EVACUATION TIME ESTIMATES

WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE

FOR THE

BYRON NUCLEAR GENERATING STATION

COMMONWEALTH EDISON COMPANY

DECEMBER 1982

EVACUATION TIME ESTIMATES
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FOR THE
BYRON 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 Byron Nuclear Generating Station, hereafter referred to as Byron Station. The Byron Station is located near the Rock River in Rockvale, Illinois (Figure 1-1). The Byron Station plume exposure pathway EPZ includes portions of Ogle and Winnebago Counties. Figure 1-1 presents a map of the Byron Station EPZ.

1.1 SUMMARY

The evacuation time estimates presented in this study have been developed using the NETVAC2 traffic simulation computer model. Detailed site-specific evacuation road network and vehicle data, and public response time distributions have been used in NETVAC2 to determine evacuation time estimates. For each of ten primary evacuation zones, evacuation time estimates for the general population within the Byron Station EPZ have been developed for eight combinations of conditions: summer and winter seasons; daytime and nighttime; normal and adverse weather. Results of the general population evacuation time estimates, for these eighty scenarios, rounded to the nearest minute, are summarized in Tables 1-1 and 1-2.

Results indicated that summer and winter evacuation time estimates are similar. Tables 1-1 and 1-2 show that for normal weather conditions in summer and winter, the general population evacuation time estimates for the full plume exposure pathway EPZ range from approximately 191 minutes

during the day to 111 minutes at night. In adverse weather, these time estimates range from approximately 227 minutes for day to approximately 123 minutes for night scenarios, respectively.

Evacuation time estimates for the general population have also been 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 184 minutes during the day to 110 minutes at night. Adverse weather condition evacuation time estimates for 0-2 miles for the same time periods are 217 minutes during the day and 120 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 184 to 191 minutes for the day to 96 to 110 minutes at night. The 0-5 mile adverse weather estimates range from 217 to 226 minutes during the day to 98 to 122 minutes at night.

In normal weather conditions, the evacuation times for the other 0-10 mile primary evacuation zones during the day are about 191 minutes and at night range from 106 to 111 minutes. The adverse weather condition time estimates range from 226 to 227 minutes for daytime and from 114 to 123 minutes for nighttime.

Special facility evacuation time estimates range from approximately 50 minutes to 60 minutes for normal weather, and from approximately 51 minutes to 68 minutes for adverse weather scenarios. These estimates have been based on winter simulations for the general population, since schools are the most numerous special facilities in the EPZ.

1.2 PURPOSE

This evacuation time estimate study has been developed in support of the State of Illinois Plan for Radiological Accidents (IPRA), Byron Volume VI, Revision 0, 12-82, and Commonwealth Edison's Generating Stations Emergency Plan Byron Annex. The primary purpose of this evacuation time estimate study is to analyze the feasibility of evacuation for the Byron Station Emergency Planning Zone. This 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 Byron Volume of IPRA. It is important to note that while the Byron Volume of IPRA is a detailed emergency operations plan, this study presents representative time frames for the evacuation of various areas around the Byron Station for a range of seasonal, diurnal, and weather conditions. This study has been been favorably reviewed by Ogle County and State of Illinois ESDA officials. Copies of this study have been provided to these ESDA officials.

1.3 SCOPE

This study has been prepared by the Commonwealth Edison Company in compliance with the recommendations of Appendix 4 to NUREG-0654/FEMA-REP-1, Rev. 1, Evacuation Time Estimates within the Plume Exposure Pathway Emergency Planning Zone,[1] which is 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. This includes both the general population and the special facilities methodology. Section 5 is a description of the evacuation road network. Section 6 presents the evacuation time estimates. The conclusions and recommendations are presented in Section 7.

TABLE 1-1

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	10,757,	7,857	4,942	3,512	184	217	110	120
0-5 mile A,B,C	17,129	12,380	7,364	5,050	188	225	110	122
0-5 mile A,B,D	11,149	8,249	5,076	3,646	184	217	110	120
0-5 mile A,B,E	18,993	12,755	8,053	5,228	191	225	110	120
0-5 mile A,B,F	11,409	8,209	5,183	3,633	184	217	110	120
0-10 mile A-F,G	31,027	22,040	12,528	8,518	191	227	111	123
0-10 mile A-F,H	28,134	19,747	11,456	7,627	191	226	111	123
0-10 mile A-F,I	34,060	22,946	14,332	8,786	191	226	111	122
0-10 mile A-F,J	28,842	20,455	11,709	7,880	191	227	110	122
Full EPZ A-J	42,836	31,122	17,475	11,748	191	227	111	123

NOTES:

(1) See Figure 2-1 for evacuation study area locations.
(2) Population is composed of permanent population and appropriate transients and special facilities.
(3) All times have been rounded to nearest minute.

TABLE 1-2

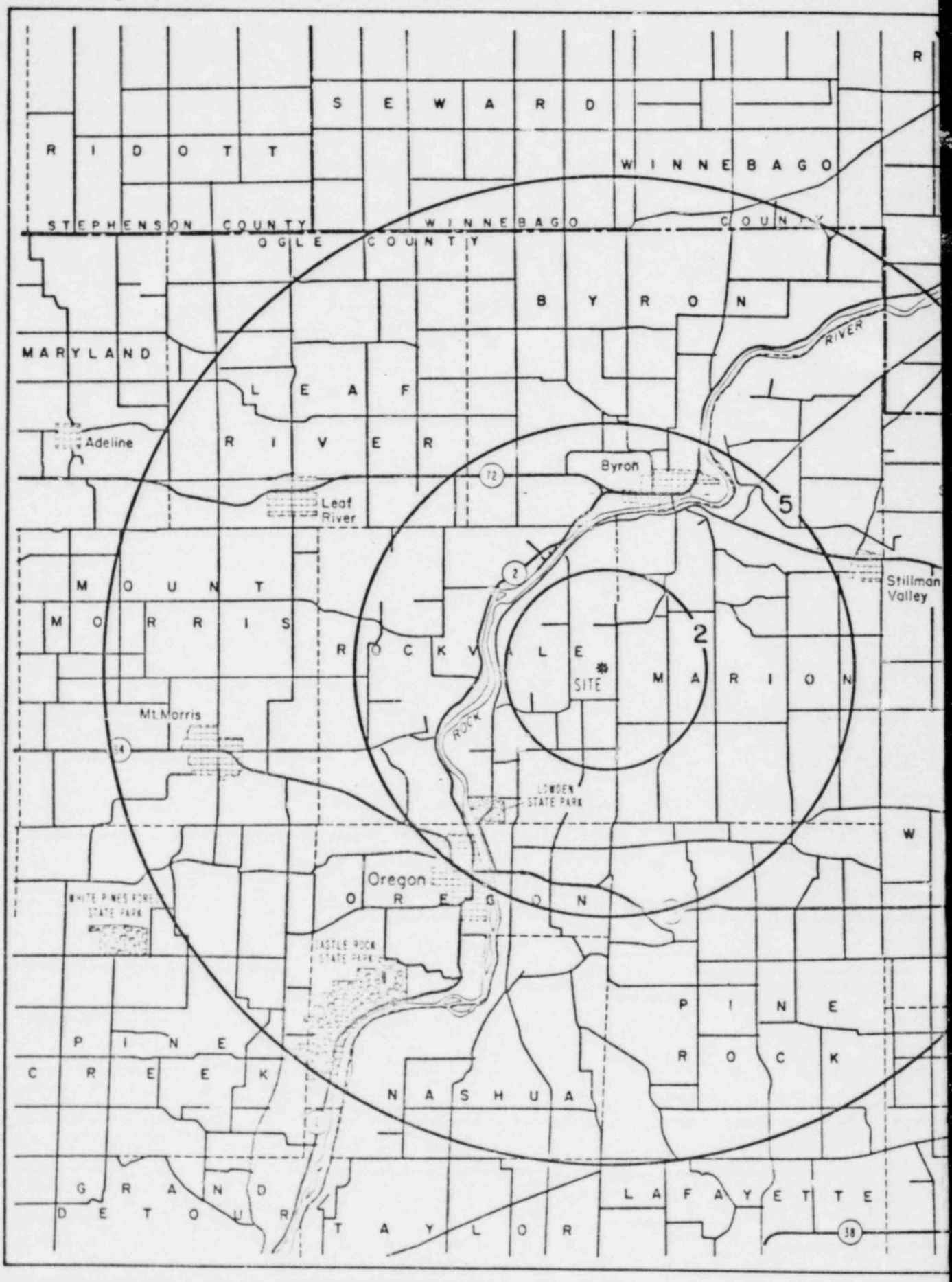
SUMMARY OF EVACUATION TIME ESTIMATES

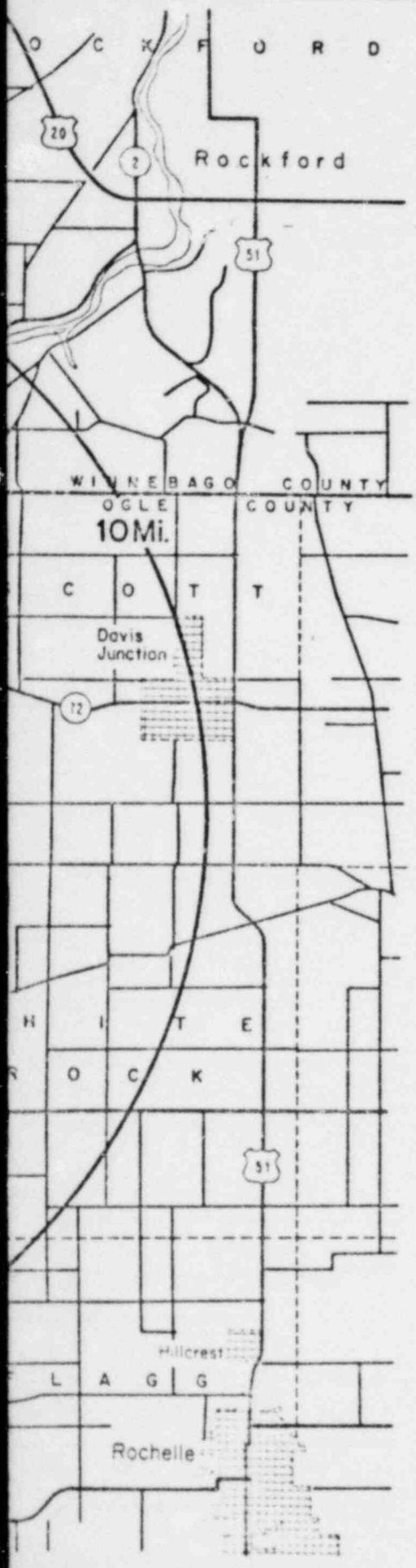
WINTER

Evacuation Zone (1) Primary	Population (2)		Vehicles		General Public Evacuation Times (minutes)(3)			
					Daytime		Nighttime	
	Daytime	Nighttime	Daytime	Nighttime	Normal	Adverse	Normal	Adverse
0-2 mile A,B	4,257	1,457	1,988	588	184	217	96	98
0-5 mile A,B,C	8,975	4,792	3,736	1,766	188	223	105	113
0-5 mile A,B,D	4,649	1,849	2,122	722	184	217	96	98
0-5 mile A,B,E	12,180	6,319	4,892	2,292	191	226	105	112
0-5 mile A,B,F	4,759	1,809	2,184	709	191	217	105	98
0-10 mile A-F,G	23,043	14,356	8,564	5,162	191	226	106	115
0-10 mile A-F,H	19,781	12,223	7,632	4,361	191	226	106	114
0-10 mile A-F,I	24,819	14,932	10,137	5,359	191	226	106	114
0-10 mile A-F,J	20,674	12,831	7,917	4,584	191	226	106	114
Full EPZ A-J	34,941	23,148	13,340	8,291	191	227	106	115

NOTES:

(1) See Figure 2-1 for evacuation study area locations.
(2) Population is composed of permanent population and appropriate transients and special facilities.
(3) All times have been rounded to nearest minute.


SEWARD
RIDOTT
WINNEBAGO
STEPHENSON COUNTY
WINNEBAGO COUNTY
OGLE COUNTY
BYRON
MARYLAND
LEAF
RIVER
Adeline
Leaf River
Byron
5
2
MOUNT MORRIS
ROCKVALE
SITE
MARION
Stillman Valley
Mt. Morris
LOWDEN STATE PARK
Oregon
OREGON
WHITE PINES FOREST STATE PARK
CASTLE ROCK STATE PARK
PINE CREEK
NASHUA
PINE ROCK
GRAND DETOUR
TAYLOR
LAFAYETTE



LEGEND

- (2) STATE HIGHWAY
- (51) INTERSTATE HIGHWAY
- INCORPORATED AREA (CITY OR VILLAGE)
- TOWNSHIP BOUNDARY
- COUNTY BOUNDARY

0 2 4

SCALE - MILES

FIGURE 1-1
BYRON STATION
PLUME EXPOSURE PATHWAY
EMERGENCY PLANNING ZONE
AND SITE VICINITY

SECTION 2

EMERGENCY PLANNING ZONE AND EVACUATION SCENARIOS

The study area for potential evacuation is the plume exposure pathway emergency planning zone (EPZ) for the Byron Station. Since it may not be necessary or desirable to evacuate the entire plume exposure pathway EPZ at once, for the purposes of this study, several evacuation study areas have been defined within the plume exposure pathway EPZ.

2.1 EVACUATION STUDY AREAS

The evacuation study areas for the plume exposure pathway EPZ approximate the 0-2 mile, 2-5 mile, and 5-10 mile sectors suggested in NUREG-0654. These evacuation study areas have been discussed with and favorably reviewed by ESDA officials of Ogle County and the State of Illinois.

Figure 2-1 identifies the ten evacuation study areas. Table 2-1 lists their locations in addition to the communities and facilities contained within each study area.

2.2 PRIMARY EVACUATION ZONES

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

- 0-2 mile, Evacuation Study Areas A and B
- 0-5 mile, Evacuation Study Areas A,B and C
- 0-5 mile, Evacuation Study Areas A,B and D

- 0-5 mile, Evacuation Study Areas A,B and E
- 0-5 mile, Evacuation Study Areas A,B and F
- 0-10 mile, Evacuation Study Areas A through F and G
- 0-10 mile, Evacuation Study Areas A through F and H
- 0-10 mile, Evacuation Study Areas A through F and I
- 0-10 mile, Evacuation Study Areas A through F and J
- Full EPZ, Evacuation Study Areas A through J.

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 have been 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.

The summer season attracts vacationers to the recreational facilities in the area of Byron Station. Therefore, the summer daytime scenarios have included the permanent resident, daytime employee, seasonal, and visiting or transient populations. The summer nighttime scenarios have included the permanent resident, nighttime employee, and overnight

transient populations. The winter daytime scenarios have included the permanent resident, school student, and daytime employee populations. The winter nighttime scenarios have included the permanent resident population, and nighttime employee populations.

These baseline evacuation scenarios are representative of weekday conditions because they are the most frequent situations. To address the weekend events, additional simulations of special events have been undertaken (see Section 6). These special events include the Autumn on Parade, which occurs the first weekend in October and large weekend events at the Byron Dragway and Motosport Speedway.

Section 3 further describes the aforementioned populations. Normal and adverse weather conditions have also been considered. Adverse weather has been defined as those conditions that reduce road capacity to 70 percent of normal weather capacity, and includes conditions that may impair visibility and/or traction, such as light snow, icing, rain, or fog.

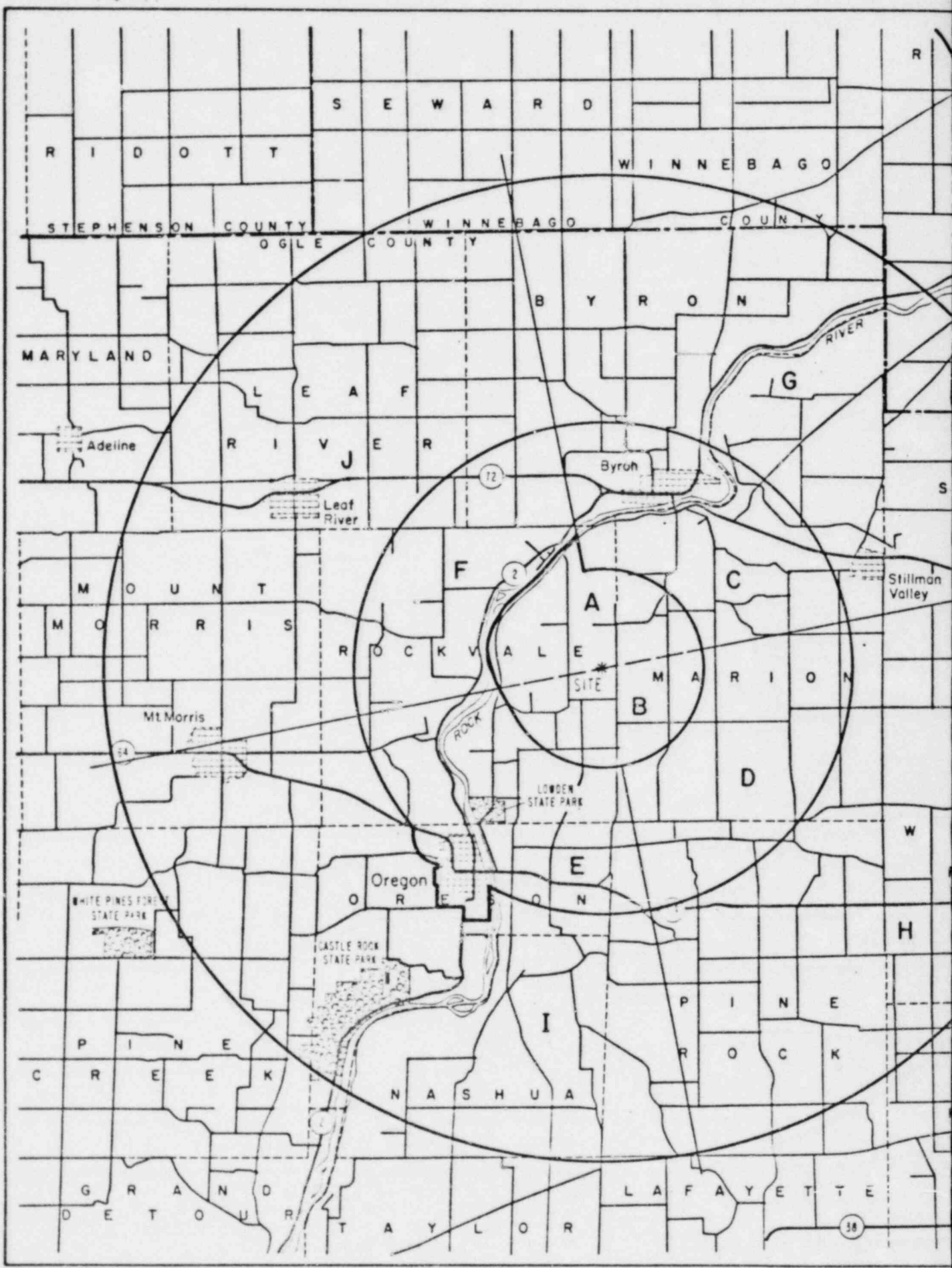
TABLE 2-1

COMMUNITIES AND FACILITIES BY EVACUATION STUDY AREA

Evacuation Area	County	Study Area	Major Communities/Facilities
0-2 Miles North	Ogle	A	Byron Nuclear Generating Station, Rockvale Twp., Marion Twp.
0-2 Miles South	Ogle	B	Byron Nuclear Generating Station, Rockvale Twp., Marion Twp.
2-5 Miles Northeast	Ogle	C	Rockvale Twp., Byron Twp., Marion Twp., Byron
2-5 Miles Southeast	Ogle	D	Marion Twp., Pine Rock Twp.
2-5 Miles Southwest	Ogle	E	Rockvale Twp., Oregon Twp., Pine Rock Twp., Oregon, Lowden State Park
2-5 Miles Northwest	Ogle	F	Rockvale Twp., Byron Twp.
5-10 Miles Northeast	Ogle Winnebago	G	Byron Twp., Rockford Twp., Marion Twp., Scott Twp., Winnebago Twp., Seward Twp., Davis Junction, Stillman Valley, Westfield Corners
5-10 Miles Southeast	Ogle	H	Scott Twp., Marion Twp., White Rock Twp., Pine Rock Twp., Holcomb, Davis Junction, Chana, Kings, Paynes Point, Flagg Twp.
5-10 Miles Southwest	Ogle	I	Oregon Twp., Nashua Twp., Pine Creek Twp., Mt. Morris Twp., Rockvale Twp., Mt. Morris, Castle Rock State Park, Daysville, Honey Creek
5-10 Miles Northwest	Ogle Winnebago	J	Rockvale Twp., Mt. Morris Twp., Leaf River Twp., Byron Twp., Seward Twp., Lightsville, Leaf River, Myrtle, Egan

NOTE:

See Figure 2-1 for Study Area Identification.


SEWARD
RIDOTT
WINNEBAGO
STEPHENSON COUNTY
WINNEBAGO COUNTY
OGLE COUNTY
BYRON
MARYLAND
LEAF RIVER
Adeline
Leaf River
Byron
Stillman Valley
MOUNT MORRIS
ROCKVALE
SITE
MARION
Mt Morris
ROCK RIVER
LOWDEN STATE PARK
Oregon
OREGON
WHITE PINES FOREST STATE PARK
CASTLE ROCK STATE PARK
PINE CREEK
NASHUA
PINE ROCK
GRAND DETOUR
TAYLOR
LAFAYETTE
A
B
C
D
E
F
G
H
I
J
72
64
2
38

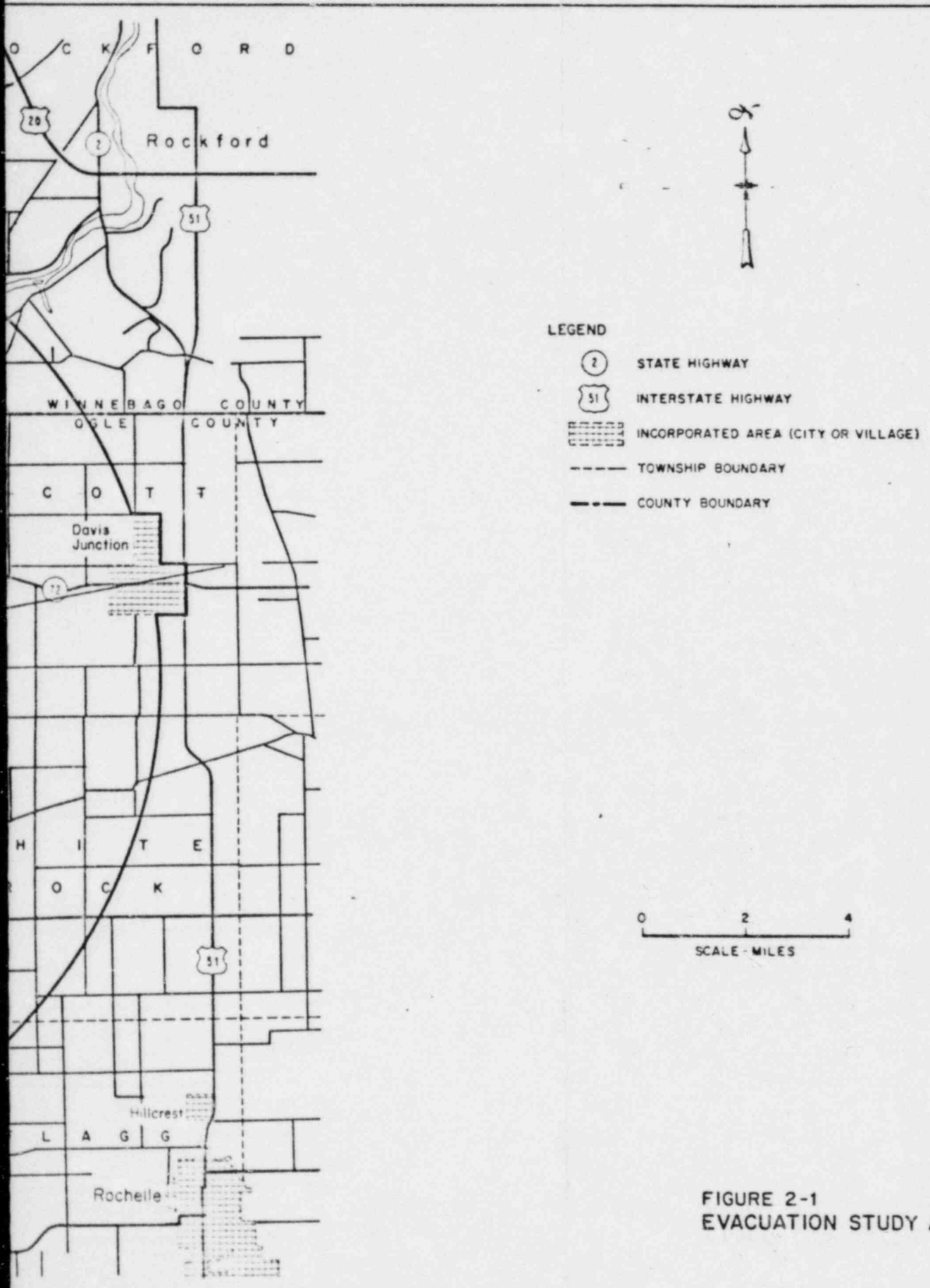


FIGURE 2-1
EVACUATION STUDY AREAS

SECTION 3

DEMOGRAPHIC AND VEHICLE DATA

Demographic data for this study has been derived from the official 1980 census data.[7] Additional information has been provided from field survey work, and Ogle County and State of Illinois Emergency Services and Disaster Agency (ESDA) officials. Further information has been obtained by Illinois ESDA personnel from local property owners and employers. The vehicle data has been derived from the demographic data and the Ogle County average number of persons per household. It has been assumed that each household represents one vehicle. The number of registered vehicles in Ogle and Winnebago Counties supports the adequacy of this assumption. Figures 3-1 through 3-10 present specific population and vehicle data by compass sector and distance from the Byron Station for various seasonal and diurnal conditions.

This study has identified 21,622 permanent residents within the evacuation study areas. Figures 3-1 and 3-2 present the permanent (resident) population and vehicle data by compass sector and distance. The summer daytime period represents the period of greatest population, reaching about 42,800 persons due to the additional count of seasonal transients, employees and appropriate special facilities population. The summer daytime period also has the greatest number of vehicles due to the increase in transient (non-resident) population. The summer nighttime population is about 31,100 representing the permanent population, overnight transients, and appropriate special facilities population. The winter daytime population is about 34,900. Students and employees residing within the EPZ have been counted twice in the

winter day population, thus resulting in a conservative estimate. The winter nighttime population is essentially representative of the permanent (resident) population and represents the lowest population and fewest vehicles for the evacuation study areas. 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 events such as the Autumn on Parade and large events at the Byron Dragway and Motosport Speedway.

3.1 SUMMER SEASON POPULATION DATA

The summer season extends from Memorial Day weekend through Labor Day weekend. There is a significant population influx during this season.

3.1.1 Summer Daytime Data

Summer daytime population includes summer visitors, campers, and boaters (see Table 3-4), and appropriate special facilities (see Table 3-5), in addition to the permanent and employee populations. Figures 3-3 and 3-4 present this data by sector for population and vehicles, respectively.

3.1.2 Summer Nighttime Data

The seasonal population increase caused by overnight transients (i.e., campgrounds, summer camps, and other special facilities), and the associated vehicles, have been added to the winter nighttime population and vehicle distribution to obtain the summer nighttime data shown by sector on Figures 3-5 and 3-6.

3.2 WINTER SEASON POPULATION DATA

The winter season includes the non-tourist months, when schools are in session. In this study, this season extends from Labor Day through Memorial Day.

3.2.1 Winter Daytime Data

Winter daytime populations include permanent residents, school enrollments (see Table 3-2), employees (see Table 3-3), appropriate camps and recreational facilities (see Table 3-4), appropriate special facilities (see Table 3-5), and the visitors at facilities where significant populations have been known to gather. The winter daytime populations and vehicle data are shown by compass sector on Figures 3-7 and 3-8.

3.2.2 Winter Nighttime Data

Winter nighttime populations include permanent residents, employee night-shift populations, and appropriate special facilities (see Table 3-5). These population estimates and corresponding vehicle data are shown by compass sector on Figures 3-9 and 3-10.

3.3 SPECIAL FACILITIES POPULATION DATA

For the purpose of this study, special facilities are those institutions or other population concentrations, which are transportation-dependent or have other special problems such as long mobilization times. These special facilities include schools, major employers, recreation areas, health care facilities, and the Ogle County jail.

Schools are shown on Figure 3-11. Figures 3-12 and 3-13 identify the locations of transient populations, including major employers and camps and recreation areas. Nursing homes, campgrounds, the Ogle County jail, and other similar institutions that have been identified within the EPZ are shown on Figure 3-13.

TABLE 3-1

DEMOGRAPHIC AND VEHICLE DATA BY EVACUATION STUDY AREA

Evacuation Study Area	Summer				Winter			
	Daytime		Nighttime		Daytime		Nighttime	
	Population	Vehicles	Population	Vehicles	Population	Vehicles	Population	Vehicles
A	7,157	3,183	7,057	3,153	657	229	657	229
B	3,600	1,759	800	359	3,600	1,759	800	359
C	6,372	2,422	4,523	1,538	4,718	1,748	3,335	1,178
D	392	134	392	134	392	134	392	134
E	8,236	3,111	4,898	1,716	7,923	2,904	4,862	1,704
F	652	241	352	121	502	196	352	121
G	4,618	1,678	4,018	1,497	5,251	1,594	3,958	1,437
H	1,725	606	1,725	606	1,989	662	1,825	636
I	7,651	3,482	4,924	1,765	7,027	3,167	4,534	1,634
J	2,433	859	2,433	859	2,882	947	2,433	859

TABLE 3-2

SCHOOLS WITHIN THE EMERGENCY PLANNING ZONE (1)

Facility No.(2)	Direction/ Mile	Study Area	Name of School	No. of Students/Staff(3)
41	WSW/7-8	I	Mt. Morris E.S.	343/26
42	WSW/7-8	I	Mt. Morris Jr. H.S.	189/16
43	WSW/7-8	I	Mt. Morris Sr. H.S.	235/25
44	SSW/5-6	E	Oregon Community H.S.	408/38
45	SSW/5-6	E	Etnyre Middle School	338/28
46	SSW/5-6	E	Jefferson E.S.	427/26
49	SSW/4-5	E	Oregon Bible College	80
50	SW/4-5	E	Lorado Taft Field Campus	122
51	WNW/6-7	J	Leaf River Community School, K-12	413/36
52	WSW/7-8	I	Ogle County Educational Coop	40/17
53	NNE/3-4	C	Byron Middle School	231/32
54	NNE/3-4	C	Byron Mary Morgan School, K-5	388/43
55a	ENE/5-6	G	Highland Grade School & Early Childhood	417/20
55b	ENE/5-6	G	Meridian Jr. H.S.	341/20
55c	ENE/5-6	G	Stillman Valley H.S.	462/33
56	NNE/3-4	C	Byron H.S.	316/49
57	SSW/5-6	E	Oregon Annex School Special Education Bldg.	76/11
58	SSW/5-6	E	Oregon Daycare Center	68
66	SW/6-7	I	Village of Progress	106

Notes

(1) This information provided by State of Illinois, ESDA personnel responsible for the development of IPRA, Byron Volume VI (See Reference 6).

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

(3) Numbers represent students plus staff.

TABLE 3-3

MAJOR EMPLOYERS WITHIN THE EMERGENCY PLANNING ZONE(1) (2)

Facility No.(3)	Direction/ Mile	Study Area	Name of Manufacturer	No. of Employees Day	Night
24	NNE/4-5	C	Quality Metal Finishing Co.	204	0
25	NNE/4-5	C	Kysor of Byron	120	0
26	SW/6-7	I	Acme Resin Co.	20	20
27	SSW/5-6	E	Atwood Vacuum Machine Co.	80	0
28	SSW/5-6	E	Cook Manufacturing	55	0
29a	SSW/5-6	E	E.D. Etnyre & Co.	86	0
29b	SSW/5-6	E	E.D. Etnyre & Co.	78	0
30	SW/6-7	I	Martin Marietta Aggregates	53	0
31	SSW/4-5	E	Progressive Graphics	135	0
32	SSW/7-8	I	Woods Brothers, Div. of Hesston Corp.	440	0
33	WSW/7-8	I	Kable Printing Co.	500	0
34	WSW/7-8	I	Kable News	272	0
38	E/0-1	B	Byron Nuclear Generating Station	3340	540

Notes

(1) For the purpose of this study major employers are those with 25 or more total employees.

(2) This information provided by State of Illinois ESDA personnel responsible for the development of IPRA, Byron Volume VI (See Reference 6).

(3) See Figure 3-12 for employer locations.

TABLE 3-4

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	Transient Population Night
1	SW/9-10	I	Lake LaDonna	Summer/Day	1200	0
3	W/1-2	A	River Road Camping and Marina	Summer/Day & Night	1500	1400
4(3)	N/1-2	A	Motosport Park	Summer/Day	5000	0
6	SW/8-9	I	White Pines Ranch	Summer/Day & Night Winter/Day & Night	170 140	170 140
7(3)	N/3-4	C	Byron Dragway	Summer/Night	500	0
8	NNE/4-5	C	Lake Louise	Summer/Day & Night	2188	1188
9	WSW/3-4	E	Stronghold Camp	Summer/Day & Night Winter/Day & Night	170 140	170 140
10	SSW/8-9	I	Castle Rock State Park and Nature Preserve	Summer/Day Winter/Day	212 107	0 0
11	SW/4-5	E	Lowden Memorial State Park	Summer/Day Winter/Day	1844 865	0 0
12	SSW/9-10	I	Camp Lowden Boy Scout Camp	Summer/Day & Night Winter/Day & Night	150 100	150 100
13	NNE/6-7	G	Camp McCormick Girl Scout Camp	Summer/Day & Night Winter/Day & Night	120 60	120 60
14	E/6-7	H	Kings Camp	Summer/Day & Night	10	10
15	NNW/3-4	F	Byron Sportsmen's Club	Year-round	150	150
16	SSW/7-8	I	Lutheran Outdoor Ministry	Summer/Day	200	100
17	SSE/8-9	H	Rochelle Conservation Club	Year-round	50	50
18	WSW/8-9	I	Camp Ross	Summer/Day & Night	60	60
19	NW/2-3	F	Mt. Morris Boat Club	Summer/Day	150	0
20	ENE/3-4	C	Weld Memorial Park	Summer/Day	25	0
21	SSW/4-5	E	Oregon Country Club	Summer/Day	100	0

TABLE 3-4 (Cont)

Facility No.(2)	Direction/ Mile	Study Area	Facility Name	Periods of Operation	Transient Population Day	Transient Population Night
22	NE/9-10	G	Fuller Memorial Forest Preserve	Summer/Day	600	0
23	SSW/5-6	E	Oregon Park District	Summer/Day	870	0
70	WSW/9-10	I	Camp Emmaus	Summer/Day & Night	60	60
				Winter/Day & Night	20	20

Notes:

(1) This information provided by State of Illinois ESDA personnel responsible for the development of IPRA, Byron Volume VI (See Reference 6)

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

(3) Weekends only

TABLE 3-5

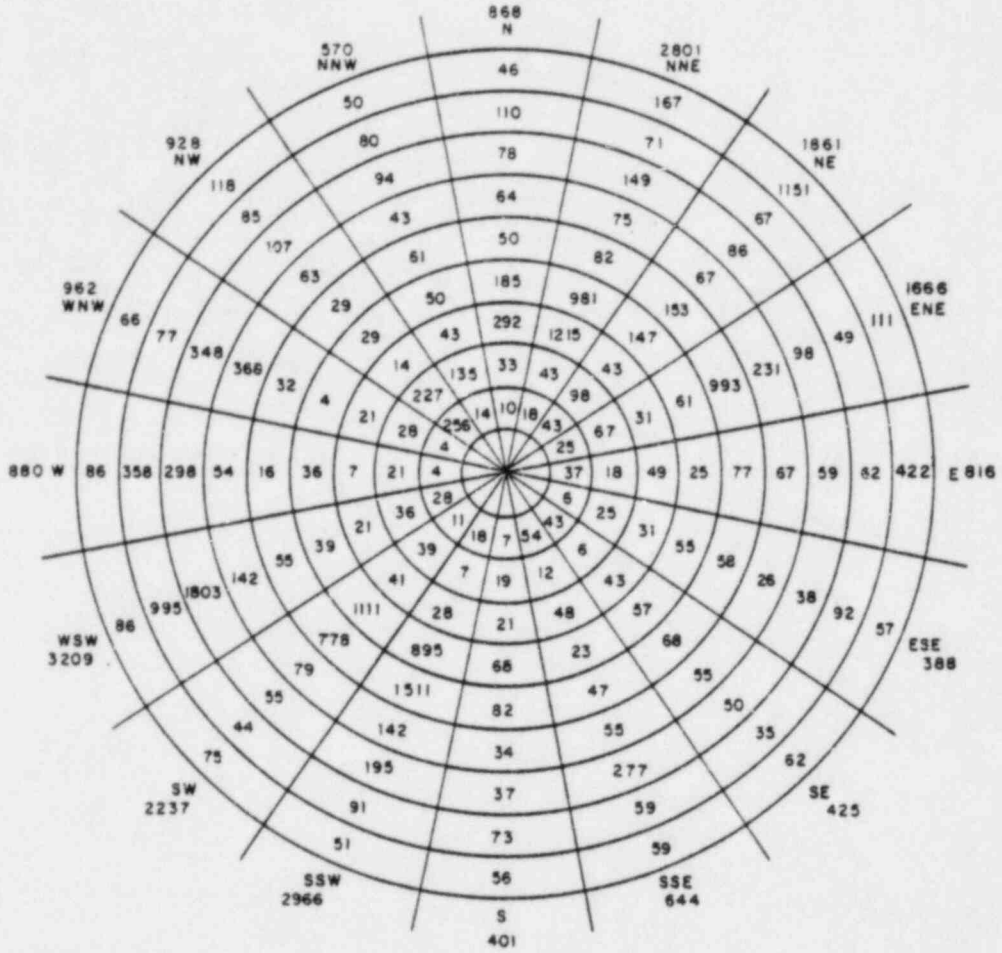
HEALTH CARE FACILITIES, MOTELS AND COUNTY JAIL
WITHIN THE EMERGENCY PLANNING ZONE(1)

Facility No.(2)	Direction/ Mile	Study Area	Facility Name	Transient Population
61	WSW/7-8	I	Mt. Morris Motel	14 Summer 8 Winter
62	SW/4-5	E	V.I.P. Motel	24 Summer 24 Winter
63	NNE/4-5	C	The Neighbors Nursing and Care Center	139
64	SSW/5-6	E	White Pines Manor	65
65	WSW/7-8	I	Pine Crest Manor	159
68	SSW/4-5	E	Ogle County Jail	35

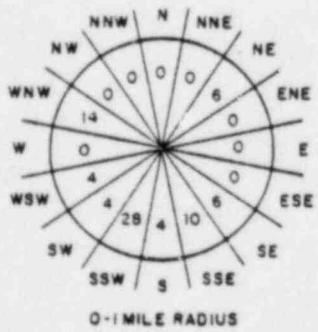
Notes

(1) This information provided by State of Illinois ESDA personnel responsible for the development of IPRA, Byron Volume VI (See Reference 6).

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

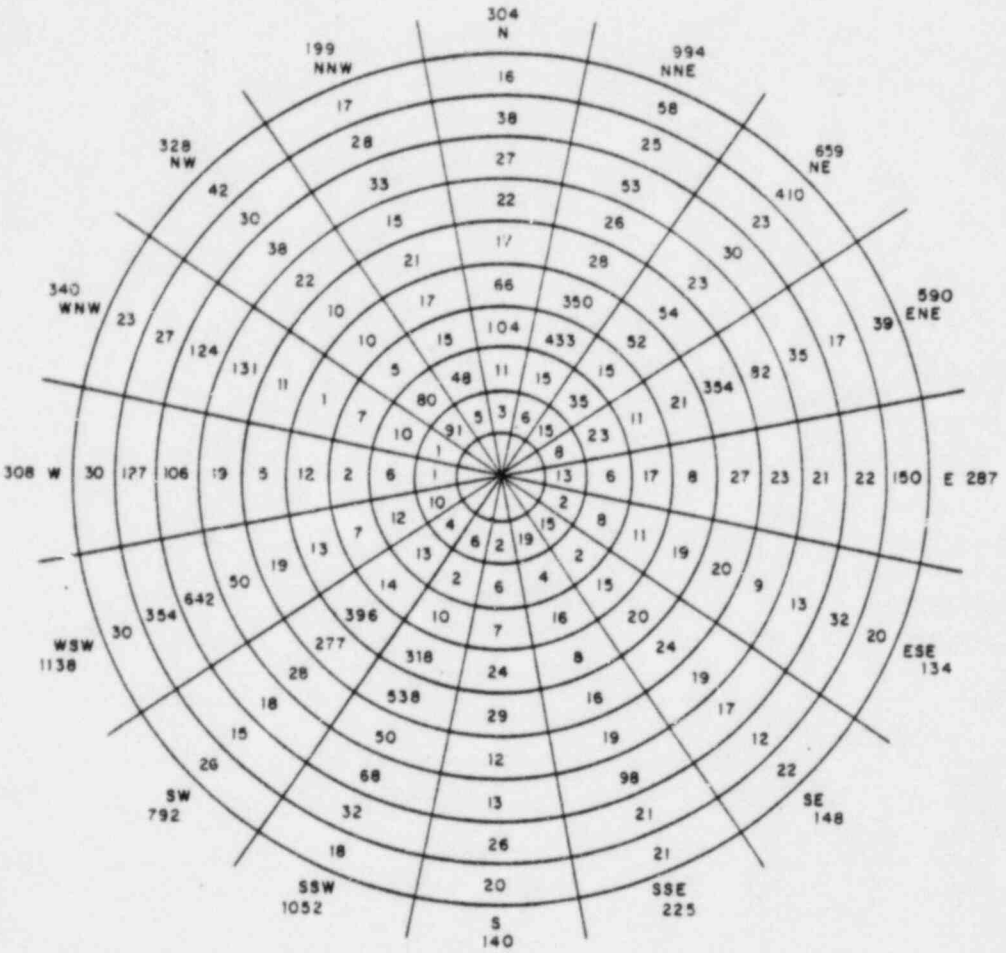


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
654	7182	21622	6528	14440

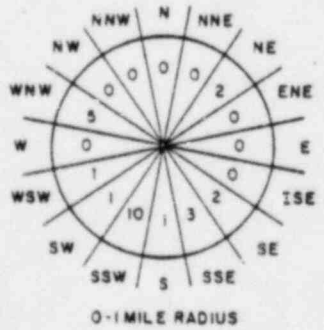


0-1 MILE RADIUS

FIGURE 3-1
PERMANENT POPULATION DISTRIBUTION
BY COMPASS SECTOR

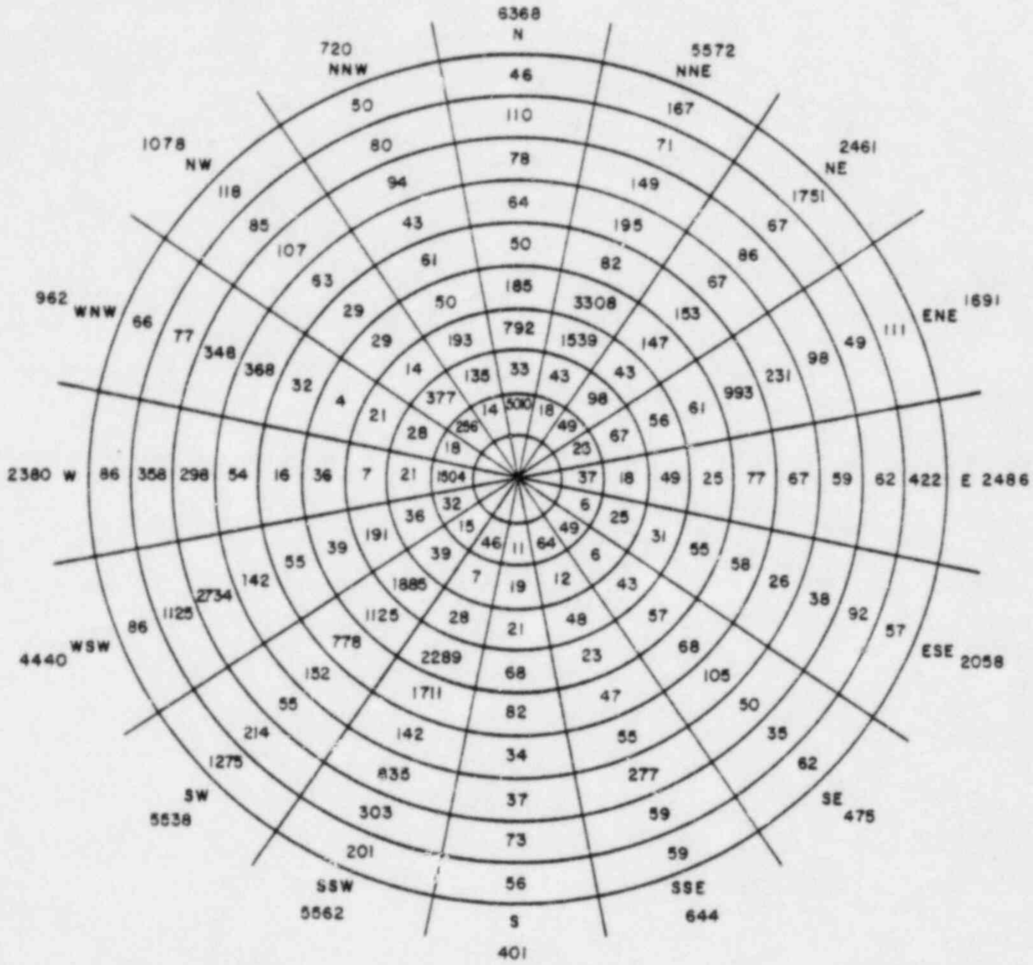


0-2 MI	0-5 MI	0-10MI	2-5 MI	5-10 MI
226	2531	7638	2305	5107

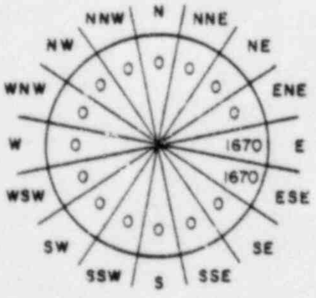


0-1 MILE RADIUS

FIGURE 3-2
PERMANENT VEHICLE DISTRIBUTION
BY COMPASS SECTOR



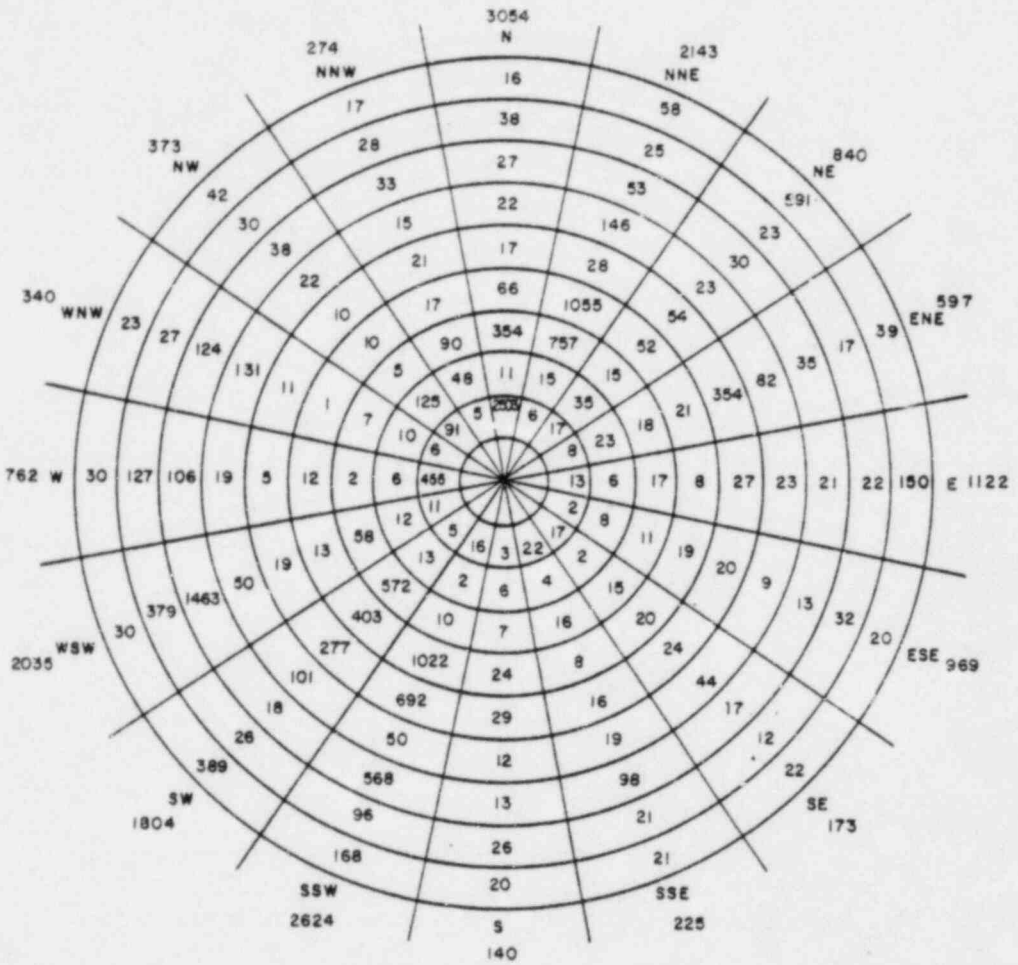
0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
10494	23920	42836	13426	18916



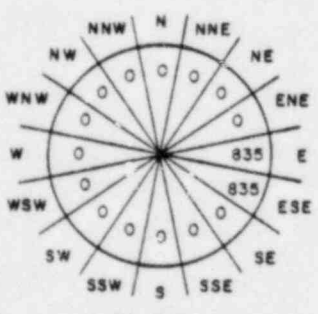
0-1 MILE RADIUS

FIGURE 3-3

POPULATION DISTRIBUTION BY COMPASS SECTOR - SUMMER DAY

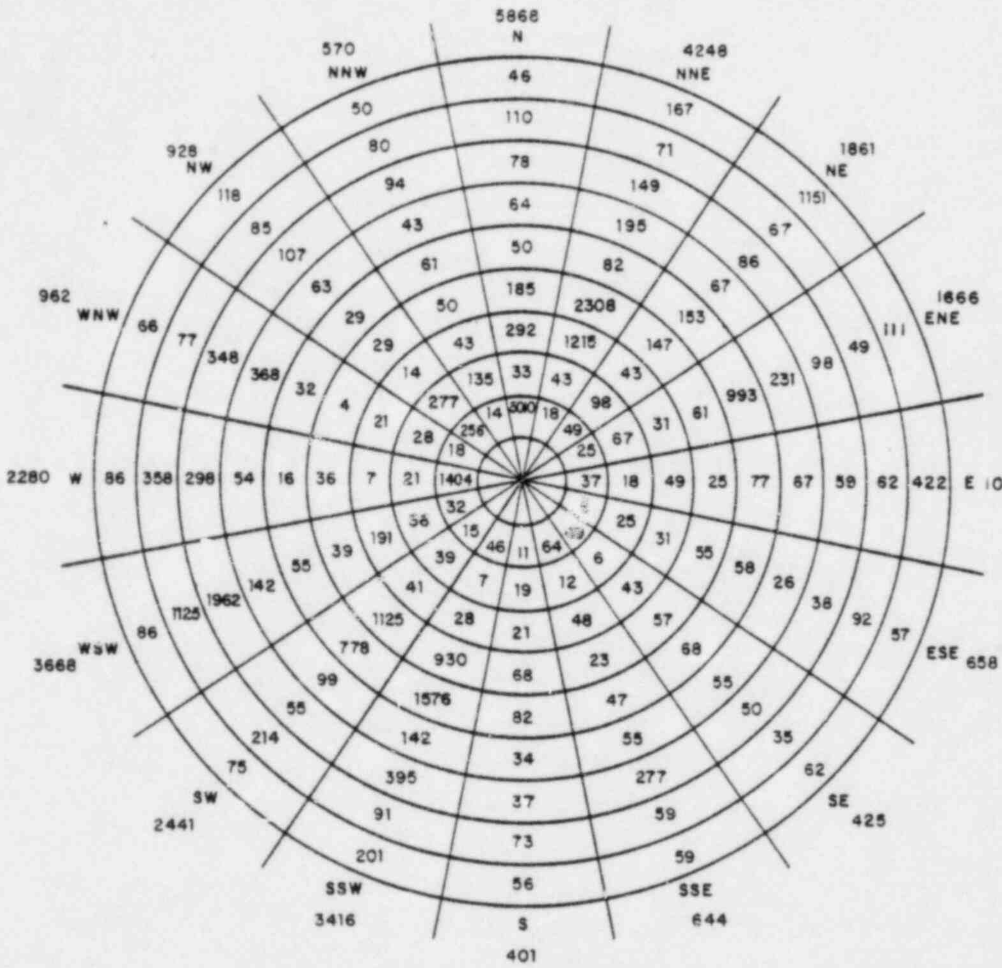


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
4850	9881	17475	5031	7594

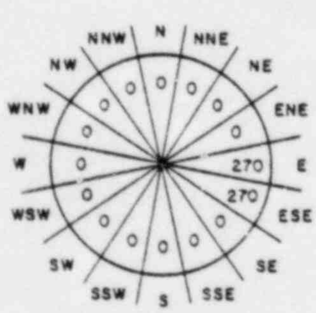


0-1 MILE RADIUS

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

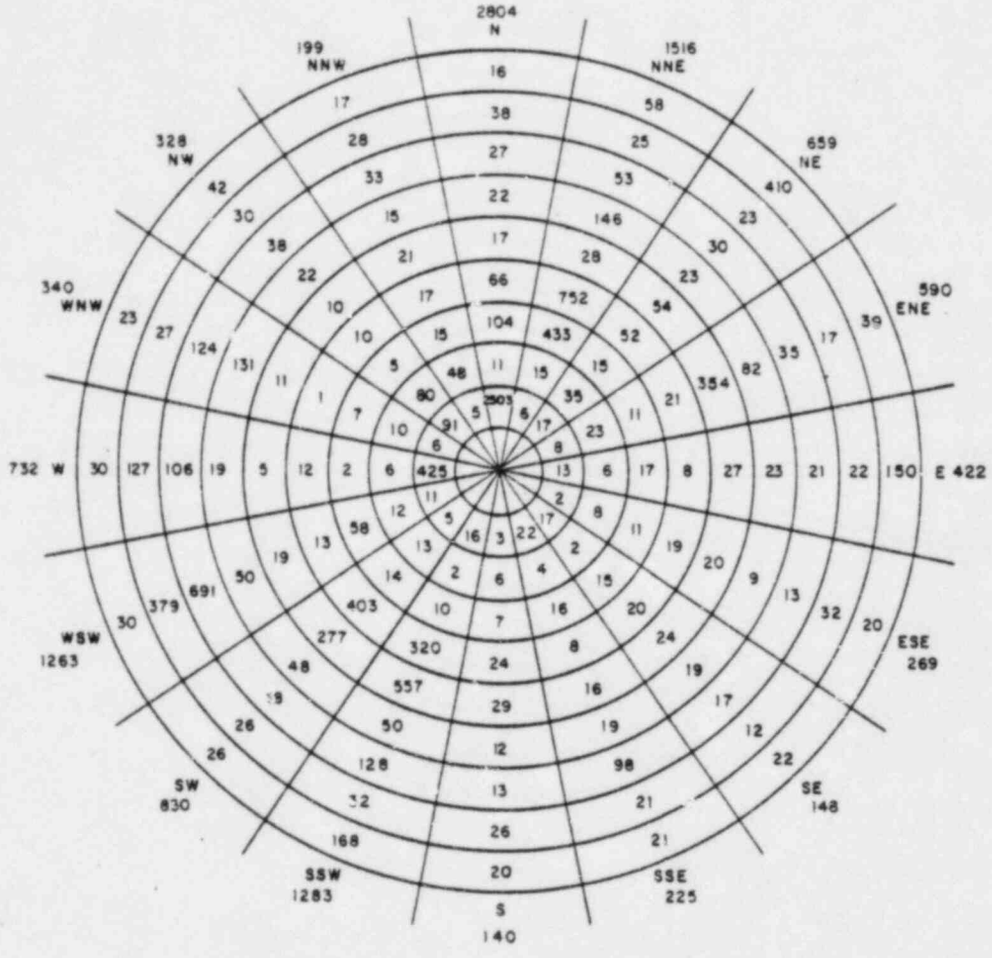


0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
7394	15668	31122	8074	15454



0-1 MILE RADIUS

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



0-2 MI	0-5 MI	0-10MI	2-5 MI	5-10 MI
3420	6187	11748	2767	5561

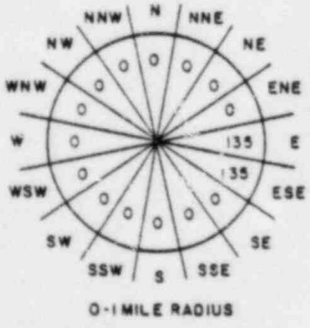
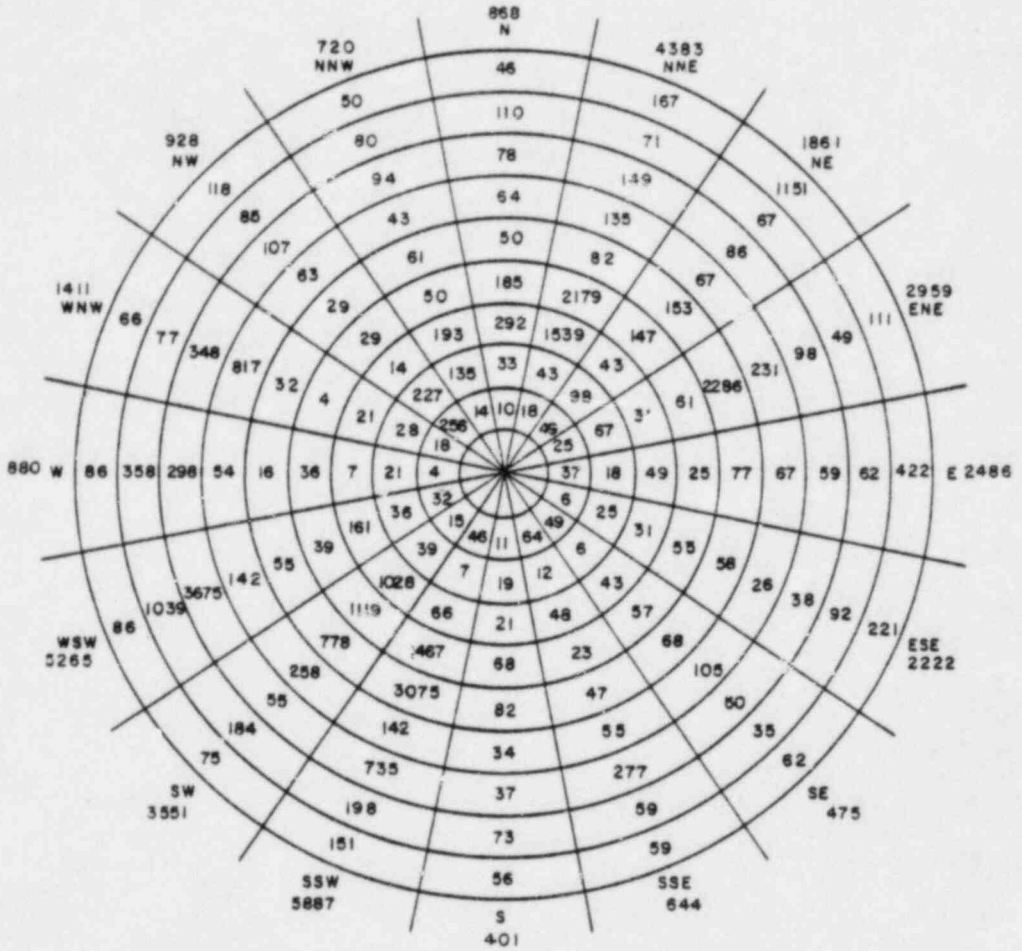


FIGURE 3-6
VEHICLE DISTRIBUTION BY
COMPASS SECTOR-SUMMER NIGHT



0-2 MI	0-5 MI	0-10MI	2-5 MI	5-10 MI
3994	13939	34941	9945	21002

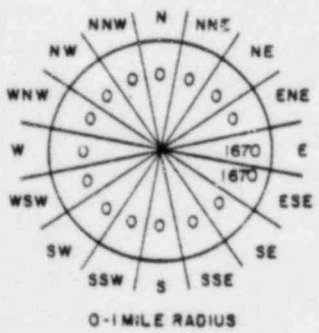
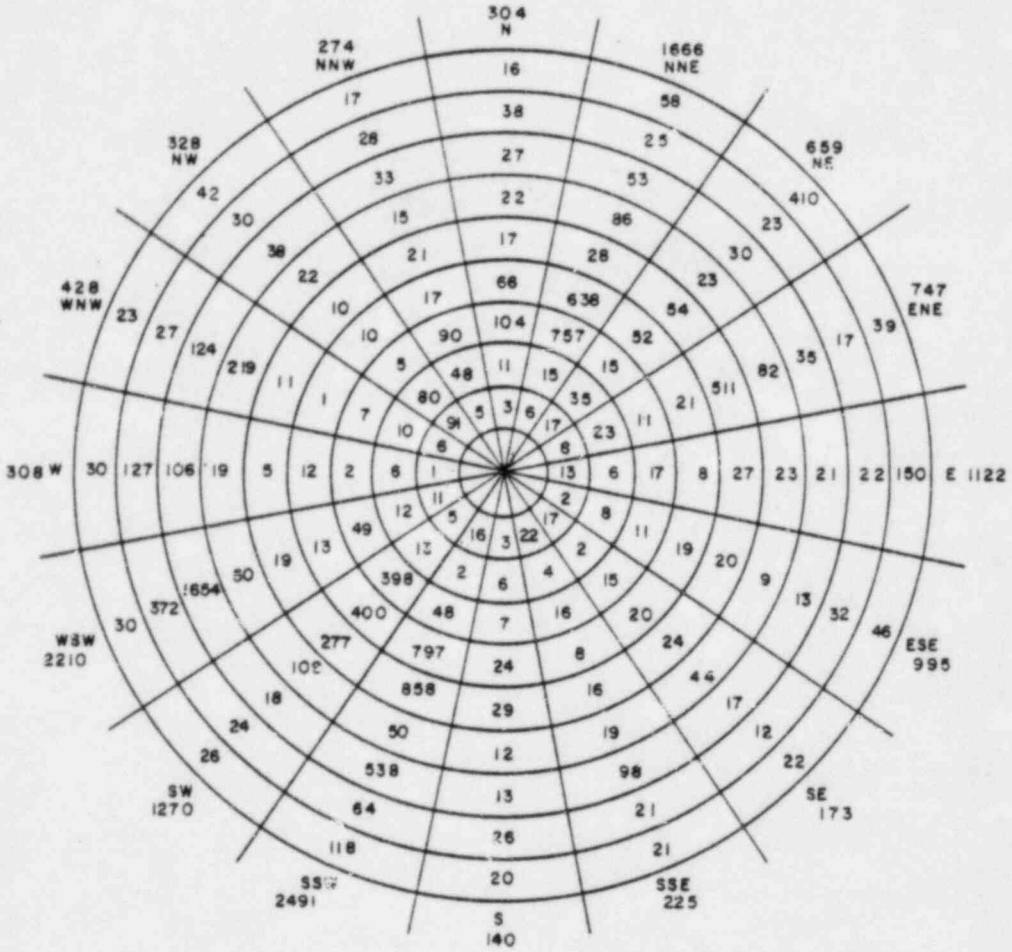


FIGURE 3-7
POPULATION DISTRIBUTION BY
COMPASS SECTOR-WINTER DAY



0-2 MI	0-5 MI	0-10MI	2-5 MI	5-10 MI
1896	5838	13340	3939	7505

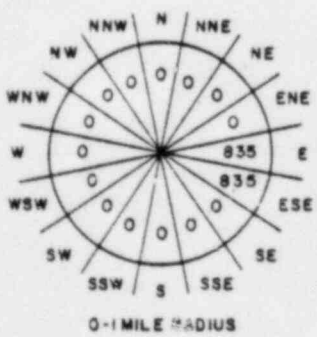
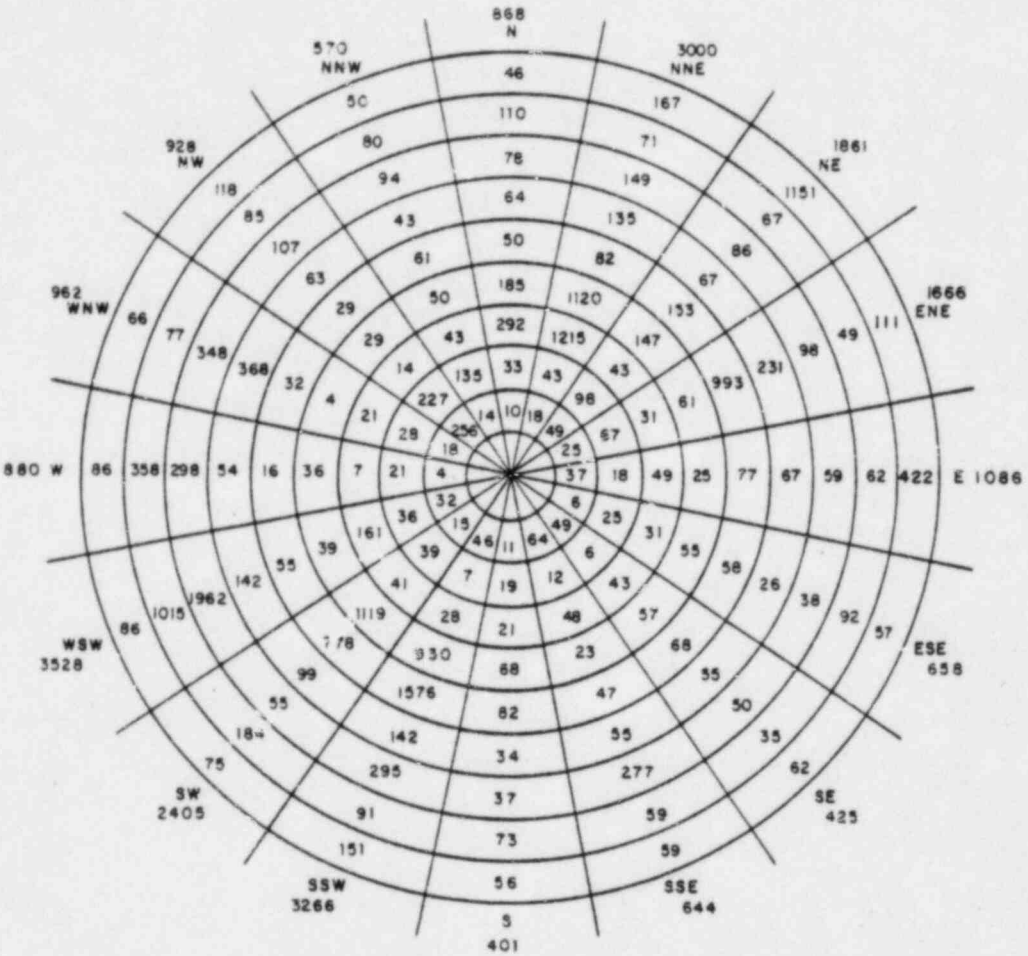


FIGURE 3-8
VEHICLE DISTRIBUTION BY
COMPASS SECTOR—WINTER DAY



0-2 MI	0-5 MI	0-10 MI	2-5 MI	5-10 MI
1194	8044	23148	6850	15104

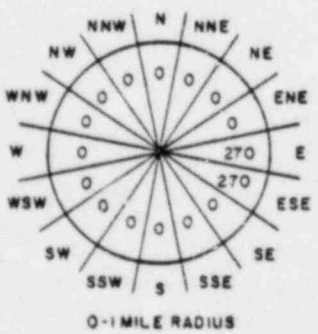
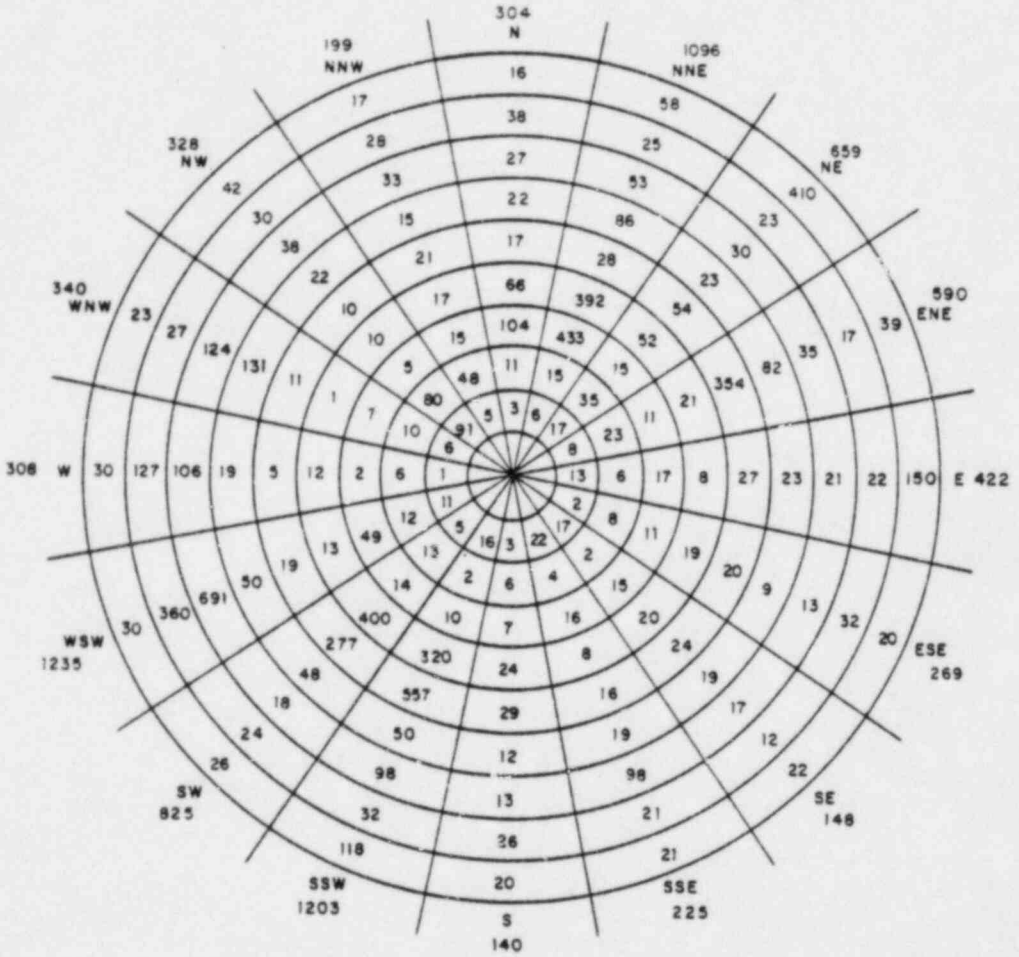
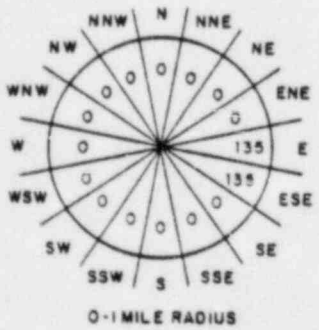


FIGURE 3-9
POPULATION DISTRIBUTION BY
COMPASS SECTOR-WINTER NIGHT

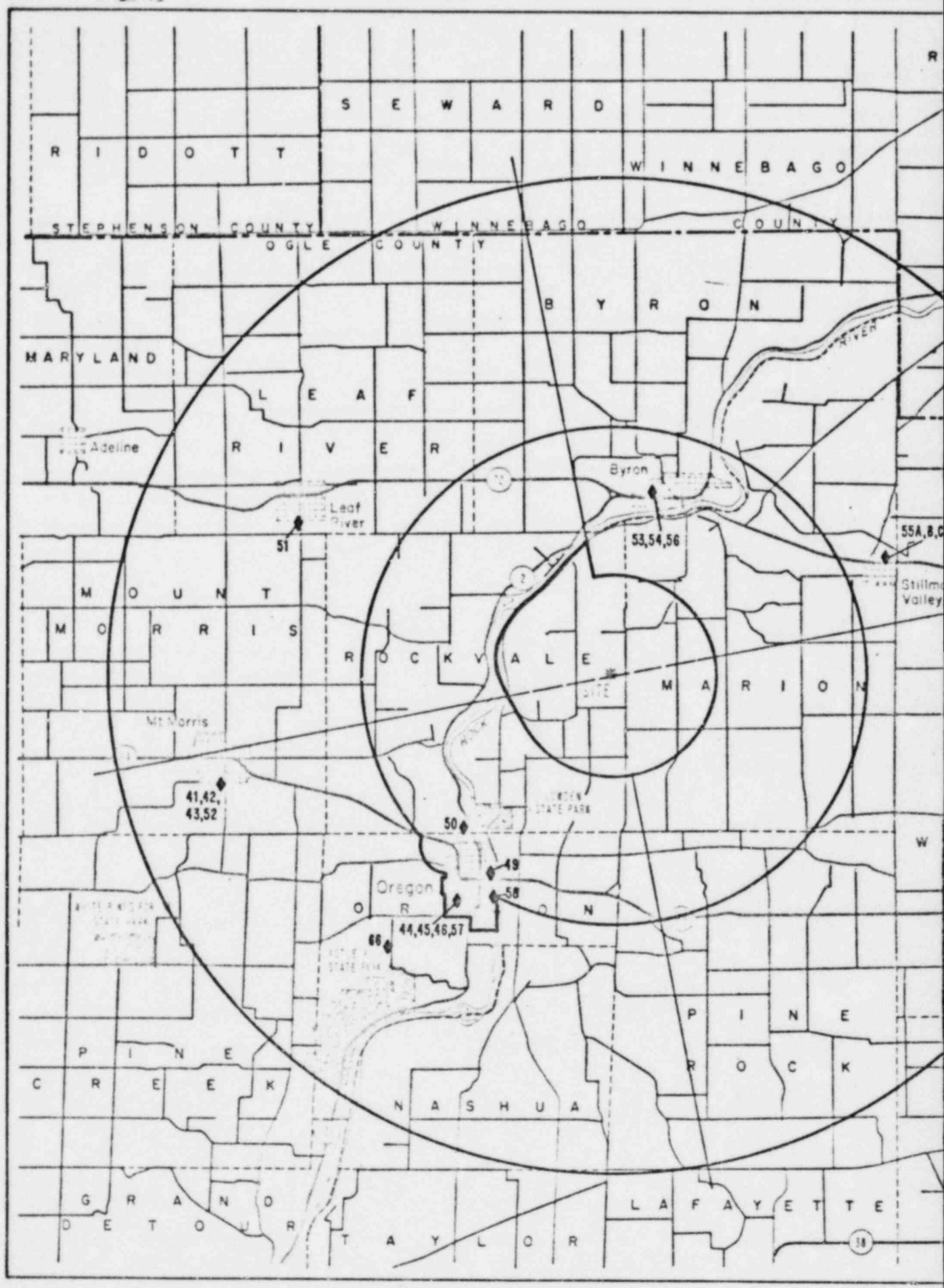


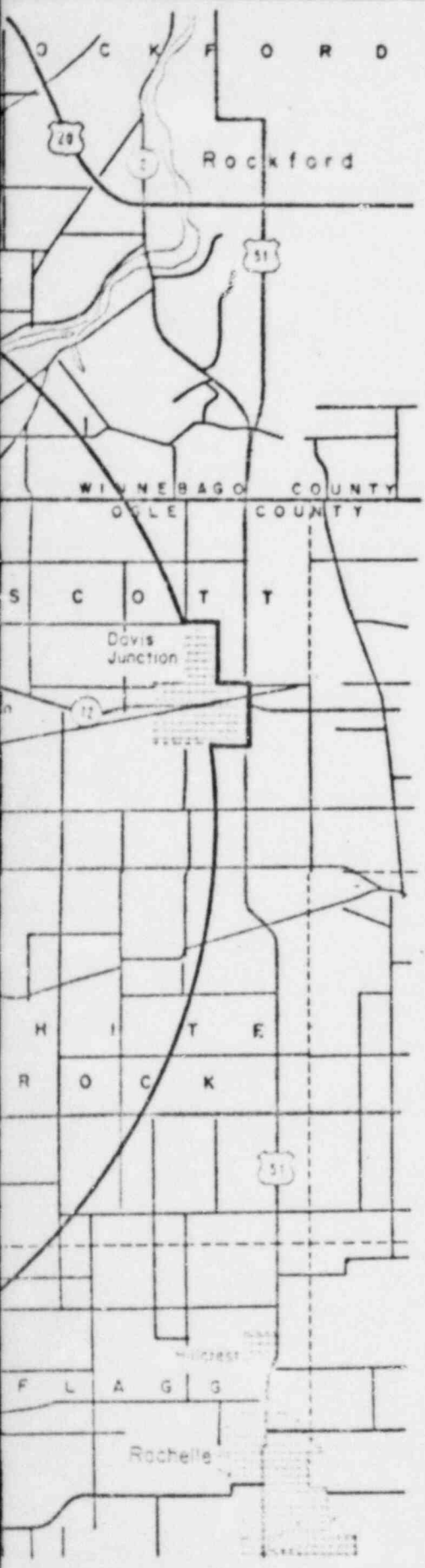
0-2 MI	0-5 MI	0-10MI	2-5 MI	5-10 MI
496	2891	8291	2395	5400



0-1 MILE RADIUS

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


SEWARD
RIDOTT
WINNEBAGO
STEPHENSON COUNTY
WINNEBAGO COUNTY
OGLE COUNTY
BYRON
MARYLAND
LEAF
RIVER
Adeline
Byron
Leaf River
51
53,54,56
55A,B,C
MOUNT MORRIS
ROCKVALE
MARION
Mt. Morris
41,42,
43,52
50
49
58
Oregon
44,45,46,57
66
PINE CREEK
NASHUA
PINE ROCK
GRAND DETOUR
TAYLOR
LAFAYETTE



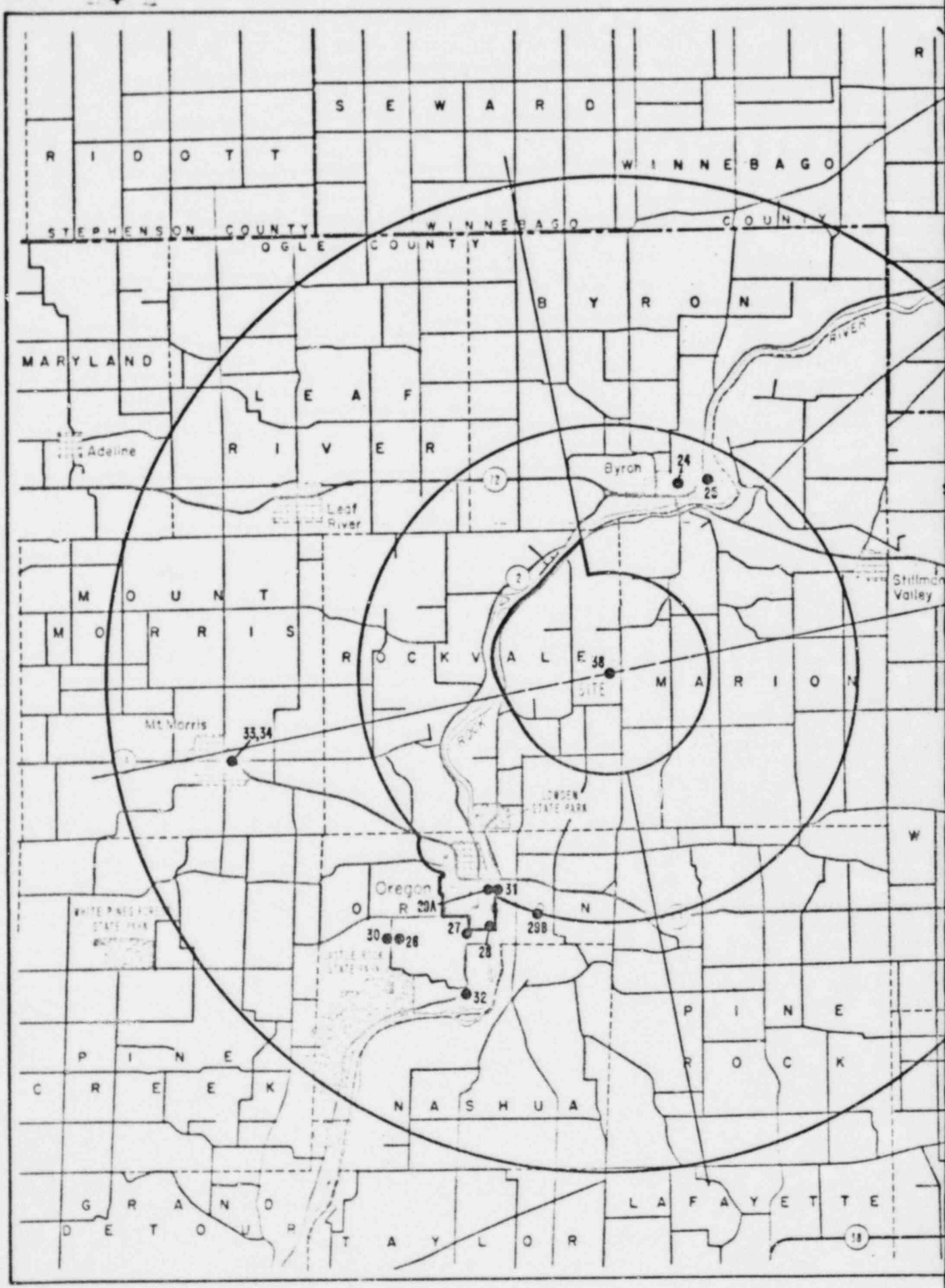
LEGEND

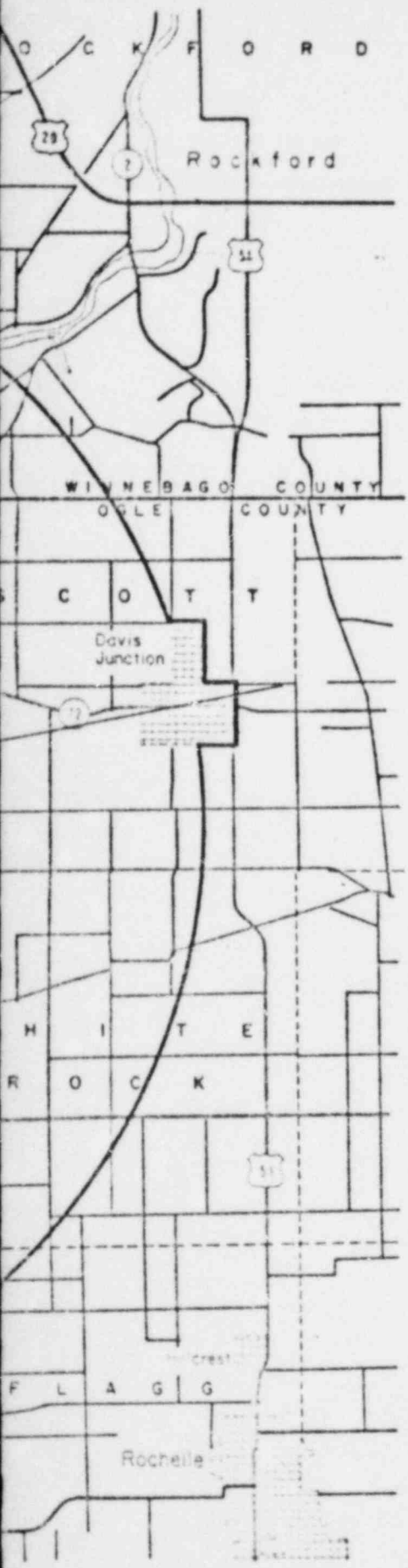
- STATE HIGHWAY
- INTERSTATE HIGHWAY
- INCORPORATED AREA (CITY OR VILLAGE)
- TOWNSHIP BOUNDARY
- COUNTY BOUNDARY
- SCHOOLS

NOTE
NUMBERS REFER TO FACILITIES IDENTIFIED ON TABLE 3-2.

0 2 4
SCALE - MILES

FIGURE 3-11
SPECIAL FACILITIES-SCHOOLS


SEWARD
RIDOTT
WINNEBAGO
STEPHENSON COUNTY
WINNEBAGO COUNTY
OGLE COUNTY
BYRON
MARYLAND
LEAF
RIVER
Adeline
Byron
24
25
Leaf River
MOUNT MORRIS
ROCKVALE
58
SITE
MARION
Mt Morris
33,34
LOWDEN STATE PARK
Oregon
31
29A
29B
27
28
30
26
32
PINE CREEK
NASHUA
PINE ROCK
GRAND DETOUR
TAYLOR
LAFAYETTE
Stillman Valley



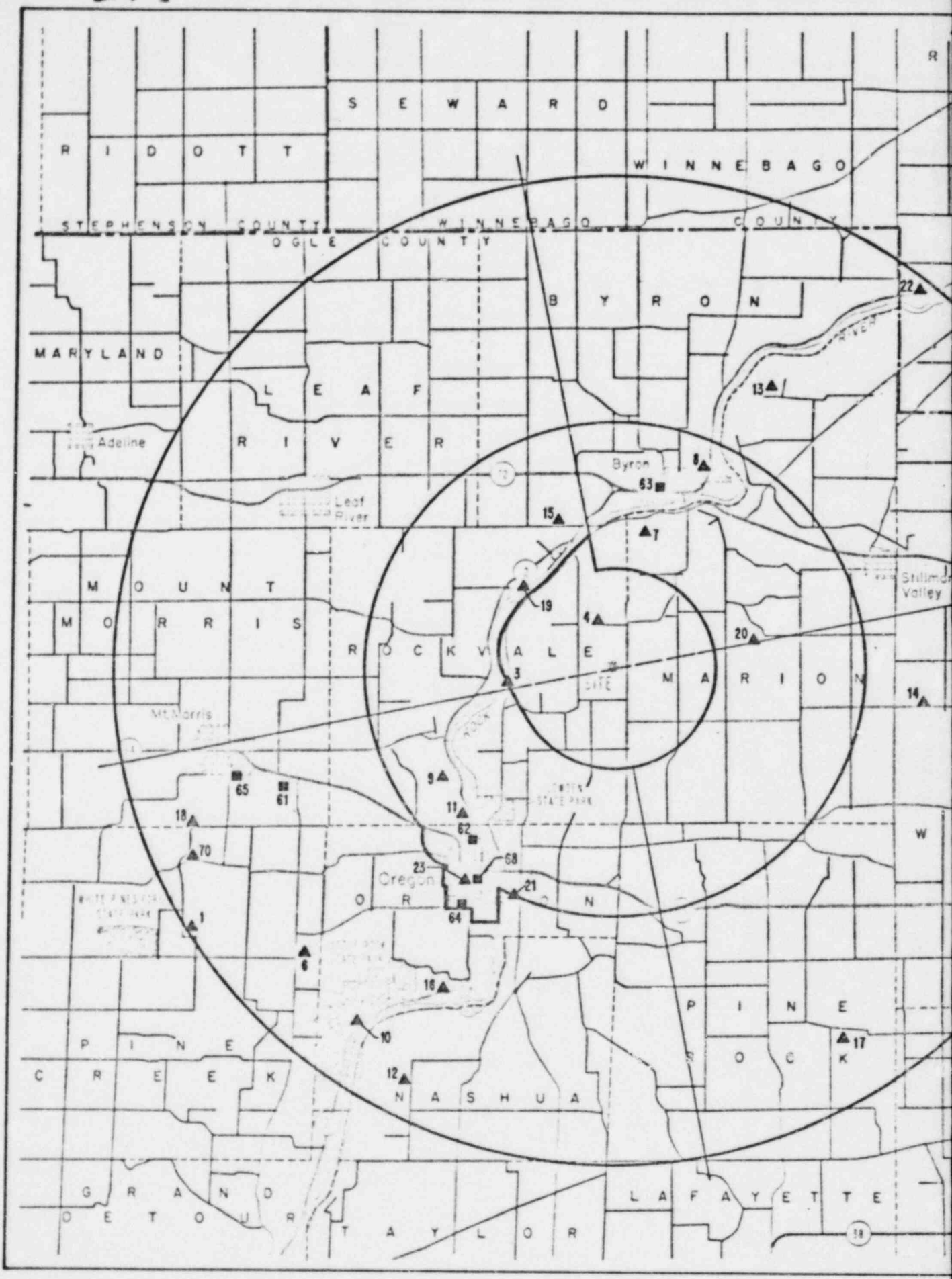
LEGEND

- STATE HIGHWAY
- INTERSTATE HIGHWAY
- INCORPORATED AREA (CITY OR VILLAGE)
- TOWNSHIP BOUNDARY
- COUNTY BOUNDARY
- EMPLOYERS

NOTE
NUMBERS REFER TO FACILITIES IDENTIFIED ON TABLE 3-3.

0 2 4
SCALE - MILES

FIGURE 3-12
TRANSIENT POPULATION-
MAJOR EMPLOYERS


SEWARD
RIDOTT
WINNEBAGO
STEPHENSON COUNTY
WINNEBAGO COUNTY
OGLE COUNTY
BYRON
MARYLAND
LEAF
RIVER
Adeline
Byron
Leaf River
MOUNT MORRIS
ROCKVALE
MARION
Mt.Morris
Stillman Valley
Oregon
PINE CREEK
NASHUA
PINE
SOCK
GRAND DETOUR
TAYLOR
LAFAYETTE
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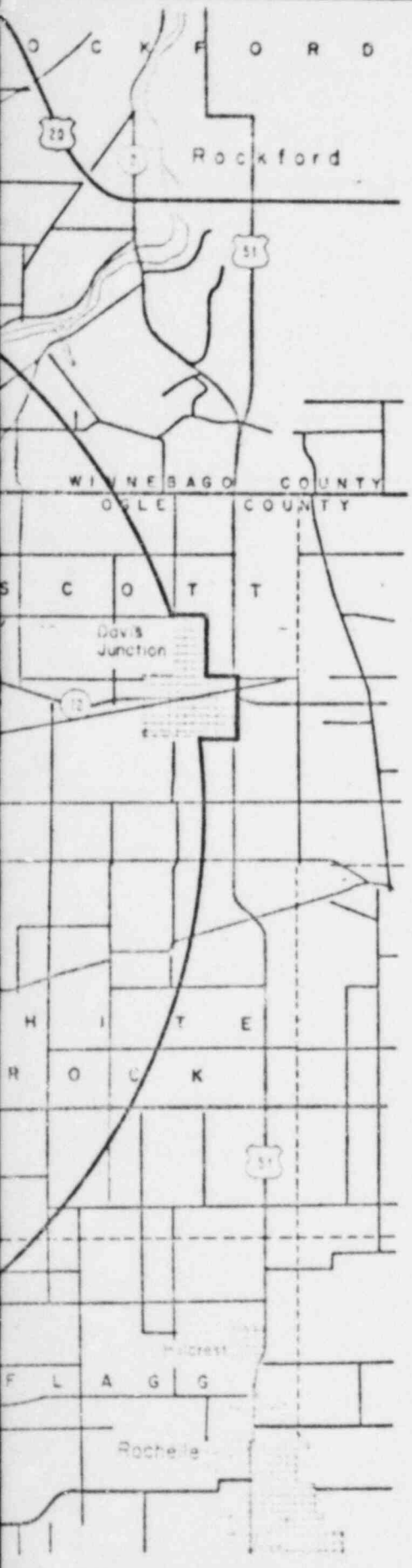


LEGEND

- (2) STATE HIGHWAY
- (51) INTERSTATE HIGHWAY
- INCORPORATED AREA (CITY OR VILLAGE)
- TOWNSHIP BOUNDARY
- COUNTY BOUNDARY
- ▲ CAMPS AND RECREATION AREAS
- ■ SPECIAL FACILITIES (HEALTH CARE AND COUNTY JAIL)

NOTE
NUMBERS REFER TO FACILITIES IDENTIFIED ON TABLES 3-4 AND 3-5.

0 2 4
SCALE - MILES

FIGURE 3-13
TRANSIENT POPULATION-
CAMPS, RECREATION AREAS
AND SPECIAL FACILITIES

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 and special facilities.

4.1 GENERAL POPULATION EVACUATION TIME ESTIMATES

The general population, for the purposes of developing evacuation time estimates, has been defined as being composed of the permanent population, transients, and special facilities population 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 have been calculated using the NETVAC2 computerized traffic simulation model[2] 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 Manual[3] equations and revisions contained in the Interim Material on Highway Capacity[4] 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 Byron 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 has been approximated by a probability distribution of the public's reaction time during an evacuation and is discussed in detail in Section 4.1.2.

In addition, NETVAC2 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 have been described by a probability distribution of response times. This response time distribution has been derived by combining the response time distributions for several smaller components or events of the public response to the evacuation notification process. These events have been assumed to be the following:

- Receive Warning, the time period from when the prompt public notification system is activated to when the public has received 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
- Evacuate the Home, the time period required to pack belongings and prepare home for absence.

Total mobilization times have been determined by combining these events for each evacuation scenario. Average public response times for each of the above events are shown in Table 4-1. These event times have been favorably reviewed by Ogle County and State of Illinois ESDA officials.

A normal distribution has been assumed for the time spread of these individual events. Normal distribution represents the situation in which most persons respond in the average time for a given event and lesser numbers of individuals respond earlier and later than the average time. Therefore, the cumulative probability distribution of each of these events is an "S" shape. The curves have been derived by using standard mathematical techniques based on NUREG-0654/FEMA-REP-1 recommendations[1]. Figure 4-1 presents the distribution curves used for this study. Nighttime curves have been derived by combining two events: Receive Warning and Evacuate Home. Daytime curves have been derived by combining the Receive Warning, Leave Work, Travel Home, and Evacuate Home time distributions. The cumulative distribution of these different events combined has an "S" shape similar to the curves for the individual events, and represents the spectrum of public response times.

These public response time curves have been used to determine the rate and time for vehicle loading. 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.

4.1.3 Assumptions Used in Developing the Evacuation Time Estimates

The following assumptions have been used in this evacuation time estimate study:

- All persons within the plume exposure pathway EPZ when instructed to evacuate, will leave.

- People in the outer primary evacuatin zones will not evacuate when an inner primary evacuation zone is the only zone to be evacuated.

- 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 plume exposure pathway EPZ population has been estimated to be 15 minutes.)

- Traffic rules and controls will be obeyed, only the proper travel lane will be used (not shoulders or opposite flow lanes), and all traffic lights will be operating normally.

- Appropriate traffic and access control points will be manned.

- Evacuation routes will be passable.

- No major traffic will be on the road network prior to the start of an evacuation.

- Roadway capacities will be reduced to 70 percent of normal weather capacity during adverse weather.[5]

- Private vehicles will be the primary mode of evacuation.

- Only one car per household will be used in an evacuation. (There are 2.8 persons per household, based on people per household in Ogle County.[7])

- The people without cars will receive rides from either neighbors or designated public service vehicles.

- One car per employee at major employers and schools will be used in an evacuation.
- Boats will moor and the occupants will then evacuate by car with one vehicle allotted per boat.
- One car per campsite at recreational campgrounds will be used for evacuation. (This assumes 3.3 people per car as this is the Illinois State average number of people per family.[8])
- Adequate transportation will be available for summer camps.

4.2 SPECIAL FACILITIES TIME ESTIMATE METHODOLOGY AND ASSUMPTIONS

In addition to an estimate of the time required to evacuate the general population, NUREG 0654 recommends that a separate estimate be made of the time required to evacuate special facilities within the EPZ. Special facilities, as defined in NUREG 0654, can include health care facilities, nursing homes, jails, schools, and other facilities requiring special transportation or mobilization considerations during an evacuation. For this study, special facilities identified as requiring separate estimates included schools, nursing homes, and the Ogle County jail. These evacuation time estimates for special facilities are presented in Section 6.2.

Special facility evacuation time estimates include mobilization time for obtaining transportation, time for loading persons into vehicles, and the travel time out of the EPZ. Mobilization and loading times for special facilities have been obtained by State of Illinois ESDA personnel through interviews with facility officials. Special

facilities and transient populations have been loaded on the network with an average of 15 minutes to receive warning and an average of 30 minutes to prepare to leave. The 30-minute average time for preparation to enter the roadway conforms to the estimates provided by school officials through State of Illinois ESDA personnel. Therefore, the response curve for these populations is similar, with respect to time, to the night scenario shown on Figure 4-1, since that curve is also the combination of a 15-minute and a 30-minute event.

Travel time out of the plume exposure pathway EPZ has been determined using the average vehicle speed calculated by the NETVAC2 model along the appropriate evacuation route. Data for these calculations has been taken from the general population evacuation simulation for the full EPZ winter daytime scenario for both normal and adverse weather conditions. The winter simulation has been utilized for these special facility evacuation time estimates since the winter period is concurrent with the school year. The individual mobilization time estimates for each special facility have been combined with the travel time out of the plume exposure pathway EPZ to calculate the total special facilities evacuation time.

TABLE 4-1

PUBLIC RESPONSE TIME ESTIMATES(1)

	Average Time for Event (minutes) (2)
Receive Warning(3)	15
Leave Work(4)	15
Travel Home(4)	
Normal Weather	30
Adverse Weather(5)	45
Evacuate Home	30

NOTES:

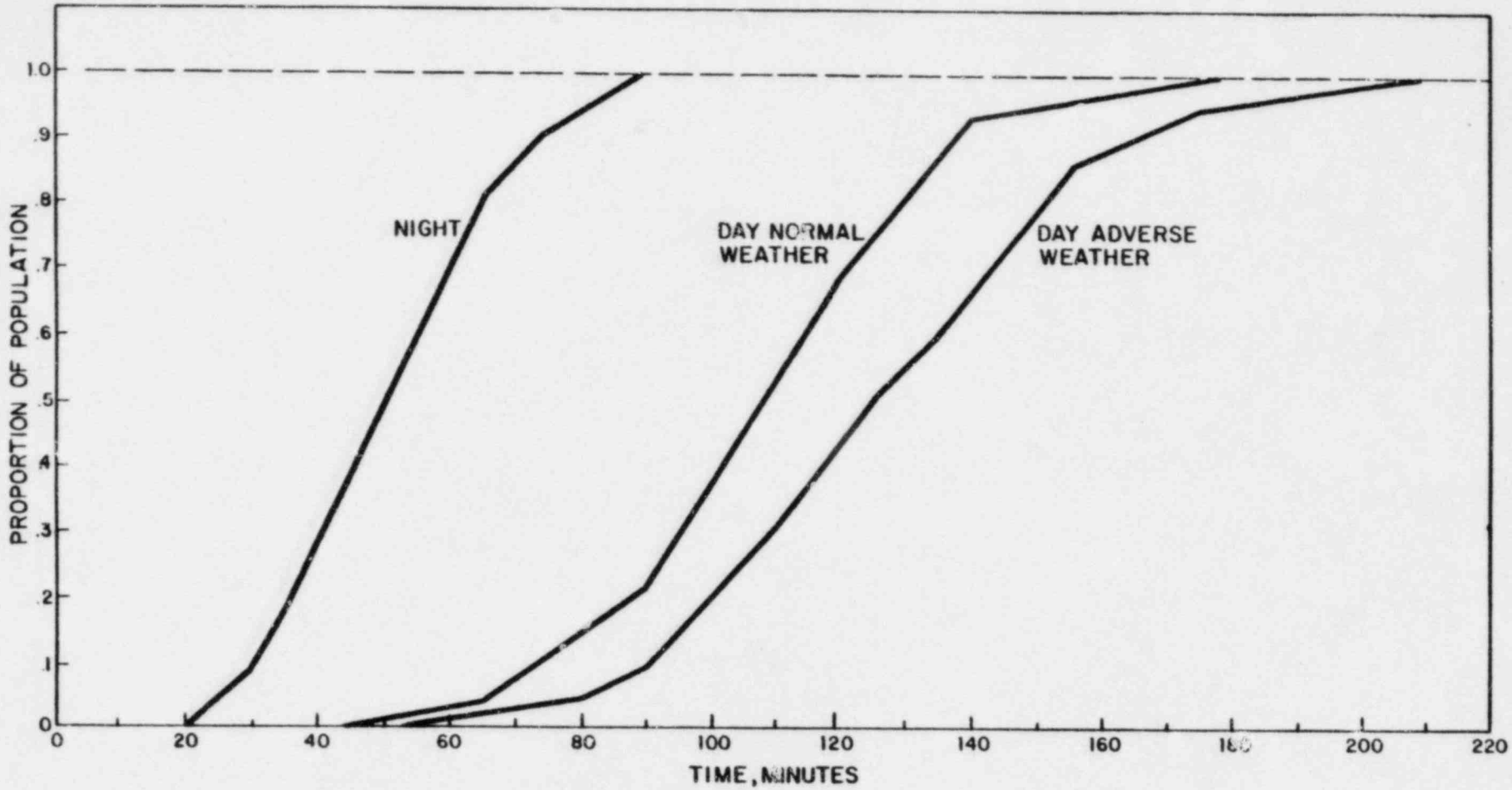
(1) Favorably reviewed by Ogle County and State of Illinois ESDA Officials.

(2) See Figure 4-1 for public response distribution curves.

(3) An average time of 15 minutes has been utilized with a 0 to 30 minute time distribution.

(4) Daytime evacuation scenarios only.

(5) Based on a reduced adverse weather road capacity factor of 0.7.



NOTE:
SEE TABLE 4-1 FOR AVERAGE TIME FOR EVENTS

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 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 Byron 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 Byron Station EPZ, have been numbered in the 800s. 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 Ogle 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 rural divided highways.

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SECTION 6

EVACUATION TIME ESTIMATES

6.1 GENERAL PUBLIC EVACUATION TIMES

Evacuation time estimates for the general public, including mobilization and travel times, have been 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 has been analyzed for four population combinations associated with summer and winter, day and night times, and normal and adverse weather conditions. Thus, a total of eighty evacuation scenarios have been considered in this evacuation time estimate study. Table 6-1 presents the evacuation time estimates for these NETVAC2 calculations for each primary evacuation zone.

The NETVAC2 model results have shown 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 about 191 minutes for the daytime scenario and about 106 to 111 minutes for the nighttime scenario. For adverse weather conditions the evacuation time estimates are about 227 minutes during the day, and about 115 to 123 minutes at night for the full EPZ scenario.

In normal weather conditions, the evacuation times for the other 0-10 mile evacuation zones are about 191 minutes during the daytime and range from 106 to 111 minutes for the nighttime condition. The adverse weather time estimates range from 226 to 227 minutes during the daytime and from 114 to 123 minutes during the night.

The evacuation time estimates for the four 0-5 mile evacuation zones in normal weather for the daytime range from about 184 minutes to about 191 minutes, and for the nighttime evacuation from 96 to 110 minutes. The adverse weather condition evacuation time estimates for the four 0-5 mile evacuation zones during the day range from about 217 minutes to 226 minutes, and at night from about 98 to 122 minutes. The evacuation time estimates for the 0-2 mile evacuation zone are only a few minutes less than the 0-5 mile results.

Special events evacuation scenarios, such as the Autumn on Parade in Oregon (attendance approximately 25,000 to 30,000) and large weekend events at the Byron Dragway and Motosport Speedway have been analyzed by separate simulations. These special events do not increase the time required to evacuate (191 minutes) the primary evacuation zones even with the larger number of vehicles associated with these special events.

6.2 SPECIAL FACILITIES EVACUATION TIMES

As discussed in Section 4.2, the evacuation time estimates for special facilities have been calculated separately from those of the general population. These results are shown in Table 6-2. The special facilities evacuation times range from approximately 50 to 60 minutes during normal weather conditions, and from about 51 to about 68 minutes during adverse weather conditions. The largest component of these time estimates is the mobilization time, 45 minutes. This indicates that a significant factor in evacuating many special facilities is the time required to ready persons and necessary vehicles, and not the travel time out of the EPZ.

6.3 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 services 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. The number of emergency service vehicles available for confirmation of evacuation has been discussed with State of Illinois ESDA personnel and 15 vehicles have been assumed. The time estimates for evacuation confirmation are presented in Table 6-3.

TABLE 6-1

EVACUATION TIME ESTIMATES
GENERAL PUBLIC EVACUATION TIMES (1)

Primary Evacuation Zone (2)	Summer				Winter			
	Daytime		Nighttime		Daytime		Nighttime	
	Normal	Adverse	Normal	Adverse	Normal	Adverse	Normal	Adverse
0-2 mile A,B	184	217	110	120	184	217	96	98
0-5 mile A,B,C	188	225	110	122	188	223	105	113
0-5 mile A,B,D	184	217	110	120	184	217	96	98
0-5 mile A,B,E	191	225	110	120	191	226	105	112
0-5 mile A,B,F	184	217	110	120	191	217	105	98
0-10 mile A-F,G	191	227	111	123	191	226	106	115
0-10 mile A-F,H	191	226	111	123	191	226	106	114
0-10 mile A-F,I	191	226	111	122	191	226	106	114
0-10 mile A-F,J	191	227	110	122	191	226	106	114
Full EPZ A-J	191	227	111	123	191	227	106	115

NOTES:

(1) Times have been rounded to nearest minute.

(2) See Figure 2-1.

TABLE 6-2

SPECIAL FACILITIES
EVACUATION TIMES

Facility (2)	Location	Evacuation Time(1) Normal Weather	Evacuation Time(1) Adverse Weather
Oregon Schools	SSW/5-6	55	58
Mt. Morris Schools	WSW/7-8	50	51
Leaf River Schools	WNW/6-7	50	52
Byron Schools	NNE/4-5	53	57
Stillman Valley Schools	ENE/5-6	51	53
Oregon Bible College	SSW/4-5	56	62
Lorado Taft Field Campus	SW/3-4	60	68
Ogle County Educational Co-op	WSW/7-8	50	51
Oregon Annex School	SSW/5-6	54	58
Neighbor's Nursing Home	NNE/4-5	54	58
White Pines Manor	SSW/5-6	54	58
Pine Crest Manor	WSW/7-8	50	51
Ogle County Jail	SSW/4-5	56	62

NOTES:

(1) Times have been rounded to the nearest minute.

(2) Figures 3-11 and 3-13 show Special Facilities locations.

TABLE 6-3

EVACUATION CONFIRMATION TIMES BY
PRIMARY EVACUATION ZONE

Primary Evacuation Zone (1)	Evacuation Confirmation Time (2)
0-2 mile A, B	17
0-5 mile A, B, C	38
0-5 mile A, B, D	30
0-5 mile A, B, E	38
0-5 mile A, B, F	35
0-10 mile A-F, G	157
0-10 mile A-F, H	161
0-10 mile A-F, I	152
0-10 mile A-F, J	152
Full EPZ A-J	349

NOTE:

(1) See Figure 2-1 for evacuation study area locations which comprise the primary evacuation zones.

(2) Evacuation confirmation times have been rounded to the nearest minute.

SECTION 7

CONCLUSIONS AND RECOMMENDATIONS

Based upon this evacuation time estimate study, it has been concluded that the entire population within the plume exposure pathway EPZ for Byron 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 full EPZ in normal weather is approximately 191 minutes. The longest daytime adverse weather evacuation time estimate for the full EPZ is approximately 227 minutes for the full EPZ.

For the eighty baseline, evacuation Scenarios, the NETVAC 2 model results indicate that there has been no queuing (backup) on the evacuation road network during summer or winter, daytime or nighttime evacuations in either normal or adverse weather conditions. Consequently, the evacuation time estimates are only slightly longer than the total public response times.

For the special event evacuation scenarios, the NETVAC2 model results indicate that there will be queuing in the evacuation road network. The special event evacuation simulation of the Autumn on Parade indicates queuing in Oregon at all intersections in the evacutation road network. Also, the special event evacuation simulation of large weekend events at the Byron Dragway and Motosport Speedway indicates queuing along German Church Road south of the town of Byron including the intersection of Route 72, River Road and German Church Road.

As discussed in Section 6.1, these special events do not increase the time required to evacuate the primary evacuation zones. The queuing indicated in the special events simulations could be reduced through the deployment of traffic control personnel.

The results, conclusions, and recommendations of this study have been provided to Ogle County and State of Illinois Emergency Services and Disaster Agency officials.

REFERENCES

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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 perference factor for the j-th outbound link at some intersection. In other words, the relative 'a priori' preference of link j is $PF_j / \sum_k PF_k$ 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 inupt 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.

APPENDIX B

EVACUATION NETWORK NODE IDENTIFICATION

APPENDIX B

EVACUATION NETWORK NODE IDENTIFICATION

Node	Location
5	Rte. 64 & Church Rd.
6*	Rte. 64 & Meridian Rd.
7*	Lindenwood Rd. & Meridian Rd.
8*	Church Rd. & Lindenwood Rd.
11*	Holcomb Rd. & Church Rd.
12*	Holcomb Rd. & Meridian Rd.
13*	Rte. 72 & Meridian Rd.
14	Rte. 72 & Rothwell Rd.
	Rte. 72 (Chicago St.) & Rte. 51
16	Rte. 72 & Stillman Rd.
17*	Stillman Rd. & Holcomb Rd. (east of Stillman Rd.)
18*	Stillman Rd. & Holcomb Rd. (west of Stillman Rd.)
19*	Holcomb Rd. & German Church Rd.
20*	Hill St., Seventh St. & Pine St.
21*	Rte. 64 & German Church Rd.
22*	Rte. 64 & Chana Rd.
23*	Chana Rd. & Brick Rd.
24*	Brick Rd. & Stillman Rd.
28*	Daysville Rd., Honey Creek Rd. & Lowden Rd.
29*	Rte. 64 & Daysville Rd.
30	Rte. 64 & River Rd.
31	Rte. 64 (Washington St.) & Third St.
32*	Third St. & Gale St.

Node	Location
33*	Gale St. & Rte. 2 (Fourth St.)
34	Rte. 2 (Fourth St.) & Rte. 64 (Washington St.)
35*	Rte. 64 & Monroe St.
36*	Rte. 64 & Ridge Rd.
37*	Ridge Rd. & Oregon Trail
38*	Pines Rd. & Ridge Rd. (east of Ridge Rd.)
39*	Pines Rd. & Ridge Rd. (west of Ridge Rd.)
41*	Brayton Rd. & S. McKendrie Ave.
42	N. McKendrie Ave. & Rte. 64 (E. Hitt St.)
43*	Rte. 64 (E. Hitt St.) & Ogle Ave.
44*	Mt. Morris Rd. & West Grove Rd.
45*	West Grove Rd. & Leaf River Rd.
46*	Rte. 2 & Mud Creek Rd.
47*	Rte. 72 & Mt. Morris Rd.
49*	Rte. 72 & Main St.
50*	Rte. 72 & Pecatonica Rd.
51*	Rte. 2 & Rte. 72
52*	Rte. 2 (Main St.) & Tower Rd.
53*	Second St. & Tower Rd.
54	Union St. & Rte. 2 (Main St.)
55*	Second St. & Union St.
56*	Tower Rd. & Mill Rd. (east of Tower Rd.)
57*	Tower Rd. & Mill Rd.

Node	Location
58*	Montague Rd. & Tower Rd.
59*	Pecatonica Rd. & Montague Rd.
62*	Rte. 72, German Church Rd. & River Rd.
63*	Rte. 72 & Kishwaukee Rd.
64*	Rte. 2 & Kennedy Hill Rd.
65*	Kennedy Hill Rd. & McGregor Rd.
66*	McGregor Rd. & Meridian Rd.
67*	Rte. 2 & Meridian Rd.
68*	Meridian Rd. & Kishwaukee Rd.
69*	Stillman Valley Rd. & Meridian Rd.
74	Montague Rd. & Osborne Rd.
75*	Westfield Rd., Kennedy Hill Rd. & Montague Rd.
86*	Stillman Valley Rd. & Rothwell Rd.
88	Rte. 64, 1 block north of Monroe St.
89	Rte. 2 (Fourth St.) & Ford St.
90*	Jackson St., between Rte. 2 & Rte. 64
91*	Rte. 2 & Camling Rd.
92*	Rte. 72 & Junction Rd.
93*	Rte. 2 & Castle Rd.
94*	Rte. 64 (W. Hitt St.) & S. Reynolds Ave.
103*	Rte. 64 & White Rock Rd.
104	Lindenwood Rd. & Stillman Valley Rd.
105*	Brick Rd. & German Church Rd.

Node	Location
106*	Honey Creek Rd. & Chana Rd.
107*	Daysville Rd. (Daysville North City Limits)
108*	River Rd. & Park Rd.
109*	River Rd. & Spring Creek Rd.
110*	River Rd. & Devil's Lane
111*	River Rd. & Razorville Rd.
112*	River Rd. & Byron Dragway Entrance
113*	Ash Rd. & German Church Rd.
114*	German Church Rd. & N. Site Access Rd.
115*	German Church Rd. & S. Site Access Rd.
116*	Rte. 72 & Bradley St.
117*	Stillman Rd. & Valley Dr.
118*	Rte. 72 & Armour Rd.
120*	Holcomb Rd. & Junction Rd.
121	Rothwell Rd. & Edson Rd.
122	Tower Rd. & Byron High School Entrance
124*	Mt. Morris Rd. & Midtown Rd.
125	West Grove Rd. & Adeline Rd.
129*	Kendall Rd. & Montague Rd.
801**	Rte. 51, north of Utility Rd.
802**	Rte. 72, west of Blackwood Rd.
803**	Rte. 51 & Big Mound Rd.
804**	Rte. 51 & Holcomb Rd.

Node	Location
80[illegible]**	Rte. 51 & Lindenwood Rd.
806**	Rte. 64 & First St.
807**	Chana Rd. & Flagg Rd.
[illegible]**	Flagg Rd. & Daysville Rd.
809**	Hay Rd. & Lowden Rd.
810**	Rte. 2, north of Nashua Township line
811**	Ridge Rd. & Henry Rd.
812**	Pines Rd. & Columbian Rd.
813**	Canada Rd. & Lowell Park
814**	Rte. 64, east of Maple Grove Rd.
815**	West Grove Rd., east of Cedar Rd.
816**	Rte. 72, east of Adeline Rd.
817**	Egan Rd. & Leaf River Rd.
818**	Spielman Rd. & Montague Rd.
819**	Pecatonica Rd., south of Murphy Rd.
820**	Osborne Rd., south of Edwardsville Rd.
821**	Westfield Rd., south of Edwardsville Rd.
822**	Severson Rd. & Montague Rd.
823**	Meridian Rd., south of Tipple Rd.
824**	Rte. 2 & Prairie Rd.
825**	Kishwaukee Rd. & Stillman Valley Rd.

* Utilized as a vehicle entry node.

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

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

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.

1	5	806	2690.	12.	11.	6.	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.
2	6	103	10032.	11.	11.	6.	1	1	7	4	F	38.	147.	1.00	1400.	5	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
3	7	8	16500.	10.	9.	6.	1	1	7	4	F	35.	123.	0.90	1078.	805	0.0	980.	5	0.0	0.	11	0.0	0.	0	0.0	0.
4		6	10560.	9.	9.	6.	1	1	7	4	F	31.	137.	0.10	1078.	0	0.0	902.	0	0.0	0.	103	0.0	0.	0	0.0	0.
5	8	5	12672.	9.	9.	2.	1	2	7	4	F	35.	117.	0.05	1022.	0	0.0	902.	0	0.0	0.	806	0.0	0.	0	0.0	0.
6		805	13200.	9.	9.	4.	1	1	7	4	F	28.	150.	0.90	1050.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
7		11	8448.	9.	10.	6.	1	1	7	4	F	28.	179.	0.05	1246.	0	0.0	902.	120	0.0	0.	0	0.0	0.	0	0.0	0.
8	11	120	5280.	9.	10.	6.	1	1	7	4	F	29.	178.	1.00	1246.	804	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
9	12	7	10560.	9.	9.	4.	1	1	7	4	F	31.	133.	0.05	1050.	6	0.0	902.	0	0.0	0.	8	0.0	0.	0	0.0	0.
10		11	15840.	9.	10.	2.	1	1	7	4	F	31.	151.	0.90	1190.	120	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
11		13	15840.	9.	9.	4.	1	1	7	4	F	31.	133.	0.05	1050.	0	0.0	902.	118	0.0	0.	0	0.0	0.	0	0.0	0.
12	13	113	5280.	12.	12.	4.	1	1	7	4	F	21.	293.	1.00	1400.	14	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
13	14	121	16896.	9.	9.	6.	1	1	7	4	F	28.	154.	0.05	1078.	86	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
143		92	13200.	12.	12.	1.	1	1	7	4	F	38.	155.	0.95	1400.	15	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
14	15	801	5000.	12.	12.	6.	1	1	8	4	F	38.	145.	0.40	1400.	0	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
15		802	5000.	10.	10.	6.	1	1	7	4	F	35.	142.	0.20	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
16		803	5000.	12.	12.	6.	1	1	8	4	F	38.	145.	0.40	1400.	0	0.0	1400.	0	0.0	0.	0	0.0	0.	0	0.0	0.
17	16	13	3168.	12.	12.	6.	1	1	7	4	F	21.	299.	0.75	1400.	118	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
18		69	14256.	9.	11.	2.	1	1	7	4	F	31.	172.	0.25	1358.	86	0.0	902.	0	0.0	0.	68	0.0	0.	0	0.0	0.
19	17	12	10032.	10.	10.	2.	1	1	7	4	F	31.	151.	0.75	1190.	11	0.0	980.	7	0.0	0.	0	0.0	0.	0	0.0	0.
20		117	19008.	11.	11.	6.	1	1	7	4	F	38.	147.	0.25	1400.	16	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
21	18	17	1056.	10.	10.	6.	1	1	7	4	F	35.	142.	0.75	1246.	117	0.0	980.	12	0.0	0.	0	0.0	0.	0	0.0	0.
132		104	11560.	11.	11.	6.	1	1	7	4	F	35.	162.	0.25	1400.	24	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
22	19	18	18216.	10.	9.	4.	1	1	7	4	F	35.	120.	0.25	1050.	0	0.0	980.	104	0.0	0.	17	0.0	0.	0	0.0	0.
23		105	13464.	12.	10.	6.	1	1	7	4	F	28.	178.	0.75	1246.	21	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
24	20	39	18480.	10.	10.	6.	1	1	7	4	F	28.	178.	0.10	1246.	0	0.0	980.	0	0.0	0.	39	0.0	0.	0	0.0	0.
145		93	15840.	14.	12.	6.	1	1	7	4	F	28.	224.	0.90	1400.	810	0.0	1294.	0	0.0	0.	0	0.0	0.	0	0.0	0.
25	21	29	9240.	11.	12.	6.	1	1	7	4	F	38.	163.	0.20	1400.	30	0.0	1058.	0	0.0	0.	107	0.0	0.	0	0.0	0.
26		22	17424.	11.	12.	6.	1	1	7	4	F	38.	163.	0.80	1400.	6	0.0	1058.	106	0.0	0.	0	0.0	0.	0	0.0	0.
27	22	6	13464.	11.	11.	2.	1	1	7	4	F	38.	141.	0.90	1358.	103	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
28		106	7920.	10.	10.	6.	1	1	7	4	F	38.	129.	0.10	1246.	807	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
29	23	22	7128.	11.	11.	2.	1	1	7	4	F	31.	172.	1.00	1358.	106	0.0	1058.	0	0.0	0.	6	0.0	0.	0	0.0	0.
30	24	23	4224.	9.	9.	6.	1	1	7	4	F	28.	154.	1.00	1078.	0	0.0	902.	0	0.0	0.	22	0.0	0.	0	0.0	0.
31	28	808	22176.	11.	11.	6.	1	1	7	4	F	38.	147.	0.50	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
32		809	19270.	10.	10.	4.	1	1	7	4	F	21.	232.	0.50	1218.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
33	29	30	1584.	15.	11.	6.	1	1	7	4	F	31.	180.	0.45	1400.	31	0.0	1372.	0	0.0	0.	0	0.0	0.	0	0.0	0.
34		21	8976.	11.	12.	6.	1	1	7	4	F	38.	163.	0.45	1400.	22	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
35		107	8976.	11.	12.	1.	1	1	7	4	F	35.	171.	0.10	1400.	28	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
36	30	29	1584.	10.	11.	6.	1	1	7	4	F	31.	180.	0.05	1400.	21	0.0	980.	107	0.0	0.	0	0.0	0.	0	0.0	0.
37		31	1320.	13.	13.	1.	2	1	4	3	F	31.	178.	0.95	1400.	34	0.57	475.	0	0.0	0.	32	0.57	240.	0	0.0	0.
38	31	32	2640.	16.	12.	3.	1	1	5	3	T	21.	259.	0.05	1358.	0	0.0	822.	33	0.0	0.	0	0.0	0.	0	0.0	0.
39		34	1056.	11.	12.	2.	2	1	4	3	F	21.	256.	0.95	1344.	35	0.44	392.	0	0.0	0.	33	0.44	840.	0	0.0	0.
40	32	31	2640.	22.	12.	3.	1	1	5	3	T	21.	259.	0.05	1358.	0	0.0	1164.	0	0.0	0.	34	0.43	840.	0	0.0	0.
41		33	1320.	17.	12.	3.	1	1	4	3	F	17.	310.	0.95	1358.	0	0.0	1282.	34	0.0	0.	20	0.0	0.	0	0.0	0.
42	33	34	2640.	12.	12.	5.	1	1	4	3	F	28.	198.	0.05	1386.	0	0.0	866.	0	0.0	0.	35	0.56	840.	0	0.0	0.
43		20	1580.	13.	13.	6.	1	1	7	4	F	28.	246.	0.95	1400.	93	0.0	1215.	38	0.0	0.	0	0.0	0.	0	0.0	0.
44	34	33	2640.	16.	12.	5.	1	1	4	3	F	28.	198.	0.10	1386.	20	0.0	1199.	0	0.0	0.	0	0.0	0.	0	0.0	0.
45		35	2640.	11.	12.	6.	1	1	7	4	F	28.	224.	0.90	1400.	88	0.0	1058.	0	0.0	0.	37	0.0	0.	0	0.0	0.
46	35	37	17160.	10.	12.	6.	1	1	7	4	F	35.	179.	0.10	1400.	0	0.0	980.	0	0.0	0.	38	0.0	0.	0	0.0	0.
138		88	2640.	12.	12.	6.	1	1	7	4	F	38.	163.	0.90	1400.	36	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
47	36	37	10032.	10.	9.	6.	1	1	7	4	F	31.	137.	0.05	1078.	38	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
48		43	7920.	12.	12.	6.	1	1	7	4	F	28.	224.	0.95	1400.	42	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
49	37	38	6600.	10.	11.	6.	1	1	7	4	F	31.	180.	1.00	1400.	39	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
50	38	39	2640.	10.	10.	1.	1	1	7	4	F	35.	134.	1.00	1176.	811	0.0	980.	612	0.0	0.	0	0.0	0.	0	0.0	0.

51	39	812	10560.	12.	10.	4.	1	1	7	4	F	35.	142.	0.50	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
52		811	10560.	10.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
53	41	813	15840.	11.	11.	1.	1	1	7	4	F	28.	192.	0.25	1344.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
54		42	1848.	16.	12.	6.	1	2	7	4	F	21.	299.	0.75	1400.	124	0.0	1400.	0	0.0	0.	94	0.0	0.	0	0.0	0.
55	42	124	7920.	11.	12.	6.	1	1	7	4	F	31.	199.	0.05	1400.	44	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
147		98	1848.	15.	13.	6.	1	1	7	4	F	31.	219.	0.95	1400.	814	0.0	1372.	0	0.0	0.	0	0.0	0.	0	0.0	0.
56	43	42	1056.	15.	12.	6.	1	1	7	4	F	21.	299.	1.00	1400.	94	0.0	1372.	124	0.0	0.	0	0.0	0.	0	0.0	0.
57	44	47	10560.	12.	12.	5.	1	1	7	4	F	35.	178.	0.50	1400.	0	0.0	1137.	0	0.0	0.	816	0.0	0.	0	0.0	0.
58		125	10560.	10.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	815	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
59	45	44	7656.	12.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	125	0.0	1137.	47	0.0	0.	0	0.0	0.	0	0.0	0.
60		49	11880.	12.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	817	0.0	1137.	0	0.0	0.	47	0.0	0.	0	0.0	0.
61	46	43	21648.	14.	11.	6.	1	1	7	4	F	38.	147.	0.75	1400.	42	0.0	1294.	0	0.0	0.	0	0.0	0.	0	0.0	0.
136		89	10560.	15.	12.	2.	1	1	4	3	F	38.	140.	0.25	1344.	34	0.0	1116.	0	0.0	0.	0	0.0	0.	0	0.0	0.
62	47	816	10560.	12.	12.	6.	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.
63	49	47	8448.	12.	11.	6.	1	1	7	4	F	28.	202.	0.90	1400.	816	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
64		817	22968.	12.	11.	6.	1	1	7	4	F	28.	202.	0.05	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
65		45	11880.	10.	10.	6.	1	1	7	4	F	35.	142.	0.05	1246.	0	0.0	980.	44	0.0	0.	0	0.0	0.	0	0.0	0.
66	50	59	26400.	11.	12.	6.	1	1	7	4	F	38.	163.	0.05	1400.	819	0.0	1058.	0	0.0	0.	818	0.0	0.	0	0.0	0.
67		49	13200.	12.	12.	6.	1	1	7	4	F	31.	199.	0.95	1400.	47	0.0	1137.	817	0.0	0.	45	0.0	0.	0	0.0	0.
68	51	50	21120.	12.	12.	6.	1	1	7	4	F	38.	163.	0.75	1400.	49	0.0	1137.	59	0.0	0.	0	0.0	0.	0	0.0	0.
134		91	15680.	13.	11.	2.	1	1	7	4	F	38.	141.	0.25	1358.	46	0.0	1215.	0	0.0	0.	0	0.0	0.	0	0.0	0.
69	52	51	4224.	11.	11.	6.	1	1	7	4	F	38.	147.	0.20	1400.	50	0.0	1058.	0	0.0	0.	91	0.0	0.	0	0.0	0.
70		53	1848.	11.	11.	6.	1	1	4	3	F	21.	253.	0.20	1330.	122	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
71		54	2112.	21.	12.	0.	1	1	5	3	T	24.	215.	0.60	1316.	64	0.0	1107.	62	0.0	0.	0	0.0	0.	0	0.0	0.
72	53	52	1848.	11.	11.	6.	1	1	4	3	F	21.	253.	0.50	1330.	0	0.0	783.	51	0.0	0.	54	0.0	0.	0	0.0	0.
73		122	1320.	11.	11.	6.	1	1	4	3	F	14.	380.	0.50	1330.	56	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
74	54	62	1584.	10.	9.	2.	1	1	7	4	F	21.	195.	0.10	1022.	0	0.0	980.	0	0.0	0.	63	0.0	0.	0	0.0	0.
75		64	13200.	12.	12.	6.	1	1	7	4	F	35.	179.	0.45	1400.	67	0.0	1137.	0	0.0	0.	65	0.0	0.	0	0.0	0.
76		52	2112.	21.	12.	0.	1	1	5	3	T	24.	215.	0.45	1316.	51	0.0	1107.	53	0.0	0.	0	0.0	0.	0	0.0	0.
77	55	53	2112.	17.	12.	0.	1	1	5	3	T	17.	301.	0.50	1316.	0	0.0	879.	122	0.0	0.	52	0.0	0.	0	0.0	0.
78		54	1584.	21.	12.	0.	1	1	5	3	T	21.	251.	0.50	1316.	62	0.0	1107.	52	0.0	0.	64	0.0	0.	0	0.0	0.
79	56	122	1320.	11.	10.	6.	1	1	4	3	F	14.	356.	0.50	1246.	53	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
80		57	2640.	15.	10.	6.	1	1	4	3	F	35.	142.	0.50	1246.	0	0.0	1116.	58	0.0	0.	0	0.0	0.	0	0.0	0.
81	57	56	2640.	10.	10.	6.	1	1	4	3	F	35.	142.	0.25	1246.	0	0.0	700.	122	0.0	0.	0	0.0	0.	0	0.0	0.
82		58	23760.	13.	11.	6.	1	1	4	3	F	35.	152.	0.75	1330.	0	0.0	783.	74	0.0	0.	0	0.0	0.	0	0.0	0.
83	58	129	1848.	11.	10.	6.	1	1	7	4	F	31.	158.	0.40	1246.	59	0.0	1058.	0	0.0	0.	820	0.0	0.	0	0.0	0.
84		74	1188.	11.	10.	6.	1	1	7	4	F	31.	158.	0.60	1246.	75	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
85	59	818	5280.	10.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
86		819	2904.	10.	10.	6.	1	1	7	4	F	35.	142.	0.50	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
87	62	63	6072.	12.	12.	4.	1	1	7	4	F	35.	176.	0.50	1400.	116	0.0	1137.	0	0.0	0.	68	0.0	0.	0	0.0	0.
88		54	1584.	21.	11.	2.	1	1	5	3	T	21.	243.	0.50	1274.	0	0.0	1107.	64	0.0	0.	52	0.0	0.	0	0.0	0.
89	63	116	3168.	12.	12.	6.	1	1	7	4	F	31.	199.	0.75	1400.	16	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
90		60	22704.	11.	10.	3.	1	1	7	4	F	31.	153.	0.25	1204.	825	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
91	64	65	12672.	10.	10.	6.	1	1	7	4	F	38.	129.	0.10	1246.	75	0.0	980.	66	0.0	0.	0	0.0	0.	0	0.0	0.
92		67	22176.	11.	12.	6.	1	1	7	4	F	38.	163.	0.90	1400.	824	0.0	1058.	0	0.0	0.	66	0.0	0.	0	0.0	0.
93	65	66	16368.	10.	10.	6.	1	1	7	4	F	38.	129.	0.10	1246.	0	0.0	980.	0	0.0	0.	823	0.0	0.	0	0.0	0.
94		75	7392.	11.	10.	6.	1	1	7	4	F	38.	129.	0.90	1246.	821	0.0	1058.	822	0.0	0.	0	0.0	0.	0	0.0	0.
95	66	823	5808.	11.	11.	6.	1	1	7	4	F	38.	147.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
96	67	66	1848.	11.	11.	6.	1	1	7	4	F	38.	147.	0.10	1400.	823	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
97		824	4752.	11.	11.	6.	1	1	7	4	F	38.	147.	0.90	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
98	68	825	11880.	11.	12.	6.	1	1	7	4	F	38.	163.	1.00	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
99	69	68	5280.	12.	10.	6.	1	1	7	4	F	38.	129.	0.50	1246.	0	0.0	1137.	825	0.0	0.	0	0.0	0.	0	0.0	0.
100		86	10032.	9.	9.	6.	1	1	7	4	F	31.	137.	0.50	1078.	825	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
101	74	820	4488.	9.	10.	6.	1	1	7	4	F	38.	129.	0.50	1246.	0	0.0	902.	0	0.0	0.	821	0.0	0.	0	0.0	0.
102		75	10560.	11.	11.	6.	1	1	7	4	F	38.	147.	0.50	1400.	822	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.

103	75	821	2640.	11.	10.	6.	1	1	7	4	F	38.	147.	0.50	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
104		822	4224.	11.	11.	6.	1	1	7	4	F	38.	147.	0.50	1400.	0	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
105	86	825	6336.	9.	9.	6.	1	1	7	4	F	28.	154.	1.00	1078.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
139	88	36	17424.	12.	12.	6.	1	1	7	4	F	38.	163.	1.00	1400.	43	0.0	1137.	0	0.0	0.	37	0.0	0.	0	0.0	0.
137	89	34	4220.	15.	12.	2.	1	1	4	3	F	38.	140.	0.50	1344.	33	0.56	1116.	35	0.0	0.	0	0.0	0.	0	0.0	0.
142		46	10560.	13.	12.	2.	1	1	7	4	F	38.	157.	0.50	1400.	0	0.0	1215.	0	0.0	0.	43	0.0	0.	0	0.0	0.
140	99	88	2000.	12.	12.	6.	1	1	7	4	F	28.	224.	0.50	1400.	0	0.0	1137.	0	0.0	0.	0	0.0	0.	36	0.0	1137.
141		89	2000.	12.	12.	6.	1	1	7	4	F	28.	224.	0.50	1400.	0	0.0	1137.	34	0.0	0.	46	0.0	0.	0	0.0	0.
133	91	46	16000.	13.	11.	2.	1	1	7	4	F	38.	141.	0.50	1358.	89	0.0	1215.	43	0.0	0.	0	0.0	0.	0	0.0	0.
135		51	15680.	11.	11.	2.	1	1	7	4	F	38.	141.	0.50	1358.	0	0.0	1058.	0	0.0	0.	50	0.0	0.	0	0.0	0.
144	92	15	5280.	12.	12.	1.	1	1	7	4	F	38.	156.	1.00	1400.	802	0.0	1137.	803	0.0	1500.	801	0.0	1500.	0	0.0	0.
146	93	810	10560.	14.	12.	4.	1	1	7	4	F	28.	224.	1.00	1400.	0	0.0	1294.	0	0.0	0.	0	0.0	0.	0	0.0	0.
148	94	814	10560.	15.	13.	6.	1	1	7	4	F	31.	219.	1.00	1400.	0	0.0	1372.	0	0.0	0.	0	0.0	0.	0	0.0	0.
106	103	5	5280.	12.	12.	6.	1	1	7	4	F	38.	163.	1.00	1400.	806	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
107	104	24	2112.	10.	11.	6.	1	1	7	4	F	31.	180.	1.00	1400.	0	0.0	980.	23	0.0	0.	0	0.0	0.	0	0.0	0.
108	105	21	5280.	12.	12.	5.	1	1	7	4	F	28.	222.	1.00	1400.	0	0.0	1137.	29	0.0	0.	22	0.0	0.	0	0.0	0.
109	106	807	20064.	10.	10.	2.	1	1	7	4	F	35.	136.	1.00	1190.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
110	107	28	3432.	10.	12.	1.	1	1	7	4	F	35.	171.	1.00	1400.	808	0.0	980.	809	0.0	0.	0	0.0	0.	0	0.0	0.
111	108	30	10560.	12.	11.	6.	1	2	7	4	F	31.	180.	1.00	1400.	0	0.0	1137.	31	0.0	0.	29	0.0	0.	0	0.0	0.
112	109	108	9504.	10.	11.	6.	1	1	7	4	F	38.	147.	0.50	1400.	30	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
113		110	13200.	11.	11.	2.	1	1	7	4	F	38.	141.	0.50	1358.	111	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
114	110	111	6864.	11.	11.	5.	1	1	7	4	F	38.	145.	1.00	1400.	112	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
115	111	112	8976.	11.	11.	6.	1	1	7	4	F	38.	147.	1.00	1400.	62	0.0	1058.	0	0.0	0.	54	0.0	0.	0	0.0	0.
116	112	62	4224.	11.	10.	4.	1	1	7	4	F	21.	232.	1.00	1218.	63	0.0	1058.	0	0.0	0.	0	0.0	0.	0	0.0	0.
117	113	62	16896.	12.	12.	6.	1	1	7	4	F	31.	199.	1.00	1400.	54	0.0	1137.	63	0.0	0.	0	0.0	0.	0	0.0	0.
118	114	113	3960.	12.	12.	3.	1	1	7	4	F	31.	194.	0.50	1400.	62	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
119		115	1320.	12.	12.	6.	1	1	7	4	F	28.	224.	0.50	1400.	19	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
120	115	114	1320.	12.	12.	6.	1	1	7	4	F	28.	224.	0.50	1400.	113	0.0	1137.	0	0.0	0.	0	0.0	0.	0	0.0	0.
121		19	4277.	12.	10.	6.	1	1	7	4	F	28.	178.	0.50	1246.	105	0.0	1137.	0	0.0	0.	18	0.0	0.	0	0.0	0.
122	116	16	10560.	12.	12.	4.	1	1	7	4	F	21.	293.	1.00	1400.	13	0.0	1137.	0	0.0	0.	69	0.0	0.	0	0.0	0.
123	117	16	3696.	11.	11.	6.	1	2	7	4	F	21.	269.	1.00	1400.	69	0.0	1058.	13	0.0	0.	0	0.0	0.	0	0.0	0.
124	118	14	2640.	12.	12.	6.	1	1	7	4	F	31.	199.	1.00	1400.	92	0.0	1137.	0	0.0	0.	121	0.0	0.	0	0.0	0.
125	120	804	5280.	9.	11.	6.	1	1	7	4	F	31.	180.	1.00	1400.	0	0.0	902.	0	0.0	0.	0	0.0	0.	0	0.0	0.
126	121	86	5280.	9.	9.	6.	1	1	7	4	F	31.	137.	1.00	1078.	0	0.0	902.	825	0.0	0.	0	0.0	0.	0	0.0	0.
127	122	56	1320.	10.	10.	6.	1	1	4	3	F	14.	356.	0.50	1246.	0	0.0	700.	0	0.0	0.	57	0.0	0.	0	0.0	0.
128		53	1320.	11.	11.	6.	1	1	4	3	F	14.	380.	0.50	1330.	52	0.0	783.	0	0.0	0.	0	0.0	0.	0	0.0	0.
129	124	44	7920.	10.	12.	6.	1	1	7	4	F	35.	179.	1.00	1400.	47	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
130	125	815	2640.	10.	10.	6.	1	1	7	4	F	35.	142.	1.00	1246.	0	0.0	980.	0	0.0	0.	0	0.0	0.	0	0.0	0.
131	129	59	20592.	12.	12.	6.	1	1	7	4	F	21.	299.	1.00	1400.	818	0.0	1137.	819	0.0	0.	0	0.0	0.	0	0.0	0.