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FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA. V--ETC(U)
SEP 80 A W SIMPSON, J W BILLHEIMER DCPA01-78-C-0220
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FINAL REPORT

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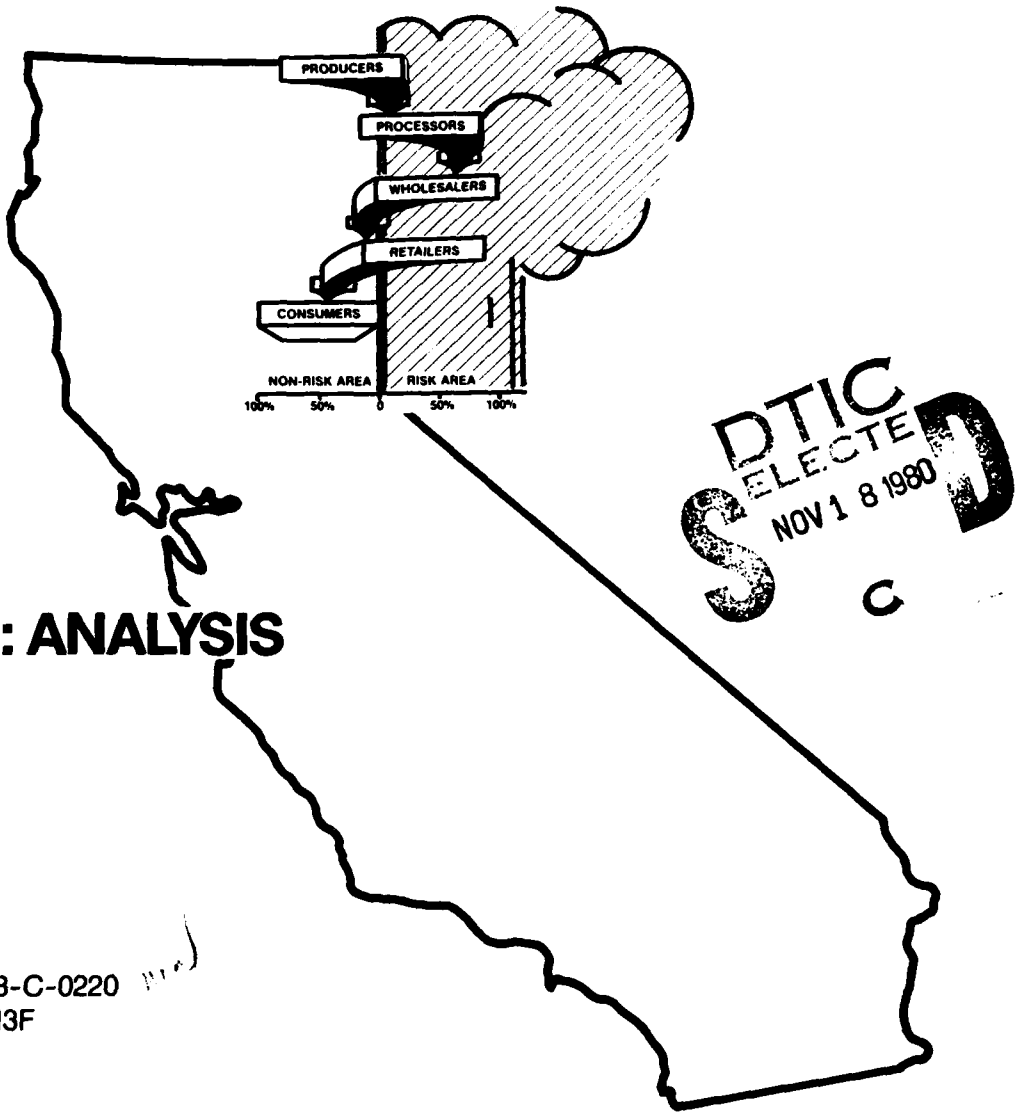
FOOD SYSTEM SUPPORT of the RELOCATION STRATEGY in CALIFORNIA



VOLUME I: ANALYSIS

Contract DCPA01-78-C-0220
FEMA Work Unit 2313F

September 1980

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F I N A L R E P O R T

FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA

Volume I: Analysis

by:

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Washington, D.C. 20301
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D162

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FEMA REVIEW NOTICE:

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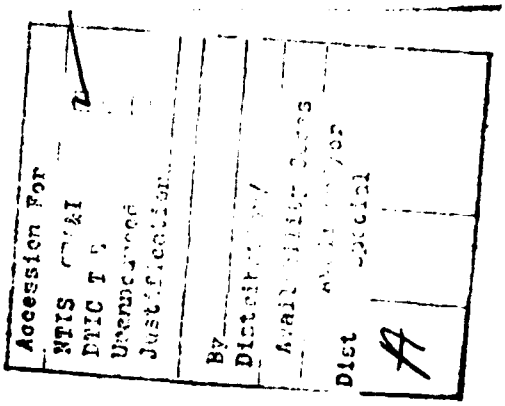

SUMMARY

INTRODUCTION

Background

The movement of large masses of population from threatened target areas in advance of a potential nuclear attack will severely test the flexibility of national, state, and local food distribution systems. Past research has assessed the food requirements of the relocated populations; identified promising means of reconfiguring the existing food distribution system to meet these requirements; and developed and documented guidelines for food distribution under crisis relocation and postattack conditions. This study extends previous research efforts by investigating food distribution alternatives in a state, California, where relocation distances are unusually long, and heavy population concentrations in targeted areas are expected to stretch the capabilities of host areas to the limit.

Objectives

The objectives of this research have been to (1) trace the existing patterns of food distribution in California; (2) develop and analyze alternative strategies for reconfiguring the existing food distribution system to support the relocated population; (3) investigate the transportation requirements imposed by distribution changes and recommend means for reducing stress on the transportation system; (4) draft prototype plans for reconfiguring the state food distribution network in an emergency; and (5) develop appropriate guidelines to be used by Nuclear Civil Protection (NCP) planners and local officials in organizing and implementing food distribution under crisis relocation conditions in their jurisdictions.

RELOCATION OPTIONS

California is highly urbanized, with over 80% of its population living in areas threatened by nuclear attack. Hosting accommodations are relatively scarce outside these areas, and the average host area would have to accommodate several times its normal population under crisis relocation conditions. Four different relocation options were considered in this study:

1. Regional Hosting, a plan prepared by the California Office of Emergency Services (OES), in which areas threatened only by potential fallout are permitted to host evacuees, thereby lowering the ratio of risk area residents to host area residents (to roughly 4.5 to 1) and making it possible to assign most risk area relocatees to host areas within their own geographic regions.

2. Uniform Hosting, in which each host area accommodates exactly seven times its normal population. Since the majority (64%) of the state's residents live in Southern California, while the majority of the available low-risk areas (54%) are located in the northern portion of the state, this option imposes lengthy travel distances on many evacuees. The average distance traveled from risk to host area is 200 miles, and food distribution distances are stretched accordingly.

3. Proximity Hosting, in which evacuees are assigned only to host areas near their departure points and areas theatened by fallout in evacuation. This option results in high risk- to host-area population ratios of 12 to 1, but travel distances are correspondingly shorter.

4. Proximity Hosting with Transport Constraints. In this option, only 80% of the risk-area population is relocated, and highway capacity is a deciding factor in determining the number of people assigned to each host area.

EXISTING FOOD DISTRIBUTION PATTERNS

As a major agricultural producer, California exports more than half of its home-grown foodstuffs, particularly fruits and vegetables, to other states. In turn, the state imports significant shipments of meat and cereal products. This report traces California's food supply through the channels of distribution from producer to consumer, and assesses the vulnerability of each element to nuclear attack. Approximately 85% of California's farmland is low-risk area removed from the threat of nuclear attack, as is 21% of the state's food processing capacity. Of those foodstocks most readily available for distribution under crisis relocation conditions, California wholesalers have between two and three weeks of inventory on hand, retail grocers have between one and three weeks of inventory, and seven to ten days of supplies are estimated to be in transit to wholesale warehouses at any time. Food wholesalers are the most vulnerable element of the distribution chain. Wholesale stocks tend to be held in distribution centers in such major cities as Los Angeles, San Francisco, and San Diego, with only 6% of the state's wholesale food warehouses located in host areas. Food stockpiles under federal control are quite small, except for stocks of dry milk maintained in several risk-area locations.

DISTRIBUTION OPTIONS

A number of different alternatives for distributing food under crisis relocation conditions were identified and evaluated in terms of specific criteria encompassing set-up and maintenance costs, system disruption, attack vulnerability, operating requirements, equity, transportation stress, and system effectiveness. The results of this evaluation are reflected in the guidelines of Summary Exhibit 1. It appears that the most effective basic strategy for food distribution under crisis relocation conditions is to allow agricultural output and

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Summary Exhibit I RECOMMENDED GENERAL GUIDELINES FOR PROVIDING FOOD SUPPORT FOR THE CRISIS RELOCATION STRATEGY

STATE AND REGIONAL ACTIVITIES

- Define distribution patterns for chain and independent wholesalers.
- Arrange for any additional drivers and equipment made necessary by revised distribution patterns through NDTA.
- Waive vehicle highway weight restrictions.
- Publicize waiving of DOT Driver Restrictions.

	RISK AREA ACTIVITIES	HOST AREA ACTIVITIES
PRODUCERS	• Continue any agricultural activity of national, regional, or local significance. (Little significant agricultural production currently occurs in risk areas.)	• Continue all agricultural activity.
PROCESSORS	• Continue only those processing activities that lead to production of commodities included in emergency standards and that either are national or regional in scope or command a significant share of the local market. • Encourage workers in discontinued processing activities to transfer their skills to similar host area processing facilities. • Ship excess inventory of canned goods and other dry groceries, as ordered, to host area storage points.	• Continue all food processing activity, expanding operations where possible through the use of relocated workers and unused capacity.
WHOLESALERS	• Continue to operate all chain and independent wholesale operations that command a significant (i.e., over 10%) share of the local market, following revised distribution patterns specified at state and regional level. • Empty smaller warehouses as quickly as possible, transferring goods to host area commissaries and warehouses. Encourage workers in discontinued operations to seek employment in host area warehouses. • Augment transportation fleet and driver pool as required, following guidelines and procedures established by NDTA for obtaining personnel and equipment from other sectors. • Increase vehicle and driver productivity by taking advantage of waived driver restrictions and weight limitations; minimizing down-time; relaxing maintenance requirements; increasing vehicle loads; loading only full-pallet quantities; and shipping only necessary commodities.	• Continue all food warehousing and distribution activities, expanding operations where possible through the use of commandeered space, worker overtime, and relocated workers. Transfers between different companies may be worked out as necessary. • Augment transportation fleet and driver pool as required, following guidelines and procedures established by NDTA for obtaining personnel and new equipment from other sectors. • Increase vehicle and driver productivity by taking advantage of waived driver restrictions and weight limitations; minimizing down time; relaxing maintenance requirements; increasing vehicle loads; loading only-full pallet quantities; and shipping only necessary commodities.
RETAILERS	• Observe price controls & single purchase limitations established nationally during pre-crisis period and evacuation period. • As inventories & personnel permit, remain open during evacuation period. Then close operations for duration of crisis relocation period & report on remaining inventories. • Chain stores arrange for employees to transfer to chain's host area outlets for duration of emergency. Employees of independent stores should be encouraged to seek employment in host area retail outlets.	• Observe price controls, single purchase limitations, rationing plans, & coupon redemption policies established nationally during pre-crisis period & for duration of crisis relocation period. • Continue all retail food operations, expanding as required by using added personnel relocated from risk area; extending business hours; authorizing overtime work; stocking at night; and identifying and using expedient nearby storage space.
PREPARERS AND SERVERS	• Chain restaurants with host area outlets should transport inventories to these outlets & reassign workers to host area operations. • Fast food operations should prepare as many meals as possible during evacuation period & make them available at evacuation staging area. • Caterers should relocate all mobile food preparation equipment & as much of their inventories as possible to host area. • Institutions & stores with equipment for large-scale food preparation should transport inventories & equipment to host area.	• Restaurants & kitchen-equipped institutions should expand operations by using additional personnel relocated from risk area, enlarging seating capacity; & identifying & using expedient nearby storage space (garages, etc • Large-scale mass feeding operations in kitchen-equipped institutions will be supervised by disaster agencies such as Red Cross • Distribute food preparation equipment & incoming inventories as needed among institutions, restaurants, congregate care facilities, & private residences with hosting capacity.
CONSUMERS	• Avoid hoarding in pre-crisis period. • Transport as much non-perishable food to host area as is permitted by home stocks and mode of transportation. A one- to two-week supply should suffice.	• Avoid hoarding in pre-crisis period. • Encourage host area residents to provide shelter and food to members of relocated population.
CONTROLS	• Price regulation & liberal single-purchase limitations at retail outlets during pre-crisis and evacuation periods.	• Price regulation & conservative single-purchase limitations at retail outlets during pre-crisis period. • Price regulation & coupon rationing at retail outlets, restaurants, & mass feeding facilities during crisis relocation...

major processing plants to follow normal distribution channels, and to continue using risk-area wholesale facilities to serve the evacuated population. This strategy places stress on host-area retail outlets and on the transportation system linking risk-area wholesalers with host-area retailers and mass feeding centers. In spite of this stress, the continued operation of major risk-area wholesalers is preferable to the alternative strategies considered for staging and transporting food to host areas: pre-crisis stockpiling is too costly; extensive direct shipments from processors to the host areas would disrupt existing channels and require impossible priority judgments; and heavy use of expedient host-area warehouse space is both inefficient and difficult to accomplish within a one-week time frame.

Even though the options of stockpiling direct shipments from processors to host areas and host-area warehouses are not attractive as alternatives to the basic strategy of continuing of operation risk-area warehouses, each of these options may be used to a limited extent to augment the basic strategy. Existing stocks of dried milk held under federal control should be moved from risk areas in advance of the crisis and stockpiled in selected host-area locations. A similar strategy should be followed in the case of canned goods inventories held by California processors. These processors typically have large inventories, particularly of canned fruits and vegetables, which are laid in following the harvest and drawn down during the year by shipments to all parts of the country. Removal of the sizable inventories from risk areas would reduce their vulnerability, and help to ensure the availability of food following an attack. Under normal conditions, California processors typically use railroads for out-of-state shipments and trucks for shipments to California locations. During crisis relocation, however, canned goods should be shipped by rail to host areas, where they may be stockpiled in wholesale warehouses, secondary distribution centers, intermodal transfer points, or simply left in railcars on sidings identified for that purpose.

Direct or "drop" shipments from processors to retailers can be used to a limited extent under emergency conditions. Major chains normally try to minimize such shipments because they are expensive and strain the processors' transportation capabilities. During the 1978 truckers' strike in California, however, several food distributors increased the volume of these drop-shipments to ease the strain on limited trucking resources. Under crisis relocation conditions, drop-shipments are most appropriate when the producer or processor is located in the host area and can drop-ship to wholesale, retail, or mass feeding centers nearby. The billing should be done through the distributor so that centralized control can be maintained. Even under emergency conditions, it is unlikely that drop-shipments will exceed 10% or 15% of all distributor shipments.

In California, each retail food chain and major wholesaler has been assigned secondary host-area warehouse space to be used as an adjunct to its risk-area operations. Although risk-area warehouses will continue to carry the main distribution burden, these secondary warehouses will also be used to stage deliveries to host-area stores and mass feeding

centers. Discussions with retail chain representatives indicate that certain types of nonperishable foodstuffs, particularly canned goods, can be efficiently distributed from secondary warehouse space. This option is particularly attractive in California, where host-area foodstocks are substantial and significant amounts of host-area warehouse space are available, much of it used by the food processing industry on a seasonal basis.

The use of secondary host-area warehouse space as an adjunct to primary risk-area space has the advantage of making some goods and personnel less vulnerable to attack; reducing transportation stress somewhat; and providing a base for postattack operations without unduly disrupting existing distribution patterns. In the event that the crisis is not resolved for some period of time, distributors may wish to channel more and more of their supplies through secondary host-area warehouses.

DELIVERY OPTIONS

A number of alternatives for preparing and serving food to the evacuated population have been identified and assessed in earlier research. These include the use of family residences, restaurants, institutions, and remote commissaries. Each of the alternatives will be employed to some extent under crisis relocation conditions in California. In general, small group sizes and low set-up costs are desirable features of any preparation and serving alternative. On the basis of these two criteria, family residences and restaurants would be preferable to mass feeding operations. In California, the high hosting ratios will strain the serving capacity of mass feeding facilities, so it is particularly important that family residences be used to the maximum extent possible. Other considerations, such as relative availability of homes, restaurants and institutional kitchens, the number of relocatees, the location of lodging accommodations, and the need for transportation will determine the relative attractiveness of each alternative in a specific host area.

TRANSPORTATION REQUIREMENTS

Food transportation requirements under crisis relocation conditions in California are significantly affected by the state's high hosting ratios and unique geography. Summary Exhibit 2 lists the transportation requirements imposed by a combination of alternative hosting and distribution options. Measuring transportation stress in terms of the ton-mile increase under crisis relocation conditions, the regional hosting option proposed by OES increases distribution mileage by a factor of approximately two to one over normal conditions. The uniform hosting option results in higher transportation stress (a ratio of 2.9 to 1 over normal conditions with direct warehouse shipments), and places a proportionately heavier load on mass feeding centers and congregate care facilities. If the uniform hosting strategy is replaced with a proximity hosting strategy (keeping the same risk/host definitions), it is possible to lower the transportation stress factor to 2.1, but the load on mass feeding centers increases, and the population of some southern California counties increases by a factor of 12.

SUMMARY EXHIBIT 2

TRANSPORTATION STRESS FOR CALIFORNIA FOOD DISTRIBUTION

UNDER NORMAL AND CRP CONDITIONS

Tonnage	Normal Conditions	OES Regional Hosting Option Risk/Host Ratio: 4½:1		Uniform Hosting Option Risk/Host Ratio: 7:1		Proximity Hosting Risk/Host Ratio: 7:1
		Direct Warehouse Shipments	Direct Warehouse Shipments with Intercompany Diversion	Direct Warehouse Shipments	Direct Warehouse Shipments with Intercompany Diversion	Direct Warehouse Shipments
Millions of Ton-Miles/Year	1,181	2,414	2,253	3,452	2,482	2,482
Millions of Tons Shipped to Stores	12.34	9.41	11.36	8.39	10.81	8.22
Millions of Tons Shipped to Restaurants and Institutions	4.12	2.69	2.69	2.59	2.58	2.18
Millions of Tons Shipped to Mass Feeding Centers	0	4.36	2.26	5.48	3.07	6.07
Transportation Stress Factor	1.0	2.0	1.9	2.9	2.7	2.1
Additional Resources Needed						
• Tractors			1,491	3,800		
• Trailers			2,815	7,400		
• Drivers			4,239	9,100		

Preferred Planning Option

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Transportation stress can be reduced somewhat by encouraging selective intercompany transfers in which wholesalers with few host-area outlets ship to the stores of wholesalers with a relatively large number of host-area outlets. In California, for example, Ralph's Los Angeles warehouse should supply some of Safeway's host-area stores, while the Lucky warehouse in Vacaville should ship to some of United Grocers' host-area outlets. The limited use of drop-shipments and secondary host-area warehouses as recommended will also reduce transportation stress. Other means for reducing transportation stress include the relaxation of such regulatory constraints as driver restrictions and weight limitations, and the improvement of equipment utilization by minimizing down time, relaxing maintenance requirements, eliminating light loads, shipping only full-pallet loads, and limiting shipments to essential commodities.

Since existing transportation equipment is not used to capacity, existing distribution systems can typically support a doubling of vehicle-miles for short periods of time without requiring additional vehicles. Thus a doubling of transportation stress does not necessarily imply the need for twice as many drivers and trucks. A tripling of the stress factor might be met by doubling the driver pools and increasing the vehicle fleet by 50%. In the case of the regional hosting option proposed by OES, a detailed redistribution plan was developed for each major warehouse in California, and individual stress factors and equipment needs were estimated for each distributor. This resulted in a requirement for 1,491 additional tractors, 2,815 additional trailers, and 4,239 additional drivers. These requirements can be met readily by diverting vehicles and drivers from less critical sectors of the economy.

IMPLICATIONS OF RESEARCH ON CRISIS RELOCATION GUIDANCE

The results of the California research have been reviewed in light of the current guidance for crisis relocation planning. As a result of this review, it appears that the basic strategy proposed for food distribution under crisis relocation conditions is sound and suitable for use in highly-urbanized areas that have problems similar to those found in California. However, analysis of the food distribution system in California has brought to light several elements which should be included in the crisis relocation guidance for areas with similar characteristics. These elements include:

1. Planning for limited intercompany transfers to reduce transportation stress and balance host-area shipments;

2. Assignment of secondary warehouse space in the host areas to each major risk-area distributor, to be used as necessary to augment risk-area wholesale operations;

3. Guidelines for limited use of drop-shipments directly from processors to host-area retailers, under the central control of major distributors; and

4. Provision for rail shipments of canned goods and other dry groceries from processors' risk-area warehouses to host-area warehouses, secondary distribution centers, intermodal transfer points, or rail sidings.

Guidelines for state and local planners have been updated to reflect these elements, as well as other factors identified in extensive interviews with planners and industry personnel. These elements have also been incorporated in the food sections of prototype crisis relocation plans for California.

FINAL REPORT

FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA

Volume I: Analysis

by:

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Unclassified
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A092 056	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA.	5. TYPE OF REPORT & PERIOD COVERED Final
	6. PERFORMING ORG. REPORT NUMBER SYSTAN D162 Vol I
7. AUTHOR(s) Arthur W. Simpson, John W. Billheimer	8. CONTRACT OR GRANT NUMBER(s) Contract DCPA01-78-C-0220
9. PERFORMING ORGANIZATION NAME AND ADDRESS SYSTAN, Inc. P.O. Box U Los Altos, CA 94022	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Work Unit 2313F
11. CONTROLLING OFFICE NAME AND ADDRESS Federal Emergency Management Agency Washington, D.C. 20472	12. REPORT DATE September 1980
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release: Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Two Volumes:
Volume I: Analysis
Volume II: Prototype Plans and Revised Guidance

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Food Distribution, Emergency	Crisis Relocation
Food Distribution, Local	Protype Crisis Relocation Plans
Food Resources, California	Population Relocation, California
Emergency Planning, Food	Emergency Planning, California

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study extends previous research into food distribution under crisis relocation conditions by investigating detailed distribution problems in a state, California, where relocation distances are unusually long, and heavy population concentrations in threatened areas are expected to stretch the capabilities of host areas to the limit.

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The report traces the existing patterns of food distribution in California; develops and analyzes alternative strategies for redirecting the existing food distribution system to support the relocated population; investigates the transportation requirements imposed by distribution changes; drafts prototype plans for redirecting the state food distribution network in an emergency; and develops appropriate guidelines for the use of Nuclear Civil Protection planners and local officials.

Although roughly 85% of California's extensive agricultural lands are removed from direct threat of nuclear attack, only 21% of the state's food processing capacity is located in unthreatened areas. Food wholesalers, which carry between two and three weeks of food stocks, are the most vulnerable element of the distribution chain, with only 6% of these stocks likely to survive a nuclear attack undamaged. Retail grocers, with one to three weeks of inventory, are distributed in proportion to the population itself, with roughly 18% in areas free from blast effects.

It appears that the most effective strategy for food distribution under crisis relocation conditions is to allow agricultural output and major processing plants to follow normal distribution channels and to continue using risk-area wholesale facilities to serve the evacuated population. This strategy places stress on host-area retail outlets and on the transportation system linking risk-area wholesalers with the evacuated population. In California, this strategy can be expected to increase the mileage traveled in distributing food by a factor of two or three, depending on the evacuation pattern selected. This additional mileage can be accommodated by a number of actions, including those listed below:

- Encouraging selective intercompany food transfers designed to redress supply/demand imbalances;
- Assigning secondary host-area warehouse space to each major wholesale;
- Identifying instances in which drop-shipments directly from processors to host-area retailers are feasible;
- Relaxing such regulatory constraints as driver restrictions and weight limitations; and
- Improving equipment utilization by minimizing down time, relaxing maintenance requirements, eliminating light loads, shipping only full-pallet loads, and limiting shipments to essential commodities.

If these actions are taken, it appears that the transportation requirements associated with food distribution under crisis relocation conditions in California can be met with existing food industry resources and a nominal diversion of drivers and vehicles from less critical sectors of the economy.

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PREFACE

This report has been prepared as one of the first in a series of studies undertaken by the Federal Emergency Management Agency (FEMA) and the California Office of Emergency Services (OES) to investigate the potential logistic problems to be encountered in implementing a strategy of crisis relocation in California. The report was prepared under Contract No. DCPA01-78-C-0220, and addresses the problems incurred in distributing food to residents evacuated from high-risk areas of the state during periods of severe international crisis. The research described in this report was accomplished over a one-year period in the Los Altos, California offices of SYSTAN, Inc. Dr. John W. Billheimer acted as project manager, while Arthur W. Simpson was principal investigator. Mr. Andrew Canfield and Ms. Gail Fondahl assisted Mr. Simpson with data processing tasks, while Ms. Carole Parker and Ms. Bracey Avery organized and edited the final report.

Technical monitors on the project were Mr. James Kerr of FEMA National Headquarters and Ms. Frances Diaz of FEMA Region VII. Mr. George Van Den Berghe of FEMA also provided technical guidance at the national level, while Jack Kearns, Loren Fields, and Orlin Orr of the California OES supplied guidance at the state level. Thanks are also extended to the many representatives of the California food industry who provided invaluable insights into the production, processing, and distribution of food throughout the state.

This report has been prepared in two volumes:

Volume I: Analysis

Volume II: Prototype Plans and Revised Guidance

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4. Proximity Hosting with Transport Constraints. In this option, only 80% of the risk-area population is relocated, and highway capacity is a deciding factor in determining the number of people assigned to each host area.

EXISTING FOOD DISTRIBUTION PATTERNS

As a major agricultural producer, California exports more than half of its home-grown foodstuffs, particularly fruits and vegetables, to other states. In turn, the state imports significant shipments of meat and cereal products. This report traces California's food supply through the channels of distribution from producer to consumer, and assesses the vulnerability of each element to nuclear attack. Approximately 85% of California's farmland is low-risk area removed from the threat of nuclear attack, as is 21% of the state's food processing capacity. Of those foodstocks most readily available for distribution under crisis relocation conditions, California wholesalers have between two and three weeks of inventory on hand, retail grocers have between one and three weeks of inventory, and seven to ten days of supplies are estimated to be in transit to wholesale warehouses at any time. Food wholesalers are the most vulnerable element of the distribution chain. Wholesale stocks tend to be held in distribution centers in such major cities as Los Angeles, San Francisco, and San Diego, with only 6% of the state's wholesale food warehouses located in host areas. Food stockpiles under federal control are quite small, except for stocks of dry milk maintained in several risk-area locations.

DISTRIBUTION OPTIONS

A number of different alternatives for distributing food under crisis relocation conditions were identified and evaluated in terms of specific criteria encompassing set-up and maintenance costs, system disruption, attack vulnerability, operating requirements, equity, transportation stress, and system effectiveness. The results of this evaluation are reflected in the guidelines of Summary Exhibit 1. It appears that the most effective basic strategy for food distribution under crisis relocation conditions is to allow agricultural output and

Summary Exhibit I RECOMMENDED GENERAL GUIDELINES FOR PROVIDING FOOD SUPPORT FOR THE CRISIS RELOCATION STRATEGY

	RISK AREA ACTIVITIES	HOST AREA ACTIVITIES
STATE AND REGIONAL ACTIVITIES	• Define distribution patterns for chain and independent wholesalers. • Arrange for any additional drivers and equipment made necessary by revised distribution patterns through NDTA. • Waive vehicle highway weight restrictions. • Publicize waiving of DOT Driver Restrictions.	
PRODUCERS	• Continue any agricultural activity of national, regional, or local significance. (Little significant agricultural production currently occurs in risk areas.)	• Continue all agricultural activity.
PROCESSORS	• Continue only those processing activities that lead to production of commodities included in emergency standards and that either are national or regional in scope or command a significant share of the local market. • Encourage workers in discontinued processing activities to transfer their skills to similar host area processing facilities. • Ship excess inventory of canned goods and other dry groceries, as ordered, to host area storage points.	• Continue all food processing activity, expanding operations where possible through the use of relocated workers and unused capacity.
WHOLESALERS	• Continue to operate all chain and independent wholesale operations that command a significant (i.e., over 10%) share of the local market, following revised distribution patterns specified at state and regional level • Empty smaller warehouses as quickly as possible, transferring goods to host area commissaries and warehouses. Encourage workers in discontinued operations to seek employment in host area warehouses. • Augment transportation fleet and driver pool as required, following guidelines and procedures established by NDTA for obtaining personnel and equipment from other sectors. • Increase vehicle and driver productivity by taking advantage of waived driver restrictions and weight limitations; minimizing down-time; relaxing maintenance requirements; increasing vehicle loads; loading only full-pallet quantities; and shipping only necessary commodities.	• Continue all food warehousing and distribution activities, expanding operations where possible through the use of commandeered space, worker overtime, and relocated workers. Transfers between different companies may be worked out as necessary. • Augment transportation fleet and driver pool as required, following guidelines and procedures established by NDTA for obtaining personnel and new equipment from other sectors. • Increase vehicle and driver productivity by taking advantage of waived driver restrictions and weight limitations; minimizing down time; relaxing maintenance requirements; increasing vehicle loads; loading only-full pallet quantities; and shipping only necessary commodities.
RETAILERS	• Observe price controls & single purchase limitations established nationally during pre-crisis period and evacuation period. • As inventories & personnel permit, remain open during evacuation period. Then close operations for duration of crisis relocation period & report on remaining inventories. • Chain stores arrange for employees to transfer to chain's host area outlets for duration of emergency. Employees of independent stores should be encouraged to seek employment in host area retail outlets.	• Observe price controls, single purchase limitations, rationing plans, & coupon redemption policies established nationally during pre-crisis period & for duration of crisis relocation period. • Continue all retail food operations, expanding as required by using added personnel relocated from risk area; extending business hours; authorizing overtime work; stocking at night; and identifying and using expedient nearby storage space.
PREPARERS AND SERVERS	• Chain restaurants with host area outlets should transport inventories to these outlets & reassign workers to host area operations. • Fast food operations should prepare as many meals as possible during evacuation period & make them available at evacuation staging area • Caterers should relocate all mobile food preparation equipment & as much of their inventories as possible to host area. • Institutions & stores with equipment for large-scale food preparation should transport inventories & equipment to host area.	• Restaurants & kitchen-equipped institutions should expand operations by using additional personnel relocated from risk area, enlarging seating capacity; & identifying & using expedient nearby storage space (garages, etc • Large-scale mass feeding operations in kitchen-equipped institutions will be supervised by disaster agencies such as Red Cross • Distribute food preparation equipment & incoming inventories as needed among institutions, restaurants, congregate care facilities, & private residences with hosting capacity.
CONSUMERS	• Avoid hoarding in pre-crisis period. • Transport as much non-perishable food to host area as is permitted by home stocks and mode of transportation. A one- to two-week supply should suffice.	• Avoid hoarding in pre-crisis period. • Encourage host area residents to provide shelter and food to members of relocated population.
CONTROLS	• Price regulation & liberal single-purchase limitations at retail outlets during pre-crisis and evacuation periods.	• Price regulation & conservative single-purchase limitations at retail outlets during pre-crisis period. • Price regulation & coupon rationing at retail outlets, restaurants, & mass feeding facilities during crisis relocation

major processing plants to follow normal distribution channels, and to continue using risk-area wholesale facilities to serve the evacuated population. This strategy places stress on host-area retail outlets and on the transportation system linking risk-area wholesalers with host-area retailers and mass feeding centers. In spite of this stress, the continued operation of major risk-area wholesalers is preferable to the alternative strategies considered for staging and transporting food to host areas: pre-crisis stockpiling is too costly; extensive direct shipments from processors to the host areas would disrupt existing channels and require impossible priority judgments; and heavy use of expedient host-area warehouse space is both inefficient and difficult to accomplish within a one-week time frame.

Even though the options of stockpiling direct shipments from processors to host areas and host-area warehouses are not attractive as alternatives to the basic strategy of continuing of operation risk-area warehouses, each of these options may be used to a limited extent to augment the basic strategy. Existing stocks of dried milk held under federal control should be moved from risk areas in advance of the crisis and stockpiled in selected host-area locations. A similar strategy should be followed in the case of canned goods inventories held by California processors. These processors typically have large inventories, particularly of canned fruits and vegetables, which are laid in following the harvest and drawn down during the year by shipments to all parts of the country. Removal of the sizable inventories from risk areas would reduce their vulnerability, and help to ensure the availability of food following an attack. Under normal conditions, California processors typically use railroads for out-of-state shipments and trucks for shipments to California locations. During crisis relocation, however, canned goods should be shipped by rail to host areas, where they may be stockpiled in wholesale warehouses, secondary distribution centers, intermodal transfer points, or simply left in railcars on sidings identified for that purpose.

Direct or "drop" shipments from processors to retailers can be used to a limited extent under emergency conditions. Major chains normally try to minimize such shipments because they are expensive and strain the processors' transportation capabilities. During the 1978 truckers' strike in California, however, several food distributors increased the volume of these drop-shipments to ease the strain on limited trucking resources. Under crisis relocation conditions, drop-shipments are most appropriate when the producer or processor is located in the host area and can drop-ship to wholesale, retail, or mass feeding centers nearby. The billing should be done through the distributor so that centralized control can be maintained. Even under emergency conditions, it is unlikely that drop-shipments will exceed 10% or 15% of all distributor shipments.

In California, each retail food chain and major wholesaler has been assigned secondary host-area warehouse space to be used as an adjunct to its risk-area operations. Although risk-area warehouses will continue to carry the main distribution burden, these secondary warehouses will also be used to stage deliveries to host-area stores and mass feeding

centers. Discussions with retail chain representatives indicate that certain types of nonperishable foodstuffs, particularly canned goods, can be efficiently distributed from secondary warehouse space. This option is particularly attractive in California, where host-area foodstocks are substantial and significant amounts of host-area warehouse space are available, much of it used by the food processing industry on a seasonal basis.

The use of secondary host-area warehouse space as an adjunct to primary risk-area space has the advantage of making some goods and personnel less vulnerable to attack; reducing transportation stress somewhat; and providing a base for postattack operations without unduly disrupting existing distribution patterns. In the event that the crisis is not resolved for some period of time, distributors may wish to channel more and more of their supplies through secondary host-area warehouses.

DELIVERY OPTIONS

A number of alternatives for preparing and serving food to the evacuated population have been identified and assessed in earlier research. These include the use of family residences, restaurants, institutions, and remote commissaries. Each of the alternatives will be employed to some extent under crisis relocation conditions in California. In general, small group sizes and low set-up costs are desirable features of any preparation and serving alternative. On the basis of these two criteria, family residences and restaurants would be preferable to mass feeding operations. In California, the high hosting ratios will strain the serving capacity of mass feeding facilities, so it is particularly important that family residences be used to the maximum extent possible. Other considerations, such as relative availability of homes, restaurants and institutional kitchens, the number of relocatees, the location of lodging accommodations, and the need for transportation will determine the relative attractiveness of each alternative in a specific host area.

TRANSPORTATION REQUIREMENTS

Food transportation requirements under crisis relocation conditions in California are significantly affected by the state's high hosting ratios and unique geography. Summary Exhibit 2 lists the transportation requirements imposed by a combination of alternative hosting and distribution options. Measuring transportation stress in terms of the ton-mile increase under crisis relocation conditions, the regional hosting option proposed by OES increases distribution mileage by a factor of approximately two to one over normal conditions. The uniform hosting option results in higher transportation stress (a ratio of 2.9 to 1 over normal conditions with direct warehouse shipments), and places a proportionately heavier load on mass feeding centers and congregate care facilities. If the uniform hosting strategy is replaced with a proximity hosting strategy (keeping the same risk/host definitions), it is possible to lower the transportation stress factor to 2.1, but the load on mass feeding centers increases, and the population of some southern California counties increases by a factor of 12.

SUMMARY EXHIBIT 2

TRANSPORTATION STRESS FOR CALIFORNIA FOOD DISTRIBUTION

UNDER NORMAL AND CRP CONDITIONS

Tonnage	Normal Conditions	OES Regional Hosting Option Risk/Host Ratio: 4½:1		Uniform Hosting Option Risk/Host Ratio: 7:1		Proximity Hosting Risk/Host Ratio: 7:1
		Direct Warehouse Shipments	**Direct Warehouse Shipments with Intercompany Diversion**	Direct Warehouse Shipments	*Direct Warehouse Shipments with Intercompany Diversion*	Direct Warehouse Shipments
Millions of Ton-Miles/Year	1,181	2,414	**2,253**	3,452	2,482	2,482
Millions of Tons Shipped to Stores	12.34	9.41	**11.36**	8.39	10.81	8.22
Millions of Tons Shipped to Restaurants and Institutions	4.12	2.69	**2.69**	2.59	2.58	2.18
Millions of Tons Shipped to Mass Feeding Centers	0	4.36	**2.26**	5.48	3.07	6.07
Transportation Stress Factor	1.0	2.0	**1.9**	2.9	2.7	2.1
Additional Resources Needed						
• Tractors			**1,491**	3,800		
• Trailers			**2,815**	7,400		
• Drivers			**4,239**	9,100		

Preferred Planning Option

Transportation stress can be reduced somewhat by encouraging selective intercompany transfers in which wholesalers with few host-area outlets ship to the stores of wholesalers with a relatively large number of host-area outlets. In California, for example, Ralph's Los Angeles warehouse should supply some of Safeway's host-area stores, while the Lucky warehouse in Vacaville should ship to some of United Grocers' host-area outlets. The limited use of drop-shipments and secondary host-area warehouses as recommended will also reduce transportation stress. Other means for reducing transportation stress include the relaxation of such regulatory constraints as driver restrictions and weight limitations, and the improvement of equipment utilization by minimizing down time, relaxing maintenance requirements, eliminating light loads, shipping only full-pallet loads, and limiting shipments to essential commodities.

Since existing transportation equipment is not used to capacity, existing distribution systems can typically support a doubling of vehicle-miles for short periods of time without requiring additional vehicles. Thus a doubling of transportation stress does not necessarily imply the need for twice as many drivers and trucks. A tripling of the stress factor might be met by doubling the driver pools and increasing the vehicle fleet by 50%. In the case of the regional hosting option proposed by OES, a detailed redistribution plan was developed for each major warehouse in California, and individual stress factors and equipment needs were estimated for each distributor. This resulted in a requirement for 1,491 additional tractors, 2,815 additional trailers, and 4,239 additional drivers. These requirements can be met readily by diverting vehicles and drivers from less critical sectors of the economy.

IMPLICATIONS OF RESEARCH ON CRISIS RELOCATION GUIDANCE

The results of the California research have been reviewed in light of the current guidance for crisis relocation planning. As a result of this review, it appears that the basic strategy proposed for food distribution under crisis relocation conditions is sound and suitable for use in highly-urbanized areas that have problems similar to those found in California. However, analysis of the food distribution system in California has brought to light several elements which should be included in the crisis relocation guidance for areas with similar characteristics. These elements include:

1. Planning for limited intercompany transfers to reduce transportation stress and balance host-area shipments;

2. Assignment of secondary warehouse space in the host areas to each major risk-area distributor, to be used as necessary to augment risk-area wholesale operations;

3. Guidelines for limited use of drop-shipments directly from processors to host-area retailers, under the central control of major distributors; and

4. Provision for rail shipments of canned goods and other dry groceries from processors' risk-area warehouses to host-area warehouses, secondary distribution centers, intermodal transfer points, or rail sidings.

Guidelines for state and local planners have been updated to reflect these elements, as well as other factors identified in extensive interviews with planners and industry personnel. These elements have also been incorporated in the food sections of prototype crisis relocation plans for California.

1. INTRODUCTION

1.1 BACKGROUND

1.1.1 Evolution of the Civil Preparedness Program

Since 1961, when the Federal Civil Defense Program was made a responsibility of the Department of Defense, the Program's basic objectives have been to assist local and state governments--financially, technically, and administratively--in protecting their residents from the dangerous radioactive fallout that would follow a nuclear attack on the United States. In pursuing this objective, federal, state and local governments have identified more than 226,000 facilities with fallout shelter space for about 225 million persons. Despite this seemingly adequate capacity, a deficit of public shelter space exists in rural and suburban areas. However, a great deal of lower-quality shelter in these areas could be upgraded during a crisis to provide fallout protection. In addition to fallout shelters, other necessary components of a nationwide civil defense system have been developed, including warning and communications networks, radiological monitoring, and state and local emergency operating centers.

As the nationwide program of defense against nuclear radiation moved forward in the 1960's and early 1970's, all state governments and most local governments expanded their emergency preparedness programs to include protection of residents from natural disasters and other peacetime catastrophes, as well as from nuclear fallout. Following this lead, the Defense Civil Preparedness Agency (DCPA) broadened its effort a few years ago by instituting an all-hazard, all-contingency program designed to help state and local governments develop the emergency operating capability needed for coping with peacetime disasters as well as nuclear attack. Emergency planning for both peacetime disasters and nuclear attack was further consolidated in 1978, when President Carter recommended the creation of a Federal Emergency Management Agency (FEMA), officially combining all emergency planning functions in a single executive agency.

1.1.2 The Concept of Crisis Relocation Planning (CRP)

FEMA's current civil preparedness program involves two basic protection strategies: The first provides the best protection possible with the population essentially in place at or near their homes, schools, and places of work; the second requires people to leave threatened areas to seek refuge in safer places.

The need for crisis relocation planning to support the second strategy, that of evacuation, is suppported by five primary arguments:

1. It is probable that a nuclear attack upon the United States would be preceded by a crisis buildup of sufficient duration to permit population relocation from high-risk areas;

2. If an adversary's cities were to be evacuated during a period of crisis, the United States cities should also be evacuated;

3. Many citizens will likely leave large cities in the face of crisis in a "spontaneous evacuation" whether or not they are so advised;

4. Crisis evacuation has proven feasible in recent large-scale evacuations during hurricane warnings; and

5. Given the existing availability and location of shelter space, studies show that population relocation could save far more lives than reliance on in-place protection.

1.1.3 Current Status of Crisis Relocation Planning

CRP can be defined as a comprehensive effort by FEMA to develop plans for evacuating high-risk areas if a nuclear attack threatens, and temporarily relocating non-essential residents of those areas into small towns and rural areas where nuclear blast and fire effects are unlikely.

To improve CRP expertise, FEMA is now engaged in:

1. Finding solutions to the following CRP problems:

   a) Determining how fallout protection and other life-sustaining services can best be provided to residents of high-risk areas after they are relocated;

   b) Identifying "key workers" who should commute from host area to high-risk area to operate essential industries; and

   c) Locating shelter space within the high-risk area for use by key workers.

2. Testing and verifying the "workability" of proposed solutions to CRP problems through special studies, prototype plans, exercises, and pilot projects.

3. Developing plans at the state and local level for evacuating the high-risk areas of the United States.

The movement of large population masses in advance of a threatened attack will severely test the flexibility of local and national food distribution systems. Past research undertaken by SYSTAN (References 2 and 5) has assessed the food requirements of the relocated populations, identified promising means of reconfiguring the existing food distribution system to meet these requirements, and developed and documented guidelines for food distribution under crisis relocation and postattack conditions. Current study extends the previous research by investigating food distribution alternatives in a state, California, where relocation distances are unusually long, and heavy population concentrations in targeted areas are expected to stretch the capabilities of host areas to the limit.

1.2 OBJECTIVES

The general objective of this research is "to investigate alternative strategies for distributing food to the California risk-area populace that has been relocated under Crisis Relocation Planning (CRP), develop plans for food redistribution in California, and formulate planning guidelines to enable local officials to organize and implement food distribution under crisis conditions in their jurisdictions." Specific contractual tasks are to:

1. Analyze the existing food distribution system in California to support the populace;

2. Develop alternative strategies for reconfiguring the existing food system to support the evacuees from the California high-risk areas that would be relocated during CRP;

3. Investigate the transportation needed to reconfigure the food system and make recommendations for minimizing the transportation "stress";

4. Draft appropriate plans (such as a suggested Food Annex to a California Statewide Crisis Relocation Plan and possible others) for reconfiguring the food system; and

5. Develop appropriate guidance documents for Nuclear Civil Protection (NCP) planners and local officials on organizing and implementing food distribution under crisis conditions in their jurisdictions. Such guidance would be based on the "California" experience, but would be intended to assist those involved in developing food distribution plans in other,

highly-urbanized areas that have problems similar to those encountered in California.

Tasks 1 through 3 are the subjects of Volume I of this report (Chapters 1 through 6). Volume II contains the products of Task 4, the prototype plans, and Task 5, the guideline revisions.

1.3 REPORT ORGANIZATION

Chapter 2 discusses three alternative evacuation patterns, and discusses the effect of each on the food distribution aspects of crisis relocation planning. Chapter 3 provides an overview of the California food distribution system, and describes normal food distribution patterns in California. The flow of individual commodities is traced through the distribution network from producer to consumer, and data describe the location and vulnerability of food stocks within that network. Chapter 4 identifies and evaluates alternative strategies for reconfiguring California's food distribution system to support the relocated population. Chapter 5 analyzes the transportation requirements imposed by the reconfigured system and makes recommendations for minimizing transportation stress. Chapter 6 summarizes alternative strategies for reconfiguring the food distribution network, and discusses the implications of these strategies on transportation and other CRP activities.

2. EVACUATION PATTERNS AND PROBLEMS

2.1 HOST AND RISK AREAS

Risk areas in California have been defined by FEMA to include the following categories:

1. Category I - Strategic military forces, termed "counterforce military facilities;"

2. Category II - Other military forces, and supporting industrial, transportation, and logistics facilities; and

3. Category III - Industries, governmental centers, and other facilities that contribute significantly to the maintenance of the United States economy; and other urbanized areas with centralized population greater than 50,000 that are not associated with Category I or Category II targets.

California high-priority targets are shown in Exhibit 2.1. The hazard analysis performed by FEMA for California has determined that more than four-fifths of the population reside in high-risk areas. An evacuation of the high-risk areas of California would increase the population of the remaining low-risk areas by several times, and would necessarily impose significant stresses on local resources. In addition, travel distances separating high-risk and low-risk areas are considerably longer in California than in most of the United States, imposing a disproportionately heavy burden on the State's transportation network.

2.2 POPULATION DISTRIBUTION

Approximately 17.2 million California residents, or 81.7% of the state's population, live in areas that are threatened by significant blast effects. An additional 1.2 million, or 5.8% of the state's population, either live on the fringes of blast areas or are threatened by fallout alone. The remaining 2.6 million of the state's residents (12.6%) live in areas that are not likely to be threatened by either blast or fallout. Early relocation plans assumed that only those areas entirely free from blast and fallout effects would be used as host areas in the event of a massive relocation effort. This assumption resulted in a 7 to 1 ratio of risk area to host area population, and led to

EXHIBIT 2.1

California Risk Areas

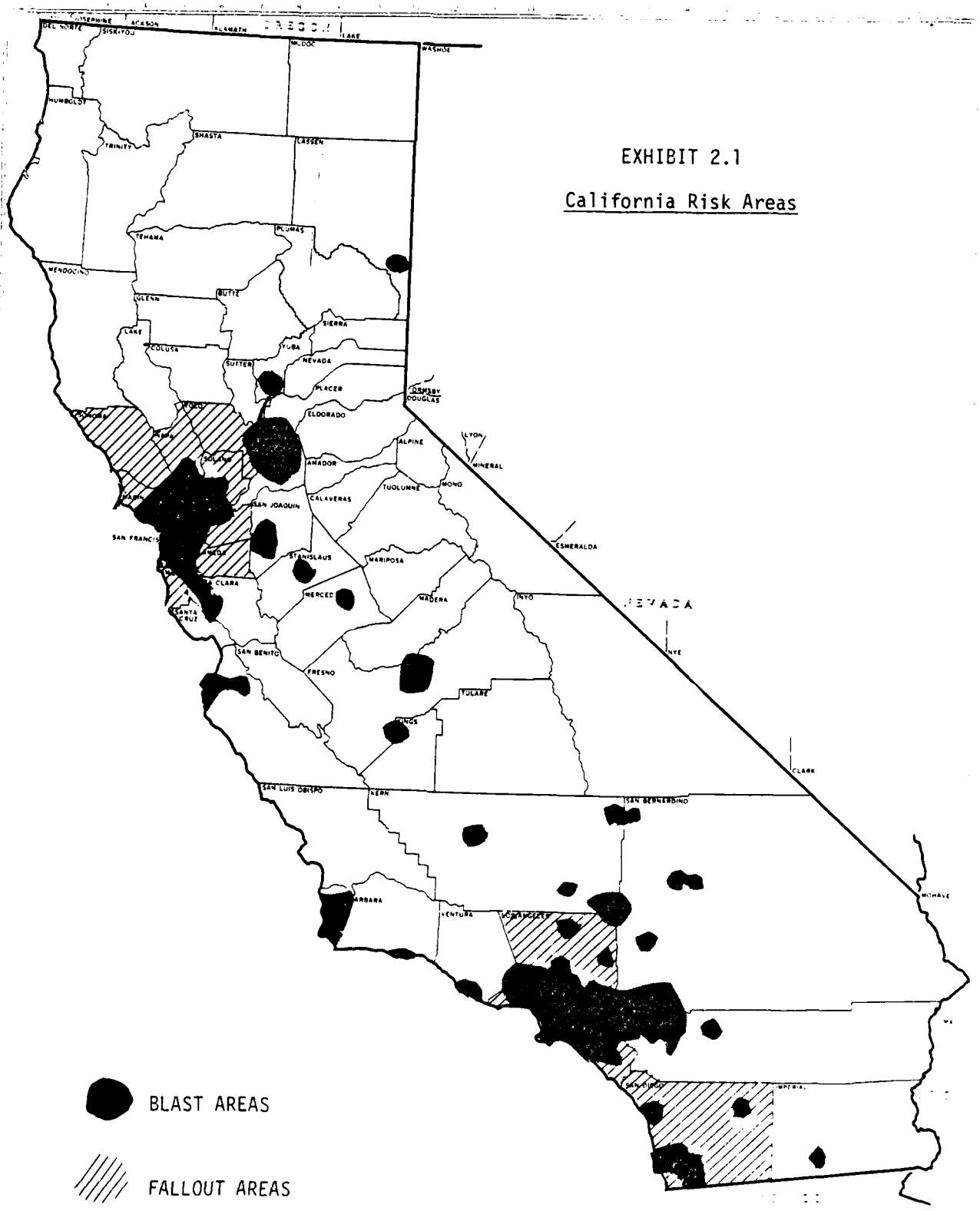
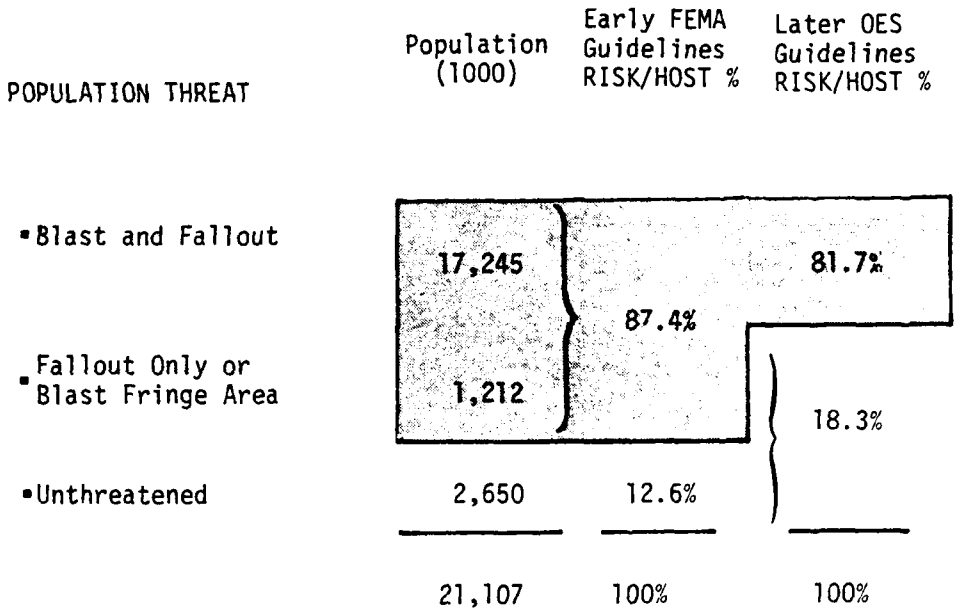


EXHIBIT 2.2

POPULATION AT RISK



Risk Area Population

average evacuation destances of as much as 200 miles. Subsequent planning by the California Office of Emergency Services (OES) redefined risk and host areas so that areas threatened only by fallout could be used to host evacuees. Although this redefinition directly affected only 5.8% of the state's population (see Exhibit 2.2), it significantly lowered the risk area/host area ratio (from 7:1 to 4.5:1), paved the way for regional hosting plans, and helped to alleviate many of the potential transportation and hosting problems associated with crisis relocation in California. A more complete description of the rationale and revised allocations associated with the OES plan may be found in Part Four, Section Two of the state of California Emergency Plan. (Reference 21, Attachment 1)

Exhibit 2.2 summarizes the distribution of the total state population between risk areas and host areas for the two assumptions used in this study. Both of these assumptions result in a disproportionate imbalance of risk and host areas between Northern and Southern California. The majority of Californians live in the southern part of the state, roughly defined as that portion south of Fresno County. (See Exhibit 2.3). Although approximately 64% of the state's residents live in Southern California, under the strictest risk-area definitions only 46% of the low-risk areas available in state are located south of Fresno County. Under the more relaxed risk-area definition adopted by the California OES, 54% of the state's host areas are located in the southern part of the state. Under both risk-area assumptions, therefore, Northern and Central California, with only 36% of the total state population, have a proportionately higher share of the identified hosting capacity for evacuees. This disproportionate balance of high- and low- risk areas has significant implications for relocation planning

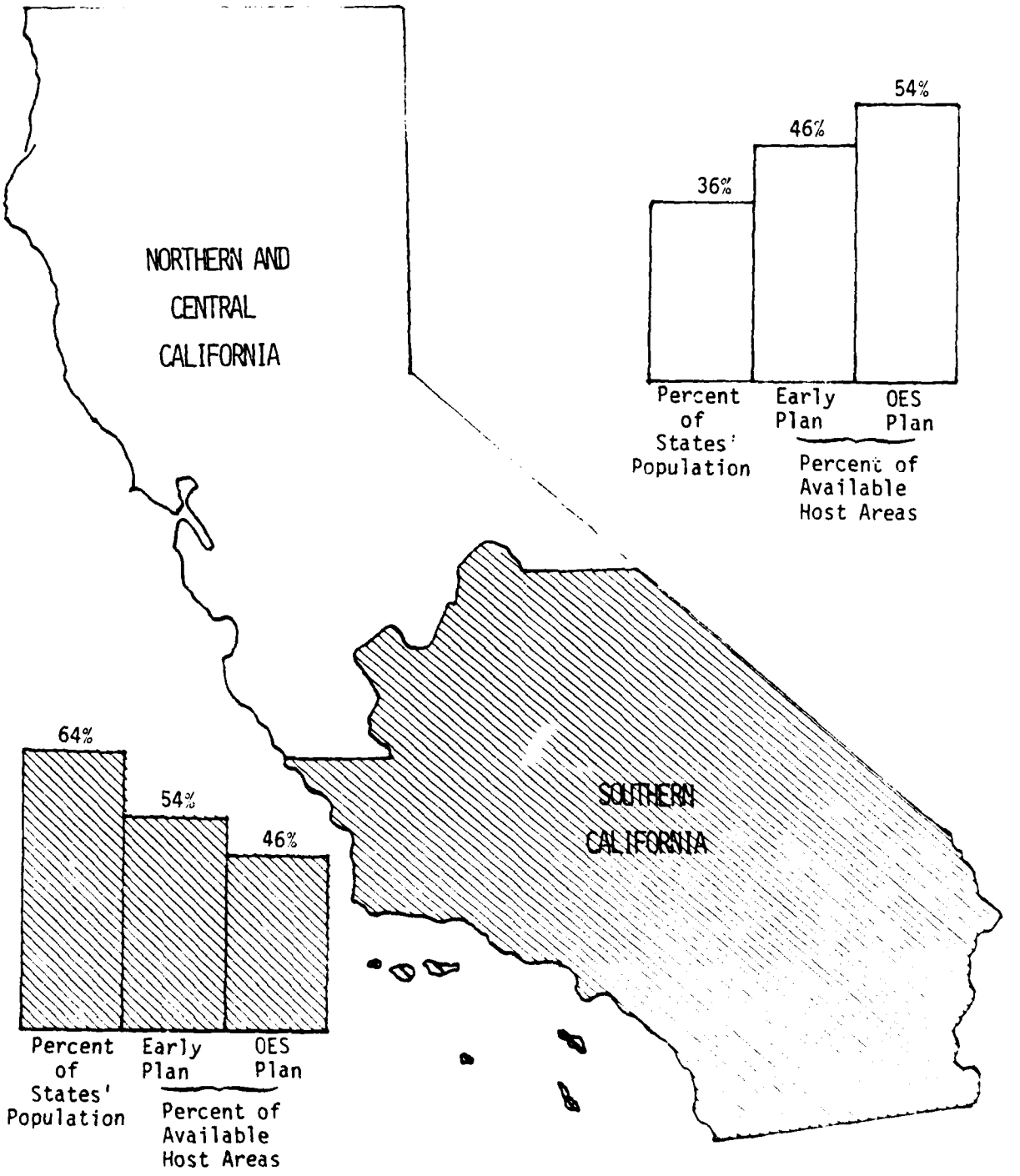
2.3 ALTERNATIVE RELOCATION STRATEGIES

Four different relocation options were evaluated to determine their effects on the food distribution and delivery systems under crisis relocation conditions. These were (1) the regional hosting plan devised by the State Office of Emergency Services; (2) uniform hosting; (3) proximity hosting; and (4) proximity hosting with transport capacity constraints. Under the first plan, areas solely at risk from potential fallout were classified as hosting areas. In the remaining three plans, these fallout-only areas were considered part of the risk area.

EXHIBIT 2.3

NORTH - SOUTH DISTRIBUTION

OF POPULATION AND LOW-RISK REFUGE AREAS



2.3.1 Regional Hosting (The California OES Plan)

In order to limit travel distances for evacuees, thereby reducing fuel and resource distribution problems, this plan attempts to assign risk area relocatees to host areas within their immediate geographic region. In broad geographic terms, Southern California residents remain in the southern half of the state. The area assigned to Southern California residents for hosting is that half of the state generally south of a line drawn west to east from Monterey County to Mono County (i.e. the dividing line in Exhibit 2.3).

On a more immediate geographic level, an attempt was made to host risk-area residents within their own counties. Exceptions were made in cases where the hosting capacity of the county was insufficient, where traffic flow would be complicated, and/or where the hosting area of a risk county could be better used by another risk county. To alleviate the extreme shortage of hosting capacity throughout California, and particularly in Southern California, areas solely at risk due to potential fallout levels were classified as hosting areas.

Additional guidelines followed in assigning risk area residents to regional host areas are cited below:

> "Essential workers and their families will be assigned on an organizational basis to those host areas closest to their place of work, normally within 50 miles. This approach has the advantages of shortening their relocation travel time, minimizing the time needed to relocate, and reducing their commute, thus insuring their availability to return to work at the earliest possible time.
>
> "Households without access to automobiles are given the next closest assignments thus reducing turnaround time for buses and/or other mass transit systems. Evacuees using air or rail transportation will be assigned as near related host area terminals as feasible." (Reference 2)

A county-by-county breakdown of the risk and host area asignments under the regional hosting plan established by the California State OES may be found in Exhibit 2.4.

2.3.2 Uniform Hosting Option

The uniform hosting allocation involves 100% evacuation of risk areas and equal use of all hosting areas, with a resulting hosting ratio of 7.0 to 1.0 throughout the state.

Exhibit 2.4 contains a county-by-county breakdown of the number of residents at risk and the projected hosting capacity if a uniform hosting ratio is maintained throughout the state. The average distance traveled by relocatees under this option is 200 miles (Reference 13).

EXHIBIT 2.4: Population Data Used in Analyses of California Crisis Relocation Plans (populations in thousands)

COUNTY	1975 POPULATION (pre-crisis)	HIGH-RISK AREAS		RISK-FREE AREAS	OES REGIONAL RELOCATION PLAN		UNIFORM HOSTING RELOCATION PLAN	
		blast	fallout only		hosted	post-crisis total	hosted	post-crisis total
Alameda	1090	890	200	0	530	730	0	0
Alpine	1	0	0	1	3	4	7	8
Amador	15	0	0	15	45	60	105	120
Butte	120	0	0	120	196	316	840	960
Calaveras	16	0	0	16	59	75	112	128
Colusa	13	0	0	13	14	27	91	104
Contra Costa	586	567	19	0	77	96	0	0
Del Norte	16	0	0	16	23	39	112	128
El Dorado	59	0	0	59	173	232	413	472
Fresno	445	308	27	110	751	888	770	880
Glenn	19	0	0	19	43	62	133	152
Humboldt	105	0	0	105	228	333	735	840
Imperial	84	31	4	49	395	448	343	392
Inyo	17	0	0	17	85	102	119	136
Kern	342	223	18	101	704	823	707	808
Kings	66	11	5	50	281	336	350	400
Lake	25	0	0	25	77	102	175	200
Lassen	17	1	1	15	48	64	105	120
Los Angeles	6937	6889	48	0	356	404	0	0
Madera	46	0	0	46	171	217	322	368
Marin	213	209	4	0	13	17	0	0
Mariposa	8	0	0	8	30	38	56	64
Mendocino	58	0	0	58	176	234	406	464
Merced	118	56	16	46	249	311	322	368
Modoc	8	0	0	8	24	32	56	64
Mono	7	0	0	7	35	42	49	56
Monterey	269	199	12	58	261	331	406	464
Napa	90	71	19	0	50	69	0	0
Nevada	34	0	0	34	100	134	238	272
Orange	1708	1575	133	0	989	1122	0	0
Placer	91	33	15	43	169	227	301	344
Plumas	14	0	0	14	41	55	98	112
Riverside	526	282	59	185	1813	2057	1295	1480
Sacramento	685	658	26	1	46	73	7	8
San Benito	20	0	0	20	74	94	140	160
San Bernardino	698	573	58	67	927	1052	469	536
San Diego	1587	1305	57	225	2033	2315	1493	1707
San Francisco	670	670	0	0	0	0	0	0
San Joaquin	298	206	12	80	308	400	560	640
San Luis Obispo	128	0	0	128	654	782	896	1024
San Mateo	571	569	2	0	8	10	0	0
Santa Barbara	280	160	97	23	635	755	161	184
Santa Clara	1171	1103	37	31	253	321	217	248
Santa Cruz	151	2	0	149	554	703	1043	1192
Shasta	89	0	0	89	236	325	623	712
Sierra	3	0	0	3	9	12	21	24
Siskiyou	35	0	0	35	93	128	245	280
Solano	185	105	80	0	212	292	0	0
Sonoma	246	35	122	89	424	635	623	712
Stanislaus	224	144	5	75	231	311	525	600
Sutter	46	0	0	46	16	62	322	368
Tehama	32	0	0	32	80	112	224	256
Trinity	10	0	0	10	26	36	70	80
Tulare	208	0	0	208	1049	1257	1456	1664
Tuolumne	26	0	0	26	97	123	182	208
Ventura	435	318	53	64	868	985	448	512
Yolo	101	38	63	0	167	230	0	0
Yuba	45	14	20	11	36	67	77	88
TOTAL	21107	17245	1212	2650	17245	21107	18469	21107

2.3.3 Proximity Hosting Option

The non-uniform proximity hosting allocation uses only those nearby host areas that surround the major conglomerate high-risk areas. For this proximity allocation, the hosting ratios are different for each major area. Hosting ratios are especially high in the lower-risk areas surrounding the Los Angeles and San Diego conglomerate, where risk-to-host area population ratios of 12 to 1 are required. A county-by-county breakdown of population distribution before and after a relocation to nearby host areas appears in Appendix A. The average distance traveled by a relocatee under this option is less than that traveled under the uniform hosting option.

2.3.4 Proximity Hosting With Transport Constraints

The proximity hosting option with transport capacity constraints assumes 80% rather than 100% evacuation. In this third hosting allocation plan, which was suggested by the California Office of Emergency Services (OES), major consideration was given to highway capacity in determining the number of people assigned to each host area. OES assumed conditions of minimum highway regulation during the relocation period. A county-by-county breakdown of population redistribution under this relocation option appears in Appendix A2.

2.4 CALIFORNIA TRANSPORTATION SYSTEM VULNERABILITY

In addition to the high hosting ratios required in relocating California residents, the unique geography of the state also poses potential barriers hindering emergency transportation. Past SYSTAN research has shown that the California road network is particularly vulnerable to nuclear attack (Reference 14). In most areas of the United States, road networks are sufficiently dense that enough alternative detour routes will survive to permit travel between any set of origins and destinations. Detours may increase travel distances from 15% to 40% above normal, but travel is likely to be possible between all points surviving an attack. This is not necessarily the case in California. Assuming an attack destroys all areas identified by the FEMA report on "High Risk Areas" (Reference 16) as potential target areas, portions of California could be completely isolated by a nuclear attack. Projected target areas in California include most large urban areas. These areas are located along the major state highways, which would also be destroyed. Roads in the less population, "safe" eastern area of the state are unsuitable for long hauls due to mountainous terrain and weather limitations during the winter; in the southeast, alternate routes simply do not exist. This combination of limited road networks with heavy damage to key intersections will limit surface travel options following an attack, particularly if the attack occurs during the winter.

East/west rail links into and out of California are also vulnerable to attack. California has about seven points at which rail lines connect California to adjacent eastern states. These points are listed in Exhibit 2.5. They would be relatively easy to target for distribution. Should these rail junctions be destroyed, shipment of grain and other food products from eastern points would be considerably reduced. Also, a more critical aspect of this isolation would be that large quantities of fresh and processed food shipped from California to the rest of the country would be stopped.

Although the rail lines going east from California are vulnerable, the most heavily traveled sections of these lines are often double track; damage to the short sections of lines could probably be repaired in a relatively short time depending on the extent of the damage and location. Damage to bridges, of course, would be critical.

EXHIBIT 2.5

CALIFORNIA RAIL ENTRY-EXIT POINTS TO THE EAST

Railroad	Nearby City	County	Adjoining State
Southern Pacific	Floriston (near Truckee)	Placer	Nevada
Southern Pacific	Herlong	Alpine	Nevada
Southern Pacific	Araz	Imperial	
Union Pacific	San Bernardino	San Bernardino	Nevada
Santa Fe	Needles	San Bernardino	Arizona
Santa Fe	Ripley	Riverside	Arizona
Western Pacific	Clio	Plumas	Nevada

3. EXISTING FOOD DISTRIBUTION PATTERNS IN CALIFORNIA

3.1 OVERVIEW OF THE CALIFORNIA FOOD DISTRIBUTION SYSTEM

3.1.1 Channels of Distribution

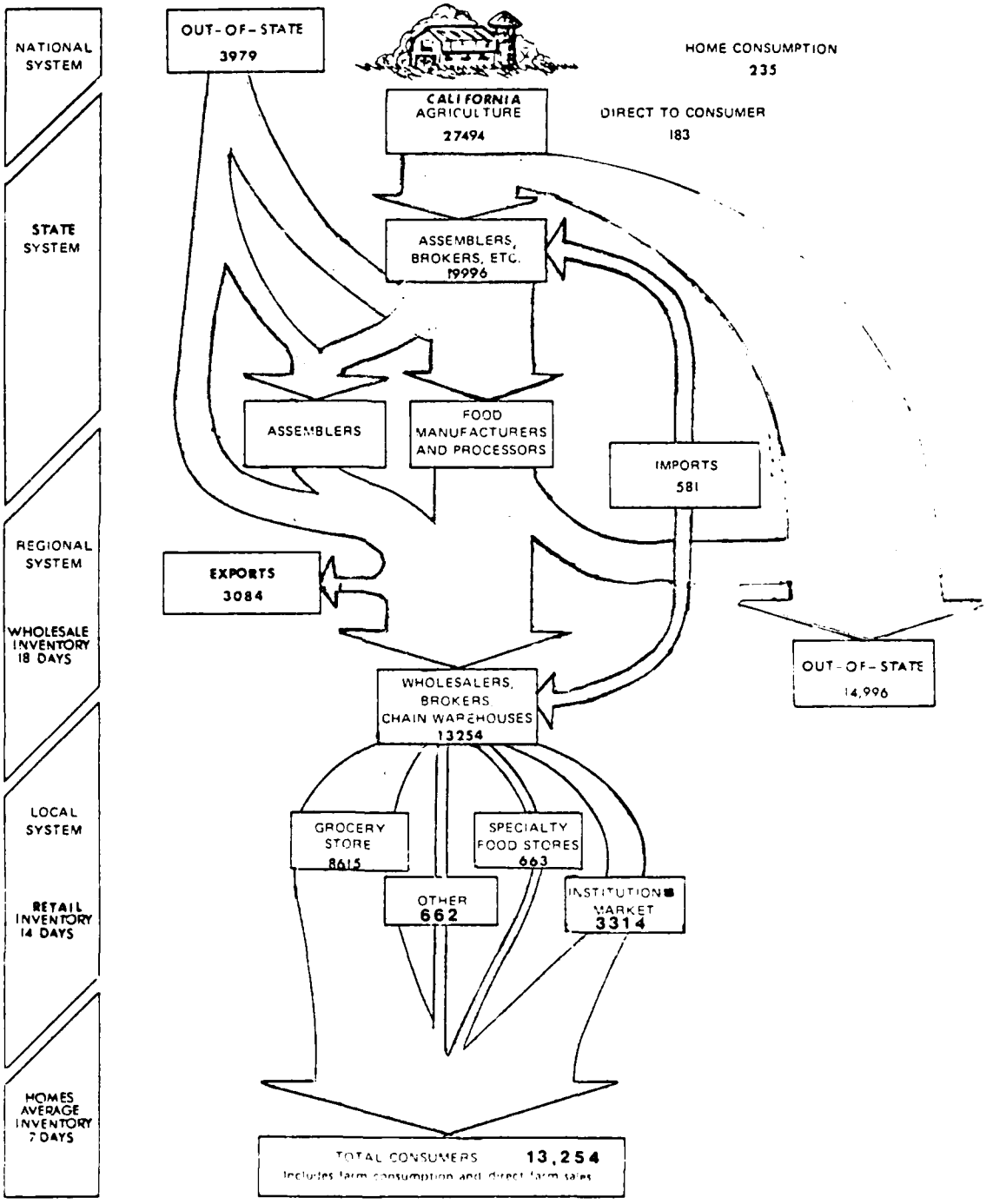
Exhibit 3.1 traces the existing volume of food flow in California from sources to destinations. California is the leading U.S. agricultural producer, providing a large part of the nation's fruits and vegetables and other commodities. Because the nation's agricultural production is concentrated in a few large areas, including California, significant production/consumption imbalances can be found at local and regional levels throughout the United States. Some major agricultural areas may produce enough food to feed five times the regions' population; others, like the Northeast Region, produce only enough food to feed two out of thirteen of their residents. Under conditions of crisis relocation, of course, California, as well as other agricultural "surplus" states, would continue to maintain pre-crisis distribution ratios to local and out-of-state customers.

Food processors in California are spread throughout the state. The majority of food processing, however, takes place in the Los Angeles and San Francisco Bay areas, and in and around the San Joaquin and Sacramento Valley cities of Fresno, Modesto, Stockton and Sacramento. California food processors serve both national and regional markets; sugar refineries and yeast manufacturing plants typically produce for a national market, while bakeries and dairies tend to concentrate on regional or even local markets. California processors ship large quantities of fresh, canned and frozen fruits and vegetables to other states. Main shipments to California from other states are cereal products and meat.

Wholesale distribution warehouses serve a relatively large area and are usually located in the large population centers. In California, most of the major chains and wholesale distributors have large distribution centers in the Los Angeles and San Francisco areas, with smaller warehouses in other outlying cities such as Sacramento, Fresno, Santa Rosa, Modesto and Riverside. Some major chains (such as Ralph's), however, have only one major warehouse location and distribute to all their stores from that one location.

California retail food outlets tend to be distributed in accordance with the population. Retail food grocery sales in Northern and Southern California counties, for example, are virtually proportional to the population in those areas.

EXHIBIT 3.1 PRINCIPAL CALIFORNIA FOOD DISTRIBUTION CHANNELS



(Source: Exhibit 3.5)

3.1.2 Available Food Inventories

Food stocks are held in inventory at each stage of the distribution pipeline shown in Exhibit 3.1. In the cases of California producers and processors, over 50% of raw product and processed foodstuffs held in inventory are destined for consumption outside the state. Most of the food on the shelves of California wholesalers and retailers is destined for consumption in California, and is stored close enough to the consuming population to be used in feeding evacuees under crisis relocation conditions. The left-hand margin of Exhibit 3.1 shows the average inventory levels in each of these stages of the distribution system, measured in terms of current consumption rates.

SYSTAN's research indicates that sufficient inventories of food at California's wholesale and retail levels exist to support populations of the host and risk areas for the anticipated duration of a crisis relocation period. Based on data obtained in interviews with representatives of chains and wholesale distributors, inventories tended to average between one and three weeks for retail and two to three weeks for wholesale, which is similar to the national average. The inventory level of perishable goods, of course, is much lower. The lower end of this range of wholesale inventory levels reflects the performance of a chain store operation serving a limited geographic areas, while the upper end is more characteristic of an independent wholesaler serving clients scattered over a wide area. In addition to stock on the shelves of wholesalers and retailers, seven to ten days of supplies are estimated to be in transit to wholesale warehouses at any time. Although no data on California home supply levels are available, according to a nationwide study (Reference 19), consumers have estimated that food stocks on hand could be made to last between one and two weeks in time of emergency.

Using the most conservative estimates of inventories on the shelves of wholesalers, retailers, and consumers, it can be estimated that a minimum of three weeks of food supplies would be available in California at any time, with an additional week of supplies in transit. Given the length of time required to evacuate a major city and to organize and accomplish a return, the minimum duration of the relocation period would be one week. Moreover, in view of the heated state of world affairs necessary to trigger a crisis relocation, it appears unlikely that the maximum duration of the relocation posture will exceed three weeks before an attack ensues or a settlement is negotiated. A negotiated settlement would trigger an order to return to risk-area residences. Although such a return could not be accomplished overnight, sufficient food supplies would be available to support California's evacuated populations for the duration of the relocation period. One of the chief problems of providing food for the crisis relocation strategy, then, will be to identify and supply the logistic support needed to make this food accessible to the evacuated populations.

More specific data on retail grocery locations in California are presented in Section 3.7.

3.2 EXISTING PATTERNS OF FOOD DISTRIBUTION IN CALIFORNIA

3.2.1 Three Key Questions

A necessary component of any plan for food distribution under crisis relocation conditions is information on the food sources normally supplying the affected area, typical transportation modes, and the location and amount of food supplies in the distribution network.

In SYSTAN's guidance to NCP planners and agency officials (Reference 2), this information is represented by three questions:

1. Where does the food come from?

2. How does it come?

3. Who has the food now?

For California, these questions will be reviewed beginning with production, and proceeding through the processing, wholesale, retail, and consumption stages. Exhibit 3.2 depicts these major elements of the California food distribution system and indicates their approximate vulnerability to nuclear attack, as measured by the relative location of each element in designated risk areas.

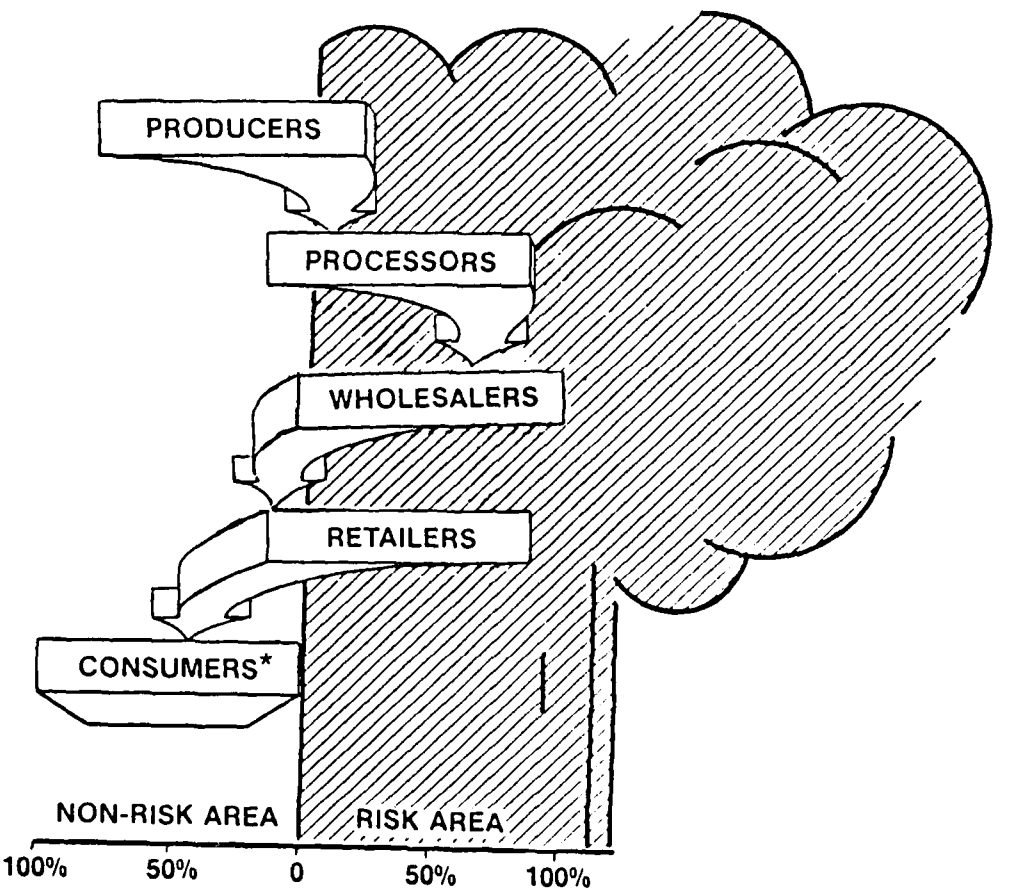
3.2.2 Production

The twenty leading California farm products are shown in Exhibit 3.3. These crop and livestock commodities account for about 80% of the state's gross farm income. In 1977, dairy products, cattle and calves, and eggs continued to dominate the livestock industry, while cotton, grapes, hay, processing tomatoes, and lettuce were the most important crops. California agriculture is considered one of the most diversified in the world, with no one crop dominating the state's farm economy. California leads the nation in production of fruits, nuts, and vegetables, accounting for over 40% of the nation's receipts for fruits and nuts and 33% for vegetables. Exhibit 3.4 shows the leading commodities by county by weight. The leading agricultural counties in California are Fresno, Kern, Tulare, San Joaquin, Merced, Monterey, and Riverside.

Most of the food consumed in California is produced and processed in California, especially dairy products and fruits and vegetables. Most of the meat brought into California is processed elsewhere, although California does receive a considerable quantity of live cattle and calves from other states. A number of finished grain products are shipped in from the Midwest, but California also receives raw wheat from other states to be milled here. Overall, California produces about twice as much food as is consumed in the state. California food production, consumption, imports, exports, out-of-state shipments, and receipts by food group are summarized in Exhibit 3.5, and are shown in more detail in Appendix B.

EXHIBIT 3.2

PRINCIPAL ELEMENTS OF THE FOOD DISTRIBUTION SYSTEM



* Assumes consumer relocation to non-risk areas under crisis relocation conditions.

EXHIBIT 3.3

RANKING AND VALUES OF 20 LEADING FARM PRODUCTS FOR CALIFORNIA, 1976-77

Farm Product	Commodity ranking		Value 1/		Percentage of State total	
	1976	1977	1976	1977	1976	1977
	-- *Number* --		-- *1,000 dollars* --		-- *Percent* --	
Milk & Cream	2	1	1,089,142	1,180,840	12.0	12.7
Cattle & Calves	1	2	1,094,422	987,706	12.1	10.6
Cotton	3	3	920,870	816,228	10.2	8.8
Grapes	5	4	561,289	705,145	6.2	7.6
Hay	4	5	562,773	456,011	6.2	4.9
Tomatoes, Processing	8	6	284,734	426,184	3.1	4.6
Eggs, Chicken	6	7	384,977	353,272	4.2	3.8
Lettuce	7	8	327,685	304,952	3.6	3.3
Nursery Products	9	9	279,930	297,390	3.1	3.2
Flowers & Foliage	10	10	255,163	273,475	2.8	2.9
Almonds	13	11	188,730	267,750	2.1	2.9
Strawberries	18	12	135,809	168,362	1.5	1.8
Rice	15	13	152,137	167,666	1.7	1.8
Oranges	14	14	156,896	160,410	1.7	1.7
Tomatoes, Fresh Market	17	15	137,904	153,961	1.5	1.7
Walnuts	21	16	114,741	147,810	1.3	1.6
Peaches	20	17	116,722	139,398	1.3	1.5
Chickens	19	18	124,838	138,405	1.4	1.4
Sugar Beets	12	19	199,629	126,381	2.2	1.4
Potatoes	22	20	110,161	124,943	1.4	1.3

1/ Based on value of quantity harvested for crops and on value of quantity marketed for livestock and poultry products.

Source: California Crop and Livestock Reporting Service, California Principal Crop and Livestock Commodities, 1977, California Department of Food and Agriculture, Sacramento, June 1978, page 14.

EXHIBIT 3.4: LEADING CALIFORNIA COUNTIES IN AGRICULTURAL PRODUCTION (BY WEIGHT)

Meat & Meat Alternatives

County	%
Stanislaus	12.65
Merced	11.73
Imperial	8.07
Madera	7.82
Tulare	6.45
Kern	6.00
Fresno	5.79
San Bernadino	3.98
Kings	3.11
San Joaquin	2.54
Monterey	2.53
Solano	1.91
Riverside	1.79
Sacramento	1.67
Ventura	1.62
Other Counties	22.34
Total	100.00

Milk & Dairy Products

County	%
San Bernadino	16.5
Tulare	11.6
Riverside	11.3
Stanislaus	9.6
Merced	8.0
San Joaquin	6.7
Kings	5.7
Fresno	5.5
Ventura	4.3
Sonoma	4.0
Kern	2.5
San Diego	2.0
Sacramento	1.8
Los Angeles	1.6
Madera	1.5
Other Counties	7.4
Total	100.0

Eggs

County	%
Riverside	21.90
San Bernadino	18.15
San Diego	16.26
Stanislaus	11.16
San Joaquin	9.87
Ventura	7.10
Merced	2.77
Placer	2.69
Orange	2.04
Los Angeles	1.37
Santa Barbara	1.10
Fresno	1.05
Napa	0.66
Monterey	0.63
Butte	0.51
Other Counties	2.74
Total	100.00

Cereals and Cereal Products

County	%
Colusa	15.37
Butte	11.37
Yolo	10.09
Sutter	9.78
Imperial	9.40
Glenn	7.33
Sacramento	6.15
Yuba	4.24
Kern	4.06
San Joaquin	3.65
Fresno	3.37
Solano	3.16
Madera	1.99
Kings	1.89
Merced	1.59
Other Counties	6.56
Total	100.00

Fruits & Vegetables

County	%
Fresno	12.3
Monterey	9.2
San Joaquin	7.4
Kern	7.0
Yolo	6.8
Tulare	5.9
Sutter	4.9
Stanislaus	4.8
Imperial	4.1
Riverside	4.2
Merced	3.3
Ventura	2.8
Solano	2.5
Kings	2.3
Madera	2.3
Other Counties	19.9
Total	101.0

Potatoes

County	%
Kern	62.63
Riverside	11.51
Siskiyou	9.94
Modoc	8.16
Santa Barbara	2.91
San Joaquin	2.89
Humboldt	0.89
Madera	0.75
Total	100.00

Sugar & Sweets

County	%
Imperial	20.00
San Joaquin	11.70
Solano	11.34
Monterey	8.04
Yolo	7.79
Kern	6.78
Colusa	4.89
Merced	3.87
Fresno	3.72
Glenn	2.60
Sutter	2.49
Madera	2.42
Los Angeles	2.41
Tulare	1.91
Butte	1.64
Other Counties	8.39
Total	100.00

Source: Reports of California County Agricultural Commissioners (assembled by SYSTAN)

EXHIBIT 3.5

ESTIMATED CALIFORNIA FOOD PRODUCTION, DISTRIBUTION AND CONSUMPTION
1975-1976
(In Thousands of Short Tons)

Food Group	California Production	Imports	Exports	Shipments From Other States	Shipments to Other States	California Consumption	Per Capita Consumption Annually	Per Capita Consumption Weekly
Meat and Meat Alternates[1]	787	148	12	1586	38	2471	234.0	4.5
Eggs	560	0	5	0	176	379	35.9	0.69
Milk and Dairy Products[2]	2919	0	0	29	29	2919	276.5	5.32
Cereals and Cereal Products[1]	2717	0	1519	868	842	1224	116.0	2.2
Fruits and Vegetables	17593	378	2144	221	12900	3148	298.2	5.7
Food Fats and Oils	305	55	78	333	66	549	53.4	1.0
Potatoes	1202	0	46	694	522	1328	125.8	2.4
Sugars and Sweeteners	1411	0	0	248	423	1236	117.1	2.3
Totals	27494	581	3804	3979	14996	13254	1256.9[3]	24.11

[1] Retail weight basis

[2] Class 1 Products

[3] U.S. per capita total of all products consumed based on USDA figures (Reference 8) is 1290.8 pounds. Figure shown in table above is 97% of the USDA figure for the commodities consumed.

Source: *Appendix B*

3.2.3 Processing

The food processing industry in California is dispersed throughout the state with every county having some processing operations. The main areas of concentration are: (1) the medium-sized cities in or near the agricultural areas of Southern California, the San Joaquin and Sacramento Valleys; and (2) in or near the San Francisco/Oakland/San Jose and Los Angeles/Orange County Metropolitan Areas. The location, however, varies considerably with the specific type of processing industry. The dairy industry, for example, tends to be near the centers of consumption, primarily near major metropolitan areas. Most of the fruit and vegetable processing industry is located in the growing areas of the Sacramento and San Joaquin Valleys (much of it in or near Sacramento, Stockton, Modesto and Fresno), the Salinas Valley, and Imperial Valley. There is also a sizeable fruit and vegetable processing industry in former growing areas such as the Santa Clara Valley, Los Angeles and Orange Counties. Data on the food processing industry in the leading counties are summarized in Exhibit 3.6, and shown in more detail in Appendix B. Appendix B shows food processing industry sales by SMSA.

Approximately 21% of California's food processing industry is located in the host areas. A detailed county-by-county breakdown of risk-area/host-area distribution is shown in Appendix B.

3.2.4 Wholesale Distribution

Exhibit 3.7 shows the approximate distribution of wholesale operations, based on sales. Most of the wholesalers/distributors are located in the largest cities; The San Francisco/Oakland and Los Angeles SMSA's account for two-thirds of all wholesale sales. With the San Jose, Orange and San Diego SMSA's, these major centers account for almost 80% of all California wholesale sales (Appendix B). Roughly 85% of the food consumed in these five major areas is warehoused locally, while 15% comes from other metropolitan areas. Eight smaller cities in California are supplied primarily from the Los Angeles and San Francisco areas, as shown in Exhibit 3.8. This exhibit also shows the average distance to stores served in the metropolitan areas and to stores in outlying cities (smaller markets also served by the central warehouses in the metropolitan areas).

Center Locations

Major chains and wholesalers usually distribute to stores or customers over a large geographic area. A single distribution center may serve all the stores in a state or even parts of several states. Several chains have distribution centers in Los Angeles, for example, that serve stores in Arizona as well as in Southern California.

Most of California's major cities and those nationwide are served by distribution centers within their borders or suburbs. The San

EXHIBIT 3.6

CALIFORNIA FOOD PROCESSING ESTABLISHMENTS RANKED BY VALUE OF SHIPMENTS

(Leading Counties)

Counties	Number of Establishments	Sales ($ Mil)	Sales Share (%)	Cumulative Sales Share (%)
Los Angeles	773	3697.9	31.4	31.4
Alameda	186	929.6	7.9	39.3
San Joaquin	89	647.7	5.5	44.8
San Francisco	166	635.8	5.4	50.2
Santa Clara	136	619.2	5.2	55.4
Stanislaus	27	608.2	5.2	60.6
Orange	104	536.8	4.6	65.2
Fresno	113	511.5	4.3	69.5
Sacramento	61	356.8	3.0	72.5
San Diego	94	352.7	3.0	75.5
Others	1749	2898.4	24.5	100.0
Totals	2594	11794.6	100.0	100.0

EXHIBIT 3.7

MAJOR WHOLESALE FOOD DISTRIBUTION AREAS
AND PERCENTAGE OF CALIFORNIA POPULATION SERVED

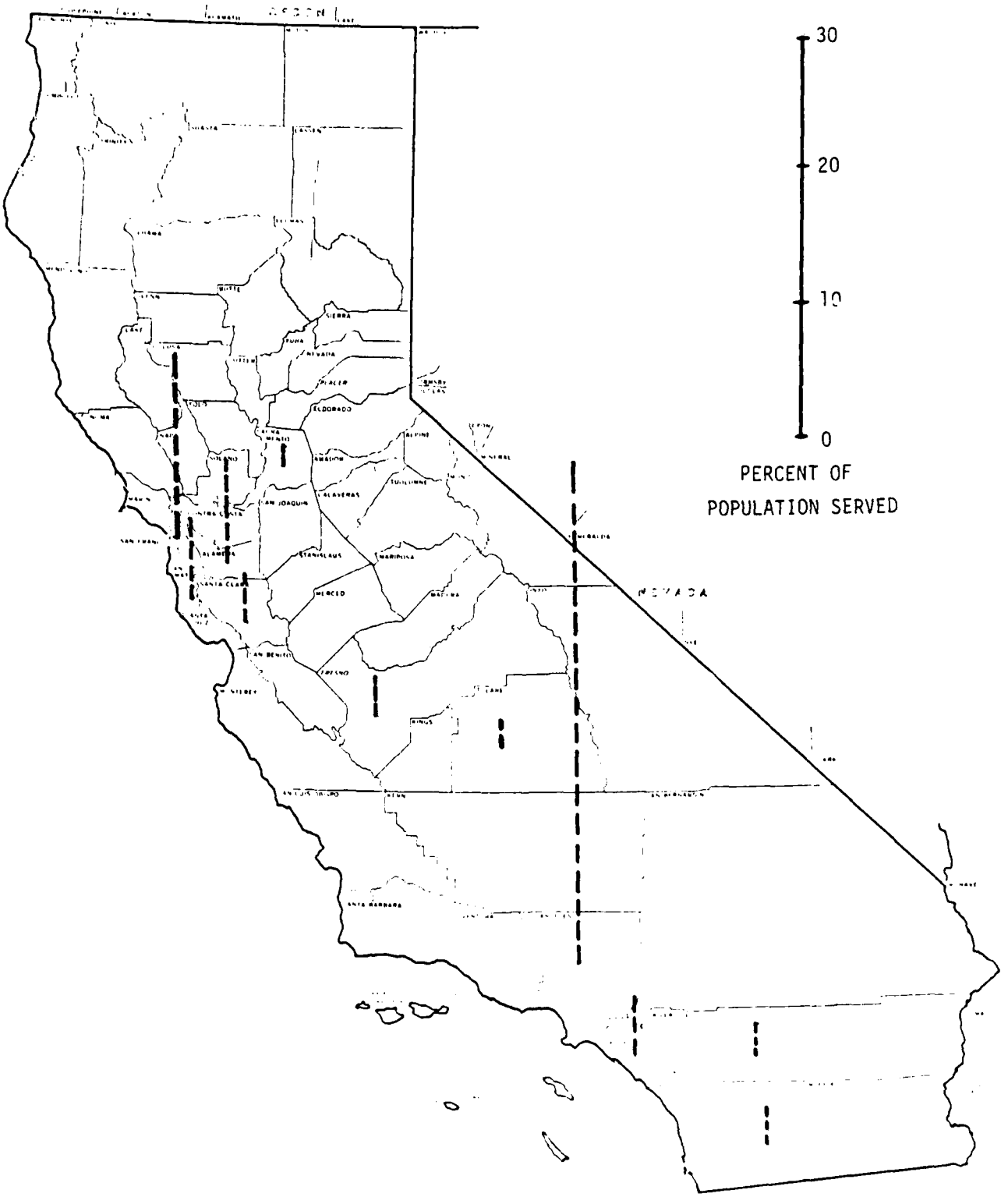
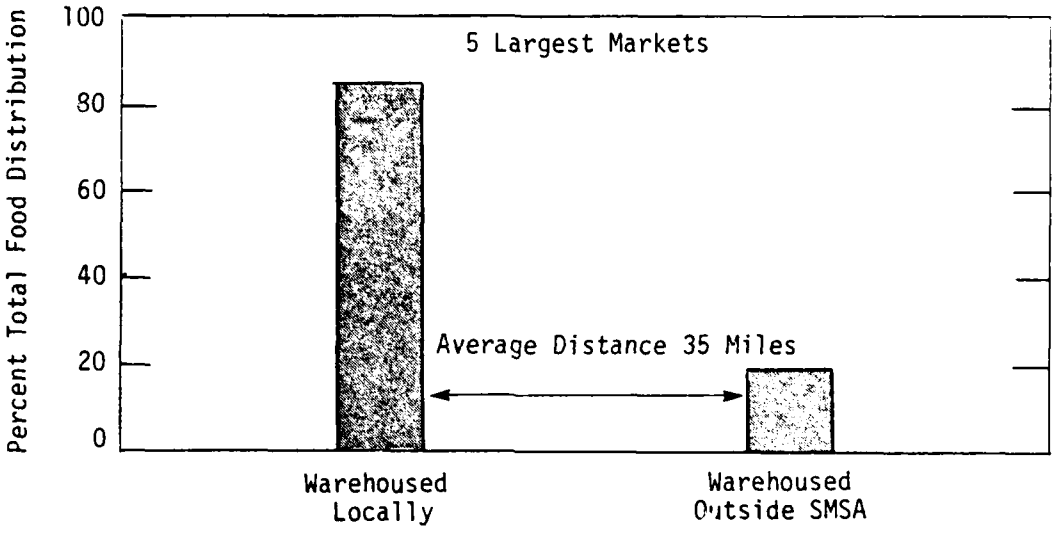
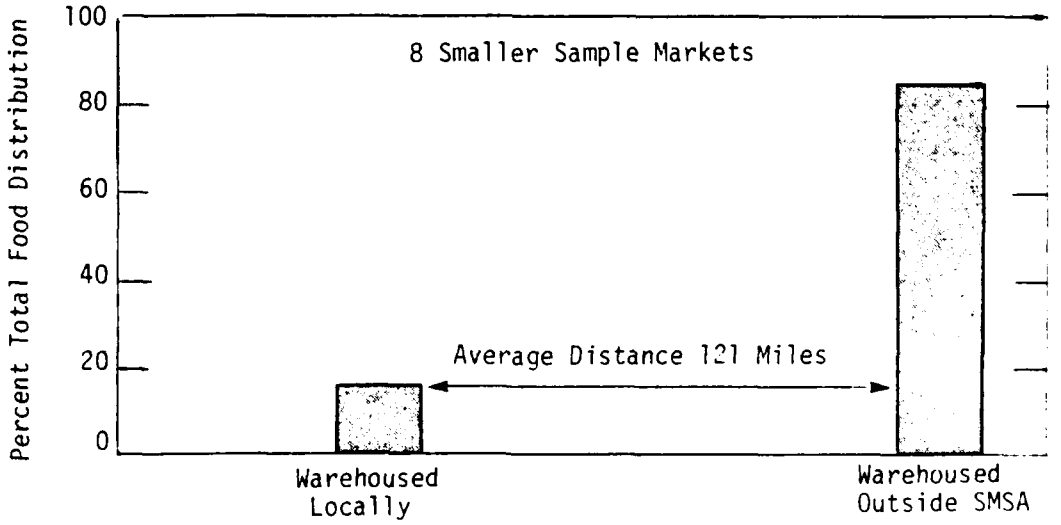


EXHIBIT 3.8

DISTANCE TO CALIFORNIA WHOLESALE FOOD DISTRIBUTION CENTERS





Francisco metropolitan area and the Los Angeles/Orange County area each have more than 75% of their wholesale food stocks available from distribution centers within their SMSA. Two additional cities (Sacramento and Fresno) have more than half their wholesale food stocks available locally. Three other metropolitan areas, San Diego, Modesto and Riverside/San Bernardino/Ontario, have more than 25% of their wholesale food stocks available locally. The other cities in California (including Chico, Bakersfield, Santa Cruz, Salinas, Santa Barbara and Stockton) have more than 90% of their food supplies stored in wholesale warehouses outside of their local areas. The smaller cities generally receive most of their dry grocery and produce supplies from warehouses in Los Angeles, San Francisco or Sacramento. In some cases, however, a portion of fresh produce is obtained from a local produce market.

Approximately 87% of California's population resides in risk areas, mainly concentrated in the Los Angeles and San Francisco Bay areas, with only 13% in the host areas. The ratio of wholesaler/distributor concentration in the risk areas is greater than that of the population, with 94% of wholesale sales in the risk area and only 6% in the host area. This is shown in graphic form in Exhibit 3.3, and on a county-by-county basis in Appendix B.

While the ratio of wholesaler/distributor concentration in the major cities is greater than that of the population, their north/south distribution in the state is similar to that of the population. Southern California has approximately 64% of the population and accounts for about 60% of the wholesale grocery sales (Appendix B).

3.2.5 Retail Stores

3.2.5.1 Store Location.

The U.S. Census of Retail Trade (Reference 3) indicates that in 1972 California had a total of 19,238 retail food stores with sales of $10.64 billion. On a regional basis, retail sales of food are fairly proportional to population. There is, however, significant variation among different cities and counties. The average annual sales per store in California is $554,000, with sales in rural areas slightly lower than urban areas. Approximately 13% of the grocery store sales in California are in host areas and 87% in risk areas. The number and sales of retail food stores by county are shown in Appendix B.

To obtain the necessary retail and wholesale data for this study, SYSTAN interviewed distribution representatives of each of the major food chains, such as Safeway, as well as wholesaler/distributors, such as United Grocers. The names of the chains and distributors contacted, the warehouse locations and approximate number of stores served by each are shown in Exhibit 3.9.

EXHIBIT 3.9 MAJOR CALIFORNIA RETAIL GROCERY CHAINS BY LOCATION AND NUMBER OF STORES

Company Name	Warehouse Location		Approximate Number Of Stores Served	Stores In Risk And Host Areas (Percentage)	
	City	County		Risk	Host
Alpha Beta	La Habra	Orange	C	94	6
Alpha Beta	Milpitas	Santa Clara	B	90	10
Certified Grocers	Los Angeles	Los Angeles	G	93	7
Fleming Foods	Fremont	Alameda	E	87	13
Lucky Stores	Buena Park	Orange	C	97	3
Lucky Stores	Vacaville	Solano	B	94	6
Market Basket	Los Angeles	Los Angeles	A	100	0
Market Wholesale Grocery Co.	Santa Rosa	Sonoma	D	69	31
Market Wholesale Grocery Co.	Fresno	Fresno	D	38	62
Market Wholesale Grocery Co.	Sacramento	Sacramento	E	71	29
Market Wholesale Grocery Co.	Redding	Shasta	D	1	99
Ralph's Grocery Company	Compton	Los Angeles	B	100	0
Safeway Stores, Inc.	Richmond	Contra Costa	B	88	12
Safeway Stores, Inc.	Sacramento	Sacramento	A	46	54
Safeway Stores, Inc.	Santa Fe Springs	Los Angeles	B	87	13
Safeway Stores, Inc.	San Diego	San Diego	A	84	16
United Grocers	Richmond	Contra Costa	F	89	11
United Grocers	Sacramento	Sacramento	D	49	51
United Grocers	Fresno	Fresno	E	31	69
Vons	El Monte	Los Angeles	B	92	8

Number of Stores Served

Category	Range	Category	Range
A	50-99	E	500-999
B	100-199	F	1000-1999
C	200-299	G	2000+
D	300-499		

3.2.5.2 Store Volume.

The annual volume of food-per-store sold varies considerably, from a high of about 8,000 tons for a major chain with all relatively large stores, to independent wholesale distributors which serve stores averaging about 125 tons. There are, of course, many stores with even smaller annual throughput. The annual throughput for the major chains averages 4,000-5,000 tons per store. On a volume basis, most food is sold through supermarkets. National figures indicate that although supermarkets accounted for only 16.5% of the total number of stores in 1977, they accounted for 75.1% of total store sales (Reference 4). The same studies show that chain grocery stores accounted for 58% of all grocery store sales.

3.2.5.3 Store Operations.

Information obtained in the interviews indicates that major chains supply as much of their stores' requirements directly from their own warehouses as possible and keep "drop shipments" by manufacturers or their wholesalers to a minimum. Chain stores such as Safeway and Alpha Beta, which sell a full range of goods (including produce, dry grocery, delicatessen, dairy, frozen and non-food items), generally handle more than 95% of their stores' orders through their own warehouses.

Non-chain stores, or smaller chains which belong to member association distributors such as United Grocers, may receive only 65-75% of their supplies from such an organization, although the share of goods received from its primary distributor varies considerably from one organization to another. Certified Grocers in Los Angeles, for example, handles fresh produce and other perishables, while United Grocers in Sacramento does not. Goods not supplied through chain stores or primary grocery distributor warehouses may be supplied by the manufacturer; dairy products and bottled and canned beverages are often supplied in this way. Fresh produce may be supplied by an independent produce wholesaler or even purchased directly by the store itself in the nearest wholesale produce market.

A typical breakdown of types of goods handled (annual throughput on a weight basis) by a "complete line" California supermarket chain is shown below:

COMMODITY CATEGORY	PERCENT
Grocery	47
Produce	22
Meat	12
Frozen Foods	7
Variety	7
Miscellaneous Perishables	5
Total	100

Produce constitutes a substantial share of the volume of goods delivered to a chain store from a central warehouse. In the case of independent stores, total tonnage supplied by the primary distributor would be substantially lower if produce is obtained from an outside source.

All chain stores and major grocery store wholesaler have their own delivery fleets. Almost all operate their warehouses and delivery trucks at least two shifts per day and some operate three shifts per day. Delivery schedules vary considerably with the company and the types of merchandise, but most stores get deliveries three to five days per week. A variety of truck types are used, but the predominant unit is a tractor/trailer combination with a 35,000 to 40,000 pound carrying capacity. Transportation is discussed in greater detail in Chapter 6.

3.2.5.4 Peak Operating Periods.

The weekend is by far the busiest time of the week for the eight checkout counters in the average new supermarket. More than 75% of the nation's food purchases are made between Thursday and Saturday. The unbalanced distribution of supermarket sales that results from heavy weekend buying indicates that the modern supermarket rarely operates at peak capacity. In a typical supermarket, the peak sales period is 6:00 P.M. to 9:00 P.M. on Friday, when nearly 14% of the week's total volume is sold. If this sales rate were maintained uniformly for seven days, the average supermarket could handle nearly four times its usual business.

This measure of capability views the supermarket merely as an outlet, and does not consider resupply problems. The inference that business could be quadrupled also assumes, not unreasonably, that patrons would be willing to adjust their normal shopping patterns in time of emergency. Granting the oversimplification involved in using a supermarket's peak period to indicate outlet capacity, it seems clear that a substantial amount of unused capacity exists in the modern supermarket.

Due to their large share of total grocery sales and expandable capacity, supermarkets may expect to bear the brunt of any demand increases accompanying population shifts caused by crisis relocation.

3.2.6 Restaurants and Institutions

On a retail weight basis, about 16.7 million tons of groceries are delivered per year in California. Roughly 75% of this goes to grocery stores and 25% to restaurants and institutions.

According to a 1976 study by the U.S. Department of Agriculture, eating away from home has increased considerably in recent years. Exhibit 3.10 shows that approximately 25% of all food consumed in the United States in 1975-1976 was eaten away from home at either restaurants or institutions.

Existing studies indicate that the share of food by weight going to restaurants and institutions is higher in metropolitan areas than in the nation as a whole. In Detroit, for example, approximately 30% of the food by weight was distributed to restaurants and institutions (Reference 6). The share of food consumed away from home also varies considerably with family income (References 7, 8 and 9). The share of food eaten out in California on a county-by-county basis is shown in Appendix B. This exhibit shows that a greater share of food is eaten away from home in counties with larger cities having a substantial daily influx of commuting workers. In San Francisco, Los Angeles and Orange Counties, for example, a higher percentage of food is eaten away from home than for the state as a whole.

3.2.7 Consumption

The U.S. Department of Agriculture has made estimates of national weekly per-capita food consumption levels. These USDA estimates for 1975, along with the USDA's National Emergency Maximum Distribution Allowance, are shown in Exhibit 3.11.

U.S. per-capita consumption on a retail weight basis is estimated at approximately 24 pounds per person per week. Total retail sales increase to 30 pounds per person per week if shipping materials, damage, losses, and trimming of fruits and vegetables are included. In the case of some food groups, California consumption varies slightly from the national average; in this study, however, where no per-person data specific to California were available, the national average figures were used. Using a total "shipped-to-store" weight of 30 pounds per person, and a 1975 population of 21,116,000, shipments of food to California consumers total approximately 16,470 million tons per year. Total food store sales are estimated at about 75% of this total, or 12,353,000 tons. The balance was supplied by restaurants and institutions.

EXHIBIT 3.10

FOOD DISTRIBUTION BY RESTAURANTS, INSTITUTIONS AND RETAIL ESTABLISHMENTS

ESTABLISHMENT	1955-60	1970	1975-76
Food served in institutions and in restaurants to expense-account patrons	6%	7%	8%
Food eaten in restaurants by those living in households	14-15%	16%	17%
All food consumed away from home*	20-21%	23%	25%
Food consumed at home	79-80%	77%	75%
	100%	100%	100%

Source: U.S. Department of Agriculture, Economic Research Service, National Food Situation NFS-161, September, 1977. p.25 (Reference 9)

*Figures based on cost of food to serving establishments.

EXHIBIT 3.11

COMPARISON OF NATIONAL EMERGENCY MAXIMUM FOOD DISTRIBUTION ALLOWANCE AND 1975 WEEKLY PER CAPITA CONSUMPTION LEVELS

Food Groups and Food Items	Amount Per Week	
	MAXIMUM EMERGENCY ALLOWANCE	1975 Consumption Levels
Meat and meat alternates (red meat, poultry, fish, shellfish, cheese, dry beans, peas, and nuts)	3 lbs.	4.5 lbs.
Eggs	6 (0.78 lbs.)	5.3 (0.69 lbs.)
Milk (fluid, whole)	7 pints (7.53 lbs.)	4.6 pints (4.97 lbs.)
Cereals and cereal products (flour including mixes, fresh bakery products, corn meal, rice, hominy, macaroni, and breakfast cereals)	4 lbs.	2.4 lbs.
Fruits and vegetables (fresh and frozen)	4 lbs.	5.7 lbs.
Food fats and oils (butter, margarine, lard, shortening, and salad and cooking oils)	0.5 lbs.	1.0 lbs.
Potatoes (white and sweet)	2 lbs.	2.4 lbs.
Sugars, syrups, honey, and other sweets	0.5 lbs.	2.3 lbs.
TOTAL (Equivalent Pounds Per Week)	22.31 lbs.	23.96 lbs.

3.2.8 Implications of Food Distribution Patterns for Crisis Relocation

Approximately 94% of California's food distribution centers are located in the Los Angeles and San Francisco regions or other risk areas, and most of the stores served by these centers are also located in these risk areas, with relatively few in the host areas. The implications of this food distribution pattern on crisis relocation are two-fold. One is that there is likely to be considerable stress placed on the transportation system in supplying the relocated population. Second, there will be considerable stress on host-area retail stores, restaurants, and institutions. Other factors which bear on food distribution under crisis relocation conditions are California's high-level agricultural production, host-area food processing, and the substantial quantity of host-area warehousing space. Each of these factors has been considered in identifying and evaluating alternatives for distributing food to California's residents.

4. IDENTIFICATION AND EVALUATION OF FOOD DISTRIBUTION ALTERNATIVES

In this study, five distinct alternatives are considered for providing the logistic support needed to assemble food supplies and transport them to the host areas:

1. Pre-crisis stockpiling;
2. Bypassing the wholesaler with direct shipments from manufacturers to the host area;
3. Maintaining risk-area wholesale operations;
4. Establishing emergency warehouses in host areas; and
5. Supplementing risk-area warehouses with secondary warehouses in host areas.

Alternative 1 requires extensive pre-crisis preparation; while Alternatives 2 through 5 involve adjustments to the existing distribution system. Alternatives 1 and 2 are briefly discussed below; for further detail, see References 2, 5 and 6. The remainder of the chapter is devoted to a discussion of of Alternatives 3 and 4, and to the combinations of these two alternatives in Alternatives 5. Exhibit 4.1 briefly summarizes the advantages and disadvantages of all five alternatives.

4.1 PRE-CRISIS STOCKPILING

In the past, food for survivors of localized disasters in the United States has often been obtained from stockpiles maintained by the USDA as part of their Donated Commodities Program. Since the 1930's, the USDA has purchased surplus commodities under this program for distribution to school lunch programs, summer camps, state and federal institutions, and welfare recipients. Stockpiles of these commodities were located throughout the United States and have served as a source of immediate relief to victims of natural or manmade disasters. In recent years, however, the availability of USDA-donated foods from state warehouses has been on the decline due to the switch from donated foods to food stamps for needy people. This trend has reversed recently to the extent that the USDA Food and Nutrition Service is now purchasing more food commodities for school lunch programs than previously. The Food Stamp and the School Lunch Programs are on-going USDA projects. In 1977, there were two instances where the USDA/Food Nutrition Service authorized the use of School Lunch Program food in natural disasters.

EXHIBIT 4.1

SUMMARY OF ALTERNATIVES FOR ASSESSING AND STAGING

FOOD SUPPLIES OF CALIFORNIA CRISIS RELOCATION

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
1. Pre-Crisis Stockpiling. Create and maintain food stockpiles in host areas on a contingency basis in the pre-crisis period.	Reduces attack vulnerability and transportation requirements for food distribution. Normally undergoes minimal disruption, and can be quickly reestablished following crisis relocation.	Extremely costly to set up and maintain.
2. Bypass Wholesalers With Direct Shipments. Ship food directly from manufacturer to host area, bypassing the wholesale function.	Removal of stocks from processor inventories. Decreases attack vulnerability. Possible limited use in California in conjunction with Alternative 1, where processors are in host area.	Places strain on processors operating and transportation resources. Disrupts distribution system.
3. Maintain Risk Area Warehouses. Continue to operate risk-area warehouses to deliver proportionally greater supplies to host-area retail outlets.	Negligible cost. Conceptually simple and builds on the existing system without creating new operating entities. Ease of post-crisis resumption of operations.	Increased vulnerability to attack for goods and personnel.
4. Establish Host-Area Warehouses. Drain risk-area warehouses as possible, moving supplies to expedient host-area space.	Decreases the vulnerability of risk-area food supplies and key workers to attack.	Operating inefficiencies, system disruption, and the occurrence of major delays in reestablishing normal food distribution operations in the post-crisis period. Requires additional host-area personnel to staff emergency warehouses and increased transportation resources to drain risk-area warehouses.
5. Chains and Major Wholesalers Establish Secondary Host-Area Distribution Centers as Adjunct to Alternative 1. Maintain risk-area warehouses to distribute some types of food supplies. Subsequent distribution to stores and mass feeding facilities.	Basically sound concept of distributing from major chain risk-area warehouses remains intact. Transportation stress is reduced for goods originating in the host area and distributed from host-area warehouses. Supply level of risk-area warehouses is reduced. Number of risk-area critical workers is reduced. Provides basic structure and personnel nucleus which could be expanded if crisis or attack is extended.	Expanded number of distribution points adds to chains and wholesaler task of maintaining centralized control. Requires greater post-crisis effort (e.g., shut down secondary distribution points.
° Commandeered Host-Area Warehouses.	Relatively more warehouse space available in California due to widespread food production and processing.	Difficulty of locating suitable warehouse space.
° Emergency Construction of warehouses.	Advances in technology allow fast (2 or 3 day), relatively low-cost construction of some types of structures (e.g., air-supported structures).	Shipment of temporary structure equipment and materials to site is time-consuming if not manufactured locally.
° Use of Railcar Shipments. Use railcars to move food from risk-area processors to host-area points. Chains and wholesalers order shipments.	Large inventories of California risk-area processors normally shipped by rail could be increased. Would reduce highway congestion and decrease risk-area supplies.	Difficulty in locating suitable storage or distribution facility space. Possible difficulty in maintaining centralized control.
° Use of Railcars as Host-Area Distribution Points.	Track space available in California. Some cars available from less essential sectors.	Unloading and distribution inefficiencies. Possible difficulty in maintaining centralized control.

Replenishment of stocks was then carried out by USDA/ASCS. It should be noted, however, that food donated to the School Lunch Program is owned by state and local school lunch agencies, and may be handled as these agencies see fit. The USDA Donated Commodities Program, which includes the School Lunch Program, maintains an average inventory of about 10,000 tons of food in its Sacramento and Los Angeles warehouses.

USDA/ASCS food stockpiles are presently quite limited in the type and quantity of commodities held. In California, dried milk is the main commodity held by USDA/ASCS. These stockpiles total about 160,000,000 pounds of dried milk (see Guidelines). This quantity of milk would last California evacuees for more than three weeks if used on the same emergency standard basis as whole milk. USDA/ASCS dried milk presently stored in the risk areas would be moved to the host areas under crisis relocation conditions.

Although food stockpiles for disaster relief are smaller than in earlier years, the creation of a system of stockpiles in prospective host areas represents one option for providing food under crisis relocation conditions. Past research projects have explored the cost of establishing and maintaining a nationwide network of stockpiles of both raw wheat and processed foodstuffs (References 11 and 12). These cost figures, prorated to reflect California's share of the total population, have been projected to a common year through the use of the Consumer Price Index and are summarized in Exhibit 4.2 for different levels of stockpiles. Because the wheat stockpiling costs cover stockpiles sufficiently large to provide postattack sustenance as well as crisis relocation relief, the costs are not directly comparable with those displayed for stockpiles of prepared food, which cover only crisis relocation relief. If stockpiles were designed to cover comparable periods, it has been estimated that the cost of acquiring stockpiles of processed foods would be six times the cost of acquiring stockpiles of raw wheat (Reference 12).

The availability of stockpiled food in host areas would reduce both attack vulnerability and transportation requirements without disrupting the existing distribution system. Since the regional and local systems have sufficient food to support the population during and after crisis relocation, it appears that a strategy of stockpiling either wheat or processed foods in host areas in advance of relocation is prohibitively costly. A moderate nationwide program of wheat stockpiling, for example, would require more than half of the present civil defense expenditures.

4.2 BYPASS WHOLESALERS WITH DIRECT SHIPMENTS

Under this alternative, food would be shipped directly from the manufacturer to the host area, bypassing the wholesaler. Shipments could be delivered directly to retailers or mass feeding centers. This alternative might be effective for some manufacturers, particularly those located in host areas. For processors located in risk areas, a

EXHIBIT 4.2

ESTIMATED COST OF PROVIDING AND MAINTAINING
CALIFORNIA PRE-CRISIS FOOD STOCKPILES

(Millions of 1975 Dollars)

Commodity	Stockpile Level	Set-Up Cost	Additional Maintenance Cost
Raw Wheat Stockpiles	Minimal (augment existing pipeline supplies to yield 3-month total)	9	1
	Moderate (augment existing pipeline supplies to yield 6-month total)	77	10
	Extensive (3-month supply)	151	17
Prepared Food Stock-piles	Minimal (austere rations of 2000 calories per week per person for two weeks)	78	17
	Moderate (minimal level plus milk powder and dry rations for evacuation use)	253	56
	Extensive (moderate level plus more varied and expen-sive foods)	495	111

(Source: Based on References 11 and 12 and SYSTAN analysis.)

major advantage of this alternative is the removal of inventories from locations which are vulnerable to attack.

The setup costs needed to bypass wholesalers with direct host-area shipments are negligible. The main disadvantage of this alternative is the heavy strain on the processors' operations, especially transportation. Some processors have their own fleets, while others don't. Many California meat processors have their own fleets and routinely deliver directly to distributors or independent stores. However, major California canners generally have relatively few trucks of their own and rely heavily on common carriers. Heavy reliance on direct shipments under crisis conditions disrupts normal distribution patterns, and can potentially cause supply/demand imbalances and the loss of centralized distribution control. Impossible priority decisions are required of processors with nationwide distribution networks, as local and regional requests for direct shipments are balanced against nationwide demand patterns. The distribution system that can be expected to work best in an emergency is that system which most closely resembles normal operating conditions. In the case of food distribution, normal patterns call for consolidation of shipments in wholesale warehouses. This pattern permits better control over the composition and scheduling of deliveries to individual stores.

Direct or "drop shipments" as a percentage of total retail volume vary considerably by firm as well as product type. During the 1978 truckers' strike in California, major food distributors found they could substantially increase the volume of food shipments directly from the supplier to retail stores. One major distributor indicated that its drop shipments increased from 2% to 14% of total volume. With this type of shipment, the order still originates with the store and is processed by the distributor, who notifies the supplier to ship directly to the store. The supplier bills the distributor and the distributor bills the store. Centralized control is at least partially maintained. Under normal conditions, major chains keep drop shipments to a minimum because it is expensive. Also, it places a strain on the suppliers' transportation facilities.

In summary, drop shipments can only be used effectively to a limited extent under emergency conditions. It may be most appropriate where the supplier (producer or processor) is located in the host area, and can drop-ship to wholesale, retail or mass feeding facilities nearby. The billing could be done through the distributor so that centralized control would be maintained.

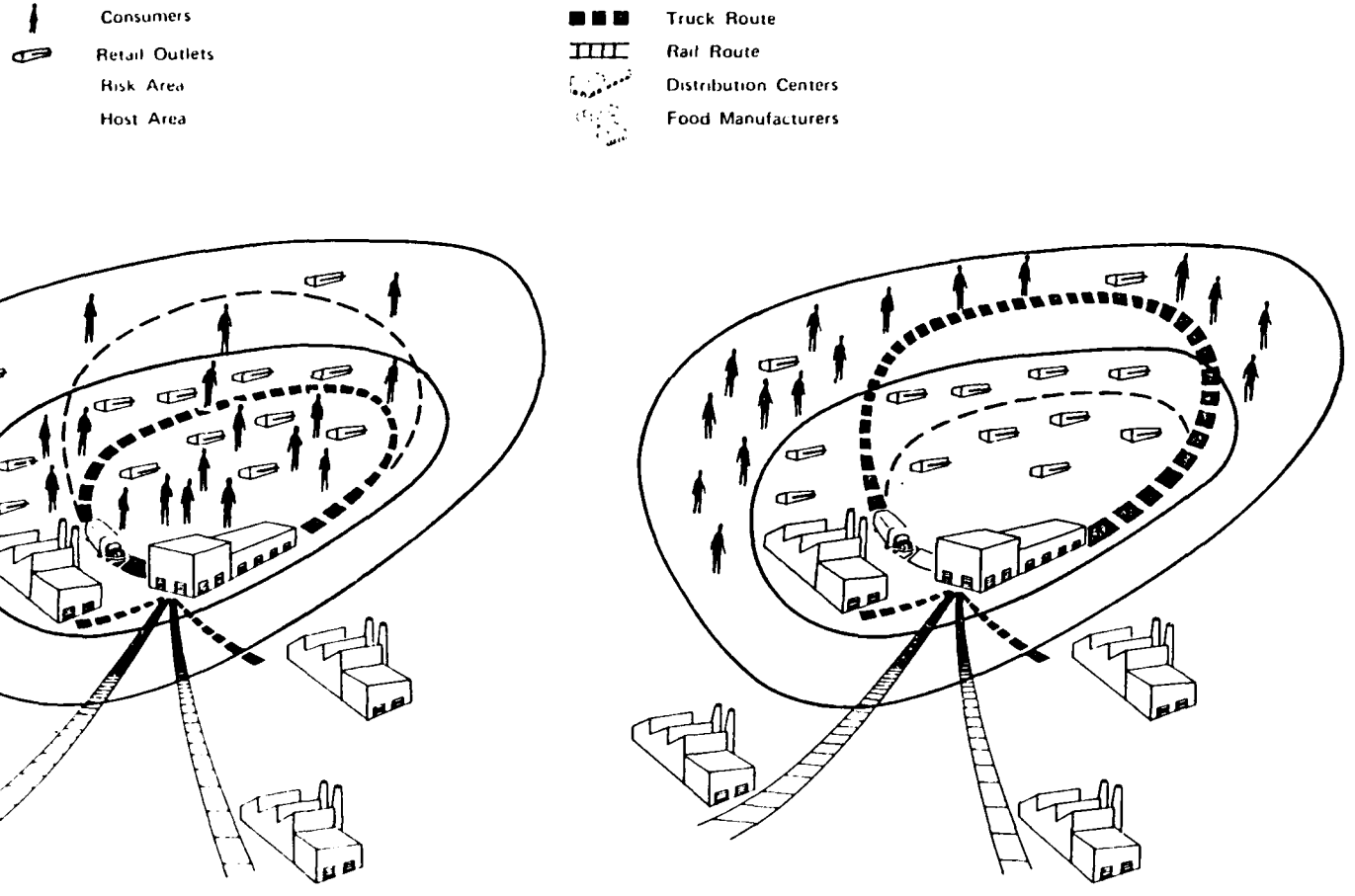
4.3 MAINTENANCE OF RISK-AREA WHOLESALE OPERATIONS

One of the simplest distribution system adjustments capable of supporting mass population movement is using wholesale distribution centers in high-risk areas, and increasing the level of supplies shipped to retail stores in outlying host areas. Exhibit 4.3 illustrates this type of distribution adjustment when normal wholesale channels are centered in the risk area itself.

EXHIBIT 4.3

PROPOSED DISTRIBUTION SYSTEM ADJUSTMENT

ENTAILING MAINTENANCE OF RISK AREA WHOLESALE OPERATIONS



(a) NORMAL DISTRIBUTION SYSTEM

(b) DISTRIBUTION SYSTEM FOR ALTERNATE HOSTING CONCEPT

(Source: Billheimer and Thomas, Reference 6)

The system adjustment shown in Exhibit 4.3 has several advantages; this alternative is conceptually simple and builds on existing operating entities. Corporate food chains are maintained as distribution units and most host-area retail stores will be supplied by their preevacuation sources. Strain on the national distribution system is minimized and supplies on the road from national processors to regional and local wholesalers need not be rerouted at the time of evacuation.

The disadvantages of continuing to distribute from existing major chain, risk-area warehouses are: (1) the necessity to supply increased quantities of food to host-area stores results in considerable stress on the local transportation system; (2) this alternative also places a heavy load on retail stores in the outlying host areas; (3) valuable food inventories remain in the high-risk areas; and (4) continued operation of risk-area warehouses subjects critical warehouse workers to additional risks should an attack occur.

The ability of local transportation and distribution systems to accommodate the stress imposed by continued operation of risk-area warehouses has been analyzed in detail in past case studies of crisis relocation undertaken in Detroit, Michigan (Reference 6), Richmond, Virginia (Reference 12), and Colorado Springs, Colorado (Reference 2). In these studies, mathematical models were developed to quantify the amount of stress placed on the local distribution system by an evacuation process of specified distance and magnitude. Critical points of stress were identified and quantified for both the host-area retail stores and local distribution systems supplying these stores under a strategy of crisis evacuation. To supplement the quantititative analysis, food industry personnel were interviewed regarding the ability of local retailers and wholesalers to withstand transportation and distribution system stress. Because of the importance of regional and local transportation and distribution systems to the success of the crisis relocation strategy, additional model development and extensive food industry interviews have been undertaken in the current study.

The quantitative and qualitative insights gleaned from modeling and interviews have been distilled to provide a foundation for developing food distribution guidelines for evacuation planning purposes. These insights and guidelines are discussed in more detail elsewhere in this report, specifically in the transportation analysis of Chapter 6, and the guidelines of Volume II. For the purposes of the present discussion, it should be noted that California's food industry personnel overwhelmingly favor a food distribution strategy that enables them to continue to operate warehouses located in risk areas. It appears that host-area retail outlets are capable of withstanding the stresses imposed by such a strategy. The ability of the local transportation system to withstand the stress imposed by increased vehicle mileage emerges as the most critical element in determining the success of a strategy entailing the continued operation of risk-area warehouses. Food industry leaders estimate that a doubling of vehicle mileage may be tolerated for short periods (one to two weeks) without requiring additional equipment. More detailed discussions regarding the level of transportation stress imposed by a strategy of risk-area warehouse

operations may be found in Chapter 6, along with an analysis of different measures for alleviating this stress.

4.4 ESTABLISHING EMERGENCY WAREHOUSING IN HOST AREAS

Under this alternative, risk-area warehouses would be emptied as quickly as possible into converted, comandeered or hastily-constructed warehouses in the host area. This procedure would have the advantage of decreasing the vulnerability of the food supplies and the key workers. The disadvantages include operating inefficiencies, system disruption, and the occurrence of major delays in reestablishing normal food distribution operations in the event attack does not occur. One problem with establishing emergency host-area warehouses is the difficulty of locating suitable structures. Modern centers for food distribution may devote more than 500,000 square feet to the storage of dry groceries alone. Very few structures of this size, if any, are likely to be in the host area. Furthermore, previous research into the construction of warehouse space under postattack conditions (References 2, 3 and 5) has determined that the emergency construction of suitable warehouse space would require several weeks.

Another important disadvantage of host-area warehouse space lies in the length of time required to empty existing risk-area warehouses. Food industry personnel estimate they would require a minimum of four days to a maximum of two weeks to empty existing warehouses using their own personnel and equipment.

4.5 SUPPLEMENTING RISK-AREA WAREHOUSES WITH SECONDARY HOST-AREA WAREHOUSES

Under this alternative, retail food chains and major wholesalers would establish temporary secondary host-area distribution centers as an adjunct to Alternative 3. Risk-area warehouses would continue to operate and carry the main load of distributing supplies to the host areas, while temporary warehouses in the host areas would also distribute goods to the host-area stores, institutions and mass feeding centers. Discussions with retail chain representatives indicate that certain types of goods (particularly canned goods and the nonperishables) may be efficiently distributed from emergency warehouses constructed or commandeered in the host areas.

This alternative has the advantages of: (1) maintaining the existing structure; (2) moving some goods and personnel out of the risk area; (3) possibly reducing transportation stress; and (4) providing a base for postattack operations. The disadvantages include difficulties such as: (1) establishing and maintaining reliable communications with a temporary host-area warehouse; (2) reestablishing normal flow patterns after the crisis abates; and (3) locating suitable warehouse space. These advantages and disadvantages are discussed in more detail in the following subsections.

4.5.1 Maintaining the Existing Structure

Earlier studies have shown that continued distribution of goods to the host areas from risk-area warehouses is conceptually simple and extends existing operations. Corporate food-chains are preserved as distribution units, and most host-area retail stores would be supplied by their preevacuation sources. Strain on the national distribution system is minimized and supplies on the road from national processors to regional and local wholesalers need not be rerouted at the time of evacuation. The importance of building on the existing structure was also emphasized by most retail food distribution executives interviewed. Distribution from secondary host-area warehouses would serve to supplement distribution from existing risk-area warehouses, supplying perhaps 20% to 30% of total requirements under crisis relocation conditions. Each chain or wholesale distributor would operate its own temporary host-area warehouse or warehouses. Supplies shipped to the supplementary host-area warehouse (or distribution center) could come from three possible sources:

1. Local California Risk-Area Processors. Substantial quantities of canned goods and other processed foods are held in processors' warehouses located in major risk areas, either for subsequent distribution in California or to other states. Shipments of food held in processors' risk-area warehouses would reduce the vulnerability of these supplies.

2. Local Host-Area Producers or Processors. As shown in Section 3.0, substantial quantities of processed foodstuffs, including canned goods, are processed in host-area counties. Appendix B shows that substantial portions of California's food processing takes place in the San Joaquin, Sacramento, Salinas and Imperial Valleys. The counties of San Joaquin, Sacramento, Stanislaus, Monterey, Fresno, Riverside and Imperial account for 21% of California's food processing. Overall about 85% of California's agricultural production takes place in the host areas. Under crisis relocation conditions, there is no need for local producers and processors to ship all goods to the risk-area warehouses only to have some returned to the local host area through regular channels. Such food products could be delivered directly to the chain or wholesaler's temporary host-area warehouse for subsequent host-area distribution.

3. Chain or Wholesaler Risk-Area Warehouses. Previous investigations (Reference 2) have shown that the strategy of draining the warehouses rapidly to supply emergency host-area warehouses should be followed only in the case of the smallest risk-area wholesalers. Chains with risk-area warehouses will be engaged in supplying their own host-area stores and mass feeding centers.

4. Diversion of In-Transit Shipments. A portion of in-transit shipments destined for risk-area warehouses can be diverted to host-area warehouses.

4.5.2 Moving Some Goods and Personnel Out of the Risk Area

If 20% to 30% of the goods are handled by the chain's or wholesaler's temporary host-area warehouses, the supply level of goods in the risk-area warehouses would be reduced by that amount. The number of critical risk-area workers would be reduced proportionately.

4.5.3 Possibly Reducing Transportation Stress

The need to supply increased quantities of food to host-area stores would result in considerable stress on the local transportation system. If a portion of the host-area requirements were met from the temporary host-area warehouses, overall transportation system stress would be reduced, assuming supplies delivered to host-area warehouses were from producers or processors. If a portion of the secondary warehouse stock were shipped from the risk-area warehouse, however, the double-handling involved would increase transportation stress. Transportation stress is discussed in more detail in Chapter 6.

4.5.4 Providing a Base for Postattack Operations

A temporary host-area warehouse established by a chain or wholesaler would provide a basic warehouse and personnel nucleus for expansion should an extended crisis situation or actual attack occur.

4.5.5 Establishing Communications with a Temporary Host-Area Warehouse

Establishing host-area warehouses increases the number of distribution points and could add to the problem of maintaining centralized control. Existing studies (References 2, 5, 6 and 12) emphasize the importance of maintaining centralized control in the food distribution system. Without it, there is the danger of diverting food that should be bound for other national markets. Reliable communications are critical for centralized control, and communications with a temporary host-area warehouse could be a potential problem under crisis relocation conditions. From a technical standpoint, however, communications should present no difficulty. In fact, several major food distributors currently maintain completely centralized control of warehouses separated from the control facility. One San Francisco distributor, for example, has its main warehouse and centralized computer-controller-ordering system in Fremont, while its perishable goods distribution warehouse is located in Oakland. At present, orders received from stores go directly into the Fremont computer in Fremont where they are processed. Orders for perishable food (including warehouse location and labels for cases) are printed out at the Oakland warehouse. The company is currently studying the possibility of building a new warehouse in a host area that commands approximately 25%

of their business. If such a warehouse were built, order processing would still be done in Fremont and printed out at the new warehouse. A similar procedure could be followed if distribution were made from a temporary host-area warehouse. Company representatives also indicate that the layout of goods in a temporary host-area warehouse could be made according to the same format used in Fremont, and that the computerized-ordering system would not have to be changed. This would allow relocation of a substantial portion of warehouse personnel, but those operating the central computer system would continue to work in the risk area.

4.5.6 Reestablishing Normal Flow Patterns

If an attack is avoided and relocatees return to their homes, temporary host-area warehouses would have to be closed and the remaining goods distributed to host-area stores. Commandeered space could be returned to original use and temporary structures could be either used for other purposes or dismantled. Various types of temporary warehousing are discussed in Section 4.5.8.

4.5.7 Locating Suitable Warehouse Space

Food distribution centers or warehouses are designed to handle large volumes of groceries. This means specific requirements for refrigeration, floor design, ceiling height, number of truck-loading doors, rail and highway access, temperature control, lighting, and suitable handling equipment. The availability of sufficient warehouse space is of primary importance in any evaluation of the secondary host-area warehouse alternative. The three main potential sources of host-area warehouse space are commandeered existing space, emergency construction, and use of railcars at distribution points. The respective advantages and disadvantages of these options are discussed below.

1. Commandeer Existing Space. Commandeered space is a promising source of host-area warehousing capacity in California. Partly due to California's widespread agricultural production, as well as its seasonal storage and processing, more host-area warehouse space is available than in some other states. Exhibits 4.4 and 4.5 list actual and potential warehousing space in existing structures in selected cities of Southern, Central, and Northern California, while Exhibit 4.6 maps the location of possible secondary distribution centers. This space generally meets the construction requirements listed above; however, one requirement is deficient. Almost all of these buildings were designed for storage rather than for high-volume throughput, so that the number of loading docks is limited. The existing structure might have 5 or 6 doors, whereas a building of comparable size designed specifically

EXHIBIT 4.4 MAJOR DISTRIBUTION WAREHOUSE LOCATIONS FOR SOUTHERN CALIFORNIA

PRESENT LOCATIONS	WAREHOUSE AREA
Los Angeles: Market Basket	370,000
Certified Grocers	960,000
La Habra: Alpha Beta	700,000
Buena Park: Lucky Stores	1,400,000
Compton: Ralph's	800,000
San Fernando: Certified Grocers	400,000
San Diego: Safeway	319,000
Fresno: United Grocers	344,000
Market Wholesale	169,000
Santa Fe Springs: Safeway	1,006,000
Vons	750,000
Others	1,950,000
Restaurants And Institutions	3,701,000
TOTAL SQUARE FEET OF SPACE:	10,869,000

POSSIBLE LOCATION FOR SUPPLEMENTARY HOST AREA WAREHOUSES	WAREHOUSE AREA
Coachella	250,000
Visalia	300,000
Selma	100,000
Cutler	100,000
Tulare	300,000
Indio	300,000
San Luis Obispo	400,000
Brawley	110,000
Fresno*	
Bakersfield*	
	1,860,000

*Locations of Food Processors With Substantial Warehousing Space On Fringes Of Risk Area.

EXHIBIT 4.5 MAJOR DISTRIBUTION WAREHOUSE LOCATIONS FOR NORTHERN AND CENTRAL CALIFORNIA

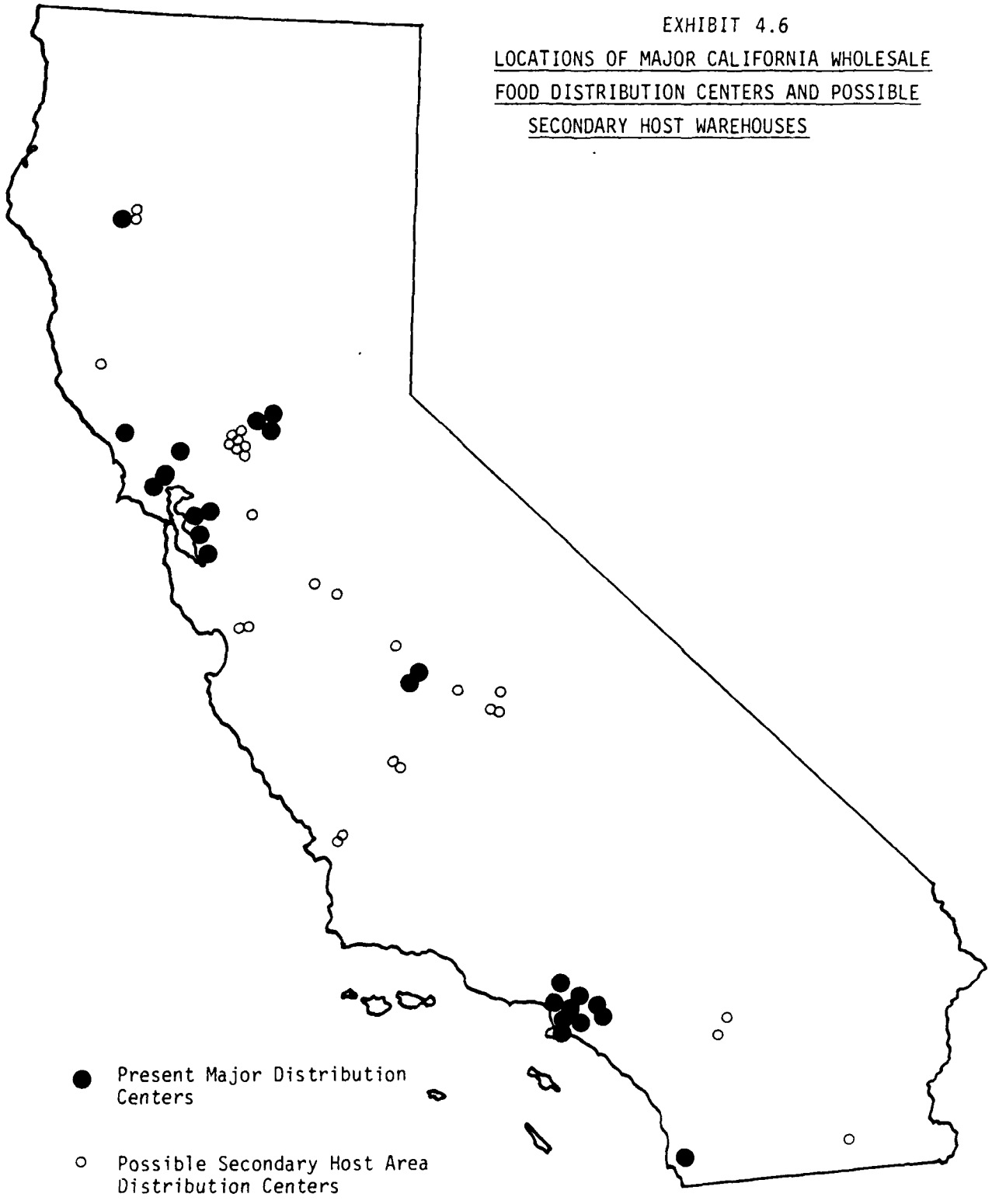
PRESENT LOCATIONS		WAREHOUSE AREA
Sacramento:	United Grocers	300,000
	Market Wholesale	121,000
	Safeway	369,000
Richmond:	United Grocers	435,000
	Safeway	1,106,000
Redding +:	Market Wholesale	127,000
Vacaville:	Lucky Stores	1,300,000
Milpitas:	Alpha Beta	300,000
Fremont:	Fleming Foods	495,000
Santa Rosa:	Market Wholesale	125,000
Others		1,585,000
Restaurants And Institutions		3,701,000
TOTAL SQUARE FEET OF SPACE		9,964,000

POSSIBLE LOCATION FOR SUPPLEMENTARY HOST AREA WAREHOUSES	WAREHOUSE AREA
Vacaville	1,300,000
Merced	125,000
Gilroy	500,000
Livingston	200,000
Oakdale	60,000
Tracy	165,000
Madera	200,000
Ukiah	60,000
Modesto*	
Oakdale*	
Stockton*	
Merced*	
Sacramento*	
+Host Area	2,610,000

*Locations of Food Processors With Substantial Warehousing Space On Fringes Of Risk Area.

EXHIBIT 4.6

LOCATIONS OF MAJOR CALIFORNIA WHOLESALE FOOD DISTRIBUTION CENTERS AND POSSIBLE SECONDARY HOST WAREHOUSES



for food distribution might have 10 or more doors. The number of doors or loading docks is a critical factor in determining throughput capacity. Using pallet loading only, trucks can be loaded in thirty minutes. Thus, the constraint is not in handling within the warehouse but rather at the doors. The overall efficiency factor in terms of throughput per square foot of area for these warehouses will be between 25% and 50%, compared with a warehouse designed and built specifically for food distribution. Under favorable weather conditions, however, secondary warehouse capacity could be increased by use of temporary covering over a portion of the adjacent parking area, although the use of such an outside area could require additional security measures.

Another important factor in considering potential secondary warehouses is the availability of additional nearby warehouse space. This space would be used to handle a larger share of goods through the chain's secondary warehouse if necessary due to increased danger of attack, an extended crisis situation, or an actual attack.

The throughput factor of emergency commandeered warehouses is less than a warehouse designed specifically for food distribution. At a chainstore distribution center, a semi-trailer can be loaded with 40,000 pounds in about thirty minutes. This is equivalent to 648,000 pounds per door, per eight-hour shift, or 333,600 tons per door annually, assuming two shifts per day. At an efficiency of 0.3 for secondary host-area warehouses, this would equal 70,080 tons per door per year. Thus, the throughput capacity of a temporary warehouse with five doors per 100,000 square feet would be 175,200 tons annually; a warehouse with ten doors per 100,000 square feet would have a throughput capacity of 350,400 tons per year (five doors in and five doors out). Major distributors' present risk-area warehouse space is roughly twenty million square feet. Virtually all of this would be destroyed or badly damaged except for the Lucky Stores Vacaville warehouse, which would sustain relatively minor damage. If the Lucky Stores warehouse, which is located on the fringe of the risk area, is included in host-area space, and other host-area space is added, total effective space (using a 2.5 throughput factor for pallet loading, more shifts, and more work days) would be 5.4 million square feet (see Exhibit 4.7), or about half that presently used by the chains in their risk-area distribution warehouse operations.

Of course, loading times would be considerably longer (and efficiency lower) than shown above if part or all hand labor were used. With hand labor, four to six hours would be needed to load 40,000 pounds of food into a semi-trailer. For this reason, forklift trucks or pallet jacks would be essential if trucks were to be loaded quickly. It should be noted, however, that many forklift trucks and pallet jacks used by

existing chain distribution centers are battery-operated. Special facilities for recharging them would not be readily available in most host-area warehouses.

2. Construct Emergency Warehouses. The main advantage of emergency construction is that the warehouse can be placed at the appropriate location and can be constructed to meet the general requirements of an emergency food distribution center. The main disadvantages are the cost, and time required for shipping materials and for actual construction.

   Two types of structures are probably most suitable for temporary distribution centers: air-supported and tilt-up buildings. Air-supported structures have been developed only in recent years and are in relatively limited use today, serving as warehouses, greenhouses, and construction site enclosures. The main advantages of this type of structure are its relatively low cost (about $3 per square foot) and its fast construction time (2 to 4 days). At present, almost all of the large (200 x 500 feet or more) air-supported structures are made to order, and the still small industry cannot produce a large number of such inflatable structures on short notice. If in stock, shipment from the manufacturer would take about one week. Most sizes can be transported on a semi-trailer with blowers and the other equipment on a second truck. Precrisis stockpiling of inflatable structures at host-area sites would be expensive and the material would be subject to deterioration.

   Tilt-up emergency structures could also be used for secondary warehousing and distribution in the host area. These would be one-story Butler-type buildings erected on slab floors. If the design and material requisitions were prepared in advance, these buildings might be constructed in a period of four to eight weeks, provided necessary materials were available. Total cost per square foot would probably be about $9 to $12, depending on the type of structure and equipment required. Thus, a 400,000 square foot building would cost approximately $3.6 to $4.8 million and would require a total construction labor force of 150 to 250 people. Precrisis costs would be limited to the preparation of designs and lists of materials.

   Stocking any emergency warehouse would require the average ten-day lead time currently experienced by warehouse operators.

   In addition to the cost and time required for construction, there is the problem of choosing sites. To ensure minimum attack damage, it would be preferable to build several moderate-sized warehouses that are widely dispersed rather than one or two very large ones.

EXHIBIT 4.7

PARTIAL LISTING OF POTENTIAL SECONDARY

DISTRIBUTION WAREHOUSE SPACE IN THE HOST AREA

Organization	City	County	Square Feet	Normal Thruput Factor	Emergency Thruput Factor with Pallets	Effective Warehouse Space (Square Feet)	Over Pressure
Market Wholesale	Redding	Shasta	100,000	1.0	2.50	250,000	<1
Lucky Stores	Vacaville	Solano	1,300,000	1.0	2.50	3,250,000	1-2
Warehouse	Turlock	Stanislaus	100,000	0.3	0.75	75,000	<1
Food Processor	Gilroy	Santa Clara	500,000	0.3	0.75	375,000	<1
Hunt Wesson and Neighboring Warehouses	Oakdale	San Joaquin	60,000	0.3	0.75	45,000	1-2
Foster Farms and Neighboring Warehouses	Livingston*	Merced	200,000	0.3	0.75	150,000	<1
Maracay Mills	Merced**	Merced	125,000	0.3	0.75	94,000	<1
Armco, Advance, Oberti	Madera	Madera	190,000	0.3	0.75	142,000	<1
American Home Foods and Neighboring Warehouses	Vacaville*	Solano					1-2
Warehouses	Visalia	Tulare	300,000	0.3	0.75	225,000	<1
Warehouses	Selma	Fresno	100,000	0.3	0.75	75,000	<1
Warehouses	Tulare	Tulare	300,000	0.3	0.75	225,000	<1
Warehouses	San Luis Obispo	San Luis Obispo	400,000	0.3	0.75	300,000	<1
Warehouses	Coachella	Imperial	250,000	0.3	0.75	187,000	<1
			3,925,000			5,393,000	

* Locations of food processors with substantial warehousing space on fringes of risk areas.

** Locations of other manufacturers with substantial warehousing or convertible manufacturing space on the fringes of risk areas.

3. Use Railcars as Distribution Points. Discussions with California railroad officials indicate that it will be possible to ship foodstuffs from risk-area processor or wholesaler warehouses to the host areas by rail, and then to use the railcars as emergency distribution points. This option would be used in conjunction with maintaining risk-area warehouses (Alternate 3 above). Adequate track siding space is available to support this option. However, unloading directly from railcars will involve distribution inefficiencies and centralized control may be more difficult.

As the use of trucks for short-haul of fresh and processed foods and other goods has increased, non-mainline railroad track (secondary lines, spurs and sidings) has been used less frequently. This is particularly true in the agricultural areas of California. Such track could be used for intermodal transfer and for siting of individual boxcars or train sections brought from the risk areas. Agricultural products could be unloaded from railcars at these locations without disrupting mainline operations. Some of the locations where operations could be carried out are shown in Exhibit 4.8. Exhibit 4.9 shows all siding on the Southern Pacific lines in California; at least 15% of these sidings would be suitable for such intermodal transfer or siting of boxcars or train sections.

Although some oversized cars are used to carry paper products and lighter goods, railcars used to transport dry groceries (such as canned goods) are typically 60 feet long and have a capacity of 1500-2000 cases; cases are usually on pallets or slipsheets. If this type of car were sited at a railroad terminal platform or warehouse loading dock where forklift or pallet trucks were available, they could be unloaded in two or three hours. If such facilities and equipment were unavailable, railroad representatives estimate that unloading by hand would require ten men and take about six to eight hours per railcar. Where there are no terminal platforms, goods could be loaded into pickups or other single-unit trucks, which are available in the host area. The supplies could then be delivered to host area warehouses, stores or mass feeding centers.

Using railcars as temporary distribution points would effectively reduce the transportation stress for the truck transport system. Each railcar could carry about 1-1/2 times as much dry groceries as a typical semi-trailer, which normally carries 40,000 pounds. The effect of this potential substitution of railcars for trucks is discussed further in Chapter 6.

As an adjunct to maintaining risk-area wholesale operations, the railcar distribution procedure could increase outflow of canned goods from the large supplies held in processor

EXHIBIT 4.8

SELECTED POSSIBLE RAILCAR SITING LOCATIONS

Railroad	City	County	Miles of Track	Car Capacity
Western Pacific Southern Pacific	Oroville	Butte	2	100
Southern Pacific	Gerber-Roseville	Tehama-Placer	7	350
Southern Pacific	Orland-Arbuckle	Glenn-Colusa	5	250
Santa Fe Southern Pacific	Oakdale	Stanislaus	2	100
Southern Pacific	Turlock	Stanislaus	1	50
Santa Fe Southern Pacific	Tulare	Tulare	2	100

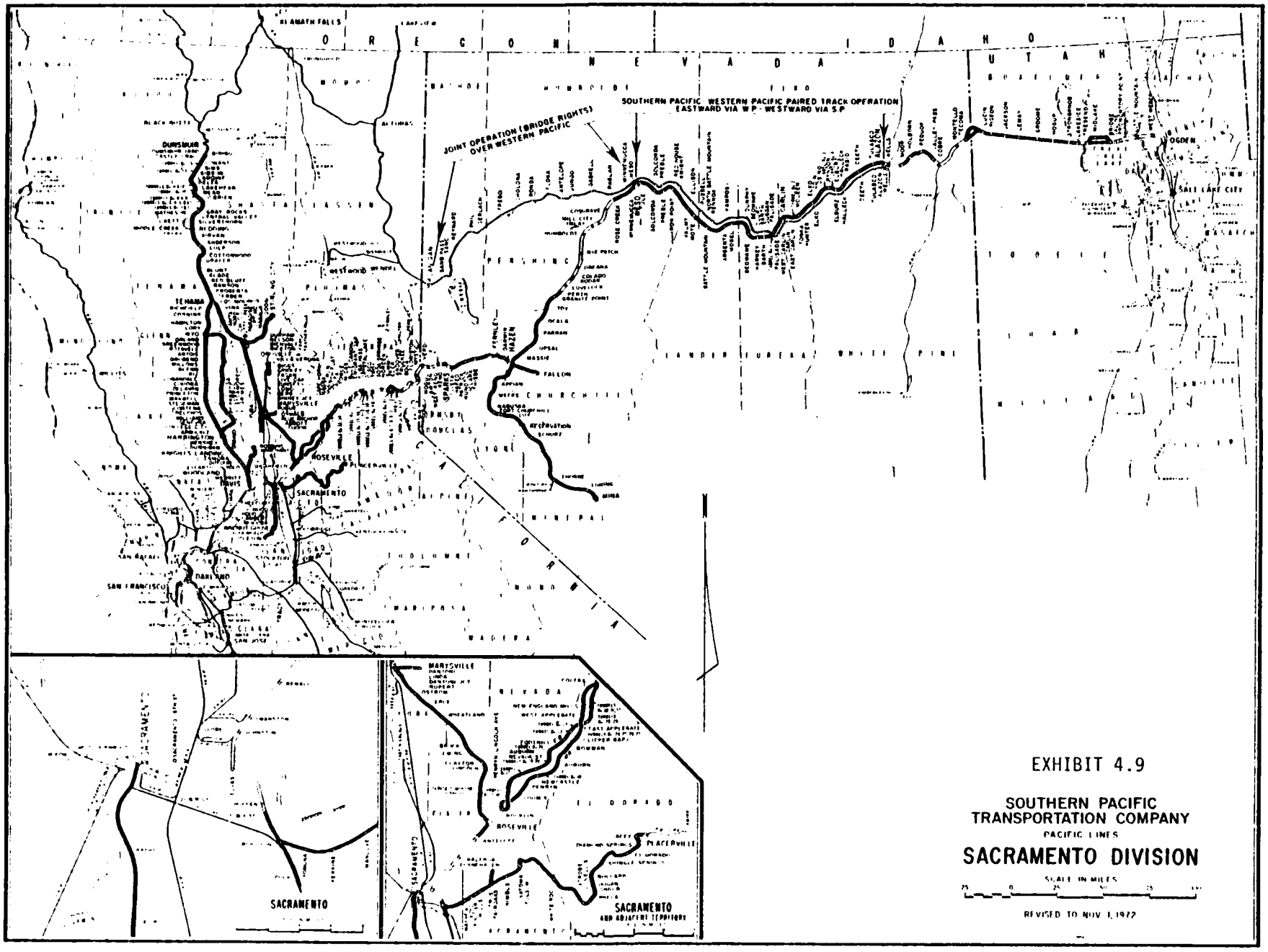


EXHIBIT 4.9

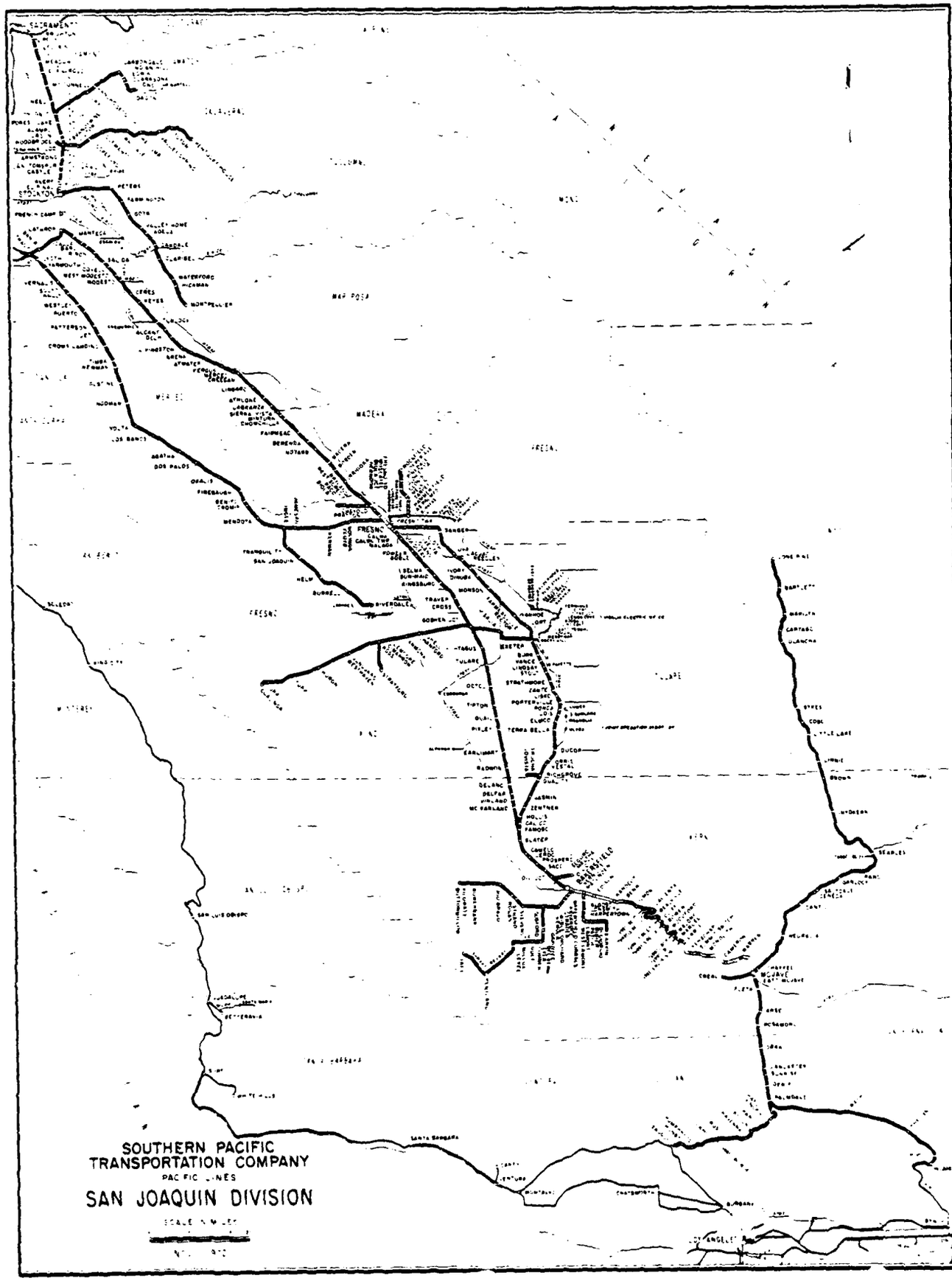
SOUTHERN PACIFIC TRANSPORTATION COMPANY

PACIFIC LINES

SACRAMENTO DIVISION

SCALE IN MILES

REVISED TO NOV. 1, 1972



(EXHIBIT 4.9, cont'd.)

warehouses in San Francisco and Los Angeles risk areas. The process could begin during relocation if it did not interfere with the evacuation of the risk areas. Canned goods from processor warehouses in the San Francisco Bay Area, for example, are shipped to eastern points outside California almost daily (and almost totally by rail). These shipments could be increased when crisis relocation is implemented. Movement of essential cargo under crisis relocation conditions accounts for 41% of inter-city rail traffic; therefore, some railcars normally used to carry less critical goods could be used for food transport.

Trains loaded with canned food products destined for eastern points pass through major host-area counties. Southern Pacific, carrying canned goods east from the Santa Clara Valley, for example, travels through Sacramento and across the Sierras via Emigrant Gap, and then through to Ogden, Utah. Alternatively, trains destined for southern and southwestern points go through Tracy, Turlock and Tulare in the San Joaquin Valley and then east via Mojave on Union Pacific and Santa Fe or via Colton on Southern Pacific. A predetermined number of loaded cars could be left at selected Central Valley host-area points before the final make-up of the train heading east.

The use of trains to move certain dry grocery foodstuffs in California has the following advantages: (1) decreasing the transportation stress on the intercity truck fleet; (2) reducing foodstocks stored in high-risk areas; (3) decreasing the requirement for host-area warehouse space; and (4) leaving intact the basically sound concept of distributing from major chain risk-area warehouses. The disadvantages include: (1) possibly more difficulty in maintaining centralized control; (2) rail door-to-door time in transit (usually greater than by motor truck); and (3) host-area unloading from railcars directly to trucks requiring a relatively high ratio of labor input and being relatively slow.

4.5.8 Comparison of Warehousing Options

The warehouse options and evaluation criteria discussed above are summarized in Exhibit 4.10. As is the case for other elements of the emergency food distribution system, selecting local storage options entails trade-offs between precrisis preparation and the likelihood of effective performance during the crisis relocation period.

Although generalizations are difficult in light of the wide range of available facilities in California host areas, converted or commandeered space appear to be the most attractive of the secondary distribution warehouse options in the crisis relocation period. The option requires negligible precrisis investment and, as shown in Exhibit 4.6, a sufficient number of suitable host-area buildings exists to

handle anticipated requirements. Converted host-area space would be used in conjunction with railcars, which provide a means of both transporting and storing vulnerable inventories of canned goods.

4.6 SUMMARY

The main advantages and disadvantages of the five alternatives for assessing and staging food supplies for California crisis relocation have been summarized in Exhibit 4.1.

An analysis of the various alternatives indicates that maintaining risk-area warehouses (Alternative 3) appears to be the single most suitable alternative for California. This alternative has a negligible cost, builds on the existing food distribution system, and results in the least stress on the transportation system and mass feeding centers. (Transportation stress in discussed further in Chapter 6.) Secondary host-area warehouses should also be used to supplement the alternative of maintaining risk-area warehouses. One of the main advantages of secondary host-area warehouses is that they provide flexibility for the distributors.

By-passing the wholesaler with direct shipments to retailers could be used in conjunction with Alternative 3, and has some applicability in California, where a substantial volume of the fresh and processed food originates in the host areas. While direct shipments are not used extensively by major chain stores, about 30% of supplies to independents and smaller chains are delivered by the manufacturer or special wholesalers. A critical limitation on direct shipments to stores, however, is the transport capacity of the processor.

EXHIBIT 4.10

POTENTIAL SOURCES OF HOST AREA WAREHOUSE SPACE

ALTERNATIVE	ADVANTAGES	DISADVANTAGES
1. COMMANDEER EXISTING SPACE: - WAREHOUSES - PROCESSORS	- RELATIVELY MORE SPACE AVAILABLE IN CALIFORNIA, PARTICULARLY WHEN CANNING INVENTORIES HAVE BEEN REDUCED.	- POSSIBLE LACK OF SUITABLE HOST AREA SPACE.
2. CONSTRUCT EMERGENCY WAREHOUSES	- RELATIVELY LOW COST OF QUICK CONSTRUCTION FOR AIR-SUPPORTED BUILDINGS. - BUTLER-TYPE TILT-UP BUILDINGS CAN BE BUILT WITH SUFFICIENT LOADING DOCKS.	- MATERIAL SHIPMENT FOR AIR SUPPORTED BUILDINGS IS TIME CONSUMING. - TILT-UP BUILDINGS REQUIRE A MINIMUM OF FOUR WEEKS TO CONSTRUCT.
3. USE RAILCARS AS DISTRIBUTION POINTS	- TRACK SPACE AVAILABLE.	- OPERATING INEFFICIENCIES. - CENTRALIZED CONTROL PROBLEMS.

5. DELIVERY ALTERNATIVES

This chapter discusses preparing and serving food to the indigenous and evacuee populations once it has been made available to the host area. This section cannot, however, be viewed independently of the staging alternatives. Coordination of staging and delivery is necessary to identify the distribution channels through which the food preparers receive their supplies. An overview of the entire system is shown in Exhibit 5.1.

5.1 STAGING - DELIVERY COORDINATION

Exhibit 5.1 suggests two channels through which food may be supplied to the food preparers: (1) directly from the wholesale level of distribution; and (2) indirectly through the retail level of distribution. Initially, the former seems more efficient since it obviates the unloading and handling of food at the retail level. Under certain circumstances, however, the link through the retail level may prove more efficient despite the additional handling.

Less planning and coordination will be needed if ordinary channels of distribution are followed to the maximum extent possible. This would require that institutional wholesalers continue to supply their normal customers (restaurants, hospitals, schools, convalescent homes), and that grocery wholesalers continue to supply their normal customers (grocery stores). In attempting to decide the extent to which these normal lines of distribution should be altered in the event of a crisis relocation, it is relevant to note that grocery wholesalers ordinarily handle a much larger volume of food shipments than institutional wholesalers.

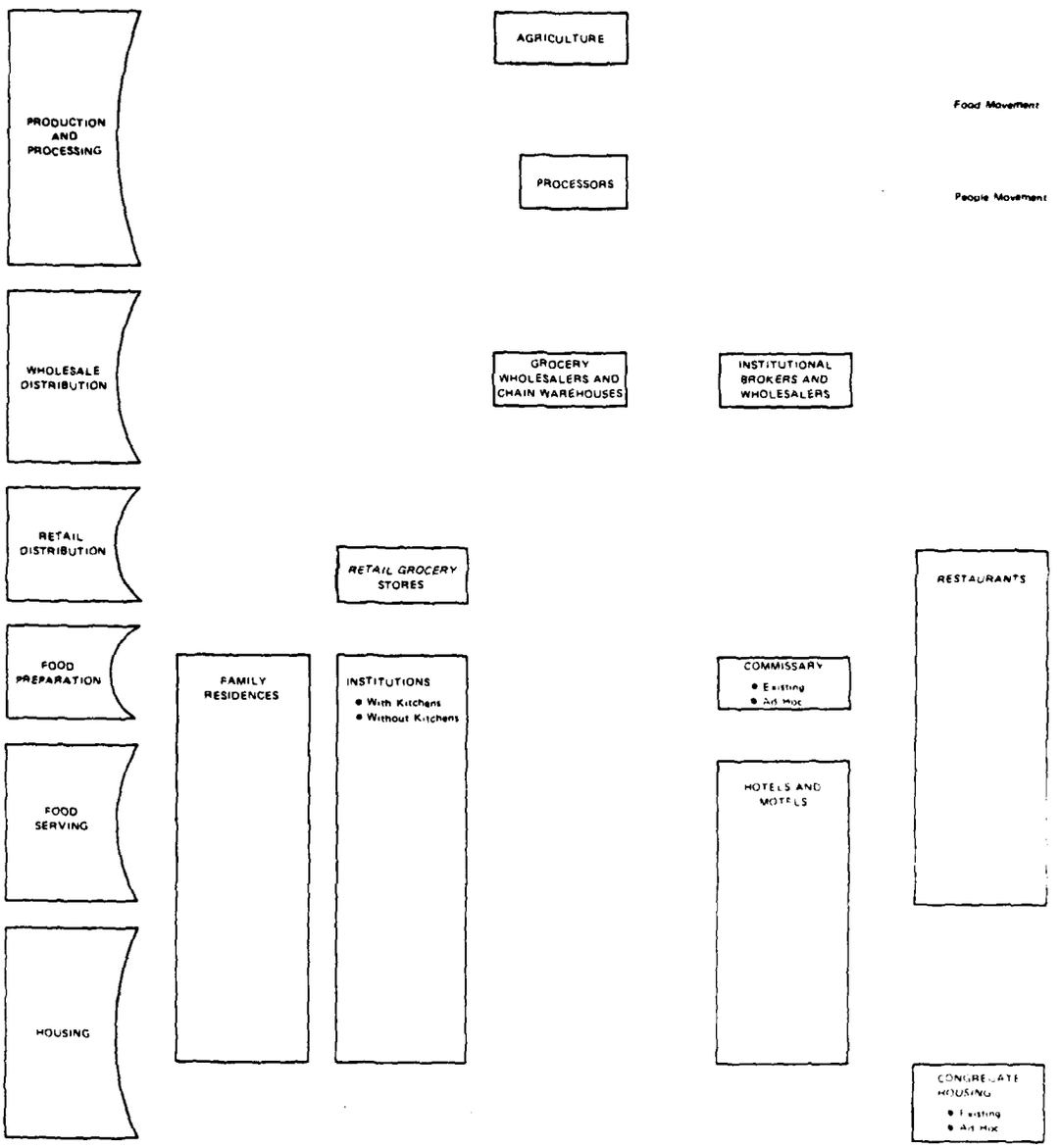
Since the relative proportion of foods prepared in the home will undoubtedly decrease under conditions of crisis relocation, any modifications in present distribution patterns should be made by the grocery wholesalers. For instance, if normal customers (grocery stores) were bypassed, wholesalers could ship the food directly to the food preparers.

Major institutional wholesalers should continue to operate their normal distribution channels under crisis relocation conditions. Family residences should continue to receive their supplies through grocery stores. In addition, small restaurants and small congregate-feeding facilities should also receive their supplies through a grocery store. These facilities would not have enough storage space to handle a full wholesale truck, nor would it be efficient to have a

EXHIBIT 5.1

TYPICAL FOOD DISTRIBUTION PATTERNS UNDER

CRISIS RELOCATION CONDITIONS



(Source: Reference 2)

large truck make many stops for small deliveries. Depending on the fraction of the evacuee population fed in family residences and small groups (i.e., small restaurants and small mass feeding operations), grocery stores may have excess supplies which will be distributed through large mass feeding outlets. These excess supplies might more efficiently be shipped directly to the food preparer rather than indirectly through a grocery store. Where storage space is available, direct shipments to mass feeding centers will relieve the stress on the host-area grocery stores and eliminate one step in the food distribution process.

In establishing shipping patterns under crisis relocation conditions, the demand for food in private residences, small restaurants, and large institutions should first be identified. Grocery wholesalers would then be directed to deliver a sufficient amount to grocery stores to satisfy the demand of residences and small restaurants, and then deliver any excess to large restaurants, commissaries, and other institutions. Institutional wholesalers would then deliver only to the latter category. If the amount of home feeding cannot be gauged in advance, chain stores without host-area retail outlets should be instructed to supply commissaries and mass feeding centers directly, while chains with host-area outlets supply them. Appropriate adjustments can be made in the delivery system once feeding patterns have been established.

5.2 EVALUATION OF ALTERNATIVE METHODS OF FOOD PREPARATION AND SERVING

Exhibit 5.1 suggests many methods of food preparation and serving. Of the many that are feasible, the following methods are selected as deserving serious consideration and evaluation:

1. Family Residences (preparation and serving);
2. Institutions with Kitchens (preparation and serving);
3. Restaurants (preparation and serving);
4. Existing Commissaries (preparation and delivery to kitchenless institutions); and
5. Ad Hoc Commissaries (preparation and delivery to kitchenless institutions).

An overview of the major advantages and disadvantages of these methods is given in Exhibit 5.2. The first four methods require a minimum addition to or modification of existing facilities. The fifth requires a major addition, and consequently, would not be used unless the facilities for the first four methods are inadequate.

The first four methods have differences in the supporting transportation facilities needed. In the "Family Residences" approach,

the food is prepared and served in the same establishment in which the people reside. However, in the next three methods, it may be necessary to either transport the people to the food preparation/service facility or to transport the food from the preparation facility to the location of the people. The "Institutional Kitchens" and "Restaurants" alternatives require that the people be transported to the food. (In many institutions, such as hospitals, convalescent homes, hotels, military facilities, or penitentiaries, the people may live and eat in the same facility and consequently no transportation would be necessary.) This may be of minor consequence if their residences are close to the serving facility. If not, a major transportation effort may be required two times a day. Under the "Commissaries" alternatives, the food is transported to the people. This may be more efficient if the residences and the food preparation locations are widely separated. Hence, the distance between residences and food preparation areas may be the major factor in choosing between "Institutions" and "Restaurants" on one hand and "Commissaries" on the other.

Other differences exist among the first four methods. The "Family Residences" provide the most home-like setting, the maximum flexibility of menu selection and portion assignment, and the localization of disorders. In addition, the residents themselves transport the food from the point of wholesale dropoff, the grocery store, to the point of preparation--no centralized method of transportation is needed. For these reasons, "Family Residences" should be used to the maximum extent possible for food preparation and serving. One factor which may limit its use would be the willingness of the host-area residents to accept evacuees.

"Institutions with Kitchens", especially those which do not provide residential facilities, and "Restaurants" have many similar characteristics. The institution, however, will usually have more versatile kitchens for preparing a wider variety of meals, and on a larger scale. In addition, institutions usually have a cafeteria mode of service which is more efficient than the sit-down mode of restaurants. Consequently, due to their efficiency of preparation and service, institutions have larger throughput than restaurants. On the other hand, restaurants will usually provide a more pleasant atmosphere for the population. Whether institutions or restaurants are used in a particular situation will depend on the availability of each and their proximity to residential establishments.

Although the number of seats associated with a particular feeding facility can be a useful guide to feeding capacity, it is not essential that people always be seated while eating or that they be served indoors. Outdoor feeding has been used in various exercises and under actual emergency conditions when no indoor facilities were available. The American Red Cross has indicated that, although outdoor feeding is sometimes necessary, it is usually practical for a relatively short period of time since the sites may be largely unprotected. The Red Cross suggests that improvised outdoor feedings should be resorted to only if (1) conventional facilities are lacking or are not usable, or (2) the number of people to be fed exceed the capacity of existing or usable indoor facilities (Reference 18).

EXHIBIT 5.2: ALTERNATIVE DELIVERY METHODS

ALTERNATIVE METHOD	CHARACTERISTICS	PRINCIPAL ADVANTAGES	PRINCIPAL DISADVANTAGES
1. Family Residence (Preparation and Serving)	Food prepared and served by the host and evacuee population living in the residence.	No new facilities or additional labor needed. Once food is allocated to household, it can be allocated to individuals on basis of need. Flexibility over menu type. No transportation of people necessary. Home-like environment.	Allocating food to households (minor). Possible friction among residents (minor). Possibe disorder at grocery stores. Failure of kitchen equipment.
2. Institutions with Adequate Kitchens (Preparation and Serving)	Food prepared and served in a congregate feeding facility.	Food is transported only once. Use existing kitchen and food preparation facility (including labor). Use existing serving and dining facilities (probably cafeteria, which is efficient). Easy to allocate food by size of portions. Versatility of kitchen facilities. Speed of food preparation and distribution. No transportation of people necessary if they reside in same institution.	Hurried atmosphere.
3. Restaurants (Preparation and Serving)	Food prepared and served in an operating restaurant.	Food is transported only once. Use existing kitchen and food preparation facilities (including labor). Use existing serving and dining facilities. Easy to allocate food by size of portion. Can often be converted to efficient cafeteria service.	Lack of versatility of kitchen. Sit-down meal results in slower distribution and require additional serving resources. Transportation of people necessary.
4. Central Commissary - Existing (Preparation) to Institutions Without Kitchens or With Inadequate Kitchens (Serving)	Food pre-prepared in a kitchen previously used for take-out meals, and then delivered to other institutions	Efficient production of meals due to large-scale production. Efficient serving of food due to pre-allocated portions and pre-selected types of food.	Transportation hot food--warming facilities may be needed if insulated containers were not used.
5. Central Commissary - Ad Hoc (Preparation) to Institutions Without Kitchens of With Inadequate Kitchens (Serving)	Food prepared in a kitchen newly set up to provide take-out meals and then delivered to other institutions.	Efficient production of food due to large-scale production. Efficient serving of food due to pre-allocated portions and pre-selected types of food.	

The outdoor feeding mode is generally suitable for California where most areas of the state experience relatively mild weather most of the year. Precipitation is likely during certain periods of the year, but tents and other temporary shelters may be set up and used for preparing and serving food. Appendix D.1-2 of the Planning Guidelines provides further data on outdoor feeding under emergency conditions.

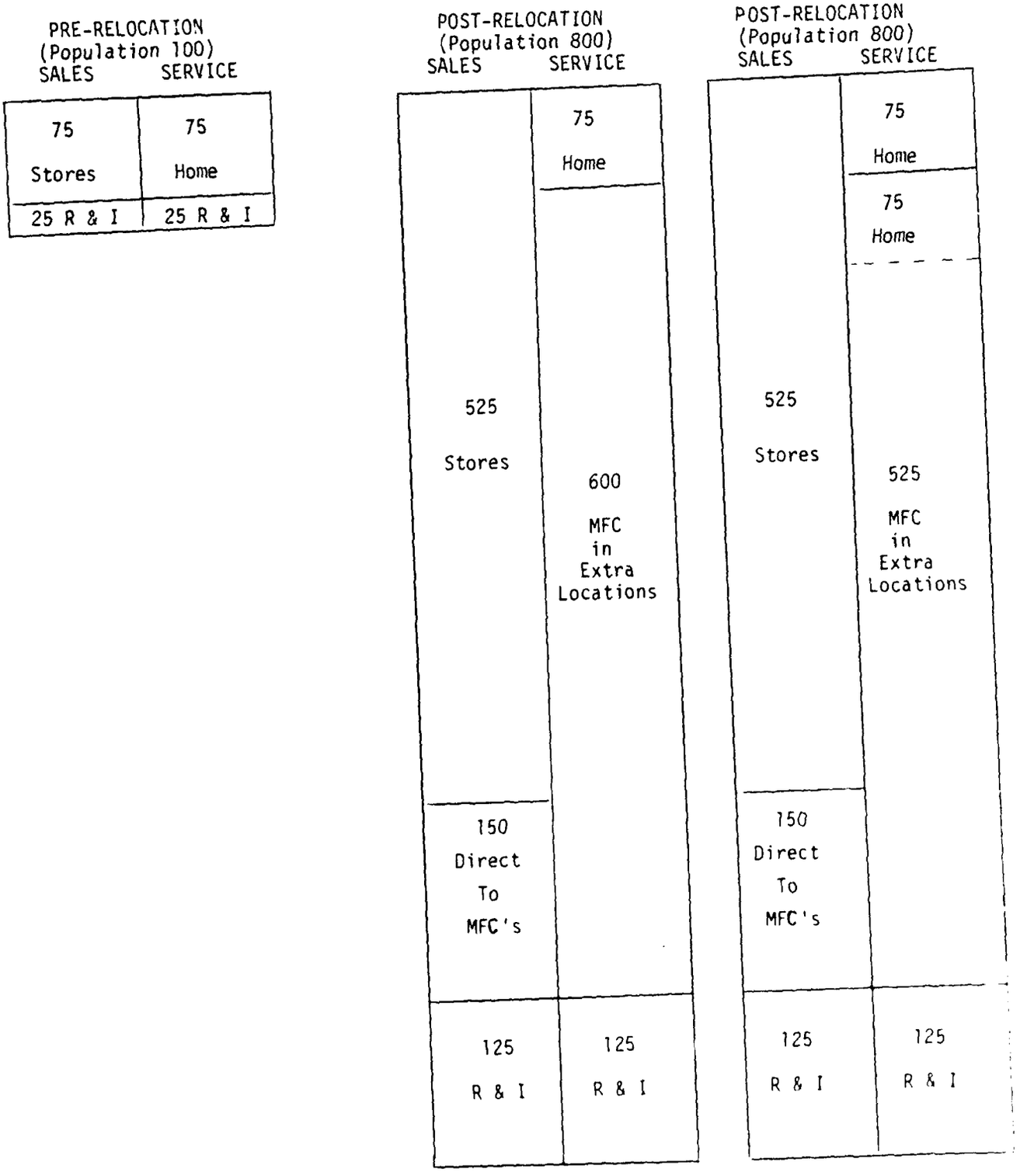
5.3 SPECIFIC CALIFORNIA PROBLEMS

In the event of a national emergency with the implementation of crisis relocation, California would have one of the highest hosting ratios in the country. This high hosting ratio (approximately 7 to 1) would place a considerable strain on host-area food distribution and delivery systems. Exhibit 5.3 shows the increase in number of people served depending on the extent to which the "Family Residences" are used. Exhibit 5.3 shows that in the host area for each 100 people served under "normal" conditions, 700 additional people will have to be served under crisis relocation conditions. It also shows (Column 2) that if no evacuees are served in "Family Residences", 600 out of the 700 evacuees will have to be served in mass feeding centers. It is assumed here that restaurants and institutions increase the number of people served fivefold. Concurrently, this could be increased to sevenfold but with additional strain on the system.

The 600 out of 700 evacuees which would have to be served at mass feeding centers (shown in Column 2 of Exhibit 5.3) illustrates one of the primary reasons why the use of the "Family Residences" to the maximum extent possible is of particular importance in California. The third column of Exhibit 5.3 shows the results of host-area residents accepting relocatees and doubling the number of persons in each "Family Residence". Even so, a large number of people would have to be fed at mass feeding centers.

Another problem aggravated by the high hosting ratio in California is the transporting of relocatees to the food serving centers. Feeding large numbers of people in central locations such as mass feeding centers, as well as institutions with kitchens and restaurants, would result in heavy requirements for local transportation. Even with the use of buses wherever possible, actual transport and parking may be difficult. Thus, the high hosting ratio and its resulting effect on host-area transportation is another reason "Family Residences" should be used to the maximum extent possible in California.

EXHIBIT 5.3: HOST AREA FOOD DISTRIBUTION AND DELIVERY



5.4 FEEDING FACILITIES AND OPERATIONS IN CALIFORNIA

A review of several emergency feeding exercises in California (Reference 15) indicates that when choice of dishes is permitted in cafeteria-type serving lines, the rate of flow averaged between 6 and 8 persons per minute, with a maximum of 12 per minute. Where a "one-stop pickup" cafeteria line was used, about 20 people per minute could be served. Also, existing facilities could be used to better advantage by increasing the hours of operation. In recent California emergency mass feeding exercises, for example, it was determined that by increasing the number of hours of operation from 4.5 to 16 per day and using mass feeding methods, a sevenfold increase in the number of meals served could be achieved.

The cafeteria mode of preparation and serving is very efficient. A related disadvantage, the close and hurried atmosphere, is a small price to pay when compared to the advantage of efficiency. Another disadvantage is that transportation would be necessary for evacuees not housed in or near the institution. Food would normally be acquired directly from the wholesale distributor and not through a grocery store, eliminating an extra handling step.

5.5 MERCED COUNTY FACILITIES AND FEEDING RATES

During this study, an overall evaluation of the food distribution and serving system in California was made. At the same time, a closer look was taken at the facilities in one county in California, Merced County. Data for this evaluation of the distribution system and facilities in Merced County were obtained through use of the CRP Hosting Area Survey (1975), and on-site visits.

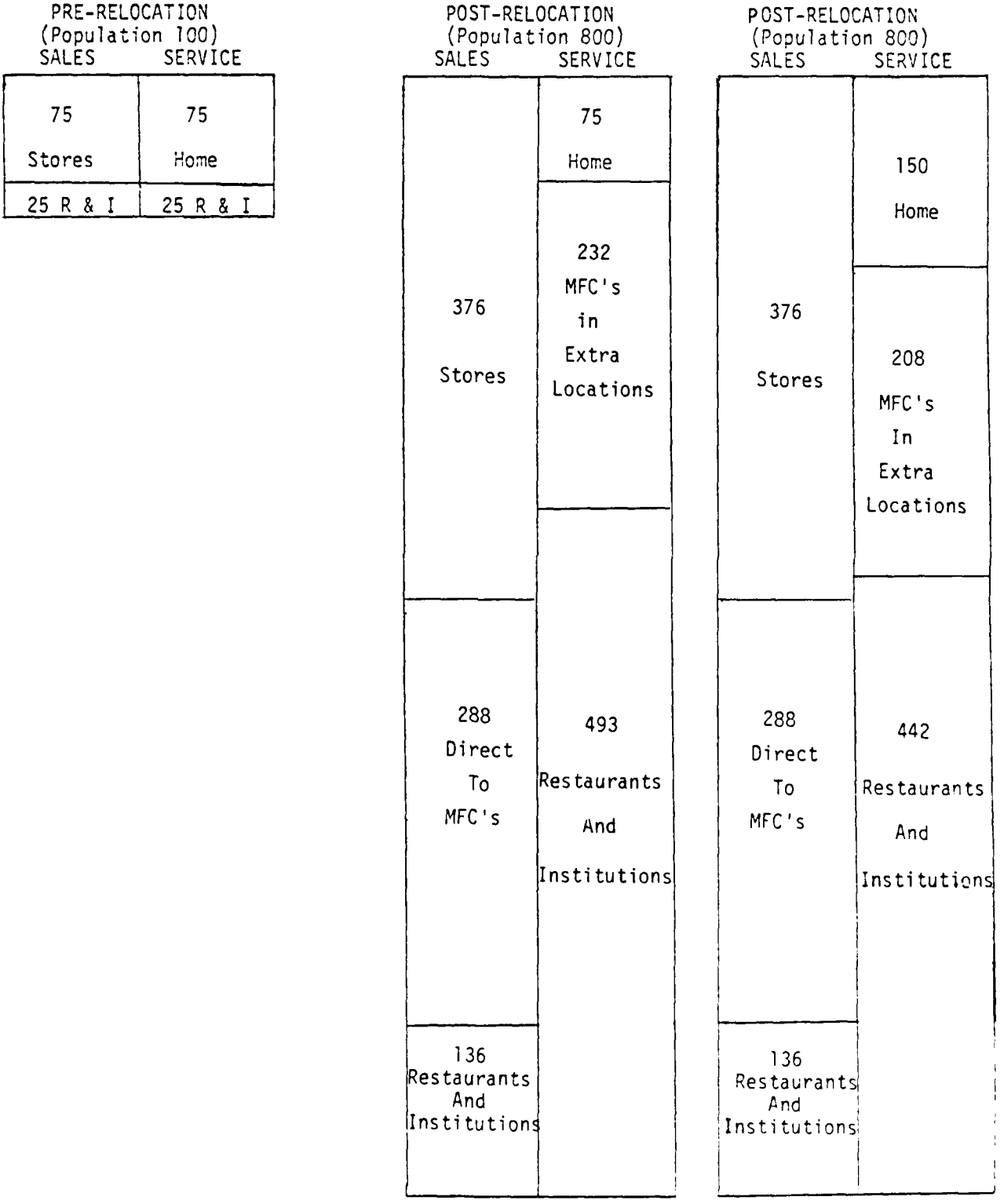
The CRP Host Area Survey (1975) indicates that Merced County has a 18,325 seating capacity for serving emergency meals. The serving organizations are shown according to type and supplier category in Exhibit 5.4. It is estimated that approximately 68% of Merced County's emergency seating capacity is comprised of organizations whose food is currently received from institutional suppliers. The organizations representing the other 32% of the seating capacity serve or consume relatively little food and their cooking facilities are not in use most of the time. Under crisis relocation conditions, these organizations will serve as mass feeding centers and will be supplied by major retail chain distributors or institutional suppliers. This feeding capacity will be useful where a substantial portion of the relocatees are staying with host-area families, and they will be critical where no relocatees stay in "Family Residences". Exhibit 5.5 shows the distribution of food by "sales" and "service" in Merced County. About 47% would be sold through stores, 36% per mass feeding centers, and 17% through restaurants and institutions. Based on available seats and assuming no relocatees are served in residences, about 68% of the relocatees would be served in restaurants and institutions, and 32% in churches, community centers, and fairgrounds.

EXHIBIT 5.4

MERCED COUNTY FOOD PREPARATION SEATING CAPACITY

TYPE ORGANIZATION	From Institutional Suppliers	From Retail Stores	Total
Schools	6314	----	6314
City,County or State	192	1165	1357
Community Centers	----	520	520
Churches	----	1335	1335
County Fairgrounds	----	1320	1320
Restaurants	5409	----	5409
Other Public Eating Places	385	----	385
Hospitals	90	----	90
Other	----	1595	1595
Totals	12390	5935	18325
Percent	68%	32%	100%

EXHIBIT 5.5: MERCED COUNTY FOOD DISTRIBUTION AND DELIVERY



As shown in Exhibit 5.4, Merced County has a total seating capacity of 18,325. Using the 1975 host-area population figure of 46,000, there would be 0.40 seats per person for the host-area population, assuming a 7 to 1 hosting ratio. After relocation, the number of relocatees in Merced County would be 322,000. If it is assumed that the residents have meals in their homes and relocatees are all residing in congregate-care facilities and are served at dining facilities other than residences, then there would only be 0.057 seats per relocatee. Allowing 30 minutes per meal per person[1], the total time required to feed all relocatees would be 8.77 hours, or 17.54 hours for two meals. This does not take into account the time savings that would be obtained through preparation of food in central kitchens as discussed in Section 5.2. Also this does not take into account the fact that it is not necessary for all persons to be seated while eating as noted in the above discussion of outdoor feeding. Exhibit 5.6 shows the number of hours required to feed relocatees in restaurants, institutions, and mass feeding centers if some relocatees stay in "Family Residences".

5.6 MEASURES FOR RELIEVING STRESS

The level of stress in the distribution system will depend on the relation between the number of food preparation and serving facilities available in the host area and the number of evacuees accepted by the host area. One overall method of relieving stress in the delivery system is not to rely on any single mode of delivery but to design an overall delivery system which makes use of each of the first four delivery alternatives (and the fifth after the first four are exhausted) in a balanced way. Then, if the stress imposed by one delivery alternative were too great, its feeding volume could be reduced, and the volume of another alternative increased as appropriate.

Regardless of these alternative tradeoffs, there are measures which can be used for reducing stress in any particular alternative. These measures are summarized below for each proposed alternative (Reference 2).

1. Family Residences.

   a) Distribute mass feeding menus in advance to host-area family residences accepting evacuees. Selection of mass feeding menus are included in general CRP food guidelines (Reference 2).

   b) Recommend preparation of only two meals a day. Serve one-dish meals when possible. Service one cold meal a day where appropriate.

---

[1]A somewhat conservative figure suggested by experts who have recently conducted mass feeding exercises in California (Reference 15).

EXHIBIT 5.6

TIME REQUIRED FOR SERVING IN HOST AREA RESTAURANTS,

INSTITUTIONS AND MASS FEEDING CENTERS IN MERCED COUNTY

(With Some Relocatees Residing In Family Residences)

(Population In Thousands)

Multiple Of Increase In "Family Residence" Population	Number Of People In "Family Residence"	Relocatees Served In Restaurants, Institutions And MFC's	Hours Required For Serving In Restaurants, Institutions And MFC's
1	46	332	17.54
2	92	276	14.58
3	138	230	12.15
4	184	184	9.72

c) Make available additional preparation and serving hardware, such as pots and pans, where necessary and where appropriate.

d) Make available repair services for stoves, refrigerators, etc.

2. Institution and Restaurant Preparation.

a) Prepare simple and basic meals with minimum of choice. Prepare one-dish meals where possible. Prepare only two meals a day.

b) Arrange meal assembly equipment and personnel for efficiency.

3. Cafeteria Service.

a) Provide sufficient cashiers to accept money or ration tickets or to check identification cards. In most cafeterias, the checkout is the limiting point in line.

b) Provide few choices of food to speed up progress through the line.

c) Pre-allocate the portions, when efficient.

d) Use scramble system self-service, rather than straight-line self-service when possible.

e) Establish guidelines for eating time at tables. Many Army facilities use 18-minute eating time.

f) Reduce space between tables and provide additional tables and chairs where possible to provide seating space consistent with greater throughput of cafeteria line.

g) At completion of meal, diners should deposit dishes and silverware on assigned receiving trays at exit.

4. Sit-Down Service.

a) Consider using more efficient cafeteria service wherever possible.

b) Serve meal on one dish where possible.

c) Where possible, have a pickup station at which diners can pick up their meal.

d) Establish guidelines for eating time. 18 minutes is used by many Army facilities.

e) At completion of meal, diner should deposit dishes and silverware on an assigned receiving tray.

5. Commissary Preparation and Serving.

a) For ease of transportation with minimum cooling, prepare one-dish meals and transport in large vats or pots. When transporting individual meals, package to reduce cooling.

b) Serve cold meals once a day.

c) Adapt the most efficient kitchens for use as a commissary.

d) Use efficient kitchens during off-hours; for example, hospital kitchens when they are not being used to prepare resident meals.

6. General Measures.

a) Serve only two meals a day. Serve one-dish meals where possible. Serve one cold meal a day where appropriate.

b) Use methods of mass preparation rather than individual preparation; for example, prepare scrambled eggs rather than fried eggs.

c) In all cases, the local chapter of the American Red Cross should be contacted to obtain the benefit of their mass feeding experience.

5.7 SUMMARY

The two major channels through which food may be supplied to the food preparers are (1) directly through the wholesale level of distribution and (2) indirectly through the retail level of distribution.

In general, ordinary channels of distribution should be followed as much as possible. Institutional wholesalers would continue to supply their normal customers, and grocery wholesalers should continue to supply grocery stores. Family residences should continue to receive their supplies through grocery stores. In addition, small restaurants and small congregate-care facilites could also receive their supplies through grocery stores.

With the vast majority of the population homeless, the relative proportion of all meals prepared in the home will undoubtedly [illegible] therefore, some of the grocery wholesalers with few or no stores in host areas would ship food directly to food preparers.

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FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA, V--ETC(U)
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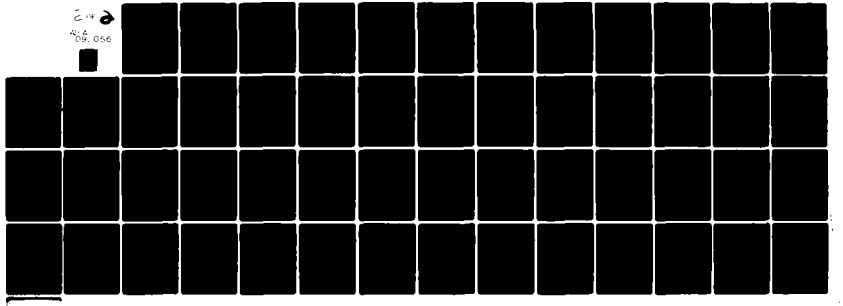

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Of the several methods of food preparation and serving, the most appropriate are family residences, institutions with kitchens, restaurants, existing commissaries, ad hoc commissaries, and outdoor feeding. "Family Residences", because of the particular problems in California, should be used as much as possible. Outdoor feeding is also a suitable feeding mode in California where the climate is relatively mild much of the year.

The high 7 to 1 hosting ratio in California poses special problems for food delivery under crisis relocation conditions. If no evacuees are served in "Family Residences" and restaurants and institutions served from 5 to 7 times as many people as they usually do, 550 to 600 of each 700 relocatees would still have to be served in mass feeding centers.

Several of the delivery alternatives discussed above, including institutions and restaurants, require that people be transported to the serving location. Even though the able-bodied could often walk to feeding centers, transportation would have to be arranged for the aged and infirm. The greater the dependence on institutions, restaurants and other centers for feeding them, the greater the potential stress on the local transportation system. In California, the maximum use of "Family Residences", as well as commissaries, would help to alleviate this problem.

6. TRANSPORTATION IMPLICATIONS OF ALTERNATIVE PLANS

6.1 INTRODUCTION

Under crisis relocation conditions, the major sources of food supply in the United States will remain undisturbed. Thus, the chief consideration is not whether food will be available, but whether it will be accessible to the relocated population. The problems are not to be expected in production and processing, but rather in transportation and distribution. This is especially true in California where both the evacuating population and food supplies will be moving long distances. A preliminary feasibility study (Reference 13) estimates that the average travel distance covered by relocatees will be approximately 200 miles. Evacuation movements over these distances will require transportation support for the food distribution industry to stretch to several times the travel distances normally encountered.

As long as the wholesale distribution centers located in the risk areas are maintained, the local adjustment required to direct large quantities of food to the host area need not interfere with the flow of national supplies. These adjustments will, however, place a heavy strain on the local food transportation system. Supermarkets generally receive a minimum of one delivery of dry groceries each week from local wholesalers, with more frequent deliveries of meat and perishable items. A typical high-volume market may receive an average of four deliveries of dry groceries per week and daily deliveries of meat and perishables. Dry grocery deliveries are made by tractors and trailers owned or leased by the supermarket chain or independent wholesaler, and driven by company employees. Most meat and perishable deliveries are made in a similar fashion. The extent of stress will depend on the increase in distance traveled in order to supply goods to the host-area stores. The measurement of this stress is described in more detail in the following section.

6.2 ESTIMATING TRANSPORTATION STRESS

6.2.1 Findings of Existing Studies

One model used in past SYSTAN studies to estimate transportation stress under crisis relocation conditions is a network model patterned after the traffic assignment models currently used throughout the United States in local and statewide transportation planning. This model uses a node-link representation of the local highway network, descriptions of

the location and market shares of each major wholesaler serving an area, and descriptions of the number and location of retail outlets in the host and risk area served by each wholesaler to compute the number of vehicle-miles and hours associated with a particular demand pattern. This model had been used to estimate the increases in vehicle mileage and time imposed on the food distribution system by crisis relocations in several cities and states. The results of these analyses are summarized in Exhibit 6.1. The transportation stress factor represents the ratio of vehicle mileage required to support crisis relocation to the vehicle mileage incurred under normal operating conditions. Thus, a stress of 1.50 reflects a 50% increase in vehicle mileage under crisis relocation conditions. Exhibit 6.1 shows that the regionwide transportation stress factor exceeds 2.0 (i.e., vehicle mileage requirements double) in the case of only one of the five regions studied. In this single case, which encompassed the State of Colorado, long evacuation distances, coupled with heavy concentration of normal business in the Denver metropolitan area, caused vehicle mileage requirements to triple under crisis relocation conditions.

Exhibit 6.1 also displays the transportation stress factors associated with the individual wholesalers undergoing minimum and maximum stress in each of the study areas. In general, the greatest transportation stress was imposed on wholesalers serving a heavy concentration of risk-area retail outlets, while wholesalers whose normal range of operation encompassed host-area retail outlets experienced minimal stress.

6.2.2 Application of the Transportation Stress Model to California

The model developed to measure transportation stress has been revised to meet the specific requirements of this study of food distribution in California. The revised model was used to predict the transportation stress resulting from the shift in the demand for food under crisis relocation conditions. Census population data gave both normal existing demand and sales capacity. Major distributors reported warehouse supplies, and other supplies were assumed to meet normal demand. Post-relocation demands were predicted on the basis of population shifts and allocated to companies, and finally shipping patterns were assigned to link supply and demand.

A network of 166 links connecting 85 nodes represented the California highway system (Exhibit 6.2). In addition to nodes at major intersections, a node in each county represented the population center for that county. In lightly-populated areas, the same node could represent both a highway junction and the population center, but in large urban areas, such as Los Angeles, separate nodes were used to model distribution costs. Shipping was assumed to occur along minimum-distance routes.

Major food distributors in California supplied most of the food reaching relocatees. The location and capacity of the warehouses of

EXHIBIT 6.1

COMPARISON OF TRANSPORTATION STRESS FACTORS FOR FIVE AREAS

REGION OR METROPOLITAN AREA	LOCATION OF MAJOR WHOLESALERS	VEHICLE MILEAGE STRESS FACTORS		
		Total Region	Least Stressed Wholesaler	Most Stressed Wholesaler
Detroit	Detroit	1.92	1.20	2.62
San Jose	San Francisco, Oakland	1.18	1.11	1.56
Richmond	Richmond, Washington, D.C.	1.50	1.07	1.92
Colorado Springs	Denver, Pueblo	1.75	1.58	2.92
State of Colorado	Denver, Pueblo, Grand Junction	3.04	1.46	7.45

NOTE: Transportation Stress Factor =

$$\frac{\text{Vehicle Mileage Under Crisis Relocation Conditions}}{\text{Normal Vehicle Mileage}}$$

these distributors were represented exactly in the model. Sales through minor distributors and restaurants were assumed to come from additional warehouses in Los Angeles and Oakland.

Demand was based on population census data and a retail delivery rate of 30 pounds per person per week. Predicted normal total sales were based on reported population by county in both risk and host areas. Estimated sales from store counts were then adjusted for variation in store size and location, and sales through miscellaneous suppliers were predicted. Alternative crisis relocation plans were specified by giving the post-relocation population in each county. The capacities of host-area food supplies were increased (700% for stores, 400% for restaurants and institutions) to reflect reasonable performance limitations under conditions of vastly increased demand.

Supply and demand were balanced for each county and company. In counties where sales exceeded demand, company sales were uniformly lowered to match the demand. In counties where demand exceeded sales, the excess demand had to be serviced from shipments direct to mass feeding centers (MFC's). Companies whose supplies exceeded total sales shipped the excess directly to the MFC's, while companies whose sales capacity exceeded supplies had to lower their sales in all counties, the unmet demand again being serviced by shipments to MFC's.

In deciding which warehouses would ship to which stores, the program treated each company as an independent problem. Host areas were ranked by the added cost of shipping from the second nearest warehouse instead of the nearest warehouse, and the stores were supplied in order of increasing marginal cost. Thus, the algorithm was optimal for two-warehouse companies, and near-optimal for multi-warehouse companies.

6.3 EVALUATION OF TRANSPORTATION ALTERNATIVES FOR CALIFORNIA

Food transportation requirements under crisis relocation conditions in California are significantly affected by the state's high hosting ratios and unique geography.

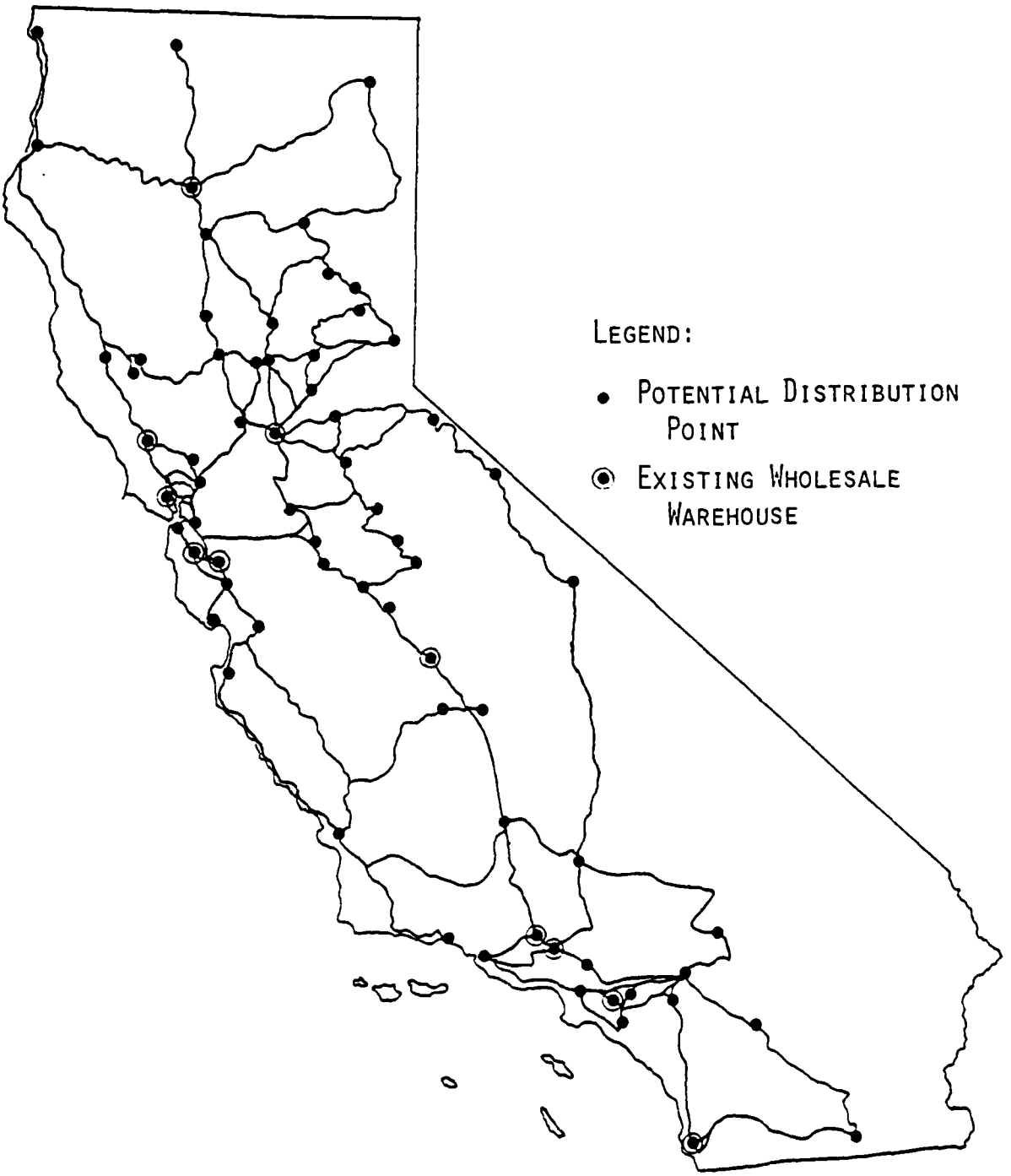
The high hosting ratios mean that large quantities of food must be moved from high-risk urban areas, where 94% of the food distribution volume originates, to the host areas where people will be relocated. Thus, California's high-risk to host-area population ratio imposes stress on the transportation system in the movement of both people and food.

Sixty-four percent of the population resides in Southern California. The ratio of urban to rural (risk to non-risk) population is greater in Southern California than in Northern and Central California. (See Exhibit 2.3.) Much of the rural area of Southern California is quite arid and is sparsely populated. Consequently, proximity hosting in much of Southern California, particularly Riverside and San Bernardino Counties, results in relatively high hosting ratios.

EXHIBIT 6.2

ROAD NETWORK

FOR FOOD DISTRIBUTION ANALYSIS



Uniform hosting throughout the state, on the other hand, means that a substantial number of people (approximately 18% of the state's population) would have to move from Southern California to Northern and Central California. If risk-area warehouses are maintained, of course, food supplies must also be shipped to the relocated population in the northern and central parts of the state. This would add substantially to the distance food must be carried and to the strain on equipment and manpower resources.

The effects of four different hosting allocation patterns on transportation resources were evaluated (see Section 2.3). These four hosting allocations were (1) the regional hosting plan of the California Office of Emergency Services, (2) uniform hosting, (3) non-uniform proximity hosting, and (4) proximity hosting/transport capacity allocation (80% evacuation).

Using each of the hosting allocation plans noted above to distribute population by host area county, three different alternative food distribution patterns were analyzed. These are (1) distribution from risk area warehouses, (2) distribution from risk area with limited intercompany diversion, and (3) distribution from risk area and secondary host area warehouses. Each of these alternatives was discussed in Chapter 4 and therefore, the discussion here will be limited primarily to the transportation aspects of these alternatives.

Exhibit 6.3 summarizes the results of using each of these three distribution alternatives in conjunction with the regional hosting plans proposed by the California OES, while Exhibit 6.4 summarizes similar findings for a uniform hosting strategy. Exhibit 6.4 also contains the transportation stress factors associated with alternative proximity hosting strategies.

6.3.1 Regional Hosting Plans of California OES.

When compared with normal distribution patterns, each of the three distribution alternatives considered in conjunction with the regional hosting plan proposed by the California OES required approximately twice the ton-miles needed to supply food to the California population.

1. Distribution from Risk-Area Warehouses. Under this alternative all major grocery wholesalers and institutional suppliers continue to operate risk area warehouses, supply increased quantities to host area stores, restaurants and institutions or mass feeding centers. It is assumed that grocery wholesalers serve only their own host-area stores. Those wholesalers with very few host-area stores will supply mass feeding centers. It can be seen from Exhibit 6.3 that the resulting stress factor is 2.0, that is, that the number of ton-miles needed to meet the revised population allocation doubles. Store throughput drops significantly from 75% of the

total volume under normal conditions to 57% under crisis relocation conditions. Approximately 27% of the food would be distributed through mass feeding centers.

2. Distribution from Risk-Area Warehouses with Limited Intercompany Diversion. This alternative is the same as (1) above except that grocery chain warehouses which serve no or very few host-area stores ship to another chain's host-area stores. For the alternatives considered, Ralph's, which has few host-area outlets, would deliver to Safeway's stores as well as mass feeding centers; also, Lucky's Vacaville warehouse would supply United Grocers' Northern California stores as well as mass feeding centers. Exhibit 6.3 shows that transportation stress for this alternative is 1.9, and that total tons shipped to stores are approximately 61% of the total foodstuffs shipped in California. This appears to be the best of the alternatives examined since it has the lowest transportation stress factor and the highest percentage shipment to stores. Only 12% of total food shipments are distributed directly to mass feeding centers. Because of the promise of this alternative, it has been incorporated in the prototype plans presented in Volume II of this report.

   Exhibit 6.5 contains a county-by-county summary of the distribution patterns followed by each major food warehouse in California under this alternative. The "Store sales factor" listed in this Exhibit is a planning factor indicating the amount by which the warehouse should increase its shipments to stores in the identified county. The associated transportation stress factor is listed for each supplier and county, and an estimate is provided of the number of additional tractors, trailers, and drivers needed to accommodate this stress.

3. Distribution from Risk-Area and Secondary Host Area Warehouses. This alternative allows some diversion of supplier shipments to a secondary host-area warehouse. Secondary warehouses would be operated by some of the workforce transferred from the risk-area warehouses. The transportation stress factor is 2.0 which is the same as under alternative 1 above. Approximately 50% of total foodstuffs shipped would go to stores while 23% would go to mass feeding centers.

4. Sensitivity Analysis--Store Capacity Plus and Minus 10%. Changing store capacity by 10% had almost no effect on transportation stress. An increase in the volume shipped to stores, however, reduces the volumes sent to mass feeding centers.

SUMMARY EXHIBIT 6.3

SUMMARY OF TRANSPORTATION STRESS RESULTS FOR CALIFORNIA

BASED ON REGIONAL HOSTING PLAN OF CALIFORNIA OES

Merchandise Category	Normal Conditions	DISTRIBUTION ALTERNATIVE		
		Distribution From Risk Area Warehouses	Distribution From Risk Area Warehouses With Limited Inter-company Diversion	Distribution From Risk Area and Secondary Host Area Warehouses
Thousands of Ton-Miles/Year	1,181,210	2,413,633	2,252,548	2,383,714
Tons Shipped to Stores	12,346,048	9,414,912	11,360,908	9,432,956
Tons Shipped to Restaurants and Institutions	4,124,484	2,692,872	2,692,872	2,692,872
Tons Shipped to MFD's**	0	4,363,580	2,256,332	4,363,476
Transportation Stress Factor	1.0	2.0	1.9	2.0

Note: Total annual food shipments are 16,470,532 tons.

* Mass Feeding Centers

6.3.2 Uniform Hosting Allocation

1.

Under the uniform hosting allocation, transportation stress factors approach 3.0. That is, distribution distances are nearly three times normal distances, and 50 percent higher than the distances required by the regional hosting strategy. This increase in transportation stress reflects the longer evacuation distances required when areas threatened by potential fallout (but not by blast) are treated as risk areas.

1. Distribution from Risk-Area Warehouses. Exhibit 6.4 shows that the resulting transportation stress factor under this alternative is 2.9, and that store throughput drops significantly from 75% of the total volume of food distribution to 51%. Approximately 33% of the food would be distributed through mass feeding centers. Appendix C breaks down the individual stress factors by supplier and county, and estimates the number of additional tractors, trailers, and drivers needed to accommodate the additional distribution distance.

2. Distribution from Risk-Area with Limited Intercompany Diversion. Exhibit 6.4 shows that transportation stress for this alternative is 2.730, and that total tons shipped to stores are approximately 65% of total foodstuffs shipped in California. Shipments to mass feeding centers are 19% of total food shipments.

3. Distribution from Risk-Area and Secondary Host Area Warehouses. The transportation stress factor under this alternative is approximately 2.9.

4. Sensitivity Analysis--Store Capacity Plus and Minus 10%. Changing store capacity had very little effect on transportation stress.

6.3.3 Non-Uniform Proximity Hosting

Under this hosting allocation, a larger proportion of evacuees will be hosted in counties near the risk areas. This has the effect of increasing the hosting ratio in San Bernardino and Riverside Counties to approximately 12 to 1. This hosting alternative also decreases the distance food must be transported from risk-area warehouses to the relocation population compared with the Uniform Hosting alternative. Annual ton-miles are decreased 28% and the total volume shipped to mass feeding centers in the state is increased by 11%. The transportation

EXHIBIT 6.4

TRANSPORTATION STRESS RESULTS FOR CALIFORNIA

FOOD DISTRIBUTION BASED ON ALTERNATIVE HOSTING ALLOCATION PATTERNS

Merchandise Category	Normal Conditions	UNIFORM HOSTING ALLOCATION			Proximity Hosting Allocation	Proximity * Hosting Transport Capacity
		Distribution From Risk Area Warehouses	Distribution From Risk Area Warehouses With Limited Inter-company Diversion	Distribution From Risk Area and Secondary Host Area Warehouses		
Thousands of Ton-Miles/Year	1,181,210	3,452,302	3,225,047	3,413,695	2,482,553	1,969,801
Tons Shipped to Stores	12,346,048	8,394,372	10,814,308	8,441,108	9,223,175	7,113,980
Tons Shipped to Restaurants and Institutions	4,124,484	2,592,094	2,583,152	2,583,100	2,179,246	1,736,394
Tons Shipped to MFC's**	0	5,483,179	3,072,472	5,446,324	5,068,111	7,820,168
Transportation Stress Factor	1.00	2.913	2.730	2.890	2.090	1.660

Note: Total annual food shipments are 16,470,532 tons.

* Assumes 30 percent evacuation of risk areas.
** Mass Feeding Centers

Exhibit 6.5: SUMMARY OF REVISED WHOLESALE-RETAIL DISTRIBUTION PATTERNS

PLAN FOR ALPHA BETA WAREHOUSE IN LA HABRA

Stress level is 1.631
20 additional drivers needed

Store sales factors:

San Diego	8.0	
Riverside	8.0	
San Bernardino	8.0	
Ventura	8.0	
Tulare	6.7	(1) (2)

Shipments to mass feeding centers (tons/wk)

Orange	4680
San Diego	601

PLAN FOR ALPHA BETA WAREHOUSE IN MILPITAS

Stress level is 1.193

Store sales factors:

Santa Clara	5.2	
Alameda	4.0	
Fresno	7.2	
San Benito	5.2	
Santa Cruz	5.2	
Sonoma	3.3	
Solano	4.0	
Tulare	6.7	(2)

Shipments to mass feeding centers (tons/wk)

San Luis Obispo	2095

PLAN FOR CERTIFIED GROCERS WAREHOUSE IN LOS ANGELES

Stress level is 2.284
30 additional tractors needed
67 additional trailers needed
195 additional drivers needed

Store sales factors:

San Diego	8.0	
Alameda	4.0	
Fresno	7.2	
Kern	7.6	
Inyo	6.6	
Mono	6.6	
Riverside	8.0	
Imperial	8.0	
San Bernardino	8.0	
San Luis Obispo	6.7	
Santa Barbara	6.9	
Ventura	8.0	
Tulare	6.7	

Shipments to mass feeding centers (tons/wk)

Santa Barbara	506
Ventura	2577

PLAN FOR FLEMING WAREHOUSE IN FREMONT

Stress level is 1.208

Store sales factors:

Sacramento	2.8
Santa Clara	4.8
Contra Costa	5.1
Alameda	3.7
Merced	5.1
Stanislaus	4.0
Napa	3.7
Marin	4.3
Santa Cruz	4.8
Sonoma	3.1
San Joaquin	4.4
Solano	3.7

PLAN FOR LUCKY'S WAREHOUSE IN VACAVILLE

Stress level is 2.455
57 additional tractors needed
115 additional trailers needed
302 additional drivers needed

Store sales factors:

Santa Clara	5.2	
Alameda	4.0	
Madera	5.2	(2)
Stanislaus	4.3	
Monterey	5.2	
Marin	4.7	
United Grocers stores in:		
Santa Clara	3.8	
Fresno	5.1	(3)
Modoc	3.2	
Kern	5.5	
Madera	3.7	
Mariposa	3.8	
Humboldt	2.5	
San Benito	3.7	
Lake	3.2	
Merced	4.0	
Monterey	3.8	
Tehama	2.8	
Shasta	2.9	
Marin	3.4	
San Luis Obispo	4.9	
Santa Cruz	3.7	
Sonoma	2.4	(3)

(1) normally served at least partially by another warehouse
(2) served partially by another warehouse of the same company
(3) served partially by a warehouse of another company

Exhibit 6.5: SUMMARY OF REVISED WHOLESALE-RETAIL DISTRIBUTION PATTERNS
(continued)

PLAN FOR RALPH'S WAREHOUSE IN COMPTON

Stress level is 2.067
63 additional drivers needed

Store sales factors:
Safeway stores in:

Santa Clara	4.1	
San Diego	6.3	(3)
Fresno	5.6	
Kern	6.0	
Kings	5.3	
San Bernardino	6.3	(3)
Monterey	4.1	
Santa Barbara	5.4	
Santa Cruz	4.1	
Tulare	5.2	

PLAN FOR SAFEWAY WAREHOUSE IN SACRAMENTO

Stress level is 1.027

Store sales factors:

Inyo	5.2	(1)
Mono	5.2	(1)
Amador	3.5	
Merced	4.3	
Stanislaus	3.4	
Butte	2.3	
El Dorado	3.4	
Plumas	3.4	
Tehama	3.0	
Shasta	3.2	(2)

PLAN FOR SAFEWAY WAREHOUSE IN RICHMOND

Stress level is 2.855
95 additional tractors needed
190 additional trailers needed
321 additional drivers needed

Store sales factors:

Orange	6.3	(1) (2)
Alameda	3.2	
Calaveras	4.1	(1)
Placer	3.4	(1)
Del Norte	2.1	
Humboldt	2.7	
Nevada	3.4	(1)
Lake	3.5	
Napa	3.1	
Shasta	3.2	(1) (2)
Sonoma	2.6	
Tuolumne	4.1	(1)
San Joaquin	3.8	(1)
Lassen	3.5	(1)
Mendocino	3.5	
Solano	3.2	(1)
Glenn	2.8	(1)
Siskiyou	3.2	(1)
Sutter	1.2	(1)

PLAN FOR SAFEWAY WAREHOUSE IN SANTA FE SPRINGS

Stress level is 1.164

Store sales factors:

Orange	6.3	(2)
Los Angeles	6.3	
Riverside	6.3	
San Bernardino	6.3	(3)
Ventura	6.3	

PLAN FOR SAFEWAY WAREHOUSE IN SAN DIEGO

Stress level is 1.614
4 additional drivers needed

Store sales factors:

San Diego	6.3	(3)
Imperial	6.3	

PLAN FOR UNITED GROCERS WAREHOUSE IN FRESNO

Stress level is 0.298

Store sales factors:

Fresno	5.1	(3)
Kings	4.9	

PLAN FOR UNITED GROCERS WAREHOUSE IN RICHMOND

Stress level is 1.932
25 additional drivers needed

Store sales factors:

Sacramento	2.1	(1)
Alameda	2.9	
Calaveras	3.7	
Placer	3.1	
Mono	4.8	(1)
Colusa	1.7	
Nevada	3.1	
Amador	3.2	(1)
Yuba	1.7	(1)
Napa	2.9	
Butte	2.1	(1)
El Dorado	3.1	(1)
Plumas	3.1	(1)
Sierra	3.2	(1)
Sonoma	2.4	(1) (3)
Tuolumne	3.8	(1)
San Joaquin	3.5	(1)
Mendocino	3.2	(1)
Solano	2.9	(1)
Tulare	4.8	(1) (2)
Trinity	2.9	(1)
Glenn	2.6	(1)
Yolo	2.9	(1)
Siskiyou	2.9	(1)
Sutter	1.1	(1)

(1) normally served at least partially by another warehouse
(2) served partially by another warehouse of the same company
(3) served partially by a warehouse of another company

Exhibit 6.5: SUMMARY OF REVISED WHOLESALE-RETAIL DISTRIBUTION PATTERNS
(continued)

PLAN FOR LUCKY'S WAREHOUSE IN BUENA PARK

Stress level is 5.991
851 additional tractors needed
1703 additional trailers needed
1819 additional drivers needed

Store sales factors:

Sacramento	3.0	
Fresno	7.2	(1)
Madera	5.2	(1) (2)
Riverside	8.0	
San Bernardino	8.0	
Sonoma	3.3	(1)
San Joaquin	4.8	(1)
Solano	4.0	(1)
Ventura	8.0	

Shipments to mass feeding centers (tons/wk)

San Diego	5512
Riverside	6013
Imperial	1222
San Bernardino	1381

PLAN FOR MARKET BASKET WAREHOUSE IN LOS ANGELES

Stress level is 4.977
54 additional tractors needed
134 additional trailers needed
149 additional drivers needed

Shipments to mass feeding centers (tons/wk)

Kern	2015
Inyo	167
San Bernardino	1772
San Luis Obispo	451
Santa Barbara	997

PLAN FOR MARKET WHOLESALERS WAREHOUSE IN FRESNO

Stress level is 1.411

Store sales factors:

Fresno	2.3	(2)
Kern	2.4	
Kings	2.1	
San Luis Obispo	2.1	

PLAN FOR MARKET WHOLESALERS WAREHOUSE IN SACRAMENTO

Stress level is 2.155
7 additional drivers needed

Store sales factors:

Fresno	2.3	(1) (2)
Calaveras	1.6	
Placer	1.4	
Colusa	0.7	(1)
Nevada	1.4	
Amador	1.4	
Yuba	0.8	
Stanislaus	1.4	(1)
Butte	0.9	(1)
El Dorado	1.4	
Plumas	1.4	(1)
Sierra	1.4	
Tuolumne	1.6	(1)
San Joaquin	1.5	(1)
Tulare	2.1	(2)

PLAN FOR MARKET WHOLESALERS WAREHOUSE IN SANTA ROSA

Stress level is 2.631
4 additional tractors needed
4 additional trailers needed
11 additional drivers needed

Store sales factors:

Alameda	1.3	(1)
Mariposa	1.7	(1)
Lake	1.4	(1)
Merced	1.7	(1)
Napa	1.3	
Marin	1.5	
Sonoma	1.0	(1)
Mendocino	1.4	(1)
Solano	1.3	(1)
Tulare	2.1	(1) (2)
Trinity	1.3	(2)
Yolo	1.3	(1)

PLAN FOR MARKET WHOLESALERS WAREHOUSE IN REDDING

Stress level is 0.823

Store sales factors:

Modoc	1.4	(1)
Del Norte	0.8	
Humboldt	1.1	(1)
Tehama	1.2	(1)
Shasta	1.3	(1)
Lassen	1.4	(1)
Trinity	1.3	(2)
Glenn	1.1	(1)
Siskiyou	1.3	
Sutter	0.5	(1)

(1) normally served at least partially by another warehouse
(2) served partially by another warehouse of the same company
(3) served partially by a warehouse of another company

Exhibit 6.5: SUMMARY OF REVISED WHOLESALE-RETAIL DISTRIBUTION PATTERNS
(continued)

PLAN FOR UNITED GROCERS WAREHOUSE IN SACRAMENTO

Stress level is 2.533
12 additional tractors needed
19 additional trailers needed
41 additional drivers needed

Store sales factors:

Stanislaus	3.1	(1)
Lassen	3.2	
Tulare	4.8	(1) (2)

PLAN FOR VONS WAREHOUSE IN EL MONTE

Stress level is 1.781
30 additional drivers needed

Store sales factors:

San Diego	7.6
Riverside	7.6
San Bernardino	7.6
Santa Barbara	6.6

PLAN FOR RESTAURANT AND INSTITUTIONAL WAREHOUSES IN NORTHERN CALIFORNIA

Stress level is 1.133

Shipments to mass feeding centers (tons/wk)

Sacramento	26
Contra Costa	97
Alameda	450
Fresno	2608
Calaveras	220
Modoc	141
Placer	439
Mono	76
Madera	366
Colusa	127
Mariposa	142
Del Norte	129
Humboldt	1125
Nevada	391
Kings	1143
Amador	189
Lake	332
Yuba	255
Merced	934
Stanislaus	530
Alpine	5
Napa	204
San Mateo	13
Marin	16
Sierra	45
Sonoma	1260
Mendocino	852

PLAN FOR RESTAURANT AND INSTITUTIONAL WAREHOUSES IN SOUTHERN CALIFORNIA

Stress level is 3.318
369 additional tractors needed
554 additional trailers needed
1024 additional drivers needed

Shipments to mass feeding centers (tons/wk)

Santa Clara	247
Los Angeles	1674
Placer	309
San Benito	101
Monterey	405
Butte	1127
El Dorado	731
Plumas	239
Tehama	467
Shasta	1230
Santa Cruz	1221
Tuolumne	361
San Joaquin	921
Lassen	253
Solano	540
Ventura	735
Tulare	2628
Trinity	169
Glenn	290
Yolo	920
Siskiyou	462
Sutter	238

PLAN FOR OTHERS WAREHOUSES IN NORTHERN CALIFORNIA

Stress level is 1.058

PLAN FOR OTHERS WAREHOUSES IN SOUTHERN CALFORNIA

Stress level is 2.238
19 additional tractors needed
29 additional trailers needed
228 additional drivers needed

(1) normally served at least partially by another warehouse
(2) served partially by another warehouse of the same company
(3) served partially by a warehouse of another company

stress factor is reduced to approximately 2.1 but the additional strain on congregate care facilities and mass feeding centers in San Bernardino and Riverside Counties would be considerable.

6.3.4 Proximity Hosting/Transport Capacity (assumes 80% relocation)

Under this hosting allocation, ton-miles are 42% less than for the Uniform Hosting allocation. Shipments to mass feeding centers increase by 39% statewide. Transportation stress is reduced to 1.85. One of the major problems with this hosting allocation is it results in hosting ratios of 17 to 1 in San Bernardino ard Riverside Counties with a consequent heavy strain on congregate care facilities and mass feeding centers.

6.4 METHODS OF RELIEVING TRANSPORTATION STRESS

As part of earlier studies (References 2, 6 and 12), distribution managers for major food wholesalers serving five different metropolitan areas of the United States were interviewed at some length regarding potential measures that might be employed to ease the transportation stress imposed on the food distribution system by a crisis relocation. Similar interviews were carried out with major food wholesalers in California. Most of the distribution managers interviewed felt that the vehicle mileage covered by the truck fleets in making local deliveries could be doubled under emergency conditions; additional increases would require additional equipment. The larger food distributors interviewed indicated a willingness to lease additional equipment in time of emergency. This is their current practice when demand surges or emergencies render their truck fleets inadequate. Additional strategies for increasing truck and driver productivity include:

1. Relaxing Regulatory Constraints.

   a) Relaxing union and DOT driver restrictions

   b) Ignoring over-the-road weight limitations

2. Improving Utilization of Existing Equipment.

   a) Relaxing maintenance requirements

   b) Minimizing downtime

   c) Shipping only full-pallet commodity loads

   d) Eliminating light loads

   e) Shipping only necessary commodities

3. Obtaining Additional Equipment and Drivers

   a) Leasing equipment

   b) Using incoming equipment from manufacturers

   c) Commandeering additional drivers and equipment from less critical sectors of the economy

Each of these strategies, discussed in detail in Impacts of the Crisis Relocation Strategy on Transportation Systems (Reference 17), is briefly reviewed in the following paragraphs.

1. Relaxing Regulatory Constraints. Relaxing union and DOT restrictions on the length of time a driver may spend at the wheel during a tour of duty (consistent with safety precautions) would increase driver availability, while waiving truck weight limitations would improve vehicle utilization.

2. Improving Utilization of Existing Equipment. Existing equipment is not fully utilized, and additional vehicle-hours may be realized over short periods by cutting back on maintenance procedures. By ignoring brand differences and loading only full-pallet loads of specified items, additional savings of from one to three hours per trip may be attained at the warehouse loading dock.

   Another means of improving vehicle utilization under emergency conditions is to ship only essential items. Every retail grocery store and grocery wholesaler carries many items which would not be required for survival under crisis relocation or postattack conditions. The identification of non-essential items is not simply a matter of separating food and non-food items and shipping only food items to host-area outlets. While some non-food items carried by grocers are clearly not essential to survival (e.g., toys, hairspray, and tobacco products), many other items in this classification will contribute significantly to the well-being of the evacuated population (e.g., aspirin, toilet tissue, and detergents). Food distribution and transportation guidelines prepared by SYSTAN contain a suggested listing of essential and non-essential commodities, classified according to wholesaler inventory categories (Reference 17).

   Trucks and drivers making deliveries from food manufacturers to wholesale distribution warehouses might be induced to make local shipments from the warehouse to the host area as part of their return journey to the manufacturer. Many manufacturers currently arrange to have their trucks backhaul other commodities on the return journey as a matter of course, so the use of these trucks in local food shipments would require an assessment of relative shipment priorities.

Equipment utilization may also be increased by dropping trailers at host-area locations, especially mass feeding centers where unloading may be slow, and returning for a second load.

3. Obtaining Additional Drivers and Equipment. One obvious means of coping with the transportation stress imposed on the food distribution system by a crisis relocation is to secure the use of drivers and equipment from other, less critical sectors of the distribution community. This approach is currently practiced on a small scale by most food distributors, who typically lease additional equipment when demand surges or emergencies render their truck fleets inadequate. During the recent truckers' strike in California, several of the grocery chains interviewed indicated they obtained the services of outside carriers. Under emergency conditions, additional vehicles and drivers might also be obtained on a somewhat larger scale from the household moving industry and from manufacturing firms shutting down for the duration of the crisis.

6.5 INTERPRETING TRANSPORTATION STRESS MEASUREMENTS

Since existing equipment is not used to capacity, it is necessary to estimate the additional usage that may be obtained from this equipment before additional drivers and equipment are necessary. Estimates for the requirements for additional drivers and equipment have been made in existing studies (References 2 and 17). Exhibit 6.5 lists the estimated range of increase of driver and vehicle productivity associated with each of the labor- and equipment-saving measures proposed above. Some of the proposed measures would have the effect of increasing vehicle productivity without increasing driver productivity (i.e., relaxing maintenance requirements), while other measures (i.e., relaxing union and DOT restrictions) would primarily increase driver productivity, and still others (i.e., relaxing weight restrictions) would improve both driver and vehicle productivity. Exhibit 6.5 shows that the average potential increase in driver productivity is 51%, while the average increase in productivity possible for existing food transportation vehicles is 112.5%. This figure could range from 76% to 149%, depending on existing vehicle down time.

Exhibit 6.6 charts the rough results of Exhibit 6.5 as a function of different transportation stress factors. On the average, a transportation stress factor of 2.5 (i.e., a 150% increase in vehicle mileage) would require an influx of 18% more vehicles and 71% more drivers from other sectors of the economy. These estimates allow for no attrition in the existing driver force in the face of emergencies, and assume that the length of the crisis relocation period will be relatively short (one to two weeks). Although Exhibit 6.6 was prepared from rough estimates of the likely impact of different measures for improving distribution system productivity, it confirms two of the major

EXHIBIT 6.6

SUMMARY OF POTENTIAL PRODUCTIVITY INCREASES

EMERGENCY MEASURE	ESTIMATED PERCENT INCREASE IN EFFICIENCY					
	Vehicle Time			Driver Time		
	Lower	Mid-Range	Upper	Lower	Mid-Range	Upper
REGULATORY CONSTRAINTS						
Relaxing Driver Restrictions	--	--	--	18%	20%	22%
Relaxing Weight Limitations	4%	6%	8%	4%	6%	8%
EQUIPMENT USE						
Minimizing Down Time	37%	54%	71%	--	--	--
Relaxing Maintenance Requirements	15%	17.5%	20%	--	--	--
Eliminating Light Loads	5%	10%	15%	5%	10%	15%
Shipping Only Full-Pallet Loads	5%	10%	15%	--	--	--
Shipping Only Necessary Commodities	10%	15%	20%	10%	15%	20%
TOTAL	76%	112.5%	149%	37%	51%	65%

(Source: Reference 2)

intuitive observations of distribution managers regarding emergency operations under crisis relocation conditions:

1. Driver availability is likely to be more critical than vehicle availability. That is, more additional drivers than vehicles are required to meet a specified increase in vehicle mileage.

2. The existing distribution system can support a doubling of vehicle-miles for short periods of time without requiring additional transportation equipment.

The relationships of Exhibit 6.6 have been used to compute the additional number of food trucks and drivers needed to accomplish a relocation in California. Exhibit 6.4 has summarized these numbers on a warehouse-by-warehouse basis for major food distributors under a uniform hosting allocation. This exhibit shows that a total of 3820 tractors, 7422 trailers, and 9143 drivers would have to be diverted from less critical sectors of the economy to distribute food under crisis relocation conditions.

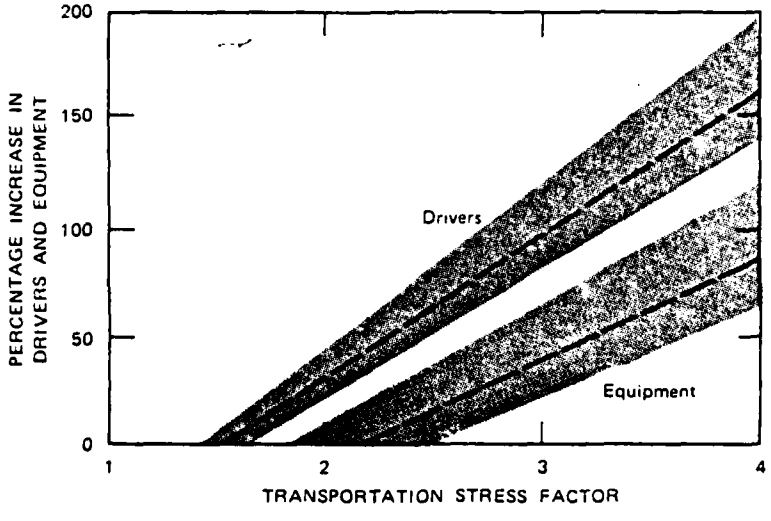
6.6 MEETING ADDITIONAL EQUIPMENT NEEDS

Of a total of nearly 1,000,000 trucks currently registered in California, 600,000 are dedicated to specific purposes such as construction, forestry, mining and manufacturing, leaving 400,000 primarily used to haul general cargo. Of these 400,000 trucks, approximately 225,000 are already used by California agriculture. In addition, approximately 95,000 of the 400,000 are small pickups and parcel trucks that are unsuited for intercity cargo transport. This leaves a total of 80,000 general cargo trucks large enough to be employed efficiently in making intercity food shipments (1978 Census of Transportation and Reference 13). Many of these trucks are already carrying what would be considered essential cargo under crisis relocation conditions. A past SYSTAN survey (Reference 12) estimated that 62% of all intercity truck ton-miles and 51% of all intracity ton-miles were consumed in delivering essential cargo.

Conservatively assuming that 62% of the 80,000 larger cargo trucks in California are currently engaged in delivering essential goods, 38% or 30,000 vehicles could be diverted from less critical sectors of the economy in an emergency. Exhibit 6.5 estimates that 1,491 tractors and 2,815 trailers (20,000 to 40,000 pound capacity) will have to be added to the existing wholesale food distribution fleets to deliver food from risk-area warehouses to host-area evacuees. Thus, there appears to be more than enough vehicles in less critical sectors of the economy to meet food distribution needs under crisis relocation conditions. The problem under these conditions is not likely to be lack of vehicles, but rather the identification, organization, and coordination of surplus vehicles so that they are in the right place at the right time. In a separate study (Reference 20), SYSTAN has prepared a videotape and workshop guidance materials designed to encourage the transportation

EXHIBIT 6.7

RANGE OF ADDITIONAL DRIVERS AND EQUIPMENT
ASSOCIATED WITH TRANSPORTATION STRESS FACTORS



(Source: Reference 2)

industry to work with civil defense officials in planning for the emergency use of transportation equipment.

In addition to planning for the emergency use of trucks and trailers, it appears that some railcars can also be diverted from less critical uses in time of emergency.

In an earlier study (Reference 17), it was determined that 41% of all intercity rail ton-miles were accounted for by essential cargo. Each rail boxcar can carry about 1-1/2 times the volume carried by truck semi-trailers with a 40,000 pounds capacity. Southern Pacific has about 40,000 boxcars in its system, some of which could be secured to relieve transportation stress on the food distribution system.

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APPENDIX A: POPULATION

APPENDIX TABLE A-1

POPULATION DATA FOR LOS ANGELES HOSTING REGIONS UNDER NON-UNIFORM HOSTING PLAN

(Population in Thousands)

County	1975 Population	Population in High Risk Areas	Resident Population In Lower Fallout Risk Areas	Relocatees Assuming Non-Uniform Hosting Ratio	Resident & Relocatee Population
Hosting Region-LA 1					
Los Angeles	4659	4659	0	0	0
Ventura	438	374	64	538	602
Fresno	447	337	110	924	1034
Kings	68	18	50	420	470
Kern	343	242	101	848	949
Santa Barbara	281	258	23	193	216
Inyo	17	0	17	143	166
Tulare	208	0	208	1747	1955
San Luis Obispo	128	0	128	1075	1203
Totals	6589	5888	701	5888	6589
Hosting Region-LA 2					
Los Angeles	2311	2311			
Orange	1695	1695	0	0	0
Riverside	527	342	185	2237	2422
San Bernadino	698	631	67	810	877
San Diego	1572	1347	225	2722	2947
Imperial	84	35	49	592	641
Totals	6887	6361	526	6361	6887

APPENDIX TABLE A-1 (Continued)

POPULATION DATA FOR NORTHERN AND CENTRAL CALIFORNIA UNDER NON-UNIFORM HOSTING PLAN

(Population in Thousands)

County	1975 Population	Population in High Risk Areas	Resident Population In Lower Fallout Risk Areas	Relocatees Assuming Non-Uniform Hosting Ratio	Resident & Relocatee Population
Hosting Region-Northern					
Modoc	8	0	8	0	8
Siskiyou	35	0	35	0	35
Del Norte	16	0	16	0	16
Humboldt	104	0	104	0	104
Trinity	10	0	10	0	10
Shasta	88	0	88	0	88
Plumas	14	0	14	0	14
Tehama	32	0	32	0	32
Lassen	19	4	15	4	19
Totals	226	4	222	4	226
Hosting Region-Central					
Alpine	1	0	1	0	1
Mono	7	0	7	0	7
Tuolumne	26	0	26	0	26
Mariposa	8	0	8	0	8
Madera	46	0	46	0	46
San Benito	20	0	20	0	20
Merced	117	71	46	71	117
Monterey	266	208	58	208	266
Totals	491	279	212	279	491

APPENDIX TABLE A-1 (Continued)

POPULATION DATA FOR SAN FRANCISCO HOSTING REGION UNDER NON-UNIFORM HOSTING PLAN

(Population in Thousands)

County	1975 Population	Population in High Risk Areas	Resident Population In Lower Fallout Risk Areas	Relocatees Assuming Non-Uniform Hosting Ratio	Resident & Relocatee Population
Hosting Region-S.F.					
San Francisco	668	668	0	0	0
San Mateo	571	571	0	0	0
Santa Clara	1190	1159	31	208	239
Alameda	1087	1087	0	0	0
Contra Costa	585	585	0	0	0
San Joaquin	302	222	80	537	617
Sacramento	687	686	1	7	8
Placer	90	47	43	289	332
Yolo	102	102	0	0	0
Solano	184	184	0	0	0
Napa	89	89	0	0	0
Sonoma	243	154	89	598	687
Marin	214	214	0	0	0
Yuba	45	34	11	74	85
Stanislaus	212	137	75	504	579
Mendocino	58	0	58	390	448
Lake	26	0	26	175	201
Glenn	19	0	19	128	147
Colusa	13	0	13	87	100
Butte	117	0	117	786	903
Sierra	3	0	3	20	23
Nevada	34	0	34	228	262
Sutter	46	0	46	309	355
El Dorado	59	0	59	396	455
Amador	15	0	15	101	116
Calaveras	16	0	16	107	123
Santa Cruz	148	0	148	995	1143
Totals	6823	5939	884	5939	6823

APPENDIX A-2 : POPULATION DATA FOR NON-UNIFORM-TRANSPORT CAPACITY HOSTING PLAN
(80% evacuation)

COUNTY	1975 POPULATION (1000)	POPULATION IN HIGH RISK AREAS (1000)	RESIDENT POPULATION IN LOWER FALLOUT RISK AREAS (1000)	RESIDENT & RELOCATEE POPULATION (1000)
SAN FRANCISCO CONGLOMERATE:				
San Francisco	668	668	0	134
San Mateo	571	571	0	114
Santa Clara	1,190	1,159	31	481
Alameda	1,087	1,087	0	167
Contra Costa	585	585	0	117
San Joaquin	302	222	80	94
Sacramento	687	686	1	135
Placer	90	47	43	203
Yolo	102	102	0	123
Solano	184	184	0	34
Napa	89	89	0	202
Sonoma	243	154	89	332
Marin	214	214	0	98
LOS ANGELES CONGLOMERATE:				
Los Angeles	6,970	6,970	0	1,394
Orange	1,695	1,695	0	339
Riverside	527	342	185	3,553
San Bernardino	698	631	67	1,458
Ventura	438	374	64	161
SAN DIEGO CONGLOMERATE:				
San Diego	1,572	1,347	225	1,700
Imperial	84	35	49	84
INDIVIDUAL AREAS:				
Lassen	19	4	15	20
Yuba	45	34	11	17
Stanislaus	212	137	75	212
Monterey	266	208	58	456
Merced	117	71	46	102
Fresno	447	337	110	680
Kings	68	18	50	64
Kern	343	242	101	1,105
Santa Barbara	281	258	23	73
TOTAL	19,794	18,471	1,323	13,652

APPENDIX A-2 (Continued)

POPULATION DATA FOR NON-UNIFORM-TRANSPORT CAPACITY HOSTING PLAN

(Population in Thousands)

COUNTY	1975 POPULATION	RELOCATEES ASSUMING NON-UNIFORM HOSTING	RESIDENT & RELOCATEE POPULATION
NORTHERN CALIFORNIA:			
Modoc	8	0	8
Siskiyou	35	0	35
Del Norte	16	0	16
Humboldt	104	0	104
Trinity	10	0	10
Shasta	88	0	88
Plumas	14	49	63
Tehama	32	0	32
SAN FRANCISCO PROXIMITY:			
Mendocino	58	0	58
Lake	26	306	332
Glenn	19	207	226
Colusa	13	154	167
Butte	117	103	220
Sierra	3	9	12
Nevada	34	119	153
Sutter	46	260	306
El Dorado	59	141	200
Amador	15	240	255
Calaveras	16	256	272
Santa Cruz	148	1,043	1,191
CENTRAL CALIFORNIA:			
Alpine	1	0	1
Mono	7	0	7
Tuolumne	26	44	70
Mariposa	8	8	16
Madera	46	394	440
San Benito	20	15	35
LOS ANGELES PROXIMITY:			
Inyo	17	65	82
Tulare	208	1,973	2,181
San Luis Obispo	128	756	884
TOTAL:	1,322	6,142	7,464

APPENDIX B: FOOD PRODUCTION, PROCESSING AND DISTRIBUTION

APPENDIX TABLE B-1

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION OF MEAT IN CALIFORNIA

Consumption and Sources of Supply	Imports	From Out-of-State	California Production	Total California Consumption
Volume in Short Tons				
Liveweight	275,000	2,936,000	1,364,000	4,575,000
Dressed Weight	165,000[c]	1,762,000[e]	818,000	2,745,000[b]
Retail Weight	132,000	1,410,000	654,000	2,196,000[f]
Percentage Share	6%	64%	30%	100%
Meat Alternates	16,000	176,000	83,000	275,000
	148,000	1,586,000	737,000	2,471,000

Production and Distribution	California Consumption	Exports	To Other States	Total California Production
Volume in Short Tons				
Liveweight	1,364,000[d]	16,000[a]	-0- [e]	1,380,000[a]
Dressed Weight	818,000	10,000		828,000
Retail Weight	654,000	8,000		662,000
Percentage Share	99%	1%	-0-	100%
Meat Alternates	83,000	4,000	38,000	125,000
	737,000	12,000	38,000	78,000

[a] Liveweight basis, 1976. Data from Exports of Agricultural Commodities Grown or Produced in California. Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service, USDA and California Department of Food and Agriculture, Sacramento, California, April, 1978, Page 14.

[b] Dressed weight varies with each type of livestock and from year to year, but here a weighted average of 60% of liveweight is used. Retail weight is calculated at 80% of dressed weight. This data is based on information from the American Meat Institute, Washington, D.C.

[c] Based on National Food Situation, NFS-161 Economic Research Service, U.S. Department of Agriculture, September, 1977, Page 25. Imports based on 6% of available supplies (consumption).

[d] Balance

[e] This figure is net. Out-of-state shipments to California includes shipment of live animals into and out of the state. In 1977, for example, 1,722,000 head of cattle and calves were shipped into California and 343,000 were shipped out to other states. A substantial number of hogs and sheep and lambs are also shipped into California from other states. These shipments of live animals to California from other states account for about one-fifth of all California's meat consumption. In addition, a substantial quantity of dressed or halves and quarters of beef, as well as poultry, come into California from other states.

[f] Based on four pounds per capita per week. Meat alternates based on 0.5 pounds per capita per week. Source: USDA, National Food Review NFR-3, Economics, Statistics, and Cooperatives Service, USDA, Washington, D.C., June 1978, Page 54.

APPENDIX TABLE B-1 (Continued)

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION

OF EGGS IN CALIFORNIA

	Imports	From Out-of-State	California Production	Total California Consumption
Consumption and Sources of Supply				
Volume in Short Tons	-0-	-0-	379,000	379,000[b]
Percentage Share	0%	0%	100%	100%

	California Consumption	Exports	To Other States	Total California Production
Production and Distribution				
Volume in Short Tons	379,000[b]	5,000[a]	176,000[c]	560,000[a]
Percentage Share	68%	1%	31%	100%

[a] Data from Exports of Agricultural Commodities Grown or Produced in California, Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service, USDA and California Department of Agriculture, Sacramento, California, April 1978.

[b] Based on 0.69 pounds per week or 35.88 pounds per year, and the 1975 California population. See National Food Review, Economics, Statistics and Cooperatives Service, USDA, June 1978, page 54.

[c] Balance.

APPENDIX TABLE B-1 (Continued)

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION OF MILK IN CALIFORNIA

	Imports	From Out-of-State	California Production	Total California Consumption
Consumption and Sources of Supply				
Volume in Short Tons	-0-	29,000[b]	2,890,000	2,919,000[a]
Percentage Share	0%	1%	99%	100%

	California Consumption	Exports	To Other States	Total California Production
Production and Distribution				
Volume in Short Tons	2,890,000	-0-	29,000	2,919,000[a]
Percentage Share	99%	0%	1%	100%

[a] Class 1 products only (primarily fluid milk and cream). Class 1 products generally account for roughly half of the total milk produced in California. There is very little shipment of Class 1 products into or out of California, although there is some shipment of Class 4 products; milk for drying as well as some butter is shipped out of state and some hard cheeses are shipped in. Per capita consumption of Class 1 dairy products in California in 1975 was 128.6 quarts (@ 2.15 pounds per quart) or 276.49 pounds per capita. Source: McEwen, J.H., California Dairy Industry Statistics, 1976, California Crop and Livestock Reporting Service, California Department of Food and Agriculture, and USDA, Sacramento, California, 1977, page 72.

[b] Product Classes 1, 2 and 3; actual 1975 California commercial milk production was approximately 5,354,000 short tons. The 1975 per capita consumption of Class 1 products was 276.49 pounds (5.32 pounds per week). Class 1, 2 and 3 milk and milk products consumption in California was 340.2 pounds. (California Dairy Industry Statistics, 1976, California Crop and Livestock Reporting Service, USDA, and California Department of Food and Agriculture, Sacramento, 1977, pages 13 and 72.) The national average per capita consumption is 329.3 pounds. (National Food Review, NFR-3, Economics, Statistics and Cooperatives SErvice, USDA, June 1978, page 54.) In addition to the products in Class 1, 2 and 3, a substantial amount of milk goes into Class 4 products, which include hard cheeses and powdered milk. Class 1, which is primarily fluid milk, is only about 50% of total commercial milk production.

[c] California imports some cheeses (not Class 1) from abroad and brings in some from other states, while shipping some butter and powdered milk. Overall, however, there is an approximate balance between California's production and consumption of milk and other dairy products. The shipment into and out of state of Class 1 products are estimated at one percent of production on a product weight basis. Precise figures on into and out-of-state shipment are not available from California Crop and Livestock Reporting Service.

APPENDIX TABLE B-1 (Continued)

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION OF CEREALS IN CALIFORNIA

	Imports	From Out-of-State[c]	California Production	Total California Consumption[b]
Consumption and Sources of Supply				
Whole Grain Volume in Short Tons				
Rice	-0-	-0-	94,000	94,000
Wheat	-0-	1,173,000	368,000	1,541,000
Total	-0-	1,173,000	462,000	1,635,000
Flour Volume in Short Tons				
Rice	-0-	-0-	84,000	84,000
Wheat	-0-	868,000	272,000	1,140,000
Total	-0-	868,000	356,000	1,224,000
Percentage Share				
Rice	0%	0%	100%	100%
Wheat	0%	76%	24%	100%
Total	0%	71%	29%	100%

	California *Consumption*	*Exports*[a]	To Other States[c]	Total California Production[a]
Production and Distribution				
Whole Grain Volume in Short Tons				
Rice	94,000	481,000	934,000	1,509,000
Wheat	368,000	1,469,000	-0-	1,837,000
Total	462,000	1,950,000	934,000	3,346,000
Flour Volume in Short Tons				
Rice	84,000	432,000	842,000	1,358,000
Wheat	272,000	1,087,000	-0-	1,359,000
Total	356,000	1,519,000	842,000	2,717,000
Percentage Share				
Rice	6%	32%	62%	100%
Wheat	20%	80%	0%	100%
Total	13%	56%	31%	100%

[a] From Exports of Agricultural Commodities Grown or Produced in California, Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service, USDA, and California Department of Food and Agriculture, Sacramento, 1978, page 12.

[b] Consumption is based on 8 pounds of rice and 108 pounds of wheat per capita per year (National Food Review, NFR-3, Economics, Statistics, and Cooperatives Service, USDA, June 1978, page 54). Ratio of wheat retail weight (flour) to whole grain is 0.74, and for rice without husks, the ratio is estimated at 0.90.

[c] Balance.

APPENDIX B-1 (Continued)

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION

OF FRUITS AND VEGETABLES IN CALIFORNIA

	Imports	From Out-of-State	California Production	Total California Consumption
Consumption and Sources of Supply				
Volume in Short Tons	378,000[c]	221,000[d]	2,549,000[e]	3,148,000[a]
Percentage Share	12%	7%	81%	100%
	California Consumption	Exports	To Other States	Total California Production
Production and Distribution				
Volume in Short Tons	2,549,000[a]	2,144,000[b]	12,900,000[e]	17,593,000[b]
Percentage Share	15%	12%	73%	100%

[a] Based on 298.2 pounds per capita per year (5.7 pounds per week) from National Food Review, NFR-3, Economics, Statistics and Cooperatives Service, USDA, Washington, D.C., July 1978. California per capita consumption could be above the national average, but data are unavailable.

[b] From Exports of Agricultural Commodities Grown or Produced in California, Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service, USDA, California Department of Food and Agriculture, pages 12 and 14. (Production data for 1976; export data for 1976-77,)

[c] Based on National Food Situation, NSF-161, Economic Research Service, USDA, September 1977, page 25.

[d] Estimated based on interviews with chain store distribution managers and USDA Crop and Livestock Reporting Service personnel in Sacramento.

[e] Determined by difference.

APPENDIX B-1 (Continued)

ESTIMATED PRODUCTIONS, DISTRIBUTION AND CONSUMPTION
OF FOOD FATS AND OILS IN CALIFORNIA

	Imports	From Out-of-State	California Production	Total California Consumption
Consumption and Sources of Supply				
Volume in Short Tons				
Cottonseed Oil	-0-	-0-	55,000	55,000
Other Vegetable Oils	45,000[c]	274,000[d]	5,000[c]	324,000
Butter	-0-	-0-	51,000	51,000
Other Fats and Oils	10,000[c]	59,000[d]	50,000[c]	119,000
	55,000[a]	333,000	161,000	549,000[b]
Percentage Share	10%	61%	29%	100%

	California Consumption	Exports	To Other States	Total California Production
Production and Distribution				
Volume in Short Tons				
Cottonseed Oil	55,000	78,000[e]	43,000[d]	176,000[e]
Other Vegetable Oils	5,000	-0-	-0-	5,000[c]
Butter	51,000	-0-	23,000[d]	74,000[f]
Other Fats and Oils	50,000	-0-	-0-	50,000[c]
	161,000	78,000	66,000	305,000
Percentage Share	53%	26%	22%	100%

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[a] Based on data shown in National Food Situation, NFS-161, USDA, Washington, D.C., 1977, Page 25.

[b] Based on per capita consumption of one pound per capita, per week in California, as shown in National Food Review, NFR-3 Economics, Statistics, and Co-Operatives Service, U.S. Department of Agriculture, June 1978, Page 54. Individual shares of food fats and oils components are based on data on Page 25 and on Fats and Oils Situation FOS-282, USDA, Economic Research Service, Washington, D.C., April 1976, Page 13.

[c] Estimated

[d] Balance

[e] Based on Exports of Agriculture Commodities Grown or Produced in California, Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service. USDA and California Department of Food and Agriculture, 1978, Page 92.

[f] From California Dairy Industry Statistics, 1976, California Crop and Livestock Reporting Service, California Department of Food and Agriculture, Sacramento and USDA, Sacramento, California, Page 58.

APPENDIX B-1 (Continued)

ESTIMATED PRODUCTION, DISTRIBUTION AND CONSUMPTION

OF POTATOES IN CALIFORNIA

	Imports	From Out-of-State	California Production	Total California Consumption
Consumption and Sources of Supply				
Volume in Short Tons	-0-	694,000[c]	634,000	1,328,000[b]
Percentage Share	0%	52%	48%	100%

	California Consumption	Exports	To Other States	Total California Production
Production and Distribution				
Volume in Short Tons	634,000	46,000[a]	522,000[c]	1,202,000[a]
Percentage Share	53%	4%	43%	100%

[a] Based on Exports of Agricultural Commodities Grown or Produced in California, Fiscal Year 1976 and 1977, California Crop and Livestock Reporting Service, USDA and California Department of Food and Agriculture, Sacramento, 1978, page 14.

[b] Consumption based on 1975 U.S. per capita annual consumption of 125.8 pounds, from National Food Review, NFR-3, Economics, Statistics and Cooperatives Service, USDA, Washington, D.C., June 1978, page 54.

[c] The into and out-of-state figures are estimated.

APPENDIX TABLE B-2

CALIFORNIA FOOD PROCESSING ESTABLISHMENTS, RANKED BY VALUE OF SHIPMENTS, BY COUNTY

Counties	Number of Establishments	Sales ($mil)	Cumulative Sales Share ($mil)	Sales Share (%)	Cumulative Sales Share (%)
Los Angeles	773	3,697.9	3,697.9	31.4	31.4
Alameda	186	929.6	4,627.5	7.9	39.3
San Joaquin	89	647.7	5,275.2	5.5	44.8
San Francisco	166	635.8	5,911.0	5.4	50.2
Santa Clara	136	619.2	6,530.2	5.2	55.4
Stanislaus	27	608.2	7,138.4	5.2	60.6
Orange	104	536.8	7,675.2	4.6	65.2
Fresno	113	511.5	8,186.7	4.3	69.5
Sacramento	61	356.8	8,543.5	3.0	72.5
San Diego	94	352.7	8,896.2	3.0	75.5
Merced	29	328.0	9,224.2	2.8	78.3
San Mateo	54	264.3	9,488.5	2.2	80.5
Monterey	41	218.9	9,707.4	1.9	82.4
Yolo	21	202.1	9,909.5	1.7	84.1
San Bernardino	90	171.2	10,080.7	1.5	85.6
Solano	18	151.0	10,231.7	1.3	86.9
Tulare	42	117.7	10,349.4	1.0	87.9
Madera	18	111.6	10,461.0	0.9	88.8
Kings	18	101.1	10,562.1	0.9	89.7
Sonoma	67	93.9	10,656.0	0.8	90.5
Kern	40	91.6	10,747.6	0.8	91.3
Santa Barbara	23	80.8	10,828.4	0.7	92.0
Ventura	28	75.3	10,903.7	0.6	92.6
Butte	24	69.3	10,973.0	0.6	93.2
Riverside	44	61.1	11,034.1	0.5	93.7
Imperial	22	51.8	11,085.9	0.4	94.1
Napa	26	47.9	11,133.8	0.4	94.5
Sutter	11	31.5	11,165.3	0.3	94.8
Humboldt	17	29.9	11,195.2	0.2	95.0
San Benito	7	23.3	11,218.5	0.2	95.2
Contra Costa	39	*	-	-	-
All Other Counties	170	576.1	11,794.6	4.8	100.0
Total Statewide	2,594	11,794.6	11,794.6	100.0	100.0

*Withheld to avoid disclosing figures of individual firms.

(Source: Bureau of the Census, 1972 Census of Manufacturers: Volume III, Area Statistics, Tables 5 and 6, Department of Commerce, Washington, D.C.)

APPENDIX TABLE B-3

CALIFORNIA FOOD PROCESSING ESTABLISHMENTS

BY STANDARD METROPOLITAN STATISTICAL AREAS, 1972

SMSA's	Number of Establishments	Sales ($mil)	Cumulative Sales Share ($mil)	Sales Share (%)	Cumulative Sales Share (%)
Los Angeles - Long Beach	773	3,697.9	3,697.9	31.4	31.4
San Francisco - Oakland	449	2,134.7	5,832.6	18.1	49.5
Stockton	89	647.7	6,480.3	5.5	55.0
San Jose	136	619.2	7,099.5	5.2	60.2
Modesto	27	608.2	7,707.7	5.2	65.4
Sacramento	83	559.1	8,266.8	4.7	70.1
Anaheim - Santa Ana - Garden Grove	104	536.8	8,803.6	4.6	74.7
Fresno	113	511.5	9,315.1	4.3	79.0
San Diego	94	352.7	9,667.8	3.0	82.0
Riverside - San Bernardino	134	232.2	9,900.0	2.0	84.0
Salinas - Seaside - Monterey	41	218.9	10,118.9	1.9	85.9
Vallejo - Fairfield - Napa	44	198.9	10,317.8	1.7	87.6
Santa Cruz	33	157.8	10,475.6	1.3	88.9
Santa Rosa	67	93.9	10,569.5	0.8	89.7
Bakersfield	40	91.6	10,661.1	0.8	90.5
Santa Barbara - Santa Maria - Lompoc	23	80.8	10,741.9	0.7	91.2
Oxnard - Simi Valley - Ventura	28	75.3	10,817.2	0.6	91.8
Outside SMSA's	316	977.4	11,794.6	8.2	100.0
Total Statewide	2,594	11,794.6	11,794.6	100.0	100.0

(Source: Bureau of the Census, 1972 Census of Manufacturers: Volume III, Area Statistics, Tables 5 and 6, Department of Commerce, Washington, D.C.)

APPENDIX TABLE B-4: CALIFORNIA FOOD PROCESSING ESTABLISHMENTS, BY COUNTY, 1972

(Showing Estimated Share of Value of Shipments in Risk and Host Areas)

Counties	Number of Establishments	Value of Shipments ($mil)	Percentage of Value of Shipments			Actual Value of Shipments ($mil)		
			Risk	Host	Total	Risk	Host	Total
Alameda	186	929.6	100	0	100	929.6	0	929.6
Butte	24	69.3	0	100	100	0	69.3	69.3
Contra Costa	35	*	-	-	-	-	-	*
Fresno	113	511.5	70	30	100	358.1	153.4	511.5
Humboldt	17	29.9	0	100	100	0	29.9	29.9
Imperial	22	51.8	50	50	100	25.9	25.9	51.8
Kern	40	91.6	70	30	100	64.1	27.5	91.6
Kings	18	101.1	15	85	100	15.2	85.9	101.1
Los Angeles	773	3,697.9	100	0	100	3,697.9	0	3,697.9
Madera	18	111.6	0	100	100	0	111.6	111.6
Merced	29	328.0	18	82	100	59.0	269.0	328.0
Monterey	41	218.9	70	30	100	153.2	65.7	218.9
Napa	26	47.9	100	0	100	47.9	0	47.9
Orange	104	536.8	100	0	100	536.8	0	536.8
Riverside	44	61.1	70	30	100	42.8	18.3	61.1
Sacramento	61	356.8	90	10	100	321.1	35.7	356.8
San Benito	7	23.3	0	100	100	0	23.3	23.3
San Bernardino	90	171.2	70	30	100	119.8	51.4	171.2
San Diego	94	352.7	80	20	100	70.5	282.2	352.7
San Francisco	166	635.8	100	0	100	635.8	0	635.8
San Joaquin	89	647.7	70	30	100	453.4	194.3	647.7
San Mateo	54	264.3	100	0	100	264.3	0	264.3
Santa Barbara	23	80.8	50	50	100	40.4	40.4	80.8
Santa Clara	136	619.2	90	10	100	557.3	61.9	619.2
Solano	18	151.0	100	0	100	151.0	0	151.0
Sonoma	67	93.9	75	25	100	70.4	23.5	93.9
Stanislaus	27	608.2	70	30	100	425.7	182.5	608.2
Sutter	11	31.5	0	100	100	0	31.5	31.5
Tulare	42	117.7	0	100	100	0	117.7	117.7
Venture	28	75.3	40	60	100	30.1	45.2	75.3
Yolo	21	202.1	100	0	100	202.1	0	202.1
All Other Counties	170	576.1	5	95	100	28.8	547.3	576.1
Total Statewide	2,594	11,794.6	79	21	100	9,301.2	2,493.4	11,794.6

* Withheld to avoid disclosing figures of individual firms.

(Source: Bureau of the Census, 1972 Census of Manufacturers: Volume III, Area Statistics, Tables 5 and 6, Department of Commerce, Washington, D.C., and SYSTAN analysis.)

APPENDIX TABLE B-5

CALIFORNIA GROCERY AND RELATED PRODUCTS WHOLESALE ESTABLISHMENTS

RANKED BY SALES ACCORDING TO STANDARD METROPOLITAN STATISTICAL AREAS, 1972

SMSA's	Number of Establishments	Sales ($1000)	Cumulative Sales Share ($1000)	Sales Share (%)	Cumulative Sales Share (%)
Los Angeles - Long Beach	1,332	4,984,248	4,984,248	37.7	37.7
San Francisco - Oakland	779	3,821,898	8,806,146	28.9	66.6
Anaheim - Santa Ana - Garden Grove	165	616,029	9,422,175	4.6	71.2
San Jose	150	511,015	9,933,190	3.9	75.1
Riverside - San Bernardino	204	471,396	10,404,586	3.6	78.7
San Diego	183	443,478	10,848,064	3.4	82.1
Fresno	159	432,598	11,280,662	3.3	85.4
Sacramento	139	317,001	11,597,663	2.4	87.8
Oxnard - Simi Valley - Ventura	62	213,532	11,811,195	1.6	89.4
Salinas - Seaside - Monterey	99	180,110	11,991,305	1.4	90.8
Stockton	95	173,433	12,164,738	1.3	92.1
Modesto	47	110,669	12,275,407	0.8	92.9
Santa Rosa	53	109,009	12,384,416	0.8	93.7
Bakersfield	79	106,246	12,490,662	0.8	94.5
Santa Barbara - Santa Maria - Lompoc	52	91,066	12,581,728	0.7	95.2
Santa Cruz	48	47,706	12,629,434	0.4	95.6
Vallejo - Fairfield - Napa	22	20,362	12,649,796	0.2	95.8
Outside SMSA's	361	553,560	13,203,356	4.2	100.0
Total Statewide	4,029	13,203,356	13,203,356	100.0	100.0

(Source: Bureau of the Census, 1972 Census of Wholesale Trade: Volume II, Area Statistics, Tables 2 and 3, Department of Commerce, Washington, D.C.)

APPENDIX TABLE B-6

GROCERY AND RELATED PRODUCTS WHOLESALE ESTABLISHMENTS

FOR SOUTHERN, NORTHERN AND CENTRAL CALIFORNIA, 1972

(Percentage Share According to Sales Volume by County)

Counties	Sales Share (%)	Population (000)	Population Percentage
Southern			
Los Angeles	37.7	6970	33.0
Orange	4.7	1695	8.0
San Diego	3.4	1572	7.4
Fresno	3.3	444	2.1
Riverside	2.6	527	2.5
Tulare	2.3	208	1.0
Ventura	1.6	438	2.1
San Bernardino	1.0	698	3.3
Kern	0.8	343	1.6
Santa Barbara	0.7	281	1.3
Others**	1.2	297	1.4
Subtotal	59.3	13473	63.7
Northern & Central			
San Francisco	13.5	668	3.2
Alameda	7.5	1087	5.1
San Mateo	5.3	571	2.7
Santa Clara	3.9	1190	5.6
Sacramento	2.2	687	3.3
Contra Costa	1.9	585	2.8
Monterey	1.4	266	1.3
San Joaquin	1.3	302	1.4
Stanislaus	0.8	212	1.0
Sonoma	0.8	243	1.2
Marin	0.7	214	1.0
Placer-Yolo	0.2	192	0.9
Napa-Solano	0.2	273	1.3
Other	1.0	1153	5.5
Subtotal	40.7	7643	36.3
TOTAL	100.0	21,116	100.0

*Inyo 17; San Luis Obispo 128; Kings 68; Imperial 84.

Source: Bureau of the Census, 1972 Census of Wholesale Trade; Volume II, Area Statistics, Table 2, U.S. Department of Commerce, Washington, D.C.

APPENDIX TABLE B-7 : CALIFORNIA GROCERY AND RELATED PRODUCTS WHOLESALE ESTABLISHMENTS, BY COUNTY, RANKED BY SALES

County	Number	Sales ($1000)	Cum. Sales Share ($1000)	Sales Share (%)	Cum. Sales Share (%)
1. Los Angeles	1332	4,984,248	4,984,248	37.7	37.7
2. San Francisco	349	1,781,779	6,766,027	13.5	51.2
3. Alameda	209	991,159	7,757,186	7.5	58.7
4. San Mateo	142	704,595	8,461,781	5.3	64.0
5. Orange	165	616,029	9,077,810	4.7	68.7
6. Santa Clara	150	511,015	9,588,825	3.9	72.6
7. San Diego	183	443,478	10,032,303	3.4	76.0
8. Fresno	159	432,598	10,464,901	3.3	79.3
9. Riverside	85	336,030	10,800,931	2.6	81.9
10. Tulare	94	305,865	11,106,796	2.3	84.2
11. Sacramento	115	291,167	11,397,963	2.2	86.4
12. Contra Costa	49	248,881	11,646,844	1.9	88.3
13. Ventura	62	213,532	11,860,376	1.6	89.9
14. Monterey	99	180,110	12,040,486	1.4	91.3
15. San Joaquin	95	173,433	12,213,919	1.3	96.2
16. San Bernardino	119	135,366	12,349,285	1.0	93.6
17. Stanislaus	47	110,669	12,459,954	0.8	94.4
18. Sonoma	53	109,009	12,568,963	0.8	95.2
19. Kern	79	106,246	12,575,209	0.8	96.0
20. Marin	30	95,484	12,770,693	0.7	96.7
21. Santa Barbara	52	91,066	12,861,759	0.7	97.4
22. Placer-Yolo	24	25,834	12,887,593	0.2	97.6
23. Napa-Solano	22	20,362	12,907,955	0.2	97.8
All Other Counties	315	295,401	13,203,356	2.2	100.0
TOTAL STATEWIDE	4029	13,203,356	13,203,356	100.0	100.0

APPENDIX TABLE B-8

CALIFORNIA GROCERY AND RELATED PRODUCTS WHOLESALE ESTABLISHMENTS, BY COUNTY, 1972

(Showing Estimated Share of Sales Volume in Risk and Host Areas)

Counties	Number of Establishments	Percentage of Sales Volume		Sales Volume ($1000)		
		Host	Risk	Risk	Host	Total
Alameda	209	100	0	991,159	0	991,159
Contra Costa	49	100	0	248,881	0	248,881
Fresno	159	85	15	367,708	64,890	432,598
Kern	79	85	15	90,309	15,937	106,246
Los Angeles	1332	100	0	4,984,248	0	4,984,248
Marin	30	100	0	95,484	0	95,484
Monterey	99	80	20	144,088	36,022	180,110
Orange	165	100	0	616,029	0	616,029
Riverside	85	85	15	285,626	50,404	336,030
Sacramento	115	90	10	262,050	29,117	291,167
San Bernardino	119	85	15	115,061	20,305	135,366
San Diego	183	85	15	376,956	66,522	443,478
San Francisco	349	100	0	1,781,779	0	1,781,779
San Joaquin	95	80	20	138,746	34,687	173,433
San Mateo	142	100	0	704,595	0	704,595
Santa Barbara	52	85	15	77,406	13,660	91,066
Santa Clara	150	100	0	511,015	0	511,015
Sonoma	53	85	15	92,658	16,351	109,009
Stanislaus	47	80	20	88,535	22,134	110,669
Tulare	94	0	100	305,865	0	305,865
Venture	62	40	60	85,413	128,119	213,532
Placer-Yolo	24	85	15	21,959	3,875	25,834
Napa-Solano	22	100	0	20,362	0	20,362
All Other Counties	315	5	95	14,770	280,631	295,401
Total Statewide	4029	94.07%	5.93%	12,420,702	782,654	13,203,356

(Source: Bureau of the Census, 1972 Census of Wholesale Trade: Volume II, Area Statistics, Tables 2 and 3, Department of Commerce, Washington, D.C. and SYSTAN analysis.)

Appendix Table B-9

CALIFORNIA COUNTIES WITH 500 RETAIL ESTABLISHMENTS OR MORE - 1972

County	FOOD STORES			RESTAURANTS		Total Restaurant and Food Store Sales ($000)	Restaurant Sales as % of Food Store and Restaurant Total
	Number	Sales ($000)	Sales Per Store ($000)	Number	Sales ($000)		
Alameda	981	553,014	564	1,348	178,813	731,827	24.4
Butte	140	58,762	420	157	14,899	73.661	25.4
Contra Costa	465	315,664	679	561	76,379	392,043	19.5
El Dorado	68	32,150	473	117	12,280	44,430	27.6
Fresno	515	208,876	406	600	64,465	273,341	23.6
Humboldt	145	55,120	380	166	14,837	69,957	21.2
Imperial	122	53,047	435	170	12,075	65,122	18.5
Kern	345	156,655	454	510	57,402	214,057	26.8
Kings	67	27,156	405	91	7,149	34,305	20.8
Los Angeles	5,703	3,643,167	639	9,514	1,451,589	5,094,756	28.5
Marin	208	138,281	665	260	37,982	176,263	21.5
Mendocino	82	32,964	402	102	9,360	42,324	22.1
Merced	111	41,511	374	146	14,984	56,495	26.5
Monterey	258	123,130	477	396	50,934	174,064	29.3
Napa	86	44,870	522	99	11,035	55,905	19.7
Orange	1,100	788,328	717	1,812	352,605	1,140,933	30.9
Placer	110	46,087	419	171	16,805	62,892	26.7
Riverside	461	258,012	560	658	90,723	348,735	26.0
Sacramento	616	358,245	582	1,160	127,209	485,634	26.2
San Bernardino	649	333,527	514	853	102,657	436,184	23.5
San Diego	1,153	645,245	560	1,520	248,929	894,174	27.8
San Francisco	1,270	401,279	316	1,605	271,369	672,648	40.3
San Joaquin	335	138,576	414	412	44,331	182,907	24.2
San Luis Obispo	145	53,311	368	195	22,207	75,518	29.4
San Mateo	546	330,369	605	615	109,194	439,563	24.8
Santa Barbara	263	134,180	510	417	62,112	196,292	31.6
Santa Clara	968	613,662	634	1,138	178,127	809,789	22.0
Santa Cruz	183	82,942	453	266	29,030	111,972	25.9
Shasta	115	50,845	422	134	13,879	64,724	21.4
Solano	141	81,967	581	199	36,795	118,762	31.0
Sonoma	289	136,850	474	339	32,981	169,831	19.4
Stanislaus	241	112,403	466	265	25,407	137,810	22.6
Tulare	286	97,627	341	290	25,158	122,785	20.5
Ventura	291	198,820	683	425	56,253	255,073	22.1
Yolo	73	49,543	679	114	14,238	63,781	22.3
Areas Outside SMSA	1,988	758,170		2,417	216,037	974,207	22.2
State	19,238	10,652,042	554	27,289	3,920,109	14,572,151	26.9

(Source: U.S. Department of Commerce, Bureau of the Census, 1972 Census of Retail Trade, Area Statistics (RC72-A-5), Washington, D.C.)

APPENDIX C: SUMMARY OF WHOLESALE/RETAIL DISTRIBUTION PATTERNS

UNIFORM HOSTING ALLOCATION: SHIPMENTS FROM RISK AREA WAREHOUSES

APPENDIX C: SUMMARY OF WHOLESALE/RETAIL DISTRIBUTION PATTERNS

UNIFORM HOSTING ALLOCATION: SHIPMENTS FROM RISK AREA WAREHOUSES

DISTRIBUTION CENTER	RELOCATION SHIPMENTS				TRANSPORTATION STRESS FACTORS	ESTIMATED ADDITIONAL RESOURCE REQUIREMENTS		
	TO STORES		TO MASS FEEDING CENTERS					
	SHIPPING LEVEL FACTOR	COUNTY	TONS PER WEEK	COUNTY		TRACTORS	TRAILERS	DRIVERS
United Grocers, Fresno	2.7	Fresno	-	-	1.193	-	-	-
	2.7	Madera						
	2.7	Mariposa						
	2.7	Merced						
	2.7	San Luis Obispo°						
United Grocers, Richmond	2.7	Calaveras*	-	-	2.733	23	25	74
	2.7	Humboldt*						
	2.7	Kern*						
	2.7	Kings*						
	2.7	Nevada*						
	2.7	Placer*						
	2.7	Plumas*°						
	2.7	Sierra*						
	2.7	Sutter*						
	2.7	Tulare*						
	2.7	Amador						
	2.7	Lake						
	2.7	Mendocino						
	2.7	Monterey						
	2.7	San Benito						
	2.7	San Joaquin						
	2.7	San Luis Obispo°						
	2.7	Santa Clara						
	2.7	Santa Cruz						
	2.7	Sonoma						
	2.7	Tuolumne						
	2.7	Yuba						
United Grocers, Sacramento	2.7	Butte	-	-	1.626	-	-	5
	2.7	Colusa						
	2.7	El Dorado						
	2.7	Glenn						
	2.7	Lassen						
	2.7	Modoc						
	2.7	Mono						
	2.7	Plumas°						
	2.7	Shasta						
	2.7	Siskiyou						
	2.7	Stanislaus						
	2.7	Tehama						
	2.7	Trinity						
Market Wholesalers, Sacramento	1.7	Amador	-	-	1.740	-	-	-
	1.7	Butte						
	1.7	Calaveras						
	1.7	Colusa						
	1.7	El Dorado						
	1.7	Nevada						
	1.7	Placer						
	1.7	Plumas						
	1.7	San Joaquin						
	1.7	Sierra						
	1.7	Stanislaus						
	1.7	Sutter°						
	1.7	Tulare°						
	1.7	Tuolumne						
	1.7	Yuba						
Market Wholesalers, Fresno	1.7	Fresno	-	-	1.162	-	-	-
	1.7	Kern						
	1.7	Kings						
	1.7	San Luis Obispo						
	1.7	Tulare°						

* indicates a county which is normally served by a different warehouse of the same firm.

° indicates a county which is partially served by a different warehouse of the same firm.

APPENDIX C (continued)

DISTRIBUTION CENTER	RELOCATION SHIPMENTS				TRANSPORTATION STRESS FACTORS	ESTIMATED ADDITIONAL RESOURCE REQUIREMENTS		
	TO STORES		TO MASS FEEDING CENTERS					
	SHIPPING LEVEL FACTOR	COUNTY	TONS PER WEEK	COUNTY		TRACTORS	TRAILERS	DRIVERS
Market Wholesalers, Santa Rosa	1.7	Lake	-	-	3.434	9	9	19
	1.7	Mariposa						
	1.7	Mendocino						
	1.7	Merced						
	1.7	Shasta°						
	1.7	Siskiyou						
	1.7	Sonoma						
	1.7	Trinity						
Market Wholesalers, Redding	1.7	Del Norte	-	-	1.106	-	-	-
	1.7	Glenn						
	1.7	Humboldt						
	1.7	Lassen						
	1.7	Modoc						
	1.7	Shasta°						
	1.7	Sutter°						
	1.7	Tehama						
Safeway, Sacramento	5.4	Amador	-	-	0.919	-	-	-
	5.4	Butte						
	5.4	El Dorado³						
	5.4	Fresno						
	5.4	Merced						
	5.4	Stanislaus						
	5.4	Inyo*						
	5.4	Mono*						
Safeway, Richmond	5.4	Calaveras*°	-	-	2.092	-	-	142
	5.4	El Dorado*°						
	5.4	Kings*						
	5.4	Plumas*						
	5.4	Shasta*						
	5.4	Tehama*						
	5.4	Del Norte						
	5.4	Humboldt						
	5.4	Lake						
	5.4	Mendocino						
	5.4	Monterey						
	5.4	Santa Clara						
	5.4	Santa Cruz						
	5.4	Sonoma						
Safeway, Santa Fe	5.4	Calaveras*°	-	-	3.758	194	389	530
	5.4	Glenn*						
	5.4	Lassen*						
	5.4	Nevada*						
	5.4	Placer*						
	5.4	San Diego*°						
	5.4	San Joaquin*						
	5.4	Siskiyou*						
	5.4	Sutter*						
	5.4	Tulare*						
	5.4	Tuolumne*						
	5.4	Kern						
	5.4	Riverside						
	5.4	San Bernardino						
	5.4	Santa Barbara						
	5.4	Ventura						
Safeway, San Diego	5.4	Imperial	-	-	1.449	-	-	-
	5.4	San Diego³						

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³ indicates a county which is partially served by a different warehouse of the same firm.

APPENDIX C (continued)

DISTRIBUTION CENTER	RELOCATION SHIPMENTS				TRANSPORTATION STRESS FACTORS	ESTIMATED ADDITIONAL RESOURCE REQUIREMENTS		
	TO STORES		TO MASS FEEDING CENTERS					
	SHIPPING LEVEL FACTOR	COUNTY	TONS PER WEEK	COUNTY		TRACTORS	TRAILERS	DRIVERS
Vons, Los Angeles	8.0 8.0 8.0 8.0	Riverside San Bernardino San Diego Santa Barbara	3000	Kern	1.727	-	-	26
Alpha Beta, La Habra	8.0 8.0 8.0 8.0 8.0	Tulare *° Riverside San Bernardino San Diego Ventura	3900 4200	Riverside San Diego	1.989	-	-	80
Alpha Beta, Milpitas	8.0 8.0 8.0 8.0 8.0	Tulare° San Benito San Joaquin Santa Clara Santa Cruz	3200	San Luis Obispo	1.242	-	-	16
Market Basket, Los Angeles			500 1300 3600	Inyo Kern San Luis Obispo	7.390	95	239	255
Fleming Foods, Fremont	6.6 6.6 6.6 6.6 6.6	Merced San Joaquin Santa Cruz Sonoma Stanislaus	-	-	1.348	-	-	-
Ralph's, Compton			6000 2900 800 800 400 2700 1700	Butte El Dorado Lassen Plumas San Joaquin Shasta Tehama	5.738	196	579	480
Certified Foods, Los Angeles	8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0 8.0	Fresno Imperial Inyo Kern Mono Riverside San Bernardino San Diego San Luis Obispo Santa Barbara Tulare Ventura	600 500 3400 1700	San Luis Obispo Santa Barbara Tulare Ventura	2.547	67	151	265
Lucky's, Buena Park	8.0 8.0 8.0 8.0 8.0 8.0	Riverside San Bernardino Ventura Fresno*° San Joaquin* Sonoma*	1100 1000 1800 100 600 1700 900 5400 1900 1800 2600 600	Glenn Imperial Monterey Riverside San Benito San Bernardino Santa Clara Santa Cruz Shasta Siskiyou Sutter Trinity	12.326	2203	4566	4629

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APPENDIX C (continued)

DISTRIBUTION CENTER	RELOCATION SHIPMENTS				TRANSPORTATION STRESS FACTORS	ESTIMATED ADDITIONAL RESOURCE REQUIREMENTS		
	TO STORES		TO MASS FEEDING CENTERS					
	SHIPPING LEVEL FACTOR	COUNTY	TONS PER WEEK	COUNTY		TRACTORS	TRAILERS	DRIVERS
Lucky's, Vacaville	8.0	Fresno*	800	Calaveras	2.624	75	150	362
	8.0	Madera	700	Del Norte				
	8.0	Monterey	4600	Humboldt				
	8.0	Santa Clara	1300	Lake				
	8.0	Stanislaus	2900	Mendocino				
			500	Modoc				
			200	Mono				
			200	Nevada				
			30	Sacramento				
			3300	Sonoma				
			700	Yuba				
Others, Oakland	8.0	Various	19019	Various	1.380	-	-	-
Others, Los Angeles	8.0	Various	24216	Various	3.724	258	385	700
Restaurant & Institutional Suppliers, Oakland	5.0	Various	4800	Fresno	1.350	-	-	-
			2700	Kings				
			500	Mariposa				
			2300	Merced				
			2800	Stanislaus				
Restaurant & Institutional Suppliers, Los Angeles	5.0	Various	30	Alpine	4.236	620	929	1560
			700	Amador				
			800	Colusa				
			900	Fresno				
			1900	Madera				
			1400	Nevada				
			2100	Placer				
			2400	San Joaquin				
			200	Sierra				
			4800	Tulare				
			1300	Tuolumne				
TOTAL					2.912	3820	7422	9143

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' indicates a county which is partially served by a different warehouse of the same firm.

NOTE: In the shipments shown above, it was assumed that grocery chains shipped only to their own stores. However, limited inter-company transfer results in higher store throughput as follows: (1) Ralph's ships to Safeway stores, increasing the Safeway shipping level factor to 7.5; and (2) Lucky warehouses at Vallejo and Buena Park ship to United Grocers, increasing the United Grocers shipping level factor to 8.0.

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FOOD SYSTEM SUPPORT OF THE RELOCATION STRATEGY IN CALIFORNIA, by Arthur W. Simpson and John W. Billheimer, September 1980, Contract DCPA01-78-C-0220, Work Unit 2313F.

The report traces the existing patterns of food distribution in California; develops and analyzes alternative strategies for redirecting the existing food distribution system to support the relocated population; investigates the transportation requirements imposed by distribution changes; drafts prototype plans for redirecting the state food distribution network in an emergency; and develops appropriate guidelines for the use of Nuclear Civil Protection planners and local officials.

Although roughly 85% of California's extensive agricultural lands are removed from direct threat of nuclear attack, only 21% of the state's food processing capacity is located in unthreatened areas. Food wholesalers, which carry between two and three weeks of food stocks, are the most vulnerable element of the distribution chain with only 6% of these stocks likely to survive a nuclear attack undamaged. Retail grocers, with one to three weeks of inventory, are distributed in proportion to the population itself, with roughly 18% in areas free from blast effects.

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