Analysis of Time Required to Evacuate Transient and Permanent Population from Various Areas Within the Plume Exposure Pathway Emergency Planning Zone

San Onofre Nuclear Generating Station

Revision 3

Prepared for
Southern California Edison Company
Rosemead, California

by

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(Continued)

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CHAPTER 1

INTRODUCTION

The San Onofre Nuclear Generating Station (SONGS) is located in San Diego County approximately four miles south of San Clemente, California (Figure 1). Situated on a man-made shelf cut into the San Onofre Bluffs, the station has been producing electricity from one generating unit since 1967. Southern California Edison Company and San Diego Gas and Electric Company, co-owners of SONGS, are presenting constructing two additional generating units which, when operational, will have more than four times the generating capacity of the first unit.

The Nuclear Regulatory Commission has requested that all applicants for construction permits and licensees of nuclear power plants under construction provide information regarding time estimates for evacuation of the resident and transient population within a radius of about 10 miles from the nuclear reactor sites. The Nuclear Regulatory Commission has adopted regulations which set forth the information to be included and the format to be employed in the development and presentation of evacuation time estimates. These are set forth in "Appendix 4 Evacuation Time Estimates Within the Plume Exposure Pathway Emergency Planning Zone, Revision 1," of NUREG-0654. [1] This section specifies the geographical area to be considered and the scenarios to be evaluated, and indicates the general methodology to be employed in the analysis.

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(1) "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," U.S. Nuclear Regulatory Commission, November, 1980 (Revision 1).

In response to the Nuclear Regulatory Commission request and regulatory requirement, Southern California Edison Company has retained and directed Wilbur Smith and Associates to conduct an evacuation time assessment for the land areas surrounding the San Onofre Nuclear Generating Station (SONGS). This evacuation time study includes:

1. The identification, based upon the most recent available information, of the resident and transient populations within the area, and the location of institutions or facilities requiring special evacuation assistance.

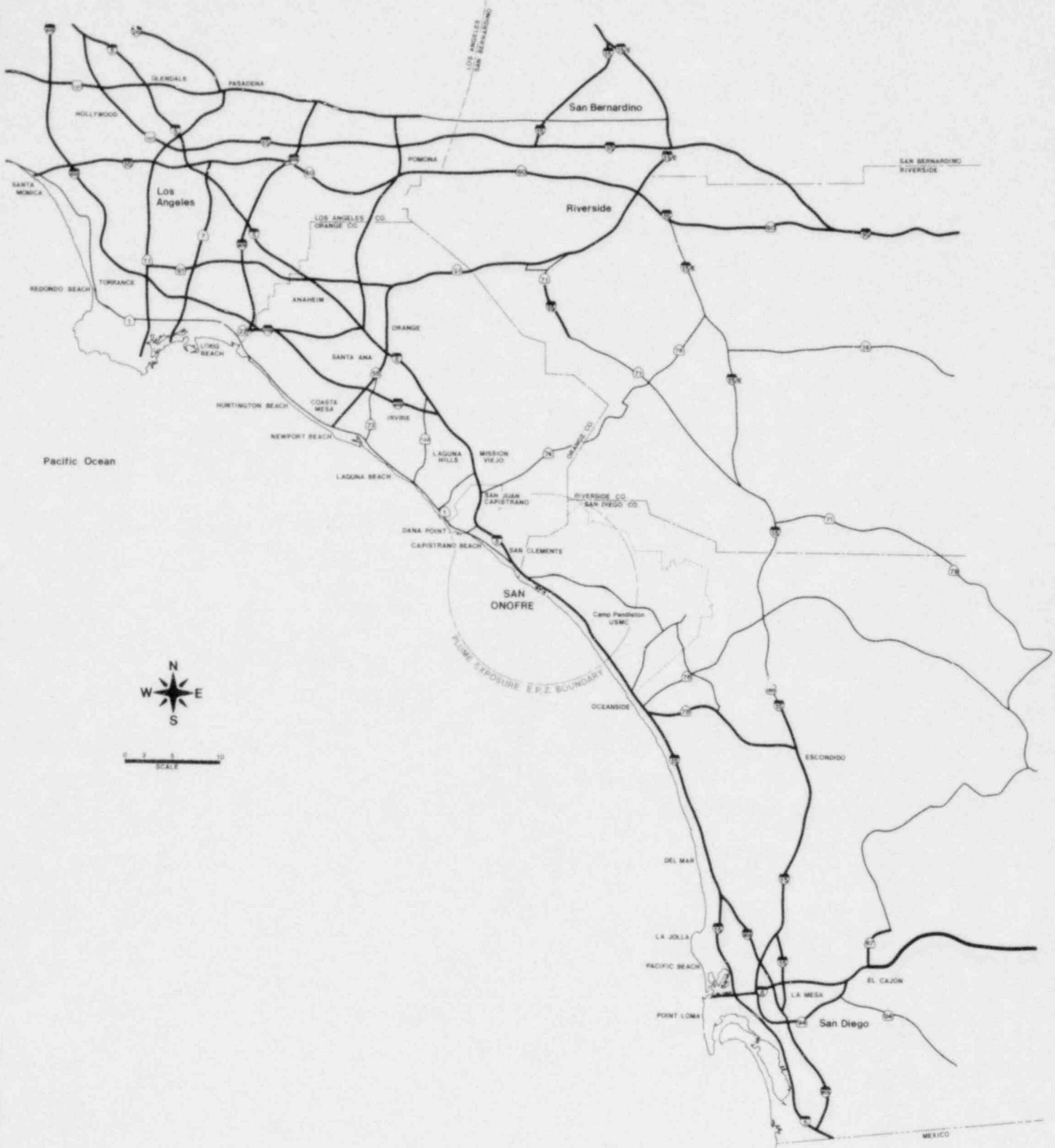
2. An evaluation of the planned evacuation routes relative to their traffic-carrying capacity during an evacuation.

3. An evaluation of the response time and travel time requirements for the area population, and special institutions, to evacuate the area.

4. The assessment of evacuation time requirements if major damage occurs to the primary evacuation routes as a result of an earthquake (or similar disruptive event) occurring prior to or during the evacuation.

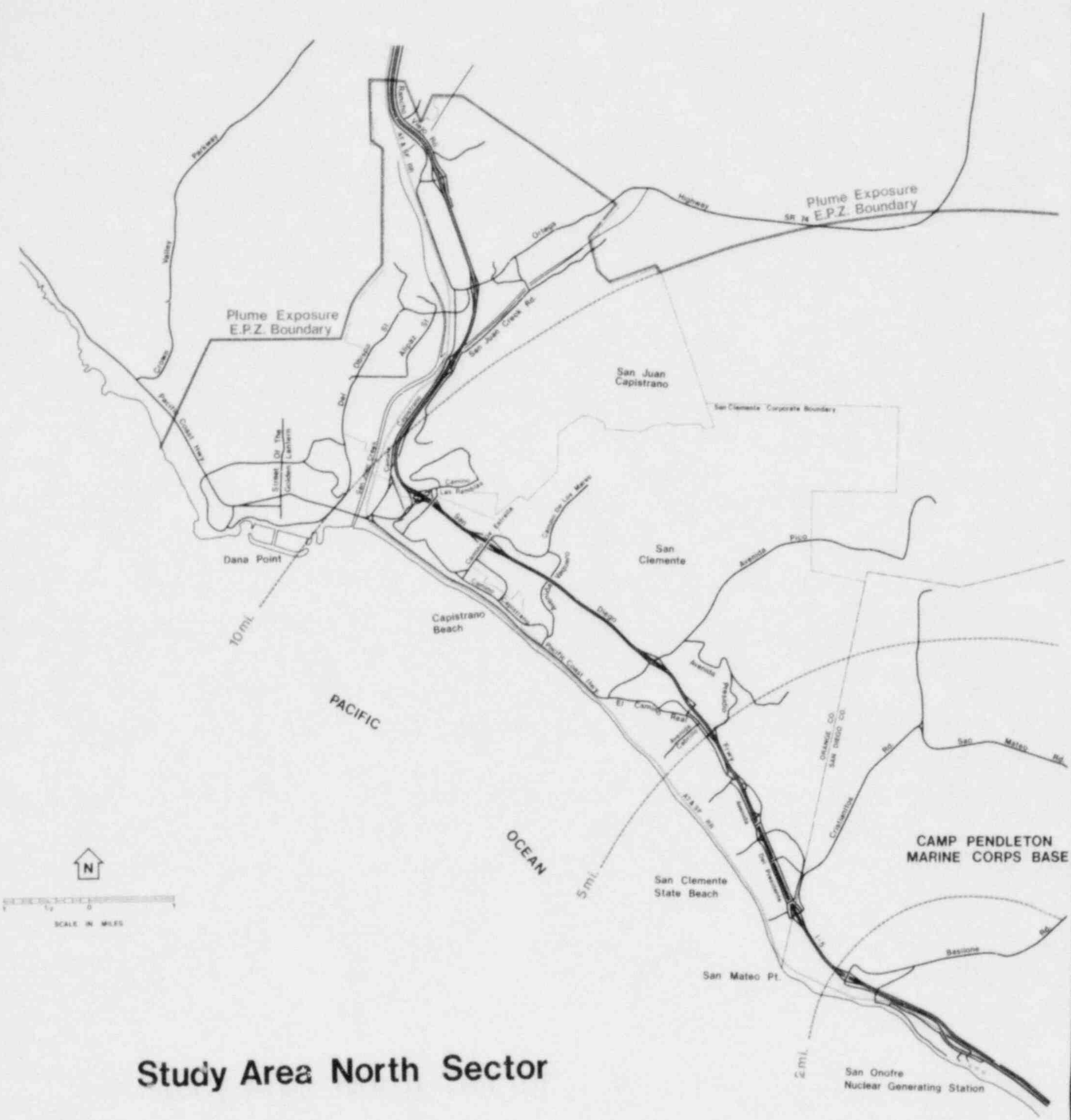
Emergency Planning Zone

Evacuation time estimates were prepared to reflect full or partial evacuation of the Plume Exposure Pathway Emergency Planning Zone (EPZ). As stipulated by the Nuclear Regulatory Commission, the EPZ must include those land areas located within an approximate 10-mile radius of the SONGS site. As illustrated in Figures 2a and 2b, the 10-mile radius boundary encompasses all or a portion of the cities of San Clemente, San Juan Capistrano, the unincorporated area of Capistrano Beach, and Dana Point, and



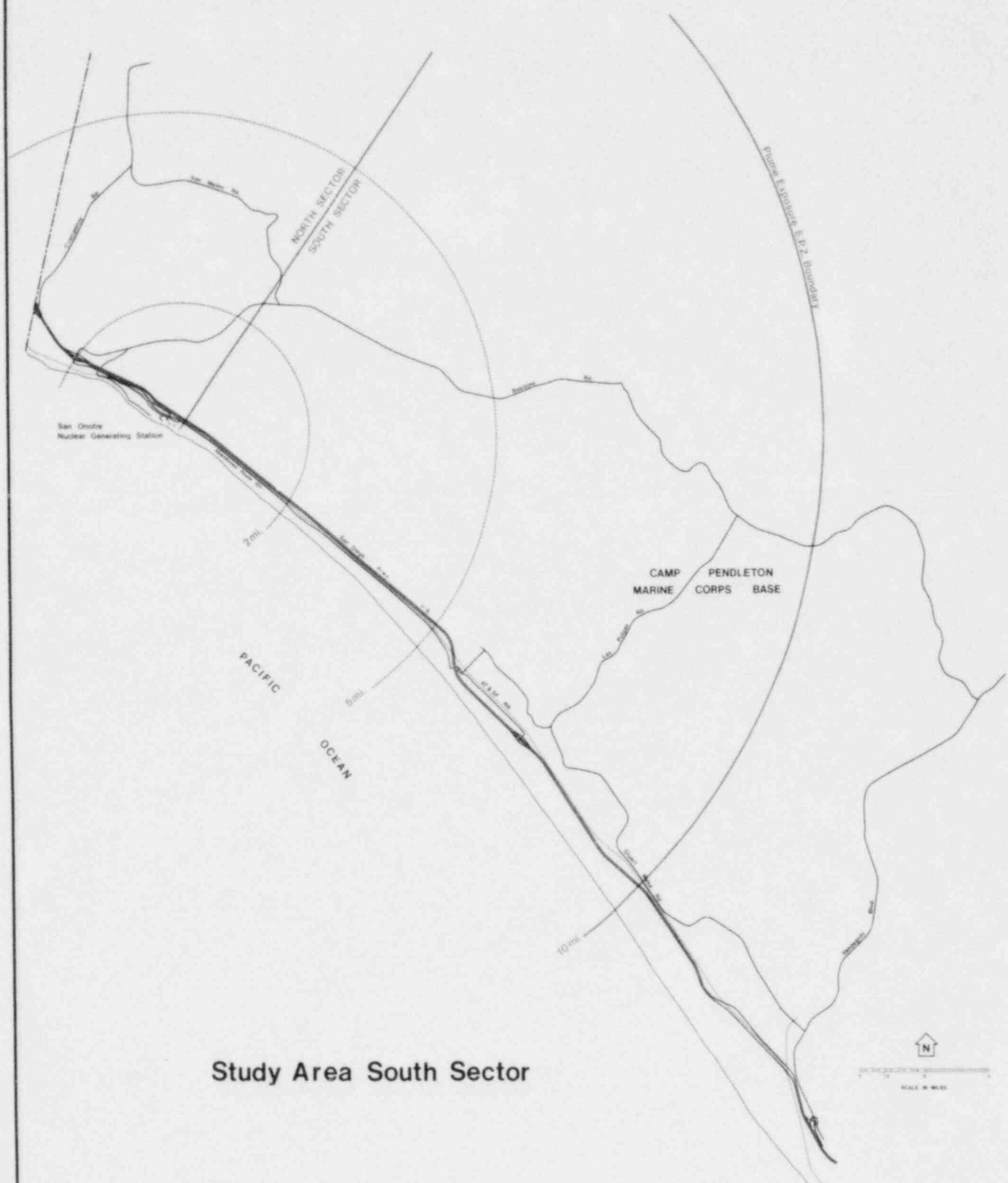
Regional Location Map

Figure 1



Study Area North Sector

Figure 2a



Study Area South Sector

Figure 2b

the northern section of the United States Marine Corps Base (Camp Pendleton). Although the 10-mile radius actually bisects San Juan Capistrano, Dana Point and Ortega, the entire area and population of these communities have been included within the evacuation time estimates and incorporated within the emergency response plans for the local agencies. This expanded planning area is hereinafter referred to as the "EPZ" or study area.

EPZ Population - Within the EPZ boundary there are five urbanized areas representing an estimated resident population of approximately 79,600. In Orange County, the area within the EPZ boundary contains an estimated resident population of 62,400, or 78 per cent of the EPZ population. The remaining EPZ resident population (17,200) is located in San Diego County within the Camp Pendleton United States Marine Corps Base.

It is estimated that approximately 32,150 non-residents visit the area on a peak weekend day during the summer. This transient population is generally concentrated in or near the state and local beach recreation areas. Also included in the transient population segment are local workers who reside outside the study area. Estimated 1980 resident and transient populations are summarized in Table 1 for identifiable areas within the EPZ. Daytime summer weekend population distribution by 22.5° Sector is summarized in Appendix A for the San Onofre EPZ.

Major Transportation Facilities - One interstate route (I-5) and two state routes (S.R. 1 and S.R. 74) serve the area within the EPZ limits. Interstate Route 5, (San Diego Freeway) is the primary north-south route serving traffic between Orange and San Diego Counties.

State Route 1 (Pacific Coast Highway) provides secondary north-south access within the EPZ north sector. State Route 74

Table 1

1980 POPULATION ESTIMATES

AREA	RESIDENT POPULATION	TRANSIENT POPULATION
San Clemente	27,200 (a)	14,900 (a)
San Juan Capistrano	18,500 (c)	1,000 (b)
Capistrano Beach	6,200 (d)	1,400 (b)
Dana Point	10,500 (d)	1,600 (b)
Doheny State Beach	0 (e)	5,750 (f)
San Clemente State Beach	* (e)	2,500 (f)
San Onofre State Beach	0 (e)	4,500 (f)
Camp Pendleton Enlisted Men's Beach Club	* (g)	500 (h)
Camp Pendleton (i)	17,200 (g)	N.A.
TOTAL	79,600	32,150

(a) Source: San Clemente Public Works and Planning Department.
(b) Based on Chamber of Commerce visitation figures.
(c) San Juan Capistrano Public Works and Planning Department.
(d) Source: Orange County Environmental Management Agency.
(e) Source: California Department of Parks and Recreation.
(f) Source: (e); Assumes maximum utilization.
(g) Source: Base Operations and Training Office, Camp Pendleton. Marine Corps Base.
(h) Source: (g), Estimated maximum utilization based on average summer and weekend visitation of 300 persons.
(i) Camp population within a ten-mile radius from SONGS excluding recreation beach.
(*) Negligible
N.A. Not Available

(Ortega Highway) is the only regional east-west roadway within the study area. Ortega Highway is a winding, mountain-area roadway which connects the area to I-15 approximately 32 miles to the east.

Figures 2a and 2b illustrate the network of arterial and freeway facilities which presently provide the major travel-ways in the study area. These major roadways are restricted somewhat by geographic features and tend to either parallel the coastline or follow the inland valleys and canyons.

Emergency Response Plans

This study has been completed in consultation and cooperation with primary local response agencies responsible for evacuation planning and implementation within the area. The evacuation time estimates presented in this study were developed to reflect the plans and procedures set forth in the relevant emergency response plans which have been developed and adopted by the various local agencies. These plans set forth the agency responsibilities, assigned functions, and procedures to be utilized in the event of a radiological incident at SONGS. The principal emergency response plans include:

- California Nuclear Power Plant Emergency Response Plan, July, 1978.
- Orange County Emergency Response Plan, San Onofre Nuclear Generating Station, December, 1980.
- San Diego County Nuclear Power Plant Emergency Response Plan, December 1980.
- Camp Pendleton Marine Corps Base Emergency Response Plan, April, 1979 (with revisions).

- San Clemente Nuclear Power Plant Emergency Response Plan, March, 1981.
- San Juan Capistranc Radiological Emergency Response Plan, December 1980.

CHAPTER 2

STUDY METHODOLOGY

The evacuation time assessment was conducted through the use of a computerized transportation model package developed by Wilbur Smith and Associates especially for the purpose of estimating time requirements and related information for the evacuation of large areas and populations. This model provides a simulation of the evacuation traffic conditions, given the public response characteristics, route capacities, and vehicular demands. The methodology for applying this computer model to assess evacuation time can be divided into four phases: data collection; development of the evacuation network; the computer evacuation time assessment for various scenarios; and analysis of findings and recommendation to reduce evacuation time. A general description of the methodology is summarized in the following sections.

Data Collection

Collection of the data necessary for the evacuation time estimate includes the following efforts:

- o Review of Emergency Response Plans for the various jurisdictions and agencies within the EPZ.

- o Inventory of existing highway facilities, including facility, type, number of lanes, operating speeds, and traffic controls.

- o Review of existing land use and recreation facilities.

- o Assemblage of current demographic data for the area.

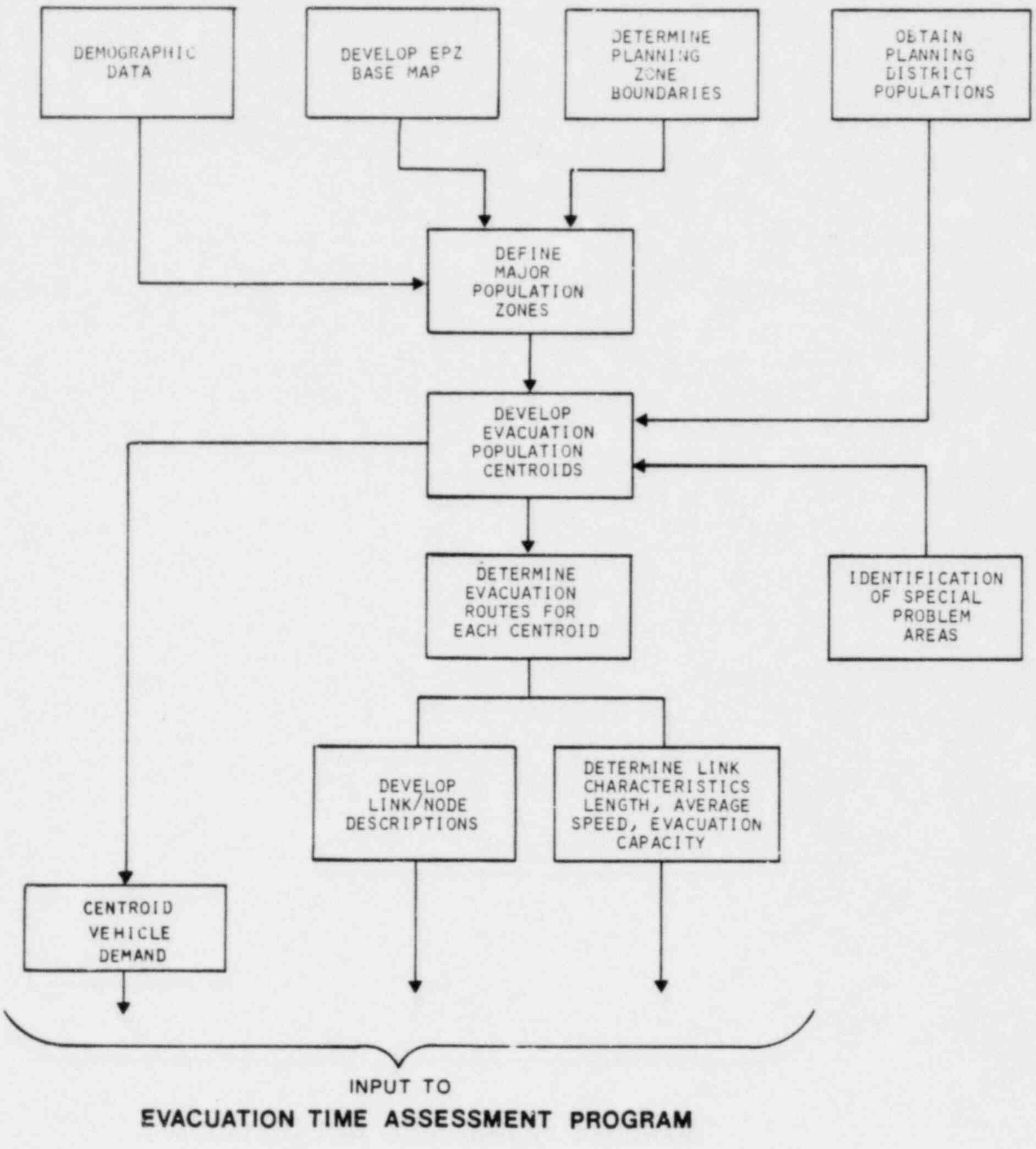
Contacts were made with local and regional planning agencies, county and state highway departments, and other local and county officials responsible for emergency response planning. Available data on existing traffic characteristics, transportation facilities, land use and demography were supplemented by extensive field reconnaisance in the study area as well as interviews with those local agencies which would have a primary responsibility or role for an evacuation of part or all the EPZ.

Evacuation Route Network Development

The evacuation route network outlined in the EPZ emergency response plans was developed for input to the evacuation time estimate computer model. The procedure for accomplishing this is illustrated in Figure 3 and described in the following paragraphs.

Development of EPZ Base Maps - Base maps of the study area were prepared using USGS Quandrangle Maps. Since the most recent USGS maps of this area were last revised in 1974, local municipality maps were utilized to update the area roadway network and the areas of development.

Determination of Planning Zone Boundaries - The EPZ was first divided into various planning sectors in a manner which complies with the format requested by the Nuclear Regulatory Commission. These sectors were further subdivided into planning subsectors which are used in the respective County Emergency Response Plans to facilitate public communication and instructions.



EVACUATION ROUTE DEVELOPMENT
WORK FLOW

Wilbur Smith and Associates

FIGURE 3

Subsector boundaries generally follow readily identifiable natural geographic boundaries or manmade features. The criteria by which these sectors and subsectors were developed is discussed in Chapter 4.

Definition of Population Centroids - The area population was assigned to individual planning subsectors based on available demographic data. Where possible, detailed 1980 Census results were used to identify population within each subsector. In most instances, the areas for which demographic data was available were too large to relate to local access capacities to the primary evacuation routes. Therefore, it was necessary to subdivide most planning subsectors into a number of population centroids. The number of centroids was generally governed by the number of arterial roadways and interchanges providing access to the major evacuation route facilities. The population assignments to centroids were based upon census tract information where available, or upon relative intensity of land use as indicated by local planning agencies.

Traffic routing between each centroid and the major evacuation routes were determined on the basis of directness and available roadway capacity. Also, all centroids from the same subsector must be routed onto the same principal evacuation route. This facilitates the process by which the public is informed of their corresponding evacuation routes and assigned reception centers.

Development of Roadway Link/Node Descriptions - To employ a computerized time assessment, the roadways to be used as evacuation routes must be defined as a series of "links" and "nodes." Each "link" represents a specific segment of roadway which has common geometric features as well as similar operational characteristics. A pair of "nodes" identifies the limits of each link and are located wherever the evacuation routes:

- Intersect or converge,
- Change operational characteristics; i.e., capacity or operating speed.

The traffic characteristics of each link in the evacuation network were determined by traffic engineering analyses. The link was described by the two node numbers; the "A" node at the beginning and the "B" node at the end of the link. A listing of the link characteristics was prepared relating the two node numbers, the link distance, operating speed, and link capacity (the number of lanes times the assigned lane capacity). The operating speeds and lane capacities reflect average operating conditions. These speeds are adversely affected where vehicle volumes exceed the assigned capacity.

Centroid Population and Average Car Occupancy - Another input to the Evacuation Time Assessment Program consisted of the population and vehicles to be employed in estimating the volume of vehicles to be evacuated from the area represented by each of the EPZ centroids. In this assessment, it was assumed that each household would evacuate as a unit where possible. Therefore, evacuation of resident population was assumed to occur in one vehicle per household for those households having access to one or more vehicles. Vehicle occupancy factors of 1.2 and 3 persons per vehicle were used in estimating vehicle demand for transient workers and transient tourists/ beach users, respectively.

Identification of Special Institutions and Recreation Areas - Several population segments would require special evacuation consideration. These are identified in the respective emergency response plans. These include resident population not having access to an automobile and special institutions and areas such as schools, nursery schools, hospitals, nursing homes, jails, recreational areas, and beaches. Each of these was given special consideration concerning transportation requirements and evacuation time estimates.

Evacuation Time Assessment for Various Scenarios

The evacuation time assessment was performed through the use of an evacuation simulation computer model. A general description of the evacuation time assessment model is presented below. A more detailed description of the computer model and procedures involved is presented in Appendix B.

Evacuation Time Assessment Simulation Model - For each evacuation time simulation, the number of trips originating from each centroid is specified by the user. These trips are loaded onto the network at the rate corresponding to the composite mobilization time distribution representing public response time following an evacuation order. This mobilization time is the combination of individual time distributions to receive the warning, travel home, and make preparations to leave home. Also, input to the computer program is the route to be followed by trips from each individual centroid.

In the evacuation simulation procedure, the total evacuation period is analyzed as a series of small time increments. Within each time increment, trips are loaded onto the roadway network from the zone centroids in accordance with the mobilization time distribution. Vehicles flow through the network with each's progress along its evacuation route constrained first by the operating speeds assigned to each roadway section. As demand exceeds the normal capacity on specific links, the simulation model develops traffic queues on approach links to the point of constraint. Where queues build on a route, they introduce a delay time on the constrained link (roadway segment) and on further upstream links. Each vehicle entering the queue will experience a proportionate time delay while moving through the queuing area. These delays are encountered by all traffic on the capacity-constrained links until the vehicle volumes decrease to below the link capacity. Once beyond the vehicle queuing area, the vehicles again regain the normal link operating speeds until either they encounter a new queue or pass beyond the evacuation area.

The model produces several kinds of evaluation information. These include, the total evacuation time and a distribution of the percentage of trips reaching safety by elapsed time from start of evacuation. The above distributions may also be produced for trips leaving from any specified subareas within the total evacuation area. Average travel time and delay time is calculated for trips exiting the EPZ for each successive time increment within the total evacuation period.

The simulation model can also provide "snapshots" of transport system conditions at specified instants of time within the evacuation period. These "snapshots" consist of link volume, queue lengths, average delay by link, and volume-capacity ratios for each link in the system.

Recommendations for Reducing Evacuation Time

Following the analysis of evacuation times for several scenarios, centroid evacuation assignments were re-evaluated to determine whether alternative routings could reduce the overall evacuation time. After centroid routings were reassigned to balance vehicle demand on primary evacuation routes, the network was checked by re-running the evacuation time assessment program.

In addition to the evacuation route refinement exercise, additional traffic control measures were identified which would expedite the evacuation.

CHAPTER 3

GENERAL ASSUMPTIONS

Various assumptions were made in the analysis of evacuation times. The most significant of these are presented in the sections which follow.

1. Emergency evacuation of the general public from the EPZ will be performed largely from the home by the family as a single unit. This assumption is prefaced by the following quote: [(1)]". . . people will not evacuate an area, regardless of the danger, if their family group is separated, unless they know that members of their family are safe, accounted for, and that arrangements have been made for them to evacuate." This psychological pressure is so prevalent and strong that the above assumption appears justified. To assure that segments of the family are safe and accounted for, a system of reception centers and a reception center plan have been provided for in the County emergency response plans. In this analysis it is assumed that resident households would evacuate as a single unit thereby generating a vehicle demand rate of one car per household.

2. Experience gained in a large range of evacuations indicates that private vehicles [(2)] ". . . were the predominant mode for evacuation (more than 99 per cent). Population density ranged from approximately 15 persons per square mile to 20,000 persons per square mile." It was assumed in this analysis that

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(1) Evacuation Risks - An Evaluation, U.S. Environmental Protection Agency, Office of Radiation Programs, EPA-520/6-74-002, June, 1974, p. 49.

(2) Ibid., p. 52.

93 per cent of the households in the study area would have access to at least one vehicle.[3] Under the emergency response plans, persons without private vehicle transportation would be provided transportation, at their telephone request, by vehicles arranged especially for this purpose. Only a small number of these public transportation vehicles, probably between 100 to 500 vehicles, would use the evacuation routes. This number of vehicles would not be expected to affect the computed evacuation times of the general population evacuating in their personal automobiles.

3. It has been observed that not all persons will evacuate the EPZ. "In many cases, even when presented with a grave threat, people refuse to evacuate."[4] This source continues, "Results of this study indicate that approximately six per cent of the total population refused to evacuate." Other reports indicate this figure can be as high as 50 per cent. It is believed that a majority of this hesitance to evacuate is based on fear of exposing their property to looting and vandalism. Notwithstanding this evidence, this time assessment study assumed that all persons, resident and visitor, evacuate.

4. It has been assumed that the traffic network within the EPZ has been isolated from external traffic. Diversion of through traffic around the affected area is assumed to begin within 30 minutes after the evacuation warning has been issued.

5. All residents and/or employees in the EPZ have been provided, in advance, sufficient information regarding the assigned evacuation route from their place of residence or employment.

6. Assumptions used in the estimation of vehicle demand requirements for different segments of the population are included in Chapter 5.

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(3) 1970 Census.

(4) Evacuation Risks - An Evaluation, U.S. Environmental Protection Agency, Office of Radiation Programs, EPA-520/6-74-002, June, 1974, p. 48.

7. Assumptions concerning beach utilization are included in Chapter 5.

8. Vehicle capacities of study area roadways under adverse weather conditions are assumed to be 85 per cent of vehicle capacities during normal weather conditions.

9. Assumptions concerning evacuation time assessment program inputs for Earthquake/Evacuation scenarios are included in Chapter 9.

CHAPTER 4

EMERGENCY PLANNING ZONE

The Plume Exposure Emergency Planning Zone (EPZ) was divided into a system of evacuation sectors and subsectors to facilitate the planning and analysis of evacuation requirements. The study area is divided into evacuation sectors to permit partial evacuations of the study area, based upon the nature of the radiological emergency and the wind directions at the time of the event. The sector boundaries reflect radial distances and direction from SONGS, and geographic features.

Analysis subsectors are used in the various emergency response plans to associate specific neighborhoods and activity areas with evacuation route assignments and to permit evacuation by smaller population increments if necessary. For the evacuation time analyses, these subsectors provide a base for grouping and quantification of demographic data.

For purposes of the computer evacuation time assessment, the subsectors are further subdivided into one or more population centroids (Chapter 7) for the purpose of assigning traffic to specific evacuation routes in the roadway network.

Evacuation Sectors

Evacuation sectors were designated to comply with the format as requested by the Nuclear Regulatory Commission for the area within the Plume Exposure Emergency Planning Zone (EPZ). The sector requirements are:

Radial Distance From Site	Area Division
0 to 2 miles	four 90° sectors
2 to 5 miles	four 90° sectors
5 to 10 miles	four 90° sectors
0 to 10 miles	entire EPZ

As previously discussed, the five-mile and ten-mile radial distances were extended where necessary to avoid bisecting incorporated areas or communities. Also, the compass locations of the sector boundaries were oriented so as to avoid dividing densely populated areas.

Due to the coastal location of SONGS, the relatively straight coastline, and the tendency of prevailing winds to be either onshore or offshore, the 180° sector boundary was aligned with the coastline. With this orientation, it was only necessary to identify two 90° sectors for the purpose of evaluating land evacuation beyond the two-mile radius. (See Figures 4a and 4b.) The northern 90° sector includes the densely populated residential communities, while the southern 90° sector includes beach area activities, scattered activities along I-5, and the Camp Pendleton facilities. Thus, the 90° sector boundary, oriented perpendicular to the coastline, results in the location of the great majority of the EPZ population within a single 90° northern sector. The southern sector includes primarily those areas having unique evacuation requirements -- the State beach areas and the Marine Corps activities.

Emergency Planning Zone Subsectors

Specific subsectors were developed to encompass existing population concentrations and/or easily identifiable land uses. Subsectors were delineated to follow existing political boundaries, natural and manmade features, or other readily recognizeable features. For those areas comprised of family military housing or barracks concentrations, the approximate areas of habitation were outlined as the subsector boundary.

The EPZ subsectors are depicted in Figures 4a and 4b. Each subsector has been assigned an identification number for later reference. A brief description of the area encompassed by each subsector is presented in Appendix C.

The subsectors comprising each NRC-prescribed sector are as follows:

Radial Sector	Radial Distance from SONGS	Subsectors
Both	0-2 Miles	11, 12
North	2-5 Miles	1, 2, 3
	5-10 Miles	4, 5, 6, 7
	10 Miles - EPZ Boundary	8, 9
South	2-5 Miles	11, 12
	5-10 Miles	12

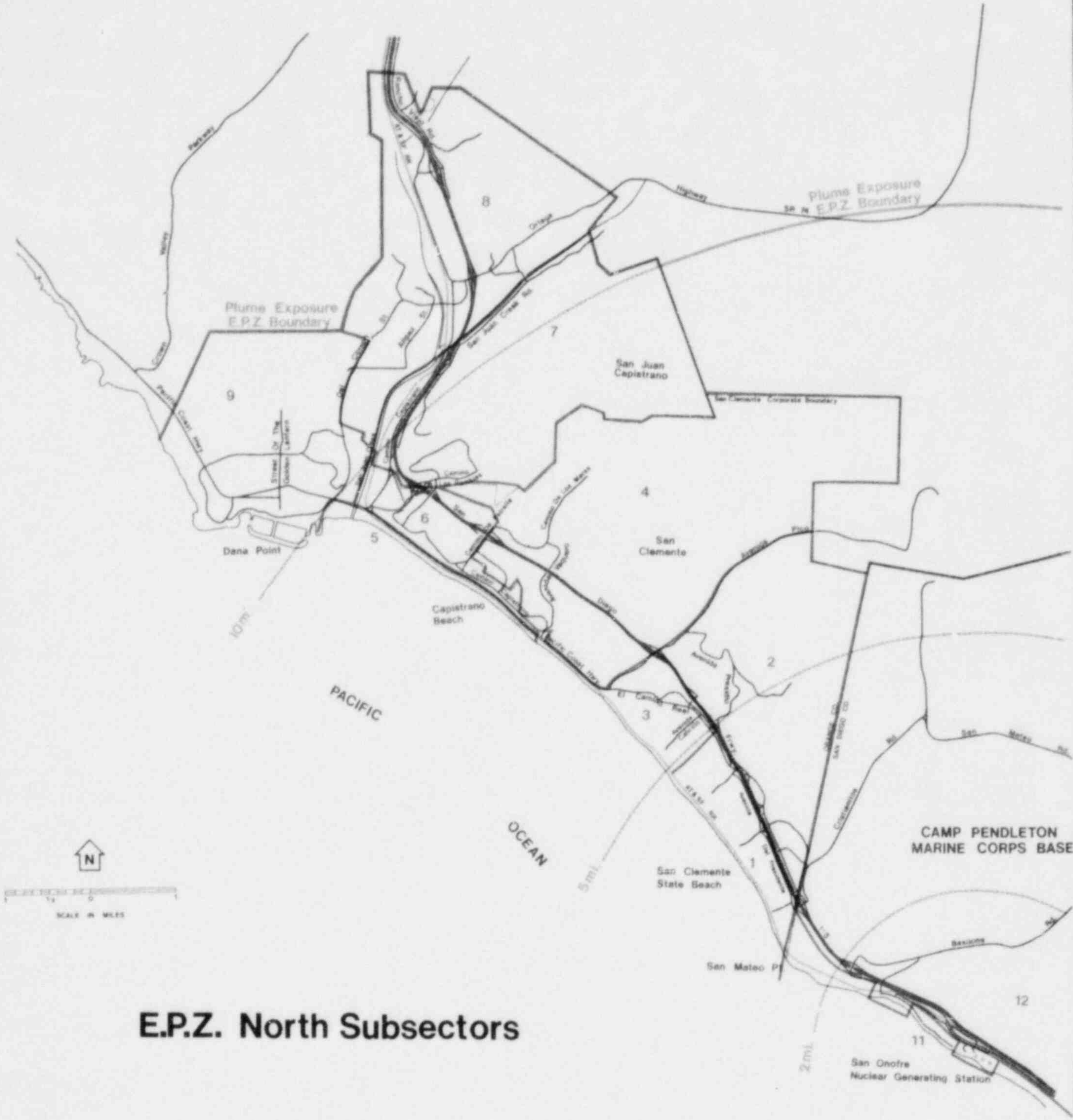
The estimated 1980 resident and transient populations are presented for each EPZ subsector in Table 2.

Table 2

EPZ PERMANENT AND TRANSIENT POPULATION SUMMARY[(a)]

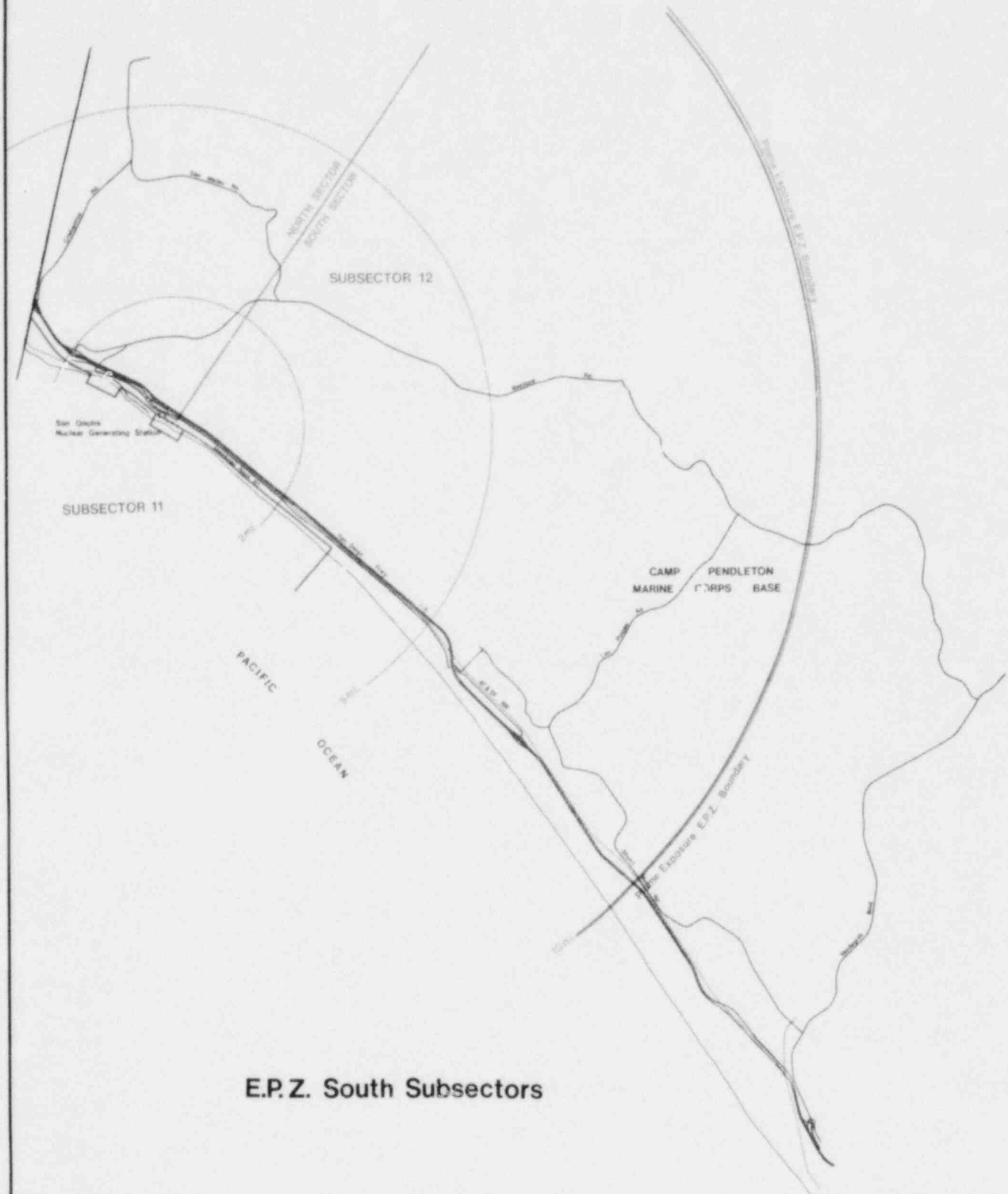
SUBSECTOR	ALL SCENARIOS RESIDENT	SUMMER WEEKEND WORKER	SUMMER WEEKEND TOURIST/ BEACH	SUMMER WEEKDAY WORKER	SUMMER WEEKDAY TOURIST/ BEACH	NIGHTTIME WORKER	NIGHTTIME TOURIST/ BEACH
11	0	30	4,260	10	1,650	0	390
1	4,400	60	3,530	50	1,140	10	270
2	6,500	10	60	40	50	0	50
3	10,200	350	7,440	450	2,970	20	60
4	7,000	40	0	40	0	0	0
5	100	20	4,370	10	1,740	0	150
6	6,000	10	920	10	560	0	0
7	3,650	0	60	0	50	0	0
8	14,850	120	540	260	500	40	150
9	10,500	70	1,040	160	630	20	60
TOTAL	63,200	710	22,166	1,030	9,290	90	1,130

(a) Excludes Camp Pendleton Marine Corps Base (Subsector 12).



E.P.Z. North Subsectors

Figure 4a



E.P.Z. South Subsectors

Figure 4b

CHAPTER 5

EVACUATION DEMAND ESTIMATES

Demographic data within the EPZ boundary was reviewed to identify population characteristics and other pertinent factors which would affect evacuation vehicle demand. Current resident population estimates were obtained from local planning agencies and reflect preliminary U.S. Census Bureau 1980 census figures. Estimates for the transient population segment are based upon information obtained from local agency plans and reports, area reconnaissance, and interviews with public officials.

In an evacuation of this type, the key factors which would contribute to the total evacuation time is the relationship between the mode of transportation used by the populace and the capacity of the established transportation network to handle that mode. The populace within the study area can be classified in five groups by transportation need. These groups are:

- o Permanent residents who own automobiles
- o Permanent residents without automobiles
- o Transients (visitors and non-resident employees)
- o School children
- o Special populations having restricted mobility.

The following section identifies the transportation requirements and vehicle demand expected for each population segment.

Automobile-Owning Resident Population

Household automobile ownership data from the 1970 Census indicates that approximately 93 per cent of the households within the study area had access to one or more automobiles. It is likely that this percentage has increased since 1970. However, since substantiating 1980 Census data was not available at the time of this analysis, the 1970 Census automobile ownership data was used.

In the estimation of evacuation vehicle demand it is assumed that families will tend to evacuate as a unit. (See Chapter 3.)

Accordingly, if each auto-owning household within the EPZ were to use a single vehicle, this would yield an evacuation totalling 25,400 vehicles for this population segment. Resident population vehicle demand is summarized by subsector in Table 3.

Vehicle demand estimates for this segment of the population are assumed to remain constant for the four evacuation scenarios, which yields a conservative estimate for the weekday scenario. This results from the fact that the family car for many of single auto-owning households may be outside the area at the place of work and thus not available at the time of evacuation.

Residents Without Automobiles

Household automobile ownership data from the 1970 Census reveals that 7 per cent of the households in the study area do not have access to an automobile. Applying the average rate of 2.34 persons per household to the number of households without autos yields an estimated 4,450 persons who may require transportation assistance. This demand estimate included many who are residents of nursing homes, which are addressed as special institutions. It also includes many school-age children in these

Table 3

EVACUATION VEHICLES GENERATED BY SUBSECTOR[a]

SUBSECTOR	ALL SCENARIOS RESIDENT	SUMMER WEEKEND WORKER	SUMMER WEEKEND TOURIST/ BEACH	SUMMER WEEKDAY WORKER	SUMMER WEEKDAY TOURIST/ BEACH	NIGHTTIME WORKER	NIGHTTIME TOURIST/ BEACH
11	0	25	1,420	10	550	0	130
1	1,870	50	1,175	40	380	10	0
2	2,740	10	20	35	15	0	15
3	4,655	290	2,480	375	990	15	20
4	3,080	35	0	35	0	0	0
5	35	15	1,455	10	580	0	50
6	2,020	10	305	10	185	0	0
7	1,210	0	20	40	15	0	0
8	5,140	100	180	220	165	35	50
9	4,665	55	345	135	210	20	20
TOTAL	25,415	590	7,400	910	3,090	80	285

(a) Excludes Camp Pendleton Marine Corps Base (Sibsector 12).

households, who, if an evacuation occurs on a school day, would be provided transportation through the school authorities.

Another segment of the population which may require public transportation are those members of households having only one vehicle available. Under the weekday scenario, it is possible that the family automobile could be outside of the evacuation area at the breadwinner's place of work. Such families may require assistance if an evacuation were to occur on a weekday without sufficient warning time to permit the family commuter to return home to evacuate the family members.

Census data indicates that approximately 34 per cent of the households in the area have access to only one vehicle. Based upon regional work trip patterns, it is estimated that approximately 25 per cent of these one-car households have workers who commute more than 20 miles from home and would be beyond the traffic control/diversion perimeter. Applying an average household occupancy rate of 1.34 persons per household to the one-car-households left without autos yields an additional total of 3,100 persons who may also require transportation assistance.

As stipulated in the Orange County Emergency Response Plan, the Orange County Emergency Services Division will coordinate the dispatch of public transportation as necessary to provide for individuals and families lacking transportation.[1] Interviews with representatives from Orange County Transit District (OCTD) revealed that the average seating capacity of their bus fleet is approximately 45 persons per bus. Since most riders would be carrying at least one parcel or handbag, a more conservative seating capacity of 40 persons per bus was applied in determining bus demand. Applying the above factors to the segment of population without autos produces a minimum public

(1) ORANGE COUNTY EMERGENCY RESPONSE PLAN/SAN ONOFRE NUCLEAR GENERATING STATION, December 1980, p. V-12.

transportation demand of 112 buses for the evening and weekend scenario and 189 for the weekday scenario. (School children are not accounted for in this bus demand for the weekday scenario since they are addressed as a separate requirement.)

Transient Population

Transient population can be divided into two categories, workers and tourists/park visitors. Transient workers are defined as persons who reside outside the EPZ and travel into the area for employment reasons. Based upon regional employment characteristics, it is estimated that approximately 1,630 transient workers are present in the study area on an average weekday. Using the regional average vehicle occupancy of 1.2 persons per vehicle for work trips produces an estimated 1,360 vehicles for transient workers in the EPZ. In the weekend scenario, it is assumed that approximately 50 per cent of the average weekday transient worker population would be in the area. This translates into approximately 670 transient worker vehicles.

The second segment of the transient population consists of out-of-town tourists and recreation-oriented visitors. State parks located within the EPZ include San Onofre State Beach, San Clemente State Beach and Doheny State Beach in Dana Point. Other recreation and tourist attractions in the area include San Clemente City Beach, Dana Point Harbor and San Juan Capistrano Mission.

The California Department of Parks and Recreation and City of San Clemente Marine Safety staffs were contacted regarding the estimating of transient tourist/beach populations and vehicle demand. Based upon these discussions, the following assumptions were made:

- For the weekend scenario, the beach population figures reflect peak summer utilization.

- For the weekday scenario, beach visitation would be approximately 40 per cent of the peak summer weekend utilization. This would represent the peak use for a non-holiday summer weekday.

- A maximum of 65 per cent of the total daily beach visitation would be present at any given time during the day.

- Approximately 35 per cent of park and beach populations are local residents, and thus would proceed home before evacuating.

- Average occupancy rate was estimated to be 3 persons per vehicle, which is typical for recreational trips.

On a peak summer weekend approximately 19,600 persons (daily) can be expected to visit the State beaches. An additional 22,000 persons (daily) are estimated to use San Clemente City Beach on a peak summer weekend.

It was assumed that all transients would evacuate the area by automobile. Emergency response plans, however, anticipate that some transients may require transportation assistance. Transient worker and tourist/beach vehicle demand is summarized by subsector in Table 3.

School Children

In the event that an evacuation warning is given on a weekday while school is in session, the Capistrano Unified School District, supported by Orange County Transit District, would provide for the relocation of students from schools within the EPZ to pre-designated schools outside the affected area.(2) The primary means of transport would be by bus.

The evaluation of transportation requirements for school children assumes that the majority of students attending public schools would be transported outside the affected area by school district or public transit buses which would be assigned to each school. Parents of these children would be encouraged to reunite with their children at assigned reception schools outside the EPZ.

Due to the limited number of buses owned by private schools, the emergency response plans envision that children attending these schools would be picked up by their parents prior to evacuating the area. Any children remaining at private schools when public transportation arrives at the school would be evacuated via bus to the pre-designated reception centers.

Prior to assessing bus demand an inventory was made of student enrollment in public and private schools located within the EPZ. A summary of student enrollment in public and private schools within the EPZ is presented in Table 4. Current enrollment for institutions within the study area is approximately 10,170 students for public schools and 1,850 students for private schools.

Interviews with Capistrano Unified School District and Orange County Transit District officials have indicated that the average seating capacity of the buses in their fleets is approximately 45 adults (junior and senior high school students) or 67 children (pre-school and elementary school children). Applying these capacities, it is estimated that approximately 200 buses would

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(2) Ibid., p. V-14.

Table 4

PUBLIC AND PRIVATE SCHOOL ENROLLMENT

SCHOOL	ADDRESS	SECTOR	SUB-SECTOR	STUDENT ENROLLMENT[a]
PUBLIC:				
Concordia Elementary School	3120 Avenida Del Presidentes S.C.	5 MI.	1	693
Ole Hanson Elementary School	189 Avenida La Cuesta S.C.	5 MI.	2	523
San Clemente High School	700 Avenida Pico S.C.	5 MI.	2	1,829
Las Palmas Elementary School	1101 Calle Puente S.C.	5 MI.	3	347
Sho.ecliffs Junior High School	240 Via Socorro S.C.	10 MI.	4	667
Palisades Elementary School	26462 Via Sacramento C.B.	10 MI.	6	592
Harold J. Ambuehl Elementary School	28001 San Juan Creek Road S.J.C.	10 MI.	7	630
San Juan Elementary School	31642 El Camino Real S.J.C.	10 MI.+	8	502
Capistrano Elementary School	31422 Camino Capistrano S.J.C.	10 MI.+	8	354
Marco F. Forster Junior High School	25601 Camino Del Avion S.J.C.	10 MI.+	8	817
Del Obispo Elementary	25591 Camino Del Avion S.J.C.	10 MI.+	8	605
Dana Hills High School	33333 Golden Lantern D.P.	10 MI.+	9	1,933
Richard Henry Dana Elementary School	24242 La Cresta Drive D.P.	10 MI.+	9	680
PRIVATE:				
San Onofre Elementary School	Camp Pendleton	2 MI.		627
Chapel Hill Luthern Pre-School	200 Avenida San Pablo S.C.	5 MI.	2	70
Our Lady of Fatima School	105 South La Esperanza S.C.	5 MI.	2	266
San Clemente Pre-school	163 Avenida Victoria S.C.	5 MI.	3	80
Vantage Foundation Pre-School	141 Avenida Miramar S.C.	5 MI.	3	20
Orange Coast Christian School	107 West Marquita S.C.	5 MI.	3	150
Christ Lutheran Church Pre-School	35522 Camino Capistrano S.C.	10 MI.	4	20
Palisades United Methodist Church Pre-School	27002 Camino De Estrella S.C.	10 MI.	4	20
Capistrano Valley Christian	32032 Del Obispo S.J.C.	10 MI.+	8	600

[a] Registered in 1979-1980

be required to evacuate all public schools within the EPZ. Public school bus demand is summarized by sector in the table below:

SECTOR	BUSES NECESSARY
0 to 5 Miles	65
5 to 10 Miles	38
10 Miles to EPZ Boundary	94
TOTAL	197

Special Populations Having Restricted Mobility

There are four types of institutions within the EPZ which would require assistance in relocation. These are:

- o Hospitals
- o Retirements homes
- o YANA-Check members
- o San Clemente City Jail.

As indicated in the Orange County Emergency Response Plan persons from these institutions would be relocated to hospitals, nursing homes and other appropriate facilities outside the affected area.[3] Transportation requirements for the relocation of these special institutions are identified in the following sections.

Hospitals - Three hospitals are located within the EPZ including San Clemente General, Beverly Manor Convalescent and Capistrano By The Sea. Patients in these facilities would be transported by bus or ambulance. Transportation requirements are based on assessments made by officials representing these medical institutions. A summary of transport vehicle demand is presented below for each facility.

(3) Ibid., p. V-14.

HOSPITAL	SUBSECTOR	PATIENTS AMBULATORY	PATIENTS NON-AMBULATORY	REQUIRED VEHICLES BUS[c]	REQUIRED VEHICLES AMBULANCE
San Clemente General	4	60[a]	20[a]	3	14[d]
Beverly Manor Convalescent	6	126[b]	0	3	0
Capistrano By The Sea	9	82[b]	0	2	0

(a) Estimates provided by San Clemente General Hospital.
(b) Based on maximum capacity of facility.
(c) Assumes an average seating capacity of 43.
(d) Includes 8 single occupancy and 6 double occupancy.

Retirement Homes - Retirement homes located within the EPZ are:

RETIREMENT HOME	SUB-SECTOR	POPULATION[a]
Casa Romantica	3	40
San Clemente Hotel	3	48

(a) Based on maximum capacity of facility.

Discussions with facility operators reveal that all residents would be capable of using bus transportation for evacuation purposes. A total of 88 residents would require two buses having an average seating capacity of 44 or greater.

YANA-Check - The City of San Clemente Police Department maintains an "YANA-Check" (You Are Not Alone) file of persons, principally the elderly, who live alone and have chronic disabilities which may limit their mobility. Transportation assistance for this segment of the population would have to be assigned on an individual basis and the type of transportation required would depend on the nature of the person's disability.

At the present time, there are approximately 40 members on file. It is estimated that 10 per cent of the members would require ambulance service for evacuation. Using a vehicle occupancy rate of two patients per ambulance and 45 persons per bus, two ambulances and one bus would be required.

San Clemente City Jail - As indicated in the San Clemente Radiological Emergency Response Plan, the City Police will register and release those detainees being held for minor offenses with a notice to report to jail within 72 hours following recovery of the area. Persons held for major offenses would be evacuated by Orange County Sheriff or City Police Department vehicles to appropriate detention facilities outside the affected area.

United States Marine Corps Base-Camp Pendleton

Transportation requirements to evacuate areas will be met by the utilization of privately-owned vehicles and government transportation, as available.[4] Peak population figures and transportation requirements for the affected areas within Camp Pendleton are presented in Table 5.

Since the available vehicles within Camp Pendleton Marine Corps Base vary significantly in type and passenger capacity, estimated evacuation demand has been expressed only in terms of persons requiring transportation.

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(4) STANDARD OPERATING PROCEDURES FOR EMERGENCY RESPONSE, U.S. Marine Corps, Camp Pendleton, California, April, 1979, p. K-3-B-1.

Table 5

ESTIMATED PEAK POPULATION AND TRANSPORTATION REQUIREMENTS

Marine Corps Base, Camp Pendleton

AREA	ESTIMATED PEAK POP.	NO. OF PERSONNEL TO BE TRANSPORTED	
		Normal Wk./Hrs.	After Wk./Hrs.
San Onofre Recreation Beach	200	50	50
San Onofre Family Housing	2,906	1,800	300
Mobile Home Park 148 trailers	740	400	100
San Onofre	3,000	3,000	3,000
San Mateo	3,197	3,197	3,197
Horno	3,245	3,245	3,245
Talega	307	307	307
Las Flores	930	930	930
Las Pulgas	2,886	2,886	2,886
TOTAL	17,211	15,765	13,965

CHAPTER 6

BASIS FOR TIME ESTIMATES

An evacuation of part or all of the EPZ could be initiated during the daytime on either a weekday or weekend, or during the nighttime. The evacuation might occur under any of a broad range of seasonal factors, involving varying weather conditions and levels of recreational area activity. As discussed in Chapter 5, a transient population of up to 23,000 persons may be located within the area during the daytime on a peak summer weekend.

The time at which an evacuation is initiated would affect the number of persons to be evacuated, and the response time required to respond to the evacuation warning, and thus affect the time required to evacuate the area. Therefore, several different time periods and conditions, and population response time characteristics were considered in the evacuation time assessment.

Period of Evacuation

A set of three different time periods were selected for the development of evacuation time estimates. These are:

- o Daytime on a peak summer weekend.
- o Daytime on a summer weekday.
- o Nighttime, either on a weekend or weekday.

Summer conditions were chosen for the two daytime scenarios to maximize the population evacuation requirements for the evacuation time assessment. A fourth scenario was considered which reflects an evacuation during adverse weather conditions (rain, fog, snow, sleet, etc.) A fifth set of conditions was also considered. These reflect the affect of an earthquake upon evacuation time estimates through the potential disruption of the transportation facilities prior to or during an evacuation. This is discussed separately in Chapter 9, and would also apply to the disruptive effects on evacuation time of other similar events affecting evacuation routes -- such as flooding, mudslides, and brush fires.

Daytime Summer Weekend Evacuation - In the event that an evacuation takes place on a summer weekend, a significant portion of the populace would be non-residents who are in the area as tourists, workers or for recreation purposes. Resident population in the area would be higher than on a weekday when many residents would be out of the area at their place of work. In this scenario, it is assumed that the evacuation occurs at mid-day when the largest number of persons would be in the area.

Daytime Summer Weekday Evacuation - The second case is the condition where an evacuation takes place during a summer weekday. In this scenario many residents would be outside the area at their place of work. Although this scenario is termed a "summer" weekday, it is assumed that school is in session (early June) with all school children attending classes. In terms of non-residents, this condition would include a substantial number of non-resident workers as well as tourists. Recreation facilities such as State Parks and City beaches are assumed to be utilized at 40 per cent of the peak summer weekend utilization. Analysis of this scenario also assumes that the evacuation occurs during the mid-day period.

Nighttime Evacuation - In the event that an evacuation takes place at night, the maximum resident population and the minimum non-resident population would be in the EPZ. This scenario assumes evacuation warning would occur in the late evening when most people would be at their permanent or temporary place of residence.

Adverse Weather - Several adverse weather conditions occur in the EPZ which could potentially coincide with and impede an evacuation. The most probable would be the effects of heavy rainfall or dense fog. (Blockage of roadways, by earthquake or otherwise, is discussed separately in Chapter 9.)

Although winter weather is generally more severe, the combined effects of peak summer weekend population and reduced visibility from fog or heavy rainfall would produce the "worst case" effects on the evacuation time estimates, and was therefore utilized in this analysis. The weather condition was assumed to result in a 15 per cent reduction in evacuation route capacities.

Notification of Evacuation

There are two distinct events which are necessary to initiate the evacuation. One event is the direct notification of public agencies, schools, and institutions requiring special evacuation considerations. The second event is the dissemination of the evacuation warning to the general population. Both of these events must include instructions regarding the sectors to be evacuated. The first event is assumed to be accomplished by telephone from the various emergency response organizations to each affected group. The second event would be initiated by a public warning system, which would combine an acoustical warning system by sirens or horns, and then supplemented by instructions over selected emergency broadcast stations.

Public Evacuation Time Components

For the general population, the time required to evacuate is comprised of several individual time components. During an evacuation, each individual would react differently in terms of actions and speed. Therefore, each of these time components must be considered as a distribution of individual time rather than a single, fixed-time increment. The sequence of actions during an evacuation have been formulated to reflect those actions which may be expected from the majority of the population. The evacuation time components used in this analyses are as follows:

1. Receipt of Notification - The time required for the general population within the affected area to receive notification of evacuation once the public warning is initiated by the local authorities.

2. Return to Home - The time required for persons to return to their homes, if not already at home, prior to evacuation of the area. This reflects the time required to close up businesses and places of work.

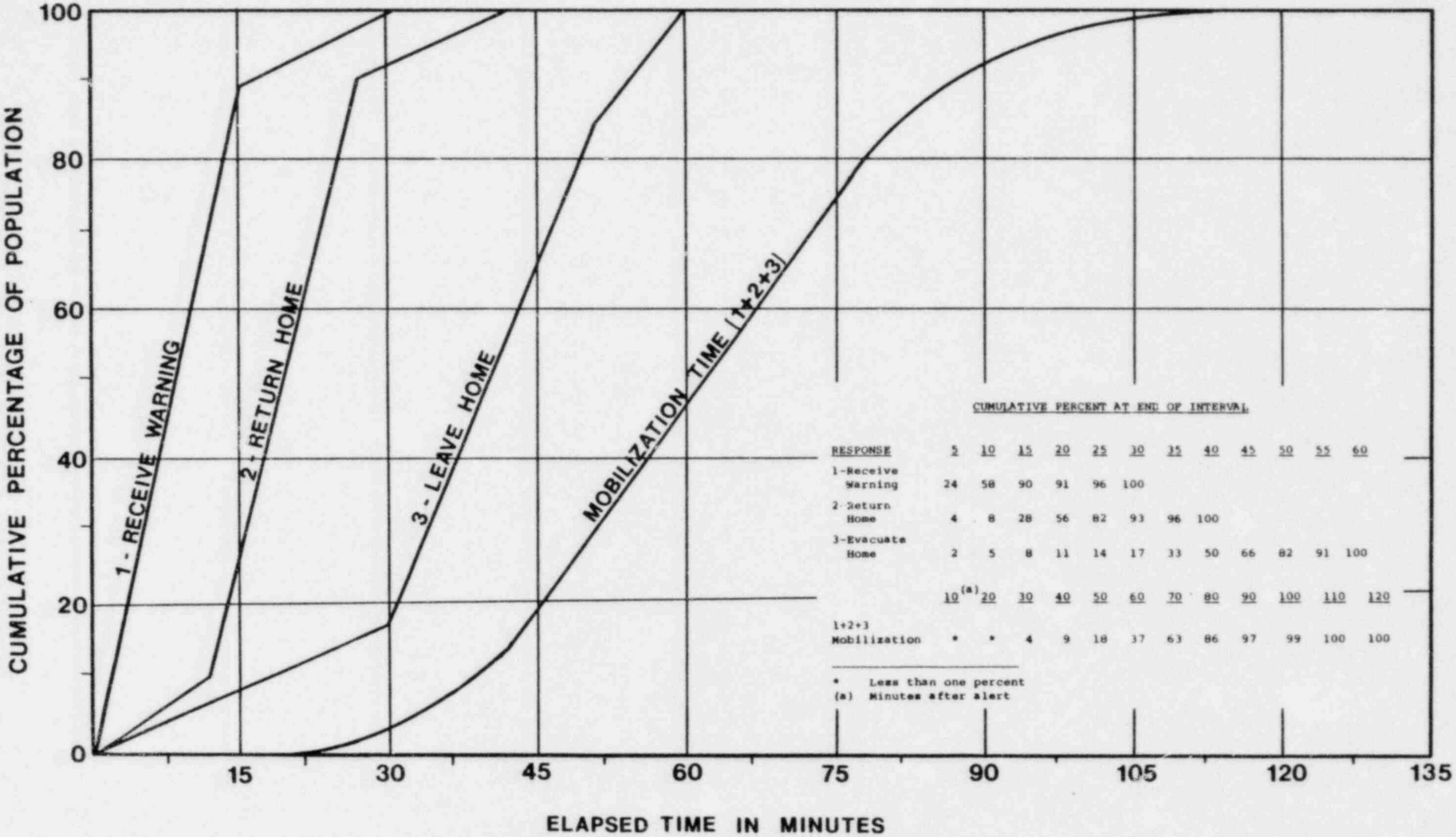
3. Departure from Home - Once home, the time required to assemble family members and prepare to leave.

4. Evacuation Travel Time - Once underway, the time required for the population to travel out of the affected area.

Each evacuation time component can be expressed graphically as a normal distribution curve where the height of any given point along the curve represents the percentage of the population completing that particular public response component at a given point in time. The response time curves representing the first three components, when combined, form the mobilization time distribution. Mobilization time is that period between the initial evacuation notification and the time that the person(s) leaves home. It is the mobilization time distribution which controls the rate at which vehicles are loaded onto the evacuation roadway network.

In this study, two different mobilization distributions were developed, one to represent daytime public response and one to reflect nighttime response. Public response during the daytime scenarios would vary somewhat for tourists/beach visitors, transient workers, and residents. For example, residents and some tourists registered in local hotel/motels would return home prior to evacuating. Transient beach visitors and transient workers would begin evacuating immediately. To simplify the analysis it was assumed that all public responses would include the return-to-home time component, thus slightly increasing the daytime mobilization time requirement.

The individual and combined public response curves are illustrated in Figures 5 and 6 for the daytime and nighttime condition, respectively.



CUMULATIVE PERCENT AT END OF INTERVAL

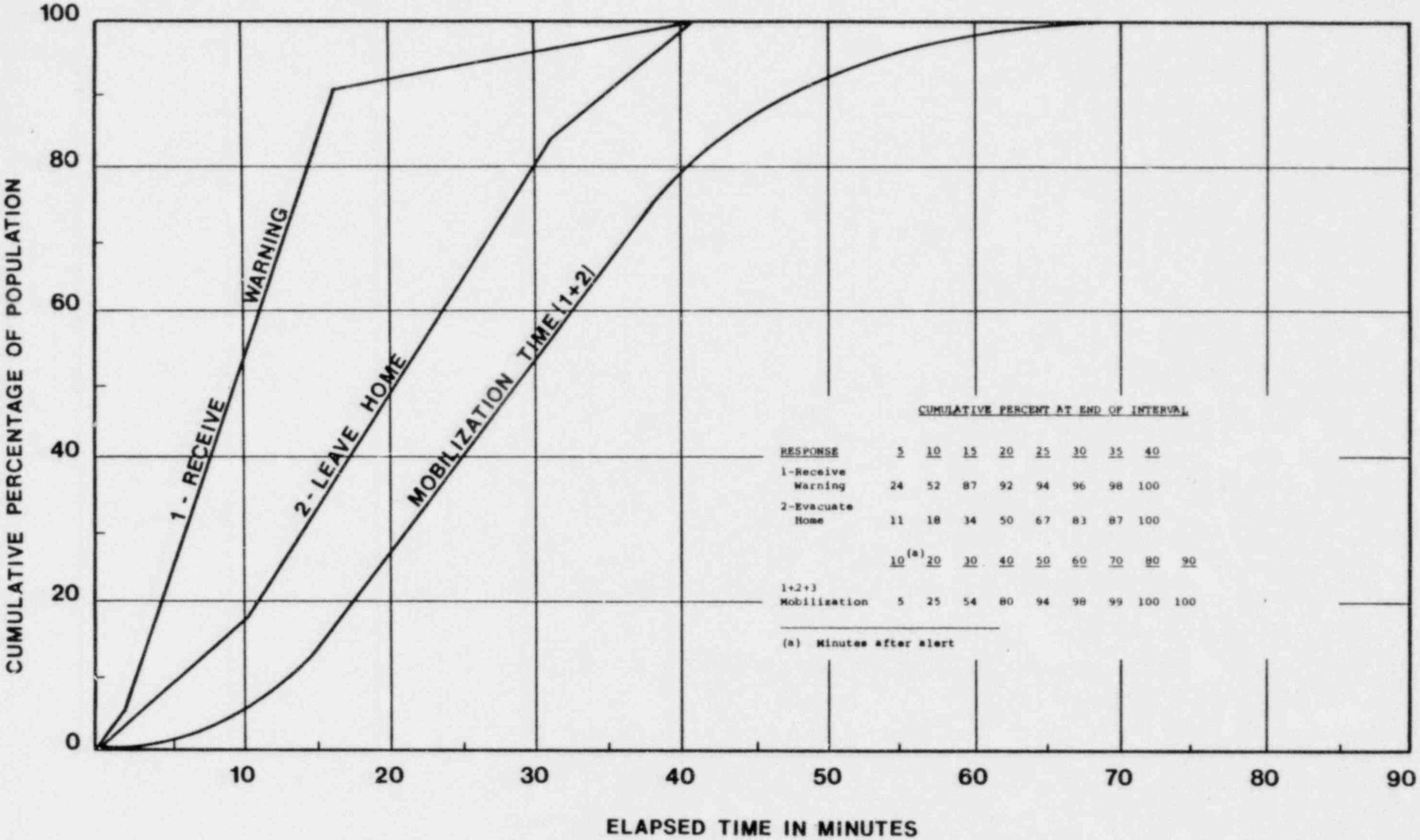
RESPONSE	5	10	15	20	25	30	35	40	45	50	55	60
1-Receive Warning	24	58	90	91	96	100						
2-Return Home	4	8	28	56	82	93	96	100				
3-Evacuate Home	2	5	8	11	14	17	33	50	66	82	91	100
	10[(a)]	20	30	40	50	60	70	80	90	100	110	120
1+2+3 Mobilization	*	*	4	9	18	37	63	86	97	99	100	100

* Less than one percent
(a) Minutes after alert

San Onofre Daytime Response

Wilbur Smith and Associates

FIGURE 5



CUMULATIVE PERCENT AT END OF INTERVAL

RESPONSE	5	10	15	20	25	30	35	40	
1-Receive Warning	24	52	87	92	94	96	98	100	
2-Evacuate Home	11	18	34	50	67	83	87	100	
	10[a]	20	30	40	50	60	70	80	90
1+2+3 Mobilization	5	25	54	80	94	98	99	100	100

(a) Minutes after alert

San Onofre Nighttime Response

CHAPTER 7

EVACUATION ROADWAY NETWORK

Evacuation plans are set forth as part of the emergency response plans (Chapter 1) for the local organization responsible for the planning and implementation of an evacuation of the EPZ. These plans identify the area roadways to be used as evacuation routes by each community. The major roadway system and the principal evacuation routes within the Orange and San Diego Counties EPZ sectors are depicted in Figures 7a and 7b, respectively.

Major Evacuation Routes

Major roadways in the area which were examined for use as evacuation routes are described in the following paragraphs. These facilities, with the exception of Ortega Highway, were included as evacuation routes.

- o Interstate Route 5 (San Diego Freeway), the principal area roadway follows a general north-south direction along the coast and passes just east of SONGS. I-5 is primarily an eight-lane facility built to full freeway standards. However, it narrows to six lanes through the City of San Clemente, widening again to eight lanes near Capistrano Beach.

- o Basilone Road, a two-lane road which intersects I-5 approximately two miles north of the site, runs in a southeasterly direction into the interior of Camp Pendleton.

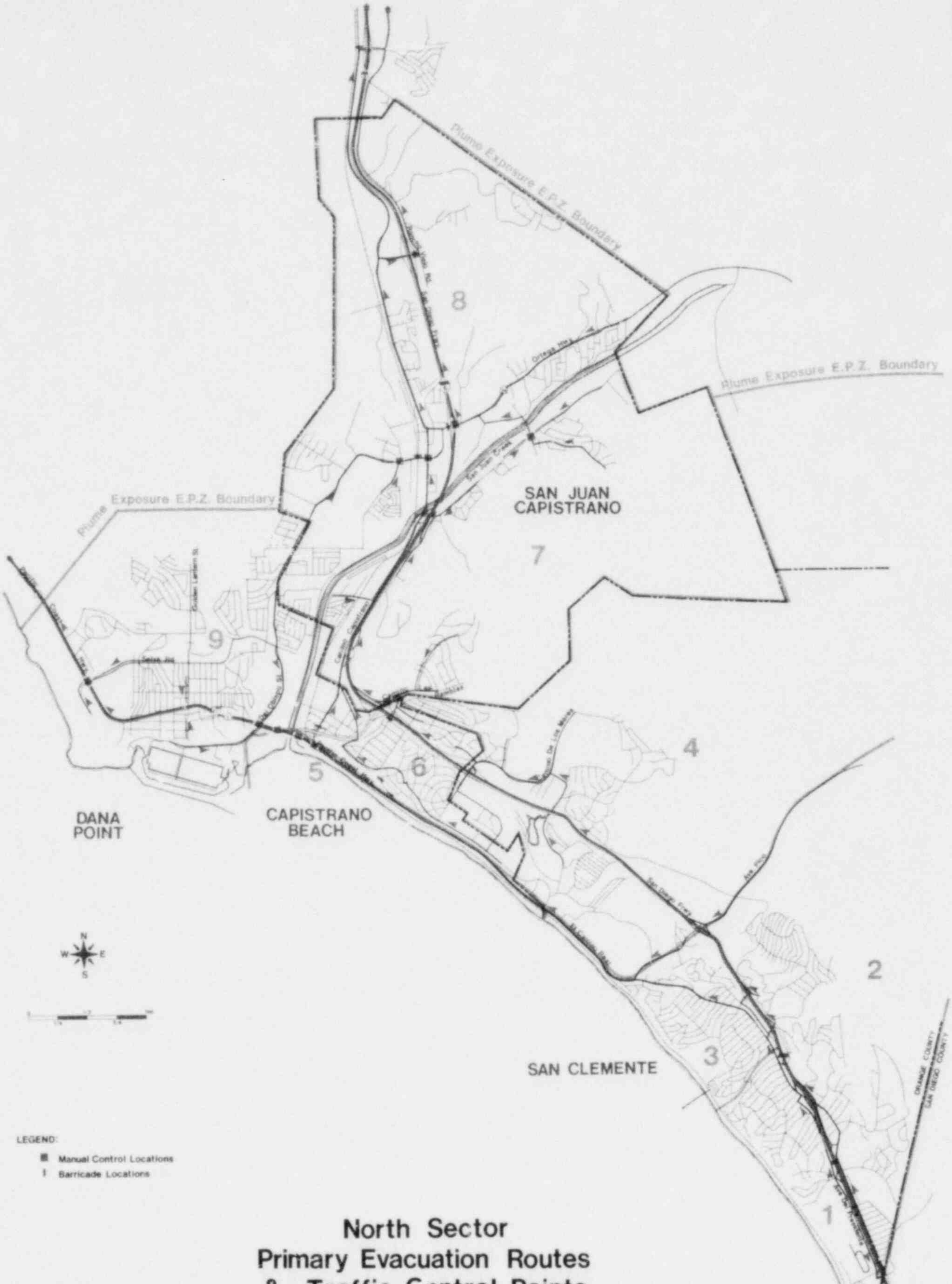
- Access Road, formerly Route 101, was originally a four-lane facility, but has been narrowed to two lanes in order to provide shoulder-area parking for visitors to the State beach areas. This highway parallels I-5 from the Basilone Road interchange past the SONGS facility, with a southern connection to I-5 via the Las Pulgas Interchange approximately seven miles south of the SONGS site.

- El Camino Real (State Route 1), is a four-lane undivided roadway, which generally parallels I-5 from the Orange County line northward to Avenida Estacion.

- Pacific Coast Highway (State Route 1), State Route 1 continues north of Avenida Estacion, as the Pacific Coast Highway. Between Avenida Estacion and Doheny Park Road, Pacific Coast Highway has been constructed as a four-lane facility, however, at the present time only two lanes are open to vehicular traffic. North of Doheny Park road, Pacific Coast Highway is a four-lane facility aligned generally parallel to the coastline.

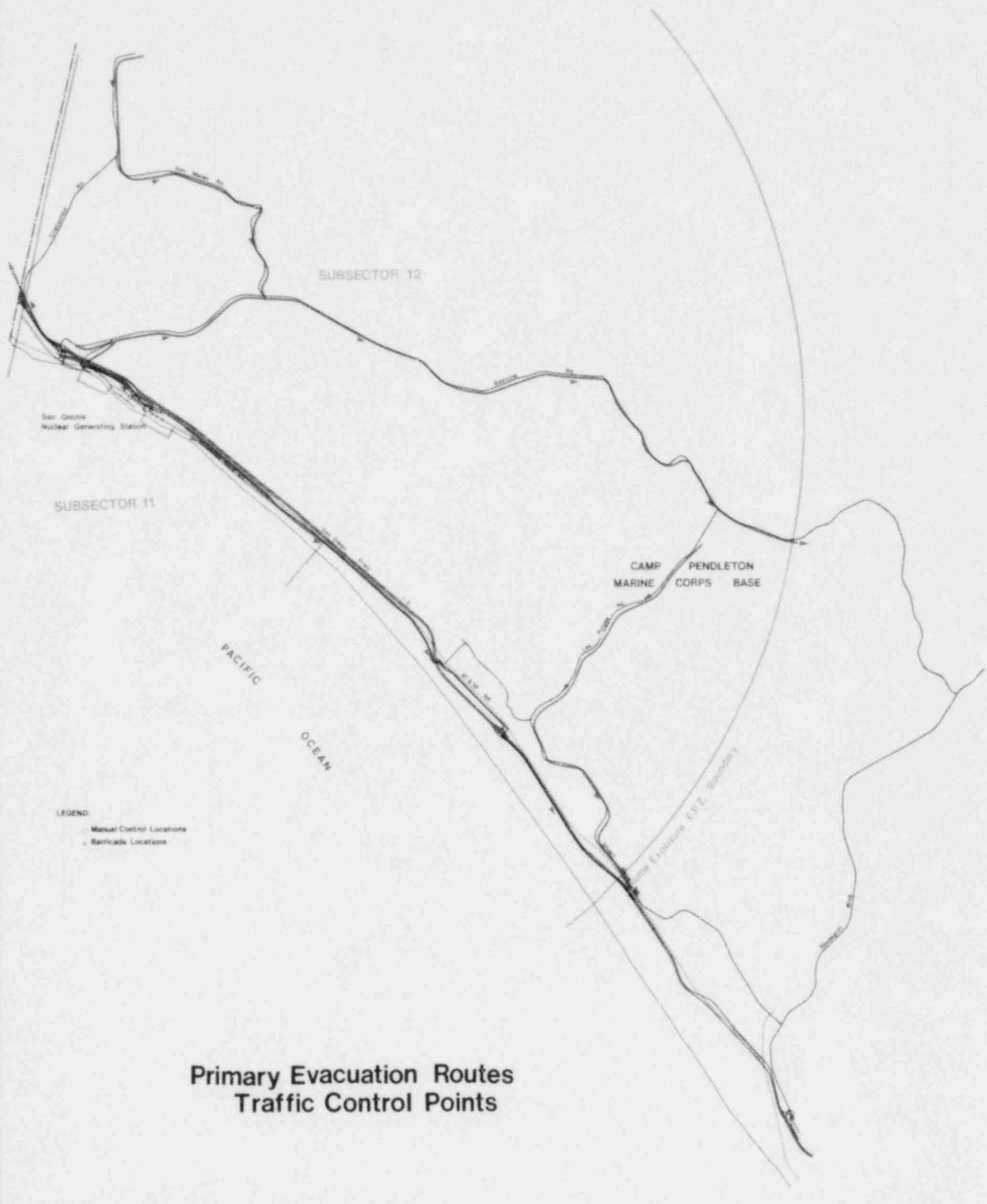
- Avenida Pico is a four-lane arterial within the City of San Clemente with its western terminus at El Camino Real near the Pacific Ocean. It narrows to two lanes east of I-5 and continues eastward to the TRW Systems Group property, where it terminates.

- Ortega Highway (State Route 74), is a four-lane, east-west, roadway between Camino Capistrano and Ganado Road. East of Ganado Road, Ortega Highway narrows to two lanes and continues along San Juan Creek Road to the Lake Elsinore area in Riverside County. This route is not planned as a major evacuation route due to the mountainous terrain it crosses and the resultant ease of blockage by landslides or accidents.



North Sector
Primary Evacuation Routes
& Traffic Control Points

FIGURE 7a



**Primary Evacuation Routes
Traffic Control Points**

Figure 7b

- Camino Capistrano is a two-lane arterial, originating at Pacific Coast Highway in North San Clemente, and parallels the Coast Highway through residential areas of Capistrano Beach. At Camino Las Ramblas, it turns northward, paralleling I-5 through San Juan Capistrano. At it's juncture with Doheny Park Road, Camino Capistrano widens to a four-lane cross section, which is continued through most of San Juan Capistrano.

- Rancho Viejo Road is a four-lane, north-south roadway which is aligned parallel to and east of I-5 from Junipero Serra Road to the San Juan Capistrano City Limit, where it becomes Marguerite Parkway.

Planned Improvements to the Highway Network

There is one significant improvement planned to the highway network which will affect access and egress from the ten-mile radius study area. The six-lane section of I-5, through the City of San Clemente, will be widened to eight lanes. This improvement project is currently underway and is expected to be completed in 1982.

Longer term, there are several regional arterials being considered in or near the study area. Those which could increase available evacuation route capacity are summarized below.

- Avenida San Pablo Corridor (between I-5 in San Clemente and Ortega Highway) - The Orange County Environmental Management Agency is currently studying alternatives for this corridor. The results of the study will determine the general alignment and extent of the facility.

- Golden Lantern Corridor (between Pacific Coast Highway and Crown Valley Parkway) - When the remaining segment is implemented, additional evacuation capacity will be available to the north.

- Extension of Alipaz Street between Pacific Coast Highway and Junipero Serra Road in San Juan Capistrano - This extension would serve as an alternative evacuation route for the local populace.

- Extension of Camino Del Avion between Del Obispo Street and Crown Valley Parkway - This extension would provide an alternative evacuation route for the local populace.

The Orange County Development Monitoring Program includes these arterial highway projects in the 1988 arterial system. Recent assessments of these projects, however, do not anticipate their completion before 1990. None of the above mentioned short-range or long-range regional arterial improvements were considered in this evacuation time analysis.

Designated Evacuation Routes and Reception Centers

Transportation routes leading out of the EPZ to pre-selected reception centers have been designated for each subsector within the EPZ.[1] This information is to be distributed to the populace within the EPZ as part of the public information program.

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(1) Orange County Emergency Response Plan/San Onofre Nuclear Generating Station; San Diego County, Nuclear Power Plant Emergency Response Plan; U.S. Marine Corps Base Camp Pendleton Emergency Response Plan.

In the EPZ evacuation plans, all persons within each subsector have been assigned the same principal evacuation route and the same reception center. Reception centers are located beyond a fifteen-mile radius from SONGS and would be available to those evacuees requiring emergency shelter and/or medical aid.

For the Orange County subsectors, assigned evacuation routes lead northward, away from the SONGS facility and generally represent the most direct routes out of the EPZ. The principal evacuation routes out of the area are I-5 and the Pacific Coast Highway, with Camino Capistrano as a secondary route.

Population from within U.S. Marine Corps Base Camp Pendleton and San Onofre State Park, Bluffs Area, have assigned evacuation routes leading to the South. The principal evacuation routes to the south are Basilone Road, primarily for the Camp Pendleton facilities, and I-5.

Evacuation Route Link/Node Network

These designated evacuation routes were translated into a link/node network for input to the computerized Evacuation Time Assessment Program. First, area roadway network was redefined as a system of roadway links (segments) and nodes (roadway intersections). Network nodes were then numbered and coded for input to the computer program.

The designated evacuation routes were then translated into a series of link/nodes for each individual subsectors. Subsectors were further divided into several population centroids, each representing an individual population concentration within the subsector who require a separate local access route to reach the primary evacuation routes. Table 6 identifies the evacuation route link/node description for each population centroid. Presented

Table 6

EVACUATION ROUTE

LINK/NODE DESCRIPTION BY CENTROID

CENTROID	EVACUATION ROUTE
011	0011 2002 1012 1008 0206 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
012	0012 2005 1017 1018 1019 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
013	0013 2007 1023 1024 2008 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
021	0021 2003 1009 1008 0206 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
022	0022 2004 1018 1019 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
023	0023 2006 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
024	0024 2008 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
025	0025 2009 0220 0224 0228 0230 0234 0236 0240 0244 0252
026	0026 2012 1085 1033 1032 0224 0228 0230 0234 0236 0240 0244 0252
031	0031 2010 1029 2013 1087 2022 1055 2023 2024 1063
032	0032 2013 1087 2022 1055 2023 2024 1063
033	0033 2011 1030 1029 2013 1087 2022 1055 2023 2024 1063
034	0034 1026 1027 2009 0220 0224 0228 0230 0234 0236 0240 0244 0252
035	0035 1029 1030 2011 1032 0224 0228 0230 0234 0236 0240 0244 0252
041	0041 2016 1040 0230 0234 0236 0240 0244 0252
042	0042 2015 1036 2016 1040 0230 0234 0236 0240 0244 0252
043	0043 2017 1039 1040 0228 0230 0234 0236 0240 0244 0252
044	0044 2014 1038 2018 2021 1062 0236 0240 0244 0252
045	0045 2019 2020 1044 1045 0234 0236 0240 0244 0252
051	0051 2022 1055 2023 2024 1063
052	0052 2023 2024 1063
061	0061 2018 2021 1062 0236 0240 0244 0252
062	0062 2021 1062 0236 0240 0244 0252
071	0071 2020 1044 1045 0234 0236 0240 0244 0252
072	0072 2028 1064 1066 1067 1068 2032 1073 1075 1076 2033 1077
073	0073 2029 1065 0240 0244 0252
074	0074 2030 1072 1071 0244 0252
081	0081 2027 1067 1068 2032 1073 1075 1076 2033 1077
082	0082 2026 2027 1067 1068 2032 1073 1080 1078 0252
083	0083 2031 1072 1071 0244 0252
084	0084 2032 1073 1080 1078 0252
085	0085 2033 1077
091	0091 2025 2023 2024 1063
092	0092 2024 1063
111	0111 2000 1095 1101 1100 0257 0259
112	0112 1002 1001 2001 1007 0202 0206 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252
113	0113 2001 1007 0202 0206 0210 0214 0218 0220 0224 0228 0230 0234 0236 0240 0244 0252

in this table are the numbers of each node through which the evacuation route passes. Illustrated in Figures 8a and 8b are the coded line/node network and the evacuation routes for each centroid.

A description of roadway characteristics represented by each link in the evacuation route network is presented in Table 7. Evacuation network links are identified by the numbered A and B nodes which represent either end of the link. The order of the nodes (from A to B) indicates the direction of travel. Also identified is the link travel time (under normal conditions), length, traffic capacity, and roadway identification. A brief description of each is given below:

- Travel Time on a particular link is determined by dividing the normal traffic speed on each segment by the link length. Travel time is expressed in minutes.
- Distance represents the length of the roadway link and is expressed in miles.
- Capacity identifies the number of vehicles which can be accommodated on a particular roadway link during a fixed increment of time. In this case, capacity has been expressed in vehicles per 15 minute increment.
- Roadway Identification is the name of the roadway facility of which the link is a segment.

The following assumptions were utilized in developing the link travel times and capacities.

Directional Flow - All roadways will operate as they do under present conditions. As an example, for a two-lane, two-way facility, only the two outbound lanes would be utilized for evacuation under normal conditions, with the inbound lane used for circulating traffic and/or emergency vehicles.

Table 7

LINK-NODE NETWORK

IDENTIFICATION AND CHARACTERISTICS

ANODE	BNODE	TIME	DIST	INC CAP	HOLD CAP	ROADWAY IDENTIFICATION
11	2002	1.2	0.3	250	85	Centroid Connector
12	2005	1.3	0.3	250	96	Centroid Connector
13	2007	1.6	0.4	500	234	Centroid Connector
21	2003	2.0	0.5	500	299	Centroid Connector
22	2004	1.8	0.5	250	134	Centroid Connector
23	2006	3.7	0.9	500	539	Centroid Connector
24	2008	3.0	0.8	250	222	Centroid Connector
25	2009	2.2	0.6	250	164	Centroid Connector
26	2012	0.6	0.1	250	43	Centroid Connector
31	2010	2.1	0.5	1000	457	Centroid Connector
32	2013	0.8	0.2	250	58	Centroid Connector
33	2011	2.1	0.5	250	152	Centroid Connector
34	1026	4.0	1.0	500	536	Centroid Connector
35	1029	3.2	0.8	500	469	Centroid Connector
41	2016	1.5	0.4	500	222	Centroid Connector
42	2015	2.7	0.7	250	199	Centroid Connector
43	2017	2.2	0.6	500	328	Centroid Connector
44	2014	1.2	0.3	250	87	Centroid Connector
45	2019	2.1	0.5	250	155	Centroid Connector
51	2022	0.4	0.1	200	29	Centroid Connector
52	2023	0.8	0.2	250	58	Centroid Connector
61	2018	2.1	0.5	250	155	Centroid Connector
62	2021	1.6	0.4	250	120	Centroid Connector
71	2020	2.4	0.6	250	175	Centroid Connector
72	2028	2.0	0.5	250	143	Centroid Connector
73	2029	1.4	0.3	250	99	Centroid Connector
74	2030	1.2	0.3	250	87	Centroid Connector
81	2027	6.0	1.5	450	879	Centroid Connector
82	2026	1.0	0.3	250	76	Centroid Connector
83	2031	1.4	0.3	450	199	Centroid Connector
84	2032	1.2	0.3	250	87	Centroid Connector
85	2033	2.0	0.5	250	143	Centroid Connector
91	2025	1.6	0.4	500	240	Centroid Connector
92	2024	3.4	0.9	500	504	Centroid Connector
111	2000	0.2	0.1	250	29	Centroid Connector
112	1002	0.4	0.1	200	29	Centroid Connector
113	2001	0.4	0.1	250	29	Centroid Connector

TIME - Travel time from A Node to B Node (minutes)

DIST - Distance from A Node to B Node (miles)

INC CAP - Incremental link capacity (vehicles per 15 minutes)

HOLD CAP - Queuing capacity from A Node to B Node (vehicles)

Table 7

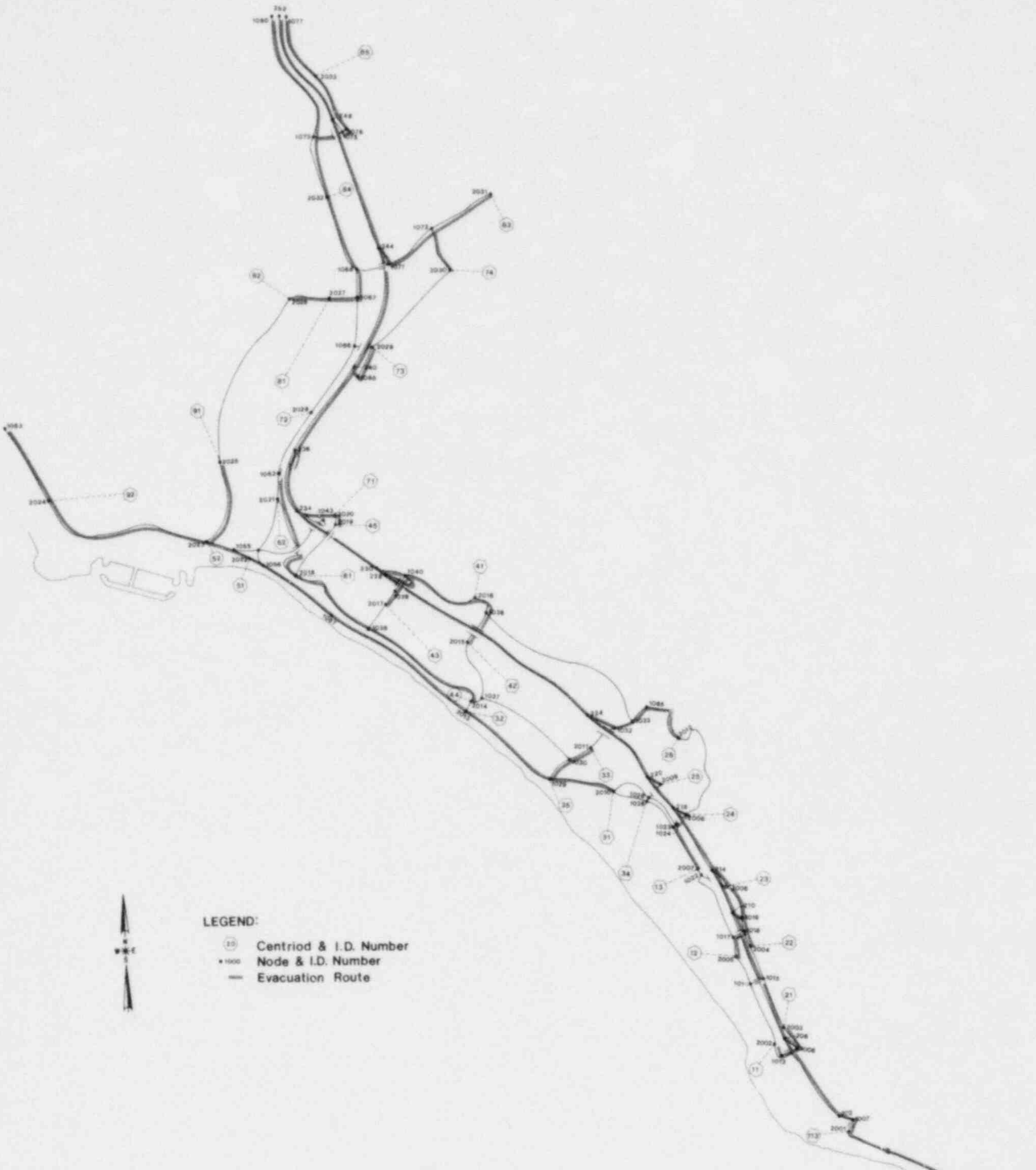
(Continued)

ANODE	BNODE	TIME	DIST	INC CAP	HOLD CAP	ROADWAY IDENTIFICATION
202	206	1.2	1.0	1300	1196	I-5 Northbound
206	210	1.2	1.0	1350	1196	I-5 Northbound
210	214	0.7	0.6	1350	668	I-5 Northbound
214	218	0.7	0.6	1350	692	I-5 Northbound
218	220	0.4	0.3	1350	387	I-5 Northbound
220	224	0.8	0.7	1350	833	I-5 Northbound
224	228	2.9	2.5	1350	2836	I-5 Northbound
228	230	0.0	0.0	1350	35	I-5 Northbound
230	234	1.2	1.0	1350	1208	I-5 Northbound
234	236	0.6	0.5	1800	536	I-5 Northbound
236	240	1.5	1.3	1800	1466	I-5 Northbound
240	244	1.2	1.0	1800	1173	I-5 Northbound
244	252	4.0	3.4	1800	3965	I-5 Northbound
257	259	8.8	7.3	1800	8565	I-5 Southbound
1001	2001	3.6	1.8	300	522	Old Route 101
1002	1001	1.0	0.4	300	123	San Onofre State Beach Service Rd.
1007	202	6.4	0.2	300	52	On-Ramp to I-5 Northbound
1008	206	0.4	0.2	375	58	On-Ramp to I-5 Northbound
1009	1008	0.1	0.0	300	14	El Camino Real
1012	1008	0.3	0.1	300	29	Ave. Del Presidente/I-5 Overpass
1017	1018	0.1	0.0	300	11	Ave. Mendocino
1018	1019	0.2	0.1	500	58	El Camino Real
1019	210	0.2	0.1	300	23	I-5 On-Ramp Northbound
1023	1024	0.1	0.0	250	11	Ave. Presidio
1024	2003	0.2	0.1	250	17	Ave. Presidio
1026	1027	0.1	0.0	250	11	Ave. Palizada
1027	2009	0.2	0.1	250	23	Ave. Palizada
1029	1030	0.4	0.3	250	73	Ave. Pico
1029	2013	1.7	1.0	300	293	Pacific Coast Highway
1030	1029	0.4	0.3	500	146	Ave. Pico
1030	2011	0.3	0.2	500	117	Ave. Pico
1032	224	0.2	0.1	300	29	I-5 On-Ramp Northbound
1033	1032	0.4	0.3	500	146	Ave. Pico
1036	2016	0.8	0.3	250	73	Ave. Vaquero
1038	2018	3.0	1.0	250	293	Camino Capistrano
1039	1040	0.2	0.1	500	58	Camino de Estrella
1040	228	0.5	0.3	300	73	I-5 On-Ramp Northbound
1040	230	0.3	0.2	300	49	I-5 On-Ramp Northbound
1044	1045	0.2	0.1	375	29	I-5 On-Ramp Northbound
1045	234	0.5	0.3	375	73	I-5 On-Ramp Northbound
1055	2023	0.5	0.3	500	146	Pacific Coast Highway
1062	236	0.4	0.2	300	64	I-5 On-Ramp Northbound
1064	1066	0.1	0.1	300	29	Camino Capistrano
1065	240	0.4	0.2	300	58	I-5 On-Ramp Northbound
1066	1067	1.1	0.5	500	269	Camino Capistrano
1067	1068	0.7	0.2	500	134	Camino Capistrano
1068	2032	1.8	0.7	500	428	Camino Capistrano

Table 7

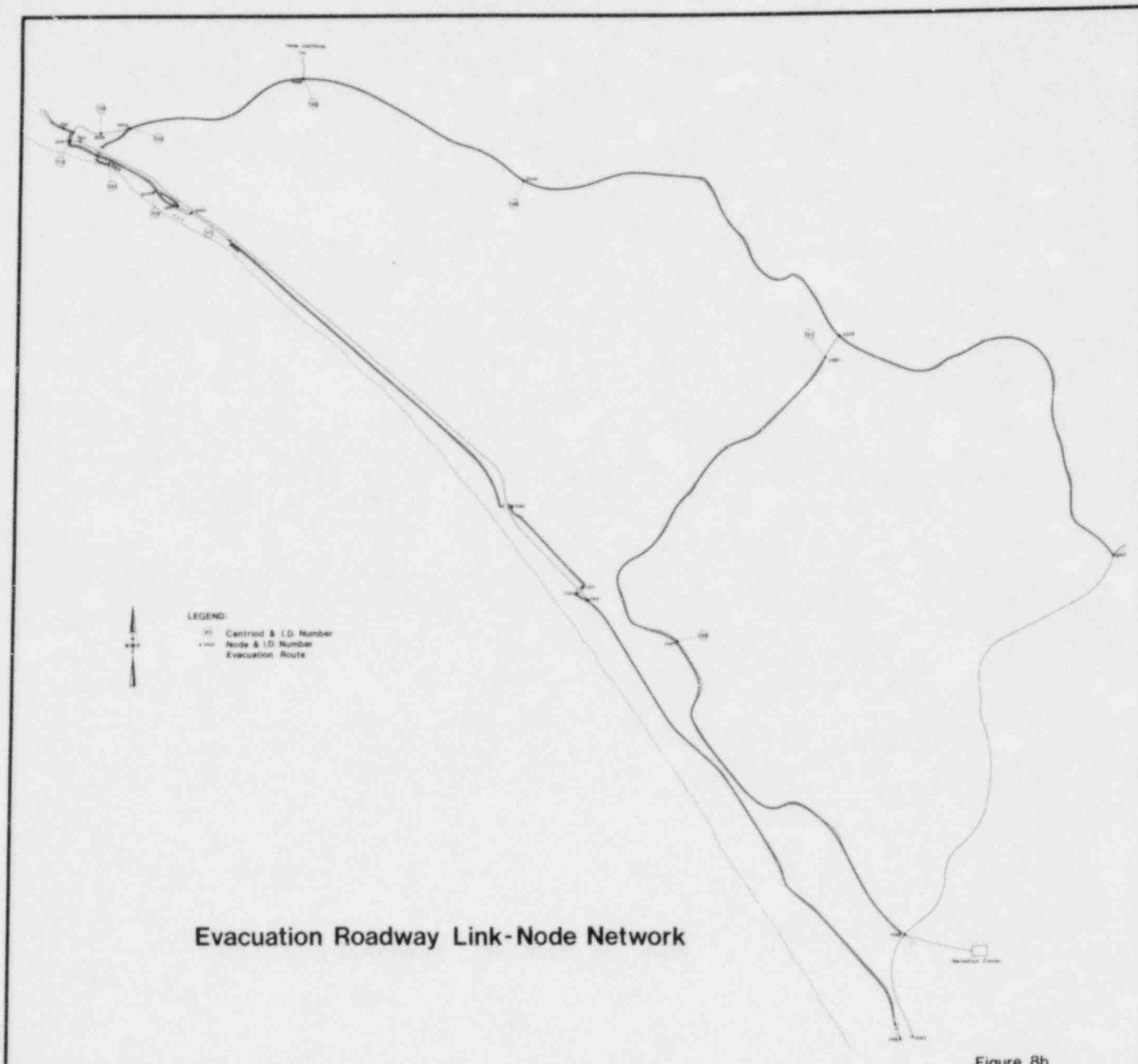
(Continued)

ANODE	BNODE	TIME	DIST	INC CAP	HOLD CAP	ROADWAY IDENTIFCATION
1071	244	0.4	0.2	300	52	I-5 On-Ramp Northbound
1072	1071	1.1	0.6	500	334	Ortega Highway
1073	1075	5.0	2.5	300	733	Junipero Serra Road
1073	1030	4.8	2.4	300	703	Camino Capistrano
1075	1076	0.1	0.0	300	8	Junipero Serra Road
1076	2033	1.2	0.6	600	363	Rancho Viejo Road
1078	252	0.5	0.3	300	73	I-5 On-Ramp Northbound
1080	1078	0.2	0.1	300	29	Avery Parkway
1085	1033	0.4	0.2	500	129	Ave. Pico
1087	2022	1.6	0.9	500	539	Pacific Coast Highway
1095	1101	3.6	1.5	300	439	Old U.S. Route 101
1100	257	0.4	0.2	300	58	I-5 On-Ramp Southbound
1101	1100	0.2	0.1	250	29	Old U.S. Route 101/I-5 Underpass
2000	1095	12.5	5.2	300	1525	Old U.S. Route 101
2001	1007	0.2	0.1	300	29	Basilone Rd. Interchange Overpass
2002	1012	1.2	0.3	250	87	Ave. Del Presidente
2003	1009	0.5	0.2	500	117	El Camino Real
2004	1018	2.9	1.2	500	703	El Camino Real
2005	1017	0.5	0.2	250	58	Ave. Del Presidente
2006	214	0.4	0.2	300	61	I-5 On-Ramp Northbound
2007	1023	1.2	0.5	450	293	Ave. Del Presidente
2008	218	0.2	0.1	300	35	I-5 On-Ramp Northbound
2009	220	0.2	0.1	300	29	I-5 On-Ramp Northbound
2010	1029	1.4	0.7	300	410	El Camino Real
2011	1030	0.4	0.3	500	146	Ave. Pico
2011	1032	0.4	0.2	500	123	Ave. Pico
2012	1085	1.5	0.5	250	146	Ave. Presidio
2013	1087	2.8	1.6	300	483	Pacific Coast Highway
2014	1033	3.9	1.3	250	384	Camino Capistrano
2015	1036	1.2	0.4	300	117	Ave. Vaquero
2016	1040	1.9	0.8	500	469	Camino de Los Mares
2017	1039	0.5	0.2	500	117	Camino de Estrella
2018	2021	2.3	0.8	250	225	Camino Capistrano
2019	2020	0.4	0.1	250	38	Via California
2020	1034	0.2	0.1	600	53	Camino las Ramblas
2021	1062	0.5	0.2	300	67	Camino Capistrano
2022	1055	0.2	0.1	500	70	Pacific Coast Highway
2023	2024	3.1	1.8	500	1061	Pacific Coast Highway
2024	1053	2.4	1.4	500	809	Pacific Coast Highway
2025	2023	1.5	0.7	300	214	Del Obispo Street
2026	2027	1.2	0.5	300	146	Del Obispo Street
2027	1067	0.4	0.1	500	87	Del Obispo Street
2028	1064	1.5	0.8	300	219	Camino Capistrano
2029	1065	0.5	0.2	300	67	Valle Road
2030	1072	1.3	0.4	250	123	La Novia Avenue
2031	1072	1.1	0.6	500	363	Ortega Highway
2032	1073	1.5	0.6	500	363	Camino Capistrano
2033	1077	2.4	1.1	600	833	Marguerite Parkway



Evacuation Roadway Link-Node Network

Figure 8a



Evacuation Roadway Link-Node Network

Figure 8b

Travel Speeds - Speeds were assigned to each link according to the character of the roadway. Freeway speeds were assigned at 50 miles per hour with ramp speeds at 30 miles per hour. Four-lane roadways were generally assigned speeds ranging from 25 miles per hour (El Camino Real) to 35 miles per hour (Pacific Coast Highway) depending on posted speed limits and roadway quality. Speeds for two-lane roadways ranged from 20 to 30 miles per hour. Centroid connectors were considered as local or neighborhood streets and assigned a speed of 15 miles per hour.

The assigned speeds reflect roadway conditions where traffic control signals have been switched from normal operation to a flashing mode. Under these conditions, the primary evaucation route is given the right-of-way (flashing yellow signal) and side streets are given lower priority (flashing red signal). Manual traffic control at key interesections, where primary evaucation routes merge, is also assumed in and reflected by the estimated travel speeds.

It should be noted that the above mentioned speed assignments represent average speeds only when the roadway facilities are operating below the assigned roadway capacity. Once traffic flow reaches or exceeds the roadway capacity, the computer simulation model begins to form traffic queues on the "over-capacity" links and any adjacent links affected by the over-capacity link. The computer model adjusts the travel times to reflect the congested conditions.

Capacities - Capacities assigned to each roadway take into consideration general roadway geometrics as well as side road interference.

For the purpose of this analysis, the following capacities were assigned:

- Freeway - An average 1,800 vehicles per lane per hour was estimated for I-5. This yields a three-lane section capacity equal to 5,400 vehicles per hour and a four-lane section capacity of 7,200 vehicles per hour.

- Interchange Ramp - 1,200 vehicles per hour for a single-lane on-ramp.

- High-Type Roadway - Two and four-lane roadways with limited access were assigned capacities of 1,200 vehicles per lane per hour.

- Unlimited Access Roadways - Two and four-lane facilities with substantial side-street interference were assigned capacities of 1,000 vehicles per lane per hour.

The average lane capacities summarized above are consistent with those used in standard traffic engineering and planning studies and should be considered conservative estimates for emergency evacuation conditions.

Once an evacuation is well underway, most vehicles would be headed in the same direction. Because of the directional flow and controlled routings, lane capacities could be higher than those observed under normal circumstances. Another factor which could contribute to smoother flow and higher capacities is that the drivers involved in the evacuation would probably be the most seasoned, experienced driver of each household.

CHAPTER 8

EVACUATION TIME ESTIMATES

In the development of evacuation time estimates, the emphasis was placed on the more densely populated areas within the north sector. Approximately 78 per cent of the total resident population within the EPZ is located in Orange County, north of SONGS. The time estimates to evacuate the five-mile, ten-mile, and entire EPZ north sector areas reflect the implementation of evacuation plans developed in the Orange County Emergency Response Plan. Similarly, evacuation time estimates for the south sector, which include those subsectors located within San Diego County and Camp Pendleton U.S. Marine Corps Base, are based upon the implementation of emergency response plans for those areas.

Evacuation time estimates were made for the following four conditions:

1. Daytime Summer Weekend (recreation and tourist peak)

2. Daytime Summer Weekday (workers at work, children in school, some beach visitation)

3. Nighttime (almost everyone at home)

4. Adverse Weather (rain or dense fog), with Daytime Summer Weekend population conditions

These conditions and their implications on population are discussed in Chapter 6.

The analysis sectors included:

Radial Distance from SONGS	Area Evaluated
. 0-2 Miles	One Sector
. 0-5 Miles	North and South Sectors
. 0-10 Miles	North Sector Only
. 0-EPZ Boundary	North and South Sectors

The time estimates for evacuation of the general populace within Orange County and the State beach areas were developed through the use of a computer model which is described in Chapter 2 and in Appendix A. The evacuation time estimates generated by the computer simulation model are listed in Table 8 by analysis sector for each of the four time periods. The evacuation times listed in Table 8 do not reflect the time required to evacuate the populated areas within Camp Pendleton U.S. Marine Corps Base. In this analysis, Camp Pendleton is considered a special institution. Evacuation time estimates for special institutions are discussed separately later in this chapter.

Summer Weekend

The evacuation time assessment indicates that an evacuation on a daytime summer weekend would result in the longest time period to evacuate the Orange County and State beach subsectors. Evacuation of the EPZ population under these conditions would require approximately 6 hours and 15 minutes. Evacuation of the areas within the 10 mile radius is estimated to require 4 hours and 30 minutes.

The approximate rate at which the population are able to evacuate the area is summarized in Table 9 for each of the north sectors. The time estimates indicate that for each sector approximately 50 per cent of the population would complete the evacuation within one-third of the total evacuation time.

Table 8

SUMMARY OF EVACUATION TIME ESTIMATES[(a)]

FOR GENERAL POPULATION

CONDITION	EVACUATION TIME (in hours)[(b)]					
	0-2 Miles	0-5 Miles North	0-5 Miles South	0-10 Miles North Only	0-EPZ Boundary North	0-EPZ Boundary South[(c)]
With Existing Evacuation Routing Plan						
Summer Weekend	2.00	4.50	2.00	4.50	6.25	2.25
Summer Weekday	1.75	4.50	1.75	4.50	5.50	1.75
Nighttime	1.50	4.00	1.50	4.00	4.75	1.50
Adverse Weather[(d)]	2.25	5.25	2.25	5.25	7.25	2.25
With Balanced Evacuation Routing on I-5 and PCH						
Summer Weekend	*	3.25	*	3.25	3.75	*
Summer Weekday	*	3.00	*	3.00	3.25	*
Nighttime	*	2.50	*	2.50	2.50	*
Adverse Weather[(d)]	*	4.25	*	4.25	4.75	*

(a) Does not include U.S. Marine Corp Base, Camp Pendleton.
(b) Elapsed time between public warning and the crossing of the EPZ boundary by the last exiting vehicle.
(c) The EPZ boundary in the south sector is located along the 10-mile radius arc.
(d) Reflects peak summer weekend permanent and transient populations and a 15 per cent reduction in the capacities of all evacuation roadways.
* Time estimate for this sector would not be affected by balanced evacuation routing on northbound I-5 and PCH.

Table 9

ESTIMATED RATE OF EVACUATION
NORTH SECTOR

CONDITION AND AREA OF EVACUATION	HOURS TO EVACUATE			
	25% of Population	50% of Population	75% of Population	All
DAYTIME SUMMER WEEKEND				
0-5 Miles	1.25	1.75	2.25	4.50
0-10 Miles	1.25	1.75	2.25	4.50
0 to EPZ Boundary	1.25	2.00	2.75	6.25
*	*	*	*	
DAYTIME SUMMER WEEKDAY				
0-5 Miles	1.00	1.50	2.25	4.50
0-10 Miles	1.00	1.50	2.00	4.50
0 to EPZ Boundary	1.25	1.75	2.50	5.50
*	*	*	*	
NIGHTTIME				
0-5 Miles	0.50	1.00	2.00	4.00
0-10 Miles	0.50	1.00	1.50	4.00
0 to EPZ Boundary	0.75	1.25	1.75	4.75
*	*	*	*	
DAYTIME SUMMER WEEKEND-ADVERSE WEATHER				
0 to EPZ Boundary	1.25	2.25	3.00	7.25

The evacuation time analysis reveals that evacuation of the zero to ten-mile area is controled by the rate at which the zero to five-mile area can be evacuated. The controlling factor in both the five and ten-mile sector evacuations is a "bottleneck" which occurs on Pacific Coast Highway immediately south of Camino Capistrano (approximately six miles from SONGS). At this point, Pacific Coast Highway narrows from a four-lane roadway section to a three-lane section, with only one outbound (northbound) lane.

During an evacuation, vehicles from Subsector 3 would begin to form queues along El Camino Real (south of the bottleneck) approximately one hour after the evacuation notification. Once this occurs, exiting traffic would be metered at a continuous rate of approximately 1,200 vehicles per hour (if traffic is restricted to one northbound lane on Pacific Coast Highway).

When the populace from the area between the ten-mile radius and the EPZ boundary are included in the evacuation, the controlling evacuation route constraint is found to be on Pacific Coast Highway immediately north of Selva Road. It is estimated that the roadways' two-lane capacity would be reached approximately 45 minutes after the initial evacuation notification. For the following 5 hours and 30 minutes exiting traffic would be metered at a continuous rate of approximately 2,000 vehicles per hour.

Summer Weekday

The results of the weekday scenario analysis are similar to those of the weekend scenario. Evacuation of the entire area within the EPZ boundary would require approximately 5 hours and 30 minutes to complete. Evacuation of only the area inside the ten-mile radius is estimated to take 4 hours and 30 minutes for this population condition.

A comparison of the ten-mile evacuation time estimates for the weekend and weekday scenarios indicate that there would be no significant difference. This is because the number of vehicles evacuating via Pacific Coast Highway (the controlling constraint) does not differ significantly in the weekend and weekday scenarios.

Table 9 indicates the estimated rate of evacuation for the population within the five, ten, and entire EPZ sectors for the summer seekday condition.

Nighttime

An evacuation under nighttime conditions is estimated to require slightly less time than the daytime summer conditions. This results from: 1) fewer people within the EPZ to be evacuated; and 2) shorter mobilization times for the general population since most families would already be at home. (See Figures 5 and 6.)

Evacuation of the area within the EPZ boundary is estimated to take approximately 5 hours and 30 minutes. Evacuation of only the population within the ten-mile radius of SONGS would take approximately 4 hours to complete.

Since evacuation route assignments remain the same in the nighttime scenario as in the weekend and weekday scenarios, the identified roadway bottleneck or constraints would also apply in the nighttime evacuation.

The approximate rate of evacuation for this scenario, as summarized in Table 9, indicates that for all sector evacuations, approximately 75 per cent of the population would complete the evacuation within 2 hours.

Adverse Weather

The impact of adverse weather on evacuation time was tested for the peak population summer weekend condition. For the analysis, adverse weather conditions were simulated by reducing all evacuation roadway capacities in the computer model input data.

A study published by the Highway Research Board in 1970 on "The Environmental Influence of Rain on Freeway Capacity" concluded that the capacity of freeways during rain can be expected to be between 81 and 86 per cent of the dry weather capacity. The study did not, however, consider the influence of rain on surface street capacity.

For the purpose of our analysis it was assumed that capacities would be reduced by 15 per cent for both freeway and surface street evacuation routes during adverse weather conditions. An evacuation roadway having a capacity of 1,000 vehicles per hour under normal weather conditions would thus be assigned a capacity of 850 vehicles per hour for adverse weather conditions. This assumes only minor potential flooding or slide blockage of road ith no road closures occurring on major evacuation rout

The evacuation time analysis indicated that such adverse weather would have a moderate impact on evacuation time. The 7 hour and 15 minutes evacuation time estimated for the entire EPZ during the adverse weather condition was approximately one hour longer than that for normal weather conditions.

Potentially, severe adverse weather could also affect evacuation route capacity through partial or complete blockage of roadways by flooding or mudslides. Interstate 5 generally should not be significantly affected by mudslides or flooding. Pacific Coast Highway, in the bluff area south of Camino Capistrano, is subject to slides which could affect the roadway capacity. Complete blockage of Pacific Coast Highway at this location could increase the evacuation time by as much as 90 minutes. Weather-related blockage of other roadways could likely be bypassed without significantly increasing evacuation time.

Special Institutions

Evacuation time estimates for special institutions such as schools, hospitals, retirement and nursing homes and Camp Pendleton United States Marine Corps Base are summarized in Table 10 and briefly discussed in the section which follows.

Generally, the time estimates indicate that the schools, hospitals, retirement and nursing homes would be evacuated in equal or slightly less time than that required for the general population. The evacuation time estimated for Camp Pendleton is slightly longer than that for the general populace.

Schools - Evacuation of public schools within the five-mile sector could be accomplished through the utilization of available school district and public transit buses which would be present in the EPZ. Mobilization of these buses is estimated to occur within two hours after notification.

The buses would proceed to assigned schools and pick-up all students requiring transportation. Once buses are loaded they would evacuate the area via Interstate 5. It is estimated that the evacuation of all schools in the five-mile sector could be accomplished within approximately 3 hours and 45 minutes.

Evacuation of schools beyond the five-mile boundary would require the use of Orange County Transit District (OCTD) buses dispatched from central or northern Orange County. Mobilization and travel time into the EPZ is estimated to take from 2 hours and 30 minutes for the Irvine OCTD facility to 3 hours and 30 minutes for buses from the Garden Grove OCTD facility.

It is expected that OCTD buses arriving in the area would be assigned to the remaining unevacuated schools in a manner which would give priority to schools closest to SONGS. Using this plan, it is estimated that schools within the five to ten-mile and the entire EPZ sectors could be evacuated within 4 and 5 hours, respectively.

Table 10

SPECIAL INSTITUTION

EVACUATION TIME ESTIMATE SUMMARY

INSTITUTION	EVACUATION TIME (hours) BY SECTOR			SCENARIO
	5 MILES	10 MILES	ENTIRE EPZ	
Schools	3.75	4.00	5.00	Weekday
Hospitals	-	4.00	5.00	All
Retirement Homes	4.50	-	-	All
U.S. Marine Corps Base Camp Pendleton	2.75	5.25	-	All

Hospitals - Ambulances and buses required for the evacuation of hospitals within the EPZ would likely be mobilized from locations in the northern Orange County area. It is estimated that mobilization of the emergency vehicles and travel time to the hospitals would require from 2 hours and 30 minutes to 3 hours and 30 minutes.

The three hospitals within the EPZ are located in the five to ten-mile and the ten-mile to EPZ boundary sectors. It is estimated that all patients requiring special transportation could be evacuated within a 4 hour period for San Clemente General and Beverly Manor Convalescent Hospital, and within 5 hours for Capistrano by the Sea Hospital. This assumes that transportation priorities are given to the medical facilities closest to SONGS.

It should be noted that by the time that the emergency vehicles are entering the area (2½ to 3½ hours after notification), over 75 per cent of the general populace would have already completed the evacuation. Once the emergency vehicles have picked up their patients, Interstate 5 would be clear of traffic congestion. Therefore, the vehicles evacuating the patients should not encounter any extensive queuing and delays in exiting the EPZ.

Retirement Homes - Retirement home residents and other persons having restricted mobility would be evacuated primarily by OCTD buses. As with the schools and hospitals located within the ten-mile sector, the estimated time of arrival of those buses would be approximately 2 hours and 30 minutes. Evacuation of the retirement homes, Casa Romantica and San Clemente Hotel, could be accomplished within approximately 3 hours and 30 minutes from the time of request for transportation assistance. The collection and evacuation of other persons having restricted mobility, such as YANA-Check members, would require approximately 4 hours and 30 minutes.

U.S. Marine Corps Base, Camp Pendleton - The areas of Camp Pendleton located within the two-mile sector are estimated to require approximately 2 hours and 15 minutes to evacuate for either of the two daytime conditions and approximately 1 hour and 45 minutes at nighttime.

Evacuation of all persons within the five-mile and ten-mile sectors would require approximately 2 hours and 45 minutes and 5 hours and 15 minutes, respectively, for any of the conditions.

In the evacuation plans prepared by Camp Pendleton Marine Corps Base, it is estimated that all military personnel could be relocated beyond the EPZ Boundary within six hours.

Recommendations for Reducing Evacuation Time

The analysis for each condition indicates that Pacific Coast Highway is the controlling factor in the determination of evacuation time. Given the subsectors assigned to evacuate on Interstate 5 and those on Pacific Coast Highway, Interstate 5 clears of traffic between 3 and 4 hours before Pacific Coast Highway in each combination of evacuation areas and time of initiation (weekday, weekend, nighttime).

At the time evacuation routes were being developed and subsectors routes were assigned for each subsector, 1980 Census data was not available. Earlier projections used for the development of subsector evacuation route assignments for the emergency response plans were found to have slightly underestimated the population and vehicle demand for Subsector 3, which was assigned to Pacific Coast Highway. Population for several subsectors assigned to Interstate 5 were found to have been overestimated by a similar amount.

When the subsector populations were revised to reflect 1980 Census information, the result was traffic imbalance between the Interstate 5 and Pacific Coast Highway evacuation routes. The ratio of vehicle demand to available capacity was lower on Interstate 5 than on Pacific Coast Highway, thus indicating that Interstate 5 would be underutilized and Pacific Coast Highway would be overutilized.

Available evacuation route capacity could be more efficiently utilized by revising the evacuation plan in either one or both of the following methods:

- o The provision of two northbound evacuation lanes on PCH along the "Bluffs" segment (between Camino Capistrano and Palisades Drive) could significantly decrease the evacuation time estimates for the five and ten-mile sectors. The existing configuration of PCH along this segment includes two vehicular lanes (one in each direction) and bicycle lanes along side each vehicular lane. Given the existing width of the roadway it would be possible to accommodate two lanes of evacuation traffic in the northbound direction and one emergency vehicle lane in the southbound direction.

  The additional northbound lane would decrease the 4-hour and 30-minute evacuation time estimate for the five and ten-mile sectors to 3 hours (1 hour and 30 minute reduction). Since the capacity constraint for the evacuation of the entire north sector EPZ is on PCH immediately north of Dana Point, an increase in capacity further south in the "Bluffs" area would not reduce the estimated evacuation time. It should be noted, however, that the provision of two evacuation lanes in the "Bluffs" area reduces the amount of traffic which would experience delay in this area.

- o The utilization of available evacuation capacity on Interstate 5 could be maximized by re-assigning Subsector 3 traffic to Interstate 5 as follows:

- The area within Subsector 3, bounded by Avenida Palizada on the south east, El Camino Real on the North, would continue to evacuate via Pacific Coast Highway to Camino Las Ramblas. At this point, vehicles from this area would turn each and enter I-5 at Camino Las Ramblas interchange.

- The area within Subsector 3 and south of Avenida Palizada would enter I-5 using Avenida Palizada interchange.

- The Subsector 3 area located north of Avenida Palizada and El Camino Real and south of Avenida Pico would enter I-5 at the Avenida Pico interchange.

The plan was tested for the peak population summer weekend scenario and the evacaution of the EPZ north sector. The evacuation time assessment indicated that evacuation time would be reduced from the estimated 6 hours and 15 minutes to a "balanced" system estimate of 3 hours and 45 minutes. This is a reduction of 2 hours and 30 minutes for the EPZ north sector. A proportionate reduction for the five and ten-mile sectors evacuation times would also be expected if Sector 3 were assigned to Interstate 5.

Time Estimate to Evacuate All Personal Vehicles

As previously stated in Chapter 3, permanent population vehicle demand anticipated during an evacuation has been estimated applying the assumption that one vehicle per auto-owning household would be used. This vehicle demand assumption translates to an average vehicle occupancy rate of approximately 2.3 persons per vehicle.

The most conservative approach to estimating vehicle demand is to assume that all personal automobiles within the EPZ are used in an evacuation. Within the EPZ north sector there is an average of approximately 1.4 vehicles per household. Applying the average number of persons per household (2.34) for this area results in an average vehicle occupancy of 1.7 persons per vehicle.

Time estimates based on the evacuation of all personal automobiles were developed for various evacuation conditions (daytime summer weekend; daytime summer weekday and nighttime) and EPZ sectors (five-mile; ten-mile; entire EPZ). A summary of the results are listed in Table 11.

The "maximum vehicle demand" scenario (full utilization of all personal automobiles) results in an approximate 30 to 40 per cent increase in evacuation over the "family evacuation" scenario (one car per household) times depending on the sector chosen in the comparison. Using the planned evacuation routes, the "maximum vehicle demand" scenario would lengthen the evacuation lane by approximately 1 hour and 30 minutes for the five and ten-mile sectors and by 2 hours and 30 minutes for the entire EPZ.[1]

A comparison of the "maximum vheicle demand" scenario and "family evacuation" scenarios was also made for the recommended balanced evacuation routing plan. In this situation, the maximum vehicle demand scenario would increase the estimated evacuation time by approximately 45 minutes for the five and ten-mile sectors and approximately 1 hour and 45 minutes for the entire EPZ.

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(1) See Table 8 for time estimates using a vehicle demand of one car per household.

Table 11

TIME ESTIMATE SUMMARY

FOR EVACUATION OF ALL PERSONAL AUTOMOBILES

CONDITION	NORTH SECTOR 0-5 MILES	NORTH SECTOR 0-10 MILES	ENTIRE EPZ
WITH EXISTING EVACUATION ROUTING PLAN			
Summer Weekend	6.00	6.00	8.75
Summer Weekday	6.00	6.00	8.00
Nighttime	5.50	5.50	7.25
Adverse Weather (b)	7.00	7.00	10.00
WITH BALANCED EVACUATION ROUTING ON I-5 AND PCH			
Summer Weekend	4.00	4.00	5.50
Summer Weekday	3.75	3.75	5.00
Nighttime	3.25	3.25	4.25
Adverse Weather (b)	5.25	5.25	6.75

(a) Elapsed time between public warning and crossing of the EPZ boundary by the last exiting vehicle.

(b) Reflects peak summer weekend permanent and transient population and a 15 per cent reduction in capacities of all evacuation roadways.

CHAPTER 9

EARTHQUAKE EFFECTS ON EVACUATION TIME

The Nuclear Regulatory Commission (NRC) has requested that the SONGS licensee consider the potential complicating effects of an earthquake on communication systems and transportation facilities. The licensee was requested to evaluate the effects that earthquakes would have on the emergency response capability and include these in the emergency response plans. This information should be available to factor into the decision making process of offsite authorities for protective actions after an earthquake.

In response to the NRC request, this study has addressed the issue of earthquake effects upon those transportation facilities which would affect evacuation of the EPZ. This analysis encompasses three tasks:

1) To identify areas (i.e. bridge structures and unstable bluffs) where a problem could potentially arise during a seismic event that would disrupt a primary transportation route;

2) To identify alternative routes which bypass the potential problem areas; and,

3) To assess the impact of potential transportation route disruption on evacuation time estimates.

This analysis is intended to assist off-site authorities, in the preparation of their radiological emergency response plans, to provide contingency plans to address the potential disruptive effects of an earthquake upon EPZ evacuation. Many of the findings presented herein would also assist in the planning for other forms of evacuation route disruptions which could occur, such as fires, floods, mudslides, and flammable or toxic chemical spills.

As requested by the NRC, the analysis presented in this section considers that an earthquake occurs prior to one of the four emergency level conditions being in effect at SONGS. It should be noted that the analysis which follows also applies to the condition where a seismic event occurs after one of the emergency levels has been declared at SONGS, but prior to the evacuation notification.

Potential Impairments Along Primary Transportation Routes

Earthquake-related damage to transportation infrastructure could range from inconsequential localized damage to the potential blockage of one or more primary routes, depending upon the magnitude and location of the earthquake. The NRC has stated that for purposes of this evaluation, it should be assumed that SONGS experiences a seismic event equal to or less severe than the Safe Shutdown Earthquake (SSE), which approximates a magnitude of 7 on the Richter scale.

Considering past performance records of typical freeway bridge structures during earthquakes of this general magnitude, plus the efforts of the California Department of Transportation to further strengthen structures following the 1971 Sylmar earthquake, it is reasonable to assume that most bridges and overpasses would remain intact.

The purpose of this analysis, however, is not to forecast the extent of structural failure or blockage along primary transportation routes following an earthquake, but rather to identify the locations at which major problems could potentially occur along these routes and assess the potential impacts of these upon evacuation time.

Route blockage(s) can be the result of several types of structural or geological failures. Basically there are two types of roadway impairments.

- o The roadway can be blocked by debris, i.e., a fallen overcrossing or a landslide; or
- o The roadway deck can collapse at the point of a bridge crossing over a surface street, railroad, or water course.

Locations where such problems could occur along the primary evacuation routes within the EPZ are indicated in Figures 9a and 9b. In addition to the above-mentioned roadway impairments, there is a potential for roadway pavement to fail under stresses caused by seismic activity.

These impairments could involve only one of the two roadway directions, or could effectively block the entire facility cross section. Where only a partial blockage occurs on a surface arterial roadway, the traffic can be routed around the blockage in the remaining lanes and/or using the shoulder area. Where only the outbound evacuation direction of the freeway is blocked, traffic can be rerouted onto the opposing lanes at the interchange(s) prior to the blockage.

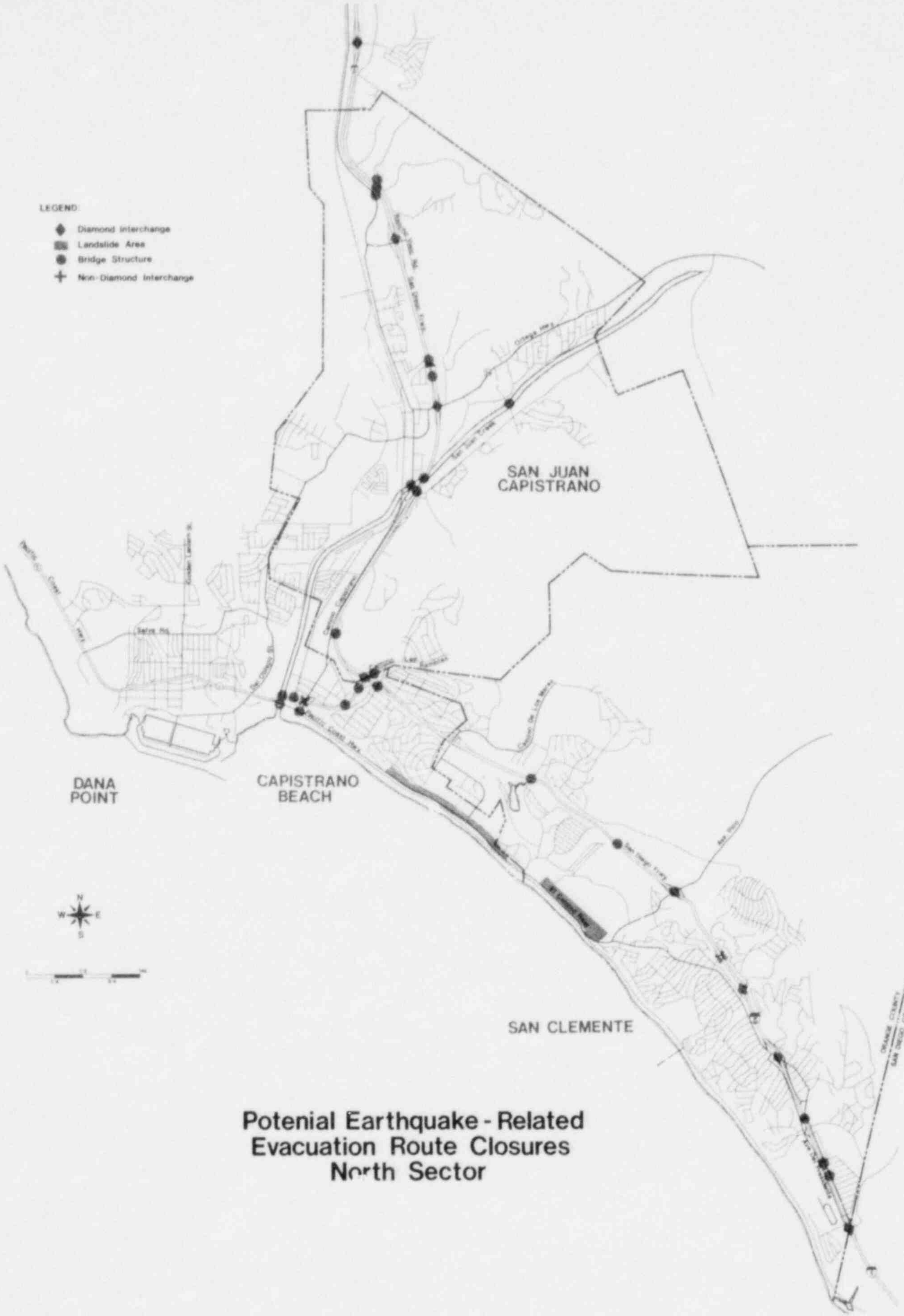
In the event of a complete blockage in both directions, there are various mitigative alternatives available. Under emergency conditions, response measures which require the least amount of time and manpower expenditures are essential. For this reason, alternative routings which bypass the point of blockage are generally the most practical and expeditious solutions for the majority of potential route disruptions. Time consuming measures such as the removal of major obstructions or roadway reconstruction should be considered only where a long lead time, a minimum of 16 to 24 hours, is available prior to the initiation of evacuation.

The method of re-routing traffic around route impairments depends on the following factors:

- o The configuration of the roadway in the area of damage.
- o The number of locations where blockages have occurred and the location of these impairments with respect to each other.
- o The availability of alternative routes parallel to the point or area of damage.

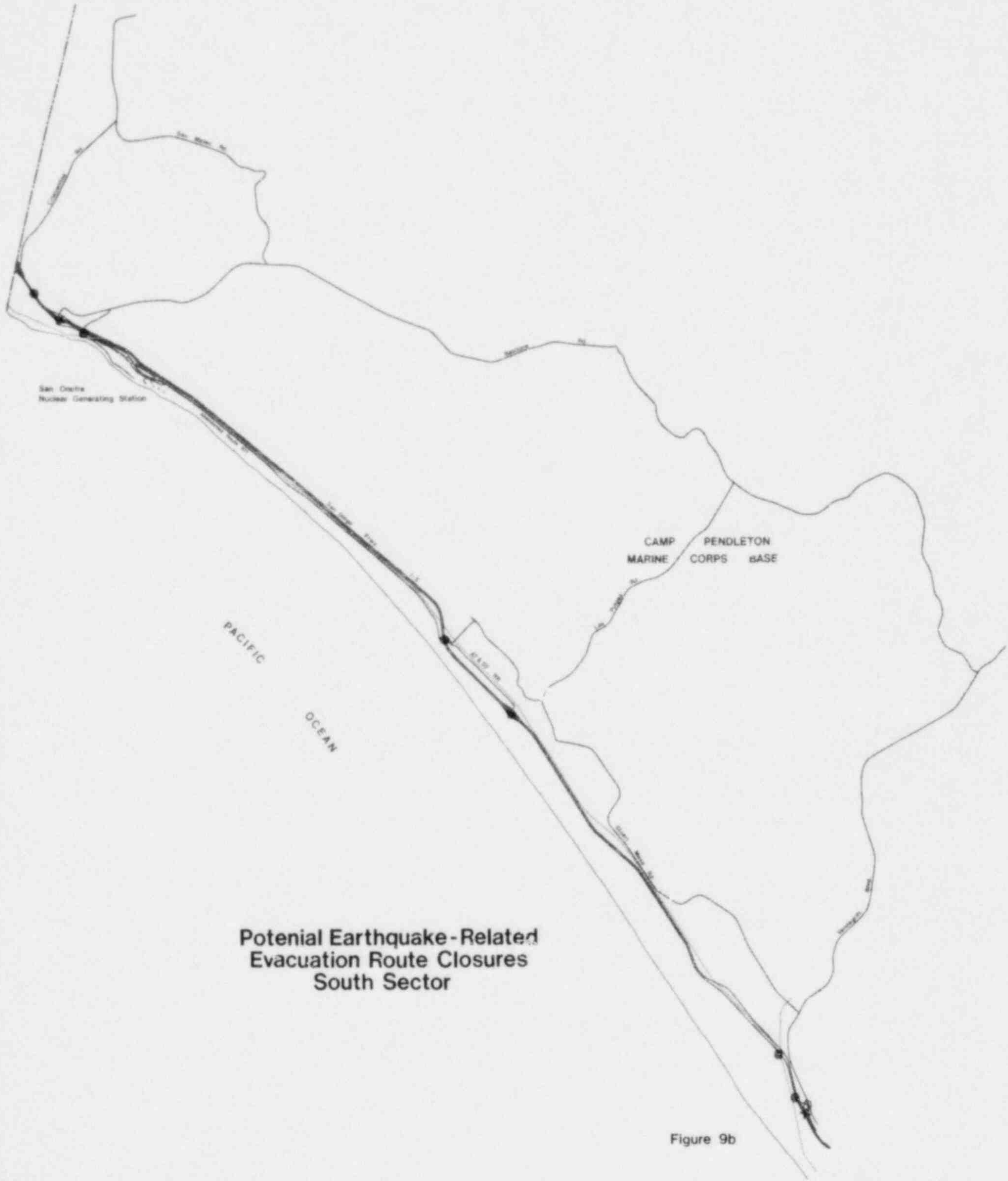
Standard traffic diversion procedures exist for blockages which occur at particular types of freeway interchanges, and for those which occur between freeway interchanges.

- o Diamond Interchange - Structural failure of this type of interchange would not likely damage the on and off-ramps. In this case traffic could probably be diverted around the damaged travelway via the on and off-ramps at the damaged interchange(s). A portion of the trafic could also be diverted to parallel routes to reduce delay time in bypassing the problem area.



Potenial Earthquake - Related Evacuation Route Closures North Sector

Figure 9a



Potenial Earthquake-Related Evacuation Route Closures South Sector

Figure 9b

- Non-diamond interchange with direct off-ramps - Failure of this type of freeway interchange would require traffic to exit the facility at or prior to the damaged interchange. Traffic would be diverted to parallel surface streets and routed back onto the freeway at the first available on-ramp beyond the blockage.

- Other non-diamond interchanges, overcrossings, undercrossings, and blockage between interchanges - Blockages which occur at any of these locations would require traffic to be routed off of the freeway at an interchange prior to the blockage area. Traffic would be diverted to parallel surface streets and returned to the principal evacuation route past the point of blockage.

It is important to note that these procedures apply to individual route impairments and may have to be modified when considering multiple blockages, especially when they occur in succession along the same route. For a succession of blockages, other than diamond interchanges, traffic would generally be rerouted onto parallel routes, if available, for longer distances.

Summarized in Table 12 are bridge structures and potential slide areas along primary transportation routes. Indicated for each listing is the type of separated grade crossing and a brief description of the probable alternative route.

Public Response Considerations

As discussed in Chaper 5, public response begins at the time of initial evacuation notification. In the event of an earthquake preceding a radiological emergency, it is possible that the seismic activity would disable the siren warning system. This is not considered a serious problem however, since notification

Table 12

POTENTIAL PROBLEM AREAS ON PRIMARY TRANSPORTATION ROUTES

LOCATION	TYPE OF STRUCTURE	ALTERNATIVE ROUTING
I-5/ORANGE COUNTY		
o Ave. Del Presidente/ Cristianitos Road	Diamond Interchange (Overcrossing Freeway)	Use Interchange Ramps.
o Pedestrian Bridge/ Ave.	Overcrossing (No Access)	Exit Freeway at Ave. Del Presidente/Cristianitos Road. Use S. El Camino Real to First I-5 On-Ramp.
o Ave. San Luis Rey	Overcrossing (No Access)	Same as Above.
o Ave. Mendocino	Overcrossing (No Access)	Same as Above.
o El Camino Real	Diamond Interchange (Undercrossing)	Use Interchange Ramps.
o Ave. Presidio	Partial Diamond Interchange (Undercrossing)	Use Interchange Ramps.
o Ave. Palizada	Partial Diamond Interchange (Undercrossing)	Exit Freeway at Ave. Presidio and Use Ave. La Esperanza to On-Ramp at Ave. Palizada Interchange.
o Ave. Pico	Diamond Interchange (Undercrossing)	Use Interchange Ramps.
o New Development (No Official Name)	Overcrossing (No Access)	Exit Freeway at Ave. Pico and use Calle Frontera to Calle Vallarta to Ave. Vaquero to Camino De Los Mares On-Ramp.
o Ave. Vaquero	Undercrossing (No Access)	Same as above.
o Camino De Estrella/ Camino De Los Mares	Diamond Interchange (Overcrossing)	Use Interchange Ramps.
o Via California	Overcrossing (No Access)	Exit Freeway at Camino De Los Mares and Use Camino El Molino to Via California to Camino De Las Ramblas On-Ramp.

Table 12 (Continued)

POTENTIAL PROBLEM AREAS ON PRIMARY TRANSPORTATION ROUTES

LOCATION	TYPE OF STRUCTURE	ALTERNATIVE ROUTING
o Camino De Las Ramblas	Partial Clover Leaf (Undercrossing)	Use Interchange Ramps.
o Camino Capistrano On-Ramp	Undercrossing	Exit Freeway at Camino Las Ramblas and Use Doheny Park Rd. to Camino Capistrano to San Juan Creek Rd. to Valle Rd. On-Ramp.
o San Juan Creek Road	Undercrossing (No Access)	Exit Freeway at Camino Las Ramblas and Use Doheny Park Rd. to Camino Capistrano to Ortega Hwy. On-Ramp.
o San Juan Creek	Undercrossing	Same as above.
o Ortega Highway	Diamond Interchange (Overcrossing)	Use Interchange Ramps.
o Horno Creek	Undercrossing	Exit Freeway at Ortega Hwy. and Use Camino Capistrano to Junipero Serra On-Ramp.
o El Horno Street	Undercrossing	Same as Above.
o Junipero Serra Road	Diamond Interchange (Undercrossing)	Use Interchange Ramps.
o Trabuco Creek	Undercrossing	Exit Freeway at Junipero Serra Rd. and Use Rancho Viejo Rd. to Avery Pkwy. On-Ramp.
o Avery Parkway	Diamond Interchange (Undercrossing)	Use Interchange Ramps.
o Crown Valley Parkway	Partial Diamond Interchange (Overcrossing)	Exit Freeway at Crown Valley Pkwy. and use Marguerite Pkwy. to Oso Pkwy. On-Ramp.

Table 12 (Continued)

POTENTIAL PROBLEM AREAS ON PRIMARY TRANSPORTATION ROUTES

LOCATION	TYPE OF STRUCTURE	ALTERNATIVE ROUTING
PACIFIC COAST HWY/ORANGE COUNTY		
o Ave. Estacion to Camino Capistrano	Unstable Bluff Area	Use Ave. Pico to I-5 to Camino Las Ramblas to Pacific Coast Highway.
o Camino Capistrano to Palisades Drive	Unstable Bluff Area	Use Camino Capistrano to Doheny Park Road to Camino Las Ramblas to Pacific Coast Hwy.
o AT&SF Railroad Bridge	Overcrossing	Use Doheny Park Road to Camino Las Ramblas to Pacific Coast Highway.
o San Juan Creek	Undercrossing	Same as Above.
CAMINO CAPISTRANO/ORANGE COUNTY		
o Camino Las Ramblas	Overcrossing	Use Via California to Camino Las Ramblas/I-5 On-Ramp.
o San Juan Creek	Undercrossing	Use San Juan Creek Road to Valle Road/I-5 On-Ramp.
o Trabuco Creek	Undercrossing	Use Junipero Serra Road to I-5 On-Ramp.
RANCHO VIEJO ROAD/ORANGE COUNTY		
o Trabuco Creek	Undercrossing	Use Junipero Serra Road/I-5 On-Ramps.
I-5/SAN DIEGO COUNTY		
o San Mateo Creek	Undercrossing	Use I-5 Southbound.
o Basilone Road	Diamond Interchange (Overcrossing)	Use Interchange Ramps.

Table 12 (Continued)

POTENTIAL PROBLEM AREAS ON PRIMARY TRANSPORTATION ROUTES

LOCATION	TYPE OF STRUCTURE	ALTERNATIVE ROUTING
I-5/SAN DIEGO COUNTY (Cont'd.)		
o Old Highway 101	Undercrossing	Use I-5 Northbound Lanes.
o Las Pulgas Road	Diamond Interchange (Overcrossing)	Use Interchange Ramps.
OLD HIGHWAY 101		
o I-5 (Near Las Pulgas Road Interchange)	Overpass	Use Basilone Road On-Ramp to Northbound I-5.

and instruction would still be available through the various emergency broadcast media. It is very likely that the populace would be monitoring their radios for news regarding the earthquake, thus largely negating the need for a siren warning to alert the populace to listen to the emergency broadcast media.

Since consideration of an evacuation due to an accident several days or weeks following an earthquake would reflect the fact that there would be sufficient time to rectify earthquake caused damage, and thus largely remove the effects of such damage upon evacuation, this analysis assumes:

- That the evacuation is initiated within hours of a major earthquake, which has created blockage at several locations along the primary evacuation routes, and before such blockages can be repaired.

The analysis also assumes:

- Although some vehicles may be damaged, sufficient vehicles would be operable to evacuate the normal automobile-owning population. It is estimated that there are at least 25,500 privately-owned vehicles serving approximately 15,600 households within the ten-mile north sector (1.6 vehicles per household).

- Mobilization of the populace would occur at the following rate:

Time After Notification	Percent of Households Leaving Home	
	Incremental	Cumulative
0 - 30 Minutes	4	4
30 - 60 Minutes	33	37
60 - 90 Minutes	60	97
90 -120 Minutes	3	100

This is the same distribution as for evacuation without an earthquake, since many of the public response time factors, such as assembly of the family unit, will likely have already occurred. The response time assumption is not critical to evacuation time estimate in most cases where there is a major disruptive effect on a primary evacuation route, since extensive time may be spent in the traffic queues prior to the point of traffic constraint, (i.e., a faster mobilization may result in a longer travel time, with no change in total evacuation time).

Evacuation Time Analysis Cases

It is impractical to evaluate all combinations of transportation route disruptions which could occur as a result of an earthquake. For the purposes of this analysis, which is to assess the impact of various degrees and locations of damage on emergency evacuation times, a series of four "representative blockage conditions were identified for evaluation.

Generally, earthquake blockages of the principal evacuation route -- Interstate 5 -- can be grouped into two types of impairments, with the various potential combination of blockages within each of the two groups requiring similar traffic diversions. These are:

1. The failure of one or more diamond-type interchange bridges. This type of blockage is considered as a separate case since evacuation traffic would generally be able to use the "diamond" on and off-ramps to bypass the damaged bridge structure.

2. The failure of roadway sections or one or more structure(s) other than those in diamond-type interchanges. This would encompass non-diamond interchange bridges failures; failure of bridge over or under-crossings of streams, railroads and streets; or the loss of a short section of roadway by vertical or horizontal displacement.

For each of these two cases, a series of bridge failures was identified which would have the maximum adverse impact upon evacuation time, short of total blockage of all parallel area roadways. The "test case" blockages were located in the northern portion of the EPZ to affect the largest number of evacuation vehicles.

A third case was selected for evaluation which would reflect conditions where route impairments occured in a very localized area, and severely limited both primary evacuation routes (Interstate 5 and Pacific Coast Highway).

The fourth analysis condition was chosen to evaluate the evacuation time for a southerly evacuation of the north sector. This case would apply to major problems which might occur at or north of the 10-mile radius and which may result in the consideration of a southward evacuation past the SONGS facility. Examples of this condition could include:

- The collapse of all or most bridges across San Juan Creek;

- Severe damage to structures along both I-5 and Pacific Coast Highway north of the EPZ;

- Unavailability of the reception/care centers in northern Orange County, either through damage to these receptions centers or the full use of these facilities by northern Orange County residents should the earthquake severely affect that area of the County.

The specific roadway blockages for the estimating of evacuation times are discussed in detail in the following paragraphs.

Loss of Diamond-Type Interchange(s) - In this case, it is assumed that within the EPZ both Junipero Serra Road/I-5 and Avery Parkway/I-5 interchange structures have collapsed. It is also assumed that Crown Valley Parkway interchange, beyond the EPZ boundary, has failed. These selected locations for route disruptions represent the "most critical case" for diamond interchange failures for the reason that the maximum number of evacuation vehicles would be impacted by the impairments. (See Figure 10.)

Loss of Non-Diamond Interchange Structure - This case involves the loss of overpass structures on I-5 at Horno Creek and at Camino Capistrano to northbound I-5 on-ramp. In this case all vehicles assigned to I-5 would be re-routed onto Camino Capistrano. Again this combination of non-diamond interchange failures represents the most critical case other than loss of all major evacuation routes. (See Figure 11.)

Loss of Major Routes in Northern San Clemente - For this scenario, two consecutive interchanges are assumed to be damaged on

I-5 including those at Avenida Palizada and Avenida Pico. In addition, a third structure, an overpass immediately north of Avenida Pico on I-5 is also assumed to be damaged. Finally, Pacific Coast Highway/El Camino Real is assumed to be blocked by a landslide between Avenida Estacion and Camino Capistrano. All traffic normally evacuating to the north on I-5 and Pacific Coast Highway would be limited to the only remaining route, Calle Frontera, a four-lane facility east of I-5. (See Figure 12.)

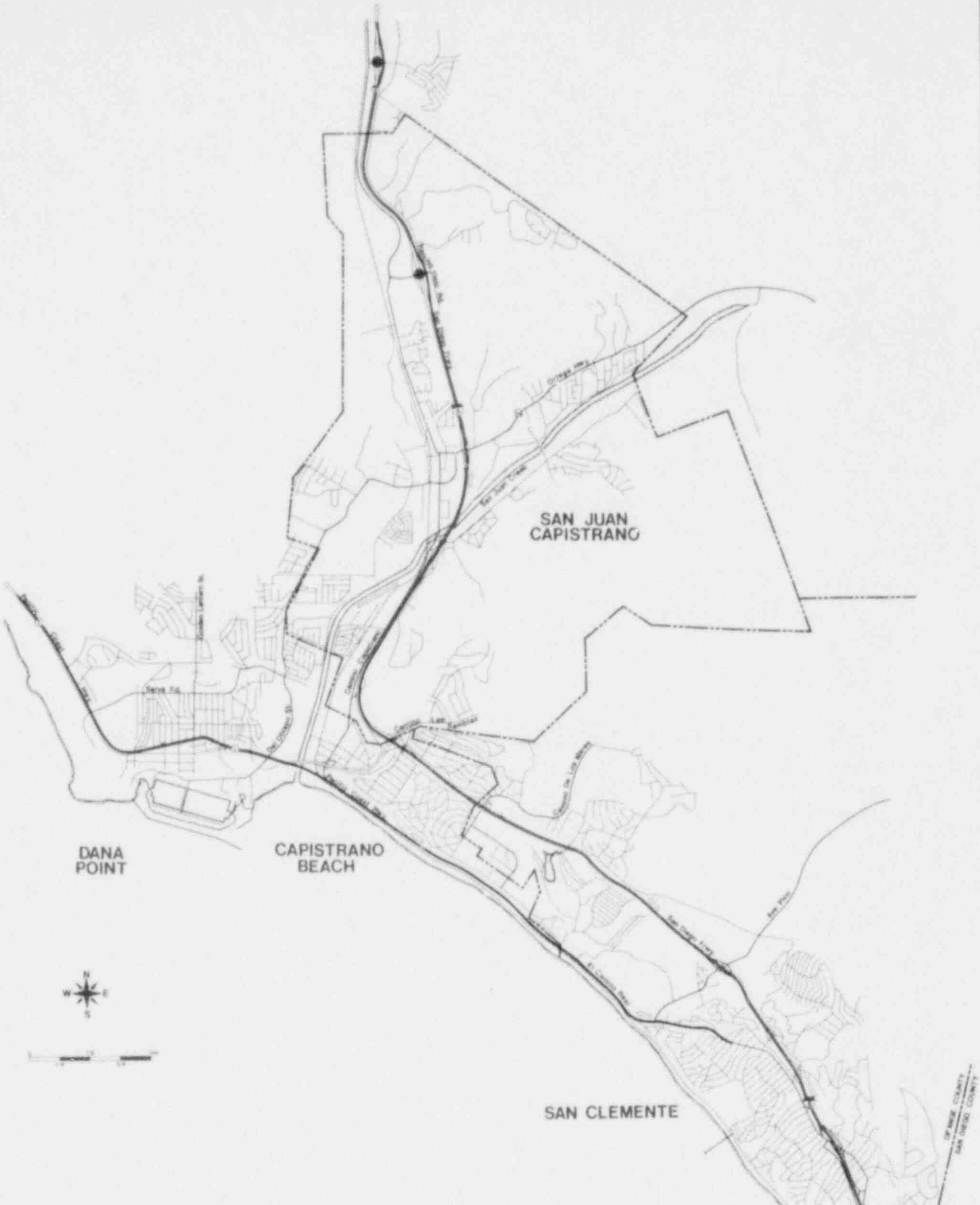
Severe Disruption of Primary Evacuation Routes to the North - For the purposes of the evacuation time assessment, it is assumed in this case that I-5 is blocked by a fallen overpass at Camino Las Ramblas; Pacific Coast Highway is blocked by fallen structures at Doheny Park Road/Camino Las Ramblas and San Juan Creek. In this scenario the zero to five mile area (south of Avenida Pico) is assumed to evacuate to the south on I-5 and the population between Avenida Pico and Camino Las Ramblas would be instructed to take shelter. (See Figure 13.)

Evacuation Time Assessment Program

The procedures followed in the assessment of evacuation times for the selected earthquake scenarios were essentially the same as those presented in Chapter 2 under Evacuation Time Assessment Program.

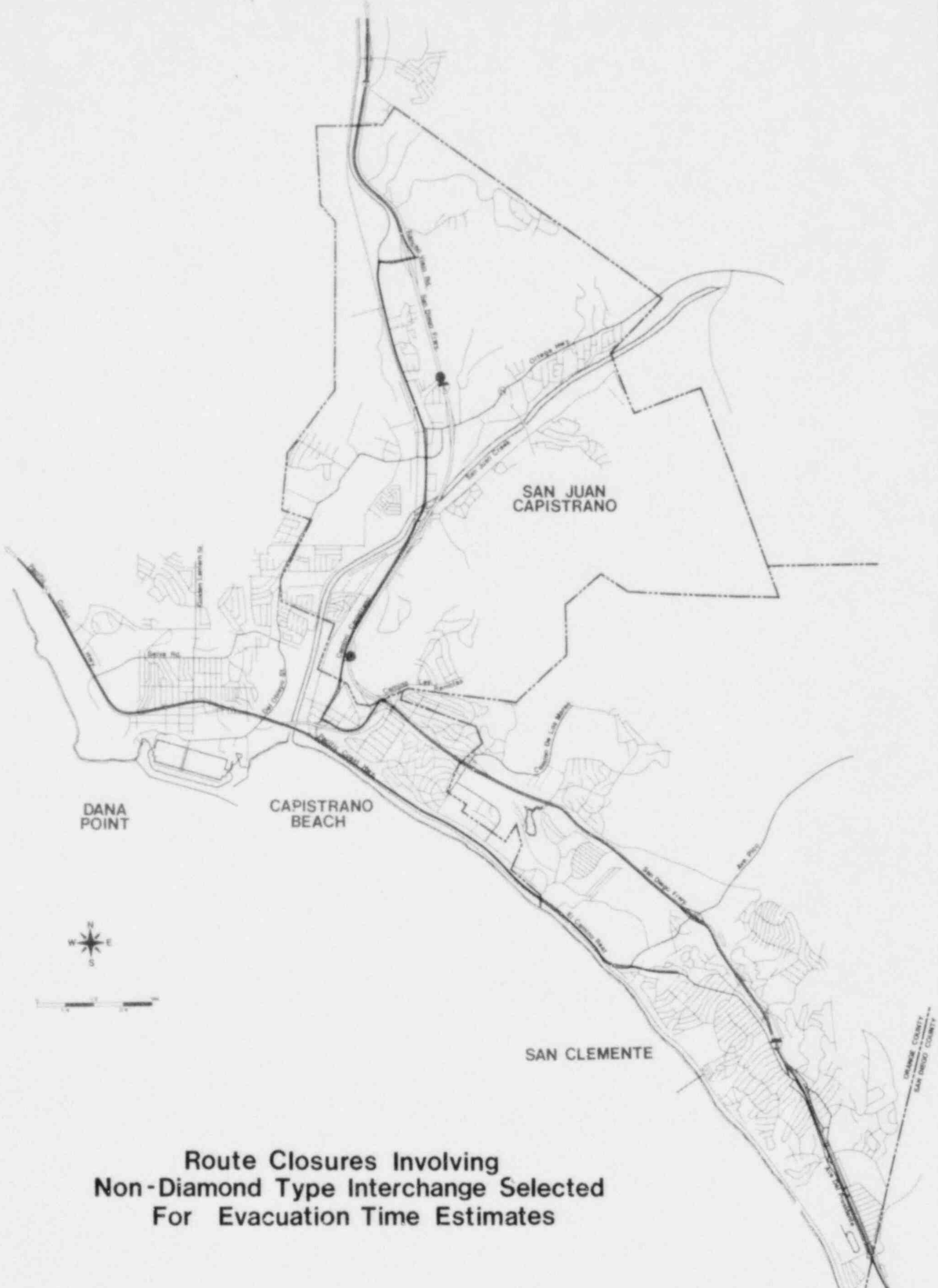
The basic input data to the evacuation time assessment program is presented in the following sections.

Analysis Area - The analysis of the first three cases assumes evacuation of the populace within the north sector EPZ (Subsectors 1, 2, 3, 4, 5, 6, 7, 8, 9, and 11). In the fourth case, where evacuation of the five-mile north sector was considered, Subsectors 1, 2, 3 and 11 populations were assumed to evacuate.



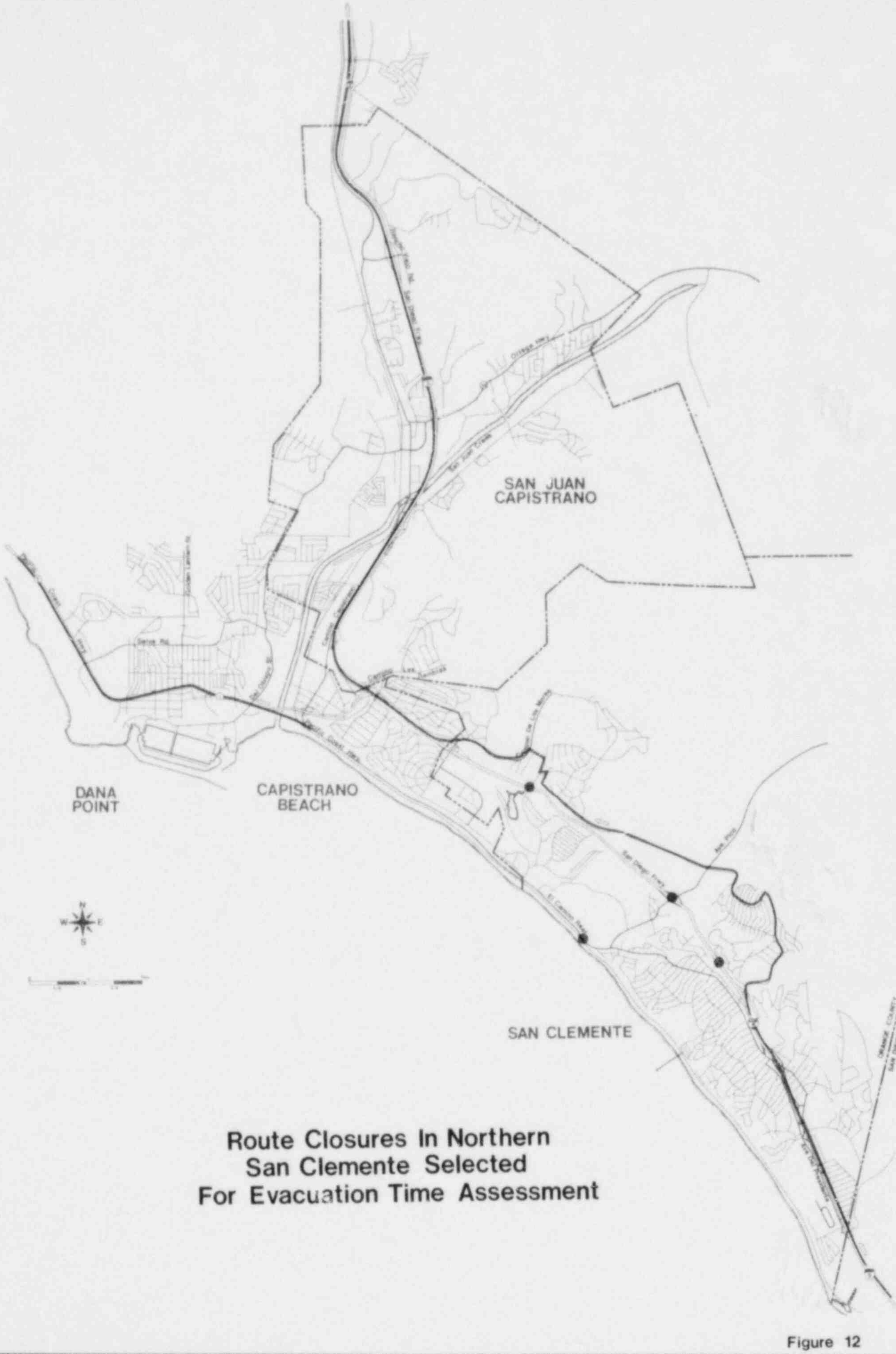
Route Closures Involving Diamond-Type Interchanges Selected For Evacuation Time Assessment

Figure 10



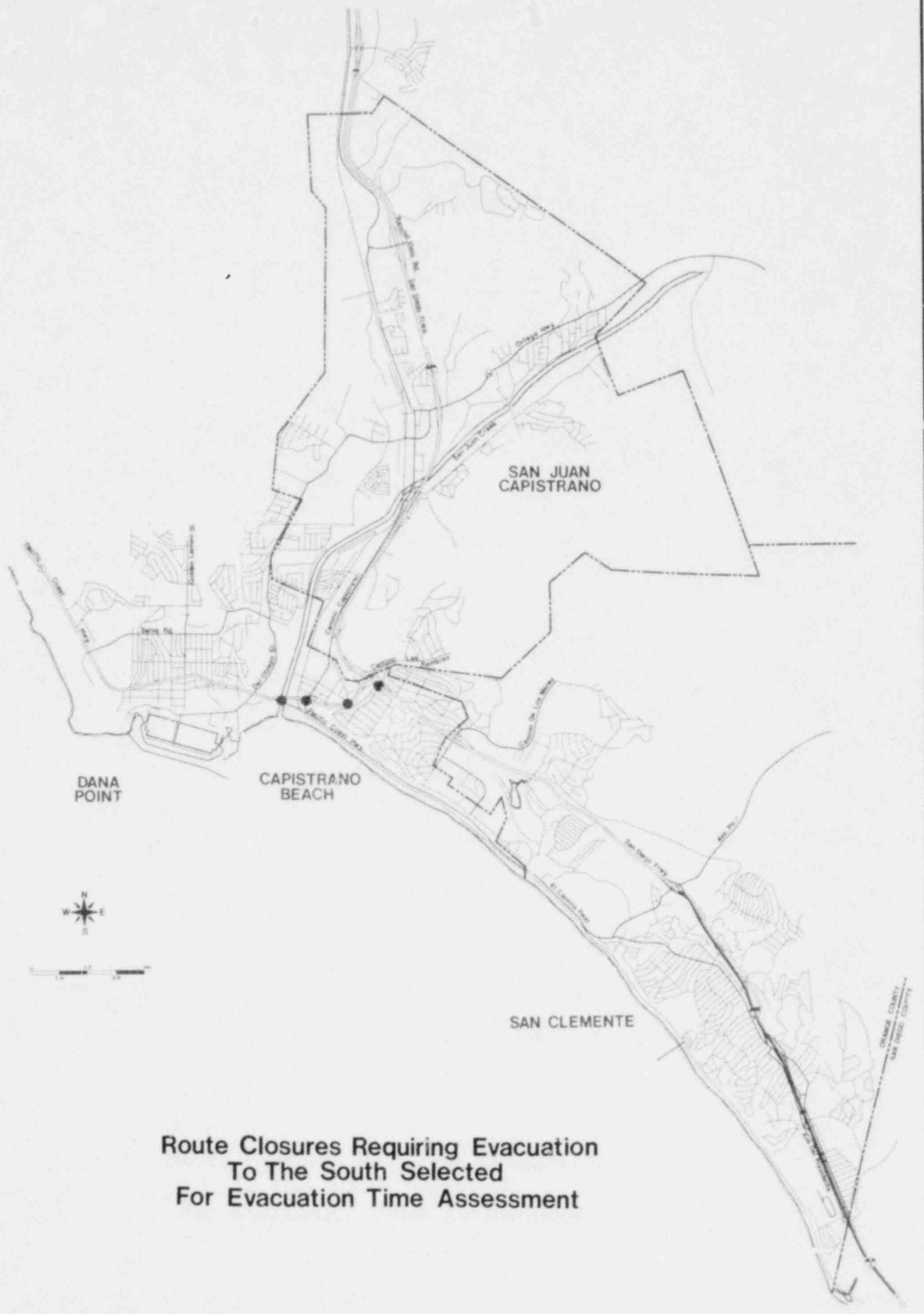
Route Closures Involving
Non-Diamond Type Interchange Selected
For Evacuation Time Estimates

Figure 11



Route Closures In Northern San Clemente Selected For Evacuation Time Assessment

Figure 12



Route Closures Requiring Evacuation To The South Selected For Evacuation Time Assessment

Figure 13

Vehicle Demand - All four earthquake/evacuation analysis cases assume peak population daytime summer weekend conditions as described in Table 2.

Evacuation Roadway Network - Link characteristics (i.e. capacity, average speed) have not been modified except in the vicinity of the evacuation route impairments. Alterations were made to the evacuation route network to reflect the loss of routes as identified for each scenario. Links were added to the network, where required, to represent secondary evacuation routes. Evacuation route descriptions were modified for each centroid as the individual scenarios dictated. Secondary evacuation routes were assigned under the constraint that population from the subsectors normally assigned to I-5 would resume evacuation via I-5 once the route impairment has been by-passed.

Impact on Evacuation Time

Evacuation time assessment program results for the four representative earthquake scenarios were compared to non-earthquake summer weekend conditions to determine the general impacts on evacuation time. Table 13 summarized the results of the evacuation time assessment. Three time estimates were given for each of the first three cases. The first estimate represents the time to evacuate the five-mile north sector independent of the five to ten-mile area. The second estimate represents the time to evacuate the ten-mile north sector beyond the EPZ boundary assuming simultaneous evacuation of the inner five-mile sector. The third estimate represents the time to evacuate the entire north sector EPZ. All time estimates include evacuation beyond the EPZ boundary because in most cases the evacuation route impairments were located between the ten-mile and EPZ area boundaries.

A second set of time estimates (i.e. 0-5 Mi., 0-10 Mi., 0-EPZ) have been given for each of the first two earthquake

Table 13

EVACUATION TIME ASSESSMENT SUMMARY
FOR POTENTIAL EARTHQUAKE EFFECTS ON MAJOR ROUTES

CONDITION[a]	ESTIMATED TIME TO EVACUATE AREA[b] 0-5 Miles	0-10 Miles	0-EPZ
Reference Evacuation Without Earthquake Effects			
Using Assigned Evacuation Routes[c]	4 Hrs. 30 Min.	4 Hrs. 30 Min.	6 Hrs. 15 Min.
With Diversion to Pacific Coast Hwy[d]	3 Hrs.	3 Hrs.	3 Hrs. 45 Min.
1. Loss of Diamond Interchanges			
Using Assigned Evacuation Routes[c]	8 Hrs. 15 Min.	13 Hrs. 15 Min.	17 Hrs. 30 Min.
With Diversion to Pacific Coast Hwy[d]	6 Hrs. 30 Min.	9 Hrs.	10 Hrs. 30 Min.
2. Loss of Non-Diamond Interchanges			
Using Assigned Evacuation Routes[c]	8 Hrs. 30 Min.	13 Hrs. 30 Min.	17 Hrs. 30 Min.
With Diversion to Pacific Coast Hwy[d]	6 Hrs. 45 Min.	9 Hrs. 30 Min.	12 Hrs. 30 Min.
3. Loss of Major Routes in North San Clemente, Evacuation to the North	14 Hrs. 15 Min.	14 Hrs. 15 Min.	14 Hrs. 15 Min.
4. Loss of Major Routes to the North, Evacuation to the South	4 Hrs.	Not Considered	Not Considered

(a) Assumes Daytime Summer Weekend Condition.
(b) Includes Evacuation of Orange County Subsectors and State Beach Areas.
(c) Based Upon all Traffic Normally Assigned to I-5 Continuing North in I-5 Corridor, Despite Impairments
(d) Reflects a Sufficient Part of Traffic Assigned to I-5 Being Diverted to Pacific Coast Highway to Fully Use the Capacity of Both Routes.

conditions. These estimates provide a comparison of evacuation times for conditions where traffic is diverted to Pacific Coast Highway in a manner which utilizes the available capacity of both routes more effectively. The methods of achieving this are discussed in Chapter 8 beginning on page 61.

Loss of Diamond Interchanges - Evacuation of the entire north EPZ is estimated to take 17 hours and 30 minutes. This estimate represents the time for vehicles assigned to I-5 to bypass the route blockages and exit the EPZ. The capacity-limiting factor in the evacuation scenario is the off and on-ramps at the assumed damaged interchanges. Exiting vehicles at this point are assumed to be metered at a rate of approximatly 1,200 vehicles per hour.

It should be noted that the selected locations for route disruptions represent the "most critical case" for diamond interchange failures as it requires all vehicles west of I-5, assigned to Camino Capistrano/Rancho Viejo Road to enter I-5 south of the blockages (i.e. via Ortega Highway interchange) and pass through the critical section. If only one of the three "damaged" interchanges were to fail, part of the evacuation traffic would be able to exit on surface streets parallel to I-5 (i.e. Camino Capistrano, Rancho Viejo Road), thus reducing the evacuation time by 6 to 7 hours.

Subsector 3 which evacuates via Pacific Coast Highway would be unaffected by the impairments on I-5 and would complete its evacuation in approximately 6 hours and 15 minutes.

One possible method of reducing evacuation time in this type of situation would be to divert traffic assigned to I-5 to Pacific Coast Highway. This could be accomplished by diverting traffic already on I-5 to Pacific Coast Highway via Camino Las Ramblas interchange and/or re-routing traffic from Subsector 1 up Pacific Coast Highway prior to them entering I-5. In either case, the resulting "balanced" evacuation route loading would reduce the north sector EPZ evacuation time to between 10 and 11 hours.

Another method of reducing evacuation time would be to provide manual traffic control at the critical off and on-ramps (i.e. at the damaged interchanges) to allow for two-lane operation. Two lanes could be accommodated on the ramps at each of these locations and would increase ramp capacity to 2,000 vehicles per hour. This measure by itself would reduce the north sector EPZ evacuation time to 10 hours and 45 minutes, and when used in conjunction with the balancing of evacuation route loading would reduce the evacuation time to between 8 hours and 30 minutes and 9 hours.

Loss of Non-Diamond Interchanges - The blockage of I-5 immediately north of Camino Las Ramblas, would require the diversion of freeway traffic to Camino Capistrano. Under these conditions evacuation of the north sector EPZ would require approximately 17 hours and 30 minutes.

In this case, the capacity-limiting factors in the evacuation are the two-lane, two-direction sections of Camino Capistrano between Camino Las Ramblas and Junipero Serra Road. These sections of Camino Capistrano, which have an approximate evacuation capacity of 1,200 vehicles per hour (one outbound lane), would control the rate of evacuation.

As in the previous case, evacuation time could be reduced to between 10 and 11 hours by diverting traffic from the western part of San Clemente to Pacific Coast Highway. In this case however, since Camino Las Ramblas is not available to divert traffic from I-5 to Pacific Coast Highway, traffic control would be required along the "Bluffs" section of Pacific Coast Highway to provide two northbound lanes of traffic through the present two-lane, two direction section.

Loss of Major Routes in North San Clemente - In this scenario, the evacuation route for all of the population between SONGS and Avenida Pico is limited to a two-lane street which parallels I-5 to the east. It is estimated that evacuation of the population within this area would take approximately 14 hours and 15 minutes to complete under these conditions. The remaining portions of the north sector EPZ would not be significantly affected by the damaged freeway sections and would exit the EPZ in less than 6 hours.

Under the constraints of this case, the only mitigative measure would be to evacuate the population south of Avenida Pico towards the south on I-5. The evacuation time implications of this alternative are discussed in the next analysis condition.

Loss of Northern Evacuation Routes - Under the specific conditions chosen to represent the general scenario of evacuating to the south, the five-mile sector population would complete the evacuation beyond the southern EPZ boundary in San Diego County within approximately 4 hours. This evacuation time estimate reflects the simultaneous evacuation of the resident and transient populations from the two-mile sector and the north five-mile radius (subsectors 1, 2 and 3).

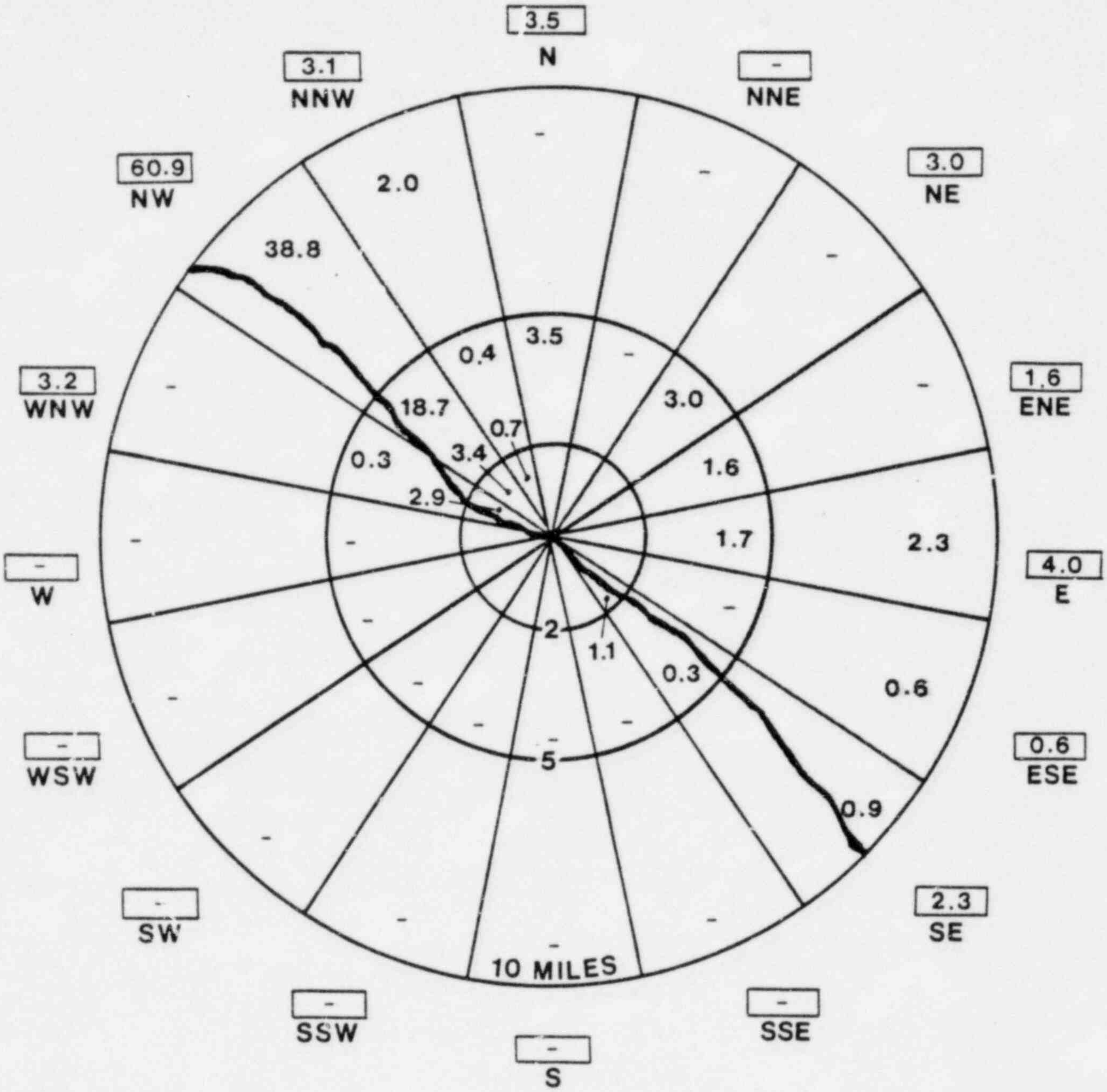
Extensive, pre-positioned traffic controls would have to be utilized for a southward evacuation, since the evacuation routing of the populations would be in the opposite direction from that anticipated by the area population.

Conclusions

In summary, the analysis reveals that under severe evacuation route disruptions, evacuation of the north sector EPZ would require up to an estimated 17 to 18 hour period. It is evident in the first three cases, that a great portion of the evacuation time would be spent waiting in traffic queues. Under these conditions, serious consideration should be given to evacuating the populace incrementally, thereby reducing the delay time on the roadway.

APPENDICES

APPENDIX A
POPULATION DISTRIBUTION BY 22.5° SECTOR
SAN ONOFRE E.P.Z.



LEGEND:

2.0 Population X 1,000

- Less Than 100 Population

POPULATION TOTALS*			
RING, MILES	RING POPULATION	TOTAL MILES	CUMULATIVE POPULATION
0-2	8,100	0-2	8,100
2-5	29,500	0-5	37,600
5-10	44,600	0-10	82,200
10-EPZ	29,500	0-EPZ	111,700

* ESTIMATES REPRESENT PEAK SUMMER WEEKEND CONDITIONS

POPULATION DISTRIBUTION BY SECTOR

POPULATION DISTRIBUTION BY SECTOR FOR SAN ONOFRE

1980 ESTIMATED

SECTOR	RADIAL DISTANCE FROM SONGS 0-2 MILES	2-5 MILES	5-10 MILES	10 MILES-EPZ	TOTAL
N	-	3,500	-	*	3,500
NNE	-	-	-	*	-
NE	-	3,000	-	*	3,000
ENE	-	1,600	-	*	1,600
E	-	1,700	2,300	*	4,000
ESE	-	-	600	*	600
SE	1,100	300	900	*	2,300
SSE	-	-	-	*	-
S	-	-	-	*	-
SSW	-	-	-	*	-
SW	-	-	-	*	-
WSW	-	-	-	*	-
W	-	-	-	*	-
WNW	2,900	300	-	*	3,200
NW	3,400	18,700	38,800	23,500	84,400
NNW	700	400	2,000	6,000	9,100
TOTAL	8,100	29,500	44,600	29,500	111,700

\- Less than 100 population

* The EPZ boundary for this sector does not extend beyond the 10-mile radius.

APPENDIX B
EVACUATION TIME ASSESSMENT PROGRAM METHODOLOGY

APPENDIX B

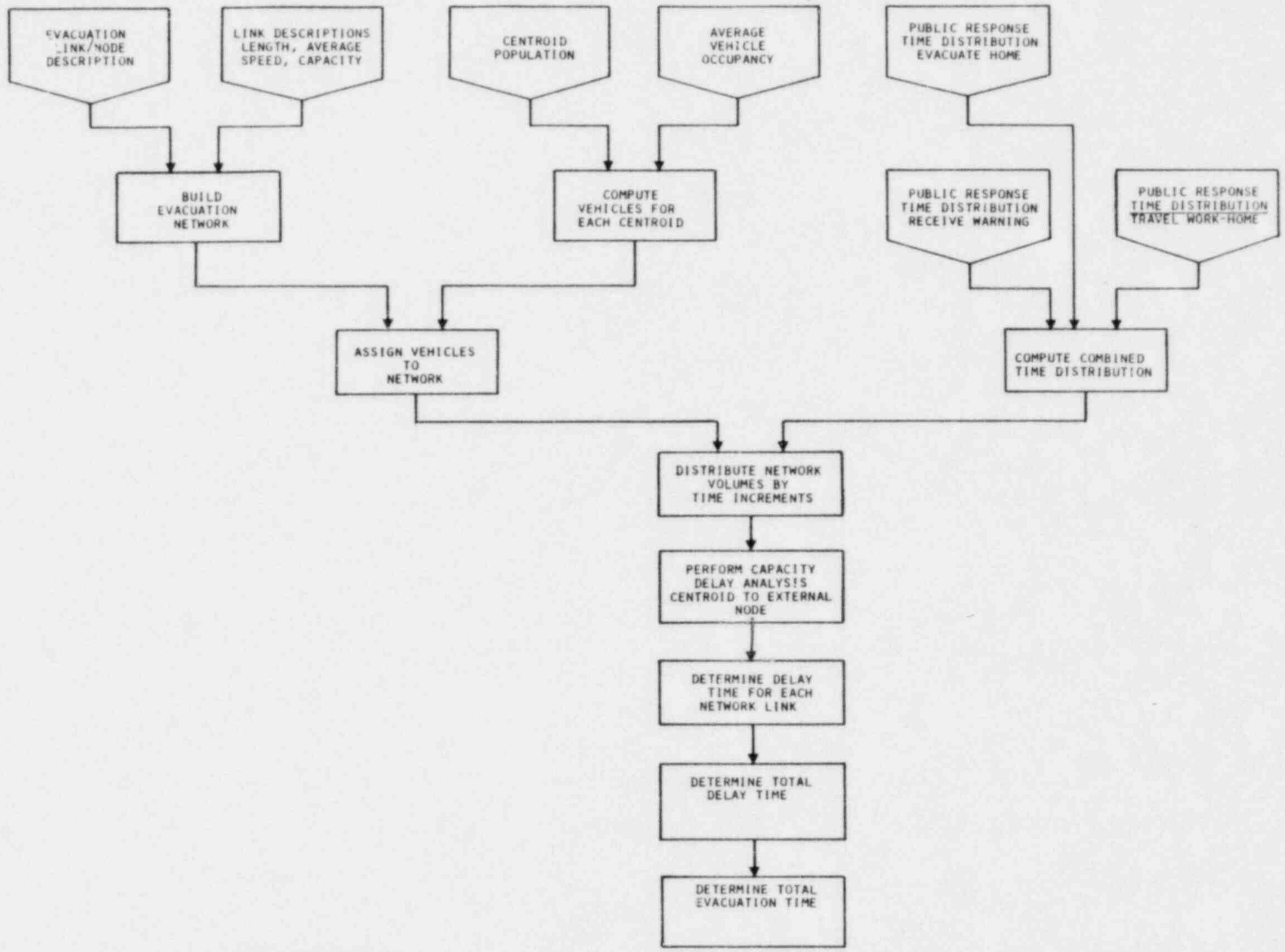
EVACUATION TIME ASSESSMENT PROGRAM METHODOLOGY

The evacuation time assessment was performed in two separate packages of computer programs. The general flow of these packages is illustrated in Figure B-1.

Build Evacuation Network - This portion of the program is accomplished, utilizing the link/node descriptions from Evacuation Route development task. The computer program, utilizing well-established principles, was extracted from an in-house program, TRANSIT, which was basically created for transit route development. It organized the input data and it assembles link data such as distance, speed, hourly capacity, and queuing capacity.

Assignment of Vehicles to Each Centroid - Using centroid population and car occupancy inputs, the user computes vehicle volumes to be evacuated and assigns these volumes to each centroid. Remaining steps are also computed in the evacuation time assessment routine.

Public Response Time Distributions - Since the predicted volume of vehicles entering the network from each centroid is a function of various public response times to the evacuation warning, it is necessary to establish quantification of these responses by certain assumed conditions. Three public response time distributions were combined to assess evacuation times under the four scenarios - summer weekday, nighttime, peak summer weekend, and adverse weather conditions.



BASIC FLOW DIAGRAM

EVACUATION TIME ASSESSMENT

FIGURE B-1

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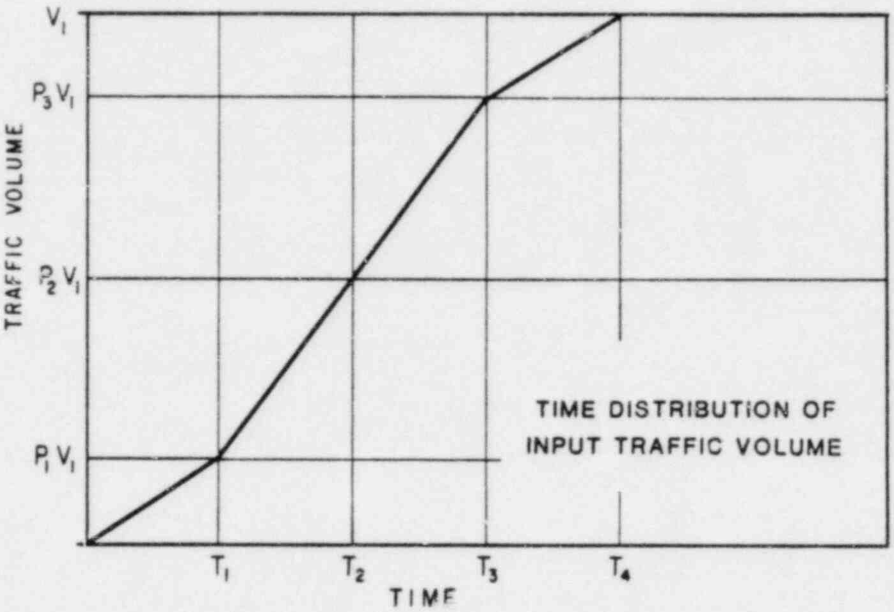
Determination of Mobilization Time - Mobilization time is defined as that period between the issuance of the evacuation warning and the time taken for the last vehicle to leave any centroid under the specified scenario conditions.

Time Distribution of Traffic Volumes on the Evacuation Network - The traffic volumes previously assigned to each centroid are then distributed onto the network incrementally as determined by the combined public response distributions.

Capacity Delay Analysis - The capacity delay analysis is performed in the assessment program by the four time increments determined in the above step. It is based upon the rudimental principle of queuing -- which is, if the input to a network element during a specified time period exceeds the service capacity of that element, a queue of input vehicles is formed and a delay is generated to those vehicles in the queue. These vehicles must be added to the input of the next interval and compared to the service capacity to determine if another queue is formed at the end of that interval. The process is continued until all vehicles to be serviced have passed through the element. The process is illustrated in Figures A-2 and A-3.

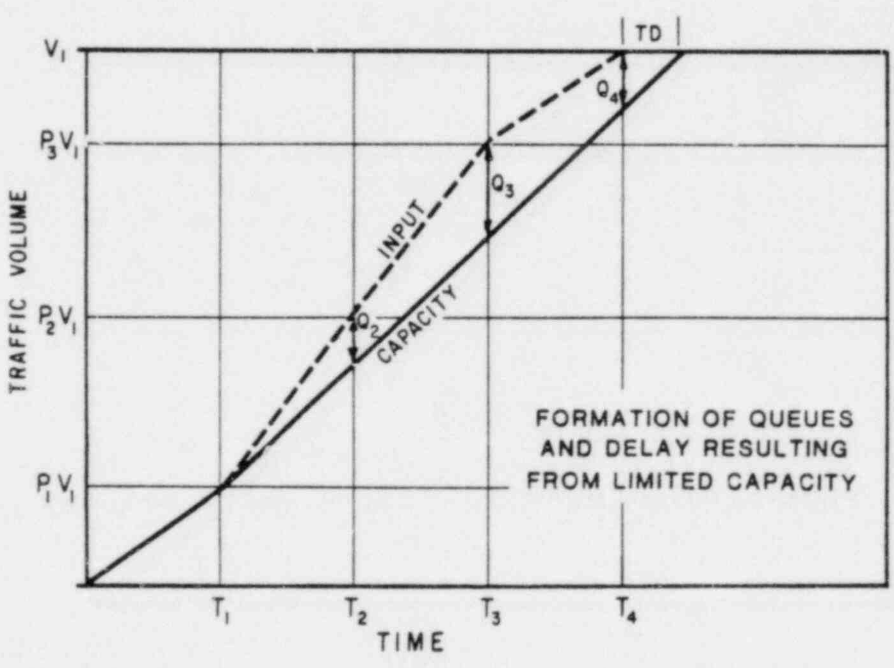
Figure B-2 indicates the distribution of a traffic volume, V, over 4 time increments in which P1 is the per cent of the total assigned to the first time increment, P2 the second and so forth.

Figure B-3 indicates the condition where the input of the first and fourth intervals do not exceed the link capacity. After the first interval, all vehicles in the input are served with no delay and no queue is formed. However, the input during the second interval exceeds the capacity, shown as a rate of vehicles served per time increment. At the end of second time interval, the input has resulted in a queue of



TIME DISTRIBUTION OF INPUT TRAFFIC VOLUME

FIGURE B-2



FORMATION OF QUEUES AND DELAY RESULTING FROM LIMITED CAPACITY

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FIGURE B-3

vehicles shown as Q2 (Q1 being zero). This volume is therefore added to the input of the third interval. At the end of this period a queue of Q3 vehicles is formed. These vehicles are added to the input of vehicles during the fourth interval because that volume exceeds the capacity, a number of vehicles Q4 remain at the end of the period. This queue must then be dissipated at a rate equivalent to the link's capacity. A delay of TD is required for this discharge and must be added to the four time increments to obtain the total time for the volume to pass through the link.

It is important to note that this process has "metered" the input to equal the link capacity. As the traffic proceeds to the next link of the evacuation route, its input is at the rate commensurate to the previous link's capacity. If no additional volume has been assigned to the subsequent link and that link has the same capacity as the upstream link, no additional delay is experienced.

If either the capacity or volume of the downstream link is different, the analysis procedure must be repeated, using the respective input volumes and capacity of that link.

Determination of Delay Times for Each Link - The evacuation routes for each centroid are analyzed using the delay analysis technique described above. The delays, if any, are assigned to each of the links. Previous delays for any link resulting from the analysis of another centroid for the same link are compared in the program. Appropriate adjustments to each link delay are made by the program and the proper delay assigned.

Determination of Link Travel Times - Travel times for each link are computed by the assessment program using the link distance and the anticipated link operating speed inputs. These travel times assume no capacity delays. Therefore, when the travel time for a link is added to the proper delay time, the actual speed for the link is represented.

APPENDIX C
E.P.Z. SUBSECTORS

SUBSECTOR 1

A. Description

Subsector 1 includes all residential, commercial, and recreational (San Clemente State Beach) areas west of I-5, south of Trafalgar Canyon and north of the Orange County/San Diego County boundary.

B. Reception Center

University of California, Irvine (intersection of University Drive and Campus Drive)

C. Evacuation Procedure

The population within Subsector 1 shall evacuate to the north on I-5.

- Vehicles from the area south of San Clemente State Beach should use the Avenida Del Presidente/I-5 interchange at the southern City limit.[1]

- The population south of West Avenida De Los Lobos Marinos to and including San Clemente State Beach should enter the freeway at the Magdalena on-ramp via the Avenida Mendocino overpass.

- The area, within Subsector 1, north of West Avenida San Antonio should use the Avenida Presidio[2] or Avenida Palizada northbound I-5 on-ramp.

- Upon entering I-5, the population from Subsector 1 should continue northbound to the I-405 junction. Interstate 405 should be taken to the University Drive interchange. Exit and take University Drive westbound to Campus Drive. Evacuation traffic will be directed from this intersection to the reception enter location.

D. Institutions Requiring Special Evacuation Consideration

1. Concordia Elementary School, 3120 Avenida Del Presidente.

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[1]Previous to the completion of the Avenida Del Presidente/I-5 interchange, all vehicles from the southern part of Subsector 1 should proceed north on Avenida Del Presidente to Mendocino overpass. Turn east over I-5 then north along South El Camino Real to Magdalena on-ramp.

[2]Avenida Presidio northbound on-ramp is presently under construction.

SUBSECTOR 2

A. Description

Subsector 2 includes all residential, commercial and recreational areas east of I-5, north . . the Orange County/San Diego County line and south of Avenida Pico.

B. Reception Center

University of California, Irvine (intersection) of University Drive and Campus Drive).

C. Evacuation Procedure

The population within Subsector 2 shall evacuate to the north on I-5.

- All evacuation traffic existing via South El Camino Real should use either Magdalena on ramp or the northbound I-5 on ramp at the South El Camino Real underpass.

- All traffic existing Subsector 2 via Avenida Presidio[1], Avenida Palizada, or Avenida Pico should use the respective I-5 northbound on-ramp.

- Once northbound on I-5, Subsector 2 traffic should continue to the I-405 junction and then take I-405 to University Drive interchange. Here traffic should exit the freeway and take University Drive westward to Campus Drive. At this point evacuation traffic will be directed to the receprion enter location.

D. Institutions Requiring Special Evacuation Consideration

1. Chapel Hill Lutheran Pre-School, 200 Avenida San Pablo
2. Our Lady of Fatima School, 105 South La Esperanza
3. Ole Hanson Elementary School, 189 Avenida La Cuerta
4. San Clemente High School, 700 Avenida Pico
5. San Clemente Civic Center, 100 Avenida Presidio

[1]Avenida Palizada northbound I-5 on-ramp is presently under construction.

SUBSECTOR 3

A. Description

Subsector 3 includes all residential, commercial and recreational areas west of I-5, north of Trafalgar Canyon and south of Avenida Pico. The northern boundary lies immediately north of Avenida Pico and from I-5 to North El Camino Real/Pacific Coast Highway. At this point the boundary assumes the alignment of Pacific Coast Highway, north to Camino Capistrano.

B. Reception Center

University of California, Irvine (intersection of University Drive and Campus Drive)

C. Evacuation Procedure

The population within Subsector 3 shall evacuate to the north on Pacific Coast Highway. All evacuation traffic from the area should exit the area via North El Camino Real/Pacific Coast Highway. Vehicles from Subsector 3 should proceed northbound on Pacific Coast Highway to Mac Arthur Boulevard. Mac Arthur Boulevard should be taken northbound to University Drive. Evacuation traffic should turn right (east) on University Drive and continue to Campus Drive. At this point traffic will be directed to the location of the reception center on U.S. Irvine Campus.

Institutions Requiring Special Evacuation Consideration

1. Las Palmas Elementary School, 1101 Calle Puente
2. Vantage Foundation Elementary School, 141 Avenida Miramar
3. Orange Coast Christian School, 107 West Marquita
4. San Clemente Pre-School, 163 Avenida Victoria
5. San Clemente Hotel Retirement Home,
6. Casa Romantica Retirement Home, 415 Granada

SUBSECTOR 4

A. Description

Subsector 4 includes all residential, commercial, and recreational areas north of Avenida Pico, east of Pacific Coast Highway and south of the San Clemente City limits. Subsector 4 does not include the Palm Beach Mobile home park which lies northeast of Pacific Coast Highway between Camino San Clemente and Camino Capistrano.

B. Reception Center

Orange Coast College, Santa Ana (intersection of Fairview Road and Adams Avenue)

C. Evacuation Procedure

The population within Subsector 4 shall evacuate to the north on I-5. Evacuation traffic from Subsector 4 should enter I-5 via either Camino De Estrella interchange, or Camino Las Ramblas interchange. The populations from neighborhoods south of Estrella Country Club should approach Camino De Los Mares. Traffic should proceed northbound on I-5 to the I-405 junction, then northbound on I-405 to Fairview Road (Orange Coast College) off-ramp. Fairview Road should be taken southbound to Adams Avenue. At this point evacuation traffic will be directed to the reception center on Orange Coast College campus.

D. Institutions Requiring Special Evacuation Consideration

1. Shorecliff Junior High School, 240 Via Socorro

2. San Clemente General Hospital, 654 Camino De Los Mares

3. Traffic Control and Operations

a. Traffic control, during evacuation, will be instrumental in preventing undue traffic delays. The primary traffic control requirements are to:

- Reduce traffic entering the area which may be advised to evacuate.
- Supply adequate traffic control within the City of San Clemente
- Provide adequate traffic control outside the evacuation area along major evacuation routes.

SUBSECTOR 5

1. Description

Subsector 5 includes the residential, commercial and recreational areas of Capistrano Beach which lie west of Pacific Coast Highway, north of the San Clemente City Limit and south of Doheny State Beach Park (inclusive).

2. Reception Center

Orange Coast College, Santa Ana (intersection of Harbor Boulevard and Adams Avenue).

3. Evacuation Procedure

The population within Subsector 5 should evacuate to the north on Pacific Coast Highway. Evacuating vehicles should proceed northbound on Pacific Coast Highway to Newport Boulevard. Here traffic should turn east and proceed on Newport Boulevard to Harbor Boulevard. Harbor Boulevard should be taken northbound to Adams Avenue where evacuation traffic would be directed to the relocation center on Orange Coast College Campus.

4. Institutions Requiring Special Evacuation Consideration

None.

SUBSECTOR 6

1. Description

   Subsector 6 includes the residential area west of I-5, north of the San Clemente City Limit, east of Pacific Coast Highway and south of San Juan Creek and the San Juan Capistrano City Limit.

2. Reception Center

   Orange Cost College, Santa Ana (intersection of Fairview Road and Adams Avenue).

3. Evacuation Procedure

   The population within Subsector 6 should evacuate to the north on I-5 via Camino Capistrano and enter I-5 at the northbound on-ramp immediately north of the San Juan Capistrano south city limit. Evacuation traffic shold proceed north on I-5 to the I-405 junction. Interstate 405 should be taken to Fairview Road (Orange Coast College) turn-off. Evacuation traffic should turn south onto Fairview Road and proceed to Adams Avenue. At this point evacuation traffic will be directed to the reception center on campus.

4. Institutions Requiring Spacial Evacuation Consideration

   - Beverly Manor Convalescent Hospital
   - Palisades Elementary School

SUBSECTOR 7

1. Description

   Subsector 7 includes the residential, commercial, and recreational areas within San Juan Capistrano which lie east and south of San Juan Creek.

2. Reception Center

   Santa Ana High School (520 W. Walnut Street), Santa Ana.

3. Evacuation Procedure

   The population within Subsector 7 should evacuate to the north on I-5. Evacuating vehicles should enter I-5 via northbound on-ramps at Camino Las Ramblar, Valle Road and Ortega Highway interchanges. Evacuation traffic should proceed northbound on I-5 to the Red Hill Avenue turn-off. Turn left (south) onto Red Hill Avenue and continue toMoulton Parkway. Moulton Parkway turn right (west) and proceed to Main Street. Turn right (north) on Main Street and continue north to Walnut Street. Turn left (west) on Walnut Street, and proceed to Santa Ana High School.

4. Institution Requiring Special Evacuation Consideration

   - Marco F. Forester Junior High School

SUBSECTOR 8

1. Description

   Subsector 8 includes the residential, commercial, and recreational aeas within San Juan Capistrano which lie west and north of San Juan Creek.

2. Reception Center

   Tustin High School (1171 Laguna Road), Tustin.

3. Evacuation Procedure

   The population with Subsector 8 should evacuate to the north on I-5. Evacuating vehicles west of I-5 could exit the city via Camino Capistrano and enter the freeway at either Avery Parkway or Oso Parkway interchange. Vehicles east of I-5 should enter I-5 at either Ortega Highway or Oso Parkway interchanges. Evacuation traffic should proceed northbound on I-5 to the Red Hill Avenue interchange. Turn right on Red Hill Avenue and then left on Laguna Road. Proceed to Tustin High School on the right.

4. Institutions Requiring Special Evacuation Consideration

   - San Juan Elementary School
   - Capistrano Elementary School
   - Capistrano Valley Christian School
   - Harold J. Ambuehl Elementary School
   - Del Obispo Elementary School

SUBSECTOR 9

1. Description

   All of Dana Point.

2. Reception and Care Center

   Edison High School, 21400 Magnolia St., Huntington Beach

3. Evacuation Procedure

   The population within Dana Point will evacuate to the north via Pacific Coast Highway. Proceed north on Pacific Coast Highway to Brookhurst Street. Right (north) on Brookhurst Street and left (west) on Verde Mar Drive. Continue west on Verde Mar Drive to Magnolia Street and then turn right. Proceed on Magnolia Street northbound to Edison High School.

4. Institutions Requiring Special Evacuation Consideration

   - Capistrano By the Sea Hospital
   - Dana Hills High School
   - Richard Henry Dana Elementary School

SUBSECTOR 9

1. Description

   All of Dana Point.

2. Reception and Care Center

   Edison High School, 21400 Magnolia St., Huntington Beach

3. Evacuation Procedure

   The population within Dana Point will evacuate to the north via Pacific Coast Highway. Proceed north on Pacific Coast Highway to Brookhurst Street. Right (north) on Brookhurst Street and left (west) on Verde Mar Drive. Continue west on Verde Mar Drive to Magnolia Street and then turn right. Proceed on Magnolia Street northbound to Edison High School.

4. Institutions Requiring Special Evacuation Consideration

   - Capistrano By the Sea Hospital

   - Dana Hills High School

   - Richard Henry Dana Elementary School

SUBSECTOR 5

1. Description

Subsector 5 includes the residential, commercial and recreational areas of Capistrano Beach which lie west of Pacific Coast Highway, north of the San Clemente City Limit and south of Doheny State Beach Park (inclusive).

2. Reception Center

Orange Coast College, Santa Ana (intersection of Harbor Boulevard and Adams Avenue).

3. Evacuation Procedure

The population within Subsector 5 should evacuate to the north on Pacific Coast Highway. Evacuating vehicles should proceed northbound on Pacific Coast Highway to Newport Boulevard. Here traffic should turn east and proceed on Newport Boulevard to Harbor Boulevard. Harbor Boulevard should be taken northbound to Adams Avenue where evacuation traffic would be directed to the relocation center on Orange Coast College Campus.

4. Institutions Requiring Special Evacuation Consideration

None.

SUBSECTOR 6

1. Description

   Subsector 6 includes the residential area west of I-5, north of the San Clemente City Limit, east of Pacific Coast Highway and south of San Juan Creek and the San Juan Capistrano City Limit.

2. Reception Center

   Orange Cost College, Santa Ana (intersection of Fairview Road and Adams Avenue).

3. Evacuation Procedure

   The population within Subsector 6 should evacuate to the north on I-5 via Camino Capistrano and enter I-5 at the northbound on-ramp immediately north of the San Juan Capistrano south city limit. Evacuation traffic shold proceed north on I-5 to the I-405 junction. Interstate 405 should be taken to Fairview Road (Orange Coast College) turn-off. Evacuation traffic should turn south onto Fairview Road and proceed to Adams Avenue. At this point evacuation traffic will be directed to the reception center on campus.

4. Institutions Requiring Spacial Evacuation Consideration

   - Beverly Manor Convalescent Hospital
   - Palisades Elementary School

SUBSECTOR 7

1. Description

   Subsector 7 includes the residential, commercial, and recreational areas within San Juan Capistrano which lie east and south of San Juan Creek.

2. Reception Center

   Santa Ana High School (520 W. Walnut Street), Santa Ana.

3. Evacuation Procedure

   The population within Subsector 7 should evacuate to the north on I-5. Evacuating vehicles should enter I-5 via northbound on-ramps at Camino Las Ramblar, Valle Road and Ortega Highway interchanges. Evacuation traffic should proceed northbound on I-5 to the Red Hill Avenue turn-off. Turn left (south) onto Red Hill Avenue and continue toMoulton Parkway. Moulton Parkway turn right (west) and proceed to Main Street. . Turn right (north) on Main Street and continue north to Walnut Street. Turn left (west) on Walnut Street, and proceed to Santa Ana High School.

4. Institution Requiring Special Evacuation Consideration

   - Marco F. Forester Junior High School

SUBSECTOR 8

1. Description

   Subsector 8 includes the residential, commercial, and recreational aeas within San Juan Capistrano which lie west and north of San Juan Creek.

2. Reception Center

   Tustin High School (1171 Laguna Road), Tustin.

3. Evacuation Procedure

   The population with Subsector 8 should evacuate to the north on I-5. Evacuating vehicles west of I-5 could exit the city via Camino Capistrano and enter the freeway at either Avery Parkway or Oso Parkway interchange. Vehicles east of I-5 should enter I-5 at either Ortega Highway or Oso Parkway interchanges. Evacuation traffic should proceed northbound on I-5 to the Red Hill Avenue interchange. Turn right on Red Hill Avenue and then left on Laguna Road. Proceed to Tustin High School on the right.

4. Institutions Requiring Special Evacuation Consideration

   - San Juan Elementary School
   - Capistrano Elementary School
   - Capistrano Valley Christian School
   - Harold J. Ambuehl Elementary School
   - Del Obispo Elementary School