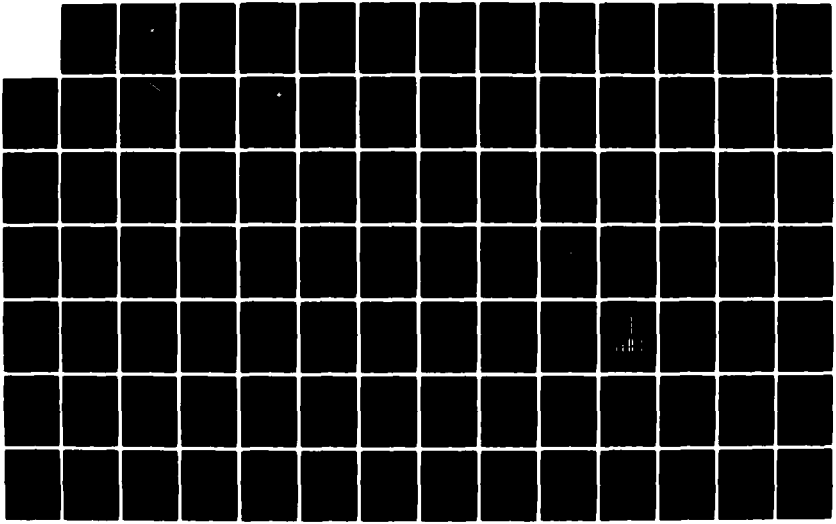
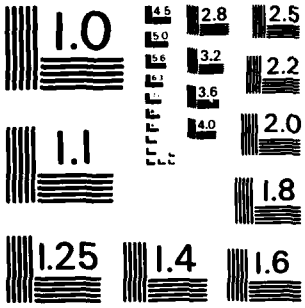
AD-A132 784 NAVY RESALE SERVICES AND SUPPORT OFFICE CONSOLIDATION AND TRANSPORTATION PLAN(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA R W GORRIE ET AL. JUN 83 1/2

UNCLASSIFIED F/G 15/5 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AD-A132 789

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

NAVY RESALE SERVICES AND
SUPPORT OFFICE CONSOLIDATION AND
TRANSPORTATION PLAN

by

Roland Wil Gorrie
and
David Robert Maddocks

June 1983

Thesis Advisor: Dan C. Boger

Approved for public release; distribution unlimited.

DTIC FILE COPY

DTIC
ELECTE
SEP 21 1983
D
E

83 09 21 060

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-A132	3. RECIPIENT'S CATALOG NUMBER 784
4. TITLE (and Subtitle) Navy Resale Services and Support Office Consolidation and Transportation Plan		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis June 1983
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Roland Wil Gorrie and David Robert Maddocks		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE June 1983
		13. NUMBER OF PAGES 118
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report)
		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

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

Freight consolidation, rate cross-subsidization, Navy resale system trucking, handling time, transit time, trailer, common carrier, contract carrier, organic government truck fleet, Navy Exchange, commissary, intercity, intracity.

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

This study delineates material consolidation and transportation options available to the Navy Resale Services and Support Office, San Diego, California. The commodities involved are Navy Exchange and Commissary resale merchandise. The discussion includes receipt from manufacturer or distributor, consolidation (if applicable), delivery to the warehouse and distribution to the retail outlets. Quantitative and qualitative aspects of commercial versus government operated facilities, equipment and personnel

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S/N 0102-LF-014-6601

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

are explored. Consideration is given to combinations of the two modes for potential economies. specific vehicle and driver scheduling requirements are derived from the known volume of merchandise to be handled.

Accession For
A

Approved for public release; distribution unlimited.

Navy Resale Services and Support Office Consolidation and Transportation Plan

by

Roland Wil Gorrie
Lieutenant Commander, Supply Corps, United States Navy
B.A., California State University Long Beach, 1973

and

David Robert Maddocks
Lieutenant Commander, Supply Corps, United States Navy
B.A., St. Mary's College, 1974

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
June 1983

Authors: Roland W. Gorrie

David R. Maddocks

Approved by: Dan C Boger
Thesis Advisor

Second Reader

Chairman, Department of Administrative Sciences

Dean of Information and Policy Sciences

ABSTRACT

This study delineates material consolidation and transportation options available to the Navy Resale Services and Support Office, San Diego, California. The commodities involved are Navy Exchange and Commissary resale merchandise. The discussion includes receipt from manufacturer or distributor, consolidation (if applicable), delivery to the warehouse and distribution to the retail outlets. Quantitative and qualitative aspects of commercial versus government operated facilities, equipment and personnel are explored. Consideration is given to combinations of the two modes for potential economies. Specific vehicle and driver scheduling requirements are derived from the known volume of merchandise to be handled.

TABLE OF CONTENTS

I. INTRODUCTION 11

A. OVERVIEW 11

B. GOALS 13

C. METHODOLOGY 15

II. CONSOLIDATION OF MERCHANDISE 18

A. INTRODUCTION 18

B. CURRENT MODE OF OPERATION 20

C. ALTERNATIVES 21

1. Alternative One (Commercial Consolidation) 21

2. Alternative Two (NRSSO Consolidation) 22

D. SENSITIVITY ANALYSIS 25

E. SENSITIVITY ANALYSIS RESULTS 26

1. Commercial and NRSSO Consolidation Analysis 26

2. A Thirty Percent Increase in Commercial Rates 32

F. CONCLUSION 33

III. INTERCITY TRANSPORTATION 35

A. INTRODUCTION 35

B. DESCRIPTION OF ALTERNATIVES ANALYZED 36

1. Alternative One (Current Operations) 36

2. Alternative Two (Total Commercial) 36

3. Alternative Three (Total NRSSO) 37

4. Alternative Four (Commercial, No Consolidation) 38

5. Alternative Five (Commercial, Hourly Rate) 38

C. COSTING ANALYSIS..... 38

1. Alternative One (Current Operations)..... 38

2. Alternative Two (Total Commercial)..... 40

3. Alternative Three (Total NRSSO)..... 43

4. Alternative Four (Commercial, No Consolidation)..... 45

5. Alternative Five (Commercial Hourly Rate)..... 47

D. COST ANALYSIS QUALIFYING FACTORS..... 50

E. SENSITIVITY ANALYSIS..... 51

F. CONCLUSION..... 55

IV. INTERCITY CONSOLIDATION AND DELIVERY SOLUTIONS..... 57

A. INTRODUCTION..... 57

B. COSTING OUT ALTERNATIVES..... 58

1. Alternative One..... 58

2. Alternative Two..... 59

3. Alternative Three..... 60

4. Alternative Four..... 60

5. Alternative Five..... 61

6. Alternative Six..... 61

7. Alternative Seven..... 62

8. Alternative Eight..... 62

9. Alternative Nine..... 62

C. ANALYSIS OF ALTERNATIVES..... 63

D. CONCLUSION..... 66

V. INTRACITY NAVY EXCHANGE TRANSPORTATION..... 68

A. BACKGROUND..... 68

B. MODES OF DELIVERY..... 69

C. COSTING METHODOLOGY..... 72

D. TRANSPORTATION ALTERNATIVE COSTS..... 75

E. SCHEDULING..... 82

F. CONCLUSION..... 87

VI. COMMISSARY TRANSPORTATION..... 89

A. BACKGROUND..... 89

B. MODES OF DELIVERY..... 92

C. COSTING METHODOLOGY..... 93

D. TRANSPORTATION ALTERNATIVE COSTS..... 96

E. SCHEDULING..... 105

F. CONCLUSION..... 108

VII. SUMMARY AND RECOMMENDATIONS..... 113

INITIAL DISTRIBUTION LIST..... 117

LIST OF TABLES

I. POTENTIAL ANNUAL CONSOLIDATION AMOUNT..... 27

II. OVERVIEW OF LONGHAUL COSTS (4 MIL LBS)..... 50

III. INDUSTRY STANDARDS..... 54

IV. SUBJECTIVE ALTERNATIVE SCALE..... 65

V. COST ANALYSIS OF THE NINE ALTERNATIVES..... 66

VI. RANKING ASSIGNMENT OF THE NINE ALTERNATIVES..... 67

VII. MATERIAL VOLUME PER WEEK..... 76

VIII. HANDLING TIME PER WEEK..... 77

IX. ROUND TRIP DISTANCES..... 78

X. TRANSIT TIME PER WEEK..... 79

XI. TOTAL DELIVERY TIME PER WEEK..... 80

XII. COMMERCIAL CONTRACTING COST PER WEEK..... 81

XIII. GOVERNMENT FLEET COST PER WEEK..... 82

XIV. CURRENT NAVY EXCHANGE SCHEDULING (40-FOOT TRAILER)..... 84

XV. CURRENT NAVY EXCHANGE SCHEDULING (27-FOOT TRAILER)..... 85

XVI. PROJECTED NAVY EXCHANGE SCHEDULING (40-FOOT TRAILER)..... 86

XVII. PROJECTED NAVY EXCHANGE SCHEDULING (27-FOOT TRAILER)..... 87

XVIII. NAVY COMMISSARY WAREHOUSE CAPACITIES..... 91

XIX. MATERIAL VOLUME PER WEEK..... 98

XX. HANDLING TIME PER WEEK..... 100

XXI. ROUND TRIP DISTANCES..... 101

XXII. TRANSIT TIME PER WEEK..... 102

XXIII. TOTAL DELIVERY TIME PER WEEK..... 103

XXIV. COMMERCIAL CONTRACTING COST PER WEEK..... 104

XXV. GOVERNMENT FLEET COST PER WEEK..... 106

XXVI. CURRENT COMMISSARY SCHEDULING (40-FOOT TRAILER)..... 109

XXVII. CURRENT COMMISSARY SCHEDULING (27-FOOT TRAILER)..... 110

XXVIII. PROJECTED COMMISSARY SCHEDULING (40-FOOT TRAILER)..... 111

XXIX. PROJECTED COMMISSARY SCHEDULING (27-FOOT TRAILER)..... 112

LIST OF FIGURES

1.1 NRSSO San Diego Warehouse Facility..... 14

1.2 Southern California NRSSO Activities..... 16

2.1 Comparison of Consolidation Alternative Costs..... 28

3.1 Map of Current Operations--Route #1..... 41

3.2 Map of Current Operations--Route #2..... 42

3.3 Map of Alternative Two-Total Commercial..... 44

3.4 Map of Alternative Three-Total NRSSO..... 46

3.5 Map of Alternative Four-Commercial 100 Lb. Rate..... 48

3.6 Map of Alternative Five-Commercial Hourly Rate..... 49

3.7 Transportation Sensitivity Chart..... 52

4.1 Alternative Costs Bar Graph..... 64

5.1 Map of Intracity Navy Exchanges..... 70

6.1 Map of San Diego Navy Commissary Region..... 90

I. INTRODUCTION

A. OVERVIEW

The mission of the Navy Resale System is to provide retail merchandise to authorized patrons of the Navy Exchange and Commissary system. This thesis addresses the distribution and transportation network of the Navy Resale and Services Support Office (NRSSO), located in San Diego, California. This office's geographic region of responsibility encompasses all such facilities in the Southern California area. Concentrations of customer populations center on San Diego and Long Beach with more remote facilities at Port Hueneme, Point Mugu, China Lake and El Centro, California.

Impetus for this topic originates with the NRSSO San Diego, Field Support Office (FSO) staff. The Traffic Management Office (TMO) within the NRSSO San Diego organization was established in 1975. Authority to utilize Section 22 rates for California transportation was concurrent with this establishment and, at that time, guaranteed the best possible rate to satisfy the region's commercial truck transportation requirements. The initial savings is estimated to have been fifteen percent on transportation charges according to the NRSSO San Diego Traffic Management staff.

The evolution of the Navy Exchange and Commissary systems has been characterized by increasing centralization of the purchasing function since 1969. This has been consistent with guidance from the Navy Resale Systems Office, headquartered in Staten Island, New York. This

progression from local buying to centralized procurement has provided the benefits which accrue to the high volume merchandiser. The inclusion of all of Southern California Navy Exchanges under this umbrella transpired in 1982. Commissary procurement is less intensely centralized but reflects the trend towards volume buying for cost reduction.

Freight consolidation is a common commercial practice. It was utilized within the Southern California Navy Exchange organization in 1978 for the first time. The initiation of commercial freight consolidation for merchandize originating within the Los Angeles area capitalized upon the fact that forty percent of NRSSO's procurements originated within this area. Triangle Corporation currently performs the consolidation function in a central Los Angeles facility. All merchandise which weighs less than 100 pounds continues to be delivered to its Navy destination by Parcel Post or United Parcel Service (UPS). Shipments free-on-board origin (FOB shipping point) weighing over 2,500 pounds in any one lot are picked up at the manufacturer's site or distribution point by Navy truck. All other merchandise originating within the Los Angeles area is delivered to the consolidator for accumulation and transportation to the NRSSO San Diego warehouse by either commercial or government truck.

Centralized distribution proceeded as a natural consequence of centralized procurement. The NRSSO San Diego plan resulted in the present covered warehousing facility at the Eighth Street, National City location adjacent to the Thirty-Second Street Naval Station, San Diego. This modern facility provides 166,000 square feet of floor space (Phase I) and there are three subsequent phases of additions to create a Central Distribution Center (CDC) for the Navy Commissary Region, San Diego.

The first addition of 81,000 square feet (Phase II) is scheduled for completion in 1984. The second addition of 40,000 square feet (Phase III) is scheduled for completion by 1986. The third addition of 31,000 square feet (Phase IV) is scheduled for completion subsequent to 1986. These additions will accommodate the anticipated twenty percent growth in sales volume of Navy Commissary Region, San Diego with the implementation of the CDC concept in conjunction with new retail Commissary facilities at Murphy Canyon and Imperial Beach. The current and projected facilities at the Eighth Street, National City location are depicted in Figure 1.1. The depiction of the relative locations of NRSSO San Diego's Southern California facilities contained in Figure 1.2 provides a basic appreciation for the distances involved in supplying the retail outlets.

B. GOALS

The trend towards centralization of procurement, distribution and facilities is driven by economic considerations. Realization of savings in costs in all possible areas of the merchandising business is essential to the continued survival of the military exchange system. The mandate to continue the satisfactory levels of service to the customer, while cutting costs, demands a stringent cost consciousness on the part of the manager. A concerted effort with the goal of attaining maximum economies while continuing high quality service is in order.

NRSSO San Diego has requested that the transportation of both Navy Exchange and Commissary merchandise be examined for potential economies. The alternatives which are advanced within this thesis are considered realistic possibilities by the authors. These alternatives are

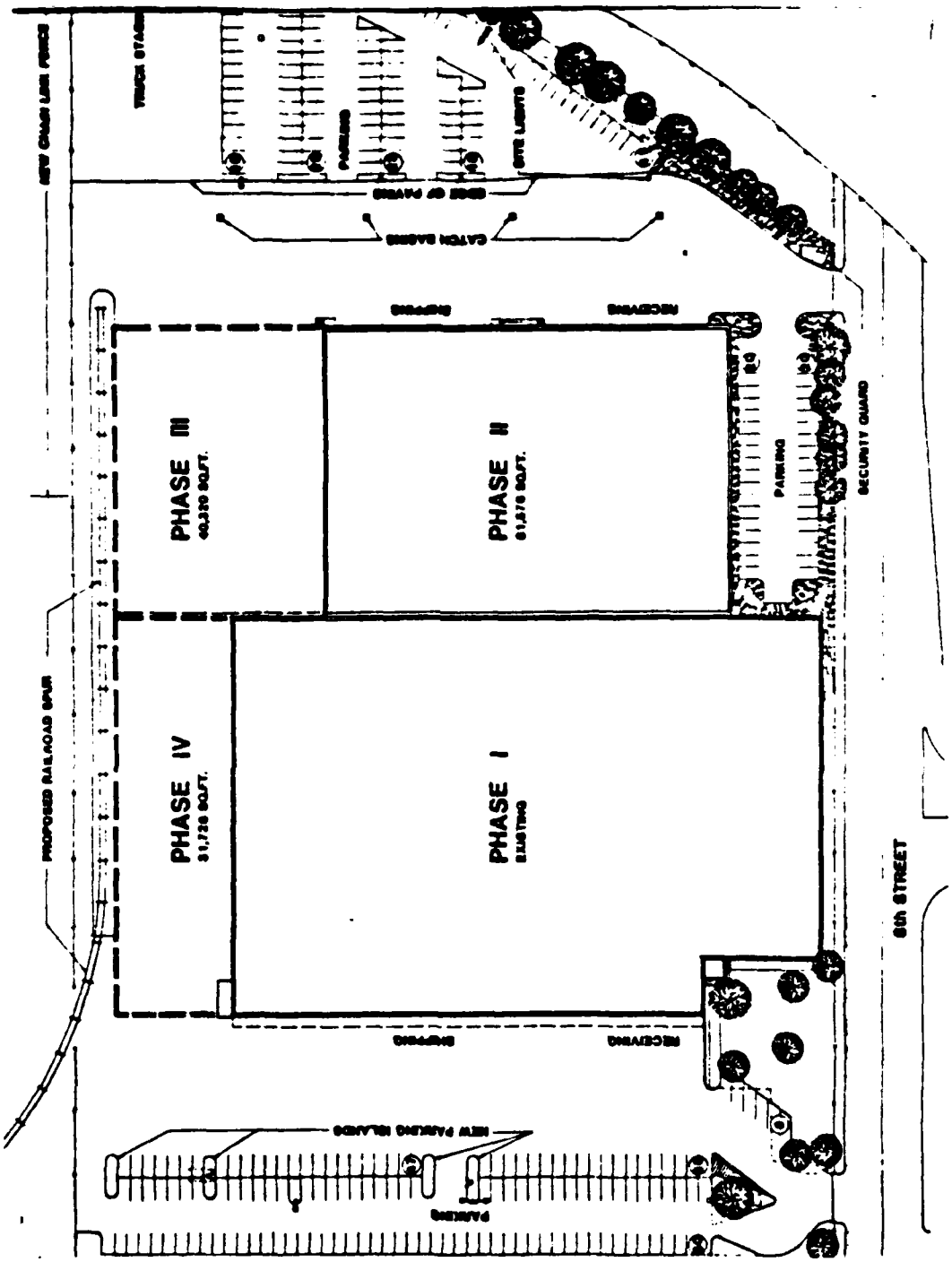


Figure 1.1 NRSSO San Diego Warehouse Facility

evaluated both quantitatively and qualitatively to assure continued high quality service while reducing costs.

The utilization of commercial truck transportation to supplement organic military truck capacities is a practice with substantial precedents. NRSSO San Diego has worked with both sources through its history and has successfully mixed the two to its own advantage. The task at this point is to ascertain the current and prospective demands for transportation. With this information the transportation needs of Navy Exchanges and Commissaries in Southern California can be anticipated and accommodated in an orderly and economical manner.

The deregulation of the trucking industry is a significant factor in this calculation. The national economic recession has contributed to increased competitiveness among the commercial trucking firms, also. In such an environment it is relatively easy to realize cost savings. It will be to the benefit of the Navy Resale System to acquire the knowledge and capacity to be cost conscious during this halcyon period in anticipation of the eventual return of a more normal market in transportation.

C. METHODOLOGY

The cases for and against the various alternatives which are advanced in this thesis are examined immediately after each option is introduced. The complete cost data and any qualitative considerations are explored within the same chapter to provide unity to the argument. The topics of procurement, merchandising and material storage are touched upon peripherally and only so far as they impact upon the distribution and transportation theme of this thesis.

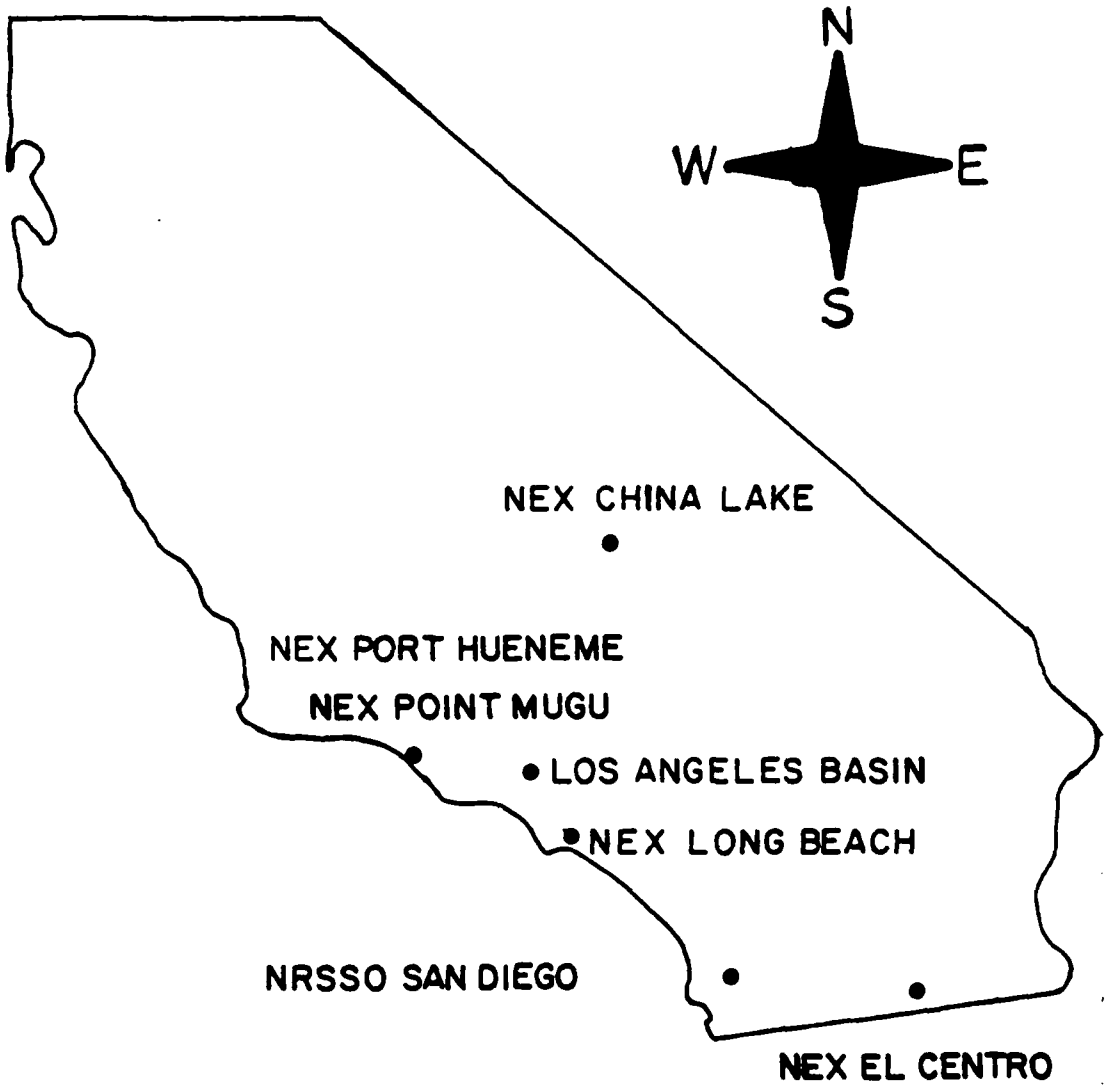


Figure 1.2 Southern California NRSSO Activities

The principal areas of interest which define the chapter topics are issues of current and future impact upon NRSSO San Diego. The current situation is an effective delivery system which is subject to review and examination for potential economies. The method of evaluation is cost-benefit analysis with sources of data identified within the narrative of the text, and computations are displayed prior to progression to the next topic. All depreciation computations utilize the sum-of-the-years'-digits method.

Chapter Two explores the two options of commercial versus government consolidation over the relevant range of one to seven million pounds per year of Navy Exchange merchandise in the Los Angeles area. Chapter Three defines the five alternatives for the long-distance transportation of twenty-two million pounds per year of Navy Exchange merchandise throughout Southern California. Chapter Four combines the consolidation and long-distance transportation options into nine alternatives. Chapter Five examines the distribution of Navy Exchange merchandise from the NRSSO San Diego warehouse to retail outlets within the San Diego area. Chapter Six investigates the overall distribution of fifty-one million pounds per year of Commissary merchandise throughout Southern California.

II. CONSOLIDATION OF MERCHANDISE

A. INTRODUCTION

Consolidation is driven by the substantial savings from utilization of FOB origin instead of FOB destination in the delivery scenarios of the purchase process. It is also noteworthy to mention that the consolidation program is not applicable to Navy Commissary merchandise. The nature of the vendors' delivery contracting and the inherent perishibility of a substantial portion of the merchandise work against FOB origin linkage to consolidation whether commercially contracted or government operated.

The phenomenon of transportation rate cross-subsidization affects the NRSSO San Diego service area. The FOB destination rates are uniform throughout a region and the actual cost differential is a benefit to the more distant customer while there is an effective overcharge to the nearby customer. This is a viable pricing practice since the vendor or manufacturer can realize an increased market area by employing this uniform pricing technique. The risk is that the competition will undercut the rate locally and absorb customers closer to the origin of the merchandise as they realize the marginal savings in shipping charges.

In the consideration of potential economies in the comparison of FOB origin to FOB destination it must be noted that title as well as liability for damages pass to the purchaser based upon these terms of FOB status. If the merchandise is of low value, high weight and is non-pilferable, the advantage of taking every possible economy in shipment

through FOB origin is evident. However, if the merchandise is of high value, low weight and pilferable, then the hidden transportation cost in the purchase price of the merchandise may be a bargain compared to the risk incurred by electing FOB origin and thereby incurring liability and risk during the transit phase of the procurement.

Chapter Two will show the substantial savings obtained through consolidated shipping compared to direct shipment from merchandise warehouses to the NRSSO San Diego warehouse. Because of this, efforts are being made to increase the volume of merchandise that can be consolidated by having NRSSO merchandise buyers ship ordered merchandise FOB origin instead of FOB destination. Other than the savings obtained through consolidation, savings can also be obtained when shipping FOB origin, if merchandise is shipped in an effective and safe manner. Preliminary studies by NRSSO San Diego have shown that there are substantial savings in shipping FOB origin.

Due to the high volume of retail merchandise being purchased in the Los Angeles area, NRSSO San Diego was able to use consolidation as a means of cutting overall transportation costs. Commercial consolidation is used solely for FOB origin merchandise. As mentioned previously, NRSSO San Diego made arrangements with Triangle Corporation in 1981 for consolidation of FOB merchandise in the Los Angeles area for Southern California Navy Exchanges. Triangle Corporation was chosen because of their low competitive rates and reputation for excellent service. In 1978, consolidation of freight coming from the Los Angeles area to local San Diego exchanges had been the first effort to reduce costs. The 1981 consolidation plan added Long Beach and Port Hueneme Navy Exchanges to

increase tonnage by approximately twenty percent. Consolidation savings based on 1978 volumes will exceed $90,000 for 1983.

B. CURRENT MODE OF OPERATION

Upon telephone notification by merchandise distributors, drivers of Triangle Corporation, Vernon, California pick up and deliver merchandise weighing between 100 and 2,500 pounds and deliver it to their warehouse for consolidation into Navy-owned 27-foot trailers. One fully-loaded 40-foot Navy trailer is picked up daily by a Navy driver and delivered to the NRSSO San Diego warehouse. Merchandise weighing less than 100 pounds is shipped United Parcel Service or Parcel Post direct to Navy Exchanges. Single shipments weighing over 2,500 pounds are picked up in Los Angeles and delivered by NRSSO San Diego drivers to the NRSSO warehouse in San Diego.

Having chosen a commercial consolidation firm the question remains, is this the most economical means of consolidation? Furthermore, could the NRSSO office set up their own consolidation point and save money? The best way to determine the answers to these questions is to evaluate the costs of commercial and NRSSO consolidation alternatives, using the same criteria for service, delivery area, volume of merchandise and scheduling. Consolidation alternatives will be presented in a narrative format describing each alternative's function and relative effectiveness. Additionally, each alternative will be costed out by a narrative description of costs and tabular display.

C. ALTERNATIVES

1. Alternative One (Commercial Consolidation)

Alternative One is the current consolidation method being used by NRSSO San Diego. A commercial consolidator picks up merchandise from the manufacturer and consolidates it into 27-foot trailers for shipment to the NRSSO warehouse by NRSSO truck drivers.

Commercial consolidation costs include a consolidation pick-up charge for receiving merchandise at point of origin in the Los Angeles area and delivering it to the consolidation point in Vernon. There is an additional charge for consolidating merchandise at the Vernon facility and for loading it into the trailers. The pick-up charge of $2.62 for each one hundred pounds of merchandise (current costs rates for pick-up and consolidation were obtained from the Triangle Corporation rate sheet) was utilized to determine the average total commercial consolidation pick-up charge per year. By taking the average annual consolidation weight of 960,000 pounds and dividing it by 100 pounds and multiplying by the $2.62 rate charge a total cost of $25,152 was obtained. A consolidation charge of $.50 for each one hundred pounds which is consolidated is used to determine the consolidation charge. Taking the $.50 rate and multiplying it times 9,600 one hundred pound units it was determined that the average yearly consolidation cost was $4,800. Upon combination of the pick-up and consolidation charges the total commercial consolidation charge amounts to $29,952 per year.

1. Consolidation pick-up charge:

a.	Average charge =	$2.62/100 pounds
b.	Average total weight/year =	960,000 pounds
c.	Total charge/year ((960,000/100) x 2.62) =	$25,151

2. Consolidation charge:

a.	Consolidation charge =	$.50/100 pounds
b.	Average total weight per year =	960,000 pounds
c.	Total charge per year ((960,000/100) x .50) =	$4,800

Total Annual consolidation cost for Alt. One = $29,952

2. Alternative Two (NRSSO Consolidation)

Alternative Two would use NRSSO personnel in all phases of pick-up, consolidation and delivery. An existing Navy warehouse located in either Naval Station Long Beach, Naval Air Station Los Alamitos or Naval Weapons Station Seal Beach would be utilized to provide a covered warehouse facility at no initial cost. Local NRSSO trucking would be established to pick up merchandise under 2,500 pounds and deliver it to the NRSSO warehouse for consolidation by NRSSO personnel.

The NRSSO warehouse would provide material handling equipment to facilitate the loading and unloading of merchandise. When established, the warehouse would require one manager, one dispatcher and two warehousemen. When gross weight increases due to migration of purchasing policy from FOB destination to FOB origin, additional trucks, employees and equipment would be added as the volume grows. NRSSO consolidation warehouse costs are based on data obtained from consolidation firms and are estimates of what physical facilities and equipment would be required as weight volume increased.

The consolidation procedure would work in this manner. Upon receiving merchandise at the consolidation warehouse, NRSSO trucks would be unloaded upon arrival and palletized as necessary. Material would be staged on the warehouse floor for consolidation into 27-foot trailers.

When the local delivery trucks are emptied, they would proceed back to the Los Angeles area and receive calls from the radio dispatcher who would be contacted by the merchandisers. Trucks would return to the consolidation point when full or at the end of working hours, as appropriate. NRSSO long-haul drivers would pick up consolidated trailers Monday through Friday at the consolidation warehouse and deliver them to NRSSO San Diego's Eighth Street warehouse facility.

NRSSO San Diego consolidation costs encompass warehouse costs, depreciation of handling equipment, NRSSO pick-up charges, depreciation of trucks and office equipment costs. By combining all of these costs the total cost for a NRSSO consolidation point can be obtained. Equipment costs and depreciation methods were obtained from NAVRESSO Instruction 11107 of 25 May 1982. Warehouse costs per year were obtained by estimating the average monthly overhead cost at $750 to render a total of $9,000 per year. Labor requirement estimates were obtained from the NRSSO San Diego Physical Distribution Manager and wage rates were obtained from Fiscal Year 1983 government wage scales. Total annual labor costs for one manager (UA-8), one dispatcher (NA-5) and two warehousemen (WG-5) total $70,447. Total annual warehouse costs equal $79,447. Costs of handling gear include the depreciation of two pallet jacks (using sum-of-the-years'-digits over 10 years) at $1,000 over ten years equals $182 per year plus two 3,000-pound fork lifts at $36,000 over ten years equals $6,552 totaling $6,734. Total NRSSO pick-up charges are computed by combining two drivers' wages and cost of fuel for operating two trucks in the Los Angeles area. This equals $54,499 per year. Driver costs were obtained by using current driver wages paid by NRSSO San Diego,

including fringe benefits which equal $34,566. Fuel costs for two trucks were obtained by taking the total mileage driven for two vehicles during the year equaling 104,000 miles per year, dividing the total mileage by six miles per gallon to derive 17,333 gallons of fuel and multiplying this figure by a $1.15 per gallon fuel charge to total $19,933. The depreciation cost for two 2.5 ton trucks is obtained using sum-of-the-years'-digits over four years. Taking the two trucks at $20,000 each we come up with a depreciation cost of $16,000 per year. Office equipment is depreciated over a ten-year period using sum-of-the-years'-digits for a $150 calculator, $2,000 copy machine, $700 electric typewriter and radio dispatch rental equipment in the amount of $2,400. The total cost equals $2,918. By adding all five areas together a total annual cost of $159,598 was obtained.

1. Total warehouse costs per year:

a. Free warehouse (assumption) - N/C	
b. Overhead cost (est. $750 per/mo x 12) =	$ 9,000
c. Labor costs	
(1) One manager (UA-8) =	$20,783
(2) One dispatcher (NA-5) =	$10,400
(3) Two warehousemen (WG-5) =	$21,000
Total labor cost = 52,183 x 1.35 fringe/ben. =	$70,447
Total warehouse cost per year =	$79,447

2. Total depreciation cost of handling gear:
(Using sum-of-the-years'-digits)

a. 2 pallet jacks ($1,000/10 years) =	$ 182
b. 2 - 3,000 lb. forklifts ($36,000/10 years)=	$ 6,552
Total equipment cost per year =	$ 6,734

3. Total local NRSSO pick-up charges per year:

a. 2 driver cost = ($492.40 x 52 wks x 1.35 fringe benefits) =	$34,566

b. Los Angeles area mileage cost for 2 trucks:
(400 miles per day x 5 days x 52 weeks)/6 mpg
= 17,333 x $1.15 gas = $19,933

Total local pick-up charges = $54,499

4. Total depreciation cost/year for two 2.5 ton trucks

a. Two trucks @ $20,000 = $40,000/ 4 years = $16,000

5. Total office equipment cost:

a. Calculator =	$ 150	
b. Copy machine =	$2,000	
c. Electric typewriter =	$ 700	
Sub-total depreciation cost for a, b, and c =		$ 518
d. Radio dispatch equipment (rental) =		$ 2,400
Total office equipment cost per year = (a, b, c, depreciated over 10 years)		$ 2,918
Total annual cost for Alternative Two =		$159,598

D. *SENSITIVITY ANALYSIS*

Sensitivity analysis will be used in two areas. It will be applied to ascertain the effects on alternatives when commercial consolidation rates are increased 30 percent based on a three-year period at a maximum ten percent inflation rate. In addition, a graphic display will be constructed illustrating commercial versus NRSSO consolidation costs in the relevant range of one to seven million pounds of merchandise annually. The relevant range was determined by considering the growth potential of consolidation in the Los Angeles area. As mentioned previously, 75 percent of Los Angeles area merchandise is shipped FOB destination. NAVRESSO San Diego studies show that FOB origin could be increased from 25 percent at present to 60 percent of all Los Angeles merchandise.

Additionally, Naval Supply Center Oakland merchandise shipped out of Los Angeles area could be included at the NRSSO consolidation point.

The possibility of including all East Coast bound merchandise was investigated, but East Coast merchandise would account for a negligible amount of freight originating out of the Los Angeles area. Considering that such merchandise would be originating from all West Coast sources the geographic distribution of such a minority of merchandise fails to support the concept of West Coast consolidation for East Coast Navy Exchanges. The consolidation of West Coast Navy Exchange merchandise originating from the Los Angeles area and even from the entire western commercial area for transshipment to the East Coast would be keyed to the volume of merchandise eastbound.

E. SENSITIVITY ANALYSIS RESULTS

1. Commercial and NRSSO Consolidation Analysis

From studies conducted at the NRSSO San Diego, it was ascertained that the volume of merchandise going through consolidation could be increased from 960,000 pounds per year by an additional 2,880,000 to a total of 3,840,000 pounds per year. This could be achieved realistically by taking the 75 vendors considered to be candidates and changing their shipping from FOB destination to FOB origin. Additionally, NRSSO Oakland consolidates a yearly average of 1,920,000 pounds of merchandise in the Los Angeles area for further shipment to Oakland. By totaling the NRSSO San Diego and Oakland potential consolidation a total of 5,760,000 pounds was obtained. Table I shows the potential amount of merchandise that could be consolidated in the Los Angeles area for Southern California and Oakland area Navy Exchanges.

TABLE I

POTENTIAL ANNUAL CONSOLIDATION AMOUNT

NRSSO San Diego consolidation amount =	3,840,000
NRSSO Oakland consolidation =	1,920,000
Total pounds per year =	5,760,000

Comparison of commercial and NRSSO consolidation costs is shown graphically in Figure 2.1. Consolidation volume of one to seven million pounds was used because this reflects the relevant range of consolidation that could be expected to occur based on the assumption that 5,760,000 pounds per year could be consolidated. Alternative One, commercial consolidation, reflects a linear progression cost increase and is based upon commercial consolidation rates provided by Triangle Corporation. A pick-up charge of $2.62 per hundred pounds and a consolidation charge of $.50 for each hundred pounds was used. By applying the aforementioned charges the following costs reflect a linear progression. At one million pounds the commercial consolidation cost is $31,200. At two million pounds it would double to $62,400 and so on in a linear progression as displayed in Figure 2.1.

1. Alternative One - Commercial Consolidation Cost:

   a. Pick-up charge - $2.62 per 100 pounds
   b. Consolidation charge - $.50 per 100 pounds

The rationale for cost determination in the Alternative Two NRSSO operated consolidation facility were determined as follows. NRSSO consolidation is a four-step function consisting of an initial start-up

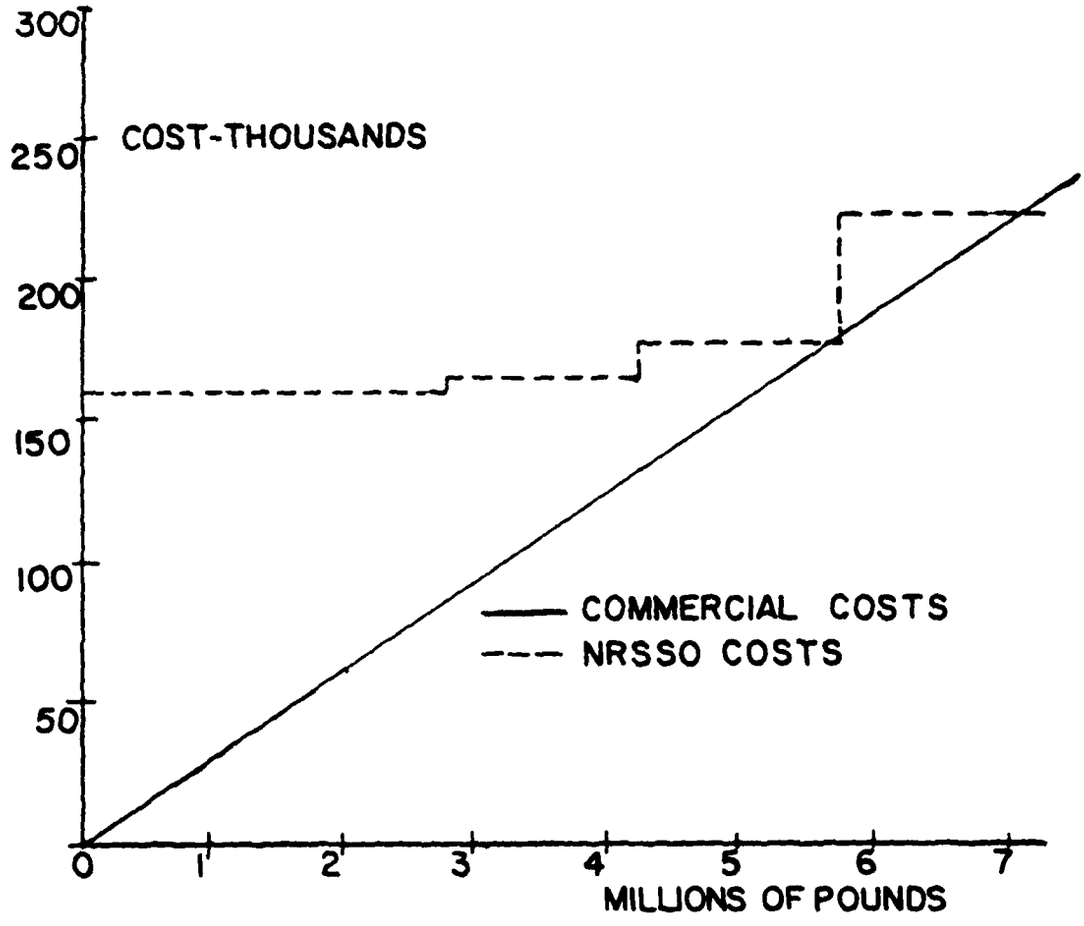


Figure 2.1 Comparison of Consolidation Alternative Costs

cost of $159,598 derived from the consolidation cost function (Chapter II,C,2). At 2.8 million pounds the two 2.5 ton trucks will reach capacity based on the assumption of two trips per day to the Los Angeles area which would total 10,000 pounds per day. The trucks would be operated on an annual total of 240 days with a 60 percent load factor reaching capacity at 2,880,000 pounds per year. A 2.5 ton truck would require replacement by a 5 ton truck increasing annual costs to $162,598. Using the same criteria, at 4.3 million pounds the remaining 2.5 ton truck would be replaced by an additional 5 ton truck and an additional warehouseman to meet handling requirements (handling requirements were determined by using the Department of Defense warehouse handbook) with a resulting annual cost of $176,098. When the consolidation weight reaches 5.7 million pounds three trucks would be required based upon the previous rationale. The additional 2.5 ton truck (totaling one 2.5 ton and two 5 ton trucks) driver and warehouseman required to maintain effectiveness would generate an annual cost of $221,848. All depreciation costs will be depreciated using sum-of-the-years'-digits.

1. Alternative Two - NRSSO Consolidation Cost:

   a. Cost data provided for in this alternative generates a step function.
   b. Vehicles are bought outright and are depreciated over a 4-year period.
   c. No trade-in value of the old truck is considered.

2. From zero to 2.8 million pounds the initial start-up is $159,598 as reflected in the NRSSO consolidation cost function (Chapter II,C,2).

3. At 2.8 million pounds per year the two existing 2.5 ton trucks will reach capacity.

a. 2 trips per day x 10,000 lbs. x 240 days x .60 load factor = 2,880,000 pounds per year
b. A 5 and 2.5 ton truck are required to meet new requirements, will reach new cap. 4.3 million lbs.
c. Cost per year:

(1) Warehouse =	N/C
(2) Total warehouse cost =	$79,447
(3) Total depreciation cost handling gear =	$ 6,734
(4) Total local pick-up charges =	$54,499
(5) Total office equipment cost =	$ 2,918
(6) Total truck depreciation cost =	$19,000
(a) 2.5 ton $20,000/4 = $ 8,000	
(b) 5 ton $27,500/4 = $11,000	
Total new cost =	$162,598

4. At 4.3 million pounds per year the 2.5 and 5 ton trucks will reach capacity.

a. Two 5 ton trucks will be required to meet new requirements which will reach capacity at 5,760,000 lbs.
b. One additional warehouseman will be required.
c. New cost per year:

(1) Warehouse =	N/C
(2) Total warehouse cost =	$ 89,947
(additional $10,500 for warehouseman)	
(3) Total dep. cost of handling gear =	$ 6,734
(4) Total local pick-up charge =	$ 54,499
(5) Total office equipment cost =	$ 2,918
(6) Total truck depreciation cost =	$ 22,000
(a) Two 5 ton trucks $55,000/4 = $22,000	
Total new cost =	$176,098

5. At 5.7 million pounds per year the two 5 ton trucks will reach capacity.

a. Two 5 ton and one 2.5 ton trucks will be required to meet new requirements capacity of 7.2 million pounds.
b. One additional warehouseman required (total 4)
c. One additional driver will be required (total 3)
d. New cost per year:

(1) Warehouse =	N/C
(2) Total warehouse cost =	$100,447
(additional warehouseman $10,500)	
(3) Total dep. cost of handling gear =	$ 6,734
(4) Total local pick-up charges:	$81,749
(a) Three driver cost: (738.60 x 52 x 1.35) =	$51,849
(b) Mileage (600 x 5 x 52)/6 = 26,000 x 1.15 =	29,900

(5) Total office equipment cost =		$ 2,918
(6) Total truck depreciation cost:		$ 30,000
(a) Two 5 ton trucks 55,000/4 =	22,000	
(b) One 2.5 ton truck 20,000/4 =	8,000	
Total new cost =		$221,848

The comparison graph (Figure 2.1) of Alternatives One and Two clearly shows that the utilization of commercial consolidation imposes a cost structure that is a linear function of the weight of merchandise handled. With the Navy operated consolidation, however, the cost structure describes a step function which rises at critical intervals as the organization must be augmented to handle increasing volumes of merchandise. The graph also portrays the NRSSO consolidation point start-up cost as being extremely high and would be higher yet if a government warehouse were not available. The trade-off cost of having a warehouse located in downtown Los Angeles could be advantageous. This assumption was ignored, however, due to the overall high cost of a NRSSO staffed and funded consolidation point.

It is quite evident that when the overall merchandise weight is increased, within the relevant range of up to seven million pounds, commercial consolidation remains the most economical means of consolidation. Increased volume does allow a NRSSO consolidation point to realize an overall cost that is more competitive with commercial rates, but NRSSO costs will remain higher in the long run. It is also important to note that commercial consolidation is much more flexible during peak merchandise periods throughout the year. Commercial consolidation costs would be incurred only when merchandise is shipped. NRSSO consolidation would include high overhead costs that would be under-utilized generating excess capacity during slack periods and would be unable to meet peak demands.

As mentioned previously, the main reason for changing merchandise from FOB destination to FOB origin and using either commercial or NRSSO consolidation is the savings in transportation costs. At this time, 75 percent of merchandise purchased from Los Angeles is shipped FOB destination. The projected FOB origin weight is based on the addition of 75 companies to this shipping method to total 4,000,000 pounds. In actuality there are many more companies that could be converted due to the large merchandise volume purchased from each company. Actual savings of conversion has been estimated by taking a sample of companies that could be converted and estimating their transportation mark-up. This was accomplished by NRSSO San Diego requesting companies to provide average mark-up for transportation on their FOB destination merchandise and comparing the information.

The possibility of saving on consolidation costs by using the NRSSO option is considered a poor prospect. Labor and equipment costs could be constrained, but in all likelihood would affect the capacity required to maintain existing high quality service. Present services being provided by the commercial consolidator are excellent. It is considered in the best interests of NRSSO San Diego to continue using the commercial mode of consolidation.

2. A Thirty Percent Increase in Commercial Rates

If consolidation price rates were increased arbitrarily 30 percent, what would be the effect on Alternatives One and Two? This would be based on a volume of 3,000,000 pounds per year. Adding the increased rate by changing from FOB destination to FOB origin and increasing consolidation rates 30 percent, there is no significant improvement in

Alternative Two (NRSSO alternative). Due to the current oil glut in the world market it is felt that commercial consolidation costs would not rise much beyond this point in next three years. Additional sensitivity analysis is deemed unnecessary in this area due to the large price disparity. Taking figures derived from the commercial linear progression in Table II a cost of $93,600 is obtained for 3,000,000 pounds of consolidation. Adding 30 percent to commercial consolidation rates the following results were achieved:

1. Alternative One -- Commercial consolidation plus 30 percent ($93,600 x 1.30) = $121,680

2. Alternative Two -- NRSSO consolidation = $162,598

F. CONCLUSION

Commercial consolidation has proven to be the more effective means of economizing on transportation costs when shipping large quantities of merchandise from a metropolitan area. The distinct advantage that commercial consolidation enjoys over a NRSSO operation is its linear pricing structure. The start-up and operation costs are borne by a wide range of clientele and, at low volumes, are more competitive than a dedicated private facility. The attainment of cost savings when changing shipping requirements from FOB destination to FOB origin provides a supplemental bonus from the procurement aspect. The masking of transportation costs in FOB destination prices is a legitimate merchandising policy. Yet, the discerning manager will ferret out potential economies or lose out to his own competition. Costs must be minimized to contribute toward the margin which is requisite to success in business. The commercial consolidation

system presently being used by NRSSO is considered excellent and should be continued. It is anticipated that NRSSO consolidation is not a feasible alternative due to the substantially high start-up costs and the sustained high expense as demonstrated in Figure 2.1.

III. INTERCITY TRANSPORTATION

A. INTRODUCTION

It is a fact that forty percent, by weight, of the merchandise acquired by NRSSO San Diego for its Navy Exchanges is from the Los Angeles area. It is essential that the most cost effective intercity transportation system be utilized to gain maximum savings from this factor. NRSSO San Diego has continued to improve its transportation efforts in this area by using the most economical and efficient modes while continuing to provide delivery at a minimum security risk. Since the establishment of NRSSO San Diego in 1969, intercity transportation has gone from strictly common carrier (100 pound rate) to consolidation and full trailer rates and on to using NRSSO trucks and drivers in an effort to decrease transportation costs.

NRSSO San Diego utilized NRSSO services and vehicles for its intercity transportation system since January 1981 as a means of keeping costs at a minimum and providing for a fixed level of effectiveness. The lack of major stockouts despite existing inadequacies in the current system supports the conclusion that a satisfactory level of effectiveness has been achieved. Information generally available through discussions with cognizant personnel indicates that almost all current equipment on the majority of routes is filled to near capacity. This, balanced by satisfactory reports on service from the retail level, indicates that the wholesale movement system is performing its mission as intended.

This chapter will define the intercity transportation system as it now exists and will explore alternative modes of transportation to determine if they will be more cost effective in the long term.

B. DESCRIPTION OF ALTERNATIVES ANALYZED

1. Alternative One (Current Operations)

This alternative is the current method being used by NRSSO San Diego. Monday through Friday each week two semi-tractors carrying two 27-foot trailers each, depart from NRSSO San Diego warehouse. One is destined for Long Beach carrying Long Beach and China Lake merchandise and the other is destined for Triangle Corporation, Vernon, California (Los Angeles area) for further line-haul transfer to Port Hueneme and Point Mugu. Twice a week two trailers are picked up by a common carrier (drop-off) from Long Beach and are delivered to China Lake. If there are no retrograde materials to Long Beach empty trailers will be delivered to the consolidation point. All trailers are returned from Port Hueneme and Point Mugu to the consolidator's terminal. Trailers at the consolidation point are used by NRSSO truck drivers to pick up equipment from manufacturers and by the consolidator for consolidation of freight.

Single shipments weighing over 2,500 pounds are picked up and delivered daily by NRSSO San Diego drivers to the NRSSO warehouse in San Diego. All merchandise which weighs less than 100 pounds will continue to be delivered to its Navy destination by Parcel Post or United Parcel Service (UPS) in all five intercity transportation alternatives.

2. Alternative Two (Total Commercial)

This alternative would use commercial trucks and drivers as well as supplemental requests for a commercial trucking firm to ship all

manufactured merchandise in the Los Angeles area and transport it to the NRSSO warehouse in San Diego. Merchandise from the NRSSO warehouse San Diego destined for Navy Exchange Long Beach would be shipped via common carrier. This method was used by NRSSO from 1978 to 1981. Utilization of a private government fleet since 1981 has proven to be more economical.

The commercial trucking firm picks up the trailer from the commercial consolidator on a daily basis, Monday through Friday, and delivers it to the NRSSO warehouse in San Diego. The NRSSO warehouse in San Diego would ship merchandise to Navy Exchange Long Beach in consolidated trailers via common carrier. A consolidated trailer would be delivered twice per week to China Lake via commercial carrier and daily to Port Hueneme/Point Mugu, also by commercial carrier. Merchandise under 100 pounds would be shipped via United Parcel Service (UPS) or Parcel Post.

3. Alternative Three (Total NRSSO)

This alternative would utilize NRSSO trucks and drivers to provide service to all destination points including Long Beach, the consolidation point in Vernon, California, Port Hueneme/Point Mugu and China Lake. Three trucks would be required to pick up and deliver merchandise. Due to time constraints the Long Beach run would be the only one that could pick up consolidated merchandise in the Los Angeles area. Therefore backhaul would be limited to 80,000 pounds per month because of time and distance constraints imposed by the routing.

Only the Long Beach driver route would provide time (within a maximum 10-hour work day) to make pick-ups of merchandise from manufacturers and the consolidator in the Los Angeles Area. The remaining two routes to Port Hueneme/Point Mugu and China Lake would not provide time to

make additional pick-ups in the Los Angeles area and return to NRSSO San Diego due to traffic congestion problems and the long distance of these two routes. (Driving time estimates were provided by NRSSO San Diego).

4. Alternative Four (Commercial, No Consolidation)

Merchandise would be shipped from commercial wholesalers (no consolidation) via common carrier, United Parcel Service or Parcel Post to the NRSSO warehouse in San Diego. NRSSO would use Section 22 rates to ship Los Angeles area merchandise via common carrier to San Diego. Merchandise under 100 pounds would be shipped United Parcel Service or Parcel Post. NRSSO warehouse merchandise destined for Navy Exchange Long Beach and Port Hueneme/Point Mugu and China Lake would be consolidated at San Diego and shipped via common carrier using Section 22 drop-off rates.

5. Alternative Five (Commercial, Hourly Rate)

Alternative Five would employ a commercial carrier to provide all transportation. Common carrier rates charged to Naval Supply Center, San Diego ($36.88 per hour) are used in this alternative to determine costs in the event that all transportation was contracted commercially. Merchandise would be shipped by NRSSO to Long Beach, Port Hueneme/Point Mugu and China Lake via commercial contractor. Consolidated merchandise at the Los Angeles commercial consolidation site would be picked up by the Long Beach driver and delivered to the NRSSO warehouse in San Diego.

C. COSTING ANALYSIS:

1. Alternative One (Current Operations)

The cost for Alternative One encompasses NRSSO truck driver salaries, fuel, maintenance and depreciation costs for two tractors and four trailers.

In addition, actual commercial transportation costs, obtained from the NRSSO San Diego traffic manager, were used to derive transportation costs for China Lake and Port Hueneme/Point Mugu. NRSSO truck driver salaries, for two drivers, were based on a 40-hour week at current NRSSO San Diego pay scales. Drivers' salaries equal $532.80 for an 80-hour week (two drivers) plus a 35 percent charge for fringe benefits. The total driver cost comes to $719.28 per week and equals $37,402 annually. Fuel costs for two trucks were obtained by taking the total mileage driven for two tractors during the year (130,000 miles), dividing the total mileage by six miles per gallon to derive 21,667 gallons of fuel used per year with total annual fuel costs equalling $24,917 based on a $1.15 per gallon fuel cost. Average maintenance costs on two tractors and four trailers were obtained from actual NRSSO San Diego maintenance records and they total $3,651. The depreciation cost for two tractors and 4 trailers equals $23,613 and was obtained by taking 25 percent of the total depreciation cost of all tractors and trailers owned by NRSSO San Diego. Total annual drop-off charges charged to NRSSO San Diego by commercial carriers equal $38,304 for China Lake and $39,600 for Port Hueneme/Point Mugu. Total annual cost for Alternative One is $167,487.

1. NRSSO truck driver salary:
   a. 80-hr wk = 532.80 x 1.35 fringe benefits = 719.28
      Avg annual salary = 719.28 x 52 wks = $ 37,402

2. Avg transportation cost/year:
   a. 2 rd/trips S.D.-L.B. = 520 dys x 250 dys = 130,000mpy
      Total mileage cost/yr = 130,000/6mpg x $1.15 = $ 24,917

3. Avg maint. cost/yr on 2 tract/4 trailers = $ 3,651

4. Avg % dep. cost per year for equipment = $ 23,613
   This was obtained by taking 25% dep. of all equip.

5. China Lake $3,192/mo x 12 Comm. drop-off = $ 38,304

6. Port Hueneme/Point Mugu $3,300/mo x 12 = $ 39,600

Total annual cost for Alternative One = $167,487

Each of the five transportation alternative routes are graphically displayed in Figures 3.1 and 3.2 to represent each alternative in a clearer and more concise manner. Alternative One (Current Operations) has two routing maps. The numbers in each map represent miles between origin and destination point. Route number one shows the delivery schedule of driver one who makes a daily delivery to Navy Exchange Long Beach. The shipment contains merchandise for both the Long Beach and China Lake Navy Exchanges. Palletized merchandise destined for China Lake will be consolidated by Navy Exchange Long Beach and shipped via common carrier (drop-off rate) as illustrated in the route one map by a broken line. The route number two driver will transport Port Hueneme/Point Mugu consolidated merchandise Monday through Friday to the Los Angeles consolidator for further shipment (drop-off rate) to the end user. Both drivers will pick up merchandise from the consolidator and manufacturers in the Los Angeles area, as required, and return to NRSSO San Diego during the same working day.

2. Alternative Two (Total Commercial)

Commercial long haul costs include a drop-off charge of $250 (all charges were obtained from Section 22 rates) for each 40-foot trailer load from Los Angeles to NRSSO San Diego. Taking the 4,000,000 pounds average of Los Angeles area FOB origin merchandise and dividing it by the 15,000 pound average trailer load, totals 267 forty-foot trailers per year and equals $66,750 annually. The San Diego to Long Beach commercial

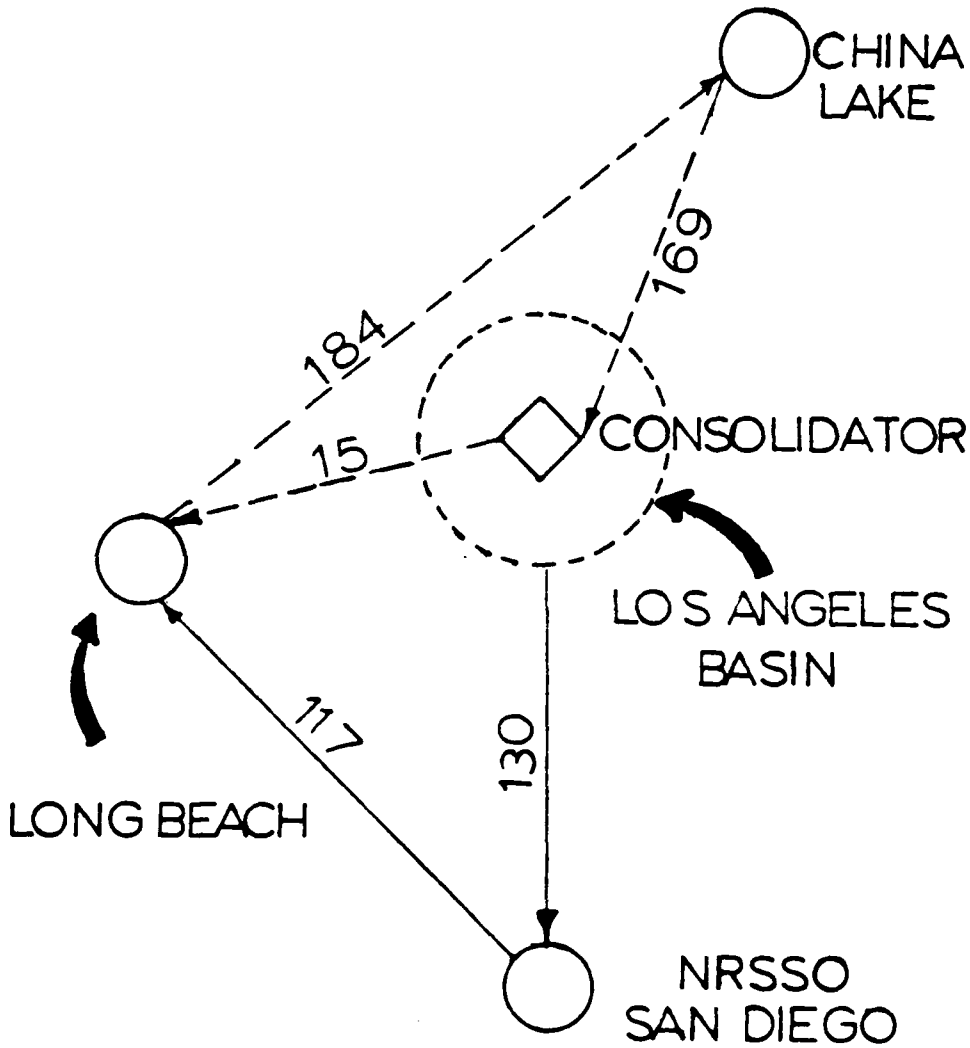


Figure 3.1 Map of Current Operations--Route #1

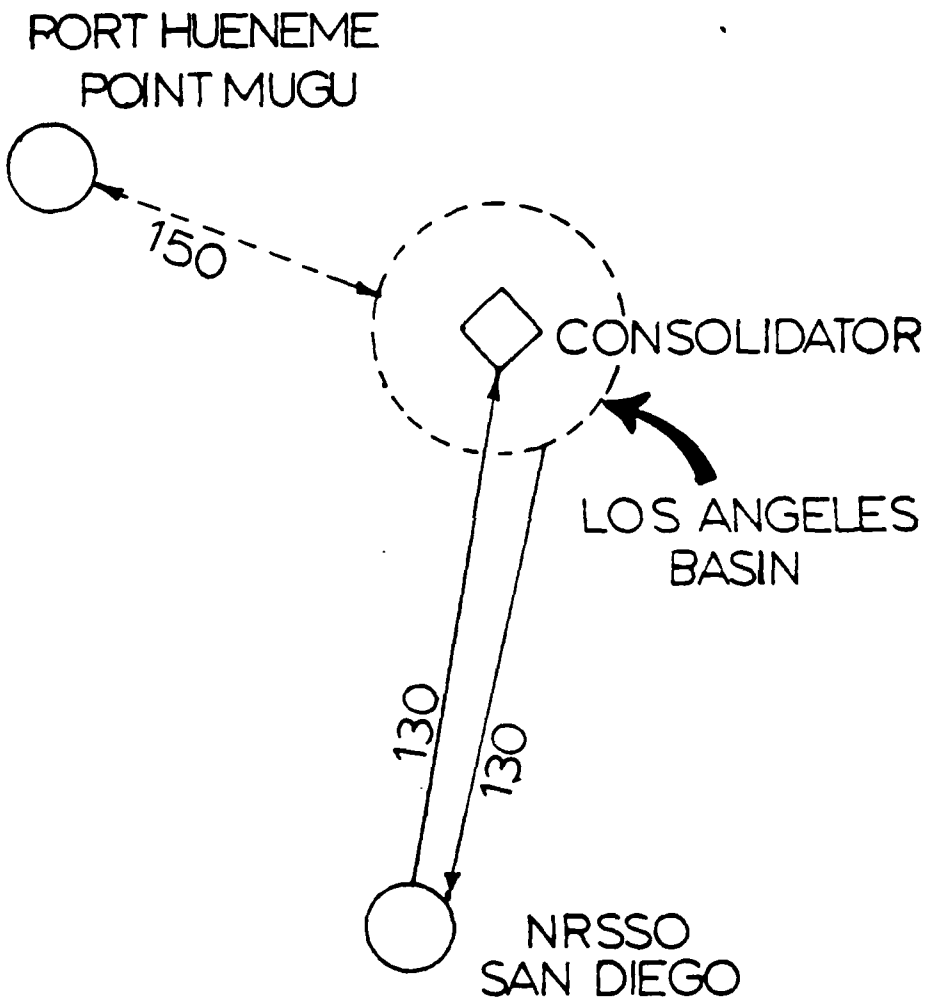


Figure 3.2 Map of Current Operations--Route #2

drop-off rate of $285 each trip will average 260 deliveries per year and total $74,100. The twice a week drop-off charge of $398 per trip to China Lake equals $41,392. The cost of daily deliveries to Port Hueneme/Point Mugu at $200 per trip equals $52,000. By adding all areas the total commercial cost equals $234,242.

1.	Total commercial long haul cost per year:	
	a. L.A.-S.D. drop-off cost for 40-foot trailer equals average total L.A. area FOB origin merchandise 4,000,000 lbs divided by 15,000 lbs avg trailer weight times $250 per load =	$ 66,750
2.	S.D.-L.B. drop-off cost for 40-foot trailer =	
	a. 5 del/per wk x 52 wks @ $285 per/trip =	$ 74,100
3.	China Lake comm. drop-off $398 per/trip =	$ 41,392
4.	Port Hueneme/Point Mugu $200 per/trip =	$ 52,000
	Total annual cost for Alternative Two =	$234,242

The destination routes of commercial carriers are displayed in Figure 3.3. Merchandise would be shipped via common carrier (drop-off rates) from the Los Angeles consolidator to NRSSO San Diego. Merchandise would also be shipped daily Monday through Friday in consolidated trailers from NRSSO San Diego to Navy Exchange Long Beach, Port Hueneme/Point Mugu and twice a week to China Lake. This alternative would require manufacturers to consolidate all merchandise weighing over 100 pounds.

3. Alternative Three (Total NRSSO)

The total NRSSO intercity transportation alternative cost was determined by using actual figures obtained from NRSSO San Diego records.

1.	Payroll =	$ 78,300
2.	Fuel -	$ 39,744
3.	Maintenance =	$ 8,604

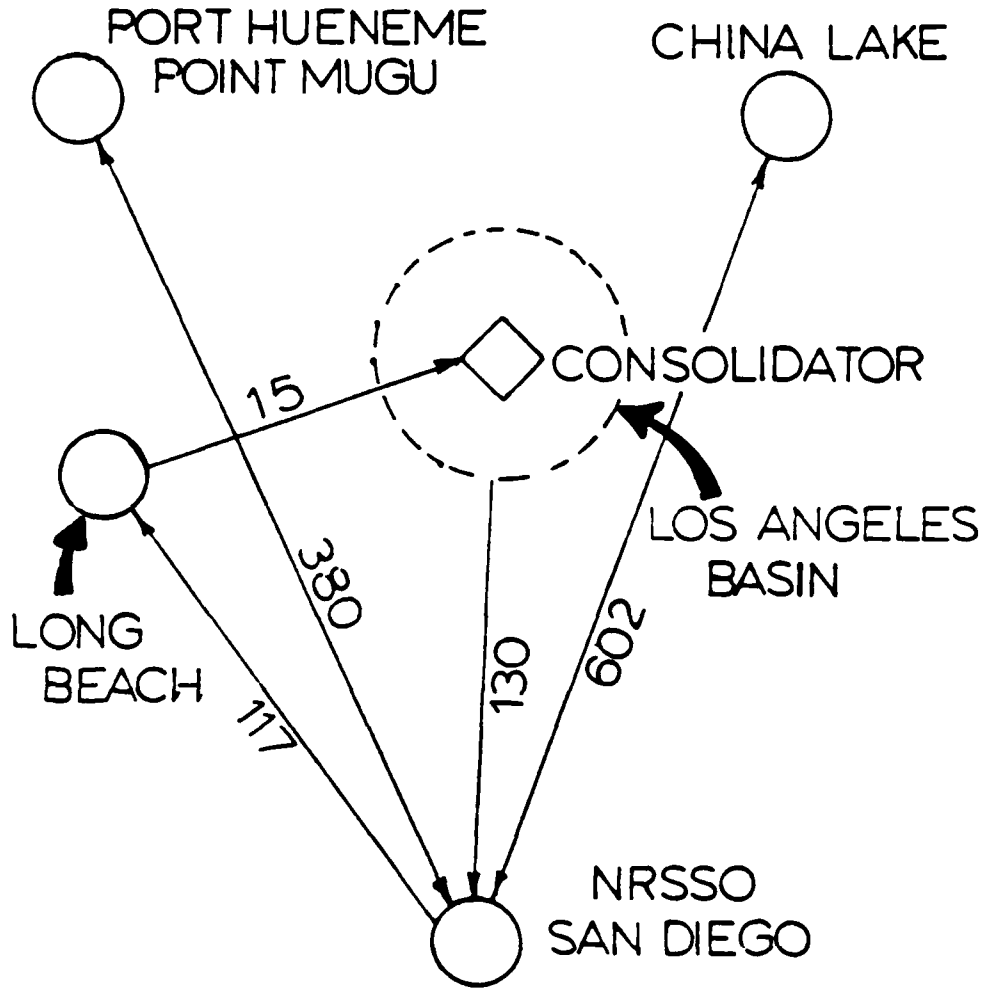


Figure 3.3 Map of Alternative Two-Total Commercial

4. Depreciation = $55,800

Total annual cost for Alternative Three =$182,448

The Alternative Three map (Figure 3.4) displays total utilization of NRSSO trucks and drivers. The three transportation routes will originate from NRSSO San Diego with daily deliveries made to Navy Exchange Long Beach, Port Hueneme/Point Mugu and twice a week to China Lake. The Long Beach driver will pick up merchandise from the consolidator and manufacturers in the Los Angeles area and return to San Diego daily.

4. Alternative Four (Commercial, No Consolidation)

This alternative requires manufacturers to ship merchandise by commercial carrier at the 100 pound Section 22 rate. Total common carrier charges from Los Angeles area manufacturers to NRSSO San Diego were based on 4,000,000 pounds delivered at $5.43 per 100 pounds, which totals $217,200. San Diego to Long Beach daily trailer drop-off costs, (260 days per year) at $285 per trailer, total $74,100. Twice a week (104 trips per year) drop-off charges at $398 per trip to China Lake equal $41,392. Daily drop-off charges to Port Hueneme from Long Beach at $200 per trip equal $52,000. Total annual cost for Alternative Four equals $384,692.

1.	Total common carrier charge L.A. to S.D. = $5.43/100 lbs x avg weight per/yr 4 mill/lbs = (Using Section 22 quote rates)	$217,200
2.	Total commercial long haul S.D. to L.B. Trailer drop-off cost same as Alt. Two =	$ 74,100
3.	China Lake commercial drop-off =	$ 41,392
4.	Port Hueneme commercial drop-off =	$ 52,000
	Total annual cost for Alternative Four -	$384,692

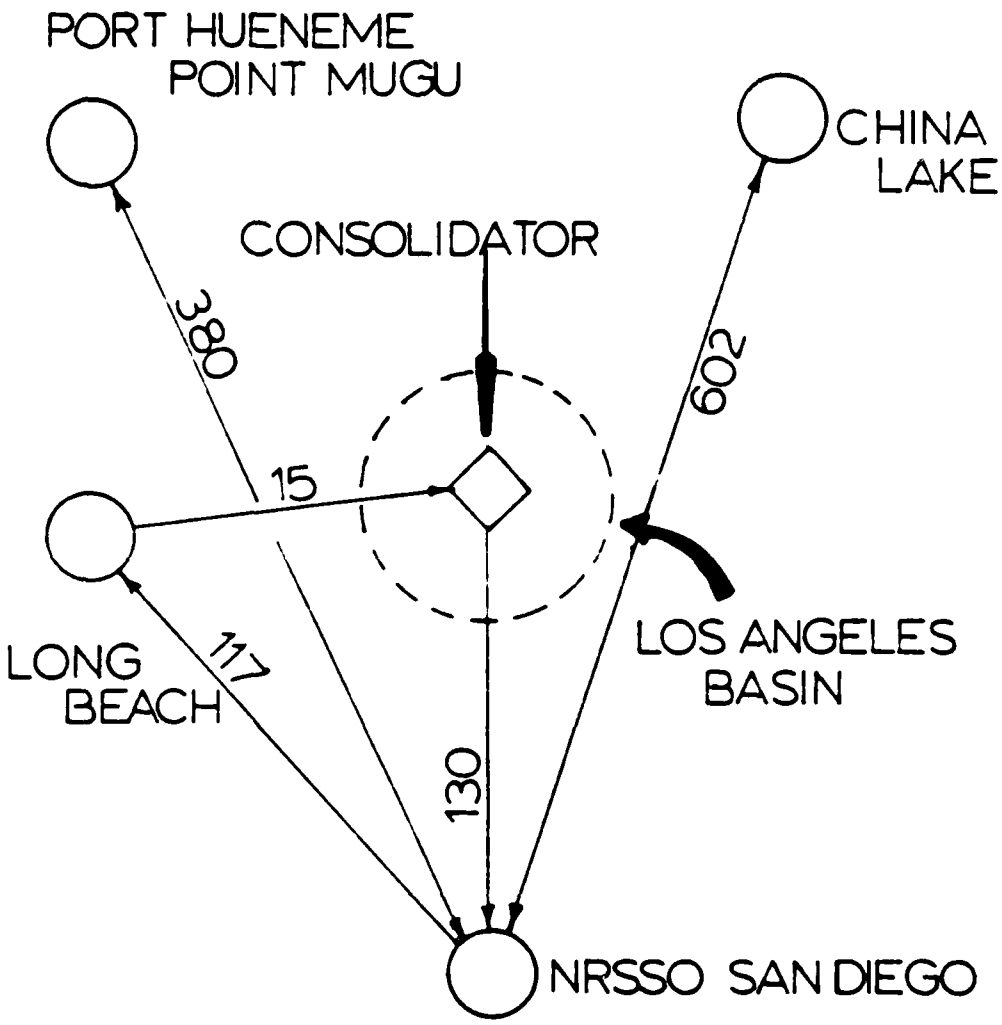


Figure 3.4 Map of Alternative Three-Total NRSSO

Alternative Four requires no consolidation and has manufacturers in the Los Angeles area ship merchandise in excess of 100 pounds via common carrier using the $5.43 per hundred pound commercial shipping rate. Merchandise destined for Long Beach, Port Hueneme/Point Mugu and China Lake will be consolidated at NRSSO San Diego and shipped according to schedule. The Alternative Four routing map is displayed in Figure 3.5.

5. Alternative Five (Commercial Hourly Rate)

Alternative Five costs were based upon the commercial hourly rate of $36.88 charged to Naval Supply Center, San Diego. NRSSO San Diego records indicate that 25,344 man hours were expended in long haul transportation. The total cost for Alternative Five equals $934,687.

1.	Total miles driven per year =	165,060
2.	Total man hours per year =	25,344
3.	Contract cost per hour =	$36.88
	Total annual cost for Alternative Five = (25,344 man hours x $36.88)	$934,687

The Alternative Five map (Figure 3.6) indicates consolidated deliveries being made from NRSSO San Diego to Port Hueneme/Point Mugu and China Lake. As illustrated, a commercial vehicle would make a daily drop-off to Navy Exchange Long Beach and proceed to the Los Angeles consolidator and manufacturers for pick-up and delivery and back haul to NRSSO San Diego.

An overview of long haul intercity transportation costs at 4,000,000 pounds in Table II indicates Alternative One (Current Operations) is the most economical mode of transportation. Alternatives One and Three transportation costs for each one hundred pounds shipped are more

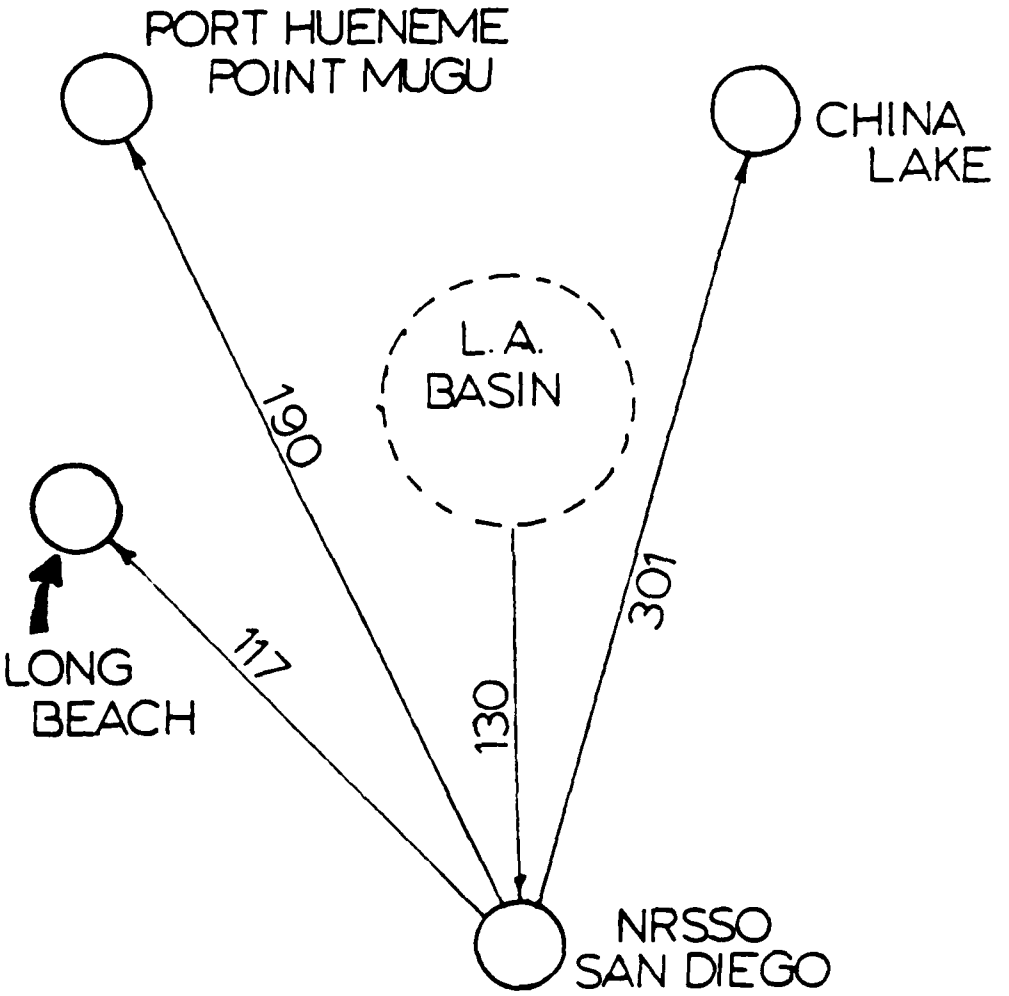


Figure 3.5 Map of Alternative Four-Commercial 100 Lb. Rate

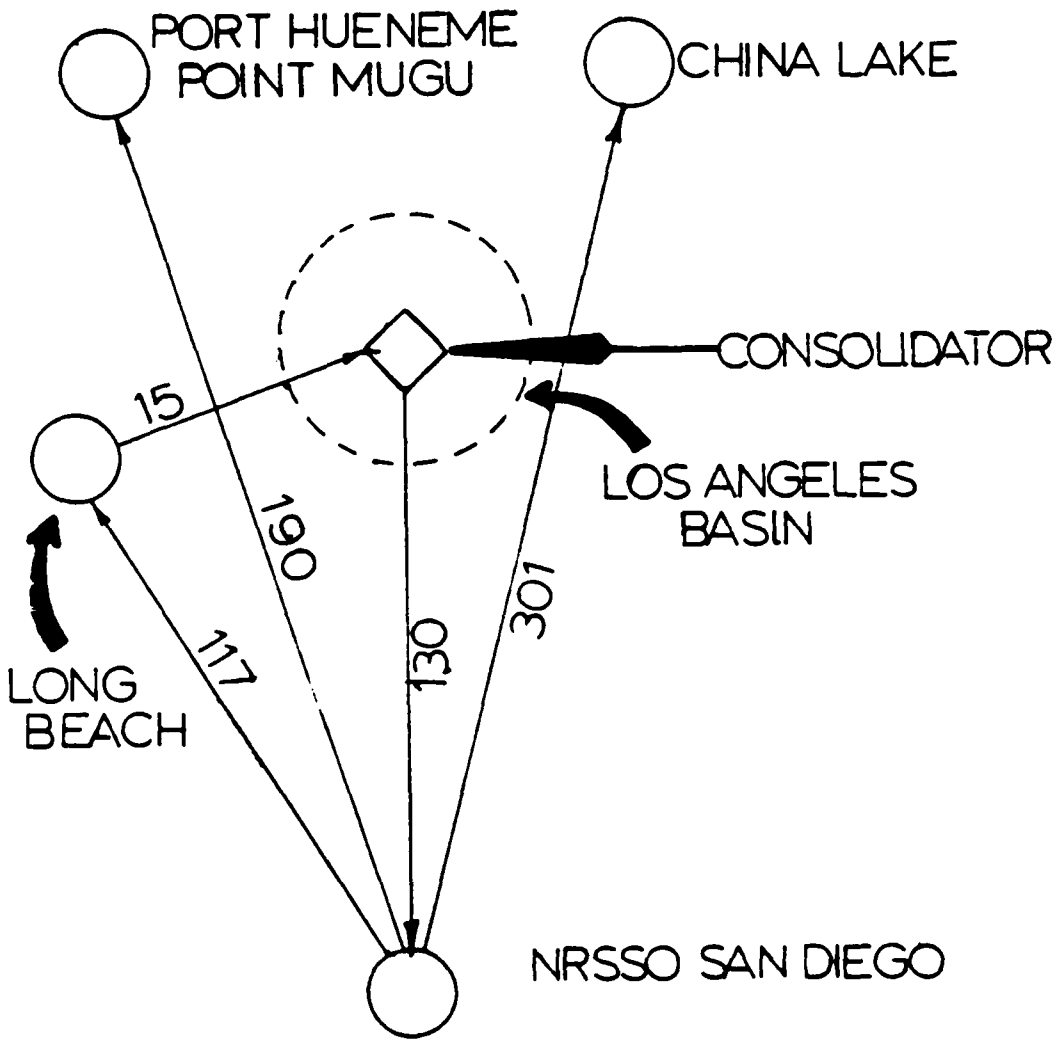


Figure 3.6 Map of Alternative Five-Commercial Hourly Rate

economical than Section 22 rates due to the low cost of NRSSO transportation. This is in fact caused by NRSSO drivers being paid a relatively low wage rate due to their non-union status. It is also important to note that NRSSO transportation costs per mile are lower than typical commercial trucking firms. Table III provides a breakdown of cost-per-mile, and cost-per-hundred pounds for intercity transportation Alternatives One through Five.

TABLE II

OVERVIEW OF LONGHAUL COSTS (4 MIL LBS)

ALTS	COST PER MILE	COST PER 100 LBS	TOTAL
1	$1.22	$ 4.19	$167,487
2	$1.71	$ 5.86	$234,242
3	$1.33	$ 4.56	$182,448
4	$2.80	$ 9.61	$384,692
5	$6.81	$23.36	$934,687

*137,280 average miles per year used to determine cost per mile.

D. COST ANALYSIS QUALIFYING FACTORS

1. Navy Exchange Long Beach back-haul shipments include merchandise from Los Angeles area and FOB destination shipments to NRSSO warehouse San Diego.

2. Costs for shipments under 100 pounds are the same for all alternatives and are therefore not entered in the totals for each alternative.

3. Alternatives One and Three use NRSSO trailers. Alternatives Two, Four and Five use common carrier trailers.

4. An average of 7,000 pounds is carried in a 27-foot trailer and a 40-foot trailer carries 15,000 pounds per load.

5. Current common carrier drop-off charges were obtained from the traffic manager at NRSSO San Diego.

E. SENSITIVITY ANALYSIS

The application of sensitivity analysis in the area of increased common carrier transportation charges is non-productive because it is evident that the NRSSO transportation system would improve its competitive position due to its cost structure.

In the non-quantitative area, any major strike by teamsters would impact upon all alternatives because merchandise manufacturers would not receive raw materials to manufacture their products. On the other hand, if a local trucking strike occurred, Alternatives One and Three would be the least affected because government employee unions are prohibited from striking.

Economies of scale were examined (Figure 3.7) to determine how increased volumes of merchandise would affect overall transportation charges in the five alternative modes of transportation. Total weight per year will start at 1,000,000 pounds due to the fact that NRSSO is presently transferring at least this amount of merchandise from the consolidator and manufacturers.

Transportation costs were obtained for Figure 3.7 by using the same costs for Alternatives One through Five as used previously in this chapter. Alternative intercity transportation costs were increased at one million pound increments. Alternative One (Current Operations) costs are a straight line function and remain at $167,486. Two tractors towing two 27-foot trailers and hauling 30,000 pounds per day (260 days per year) totals 7,800,000 pounds hauled per year until capacity of the existing system is reached.

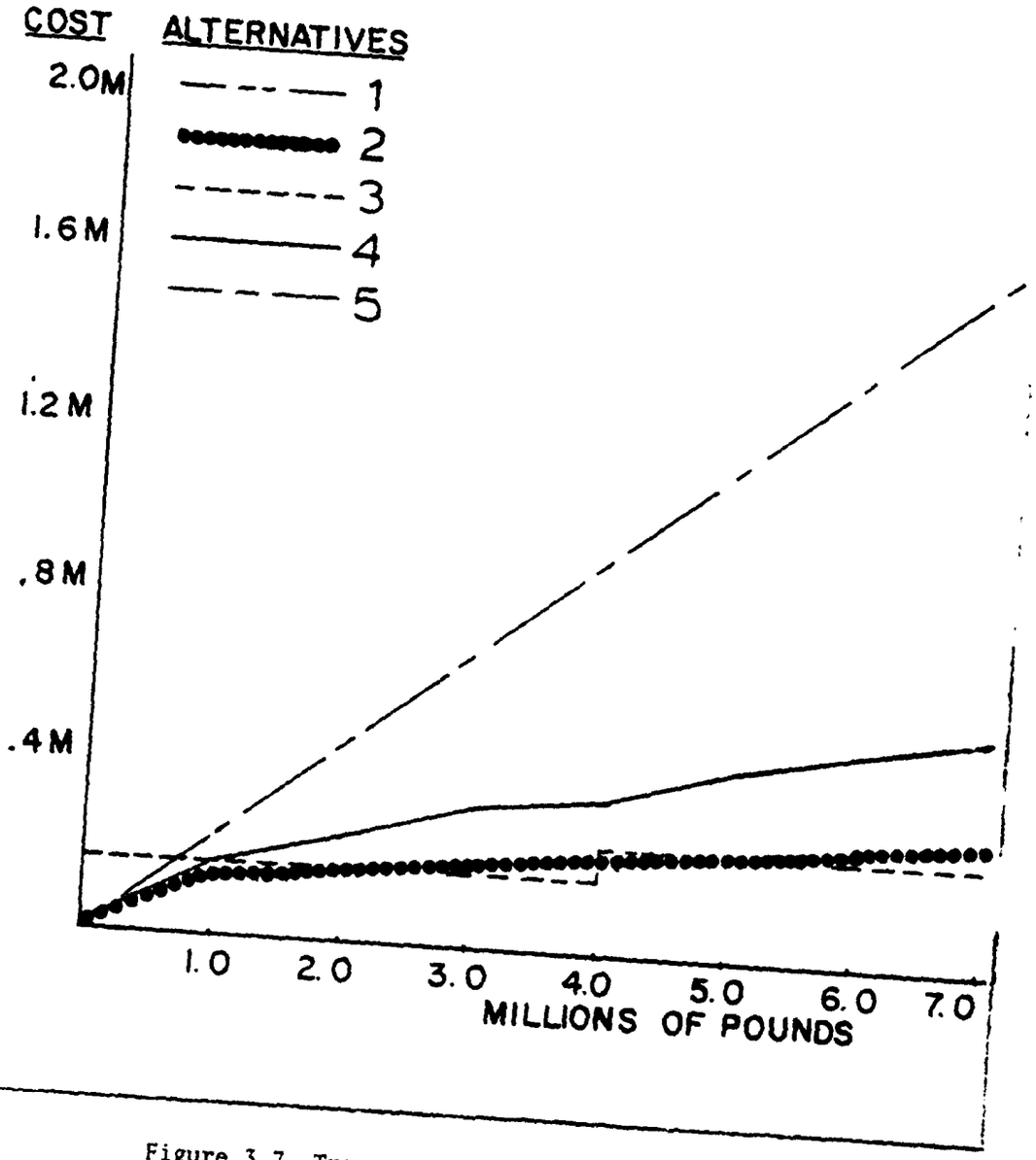


Figure 3.7 Transportation Sensitivity Chart

Alternative Two (Total Commercial) cost progression was derived by taking the total pounds per year, dividing by the 15,000 pound average trailer load and multiplying by the $250 common carrier rate. The San Diego to Long Beach drop-off rate of $285 will be included and as total weight increases, trips per week will increase (two trips to Long Beach will be required at 1,000,000 pounds per year, three trips per week for 2,000,000 pounds, four trips per week for 3,000,000 pounds and five trips per week for four to 7 million pounds). The Port Hueneme/Point Mugu and China Lake cost will remain fixed at $93,392 because of the fixed demand at the destination. Therefore the following total costs were derived for one to seven million pounds: $139,782, $171,102, $202,672, $234,242, $250,742, $267,492, and $284,242.

Alternative Three (Total NRSSO) was considered to be a two-step cost function. At 1,000,000 to 4,000,000 pounds per year the cost would remain at $182,448 annually. An increase of $58,216 and totaling $240,664 would be required to meet future requirements. This was determined by increasing the payroll, fuel, maintenance and depreciation costs by one third due to the requirement for a new truck and driver.

Alternative Four (Commercial, No Consolidation) is determined by dividing the total shipping weight per year by 100 pounds and charging $5.43 (Section 22 rate) for each 100 pounds shipped. The San Diego to Long Beach drop-off rate of $285 will increase in the same manner as Alternative Two and the Port Hueneme/Point Mugu and China Lake transportation rate will remain fixed at $93,392. Alternative Four total cost figures for one to 7 million pounds shipped annually equal $177,332, $246,452, $315,572, $384,692, $438,992, $493,292 and $547,592.

Alternative Five (Commercial Hourly Rate) linear cost growth was determined by using actual man hours required to move merchandise in 1,000,000 pound increments. At $36.88 per man hour the following figures were derived for movement of merchandise between one and seven million pounds: $233,672, $467,344, $701,016, $934,688, $1,168,360, $1,402,032 and $1,635,704.

A traffic manager utilizes several other factors to aid in transportation decisions. He should compare his average cost for transporting 100 pounds of merchandise and transportation cost per mile to the industry norms to evaluate his company's costs. NRSSO San Diego has done this and compared with industry the following data was obtained.

TABLE III

INDUSTRY STANDARDS

NRSSO SAN DIEGO	$ .59 per/100 lbs	$ .64 cost/per mile
INDUSTRY/STDS	$1.50 per/100 lbs	$1.17 " " "
*$87,416 cost per year / 137,280 miles per year =		.64
*.64 x 520 miles per day / 56,000 lbs/100 lbs per day =		.59

When compared to industry standards NRSSO San Diego is doing exceptionally well in holding down costs. Low costs are attributed to non-union truck drivers and an aggressive management system that controls all aspects of transportation. It is noteworthy to mention that NRSSO San Diego does use tachographs to monitor their truck drivers' performance and cut down on costs due to excessive work breaks and abuse of equipment. The improved

liability posture with such recording devices is of benefit to NRSSO also.

The cost analysis implies that Alternative One is the most reasonable transportation system at this time. With fuel prices holding their own NRSSO transportation should remain cost effective. What must be remembered is that the NRSSO transportation system will remain economically feasible only as long as strong and effective management prevails. Since the Motor Carrier Deregulation Act of 1980, price competition has lowered carrier rates and made them more competitive with other modes of transportation. Efforts must continue to be made by NRSSO to provide excellent transportation service at a minimum cost.

Further studies show that transportation costs for services provided to China Lake are excessive and average about $3,200 per month for an average of two hauls per week. The common carrier picks up two 27-foot trailers, one containing Navy Exchange merchandise and the other carrying Commissary merchandise and delivers them to China Lake which is approximately 195 miles one way from Long Beach. Due to this excessive cost and low volume of sales provided by China Lake, it is recommended that the China Lake Navy Exchange and Commissary be taken over by Edwards Air Force Base which is only forty miles from China Lake. It is realized that any movement in this area would involve political ramifications and would take a substantial amount of inter-service liaison to resolve.

F. CONCLUSION

The intercity transportation system developed by NRSSO San Diego is providing excellent service to Southern California Navy Exchanges.

Continued usage of this system should help control escalating transportation costs as weight and volume increase. NRSSO must also continue to seek opportunities aggressively to improve efficiency through modernized information systems, better planning and positive control procedures. With the consolidation and transportation alternatives covered in Chapters Two, Three and Four, the combined consolidation and transportation alternatives will be exhibited. The determination of which combination provides the most economical system will proceed from that.

The paramount concern is that the most economical combination of transportation modes and consolidation methods be derived and employed. Cost controls are dynamic and must accommodate evolutionary changes in the environment of the marketplace. No single set of statistics will suffice to provide a panacea for all times. Continuous and critical review of changing requirements are necessary to ensure optimal realization of the goals of economy, efficiency and effectiveness.

IV. INTERCITY CONSOLIDATION AND DELIVERY SOLUTIONS

A. INTRODUCTION

The purpose of this chapter is to find the most economical means of combining consolidation and transportation alternatives into an effective transportation system. Consolidation and transportation alternatives discussed in Chapters Two and Three will be comparatively combined and examined to determine the most advantageous system. Several factors must be incorporated to make reasonable comparisons among various alternatives. The selection of these factors is based on general applicability to all alternatives in order to improve the value of the selection process. Unquantifiables such as advertising value or the socio-economic implications of the actions of a branch of the federal government are not considered.

The comparison factors will help determine the control of the system and the impact of that on the reliability of service to the ultimate customer and what effect the cost of the system and the impact that it has on the general price level of the merchandise to the customer. In addition, alternatives will be analyzed to determine if highly pilferable products have adequate security. Flexibility in scheduling the use of equipment and the impact of changing to a different alternative upon the labor force currently employed will also be evaluated. The efficiency of each alternative will be examined by determining the projected utilization rates for drivers and equipment as affected by different alternatives.

A discussion of each separate alternative, its calculated cost and prospective advantages and disadvantages is presented. Then these

considerations are incorporated into a subjectively weighted matrix to summarize the decision process and provide support to the final recommendation. By incorporating all consolidation and transportation alternatives from Chapters Two and Three it has been found that nine transportation and consolidation systems could be derived for Los Angeles origin merchandise.

These nine transportation alternatives include the most reasonable and cost effective modes of transportation. Other modes of transportation examined included piggyback and barge transportation from Los Angeles to San Diego. Piggyback transportation, although relatively inexpensive, provided poor delivery service with respect to overall transit time. Estimates of delivery time provided ranged from three to five days, thus making it inconvenient to use this mode of transportation when compared to one-day service available by other means. Transportation by barge of large weight and volume items such as soft drinks, and paper products was also examined but because of the lengthy service time it was deemed as being an impractical mode of transportation.

B. COSTING OUT ALTERNATIVES

1. Alternative One

Alternative One (Combined commercial consolidation and NRSSO vehicles and drivers for long haul and commercial carrier for Port Hueneme/Point Mugu and China Lake/Chapter Two, Alternative One: Chapter Three, Alternative One) is presently being used by NRSSO San Diego to consolidate and transport merchandise from Los Angeles to San Diego. Service provided by this mode of transportation is satisfactory as evidenced by the adequate supplies of merchandise in the NRSSO warehouse and the overall

positive comments made by users of the system. This alternative has many advantages. NRSSO has control over all aspects of transportation except commercial delivery to Port Hueneme/Point Mugu and China Lake. NRSSO costs are also minimized in that it does not support a second fleet of small trucks in the Los Angeles area; additionally, the high cost of manning its own warehouse, as illustrated in Chapter Two, is avoided. Security is only minimally reduced in that non-government employees would be handling pilferable material only at the consolidation point. In addition, flexibility of the long haul scheduling is under NRSSO control and the numerous pick-ups made by the consolidator in the Los Angeles basis are inexpensive when compared to potential NRSSO operated consolidation costs.

1.	Commercial consolidation cost =	$ 29,952
2.	NRSSO transportation cost =	$ 89,582
3.	Commercial drop-off charge =	$ 77,904
	Total cost of Alternative One =	$197,438

2. Alternative Two

Alternative Two (NRSSO consolidation, trucking and drivers and commercial drop-off for Port Hueneme/Point Mugu and China Lake: Chapter Two, Alternative Two; Chapter Three, Alternative One) provides maximum control over all aspects of consolidation and shipping, but is too costly due to high consolidation costs. NRSSO costs would increase substantially due to the need to maintain a second fleet of trucks for local consolidation pick-ups from manufacturers. Personnel and handling equipment costs would also be high. Due to the high consolidated costs this alternative is considered a poor choice.

1.	NRSSO consolidation cost =	$159,598
2.	NRSSO transportation cost =	$ 89,583
3.	Commercial drop-off charge =	$ 77,904
	Total cost of Alternative Two =	$327,085

3. Alternative Three

Alternative Three (Commercial consolidation, NRSSO vehicles and drivers for long haul, Port Hueneme/Point Mugu and China Lake: Chapter Two, Alternative One; Chapter Three, Alternative Three) is the second most economical of the nine alternatives due to low commercial consolidation cost by consolidating only merchandise under 2,500 pounds and low NRSSO costs for long haul to and from the Los Angeles area. Transportation costs would increase when delivering merchandise to Port Hueneme/Point Mugu and China Lake because round trip deliveries would take over eight hours and overtime would be required. In addition, dead heading (empty back-haul) would occur on the return portion of the delivery.

1.	Commercial consolidation cost =	$ 29,952
2.	NRSSO transportation cost =	$182,448
	Total cost of Alternative Three =	$212,400

4. Alternative Four

Alternative Four (NRSSO consolidation, vehicles and drivers for Los Angeles area long haul, Port Hueneme/Point Mugu and China Lake: Chapter Two, Alternative Two; Chapter Three, Alternative Three) is an ideal alternative for maximum NRSSO control over all aspects of the system. Security would be the best of nine alternatives because NRSSO personnel would handle all merchandise. Overruling this factor is the substantial

cost of using NRSSO consolidation and the high cost of delivery to Port Hueneme/Point Mugu and China Lake.

1.	NRSSO consolidation cost =	$159,598
2.	NRSSO transportation cost -	$182,448
	Total cost of Alternative Four =	$342,046

5. Alternative Five

Alternative Five (Commercial consolidation using commercial carrier under contract: Chapter Two, Alternative One; Chapter Three, Alternative Five) uses an eight-hour daily rate and the same transportation procedures as Alternative One, except deliveries would be made using the hourly rate instead of the drop-off charge. Common carrier rates are $36.88 per hour for an eight-hour day. This alternative is the second most expensive and allows for very little flexibility in controlling driver working hours. Therefore, this alternative is considered to be the least feasible option.

1.	Commercial consolidation =	$ 29,952
2.	Commercial contract carrier =	$934,687
	Total cost of Alternative Five =	$964,639

6. Alternative Six

Alternative Six (NRSSO consolidation using commercial carrier under contract: Chapter Two, Alternative Two; Chapter Three, Alternative Five) is the most expensive alternative and incorporates the most expensive consolidation and transportation options. This would be the least economical choice of the nine possible alternatives.

1.	NRSSO consolidation =	$159,598
2.	Commercial contract carrier =	$934,687
	Total cost Alternative Six	$1,094,285

7. Alternative Seven

Alternative Seven (Commercial consolidation, using commercial carrier drop-off rate per trailer load/Chapter Two, Alternative One; Chapter Three, Alternative Two) could provide excellent service to the NRSSO San Diego warehouse but is considered to be too expensive due to the necessity of having all merchandise weighing greater than 100 pounds consolidated. Excessive consolidation charges would be realized in the case of high density weight shipments, e.g., batteries and tools. Transportation charges would be high when shipping large volume and low density items, such as pillows and lawn furniture, also. (Chapter Two, E, 1)

1.	Commercial consolidation at 4,000,000 lbs. =	$124,800
2.	Commercial carrier drop-off rate =	$234,242
	Total cost Alternative Seven =	$359,042

8. Alternative Eight

Alternative Eight (NRSSO consolidation and commercial carrier drop-off rate: Chapter Two, Alternative One; Chapter Three, Alternative Two) would provide adequate service, but its use would be prohibitive because of the high cost of combining NRSSO consolidation with commercial carrier drop-off rates. All 4,000,000 pounds would be consolidated by the NRSSO consolidation point and transferred to NRSSO San Diego.

1.	NRSSO consolidation at 4,000,000 lbs. =	$162,598
2.	Commercial shipment =	$234,242
	Total cost of Alternative Eight =	$396,840

9. Alternative Nine

Alternative Nine (Commercial movement, no consolidation, using a Section 22 rate per 100 pounds/Chapter Three, Alternative Four) would seem

to be one of the better alternatives considering that all shipments in excess of 100 pounds would be shipped at a $5.43 per 100 pound rate from Los Angeles basin to the NRSSO San Diego warehouse.

1. Total cost of Alternative Nine = $384,692

C. ANALYSIS OF ALTERNATIVES

The following bar graph (Figure 4.1) graphically displays total alternative costs at the 4,000,000 pound level of intercity traffic. This is the current volume of operations in Southern California. It is even more obvious at this point that contracting work on a per hour basis is beyond feasibility. Although this is readily apparent, NRSSO headquarters in Staten Island has asked the regional office to cost out transportation alternatives with the intention of contracting transportation services to reduce operational costs.

A subjective examination was undertaken by constructing Table IV with weighted factors to ascertain which alternatives would be preferable. The given factor in each alternative was subjectively evaluated to determine its numerical grading score from one to ten with ten being the most desirable score. Each alternative's factor score was multiplied by the subjective weight assigned each factor. All scores were then totaled and the alternative with the highest score became the most desirable. The subjective alternative scale (Table V) supports the conclusion that Alternative One is the most preferable alternative when evaluating non-quantifiable factors. It should be noted that this weighting scheme is not unique; however the weights selected appear to be reasonable in light of the authors' experience and NRSSO, San Diego operations.

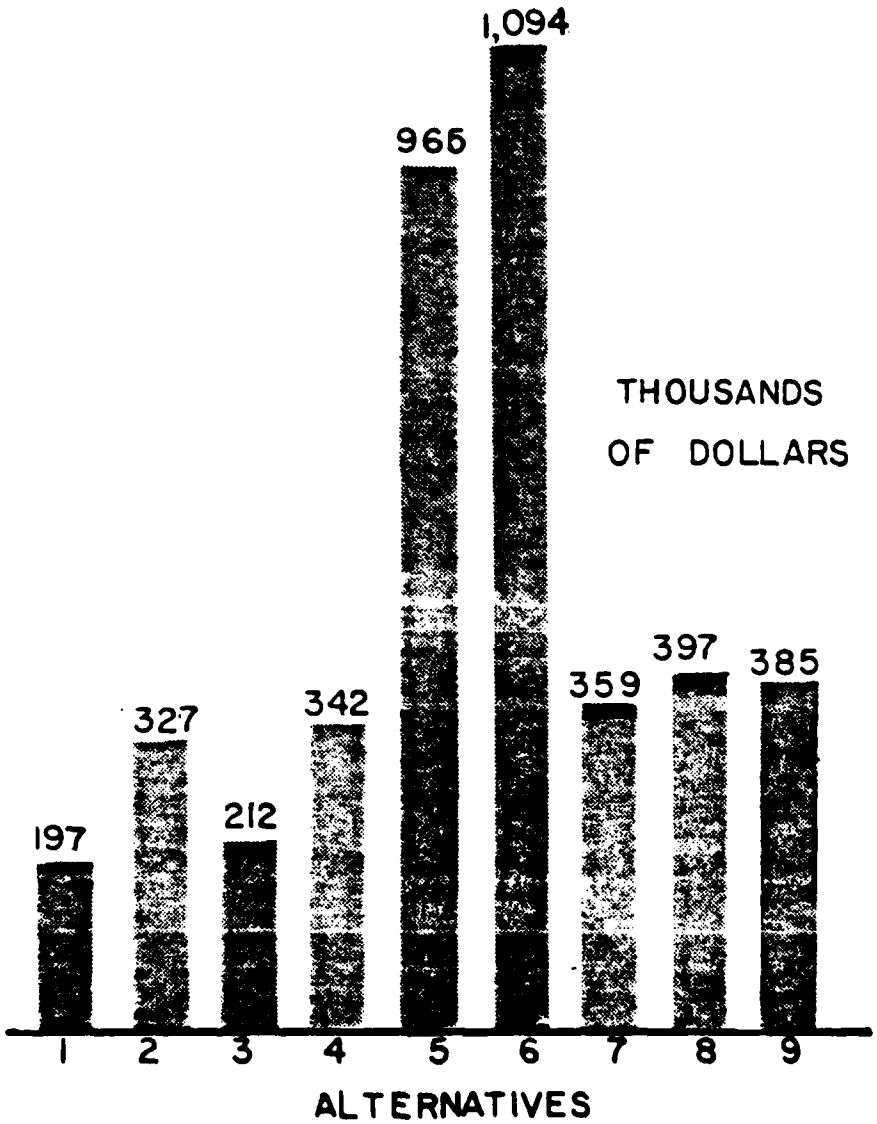


Figure 4.1 Alternative Costs Bar Graph

TABLE IV

SUBJECTIVE ALTERNATIVE SCALE

FACTOR	WEIGHT *	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6	ALT 7	ALT 8	ALT 9
CONTROL	10	8	10	9	10	4	6	6	7	5
COST	10	10	5	8	6	1	9	8	6	7
SECURITY	8	8	9	8	9	6	7	8	7	6
MAINTAIN.	3	8	8	9	8	10	9	10	9	10
FLEXIB'TY	7	8	6	7	6	5	5	8	7	9
LABOR	2	10	5	7	6	4	5	6	5	7
UTILITY	5	7	4	8	5	3	4	5	6	7
TOTAL*		379	318	304	335	186	298	327	302	310

*Weight 1-10 with 10 having the most positive value.
*Grading 1-10 with 10 being the most desirable.

The intent of showing TABLE V was to compare the total costs of the nine alternatives within the relative range of one to seven million pounds. After deriving costs for each alternative, a ranking from one to nine (least costly to most costly) was assigned for each million pound increment with the lowest total score being given the ranking of one. The ranking of alternatives by the aforementioned method reveals that Alternative One (Commercial Consolidation and NRSSO Trucking) is ranked as being the most desirable alternative in both the cost (Table VI) and Subjective (Table IV) analyses. Alternative Three (Commercial Consolidation, NRSSO Trucking, including Port Hueneme/Point Mugu and China Lake) is also ranked second in both analyses. Table V costs were obtained by using the same costing criteria as derived from Chapters Two and Three.

TABLE V

COST ANALYSIS OF THE NINE ALTERNATIVES

Weight in Millions of Pounds

ALTS	1.0	2.0	3.0	4.0	5.0	6.0	7.0
ONE	$197k	197k	197k	197k	197k	197k	197k
TWO	$328k	328k	328k	328k	328k	328k	328k
THREE	$212k	212k	212k	212k	271k	271k	271k
FOUR	$343k	343k	343k	343k	401k	401k	401k
FIVE	$264k	497k	731k	965k	1,198k	1,432k	1,666k
SIX*	$394k	628k	862k	1,095k	1,329k	1,563k	1,796k
SEVEN	$171k	234k	296k	359k	407k	455k	503k
EIGHT	$300k	332k	366k	398k	428k	490k	507k
NINE	$177k	246k	316k	385k	439k	493k	548k

*Consolidation in alternatives 1,2,3,4,5,6 and 9 remains at 960,000 pounds. Alternatives 7 and 8 must increase costs due to all merchandise being consolidated for commercial drop-off.

D. CONCLUSION

It is a tribute to the NRSSO San Diego transportation staff that the existing consolidation and transportation system is the best current alternative. Periodic review of the cost factors is required as in any dynamic system, however. The exploration of new alternatives is mandated by our commitment to continued high quality service at least possible cost. The basic elements for such research are outlined here and will serve as the format for continued critical review in the years ahead.

The advent of significant increased tax assessments upon commercial trucking as well as major evolutionary changes to the rate structure could completely revise our calculation of costs. Such legislative and regulatory fiats are not unknown. In the environment of ceaseless

TABLE VI

RANKING ASSIGNMENT OF THE NINE ALTERNATIVES

RANKING	ALTERNATIVE	SCORE
1	One	9
2	Three	16
3	Seven	27
4	Two	29
5	Four	36
6	Nine	37
7	Eight	45
8	Five	53
9	Six	63

change and unpredictable outcomes we are well advised to maintain a healthy skepticism as well as a positive attitude towards our standards and objectives.

V. INTRACITY NAVY EXCHANGE TRANSPORTATION

A. BACKGROUND

The movement of Navy Exchange merchandise from the NRSSO San Diego warehouse to retail outlets in the San Diego area is the principal issue under examination in this chapter. The specific requirements for intercity transportation are documented in Chapter Three. Transfers between stores are a minor portion of the issue and are considered within the scope of regularly scheduled transfers of merchandise as utilization of excess capacity and empty backhaul. The objective of this examination is to determine minimum vehicular and personnel requirements to maintain current levels of service. All of the merchandise is Navy-owned and subject to the self-insurance provision if transported by government conveyance. If merchandise is shipped commercially then private insurance would guarantee against any loss.

Merchandise is accumulated at the NRSSO San Diego warehouse by commercial and government transshipment from the consolidator in Los Angeles, by vendor delivery from the San Diego area, by United Parcel Service or Parcel Post receipts (if under 100 pounds per shipment) and by Navy truck direct from the manufacturer or distributor (if any single shipment exceeds 2,500 pounds).

Items which are warehoused are predominantly regularly distributed items which are not seasonal, subject to vendor direct delivery to the retail outlet or otherwise one-time in nature. They are forecasted by means of a twenty-eight-day, fixed interval, internal reorder program.

This same program also orders the regularly consumed items which are FOB destination to the retail outlet and not warehoused. These account for thirty percent of the 15,000 line items which are forecasted leaving approximately 11,000 line items as warehouse inventory.

Merchandise distributed from the NRSSO San Diego warehouse covers the spectrum of dollar value, material density and physical size. All of the material is destined for resale and it is therefore particularly susceptible to pilferage. Security measures to assure acceptability include stringent stock inventory procedures and the envelopment of each assembled pallet of outbound merchandise with corresponding documentation in a clear plastic sheath. This precludes easy access to remove partial quantities of merchandise from case lots or to alter shipment documentation. Figure 5.1 displays the Navy Exchange activities which are served by this intracity delivery network.

B. MODES OF DELIVERY

The options available to the NRSSO San Diego Traffic Management Office are threefold. The current system of organic fleet government trucking can be maintained with its capacity for resupplying the Navy Exchanges in the San Diego area. A commercial carrier could be contracted to provide the full range of services required if the cost study identified any significant economies to be realized in adopting that alternative. A combination of government and commercial transportation may be the best alternative as mixes of tonnages and destinations are varied to derive the optimal solution.

The criteria which are pertinent to this procedure are dictated by the concurrent requirement to minimize costs in the transportation network

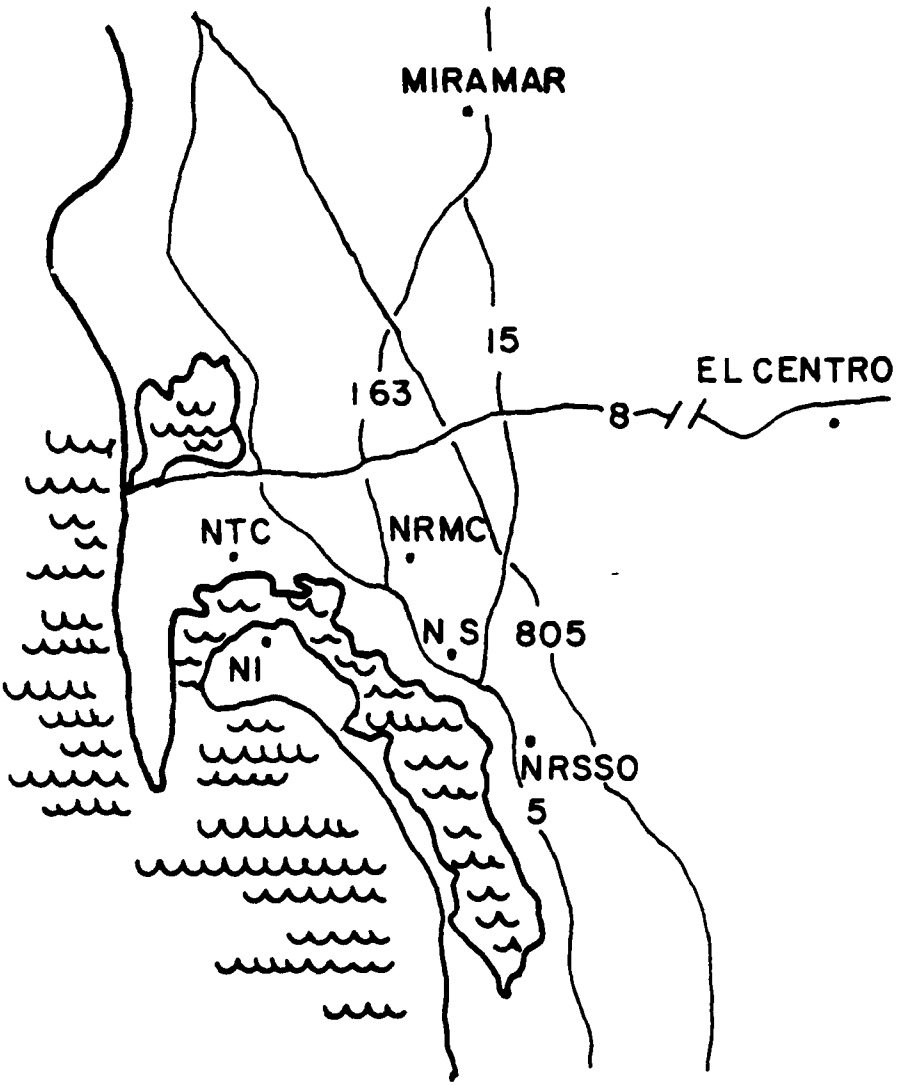


Figure 5.1 Map of Intracity Navy Exchanges

while maintaining standards of quality and timeliness in service to the retail outlets.

The continuance of the organic fleet of government vehicles provides a fixed capacity for meeting transportation needs. The augmentation of this capacity would require additional major physical purchases of vehicles as well as the hiring of more personnel. The responsiveness to future changes in volume of merchandise to be distributed would be delayed by the requirement to modify the composition of the organic fleet. The inherent reliability and predictability factors characteristic of a private fleet are valuable. A detailed financial and operational comparison to the other alternatives will enable us to decide which method is ultimately most desirable and feasible.

The option of purely commercial contracting has the distinct advantage of being a linear cost function. The characteristically positive value in this involves the elimination of excess capacity. The private fleet's inherent step function for costing is thereby circumvented. The commercial option provides a more flexible correspondence between the distributional assets and the volumes of material to be distributed. The penalty resides in the loss of internal control over the physical assets in the form of the vehicles as well as the merchandise. The potential for increased cost is a significant consideration also. Operational controls are contractually arranged but the uncertainty of dependence upon outside personnel and equipment must be weighed in any decision to embrace the commercial option to the exclusion of the other two options.

The third alternative is to blend government with commercial transportation. Such a proposal would accommodate the desire for an organic

fleet capacity while providing a surge capacity and marginal economies through commercial contracting, where applicable. The determination of the threshold above which commercial contracting would bear the traffic is crucial to the effective utilization of existing and projected vehicular assets and established personnel levels consistent with potentially higher cost in the commercial sector.

C. COSTING METHODOLOGY

The approach to the problem of deriving the most economical transportation alternative for the Navy Exchanges of Southern California is one of comparative costing. The Traffic Management Office of NRSSO San Diego is the source of the information and guidance utilized in analyzing this problem. The data are current and provide a valid basis upon which to project responsiveness to legitimate requirements within funding and manpower constraints. All fractions of whole numbers and dollar amounts are rounded to the nearest whole number unless otherwise noted.

The initial step involves determination of the sources and destinations for merchandise within the Southern California area. The sources are geographically distributed at Los Angeles, Long Beach and San Diego. Intracity transportation will address the material originating at San Diego only. The other points of origin are discussed in the intercity transportation section of this thesis. The material is from commercial sources and the thrust of this thesis is concerned with that material which is destined for the NRSSO San Diego, Eighth Street, National City warehouse and on to retail outlets throughout Southern California. The balance of the merchandise is shipped by the manufacturer or distributor

on an FOB destination basis or forwarded by Parcel Post or United Parcel Service (if under 100 pounds per shipment) directly to the retail outlet. The commercial consolidation operation by Triangle Corporation is a refinement of the distribution network which is examined elsewhere and is of no significance to the intra-city transportation situation except as it affects overall volume through the warehouse.

The destinations for retail merchandise have been reduced to the major geographic complexes with allowances made for multiple drops of merchandise at subordinate outlets through enhancement of the loading and unloading times incorporated into the calculations. The average delivery quantities are reduced to a pallet count per week to facilitate scheduling of vehicles and personnel in weekly increments. The standard pallet size of 40 inches by 48 inches is applied to the internal dimensions of the trailers and capacities of 12 pallets for the 27-foot trailers, 14 pallets for the 30-foot trailers and 20 pallets for the 40-foot trailers are derived. Loading procedures require that the 48-inch dimension be situated fore and aft and therefore define the capacity of a trailer in four-foot multiples of length times two pallets abreast across the width of the trailer. The capacities of the trailer assets are reduced to whole pallet measurements and individual capacities are delineated at the 27, 30 and 40-foot trailer sizes.

The time allowed for loading and unloading of the trailers is determined from industry standards (Material Handling Standard Time Data, 1 March 1967, Office of the Assistant Secretary of Defense, DOD Installations and Logistics) as provided by the Traffic Management Office of NRSSO San Diego. A basic quantification of 1.2 hours to load a 40-foot

trailer is applied to a proportionate scale and factors of .8 hours for a 27-foot trailer and .9 hours for a 30-foot trailer are derived to complete the desired range of trailer capacities. Multiplication of the resultant figure by two and rounding fractions to the next higher integer provides the commensurate loading and unloading time to accommodate necessary handling time for the merchandise from warehouse to retail outlet. The utilization of 22-foot and 45-foot trailers is not considered due to the marginal applicability of their capacities for the immediate future.

Transit time from the warehouse to the retail activity is determined by round trip mileage conversion to a time factor allowing for metropolitan traffic density during the Monday through Friday daytime delivery scenario. Average speeds of thirty miles per hour for intracity travel and fifty miles per hour for intercity travel are applied and peculiarities of specific routes are taken into consideration to derive the final transit times expressed in hours.

The final step in the derivation of the total time required per week for accomplishing deliveries involves a series of calculations. The number of trailers varies as a function of their capacity and is applied to the loading and unloading factors according to that capacity. The transit time provides the other multiple which produces the total time required to effect an idealized delivery.

The options which are examined in this chapter consider the possibilities of reliance upon commercially contracted carriers, a government operated private fleet or a combination of the two to attain desired economies. The cost analysis proceeds from a basis of hours required to

accomplish any given delivery. The reduction of costs to a per hour basis is straightforward in the commercial arena due to the existing rate structure which provides services of a driver with tractor and 40-foot trailer as customers may require. Such a costing structure does not materialize as readily upon examination of the NRSSO San Diego traffic operation. Annual costs for vehicle depreciation (sum-of-the-years'-digits), operation and maintenance coupled with drivers' wages are extracted from NRSSO records. The total annual dollar value is divided by the total annual hours of accumulated drivers' time to arrive at a cost per hour to operate a government fleet vehicle. With such a basis for comparison the cost analysis proceeds to examine the relative merits of each alternative to the exclusion of the other.

D. TRANSPORTATION ALTERNATIVE COSTS

The intracity transportation of Navy Exchange merchandise concerns itself with the distribution of materials originating at the Eighth Street, National City warehouse only. Such merchandise is destined for Naval Air Station North Island, Naval Station San Diego, Naval Training Center San Diego, Naval Air Station Miramar, Naval Air Station El Centro and Navy Regional Medical Center San Diego. Transportation of merchandise to other Southern California Navy Exchanges is discussed earlier in this thesis.

Sensitivity analysis is incorporated into the computations by adding twenty percent to the current merchandise volume to determine a projected volume. The tables are arranged to facilitate comparison as the computations progress towards the derivation of the final cost figures for each alternative.

The pallets per week figures are derived from current distributional volumes which are expected to remain constant through the next three years according to NRSSO San Diego. The division of the weekly pallet delivery count by the known pallet capacities of the selected trailer sizes provides the number of trailers required per week to satisfy each destination. Trailer multiples which are less than ten percent of full load are rounded down to preclude inflation of trailer requirements. The results are displayed in Table VII below.

TABLE VII

MATERIAL VOLUME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	NUMBERS OF TRAILERS 40 FT	30 FT	27 FT
NAS NORTH ISLAND	80	4	6	7
NS SAN DIEGO	164	9	12	14
NTC SAN DIEGO	134	7	10	12
NAS MIRAMAR	109	6	8	10
NAS EL CENTRO	12	1	1	1
NRMC SAN DIEGO	73	4	6	7

PROJECTED

DESTINATION	PALLETS PER WEEK	NUMBERS OF TRAILERS 40 FT	30 FT	27 FT
NAS NORTH ISLAND	96	5	7	8
NS SAN DIEGO	197	10	14	17
NTC SAN DIEGO	161	8	12	14
NAS MIRAMAR	131	7	10	11
NAS EL CENTRO	15	1	1	2
NRMC SAN DIEGO	88	5	7	8

The handling time required is based upon the generally accepted transportation industry standard time of 1.2 hours to load or unload a 40-foot trailer with a forklift and driver. Times of .9 hours for a 30-foot

trailer and .8 hours for a 27-foot trailer are further derived by multiplying the length of each trailer as a percentage of 40 feet times 1.2 hours. These factors are then doubled to accommodate loading and unloading time and rounded upwards to allow for multiple deliveries at destination. This result is multiplied by the number of trailers required per week to satisfy the delivery schedule. The results are displayed in Table VIII below.

TABLE VIII

HANDLING TIME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	HOURS LOAD/UNLOAD 40 FT	30 FT	27 FT
NAS NORTH ISLAND	80	9.6	10.8	11.3
NS SAN DIEGO	164	21.6	21.6	22.7
NTC SAN DIEGO	134	16.8	18.0	19.4
NAS MIRAMAR	109	14.4	14.4	16.2
NAS EL CENTRO	12	2.4	1.8	1.6
NRMC SAN DIEGO	73	9.6	10.8	11.3

PROJECTED

DESTINATION	PALLETS PER WEEK	HOURS LOAD/UNLOAD 40 FT	30 FT	27 FT
NAS NORTH ISLAND	96	12.0	12.6	12.8
NS SAN DIEGO	197	24.0	25.2	27.2
NTC SAN DIEGO	161	19.2	21.6	22.4
NAS MIRAMAR	131	16.8	18.0	17.6
NAS EL CENTRO	15	2.4	1.8	3.2
NRMC SAN DIEGO	88	12.0	12.6	12.8

The transit time per week is determined in a two-step process first taking the round trip distance from the NRSSO San Diego warehouse to each

destination and return. This number is multiplied by the number of trailers per week required to satisfy the delivery requirements and provides the total distance to be traveled each week by destination. The transit time itself is determined by dividing this total weekly distance by the approximate average speed of thirty miles per hour for intracity travel and fifty miles per hour for intercity travel and rounding the time figures upwards to accommodate delays enroute. The results are displayed in Tables IX AND X below.

TABLE IX

ROUND TRIP DISTANCES

CURRENT AND PROJECTED

DESTINATION	ROUND TRIP DISTANCES
NAS NORTH ISLAND	16 MILES
NS SAN DIEGO	2 MILES
NTC SAN DIEGO	23 MILES
NAS MIRAMAR	38 MILES
NAS EL CENTRO	230 MILES
NRMC SAN DIEGO	13 MILES

TABLE X

TRANSIT TIME PER WEEK

CURRENT

DESTINATION	DISTANCE			TRANSIT TIME		
	40 FT	30 FT	27 FT	40 FT	30 FT	27 FT
NAS NORTH ISLAND	64	96	112	2.0	3.0	3.5
NS SAN DIEGO	18	24	28	1.8	2.4	2.8
NTC SAN DIEGO	161	230	276	5.3	7.5	9.0
NAS MIRAMAR	228	304	380	6.0	8.0	10.0
NAS EL CENTRO	230	230	230	4.5	4.5	4.5
NRMC SAN DIEGO	52	78	91	1.6	2.4	2.8

PROJECTED

DESTINATION	DISTANCE			TRANSIT TIME		
	40 FT	30 FT	27 FT	40 FT	30 FT	27 FT
NAS NORTH ISLAND	80	112	128	2.5	3.5	4.0
NS SAN DIEGO	20	28	34	2.0	2.8	3.4
NTC SAN DIEGO	184	276	322	6.0	9.0	10.5
NAS MIRAMAR	266	380	418	7.0	10.0	11.0
NAS EL CENTRO	230	230	460	4.5	4.5	9.0
NRMC SAN DIEGO	65	91	104	2.0	2.8	3.2

The total delivery time per week is determined by summing the "Handling Time Per Week" and "Transit Time Per Week" totals and listing them with their appropriate destination. The results are displayed in Table XI below.

The commercial contracting costs per week are derived by multiplying the known commercial hourly charge rate of $36.88 (provided by Naval Supply Center, San Diego, which utilizes such a commercial delivery service, currently from the Ace High trucking company) by the total required delivery time per week. The results are displayed in Table XII below.

The government fleet cost per week is derived by a summation of cost determinants. Annual vehicle depreciation is $140,000 according to the

TABLE XI

TOTAL DELIVERY TIME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	TOTAL TIME 40 FT	30 FT	27 FT
NAS NORTH ISLAND	80	11.6	13.8	14.8
NS SAN DIEGO	164	23.4	24.0	25.5
NTC SAN DIEGO	134	22.1	25.5	28.4
NAS MIRAMAR	109	20.4	22.8	26.2
NAS EL CENTRO	12	6.9	6.3	6.1
NRMC SAN DIEGO	73	11.2	13.2	14.1

PROJECTED

DESTINATION	PALLETS PER WEEK	TOTAL TIME 40 FT	30 FT	27 FT
NAS NORTH ISLAND	96	14.5	16.1	16.8
NS SAN DIEGO	197	26.0	28.0	30.6
NTC SAN DIEGO	161	25.2	30.6	32.9
NAS MIRAMAR	131	23.8	28.0	28.6
NAS EL CENTRO	15	6.9	6.3	12.2
NRMC SAN DIEGO	88	14.0	15.4	16.0

accounting office at NRSSO San Diego. Operational expenses for fuel are computed based upon 264,000 miles per year at six miles per gallon. That quantity of fuel in gallons is multiplied by $1.15 cost per gallon and generates the $50,600 annual fuel cost. Drivers' wages are computed with fringe benefits to be $18,701 per driver per year. This figure multiplied by fourteen drivers yields the $261,814 annual driver cost. Annual maintenance costs are $40,000 for the fleet. The total of these costs equals $492,414. When divided by the man hours per year figure of 25,344 the average cost of $19.43 per hour is produced. The results are displayed in Table XIII below.

TABLE XII

COMMERCIAL CONTRACTING COST PER WEEK

CURRENT

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
NAS NORTH ISLAND	$36.88	$428	$509	$546
NS SAN DIEGO	$36.88	$863	$885	$940
NTC SAN DIEGO	$36.88	$815	$940	$1047
NAS MIRAMAR	$36.88	$752	$841	$966
NAS EL CENTRO	$36.88	$254	$232	$225
NRMC SAN DIEGO	$36.88	$413	$487	$520

PROJECTED

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
NAS NORTH ISLAND	$36.88	$535	$594	$620
NS SAN DIEGO	$36.88	$959	$1033	$1129
NTC SAN DIEGO	$36.88	$929	$1129	$1213
NAS MIRAMAR	$36.88	$878	$1033	$1055
NAS EL CENTRO	$36.88	$254	$232	$450
NRMC SAN DIEGO	$36.88	$516	$568	$590

The comparison of commercial to government transportation reveals a forty-seven percent advantage by itilization of the government owned and operated fleet in preference to commercial hourly contract vehicles. The substantial cost differential virtually mandates the government fleet operation and relegates consideration of commercial hourly or daily contracting to instances when surge capacity would be required, such as in the case of seasonal deliveries, to justify the extraordinary expenses incurred.

TABLE XIII

GOVERNMENT FLEET COST PER WEEK

CURRENT

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
NAS NORTH ISLAND	$19.43	$225	$268	$288
NS SAN DIEGO	$19.43	$455	$466	$490
NTC SAN DIEGO	$19.43	$429	$490	$552
NAS MIRAMAR	$19.43	$396	$443	$552
NAS EL CENTRO	$19.43	$134	$122	$119
NRMC SAN DIEGO	$19.43	$218	$256	$274

PROJECTED

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
NAS NORTH ISLAND	$19.43	$282	$313	$326
NS SAN DIEGO	$19.43	$505	$544	$595
NTC SAN DIEGO	$19.43	$490	$595	$639
NAS MIRAMAR	$19.43	$462	$544	$556
NAS EL CENTRO	$19.43	$134	$122	$237
NRMC SAN DIEGO	$19.43	$272	$299	$311

E. SCHEDULING

The task of scheduling the vehicles and drivers to deliver the volume of merchandise from the warehouse to the retail outlets requires an analysis of the demand for transportation services. In the case of Navy Exchange delivery the single source at the Eighth Street, National City NRSSO warehouse provides material to six major retail stores located in a geographic distribution which ranges from one mile to 115 miles distant. The element of distance has been previously reduced to units of time measured in hours.

This provides the common factor which permits allocation of assets systematically.

A five-day work week with eight-hour working days is defined as standard for this scheduling problem. The total time in one week for handling and delivering the material is divided by the number of loads to derive a time per load factor. The number of deliveries to any one location, expressed as an integer, is deployed across the five-day span in equal increments and placing remainders (i.e., other than equal increments) on Fridays when only one unequal increment results, on Tuesdays and Thursdays when two unequal increments result. This initial distribution may be modified by subsequent developments but represents the preliminary step. This factor is multiplied by the number of trailers destined to any one retail store in any one given day and a total time requirement is derived. The number of trailers on any given day to all destinations is summed and rearranged until the most equitable distribution across the five-day span is attained. The daily total time requirements for all destinations on a given day are also summed. This sum is divided by eight hours per day to derive the number of drivers required to accomplish the deliveries assigned. Any fractions are rounded up to the next higher integer. Variations of more than one driver requirement across the span of the week indicate that a more equitable distribution of the loads can be attained. The results are displayed in Tables XIV through XVII below.

TABLE XIV

CURRENT NAVY EXCHANGE SCHEDULING (40-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
NAS NORTH ISLAND					
4 LOADS/WEEK	1		1	1	1
11.6 HRS/WEEK	2.9		2.9	2.9	2.9
NS SAN DIEGO					
9 LOADS/WEEK	2	2	2	2	1
23.4 HRS/WEEK	5.2	5.2	5.2	5.2	2.6
NTC SAN DIEGO					
7 LOADS/WEEK	1	2	1	2	1
22.1 HRS/WEEK	3.2	6.4	3.2	6.4	3.2
NAS MIRAMAR					
6 LOADS/WEEK	1	1	2	1	1
20.4 HRS/WEEK	3.4	3.4	6.8	3.4	3.4
NAS EL CENTRO					
1 LOAD/WEEK	1				
6.9 HRS/WEEK	6.9				
NRMC SAN DIEGO					
4 LOADS/WEEK		1	1	1	1
11.2 HRS/WEEK		2.8	2.8	2.8	2.8
TOTAL LOADS:	6	6	7	7	5
TOTAL HOURS:	21.6	17.8	20.9	20.7	14.9
TOTAL DRIVERS:	3	3	3	3	2

TABLE XV

CURRENT NAVY EXCHANGE SCHEDULING (27-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
NAS NORTH ISLAND					
7 LOADS/WEEK	1	2	1	2	1
14.8 HRS/WEEK	2.1	4.2	2.1	4.2	2.1
NS SAN DIEGO					
14 LOADS/WEEK	3	3	3	3	2
25.5 HRS/WEEK	5.4	5.4	5.4	5.4	3.6
NTC SAN DIEGO					
12 LOADS/WEEK	3	2	3	2	2
28.4 HRS/WEEK	7.2	4.8	7.2	4.8	4.8
NAS MIRAMAR					
10 LOADS/WEEK	2	2	2	2	2
26.2 HRS/WEEK	5.2	5.2	5.2	5.2	5.2
NAS EL CENTRO					
1 LOAD/WEEK					1
6.1 HRS/WEEK					6.1
NRMC SAN DIEGO					
7 LOADS/WEEK	2	1	2	1	1
14.1 HRS/WEEK	4.0	2.0	4.0	2.0	2.0
TOTAL LOADS:	11	10	11	10	9
TOTAL HOURS:	23.9	21.6	23.9	23.9	23.8
TOTAL DRIVERS:	3	3	3	3	3

TABLE XVI

PROJECTED NAVY EXCHANGE SCHEDULING (40-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
NAS NORTH ISLAND					
5 LOADS/WEEK	1	1	1	1	1
14.5 HRS/WEEK	2.9	2.9	2.9	2.9	2.9
NS SAN DIEGO					
10 LOADS/WEEK	2	2	2	2	2
26.0 HRS/WEEK	5.2	5.2	5.2	5.2	5.2
NTC SAN DIEGO					
8 LOADS/WEEK	2	1	2	1	2
25.2 HRS/WEEK	6.4	3.2	6.4	3.2	6.4
NAS MIRAMAR					
7 LOADS/WEEK	1	2	1	2	1
23.8 HRS/WEEK	3.4	6.8	3.4	6.8	3.4
NAS EL CENTRO					
1 LOAD/WEEK			1		
6.9 HRS/WEEK			6.9		
NRMC SAN DIEGO					
5 LOADS/WEEK	1	1	1	1	1
14.0 HRS/WEEK	2.8	2.8	2.8	2.8	2.8
TOTAL LOADS:	7	7	7	7	7
TOTAL HOURS:	20.7	20.9	27.6	20.9	20.7
TOTAL DRIVERS:	3	3	4	3	3

TABLE XVII

PROJECTED NAVY EXCHANGE SCHEDULING (27-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
NAS NORTH ISLAND					
8 LOADS/WEEK	2	1	2	1	2
16.8 HRS/WEEK	4.2	2.1	4.2	2.1	4.2
NS SAN DIEGO					
17 LOADS/WEEK	3	4	3	4	3
30.6 HRS/WEEK	5.4	7.2	5.4	7.2	5.4
NTC SAN DIEGO					
14 LOADS/WEEK	3	3	3	3	2
32.9 HRS/WEEK	7.2	7.2	7.2	7.2	4.8
NAS MIRAMAR					
11 LOADS/WEEK	2	2	2	2	3
28.6 HRS/WEEK	5.2	5.2	5.2	5.2	7.8
NAS EL CENTRO					
2 LOADS/WEEK		1		1	
12.2 HRS/WEEK		6.1		6.1	
NRMC SAN DIEGO					
8 LOADS/WEEK	2	1	2	1	2
16.0 HRS/WEEK	4.0	2.0	4.0	2.0	4.0
TOTAL LOADS:	12	12	12	12	12
TOTAL HOURS:	26.0	29.8	26.0	29.8	26.2
TOTAL DRIVERS:	4	4	4	4	4

F. CONCLUSION

Current Navy Exchange intracity transportation assets and personnel are at least adequate to sustain the tempo of operations. The twenty

percent increase in merchandise volume explored by the sensitivity analysis would require no augmentation in equipment or personnel.

The utilization of the 40-foot trailer over the 27-foot trailer is of no significant scheduling advantage until the increased merchandise volume is attained. In the strict statistical sense it is more economical to utilize the 40-foot trailer at the hourly rate under any circumstance, however. The excess capacity that the larger trailer provides is of value when variations in the cyclic patterns of loading are considered, moreover.

The continued utilization of the government-owned fleet is strongly recommended. The commercial carriers should be utilized to supplement the organic fleet to meet surges in merchandise volume.

VI. COMMISSARY TRANSPORTATION

A. BACKGROUND

The Navy Commissary Region, San Diego supports the entire Southern California Commissary store system. Merchandise which is accommodated by this chapter includes all manner of dry provisions. Perishables such as dairy, meat and produce products are not subject to examination here due to their existing delivery contracts relieving the Navy Commissary Region of anything more than responsibility for ordering and receiving procedures in the administration of the contracts. The objective of this examination is to determine the minimum vehicular and personnel requirements to maintain current levels of service as well as accommodate the anticipated growth in distributional volume over the next three years. Transfers between stores are a minor portion of the issue and are considered within the scope of regularly scheduled transfers of merchandise as utilization of excess capacity and empty backhaul.

The dry provisions are procured by the Navy Commissary warehouses located at Naval Station San Diego, Naval Air Station Miramar and Naval Station Long Beach. Distribution to subordinate facilities is accomplished from these warehousing sites which are illustrated in Figure 6.1 and listed in Table XVIII below.

There is a consolidation of the warehousing function projected for the San Diego area. The Central Distribution Center (CDC) is being planned with the intention of combining the Naval Station San Diego and Naval Air Station Miramar facilities into one larger facility with an ultimate

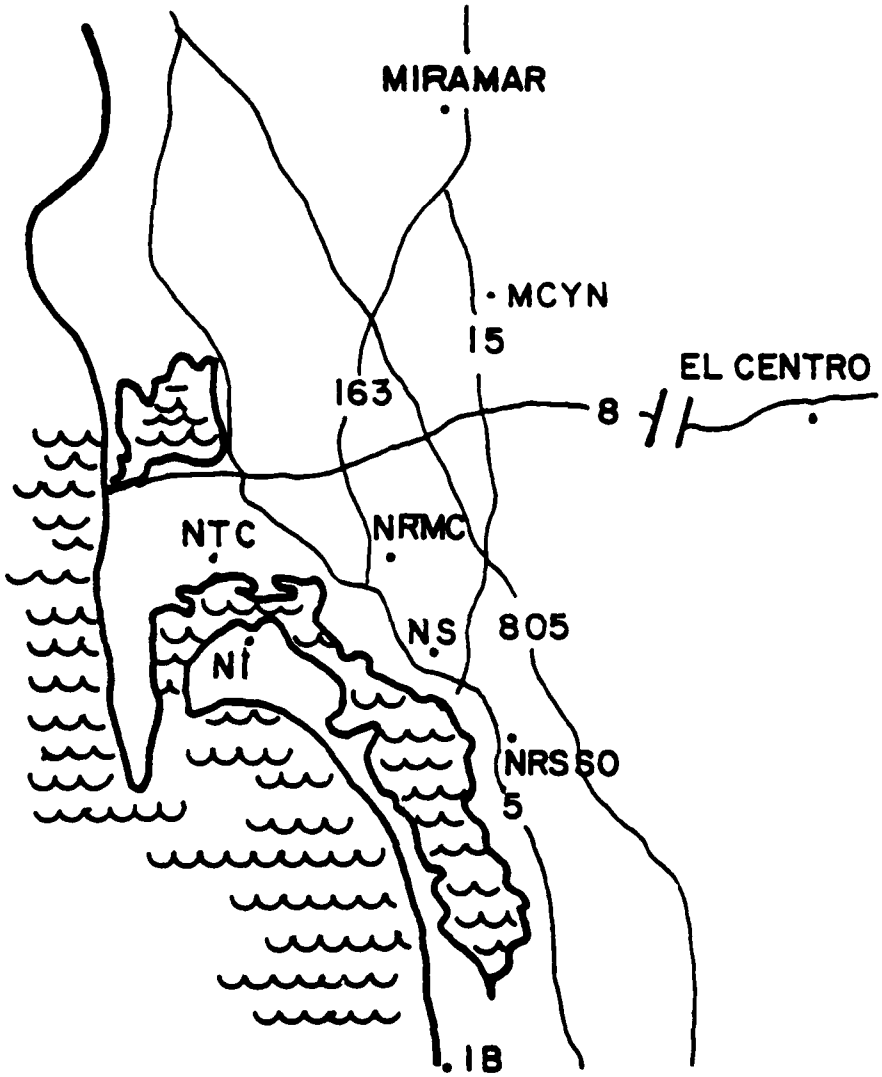


Figure 6.1 Map of San Diego Navy Commissary Region

TABLE XVIII

NAVY COMMISSARY WAREHOUSE CAPACITIES

STORE LOCATION	CAPACITY
NAVAL STATION SAN DIEGO	40,000 SQUARE FEET
NAVAL AIR STATION MIRAMAR	37,000 SQUARE FEET
NAVAL STATION LONG BEACH	60,000 SQUARE FEET

capacity of 152,000 square feet constructed in three increments beyond the existing (Phase I) structure. Completion of Phase II of the CDC project to add 81,000 square feet of warehouse capacity is anticipated in 1984. Phase III involves an addition of 40,000 square feet of capacity at the same site. This portion of the project is scheduled for completion in 1986 and accommodates the anticipated requirements for supporting the proposed retail Commissary facilities due for completion by 1986. A final addition of 31,000 square feet, termed Phase IV, is projected beyond 1986 to serve anticipated Navy Commissary Region requirements in the San Diego area.

This centralization of the warehousing function will be followed by new Commissary stores at the Murphy Canyon housing area as well as in Imperial Beach. These new facilities will alleviate congestion at existing commissaries in the San Diego area and will serve the concentrations of Navy dependents as they have evolved since the establishment of the Navy Commissary Region in San Diego. It is anticipated that the new facilities will augment current volume within the San Diego distribution area by as much as twenty percent by attracting potential patronage currently lost to existing facilities due to the inconvenience of

congestion and location according to the Navy Commissary Region Office in San Diego. The Long Beach origin distribution network is projected to be constant in merchandise volume over the next three years.

Modern pallet conveyor tracks as well as high stack storage and retrieval techniques will assure that manning requirements are minimized and current effectiveness is maintained. In the analysis of costs it becomes apparent what a significant ratio of labor over equipment costs can do to the feasibility of an operation. Attaining the state of the art is not an option, it is a necessity, in view of such analyses.

B. MODES OF DELIVERY

NRSSO San Diego Traffic Management Office handles the bulk paper products and paper sacks for the Navy Commissary Region, San Diego. The dry provisions are loaded into Navy Commissary Region trailers for delivery to individual Commissary stores. Unit trailer loads are combined with Navy Exchange trailers to attain any available economies of scale, specifically in the case of the deliveries to China Lake.

The positive value of a private fleet for meeting consistent material transportation demands characteristic of a Commissary operation is a significant consideration in this issue. The seasonal variations are less than with Navy Exchange merchandise. The staple quality of the merchandise is not conducive to large scale or frequent product rejection and consequent disruption of the distribution cycle. These factors contribute to making the private fleet concept of Commissary distribution a highly satisfactory mode of transportation despite the inherent empty backhaul.

An exclusively commercial fleet would be more responsive to any emergent fluctuations in volume. Its quality of linear cost gradients is a better matching of capacity and cost over the full range of capacity. The potential for increased cost is a significant consideration, also. If Commissary volumes and delivery schedules are, in fact, consistent within an acceptable variance, then the purely commercial alternative may not offer economies sufficient to warrant implementation.

A combination of private fleet and commercial contracting could serve to accommodate surges in delivery requirements for any seasonal variances in volume or distribution that may be experienced. The pairing of two convenient modes to attain maximum advantage from each one's characteristic virtues is an option to be considered.

C. COSTING METHODOLOGY

The approach to the problem of deriving the most economical transportation alternative for the Navy Commissary Region of Southern California is one of comparative costing. The Navy Commissary Region Office in San Diego is the source of the information and guidance utilized in analyzing this problem. The data is current and provides a valid basis upon which to project the requirements for meeting the needs of the Commissaries throughout Southern California over the next three years. All fractions of whole numbers and dollar amounts are rounded to the nearest whole number unless otherwise noted.

The initial step involves determination of the sources and destinations for merchandise within the Southern California area. The sources are geographically distributed at Naval Station San Diego, Naval Air

Station Miramar and Naval Station Long Beach. The material is in warehouses in these locations and proceeds to requisitioning commissaries from standard stock inventories. Other retail merchandise proceeds to the outlet under commercial delivery contracts, as in the case of dairy and bakery products, or under the cognizance of the Defense Subsistence Office (DSO), as in the case of meat. The consideration of the eventual combination of the Naval Station San Diego and Naval Air Station Miramar warehouse facilities into the CDC located at Eighth Street, National City requires adjustments to those mileages to destinations formerly served by the Miramar warehouse while the Long Beach origin scheduling remains the same.

The destinations for retail merchandise consist of the roster of Commissary outlets with allowances made for multiple drops of merchandise at subordinate outlets through enhancement of the loading and unloading times incorporated into the calculations. The average delivery quantities are reduced to pallet count per week to facilitate scheduling of vehicles and personnel in weekly increments. The standard pallet size of 40 inches by 48 inches is applied to the internal dimensions of the trailers and capacities of 12 pallets for the 27-foot trailers, 14 pallets for the 30-foot trailers and 20 pallets for the 40 foot trailers are derived. Loading procedures require that the 48-inch dimension be situated fore and aft and therefore define the capacity of a trailer in four-foot multiples of length times two pallets abreast across the width of the trailer. The capacities of the trailer assets are reduced to whole pallet measurements and individual capacities are delineated at the 27, 30 and 40-foot trailer sizes.

The time allowed for loading and unloading of the trailers is determined from industry standards (Material Handling Standard Time Data, 1 March 1967, Office of the Assistant Secretary of Defense, DOD Installations and Logistics) as provided by the Traffic Management Office of NRSSO San Diego. A basic quantification of 1.2 hours to load a 40-foot trailer is applied to a proportionate scale and factors of .8 hours for a 27-foot trailer and .9 hours for a 30-foot trailer are derived to complete the desired range of trailer capacities. Multiplication of the resultant figure by two and rounding fractions to the next higher integer provides the commensurate loading and unloading time to accommodate necessary handling time for the merchandise from warehouse to retail outlet. The utilization of 22-foot and 45-foot trailers is not considered due to the marginal applicability of their capacities for the immediate future.

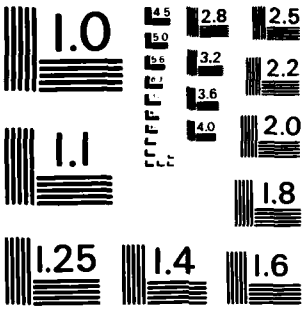
Transit time from the warehouse to the retail activity is determined by round trip mileage conversion to a time factor allowing for metropolitan traffic density during the Monday through Friday delivery scenario. An average speed of thirty miles per hour for intracity travel and fifty miles per hour for intercity travel is applied and peculiarities of specific routes are taken into consideration to derive the final transit times expressed in hours.

The final step in the derivation of the total time required per week for accomplishing deliveries involves a series of calculations. The number of trailers varies as a function of their capacity and are applied to the loading and unloading factors according to that capacity. The transit

AD-A132 784 NAVY RESALE SERVICES AND SUPPORT OFFICE CONSOLIDATION AND TRANSPORTATION PLAN(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA R W GORRIE ET AL. JUN 83 2/2.

UNCLASSIFIED F/G 15/5 NL

END
DATE
FILMED
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

time provides the other multiple which produces the total time required to effect an idealized delivery.

The options which are examined in this chapter consider the possibilities of reliance upon commercially contracted carriers, a government operated private fleet or a combination of the two to attain desired economies. The cost analysis proceeds from a basis of hours required to accomplish any given delivery. The reduction of costs to a per hour basis is straightforward in the commercial arena due to the existing rate structure which provides services of a driver with tractor and forty-foot trailer as customers may require. Such a costing structure does not materialize as readily upon examination of the Navy Commissary Region traffic operation. Annual costs for vehicle depreciation (sum-of-the-years'-digits), operation and maintenance coupled with drivers' wages are extracted from NRSSO San Diego records. The total annual dollar value is divided by the total annual hours of accumulated drivers' time to arrive at a cost per hour to operate a government fleet vehicle. With such a basis for comparison the cost analysis proceeds to examine the relative merits of each alternative to the exclusion of the other.

D. TRANSPORTATION ALTERNATIVE COSTS

The intracity transportation of Commissary merchandise concerns itself with the distribution of materials originating at Naval Station San Diego, Naval Air Station Miramar and Naval Station Long Beach in the current time frame and ultimately from the Central Distribution Center at Eighth Street, National City and Naval Station Long Beach as the CDC project completes Phase II. Such merchandise is destined for retail

Commissary stores at Naval Station San Diego, Naval Training Center San Diego, Naval Air Station El Centro, Naval Air Station Miramar, Naval Air Station North Island, Naval Station Long Beach, Port Hueneme, Point Mugu and Naval Weapons Center China Lake.

Sensitivity analysis is incorporated into the computations by adding twenty percent to the current merchandise volume to determine a projected volume. The tables are arranged to facilitate comparison as the computations progress towards the derivation of the final cost figures for each alternative.

The pallets per week figures are derived from current distributional volumes which are expected to grow by a maximum of twenty percent in the next three years by the addition of two new retail Commissary stores, one at Murphy Canyon and the other at Imperial Beach. The division of the weekly pallet delivery count by the known pallet capacities of the selected trailer sizes provides the number of trailers required per week to satisfy each destination. Trailer multiples which are less than ten percent of full load are rounded down to preclude inflation of trailer requirements. The results are displayed in Table XIX below.

The handling time required is based upon the generally accepted transportation industry standard time of 1.2 hours to load or unload a 40-foot trailer with a forklift and driver. Times of .9 hours for a 30-foot trailer and .8 hours for a 27-foot trailer are further derived by multiplying the length of each trailer as a percentage of 40 feet times 1.2 hours. These factors are then doubled to accommodate loading and unloading time and rounded upwards to allow for multiple deliveries at

TABLE XIX

MATERIAL VOLUME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	NUMBERS OF TRAILERS 40 FT	30 FT	27 FT
FROM SAN DIEGO:				
NS SAN DIEGO	276	14	20	23
NTC SAN DIEGO	82	5	6	7
NAS EL CENTRO	14	1	1	2
FROM MIRAMAR:				
NAS MIRAMAR	215	11	16	18
NAS NORTH ISLAND	99	5	8	9
FROM LONG BEACH:				
NS LONG BEACH	153	8	11	13
PORT HUENEME	89	5	7	8
POINT MUGU	27	2	2	3
NWC CHINA LAKE	18	1	2	2

PROJECTED

DESTINATION	PALLETS PER WEEK	NUMBERS OF TRAILERS 40 FT	30 FT	27 FT
FROM CDC:				
NAS NORTH ISLAND	99	5	8	9
NS SAN DIEGO	276	14	20	23
NTC SAN DIEGO	82	5	6	7
NAS MIRAMAR	215	11	16	18
NAS EL CENTRO	14	1	1	2
MURPHY CANYON	99	5	8	9
IMPERIAL BEACH	137	7	10	12
FROM LONG BEACH:				
NS LONG BEACH	153	8	11	13
PORT HUENEME	89	5	7	8
POINT MUGU	27	2	2	3
NWC CHINA LAKE	18	1	2	2

destination. This result is multiplied by the number of trailers required per week to satisfy the delivery schedule. The results are displayed in Table XX below.

The transit time per week is determined in a two-step process first taking the round trip distance from the origin to each destination and return. This number is multiplied by the number of trailers per week required to satisfy the delivery requirements and provides the total distance to be traveled by each by destination. The transit time itself is determined by dividing this total weekly distance by the approximate average speed of thirty miles per hour for intracity travel and fifty miles per hour for intercity travel and rounding the time figures upwards to accommodate delays enroute. The results are displayed in Tables XXI and XXII below.

The total delivery time per week is determined by summing the "Handling Time Per Week" and "Transit Time Per Week" totals and listing them with their appropriate destination. The results are displayed in Table XXIII below.

The commercial contracting costs per week are derived by multiplying the known commercial hourly charge rate of $36.88 (provided by Naval Supply Center, San Diego, which utilizes such a commercial delivery service currently) by the total required delivery time per week. The results are displayed in Table XXIV below.

The government fleet cost per week is derived by a summation of cost determinants for the NRSSO San Diego fleet which supports the Navy Exchange transportation network. Annual vehicle depreciation is $140,000

TABLE XX

HANDLING TIME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	HOURS LOAD/UNLOAD 40 FT	30 FT	27 FT
FROM SAN DIEGO:				
NS SAN DIEGO	276	33.6	36.0	36.8
NTC SAN DIEGO	82	12.0	10.8	11.2
NAS EL CENTRO	14	2.4	1.8	3.2
FROM MIRAMAR:				
NAS MIRAMAR	215	26.4	28.8	28.8
NAS NORTH ISLAND	99	12.0	14.4	14.4
FROM LONG BEACH:				
NS LONG BEACH	153	19.2	19.8	20.8
PORT HUENEME	89	12.0	12.6	12.8
POINT MUGU	27	4.8	3.6	4.8
NWC CHINA LAKE	18	2.4	3.6	3.2

PROJECTED

DESTINATION	PALLETS PER WEEK	HOURS LOAD/UNLOAD 40 FT	30 FT	27 FT
FROM CDC:				
NAS NORTH ISLAND	99	12.0	14.4	14.4
NS SAN DIEGO	276	33.6	36.0	36.8
NTC SAN DIEGO	82	12.0	10.8	11.2
NAS MIRAMAR	215	26.4	28.8	28.8
NAS EL CENTRO	14	2.4	1.8	3.2
MURPHY CANYON	99	12.0	14.4	14.4
IMPERIAL BEACH	137	16.8	18.0	19.2
FROM LONG BEACH:				
NS LONG BEACH	153	19.2	19.8	20.8
PORT HUENEME	89	12.0	12.6	12.8
POINT MUGU	27	4.8	3.6	4.8
NWC CHINA LAKE	18	2.4	3.6	3.8

TABLE XXI

ROUND TRIP DISTANCES

CURRENT

DESTINATION	ROUND TRIP DISTANCES
FROM SAN DIEGO:	
NS SAN DIEGO	2 MILES
NTC SAN DIEGO	23 MILES
NAS EL CENTRO	230 MILES
FROM MIRAMAR:	
NAS MIRAMAR	2 MILES
NAS NORTH ISLAND	42 MILES
FROM LONG BEACH:	
NS LONG BEACH	2 MILES
PORT HUENEME	184 MILES
POINT MUGU	154 MILES
NWC CHINA LAKE	390 MILES

PROJECTED

DESTINATION	ROUND TRIP DISTANCES
FROM CDC:	
NAS NORTH ISLAND	16 MILES
NS SAN DIEGO	2 MILES
NTC SAN DIEGO	23 MILES
NAS MIRAMAR	38 MILES
NAS EL CENTRO	230 MILES
MURPHY CANYON	34 MILES
IMPERIAL BEACH	19 MILES
FROM LONG BEACH:	
NS LONG BEACH	2 MILES
PORT HUENEME	184 MILES
POINT MUGU	154 MILES
NWC CHINA LAKE	390 MILES

TABLE XXII

TRANSIT TIME PER WEEK

CURRENT

DESTINATION	DISTANCE			TRANSIT TIME		
	40 FT	30 FT	27 FT	40 FT	30 FT	27 FT
FROM SAN DIEGO:						
NS SAN DIEGO	28	40	46	2.8	4.0	4.6
NTC SAN DIEGO	115	138	161	2.5	3.0	3.5
NAS EL CENTRO	230	230	460	4.5	4.5	9.0
FROM MIRAMAR:						
NAS MIRAMAR	22	32	36	2.2	3.2	3.6
NAS NORTH ISLAND	210	336	378	6.0	9.6	10.8
FROM LONG BEACH:						
NS LONG BEACH	16	22	26	1.6	2.2	2.6
PORT HUENEME	920	1288	1472	20.0	28.0	32.0
POINT MUGU	308	308	468	7.4	7.4	11.1
NWC CHINA LAKE	390	780	780	8.0	16.0	16.0

PROJECTED

DESTINATION	DISTANCE			TRANSIT TIME		
	40 FT	30 FT	27 FT	40 FT	30 FT	27 FT
FROM CDC:						
NAS NORTH ISLAND	80	128	144	2.5	4.0	4.5
NS SAN DIEGO	28	40	46	2.8	4.0	4.6
NTC SAN DIEGO	115	138	161	2.5	3.0	3.5
NAS MIRAMAR	418	608	684	11.0	16.0	18.0
NAS EL CENTRO	230	230	460	4.5	4.5	9.0
MURPHY CANYON	170	272	306	4.0	6.4	7.2
IMPERIAL BEACH	133	190	228	2.8	4.0	4.8
FROM LONG BEACH:						
NS LONG BEACH	16	22	26	1.6	2.2	2.6
PORT HUENEME	920	1288	1472	20.0	28.0	32.0
POINT MUGU	308	308	462	7.4	7.4	11.1
NWC CHINA LAKE	390	780	780	8.0	16.0	16.0

TABLE XXIII

TOTAL DELIVERY TIME PER WEEK

CURRENT

DESTINATION	PALLETS PER WEEK	TOTAL TIME 40 FT	30 FT	27 FT
FROM SAN DIEGO:				
NS SAN DIEGO	276	36.4	40.0	41.4
NTC SAN DIEGO	82	14.5	13.8	14.7
NAS EL CENTRO	14	6.9	6.3	12.2
FROM MIRAMAR:				
NAS MIRAMAR	215	28.6	32.0	31.8
NAS NORTH ISLAND	99	18.0	24.0	25.2
FROM LONG BEACH:				
NS LONG BEACH	153	20.8	22.0	23.4
PORT HUENEME	89	32.0	40.6	44.8
POINT MUGU	27	12.2	11.0	15.9
NWC CHINA LAKE	18	10.4	19.6	19.2

PROJECTED

DESTINATION	PALLETS PER WEEK	TOTAL TIME 40 FT	30 FT	27 FT
FROM CDC:				
NAS NORTH ISLAND	99	14.5	18.4	18.9
NS SAN DIEGO	276	36.4	40.0	41.4
NTC SAN DIEGO	82	14.5	13.8	14.7
NAS MIRAMAR	215	37.4	44.8	46.8
NAS EL CENTRO	14	6.9	6.3	12.2
MURPHY CANYON	99	16.0	20.8	21.6
IMPERIAL BEACH	137	19.6	22.0	24.0
FROM LONG BEACH:				
NS LONG BEACH	153	20.8	22.0	23.4
PORT HUENEME	89	32.0	40.6	44.8
POINT MUGU	27	12.2	11.0	15.9
NWC CHINA LAKE	18	10.4	19.6	19.8

TABLE XXIV

COMMERCIAL CONTRACTING COST PER WEEK

CURRENT

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
FROM SAN DIEGO:				
NS SAN DIEGO	$36.88	$1342	$1475	$1527
NTC SAN DIEGO	$36.88	$ 535	$ 509	$ 542
NAS EL CENTRO	$36.88	$ 254	$ 232	$ 450
FROM MIRAMAR:				
NAS MIRAMAR	$36.88	$1055	$1180	$1173
NAS NORTH ISLAND	$36.88	$ 664	$ 885	$ 929
FROM LONG BEACH:				
NS LONG BEACH	$36.88	$ 767	$ 811	$ 863
PORT HUENEME	$36.88	$1180	$1497	$1652
POINT MUGU	$36.88	$ 450	$ 406	$ 586
NWC CHINA LAKE	$36.88	$ 384	$ 723	$ 708

PROJECTED

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
FROM CDC:				
NAS NORTH ISLAND	$36.88	$ 535	$ 679	$ 697
NS SAN DIEGO	$36.88	$1342	$1475	$1527
NTC SAN DIEGO	$36.88	$ 535	$ 509	$ 542
NAS MIRAMAR	$36.88	$1379	$1652	$1726
NAS EL CENTRO	$36.88	$ 254	$ 232	$ 450
MURPHY CANYON	$36.88	$ 590	$ 767	$ 797
IMPERIAL BEACH	$36.88	$ 723	$ 811	$ 885
FROM LONG BEACH:				
NS LONG BEACH	$36.88	$ 767	$ 811	$ 863
PORT HUENEME	$36.88	$1180	$1497	$1652
POINT MUGU	$36.88	$ 450	$ 406	$ 586
NWC CHINA LAKE	$36.88	$ 384	$ 723	$ 730

according to the accounting office at NRSSO San Diego. Operational expenses for fuel are computed based upon 264,000 miles per year at six miles per gallon. That quantity of fuel in gallons is multiplied by $1.15 cost per gallon and generates the $50,600 annual fuel cost. Drivers' wages are computed with fringe benefits to be $18,701 per driver per year. This figure multiplied by fourteen yields the $261,814 annual driver cost. Annual maintenance costs are $40,000 for the fleet. The total of these costs equals $492,414. When divided by the man hours per year figure of 25,344 the average cost of $19.43 per hour is produced. Note that the rates applied in Chapter Six are identical to those found in Chapter Five due to the single source for cost information. The results are displayed in Table XXV below.

The comparison of commercial to government transportation reveals a forty-seven percent advantage by utilization of the government owned and operated fleet in preference to commercial hourly contract vehicles. The substantial cost differential virtually mandates the government fleet operation and relegates consideration of commercial hourly or daily contracting to instances when surge capacity would be required, such as for seasonal deliveries, to justify the extraordinary expense.

E. SCHEDULING

The task of scheduling the vehicles and drivers to deliver the volume of merchandise from the warehouse to the retail outlets requires an analysis of the demand for transportation services. In the case of Navy Commissary Region deliveries, the current sources at Naval Station San Diego, Naval Air Station Miramar and Naval Station Long Beach

TABLE XXV

GOVERNMENT FLEET COST PER WEEK

CURRENT

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
FROM SAN DIEGO:				
NS SAN DIEGO	$19.43	$707	$777	$804
NTC SAN DIEGO	$19.43	$282	$268	$286
NAS EL CENTRO	$19.43	$134	$122	$237
FROM MIRAMAR:				
NAS MIRAMAR	$19.43	$556	$622	$618
NAS NORTH ISLAND	$19.43	$350	$466	$490
FROM LONG BEACH:				
NS LONG BEACH	$19.43	$404	$427	$455
PORT HUENEME	$19.43	$622	$789	$870
POINT MUGU	$19.43	$237	$214	$309
NWC CHINA LAKE	$19.43	$202	$381	$373

PROJECTED

DESTINATION	HOURLY RATE CHARGE	TOTAL COST PER WEEK 40 FT	30 FT	27 FT
FROM CDC:				
NAS NORTH ISLAND	$19.43	$282	$358	$367
NS SAN DIEGO	$19.43	$707	$777	$804
NTC SAN DIEGO	$19.43	$282	$268	$286
NAS MIRAMAR	$19.43	$727	$870	$909
NAS EL CENTRO	$19.43	$134	$122	$237
MURPHY CANYON	$19.43	$311	$404	$420
IMPERIAL BEACH	$19.43	$381	$427	$466
FROM LONG BEACH:				
NS LONG BEACH	$19.43	$404	$427	$455
PORT HUENEME	$19.43	$622	$789	$870
POINT MUGU	$19.43	$237	$214	$309
NWC CHINA LAKE	$19.43	$202	$381	$385

provide material to nine major retail stores located in a geographic distribution which ranges from one mile to 195 miles distant from the supplying warehouse. The element of distance has been previously reduced to units of time measured in hours. This provides the common factor which permits us to allocate assets systematically.

A five-day work week with eight-hour working days is defined as standard for this scheduling problem. The total time in one week for handling and delivering the material is divided by the number of loads to derive a time per load factor. The number of deliveries to any one location, expressed as an integer, is deployed across the five-day span in equal increments and placing remainders (i.e., other than equal increments) on Fridays when only one unequal increment results or on Tuesdays and Thursdays when two unequal increments result. This initial distribution may be modified by subsequent developments but represents the preliminary step. This factor is multiplied by the number of trailers destined to any one retail store in any one given day and a total time requirement is derived. The number of trailers on any given day to all destinations is summed and rearranged until the most equitable distribution across the five-day span is attained. The daily total time requirements for all destinations on a given day are also summed. This sum is divided by eight hours per day to derive the number of drivers required to accomplish the deliveries assigned. Any fractions are rounded up to the next higher integer. Variations of more than one driver requirement across the span of the week indicate that a more equitable distribution of the loads can be attained.

The asterisk by the NWS China Lake entries in the Long Beach origin schedules is to note that the figures are not computed in the tables due to the Navy Exchange actually performing the delivery of the merchandise by tandem 27-foot trailers to China Lake utilizing their tractor and driver. The only obligation upon the Navy Commissary Region is to load the trailer at origin and unload the trailer at destination. There is no driver requirement on this delivery and this is the thrust of the scheduling table. Note also that the Long Beach schedules are deleted from the Projected Commissary Schedule tables due to their identity with the Current Commissary Schedule tables. Tables XXVI through XXIX display the results.

F. CONCLUSION

Current Commissary intracity transportation assets and personnel are sufficient to sustain the tempo of operations. The twenty percent merchandise volume increase which is anticipated over the next three years will require the addition of one vehicle and driver to support the San Diego CDC while Long Beach's requirements will remain constant.

The utilization of the 40-foot trailer over the 27-foot trailer is of no significant advantage until the increased merchandise volume is attained. In the strict statistical sense, however, it is more economical to utilize the 40-foot trailer at the hourly rate under any circumstance. Moreover, the excess capacity that the larger trailer provides is of value when variations in the cyclic patterns of loading are considered.

TABLE XXVI

CURRENT COMMISSARY SCHEDULING (40-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
FROM SAN DIEGO:					
NS SAN DIEGO					
14 LOADS/WEEK	3	3	3	3	2
34.6 HRS/WEEK	7.5	7.5	7.5	7.5	5.0
NTC SAN DIEGO					
5 LOADS/WEEK	1	1	1	1	1
15.8 HRS/WEEK	3.2	3.2	3.2	3.2	3.2
NAS EL CENTRO					
1 LOAD/WEEK					1
6.9 HRS/WEEK					6.9
FROM MIRAMAR:					
NAS MIRAMAR					
11 LOADS/WEEK	2	3	2	2	2
27.1 HRS/WEEK	5.0	7.5	5.0	5.0	5.0
NAS NORTH ISLAND					
5 LOADS/WEEK	1	1	1	1	1
19.0 HRS/WEEK	3.8	3.8	3.8	3.8	3.8
TOTAL LOADS:	7	8	7	7	7
TOTAL HOURS:	19.5	22.0	19.5	19.5	23.9
TOTAL DRIVERS:	3	3	3	3	3
FROM LONG BEACH:					
NS LONG BEACH					
8 LOADS/WEEK	2	1	2	1	2
19.7 HRS/WEEK	5.0	2.5	5.0	2.5	5.0
PORT HUENEME					
5 LOADS/WEEK	1	1	1	1	1
30.4 HRS/WEEK	6.1	6.1	6.1	6.1	6.1
POINT MUGU					
2 LOADS/WEEK		1		1	
11.0 HRS/WEEK		5.5		5.5	
NWC CHINA LAKE					
1 LOAD/WEEK			1		
10.2 HRS/WEEK			10.2*		
TOTAL LOADS:	3	3	4	3	4
TOTAL HOURS:	11.1	14.1	11.1	14.1	11.1
TOTAL DRIVERS:	2	2	2	2	2

*Not included in calculations.

TABLE XXVII

CURRENT COMMISSARY SCHEDULING (27-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
FROM SAN DIEGO:					
NS SAN DIEGO					
23 LOADS/WEEK	5	4	5	4	5
41.4 HRS/WEEK	9.0	7.2	9.0	7.2	9.0
NTC SAN DIEGO					
7 LOADS/WEEK	1	2	1	2	1
14.7 HRS/WEEK	2.1	4.2	2.1	4.2	2.1
NAS EL CENTRO					
2 LOADS/WEEK		1		1	
12.2 HRS/WEEK		6.1		6.1	
FROM MIRAMAR:					
NAS MIRAMAR					
18 LOADS/WEEK	4	3	4	3	4
31.8 HRS/WEEK	7.2	5.4	7.2	5.4	7.2
NAS NORTH ISLAND					
9 LOADS/WEEK	2	2	2	2	1
25.2 HRS/WEEK	5.6	5.6	5.6	5.6	2.8
TOTAL LOADS:	12	12	12	12	11
TOTAL HOURS:	23.9	28.5	23.9	28.5	21.1
TOTAL DRIVERS:	3	4	3	4	3
FROM LONG BEACH:					
NS LONG BEACH					
13 LOADS/WEEK	3	2	3	2	3
23.4 HRS/WEEK	5.4	3.6	5.4	3.6	5.4
PORT HUENEME					
8 LOADS/WEEK	2	1	2	1	2
44.8 HRS/WEEK	11.2	5.6	11.2	5.6	11.2
POINT MUGU					
3 LOADS/WEEK	1	1		1	
15.9 HRS/WEEK	5.3	5.3		5.3	
NWC CHINA LAKE					
2 LOADS/WEEK			1		1
19.2 HRS/WEEK			9.6*		9.6*
TOTAL LOADS:	6	4	6	4	6
TOTAL HOURS:	21.9	14.5	16.6	14.5	16.6
TOTAL DRIVERS:	3	2	2	2	2

*Not included in calculations.

TABLE XXVIII

PROJECTED COMMISSARY SCHEDULING (40-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
FROM CDC:					
NAS NORTH ISLAND					
5 LOADS/WEEK	1	1	1	1	1
14.7 HRS/WEEK	2.9	2.9	2.9	2.9	2.9
NS SAN DIEGO					
14 LOADS/WEEK	3	3	3	3	2
34.6 HRS/WEEK	7.5	7.5	7.5	7.5	5.0
NTC SAN DIEGO					
5 LOADS/WEEK	1	1	1	1	1
15.8 HRS/WEEK	3.2	3.2	3.2	3.2	3.2
NAS MIRAMAR					
11 LOADS/WEEK	2	2	2	3	2
40.3 HRS/WEEK	7.4	7.4	7.4	11.1	7.4
NAS EL CENTRO					
1 LOAD/WEEK					1
6.9 HRS/WEEK					6.9
MURPHY CANYON					
5 LOADS/WEEK	1	1	1	1	1
17.7 HRS/WEEK	3.5	3.5	3.5	3.5	3.5
IMPERIAL BEACH					
7 LOADS/WEEK	1	2	2	1	1
21.2 HRS/WEEK	3.0	6.0	6.0	3.0	3.0
TOTAL LOADS:	9	10	10	10	9
TOTAL HOURS:	27.5	30.5	30.5	31.2	31.9
TOTAL DRIVERS:	4	4	4	4	4

*Long Beach origin scheduling identical to current schedule.

TABLE XXIX

PROJECTED COMMISSARY SCHEDULING (27-FOOT TRAILER)

DESTINATION	MON	TUE	WED	THU	FRI
FROM CDC:					
NAS NORTH ISLAND					
9 LOADS/WEEK	2	2	2	2	1
18.9 HRS/WEEK	4.2	4.2	4.2	4.2	2.1
NS SAN DIEGO					
23 LOADS/WEEK	6	5	6	5	6
41.4 HRS/WEEK	10.8	9.0	10.8	9.0	10.8
NTC SAN DIEGO					
7 LOADS/WEEK	1	2	1	2	1
14.7 HRS/WEEK	2.1	4.2	2.1	4.2	2.1
NAS MIRAMAR					
18 LOADS/WEEK	4	3	4	3	4
46.8 HRS/WEEK	10.4	7.8	10.4	7.8	10.4
NAS EL CENTRO					
2 LOADS/WEEK		1		1	
12.2 HRS/WEEK		6.1		6.1	
MURPHY CANYON					
9 LOADS/WEEK	2	2	2	2	1
21.6 HRS/WEEK	4.8	4.8	4.8	4.8	2.4
IMPERIAL BEACH					
12 LOADS/WEEK	2	3	2	3	2
24.0 HRS/WEEK	4.0	6.0	4.0	6.0	4.0
TOTAL LOADS:	17	18	17	18	15
TOTAL HOURS:	36.3	42.1	36.3	42.1	31.8
TOTAL DRIVERS:	5	6	5	6	4

*Long Beach origin scheduling identical to current scheduling.

The continued utilization of the government owned fleet is strongly recommended. The commercial carriers should be utilized to supplement the organic fleet to meet surges in merchandise volume.

VII. SUMMARY AND RECOMMENDATIONS

Chapters Two through Six are an in-depth look at all aspects of the NRSSO San Diego Navy Exchange and Commissary transportation systems. It is felt that the NRSSO San Diego organization is doing an excellent job in managing costs and is a fine example of how traffic management costs can be controlled while maintaining a fixed effectiveness service level. The traffic office possesses the capacity to continue to improve due to a concerned and knowledgeable management team.

As requested by NRSSO San Diego, an in-depth examination of potential transportation economies for shipment of Navy Exchange and Commissary merchandise is contained herein. Current long haul and local transportation systems are costed out and alternative modes of transportation are analyzed to determine the most economical and feasible solution using both subjective and quantitative analysis. In addition, sensititivy analysis is incorporated into the study to determine the effect of a range of merchandise volume upon alternatives.

It is determined in Chapter Two that commercial consolidation is the more effective means of economizing on transportation costs when shipping large quantities of merchandise from a metropolitan area. Using sensitivity analysis, commercial consolidation rates are increased 30 percent to determine if NRSSO consolidation would become more cost effective. The comparison of NRSSO and commercial alternative consolidation costs for consolidating merchandise from one to seven million pounds is also

analyzed. In both cases it has been determined that commercial consolidation is the preferred way to consolidate merchandise due to lower costs, greater flexibility and satisfactory service. Thus, the commercial consolidation system presently being used by NRSSO is considered excellent and should be continued.

Chapter Three examines five alternative intercity transportation arrangements to determine which one is the most cost effective for NRSSO to gain maximum savings. The intercity transportation system is defined as it currently exists and the alternative modes of intercity transportation are explored. When comparing cost-per-mile and cost-per-hundred pounds for each of the five alternatives, Alternative One (current operations) emerges as the least expensive with costs of $1.22 and $4.19 (Table II), respectively. These costs are determined to be well below the industry average. Sensitivity analysis is used to determine which transportation alternative was the most cost effective when varying the volume of merchandise from one to seven million pounds. Alternative One (current operations) is again determined to be the preferred choice for maintaining fixed effectiveness at the lowest cost. The intercity transportation system developed by NRSSO San Diego is providing excellent service to Southern California Navy Exchanges.

The purpose of Chapter Four is to determine the most economical means of combining consolidation and transportation alternatives into an effective transportation system. The cost effectiveness of each of the nine alternatives is examined by determining the projected utilization rates for drivers and equipment as affected by the different alternatives.

The alternatives are again evaluated by using sensitivity analysis to determine any changes of costs in the relevant range of one to seven million pounds. It has been determined that Alternative One (combined commercial consolidation and NRSSO vehicles and drivers for long haul and commercial carrier for Port Hueneme/Point Mugu and China Lake) is the most cost effective alternative. A subjective analysis scale is also used to determine which alternative would be the most desirable when considering the factors of control, cost, security, maintainability, flexibility, labor and utility. Alternative One again proved superior. In conclusion, it has been determined that the existing consolidation and transportation system being used by NRSSO San Diego is the best current alternative available.

Chapter Five examines the movement of Navy Exchange merchandise from the NRSSO San Diego warehouse to retail outlets in the San Diego area. This is defined as intracity transportation in contrast to Chapter Three which is defined as intercity transportation. Comparative costing is used to determine which of the three alternatives (the NRSSO organic fleet of government vehicles, purely commercial contracting or the blend of government with commercial transportation) is the best alternative based upon cost. It has been determined that the utilization of larger capacity trailers provides an opportunity to obtain cost savings in both the commercial and the government fleet sectors. In addition, it has been determined that the best intracity alternative is to use the existing government transportation system and to augment the system with commercial carriers during peak periods.

Chapter Six deals with the Navy Commissary Region of Southern California. This chapter concentrates on dry provisions with the objective of determining the minimum vehicular and personnel requirements to maintain current levels of service as well as accommodate the anticipated growth in distributional volume of 20 percent over the next three years. The present system and the future Central Distribution Center are studied by using comparative total time required per week for accomplishing deliveries. The options consider the usage of a government operated private fleet, commercially contracted carriers or a combination of the two to attain desired economies. The comparison of commercial to government transportation reveals a forty-seven percent advantage through the utilization of the government operated fleet in preference to commercial hourly contract vehicles. The continued usage of a government fleet is recommended with hourly or daily commercial contracting to be used in surge periods. It has been determined that with the advent of the increased projected volume of merchandise and new routing imposed by the CDC concept that the larger trailers would offer significant savings.

This thesis has examined all relevant transportation alternatives required by NRSSO San Diego to move both Navy Exchange and Commissary merchandise. Recommendations and opinions have been submitted that merit consideration by NRSSO while planning its transportation strategy.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Defense Logistics Studies Information Exchange U. S. Army Logistics Management Center Fort Lee, Virginia 23801	1
3.	Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
4.	Commander Naval Supply Systems Command Naval Supply Systems Command Headquarters Code 05 Washington, D. C. 20376	1
5.	Commander Naval Resale and Services Support Office Fort Wadsworth Staten Island, New York 10305	1
6.	Officer in Charge Navy Resale and Services Support Office Field Support Office Naval Station P. O. Box 150 San Diego, California 92136	1
7.	Officer in Charge San Diego Commissary Region Naval Station P. O. Box 149 San Diego, California 92136	1
8.	Commanding Officer Naval School of Physical Distribution Management Oakland Army Base Oakland, California 94625	1
9.	Assistant Professor D. C. Boger, Code 54BK Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1

		No. Copies
10.	Lieutenant Commander Roland W. Gorrie, SC, USN Navy Supply Corps School Athens, Georgia 30606	1
11.	Lieutenant Commander David R. Maddocks, SC, USN Department of the Army Headquarters Military Traffic Management Command Washington, D. C. 20315	1

No. Copies

1

1

END

DATE

FILMED

10 — 8

DTIC