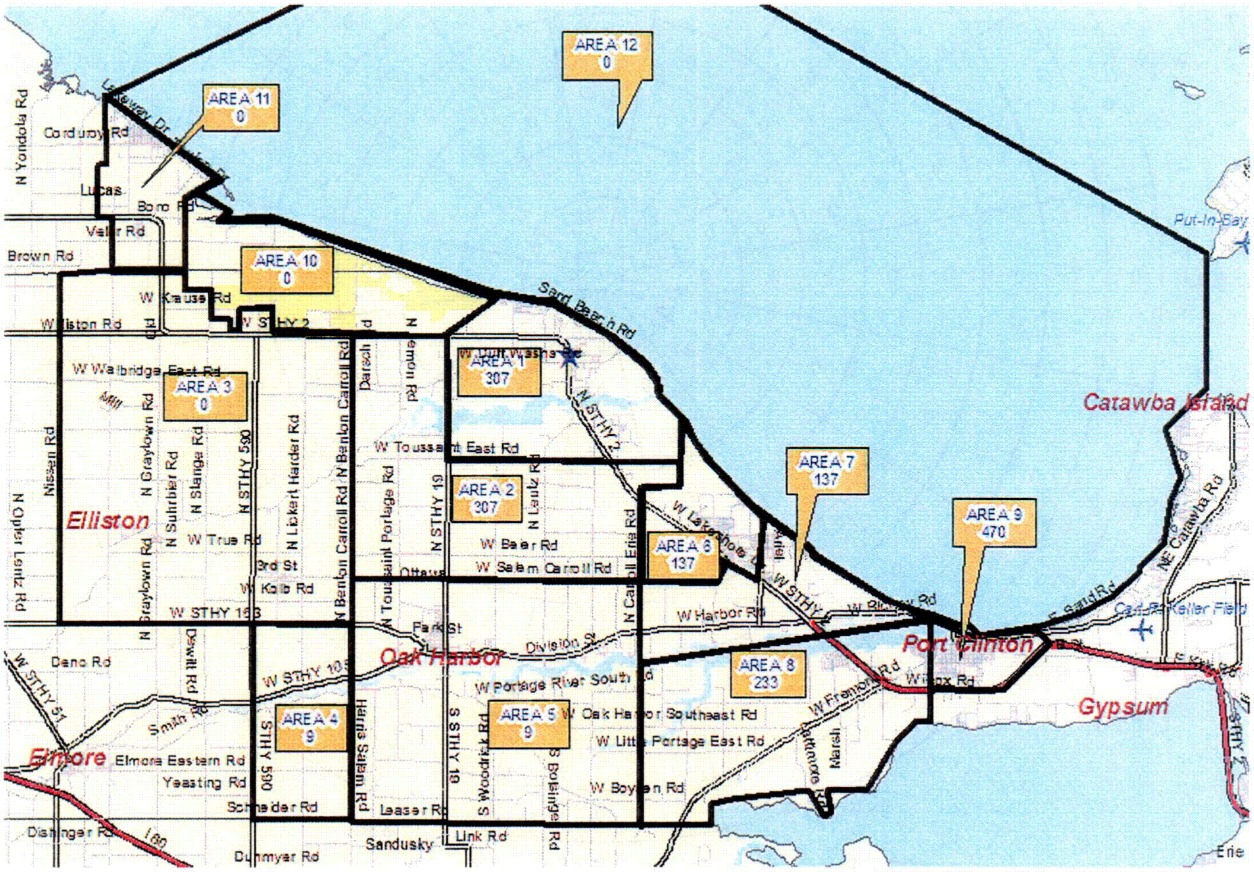
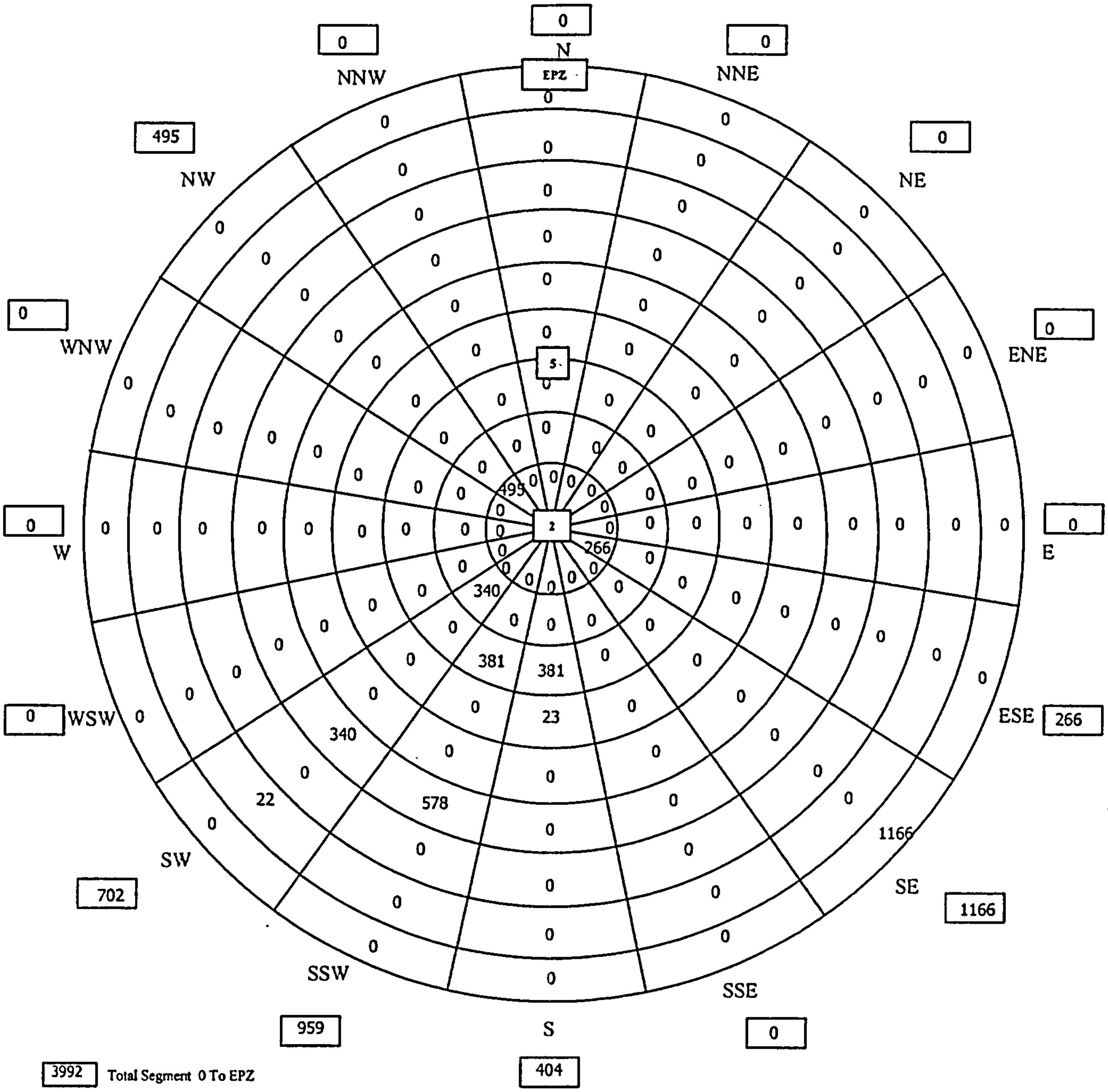
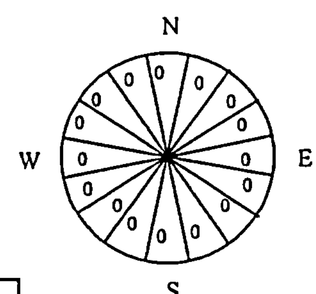


Figure 2-7. Seasonal Resident Vehicles
by Subarea

C07

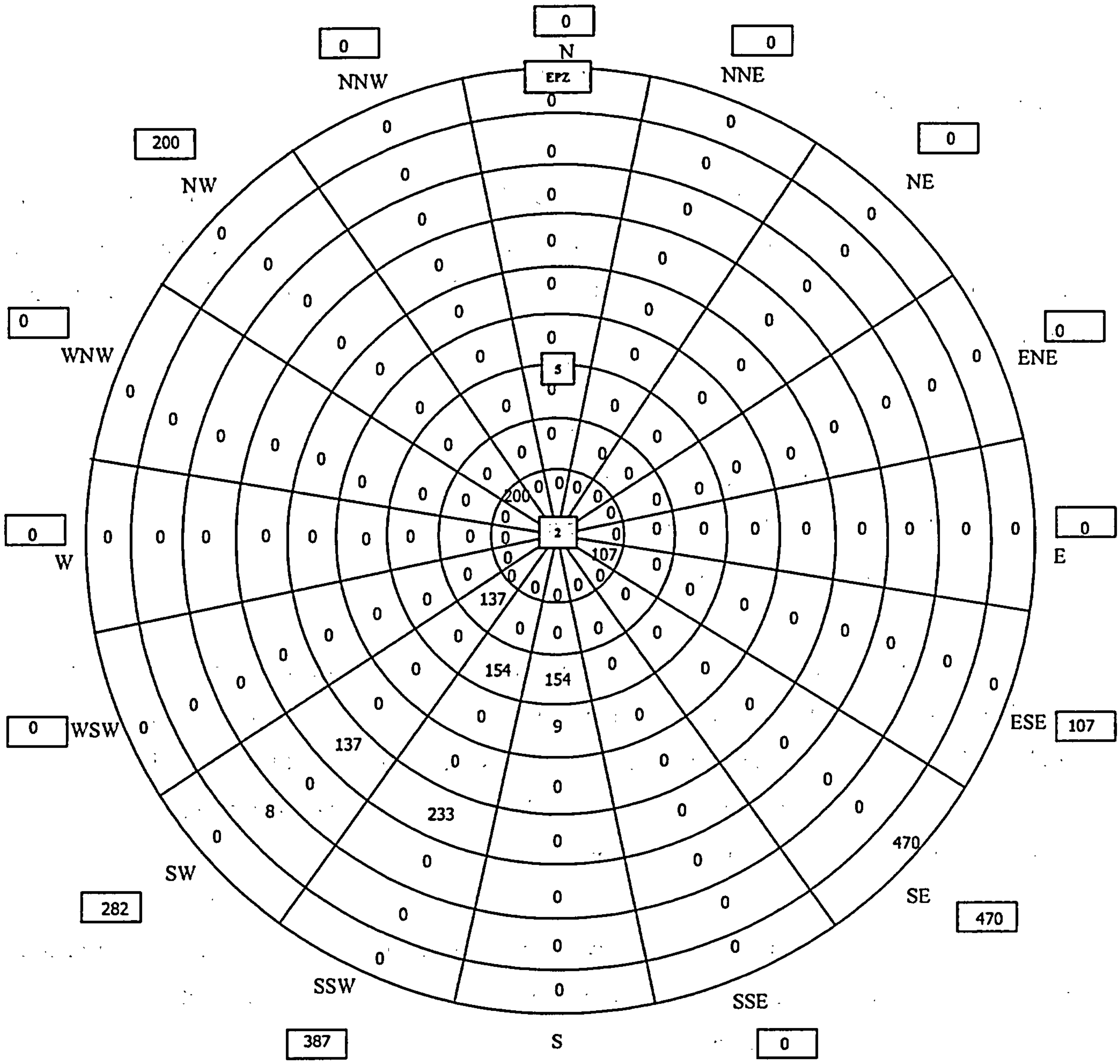


Seasonal Residents			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	0	0-2	0
2-5	1863	0-5	1863
5-10	963	0-10	2826
10-EPZ	1166	0-EPZ	3992

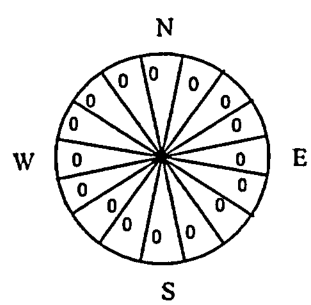


DETAIL OF 2 MILE RING

Figure 2-8. Seasonal Residents



Seasonal Resident Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	0	0-2	0
2-5	752	0-5	752
5-10	387	0-10	1139
10-EPZ	470	0-EPZ	1609



DETAIL OF 2 MILE RING

Figure 2-9 Seasonal Resident Vehicles

Transient Population

Transient population groups are defined as those people who enter the EPZ for a specific purpose (shopping, recreation) and who leave on the same day or people who stay overnight at motels or hotels. The Davis Besse EPZ has a number of areas that attract transients in significant numbers:

- Port Clinton - shopping, access to ferries, etc.
- Camp Perry - National Rifle/Pistol matches
- Wildlife refuges, parks - day trip recreational use
- Marinas - boaters on Lake Erie will be considered separately.

Because the great majority of people utilizing these facilities travel in private vehicles, it is possible to estimate the transient population by first obtaining an estimate of the parking capacity of each facility and then applying a per vehicle occupancy factor to arrive at the population estimate. Care must be taken to avoid counting vehicles belonging to permanent residents who use the facilities as belonging to the transient category.

A factor of 2.48 persons per vehicle was used in these estimates. This figure is a reasonable vehicle occupancy value for recreational purposes. The following are estimates of transient population of each of these groups.

Port Clinton

Data: (a)24 hr. traffic counts on Perry St. during August 1984
(b)Year round average traffic counts on Perry St. From ODOT Traffic Reports

1.	1984 ADT (2 directions) for Friday, Saturday, Sunday during August	24239 vehicles
2.	1985-2001 ODOT Traffic Growth Factor	1.18
3.	Estimated Current Peak Summer Traffic	28602 vehicles
4.	1999 ODOT year round ADT	14700
	a. Peak Summer excess vehicles	13902 (2-dir)
	b. Peak Summer vehicles (1-direction)	6951 vehicles
	c. Seasonal Vehicle estimates	1609
	d. Peak transient vehicles	5342 say 5400

Using a vehicular occupancy for transient vehicles of 2.48 persons/vehicle, the population estimate for this segment is 13,300.

Camp Perry

The national rifle and pistol matches are held at Camp Perry during July and August of each year. Discussions with Camp Perry Offices indicate a peak attendance of approximately 5000 people. However, there is a considerable overlap between people at Camp Perry and transients in Port Clinton during the day. For the purposes of the study, we will assume that 67 percent of the total attendance at Camp Perry is present on a peak afternoon. This leads to an estimate of 3300 people, or 1344 vehicles present at Camp Perry. The Port Clinton transient estimate includes the balance of Camp Perry attendees.

Wildlife Refuges, Parks

A number of sources of information regarding population estimate for the parks and wildlife refuges in the EPZ were utilized:

- Contacts were made with park managers or rangers.

- Contacts with Ohio Department of Natural Resources.
- Aerial photographs.
- Manual data collection.

Talks with park managers indicate that Crane Creek Park and Wildlife Refuge has approximately 2600 parking spaces. These spaces include both designated parking and empty fields used for overflow parking. Park managers also indicate that the vast majority of people arrive in private automobiles and that significant parking is not present on the park access road or on State Route 2, outside of the park boundary.

Using peak parking estimates and an estimate of 2.48 persons per transient vehicle yields a peak period attendance of approximately 7300 people.

Data was collected at Crane Creek Park over the long, July 4, 1986 weekend. An automated traffic counter was placed on the Crane Creek Park access road. The 24-hour peak park attendance occurred on Sunday, July 6. A total of 5,561 vehicles were counted entering and leaving the park (Traffic Counts were two direction counts). This implies the maximum number of vehicles in the park at any one time is approximately one half, or 2780 vehicles. This number is consistent with the parking capacity of the park. The data collected therefore supports the use of 2600 vehicles as the peak park transient vehicle count.

Further data was collected at the park to determine the origin of vehicles in the parking fields A license place survey was conducted in an attempt to identify the county or state of origin of the vehicle. The results of this survey are presented in Table 2-3. We will assume that the survey results continue to be reflective of park utilization.

These results yield two pieces of information. First, the natural westbound and southbound evacuation routes from the park (Route 2, Route 579, Route 590) are already the routes of choice for the normal park to home trip for approximately 60-70 percent of the park population. Secondly, approximately 6 percent of the people at the park already live in the EPZ (Ottawa Co.). These people are assumed to evacuate from home. Thus, using 2600 vehicles to estimate peak park transient vehicles may be high by up to 6 percent due to the double counting of Ottawa County vehicles. Therefore, it was deemed realistic to use 2440 vehicles (94% of 2600).

Figures 2-10 and 2-11 present transient population by subarea and vehicle estimates by subarea respectively. Figures 2-12 and 2-13 present the transient population and vehicle data, by sector.

Table 2-3. Results of Crane Creek License Plate Survey

Place of Origin	Number of Vehicles	Percentage
Ottawa Co.	53	6%
Lucas Co.	419	51%
Wood Co.	104	13%
Sandusky Co.	57	7%
Erie Co.	10	1%
Other Ohio	128	16%
Michigan	30	4%
Other States	23	3%
Totals	824	100%

Date: Friday, July 4, 1986

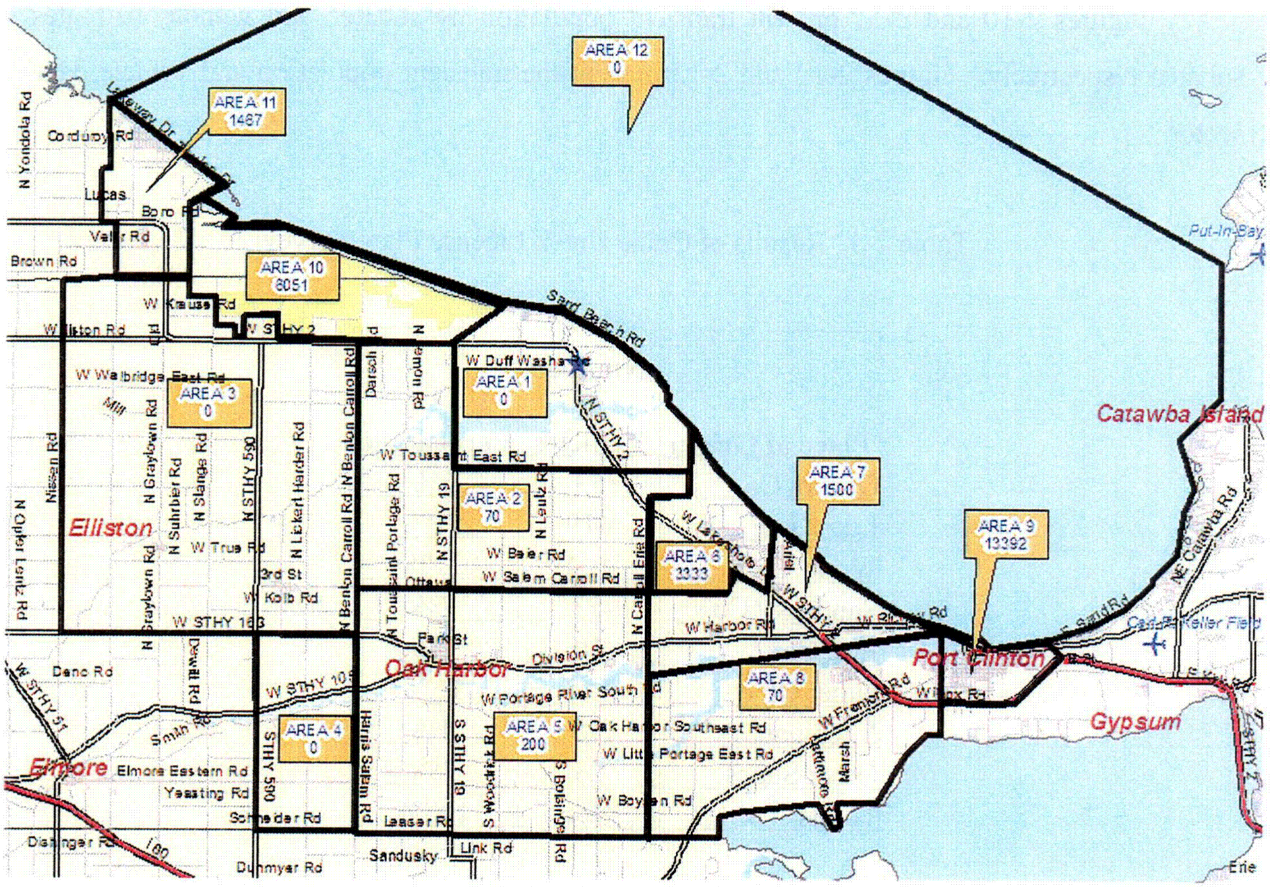


Figure 2-10. Davis Besse EPZ Transient Population

C08

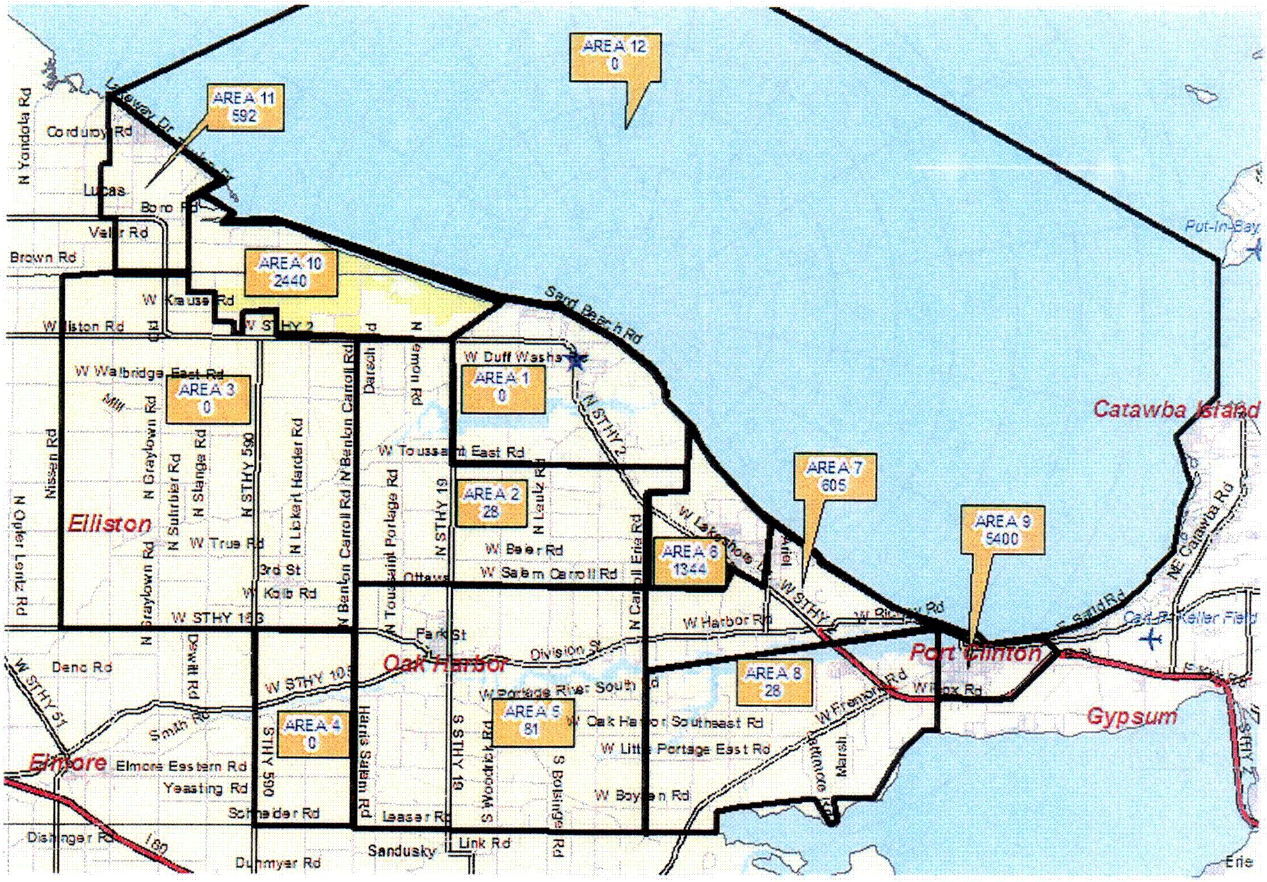
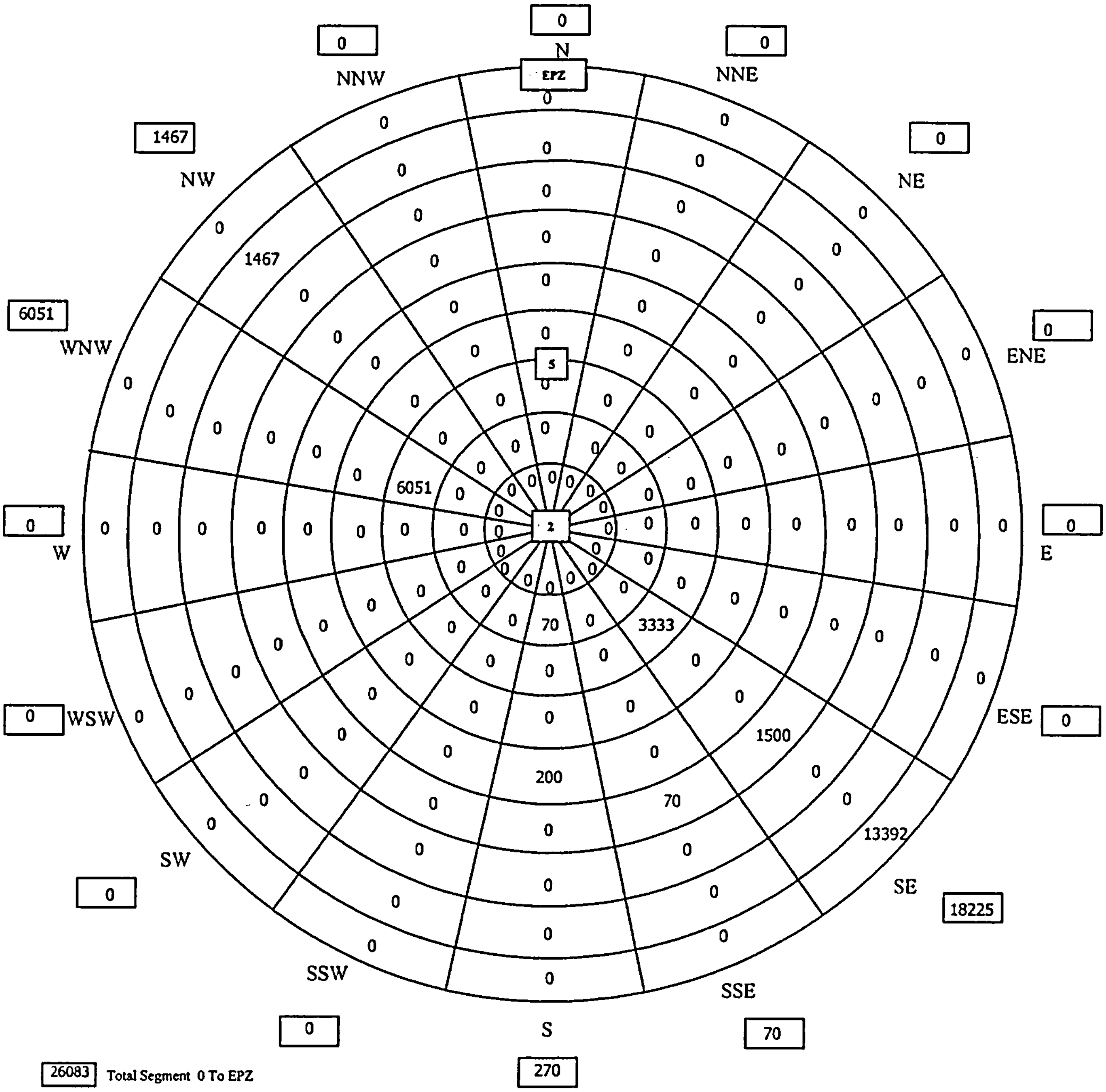
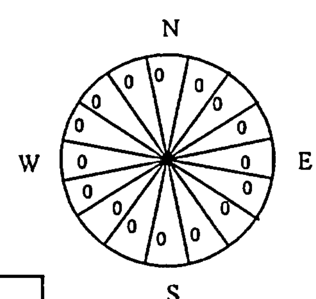


Figure 2-11. Davis Besse EPZ Transient Vehicles

C09

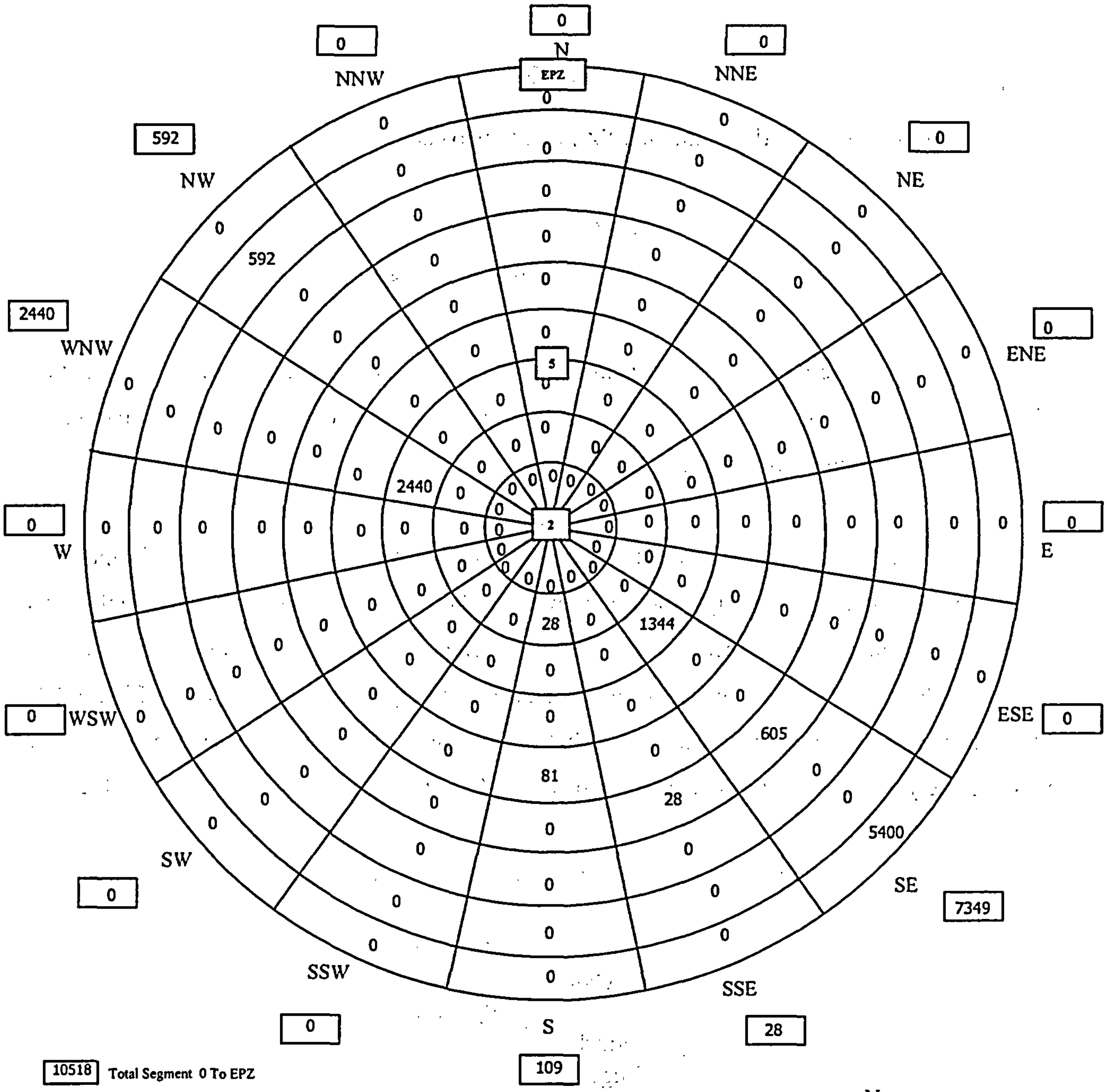


Transients			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	0	0-2	0
2-5	9454	0-5	9454
5-10	3237	0-10	12691
10-EPZ	13392	0-EPZ	26083

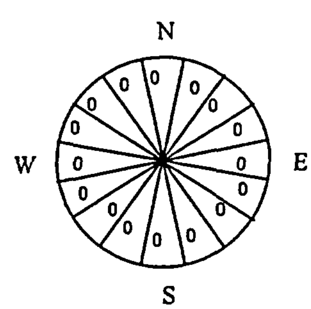


DETAIL OF 2 MILE RING

Figure 2-12. Transient Population



Transient Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	0	0-2	0
2-5	3812	0-5	3812
5-10	1306	0-10	5118
10-EPZ	5400	0-EPZ	10518



DETAIL OF 2 MILE RING

Figure 2-13. Transient Vehicles

Employees

Employees who work within the EPZ fall into two categories:

- Those who live and work in the EPZ
- Those who live outside of the EPZ and commute to jobs within the EPZ.

The first of these categories have already been counted as part of the permanent population. Therefore, to avoid double counting, we focus on those employees whose evacuation trip corresponds with their normal work to home trip.

Figure 2-14 presents Ottawa County employment trends over the last 15 years. Employment peaked in 1990 at approximately 12000 employees in the county. The latest data available shows that the employment is at or near the peak levels reached a decade ago. It is expected that peak season employment will be somewhat higher than the employment levels shown in Figure 2-14. Other employment data from the Ohio State University Data Center identifies a total of approximately 5000 workers who commute to Ottawa County. This data is presented in Table 2-4.

Table 2-4. Number of Commuters to Ottawa County

Home County	Ottawa County Workers
Sandusky	1,657
Lucas	1,252
Wood	869
Erie	725
Seneca	130
Monroe	128
Huron	111
Total	4,872

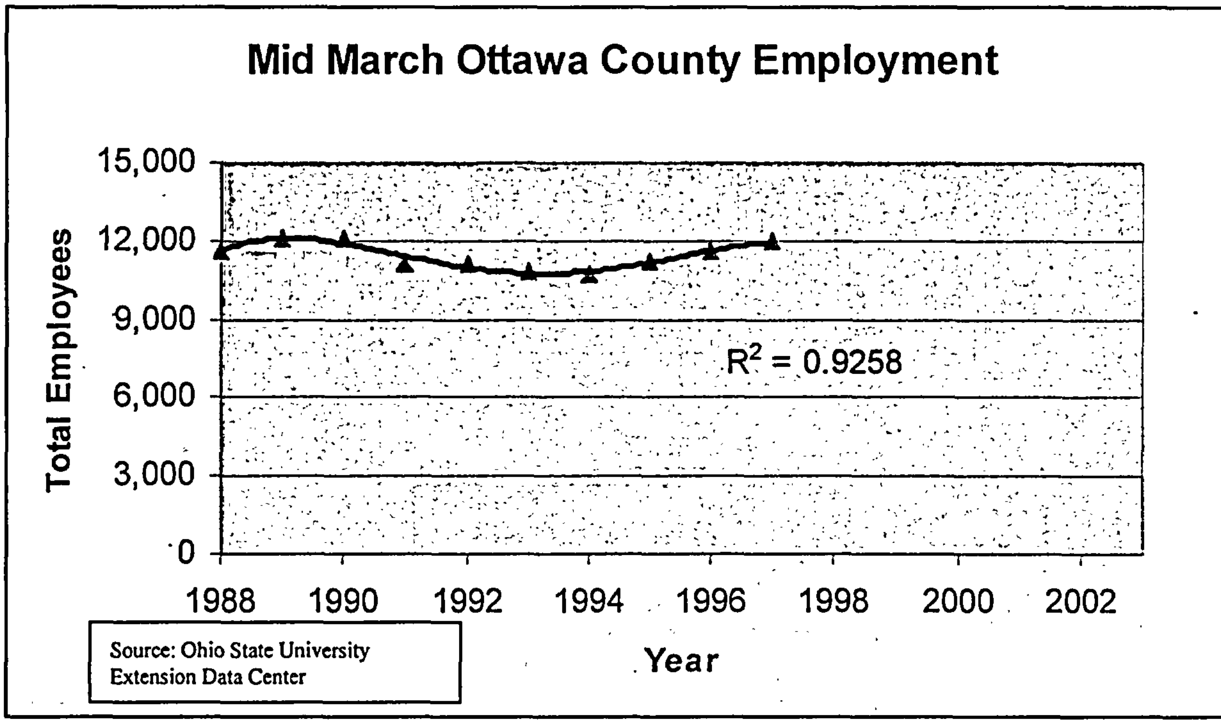


Figure 2-14. Employment Trends In Ottawa County

The major areas of employment within the Davis Besse EPZ are:

- First Energy Corporation (DBNPS)
- Erie Industrial Park – State Route 2, 5 miles west of Port Clinton
- Lake Winds Industrial Park – State Route 163, 8 miles west of Port Clinton
- Oak Harbor Park – State Route 19, north of Oak Harbor
- Port Clinton

These areas are shown in Figure 2-15. There are two additional areas within Ottawa County where employment centers are located (Elmore and Genoa). We will assign a total of 150 inbound commuters to these locations.

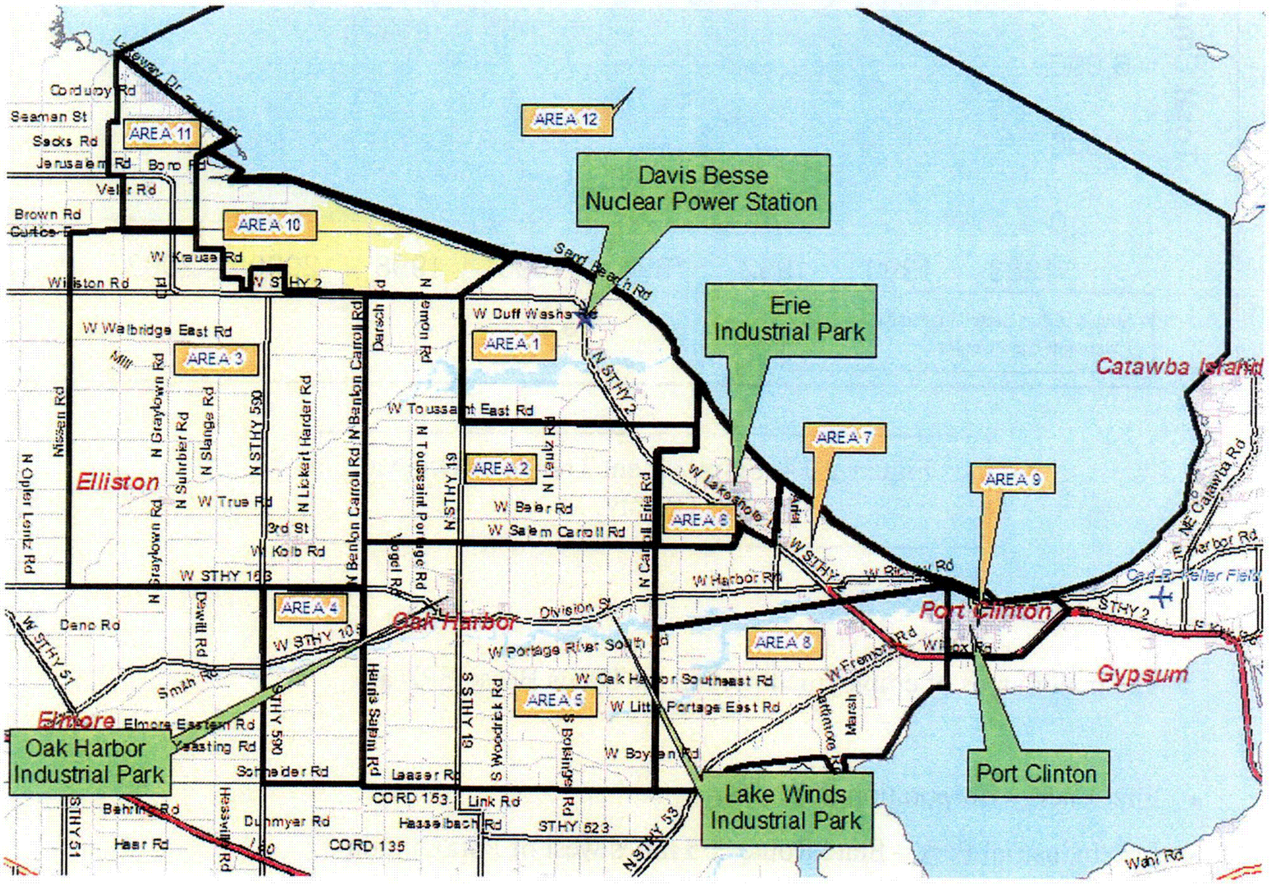


Figure 2-15. Employment Areas Within Davis Besse EPZ.

C10

Most employment occurs along the Route 2 corridor. Consequently, we have assigned a total of 4,700 workers entering the EPZ, as shown in Table 2-5.

Table 2-5. Employees Entering the EPZ

Location	Number of Employees Entering the EPZ
Davis Besse NPS	700
Erie Industrial Park	750
Lake Winds Industrial Park	375
Oak Harbor Industrial Park	375
Port Clinton	2,500

A factor of 1 person per employee vehicle was used to determine the number of evacuating vehicles. This figure was obtained from 2000 census figures for Ottawa County, which shows the vast majority of workers commuting in single occupancy autos.

Figure 2-16 presents employee and vehicle estimates by subarea. Figures 2-17 and 2-18 present this data by sector.

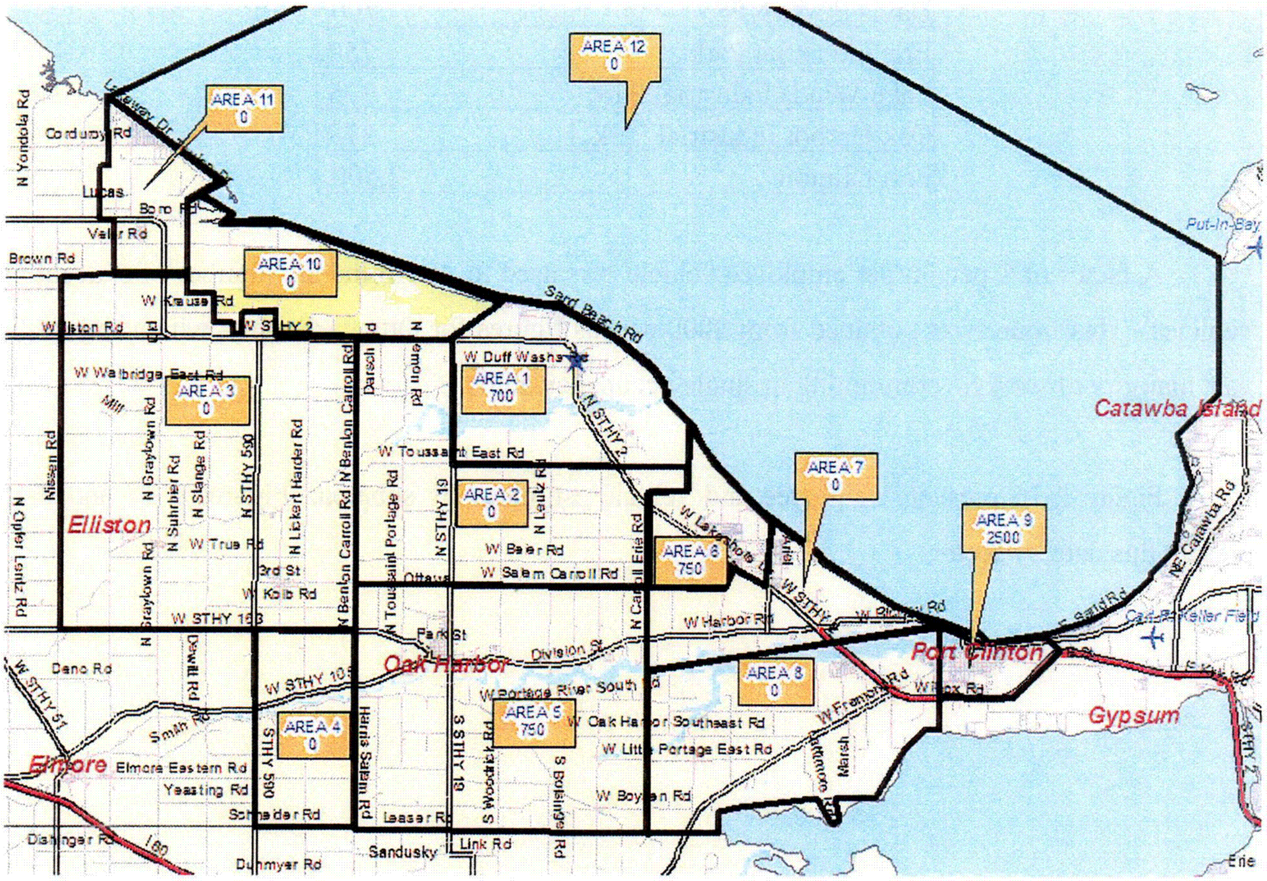
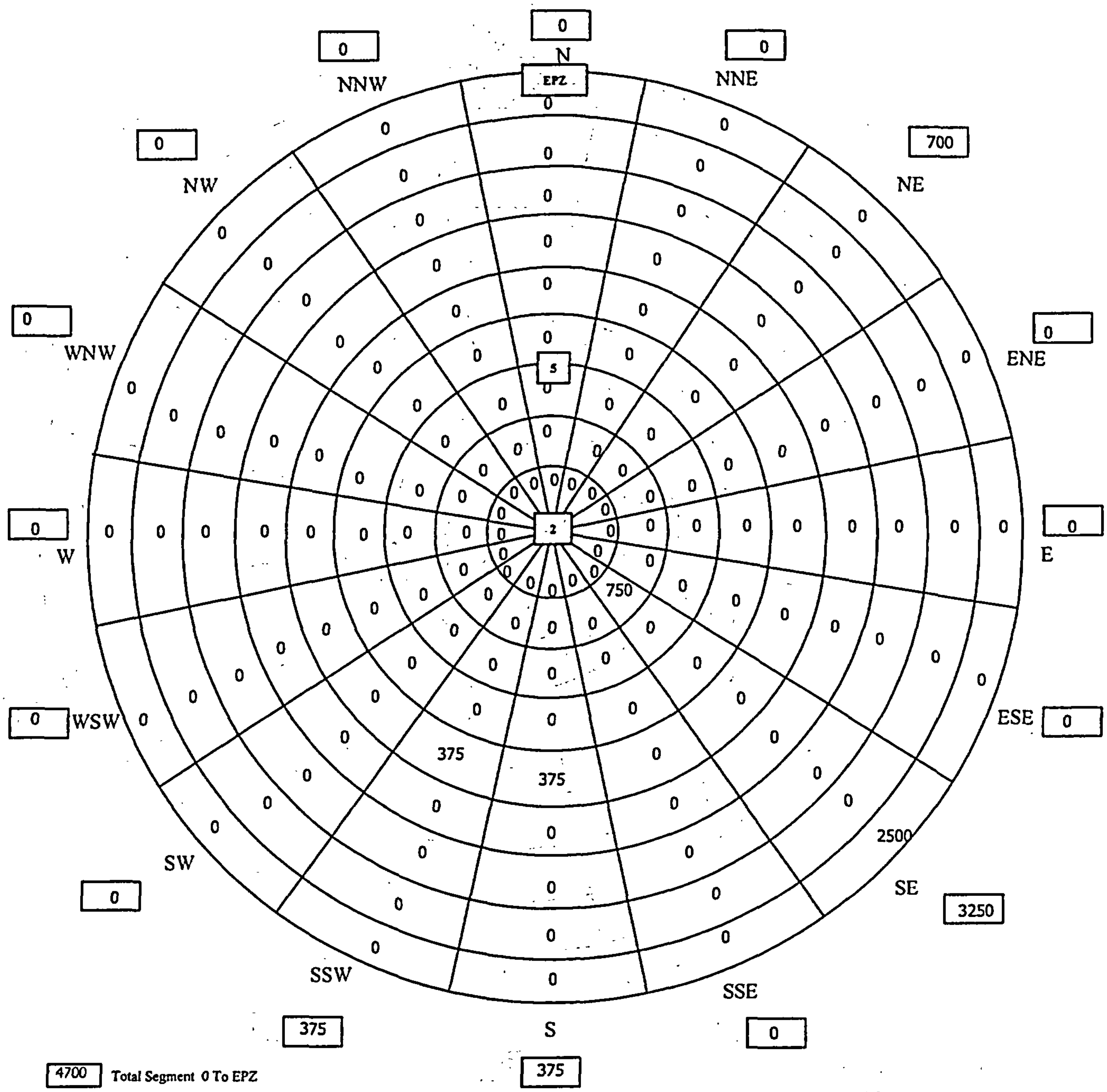
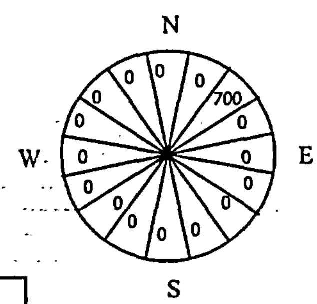


Figure 2-16. Davis Besse EPZ Employees and Employee Vehicles (Assumes 1 Veh/Employee)

C11

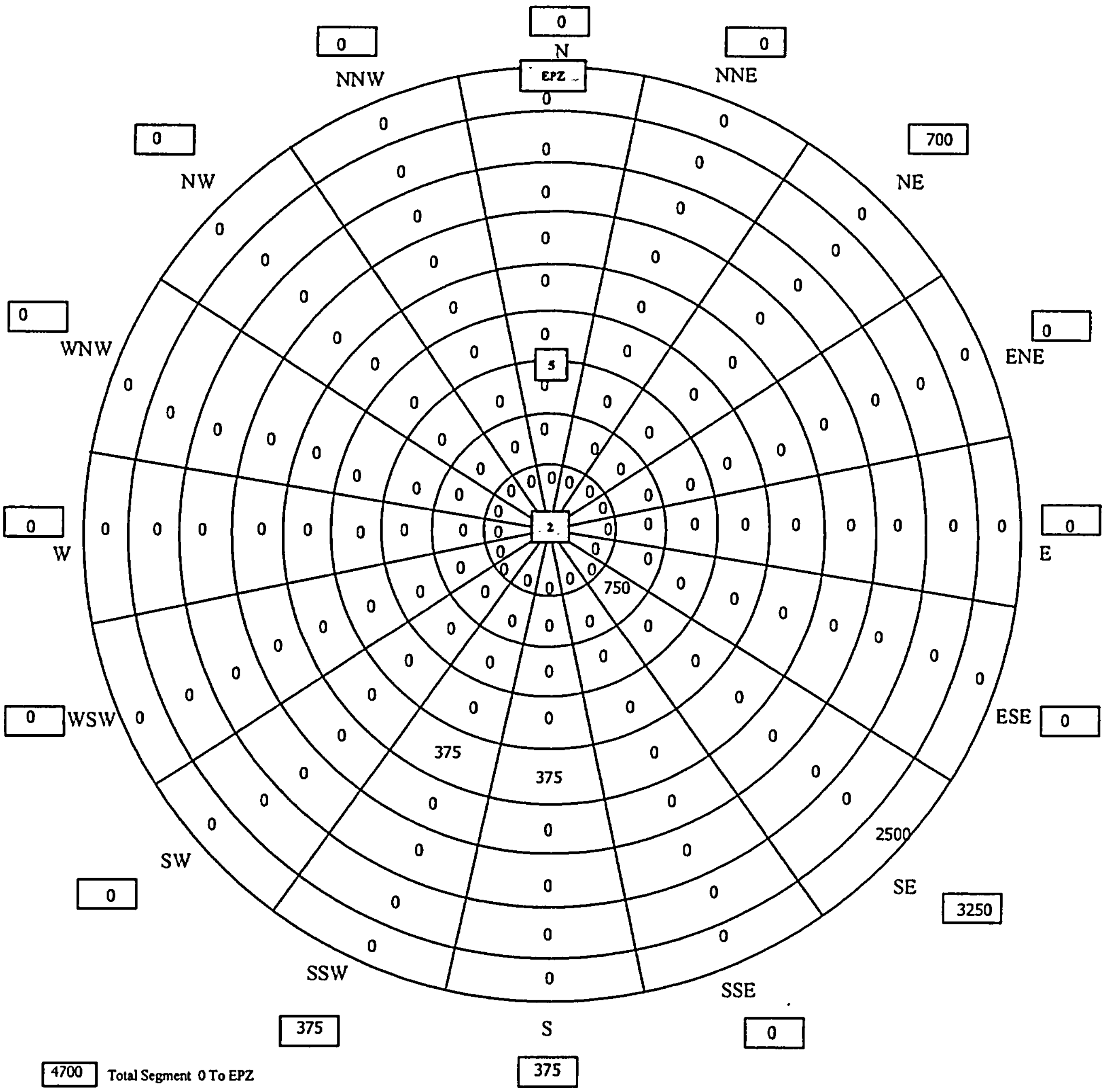




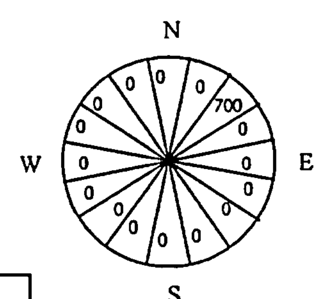
DETAIL OF 2 MILE RING

Employees			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	700	0-2	700
2-5	750	0-5	1450
5-10	750	0-10	2200
10-EPZ	2500	0-EPZ	4700

Figure 2-17. Employees



Employee Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	700	0-2	700
2-5	750	0-5	1450
5-10	750	0-10	2200
10-EPZ	2500	0-EPZ	4700



DETAIL OF 2 MILE RING

Figure 2-18. Employee Vehicles

Boaters

One of the principal features of the Davis Besse EPZ is the high utilization of Lake Erie by boaters during the peak summer season. Boaters on the lake raise several issues with regard to evacuation planning.

1. How many boats are launched from areas inside the EPZ?
2. From where are these boats launched?
3. Will boats return to marinas inside of the EPZ and, if so, what time lags will be encountered?

Issues 1 and 2 will be discussed here, issue 3 will be discussed in Section 4. The Ohio National Guard, assisted by the Ohio Department of Natural Resources and the Ohio Department of Transportation will notify boaters on the lake. The U.S. Coast Guard will issue an urgent "Notice to Mariners". Boaters would, in all probability, prefer to return to the marinas from which they launched to retrieve their automobiles. Hence, we believe it is prudent to assume that all boaters launched from marinas in the EPZ will return to those marinas to begin evacuating.

As a starting point we obtained a list of all marinas operating in Ottawa County by the Health Dept. We contacted marinas in the EPZ to ascertain:

1. Ottawa County marinas, in aggregate, launch from ramps about 21 percent as many boats as they have slips. Lucas County marinas within the EPZ launch a total of 100 boats from ramps.
2. Marina utilization on a peak summer day is estimated at 44 percent by marina operators in Ottawa County and 70 percent by marina operators in Lucas County.

A summary of the boating population by township is presented in Table 2-6. It was assumed that, on average, each boat would be serviced by one evacuating vehicle.

Figure 2-19 and 2-20 presents population and evacuation vehicle distributions by subarea. Figures 2-21 and 2-22 present this data by polar sector.

The issue of double counting the boating population must be addressed. How many of the 5378 boats identified are being used by people who have been previously counted as permanent, seasonal or transients? At this time no effort has been made to quantify this problem for the following reason. Although the notification process for boaters on Lake Erie begins earlier than that for the general population, the longer response time (time needed to sail/motor back to a marina, load the boat on a trailer, or dock the craft) coupled with potential congestion on the marina access roads makes it difficult for residents of the area to return home quickly. Therefore, it is assumed that family members at home would evacuate without the boater. The boater would then be assumed to evacuate directly from the marina.

Medical-Related Facilities

The existing plans for Ottawa and Lucas Counties present estimates of the population of facilities such as hospitals, nursing and retirement homes and other health-related facilities. The number of vehicles associated with this estimate depends on the patients' state of health. Buses can transport up to 40 people; vans, up to 12 people; ambulances, up to 2 people (patients).

Once again, the prospect of double-counting is present. The population of nursing and retirement homes is included in the resident population. Thus, the vehicle estimates for this group have already been determined. Since many residents can be transported in buses (up to 40 persons) while others in ambulances (1 or 2 persons), it is reasonable to state that these people are already accounted for, in terms of the resident vehicle count. Details of the evacuation of schools and medical related special facilities are discussed in Section 9.

Table 2-7 presents a summary of population and vehicle estimates by subarea. It is understood that the peak population for each of these groups of people need not occur at the same time. For example, peak employee population occurs during the midweek period while the peak transient population occurs over a weekend.

Table 2-6. Summary of Boating Population

	Boat Spaces	Trailer Launches	Evacuation Vehicles
Bay Township	275	58	179
Carroll Township	2,512	528	1,633
Erie Township	1,780	374	1,157
Port Clinton	1,050	221	683
Salem Township	24	5	16
Lucas County	2,300	100	1,710
Totals	**7,941**	**1,286**	**5,378**

Notes:

1. Discussion with marina managers revealed occupancy rates of 96% for Ottawa County and 100% for Lucas County.
2. Boats launch from ramps in Ottawa County at a rate of 21 percent of the number of available spaces. A total of 100 boaters launch from marinas in Lucas County within the EPZ.
3. 44 percent of boats in spaces within Ottawa County marinas, 70 percent of boats in spaces within Lucas County, and 100 percent of boats launched from ramps are used during a peak day.

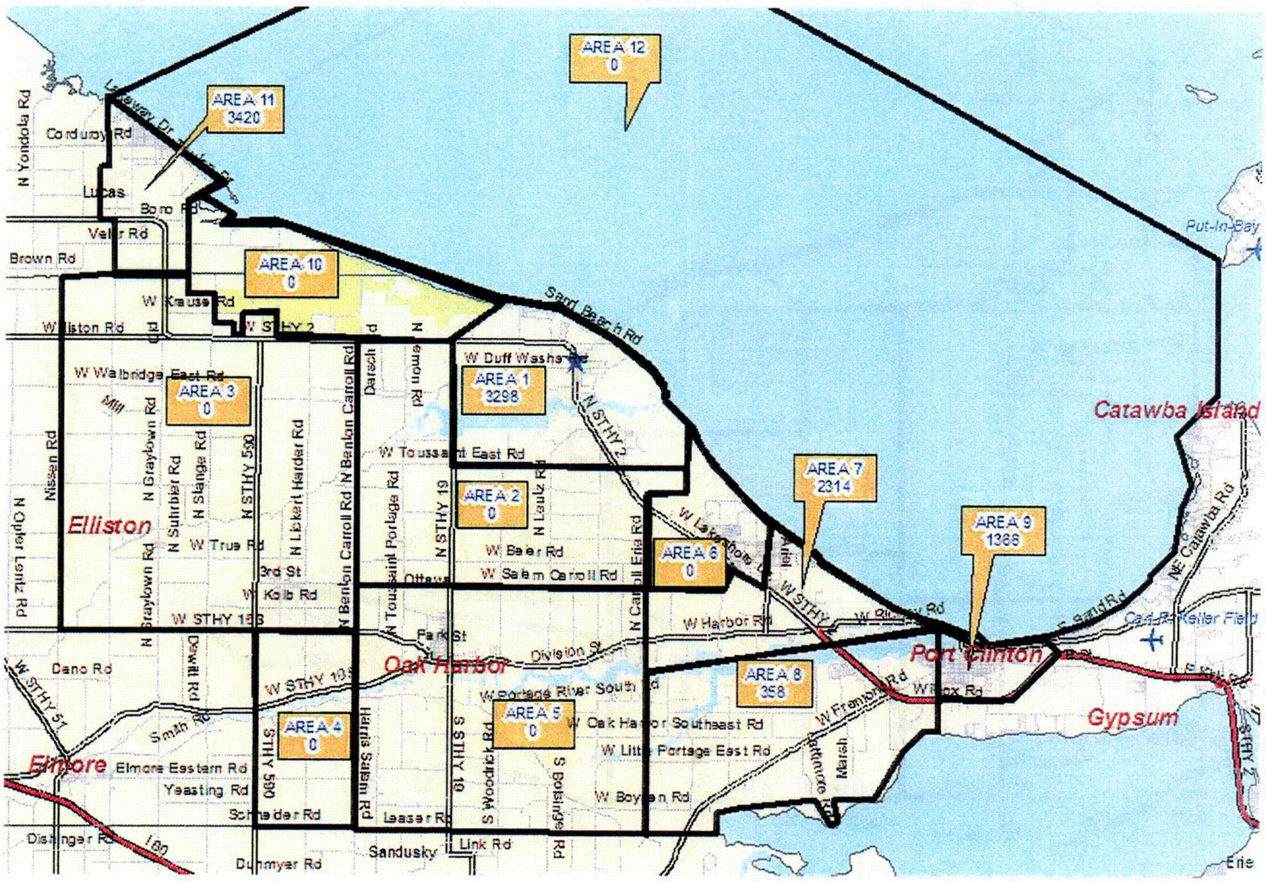


Figure 2-19. Davis Besse EPZ Boater Population

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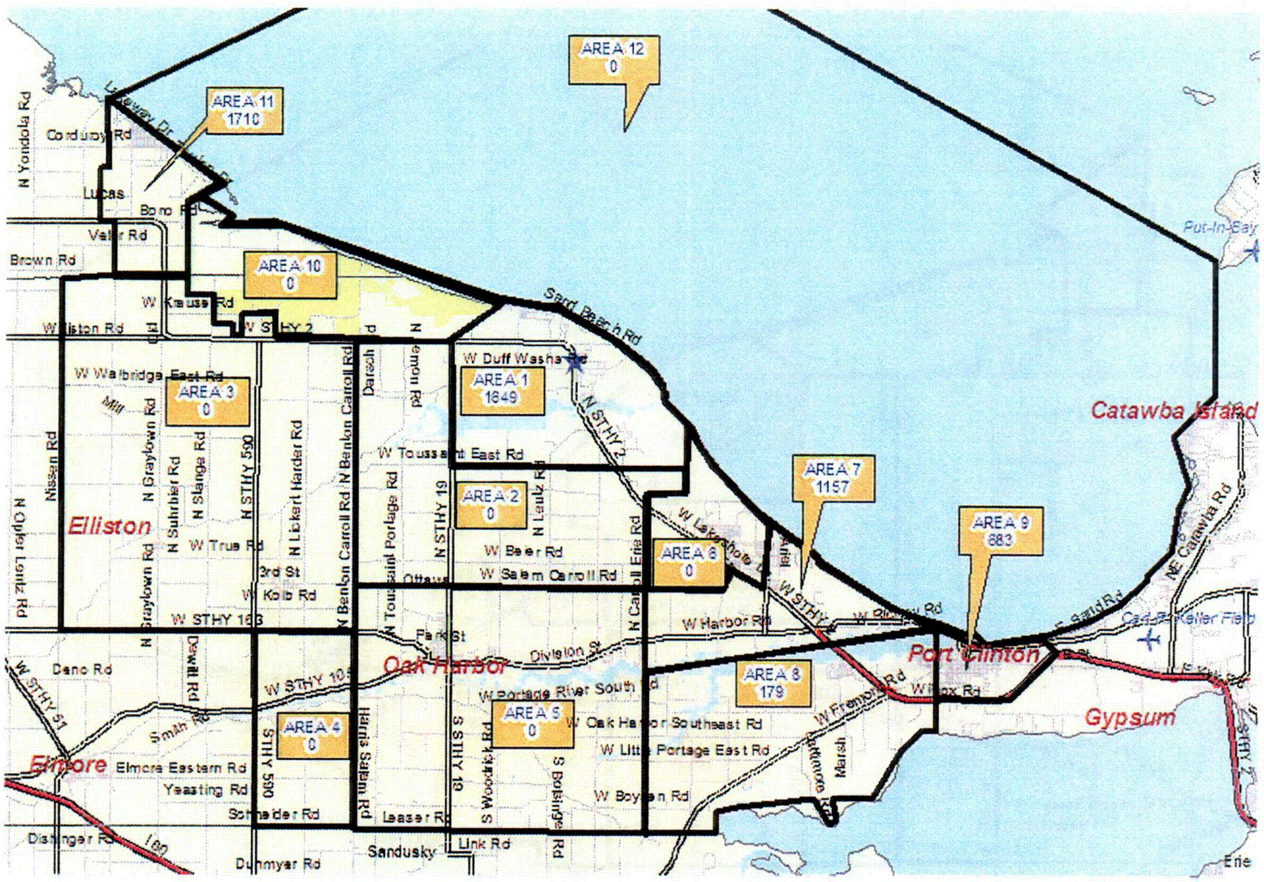
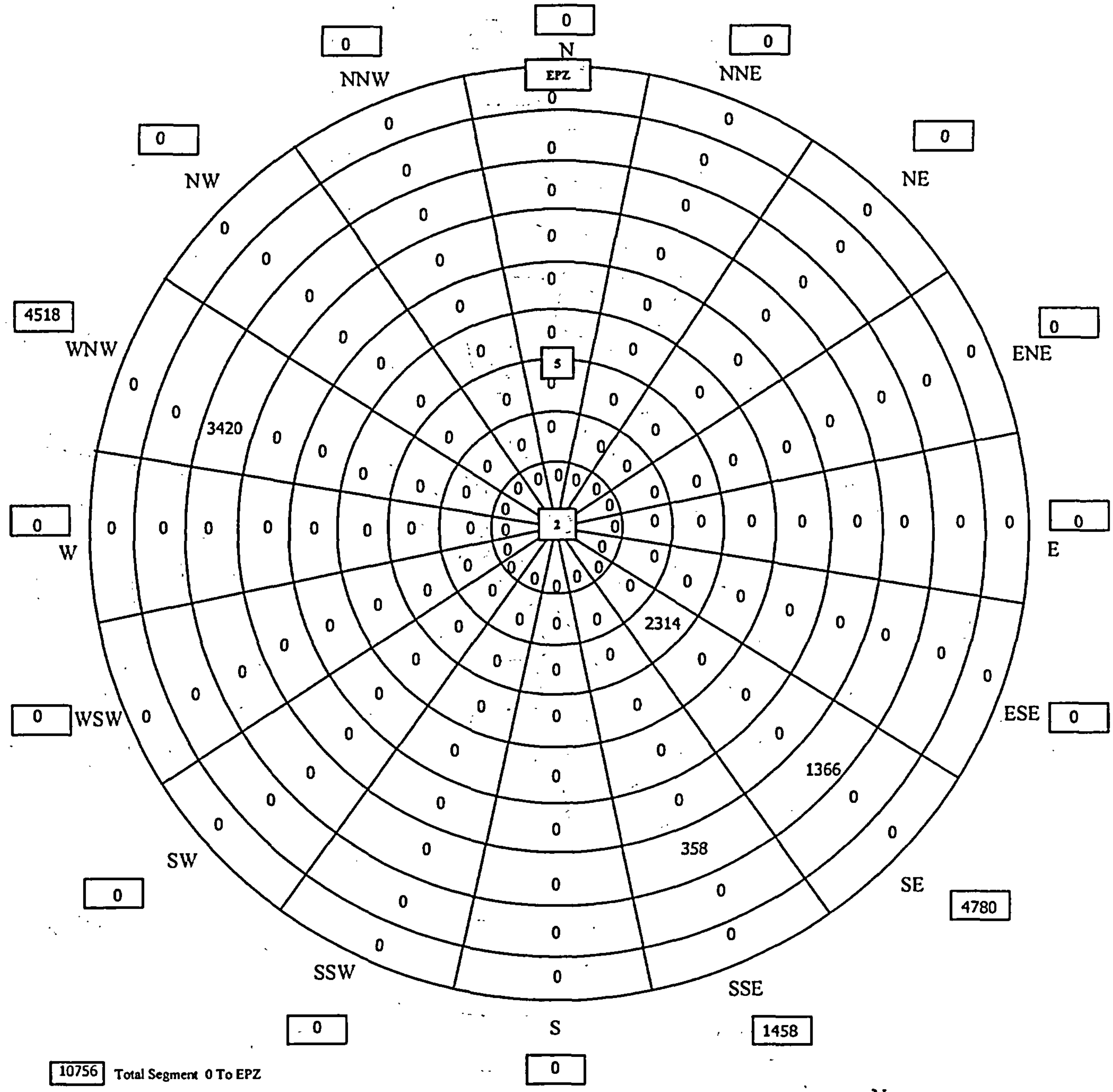


Figure 2-20. Davis Besse EPZ Boater Vehicles

C12A



Boaters			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	3298	0-2	3298
2-5	2314	0-5	5612
5-10	5144	0-10	10756
10-EPZ	0	0-EPZ	10756

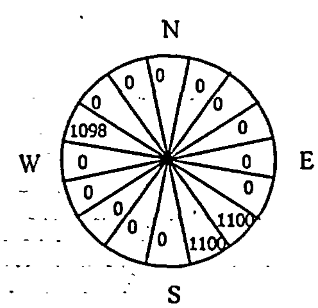
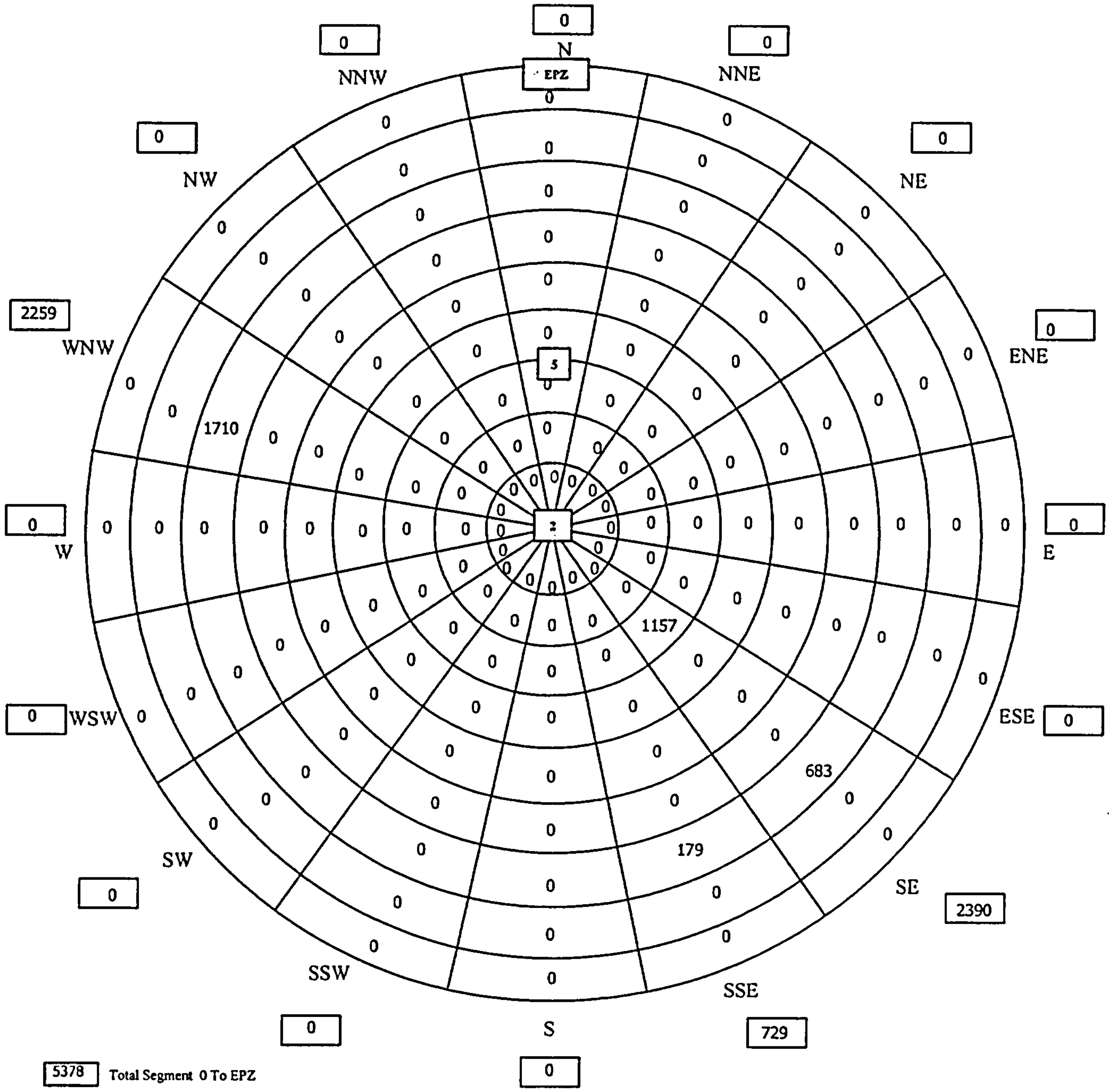
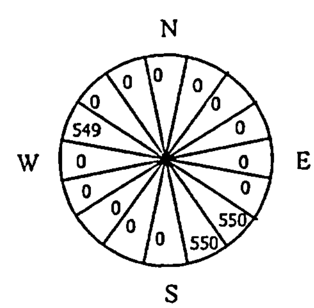


Figure 2-21. Boating Population



Boater Vehicles			
RING MILES	RING SUBTOTAL	TOTAL MILES	CUMULATIVE TOTAL
0-2	1649	0-2	1649
2-5	1157	0-5	2806
5-10	2572	0-10	5378
10-EPZ	0	0-EPZ	5378



DETAIL OF 2 MILE RING

Figure 2-22. Boating Population Vehicles

Table 2-7. Subarea Summary of Population and Vehicle Estimates

Number of People					
	Population Groups				
Subarea	Residents	Seasonal	Employees	Transients	Boaters
1	795	761	700	-	3,298
2	1,120	762	-	70	-
3	2,549	-	-	-	-
4	254	22	-	-	-
5	5,513	23	750	200	-
6	147	340	750	3,333	-
7	1,183	340	-	1,500	2,314
8	1,991	578	-	70	358
9	5,783	1,166	2,500	13,392	1,366
10	107	-	-	6,051	-
11	1,365	-	-	1,467	3,420
12	-	-	-	-	-
Totals	**20,807**	**3,992**	**4,700**	**26,083**	**10,756**
Number of Vehicles					
	Population Groups				
Subarea	**Residents**	**Seasonal**	**Employees**	**Transients**	**Boaters**
1	385	57	700	-	1,649
2	542	57	-	28	-
3	1,248	-	-	-	-
4	124	37	-	-	-
5	2,700	37	750	81	-
6	72	29	750	1,344	-
7	579	29	-	605	1,157
8	975	136	-	28	179
9	2,832	85	2,500	5,400	683
10	52	-	-	2,440	-
11	660	-	-	592	1,710
12	-	-	-	-	-
Totals	**10,169**	**465**	**4,700**	**10,518**	**5,378**

3. ESTIMATION OF HIGHWAY CAPACITY

The ability of the road network to service vehicle demand is a major factor in determining how rapidly an evacuation can be completed. The capacity of a road is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane of roadway during a given time period under prevailing roadway, traffic and control conditions. (From the 2000 Highway Capacity Manual.)

In discussing capacity, different operating conditions have been assigned alphabetical designations, A through F, to reflect the range of traffic operational characteristics. These designations have been termed "Levels of Service" (LOS). For example, LOS A connotes free-flow and high-speed operating conditions; LOS F represents a forced flow condition. LOS E describes traffic operating at or near capacity.

Because of the effect of weather on the capacity of a roadway, it is necessary to adjust capacity figures to represent the prevailing conditions during inclement weather. Based on limited empirical data, weather conditions such as heavy rain reduce the values of free speed and of highway capacity by approximately 10 percent. Over the last decade new studies have been made on the effects of rain on traffic capacity. These studies indicate a range of effects between 10 and 20 percent. Overall, the studies indicate that rain is less of a capacity restraint than previously estimated. During the winter months, we estimate free speed and capacity reductions of approximately 25 percent under snow conditions, as a reasonable expectation.

Given the rural character of the EPZ, its low population density, the availability of well-maintained highways, the absence of pronounced grades and the presence of few small metropolitan areas, congestion arising from evacuation should be mild and short lived. Nevertheless, estimates of roadway capacity must be determined with great care. Because of its importance, a brief discussion of the major factors that influence capacity is presented in this section.

On the approach to intersections

- Saturation queue discharge headways
- Turning movements
- Competing traffic streams
- Control devices, if any
- Signal Timing
- Traffic Guidance
- Traffic Composition
- Approach geometrics and lane channelization

Along highway sections

- Facility Type
- Freeway
- Multi-lane at-grade highway
- Traffic composition

General considerations

- Weather conditions
- Pavement conditions
- Lighting

Capacity Estimations on Approaches to Intersections

At-grade intersections are apt to become the first bottleneck locations under heavy traffic volume conditions. This characteristic reflects the need to allocate access time to the respective competing traffic streams by exerting some form of control. During evacuation, control at critical intersections will often be provided by traffic control personnel assigned for that purpose, whose directions may supersede traffic control devices. The Traffic Management Plan identifies these locations and the management procedures applied.

The per-lane capacity of an approach to a signalized intersection can be expressed in the following form:

$$Q_{cap,m} = \left(\frac{3600}{h_m}\right) \bullet \left[\frac{(G-L)}{C}\right]_m = \left(\frac{3600}{h_m}\right) \bullet P_m$$

where:

Qcap,m	=	Capacity of traffic on an approach, which execute movement, m, upon entering the intersection; vehicles per hour (vph)
h_m	=	Mean queue discharge headway of vehicles on an approach, which are executing movement, m; seconds per vehicle
G_m	=	The mean duration of GREEN time servicing vehicles on an approach, which are executing movement, m, for each control cycle; seconds
L	=	The mean "lost time" for each control cycle; seconds
C	=	The mean duration of each control cycle; seconds
P_m	=	The proportion of time allocated for vehicles executing movement, m, from an approach. This value is specified as part of the control treatment.
m	=	The movement executed by vehicles after they enter the intersection: through, left-turn, right-turn, diagonal.

The turn-movement-specific mean discharge headway h_m, depends in a complex way upon many factors: roadway geometrics, turn percentages, the extent of conflicting traffic streams, the control treatment, and others. A primary factor is the value of "saturation queue discharge headway", h_{sat}, which applies to through vehicles that are not impeded by other conflicting traffic streams. This value, itself, depends upon many factors including motorist behavior. Formally, we can write,

$$h_m = f_m(h_{sat}, F_1, F_2, \ldots)$$

where

h_{sat}	=	Saturation discharge headway for through vehicles; seconds per vehicle
F_1, F_2	=	The various known factors influencing h_m
$f_m(\cdot)$	=	Complex function relating h_m to the known (or estimated) values of h_{sat}, F_1, F_2

The estimation of h_m for specified values of h_{sat}, F_1, F_2, ... is undertaken by a mathematical model[1] which has been programmed into the Traffic Assignment and Traffic Simulation software of the evacuation modeling system. The resulting values for h_m always satisfy the condition:

$$h_m \geq h_{sat}$$

That is, the turn-movement-specific discharge headways are always more than, or equal to, the saturation discharge headway for through vehicles. These headways (or its inverse equivalent, "saturation flow rate"), may be determined by observations or using the procedures of the Highway Capacity Manual.

It is seen that, given the ability to determine h_m from h_{sat}, the determination of capacity of the approaches to intersections depends upon obtaining estimates of h_{sat}. Such estimates were obtained empirically at representative intersections throughout the EPZ. In all cases, the values of h_{sat} used in developing the evacuation plan represent conservative estimates[2] based on this empirical data. Specifically, observed values for h_{sat} ranged from 2.1 to 2.4 sec/veh. Capacity estimates are presented later.

Capacity Estimation Along Sections of Highway

The capacity of highway sections -- as distinct from approaches to intersections -- is a function of roadway geometrics, traffic composition (e.g. percent heavy trucks and buses in the traffic stream) and, of course, motorist behavior. There is a fundamental relationship which relates service volume (i.e. the number of vehicles serviced within a uniform highway section in a given

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1 Lieberman, E., "Determining Lateral Deployment of Traffic on an Approach to an Intersection", McShane, W. & Lieberman, E., "Service Rates of Mixed Traffic on the far Left Lane of an Approach". Both papers appear in Transportation Research Record 772, 1980.

2 Interestingly, studies have shown that h_{sat} decreases (i.e. capacity increases) during periods of congestion, relative to that during off-peak traffic conditions. This behavior reflects the fact that motorists are more attentive and are highly motivated to reduce their travel time, during congested conditions. Our estimates do not include this beneficial effect.

time period) to traffic density. Figure 3-1 describes this relationship.

As indicated, there are two flow regimes: (1) Free Flow (left side at curve); and (2) Forced Flow (right side). In the Free Flow regime, the traffic demand is fully serviced; this service volume increases as demand volume and density increase, until the service volume attains its maximum value, V_E, which is the capacity of the highway section. As traffic demand and the resulting highway density increase beyond this "critical" value, the rate at which traffic can be serviced (i.e. the service volume) actually declines below capacity. Therefore, in order to realistically represent traffic performance during congested conditions (i.e. when demand exceeds capacity), it is necessary to estimate the service volume, V_F, under congested conditions.

The value of V_F can be expressed as:

$$V_F = R \bullet V_E$$

where R = Reduction factor which is less than unity.

Based on empirical data collected on freeways, we have employed a value of R=0.85. It is important to mention that some investigators, on analyzing data collected on freeways, conclude that little reduction in capacity occurs even at Level of Service, F. While there is conflicting evidence on this subject, we adopt a conservative approach and use a value of capacity, V_F, that is lower than capacity, during LOS F conditions.

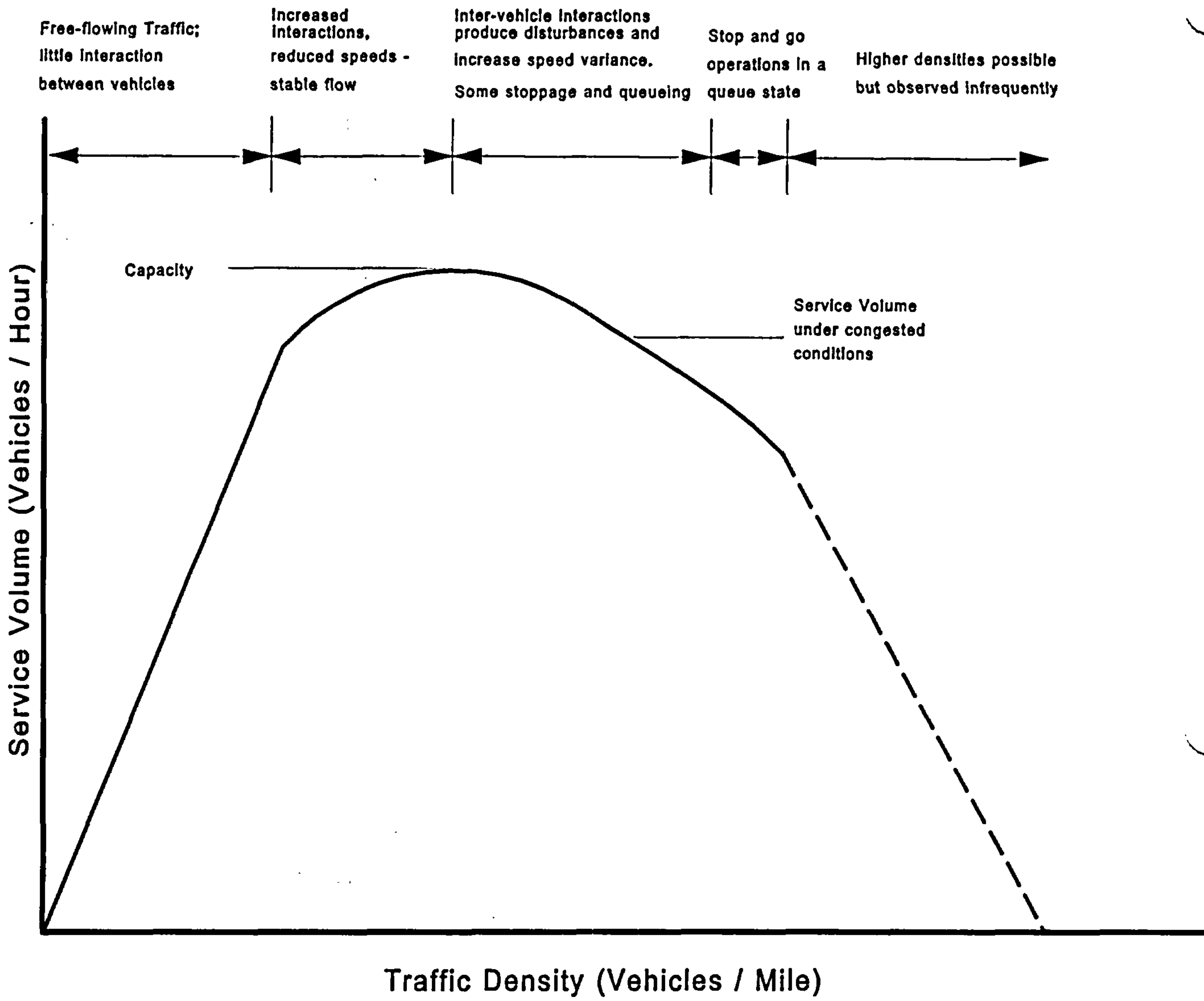

Figure 3-1. Fundamental Relationship between Volume and Density

The estimated value of capacity is based primarily upon the type of facility and on roadway geometrics. Sections of roadway with adverse geometrics are characterized by lower free-flow speeds and lane capacity.

The procedure used here was to estimate "section" capacity, V_E, based on our observations traveling over each section of the evacuation network, by the posted speed limits and travel behavior of other motorists and by reference to the 2000 Highway Capacity Manual. We then determined for each highway section, represented as a network link, whether its capacity would be limited by the "section-specific" service volume, V_E or by the intersection- specific capacity. For each link, we selected the lower value of capacity.

Application to the Davis Besse EPZ

As part of the development of the Davis Besse EPZ traffic network, an estimate of roadway capacity is required. The source material for the capacity estimates presented herein is contained in:

2000 Highway Capacity Manual (HCM), Special Report 209
Transportation Research Board
National Research Council
Washington, D.C.

The highway system in the Davis Besse EPZ consists primarily of three categories of roads:

- Two-lane roads: Local, State
- Multi-lane Highways (at-grade)
- Freeways
- Intersections

Each of these classifications will be discussed.

Two-Lane Roads

Ref: HCM Chapter 20

Two lane roads comprise the majority of highways within the EPZ. The per-lane capacity of a two-lane highway is estimated at 1700 passenger cars per hour (pc/h). This estimate is essentially independent of the directional distribution of traffic volume except that, for extended distances, the two-way capacity will not exceed 3200 pc/h. The HCM procedures then estimate Level of Service (LOS) and Average Travel Speed. The evacuation simulation model computes average speed as the outcome of its computations.

Based on the field survey and on expected traffic operations associated with evacuation scenarios:

- Most sections of two-lane roads within the EPZ are classified as "Class I", with "level terrain"; some are "rolling terrain".
- "Class II" highways are mostly those within city limits..

Multi-Lane Highway

Ref: HCM Chapter 21

Exhibit 21-23 (in the HCM) presents a set of curves that indicates a per-lane capacity of approximately 2100 pc/h, for free-speeds of 55-60 mph. Based on observation, this class of highways within the EPZ service traffic with free-speeds in this range.

Freeways

Chapter 22 describes a procedure for integrating the results obtained in Chapters 23, 24 and 25, which compute capacity and LOS for freeway components. The discussion also references

Chapter 31, which presents a discussion on simulation models. The simulation model automatically undertakes this integration process.

Chapter 23 presents procedures for estimating capacity and LOS for "Basic Freeway Segments". Exhibit 23-3 of the HCM2000 presents capacity vs. free speed estimates.

Free Speed:	55	60	65	70+
Per-Lane Capacity (pc/h):	2250	2300	2350	2400

The inputs to the simulation model are coded geometrics appropriately based on observed free speeds and the simulation logic decreases speeds as traffic demand volume approaches capacity.

Chapter 24 presents procedures for estimating capacity, speed, density and LOS. The simulation model contains logic that relates speed to demand volume: capacity ratio. The value of capacity that is obtained from Exhibit 24-8 (of the HCM2000), depends on the "Type" and geometrics of the weaving segment and on the "Volume Ratio" (ratio of weaving volume to total volume).

Chapter 25 presents procedures for estimating capacities of ramps and of "merge" areas. The capacity of a merge area "is determined primarily by the capacity of the downstream freeway segment". Values of this merge area capacity are presented in Exhibit 25-7 of the HCM2000, and depend on the number of freeway lanes and on the freeway free speed. The KLD simulation model logic performs the merging operations of the ramp and freeway traffic. If congestion results from an excess of demand relative to capacity, then the model allocates service appropriately to the two entering traffic streams and produces LOS F conditions. (The HCM does not address LOS F explicitly).

Intersections

Ref: HCM Chapters 16, 17

Procedures for estimating capacity and LOS for approaches to intersections are presented in Chapters 16 (signalized intersections) and 17 (unsignalized intersections). These are the two longest chapters in the HCM 2000, reflecting the complexity of these procedures. The simulation logic is likewise complex, but different; as stated on page 31-21 of the HCM2000:

> *"Assumptions and complex theories are used in the simulation model to represent the real-world dynamic traffic environment. "*

The KLD simulation model used for estimating ETE for emergency evacuation have been in use for many years and are proven products.

4. ESTIMATION OF TRIP GENERATION TIME

Federal Government Guidelines (see NUREG 0654, Appendix 4) specify that the planner estimate the distributions of elapsed times associated with activities undertaken by the public in preparation for evacuation. We define the sum of these distributions of elapsed times, to be defined later, as the Trip Generation Time Distribution.

Background

In general, an accident at a nuclear power station attains one or more "classes" of Emergency Action Levels (see Appendix 1 of NUREG 0654 for details):

1. Unusual Event
2. Alert
3. Site Area Emergency
4. General Emergency

At each level, the Federal Guidelines specify a set of Actions to be undertaken by the Licensee, and by State and Local offsite authorities. If we limit this discussion to the evacuation decision action, then the first off-site public notification and response can occur at the time of the Site Area Emergency.

There is an exception to this rule in the Emergency Plan for the Davis Besse Station. It is now contemplated that the public will be notified to clear the parks and lake areas at the Alert Level as a precautionary action.

As a Planning Basis, we will adopt a conservative posture, in accord with Federal Regulations, that a rapidly escalating accident will be considered in calculating the Trip Generation Time. We will assume:

- The accident escalates almost immediately to a Site Area Emergency.
- That further escalation to a General Emergency occurs 15 minutes later.
- That the order to evacuate is transmitted to the public 10 minutes after the General Emergency is declared.

We emphasize that the adoption of this planning basis is not a representation that these events can occur at the Davis Besse Station within the indicated time frame. Rather, these assumptions are only necessary in order to:

- Establish a temporal framework for estimating the Trip Generation distribution in the format recommended in Appendix 4 of NUREG 0654.
- Identify temporal points of reference for the purpose of uniquely defining "Clear Time" and Evacuation Time Estimates (ETE).

It is more likely that a longer time will elapse between the various classes of an emergency at Davis Besse. For example, suppose two hours elapse from the declaration of a General Emergency to the Order to Evacuate. In this case, it is reasonable to expect some degree of spontaneous evacuation during this two-hour period. As a result, the population within the EPZ will be lower when the Order to Evacuate is announced, than at the time of the General Emergency. Thus, the time needed to evacuate the EPZ, after the Order to Evacuate will be significantly less than the estimates presented in this report.

On the other hand, there is a low probability that an "immediate" General Emergency can arise, with the Order to Evacuate given almost simultaneously. In this case, the evacuation time estimates (ETE) will be somewhat longer than the figures presented herein.

The planning basis adopted here approximates the "worst case" conditions, and is within 25 minutes of the most extreme condition.

The notification process consists of two events:

- Transmitting information (e.g. using sirens, tone alerts, EAS broadcasts, loudspeakers).
- Receiving and correctly interpreting the information that is transmitted.

The peak population within the EPZ exceeds 70,000 persons who are deployed over an area of approximately 300 square miles (including Lake Erie), and engaged in a wide variety of activities. It must be anticipated that some time will elapse between the transmission and receipt of the information advising the public of an accident.

The amount of elapsed time will vary from one individual to the next depending where that person is, what that person is doing, and related factors. Furthermore, persons who will be directly involved with the evacuation process may be outside the EPZ at the time that the emergency is declared. These people may be commuters, shoppers and other travelers who reside within the EPZ and who will return to join the other members in the household upon receiving notification of an emergency.

As indicated in NUREG 0654, the estimated elapsed times for the receipt of notification can be expressed as a distribution reflecting the different notification times for different people within, and outside, the EPZ. By using time distributions, it is also possible to distinguish between different population groups and different day-of-week and time-of-day scenarios, so that more accurate assessments may be obtained.

For example, people at parks will be alerted with loudspeakers; there will be little time lost between transmission and receipt of information. Other persons, located inland within the EPZ will be notified by siren and radio. Those well outside the EPZ will be notified by telephone, radio, TV and word-of-mouth, with potentially longer time lags.

Furthermore, the spatial distribution of the EPZ population will differ with time of day -- families will be united in the evenings and at night, but dispersed during the day. In this respect, weekends will differ from weekdays.

Fundamental Considerations

The environment leading up to the time that people begin their evacuation trips, consist of a sequence of events and activities. Each event (other than the first) occurs at an instant in time and is the outcome of an activity.

Activities are undertaken over a period of time. Activities may be in "series" (i.e. to undertake an activity implies the completion of all preceding events) or may be in parallel (two or more activities may take place over the same period of time).

Activities conducted in series are functionally dependent on the completion of prior activities; activities conducted in parallel are functionally independent of one-another. The relevant events associated with the public's preparation for evacuation are:

Event Number	Event Description
1	No-accident condition
2	Awareness of accident situation
3	Depart place of work
4	Arrive home
5	Leave home to evacuate the area

Associated with each sequence of events are one or more activities, as outlined below:

Event Sequence	Activity
1 --> 2	Public receives notification information
2 --> 3	Prepare to leave work
2,3 --> 4	Travel home
2,4 --> 5	Prepare to leave for evacuation trip

These relationships may be depicted graphically as shown in Figure 4-1.

Note that event 5, "Leave to evacuate the area" is conditional either on event 2 or event 4. That is, activities 2 --> 5 can be undertaken in parallel with activities 2 --> 3, 3 --> 4 and 4 --> 5, as shown in Figure 4-1 (a) and (c). Specifically, it is possible that one adult member of a household can prepare to leave home (i.e. secure the home, pack clothing, etc.), while others are traveling home from work. In this instance, the household members would be able to evacuate sooner than if such preparation had to be deferred until all household members had returned home. However, we will adopt the conservative posture that all activities will occur in sequence.

It is seen from Figure 4-1, that the Trip Generation time (i.e. the total elapsed time from Event 1 to Event 5) depends on the scenario and will vary from one household to the next. Furthermore, Event 5 depends, in a complicated way, on the time distributions of all activities leading to that event. Specifically, in order to estimate the time distribution of Event 5, we must somehow obtain estimates of the time distributions of all preceding events.

Estimated Time Distributions of Activities Preceding Event 5

The time distribution of an event is obtained by "summing" the time distributions of all prior contributing activities. (This "summing" process is quite different than an algebraic sum since we are operating on distributions -- not numbers).

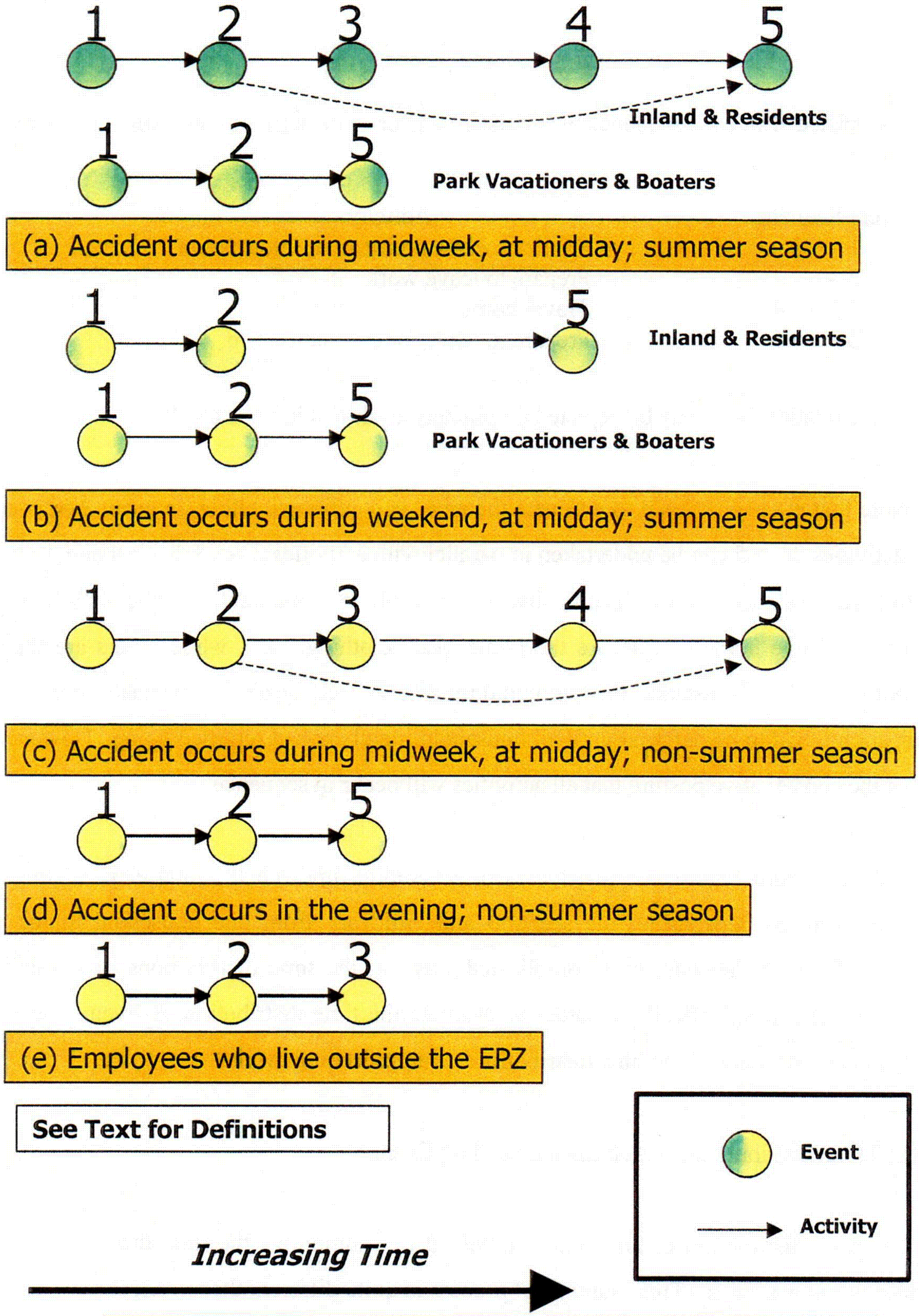

Figure 4-1. Events and Activities Preceding the Evacuation (See Text for definitions)

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Time distribution of the Notification Process - Activity 1 → 2)

We know of no survey that has accumulated empirical information describing the rate at which notification information is received. Nevertheless, there is sufficient data to obtain a reasonable estimate of a notification time frame, based largely on the information obtained from the telephone survey. (See Appendices F and G).

The following information is relevant:

Percentage of commuters working within the EPZ: 63%
Average Household (HH) Size: 2.48
Avg. Number of Commuters per HH: 1.12
Percentage of Residents who will be within the EPZ if accident occurs at mid-week, mid-day:

$$\frac{0.63\,(1.12) + (2.48 - 1.12)}{2.48} \times 100 = 83.3$$

The population within the EPZ includes 83 percent of all residents, as computed above, and 100 percent of all tourists and employees, by definition.

It is reasonable to expect that 80 percent of those within the EPZ will be aware of the accident within 15 minutes with the remainder notified within the following 15 minutes. The commuters outside the EPZ will be notified somewhat later, say uniformly between 10 and 40 minutes. Park area population will be notified within 15 minutes. The resulting distributions for this notification activity are given below.

The Ohio National Guard, assisted by the Ohio Department of Natural Resources and the Ohio Department of Transportation, will notify boaters on the lake. The U.S. Coast Guard will issue an urgent "Notice to Mariners". It is anticipated that about 1/2 hour would elapse before significant numbers of boats are notified. It is conservatively assumed that most boats do not have radios, or the radios are not tuned to the emergency frequencies. The lake notification distribution is shown as distribution 1C.

Distribution No. 1, Notification Time: Activity 1 → 2

Elapsed Time (Min)	Cumulative Percent Notified		
	General Population	Persons at the Park	Persons on Lake Erie
5	15	20	0
10	46	60	0
15	79	100	0
20	85		0
25	90		0
30	95		20
35	98		60
40	100		100

It is reasonable to expect that the vast majority of business enterprises within the EPZ will elect to shut down following notification. Most employees would take action to leave work quickly. Commuters, who work outside the EPZ could, in all probability, also leave quickly since facilities outside the EPZ would remain open and other personnel would remain. Personnel responsible for equipment would require additional time to secure the facility. The distribution of Activity 2 --> 3 reflects data obtained by the telephone survey. This distribution is plotted in Figure 4-2 and listed below as Distribution 2.

Distribution No. 2, Time to Prepare to Leave Work: Activity 2 → 3

Elapsed Time (Min)	Cumulative Percent Leaving Work
5	61
10	75
15	85
20	87
25	89
30	96
35	97
40	97
45-105	99
110	100

NOTE: The survey data was normalized to distribute the "Don't know" response

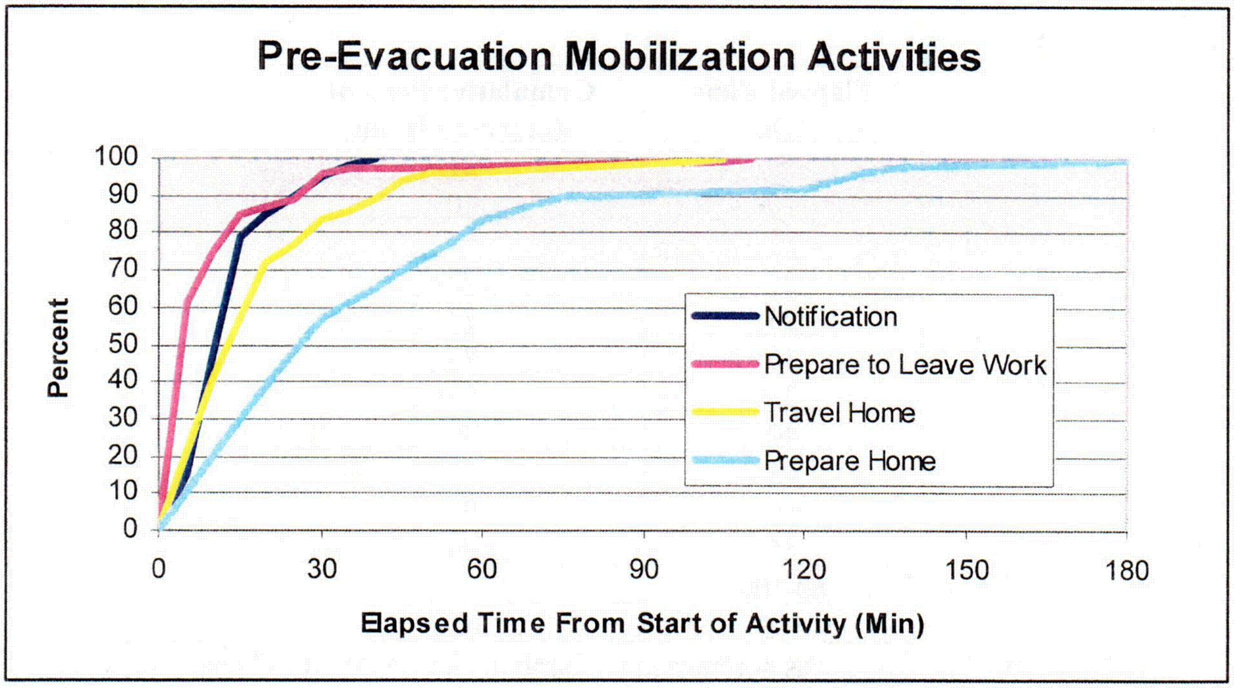

Figure 4-2. Mobilization Activity Time Distributions

Distribution No. 3, Time to Travel Home: Activity 3 ➞ 4

This data is provided directly by the telephone survey. This distribution is plotted in Figure 4-2 and listed below:

Elapsed Time (Min)	Cumulative Percent Returning Home
5	21
10	40
15	57
20	72
25	77
30	84
35	86
40	89
45	94
50	96
55	96
60-100	99
105	100

NOTE:The survey data was normalized to distribute the "Don't know" response

Distribution No. 4, Time to Prepare to Leave Home: Activity 2,4 ⟶ 5

This data is provided directly by the telephone survey. This distribution is plotted in Figure 4-2 and listed below:

Distribution 4A: Residents

Elapsed Time (Min)	Cumulative Percent Ready to Evacuate	Elapsed Time (Min)	Cumulative Percent Ready to Evacuate
5	10	65	86
10	20	70	88
15	30	75	90
20	39	80	90
25	48	85-105	91
30	57	110-120	92
35	61	125	94
40	65	130	96
45	70	135	97
50	74	140	98
55	78	145-175	99
60	84	180	100

NOTE: The original data was obtained in 15-minute increments. The above figures were calculated by interpolation and normalized as before.

Distribution 4B: Tourists at Parks or Shopping

Distribution 4B describes the estimated preparation time to leave the park area. While we have no empirical data to support this distribution, we do know the physical domain of the park area and the activities involved. After notification, people at Crane Creek Park beach or out walking would merely gather their belongings and walk to their respective cars.

Since we know that congestion will occur on the park access roads during the summer and that evacuation time will exceed Trip Generation time, any inaccuracies in the distribution will not influence the ETE. Thus, an approximate, reasonable distribution will satisfy our needs.

Visitors to the park are day-trippers, about 50 percent of these people should be able to access their respective cars within 30 minutes of the receipt of the notification information and be ready to depart. The balance, those hiking or away from beach areas, might require up to one additional hour before they are ready to depart. The resulting distribution follows:

Elapsed Time (Min)	Cumulative Percent Ready to Evacuate	Elapsed Time (Min)	Cumulative Percent Ready to Evacuate
5	5	50	70
10	10	55	75
15	20	60	80
20	30	65	85
25	40	70	90
30	50	75	92
35	55	80	95
40	60	85	98
45	65	90	100

Distribution 4C Boaters on Lake Erie

Distribution 4C describes the time required to return a boat to a marina and load it on a trailer. This distribution was obtained from the telephone survey. The data were normalized to distribute the "Don't Know" responses. Although the distribution was developed for boats launched from boat trailers, it is applied also to those boats which return to boat slips. Inaccuracies in the distribution of boater response times will not affect the ETE since we can expect traffic congestion developing on the marina access roads. As was the case for Distribution 4B, a reasonable distribution will satisfy our needs.

Elapsed Time Min	Cumulative Percent Ready to Evacuate	Elapsed Time Min	Cumulative Percent Ready to Evacuate
5	8	95	90
10	16	100	91
15	32	105	92
20	48	110	93
25	53	115	94
30	66	120	95
35	69	125	95
40	72	130	95
45	75	135	96
50	77	140	96
55	78	145	96
60	79	150	97
65	81	155	97
70	83	160	98
75	85	165	98
80	87	170	99
85	89	175	99
90	90	180	100

Calculation of Trip Generation Time Distribution

The time distributions for each of the preliminary activities presented herein must be combined to form the appropriate Trip Generation Distribution. Events can combine in two forms, serially or in parallel. A serial combination of events requires that Event k be completed before Event K+1 may begin. For example, before the home can be prepared for departure, a family must have completed the trip home. A parallel combination of events implies that Event k may occur during the same period of time as Event k+1. For example, as one member of the family prepares the home for departure, another member of the family could be clearing the driveway of snow.

The combination algorithms are applied repeatedly as shown to form the required distributions:

Apply Algorithm No. 1 To	In Order To Obtain Dist. For	Which Is Named Distribution
Distributions 1A and 2	Event No. 3	A
Distributions A and 3	Event No. 4	B
Distributions B and 4	Event No. 5	C
Distributions 1B and 4B	Event No. 5	D
Distributions 1C and 4C	Event No. 5	E

Distributions A-E are described below:

Distribution	Explanation
A.	Time distribution of commuters leaving work. Also applies to employees who work within the EPZ who live outside the EPZ.
B	Time distribution of commuters arriving home.

C	Time distribution of residents with commuters leaving home to begin the evacuation trip.
D	Time distribution of tourists and park attendees leaving the area to begin the evacuation trip.
E	Time distribution of boaters on the lake leaving the area to begin the evacuation trip.

Trip Generation Distributions for Peak Season Scenarios

For these scenarios it is assumed that the notification process for the park and lake populace begins at the Alert level, while that for the rest of the EPZ begins 15 minutes later at the General Emergency level.

In general, the sirens will not be activated until the General Emergency level is reached. A General Emergency is assumed 15 minutes after the Site Area Emergency level. We also postulate that the evacuation order is given 10 minutes after the General Emergency is declared. Thus, for the "planning-basis" accident scenario, we postulate two evacuation stages (park, lake and inland), which are displaced in time with respect to one-another:

1. The Trip Generation time distribution for the park areas and the lake has its origin point (i.e. time, zero) at the time of the announcement of the Site Area Emergency (assumed to be concurrent with the Alert level).

2. The Trip Generation time distribution for the remainder of the EPZ has its origin point (i.e. time zero) at the time of the issuance of the order to evacuate, which is assumed to take place 10 minutes after the General Emergency is declared, or 25 minutes after the Site Alert and Site Area Emergency.

Figure 4-3 presents the combined trip generation distributions previously designated A,C,D, and E. These distributions are presented on the same time scale. Note that when the order to evacuate is given to the general population, 10 percent of the vehicles at the parks have begun their trips out of the EPZ.

Note also that the first boaters to begin leaving the area do so at about 20 minutes after the order to evacuate is given to the general population. Although boaters are notified earlier, their longer response time means few, if any, of them begin their trips out of the EPZ before the general population.

The I-DYNEV model is designed to accept varying rates of trip generation for each origin centroid, expressed in the form of histograms. We partition these centroids into four sets -- those for residents, employees, park attendees, and boaters. These histograms, which represent Distributions C, A, D, and E, properly displaced with respect to one another, are tabulated in Table 4-1 and shown in Figure 4-3.

Table 4-1. Trip Generation Time Histograms for Midweek and Weekend Scenarios

	Percent of Total Trips Generated							
	Dist. C		Dist. A		Dist. D		Dist. E	
	Residents		Employees		Parks		Boaters	
Time Period Relative to Time of Order to Evacuate (Hr:Min)	**Trips**	**Rate**	**Trips**	**Rate**	**Trips**	**Rate**	**Trips**	**Rate**
-0:25 to 0:00	1	2	0	0	10	24	1	2
0:00 to 0:15	1	4	30	120	28	112	1	4
0:15 to 0:30	2	4	46	184	21	84	27	108
0:30 to 0:45	13	52	18	72	15	60	32	128
0:45 to 1:00	18	72	4	16	14	56	13	52
1:00 to 1:15	17	68	2	8	9	36	5	20
1:15 to 1:30	16	64	0	0	3	12	6	24
1:30 to 2:00	17	34	0	0	0	0	13	26
2:00 to 3:00	15	15	0	0	0	0	2	2
3:00 +	0	0	0	0	0	0	0	0

Units: Trips, percent of total trips generated at the origin centroids during indicated Time Period
Rate: Percent of total trips per hour during indicated Time Period
Note: Time zero for Distributions D and E occurs 25 minutes prior to the Order to Evacuate, i.e. at the Site Area Emergency level.

These tabulations present the trips generated and the rates of trip-making within each indicated time period, both expressed as a percentage of the total number of trips to be generated at each centroid. The rate of trip making is found by:

$$\text{Rate} = \frac{\text{Trips generated in Time Period (percent)}}{\text{Duration of Time Period (hours)}}$$

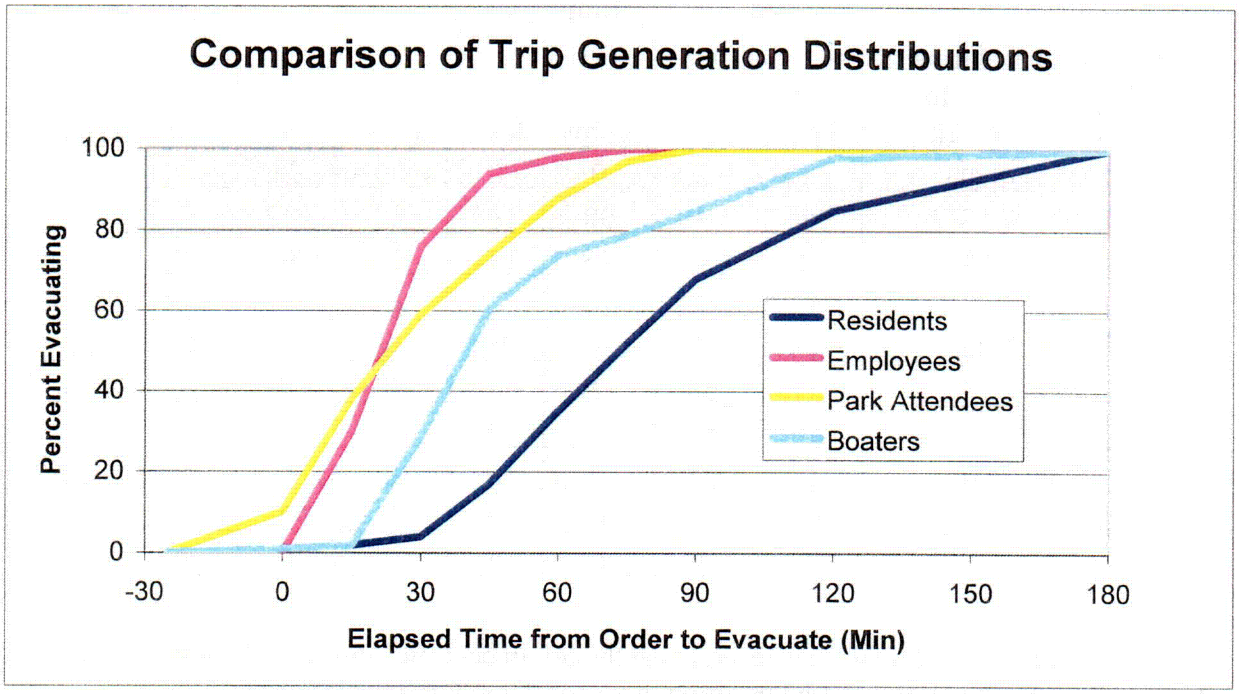

Figure 4-3. Comparison of Trip Generation Distributions

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Snow Clearance Time Distribution

Inclement weather scenarios involving snowfall must address the time lags associated with snow clearance. Discussions with local officials indicate that snow plowing equipment is mobilized and deployed during the snowfall to maintain passable roads. The general consensus is that their efforts are generally successful for all but the most extreme blizzards when the rate of snow accumulation exceeds that of snow clearance over a period of many hours.

Consequently, it is reasonable to assume that the highway system will remain passable -- albeit at a lower capacity -- under the vast majority of snow conditions. Nevertheless, for the vehicles to gain access to the highway system, it is necessary for driveways and employee parking lots to be cleared to the extent needed. These clearance activities take time, and this time lag must be incorporated into the trip generation time distributions. Thus, we must postulate a separate distribution for the driveway snow clearance activity and then introduce this distribution into the procedure used to calculate the trip generation time distribution.

The time needed to clear a driveway depends on the depth of snow, the available equipment and the number of able-bodied personnel to perform the task. Since this area is accustomed to heavy recurring snowfalls, it is reasonable to expect that virtually all households have made provision for snow clearance by either owning some form of equipment or by contracting for such service to be performed by others. The following distribution is postulated based on discussions with people in the area, for a heavy snowfall.

Elapsed Time (Min)	Cumulative Percent Driveways Cleared
15	5
30	10
45	25
60	40
90	70
120	90
150	100

It is recognized that the snow clearing activity can take place in parallel with other activities, e.g. preparing for evacuation. Nevertheless, we will adopt the conservative point of view that this activity follows the preparation activity, rather than proceeding in parallel with it. This posture will lengthen the temporal extent of the trip generation process.

The above distribution will be identified as Distribution 5. The event "Driveways cleared of snow" will be identified as Event No. 5 and the event "Leave to Evacuate" is Event No. 6 for scenarios involving snow conditions.

We must then perform the following additional operations to compute the trip generation distributions for the inclement weather, snow scenarios:

Apply Algorithm No. 1 To	In Order To Obtain Dist. For	Which Is Named Distribution
Distributions A and 5	Event No. 6	F
Distributions C and 5	Event No. 6	G

The results of these calculations are shown in Table 4-2 in a format consistent with the others. Note:

- Distribution F applies to employees
- Distribution G applies to residents during mid-day.

Table 4-2. Trip Generation Time Histograms for the Inclement Weather, Snow, Scenarios (Distributions F, G)

Time Period Relative to Time of Order to Evacuate (Hr:Min)	Percent of Total Trips Generated			
	Dist. F Employees		Dist. G Residents	
	Trips	Rate	Trips	Rate
0:00 to 0:30	13	26	1	2
0:30 to 1:00	46	92	1	2
1:00 to 1:30	24	48	6	12
1:30 to 2:00	6	12	17	34
2:00 to 3:00	11	11	44	44
3:00 to 4:00	0	0	22	22
4:00 to 4:30	0	0	9	9
4:30 +	0	0	0	0

Units: Trips, percent of total trips at centroid Rate, percent of total trips per hour.

Note: Time zero for these Distributions occurs at the start of the General Emergency.

Evening Evacuation Scenarios

During evening hours the general population is assumed to gather in household groupings. Thus, the times associated with leaving places of employment and traveling home need not be considered. Following notification, the only pre-evacuation activity is the preparation to leave home.

Table 4-3 presents the trip generation distributions for evening scenarios. Note that, for evening scenarios, all trips have been generated over a two-hour period as compared with three hours for midday scenarios.

Table 4-3. Trip Generation Time Histograms for Evening Scenarios

Time Period Relative to Time of Order to Evacuate (Hr:Min)	Percent of Total Trips Generated	
	Residents	
	Trips	Rate
0:00 to 0:15	6	24
0:15 to 0:45	49	98
0:45 to 1:15	28	56
1:15 to 2:00	17	23
2:00 +	0	0

5. DEMAND ESTIMATION FOR EVACUATION SCENARIOS

An evacuation case may be defined as a combination of the region to be evacuated and the scenario under consideration. The definition of region and scenario is as follows:

Region - A grouping of evacuation subareas, which are designed to satisfy the need to evacuate specific subsets of the EPZ due to such factors as wind direction, and accident severity.

Scenario - A combination of time of day, season and weather conditions. Scenarios define the members of and response time for various population groups.

A total of 10 regions were defined which encompass all of the potential groupings of subareas to be considered. These regions are shown in Table 5-1. Subareas are shown in Figure 5-1.

Table 5-1. Definition of Evacuation Regions

Radial Distance	Subareas To Be Evacuated	Comment
0-2 Miles	1,10,12	Crane Creek Park & Wildlife Refuge and boaters on the Lake are alerted for all scenarios.
0-5 Miles	1,2,10,12	Any winds from the north to the southeast
	1,6,10,12	Northwest winds
	1,2,6,10,12	Entire 5-Mile region
0-10 Miles	1,6,7,8,9,10,12	Northwest winds
	1,2,5,6,7,8,9,10,12	North winds
	1,2,3,4,5,10,11,12	Northeast winds
	1,2,3,10,11,12	East winds
	1,10,11,12	Southeast winds
	1 – 12	Entire 10-Mile region

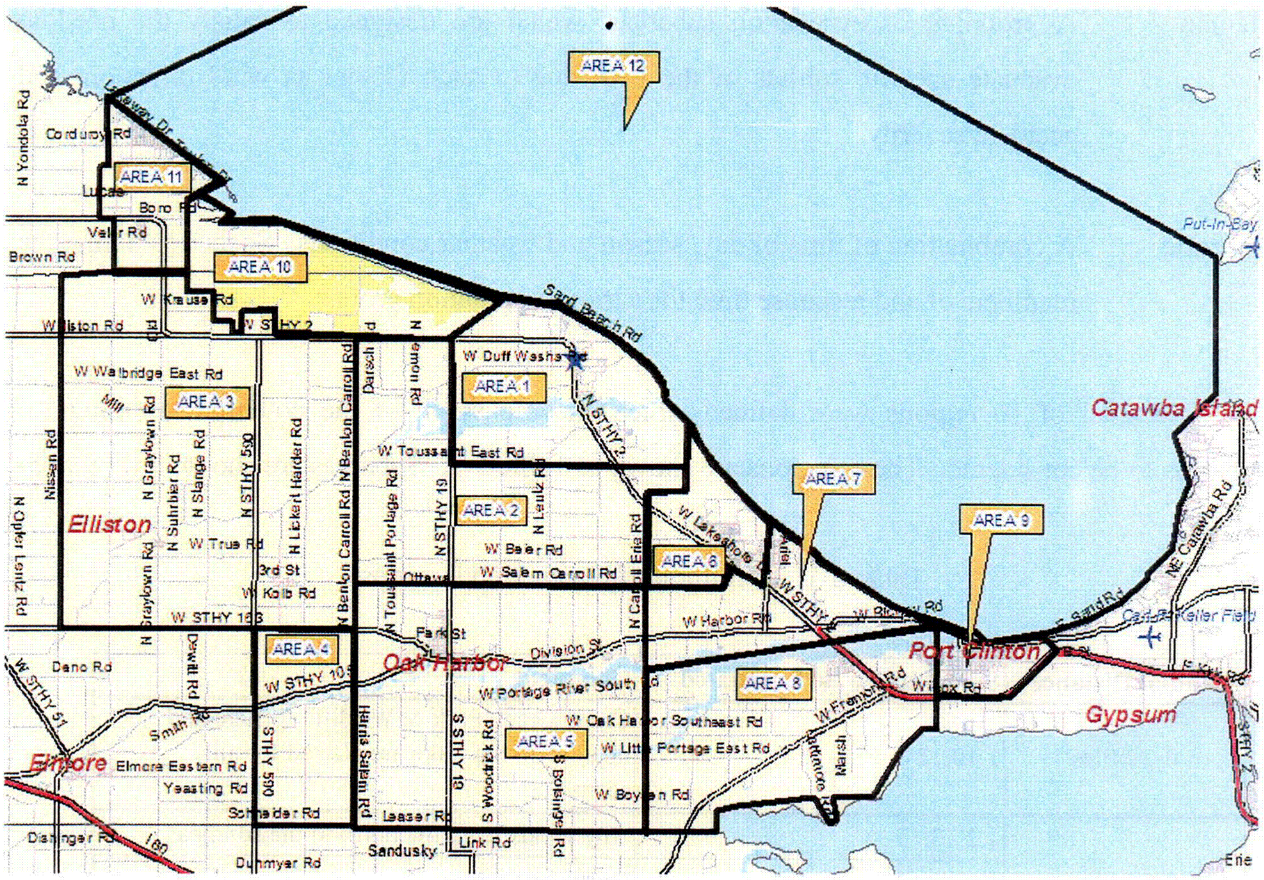

Figure 5-1. Davis Besse Subareas

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A total of 11 scenarios were evaluated for all regions (110 cases). The following is a description of all scenarios:

Scenario 1 - Summer, Midday, Midweek, Good Weather

This is a peak season scenario. Both general and seasonal population groups are present. Employment is at high levels (work to home trips are significant).

Scenario 2 - Summer, Midday, Midweek, Rain

The same population conditions exist as in Scenario 1. Sudden rain showers are hypothesized which reduce roadway capacity and speeds by 20 percent.

Scenario 3 - Summer, Midday, Midweek, Rain/Flooding

This scenario envisions low lying areas in the EPZ being flooded as a result of the combination of a sustained northeast storm and high lake water levels. Discussions with both Lucas and Ottawa County Engineers indicate that high water levels in the lake make such flooding scenarios a possibility during the peak, summer season. Consequently, a summer population scenario is used. However, since a sustained northeast storm is required to cause flooding, we would expect few, if any, transient and boaters as part of the evacuating public. Table 5-2 presents a list of roadway section susceptible to flooding due to the cited storm conditions.

Scenario 4 - Summer, Midday, Weekend, Good Weather

This scenario is the peak population situation. It represents conditions on a holiday weekend; parks are full, many boaters are on the lake, and many transients are in the Port Clinton area.

Scenario 5 - Summer, Midday, Weekend, Rain

The same population conditions exist as in Scenario 4. Sudden rain showers occur which reduce highway capacity and speed 20 percent.

Scenario 6 - Summer, Evening, Good Weather

This scenario assumes the general and seasonal population are at home; the time required to return home prior to evacuating is not an issue. Few transient, boaters or employees are present.

Scenario 7 - Winter, Midday, Midweek, Good Weather

This is the base off-peak season scenario. Peak permanent and employment population groups are present. Few, if any, transients, seasonal, and boaters are present.

Scenario 8 - Winter, Midday, Midweek, Rain

The same population conditions as exist in Scenario 7. Sudden rain showers occur which reduce highway capacity and speed 20 percent.

Scenario 9 - Winter, Midday, Midweek, Snow

The same population conditions as exist in Scenario 7. Additional time is required by evacuees to clear driveways before evacuation trips commence. Roadway capacities and speeds are reduced 25 percent.

Scenario 10 - Winter, Evening, Good Weather

This scenario assumes the general population is at home. There are few seasonal residents, transients or employees in the EPZ.

Scenario 11 - Spring, Midday, Midweek, Flood

As Scenario 3 with reduced transient and seasonal populations.

Each combination of evacuation region and accident scenario implies a specific population to be evacuated. Table 5-3 presents the percentage of each population group assumed to evacuate with each scenario. Tables 5-4a through 5-4g present the actual population and vehicle counts for each scenario. Note that the flood scenario is the only adverse weather scenario that changes the population to be evacuated since it is predicated upon a longer period of bad weather that are the other adverse weather scenarios.

Table 5-2. Areas Affected By Flooding During A Northeast Storm

Ottawa County

- Port Clinton - Perry St. is flooded
- Route 53 (Fremont Road) - Flooded in the area of Muddy Creek
- Route 2, flooded in the area of Camp Perry Rd. and Lakeshore Drive
- Route 2, flooded crossing the Toussaint River
- Route 2, flooded at the intersection with Route 19.

Lucas County

- Route 2, flooding at Teachout Road. Route 2 might be passable with up to 6 inches of water.

Source: Discussions with Ottawa, Lucas County Engineers

Table 5-3. Percent of Population Groups for Various Scenarios

Percentage of Population Present					
Scenario	Permanent	Seasonal	Transient	Employees	Boaters
1,2	100%	100%	50%	100%	50%
3	100%	100%	0%	100%	0%
4,5	100%	100%	100%	30%	100%
6	100%	100%	5%	10%	0%
7,8,9	100%	5%	5%	100%	0%
10	100%	5%	0%	10%	0%
11	100%	5%	0%	100%	0%

Table 5-4a. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Summer, Midweek, Midday

Scenario 1,2 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	761	700	3,026	1,649	7,038
[redacted]						
1,2,10,12	2,022	1,523	700	3,061	1,649	8,955
1,6,10,12	1,049	1,101	1,450	4,692	1,649	9,941
1,2,6,10,12	2,169	1,863	1,450	4,727	1,649	11,858
[redacted]						
1,6,7,8,9,10,12	10,006	3,185	3,950	12,173	3,668	32,982
1,2,5,6,7,9,10,12	16,639	3,970	4,700	12,308	3,668	41,285
1,2,3,4,5,10,11,12	11,703	1,568	1,450	3,894	3,359	21,974
1,2,3,10,11,12	5,936	1,523	700	3,794	3,359	15,312
1,10,11,12	2,267	761	700	3,759	3,359	10,846
1-12	20,807	3,992	4,700	13,042	5,378	47,919

Scenario 1,2 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	57	700	1,220	825	3,239
[redacted]						
1,2,10,12	979	113	700	1,234	825	3,851
1,6,10,12	509	85	1,450	1,892	825	4,761
1,2,6,10,12	1,051	142	1,450	1,906	825	5,374
[redacted]						
1,6,7,8,9,10,12	4,895	335	3,950	4,909	1,834	15,923
1,2,5,6,7,9,10,12	8,137	428	4,700	4,963	1,834	20,062
1,2,3,4,5,10,11,12	5,711	187	1,450	1,571	1,680	10,599
1,2,3,10,11,12	2,887	113	700	1,530	1,680	6,910
1,10,11,12	1,097	57	700	1,516	1,680	5,050
1-12	10,169	465	4,700	5,259	2,689	23,282

Table 5-4b. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Summer, Midweek, Midday, Flood

Scenario 3 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	761	700	0	0	2,363
[redacted]						
1,2,10,12	2,022	1,523	700	0	0	4,245
1,6,10,12	1,049	1,101	1,450	0	0	3,600
1,2,6,10,12	2,169	1,863	1,450	0	0	5,482
[redacted]						
1,6,7,8,9,10,12	10,006	3,185	3,950	0	0	17,141
1,2,5,6,7,9,10,12	16,639	3,970	4,700	0	0	25,309
1,2,3,4,5,10,11,12	11,703	1,568	1,450	0	0	14,721
1,2,3,10,11,12	5,936	1,523	700	0	0	8,159
1,10,11,12	2,267	761	700	0	0	3,728
1-12	20,807	3,992	4,700	0	0	29,499

Scenario 3 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	57	700	0	0	1,194
[redacted]						
1,2,10,12	979	113	700	0	0	1,792
1,6,10,12	509	85	1,450	0	0	2,044
1,2,6,10,12	1,051	142	1,450	0	0	2,643
[redacted]						
1,6,7,8,9,10,12	4,895	335	3,950	0	0	9,180
1,2,5,6,7,9,10,12	8,137	428	4,700	0	0	13,265
1,2,3,4,5,10,11,12	5,711	187	1,450	0	0	7,348
1,2,3,10,11,12	2,887	113	700	0	0	3,700
1,10,11,12	1,097	57	700	0	0	1,854
1-12	10,169	465	4,700	0	0	15,334

Table 5-4c. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Summer, Weekend, Midday,

Scenario 4,5 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	761	210	6,051	3,298	11,222
[redacted]						
1,2,10,12	2,022	1,523	210	6,121	3,298	13,174
1,6,10,12	1,049	1,101	435	9,384	3,298	15,267
1,2,6,10,12	2,169	1,863	435	9,454	3,298	17,219
[redacted]						
1,6,7,8,9,10,12	10,006	3,185	1,185	12,173	3,668	30,217
1,2,5,6,7,9,10,12	16,639	3,970	1,410	12,308	3,668	37,995
1,2,3,4,5,10,11,12	11,703	1,568	435	3,894	3,359	20,959
1,2,3,10,11,12	5,936	1,523	210	3,794	3,359	14,822
1,10,11,12	2,267	761	210	3,759	3,359	10,356
1-12	20,807	3,992	1,410	13,042	5,378	44,629

Scenario 4,5 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	57	210	2,440	1,649	4,793
[redacted]						
1,2,10,12	979	113	210	2,468	1,649	5,419
1,6,10,12	509	85	435	3,784	1,649	6,462
1,2,6,10,12	1,051	142	435	3,812	1,649	7,089
[redacted]						
1,6,7,8,9,10,12	4,895	335	1,185	9,817	3,668	19,900
1,2,5,6,7,9,10,12	8,137	428	1,410	9,926	3,668	23,569
1,2,3,4,5,10,11,12	5,711	187	435	3,141	3,359	12,833
1,2,3,10,11,12	2,887	113	210	3,060	3,359	9,629
1,10,11,12	1,097	57	210	3,032	3,359	7,755
1-12	10,169	465	1,410	10,518	5,378	27,940

Table 5-4d. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Summer, Evening

Scenario 6 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	761	70	303	0	2,036
[redacted]						
1,2,10,12	2,022	1,523	70	306	0	3,921
1,6,10,12	1,049	1,101	145	469	0	2,764
1,2,6,10,12	2,169	1,863	145	473	0	4,650
[redacted]						
1,6,7,8,9,10,12	10,006	3,185	395	1,217	0	14,803
1,2,5,6,7,9,10,12	16,639	3,970	470	1,231	0	22,310
1,2,3,4,5,10,11,12	11,703	1,568	145	389	0	13,805
1,2,3,10,11,12	5,936	1,523	70	379	0	7,908
1,10,11,12	2,267	761	70	376	0	3,474
1-12	20,807	3,992	470	1,304	0	26,573

Scenario 6 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	57	70	122	0	686
[redacted]						
1,2,10,12	979	113	70	123	0	1,285
1,6,10,12	509	85	145	189	0	928
1,2,6,10,12	1,051	142	145	191	0	1,529
[redacted]						
1,6,7,8,9,10,12	4,895	335	395	491	0	6,116
1,2,5,6,7,9,10,12	8,137	428	470	496	0	9,531
1,2,3,4,5,10,11,12	5,711	187	145	157	0	6,200
1,2,3,10,11,12	2,887	113	70	153	0	3,223
1,10,11,12	1,097	57	70	152	0	1,376
1-12	10,169	465	470	526	0	11,630

Table 5-4e. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Winter, Midweek, Midday

Scenario 7,8,9 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	38	700	303	0	1,943
[redacted]						
1,2,10,12	2,022	76	700	306	0	3,104
1,6,10,12	1,049	55	1,450	469	0	3,023
1,2,6,10,12	2,169	93	1,450	473	0	4,185
[redacted]						
1,6,7,8,9,10,12	10,006	159	3,950	1,217	0	15,332
1,2,5,6,7,9,10,12	16,639	199	4,700	1,231	0	22,769
1,2,3,4,5,10,11,12	11,703	78	1,450	389	0	13,620
1,2,3,10,11,12	5,936	76	700	379	0	7,091
1,10,11,12	2,267	38	700	376	0	3,381
1-12	20,807	200	4,700	1,304	0	27,011

Scenario 7,8,9 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	3	700	122	0	1,262
[redacted]						
1,2,10,12	979	6	700	123	0	1,808
1,6,10,12	509	4	1,450	189	0	2,152
1,2,6,10,12	1,051	7	1,450	191	0	2,699
[redacted]						
1,6,7,8,9,10,12	4,895	17	3,950	491	0	9,353
1,2,5,6,7,9,10,12	8,137	21	4,700	496	0	13,354
1,2,3,4,5,10,11,12	5,711	9	1,450	157	0	7,327
1,2,3,10,11,12	2,887	6	700	153	0	3,746
1,10,11,12	1,097	3	700	152	0	1,952
1-12	10,169	23	4,700	526	0	15,418

Table 5-4f. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Winter, Evening

Scenario 10 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	38	70	0	0	1,010
[redacted]						
1,2,10,12	2,022	76	70	0	0	2,168
1,6,10,12	1,049	55	145	0	0	1,249
1,2,6,10,12	2,169	93	145	0	0	2,407
[redacted]						
1,6,7,8,9,10,12	10,006	159	395	0	0	10,560
1,2,5,6,7,9,10,12	16,639	199	470	0	0	17,308
1,2,3,4,5,10,11,12	11,703	78	145	0	0	11,926
1,2,3,10,11,12	5,936	76	70	0	0	6,082
1,10,11,12	2,267	38	70	0	0	2,375
1-12	20,807	200	470	0	0	21,477

Scenario 10 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	3	70	0	0	510
[redacted]						
1,2,10,12	979	6	70	0	0	1,055
1,6,10,12	509	4	145	0	0	658
1,2,6,10,12	1,051	7	145	0	0	1,203
[redacted]						
1,6,7,8,9,10,12	4,895	17	395	0	0	5,307
1,2,5,6,7,9,10,12	8,137	21	470	0	0	8,628
1,2,3,4,5,10,11,12	5,711	9	145	0	0	5,865
1,2,3,10,11,12	2,887	6	70	0	0	2,963
1,10,11,12	1,097	3	70	0	0	1,170
1-12	10,169	23	470	0	0	10,662

Table 5-4g. Population and Vehicle Estimates for Various Combinations of Regions and Scenarios

Scenarios: Spring, Midweek, Midday, Flood

Scenario 11 - Persons

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	902	38	700	0	0	1,640
[redacted]						
1,2,10,12	2,022	76	700	0	0	2,798
1,6,10,12	1,049	55	1,450	0	0	2,554
1,2,6,10,12	2,169	93	1,450	0	0	3,712
[redacted]						
1,6,7,8,9,10,12	10,006	159	3,950	0	0	14,115
1,2,5,6,7,9,10,12	16,639	199	4,700	0	0	21,538
1,2,3,4,5,10,11,12	11,703	78	1,450	0	0	13,231
1,2,3,10,11,12	5,936	76	700	0	0	6,712
1,10,11,12	2,267	38	700	0	0	3,005
1-12	20,807	200	4,700	0	0	25,707

Scenario 11 - Vehicles

Region	Permanent	Seasonal	Employees	Transient	Boaters	Totals
1, 10, 12	437	3	700	0	0	1,140
[redacted]						
1,2,10,12	979	6	700	0	0	1,685
1,6,10,12	509	4	1,450	0	0	1,963
1,2,6,10,12	1,051	7	1,450	0	0	2,508
[redacted]						
1,6,7,8,9,10,12	4,895	17	3,950	0	0	8,862
1,2,5,6,7,9,10,12	8,137	21	4,700	0	0	12,858
1,2,3,4,5,10,11,12	5,711	9	1,450	0	0	7,170
1,2,3,10,11,12	2,887	6	700	0	0	3,593
1,10,11,12	1,097	3	700	0	0	1,800
1-12	10,169	23	4,700	0	0	14,892

6. PRELIMINARY TRAFFIC CONTROL AND MANAGEMENT TACTICS

This section presents the current set of traffic control and management tactics which are designed to expedite the movement of evacuating traffic. The resources required to implement these tactics include:

- Personnel with the capabilities of successfully performing the planned control functions of traffic guides.
- Equipment to assist these personnel in the performance of their tasks:
  - Traffic Barriers
  - Traffic Cones
  - Signs
- A plan, which defines all necessary details and is documented in a format that is easy to understand.

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, which 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 productive 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:

- He/she 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.
- The driver may be an emergency worker en route to perform an important activity.

The implementation of a plan must provide room for the application of sound judgment.

This set of control tactics is the outcome of the following process:

1. A field survey of these critical locations.

   The sketches of Appendix I are based on the data collected during field surveys and upon large-scale maps. We have found these maps to be less than accurate in some respects. The previous surveys did not focus at great length on any particular set of locations, since we did not know which would be included in the set of Traffic Control Posts (TCP).

2. Consultation with the officials of the area who will be implementing them: police department personnel, specifically.

   Clearly, trained personnel who are experienced in controlling traffic and who are familiar with the likely traffic patterns should review any control tactics. Also these personnel know which intersections are probable bottlenecks under heavy traffic demand conditions.

3. Prioritization of these TCP. Application of traffic control at some TCP will have a more pronounced influence on expediting traffic movements, than applying control at other TCP. Thus, during the mobilization of personnel to respond to the emergency situation, those TCP, which are assigned a higher priority, will be manned earlier than the others.

   This setting of priorities should be undertaken with the concurrence of town police. These priorities should be compatible with the availability of local manpower resources.

In each sketch that appears in Appendix I, the control policy at each TCP is presented in a manner which is self-explanatory. Figure 6-1 identifies the location of each traffic control point. Figure 6-2 presents a map of Port Clinton showing traffic control points within the City.

Table 6-1 presents a summary of traffic control requirements by subarea. The assignment of Traffic control post to specific manning agencies is presented in Table 6-2. Finally, Table 6-3 presents a proposed list of traffic control points to be activated for three evacuation regions. This activation list is prioritized so that available manpower may be assigned to high priority locations first.

It should be noted that a number of traffic control posts also correspond to perimeter control posts. Under these conditions the tactics described in Appendix I also tend to implement a perimeter control function.

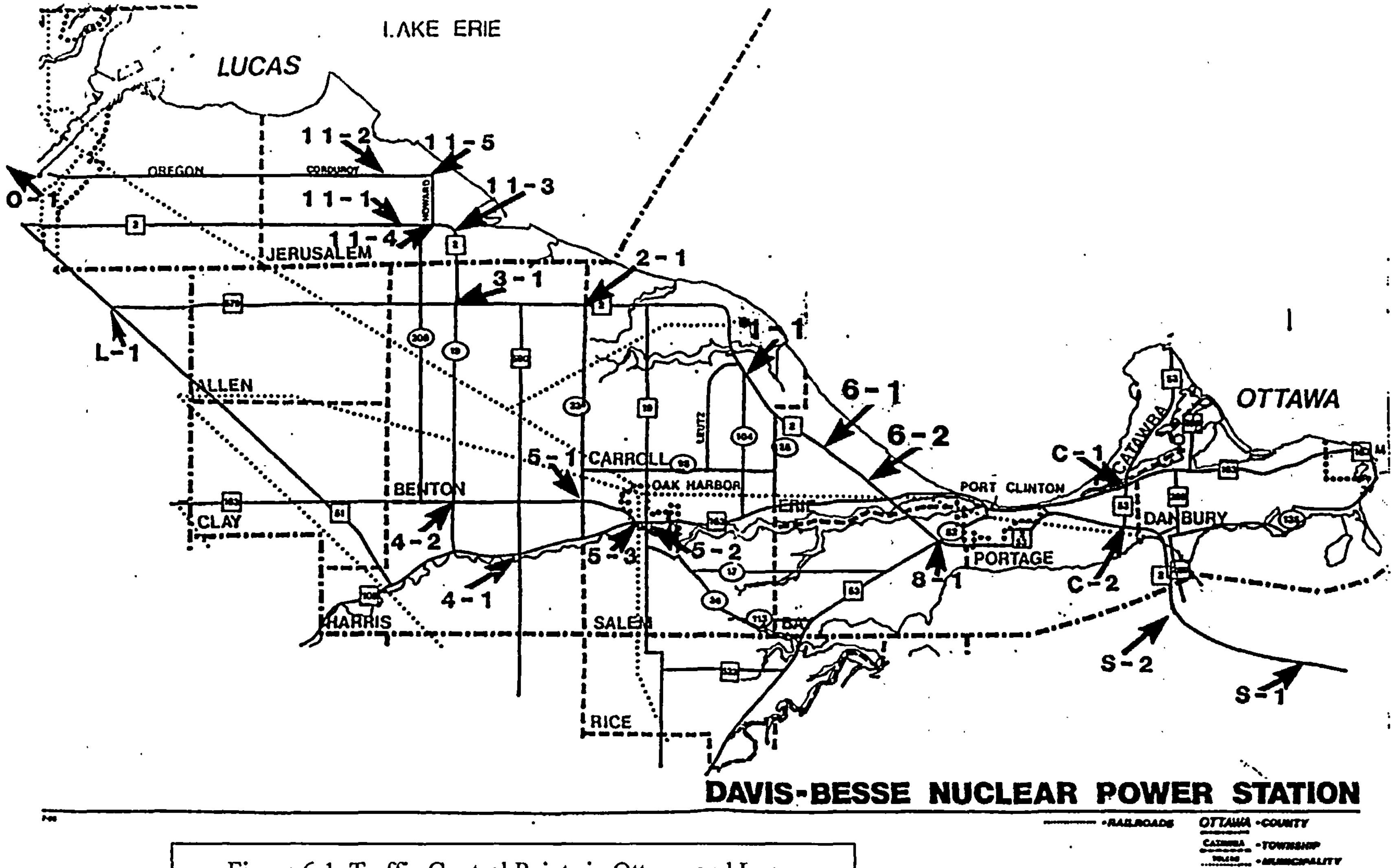

Figure 6-1. Traffic Control Points in Ottawa and Lucas Counties

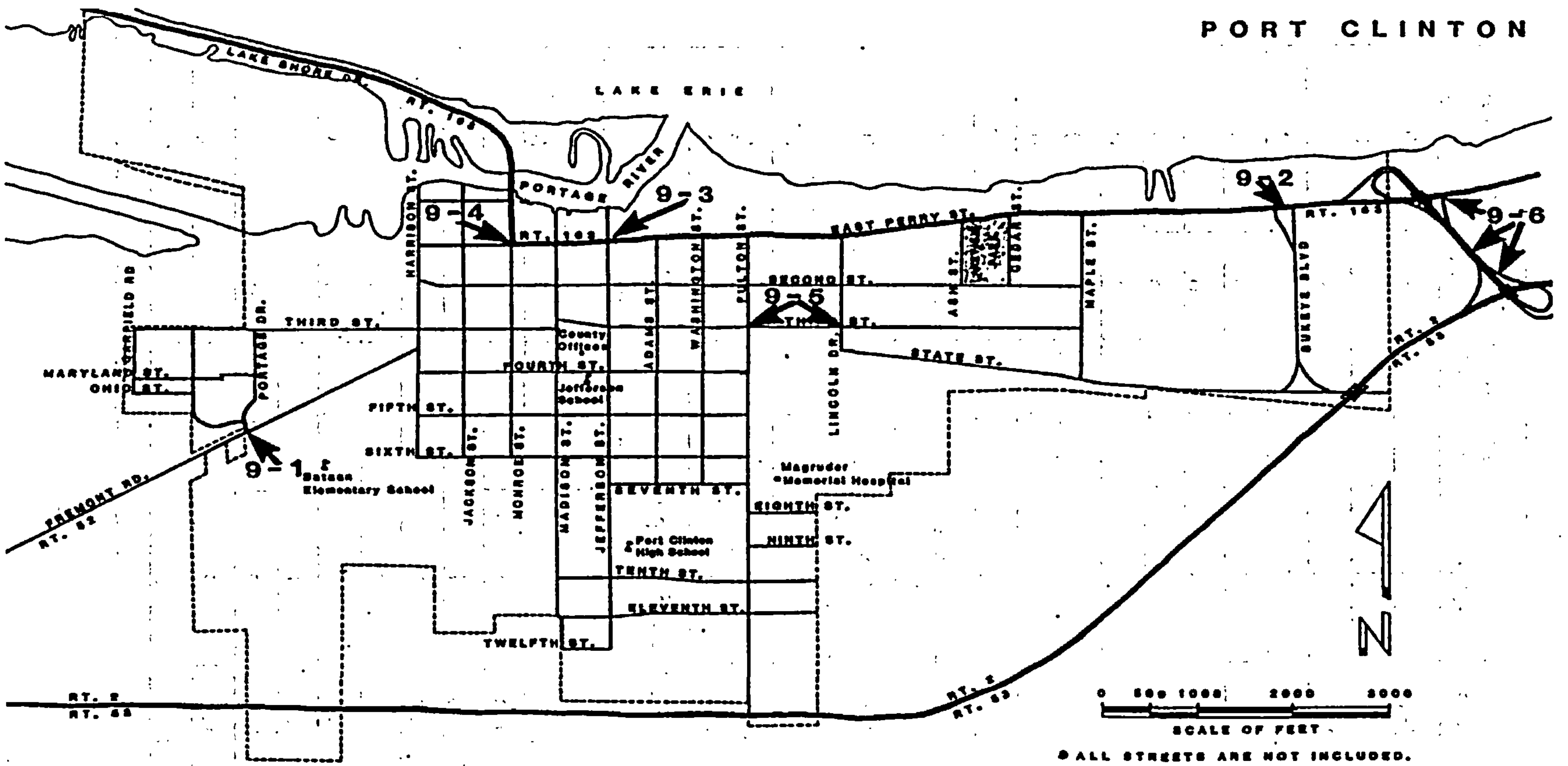

Figure 6-2. Traffic Control Points in Port Clinton

Table 6-1. Summary of Traffic Control Points

Subarea	TCP	Priority	Manpower Required	Equipment Required	
				Cones	Barricades
1	1-1	1	1	3	0
2	2-1	1	1	3	0
3	3-1	1	1	5	0
4	4-1	2	1	6	0
	4-2	1	1	6	0
5	5-1	1	1	6	0
	5-2	1	2	6	0
	5-3	2	2	3	0
6	6-1	1	2	17	0
	6-2	1	1	4	0
8	8-1	1	2	0	13
9	9-1	1-o	1	0	0
	9-2	2-o	1	0	0
	9-3	2-o	1	3	0
		(summer only)			
	9-4	1	1	3	0
	9-5	1-o	2	0	0
	9-6	1	3	33	2
Note:TCPs 9-1, 2, 3, and 5 are optional, to be activated when needed as determined by authorities in Port Clinton.					
11	11-1	1	1	3	0
	11-2	1	2	6	0
	11-3	1	1	0	0
	11-4	1	1	3	0
	11-5	1	1	6	0
Catawba	C-1	2	1	4	0
	C-2	1	0	0	4
Sandusky	S-1	1	3	12	4
	S-2	2	0	0	3
Oregon	O-1	2	1	0	2
Lake Twp.	L-1	2	1	0	0

Table 6-2. Preliminary Assignment of Traffic Control Posts to Manning Agency

Agency	Traffic Control Posts	Personnel Required
Ottawa County Sheriff	1-1, 2-1, 3-1, 4-1, 5-1, 6-1, 6-2	8
Oak Harbor Police	5-2, 5-3	4
Ohio State Highway Patrol	4-2, 8-1, 9-6, 11-1, C-1, C-2, S-2, L-1	9
Port Clinton Police Department	9-1, 9-2, 9-3, 9-4, 9-5	6
Lucas County Sheriff (Oregon Police)	11-2, 11-3, 11-4	3 (1)
Jerusalem Twp. Fire Department	11-5	1
Sandusky Police	S-1	3
Oregon Police	O-1	1
	TOTAL	**36**

Table 6-3. Activation of Traffic Control Points

PRIORITY 1

Region	TCP	Agency	Manpower	Cones	Barricades
2-mile	1-1	OCSD	1	3	0
	5-2	OHPD	2	6	0
		Totals	**3**	**9**	**0**
5-mile	1-1	OCSD	1	3	0
	2-1	OCSD	1	3	0
	3-1	OCSD	1	5	0
	4-2	OSHP	1	6	0
	5-2	OHPD	2	6	0
	6-1	OCSD	2	17	0
		Totals	**8**	**40**	**0**
10-mile	1-1	OCSD	1	3	0
	2-1	OCSD	1	3	0
	3-1	OCSD	1	5	0
	4-2	OSHP	1	6	0
	5-2	OHPD	2	6	0
	6-1	OCSD	2	17	0
	6-2	OCSD	1	4	0
	8-1	OSHP	2	0	13
	9-1	PCPD	1	0	0
	9-4	PCPD	1	3	0
	9-5	PCPD	2	0	0
	9-6	OSHP	3	33	2
	11-1	OSHP	1	3	0
	11-2	LCSD	2	6	0
	11-3	LCSD	1	0	0
	11-4	LCSD	1	3	0
	11-5	JTFD	1	6	0
		Totals	**25**	**104**	**15**

PRIORITY 2

Region	TCP	Agency	Manpower	Cones	Barricades
2-mile					
5-mile	4-1	OCSD	1	6	0
		Totals	**1**	**6**	**0**
10-mile	4-1	OCSD	1	6	0
	5-3	OHPD	2	3	0
	9-2	PCPD	1	0	0
	9-3	PCPD	1	3	0
	S-1	SPD	3	12	6
	S-2	OSHP	0	0	3
	C-1	OSHP	1	4	0
	C-2	OSHP	0	0	4
	O-1	OPD	1	0	2
	L-1	OSHP	1	0	0
		Totals	**11**	**28**	**13**

Agency Key:
JTFD - Jerusalem Twp. Fire Dept.
OHPD - Oak Harbor Police Dept.
OSHP - Ohio State Hwy. Patrol
SPD - Sandusky Police Dept.
LCSD - Lucas Co. Sheriff Dept.
OCSD - Ottawa Co. Sheriff Dept.
OPD - Oregon Police Dept.
PCPD - Port Clinton Police Dept.

7. TRAFFIC ROUTING PLANS

Evacuation routes are composed of two distinct components:

- Routing from a community being evacuated to the boundary of the Emergency Planning Zone (EPZ)
- Routing of evacuees from the EPZ boundary to Host communities and reception centers.

Evacuees should be routed within the EPZ in such a way as to minimize their exposure to risk. This requirement is met by routing traffic so as to move away from the location of Davis Besse Station to the extent practicable and by delineating evacuation routes that expedite the movement of evacuating vehicles.

The routing of evacuees from the EPZ boundary to the host communities must also be responsive to several considerations:

- Minimizing the amount of travel outside the EPZ, from the points where these routes cross the EPZ boundary to the reception centers.
- Relating the anticipated volume of traffic destined to each reception center, to the capacity of the reception center facilities.
- Assigning the residents of those towns, which are members of a regional educational system, to the same reception center, to the extent possible. This would expedite the reunion of school children with other members of the household, should the evacuation take place during a school day.

Consequently, there is a linkage between the routing plans and the choice of host communities. In light of this linkage, a review of the allocation of host communities to communities within the EPZ was performed.

The Davis Besse EPZ is comprised of 12 subareas; 10 in Ottawa County, 1 in Lucas County and 1 encompassing Lake Erie. Subarea boundaries were shown previously in Figure 2-1. The allocation of evacuation subareas to host communities is shown below.

Sandusky Ohio -	Subarea 9
Fremont Ohio -	Subareas 1, 2, 3, 4, 5, 6, 7, 8
Oregon, Ohio -	Subareas 10, 11

The routing plans for each of these subareas are presented in Appendix J. Appendix K presents maps -- one for each subarea -- delineating the evacuation routes from each community within the EPZ. These evacuation routes were submitted to the local law enforcement offices of all communities within the EPZ, for their review.

8. EVACUATION TIME ESTIMATES (ETE)

This section presents the current results of the computer analyses using the IDYNEV System. These results cover:

- Eleven evacuation scenarios as summarized in Table 8-1, and discussed in Section 5.
- Ten regions within the Davis Besse Station EPZ, as defined in Table 8-2 and discussed in Section 5. Each region consists of one or more Subareas.

The ETE for each Region-Scenario combination are presented in Tables 8-3a through 8-3c for Scenarios 1-10. These tables present the time to clear the indicated population percentages from those subareas where an evacuation is the recommended protective action. Tables 8-4a through 8-4c present the times to clear the 2, 5 and 10-mile radial areas. Note that, in most cases, subarea boundaries do not fall on these radial arcs.

The issue of voluntary evacuation must be addressed when an evacuation recommendation is issued to regions, which comprise an area less than the entire EPZ. Voluntary evacuees are defined as those people who live within the EPZ in subareas for which an evacuation recommendation has not been issued who, nevertheless, choose to evacuate spontaneously. People who have been asked to evacuate may be delayed in leaving the area at risk due to the presence of voluntary evacuees on evacuation routes.

The ETE for Davis Besse Station addressed the issue of voluntary evacuees in the manner shown in Figure 8-1. Within the annular ring defined by the furthest extent of the evacuation recommendation, 50 percent of those people in subareas not advised to evacuate will do so. In the annular ring beginning at the furthest extent of the evacuation recommendation, 25 percent of the people will evacuate spontaneously.

Table 8-3a presents the time to evacuate 50 percent of the affected population. Evacuation times are expressed as hours and minutes after the evacuation recommendation is given. It should be noted that the park and lake areas will be alerted earlier than the general population and it is likely that those areas begin evacuating before the general population is notified of an evacuation recommendation.

Table 8-3b presents the ETE for 90 percent of the affected population. Table 8-3c similarly presents the ETE for 100 percent of the affected population.

The values of ETE are obtained by interpolating from IDYNEV output, which are generated at 30-minute intervals, then rounding to the nearest 5 minutes. Thus, the numerical precision of these values is within ±10 minutes.

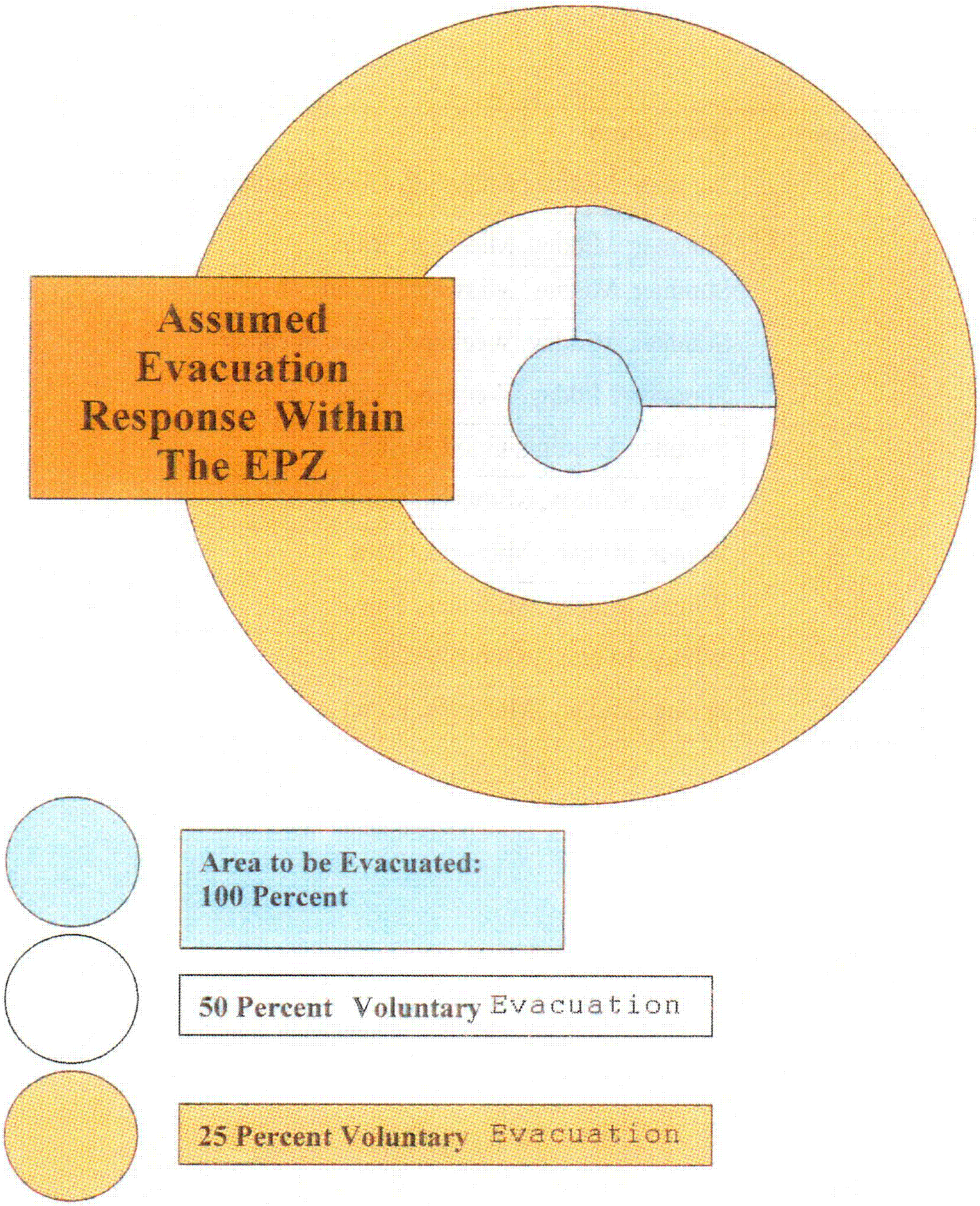

Figure 8-1. Voluntary Evacuation Rates

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Table 8-1. Summary of Evacuation Scenarios

Scenario	Description
1	Summer, Midday, Midweek, Good Weather
2	Summer, Midday, Midweek, Rain
3	Summer, Midday, Midweek, Flood
4	Summer, Midday, Weekend, Good Weather
5	Summer, Midday, Weekend, Rain
6	Summer, Evening, Good Weather
7	Winter, Midday, Midweek, Good Weather
8	Winter, Midday, Midweek, Rain
9	Winter, Midday, Midweek, Snow
10	Winter, Evening, Good Weather
11	Spring, Midday, Midweek, Flood

Table 8-2. Summary of Evacuation Regions

Region	Subareas Evacuated
0 - 2 miles	1, 10, 12
0 - 5 miles	1, 2, 10, 12
	1, 6, 10, 12
	1, 2, 6, 10, 12
0 - 10 miles	1, 6, 7, 8, 9, 10, 12
	1, 2, 5, 6, 7, 8, 9, 10, 12
	1, 2, 3, 4, 5, 10, 11, 12
	1, 2, 3, 10, 11, 12
	1, 10, 11, 12
	1 through 12

Table 8-3A: Time to Clear the Indicated Area of 50 Percent of the Affected Population (Hrs:Min)

		Summer						Winter				Spring
		Midday					Evening	Midday			Evening	Midday
		Midweek			Weekend			Midweek				
Region	Subareas	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0-2 Miles	1,10,12	1:15	1:15	1:05	1:20	1:30	0:45	0:55	1:00	1:25	0:45	0:40
0-5 Miles	1,2,10,12	1:25	1:30	1:10	1:30	1:45	0:55	1:05	1:10	2:00	0:50	0:50
	1,6,10,12	1:10	1:15	0:55	1:20	1:30	0:45	0:55	0:55	1:15	0:45	0:35
	1,2,6,10,12	1:20	1:25	1:05	1:30	1:45	0:55	1:00	1:05	1:45	0:50	0:50
0-10 Miles	1,6,7,8,9,10,12	1:35	1:45	1:25	1:50	2:05	0:55	1:10	1:15	2:15	0:55	1:15
	1,2,5,6,7,8,9,10,12	1:45	1:55	1:30	2:00	2:15	1:00	1:15	1:20	2:25	0:55	1:20
	1,2,3,4,5,10,11,12	1:45	2:00	1:40	1:50	2:05	1:10	1:20	1:25	2:30	1:00	1:25
	1,2,3,10,11,12	1:30	1:35	1:20	1:35	1:50	0:55	1:10	1:15	2:20	0:50	1:10
	1,10,11,12	1:30	1:35	1:10	1:35	1:35	0:45	1:10	1:15	1:55	0:45	0:50
	1 - 12	2:00	2:15	1:55	2:10	2:30	1:10	1:20	1:25	2:35	1:00	1:35

Table 8-3B: Time to Clear the Indicated Area of 90 Percent of the Affected Population (Hrs:Min)

		Summer						Winter				Spring
		Midday					Evening	Midday			Evening	Midday
		Midweek			Weekend			Midweek				
Region	Subareas	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0-2 Miles	1,10,12	2:30	2:50	2:05	2:40	3:15	1:30	1:50	1:50	3:10	1:30	1:45
0-5 Miles	1,2,10,12	2:55	3:30	2:15	3:05	3:50	2:00	1:55	2:10	3:40	1:45	2:00
	1,6,10,12	2:30	2:50	2:00	2:40	3:15	1:35	1:50	1:50	3:00	1:30	1:35
	1,2,6,10,12	2:55	3:30	2:10	3:05	3:50	2:00	1:55	2:05	3:30	1:40	1:55
0-10 Miles	1,6,7,8,9,10,12	3:00	3:30	2:55	3:45	4:40	1:50	1:55	2:05	3:45	1:40	2:40
	1,2,5,6,7,8,9,10,12	3:25	4:05	3:25	3:55	4:55	2:25	2:10	2:25	4:00	1:55	2:50
	1,2,3,4,5,10,11,12	3:50	4:45	3:55	3:55	4:55	2:55	2:25	3:00	4:05	2:20	3:00
	1,2,3,10,11,12	3:05	3:35	2:40	3:10	3:55	2:00	2:00	2:10	3:50	1:45	2:25
	1,10,11,12	2:30	2:50	2:10	2:40	3:10	1:30	1:55	1:55	3:35	1:30	2:00
	1 - 12	3:45	4:45	4:05	4:20	5:25	2:50	2:20	2:45	4:05	2:15	3:00

Table 8-3C: Time to Clear the Indicated Area of 100 Percent of the Affected Population (Hrs:Min)

		Summer						Winter				Spring
		Midday					Evening	Midday			Evening	Midday
		Midweek			Weekend			Midweek				
Region	Subareas	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0-2 Miles	1,10,12	3:30	3:50	3:00	4:00	4:55	1:50	2:30	2:30	4:30	1:50	3:00
0-5 Miles	1,2,10,12	4:00	4:55	3:15	4:20	5:20	3:00	2:30	2:35	4:40	2:30	3:30
	1,6,10,12	3:50	4:50	3:00	4:00	4:55	2:40	2:30	2:30	4:30	1:50	3:00
	1,2,6,10,12	4:00	4:55	3:15	4:20	5:20	3:00	2:30	2:35	4:40	2:30	3:30
0-10 Miles	1,6,7,8,9,10,12	4:25	5:55	4:30	5:10	6:15	3:30	2:35	2:45	4:35	2:15	3:20
	1,2,5,6,7,8,9,10,12	5:50	7:30	5:55	6:15	7:45	4:45	3:10	3:50	4:55	3:20	4:05
	1,2,3,4,5,10,11,12	5:50	7:30	5:55	6:15	7:45	4:45	3:25	4:20	4:55	3:20	4:05
	1,2,3,10,11,12	4:55	5:45	4:05	5:15	6:35	3:30	2:40	3:15	4:40	2:40	3:30
	1,10,11,12	3:55	4:00	3:00	4:00	4:55	1:50	2:30	2:30	4:30	1:50	3:00
	1 - 12	5:50	7:30	5:55	6:15	7:45	4:45	3:25	4:20	4:55	3:20	4:05

Table 8-4A: Time to Clear the Indicated Area of 50 Percent of the Affected Population (Hrs:Min)

	Summer						Winter				Spring
	Midday					Evening	Midday			Evening	Midday
	Midweek			Weekend			Midweek				
Region	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0 - 2 Miles	1:30	1:35	1:05	1:35	1:40	0:45	0:55	1:00	1:30	0:45	0:40
0 - 5 Miles	1:45	1:55	1:05	2:05	2:25	0:55	1:00	1:00	1:50	0:50	0:45
0 - 10 Miles	2:00	2:15	1:55	2:10	2:30	1:10	1:20	1:25	2:35	1:00	1:35

Table 8-4B: Time to Clear the Indicated Area of 90 Percent of the Affected Population (Hrs:Min)

	Summer						Winter				Spring
	Midday					Evening	Midday			Evening	Midday
	Midweek			Weekend			Midweek				
Region	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0 - 2 Miles	2:55	3:15	2:05	2:55	3:45	1:30	1:50	1:50	3:20	1:30	1:45
0 - 5 Miles	3:15	4:05	2:15	3:40	4:35	2:00	1:55	1:55	3:30	1:35	1:55
0 - 10 Miles	3:45	4:45	4:05	4:20	5:25	2:50	2:20	2:45	4:05	2:15	3:00

Table 8-4C: Time to Clear the Indicated Area of 100 Percent of the Affected Population (Hrs:Min)

	Summer						Winter				Spring
	Midday					Evening	Midday			Evening	Midday
	Midweek			Weekend			Midweek				
Region	Good Weather	Rain	Flood	Good Weather	Rain	Good Weather	Good Weather	Rain	Snow	Good Weather	Flood
0 - 2 Miles	3:25	3:50	3:00	3:25	4:30	1:50	2:30	2:30	4:30	1:50	3:00
0 - 5 Miles	3:55	5:00	3:15	4:25	5:20	3:00	2:35	2:35	4:40	2:30	3:30
0 - 10 Miles	5:50	7:30	5:55	6:15	7:45	4:45	3:25	4:20	4:55	3:20	4:05

Patterns of Traffic Congestion during Evacuation

Figures 8-2 through 8-3 illustrate the patterns of traffic congestion that arise for the case when the entire EPZ is ordered to evacuate during the summer, midday, weekend period under good weather conditions (Scenario 4).

Traffic congestion, as the term is used here, is defined as Levels of Service E and F. Level of Service E and F may be characterized as follows:

- Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.
- Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow, which causes the queue to form, and level-of-service F is an appropriate designation for such points.

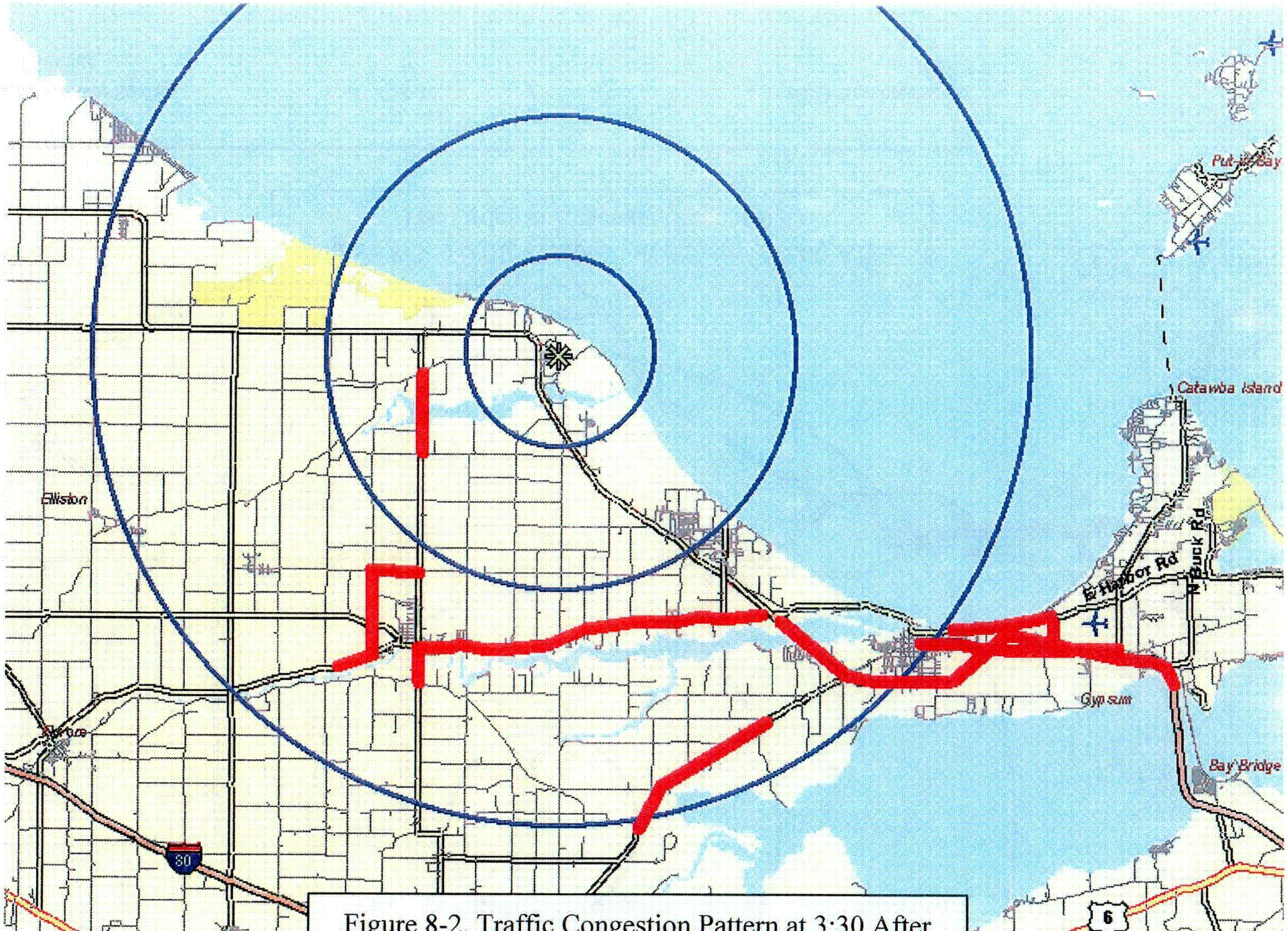

Figure 8-2. Traffic Congestion Pattern at 3:30 After The Order to Evacuate (Scenario 4)

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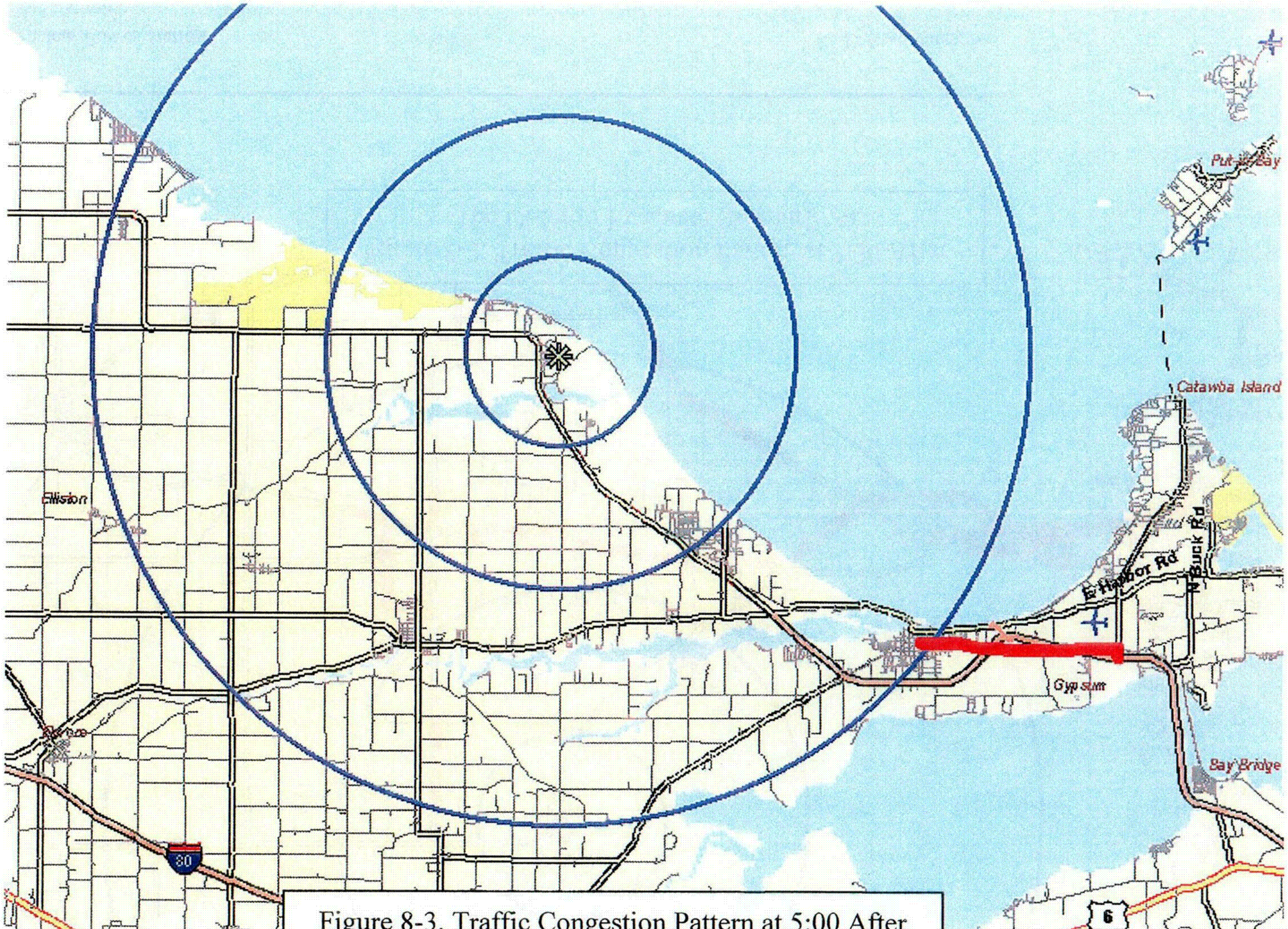

Figure 8-3. Traffic Congestion Pattern at 5:00 After The Order to Evacuate (Scenario 4)

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These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

All highway "links" which experience either Level of Service E or F are delineated in the Figures by a thick red line; all others are lightly indicated.

Congestion develops rapidly around concentrations of population and traffic bottlenecks. By 3 hours 30 minutes (Figure 8-2) after the evacuation recommendation several distinct areas are congested:

- Port Clinton - Access to Route 2 from Fremont Road is limited by the capacity of the on-ramp to eastbound Route 2. In Port Clinton proper, Perry Street shows congestion in the area of the Route 2 access road. State Road is congested into Portage Twp.
- Route 2 is congested at the approaches to the Sandusky Bay Bridge.
- Oak Harbor - congestion is present along Route 163.
- Congestion is also present in the area of Route 590 and Route 105 where major evacuation routes merge.

Figure 8-3 presents the congestion pattern 1 hour 30 minutes later at 5 hours after evacuation is recommended. Note that some congestion is present in Port Clinton. The rest of the EPZ shows no congestion. It should be noted that at time indicated, the remaining traffic congestion is at, or beyond 10 miles from DBNPS.

It should be noted that the absence of congestion does not necessarily mean that all people have been evacuated. What it does mean is that traffic demand has decreased below the roadway capacity for a sufficient period of time to dissipate any traffic queues.

Evacuation Rates

Traffic flow is a continuous process, as implied by Figures 8-2 and 8-3. Another format for displaying the dynamics of the evacuation procedure is depicted in Figure 8-4. This plot indicates the rate at which traffic flows out of the indicated areas for the case of a full 10-mile evacuation under the indicated conditions. Appendix L presents these figures for the all eleven scenarios.

As indicated in this Figure, there is typically a long "tail" to these distributions. Vehicles evacuate an area slowly at the beginning, as people respond to the order to evacuate at different rates, then builds rapidly (slopes of curves increase). When the system becomes congested, traffic flow remains at rates somewhat below capacity until some evacuation routes have cleared. As more routes clear, the rate of egress slows since many vehicles have already left the EPZ. Towards the end of the process, the one or two remaining evacuation routes service the remaining demand.

This decline in aggregate flow rate, with time, is characterized by these curves gradually becoming horizontal. Ideally, it would be desirable to fully saturate all evacuation routes so that all will service traffic near capacity levels and all will clear at the same time. For this ideal situation, all curves would remain steep until the end -- thus minimizing evacuation time. In the real world, this ideal is generally unattainable. Proper planning, however, can make an important difference in the utilization of existing highway capacity and in reducing evacuation time to a practical minimum.

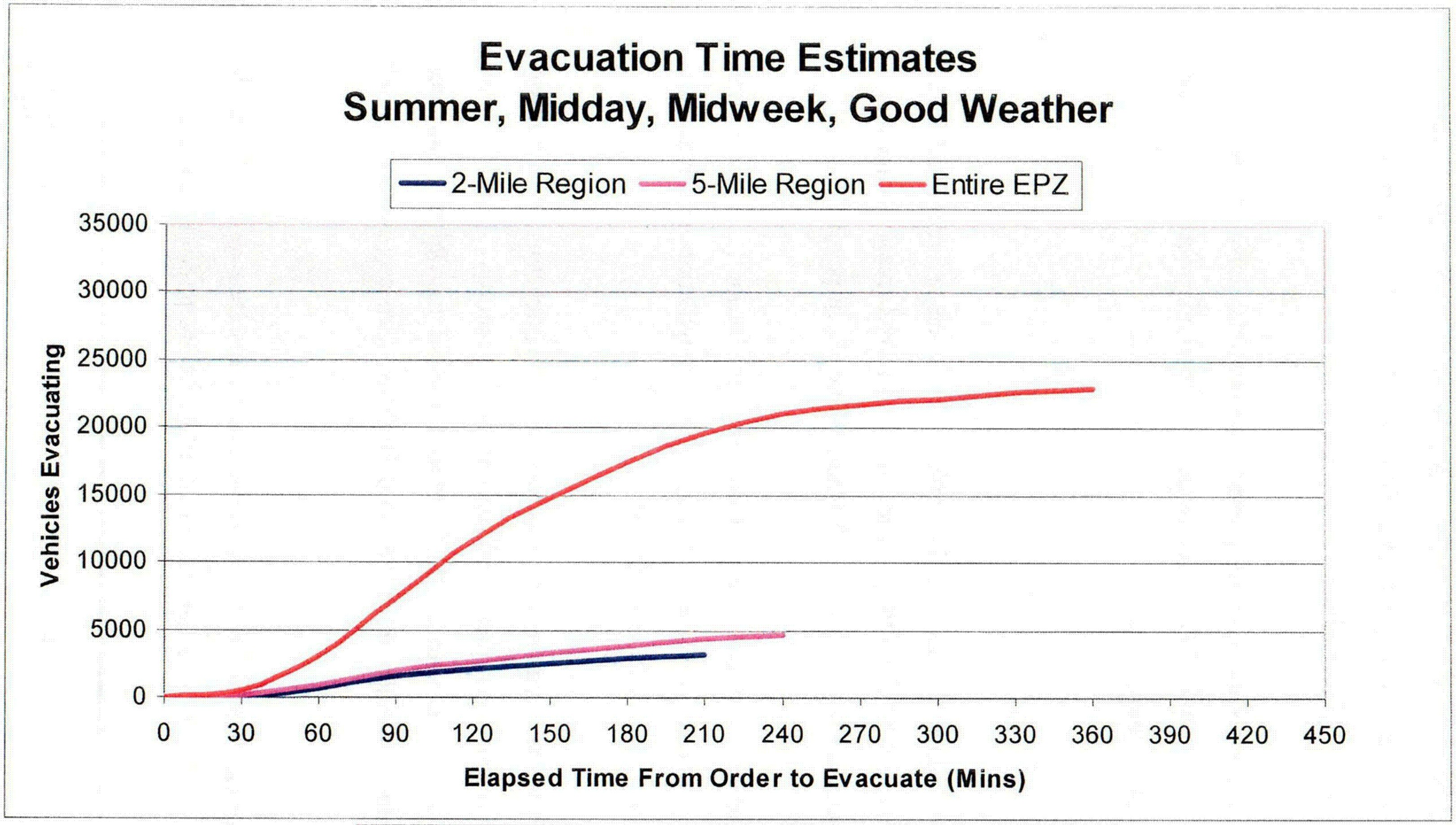

Figure 8-4. Evacuation Time Estimates for Davis Besse Summer, Midday, Midweek, Good Weather

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Distribution of Population and Vehicles

The NRC/FEMA guidelines in NUREG 0654 recommend that the distribution of population and of vehicles within the Emergency Planning Zone (EPZ) be presented in the format of Polar Sectors. These figures were presented earlier.

It must be emphasized that polar sectors are for presentation purposes, only. To define the spatial distribution of traffic demand, a total of 99 Source Nodes (i.e. centroids) were created. Each represents an area (or "Zone") within a community.

Summary of Evacuation Time Analysis

A summary of evacuation times is presented in Tables 8-5, which are presented in the format recommended in Appendix 4 of NUREG 0654. The analyses of Confirmation Time and of the ETE for Special Population segments are presented in Sections 9 and 10, respectively.

Population estimates were obtained from the data presented in Section 2. These figures were aggregated into regions as defined in Table 8-2. The appropriate population percentage was applied to these figures based upon scenarios (See Section 5).

Evacuation capacity from each region was ascertained by aggregating the highway capacities of all outward-bound roads which pierce the region's outer boundary. Here, we have employed the capacity estimates associated with Level of Service F conditions, which is estimated at 85 percent of the LOS E values obtained from the 2000 Highway Capacity Manual for all access-controlled sections.

The capacities given represent clear weather conditions. These capacities are reduced by 20 percent for rain and 25 percent for snow. It is assumed that all roads are passable and that the recommended traffic control tactics are in effect (see Appendix I).

It is important to stress that these estimates of available capacity may overstate the actual accessible capacity. Specifically, the high capacities offered by the eastern portion of State Route 2 cannot be fully utilized due to the limited number of entry ramps within the EPZ and to the limited capacities of these ramps.

The estimated notification, preparation and response (i.e. trip-generation) times which are listed correspond to the 100th percentile of the indicated population. That is, these are the times associated with the completion of the indicated process. The process itself (i.e. notification, preparation to evacuate, and departing on the evacuation trip) is best represented as a continuous distribution (see Figure 4-2). This representation graphically depicted the continuous nature of the process. The Evacuation Time Estimates (ETE) are those presented in Tables 8-3 and 8-4.

Appendix N presents the results of a number of studies designed to determine the sensitivity of the ETE to changes in some basic assumptions. The studies presented are: the effects of traffic accidents; effects of changes in the rate of voluntary evacuees; and, the effects of slowly escalating accident scenarios.

Table 8-5A. Results of Evacuation Time Analysis –
Summer, Midday, Midweek

								Relative to Siren Alert				From Order to Evacuate				
	Permanent Seasonal		Transient					Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	4012	2019	3026	1220	2954	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:35	1:15	2:05	2:30
Within Five Miles																
1,2,10,12	5894	2617	3061	1234	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:20	4:00	1:15	2:05	2:30
1,6,10,12	5249	2869	4692	1892	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:35	1:15	2:05	2:30
1,2,6,10,12	7131	3468	4727	1906	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:20	4:00	1:15	2:05	2:30
Within Ten Miles																
1,6,7,8,9,10,12	20809	11014	12173	4909	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:50	4:50	1:15	4:25	5:30
1,2,5,6,7,9,10,12	28977	15099	12308	4963	9214	0:40	2:20	3:00	3:00	1:00	1:00	4:55	6:05	1:15	7:40	8:35
1,2,3,4,5,10,11,12	18080	9028	3894	1571	9214	0:40	2:20	3:00	3:00	1:00	1:00	4:20	5:15	1:15	7:40	8:35
1,2,3,10,11,12	11518	5380	3794	1530	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:35	4:20	1:15	2:05	2:30
1,10,11,12	7087	3534	3759	1516	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:15	3:40	1:15	2:05	2:30
1-12	34877	18023	13042	5259	9214	0:40	2:20	3:00	3:00	1:00	1:00	4:55	6:05	1:15	7:40	8:35

Table 8-5B. Results of Evacuation Time Analysis – Summer, Midday, Midweek, Flood

								Relative to Siren Alert				From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
	Permanent Seasonal		Transient		Evacuation	Notify	Prep.	Time	Time	Time	Time	Time	Time		Time	Time
Areas	Pop.	Vehs.	Pop.	Vehs.	Capacity	Time	Time	Clear	Adverse	Clear	Adverse	Clear	Adverse		Clear	Adverse
Within Two Miles																
1, 10, 12	2363	1194	0	0	2954	0:40	2:20	NA	3:00	NA	NA	NA	3:05	1:15	NA	2:30
Within Five Miles																
1,2,10,12	4245	1792	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:10	1:15	NA	2:30
1,6,10,12	3600	2044	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:05	1:15	NA	2:30
1,2,6,10,12	5482	2643	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:10	1:15	NA	2:30
Within Ten Miles																
1,6,7,8,9,10,12	17141	9180	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:35	1:15	NA	5:30
1,2,5,6,7,9,10,12	25309	13265	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	5:00	1:15	NA	8:35
1,2,3,4,5,10,11,12	14721	7348	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	4:00	1:15	NA	8:35
1,2,3,10,11,12	8159	3700	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:40	1:15	NA	2:30
1,10,11,12	3728	1854	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:10	1:15	NA	2:30
1-12	29499	15334	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	5:00	1:15	NA	8:35

Table 8-5C. Results of Evacuation Time Analysis – Summer, Midday, Weekend

	Permanent Seasonal		Transient			Relative to Siren Alert						From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	5171	2353	6051	2440	2954	0:40	2:20	3:00	3:00	1:00	1:00	3:35	4:10	1:15	2:05	2:30
Within Five Miles																
1,2,10,12	7053	2951	6121	2468	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:55	4:45	1:15	2:05	2:30
1,6,10,12	5883	2678	9384	3784	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:30	4:10	1:15	2:05	2:30
1,2,6,10,12	7765	3277	9454	3812	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:55	4:45	1:15	2:05	2:30
Within Ten Miles																
1,6,7,8,9,10,12	18044	10083	12173	9817	9214	0:40	2:20	3:00	3:00	1:00	1:00	5:25	6:50	1:15	4:25	5:30
1,2,5,6,7,9,10,12	25687	13643	12308	9926	9214	0:40	2:20	3:00	3:00	1:00	1:00	5:40	6:50	1:15	7:40	8:35
1,2,3,4,5,10,11,12	17065	9692	3894	3141	9214	0:40	2:20	3:00	3:00	1:00	1:00	4:50	5:55	1:15	7:40	8:35
1,2,3,10,11,12	11028	6569	3794	3060	9214	0:40	2:20	3:00	3:00	1:00	1:00	4:10	5:05	1:15	2:05	2:30
1,10,11,12	6597	4723	3759	3032	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:40	4:15	1:15	2:05	2:30
1-12	31587	17422	13042	10518	9214	0:40	2:20	3:00	3:00	1:00	1:00	5:40	6:50	1:15	7:40	8:35

Table 8-5D. Results of Evacuation Time Analysis – Summer, Evening

	Permanent Seasonal		Transient					Relative to Siren Alert				From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	1,733	564	303	122	2954	0:40	2:00	2:00	NA	1:00	NA	2:00	NA	1:15	2:05	NA
Within Five Miles																
1,2,10,12	3,615	1,162	306	123	6108	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
1,6,10,12	2,295	739	469	189	6108	0:40	2:00	2:00	NA	1:00	NA	2:00	NA	1:15	2:05	NA
1,2,6,10,12	4,177	1,338	473	191	6108	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
Within Ten Miles																
1,6,7,8,9,10,12	13,586	5,625	1,217	491	9214	0:40	2:00	2:00	NA	1:00	NA	2:30	NA	1:15	4:25	NA
1,2,5,6,7,9,10,12	21,079	9,035	1,231	496	9214	0:40	2:00	2:00	NA	1:00	NA	4:05	NA	1:15	7:40	NA
1,2,3,4,5,10,11,12	13,416	6,043	389	157	9214	0:40	2:00	2:00	NA	1:00	NA	3:15	NA	1:15	7:40	NA
1,2,3,10,11,12	7,529	3,070	379	153	9214	0:40	2:00	2:00	NA	1:00	NA	2:30	NA	1:15	2:05	NA
1,10,11,12	3,098	1,224	376	152	9214	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
1-12	25,269	11,104	1,304	526	9214	0:40	2:00	2:00	NA	1:00	NA	4:05	NA	1:15	7:40	NA

Table 8-5E. Results of Evacuation Time Analysis – Winter, Midday, Midweek, (Rain)

	Permanent Seasonal		Transient			Relative to Siren Alert						From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	1,640	1,140	303	122	2954	0:40	2:20	3:00	0.125	1:00	0.04167	3:00	0.125	1:15	2:05	0.104167
Within Five Miles																
1,2,10,12	2,798	1,685	306	123	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:05	3:05	1:15	2:05	2:30
1,6,10,12	2,554	1,963	469	189	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:05	3:05	1:15	2:05	2:30
1,2,6,10,12	3,712	2,508	473	191	6108	0:40	2:20	3:00	3:00	1:00	1:00	3:05	3:05	1:15	2:05	2:30
Within Ten Miles																
1,6,7,8,9,10,12	14,115	8,862	1,217	491	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:05	3:10	1:15	4:25	5:30
1,2,5,6,7,9,10,12	21,538	12,858	1,231	496	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:10	1:15	7:40	8:35
1,2,3,4,5,10,11,12	13,231	7,170	389	157	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:20	1:15	7:40	8:35
1,2,3,10,11,12	6,712	3,593	379	153	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:10	1:15	2:05	2:30
1,10,11,12	3,005	1,800	376	152	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:00	3:00	1:15	2:05	2:30
1-12	25,707	14,892	1,304	526	9214	0:40	2:20	3:00	3:00	1:00	1:00	3:10	3:20	1:15	7:40	8:35

Table 8-5F. Results of Evacuation Time Analysis – Winter, Midday, Midweek, (Snow)

	Permanent Seasonal		Transient					Relative to Siren Alert				From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	1,640	1,140	303	122	2954	0:40	2:20	3:00	4:30	1:00	1:00	3:00	4:35	1:15	2:05	2:30
Within Five Miles																
1,2,10,12	2,798	1,685	306	123	6108	0:40	2:20	3:00	4:30	1:00	1:00	3:05	4:35	1:15	2:05	2:30
1,6,10,12	2,554	1,963	469	189	6108	0:40	2:20	3:00	4:30	1:00	1:00	3:05	4:30	1:15	2:05	2:30
1,2,6,10,12	3,712	2,508	473	191	6108	0:40	2:20	3:00	4:30	1:00	1:00	3:05	4:35	1:15	2:05	2:30
Within Ten Miles																
1,6,7,8,9,10,12	14,115	8,862	1,217	491	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:05	4:35	1:15	4:25	5:30
1,2,5,6,7,9,10,12	21,538	12,858	1,231	496	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:10	4:40	1:15	7:40	8:35
1,2,3,4,5,10,11,12	13,231	7,170	389	157	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:10	4:40	1:15	7:40	8:35
1,2,3,10,11,12	6,712	3,593	379	153	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:10	4:40	1:15	2:05	2:30
1,10,11,12	3,005	1,800	376	152	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:00	4:30	1:15	2:05	2:30
1-12	25,707	14,892	1,304	526	9214	0:40	2:20	3:00	4:30	1:00	1:00	3:10	4:40	1:15	7:40	8:35

Table 8-5G. Results of Evacuation Time Analysis – Winter, Evening

	Permanent Seasonal		Transient			Relative to Siren Alert						From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	1010	510	0	0	2954	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
Within Five Miles																
1,2,10,12	2168	1055	0	0	6108	0:40	2:00	2:00	NA	1:00	NA	2:10	NA	1:15	2:05	NA
1,6,10,12	1249	658	0	0	6108	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
1,2,6,10,12	2407	1203	0	0	6108	0:40	2:00	2:00	NA	1:00	NA	2:10	NA	1:15	2:05	NA
Within Ten Miles																
1,6,7,8,9,10,12	10560	5307	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	4:25	NA
1,2,5,6,7,9,10,12	17308	8628	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:40	NA	1:15	7:40	NA
1,2,3,4,5,10,11,12	11926	5865	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:35	NA	1:15	7:40	NA
1,2,3,10,11,12	6082	2963	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:10	NA	1:15	2:05	NA
1,10,11,12	2375	1170	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:05	NA	1:15	2:05	NA
1-12	21477	10662	0	0	9214	0:40	2:00	2:00	NA	1:00	NA	2:40	NA	1:15	7:40	NA

Table 8-5H. Results of Evacuation Time Analysis – Spring, Midday, Midweek, Flood

	Permanent Seasonal		Transient					Relative to Siren Alert				From Order to Evacuate				
								Permanent Response		Transient Response		General Population Evacuation			Special Population Evacuation	
Areas	Pop.	Vehs.	Pop.	Vehs.	Evacuation Capacity	Notify Time	Prep. Time	Time Clear	Time Adverse	Time Clear	Time Adverse	Time Clear	Time Adverse	Confirm Time	Time Clear	Time Adverse
Within Two Miles																
1, 10, 12	1640	1140	0	0	2954	0:40	2:20	NA	3:00	NA	NA	NA	3:05	1:15	NA	2:30
Within Five Miles																
1,2,10,12	2798	1685	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:10	1:15	NA	2:30
1,6,10,12	2554	1963	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:05	1:15	NA	2:30
1,2,6,10,12	3712	2508	0	0	6108	0:40	2:20	NA	3:00	NA	NA	NA	3:10	1:15	NA	2:30
Within Ten Miles																
1,6,7,8,9,10,12	14115	8862	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:30	1:15	NA	5:30
1,2,5,6,7,9,10,12	21538	12858	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:35	1:15	NA	8:35
1,2,3,4,5,10,11,12	13231	7170	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:35	1:15	NA	8:35
1,2,3,10,11,12	6712	3593	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:15	1:15	NA	2:30
1,10,11,12	3005	1800	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:05	1:15	NA	2:30
1-12	25707	14892	0	0	9214	0:40	2:20	NA	3:00	NA	NA	NA	3:35	1:15	NA	8:35

9. EVACUATION TIME ESTIMATES (ETE) FOR TRANSIT OPERATIONS

This section details the analyses applied and the results obtained, which provide evacuation time estimates for transit vehicles. The procedure is:

- Estimate demand for transit service
- Estimate time to perform all transit functions
- Estimate route travel time
- Determine how buses should be allocated to routes
- Develop ETE

Demand for transit service reflects the needs of different "special population" groups:

1. Residents and transients with no vehicles available.
2. Special facilities: schools, health-support, child-care, other.
3. Evacuation Time Estimates for each of these population groups will now be developed.

Transit-Dependent People - Demand Estimate

The survey conducted in April of 1986 (see Appendices F and G) acquired a database that enabled us to estimate the portion of the population requiring transit service. The survey results are applied to the 2003 population to achieve a "current" estimate. This group is divided into two subgroups:

- Those persons who belong to households that do not have a vehicle available.
- Those persons who belong to households that normally do have at least one vehicle available, but would not have a vehicle available at the time the evacuation is ordered.

The persons belonging to the latter subgroup are in households where the vehicles(s) have been driven away from home for commuting purposes and are therefore not immediately available when the order to evacuate is given and, in addition, the driver(s) of the vehicles(s) refuse to return home to gather the household members. Question 10 of the survey addressed this issue. Other, less important factors, include the possibilities that the vehicle is non-functioning or that the commuter is willing, but unable to return home.

Tables 9-1 through 9-4 are a typical print-out of the software developed to analyze the survey database and to provide the empirical basis for quantifying those two subgroups. These data were then multiplied by the sample factor (i.e. ratio of total households sampled to the total number of households) to obtain the data for each community within the EPZ. Table 9-5 presents the summary of this data. Since the survey did not include the portion of Lucas County within the EPZ, Ottawa County results were extrapolated.

There are several factors that influence the accuracy of these estimates in Table 9-5:

1. These figures include school children. On school days, separate transportation is provided for the children in school and the actual need for this transit is thereby less than the given estimates.
2. These figures do not take into account the effects of ride-sharing with family, friends and neighbors who do have vehicles available. To the extent that ride-sharing is undertaken, the actual need for this transit is less than the given estimates.
3. These figures do not take into account the prospect that vehicles may not be available due to malfunction. To that extent, the actual need for this transit is slightly greater than the given estimates.
4. Since the number of surveyed persons who require transit is small relative to the total sample, and to the population (less than 5.0 percent), we are contending with a problem of small sample size when the data is considered at the community level. That is, the confidence interval associated with these estimates is apt to be large. There is thus a statistical uncertainty associated with these estimates (as there is with any estimates obtained using statistical procedures) that should be prudently considered.

It is seen that some of the factors that cannot be readily quantified would tend to reduce these estimates, while others would tend to increase them. Despite these uncertainties, an up-to-date informational survey (as opposed to an opinion survey) remains the best means of quantifying such facts.

In consideration of the potential health-threatening effects of a radiological accident, we consider it proper and prudent to increase these estimates by 25 percent to ensure that an adequate supply of transit vehicle is provided.

Table 9-1. Survey Data on Returning Commuters

Port Clinton Households With One Car
One Commuter Who Drives

	Household Size											
	1	2	3	4	5	6	7	8	9	10	Unknown	Total
Number of Households	0	6	3	4	0	0	0	0	0	0	0	13
No. of Non-Returners	0	1	0	2	0	0	0	0	0	0	0	3
No. of Returners	0	5	3	2	0	0	0	0	0	0	0	10
No. of Unsure	0	0	0	0	0	0	0	0	0	0	0	0
Non-Returners Pct.	0.0%	16.7%	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	23.1%

Total Persons Requiring Transit 7
Total Persons at Home Requiring Transit 2

Table 9-2. Survey Data on Returning

Port Clinton Households With Two Cars
Two+ Commuters Who Drive

	Household Size											
	1	2	3	4	5	6	7	8	9	10	Unknown	Total
Number of Households	0	11	5	8	3	1	1	0	0	0	0	29
No. of Non-Returners	0	4	1	1	0	0	0	0	0	0	0	6
No. of Returners	0	5	4	7	3	1	1	0	0	0	0	21
No. of Unsure	0	1	0	0	0	0	0	0	0	0	0	1
Non-Returners Pct.	0.0%	44.4%	20.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.2%

Total Persons Requiring Transit 3
Total Persons at Home Requiring Transit 1

Table 9-3. Survey Data on Returning

Port Clinton Households With Three Cars
Three+ Commuters Who Drive

	Household Size											
	1	2	3	4	5	6	7	8	9	10	Unknown	Total
Number of Households	0	0	1	0	0	0	0	0	0	0	0	1
No. of Non-Returners	0	0	0	0	0	0	0	0	0	0	0	0
No. of Returners	0	0	1	0	0	0	0	0	0	0	0	1
No. of Unsure	0	0	0	0	0	0	0	0	0	0	0	0
Non-Returners Pct.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Total Persons Requiring Transit 0
Total Persons at Home Requiring Transit 0

Table 9-4. Survey Data on Returning

Port Clinton Households With Four Cars
Four+ Commuters Who Drive

	Household Size											
	1	2	3	4	5	6	7	8	9	10	Unknown	Total
Number of Households	0	0	0	1	0	0	0	0	0	0	0	1
No. of Non-Returners	0	0	0	0	0	0	0	0	0	0	0	0
No. of Returners	0	0	0	1	0	0	0	0	0	0	0	1
No. of Unsure	0	0	0	0	0	0	0	0	0	0	0	0
Non-Returners Pct.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Total Persons Requiring Transit 0
Total Persons at Home Requiring Transit 0

Table 9-5. Estimates of Ambulatory Persons Requiring Transit Who Do Not Reside in Special Facilities

	Persons in households with x vehicles, none of which are available					
Community x =	0	1	2	3	4	Total
Port Clinton	202	141	61	0	0	404
Oak Harbor	81	0	20	0	0	101
Rocky Ridge	0	0	0	0	0	0
Bay Township	0	0	0	0	0	0
Benton Twp.	0	0	81	0	0	81
Carroll Twp.	40	0	40	0	0	80
Erie Twp.	0	0	0	0	0	0
Salem Twp. (without Oak Harbor)	0	40	121	20	0	181
Lucas Co.	37	0	0	0	0	37
						884

NOTES:

1. Of those who responded "NOT SURE" to the question: "Would you return home in an emergency at Davis Besse?" we assume 50 percent would return home.
2. The sample factor is 20.21.
3. A factor of 3.7 percent was applied to the Lucas Co. population.

Table 9-6 presents estimates of transit demand. There are several factors that influence the accuracy of the estimates in Table 9-6:

1. These figures include school children. On school days, separate transportation is provided for the children in school and the actual need for this transit is thereby less than the given estimates.

   A reduction in estimated demand due to school children being evacuated by bus is justified only if the accident occurs during a school day. Since school is in session 180 days in a year, for about 7 hours, the probability of an accident occurring when school is in session is approximately

   $$(180 \times 7)/(365 \times 24) = 0.144 \text{ or } 14.4 \text{ percent.}$$

   Consequently, since children will not be in school over 85 percent of the time, it is prudent to assume that all school children of transit-dependent families will be at home and will require transit.

2. Ride-sharing does have a pronounced impact on estimating the need for transit. For example, nearly 80 percent of those who evacuated from Mississauga, Ontario and who did not use their own cars, shared a ride with neighbors or friends. Other documents also report that approximately 70 percent of transit-dependent persons were evacuated via ride-sharing.

   We will adopt the lower figure of 50 percent to calculate the number of transit-dependent persons who will ride-share. The remaining 50 percent will need transit vehicles in order to evacuate.

3. We will assume that the average vehicle is out of service about 3 weeks out of the year. Thus, we will increase the number of transit-dependent persons by 6 percent to account for this factor.

Table 9-6. Estimated Transit Requirements

Community	People Requiring Transit	Bus Trips Required
Port Clinton	267	9
Oak Harbor Rocky Ridge Bay Twp. Benton Twp. Carroll Twp. Erie Twp. Harris Twp. Salem Twp. Lucas Co.	318	11
Totals		20

Notes:

1. Assumption: 25 percent additive factor
2. 50 percent ridesharing
3. 6 percent additive factor for out of service vehicles
4. 30 passengers/bus trips

The number of bus trips needed is based on the conservative premise that the average bus occupancy at the conclusion of the bus run will not exceed 30 persons. This figure compares with an actual seated capacity of 40 adults or 60 children. For example, if the passengers are two-thirds adults and one-third children, then the bus capacity is (2/3) 40 + (1/3) 60 = 47 persons. On this basis, we have assumed that bus trips, at most, will be running at an average load factor of (30/47) 100 = 64 percent. Thus, even if the actual demand for service exceeds the estimates in column 1 of Table 9-6 by 57 percent, that demand can still be accommodated by the available seating capacity. Any additional demand can be accommodated by standing passengers or by rerouting buses that are more lightly loaded.

In Lucas and Ottawa Counties the responsibility for transporting transit-dependent people is assigned to the fire fighters conducting route verification. Buses will be escorted by firefighters and pick up transit dependent people.

Evacuation Time Estimates for Transit-Dependent People

Buses used for the evacuation of transit-dependent people in Port Clinton will be supplied by the Ottawa County Transportation Authority. However, before these buses become available, they are to be used to evacuate school children from Port Clinton schools.

It is important to note that "early dismissal" of students to their homes is not a viable option for the emergency scenarios considered herein. Current plans call for the precautionary evacuation of school children to host facilities early in the emergency scenario.

Although normal early dismissal plans can be accomplished in a single wave using all available buses, the use of buses for other purposes in a fast breaking emergency would require a two-stage lift of students first, and then the general transit-dependent population.

Several different scenarios must be considered in developing bus ETE's. The first scenario is defined as a winter, weekday with school in session. The second scenario is defined as a weekend, when school is not in session or during the summer. Figures 9-1 and 9-2 present the chronology of events for each of these scenarios. Note that Figures 9-1 and 9-2 are schematic; no specific elapsed time is implied for any activity.

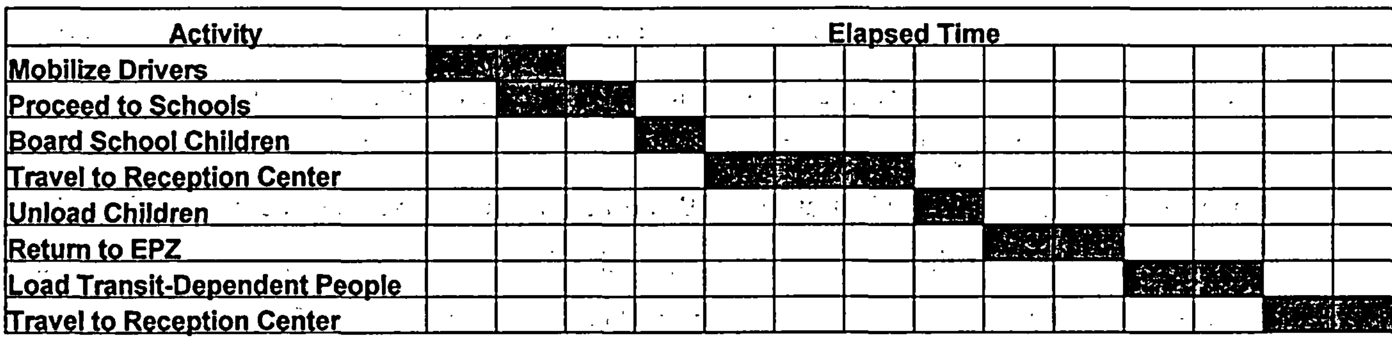

Figure 9-1. Chronology of Events For The Evacuation of Transit-Dependent People Scenario: Winter, Weekday, Schools In Session

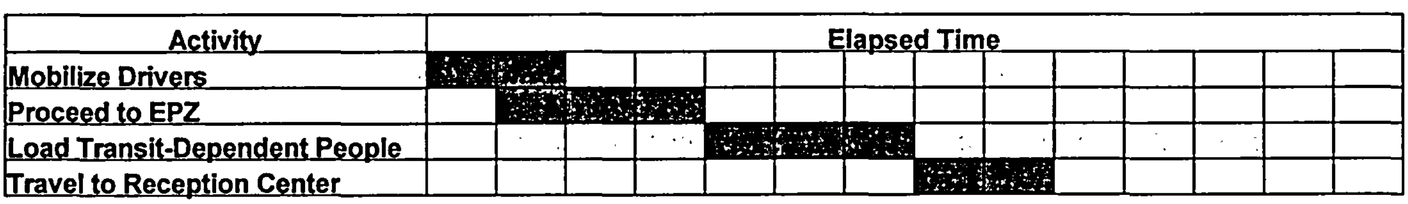

Figure 9-2. Chronology of Events For The Evacuation of Transit-Dependent People Scenario: Schools Not In Session

The elapsed time for each activity will now be discussed:

<u>Activity: Mobilize Drivers</u>

Mobilization may be defined as the elapsed time from the moment that the transit agency is notified of the need for vehicles until the time the vehicles leave their respective points of origin. Mobilization of school bus drivers is scheduled to begin at the alert stage. It is reasonable to estimate that the start of this mobilization is at 15 minutes before the order to evacuate is issued to the general public.

Discussions with Port Clinton School District personnel indicate that, historically, it takes between 30 and 45 minutes to alert bus drivers to the need for an early dismissal due to inclement weather. It has been noted that during conditions which could lead to early school dismissals (snow, storms) bus drivers are primed to respond even before the event (in this case, implementation of early dismissal plan), whereas drivers would likely require a longer period of time to mobilize for an accident at Davis Besse because they would not be aware of unfolding events in the way that they recognize the approach of a storm. Consequently, it was decided to utilize a mobilization time of 1 hour under normal conditions and 1 hour 15 minutes under adverse weather conditions.

Activity: Proceed to Schools

In general, the distance between the bus garage and the Port Clinton schools is under two miles. At an average speed of 10 miles per hour, the trip takes about ten minutes.

Activity: Load/Unload passengers

Studies have shown that passengers can board a bus at headways of 2-4 seconds (Ref. HCM2000 Page 27-27). A bus can be loaded with school children in about five minutes. Transit-dependent people take longer to load a bus because these people will have some luggage and personal possessions with them. A value of 15 minutes is used.

However, it cannot be assumed that a full load of passengers will be present when a bus makes any given stop. Buses will cruise along with the fire department route alert personnel until they have a high load factor. A 30 minute dwell time in this mode is used for the ETE computation.

Activity: Travel to Reception Center from Schools

The distance between Port Clinton and the Reception Center in Sandusky is approximately 20 miles. The results of the traffic simulation analysis for both winter snow and good weather conditions indicate that, after one hour, an average speed of 20 miles per hour is attainable in adverse weather and 40 miles per hour in good weather.

Activity: Return from Reception Center to Port Clinton

It might be expected that travel into the Port Clinton area after an evacuation has been recommended should be easier than during normal periods. This supposition is based on the fact that most people will avoid traveling into the area at risk unless there is some compelling reason to do so. On this basis, we will assume average speeds from Sandusky to Port Clinton will be 20 miles per hour in adverse weather and 40 miles per hour in good weather.

Activity: Travel to Reception Center with Transit-Dependent People

The ETE for transit-dependent people is measured to the instant these people leave the EPZ, not the time they arrive at the reception center. Assuming an average speed of 10 miles per hour in Port Clinton, about 10 minutes would be required to leave the city.

Table 9-7 summarizes the results of the transit-dependent evacuation analysis. With schools in session and a rapidly escalating accident scenario, between 3 and 4 hours elapse before the buses leave the EPZ on the last run.

When school is not in session, buses can be ready to leave within 2 hours. However, at this time only about 85 percent of the general population is prepared to leave the EPZ. Therefore, some bus service must be made available to people arriving at bus pickup points after 2 hours.

Evacuation time estimates for transit-dependent people outside of Port Clinton are based upon buses traveling approximately 40 miles inside of the 10 mile region; 25 miles inside of the 5 mile EPZ; and 5 miles inside of the 2 mile region to pick up people. Average speeds in the EPZ for various conditions are as follows:

	Normal	Adverse
Summer weekend	15 mph	10 mph
Winter	35 mph	20 mph

Mobilization time is assumed to be the same as for Port Clinton buses; 1 hour in good weather, 1 hour 15 minutes during adverse conditions. A summary of the ETE for transit-dependent people outside of Port Clinton is shown in Table 9-8.

Schools and Special Facilities - Demand Estimates

Figures 9-3 presents the locations of schools and special facilities within the DBNPS EPZ. Tables 9-10 present school and special facility population and transportation requirements. Three tables are presented; Table 9-9a for schools in the Benton-Carroll-Salem (BCS) School District, Table 9-9b for schools in the Port Clinton School District, and Table 9-9c for special facilities. Note that in each table the number of extra buses required to transport students are estimated. The estimate of the number of buses required is based on analysis of the passenger capacities of buses in the school bus fleets to be utilized. Table 9-10a summarizes the capacities of the various bus fleets; Table 9-10b summarizes EMS vehicle availability.

Table 9-7. Summary of Component Bus Evacuation Times

Activity	School in Session: Good Weather	School in Session: Adverse Weather	School Not in Session
Mobilize Drivers	1:00	1:15	1:00
Proceed to Schools	0:10	0:10	NA
Board School Children	0:05	0:05	NA
Travel to Reception Center	0:30	1:00	NA
Unload Children	0:05	0:05	NA
Proceed to Bus Pick-up points	0:30	1:00	0:10
Load Transit-Dependent People	0:30	0:30	0:30
Travel to EPZ Boundary	0:10	0:10	0:10
Total Time	3:00	4:15	1:50

Table 9-8. ETE Summary for Transit-Dependent People Outside of Port Clinton

	Summer					
	2 Mile		5 Mile		10 Mile	
Activity	Good Weather	Bad Weather	Good Weather	Bad Weather	Good Weather	Bad Weather
Mobilization	1:00	1:15	1:00	1:15	1:00	1:15
Travel Time	0:20	0:30	1:20	2:30	2:20	4:00
Passenger Pickup	0:15	0:15	0:15	0:15	0:15	0:15
ETE	**1:35**	**2:00**	**2:35**	**4:00**	**3:35**	**5:30**

	Winter					
	2 Mile		5 Mile		10 Mile	
Activity	Good Weather	Bad Weather	Good Weather	Bad Weather	Good Weather	Bad Weather
Mobilization	1:00	1:15	1:00	1:15	1:00	1:15
Travel Time	0:10	0:15	0:45	1:15	1:10	2:00
Passenger Pickup	0:15	0:15	0:15	0:15	0:15	0:15
ETE	**1:25**	**1:45**	**2:00**	**2:45**	**2:25**	**3:30**

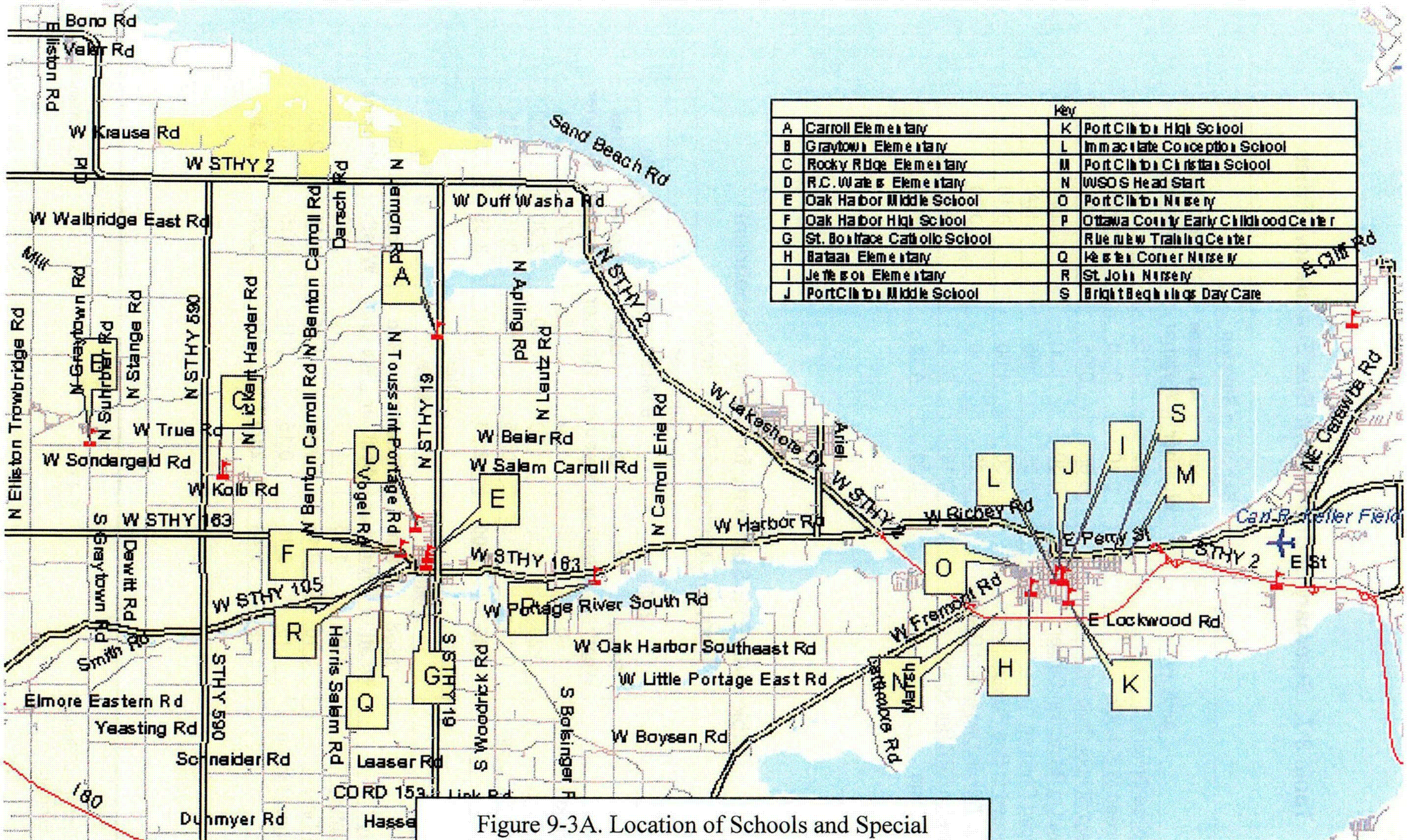

Figure 9-3A. Location of Schools and Special Facilities

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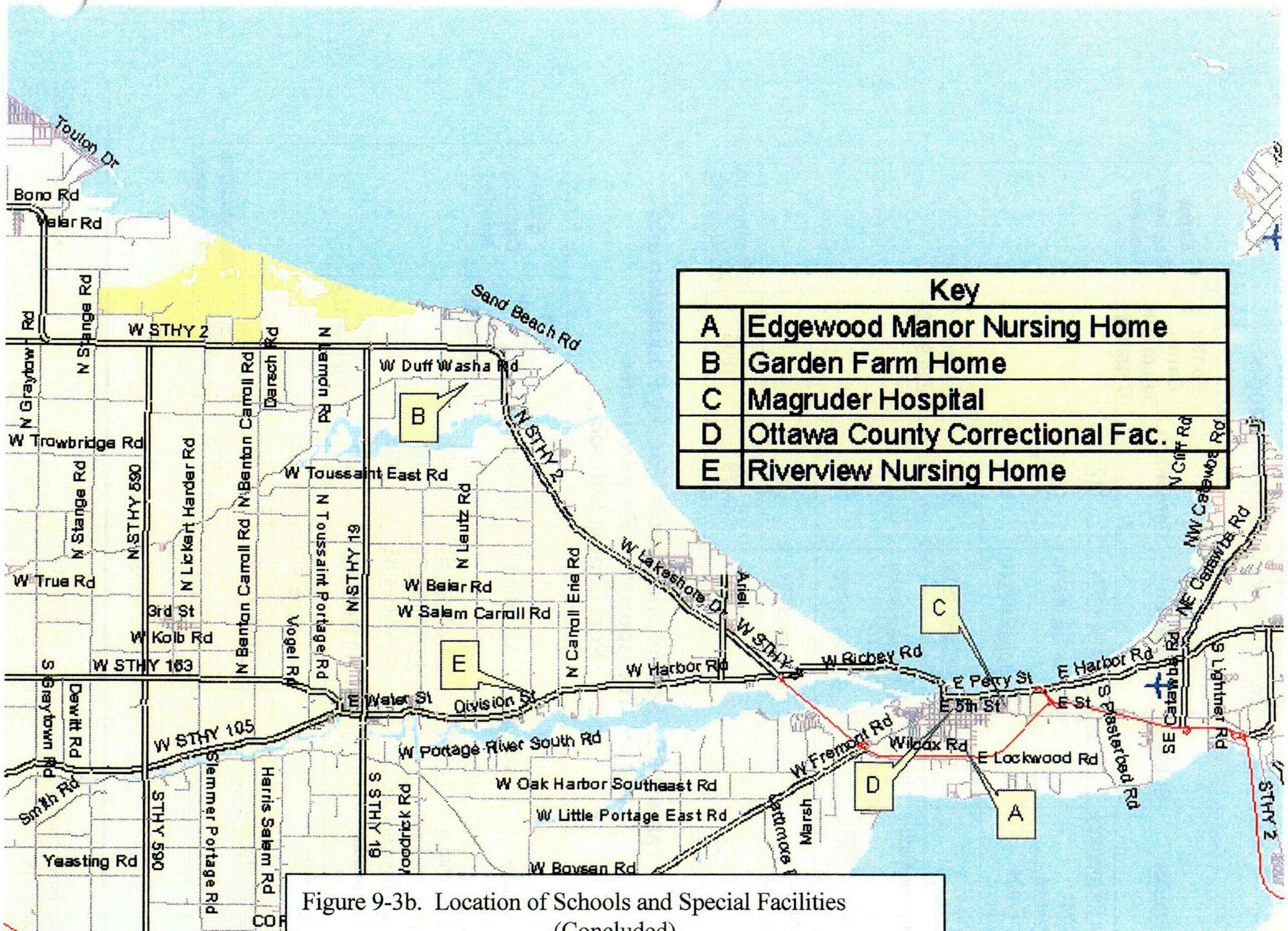

Figure 9-3b. Location of Schools and Special Facilities (Concluded)

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Table 9-9A. School and Special Facility Population and Transportation Requirements Benton-Carroll-Salem Schools

Facility	Subarea	Location	Enrollment	Benton-Carroll-Salem Bus Capacity	Extra Capacity Needed
Carroll Elementary	2	3.8 Miles SW	142	From Table 9-10A	
Graytown Elementary	3	8.5 Miles WSW	139		
Rocky Ridge Elementary	3	7.5 Miles WSW	133		
R.C. Waters Elementary	5	6.5 Miles SSW	474		
Oak Harbor Middle School	5	5.5 Miles SSW	505		
Oak Harbor High School	5	6 Miles SSW	716		
St. Boniface Catholic School	5	5 Miles SSW	70		
			2179	1905	274 students or 10 buses

Table 9-9B. School and Special Facility Population and Transportation Requirements Port Clinton Schools

Facility	Subarea	Location	Enrollment	Port Clinton Bus Capacity	Extra Capacity Needed
Bataan Elementary	9	10.0 Miles SE	340	From Table 9-10A	
Jefferson Elementary	9	10.5 Miles SE	309		
Immaculate Conception	9	10.5 Miles SE	200		
Port Clinton Middle School	9	10 Miles SE	342		
Port Clinton High School	9	11 Miles SE	756		
Port Clinton Christian	9	11 Miles SE	31		
			1978	1590	388 students or 15 buses

Table 9-9C. School and Special Facility Population and Transportation Requirements
Special Facilities

Facility	Subarea	Location	Enrollment	Buses Required	Other Transport	Bus Source
Kersten Corner Nursery	5	7.5 Miles SSW	63	2	0	Genoa
St. John Nursery	5	7.5 Miles SSW	48	1	0	Genoa
Ottawa County Early Childhood Center	5	6 Miles S	40	2	0	OCTA
Riverview Industries	5	6 Miles S	110	5	0	Riverview
W.S.O.S. Headstart	9	10 Miles SE	55	1	0	Woodmore
Bright Beginnings Daycare	9	11 Miles SE	48	1	0	Woodmore
Port Clinton Nursery	9	10.5 Miles SE	59	1	0	Woodmore
Edgewood Manor Nursing Center	9	12 Miles SE	100 Beds	1	7 Amb.; 6 Lift Vans or 1 Lift Bus	Genoa; Local Sources; Riverview
Garden Farm Home	1	1.5 Miles SE	8	Own Transport	0	
Magruder Hospital	9	11.5 Miles SE	35 Beds	1	8 Amb.; 2 Air Amb.	Port Clinton; Local Sources; "Life Flight"
Ottawa County Detention Facility	9	10.5 Miles SE	48	1	0	Ottawa Co. Sheriff
Riverview Nursing Home	5	6 Miles S	166	2	31 Amb.	Local Sources; OHARNG

Table 9-10a. Summary of Bus Fleet Capacity

School District	No.	Capacity of Bus	Total Capacity
Ottawa County Transportation Agency	1	3 passenger (lift) plus 1 wheelchair	224 + 32 Wheelchairs
	1	20 passenger (lift) plus 5 wheelchairs	
	1	25 passenger (lift) plus 3 wheelchairs	
	1	22 passenger (lift) plus 2 wheelchairs	
	3	28 passenger (lift) plus 11 wheelchairs	
	1	13 passenger (lift) plus 3 wheelchairs	
	1	24 passenger (lift) plus 7 wheelchairs	
		OCTA also has 13 vans with 6 vans having lift capability with a 96 passenger capacity	
Port Clinton	1	54 passenger (lift) plus 2 wheelchairs	1590 + 5 Wheelchairs
	6	65 passenger	
	15	71 passenger	
	1	21 passenger (lift) plus 2 wheelchairs	
	1	60 passenger (lift) plus 1 wheelchair	
Benton-Carroll-Salem	2	5 passenger (lift)	1905
	2	25 passenger (lift)	
	3	65 passenger (lift)	
	5	72 passenger	
	8	71 passenger	
	9	78 passenger	
Danbury	3	66 passenger	1524
	17	72 passenger	
	1	36 passenger (lift)	
	1	66 Passenger (lift)	
Woodmore	11	65 passenger	906
	1	83 passenger	
	1	78 passenger	
	1	30 passenger (lift)	

Table 9-10b. Summary of Emergency Medical Service Vehicle Availability

Local EMS and Fire Department Resources

Department	Manpower		Equipment	Amount
	Firefighters	EMT		
Allen Station-ACJFD	38	30	Car	1
			Pumpers	2
			Tankers	1
			Ambulances	2
			Port. Pumps	1
			Port. Generators	4
			SCBA	14
			Tanks	25
			Port. Radios	16
Bay Township	30	5	Heavy Rescue	1
			Pumpers	2
			Tanker	1
			Port. Pumps	2
			Port. Generators	2
			SCBA	10
			Port. Radios	13
			Tanks	11
Carroll Township	23	26	Car	1
			Rescue	1
			Pumper	3
			Tanker	1
			Mini-pumper	1
			Ambulance	2
			SCBA	12
			Tanks	10
			Port. Radios	17

Evacuation Time Estimates for Schools and Special Facilities

In developing evacuation scenarios for schools and special facilities, several conditions were evaluated:

1. The effect of a split evacuation for the Benton-Carroll-Salem Schools. The split evacuation scenario envisions utilizing the existing B-C-S bus fleet to evacuate all elementary students followed, in a second wave, by all high school students. Comparison was made with a simultaneous evacuation of all students with the aid of additional buses from OCTA
2. The effects of adverse weather was evaluated.

Table 9-11 presents the ETE for Benton-Carroll-Salem Schools for a single, coordinated movement of students. Note that the distances buses travel to the facility for Oak Harbor High School reflect the use of OCTA buses.

Table 9-12 presents the ETE for Benton-Carroll-Salem Schools using a split-evacuation assumption. As noted in the table, following the evacuation of elementary school children, buses must return to evacuate high school students. The sequence of events for the evacuation of Oak Harbor High School, postulated in Table 9-12 as the mobilization time is based upon the analyses presented in Table 9-13.

Tables 9-11 and 9-12 indicate that a single coordinated evacuation of the B-C-S schools will require between 1.5 and 2 hours, depending on weather conditions. If a split evacuation is undertaken, the last students leave the EPZ between 2.5 and 3.5 hours after the order to evacuate the schools is issued.

Table 9-14 presents the Facility ETE analysis for Port Clinton and the special facilities. Note that speeds within the EPZ are generally lower in Port Clinton than the rest of the EPZ. The table reflects the use of buses from the Danbury, Woodmore and Genoa School Districts.

Emergency Medical Services (EMS) Vehicles

The previous discussion focused on transit operations for ambulatory and wheelchair-bound persons within the EPZ. It is also necessary to provide transit services to non-ambulatory persons who do not -- or cannot -- have access to private vehicles.

The transportation resources for the non-ambulatory EPZ population are drawn from three sources: Cooperative agreements with fire/EMS services both within the EPZ and in nearby communities; Private ambulance and air ambulance services; and, Ohio Army National Guard sources. Since the demand for ambulances to move patients from facilities within the EPZ to reception centers is greater than the immediately available supply (National Guard response times are on the order of six hours), the ETE for this population segment is predicated on the establishment of an ambulance shuttle using local resources. As National Guard ambulances become available, they are used to transport the remaining population.

The evacuation time estimates presented in Tables 9-15 are based on the following assumptions:

1. Initially, all 4 local ambulances are available for the first evacuation run. Subsequent runs utilize 4 local ambulances.
2. Ambulances are initially dispatched to special facilities from their home base. Subsequent trips are assigned via radio when the ambulances approach to EPZ from reception centers.
3. No more than 6 ambulances may be loaded, or unloaded simultaneously at a single facility. If more than 6 ambulances are present, they will queue until space is available.
4. Travel times for ambulances being cycled back to the EPZ for more pickups include delays associated with radiological monitoring at reception centers and delays associated with crossing access control points.

Summary of ETE

Tables 8-5 contain evacuation summaries for various scenarios. Values for special population in the 10 mile region containing subareas 5 and 9 (locations of special facilities) reflect the considerably longer evacuation time for the special facility population. As was indicated, evacuation times for transit-dependent people are considerably less.

Table 9-11A: School and Special Facility Evacuation Times
Benton - Carroll - Salem Schools
Single Evacuation of all Schools
(Good Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Carroll Elementary	3.5	7.5	40	20	60	5	5	25	1:35
Graytown Elementary	6.5	1.5	40	20	60	10	5	5	1:20
Rocky Ridge Elementary	5	5	40	20	60	10	5	15	1:30
R.C. Waters Elementary	1	4	40	20	60	5	5	15	1:25
Oak Harbor Middle School	0.5	3.5	40	20	60	5	5	10	1:30
Oak Harbor High School	11	3.5	40	20	60	15	5	10	1:30
St. Boniface Catholic School	0.5	4	40	20	60	5	5	15	1:25

Notes:

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. Buses for Oak Harbor H.S. are drawn from the OCTA or nearby school district bus fleets through cooperative arrangements.

Table 9-11B: School and Special Facility Evacuation Times
Benton - Carroll - Salem Schools
Single Evacuation of all Schools
(Adverse Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Carroll Elementary	3.5	7.5	32	16	75	5	5	30	1:55
Graytown Elementary	6.5	1.5	32	16	75	10	5	5	1:35
Rocky Ridge Elementary	5	5	32	16	75	10	5	20	1:50
R.C. Waters Elementary	1	4	32	16	75	5	5	15	1:40
Oak Harbor Middle School	0.5	3.5	32	16	75	5	5	15	1:40
Oak Harbor High School	11	3.5	32	16	75	20	5	15	1:55
St. Boniface Catholic School	0.5	4	32	16	75	5	5	15	1:40

Notes:

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. Buses for Oak Harbor H.S. are drawn from the OCTA or nearby school district bus fleets by cooperative arrangements.

Table 9-12A: School and Special Facility Evacuation Times
Benton - Carroll - Salem Schools
Split Evacuation (Elementary then High Schools)
(Good Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Carroll Elementary	3.5	7.5	40	20	60	5	5	25	1:35
Graytown Elementary	6.5	1.5	40	20	60	10	5	5	1:20
Rocky Ridge Elementary	5	5	40	20	60	10	5	15	1:30
R.C. Waters Elementary	1	4	40	20	60	5	5	15	1:25
Oak Harbor Middle School	0.5	3.5	40	20	60	5	5	10	1:30
Oak Harbor High School	NA	3.5	40	20	155 See Note 3	NA	5	10	2:50
St. Boniface Catholic School	0.5	4	40	20	60	5	5	15	1:25

Notes

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. As buses evacuating school children arrive at Vanguard Vocational H.S. in Fremont, students are unloaded, and the buses are returned to Oak Harbor H.S. Mobilization time for Oak Harbor H.S. is sum of the facility ETE for elementary schools, travel time from EPZ to Vanguard H.S., bus unloading time, and travel time from Vanguard H.S. to Oak Harbor H.S.
   Table 9-13 presents details of this analysis.

Table 9-12B: School and Special Facility Evacuation Times
Benton - Carroll - Salem Schools
Split Evacuation (Elementary then High Schools)
(Adverse Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Carroll Elementary	3.5	7.5	32	16	75	5	5	30	1:55
Graytown Elementary	6.5	1.5	32	16	75	10	5	5	1:35
Rocky Ridge Elementary	5	5	32	16	75	10	5	20	1:50
R.C. Waters Elementary	1	4	32	16	75	5	5	15	1:40
Oak Harbor Middle School	0.5	3.5	32	16	75	5	5	15	1:40
Oak Harbor High School	NA	3.5	32	16	180 See Note 3	NA	5	15	3:20
St. Boniface Catholic School	0.5	4	32	16	75	5	5	15	1:40

Notes

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. As buses evacuating school children arrive at Vanguard Vocational H.S. in Fremont, students are unloaded, and the buses are returned to Oak Harbor H.S. Mobilization time for Oak Harbor H.S. is sum of the facility ETE for elementary schools, travel time from EPZ to 3. Vanguard H.S., bus unloading time, and travel time from Vanguard H.S. to Oak Harbor H.S. Table 9-13 presents details of this analysis.

Table 9-13. Estimation of the Elapsed Time Required to have Buses Available to Evacuate Oak Harbor High School (Split Evacuation)

Event	Elapsed Time	
	Good Weather	Adverse Weather
Evacuation Of Elementary Schools	95	110 (Note 1)
Travel Time From EPZ Boundary To Vanguard H.S. In Fremont	15	20 (Note 2)
Unload Buses	5	5
Radiological Monitoring And Access Control Delays	15	15
Travel Time From Vanguard H.S. In Fremont To Oak Harbor H.S.	25	30 (Note 3)
Elapsed Time	**155**	**180 (Note 4)**

Notes:

1. Elementary School ETE is defined as the time children leave the EPZ. Values are obtained from Table 9-12.
2. The distance from the EPZ boundary to Vanguard High School in Fremont is approximately 10 miles. Average speeds outside of the EPZ are 40 miles per hour in good weather and 32 miles per hour in adverse weather.
3. The distance between Vanguard H.S. and Oak Harbor H.S. is approximately 15 miles. Average speeds for this trip are 40 miles per hour in good weather and 32 miles per hour in adverse weather.
4. The elapsed time shown is the time between the issuance of an order to evacuate schools and the time buses are ready to load high school students.

Table 9-14A: School and Special Facility Evacuation Times
Port Clinton Schools and Special Facilities
(Good Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Bataan Elementary	1.5	1	40	10	60	10	5	10	1:25
Jefferson Elementary	1.5	1	40	10	60	10	5	10	1:25
Immaculate Conception	1.5	1	40	10	60	10	5	10	1:25
Port Clinton Middle School	1.5	1	40	10	60	10	5	10	1:25
Port Clinton High School	1.5	1	40	10	60	10	5	10	1:25
Port Clinton Christian	1.5	1	40	10	60	10	5	10	1:25
Kersten Corner Nursery	11	4	40	20	60	15	10	15	1:40
St. John Nursery	11	4	40	20	60	15	10	15	1:40
Ottawa County Early Childhood Center	NA	6.1	40	20	60	--	30	20	1:50
Riverview Industries	NA	6.1	40	20	60	--	30	20	1:50
W.S.O.S. Headstart	20	1	40	10	60	30	10	10	1:50
Bright Beginnings	20	1	40	10	60	30	10	10	1:50
Port Clinton Nursery	20	1	40	10	60	30	10	10	1:50

Notes:

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. Distances from bus depots to facilities reflect the use of Port Clinton, Danbury, Genoa, Woodmore, and OCTA buses.
4. Bus loading times for nursery schools are longer than loading times for elementary or high schools due to the closer supervision required by young children. Loading times for the Riverview facilities reflect the presence of handicapped clients.

Table 9-14B: School and Special Facility Evacuation Times
Port Clinton Schools and Special Facilities
(Adverse Weather)

Facility	Distance From Bus Depot to Facility (Miles)	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Miles/Hour)		Bus Driver Mobilization (Minutes)	Travel Time from Bus Depot to Facility (Minutes)	Bus Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Hrs.:Mins.)
Bataan Elementary	1.5	1	32	8	75	10	5	10	1:40
Jefferson Elementary	1.5	1	32	8	75	10	5	10	1:40
Immaculate Conception	1.5	1	32	8	75	10	5	10	1:40
Port Clinton Middle School	1.5	1	32	8	75	10	5	10	1:40
Port Clinton High School	1.5	1	32	8	75	10	5	10	1:40
Port Clinton Christian	1.5	1	32	8	75	10	5	10	1:40
Kersten Corner Nursery	11	4	32	16	75	20	10	15	2:00
St. John Nursery	11	4	32	16	75	20	10	15	2:00
Ottawa County Early Childhood Center	NA	6.1	32	16	75	--	30	25	2:10
Riverview Industries	NA	6.1	32	16	75	--	30	25	2:10
W.S.O.S. Headstart	20	1	32	8	75	40	10	10	2:15
Bright Beginnings	20	1	32	8	75	40	10	10	2:15
Port Clinton Nursery	20	1	32	8	75	40	10	10	2:15

Notes:

1. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
2. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
3. Distances from bus depots to facilities reflect the use of Port Clinton, Danbury, Genoa, Woodmore, and OCTA buses.
4. Bus loading times for nursery schools are longer than loading times for elementary or high schools due to the closer supervision required by young children. Loading times for the Riverview facilities reflect the presence of handicapped clients.

Table 9-15A: Special Facility Evacuation Times (Good Weather)

Facility	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ See Note 1 (Miles/Hour)		Bus Driver Mobilization (Minutes)	Vehicle Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Note 2) (Hrs.:Mins.)
Edgewood Manor Nursing Center	2.3	40	10	218 (Note 3)	30	15	4:25
Magruder Hospital	1.8	40	10	230 (Note 4)	20	10	4:20
Riverview Nursing Home	6.1	40	20	260 (Note 5)	50 (Note 6)	20	5:30
Ottawa Co. Detention Center	1	40	10	60	30	10	1:40
Garden Farm Home	11.5	40	20	60	30	35	2:05

Notes:

1. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
2. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
3. As lift bus evacuating school children arrives at Vanguard Vocational H.S. in Fremont, students are unloaded, and the lift bus is returned to Edgewood Manor Nursing Center. Mobilization time for Edgewood Manor is sum of the Riverview School ETE, travel time from EPZ to Vanguard Vocational H.S., bus unloading time, monitoring time, access control delay time, and travel time from Vanguard H.S. to Edgewood Manor Nursing Home
4. As ambulances evacuating occupants from first cycle of ambulance runs to Magruder Hospital arrive at Firelands Community Hospital in Sandusky, evacuees are unloaded and the ambulance is monitored and returned to Magruder Hospital. Mobilization time for Magruder is sum of the arrival time of a first cycle Magruder Hospital run at Firelands Community Hospital, access control delay time, and travel time from Firelands to Magruder Hospital.
5. Mobilization time for Riverview Nursing Home is the Evacuation time for Magruder Hospital
6. Load time includes a delay time associated with queuing ambulances at the special facility.

Table 9-15B: Special Facility Evacuation Times (Adverse Weather)

Facility	Distance From Facility to EPZ Boundary (Miles)	Average Speed Within EPZ (Note 1) (Miles/Hour)		Bus Driver Mobilization (Minutes)	Vehicle Loading Time (Minutes)	Travel Time From Facility to EPZ Boundary (Minutes)	Facility ETE (Note 2) (Hrs.:Mins.)
Edgewood Manor Nursing Center	2.3	32	8	250	30	20	5:00
Magruder Hospital	1.8	32	8	283	30	15	5:30
Riverview Nursing Home	6.1	32	16	330	90 (Note 6)	25	7:25
Ottawa Co Detention Facility	1	32	8	75	30	10	1:55
Garden Farm Home	11.5	32	16	75	30	45	2:30

Notes:

1. Average speed within the EPZ is shown for both inbound and outbound (with evacuation) directions.
2. Evacuation Time Estimates are referenced from the transmission of the Order to Evacuate To The Schools and Special Facilities. This order may precede the Order to Evacuate the general population.
3. As lift bus evacuating school children arrives at Vanguard Vocational H.S. in Fremont, students are unloaded, and the lift bus is returned to Edgewood Manor Nursing Home. Mobilization time for Edgewood Manor is sum of the Riverview School ETE, travel time from EPZ to Vanguard Vocational H.S., bus unloading time, monitoring time, access control delay time, and travel time from Vanguard H.S. to Edgewood Manor Nursing Home
4. As ambulances evacuating occupants from first cycle of ambulance runs to Magruder Hospital arrive at Firelands Community Hospital in Sandusky, evacuees are unloaded and the ambulance is monitored and returned to Magruder Hospital. Mobilization time for Magruder is sum of the arrival time of a first cycle Magruder Hospital run at Firelands Community Hospital, access control delay time, and travel time from Firelands to Magruder Hospital.
5. Mobilization time for Riverview Nursing Home is the Evacuation time for Magruder Hospital
6. Load time includes a delay time associated with queuing ambulances at the special facility.

10. SURVEILLANCE OF EVACUATION OPERATIONS

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

1. Arrangements may be made with the Civil Air Patrol or commercial flight services to provide aerial surveillance, using either helicopter or fixed-wing aircraft. Such surveillance is effective both day and night, weather permitting. The aircraft must be able to communicate with the EOC and the pilot trained to utilize dosimetry equipment.
2. Ground patrol should be undertaken along well-defined paths to ensure coverage of those highways that serve as major evacuation routes.
3. Fixed-point surveillance is provided by all traffic guides located at Traffic Control Posts and at the Access Control Posts.

These concurrent surveillance procedures are designed to provide coverage of the entire EPZ as well as the area around its periphery. With this coverage, any blockage caused by a disabled vehicle should be quickly identified within a matter of minutes:

- From the air, a blockage is identified by a marked discontinuity in traffic density. Upstream of the blockage, evacuating vehicles will exhibit a dense queuing pattern while the highway downstream will exhibit a very low density. Such a discontinuity is easily detected at night, by observing the pattern of head-lights and tail-lights, and by day, directly.
- The patrol cars, manned by experienced police personnel, should be able to travel faster than the general public along those portions of their routes that are in the outbound direction. These patrol routes should be designed so that the patrols travel counter-flow along roads that are most heavily congested.

Most patrol routes are approximately 15 miles in length. This length, in combination with skillful driving by experienced police personnel, should permit one cycle over the route to be completed well within one hour. A blockage would be identified visually using the same criteria of density discontinuity described above, or directly.

- Personnel at the TCP and ACP would recognize that a blockage (beyond visible range) has occurred, when a pronounced and extended decrease in evacuating traffic volume is observed along an evacuation route. While short-term fluctuations in demand are common, any sharp decrease in demand that prevails for more than three minutes should be viewed as a symptom of a blockage somewhere on an approach to of the TCP location. It is also probable that a passing motorist will inform the traffic guide that a blockage has taken place.

  The traffic guide would immediately report to the EOC that an apparent blockage is taking place. If more than one guide is stationed at the TCP, then one officer can leave the post to investigate the cause. If a police car is patrolling the route, then that car can be assigned to investigate.

Tow Vehicles

In a low-speed traffic environment, any vehicle disablement is likely to arise due to mechanical failure or exhausting the fuel supply. In either case, the disabled vehicle can be pushed onto the shoulder, thereby restoring access for the following vehicles.

Most accidents involving vehicles traveling at low speeds, such as present during congested conditions, will not result in a vehicle disablement; most of those that may be disabled can be pushed onto the shoulder. Experience in other emergencies indicates that evacuees who are anxious to continue their trips 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. We therefore recommend that tow trucks 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.
- Tow trucks responding to a need would most likely travel counter-flow relative to evacuating traffic.

11. 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. Since it is not feasible to confirm the compliance of every household within the EPZ in a timely manner, a procedure that employs a stratified random sample is recommended.

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 was undertaken (see Exhibit 11-1) which yielded an estimated sample size of approximately 300.

The confirmation process should start at about 3 hours after the order to evacuate is announced or 1-1/2 hours prior to the ETE value, whichever is later. For example, if the ETE, referenced to the order to evacuate, is 6:30, then the confirmation process should begin 5 hours after the order. If the ETE is 3:30, then the confirmation process should begin 3 hours after the order to evacuate. At these times, for either case, virtually all evacuees will have departed on their respective trips and the local telephone system will be largely free of traffic.

As indicated in Exhibit 11-1, almost 8-1/2 person hours are needed to complete the telephone survey. If 7 people are assigned to this task, each dialing a different set of telephone exchanges (e.g., each person can be assigned a different ERPA), then the confirmation process will extend over a time frame of about 75 minutes. Thus, the confirmation should be completed about 15 minutes before the evacuated area is cleared (for those cases where the ETE exceeds 4:30) or up to 45 minutes after the area is cleared, for situations with shorter ETE. Of course, fewer people would be needed for this survey if only a portion of the EPZ is ordered to evacuate.

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.

EXHIBIT 11-1

ESTIMATED NUMBER OF TELEPHONE CALLS REQUIRED
FOR CONFIRMATION OF EVACUATION

Problem Definition

Estimate number of phone calls, n, needed to ascertain the proportion, P 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.) = 55,000
Est. proportion, F, of households that will not evacuate = 0.20
Allowable error margin, e: 0.05
Confidence level, α: 0.95 (implies A = 1.96)

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

Applying Table 10 of cited reference,

Finite population correction:

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

$$n_F = \frac{nN}{nN1} = 306$$

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, $n_F = 215$.

Est. Person Hours to complete 300 telephone calls

Assume: Time to dial using touch-tone (random selection of listed numbers): 30 seconds
Time for 8 rings (no answer): 48 seconds
Time for 4 rings plus short conversation: 60 sec.
Interval between calls: 20 sec.

Person Hours: 300[30+20+0.8(48)+0.2(60)]/3600 = 8.4

APPENDIX A

Glossary of Terms

Term	Definition
Capacity	Maximum number of vehicles which have a reasonable expectation of passing a given section of roadway in one direction during a given time period under prevailing roadway and traffic conditions. These are estimates that are expressed as vehicles per hour (vph).
Centroid	An origin or destination located in the interior of the network.
Content	Number of vehicles occupying a section of roadway at a particular point in time
Destination	A location in the network, either within the interior or on the periphery, to which trips are attracted.
Entry Node	A network node, usually located on the periphery of a network, which serves only as an origin. That is, vehicles are generated and move into the network to travel toward their respective destinations.
Exit Node	A network node, usually located on the periphery of a network, which serves only as a destination. That is, vehicles which arrive at an exit node are discharged from the network
Green-Time to Cycle Time Ratio (G/C Ratio).	The ratio of the duration of a green interval to the cycle length. This ratio denotes the proportion of time available to service a specified traffic movement on a specific approach to an intersection.
Internal Node	All nodes that are not Entry or Exit nodes. Vehicles travel through these nodes from one link to the next along their respective paths toward their respective destinations.
Level of Service	An index (A, B, ..., E) which is a qualitative descriptor of the operational performance of traffic on a section of roadway, usually expressed in terms of speed, travel time or density. In practice, each Level of Service index is often associated with a range of service volumes. This relation depends on the type of facility (freeway, rural road, urban street).
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 a specific intersection of network links. A node has control characteristics, i.e. the allocation of service time to each approach link.
Origin	A location in the network, either within the interior, or on the periphery, where trips are generated at a specified rate expressed in vehicles per hour (vph). These trips enter the roadway system to travel to their respective destinations.

Term	Definition
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	Relate 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).
Service Volume	Maximum number of vehicles that 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 Level of Service, E, is equal to Capacity.) Service Volume is usually expressed as vehicles per hour (vph).
Signal Cycle, Cycle Time or 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. In general, several intervals, in sequence, comprise a phase.
Signal Phase	A set of signal indications (and intervals), which services a particular combination of traffic movements on the approaches to the intersection. The phase duration is expressed in seconds.
Traffic 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 which occupy one lane of a roadway section of specified length at a point of time, expressed as vehicles per lane-mile (vplm or vpm).
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.

Term	Definition
Traffic Volume	The number of vehicles that pass over a section of roadway in on 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 and air travel modes.
Trip Table or Origin-Destination Matrix	A rectangular matrix or table, whose entries contain the number of trips that are generated at each specified origin, during a specified time period, which are attracted to (and travel toward) one of the 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 that executes a specified turn maneuver from an approach at an intersection.

APPENDIX B

Traffic Assignment Model

Appendix B: Traffic Assignment Model

The traffic assignment program, which is employed in this study is an elaboration of an existing model developed by Dr. Sang Nguyen[1]. This model is an equilibrium assignment model, which employs mathematical programming methodology to search for, and attain, a global optimum solution. The term, "optimum", implies that the solution is unique and that it minimizes a specified cost function.

This cost function, in our application, is expressed directly in terms of aggregate travel time. That is, the model formulation relates travel time to the assigned volumes on each network link according to the following formulation:

$$T_i = T_{o,i}[1 + a(\frac{v_i}{c_i})^b]$$

where

T_i =Travel Time on link, i, sec
$T_{o,i}$ =Specified free-flow (zero delay) travel time on link, i, sec
V_i =Volume of traffic on a link, i, vph
C_i =Capacity of link, i, vph
a,b =Specified calibration parameters

The cost function, then, is formulated in terms of travel time along each path from each origin to each respective destination. Minimizing this path-specific travel time (i.e. the so-called User Optimization), all vehicles are assured of being routed along the shortest (in travel time) possible path to their respective destinations.

[1] Nguyen, S. and James, L., "TRAFFIC - An Equilibrium Traffic Assignment Program", Publication No. 17, Centre de Reserche sur les Transports, March 1975.

The computational algorithm assigns traffic over the network in such a way as to minimize this aggregate cost. That is, the allocation of volumes, V, to the network links, i = 1, 2, ..., N is accomplished in such a way as to:

- Satisfy all specified origin-destination demands,
- Satisfy the minimum-cost (travel time) objective,
- Satisfy any specified control treatment and turn restrictions designed to:
  - Expedite the evacuation process
  - Minimize radiation exposure of the vehicle occupants.

Most applications of traffic assignment employ constant, estimated, values of link capacity C_i. It is well known, however, that link capacity is a function of many factors including the (unknown) turn volumes on all links serviced by a common intersection. Consequently, the assumption of constant link capacity compromises the efficacy of the assignment results.

To resolve this problem, KLD has expanded the existing TRAFFIC model to incorporate a model, named the TRAFLO CAPACITY model. This model computes accurate estimates of capacity, C_i, that are always consistent with the assigned volumes, V_i, on each link. This capacity model consists of three integrated components

- A formulation which calculates the service rates for through and left-turning vehicles in a lane, given, among other data, the proportion of left-turners in the lane,
- Another formulation for through and right-turner service rates,
- A formulation which calculates the lateral deployment of traffic on an approach, yielding the proportion of through and turning vehicles in each lane.

These three components are exercised in an iterative manner to produce accurate and self-consistent estimates of service rates for approaches of general configuration and for all types of control devices. Many tests have confirmed that this solution procedure is rapid, accurate and unconditionally convergent.

In summary, the Traffic Assignment Model used in this project represents the latest state-of-the-art and provides accurate estimates of link volumes, stratified by turn movement at the downstream mode (intersection). These turn volumes on each link are subsequently input into the Traffic Simulation Program.

Another output provided by the Traffic Assignment model is the estimated travel times on each link. These estimates are not particularly accurate -- they are usually optimistic -- but they do identify the "hot spots" in the network: those links, which are severely congested. This permits the analyst to identify candidate solutions to relieve the congestions and to expedite the flow of traffic.

APPENDIX C

Traffic Simulation Model: IDYNEV

Appendix C: Traffic Simulation Model: IDYNEV

A model, named IDYNEV, is an adaptation of the TRAFLO Level II simulation model, developed by KLD for the Federal Highway Administration (FHWA), with extensions in scope to accommodate all types of facilities. This model produces an extensive set of output MOE as shown in Table C-1.

The traffic stream is described in terms of a set of link-specific statistical flow histograms. These histograms describe the platoon structure of the traffic stream on each network link. The simulation logic identifies five types of histograms:

- The ENTRY histogram that 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 histogram that describes 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 that results as traffic traverses the link. The resulting INPUT histograms reflect the specified turn percentages for the subject link.
- The SERVICE histogram that 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 was developed to estimate service rates for each turn movement, given that the control is GO.

Table C-1. Measures of Effectiveness Output by IDYNEV

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

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

- The QUEUE histogram that describes the time-varying ebb and growth of the queue 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. Note that this approach provides the IDYNEV 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. Furthermore, the IDYNEV logic will be able to recognize when one component of the traffic flow is encountering saturation conditions even if the others are not.

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

A valuable feature of IDYNEV is its 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 the 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 requirements of the IDYNEV Model.

The user must specify the physical traffic environment in order to apply the IDYNEV

Model. This input data describes:

- Topology of the roadway system
- Geometries 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 of 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 network representation. The freeway is defined by the sequence of links, (1,2), (2,3), ..., (5,6). Links (8000,1) and (7,8002) are Entry and Exit links, respectively. An arterial extends from node 7 to node 15 and is partially subsumed within a grid network.

The development of the IDYNEV model followed directly after DYNEV was completed. The perceived need for IDYNEV was based upon the requirement for a model having all the demonstrated capabilities of DYNEV, but one that consumed less computer time and storage.

The major distinction between DYNEV and IDYNEV is that the latter model directly calculates the integral of the histograms described earlier (see Figure C-1), instead of computing the amplitudes of each histogram slice, as does DYNEV. One other difference is that in

IDYNEV, vehicles which cannot travel along their assigned evacuation route due to excessive congestion will divert to another, alternative evacuation route if the latter is not congested. In all other respects, the two models are either identical (e.g., the input and output software) or are very similar, with any difference reflecting the major distinction described above.

This major distinction results in software code that consumes significantly less storage for IDYNEV than for DYNEV, reflecting the elimination of large arrays containing the amplitude values of each histogram slice. The reduced computational burden is reflected in almost a three-fold reduction in computing time.

A thorough comparison was made between the results generated by the two models. It was found that all pairs of results, DYNEV and IDYNEV, were virtually identical for a wide variety of network configurations and traffic demand levels. Note that the two models require the identical input stream and produce identical output formats.

On the basis of these results, IDYNEV is used exclusively for the EESF system, to calculate evacuation time estimates.

Table C-2. Input Requirements for the IDYNEV Model

GEOMETRICS

Links defined by upstream downstream node numbers

Links 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 or O-D matrix (Trip Table)

TRAFFIC CONTROL SPECIFICATIONS

Traffic signals: link-specific, turn movement specific

Control may be fixed-time or traffic-actuated

Stop and Yield signs

Right-turn-on-red (RTOR)

Route diversion specifications

Turn restrictions

Lane control (i.e. lane closure)

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.

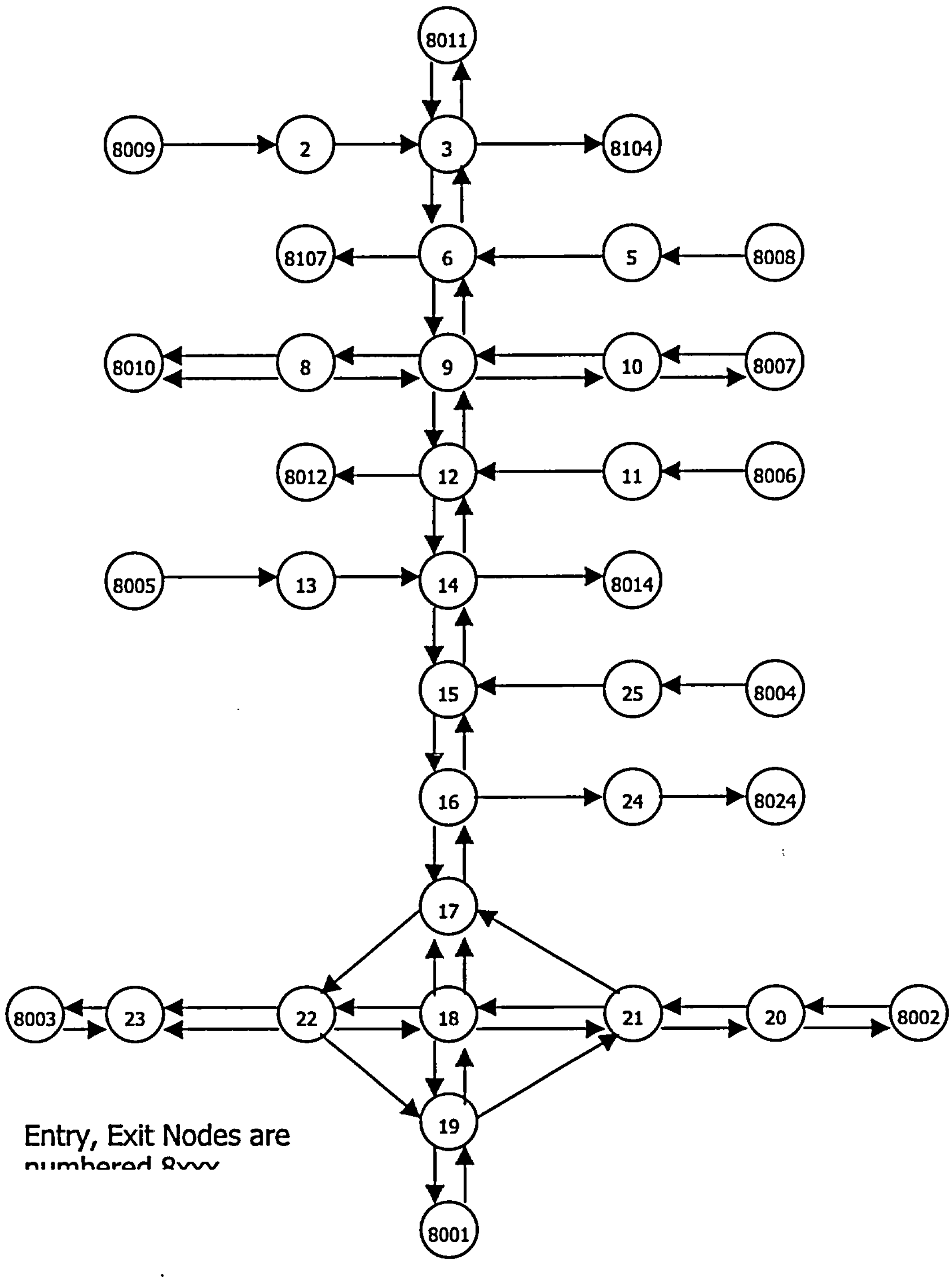


Figure C-1: Representative Analysis Network

APPENDIX D

Detailed Description of Study Procedure

This appendix describes the activities to be performed in order to produce accurate estimates of evacuation times on the Emergency Planning Zone (EPZ) for a nuclear power plant. 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 of population within the EPZ. Specifically, obtain the population in each of 160 cells of a polar grid, which is centered at the nuclear station, and consists of 22.5° sections and rings spaced one mile apart. Transient population characteristics must also be estimated on the same basis.

Step 2. The next activity is to examine a large-scale map of the EPZ. This map enables one to identify the access roads from each residential development to the adjoining elements of the analysis roadway network. This information is necessary in order to assign generated trips to the correct links of the network. This map also enables one to represent the geometrics of complex intersections properly in terms of their network configuration.

Step 3. With this information absorbed, the next step is to conduct a physical survey of the roadway system within the EPZ. The purpose of this survey is to determine the necessary measurements of roadway length and of the number of lanes on each link, the channelization of these lanes, whether or not there were any turn restrictions or special treatment of traffic at intersections and to gain the necessary insight required for estimating realistic values of roadway capacity. At each major intersection, take note of the traffic control device that was installed. In addition, determine whether or not, under emergency evacuation conditions, it would be possible to employ paved shoulders as an additional lane in the event such additional capacity was required.

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 centroids where trips would be generated during the evacuation process and then enter the analysis network.

Step 6. With all the information at hand, it is time to perform the effort of creating the input stream for the Traffic Assignment Model. This model was designed to be compatible with the Traffic Simulation Model used later in the project, in the sense that the input format required for one model was entirely compatible with the input format required by the other, thus avoiding duplication of efforts. This step in the procedure is labor-intensive. Fortunately, this input stream need only be developed once. Any changes made can be implemented quickly and at small cost. Thus, it is possible to execute these models on different scenarios with very little effort needed to modify the basic input stream to represent the specific attributes of each scenario.

Step 7. After creating the input stream by using PREDYN, execute the Traffic Assignment Model. This computer program contains upwards of 1,000 diagnostic inconsistencies and any other improper input. This diagnostic software produces messages, which assist the user in identifying the source of the problem and guide the user in preparing the necessary corrections.

Step 8. With the input stream free of error, execute the Traffic Assignment Model. The Traffic Assignment program is a very efficient software code.

Step 9. The next activity is to examine critically the statistics produced by the Traffic Assignment program. 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 result.

Essentially, the approach is to identify those "hot spots" in the network that represent locations where congested conditions are extreme. It is then necessary 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.

The examination of the Traffic Assignment output leads to one of two conclusions:

- o The results are as satisfactory as could be expected at this stage of the analysis process, or
- o Treatments must be introduced in order to improve the flow of traffic.

This decision requires, of course, the application of the user's judgment based upon the results obtained in previous applications of the Traffic Assignment Model and a comparison of the results of this last case with the previous ones. In the event the results are satisfactory, in the opinion of the user then the process continues with the exercise of the simulation model in 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.

We then perform the modifications to the input stream, reflecting the control treatments described above. As indicated previously, such modifications are implemented quickly to the extent that more than one execution of the computer program is possible in a single day.

Step 11. As noted above, the physical changes to the input stream must be implemented in order to reflect the changes in the control treatments undertaken in Step 10. At the completion of this activity, the process returns to Step 8 where the Traffic Assignment Model is once again executed.

Step 12. The output of the Traffic Assignment Model includes the computed turn movements for each link. If the user is executing the Traffic Assignment and the Traffic Simulation models in a single run, then this data is automatically accessed by the latter model. If the simulation model is executed separately, the user must modify the input stream for the Traffic Assignment model by beginning in the turn-movement data.

Step 13. After the input stream has been debugged, the simulation model is executed to provide the user with 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 Traffic Simulation Model is examined in order to identify once again the problems that exist on the network. The results of the simulation model are extremely detailed and are far more accurate in their ability to describe traffic operations than those provided by the Traffic Assignment Model. Thus, it is possible to identify the cause of the 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. In the event that changes are needed, the analysis process proceeds to Step 15. On the other hand, if the results were satisfactory, then one can decide whether it is necessary to return to Step 8 to execute the Traffic Assignment Model once again and repeat the whole process, or to accept the final results as being the "best" that can be achieved within the reasonable constraints of budget and time allotments. Generally, if there are no changes indicated by the activities of Step 14, then we can conclude that all results were satisfactory, and we can then proceed to document them in Step 17. Otherwise, we have to return to Step 8 in order to determine the effects of the changes implemented in Step 14 on the optimal routing patterns over the network. This determination can only be ascertained by executing the Traffic Assignment 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 flow of traffic over the network. These treatments can also include the consideration of additional roadway segments to the existing analysis network in order to disperse the traffic demand and thus avoid the focusing of traffic demand that can produce high levels of congestion.

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

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

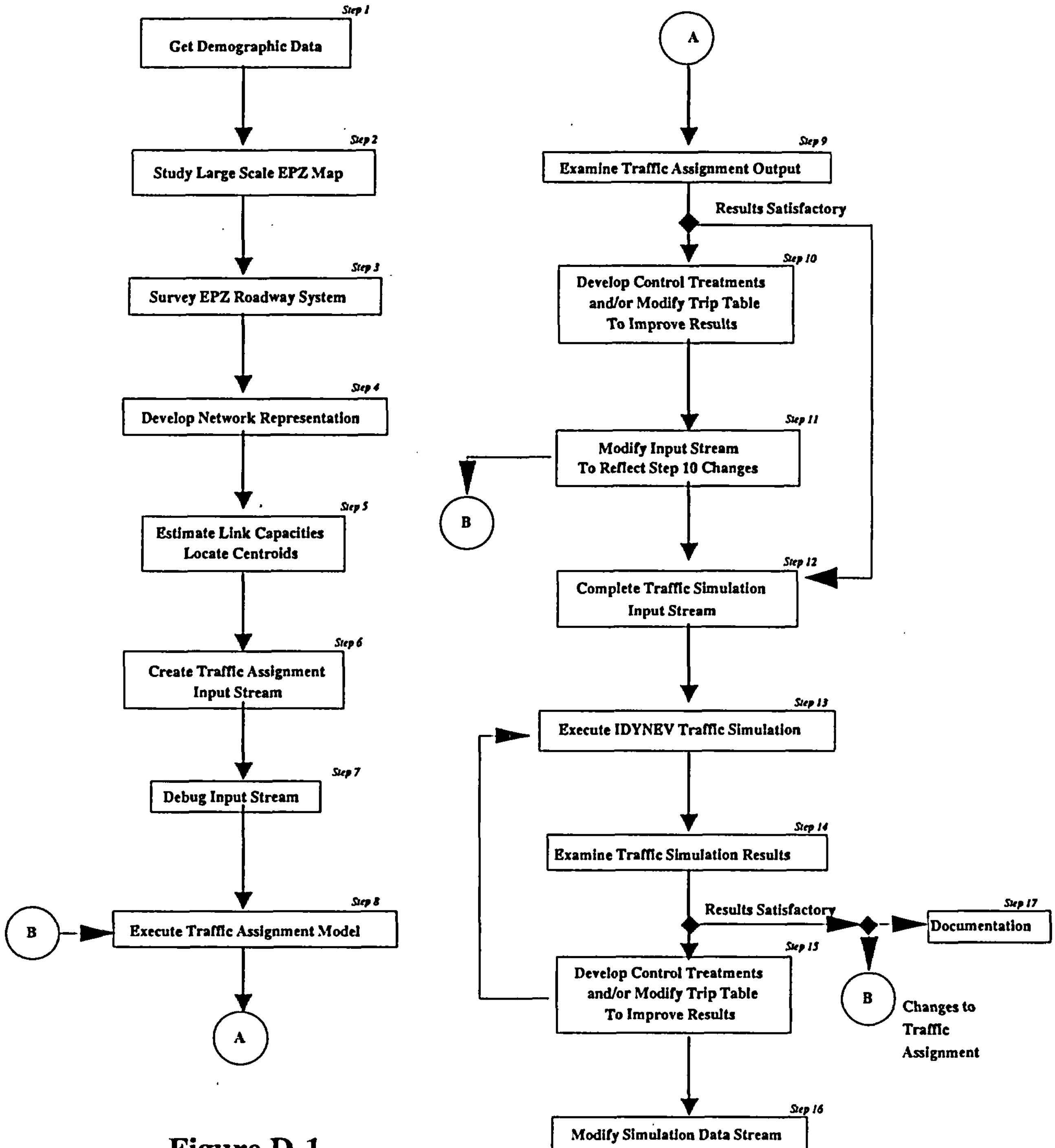


Figure D-1
Flow Diagram of Activities

APPENDIX E: LITERATURE REVIEW

APPENDIX E - LITERATURE REVIEW

The purpose of this Appendix is to provide a concise review of literature and data sources used in the development of the ETE for the Davis Besse Station.

Table E-1. List of Marinas within 10-Mile EPZ - Ottawa County

	Number of Spaces		
	Health Department	**Telephone Survey**	**Estimated No. of Spaces**
Erie Township			
Borrow Pond Marina	24	-	24
Chet's Place	40	-	40
Jacknife Marina	250	230	230
Lakefront Marina	500	640	640
L.C.Y.C. Marina	18	20	20
Riverfront Marina & R.V. Park	38	-	38
River Retreat Camp & Marina	64	74	74
Riverside Marina	98	100	100
Vacationland Marina & R.V. Park	116	124	124
White Caps Marina	26	30	30
Witterhaven Marina/Campground	60	60	60
Drawbridge Marina	-	400	400
			1780
Port Clinton			
Brand's Marina	232	368	368
Clinton Reef Marina	400	500	500
Portage Entry Marina	20	-	20
Port Clinton Yacht Club	127	150	150
Lake Motel & Charter Service	-	12	12
			1050
Salem Township			
Young's Suburban on the Portage	24	24	24
			24

Table E-1. List of Marinas within 10-Mile EPZ - Ottawa County (cont.)

	Number of Spaces Health Department	Telephone Survey	Estimated No. of Spaces
Bay Township			
Johnny's Boat Harbor	65	-	65
Nugents Canal Point Marina	16	-	16
Portage Cove Trailer Park/Marina	65	-	65
Portage River Marina	108	-	108
Scheer's Little Bar & Marina	-	21	21
			275
Carroll Township			
Al's Harbor	70	65	65
Brown's Marina	40	40	40
E&C Marina	16	16	16
East Side Marina	371	-	371
Fenwick Marina	450	412	412
Floro's Marina	250	250	250
Inland Marina	250	243	243
Sand Beach Marina	20	0	0
Toussaint River Marina	295	-	295
Turtle Creek Marina	216	240	240
Turtle Point Marina	100	-	100
Wildwings Marina	460	445	445
Wilkins Boat Launch	60	0	0
Willow Beach Marina	35	-	35
			2512

List of Marinas within 10-mile EPZ - Lucas County

	Spaces
Meinke Marina (East & West)	1300

Marinas Within EPZ
of Davis Besse Nuclear Power Station

Facility name:	FLEITZ MARINA
Facility address:	11109 CORDUROY RD. CURTICE, OH 43412
County:	LUCAS
ERPA:	SUBAREA 11
Distance of facility (in miles) from DBNPS:	10
Compass direction (i.e. (N,NNE, NE) of facility from DBNPS:	WEST
Name of contact person who provided data for this form:	MIKE HAHN
Title of contact person who provided data for this form:	EMPLOYEE
Contact telephone number:	Voice: (419) 836-1305 Fax:
Date of contact:	6-12-02
Maximum boat capacity (i.e. the maximum number of boats that the facility can accommodate):	220
Average number of boats launched at facility per day during peak season:	12
If facility has a public launch ramp, average number of boats launched during peak season:	NONE
Average number of persons per boat:	3
Number of parking spaces available for vehicles at facility:	APPROX 45 - HAS CAMPERS TOO
Average number of vehicles parked at facility during peak season:	30-35
Do vehicles also park outside the parking lot of the facility (i.e. along the side of the road):	NO
Name of Host Facility:	
Address of Host Facility:	
Notes:	

Marinas Within EPZ
of Davis Besse Nuclear Power Station

Facility name:	ANCHOR POINTE MARINA
Facility address:	10905 CORDUROY RD CURTICE, OH 43412
County:	LUCAS
ERPA:	SUBAREA 11
Distance of facility (in miles) from DBNPS:	4 MILES
Compass direction (i.e. (N,NNE, NE) of facility from DBNPS:	ESE
Name of contact person who provided data for this form:	PAT CARSON
Title of contact person who provided data for this form:	MANAGER
Contact telephone number:	(419) Voice: 836-2455
Date of contact:	JUNE 12, 2002
Maximum boat capacity (i.e. the maximum number of boats that the facility can accommodate):	500
Average number of boats launched at facility per day during peak season:	8-10
If facility has a public launch ramp, average number of boats launched during peak season:	N/A
Average number of persons per boat:	3
Number of parking spaces available for vehicles at facility:	350-400
Average number of vehicles parked at facility during peak season:	200
Do vehicles also park outside the parking lot of the facility (i.e. along the side of the road):	No
Name of Host Facility:	
Address of Host Facility:	
Notes:	

Marinas Within EPZ
of Davis Besse Nuclear Power Station

MAILING ADDRESS: **Facility name:**	MEINKE MARINA-EAST
10760 JERUSALEM RD **Facility address:** CURTICE, OH 43412	10955 CORDUROY RD CURTICE, OH 43412
County:	LUCAS
ERPA:	SUBAREA 11
Distance of facility (in miles) from DBNPS:	8
Compass direction (i.e. (N,NNE, NE) of facility from DBNPS:	WEST
Name of contact person who provided data for this form:	SARAH MEINKE
Title of contact person who provided data for this form:	EMPLOYEE
Contact telephone number:	**Voice:** 836-7774 **Fax:** 836-1309
Date of contact:	JUNE 12, 2002
Maximum boat capacity (i.e. the maximum number of boats that the facility can accommodate):	400
Average number of boats launched at facility per day during peak season:	125
If facility has a public launch ramp, average number of boats launched during peak season:	0
Average number of persons per boat:	3-4
Number of parking spaces available for vehicles at facility:	1 PER BOAT LAUNCH
Average number of vehicles parked at facility during peak season:	95
Do vehicles also park outside the parking lot of the facility (i.e. along the side of the road):	NO
Name of Host Facility:	
Address of Host Facility:	

Notes:

Marinas Within EPZ
of Davis Besse Nuclear Power Station

MAILING ADDRESS: Facility name:	MEINKE MARINA-WEST
10760 JERUSALEM RD Facility address: CURTICE, OH 43412	12805 BONO CURTICE, OH 43412
County:	LUCAS
ERPA:	SUBAREA 11
Distance of facility (in miles) from DBNPS:	10
Compass direction (i.e. (N,NNE, NE) of facility from DBNPS:	WEST
Name of contact person who provided data for this form:	SARAH MEINKE
Title of contact person who provided data for this form:	EMPLOYEE
Contact telephone number:	Voice: (419) 836-7774 Fax: (419) 836-1309
Date of contact:	JUNE 12, 2002
Maximum boat capacity (i.e. the maximum number of boats that the facility can accommodate):	1200
Average number of boats launched at facility per day during peak season:	1000
If facility has a public launch ramp, average number of boats launched during peak season:	2000
Average number of persons per boat:	3-4
Number of parking spaces available for vehicles at facility:	1 PER LAUNCH
Average number of vehicles parked at facility during peak season:	900
Do vehicles also park outside the parking lot of the facility (i.e. along the side of the road):	NO
Name of Host Facility:	
Address of Host Facility:	
Notes:	

Hotels/Motels Within EPZ
of Davis Besse Nuclear Power Station

Facility name:	ECONO LODGE
Facility address:	BAY STATE PARK 10530 CORDUROY RD CURTICE, OH 43412
County:	LUCAS
ERPA:	SUBAREA 11
Distance of facility (in miles) from DBNPS:	9-10
Compass direction of facility (i.e. N, NNE, NE) from DBNPS:	WEST
Name of contact person who provided data for this form:	ANIL MALHOTRA
Title of contact person who provided data for this form:	MANAGER
Contact telephone number:	Voice: (419) 836-2822 Fax: (419) 836-5613
Date of contact:	JUNE 12, 2002
Number of units at the facility:	60
Number of handicapped-accessible units at the facility:	-0-
Average *yearly* occupancy rate at the facility:	15-20 SEASONAL
Average number of persons *per occupied unit* at the facility:	30-40
Average number of vehicles *per occupied unit* at the facility:	30 APPROX
Number of vehicles owned by the facility:	1
Notes:	

4. Public Recreational Facilities: The major public recreational facilities in the EPZ are listed below.

No.	Facility	Township	Existing Facilities	Visitors/Day Avg.	Visitors/Day Max.
1	Ottawa National Wildlife Area (419) 898-0014	Benton-Jerusalem	Wildlife Refuge	N/A	500
2	Crane Creek Wildlife Experiment Station (419) 898-0960	Benton	Hunting, Fishing	N/A	300
3	Crane Creek State Park (419) 898-2495	Benton	Beach, Swimming,	5,000	14,000
4	Magee Marsh Wildlife Area & Metzger Marsh Wildlife Area	Carroll, Jerusalem	Hunting, Boat Ramp, Fishing	N/A	300
5	Toussaint Creek Wildlife Area	Carroll	Boat Ramp,	40	150

The major park facility within the EPZ is the Crane Creek State Park. According to the previous report, the average summertime daily attendance in this park is approximately 2500 with a peak attendance of nearly 5000. There are no overnight facilities at the park and it is closed at dark.

The FEMA letter to ODSA dated December 9, 1985 indicates that the single day peak attendance for the park has been 14,000. A telephone conversation with the Park Manager confirmed this number. According to him, the average summertime attendance at the park is 5000. On some hot weekends it could reach as much as 10,000 and on long weekends they have had as many as 14,000 visitors. He also indicated that there are nearly 2500 parking spaces in the park and people also park on grass or elsewhere if they cannot find parking in designated spots. The other park facilities in the area are considerably smaller and have corresponding smaller attendance.

Nursing Homes

Riverview Nursing Home

No. of Beds = 166 occupancy = 85%
Of this number, approximately 10% can walk, 60% use a wheelchair/walker, and 30% are bedridden.

Edgewood Manor Nursing Center

No. of Beds = 100 occupancy = 85%
Of this number, approximately 10% can walk, 80% use a wheelchair/walker, and 10% are bedridden. Total available space is for 100 residents.

Riverview Industries Clients = 110

These mentally handicapped adults, of which approximately 12 are in wheelchairs.

H.B. Magruder Hospital Bed Capacity = 71

Ottawa County Jail Inmates = 48

This capacity may be exceeded slightly at certain times of the year. On the average, 30 to 35 inmates are present at any given time.

Lucas County

A. None

Over the weekend of July 4, 1987, data collection was undertaken to confirm previous estimates of visitors to Crane Creek State Park. Traffic counts on the Friday, Saturday, and Sunday in 1987 indicate a total of 6509 vehicles entered and left the park. Counts for the same period of time in 1986 yielded an estimate of 12754 vehicles entering and leaving the park. Consequently, the 1986 population estimates remain a valid estimate of the peak number of people expected at the park.

Observations of vehicles entering the park yield the following estimates of vehicle occupancy:

Passenger Cars	3.13 persons / vehicle
Vans/Pickup Trucks	3.43 persons / vehicle

This compares with the estimate of 2.8 persons per vehicle used previously. The 1987 data indictes that there might be up to 850 more people in the park than previously estimated [2600 vehs. x (3.13 - 2.8)]. It should be noted that the total number of vehicles generated by the park (2600 vehs.) has not been modified. Hence no changes to the ETE were observed.

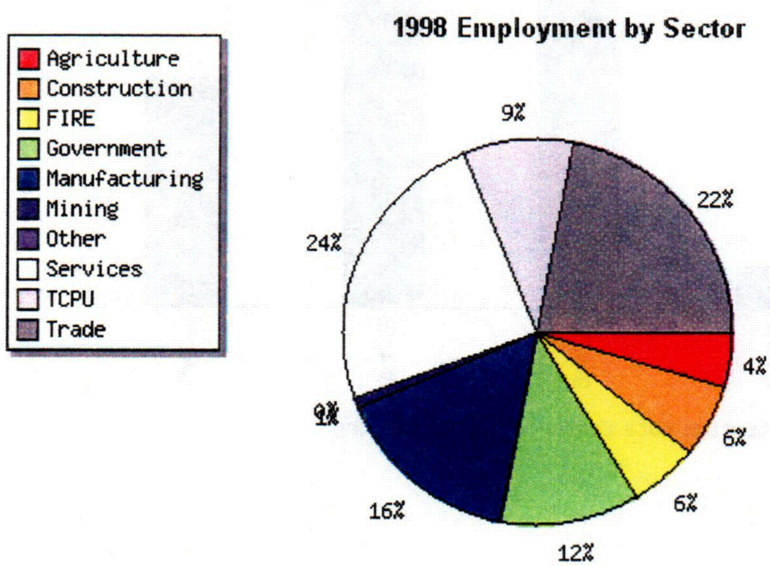
Analysis of license plate information in Crane Creek State Park have indicated the following:

Place of Origin	**1987 Count**	**1987 Percentage**	**1986 Percentage**
Ottawa Co.	156.5	6.4	
Lucas Co.	114	49.4	50.9
Wood Co.	21	9.1	12.6
Sandusky Co.	12	5.2	6.9
Erie Co.	4	1.7	1.2
Other Ohio	51	22.1	15.6
Michigan	7	3.0	3.6
Other States	7	3.0	2.8
	231	100.0	100.0

Note that the data collected in 1987 confirms the distribution of places of origin for park users.

Commuters Entering Ottawa County

Home County	Ottawa County Workers	Percentage
Sandusky	1,657	34%
Lucas	1,252	26%
Wood	869	18%
Erie	725	15%
Seneca	130	3%
Monroe	128	3%
Huron	111	2%
Total	4,872	

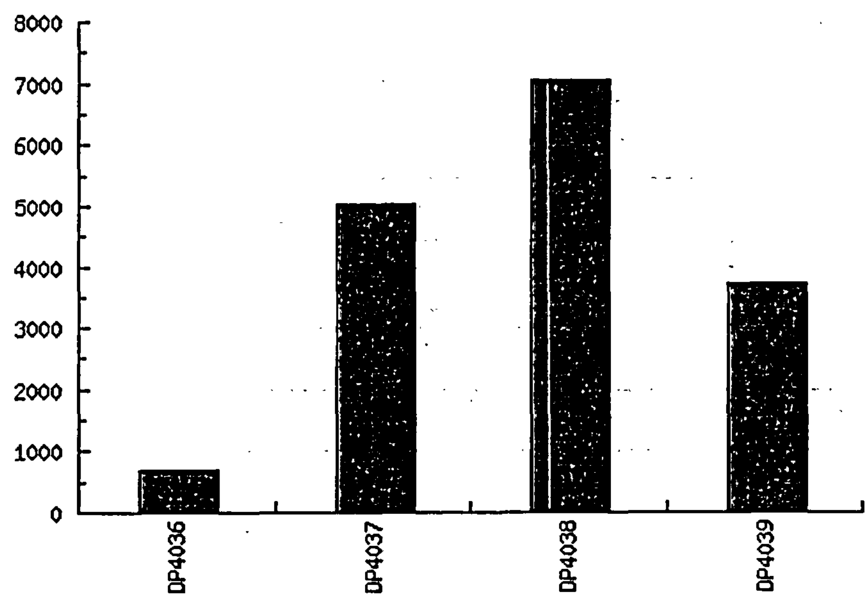


Total Employment (workers): 20,157

C23

Ottawa County (Ohio) - Business Profile Business Statistics Total Number of Mid March Employees											
Year	Agricultural Services, Forestry, And Fishing	Mining	Construction	Manufacturing	Transportation And Public Utilities	Wholesale Trade	Retail Trade	Finance, Insurance, And Real Estate	Services	Unclassified Establishments	Total
1988	30	124	477	3,872	1,774	272	2,353	421	2,122	125	11,570
1989	73	111	539	3,840	1,944	275	2,506	507	2,087	184	12,066
1990	49	0	501	3,691	2,259	286	2,479	560	2,217	0	12,042
1991	107	0	466	2,689	2,118	273	2,431	668	2,358	0	11,110
1992	89	93	392	2,844	2,053	243	2,307	603	2,511	1	11,136
1993	94	106	404	2,787	1,807	205	2,518	488	2,398	4	10,811
1994	35	75	403	2,674	1,740	197	2,546	553	2,452	3	10,678
1995	49	84	468	2,762	1,875	207	2,580	567	2,589	9	11,190
1996	0	73	477	2,969	1,936	249	2,706	583	2,624	0	11,617
1997	0	73	527	2,847	1,892	262	2,800	580	2,957	0	11,938

Ottawa County - Vehicles available



Source: OSU Extension Data Center / www.osuedc.org

	Workers 16 years and over	624
DP3016	Car, truck, or van -- drove alone	580
DP3017	Car, truck, or van -- carpooled	14
DP3018	taxicab)	0
DP3019	Walked	15
DP3020	Other means	0
DP3021	Worked at home	15
DP3022	8 (1 expressed decimal)	21.7
DP3023	years and over	659

Erie Twp

	Workers 16 years and over	601
DP3016	Car, truck, or van -- drove alone	501
DP3017	Car, truck, or van -- carpooled	66
DP3018	taxicab)	0
DP3019	Walked	6
DP3020	Other means	18
DP3021	Worked at home	10
DP3022	8 (1 expressed decimal)	26.3
DP3023	years and over	606
	Bay Twp	

DP3015	**Workers 16 years and over**	19,434
DP3016	Car, truck, or van -- drove alone	16,582
DP3017	Car, truck, or van -- carpooled	1,551
DP3018	taxicab)	85
DP3019	Walked	472
DP3020	Other means	135
DP3021	Worked at home	609
DP3022	8 (1 expressed decimal)	22.5
DP3023	years and over	19,830

Ottawa County

	Workers 16 years and over	1,370
DP3016	Car, truck, or van -- drove alone	1,218
DP3017	Car, truck, or van -- carpooled	83
DP3018	taxicab)	0
DP3019	Walked	26
DP3020	Other means	0
DP3021	Worked at home	43
DP3022	8 (1 expressed decimal)	24
DP3023	**years and over**	1,386
Benton		

DP3015	**Workers 16 years and over**	841
DP3016	Car, truck, or van -- drove alone	747
DP3017	Car, truck, or van -- carpooled	40
DP3018	taxicab)	9
DP3019	Walked	7
DP3020	Other means	0
DP3021	Worked at home	38
DP3022	8 (1 expressed decimal)	26.1
DP3023	**years and over**	848
Carroll		

	Workers 16 years and over	1,354
DP3016	Car, truck, or van -- drove alone	1,167
DP3017	Car, truck, or van -- carpooled	78
DP3018	taxicab)	3
DP3019	Walked	33
DP3020	Other means	9
DP3021	Worked at home	64
DP3022	8 (1 expressed decimal)	25.5
DP3023	**years and over**	1,377
Harris		

DP3015	**Workers 16 years and over**	733
DP3016	Car, truck, or van -- drove alone	612
DP3017	Car, truck, or van -- carpooled	86
DP3018	taxicab)	9
DP3019	Walked	26
DP3020	Other means	0
DP3021	Worked at home	0
DP3022	8 (1 expressed decimal)	16.9
DP3023	**years and over**	742

Portage

DP3015	**Workers 16 years and over**	2,731
DP3016	Car, truck, or van -- drove alone	2,391
DP3017	Car, truck, or van -- carpooled	212
DP3018	taxicab)	0
DP3019	Walked	29
DP3020	Other means	12
DP3021	Worked at home	87
DP3022	8 (1 expressed decimal)	22.3
DP3023	**years and over**	2,830

Salem

DP3015	**Workers 16 years and over**	2,952
DP3016	Car, truck, or van -- drove alone	2,309
DP3017	Car, truck, or van -- carpooled	369
DP3018	taxicab)	38
DP3019	Walked	113
DP3020	Other means	40
DP3021	Worked at home	83
DP3022	8 (1 expressed decimal)	17.4
DP3023	**years and over**	3,016

Clinton

Port Clinton/Catawba Island

Condominiums

Admiralty Condominium, 711 W Lakeshore Dr, Port Clinton, OH 43452

Come Sail Away, 5251 E Marina Ave, Port Clinton, OH 43452,

Harborside Condominium, 511 W Lakeshore Dr, Port Clinton, OH 43452

The Shores Beachfront Condominium Resort, 1801 E Perry St, Port Clinton, OH 43452

The Village at Water's Edge, E Perry St, Port Clinton, OH 43452

Waterfront Condominiums, 220 W Lakeshore Dr, Port Clinton, OH 43452

Hotels & Motels

Beach Cliff Lodge, 4189 NW Catawba Rd, Port Clinton, OH 43452, 419-797-4553

Beachfront Motel, 252 W Lakeshore Dr, Port Clinton, OH 43452, 419-732-6684, 800-732-6684

Best Budget Inn & Suites, 1735 E Perry St, Port Clinton, OH 43452, 419-734-5633, 800-221-0622

Best Western Motel, 1734 E Perry St, Port Clinton, OH 43452, 419-734-2274, 800-528-1234

Camp Perry Military Training Site, Bldg 600, Port Clinton, OH 43452, 419-635-4021, Ext. 6214 or 614-336-6214

Char-Nel Shores, 2327 Sand Rd, Port Clinton, OH 43452, 419-734-3356

Comfort Inn, 1723 E Perry St, Port Clinton, OH 43452, 419-732-2929, 800-221-2222

Country Hearth Inn, 1815 E. Perry St., Port Clinton, OH 43452, 800-282-5711

Days Inn, 2149 Gill Rd, Port Clinton, OH 43452, 419-734-4945, 800-329-7466

Fairfield Inn, 3760 E State Rd, Port Clinton, OH 43452, 419-732-2434, 800-228-2800

Fisherman's Inn, 2665 E Harbor Rd, Port Clinton, OH 43452, 419-732-3655, 800-336-3443

Holiday Inn Express, 50 N.E. Catawba Rd., Port Clinton, OH 43452, 419-732-7322 or 800-HOLIDAY

Holiday Village Resort, 3247 NE Catawba Rd, Port Clinton, OH 43452, 419-797-4732 or 800-493-7003
Island House Inn, 102 Madison St, Port Clinton, OH 43452, 419-734-2166, 1-800-233-7307

Lakeland Motel,121 E Perry St, Port Clinton, OH 43452, 419-734-2101

Orchardside Motel, 1217 NE Catawba Rd, Port Clinton, OH 43452, 419-797-2257

OurGuest Inn & Suites, 220 E Perry St, Port Clinton, OH 43452, 419-734-7111

OurGuest Inn, 2039 E Harbor Rd, Port Clinton, OH 43452, 419-734-3000

Sleep Inn, Ste. Rt 2 & St. Rt. 53 North, Port Clinton, OH 43452, 419-732-7707 or 800-SLEEPIN

Super 8 Motel, 1704 E. Perry St., Port Clinton, OH 43452 (419) 734-4446 or 800-800-8000

White Caps Motel & Campground, 2186 W Lakeshore Dr, Port Clinton, OH 43452, 734-3816, 800-733-3816

Cottages

Angel Bay Marina, 1170 W. Richey Road, Port Clinton, OH 43452 (419) 734-3803
Beach Cliff Lodge, 4189 NW Catawba Rd, Port Clinton, OH 43452, 419-797-4553,
Camp Perry Military Training Site, Bldg 600, Port Clinton, OH 43452, 419-635-4021, Ext. 6214 or 614-336-6214

Char-Nel Shores, 2327 Sand Rd, Port Clinton, OH 43452, 419-734-3356,

Catawba Copper Inn, 761 N.E. Catawba Rd., Port Clinton, OH 43452, 419-797-2019

Edgewater Cottages, 1235 W Lakeshore Dr, Port Clinton, OH 43452, 419-734-1024

Fowl Foolers Lodge, 4942 Fremont Road, Port Clinton, OH 43452 419-732-2147

Gem Beach Quarters, 5865 Plum Street, Port Clinton, OH 43452, 419-797-7777, 888-GEM-BEACH
Holiday Village Resort, 3247 NE Catawba Rd, Port Clinton, OH 43452, 419-797-4732

Kirchner's Cottages, 5831 Poplar St, Port Clinton, OH 43452, 419-797-4703, 216-481-7963
Petersen's Mobile Home Park, 3353 NE Catawba Rd, Port Clinton, OH 43452, 419-797-6160

The Scenic Rock Ledge Inn & Cabins, 2772 Sand Rd, Port Clinton, OH 43452, 419-734-3265, 1-877-994-ROCK
Ruby's Cottages & Rooms, 419-635-2310

Shade Acres, 1810 NW Catawba Rd, Port Clinton, OH 43452, 419-797-4681

Inns/Bed & Breakfasts

Bashful Mermaid Bed & Breakfast, 503 East Second Street, Port Clinton, OH 43452, 419-734-3400

Dragonfly Bed & Breakfast & Cottage, 1586 Lockwood Rd, Port Clinton, OH 43452, 419-734-6370

Five Bells Inn, 2766 Sand Rd, Port Clinton, OH 43452, 419-734-1555,

Inn at Speiss Harbor, 4495 W Darr-Hopfinger Rd, Port Clinton, OH 43452, 419-734-9117, 800-999-ERIE(3743),

Lake House Bed & Breakfast, 702 E. Perry Street, Port Clinton, OH 43452, 419-734-5447 or 419-732-2647

Marshall Inn Bed & Breakfast, 204 Monroe Street, Port Clinton, OH 43452, 419-734-3350
McKenna's Inn, 5714 Pittsburgh St, Port Clinton, OH 43452, 419-797-6148,

OurGuest Inn & Suites, 220 E Perry St, Port Clinton, OH 43452, 419-734-7111
The Scenic Rock Ledge Inn & Cabins, 2772 Sand Rd, Port Clinton, OH 43452, 419-734-3265, 1-877-994-ROCK

Sand Road Lakefront Lodging, 2203 Sand Rd, PO Box 522, Port Clinton, OH 43452, 419-732-3949
Sunnyside Tower Bed & Breakfast, 3612 NW Catawba Rd, Port Clinton, OH 43452, 419-797-9315

Oak Harbor

Condominiums

Green Cove Condominiums, 8781 W State Route 2, Oak Harbor, OH 43449, 419-898-RENT (7368), Ad

Hotels & Motels

Oak Harbor Hotel, 200 Water St, Oak Harbor, OH 43449, 419-898-4841

Ottawa County School Statistics

School System	Student Enrollment	Per Pupil Expenditure
Benton/Carroll/ Salem	2,007	$8,405
Woodmore	1,269	$5,117
Genoa	1,651	$4,949
Port Clinton	2,272	$6,324
Danbury	653	$7,205

Information

Institution Name:
Bataan Elementary School

Institution Type:
Public School

Mailing Address:
525 W 6th St
Port Clinton, OH 43452

Phone:
(419) 734-2815

District:
Port Clinton City Sd

County of District:
Ottawa

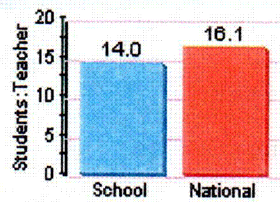
NCES District ID:
3904465

NCES School ID:
390446501532

Characteristics

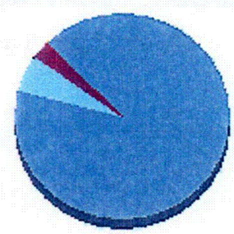
Locale: Small Town
Type: Regular school
Charter: no
Magnet: no

Total Teachers (FTE): 24.0
Total Students: 336
Student/Teacher Ratio: 14.0



Enrollment by Race/Ethnicity

American Indian/Alaskan Native: 0
Asian/Pacific Islander: 1
Hispanic: 20
Black, non-Hispanic: 9
White, non-Hispanic: 306



C24

Information

Institution Name:
Jefferson Elementary School

Institution Type:
Public School

Mailing Address:
430 S Jefferson St
Port Clinton, OH 43452
Phone:
(419) 734-3931

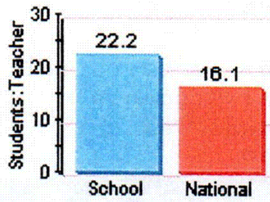
District:
Port Clinton City Sd
County of District:
Ottawa

NCES District ID:
3904465
NCES School ID:
390446501534

Characteristics

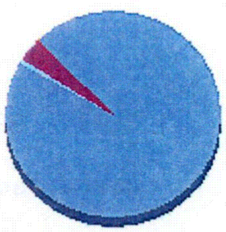
Locale: Small Town
Type: Regular school
Charter: no
Magnet: no

Total Teachers (FTE): 14.0
Total Students: 311
Student/Teacher Ratio: 22.2



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0	
Asian/Pacific Islander:	1	
Hispanic:	2	
Black, non-Hispanic:	11	
White, non-Hispanic:	297	



C25

Information

Institution Name: Catawba Elementary School

Institution Type: Public School

Mailing Address:
3321 NW Catawba Rd
Port Clinton,
OH 43452
Phone:
(419) 797-2179

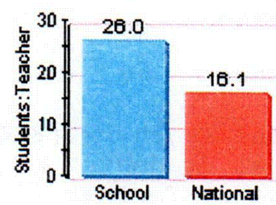
District:
Port Clinton City Sd
County of District:
Ottawa

NCES District ID:
3904465
NCES School ID:
390446501533

Characteristics

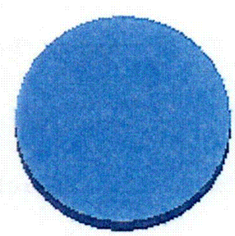
Locale: Rural, Outside MSA
Type: Regular school
Charter: no
Magnet: no

Total Teachers (FTE): 3.5
Total Students: 91
Student/Teacher Ratio: 26.0



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	0
Hispanic:	0
Black, non-Hispanic:	0
White, non-Hispanic:	91



C26

Information

Institution Name:
Port Clinton High School

Institution Type:
Public School

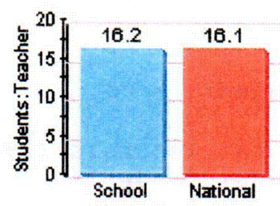
Mailing Address:
821 S Jefferson St
Port Clinton,
OH 43452
Phone:
(419) 734-2147

District:
Port Clinton City Sd
County of District:
Ottawa

NCES District ID:
3904465
NCES School ID:
390446501536

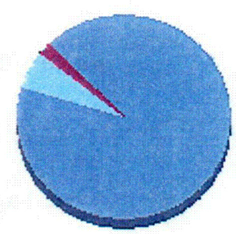
Characteristics

Locale:	Small Town
Type:	Regular school
Charter:	no
Magnet:	no
Total Teachers (FTE):	44.7
Total Students:	722
Student/Teacher Ratio:	16.2



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	1
Asian/Pacific Islander:	1
Hispanic:	44
Black, non-Hispanic:	12
White, non-Hispanic:	664



C27

Information

Institution Name:
Port Clinton Junior High Scho

Institution Type:
Public School

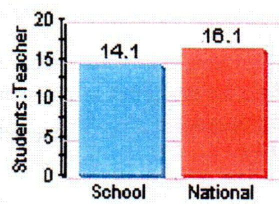
Mailing Address:
110 E 4th St
Port Clinton,
OH 43452
Phone:
(419) 734-4448

District:
Port Clinton City Sd
County of District:
Ottawa

NCES District ID:
3904465
NCES School ID:
390446501535

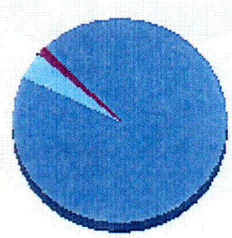
Characteristics

Locale:	Small Town
Type:	Regular school
Charter:	no
Magnet:	no
Total Teachers (FTE):	23.0
Total Students:	324
Student/Teacher Ratio:	14.1



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	0
Hispanic:	14
Black, non-Hispanic:	4
White, non-Hispanic:	306



C28

Information

Institution Name: Immaculate Conception School

Institution Type: Private School

Mailing Address: 109 West Fourth Street Port Clinton, OH 43452

Phone: (419) 734-3315

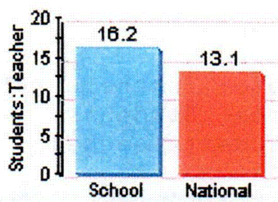
County: Ottawa

NCES School ID: 01061197

Characteristics

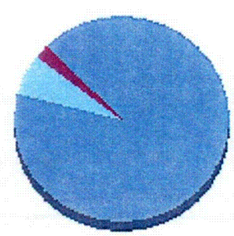
Locale:	Small Town
Type:	Regular elementary or secondary
Affiliation:	Roman Catholic
Student Body:	Coed

Total Teachers (FTE):	9.3
Total Students:	181
Students K-12:	151
Student/Teacher Ratio:	16.2



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	0
Hispanic:	10
Black, non-Hispanic:	3
White, non-Hispanic:	138



C29

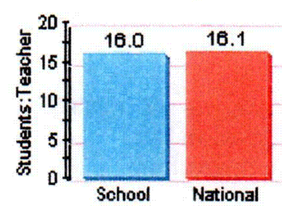
Information

Institution Name:	Institution Type:
Carroll Elementary School	Public School

Mailing Address:	District:	NCES District ID:
3536 N St Rt 19 Oak Harbor, OH 43449	Benton Carroll Salem Local Sd	3904892
Phone: (419) 898-6215	County of District: Ottawa	NCES School ID: 390489203450

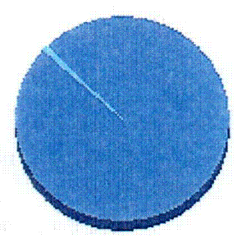
Characteristics

Locale:	Small Town
Type:	Regular school
Charter:	no
Magnet:	no
Total Teachers (FTE):	8.5
Total Students:	136
Student/Teacher Ratio:	16.0



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	0
Hispanic:	1
Black, non-Hispanic:	0
White, non-Hispanic:	135



C30

Information

Institution Name:
Oak Harbor High School

Institution Type:
Public School

Mailing Address:
11661 W St Rt 163
Oak Harbor, OH 43449

Phone:
(419) 898-6216

District:
Benton Carroll Salem Local Sd

County of District:
Ottawa

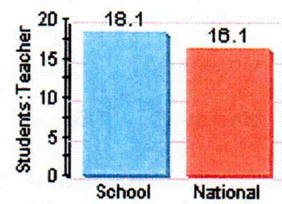
NCES District ID:
3904892

NCES School ID:
390489203452

Characteristics

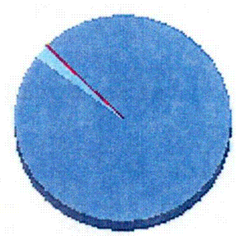
Locale:	Small Town
Type:	Regular school
Charter:	no
Magnet:	no

Total Teachers (FTE):	40.6
Total Students:	736
Student/Teacher Ratio:	18.1



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	1
Asian/Pacific Islander:	2
Hispanic:	15
Black, non-Hispanic:	1
White, non-Hispanic:	717



C31

Information

Institution Name:
Oak Harbor Middle School

Institution Type:
Public School

Mailing Address:
315 Church St
Oak Harbor, OH 43449
Phone:
(419) 898-6217

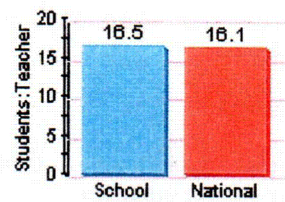
District:
Benton Carroll Salem
Local Sd
County of District:
Ottawa

NCES District ID:
3904892
NCES School ID:
390489203453

Characteristics

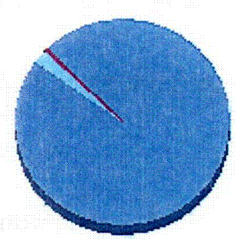
Locale: Small Town
Type: Regular school
Charter: no
Magnet: no

Total Teachers (FTE): 30.0
Total Students: 495
Student/Teacher Ratio: 16.5



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	0
Hispanic:	11
Black, non-Hispanic:	2
White, non-Hispanic:	482



C32

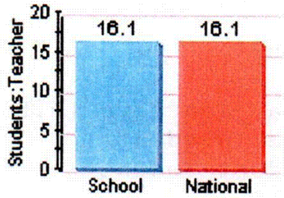
Information

Institution Name:	Institution Type:
R C Waters Elementary School	Public School

Mailing Address:	District:	NCES District ID:
220 E Ottawa St Oak Harbor, OH 43449	Benton Carroll Salem Local Sd	3904892
Phone: (419) 898-6219	County of District: Ottawa	NCES School ID: 390489203454

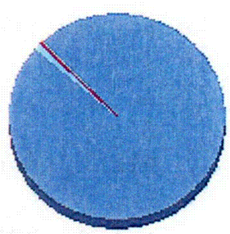
Characteristics

Locale:	Small Town
Type:	Regular school
Charter:	no
Magnet:	no
Total Teachers (FTE):	29.0
Total Students:	468
Student/Teacher Ratio:	16.1



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0	
Asian/Pacific Islander:	3	
Hispanic:	5	
Black, non-Hispanic:	1	
White, non-Hispanic:	459	



C33

Information

Institution Name:
St Boniface Elementary School

Institution Type:
Private School

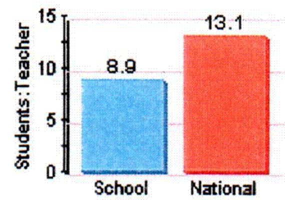
Mailing Address:
215 Oak Street
Oak Harbor, OH 43449
Phone:
(419) 898-1340

County:
Ottawa

NCES School ID:
01061153

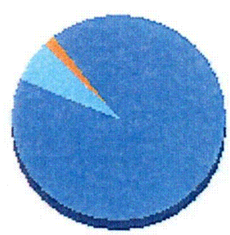
Characteristics

Locale:	Small Town
Type:	Regular elementary or secondary
Affiliation:	Roman Catholic
Student Body:	Coed
Total Teachers (FTE):	5.4
Total Students:	48
Student/Teacher Ratio:	8.9



Enrollment by Race/Ethnicity

American Indian/Alaskan Native:	0
Asian/Pacific Islander:	1
Hispanic:	3
Black, non-Hispanic:	0
White, non-Hispanic:	44



C34