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TECHNICAL REPORT

72-67-OR/SA

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A COST ANALYSIS OF MODERN HIGH PRODUCTION FOOD SERVICE SYSTEMS FOR MILITARY GARRISON APPLICATIONS

by

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May 1972

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UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

Operations Research and Systems
Analysis Office

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Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE
A Cost Analysis of Modern High Production Food Service Systems for Military Garrison Applications

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)
Robert J. Byrne, et al

6. REPORT DATE
May, 1972

7a. TOTAL NO. OF PAGES
51

7b. NO. OF REFS
9

8a. CONTRACT OR GRANT NO.

b. PROJECT NO.
1J662713AJ45

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
72-67-OR&SA

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Details of illustrations in this document may be better studied on microfiche.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
US Army Natick Laboratories
Natick, MA 01760

13. ABSTRACT

This report compares two conventional garrison food service systems to three alternative modern food service systems designed for Fort Lewis, Washington:

- a large consolidated dining hall system
- a central food preparation/central warewashing (CFPF) system
- a vendor supplied preprepared food system.

The annual operating costs, manpower requirements, and capital investment costs of these three systems are discussed and compared to a conventional base line system.

It is concluded that the CFPF system offers the greatest cost benefit, allowing a 2.0 million dollars annual savings as compared to a conventional system having a total annual cost of 13.3 million dollars. In addition, this system provides dining halls which are conveniently located and can be implemented in the shortest period of time.

The large consolidated system was found to provide a savings of 1.7 million dollars annually, but sacrifices customer convenience and requires the greatest capital investment.

The vendor supplied system was found to provide the lowest labor cost, but the labor savings is not large enough to offset the increased food cost. As a result, this system increased the total annual cost by over 0.5 million dollars. Further, a number of problems would have to be resolved before this system could be implemented.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

Security Classification

Security Classification

14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
Cost Analysis						
Food Service System						
Central Food Processing Facility						
Cost Effectiveness						
Consolidated Dining Halls						
Vendor						
Convenience Foods						
Staffing Requirements						
Labor Cost						
Food Cost						
Capital Investment						
Annual Cost						
Satellite Dining Halls						

Security Classification

Technical Report
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The authors wish to express their sincere appreciation to the following associates and consultants who provided a significant amount of assistance in the preparation of this report:

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FOREWORD

In 1969 the DOD Facilities and Equipment Planning Board accomplished an on-site survey of military garrison feeding facilities in the United States. As a result of this survey, this Board created, with DOD and Army approval, a project to study, define, and then implement a new, modern feeding system at Fort Lewis, Washington. As documented in the approval for this project, the objectives were to improve performance and reduce costs. This new system would then serve as a model for all military services.

In 1970 the newly created DOD Research and Development Food Program was implemented at NLABS. Included within this program was an increased emphasis on garrison feeding systems and a new requirement to study military feeding systems as a total systems concept. This new requirement was implemented by the Operations Research and Systems Analysis Office at NLABS, and resulted in a rather unique but logical merger of the R&D systems study effort with the DOD and Army project to study and then build a modern feeding system at Fort Lewis.

The overall study effort was initiated in November, 1970. This study was conducted as Task 03 under Project Number 1J662713AJ45, Systems Studies in Military Feeding. The purpose of the overall study activities, of which this report covers only one facet, was to increase customer satisfaction and reduce operating costs, in that order of importance.

Due to the extent and complexity of the information and data which have been developed, this report is only one of several technical reports which have been or will be published in the near future concerning the overall project.

This particular cost analysis report together with a follow on report will provide a comprehensive definition of a new, modern system of food service involving central preparation of food and central warewashing. These reports will provide the Army and DOD decision makers with the data and recommendations to accelerate the DOD and Army project to modernize the system of food service at Fort Lewis while simultaneously constructing a prototype food service system. The data base is now available to progress from the study and experimental phase of this project to the development of pilot systems and final evaluation.

ABSTRACT

This report compares two conventional garrison food service systems to three alternative modern food service systems designed for Fort Lewis, Washington.

- a large consolidated dining hall system
- a central food preparation/central warewashing (CFPF) system
- a vendor supplied preprepared food system.

The annual operating costs, manpower requirements and capital investment costs of these three systems are discussed and compared to a conventional base line system.

It is concluded that the CFPF system offers the greatest cost benefit, allowing a 2.0 million dollars annual savings as compared to a conventional system having a total annual cost of 13.3 million dollars. In addition, this system provides dining halls which are conveniently located and can be implemented in the shortest period of time.

The large consolidated system was found to provide a savings of 1.9 million dollars annually, but sacrifices customer convenience and requires the greatest capital investment.

The vendor supplied system was found to provide the lowest labor cost, but the labor savings is not large enough to offset the increased food cost. As a result, this system increased the total annual cost by over 0.5 million dollars. Further, a number of problems would have to be resolved before this system could be implemented.

INTRODUCTION

During 1971, a comprehensive study and evaluation[1] * of the garrison food service system at Fort Lewis, Washington was conducted. During this study the performance of the conventional food service system, i.e., productivity, was determined to be 2.8 meals per man-hour.

Subsequent to this initial study, a major change occurred in the mission of Fort Lewis, the basic training function was eliminated, and the planned force structure was reduced to approximately 22,000 assigned military personnel. Thus, the total meal preparation and service requirements were decreased from nearly 70,000 per day to approximately 25,000 per day. Since this change occurred near the completion of the total study effort, it was necessary to modify the definition and design of the alternative modern feeding systems to address this new smaller requirement. It was also necessary to adjust our "before" conventional system to these customer requirements to provide a basis for comparison with the alternatives.

The major reasons for low productivity in the conventional system are the basic inefficiencies dictated by a system of on-site food preparation [raw food to finished menu production] in a large number of small dining halls. The study referred to above and a subsequent analysis of high production food service systems concluded that a considerable increase in performance and substantially improved food service could be achieved by implementation of a new modern system of food service.

* Superscripts denote references

SUMMARY REPORT

OBJECTIVES

The objectives of this report are to:

1. Provide a cost analysis comparison of the conventional food service system for the planned force structure at Fort Lewis, Washington with three alternative modern food service systems.

2. Make recommendations as to which of the alternative systems should be adopted for further systems development and evaluation.

ASSUMPTIONS AND SYSTEMS REQUIREMENTS

Assumptions

The following assumptions were used in this analysis:

1. Fort Lewis will continue to be a large, active military installation during the 1974-1980 time frame, with a total force structure of approximately 20-28,000 troops throughout the entire period.

2. Barracks strength is 70% of the total enlisted troop strength and distributed according to the troop assignment information provided by the Fort Lewis Directorate of Installation Operations.[2] The remaining 30% of the total enlisted troop strength is on separate rations.

3. Based upon information obtained at Fort Lewis all personnel living in barracks will be authorized to subsist without reimbursement. Average attendance of personnel living in barracks (based on experimental data obtained at Fort Lewis) for all food service systems will be approximately 60%.

4. All food service systems analyzed will serve essentially the same menu.

5. The maximum service capacity of a dining hall is rated as 2.5 times its single-seating capacity and is based on a sixty-minute meal period. This rating factor was the result of operational data obtained during previous studies at Fort Lewis.

Systems Requirements

In addition to the above assumptions, the following requirements have been imposed on each of the alternative systems:

1. The system must produce and/or provide for approximately 166,000 meals to be served each week. It must also lend itself to being readily expanded under mobilization requirements.

2. Dining facilities, in all systems, will be staffed to serve the usual three meals per day, except for specialty and short order facilities which operate over extended hours of service.

3. All personnel, military and civilian, except for the dining hall supervisors and cooks for the TO&E configuration of the conventional system will be engaged in food service activities for a forty-hour week in each of the systems.

4. Civilian dining hall attendants (KP's) will be employed in all systems.

5. The alternatives to the conventional system will require a new management system which will be driven by consumer preference, consumer attendance patterns and meal selection data which will be collected in accordance with a preestablished sampling plan. These data will be obtained by an automated data collection system, which will also eliminate the signature headcount and cash collection requirements of the conventional system.

COST ANALYSIS

Method

There are many techniques for making comparative costs for alternative systems in cost analysis studies. Some of the more widely used and recognized methods[3,4] are the payback period, annual cost, present worth, and rate of return. The method selected for this analysis is the annual cost method which presents the total annual cost comparisons including cost of capital and amortization, etc. It also provides for proper consideration of the changing value of money with time and is most consistent with Government investment decision making because it does not emphasize the return on investment as do several of the other methods.

The "rule of thumb" payback period is not used in this analysis because of its many shortcomings. Among the more important of these shortcomings is the lack of consideration of the time value of money and the lack of sensitivity to the effects of facility and equipment depreciation. Further, this technique fails to give weight to the difference in consequences of different investment proposals after the date of payout. It should be noted that the payback period cannot be calculated directly from the differences in annual costs shown on Table I. The information in this table includes costs such as capital and depreciation which are usually excluded in the calculation of payback periods.

The capital investment costs for renovating existing dining halls for the modern central preparation and vendor supplied systems are limited to the necessary equipment and installation charges required to store and reheat preprepared foods.

Renovations of existing dining halls to improve servings lines, decor, and furnishings are not charged to the modern systems which utilize existing facilities since these renovations are related to improving troop morale and should be judged separately on that basis. Therefore, approximate costs of dining area renovations for existing facilities are presented in this report (see Table IV); however, they should be evaluated separately. The cost of providing adequate utilities for the conventional systems is also excluded from the capital investment costs of the systems which utilize existing dining halls. These investments are necessary for the conventional food service and barracks system and are not directly related to implementing modern food service systems.

Discussion

It was considered advantageous to analyze and present data on two conventional systems; a conventional system primarily based upon TO&E staffing levels and a conventional system based upon 48 dining halls and TDA staffing levels. Presenting information on these two systems will allow the reader to make his own judgments as to which of the conventional systems to compare with the modern systems. The system based on 48 dining halls and TDA staffing levels was the system selected as the base line system for cost analysis comparisons. This choice emphasizes the incremental annual cost savings which can be directly attributed to the alternative modern food service systems by eliminating from consideration savings directly related to reduction in the number of required dining halls (i.e., assigning more customers to fewer dining halls).

The reduction in the number of required dining halls to 48 in the conventional base line system was the result of quantitative analyses. Data were collected at Fort Lewis with regard to the distance troops will travel to use the service in the different types of food outlets included in the modern systems of food service. Data were also collected on the proportion of A-ration, specialty, and short order food outlets required to respond to customer needs. These data, and information as to the specific types of troop units, were used to quantitatively select the minimum number of dining halls which would maintain reasonable levels of customer convenience and unit integrity.

RESULTS

The results of this analysis are shown in Tables I thru IV where the data have been presented for each of the food service systems considered in this report.

The conventional system based on 48 dining halls is used as the base line system for cost benefit purposes. The authors felt that this particular system provided the fairest comparison between conventional Army food service and modern food service systems.

The large consolidated dining hall and central food preparation and warewashing systems were found to yield annual cost reductions of $1,864,000 and $2,037,000 respectively when compared to the conventional system with 48 dining halls. The vendor supplied convenience foods system would result in an overall annual cost increase of $534,000 when compared to the conventional system with 48 dining halls.

Table I shows a comparison of conventional and modern food service systems annual operating costs. It is interesting to note that the vendor supplied preprepared food system actually results in a cost increase as compared to the conventional base line system. This is due to the fact that the labor cost reduction is more than offset by the high cost of the food.

Table II shows a comparison of conventional and modern food service systems effectiveness expressed in meals per man-hour. The vendor supplied preprepared food system was the most effective; however, a significant amount of labor has already been put into the food products when they are delivered and therefore are not reflected in these computations. The 5.9 and 6.4 meals per man-hour figure for the new consolidated and central food preparation systems represent a 34% and 46% respective increase as compared with the base line system.

Table III shows a comparison of the manpower allocations for the various systems considered. It should be pointed out that all systems were considered to have civilians performing KP functions. It is interesting to note the significant manpower reduction potential of the three modern systems which clearly shows the manpower savings possible with state-of-the-art equipment and facilities.

Table IV shows a comparison of the capital investment costs of the three modern systems. As can be seen the vendor supplied preprepared food system is by far the lowest

cost system. This is due to the fact that the only major construction would be the central warewashing facility at an extimated cost of $340,000. On the other extreme, the construction of 13 large new consolidated dining halls would require $9,203,000. However, this system does benefit somewhat from the value of released dining hall space which would decrease the total cost by $2,029,000.

Table V presents a comparison of the advantages and shortcomings of the modern food service systems. The central preparation system provided the greatest number of advantages while at the same time providing a minimum of shortcomings. However, the increased professional expertise required at the central preparation facility is very critical to the success of this system and is discussed in the conclusions and recommendations section of this report.

Table 1

COMPARISON OF ALTERNATIVE FOOD SERVICE SYSTEMS

ANNUAL OPERATING COSTS ($1,000)

	CONVENTIONAL		MODERN		
Factors	TOE/TDA	Baseline System (48 Dining Halls)	Large, New Consolidated	Central Fd Preparation & Warewashing	Vendor Supplied Prepared Foods
Food	4,971	4,971	4,574	4,225	8,112
Labor	10,683	7,622	5,622	5,593	4,745
Other	865	730	585	870	785
Amortization of Facilities	0	0	678	598	215
TOTAL COST	16,519	13,323	11,459	11,286	13,857
Annual Savings (as compared to Baseline System)	--	--	1,864	2,037	-534 (Cost increase)

Table II

EFFECTIVENESS COMPARISON OF ALTERNATIVE FOOD SERVICE SYSTEMS

System Effectiveness* (meals/man-hour)

Conventional TOE/TDA	Conventional 48 Dining Halls	Large, New Consolidated	Central Food Preparation & Warewashing	Vendor Supplied Preprepared Food
3.1	4.4	5.9	6.4	7.6

$$*E\ (\text{sys. eff.}) = \frac{M\ (\text{no. meals served})}{P\ (\text{no. of personnel})\ X\ H\ (\text{no. of hours worked})}$$

Table III

MANPOWER ALLOCATIONS FOR ALTERNATIVE FOOD SERVICE SYSTEMS

Manpower Category	Conventional TOE/TDA	Conventional (Baseline System)	Large, New Consolidated	Central Food Preparation & Warewashing	Vendor Supplied Preprepared Foods
Military					
Management	18	15	11	22	16
Dining Hall Stewards	130	48	13	53	50
Cooks	591	418	323	209	168
Dining Room Attendants (KP)	None	None	None	None	None
Drivers	30	18	13	18	18
Other	4	4	7	13	7
Civilian					
Management and Technical	1	1	12	32	24
Cooks	None	None	None	58	48
Warewashing Attendant	None	None	None	57	43
Dining Room Attendant	527	427	301	149	149
Clerks and Typists	8	7	6	19	14
Mechanics	None	None	None	9	6
Other	16	13	12	6	6
TOTAL PERSONNEL	1,325	951	701	645	548

Table IV

CAPITAL INVESTMENT COST OF MODERN FOOD SERVICE SYSTEMS ($1,000)

	Large, New Consolidated	Central Food Prepreparation & Warewashing	Vendor Supplied Preprepared Foods
Central Food Production and Warewashing Facility	N/A	2,412	340
Equipment for Central Facility	N/A	2,327	350
Transport and Storage Equipment	N/A	760	300
Dining Hall Construction or Modifications	9,203	384	384
Dining Hall Equipment	2,605	528	528
Management Information System	120	144	144
New Vehicles and Modifications to Existing Vehicles	None	100	100
TOTAL COST	11,928	6,655[1]	2,146
Values of Released Dining Hall Space[2]	2,029[3]		
ADJUSTED TOTAL COST	9,899	6,655	2,146

[1] These figures do not include $1,104,000 for dining hall refurbishment, which is recommended for improved troop morale but is not essential to the central preparation or vendor supplied food service systems. These figures also do not include Fort Lewis's estimate of $2,200,000 for utilities upgrading which would be part of an overall Fort Lewis facilities improvement program including both dining halls and barracks.

[2] Under the provisions of AR 37-13[6] additional space savings, over and above the amount indicated, could be credited to each of these systems. These additional space savings are achieved by assigning more customers to fewer dining halls. This type of space savings was relatively constant for all systems and was excluded from our economic comparisons.

[3] This cost adjustment reflects the value of released space (48 dining halls released) in accordance with AR 37-13[6] at $20 per square foot.

Table V

ADVANTAGES AND SHORTCOMINGS OF ALTERNATIVE MODERN FOOD SERVICE SYSTEMS

Type of System	Advantages	Shortcomings
Large consolidated dining facilities with on-site preparation.	Decreased manpower requirements. High worker productivity. Reduced food cost due to better food management.	Distance customers must travel to get to dining hall. High cost of new dining hall construction.
Central preparation and warewashing with satellite dining facilities.	Decreased manpower requirements. High worker productivity. Uniform quality of food products. Reduced food cost due to increased yield from raw food. Reduced skill level requirements of operating personnel at the dining halls. Maximum customer convenience.	High cost of building a central preparation facility. Increased level of sophistication at the central processing facility requires high level of professional expertise.
Vendor supplied foods with central warewashing.	Minimum manpower requirements. High worker productivity. Reduced skill level requirements of operating personnel at the dining halls. Low initial capital investment.	Higher total meal cost than consolidated or central preparation systems. Highly variable product. Extremely difficult to control quality and formulation. Cooks lose much of their proficiency. Current availability would restrict variety of menu items.

CONCLUSIONS AND RECOMMENDATIONS

The cost effectiveness comparisons shown in Table I clearly indicate that the central preparation system and the large consolidated dining hall system are the most economical systems. In addition to being cost effective, these two systems will preserve an Army training base for TO&E units for food preparation in the field by retaining military food service personnel. These systems will also offer improved service to the customer in the form of specialty and short order meals over extended operating hours. However, the consolidated system significantly reduces convenient access to the dining halls for the customers. Based on previous study results this would indicate that the expected attendance would be significantly lower under a consolidated dining hall system.

The central food processing and warewashing system is, therefore, recommended for pilot system implementation at Fort Lewis. The advantages of preserving a higher degree of troop convenience and unit integrity, lower operating and capital investment costs support the selection of the central preparation system over the consolidated dining hall system. In addition, the lower capital investment cost minimizes the requirement for investment funds, thereby providing for wider implementation in a shorter time period.

The concept of pilot system evaluation is considered an essential basic step in the implementation process. The central preparation and warewashing system, recommended in this report, is a "one-of-a-kind" system which does not presently exist in industry or the military. The entire system -- organization structure, management, central food preparation, transportation and distribution, satellite dining hall operation and central warewashing - requires further detailed development and evaluation under actual large scale operations. As a result of a technology assessment it has been concluded that further systems development, systems testing and systems evaluation must be conducted for successful implementation of the recommended system.

It is important to note that even though this recommended system reduces the skill level required at the dining hall, it does in fact result in a high degree of sophistication at the central food processing facility, which does not exist within the military services today. Because of this new level of complexity, the success of this system is predicated upon recognizing and filling the requirement for civilian and military professional expertise at the central food processing facility. If this requirement cannot be met, this system is not recommended for implementation.

ALTERNATIVE SYSTEMS, DEFINITION AND COSTS

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CONVENTIONAL SYSTEM

System Definition

Conventional Army food service can be characterized as a decentralized system of food service. Traditionally, the responsibilities for providing food service have been delegated to each company size unit. Even today the present system still supports the idea of each dining hall being an entity unto itself although some degree of consolidation has been effected. For example, each dining hall has been equipped and staffed to perform the full range of functions required to transform raw foods into finished meals. Management is one of command responsibility vested with each unit commander authorized to operate a dining hall. Daily supervision is delegated to a mess steward who is responsible directly to his unit commander. Ordinarily raw food is furnished by Defense Supply Agency and local procurement, stored in warehouses and cold storage facilities, moved to a ration breakdown point and distributed to individual dining halls approximately three times per week, where it is prepared and served to the troops. All warewashing and sanitation efforts are conducted at the individual dining hall. Outside influences tend to be minimal except for the necessity of complying with the Army Master Menu, prescribed accounting procedures, minimum sanitation standards and ration control procedures. Thus, conventional food service in the garrison environment remains essentially a decentralized system operated at the small unit level which is supported by the usual ration breakdown and services office personnel.

Two configurations of the existing system which use conventional on-site preparation techniques are presented in this report.

The first is the system which is staffed in accordance with existing TO&E and TDA staffing regulations as they apply to the force structure planned for Fort Lewis. This configuration is based on 130 dining facilities and an extended workweek for cooks. It has been normalized, however, to reduce the workweek for KP's from the 94 hours required of military personnel to 40 hours for the civilian KP's that will be required when the troops are in garrison status.

The second is a system which is based on a reduced number of dining halls (48) and staffed in accordance with TDA staffing regulations as they apply to the number of customers that can be expected to attend these dining halls. These 48 dining halls

are the same 48 dining facilities selected for the central food processing system and discussed in that section of this report. In this case no dining hall renovations are required. The staffing levels for this conventional system have been adjusted for a 40-hour workweek for cooks and civilian KP's.

System Costs

Food

Food costs utilized for both configurations are based on the present Fort Lewis Basic Daily Food Allowance. The expected total headcounts and existing food cost data resulted in an estimated total annual food cost of $4,971,000.

Labor

The total labor cost for the TO&E and TDA configuration was computed as $10,683,000. This cost is based upon the total staffing levels (see Table III) and the existing salary data for the specific types and grades of personnel designated to operate the system. The numbers and types of dining hall management and cooks were determined from TO&E and TDA documents[7,8] which corresponded with the planned force structure for Fort Lewis. The number of KP's is based upon 130 dining halls and TDA allowances for the expected headcounts as adjusted for improved civilian KP motivation and productivity, a 40-hour workweek, and a system which provides china service. These adjustments were based on work sampling data.

The total labor cost of the conventional system with 48 dining facilities was computed as $7,622,000. This cost is also based upon the total staffing levels (see Table III) and existing salary data (see Appendix V) for the types and grades of personnel required to operate this system. The specific numbers and types of personnel, dining hall management, cooks, and civilian KP's were based upon the number of dining halls, expected attendance, and TDA allowances for these factors adjusted for a 40-hour workweek for all personnel and improved productivity from civilian KP's. These figures were also based on work sampling data and confirmed by comparison with Air Force Standards.[9]

Other

Based on previous studies,[1] other costs for the conventional TO&E and TDA system with 130 dining halls are estimated to be $865,000 annually. These include utilities, repair and maintenance, transportation, laundry, cleaning supplies, etc.

Other costs for the conventional system with 48 dining halls are estimated at $730,000 and include the same items described above.

LARGE CONSOLIDATED DINING HALL SYSTEM

System Definition

A consolidated dining hall system would require the construction of 13 new large dining halls. These dining halls were selected, designed and located to serve the same expected customer population as the other systems. These dining halls would provide variable service, i.e., there would be 4 separate dining areas in each facility which would provide regular A-ration, short-order and specialty food service. All food preparation and warewashing operations would be performed on-site. Food service equipment would be of larger capacities than in the existing dining halls and would include convection ovens, deep fat fryers, steam jacketed kettles, tilting fry pans, and high pressure steamers. Warewashing would be accomplished in a flight type dishwasher in the area located in the center of the dining hall. Dishware would be transported to the dishwashing area by means of an overhead conveyor. An artist's concept of the exterior and a conceptual floor plan are shown in Appendix I.

The flow of food would be virtually unchanged from the present practice with the conventional system. The majority of food items are furnished through Defense Supply Agency or local suppliers. The post ration breakdown activity would store and distribute these foods to the dining halls.

The organizational structure is somewhat similar to that proposed for the central food processing system (see Figure 1) except that the "Food Division" would be eliminated.

System Cost

Food

Food costs are estimated to be $4,574,000 annually based on an adjustment to the present Fort Lewis Basic Daily Food Allowance. This adjustment reflects an 8% cost savings which would be realized through the better food management possible in large dining facilities.

PROPOSED NEW CENTRAL FOOD PREPARATION FACILITY MANAGEMENT STRUCTURE

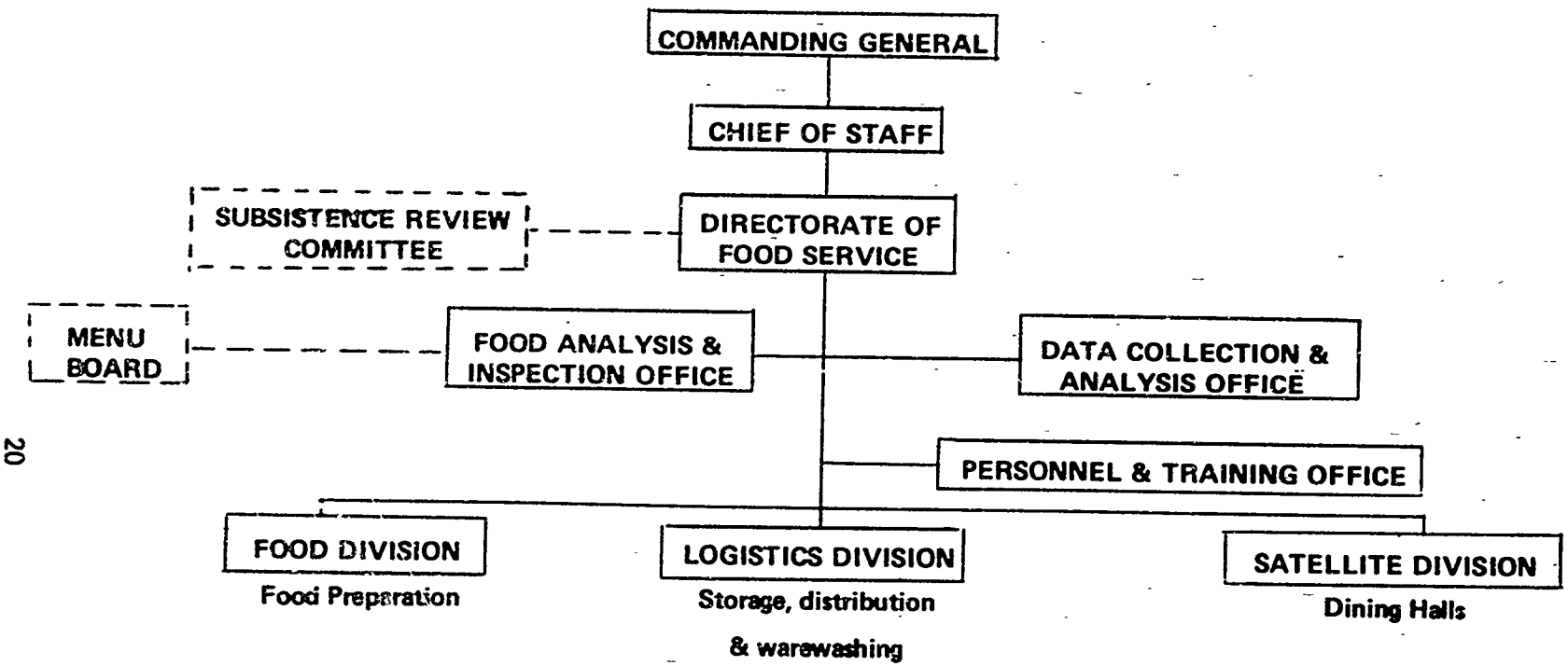

Figure 1

Labor

Labor costs are estimated to be $5,622,000 annually which is 26% less than the conventional system with 48 dining halls. This is due to the greater worker productivity which is inherent in large dining facilities.

Manpower requirements for this system were based on Air Force criteria[9] for large consolidated dining halls having chinaware. The Air Force staffing levels have been developed and verified under actual operating conditions using a 40–hour workweek for cooks and civilian dining room attendants.

Other

Other costs are estimated to be $585,000 annually and include utilities, repair and maintenance, transportation, laundry, cleaning supplies, etc.

Capital Investment

The cost of new facilities, food service equipment, furnishing and automatic data processing equipment for this system is estimated as $11,928,000. However, when this cost is adjusted to reflect the value of released existing dining hall space, the adjusted capital investment cost is reduced to $9,899,000.

Annual Operating Cost

The annual operating cost for this system (see Table I) is $11,459,000. This represents a $1,864,000 annual cost savings when compared to the conventional food service system.

Remarks

Consolidated dining facilities have been used by the Air Force and Navy for many years. The basic advantages which consolidated facilities offer are greater worker productivity and better food management than is possible with smaller dining facilities. The consolidated concept considered in this report is unusual in that it is designed for variable service (A-ration, short order and specialty) to provide the customer a highly diversified menu and dining environment within one facility.

A serious drawback inherent in this concept would be the distances many customers would have to travel from their barracks to the dining hall. Data obtained in an experiment conducted at Fort Lewis in 1971 clearly indicate that the distance a customer travels significantly affects his attendance. Based on these data, a barracks to dining hall distance in excess of 150 yards would have a serious impact on reducing customer attendance rates. Therefore, the projected troop concentrations were surveyed and the 13 dining halls were located so that the travel distances from the barracks to the dining halls were minimized. Even so, the barracks to dining hall distances were as great as 286 yards and averaged 175 yards.

Two additional drawbacks which should also be mentioned are the high capital investment cost of $11,928,000 and the long lead time required to actually construct the system.

CENTRAL FOOD PROCESSING AND WAREWASHING SYSTEM

System Definition

This system consists of a central food processing and warewashing facility with 48 satellite dining halls. The Central Food Preparation Facility (CFPF) utilizes existing space at the central meat plant (see Appendix II) and includes a 52,400 square foot addition. High capacity food processing equipment such as continuous steam cookers, microwave thawing, infrared cookers, heat exchangers, blast freezers, automated packaging equipment, etc., are used extensively. An integral part of this new system is the number of food service outlets, their locations and the type of service they offer. The selection and definition of the 48 dining halls was based on a marketing approach.[2] In general this effort was directed toward maximizing customer convenience and service requirements subject to economic and unit integrity constraints. More specifically, the numbers and types of dining halls were based on experimental data, planned barracks assignments, numbers of expected customers, travel distances for customers, serving capacities, renovation costs, staffing levels, labor costs and unit integrity. The selected facilities, their location and the type of service offered in each are shown in Appendix III. This dining hall system insures battalion level integrity and limits travel distance from barrack areas to dining halls to an average of approximately 70 yards.

As in the conventional system, existing rations are received in central preparation storage from Defense Supply Agency and local procurements. Many of these foods are then converted in central preparation to preprepared entrees, vegetables, soup concentrates, salads, pastries, desserts, salad dressings and gravies. Foods are then stored and shipped to the dining halls in the frozen, chilled and room temperature condition(s) depending upon the nature of the item. Food products are transported to the dining halls in bulk (comparable to half size steam table pans in the case of entrees) using refrigerated and non-refrigerated vehicles. The local dining hall is modified to receive, store and finish these items to serving conditions.

After being served and having consumed their food, troops self-bus their trays and dishes into dishware transporters located in the dining area. Also, after the meal the cooks load the majority of used cooking utensils in the transporters. These trays, dishes and utensils are collected at every dining hall and transported back to the central warewashing facility. The system includes sufficient extra trays, dishes and utensils to support meal preparation and serving while soiled items are being sanitized.

The central warewashing facility consists of an 11,100 square foot area connected to the central processing facility. Equipment includes four high capacity, flight type, conveyor dishwashers and an automated cart washer to clean the dirty tray transporters.

This entire system is driven by a consumer oriented data base which is collected through an automated data collection system (headcount, food preference selection data, cost data, etc.). Standard computer software and equipment are used to analyze these data to give management the reports required to effectively manage this new system.

This system will require a new management structure which will provide direct control of all dining facilities to the post Food Service Director. A proposed new management structure in shown in Figure 1.

System Cost

Food

Food costs for this system are estimated to be $4,225,000 annually and reflect a 15% cost savings which would be realized through the increase in raw food yield at the CFPF. These projected savings are based upon actual operational experience with similar systems in military, institutional, and airline food service operations.

Labor

Labor costs for this system are estimated to be $5,593,000 annually, second lowest of the three modern systems analyzed. This represents a total labor force of 645 civilian and military personnel as shown on Table III. This level of staffing is based upon a detailed analysis of: work sampling data collected in the dining halls during an experiment involving central food preparation and warewashing conducted at Fort Lewis in 1971, the menu, food processing equipment capabilities, quality control and sanitation requirements and transportation activities required to successfully operate this system. A significant factor which should be emphasized with regard to this system is the 32 civilian technical and management specialists which would be required at the CFPF due to the increased complexity of the food processing, sanitation and management information system. Further, military career opportunities are also increased due to the greater number of management and food specialists who are required as compared to the conventional system.

It is interesting to note that a comparison of the total number of personnel previously employed in the conventional food service system at Fort Lewis with military KP's was 2,003 These personnel were managing, preparing and serving meals to an average of 16,154 customers per meal.[1] The new central preparation system requires a total of 645 personnel to serve approximately 8,000 customers per meal. Comparison of these figures generally confirms the extent of manpower savings which can be realized with this system.

Other

Other costs for this system are estimated to be $870,000 annually and include such items as utilities, repair and maintenance, transportation, laundry, cleaning supplies, etc.

Capital Investment

The central preparation and warewashing system would require a capital investment of $6,655,000. This cost represents the construction of a central food preparation facility and central warewashing facility in the form of modifications of and an addition to the existing meat plant. Distribution equipment for the delivery of food products and dishware to the dining halls is also included.

A total of 48 existing satellite dining halls would also be required for this system. The total cost reflects the provision for modifications to the kitchen area to increase the frozen and chilled food storage capacities, to provide the capability to finish precooked and preprepared foods, and to enlarge the loading docks. A sample layout of a typical dining hall outlining these modifications is shown in Appendix II.

In addition to these essential modifications there are several improvements which should be made to upgrade the dining environment and to improve troop morale. These include new modular serving and beverage lines, carpeting, draperies, and the use of bright colors on wall surfaces. Partitions are also recommended to screen off the kitchen area and to close off circulation paths from the dining area. New tables and padded booths provide the customer a choice of seating arrangement. The costs of these improvements, which have not been included in the cost analysis since they are not considered essential to a CFPF system, are estimated at $1,104,000.

Also, the cost of upgrading dining hall utilities is not included since it is required for the conventional system. This cost is estimated by Fort Lewis Facilities Engineer at $2,200,000.

Annual Operating Cost

The annual operating cost of $11,286,000 represents an annual cost savings of $2,037,000 as compared to the conventional food service system shown in Table I. These cost savings include a provision for the amortization of new facilities and equipment.

Remarks

In addition to the cost effectiveness advantages of this system, data from the experiment conducted at Fort Lewis in 1971 have shown that it has the potential to significantly improve customer acceptance of military food service while maintaining customer convenience and a high degree of unit integrity. In essence this system provides the unusual opportunity to reduce operating costs while simultaneously improving service. The major disadvantage of this system is the new level of sophistication which must be introduced to support the management and central processing activities. However, this disadvantage is offset by the reduction in level of skill required at each dining hall.

VENDOR SUPPLIED PREPREPARED FOOD SYSTEM

System Definition

The vendor supplied system consists of a central facility and 48 satellite dining halls. The central facility is the existing meat plant modified to provide adequate freezer and chill food storage areas and a new central warewashing facility. Food is procured in either preprepared or precooked frozen condition from commerical food processors by the Defense Personnel Support Center. Food products will be supplied in bulk quantities, half size disposable steam table pans, etc., stored in a central warehouse and delivered to the dining halls in refrigerated vehicles. The flow of food is virtually the same as for the central food processing system except there would be no central food processing activity and/or facility.

The central warewashing facility cleans all dishware used at the dining halls. The layout of the central warewashing facility is identical to its counterpart previously described for the central food processing and warewashing system. Special transporters are used to containerize the dirty dishware for distribution back to the central warewashing facility. Also, modifications required to the forty-eight satellite dining halls are essentially the same as those outlined in the previous sections.

The organizational structure for this system is quite similar to that shown on Figure 1. This system would also be driven by a management information system identical to that utilized in the central food processing and warewashing system.

System Cost

Food

Considerable difficulties were encountered in establishing reasonable and fair food costs for this type of system. The available types and kinds of foods are not consistent with the present 42-day master menu and even if there is a specific comparable item, it is not usually offered in the quantity that (i.e., half steam table pan) is required. Also, it was not considered reasonable and fair to use institutional prices because these prices would be considerably higher than the expected prices the military would have to pay if preprepared foods were procured in large quantities. The food costs actually used (see

Appendix IV) are based on the latest information available from production tests of bulk packed preprepared frozen entrees conducted by the Defense Personnel Support Center. To insure that these costs are actually representative of costs the military would have to pay if such a system were implemented, food costs were further adjusted by a 20% reduction in the lowest bid price obtained to reflect large volume procurements. As a result of this analysis, annual food costs for this system are estimated to be $8,112,000.

Labor

Labor costs for this system are the lowest for the three modern systems included in this analysis since a significant amount of labor is already in the food when it arrives from the vendor. Therefore, the total annual labor cost for this system would be $4,745,000, which reflects a total labor force of 548 civilian and military personnel (see Table III). This staffing level includes the manpower required to staff the 48 satellite dining halls, the central warewashing facility and the various management, technical, clerical, and distribution personnel. It is important to note that approximately the same levels of management, storage, distribution, dining hall, and warewashing manpower are required to operate this system as would be required to operate the central food processing and warewashing system.

Other

Other costs for this system are estimated to amount to $785,000 annually. These costs included such items as utilities, repair and maintenance, transportation, laundry, cleaning supplies, etc.

Capital Investment

The cost of new facilities, facility modifications and new food service equipment and automatic data processing equipment are $2,146,000 for this system.

Annual Operating Cost

The estimated annual operating cost for this system is $13,857,000. This represents a $534,000 annual cost increase as compared to the conventional food service system.

Remarks

This type of system was included in our analysis and comparisons even though we realized that such a system could not be implemented within our time constraints. The longer implementation period is occasioned by the need to initiate and complete major government and industry programs to conduct a detailed technology assessment of industry capabilities. This system would also require major efforts to establish a new convenience food menu, industrial and government standards (including quality control methods and requirements) to protect the government in competitive procurements. An extensive program would also be necessary to develop requirements for and prepare and coordinate a great number of specifications for vendor supplied food items after the initial studies were completed.

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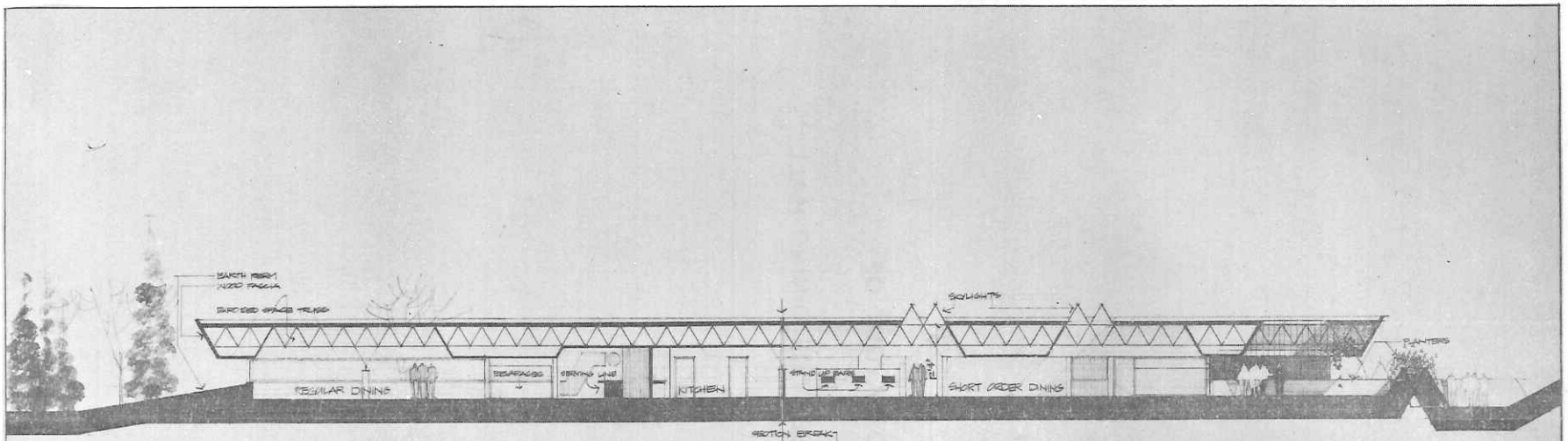
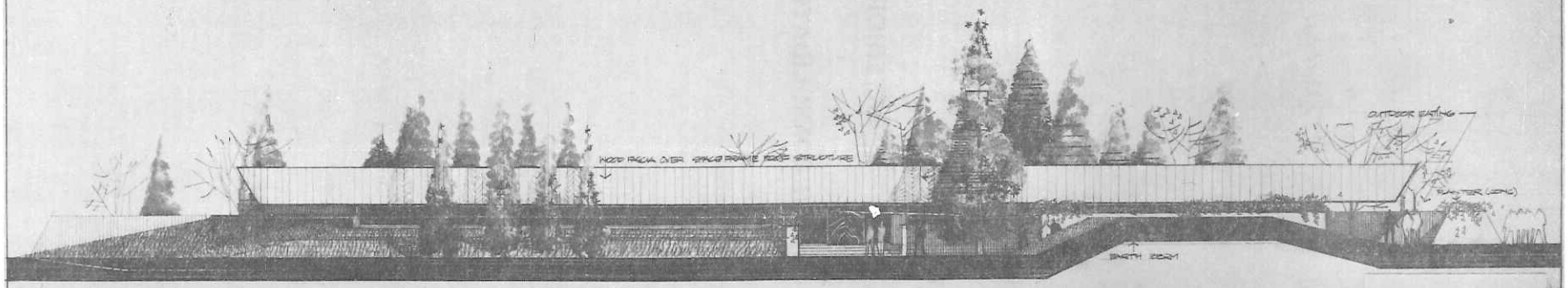
APPENDIX I

EXTERIOR CONCEPT AND LAYOUT OF

NEW CONSOLIDATED VARIABLE SERVICE DINING HALL

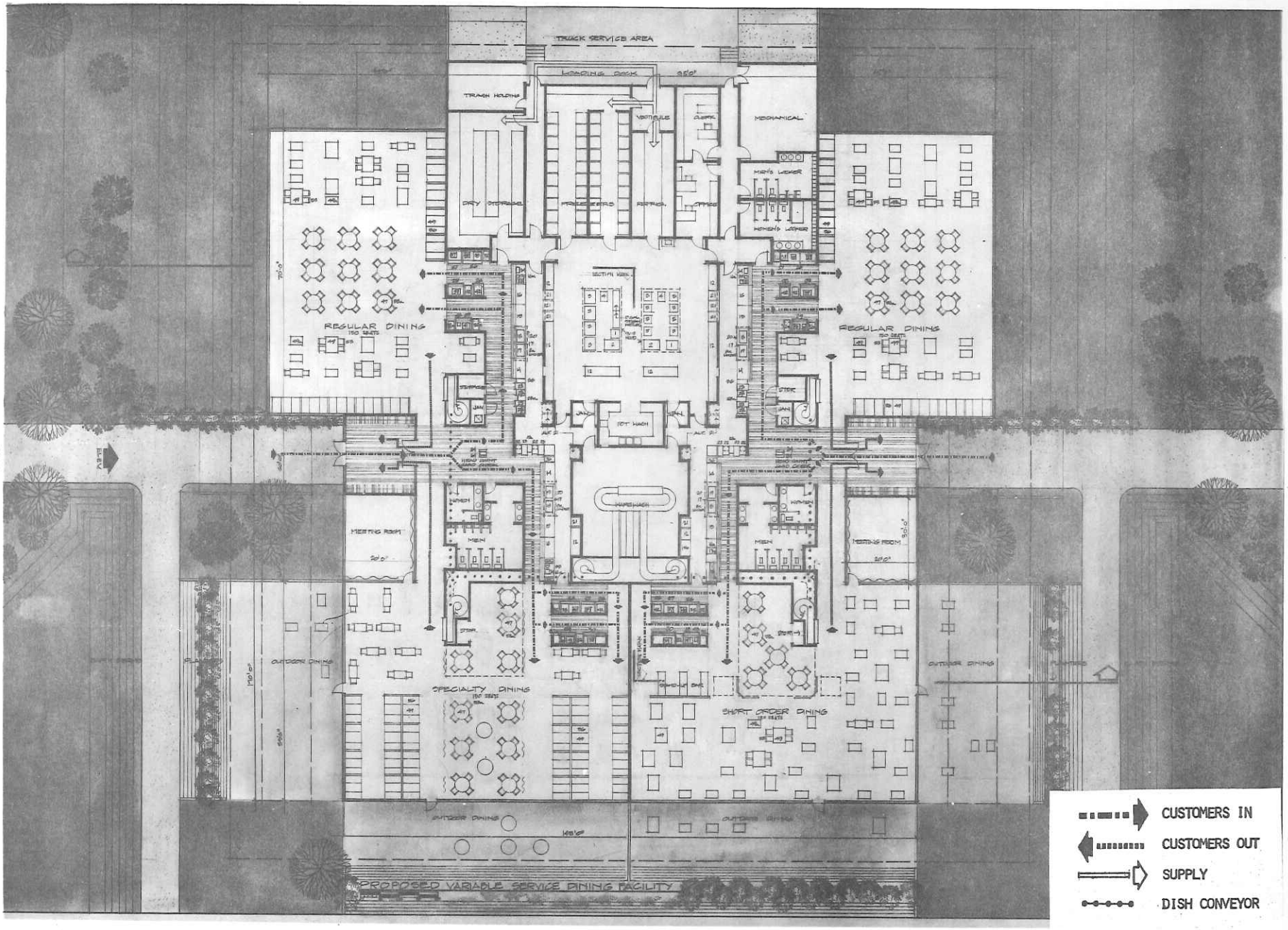


SECTION THRU PROPOSED VARIABLE SERVICE DINING FACILITY



ELEVATION OF PROPOSED VARIABLE SERVICE DINING FACILITY

CERL


TRUCK SERVICE AREA
LOADING DOCK
TRASH HOLDING
VESTIBULE
CLERK
MECHANICAL
MEN'S LOCKER
WOMEN'S LOCKER
DRY STORAGE
REFRIG.
REGULAR DINING
150 SEATS
REGULAR DINING
150 SEATS
STORAGE
STORE
JAN
POT WASH
HAMBURGER
MEETING ROOM
MEN
WOMEN
MEETING ROOM
MEN
WOMEN
STORE
STORE
OUTDOOR DINING
OUTDOOR DINING
SPECIALTY DINING
150 SEATS
SHORT ORDER DINING
OUTDOOR DINING
OUTDOOR DINING
PROPOSED VARIABLE SERVICE DINING FACILITY
CUSTOMERS IN
CUSTOMERS OUT
SUPPLY
DISH CONVEYOR

APPENDIX II

EXTERIOR CONCEPT AND LAYOUT OF CENTRAL FOOD PREPARATION AND WAREWASHING FACILITY

AND

CONCEPTUAL LAYOUT OF RENOVATED SATELLITE DINING HALL

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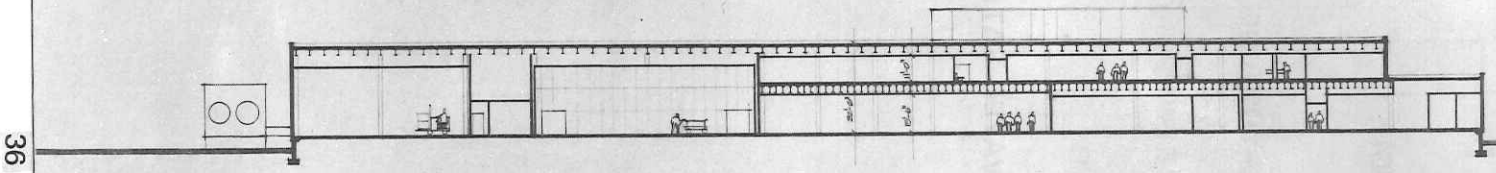
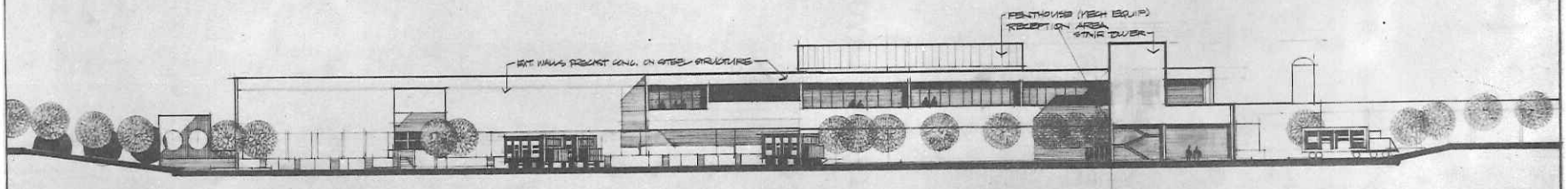


LONGITUDINAL SECTION THRU C. F. P. F.

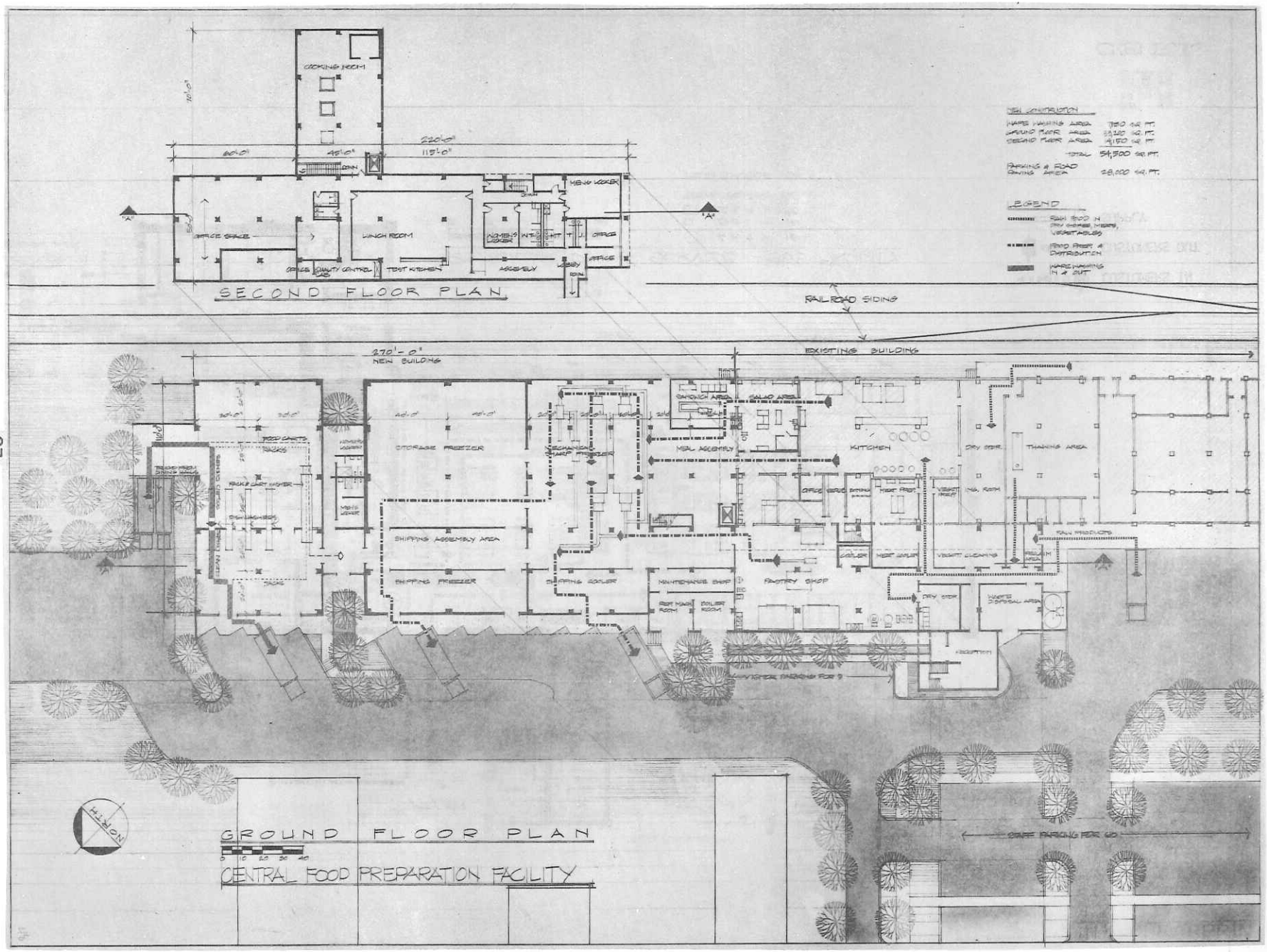
0 10 20 30 40

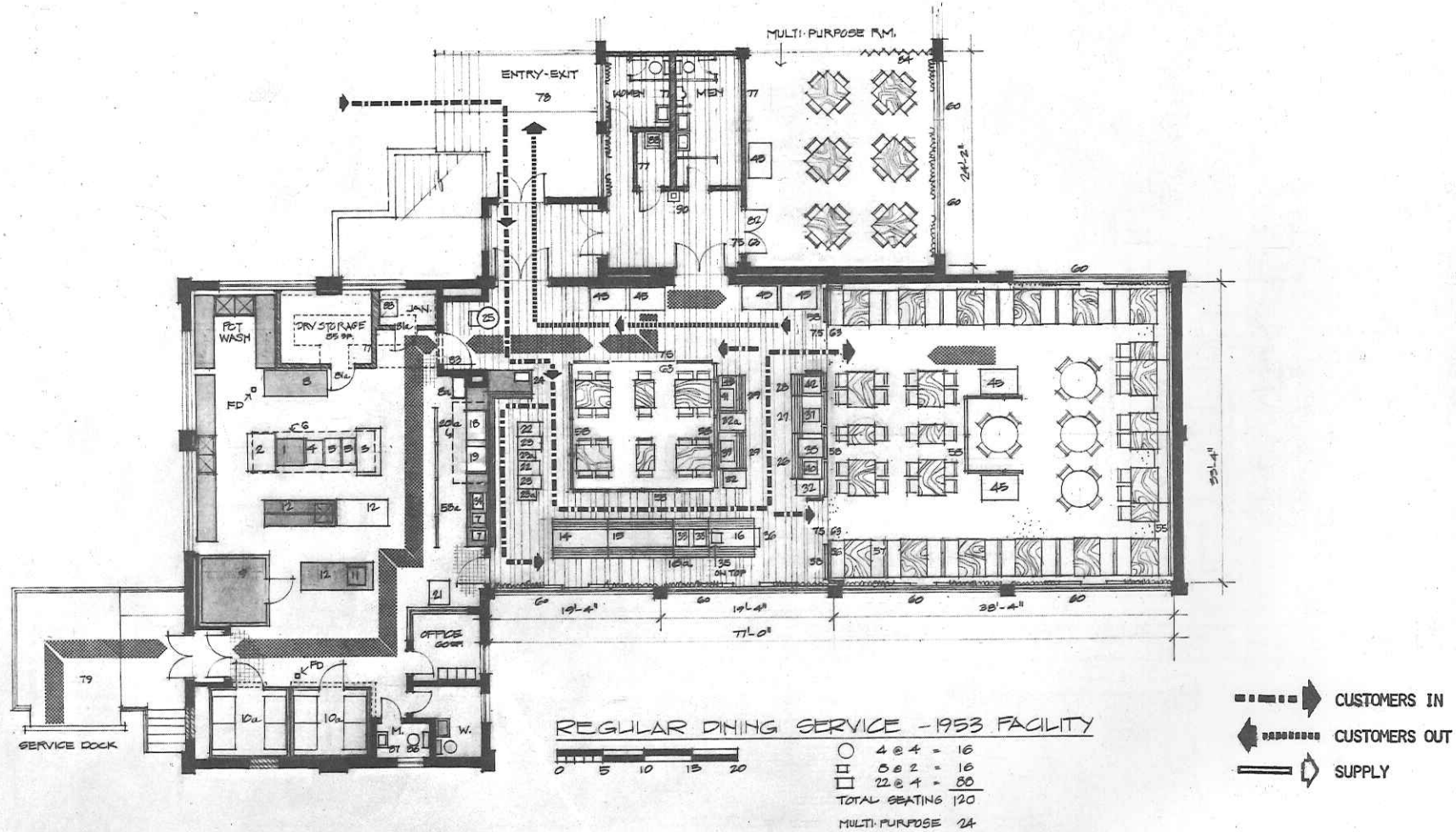


ELEVATION OF C. F. P. F.

0 10 20 30 40

CERL


SECOND FLOOR PLAN
COOKING ROOM
LUNCH ROOM
OFFICE SPACE
QUALITY CONTROL
TEST KITCHEN
ASSEMBLY
MENS LOCKER
OFFICE
LOBBY
220'-0"
115'-0"
45'-0"
60'-0"
110'-0"
RAILROAD SIDING
EXISTING BUILDING
270'-0"
NEW BUILDING
STORAGE FREEZER
SHIPPING ASSEMBLY AREA
SHIPPING FREEZER
SHIPPING COOLER
MAINTENANCE SHOP
BOILER ROOM
MEAL ASSEMBLY
SANDWICH AREA
SALAD AREA
KITCHEN
FACTORY SHOP
DRY STOR.
THAWING AREA
COOLER
WASTE DISPOSAL AREA
NORTH
GROUND FLOOR PLAN
CENTRAL FOOD PREPARATION FACILITY



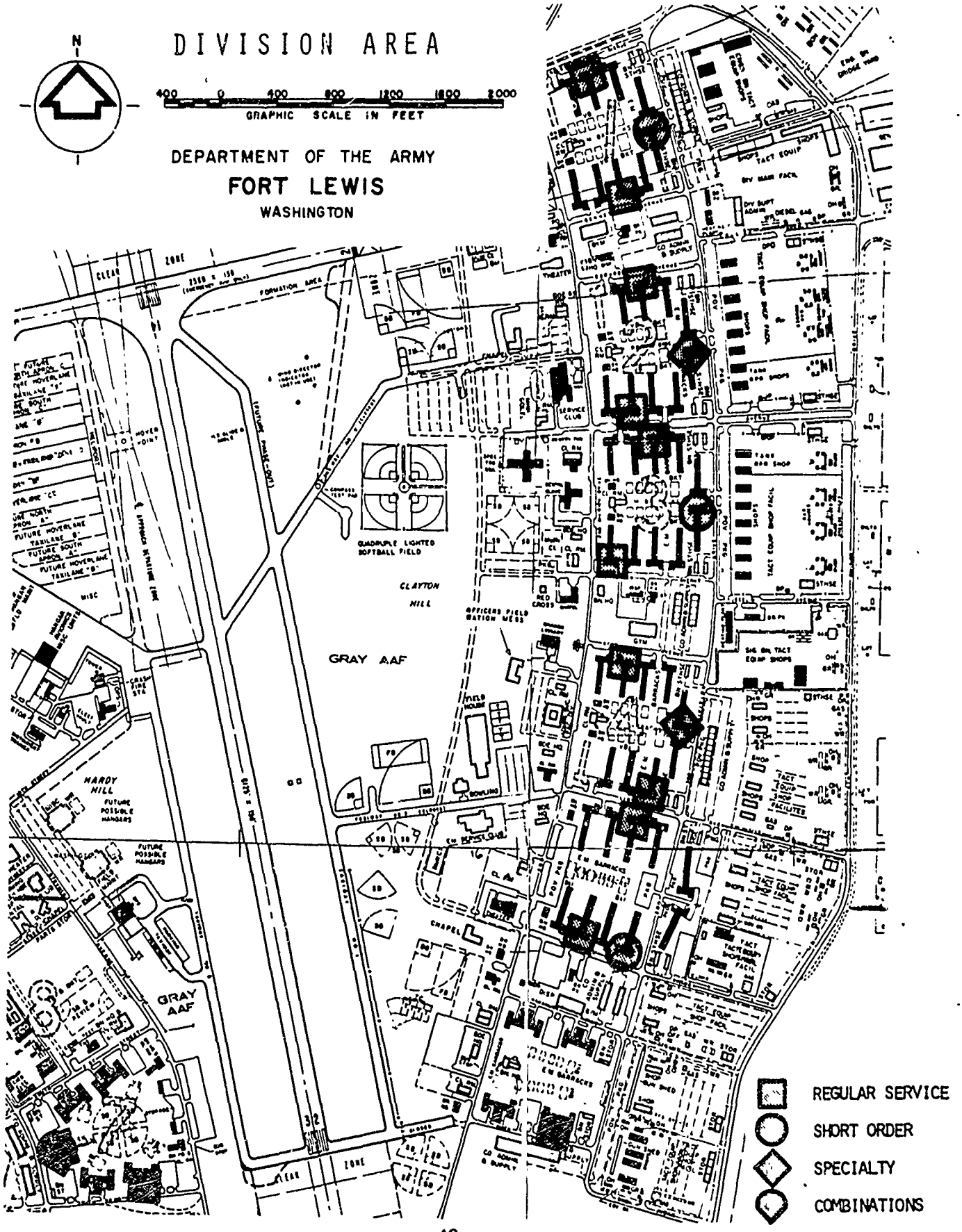
REGULAR DINING SERVICE - 1953 FACILITY

CERL

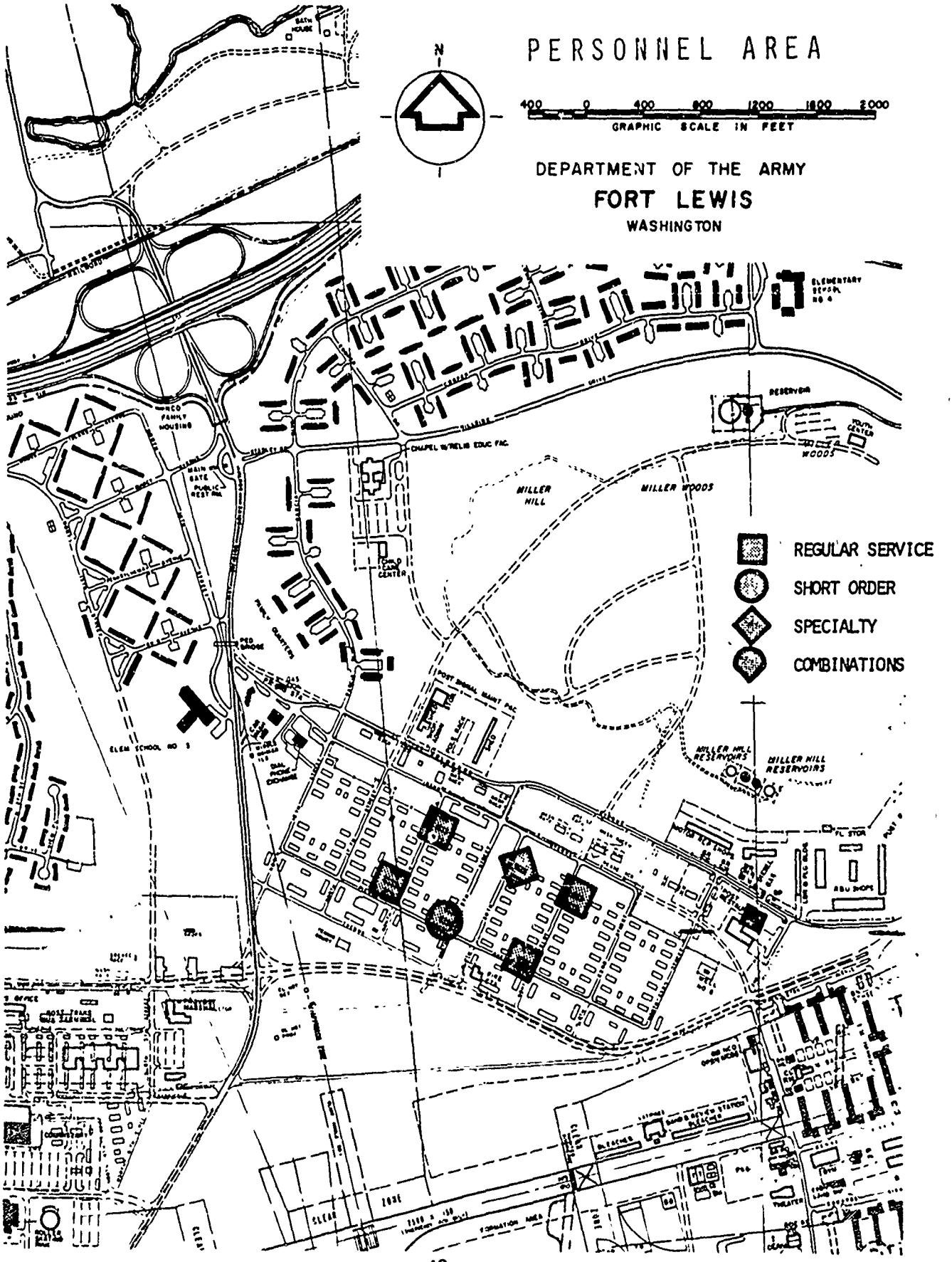
APPENDIX III

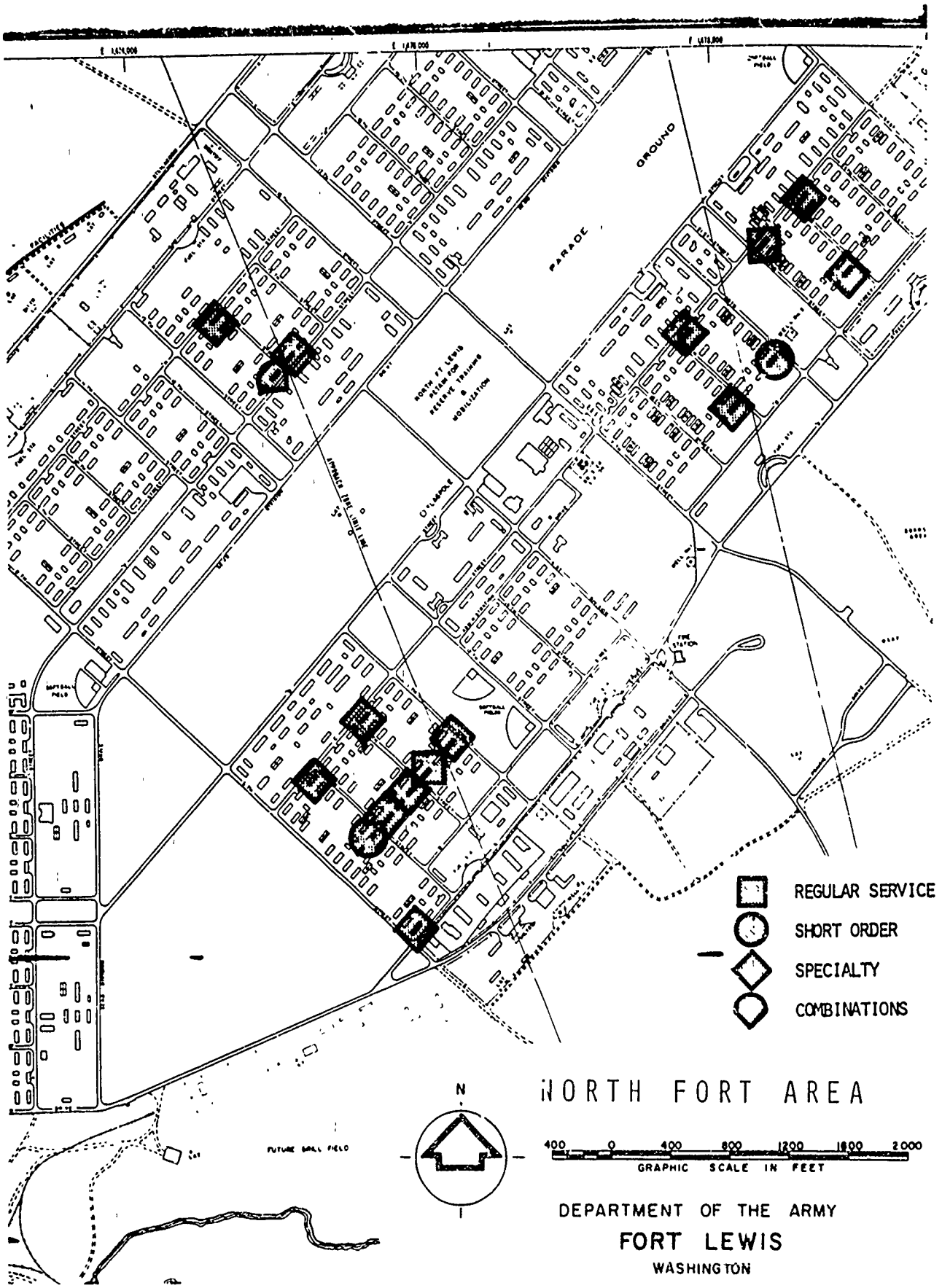
PROPOSED LOCATIONS OF 48 SATELLITE DINING HALLS

AND AREA MAP OF FORT LEWIS


DIVISION AREA
N
400 0 400 800 1200 1600 2000
GRAPHIC SCALE IN FEET
DEPARTMENT OF THE ARMY
FORT LEWIS
WASHINGTON
CLEAR ZONE
FORMATION AREA
QUADRUPLE LIGHTED SOFTBALL FIELD
CLAYTON HILL
GRAY AAF
HARDY HILL
FUTURE POSSIBLE HANGARS
CHAPEL
SERVICE CLUB
THEATER
RED CROSS
GYM
BOWLING
REGULAR SERVICE
SHORT ORDER
SPECIALTY
COMBINATIONS

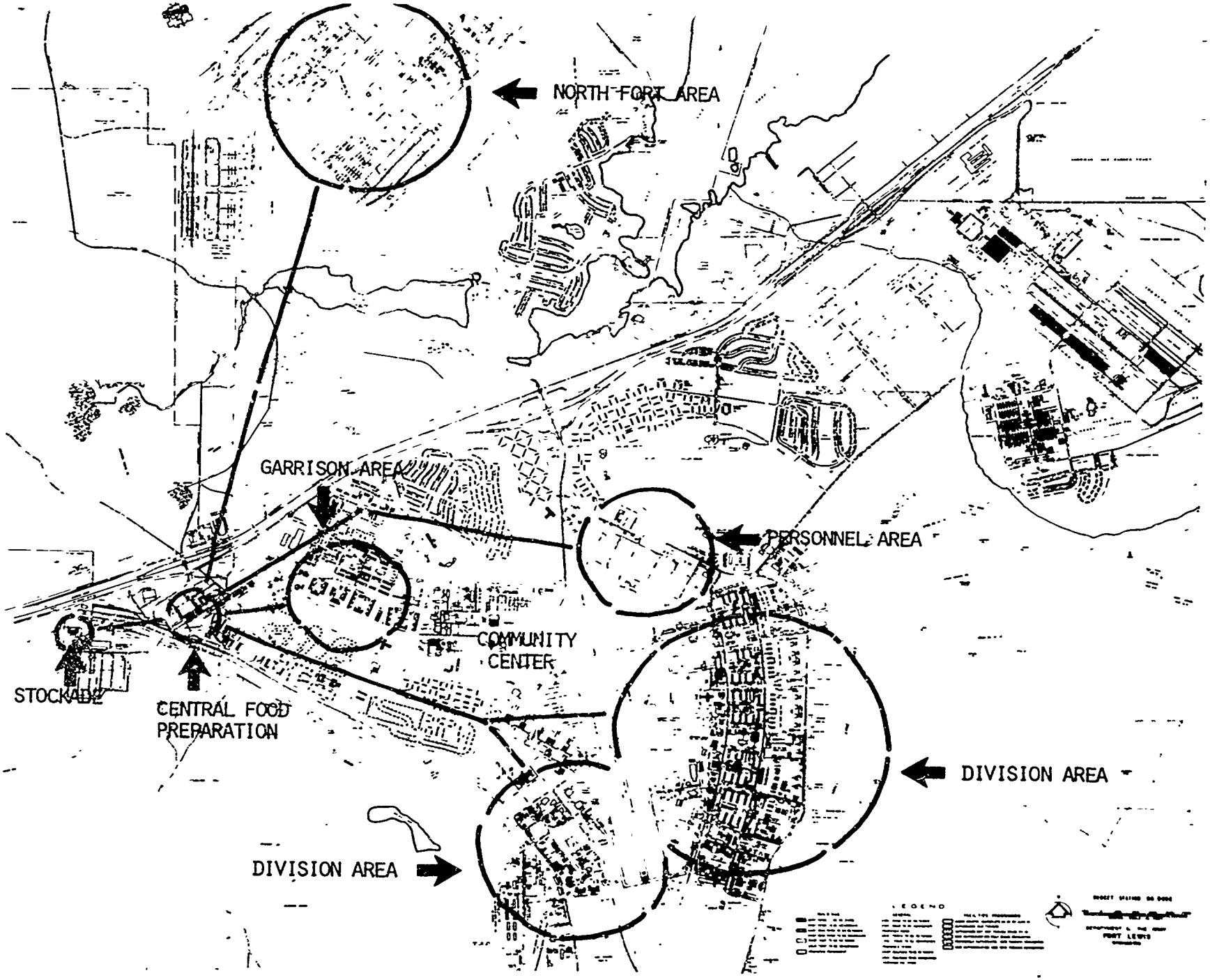
REGULAR SERVICE
SHORT ORDER
SPECIALTY
COMBINATIONS
N
GARRISON AREA
400 0 400 800 1200 1600 2000
GRAPHIC SCALE IN FEET
DEPARTMENT OF THE ARMY
FORT LEWIS
WASHINGTON


PERSONNEL AREA
N
400 0 400 800 1200 1600 2000
GRAPHIC SCALE IN FEET
DEPARTMENT OF THE ARMY
FORT LEWIS
WASHINGTON
MILLER HILL
MILLER WOODS
MILLER HILL RESERVOIRS
MILLER HILL RESERVOIRS
RESERVOIR
REGULAR SERVICE
SHORT ORDER
SPECIALTY
COMBINATIONS



NORTH FORT AREA

DEPARTMENT OF THE ARMY
FORT LEWIS
WASHINGTON


NORTH FORT AREA
GARRISON AREA
PERSONNEL AREA
COMMUNITY CENTER
STOCKADE
CENTRAL FOOD PREPARATION
DIVISION AREA
DIVISION AREA

APPENDIX IV

DERIVATION OF FOOD COSTS FOR VENDOR SUPPLIED SYSTEM

An estimate of the food costs for the Vendor Supplied System was derived from an analysis of the procurement costs of selected frozen entree items as compared to the new food cost of identical items in the Central Food Processing Facility (CFPF) System, as shown in Table A.

In order to develop a total food cost for the Vendor Supplied System, an average cost factor ratio was developed (see Table A). This ratio is based on the entree cost of the Vendor Supplied System as compared to the entree cost of the CFPF system.

Entree costs were developed for the CFPF system which reflect the cost of raw food only. CFPF food costs were determined as the proportional cost of the recipe ingredients required to provide an 8 ounce serving of the entree item, using Federal Supply Catalog Price Lists and meat prices from the "Carlot and Pork Price Quotations", The National Provisioner, 4 March 1972. Meat prices were adjusted to reflect expected processing yields (wholesale to retail and raw to cooked).

Entree costs for the Vendor System are based on an 8-ounce serving, and were the lowest bids received in production tests conducted by DPSC. They reflect not only the raw food cost but also the built-in cost of labor, packaging, shipping, and profit. The average cost factor was obtained by dividing the average Vendor Supplied entree cost by the average CFPF entree cost. This cost factor was then reduced by 20% to account for cost reductions which would be realized through volume procurement. The reduced cost factor was used to compute the total annual food cost for the vendor system. That is, the CFPF food cost from Table I was multiplied by the reduced cost factor to obtain the food cost shown in Table I for the Vendor Supplied Food System. This calculation assumes that the same cost ratio that exists for entrees also exists for all other meal components. This assumption was verified by computing a total meal cost using a potato item, vegetable item, salad, cake and rolls that were available commercially in a fully preprepared form.

TABLE A

COMPARISON OF FOOD COSTS FOR SELECTED ENTREES

Entree Item	CFPF System	Vendor System	Cost Factor
Shrimp Creole	$ 0.26	$ 0.68	2.62
Turkey w/Gravy	0.11	0.34	3.09
Pork Loin w/Gravy	0.21	0.40	1.90
Chicken a la King	0.14	0.33	2.36
Chop Suey (Pork or Beef)	0.16	0.36	2.25
Average	$0.176	$0.422	

$$\text{Average Cost Factor} = \frac{0.422}{0.176} = 2.40$$

$$\text{Adjusted Cost Factor*} = 2.40 \times 0.8 = 1.92$$

*Reflects 20% cost reduction for volume procurement.

APPENDIX V

ANNUAL COMPOSITE RATES OF PAY FOR OPERATING PERSONNEL

MILITARY		CIVILIAN							
Grade	Composite Rate $[1]	General Service Grade	Composite Rate $ [2]	Wage Supervisor Rate	Composite Rate $ [3]	Wage Leader Rate	Composite Rate $ [4]	Wage Grade Rate	Composite Rate $ [4]
06	25,829	14	26,270	08	13,640	08	11.378	10	10,993
05	21,026	13	22,416	07	13,323	03	9,546	09	10,677
04	17,268	12	18,980	02	11,649			08	10,360
03	14,783	11	15,922	01	11,319			07	10,021
WO	12,528	09	13,213					06	9,681
E9	14,031	07	10,830					05	9,365
E8	12,277	06	9,754					04	9,025
E7	10,419	05	8,755					03	8,686
E6	8,958	04	7.828					02	8,347
E5	6,807	03	6,971						
E4	5,846	02	6,179						
E3	5,136								
E2	4,760								

1. Rates are based on AR37-29 revised for FY 72 with an effective date of 1 May 1972.
2. Rates are based on step 4 of Public Law 92-210 dated 22 December 1971 and include an 8-3/4% increase for fringe benefits.
3. Rates are based on step 3 of Wage Rate Schedule for the Seattle-Everett-Tacoma Washington Wage Area dated 3 Feb 72 and includes an 8-3/4% increase for fringe benefits.
4. Rates are based on step 2 of Wage Rate Schedule for the Seattle-Everett-Tacoma Washington Wage Area dated 3 Feb 72 and includes an 8-3/4% increase for fringe benefits.