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August 23, 1985

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Board
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555Re: In the Matter of Commonwealth Edison Company
(Braidwood Station, Units 1 and 2, Docket
Nos. 50-456 and 50-457) OL

Dear Administrative Judges:

In accordance with the disclosure requirements of the McGuire decision, Duke Power Co. (William B. McGuire Nuclear Station, Units 1 & 2) ALAB-143, 6 AEC (1973), Commonwealth Edison Company hereby serves on the Licensing Board and the parties the enclosed letter dated August 23, 1985 from Mr. David Smith of Commonwealth Edison Company to Mr. Harold R. Denton, Director of The Office of Nuclear Reactor Regulation, and the document attached thereto which is entitled, "Evacuation Time Estimates Within the Plume Exposure Pathway Emergency Planning Zone for the Braidwood Nuclear Generating Station", dated August, 1985. Inasmuch as these documents pertain to emergency planning for Braidwood Station, they may be relevant to Rorem Contention 1.

Very truly yours,

Victor G. Copeland
Victor G. Copeland
One of the Attorneys for
COMMONWEALTH EDISON COMPANYVGC/mg
cc: Service List
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RELATED CORRESPONDENCE

DOCKETED
USNRC

August 23, 1985

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OFFICE OF SECRETARY
DOCKETING & SERVICE
BRANCH

Mr. Harold R. Denton, Director
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC. 20555

Subject: Braidwood Station Units 1 and 2
Emergency Evacuation Time Estimates
NRC Docket Nos. 50-456 and 50-457

References (a): August 29, 1980 letter from L. CalGeorge
to D.G. Eisenhot

Dear Mr. Denton:

This letter provides information regarding the emergency plan for Braidwood Station. Review of this information should help close Part A Outstanding Item 6 of the Braidwood SER.

Reference (a) provided preliminary evacuation time studies for both the Byron and Braidwood Stations. A detailed study for Braidwood Station has been completed in conjunction with the preparation of off-site emergency plans. Attachment A to that letter is the report of this study.

There are three areas of Attachment A which are currently being completed. They will be added to the report and we expect the report will be reissued by the late September, 1985. We contemplate making no changes to information in Attachment A when the report is reissued. The areas yet to be completed are:

1. Review and approval by local officials.
2. Evacuation time estimates for specific special facilities (Section 6.2).
3. Modeling the evacuation time of local special events (Section 6.3).

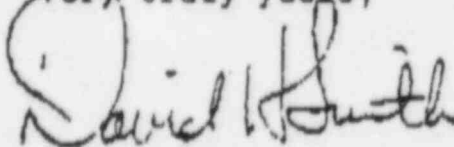
Based on current information, we do not expect the results for areas 2 and 3 to affect the overall evacuation times for the general public.

A draft of the public information brochure prepared to satisfy the requirements of 10 CFR 90.47(b)(7) is provided as Attachment B to this letter. This draft is very similar to the brochures which have been used for the last four years for our other nuclear generating stations. Unless other arrangements are made, we will provide the final version of this brochure to the NRC at the same time it is distributed to the public in October, 1985. The brochure is a subject of the licensing hearings to be held in October, 1985. While this proceeding may necessitate changes, they are not anticipated before the public distribution in October.

Please contact this office if there are additional questions.

One signed original and fifteen copies of this letter and the attachments are provided for your review. One of these fifteen is being forwarded to Jan Stevens, of your staff, by expedited mail.

Very truly yours,

A handwritten signature in cursive script that reads "David H. Smith". The signature is written in dark ink and is positioned below the typed name.

David H. Smith

DHS/k1j
0349K

RELATED CORRESPONDENCE

PRELIMINARY

DOCKETED
USNRC

'85 AUG 26 P12:22

**EVACUATION TIME ESTIMATES
WITHIN THE PLUME EXPOSURE PATHWAY
EMERGENCY PLANNING ZONE
FOR THE
BRAIDWOOD NUCLEAR GENERATING STATION**

COMMONWEALTH EDISON COMPANY

AUGUST 1985

PRELIMINARY

EVACUATION TIME ESTIMATES
WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE
FOR THE
BRAIDWOOD NUCLEAR GENERATING STATION

COMMONWEALTH EDISON COMPANY

AUGUST 1985

EVACUATION TIME ESTIMATES
 WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE
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 BRAIDWOOD NUCLEAR GENERATING STATION

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SECTION 1

INTRODUCTION

This study presents evacuation time estimates for those portions of Illinois within the Plume Exposure Pathway Emergency Planning Zone (EPZ) for the Braidwood Nuclear Generating Station, hereafter referred to as Braidwood Station. The Braidwood Station is located near and directly south of Braidwood, Illinois. The Braidwood Station EPZ includes portions of Will, Grundy, and Kankakee Counties. Figure 1-1 presents a map of the Braidwood Station site vicinity.

1.1 PURPOSE

This evacuation time estimate study has been developed by the Commonwealth Edison Company (CECo) to support the State of Illinois Plan for Radiological Accidents (IPRA), Braidwood Volume VII, Revision 0, 8-85, and Commonwealth Edison's Generating Stations' Emergency Plan, Braidwood Annex. The primary purpose of this evacuation time estimate study is to assess the relative feasibility of evacuation for the Braidwood Station EPZ.

The study identifies the approximate time frame associated with evacuation based on a detailed consideration of the EPZ's roadway network and population distribution. It is important to note that this study presents representative time frames for a range of seasonal, diurnal, and weather conditions for the evacuation of various areas around the Braidwood Station once a decision has been made to evacuate.

The Braidwood Volume of IPRA is the detailed emergency operations plan for the Braidwood Station EPZ. Braidwood IPRA Standard Operating Procedures (SOP) 7-SOP-8, 7-SOP-9, and 7-SOP-10 provide the specific instructions for the implementation of evacuation as a protective response action.

1.2 SUMMARY

The evacuation time estimates presented in this study were developed using the NETVAC2 traffic simulation computer model. Detailed site-specific evacuation road network and vehicle data and public response time distributions were used in NETVAC2 to determine evacuation time estimates. For each of ten primary evacuation zones, evacuation time estimates for the general population within the Braidwood Station EPZ were developed for eight combinations of conditions: summer and winter seasons; daytime and nighttime; and normal and adverse weather. Results of the general population evacuation time estimates for these eighty scenarios, rounded to the nearest minute, are summarized in Table 1-1.

The computer analyses indicate that summer and winter evacuation time estimates are similar. Table 1-1 shows that for normal weather conditions in summer and winter, the general population evacuation time estimates for the full EPZ range from 177 minutes during the day to 114 minutes at night. In adverse weather, these time estimates range from 211 minutes during the day to 136 minutes for night time scenarios.

Evacuation time estimates for the general population were also prepared for various other evacuation scenarios in the 0-2, 0-5, and 0-10 mile evacuation zones. Summer and winter normal weather 0-2 mile evacuation time estimates range from 176 minutes during the day to 88 minutes at night. Adverse weather condition evacuation time estimates for 0-2 miles for the same time periods are 209 minutes during the day and 92 minutes at night.

The 0-5 mile estimates are slightly longer for some scenarios, primarily due to the larger number of vehicles in the 0-5 mile zones. Normal weather conditions result in a range of 176 to 177 minutes for the day to 88 to 114 minutes at night. The 0-5 mile adverse weather estimates range from 209 to 211 minutes during the day to 92 to 136 minutes at night.

In normal weather conditions, the evacuation times for the 0-10 mile primary evacuation zones range from 176 to 177 minutes during the day to 114 minutes at night. The adverse weather condition time estimates range from 209 to 211 minutes for daytime to 136 minutes for nighttime scenarios.

It is important to note that, due to the favorable roadway capacity to population ratio, these evacuation time estimates are relatively insensitive to changes in population. An increase of 50 percent in the summer daytime transient population results in an increase of only 3 minutes for the evacuation time estimate in the full EPZ summer day normal weather scenario.

The evacuation study has been prepared in close coordination with the State of Illinois Emergency Services and Disaster Agency (ESDA) personnel responsible for the preparation of the Braidwood Volume of IPRA.

1.3 SCOPE

This study was prepared pursuant to the recommendations of NUREG-0654/FEMA-REP-1, Rev. 1¹, Appendix 4, Evacuation Time Estimates within the Plume Exposure Pathway Emergency Planning Zone, the current regulatory guidance for preparing evacuation time estimates. Section 2 presents the evacuation study areas and evacuation scenarios. Section 3 discusses the various demographic and vehicle data utilized in this study. Section 4 presents the evacuation time estimate methodology and assumptions for both the general population and the special facilities. Section 5 is a description of the evacuation road network. Section 6 presents the evacuation time estimates. Section 7 presents the conclusions and recommendations of this study.

TABLE 1-1
EVACUATION TIME ESTIMATES
GENERAL PUBLIC EVACUATION TIMES (1)

Primary Evacuation Zone (2)	Summer(3)				Winter(4)			
	Daytime		Nighttime		Daytime		Nighttime	
	Normal	Adverse	Normal	Adverse	Normal	Adverse	Normal	Adverse
0-2 mile A,B	176	209	88	92	176	209	88	92
0-5 mile A,B,C	177	211	114	136	177	211	114	136
0-5 mile A,B,D	176	209	88	92	176	209	88	92
0-5 mile A,B,E	176	209	88	92	176	209	88	92
0-5 mile A,B,F	176	209	114	136	176	209	114	136
0-10 mile A-F,G	177	211	114	136	177	211	114	136
0-10 mile A-F,H	176	209	114	136	176	209	114	136
0-10 mile A-F,I	176	209	114	136	176	209	114	136
0-10 mile A-F,J	176	209	114	136	176	209	114	136
Full EPZ A-J(5)	177	211	114	136	177	211	114	136

NOTES:

- (1) Times have been rounded to nearest minute.
- (2) See Figure 2-1 for evacuation study area locations.
- (3) As discussed in Section 3.1.
- (4) As discussed in Section 3.2.
- (5) Full EPZ A-J Scenario is analyzed in accordance with the guidance of Appendix 4 of NUREG-0654/FEMA-REP-1, Rev. 1. This analysis verifies the appropriateness of the selection of the primary evacuation zone boundaries used in the other analyses.

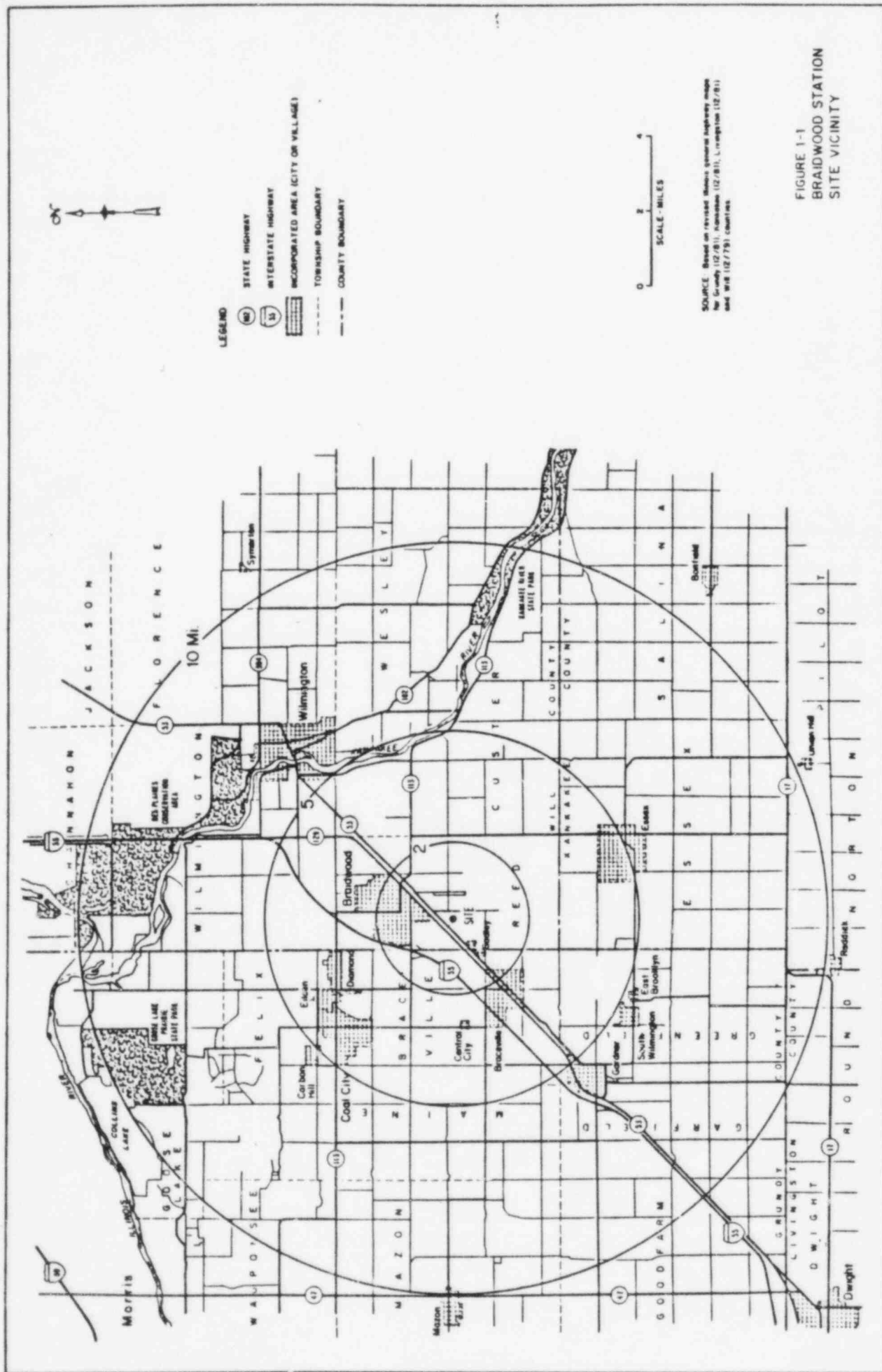


FIGURE 1-1
BRAIDWOOD STATION
SITE VICINITY

SECTION 2

EMERGENCY PLANNING ZONE AND EVACUATION SCENARIOS

2.1 EVACUATION STUDY AREAS

The area studied for potential evacuation is the Plume Exposure Pathway Emergency Planning Zone (EPZ) for the Braidwood Station. For the purposes of this study, several evacuation study areas were defined within the EPZ. The study areas for the evacuation of the EPZ approximate the 0-2 mile, 2-5 mile, and 5-10 mile sector groupings suggested in NUREG-0654/FEMA-REP-1, Rev. 1, Appendix 4.

Figure 2-1 identifies the ten evacuation study areas. Table 2-1 identifies the locations of these ten study areas and the local communities contained within each study area.

2.2 PRIMARY EVACUATION ZONES

To facilitate preparation of realistic evacuation time estimates, the evacuation study areas were grouped into ten primary evacuation zones. These primary evacuation zones have been designated as follows:

- 0-2 miles, Evacuation Study Areas A and B
- 0-5 miles, Evacuation Study Areas A, B and C
- 0-5 miles, Evacuation Study Areas A, B and D
- 0-5 miles, Evacuation Study Areas A, B and E
- 0-5 miles, Evacuation Study Areas A, B and F
- 0-10 miles, Evacuation Study Areas A through F and G
- 0-10 miles, Evacuation Study Areas A through F and H
- 0-10 miles, Evacuation Study Areas A through F and I
- 0-10 miles, Evacuation Study Areas A through F and J
- Full EPZ, Evacuation Study Areas A through J. (Full EPZ A-J Scenario is analyzed in accordance with the guidance of Appendix 4 of NUREG-0654/FEMA-REP-1, Rev. 1. This analysis verifies the appropriateness of the selection of the primary evacuation zone boundaries used in the other analyses.)

PRELIMINARY

Evacuation time estimates have been developed for each of these primary evacuation zones for the conditions discussed in the following sections.

2.3 EVACUATION SCENARIOS

Evacuation scenarios were developed to simulate evacuation conditions established by the combination of primary evacuation zones with a specified season, time of the day, and weather condition during which an evacuation may be necessary. There are ten primary evacuation zones, two seasons (summer and winter), two time considerations (daytime and nighttime), and two weather conditions (normal and adverse). Therefore, a total of eighty evacuation scenarios have been considered in this evacuation time estimate study.

2.3.1 Seasonal and Diurnal Parameters

Section 3 describes demographic data in detail. The following paragraphs summarize this description.

The summer season attracts additional visiting and transient populations to the area of Braidwood Station, principally as vacationers at the recreation facilities. Therefore, the summer daytime scenarios have included the permanent resident, daytime employee, and visiting or transient populations and applicable special facilities populations. The summer nighttime scenarios have included the permanent resident, nighttime employee, and applicable overnight transient and special facilities populations.

The winter daytime scenarios have included the permanent resident, daytime employee, school district, and applicable transient and special facilities populations. The winter nighttime scenarios have included

the permanent resident, nighttime employee, and applicable transient and special facilities populations. These baseline evacuation scenarios represent weekday conditions because they occur most frequently.

2.3.2 Weather Parameters

Normal and adverse weather conditions have also been considered. For the purposes of this study, adverse weather conditions are assumed to reduce road capacity to 80 percent of normal weather capacity, and include conditions that may impair visibility and/or traction, such as light snow, icing, rain, or fog.

Transportation studies⁵ and the opinions of recognized traffic experts⁶ indicate that such conditions can reduce road capacity to 76-92 percent of normal weather capacity. Review of the Braidwood area meteorology reveals that these weather conditions are encountered about 10 percent of the time.⁷

It is important to note that this study does not suggest that evacuations will or should occur under all adverse weather conditions. Under certain extremely adverse weather conditions where evacuation may be infeasible, the alternative protective action of sheltering would be recommended.⁸

TABLE 2-1

LOCAL COMMUNITIES BY EVACUATION STUDY AREA

<u>Evacuation Area</u>	<u>County</u>	<u>Study Area(1)</u>	<u>Local Communities</u>
0-2 Miles North	Will Grundy	A	Braidwood Twp., Braidwood, Godley (Braidwood Nuclear Generating Station)
0-2 Miles South	Will Grundy	B	Braceville, Reed Twp., Godley (Braidwood Nuclear Generating Station)
2-5 Miles Northeast	Will	C	Braidwood Twp., Wilmington, Custer Park
2-5 Miles Southeast	Will Kankakee	D	Reed Twp., Essex Twp., Essex
2-5 Miles Southwest	Will Grundy Kankakee	E	Reed Twp., Essex Twp., Braceville Twp., Gardner, South Wilmington, East Brooklyn
2-5 Miles Northwest	Will Grundy	F	Braceville Twp., Diamond, Coal City, Carbon Hill
5-10 Miles Northeast	Will Grundy	G	Wilmington Twp., Wesley Twp., Florence Twp.
5-10 Miles Southeast	Will Kankakee	H	Wesley Twp., Salina Twp., Essex Twp., Reddick, Union Hill
5-10 Miles Southwest	Grundy Kankakee	I	Greenfield Twp., Garfield Twp., Goodfarm Twp.
5-10 Miles Northwest	Grundy	J	Maine Twp., Mazon Twp., Mazon, Felix Twp., Wauponsee Twp., Goose Lake Twp.

NOTE:

(1) See Figure 2-1 for Study Area Identification.

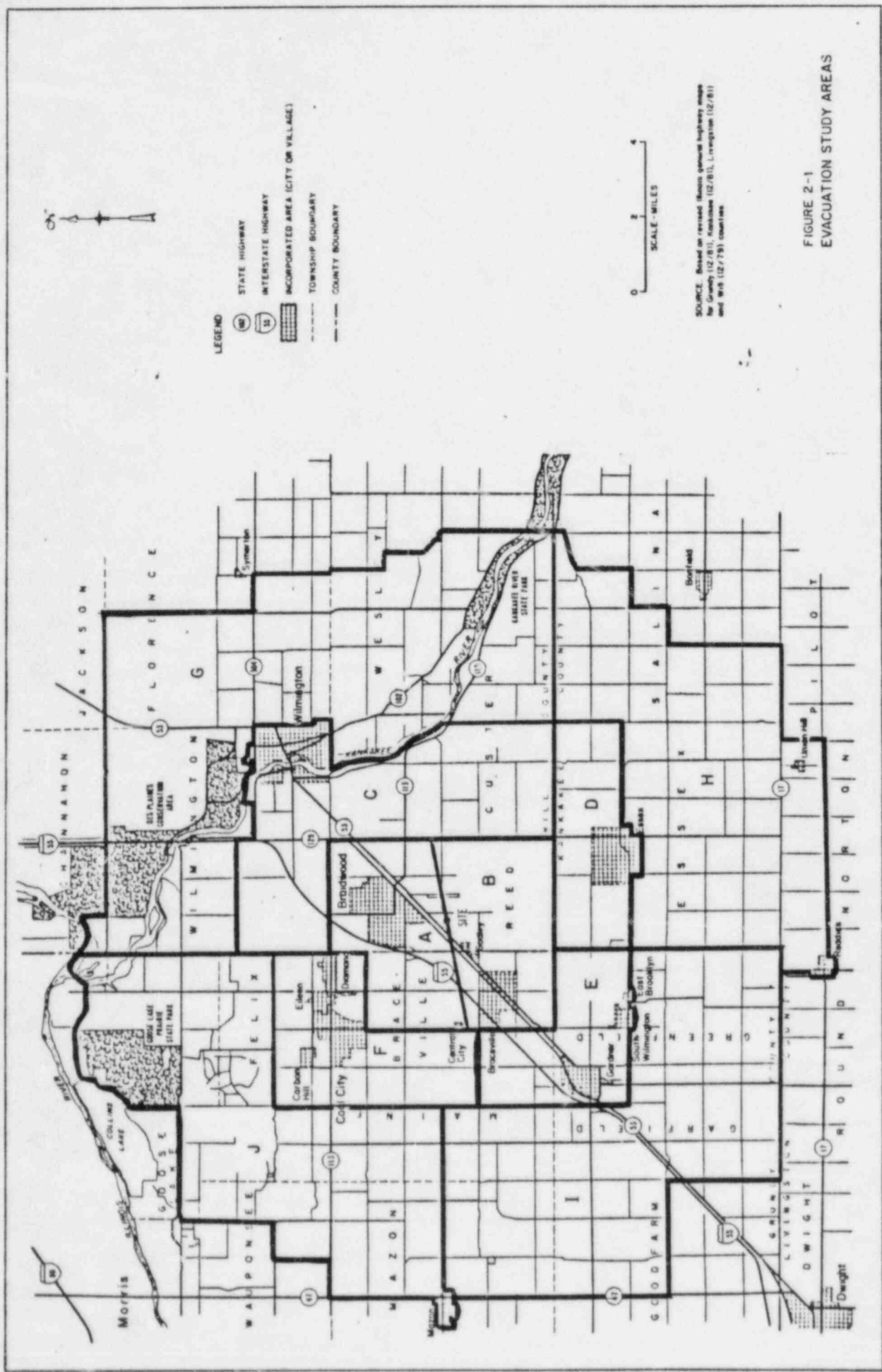


FIGURE 2-1
EVACUATION STUDY AREAS

SECTION 3

DEMOGRAPHIC AND VEHICLE DATA

Demographic data for this study was derived from the official 1980 census data.⁹ Additional information has been provided from field survey work, by State of Illinois Emergency Services and Disaster Agency (ESDA) personnel and from communications with Will, Grundy, and Kankakee County officials. The vehicle data were derived from the demographic data and the average number of persons per household in Will, Grundy, and Kankakee Counties. The study assumes one vehicle per household. The number of registered vehicles in Will, Grundy, and Kankakee Counties supports this assumption. Figures 3-1 through 3-10 present specific population and vehicle data by compass sector and distance from the Braidwood Station for various seasonal and diurnal conditions. As discussed in Section 1.2, the evacuation time estimates are relatively insensitive to changes in population.

This study identifies 28,096 permanent residents within the evacuation study areas. The permanent resident population is comprised of 27,730 persons who reside within a 10-mile radius of Braidwood Station (including the communities of Mazon, Reddick, and Union Hill) plus an additional 366 persons who reside beyond 10 miles from Braidwood Station, but who are within the Braidwood EPZ. Figures 3-1 and 3-2 present the permanent (resident) population and vehicle data by compass sector and distance. Tables 3-2 through 3-5 present various transient and special facilities populations. For the purpose of this study, as

required by NUREG 0654, Appendix 4, special facilities are those institutions or other population concentrations which are transportation-dependent or may have other special concerns. Transient (non-resident) and special facilities populations include, as applicable, recreation areas, major employers, schools, health care facilities, and motels. Schools are shown on Figure 3-11. Figure 3-12 identifies the locations of major employers. Health care facilities, recreation areas, and other similar facilities within the EPZ are shown on Figure 3-13.

The summer daytime period represents the period of greatest population. This study identifies a summer daytime population of 41,525 persons. This figure was derived by adding the number of employee, transient, and applicable special facilities populations to the permanent resident population. The summer daytime period also has the greatest number of vehicles due to the increase in transients. The Summer nighttime population of 32,224 includes the permanent resident, nighttime employee, overnight transient, and applicable special facilities populations.

This study identifies a winter daytime population of 41,610, which includes the permanent resident, daytime employee, applicable transient and special facilities populations. The winter nighttime population of 29,734 is comprised of the permanent resident, nighttime employee, and applicable transient and special facilities populations, and is the period with the lowest number of both individuals and vehicles.

Table 3-1 summarizes the population and vehicle data by seasonal period for each of the evacuation study areas. This population data does not include short term special events such as the Fourth of July. These special events are discussed in Section 3.4.

NUREG 0654, Appendix 4, recommends that the public transport-dependent population be considered. There are no public transportation systems in the Braidwood Station EPZ. Accordingly, this recommendation is not applicable.

3.1 SUMMER SEASON POPULATION DATA

The summer season, as defined by this study, extends from about Memorial Day weekend through Labor Day weekend. There is a significant population influx during this season. The specific population combinations are discussed in the following sections.

3.1.1 Summer Daytime Data

Summer daytime populations include recreational areas transients (e.g., campers and boaters, see Table 3-2), and applicable other special facilities (see Table 3-5), in addition to the employee (see Table 3-3) and permanent resident populations. Figures 3-3 and 3-4 present this data by compass sector for population and vehicles, respectively.

3.1.2 Summer Nighttime Data

The summer nighttime populations include overnight transients (e.g., applicable camps, see Table 3-2), and other special facilities populations (see Table 3-5), in addition to the nighttime employee (see Table 3-3) and permanent resident populations. Figures 3-5 and 3-6 present this data by compass sector for population and vehicles, respectively.

3.2 WINTER SEASON POPULATION DATA

The winter season, as defined by this study, extends from about Labor Day through Memorial Day. This season includes the non-tourist months when schools are in session. The specific population combinations are discussed in the following sections.

3.2.1 Winter Daytime Data

Winter daytime populations include permanent residents, applicable camps and recreational facilities (see Table 3-2), school enrollments (see Table 3-4), employees (see Table 3-3), and other special facilities (see Table 3-5). The winter daytime populations and vehicle data are shown by compass sector on Figures 3-7 and 3-8, respectively.

3.2.2 Winter Nighttime Data

Winter nighttime populations include applicable overnight recreational area transients (see Table 3-2), and other special facilities (see Table 3-5) in addition to employee night shift populations (see Table 3-3) and permanent residents. The winter nighttime populations and corresponding vehicle data are shown by compass sector on Figures 3-9 and 3-10, respectively.

3.3 TRANSIENT AND SPECIAL FACILITIES POPULATION DATA

For the purpose of this study, as required by NUREG 0654, Appendix 4, special facilities are those institutions or other population concentrations which are transportation-dependent or may have other special concerns. Transient and special facilities include, as applicable, recreation areas, major employers, schools, health care facilities and motels. Population data for these facilities are shown on Tables 3-2, 3-3, 3-4, and 3-5, respectively.

The location of schools within the EPZ are identified on Figure 3-11. Figure 3-12 identifies the locations of major employers. Health care facilities, recreation areas, and other similar facilities within the EPZ are identified on Figure 3-13.

3.4 SPECIAL EVENTS POPULATIONS

The Special Event populations associated with infrequent short-term activities or special events were identified. Included as a Special Event in this study is a special evacuation sensitivity analysis of transient populations at the recreation areas within the EPZ on a summer holiday to determine the sensitivity of the evacuation time estimates to recreation area populations.

To generate the population data for the special evacuation sensitivity analysis of transient populations at recreation areas, the transient population data for the camps and recreation areas within the EPZ, as identified in Table 3-2, were increased by 50 percent.

The Special Event populations were added to the applicable permanent resident, employee, transient, and special facilities populations. The results of these Special Event analyses are presented in Section 6.3.

TABLE 3-1
DEMOGRAPHIC AND VEHICLE DATA BY EVACUATION STUDY AREA(1)

Evacuation Study Area	Summer(2)				Winter(3)			
	Daytime		Nighttime		Daytime		Nighttime	
	Population(4)	Vehicles(5)	Population(4)	Vehicles(5)	Population(4)	Vehicles(5)	Population(5)	Vehicles(5)
A	8,672	4,034	4,692	2,040	8,423	3,723	4,682	2,037
B	2,797	1,304	1,792	646	2,380	1,041	1,677	589
C	7,758	3,002	6,953	2,571	7,764	2,476	5,428	1,974
D	520	179	490	166	582	185	480	163
E	2,905	1,019	2,620	903	3,081	956	2,330	806
F	6,202	2,221	5,792	2,017	7,682	2,367	5,772	2,010
G	5,788	2,003	4,598	1,601	5,558	1,890	4,558	1,580
H	1,323	449	1,323	449	1,629	498	1,323	449
I	576	187	576	187	576	187	576	187
J	4,985	1,944	3,389	1,186	3,936	1,535	2,909	1,039

NOTES:

- (1) Data derived from the official 1980 census data and field survey work as discussed in Section 3.
- (2) Refer to Section 3.1 for description of summer population combinations.
- (3) Refer to Section 3.2 for description of winter population combinations.
- (4) Data derived from Tables 3-2, 3-3, 3-4, and 3-5 and Figures 3-1, 3-3, 3-5, 3-7, and 3-9.
- (5) Data derived from Tables 3-2, 3-3, 3-4, and 3-5 and assumptions in Sections 4.1.3. The data are presented on Figures 3-2, 3-4, 3-6, 3-8, and 3-10.

TABLE 3-2
CAMPS AND RECREATION AREAS WITHIN THE
EMERGENCY PLANNING ZONE(1)

Facility No.(2)	Direction/ Mile	Study Area	Facility Name	Periods of Operation	Transient Population	
					Day	Night
1	N/7-10	G	Des Plaines Conservation Area	Summer/Day and Night Winter/Day and Night	685 250	20 20
2	NNW/8-10	J	Goose Lake Prairie State Park	Summer/Day Winter/Day	1000 100	0 0
3	E/8-10	G	Kankakee River State Park	Summer/Day and Night Winter/Day and Night	80 40	80 40
4	SSW/0-1	B	Chicago Beagle Club	Summer/Day and Night Winter/Day and Night	180 180	20 20
5	NE/2-3	A	Braidwood Recreation Club	Summer/Day and Night Winter/Day and Night	1500 40	20 10
6	SSE/2-3	B	South Wilmington Sportsmen's Club	Summer/Day and Night Winter/Day and Night	600 40	125 10
7	N/3-4	C	Area #1 Outdoor Club	Summer/Day and Night Winter/Day and Night	100 20	40 10
8	NNE/3-4	C	Wilmington Recreation Club	Summer/Day and Night Winter/Day and Night	300 20	10 10
9	S/3-4	D	Ponderosa Sportsmen's Club	Summer/Day Winter/Day	20 20	0 0
10	SSW/4-5	E	South Wilmington Firemen's Beach and Park Club	Summer/Day and Night Winter/Day and Night	500 40	300 10
11	NNE/4-5	C	Will County Sportsmen's Club	Summer/Day and Night Winter/Day and Night	145 20	10 10
12	NNE/4-5	C	Fossil Rock Recreation Club	Summer/Day and Night Winter/Day and Night	150 25	150 25
13	NNW/5-6	J	CECo Employee's Recreation Association	Summer/Day and Night Winter/Day and Night	450 50	300 10

TABLE 3-2 (Cont)

Facility No. (2)	Direction/ Mile	Study Area	Facility Name	Periods of Operation	Transient Population	
					Day	Night
14	NNW/5-6	F	Coal City Area Club	Summer/Day and Night Winter/Day and Night	300 40	30 10
15	NNW/7-8	J	Dresden Lakes Fishing Kamp	Summer/Day and Night Winter/Day and Night	45 45	10 10
16	NW/8-9	J	Rainbow Council Reservation Boy Scouts of America	Summer/Day and Night Winter/Day and Night	200 40	200 40
17	NNW/8-9	J	Goose Lake Association	Summer/Day and Night Winter/Day and Night	40 40	40 10
18	N/4-5	C	Lake Point Club	Summer/Day and Night Winter/Day and Night	1080 60	1080 60
19	N/9-10	G	J.Y.C. Marina	Summer/Day and Night Winter/Day and Night	180 180	60 10
20	E/1-2	B	Braidwood Fairways Golf Course	Summer/Day Winter/Day	60 40	0 0
21	NE/5-6	C	Wilmington Island Park District	Summer/Day Winter/Day	100 50	0 0
22	E/5-6	G	Isaac Walton League	Summer/Day and Night Winter/Day and Night	20 10	20 10
23	NNE/4-5	C	Ponderosa Camping Area	Summer/Day and Night Winter/Day and Night	10 10	10 10
24	S/4-5	D	Sun Recreation Club	Summer/Day and Night Winter/Day and Night	20 10	20 10
25	S/3-4	D	Joilet Braidwood Hunting Club	Summer/Day Winter/Day	10 10	0 0
26	ENE/1-2	A	Braidwood Dunes and Savannah Forest Preserve	Summer/Day Winter/Day	(3) (3)	0 0
27	NE/6-7	G	Forsythe Woods	Summer/Day and Night Winter/Day and Night	20 20	20 20

TABLE 3-2 (Cont)

Facility No. (2)	Direction/ Mile	Study Area	Facility Name	Periods of Operation	Transient Population	
					Day	Night
28	NE/3-4	C	Crow's Nest Club	Summer/Day Winter/Day	10 10	0 0
29	NE/3-4	C	New Lenox Sportsmen's Club and Recreation	Summer/Day and Night Winter/Day and Night	300 10	300 10
30	SW/1-2	B	Godley Park District	Summer/Day and Night Winter/Day and Night	(4) (4)	(4) (4)

NOTES:

- (1) This information provided by State of Illinois ESDA personnel responsible for the development of IPRA, Braidwood Volume VII (see Reference 8). Information is based on data available as of July 1985. As discussed in Section 1, the evacuation time estimates are relatively insensitive to changes in population.
- (2) See Figure 3-13 for facility locations.
- (3) Occasional use only.
- (4) New facility; no data currently available.

TABLE 3-3

MAJOR EMPLOYERS WITHIN THE EMERGENCY PLANNING ZONE(1)

Facility No.(2)	Direction/ Mile	Study Area	Name of Employer(4)	No. of Employees(3)	
				Day	Night
41	NW/4-5	F	DeMert & Daugherty, Inc.	80	10
42	NE/6-7	C	Personal Products Co.	300	150
43	Center	A&B	Braidwood Station - Unit 1 Operation	100	100
44	SW/6-7	E	Brownie Special Products Co.	25	0
45	SE/2-3	B	Production Training Center	330	20
46	SE/3-4	C	Tammen Treeberry Farm	15	0
47	NNW/9-10	J	Operator Training Services General Electric Company	120	20
48	NNW/9-10	J	Morris Operation General Electric Company	57	7
49	SW/5-6	E	Indicator Lites, Inc.	30	0
50	NE/5-6	C	Precision Components, Inc.	63	30
51	NW/3-4	F	Bowers Siemon Chemical Company	14	0
52	NW/3-4	F	E.W.R., Inc.	35	0
53	WNW/3-4	F	Witt and Associates	15	0
54	NW/10-11	J	Collins Generating Station	225	35
55	W/10-11	J	Coils, Inc.	75	4
56	NNE/10-11	C	Uniroyal-Joliet Army Ammunitions Plant	300	15
57	NE/8-9	G	Honeywell	150	30
58	NNW/9-10	J	AP Green Refractories Company	16	0

PRELIMINARY

NOTES:

- (1) For the purpose of this study major employers have been designated as those with 25 or more total employees, based on the best data available as of July 1985. As discussed in Section 1, the evacuation times estimates are relatively insensitive to changes in population.
- (2) See Figure 3-12 for employer locations.
- (3) This information provided by State of Illinois ESDA personnel responsible for the development of IPRA, Braidwood Volume VII (see Reference 8).
- (4) Seventeen of 18 employers have shut down times of 60 minutes or less. The remaining employer has a shut-down time of 90 minutes.

TABLE 3-4

SCHOOLS WITHIN THE EMERGENCY PLANNING ZONE(1)

<u>Facility No. (3)</u>	<u>Direction/ Mile</u>	<u>Study Area</u>	<u>Name of School</u>	<u>No. of Students/Staff (3)</u>
61	NNE/1-2	A	Braidwood Grade School	500/35
62	NNE/1-2	A	Braidwood Middle School	250/24
63	NE/1-2	A	Reed-Custer High School	370/32
64	WSW/2-3	B	Braceville Grade School	148/15
65	NW/4-5	F	Coal City Elementary School	677/57
66	NW/4-5	F	Coal City Middle School	388/34
67	NW/4-5	F	Coal City High School	480/57
68	SSE/4-5	D	Essex Elementary School	66/6
69	SSW/5-6	E	South Wilmington Consolidated Elementary	121/11
70	SW/5-6	E	Gardner Elementary School	229/14
71	SW/5-6	E	Gardner-South Wilmington Township High School	235/26
72	E/5-6	G	Custer Park Elementary School	180/18
73	NE/5-6	C	Bruning Elementary School	234/22
74	NE/6-7	C	L.J. Stevens Middle School	384/36
75	NE/6-7	C	Wilmington High School	499/54
76	NE/6-7	C	St. Rose School	217/20
77	NE/6-7	C	Booth Central School	470/36
78	NW/4-5	F	United Methodist Day Care Center	30/9
79	NE/6-7	C	Grace Lutheran Church Pre-School	60/4
80	S/10-11	H	Reddick High School	74/20
81	S/10-11	H	Reddick Elementary	200/12
82	W/10-11	J	Mazon Elementary/Jr. High School	190/17
83	W/10-11	J	Mazon-Verona-Kinsman High School	180/24

NOTES:

(1) Information is based on the data available as of July 1985. As discussed in Section 1, the evacuation time estimates are relatively insensitive to changes in population.

TABLE 3-4 (Cont)

(2) See Figure 3-11 for school locations.

(3) This information was provided by State of Illinois ESDA personnel responsible for the development of IPRA, Braidwood Volume VII (See Reference 8).

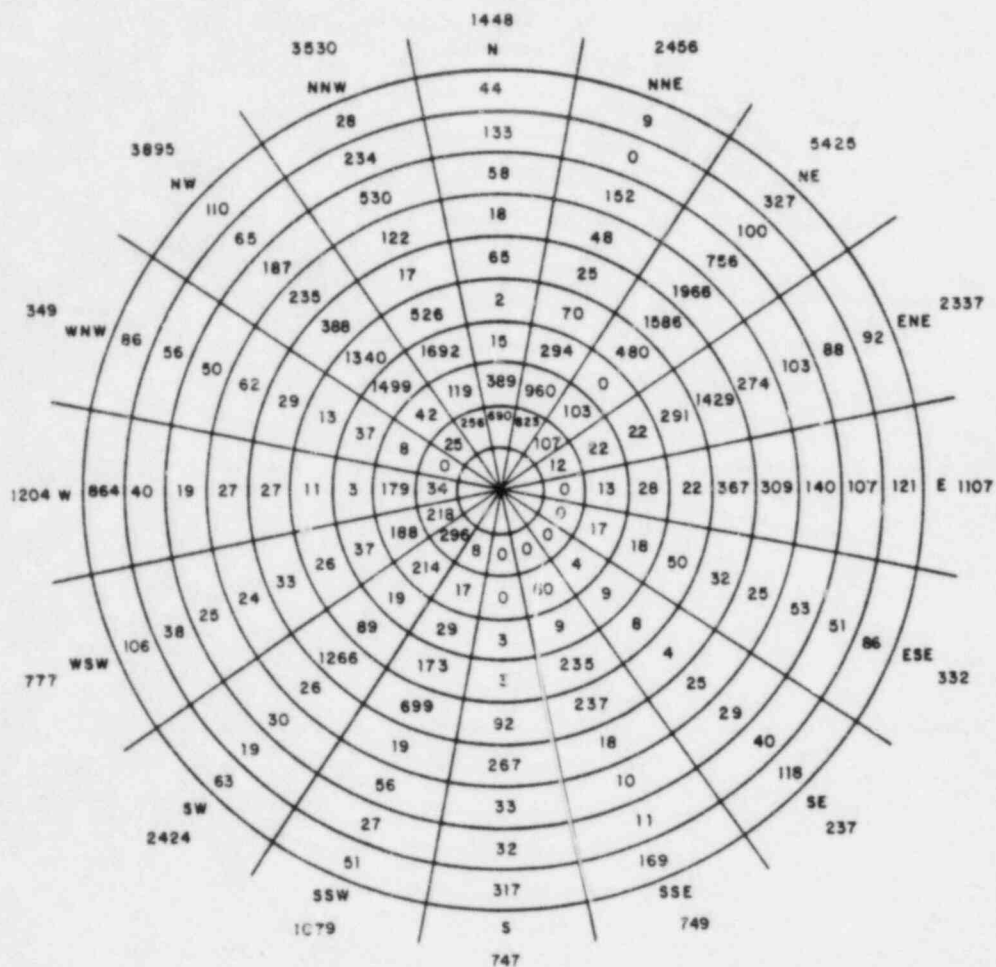
TABLE 3-5
HEALTH CARE FACILITIES AND MOTELS WITHIN THE EMERGENCY PLANNING ZONE(1)

Facility No.(2)	Direction/ Mile	Study Area	Facility Name	Resident/Staff Population	
				Day	Night
92	NW/4-5	F	Campbell House Senior Center	30/5	0
93	NE/5-6	C	Royal Willow Nursing Care Center	140/35	40/8
94	NE/5-6	C	Murphy's Motel	34	34
95	NNE/1-2	A	Rossi's Motel	32	32
96	NNW/1-2	A	Sands Motel	32	32
97	NNW/1-2	A	Braidwood Inn Motel	96	96
98	SW/5-6	E	Southeastern Grundy County Senior Citizen Center	25/5	0

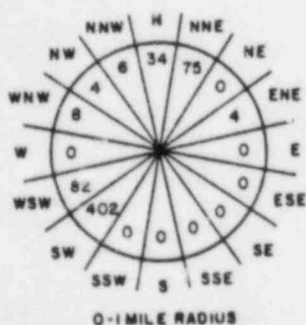
NOTES:

(1) This information was provided by State of Illinois ESDA personnel responsible for the development of IPRA, Braidwood Volume VII (see Reference 8). Information is based on data available as of July 1985. As discussed in Section 1, the evacuation time estimates are relatively insensitive to changes in population.

(2) See Figure 3-13 for facility locations.

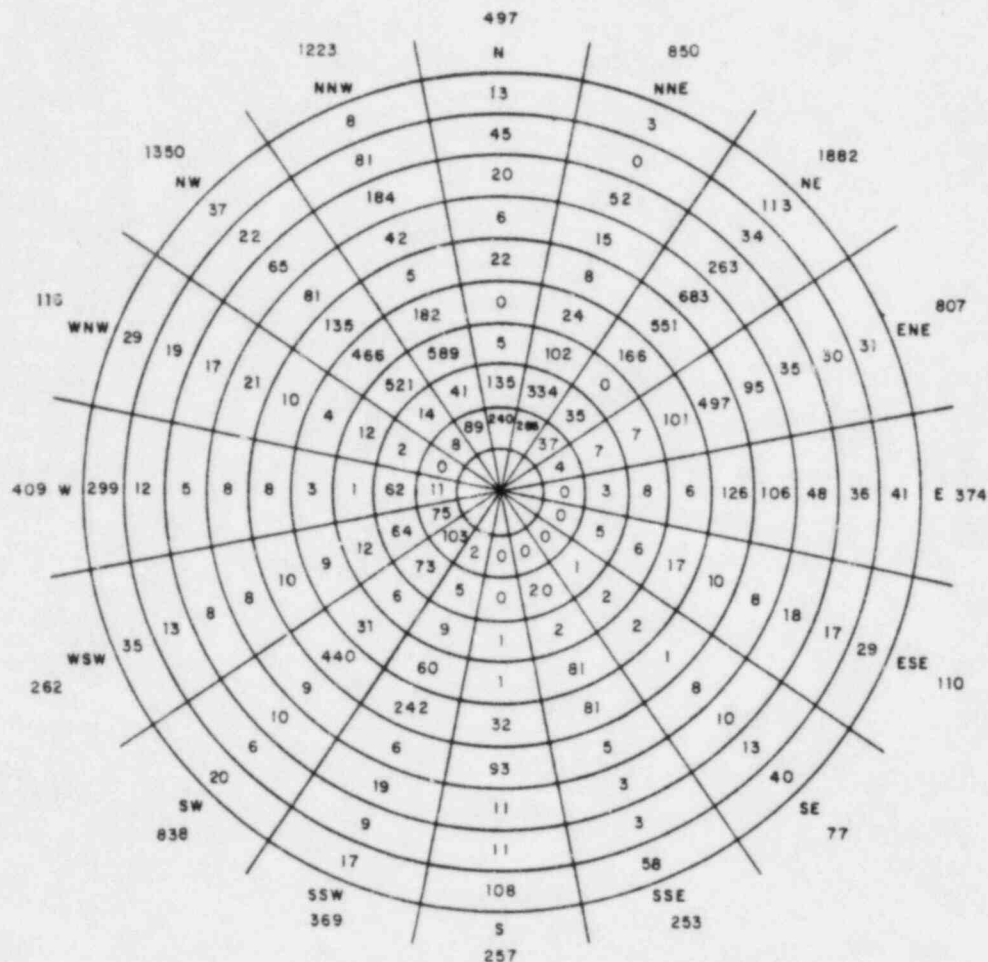


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
3084	12,472	28,096*	9388	15,624*

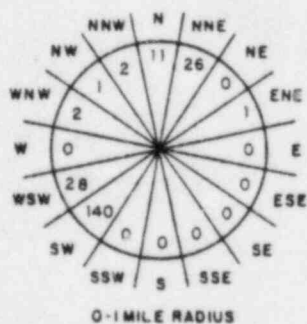


*Represents 27,730 permanent residents within 10 miles of Braidwood Station plus 366 located within the EPZ beyond 10 miles

FIGURE 3-1
PERMANENT POPULATION
DISTRIBUTION BY COMPASS SECTOR

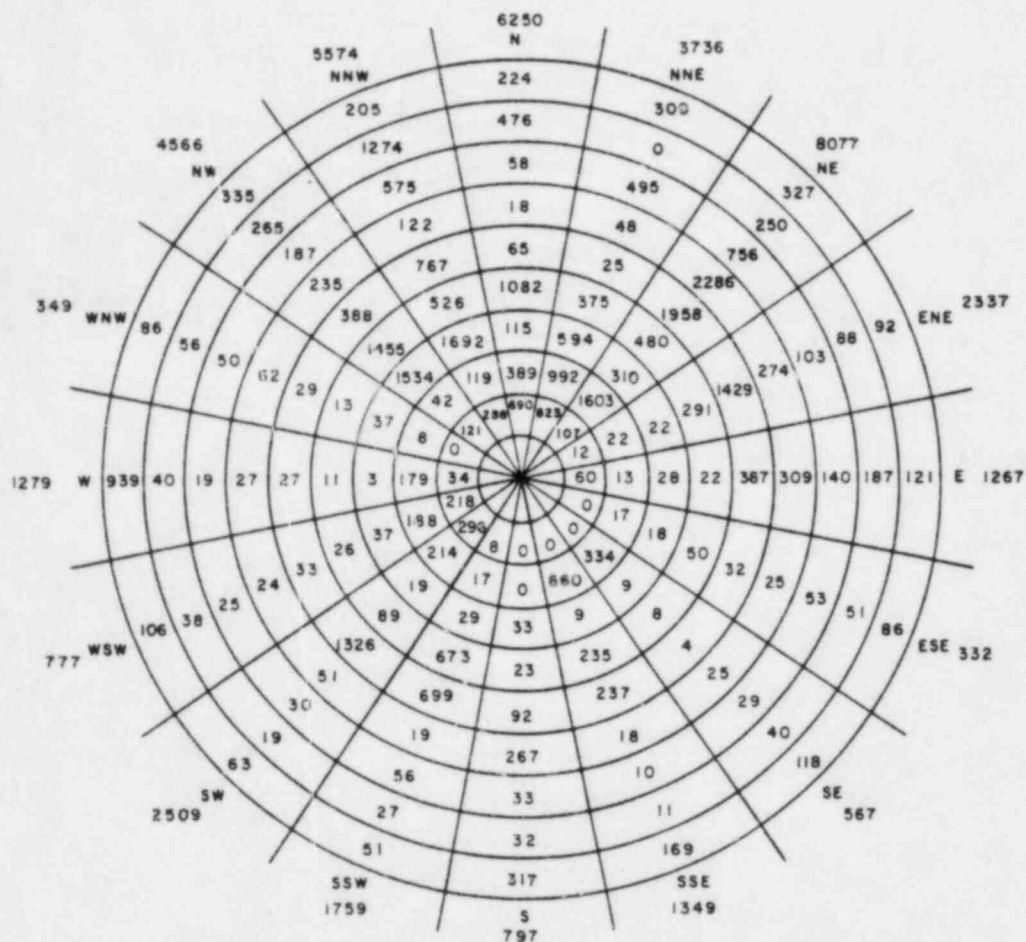


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
1066	4302	9674*	3236	5372*

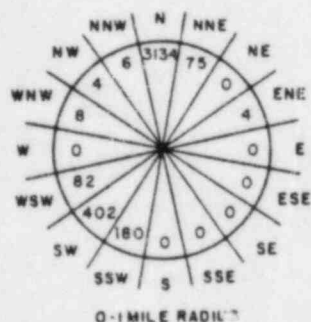


*Represents 9576 permanent resident vehicles within 10 miles of Braidwood Station plus 98 located within the EPZ beyond 10 miles

FIGURE 3-2
PERMANENT VEHICLE DISTRIBUTION
BY COMPASS SECTOR

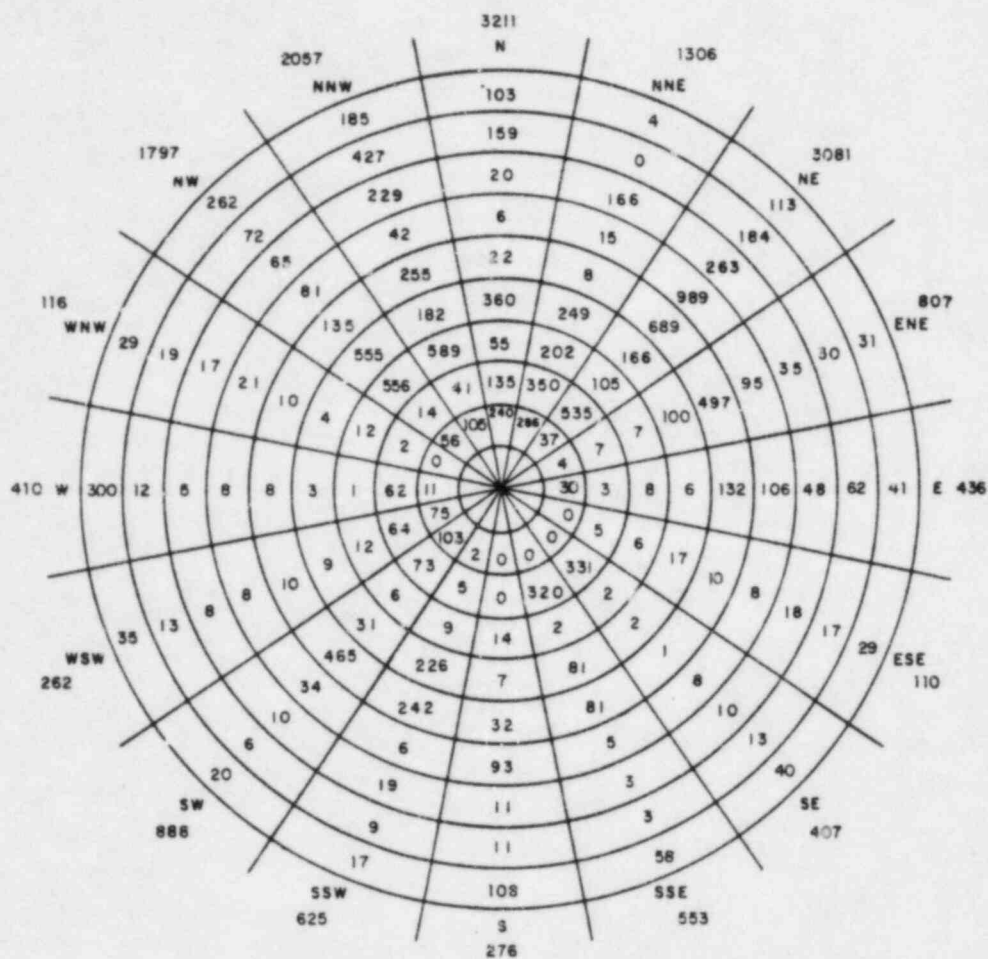


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
6552	21,197	41,525*	14,645	20,328*

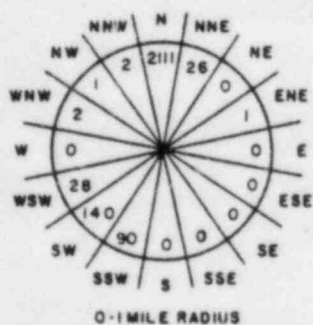


*Represents 27,730 permanent residents within 10 miles of Braidwood Station plus 366 located within the EPZ beyond 10 miles

FIGURE 3-3
POPULATION DISTRIBUTION BY
COMPASS SECTOR-SUMMER DAY

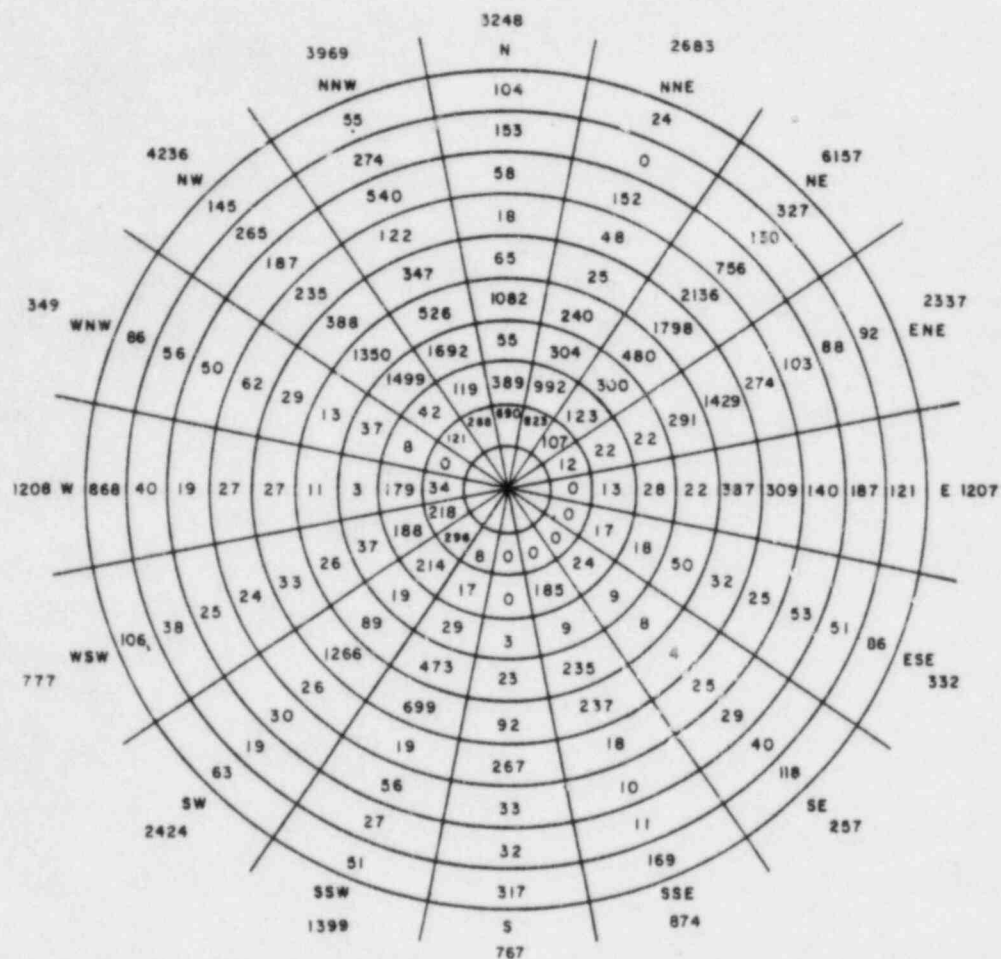


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
3350	8881	16,342*	5531	7461*

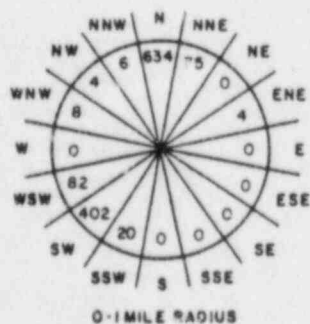


*Represents 9576 permanent resident vehicles within 10 miles of Braidwood Station plus 98 located within the EPZ beyond 10 miles

FIGURE 3-4
VEHICLE DISTRIBUTION BY
COMPASS SECTOR-SUMMER DAY

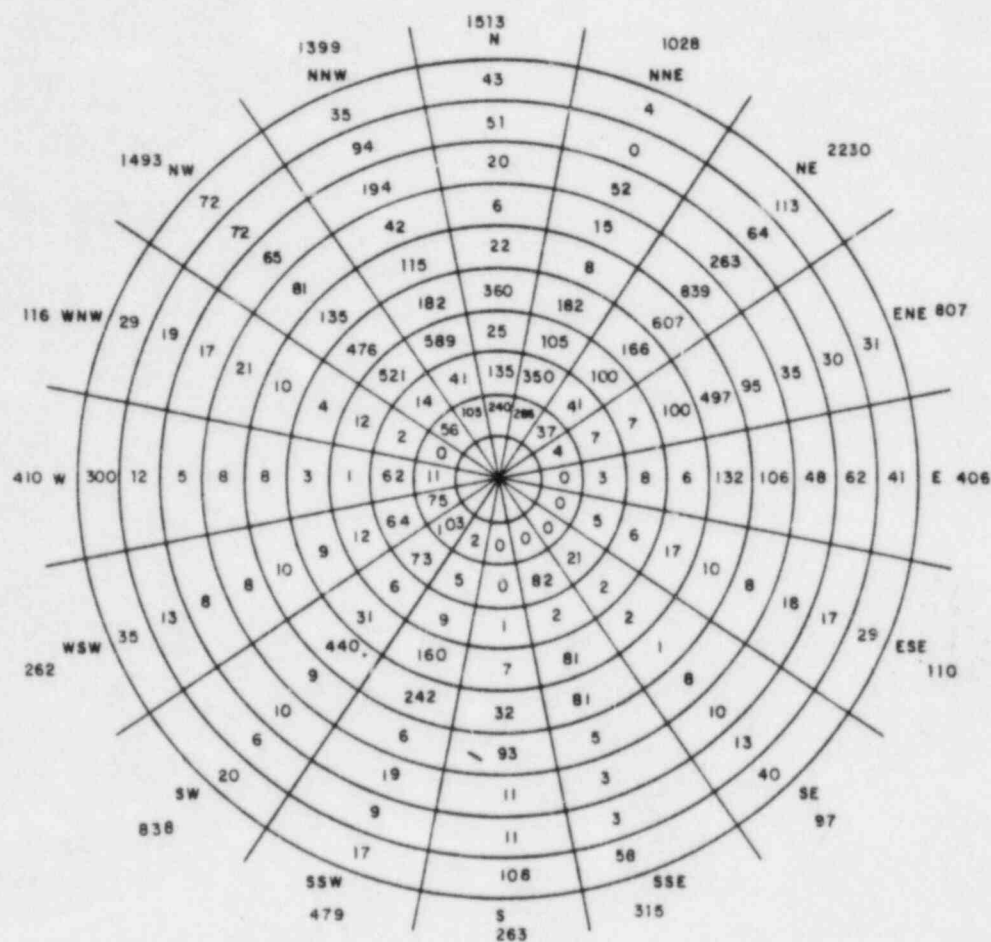


0-0.2 MI	0-0.5 MI	0-1.0 MI	2-5 MI	5-10 MI
3832	15,347	32,224*	11,515	16,877*

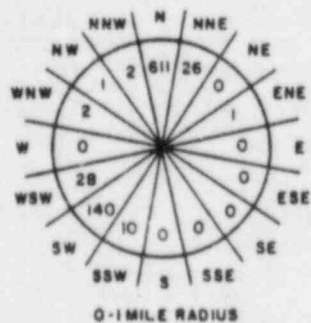


*Represents 27,730 permanent residents within 10 miles of Braidwood Station plus 366 located within the EPZ beyond 10 miles

FIGURE 3-5
POPULATION DISTRIBUTION BY
COMPASS SECTOR-SUMMER NIGHT

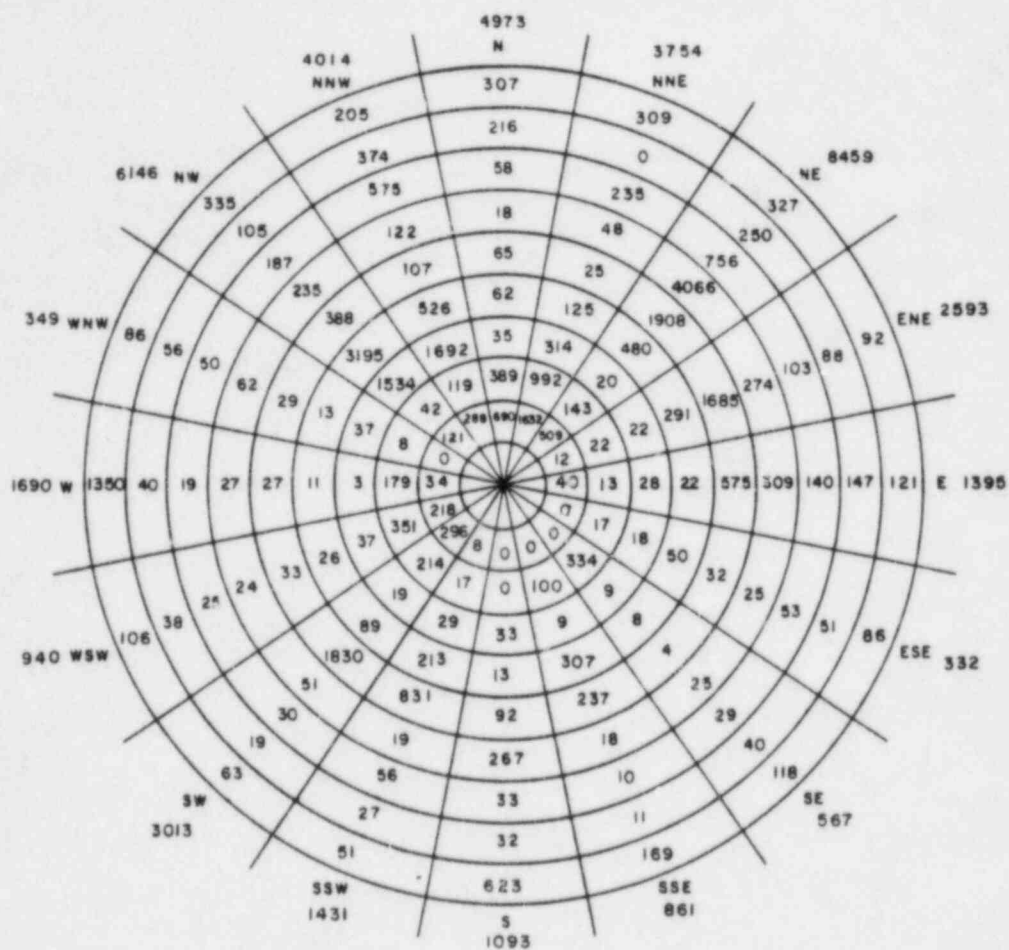


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
1740	5837	11,766*	4097	5929*

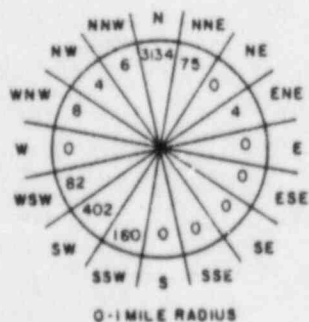


*Represents 9576 permanent resident vehicles within 10 miles of Braidwood Station plus 98 located within the EPZ beyond 10 miles

FIGURE 3-6
VEHICLE DISTRIBUTION BY
COMPASS SECTOR-SUMMER NIGHT

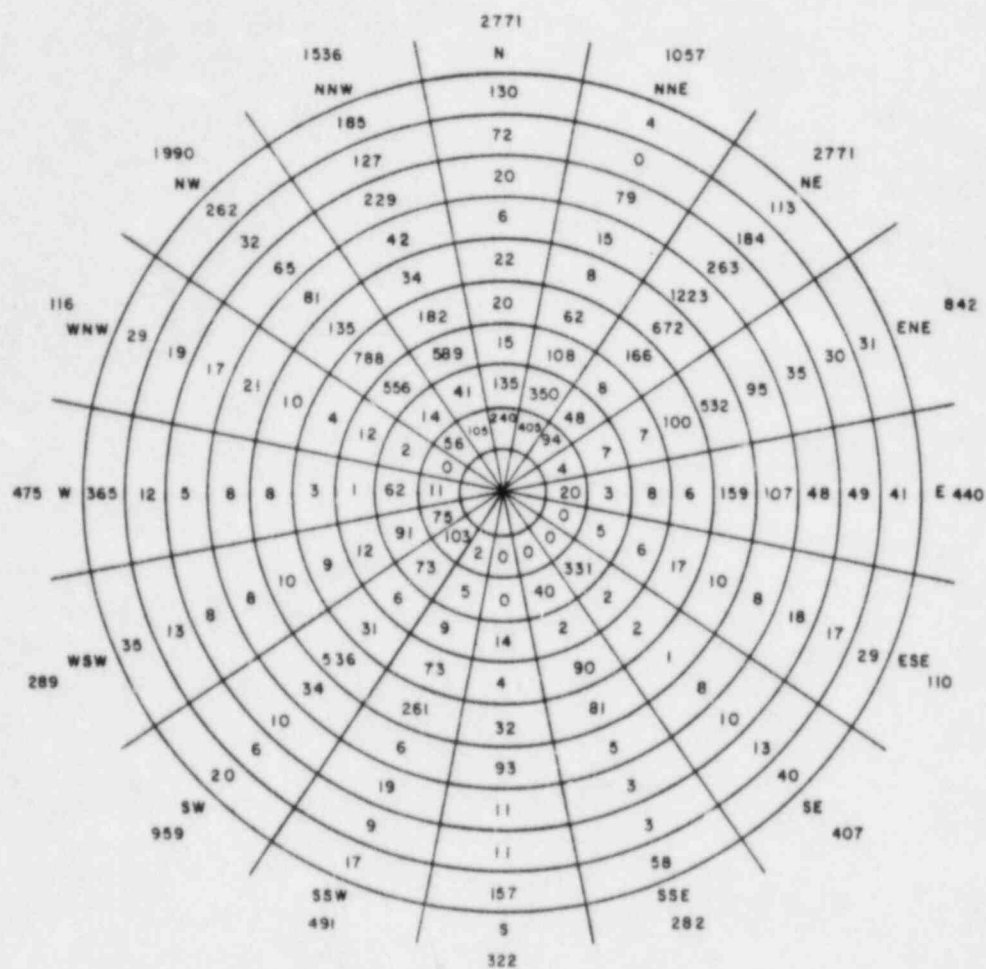


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
7743	19,953	41,611*	12,210	21,658*

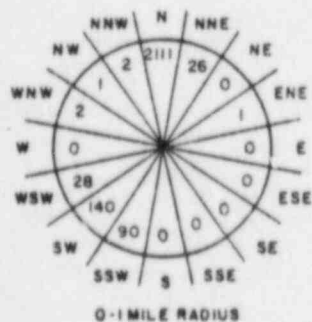


*Represents 27,730 permanent residents within 10 miles of Braidwood Station plus 366 located within the EPZ beyond 10 miles

FIGURE 3-7
POPULATION DISTRIBUTION BY
COMPASS SECTOR - WINTER DAY

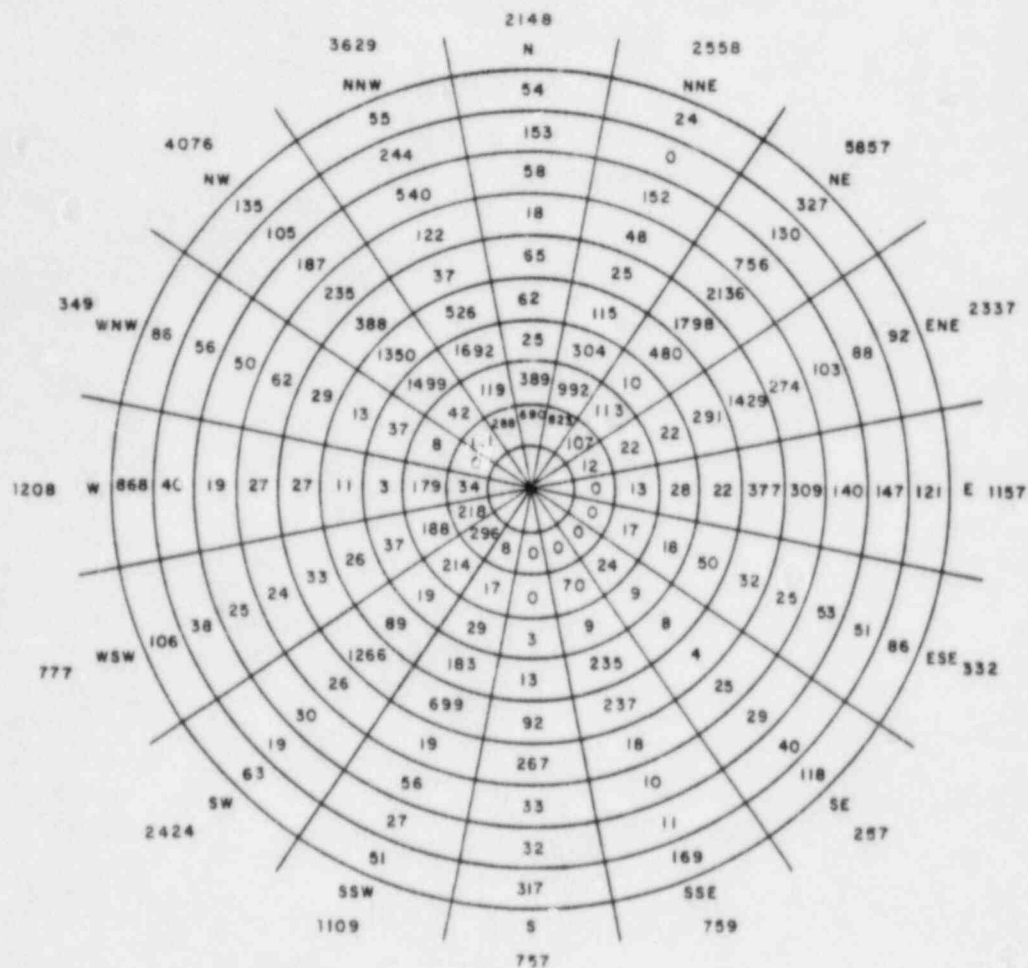


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
3516	7635	14,858*	4119	7223*

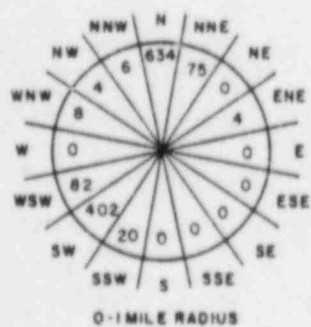


*Represents 9576 permanent resident vehicles within 10 miles of Braidwood Station plus 98 located within the EPZ beyond 10 miles

FIGURE 3-8
VEHICLE DISTRIBUTION BY
COMPASS SECTOR-WINTER DAY

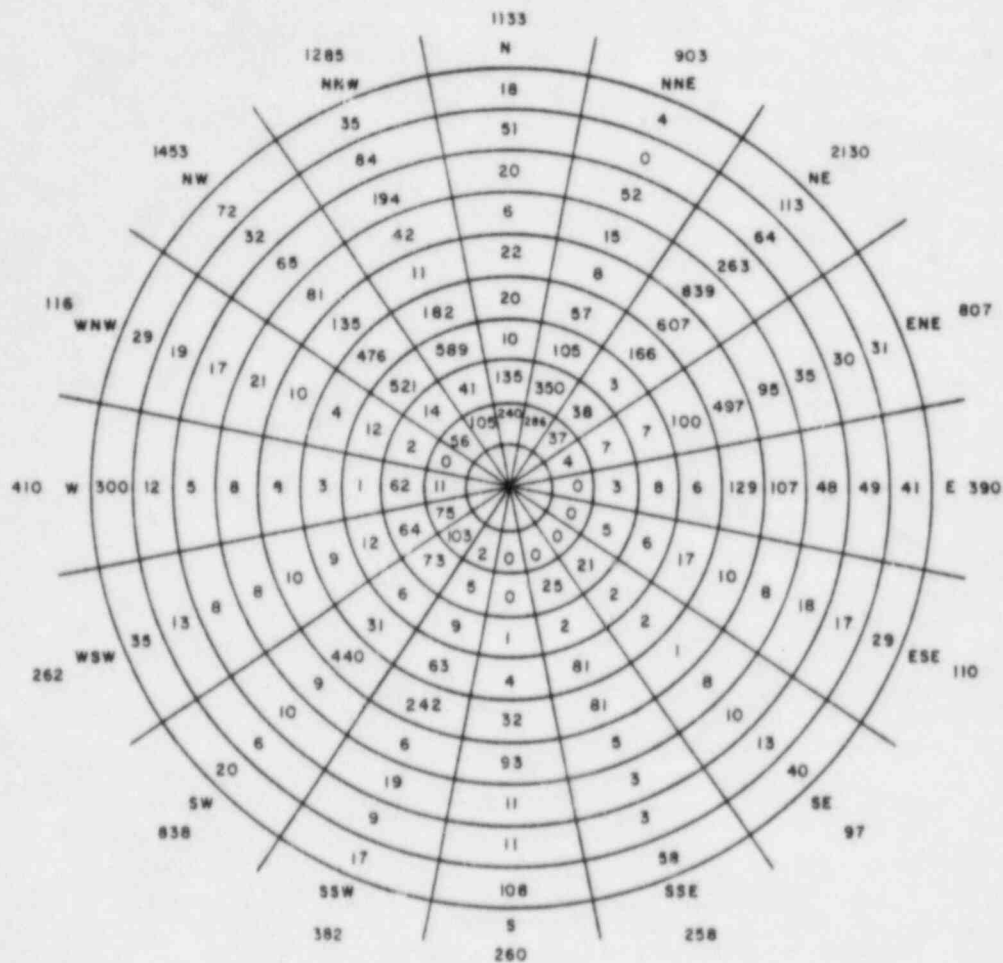


0-2 Mi	0-5 Mi	0-10 Mi	2-5 Mi	5-10 Mi
3832	13457	29,734*	9625	16,277*



*Represents 27,730 permanent residents within 10 miles of Braidwood Station plus 366 located within the EPZ beyond 10 miles

FIGURE 3-9
POPULATION DISTRIBUTION BY
COMPASS SECTOR - WINTER NIGHT



0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
1740	5100	10,834*	3360	8734*

*Represents 9576 permanent resident vehicles within 10 miles of Braidwood Station plus 98 located within the EPZ beyond 10 miles

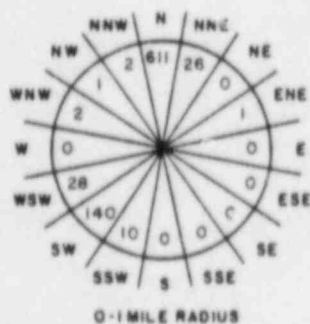
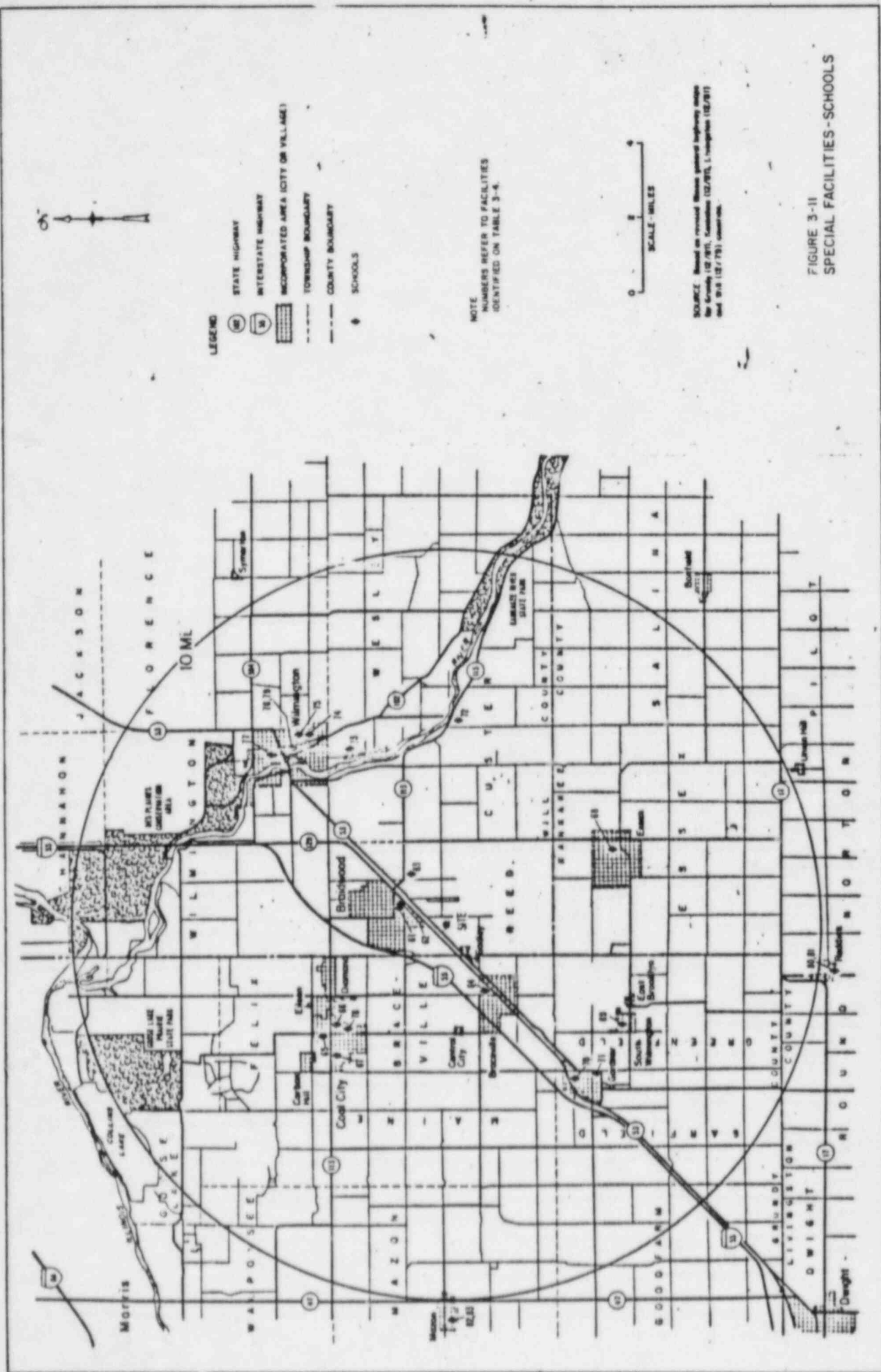
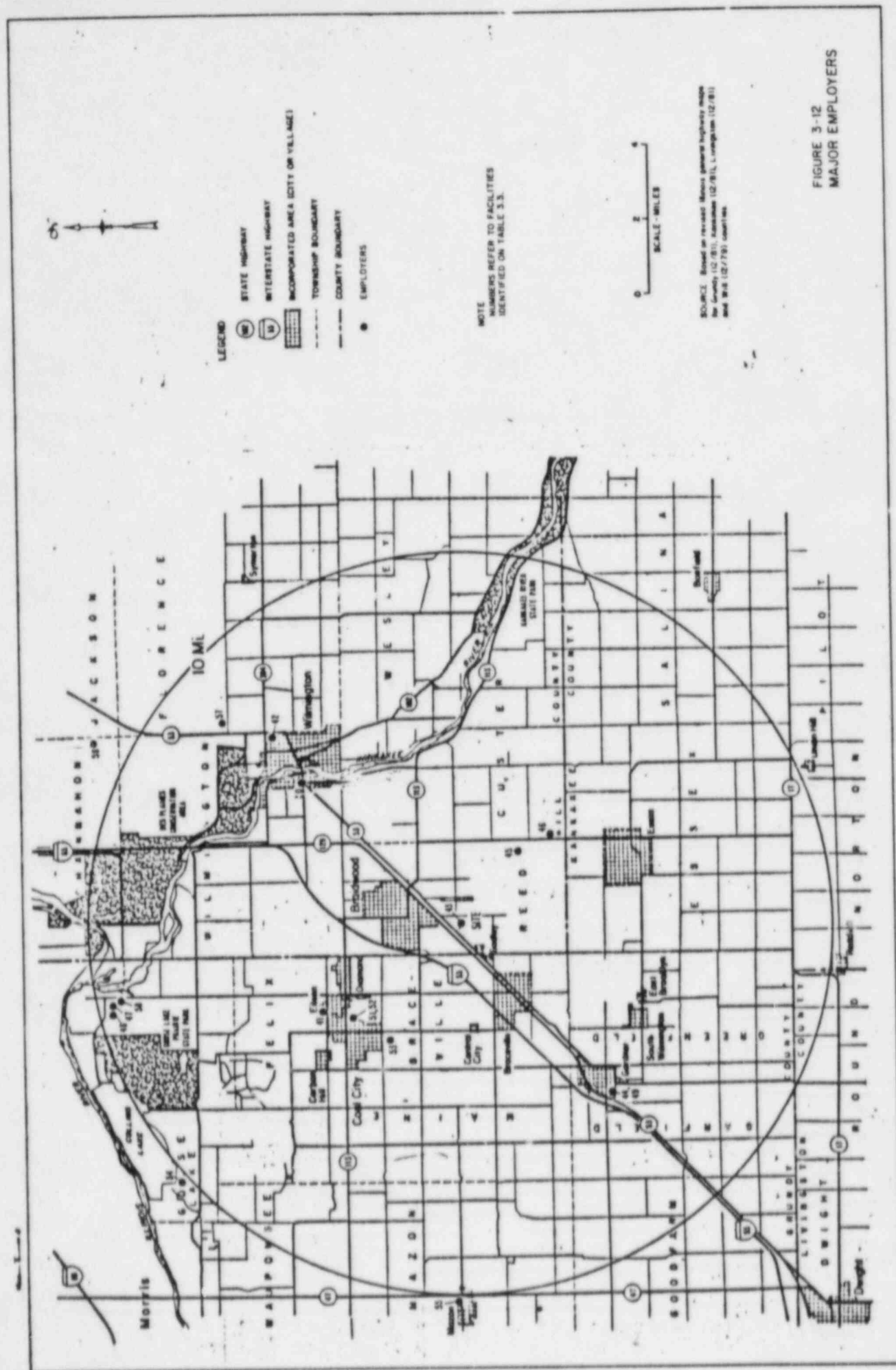
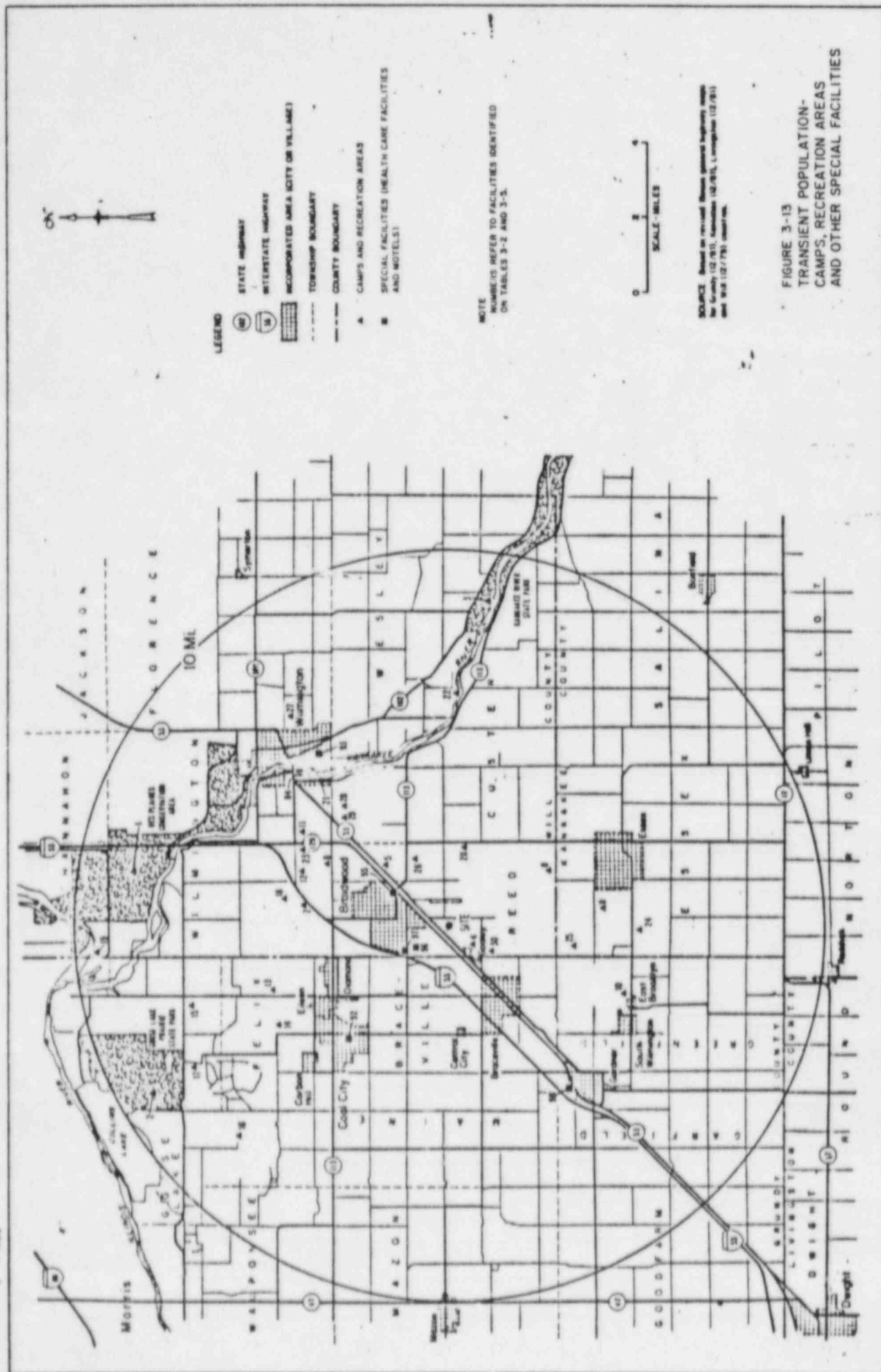


FIGURE 3-10
VEHICLE DISTRIBUTION BY
COMPASS SECTOR - WINTER NIGHT







SECTION 4

EVACUATION TIME ESTIMATE
METHODOLOGY AND ASSUMPTIONS

This section presents the methodology and assumptions used to develop the evacuation time estimates for the general population. Additionally, the methodology and assumptions used in a separate assessment for selected special facilities as required by NUREG 0654, Appendix 4, are presented.

4.1 GENERAL POPULATION EVACUATION TIME ESTIMATES

For the purposes of developing evacuation time estimates, the general population is comprised of the permanent population, transients, and special facilities populations appropriate for each of the particular evacuation scenarios. The general population evacuation time estimates are presented in Section 6.1.

The general population evacuation time estimates were calculated using the NETVAC2 computerized traffic simulation model² which has been developed to simulate the traffic flow over a transportation network during an evacuation. As input for the evacuation time estimates, this model utilizes site specific road network and vehicle data, as well as public notification and mobilization times.

4.1.1 Evacuation Time Estimates Methodology

The NETVAC2 model has been developed primarily for calculating the evacuation times for areas around nuclear power facilities. This model simulates the flow of traffic from entry nodes, where the vehicles enter the road network, to the exit nodes located outside the EPZ boundary, where the vehicles leave the network. The model uses the Highway Capacity Manual³ equations and revisions contained in the Interim Material on Highway Capacity⁴ to calculate the capacity of the road network. In addition, vehicle speeds on the road network are computed using the inverse linear relationship between speed and density presented in the Highway Capacity Manual. The NETVAC2 model has been extensively used for other evacuation studies similar to the Braidwood Study, and the results in those other studies have been favorably reviewed by the appropriate local, State and Federal authorities.

The NETVAC2 model allows a detailed evacuation road network to be analyzed by utilizing an area specific data base, which includes link (road segment) length, lane width, number of lanes, node (intersection, point of entry, or point of exit) approach width, shoulder width, traffic controls, signal timing, turning lanes, and direction of turns. This data is used to determine road network capacity and direction of traffic flow. The evacuation road network is discussed in Section 5.

Additional input data is used by the model to derive vehicle loading rates for each primary evacuation zone. Vehicles are entered at specific points (nodes) on the network and their loading rates varied

with time. Therefore, the vehicle loading rate is tailored to match actual population centers and time distributions of the public's response to notification. This notification response was approximated by a probability distribution of the public's reaction time during an evacuation and is discussed in detail in Section 4.1.2.

NETVAC2 also uses dynamic route choice, which means that vehicle turning movements at individual intersections are changed with traffic conditions to reduce the number of vehicles that have turned onto a congested roadway. Appendix A discusses the NETVAC2 Model in greater detail.

4.1.2 Public Response Times and Network Loading Rates

The range and variation of public reaction to evacuation notification were described by a probability distribution of response times. This response time distribution was derived by combining the response time distributions for several smaller components or events of the public response to the evacuation notification process. These components are as follows:

- Receive Warning, the time period between the activation of the prompt public notification system and the receipt by the public of the message to evacuate;
- Leave Work, the time period required for employees to leave work and travel to their vehicles;
- Travel from Work to Home, the time period required to drive from work to home; and
- Prepare Home for Evacuation, the time period required to gather essential belongings and prepare home for absence.

Total mobilization times were determined by combining these components for each evacuation scenario. The range and average public response times for each of the above events are shown in Table 4-1.

A normal distribution was assumed for the time span of these individual components. Normal distribution represents the situation in which most

persons respond in the average time for a given event, while fewer individuals respond earlier and later than the average time. Therefore, the cumulative probability distribution of each of these components is an "S" shaped curve. The curves were derived by using standard mathematical techniques based on NUREG-0654/FEMA-REP-1, Rev. 1¹, Appendix 4, recommendations. Figure 4-1 presents the distribution curves used for this study. Nighttime curves have been derived by combining two components: Receive Warning and Prepare Home for Evacuation. Daytime curves were derived by combining four components: Receive Warning, Leave Work, Travel Home, and Prepare Home for Evacuation. The cumulative distribution of these different components, when combined, has an "S" shaped curve similar to the curves for the individual components, and represents the spectrum of public response times.

These public response time curves were used to determine the rate and time for vehicle loading onto the evacuation road network. These curves provide information on the percentage of people leaving their homes within specific periods of time. Vehicles were loaded onto the evacuation roadway network using the percentage and times outlined in the public response time curves.

It should be noted that during the course of developing these public response times, this study assessed the employment center shut down times for the major employers in the EPZ as listed in Table 3-3. Of the 18 employers listed, 17 have shut down times of 60 minutes or less. The

remaining employer has indicated a shut-down time of 90 minutes. However, this facility is only operational during the day.

Since the response times of the major employers are well within the cumulative public response time for all evacuation scenarios, no modification of the public response curves because of the employment center shut down times is necessary or appropriate.

4.1.3 Assumptions Used in Developing the Evacuation Time Estimates

- The prompt public notification system, which utilizes sirens, will be used. (Based on this system, the time to notify essentially 100 percent of the full EPZ population has been estimated to be 15 minutes.)
- Evacuation network roads will be passable.
- Persons within the EPZ, when instructed to evacuate, will leave.
- People in the outer primary evacuation zones will not evacuate when an inner primary evacuation zone is the only zone recommended to be evacuated.
- Adequate transportation will be available for summer camps.
- Evacuation of health care facilities, recreation areas, and other special facilities will occur simultaneously with the general population.
- Traffic rules and controls will be obeyed, and only the proper travel lane will be used (not shoulders or opposing flow lanes). Traffic lights will be functioning normally or traffic control officers will be stationed at the location of nonfunctioning traffic lights.
- No major traffic will be on the road network prior to the start of an evacuation.

PRELIMINARY

- Appropriate traffic and access control points will be manned.
- Roadway capacities will be reduced to 80 percent of normal weather capacity during adverse weather.^{5,6} Adverse weather conditions are those that may impair visibility and/or traction such as light snow, icing, rain, or fog.
- Private vehicles will be the primary mode of evacuation.
- Only one vehicle per household will be used in an evacuation. (There are 2.87 persons per household, based on an average of people per household in townships entirely or partially within the EPZ.¹⁰)
- One vehicle per two visitors at clubs will be used in an evacuation.
- One vehicle per employee at major employers will be used in an evacuation with the exception of the Braidwood Unit 2 construction force for which an occupancy factor of 1.5 employees per vehicle is used.
- Boats will moor and the occupants will then evacuate by car with one vehicle allotted per boat.
- One vehicle per campsite at recreational campgrounds will be used for evacuation. (This assumes 3.3 people per vehicle as this is the Illinois State average number of people per family.⁸)
- People without vehicles will receive rides from either neighbors or designated public service vehicles in accordance with the Standard

Operating Procedures contained in IPRA - Braidwood Volume VII. (Since there are no public transportation systems in the Braidwood Station EPZ, residents without vehicles would have developed some transportation options for general daily use and movements. Additionally, Standard Operating Procedure 7-SOP-8 of IPRA-Braidwood, Volume VII⁸ has a number of mechanisms for providing transportation assistance to individuals and/or groups during an emergency. IPRA-Braidwood Volume VII also has in place 7-SOP-12 by which a Mobility Impaired Transportation List for the Braidwood Station EPZ has been developed and is maintained by Will, Grundy, and Kankakee County officials so as to be available during an emergency.)

4.2 SELECTED SPECIAL FACILITIES EVACUATION TIME ESTIMATE METHODOLOGY
AND ASSUMPTIONS

THIS SECTION WILL BE SUBMITTED IN SEPTEMBER 1985.

4.3 SPECIAL EVENT EVACUATION TIME ESTIMATE METHODOLOGY AND ASSUMPTIONS

The evacuation time estimates for the special event analyses as defined in Section 3.4 were calculated using the NETVAC2 computerized traffic simulation model² discussed in Section 4.1.

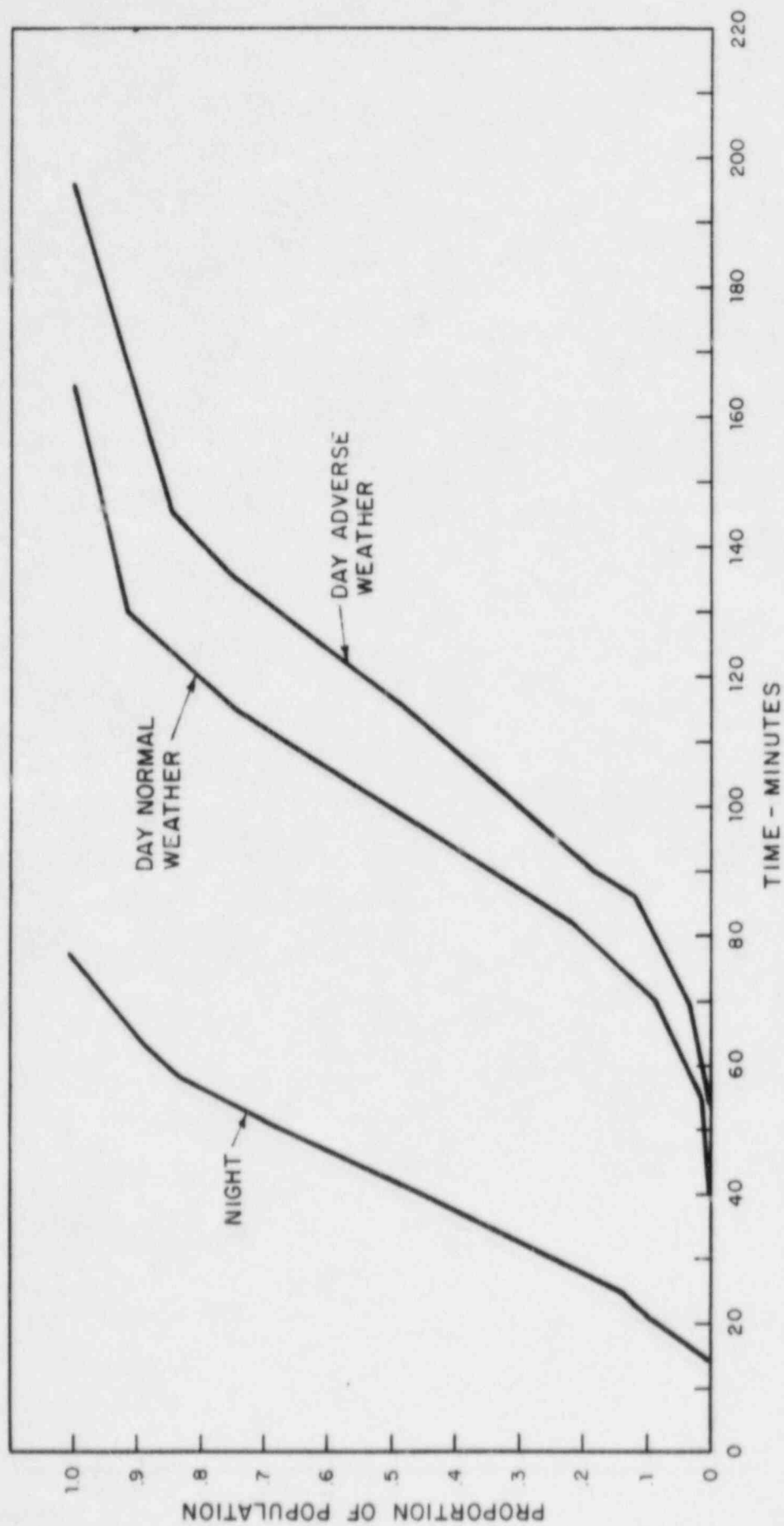
TABLE 4-1

PUBLIC RESPONSE TIME ESTIMATES(1)

	Average Time for Component (minutes)(2)	Range of Component Times (Minutes)(3)
Receive Warning	7.5	0-15
Leave Work ⁽⁴⁾	15	0-30
Travel Home ⁽⁴⁾		
Normal Weather	30	0-60
Adverse Weather ⁽⁵⁾	45	0-90
Prepare Home for Evacuation	30	0-60

NOTES:

- (1) (Later)
- (2) This range implies that some people will initiate the identified event within the lower range of the component times while others will initiate the event within the upper range of the component times.
- (3) See Figure 4-1 for public response distribution curves.
- (4) Daytime evacuation scenarios only.
- (5) Based on a reduced adverse weather road capacity factor of 0.8.



NOTE: TABLE 4-1 FOR AVERAGE TIME FOR EVENTS

LEGEND — 15 MINUTE NOTIFICATION

FIGURE 4-1
PUBLIC RESPONSE TIME ESTIMATES

SECTION 5

EVACUATION ROAD NETWORK DESCRIPTION

5.1 ROAD NETWORK DEFINITION

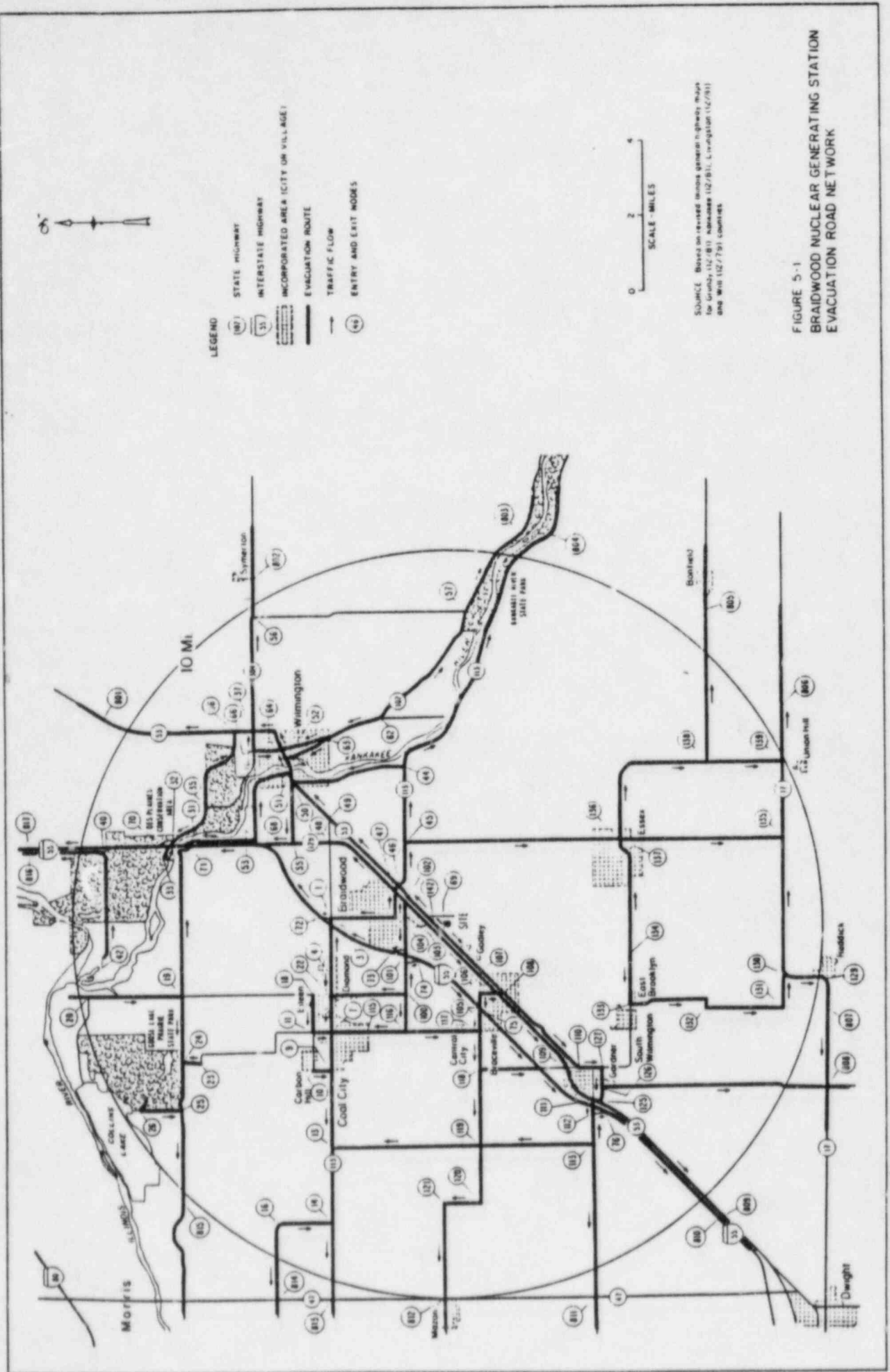
The series of roads designated to evacuate the Plume Exposure Pathway Emergency Planning Zone (EPZ) is called the evacuation road network. The network includes major arterials and collector roads. The major intersections have been assigned numbers as nodes in the network. The road segments between these nodes are called links.

Figure 5-1 illustrates the series of links and nodes that represent the evacuation road network for the Braidwood Station EPZ. Appendix B presents the location of each node by identifying the names of the roads that intersect at that node. The evacuation road network exit nodes, which are located outside the Braidwood Station EPZ, have been numbered in the 800's.

This evacuation road network has been derived from official Illinois Department of Transportation maps and has been field verified by road data collection. The evacuation network has been favorably reviewed by Will, Grundy, and Kankakee County and State of Illinois ESDA officials.

5.2 ROAD CAPACITIES AND CLASSIFICATIONS

The NETVAC2 model used field data, such as road widths and travel speeds, to calculate the capacity of each of the links and nodes in the evacuation network. The specific capacities and classifications of each road and intersection in the evacuation network are presented in Appendix C. The majority of the roads in this study have been classified as rural undivided highways, with a few limited access expressways and two lane roads.



SECTION 6

EVACUATION TIME ESTIMATES

6.1 GENERAL PUBLIC EVACUATION TIMES

Evacuation time estimates for the general public, including mobilization and travel times, were calculated using the NETVAC2 model for the various combinations of the ten evacuation study areas that have been discussed in Section 2. Each of the ten primary evacuation zones was analyzed for the various population combinations associated with summer and winter, day and night times, and normal and adverse weather conditions. Thus, a total of eighty evacuation scenarios was considered in this evacuation time estimate study. Tables 6-1 and 6-2 present the evacuation time estimates for these NETVAC2 calculations for each primary evacuation zone.

The NETVAC 2 model results show that the summer and winter evacuation time estimates for all primary evacuation zones do not differ significantly. Under normal weather conditions, evacuation of the full EPZ takes 177 minutes for the daytime scenario and 114 minutes for the nighttime scenario. For adverse weather conditions, the evacuation time estimates are 211 minutes during the day, and 156 minutes at night for the full EPZ scenario.

During normal weather conditions, the evacuation times for the 0-10 mile evacuation zones range from 176 to 177 minutes during the daytime to 114 minutes for the nighttime condition. The adverse weather time

estimates range from 209 to 211 minutes during the day and 136 minutes during the night.

The evacuation time estimates for the four 0-5 mile evacuation zones in normal weather for the daytime range from 176 to 177 minutes and for the nighttime evacuation range from 88 to 114 minutes. The adverse weather condition evacuation time estimates for the four 0-5 mile evacuation zones during the day range from 209 to 211 minutes, and at night range from 92 to 136 minutes.

The evacuation time estimates in normal weather for the 0-2 mile evacuation zone are 176 minutes for the daytime and 88 minutes at night. During adverse weather, evacuation time estimates for the 0-2 mile zone are 209 minutes during the day and 92 minutes at night.

For the eighty baseline evacuation scenarios, the NETVAC2 model results indicate that there would be some traffic queuing (back up) on the evacuation road network. However, the total times estimated for evacuation are only slightly longer than the total public response time in all cases.

6.2 SELECTED SPECIAL FACILITIES EVACUATION TIMES

THIS SECTION WILL BE SUBMITTED IN SEPTEMBER 1985

6.3 SPECIAL EVENTS EVACUATION TIMES

Special Event evacuation times were analyzed for evacuation sensitivity analysis of transient populations at the recreation areas within the EPZ on a summer holiday to determine the sensitivity of the evacuation times estimate to recreation areas populations, as discussed in Section 3.4. The results of the special evacuation sensitivity analysis of transient populations at the recreation areas within the EPZ produced an evacuation time of 180 minutes, which is only 3 minutes longer than the estimated evacuation time for the full EPZ summer day, normal weather general population scenario. It is important to note that, due to the favorable roadway capacity to population ratio, the evacuation time estimates are relatively insensitive to changes in population.

6.4 EVACUATION CONFIRMATION TIMES

Evacuation confirmation time, as defined by NUREG 0654, is the time required for emergency service vehicles to traverse the roads within the primary evacuation zones to confirm that all persons desiring to evacuate have done so. The evacuation confirmation times have been estimated by assuming that emergency service vehicles will drive the evacuated areas, road by road, at 6 miles per hour. This speed allows for the effective use of public address systems. This speed is about twice the walking speed of an adult.¹¹ Based upon discussions with State of Illinois ESDA personnel, at least 15 vehicles are expected to be available for confirmation of evacuation. The time estimates for evacuation confirmation are presented in Table 6-4.

TABLE 6-1
SUMMARY OF EVACUATION TIME ESTIMATES
SUMMER

Primary Evacuation Zone (1)	Population (2)		Vehicles		General Public Evacuation Times (minutes)(3)			
	Daytime	Nighttime	Daytime	Nighttime	Daytime		Nighttime	
					Normal	Adverse	Normal	Adverse
0-2 mile A,B	11,469	6,484	5,338	2,686	176	209	88	92
0-5 mile A,B,C	19,227	13,437	8,340	5,257	177	211	114	136
0-5 mile A,B,D	11,989	6,974	5,517	2,852	176	209	88	92
0-5 mile A,B,E	14,374	9,104	6,357	3,589	176	209	88	92
0-5 mile A,B,F	17,671	12,276	7,559	4,703	176	209	114	136
0-10 mile A-F,G	34,642	26,937	13,762	9,944	177	211	114	136
0-10 mile A-F,H	30,177	23,662	12,208	8,792	176	209	114	136
0-10 mile A-F,I	29,430	22,915	11,946	8,530	176	209	114	136
0-10 mile A-F,J	33,839	25,728	13,703	9,529	176	209	114	136
Full EPZ A-J(4)	41,525	32,224	16,342	11,766	177	211	114	136

NOTES:

- (1) See Figure 2-1 for evacuation study area locations.
- (2) Population is composed of permanent population and applicable transient and special facilities populations as discussed in Section 3.1.
- (3) All times have been rounded to nearest minute.
- (4) Full EPZ A-J scenario is analyzed in accordance with the guidance of Appendix 4 of NUREG-0654/FEMA-REP-1. This analysis verifies the appropriateness of the selection of the primary evacuation zone boundaries used in the other analyses.

TABLE 6-2
SUMMARY OF EVACUATION TIME ESTIMATES
WINTER

Primary Evacuation Zone (1)	Population (2)		Vehicles		General Public Evacuation Times (minutes)(3)			
	Daytime	Nighttime	Daytime	Nighttime	Daytime		Nighttime	
					Normal	Adverse	Normal	Adverse
0-2 mile A,B	10,803	6,359	4,764	2,626	176	209	88	92
0-5 mile A,B,C	18,567	11,787	7,240	4,600	177	211	114	136
0-5 mile A,B,D	11,385	6,839	4,949	2,789	176	209	88	92
0-5 mile A,B,E	13,884	8,689	5,720	3,432	176	209	88	92
0-5 mile A,B,F	18,485	12,131	7,131	4,636	176	209	114	136
0-10 mile A-F,G	35,470	24,927	12,638	9,159	177	211	114	136
0-10 mile A-F,H	31,541	21,692	11,246	8,028	176	209	114	136
0-10 mile A-F,I	30,488	20,945	10,935	7,766	176	209	114	136
0-10 mile A-F,J	33,848	23,278	12,283	8,618	176	209	114	136
Full EPZ A-J(4)	41,611	29,734	14,858	10,834	177	211	114	136

NOTES:

- (1) See Figure 2-1 for evacuation study area locations.
- (2) Population is composed of permanent population and applicable transient and special facilities populations as discussed in Section 3.2.
- (3) All times have been rounded to nearest minute.
- (4) Full EPA A-J Scenario is analyzed in accordance with the guidance of Appendix 4 of NUREG-0654/FEMA-REP-1. This analysis verifies the appropriateness of the selection of the primary evacuation zone boundaries used in the other analyses.

TABLE 6-3

SELECTED SPECIAL FACILITIES EVACUATION TIMES

THIS TABLE WILL BE SUBMITTED IN SEPTEMBER 1985

TABLE 6-4

EVACUATION CONFIRMATION TIMES BY
PRIMARY EVACUATION ZONE(1)

<u>Primary Evacuation Zone (2)</u>	<u>Evacuation Confirmation Time (3)</u>
0-2 mile A, B	20
0-5 mile A, B, C	40
0-5 mile A, B, D	30
0-5 mile A, B, E	40
0-5 mile A, B, F	35
0-10 mile A-F, G	160
0-10 mile A-F, H	160
0-10 mile A-F, I	150
0-10 mile A-F, J	155
Full EPZ A-J(4)	350

NOTES:

- (1) Evacuation confirmation times are required by NUREG-0654, Appendix 4.
- (2) See Figure 2-1 for evacuation study area locations which comprise the primary evacuation zones.
- (3) Evacuation confirmation times have been rounded to the nearest minute.
- (4) Full EPZ A-J Scenario is analyzed in accordance with the guidance of Appendix 4 of NUREG-0654/FEMA-REP-1, Rev. 1. This analysis verifies the appropriateness of the selection of the primary evacuation zone boundaries used in the other analyses.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Based upon this evacuation time estimate study, the entire population within the Plume Exposure Pathway Emergency Planning Zone (EPZ) for Braidwood Station (including the general public and special facilities) could be evacuated in 3 to 4 hours in most situations. The longest daytime evacuation time estimate for the EPZ in normal weather is 177 minutes; the longest daytime adverse weather evacuation time estimate for the EPZ is 211 minutes. The longest nighttime evacuation time estimate for the EPZ in normal weather is 114 minutes; the longest nighttime adverse weather evacuation time estimate for the EPZ is 136 minutes.

Given the distribution of public response times used in loading vehicles onto the evacuation network, the evacuation time estimates for the eighty-baseline evacuation scenarios are only slightly longer than the total public response time plus the travel time necessary to drive out of the EPZ under normal and adverse weather conditions. It should be noted, however, that for two of the 0-5 mile evacuation zones (A,B,C, and A,B,F), the evacuation time estimates for all nighttime scenarios are longer than the corresponding evacuation time estimates for the two other 0-5 mile evacuation zones. The two evacuation zones with the longer evacuation time estimates involve principally the Coal City and Wilmington areas.

The NETVAC2 model results indicate that traffic queuing does occur in Coal City at the intersection of Route 113 (Division Street) and Broadway for all evacuation scenarios involving this area. Model results also indicate traffic queuing along Route 53 in the vicinity of Wilmington. This traffic queuing is due to the relatively large number of vehicles entering the evacuation road network in the vicinity of both Coal City and Wilmington in a relatively short time period.

In addition, in all daytime scenarios, traffic queuing has been predicted along Route 53 northeast of Braidwood Station near the intersection of Route 113 in Braidwood, and along Route 53 southwest of Braidwood Station in Gardner as shown on Figure 7-1. This queuing results primarily from the traffic congestion associated with the Braidwood Unit 2 construction (daytime only) work force at Braidwood Station. However, this situation will be alleviated in 1988, when the Braidwood Station construction workforce will be withdrawn. No traffic queuing at these locations has been predicted for any of the nighttime scenarios when there is no significant Unit 2 construction workforce at Braidwood Station.

7.2 RECOMMENDATIONS

As discussed in Section 7.1, the results of the evacuation time estimate study predict that the evacuation times are only slightly longer than the total public response time plus the time necessary to drive out of the EPZ. Thus, special traffic control measures will not significantly reduce the overall predicted evacuation times. However, special traffic control measures could be considered to alleviate the potential traffic predicted at the following points of congestion:

- Intersections of Route 53 and Route 113 in Braidwood and Route 53 and Strip Mine Road in Wilmington
- Intersections of Route 53 and South Wilmington Road, Campus Road, and Route 129 in Gardner
- Along Route 53 and other appropriate points in Wilmington
- Intersection of Route 113 and Broadway or other appropriate points in Coal City

During the finalization of the Traffic and Access Control Standard Operating Procedure for IPRA, Braidwood Volume VII, Commonwealth Edison will make available to State of Illinois and local ESDA officials the services of Stone & Webster Engineering Corporation to assist as requested in the implementation of the above recommendations.

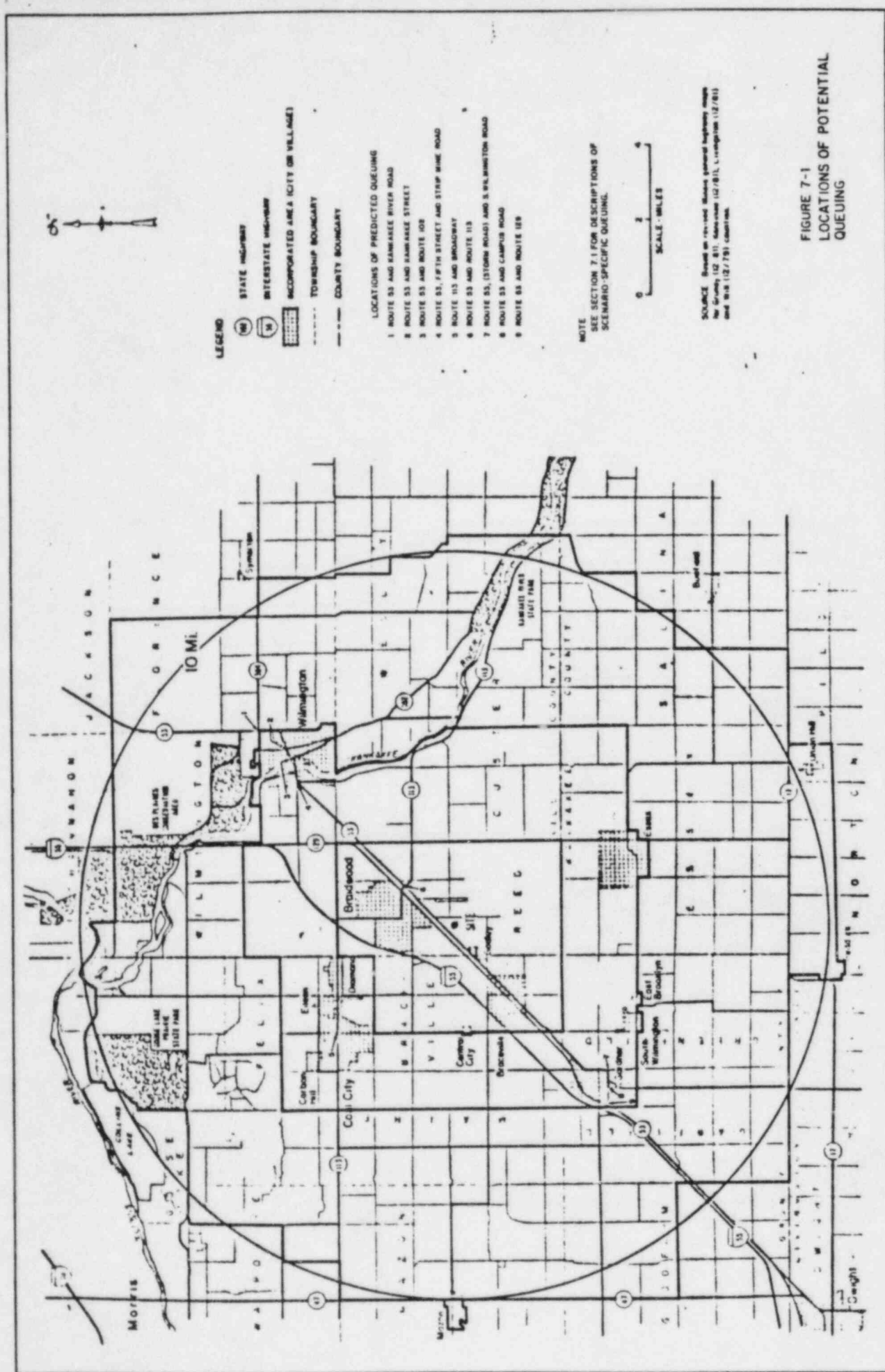


FIGURE 7-1
LOCATIONS OF POTENTIAL
QUEUING

REFERENCES

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3. Highway Capacity Manual, Highway Research Board, Special Report 87, Highway Research Board of the Division of Engineering and Industrial Research, National Academy of Sciences - National Research Council, Washington, DC, 1965.
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11. Transportation and Traffic Engineering Handbook, The Institute of Transportation Engineers, 1976.

APPENDIX A

NETVAC2 DESCRIPTION

APPENDIX A

NETVAC2 DESCRIPTION

This Appendix describes the general structure of the NETVAC2 Model and three of its major features: the dynamic route selection, the priority treatment of flow at unsignalized intersections, and the capacity calculation.

General Structure

NETVAC2 is organized in four basic units (procedures): the main program, the data procedure, the preprocessor, and the simulator. This section briefly explains the functions of each of these units. The main program controls the entire execution. It starts by calling on the data procedure, which reads in the data and execution instructions, then calls in the preprocessor, which performs some preliminary capacity calculations. Next, the main program controls the simulation itself and the reporting of the network conditions at specified intervals including the plotting. This program also controls the rest of the reports and the length of the simulation by terminating the program once the network is empty (or after a specified time).

The data procedure reads in the network, the parameters and the options to be used in the run. This subroutine uses a special list processing technique to store the network; the link list is stored with both forward and backward pointers. In other words, all the links pointing into and out of any given node can be easily identified at any moment

during the simulation. This list processing technique is one of the keys to the model's computational efficiency.

On request, the data procedure performs a set of checks on the network to ensure connectivity and validity. It also performs a set of checks on the input data to identify coding errors. It is expected that these checks would be performed only once for each site studied. If errors are found, the routine keeps scanning the network until it has been completely checked and the run is then terminated. The data procedure also produces a set of warnings if unlikely (but possible) situations are encountered.

The processor procedure converts the physical description of each link into measures of capacity, speed and density. For each specified type of link, the preprocessor computes two types of capacity:

- section capacity - which is the capacity along the link regardless of downstream intersection restrictions; and
- approach capacity - which is the capacity of the link to handle vehicles approaching the downstream intersection.

Section capacities are associated with highway sections whereas the traffic flow through intersections is controlled by the approach capacity. NETVAC2 computes both capacities since they serve different purposes. The section capacity serves as an upper bound on the flow that can move along a link, restricting the number of vehicles that will

reach the intersection during a simulation interval and the number of vehicles that can be loaded onto a link from the intersection. The approach capacity, on the other hand, limits the number of cars that can actually move through the intersection. Vehicles that reach the intersection but cannot move through it are assigned to a queue.

The NETVAC2 simulator includes two separate procedures, the link pass and the node pass. The link pass handles the flow on the links while the node pass handles the transfer of flow from link to link.

Dynamic Route Selection

NETVAC2 does not use a pre-specified set of turning movements at each intersection; instead, the turning movements are determined at each simulation interval as a function of the changing traffic conditions and direction of the links. Drivers approaching an intersection are assumed to make a choice of outbound (away from the intersection) links based on how fast this outbound link can get them to safety. This, in turn, is a function of the direction of the outbound links (away from the nuclear plant or hazard area) and the traffic conditions on the outbound links.

The route selection procedure used in NETVAC2 reflects the two above-mentioned choice criteria through a user-supplied "preference factor" which is specified for each link and the speeds on each of the outbound links. To facilitate the explanation of the route choice mechanism, let PF_j denote the preference factor for the j -th outbound link at some intersection. In other words, the relative 'a priori'

preference of link j is $PF_j \times PF_k$ where the sum goes over all the links emanating out of the node under consideration (including j). The choice probability, or the share of drivers choosing an outbound link j out of a given intersection at (simulated) time t , $P_j(t)$, is determined as a function of the preference factors and the speeds on all the outbound links are:

$$P_j(t) = \frac{PF_j \times U_j(t)}{\sum_k PF_k \times U_k(t)}$$

where $U_j(t)$ is the speed on link j at time t . Note that driver behavior during an evacuation is assumed to be myopic in that only information regarding the immediate outbound links at each intersection is assumed to influence route choice decisions. Also note that the $P_j(t)$ s are computed for each incoming link separately due to turning prohibitions from some links into some other links (a reference to the incoming link was omitted from the notation of the choice probability for clarity of exposition).

The Priority Treatment

Even under evacuation conditions, it can be expected that traffic from certain links approaching an unsignalized intersection would have the right of way over incoming traffic from lower priority approaches. Since it is not clear that such priority would correspond to the existing intersection controls, the input to NETVAC2 includes a

user-specified link priority parameter. This is a binary parameter indicating primary or secondary priority of a link.

The volume of vehicles being processed (at every intersection and at each simulation interval) and transferred from inbound to outbound links is subject to several constraints which determine the effective capacity of the intersection. During the simulation, traffic coming in from all primary priority links is assigned to the intersection first, subject only to the intersection capacity constraints. Lower priority traffic, on the other hand, is restricted by both the capacity of the intersection and the effect of the higher priority traffic.

The capacity of the secondary priority approaches is a function of the gap acceptance behavior of the minor approach drivers and the headway distribution in the primary approaches' flow. To model the capacity of secondary priority approaches, a capacity allocation problem procedure is utilized. The secondary priority approaches emit traffic only under one of the following conditions: first, if there is residual intersection capacity from the primary priority traffic, flow can be emitted into the intersection from the secondary priority road subject to the residual capacity constraint. Second, if the residual capacity is zero, NETVAC2 provides some small capacity for the lower priority approaches to allow for "sneak-in" effects.

Note that the priority treatment applies only to unsignalized intersections and that both types of approaches (primary and secondary

priority) are treated identically in the model in all respects except for the added constraint on the flow from secondary priority approaches.

Capacity Calculations

The capacity of a transportation facility is the maximum flow that can go through the facility. NETVAC2 determines capacity in two stages: first, the preprocessor assigns a section capacity and an approach capacity to each link in the network. Second, approach capacities are updated throughout the simulation depending on the conditions at certain points in the simulation.

The capacity calculations are based on the Highway Research Board's Highway Capacity Manual (HCM). Following this reference, the section capacity is calculated in the preprocessor for links with and without physical separation between opposing directions while the approach capacity is calculated as a function of the physical conditions (width, parking, turning pockets, etc.), environmental conditions (area type, peak hour and load factors), traffic characteristics (traffic mix and percentage of turning movements), and approach type. Derivations of these calculations are outlined in the users manual for the model.

As mentioned before, the approach capacities calculated in the preprocessor are not the actual bounds on the flow. NETVAC2 adjusts the approach capacity continuously in order to reflect the changing vehicular movements resulting from the dynamic route selection. The

capacity of the i -th approach coming into an intersection at simulation interval t , $C_i(t)$ is given by:

$$C_i(t) = C_i \times AL(t) \times AR(t)$$

where C_i is the standard capacity of link i calculated by the preprocessor and $AL(t)$ and $AR(t)$ are the correction factors for left and right turning movements, respectively. These correction factors are a function of the percent of turning traffic, the approach width, and parking allowance, as suggested by the HCM. These factors do not apply when the turning traffic is using special turning lanes or turning pockets.

PRELIMINARY

APPENDIX B

EVACUATION NETWORK NODE IDENTIFICATION

APPENDIX B

EVACUATION NETWORK NODE IDENTIFICATION

<u>Node</u>	<u>Location</u>
1*	State Route 113 and Route 2320
3	Route 113 W and entrance to Route 55 N
4*	Dewey Street and Division Street
7	Route 113 (Division Street) and Broadway
9	Route 113 (Division Street) and Carbon Hill Road
10*	Carbon Hill Road, McArdle Street, Seventh Street, and Rathburn Street
11*	Broadway and McArdel Road
13	Route 113 (Division Street) and Gorman Street (Route 10)
14	Route 113 and Route 6 (Higgins Street)
16*	Higgins Street and Route 6
18*	North Street in Eileen
19*	County Route 18 and Route 19
20*	County Route 18 at EPZ
22	Route 113W and Berta Road
23*	Peart Road and Goose Lake Road
24	Pine Bluff Road and Goose Lake Road
25	Pine Bluff Road (County Route 19) and Jugtown Road
26*	Entrance to Visitor's Center of Goose Lake Prairie State Natural Area and Jugtown Road
31	Route 113 and On Ramps to Route 55
32	On and Off Ramps to Route I55N
33*	On and Off Ramps to Route I55S

APPENDIX B (Cont)

<u>Node</u>	<u>Location</u>
35*	FAS 304 and entrance to Des Plaines Conservation Area
36	State Route 53 and FAS 304 (216°°W and 307°°S)
37	State Route 53 S and FAS 304 (311°°)
40	Frontage Road (west of Route 55) and Blodgett Road
42*	Blodgett Road and road along Will/Grundy County Line
44*	Route 113 W and West River Road
45*	Route 113 and Essex Road
46*	Route 113 and Route 53
47	Route 113 and Route 129
48*	Johnson Road and Route 129
49*	Johnson Road and Route 53
50	Route 53 (W. Baltimore Street), Fifth Street, and Strip Mine Road
51	Route 53 (W. Baltimore Street) and South First Street
52	Route 102 (Water Street) and Route 53 (Baltimore Street)
53*	River Drive and Frontage Road
55	Route 129 and Strip Mine Road
56*	Wilmington-Peotone and Old Chicago Road
57*	Route 102 and Old Chicago Road
62*	Route 102 and Resthaven Road
63*	Route 102, Kankakee Street, and Kahler Road
64	Route 53 and Kankakee Street
66*	Kankakee Street and Kankakee River Road

APPENDIX B (Cont)

<u>Node</u>	<u>Location</u>
68	, Route 129 and Route I55
69*	Route 53 and BPS access road (new)
70	Route I55 north of Kankakee River (Des Plains Conservation)
71	Route I55 near Route 19 (Des Plaines Conservation)
72	Route I55 near (North of) Route 113 (N of Braidwood)
73	Route I55 north of Route 12 (SW of Braidwood)
74	Route I55 south of Route 12 (Braidwood)
75	Route I55 south of Route 272 (Braceville)
76	Route 55 south of Route 293 (Gardner)
100*	Berta Road and Reed Road
101	Route I55 and Route 12
102	Kennedy Road and Washington Street
103*	Kennedy Road and Division Street
104*	Route 113 (Main Street) and South Division Street
105	Braceville Road and Berta Road
106*	Braceville Road and Mitchell Road
107	Mitchell Road and Route 129
108*	Mitchell Road and Route 53
109*	Route 129 and Carbon Hill Road
110	Route 53 and Storm Road
111	Route 129 and Route 53
112	Route 292 and Route I55

APPENDIX B (Cont)

<u>Node</u>	<u>Location</u>
113*	, Gorman Road and Gardner Road
115*	South Broadway and Spring Street
116*	Broadway and Reed Road
117	Broadway and Braceville Road
118*	Braceville Road and Carbon Hill Road
119*	Braceville Road and Gorman Road
120	Braceville Road and Tynan Road
121*	Tynan Road and Grand Ridge Road
125	Route 53 and Route 129 (End)
126*	Route 53 and Campus Road
127	Route 53, Storm Road, and South Wilmington Road
129*	Route 17 and Reddick Road
130	Route 17 and County Route 20
131	Livingston Road and Reddick Road
132*	Reddick Road and Lincoln Road
133*	Lincoln Road and Rice Road
134*	Rice Road and road at Grundy/Kankakee County Line
135	Route 17 and Essex Road
136*	East Street and Main Street
137*	Merchants Street and Main Street
138*	Main Street and Route 6
139	Route 17W, County Route 6 (Main Street), and Union Hill Road

APPENDIX B (Cont)

<u>Node</u>	<u>Location</u>
142*	Route 53 and the entrance to Braidwood Station
801**	Route 53 beyond EPZ
802**	Wilmington-Peotone and Symerton Road
803**	Route 102 and Chippewa Campground entrance
804**	Route 113 and Will/Kankakee County Line
805**	Smith Avenue and W1000N
806**	Route 17 beyond EPZ
807**	Route 17 beyond EPZ
808**	Campus Road and Route 17
809**	Route 53 beyond EPZ
810**	Route I55 beyond EPZ
811**	Route 292 (Gardner Road) and Route 47
812**	Grand Ridge Road and Route 47
813**	Route 13 and Route 47
814**	Route 47 and County Route 6
815**	Route 19 beyond EPZ
816**	Frontage Road north of Des Plaines Conservation Area beyond EPZ
817**	I55 north of Des Plaines Conservation Area beyond EPZ

*Utilized as vehicle entry node.

**Utilized as a vehicle exit node located outside the EPZ.

PRELIMINARY

APPENDIX C
NETVAC2 COMPUTER OUTPUT

APPENDIX C

KEY TO NETVAC2 COMPUTER PRINTOUT

LINK	= Link identification number
FRM	= Upstream node number (A-node) for associated link
TO	= Downstream node number (B-node) for associated link
LEN	= Link length in feet (A-node to B-node)
AW	= Approach width in feet
LW	= Link lane width in feet
SW	= Lateral clearance or shoulder width in feet = Distance from edge of travel-way to obstructions along link midblock
L	= Number of lanes in direction of travel
PR	= Priority of movement along link, in reference to movement along intersecting links. Dominant or major link approaches are classified as Priority 1. Secondary (i.e., those link approaches controlled by stop signs, yield signs, etc.) approaches are generally classified as Priority 2.
LT	= Lane type, classified as follows: 1 - One-way, no parking 2 - One-way, parking on one side 3 - One-way, parking on both sides 4 - Two way, no parking 5 - Two-way, with parking 6 - Rural divided highway, no parking 7 - Rural undivided highway, no parking 8 - Freeways and expressways
AT	= Area type, classified as follows: 1 - Central business district 2 - Fringe 3 - Outer business district 4 - Residential
PK	= T - Parking along link permitted F - Parking along link prohibited
SPD	= Free-flow or average speed over link in miles per hour

APPENDIX C (Cont)

- JAM = Jam Density or relative measure of link's carrying capacity in vehicles per mile
- PRF = User preference or movement along each outbound link in terms of percentage. Preferences are initially assigned based upon free-flow conditions. Actual route assignments are calculated by the program, considering the assigned preferences as well as speed, density and capacity relationships.
- FCAP = Link capacity per lane
- STR SPLT CAP = Identifies node destination of straight movement from downstream node, and associated percent green signal time (split) and intersection capacity.
- RGT SPLT CAP = Identifies node destination of right-turn movement from downstream node, and associated percent green signal time and special turning lane capacity, if applicable.
- LFT SPLT CAP = Identifies node destination of left-turn movement from downstream node, and associated percent green signal time and special turning lane capacity, if applicable.
- DIAG SPLT CAP = Identifies node destination of diagonal movement from downstream node, and associated percent green signal time and capacity.

NETWORK LISTING

LINK	FRH	TO	LEN	AM	LN	SH	L	PR	LT	AT	PK	SPD	JAH	PRF	FCAP	STR	SPLT	CAP	RGT	SPLT	CAP	LFT	SPLT	CAP	DIAG	SPLT	CAP
45	1	3	500.	12.	12.	8.	1	1	6	4	F	35.	160.	1.00	1400.	0	0.0	1137.	72	0.0	1500.	0	0.0	0.	0	0.0	0.
46	3	72	1084.	13.	13.	8.	1	2	8	4	F	38.	150.	1.00	1400.	68	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
100	4	3	7250.	12.	11.	7.	1	1	7	4	F	35.	162.	0.20	1400.	0	0.0	1137.	0	0.0	0.	72	0.0	1500.	0	0.0	0.
101		22	3000.	11.	11.	6.	1	1	7	4	F	24.	231.	0.80	1400.	7	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
103	7	9	5250.	12.	12.	4.	1	1	7	4	T	17.	314.	1.00	1372.	13	0.0	595.	0	0.0	0.	0	0.0	0.	0	0.0	0.
104	9	13	10584.	11.	11.	8.	1	1	7	4	F	38.	147.	1.00	1400.	14	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
109	10	9	2750.	9.	9.	6.	1	2	4	4	F	28.	154.	1.00	1078.	0	0.0	617.	13	0.0	0.	0	0.0	0.	0	0.0	0.
108	11	7	2750.	9.	9.	6.	1	1	5	4	T	21.	205.	1.00	1078.	0	0.0	424.	9	0.0	0.	0	0.0	0.	0	0.0	0.
105	13	14	10750.	11.	12.	8.	1	1	7	4	F	38.	163.	1.00	1400.	813	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
106	14	813	10916.	12.	11.	8.	1	1	7	4	F	38.	147.	1.00	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
110	16	14	8000.	9.	9.	2.	1	2	4	4	F	31.	130.	0.20	1022.	0	0.0	617.	813	0.0	0.	0	0.0	0.	0	0.0	0.
111		814	9584.	9.	9.	8.	1	1	7	4	F	35.	123.	0.80	1078.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
107	18	11	4916.	10.	9.	3.	1	1	4	4	F	17.	237.	1.00	1236.	0	0.0	700.	0	0.0	0.	7	0.0	0.	0	0.0	0.
112	19	31	22584.	11.	11.	8.	1	1	7	4	F	38.	147.	0.50	1400.	0	0.0	1058.	0	0.0	0.	71	0.0	1500.	0	0.0	0.
113		24	9250.	11.	11.	8.	1	1	7	4	F	24.	231.	0.50	1400.	25	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
117	20	19	13084.	12.	12.	8.	1	1	7	4	F	35.	179.	1.00	1400.	0	0.0	1137.	24	0.0	0.	0	0.0	0.	0	0.0	0.
102	22	7	5250.	12.	11.	2.	1	1	5	4	T	17.	291.	1.00	1274.	9	0.0	595.	0	0.0	0.	25	0.0	0.	0	0.0	0.
116	23	24	2750.	11.	11.	6.	1	2	7	4	F	28.	202.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
114	24	25	6834.	11.	10.	8.	1	1	7	4	F	35.	142.	1.00	1246.	815	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
115	25	815	13416.	11.	11.	8.	1	1	7	4	F	35.	162.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
118	26	25	5750.	10.	10.	6.	1	2	4	4	F	28.	178.	1.00	1246.	0	0.0	700.	815	0.0	0.	0	0.0	0.	0	0.0	0.
98	31	71	1000.	13.	13.	8.	1	1	8	4	F	31.	183.	1.00	1400.	70	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
99	32	70	1916.	13.	13.	8.	1	1	8	4	F	31.	183.	1.00	1400.	817	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
121	33	32	4916.	10.	10.	2.	1	1	7	4	F	28.	170.	1.00	1190.	0	0.0	980.	0	0.0	0.	70	0.0	1500.	0	0.0	0.
94	35	36	12334.	12.	11.	8.	1	2	7	4	F	38.	147.	0.30	1400.	0	0.0	1137.	0	0.0	0.	801	0.0	0.	0	0.0	0.
95		32	8166.	11.	11.	8.	1	1	7	4	F	35.	162.	0.70	1400.	0	0.0	1058.	70	0.0	1500.	0	0.0	0.	0	0.0	0.
18	36	801	18834.	23.	11.	8.	2	1	7	4	F	38.	147.	1.00	1400.	0	0.0	1025.	0	0.0	0.	0	0.0	0.	0	0.0	0.
16	37	36	3666.	11.	11.	8.	1	1	7	4	F	38.	147.	0.90	1400.	801	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
17		56	16000.	9.	10.	8.	1	1	7	4	F	38.	129.	0.10	1246.	802	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
120	40	816	3916.	12.	12.	6.	1	1	7	4	F	35.	179.	1.00	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
119	42	40	15334.	10.	10.	6.	1	1	7	4	F	31.	158.	1.00	1246.	0	0.0	980.	0	0.0	0.	816	0.0	0.	0	0.0	0.
8	44	804	41166.	12.	12.	8.	1	1	7	4	F	38.	163.	0.95	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
9		50	16334.	11.	11.	8.	1	2	7	4	F	31.	180.	0.05	1400.	0	0.0	1058.	51	0.0	0.	55	0.0	0.	0	0.0	0.
7	45	44	10660.	11.	9.	6.	1	1	7	4	F	38.	112.	0.80	1078.	804	0.0	1058.	0	0.0	0.	50	0.0	0.	0	0.0	0.
93		136	30500.	10.	11.	4.	1	1	7	4	F	38.	144.	0.20	1386.	135	0.0	980.	0	0.0	0.	138	0.0	0.	0	0.0	0.
4	46	49	13166.	12.	11.	8.	1	1	7	4	F	35.	162.	0.80	1400.	50	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
5		45	7000.	9.	9.	8.	1	1	7	4	F	35.	123.	0.05	1078.	44	0.0	902.	136	0.0	0.	0	0.0	0.	0	0.0	0.
6		47	500.	17.	12.	6.	1	1	4	4	F	21.	267.	0.15	1400.	0	0.0	1282.	48	0.0	0.	0	0.0	0.	0	0.0	0.
10	47	48	11666.	11.	12.	6.	1	1	7	4	F	38.	163.	1.00	1400.	55	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
27	48	55	5500.	11.	11.	8.	1	1	7	4	F	35.	162.	1.00	1400.	68	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
11	49	50	7834.	11.	11.	8.	1	1	7	4	F	38.	147.	1.00	1400.	0	0.0	1058.	0	0.0	0.	55	0.0	0.	51	0.0	1058.
12	50	51	1416.	9.	12.	6.	1	1	4	4	F	24.	222.	0.75	1400.	52	0.0	617.	0	0.0	0.	0	0.0	0.	0	0.0	0.
29		55	6500.	12.	12.	8.	1	2	7	4	F	36.	163.	0.25	1400.	0	0.0	1137.	68	0.0	0.	0	0.0	0.	0	0.0	0.
13	51	52	2250.	11.	10.	3.	1	1	4	4	F	21.	229.	1.00	1204.	64	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
14	52	64	750.	11.	11.	3.	1	1	4	4	F	21.	245.	1.00	1288.	37	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
96	53	51	14084.	9.	10.	6.	1	2	4	4	F	24.	203.	0.40	1246.	0	0.0	617.	0	0.0	0.	52	0.0	0.	0	0.0	0.
97		31	9000.	11.	11.	6.	1	1	7	4	F	31.	180.	0.60	1400.	0	0.0	1058.	71	0.0	1500.	0	0.0	0.	0	0.0	0.
28	55	68	3084.	11.	11.	8.	1	2	7	4	F	38.	147.	1.00	1400.	71	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
19	56	802	5334.	9.	11.	8.	1	1	7	4	F	38.	147.	1.00	1400.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
26	57	803	13750.	12.	12.	8.	1	1	7	4	F	35.	179.	1.00	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.

22	62	63	10750.	12.	12.	6.	1	1	7	4	F	38.	163.	0.50	1400.	52	0.0	1137.	0	0.0	0.	0	0.0	0.	64	0.0	1137.
25		57	20666.	11.	12.	8.	1	1	7	4	F	35.	179.	0.50	1400.	803	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
23	63	52	3916.	12.	15.	0.	1	1	4	4	F	21.	291.	0.60	1400.	0	0.0	866.	64	0.0	0.	0	0.0	0.	0	0.0	0.
24		64	4000.	12.	10.	2.	1	1	4	4	F	14.	340.	0.40	1190.	0	0.0	866.	37	0.0	0.	0	0.0	0.	0	0.0	0.

NETWORK LISTING

LINK	FRM	TO	LEN	AW	LN	SH	L	PR	LT	AT	PK	SPD	JAN	PRF	FCAP	STR	SPLT	CAP	RGT	SPLT	CAP	LFT	SPLT	CAP	DIAG	SPLT	CAP
15	64	37	6666.	14.	11.	6.	1	1	7	4	F	24.	231.	1.00	1400.	36	0.0	1294.	56	0.0	0.	0	0.0	0.	0	0.0	0.
20	66	37	4250.	10.	15.	6.	1	1	4	4	F	14.	460.	0.40	1400.	56	0.0	700.	0	0.0	0.	36	0.0	0.	0	0.0	0.
21		64	4250.	18.	9.	1.	1	2	5	4	T	21.	192.	0.60	1008.	0	0.0	936.	0	0.0	0.	37	0.0	0.	0	0.0	0.
30	68	71	11084.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	70	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
3	69	142	2416.	12.	11.	6.	1	1	7	4	F	38.	147.	0.60	1400.	46	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
71		108	12250.	12.	11.	6.	1	1	7	4	F	38.	147.	0.40	1400.	110	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
32	70	817	11500.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	0	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
31	71	70	4416.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	817	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
33	72	68	14000.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	71	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
34	73	72	11916.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	68	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
37	74	75	15500.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	76	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
38	75	76	19416.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	810	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
39	76	810	23000.	24.	12.	8.	2	1	8	4	F	38.	145.	1.00	1400.	0	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
47	100	101	7334.	11.	10.	8.	1	1	7	4	F	35.	142.	0.10	1246.	0	0.0	1058.	74	0.0	1500.	73	0.0	1500.	0	0.0	0.
48		22	10660.	10.	9.	4.	1	2	4	4	F	28.	150.	0.10	1050.	0	0.0	700.	0	0.0	0.	7	0.0	0.	0	0.0	0.
49		116	5250.	10.	10.	4.	1	1	7	4	F	35.	139.	0.80	1218.	0	0.0	980.	115	0.0	0.	117	0.0	0.	0	0.0	0.
35	101	73	1500.	13.	13.	8.	1	2	8	4	F	38.	150.	1.00	1400.	72	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
36		74	1584.	13.	13.	8.	1	2	8	4	F	38.	150.	1.00	1400.	75	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
41	102	47	2350.	11.	11.	6.	1	2	7	4	F	35.	162.	1.00	1400.	48	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
40	103	102	2750.	10.	10.	6.	1	2	4	4	F	24.	203.	0.30	1246.	0	0.0	700.	0	0.0	0.	47	0.0	0.	0	0.0	0.
42		101	5500.	11.	10.	4.	1	1	4	4	F	24.	199.	0.70	1218.	0	0.0	783.	73	0.0	1500.	74	0.0	1500.	0	0.0	0.
43	104	47	4334.	13.	12.	8.	1	1	5	4	T	17.	320.	0.30	1400.	0	0.0	652.	0	0.0	0.	48	0.0	0.	0	0.0	0.
44		1	9084.	12.	12.	6.	1	1	4	4	F	31.	178.	0.70	1400.	0	0.0	866.	0	0.0	0.	3	0.0	0.	0	0.0	0.
54	105	117	2750.	11.	12.	4.	1	1	7	4	F	35.	176.	1.00	1400.	118	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
55	106	105	2916.	11.	11.	2.	1	1	4	4	F	24.	208.	0.60	1274.	117	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
56		107	2666.	9.	9.	4.	1	2	5	4	T	14.	300.	0.40	1050.	0	0.0	424.	109	0.0	0.	0	0.0	0.	0	0.0	0.
57	107	109	14666.	11.	11.	8.	1	1	7	4	F	31.	180.	1.00	1400.	111	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
72	108	110	15334.	11.	11.	8.	1	1	7	4	F	31.	180.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	127	0.0	1058.
58	109	111	6666.	10.	11.	8.	1	1	7	4	F	38.	147.	1.00	1400.	125	0.0	980.	112	0.0	0.	0	0.0	0.	0	0.0	0.
73	110	127	3334.	9.	11.	6.	1	1	7	4	F	28.	202.	1.00	1400.	0	0.0	902.	126	0.0	0.	0	0.0	0.	0	0.0	0.
59	111	112	1750.	22.	11.	4.	2	1	7	4	F	31.	176.	0.95	1386.	0	0.0	978.	0	0.0	0.	76	0.0	1500.	0	0.0	0.
60		125	1166.	11.	11.	8.	1	1	7	4	F	24.	231.	0.05	1400.	809	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
62	112	76	1166.	13.	13.	8.	1	2	8	4	F	38.	150.	1.00	1400.	810	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
63	113	112	4500.	11.	10.	8.	1	1	7	4	F	35.	142.	0.40	1246.	0	0.0	1058.	76	0.0	1500.	0	0.0	0.	0	0.0	0.
64		119	15916.	9.	9.	4.	1	2	4	4	F	28.	150.	0.10	1050.	13	0.0	617.	0	0.0	0.	120	0.0	0.	0	0.0	0.
65		811	21500.	10.	10.	4.	1	1	7	4	F	35.	139.	0.50	1218.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
51	115	7	5166.	17.	15.	0.	1	1	5	4	T	14.	436.	1.00	1400.	0	0.0	879.	0	0.0	0.	9	0.0	0.	0	0.0	0.
50	116	115	5334.	9.	10.	4.	1	1	7	4	F	35.	139.	0.50	1218.	7	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
52		117	10834.	11.	11.	6.	1	2	7	4	F	35.	162.	0.50	1400.	0	0.0	1058.	118	0.0	0.	0	0.0	0.	0	0.0	0.
53	117	118	5416.	11.	11.	4.	1	1	7	4	F	38.	144.	1.00	1386.	119	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
66	118	119	10660.	10.	10.	4.	1	1	7	4	F	35.	139.	1.00	1218.	120	0.0	980.	13	0.0	0.	0	0.0	0.	0	0.0	0.
67	119	120	8166.	11.	11.	4.	1	1	7	4	F	35.	158.	0.85	1386.	0	0.0	1058.	121	0.0	0.	0	0.0	0.	0	0.0	0.
68		13	21416.	9.	9.	4.	1	2	4	4	F	35.	120.	0.15	1050.	0	0.0	617.	0	0.0	0.	14	0.0	0.	0	0.0	0.
69	120	121	5334.	11.	11.	6.	1	1	7	4	F	35.	162.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	812	0.0	1058.
70	121	812	13584.	10.	11.	4.	1	1	7	4	F	38.	144.	1.00	1386.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
61	125	809	24584.	10.	10.	8.	1	1	7	4	F	38.	129.	0.50	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
76		111	1000.	12.	11.	8.	1	1	7	4	F	28.	202.	0.50	1400.	0	0.0	1137.	0	0.0	0.	112	0.0	0.	0	0.0	0.
75	126	125	2666.	10.	9.	3.	1	1	7	4	F	24.	169.	0.80	1036.	0	0.0	980.	111	0.0	0.	809	0.0	0.	0	0.0	0.
77		808	31584.	10.	10.	6.	1	1	7	4	F	38.	129.	0.20	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
74	127	126	2834.	9.	9.	4.	1	1	4	4	F	28.	150.	1.00	1050.	125	0.0	617.	0	0.0	0.	808	0.0	0.	0	0.0	0.
82	129	807	5166.	12.	12.	8.	1	1	7	4	F	38.	163.	1.00	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
81	130	129	6750.	12.	12.	8.	1	1	7	4	F	38.	163.	0.60	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	807	0.0	1137.

83	135	18916.	12.	12.	8.	1	1	7	4	F	38.	163.	0.40	1400.	139	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.	
80	131	130	5000.	11.	10.	4.	1	2	7	4	F	38.	127.	1.00	1218.	0	0.0	1058.	129	0.0	0.	135	0.0	0.	0	0.0	0.
79	132	131	12000.	9.	9.	6.	1	2	4	4	F	31.	137.	1.00	1078.	0	0.0	617.	0	0.0	0.	130	0.0	0.	0	0.0	0.

NETWORK LISTING

LINK	FRH	TO	LEN	AH	LH	SH	L	PR	LT	AT	PK	SPD	JAM	PRF	FCAP	STR	SPLT	CAP	RGT	SPLT	CAP	LFT	SPLT	CAP	DIAG	SPLT	CAP
78	133	132	11000.	9.	9.	6.	1	1	4	4	F	31.	137.	1.00	1078.	0	0.0	617.	0	0.0	0.	0	0.0	0.	131	0.0	617.
86	134	133	7000.	11.	11.	4.	1	1	4	4	F	24.	213.	0.60	1302.	0	0.0	783.	0	0.0	0.	132	0.0	0.	0	0.0	0.
87		137	15834.	11.	10.	8.	1	1	7	4	F	35.	142.	0.40	1246.	0	0.0	1058.	136	0.0	0.	0	0.0	0.	0	0.0	0.
84	135	139	10750.	11.	11.	8.	1	1	7	4	F	35.	162.	1.00	1400.	806	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
89	136	135	22416.	10.	10.	4.	1	2	7	4	F	35.	139.	0.85	1218.	0	0.0	980.	0	0.0	0.	139	0.0	0.	0	0.0	0.
90		138	21750.	9.	10.	4.	1	1	4	4	F	31.	155.	0.15	1218.	139	0.0	617.	0	0.0	0.	805	0.0	0.	0	0.0	0.
88	137	136	1250.	10.	12.	2.	1	2	5	4	T	17.	307.	1.00	1344.	138	0.0	481.	135	0.0	0.	0	0.0	0.	0	0.0	0.
91	138	805	21584.	9.	10.	8.	1	1	7	4	F	38.	129.	0.50	1246.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
92		137	10660.	10.	9.	4.	1	2	4	4	F	35.	120.	0.50	1050.	0	0.0	700.	0	0.0	0.	806	0.0	0.	0	0.0	0.
85	139	806	8000.	11.	11.	8.	1	1	7	4	F	35.	162.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
1	142	46	6834.	13.	12.	8.	1	1	7	4	F	28.	224.	0.90	1400.	49	0.0	1215.	45	0.0	0.	47	0.0	0.	0	0.0	0.
2		69	2416.	12.	11.	6.	1	1	7	4	F	38.	147.	0.10	1400.	108	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.