Food Acceptance Lab

TECHNICAL REPORT

72-37-OR&SA

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A SYSTEM EVALUATION OF ARMY GARRISON FEEDING AT FORT LEWIS, WASHINGTON

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January 1972

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

Operations Research and Systems Analysis Office

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ACKNOWLEDGEMENT

The authors wish to thank Colonel Julian Turner, Chief of Services, Fort Lewis, Washington, and his staff for their outstanding cooperation and assistance in conducting the study reported herein.

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 from 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.

It should be noted that 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 will be published in the near future concerning the overall project. This report details the results of a systems analysis study of the present garrison feeding system at Fort Lewis, Washington.

TABLE OF CONTENTS

	Page
List of Tables and Figures	v
Abstract	vi
Introduction	1
Objective	2
Definition of Existing System	3
Food Service Program Objectives	3
Feeding System Component Areas and Customer Populations	7
Customer Populations	10
Management Structure	13
Food Procurement	13
Menu	17
Dining Hall Staffing Levels	17
Dining Hall Food Distribution and Kitchen Equipment	18
Dining Hall Sanitation	22
System Performance	23
Cost Analysis	23
Sources of Information	23
Cost Factors	23
Meal Production	24
Total Meal Cost	25
System Effectiveness	26
Work Sampling Study	28
Productivity Analysis	32
System Problem Areas	33
Inefficient Manpower Utilization	33
Highly Variable Food Quality	34
Obsolete Kitchen Equipment	34
Serving Line Capacity	34
Inadequate Training of Food Service Personnel	35
Source of Food Service Personnel	35
Excessive Working Hours	36
Splintered Organizational Structure	36
Lack of Career Opportunities	37
Poor Working Environment	37

TABLE OF CONTENTS (Cont'd)

	Page
Summary and Conclusions	39
References	40
Appendix I	41
Appendix II	43
Appendix III	44
Appendix IV	45

LIST OF TABLES

		Page
TABLE I	Troop Density and Customer Attendance by Location	10
TABLE II	Typical Dining Hall Staffing	18
TABLE III	Kitchen Equipment by Dining Hall Type	21
TABLE IV	Dining Hall Meal Production	25
TABLE V	Total Annual Meal Cost for Fort Lewis	25
TABLE VI	Dining Hall Personnel Work Schedule	29
TABLE VII	Dining Hall Personnel Manpower Utilization	31

LIST OF FIGURES

FIGURE 1	North Fort Lewis	4
FIGURE 2	Garrison Area	5
FIGURE 3	Division Area	6
FIGURE 4	Typical Dining Hall 1941 Type	8
FIGURE 5	Typical Dining Hall 1930 Type	9
FIGURE 6	Typical Dining Hall 1953 Type	11
FIGURE 7	Typical Dining Hall 1957 Type	12
FIGURE 8	Present Feeding System Organizational Structure	14
FIGURE 9	Flow Diagram of Procurement and Food Distribution System	15
FIGURE 10	Ration Requisition and Distribution Cycle	16
FIGURE 11	Food Flow Diagram at the Dining Hall	19

ABSTRACT

This report covers the definition, performance and problem areas of the present garrison feeding system at a large Army post, Fort Lewis, Washington.

Feeding requirements, total cost of preparing and serving a meal, system effectiveness (productivity) and major problem areas are discussed.

It is concluded that the performance of the present feeding system can be significantly improved by resolving the major problems. Solutions to these problems should result in providing the customer with more satisfying meals and improved service while also increasing worker productivity.

INTRODUCTION

Throughout the history of our Army and until the present time, the predominant mode of garrison dining has been in company level groups of approximately two hundred men. Food service was therefore under the direction of the organizational Commander who was primarily responsible for assuring that his soldiers were properly fed. This mode of operation was based on the philosophy that the company was the basic tactical and administrative unit as well as the social unit. The organizational Commander was also responsible for the supervision of the staff of full-time cooks who were trained both in school and on-the-job to prepare them to fill the food service positions within the company.

As a result of the company level feeding policy, the present garrison feeding system consists of hundreds of small dining halls with serving capacities of 200 to 300 men. Each dining hall is a separate and distinct food service operation with its own kitchen and staff of cooks. Sanitation functions (KP) are performed primarily on a duty roster basis by untrained enlisted personnel in the lower pay grades.

During the past ten years the Army, like every other food service operator, has experienced significant increases in the cost of labor. The E-5 sergeant of 1962 cost the Army $3700 annually while in 1971 his counterpart cost $6837. These increases in labor cost – together with the current emphasis to eliminate menial roster duties, such as KP, plus the demands for improved service (i.e., quality, variety, and quantity of food) – have created a serious problem within the Army. This problem concerns the reduction of system labor requirements while simultaneously improving customer service at a time when dollar resources are scarce. These same requirements have been responsible for industrial progress in developing and implementing new state-of-the-art feeding systems.

The present feeding system at Fort Lewis, defined in this report, evolved over the years as the troop populations increased and has been maintained to meet the objective of the company level feeding policy. This report, therefore, represents the quantitative "before" picture as it existed in 1971 and provides the cost and performance base line for the present system. This base line will be utilized in the cost effective analysis of a new state-of-the-art feeding system which will be designed to increase customer satisfaction and reduce operating cost. The new feeding system will be documented in a follow-on technical report.

OBJECTIVE

The objective of this study was to define the present feeding system at Fort Lewis, and its cost and performance, to establish a baseline for quantitatively measuring the impact of potential improvements. This was accomplished by determining the following:

a. Feeding requirements and managment structure
b. Types and locations of dining halls
c. System productivity and total meal cost
d. Work functions of dining hall personnel
e. Major problem areas

DEFINITION OF EXISTING SYSTEM

Fort Lewis is located forty-five miles south of Seattle, Washington. It has a total population of 70,000 including civilians and dependents, and would rank as the fifth largest city in the state of Washington. At the time of this study, Fort Lewis was the most populous Army Center in the United States. The military units assigned at Fort Lewis are representative of large Army posts in the United States, i.e., recruit training units located in North Fort Lewis, garrison units and transient units located on the main post, and combat units located in the Division Area of the main post (See Figures 1, 2, and 3).

The most outstanding feature of the feeding system at Fort Lewis is the number of small dining halls available and/or used to feed the troops. For example, there are 263 dining halls of which 122 were being utilized at the time this study was conducted. This system has been established throughout the Army because of the need for unit integrity and the desire to retain the company level feeding concept.

This large number of small dining halls has provided a powerful constraint which directly affects the cost and performance of the existing system. It also contributes to many of the problem areas which are identified in this report. However, it should be emphasized that this feature does provide maximum convenience to the troops and does meet the unit integrity requirements of tactical Army units.

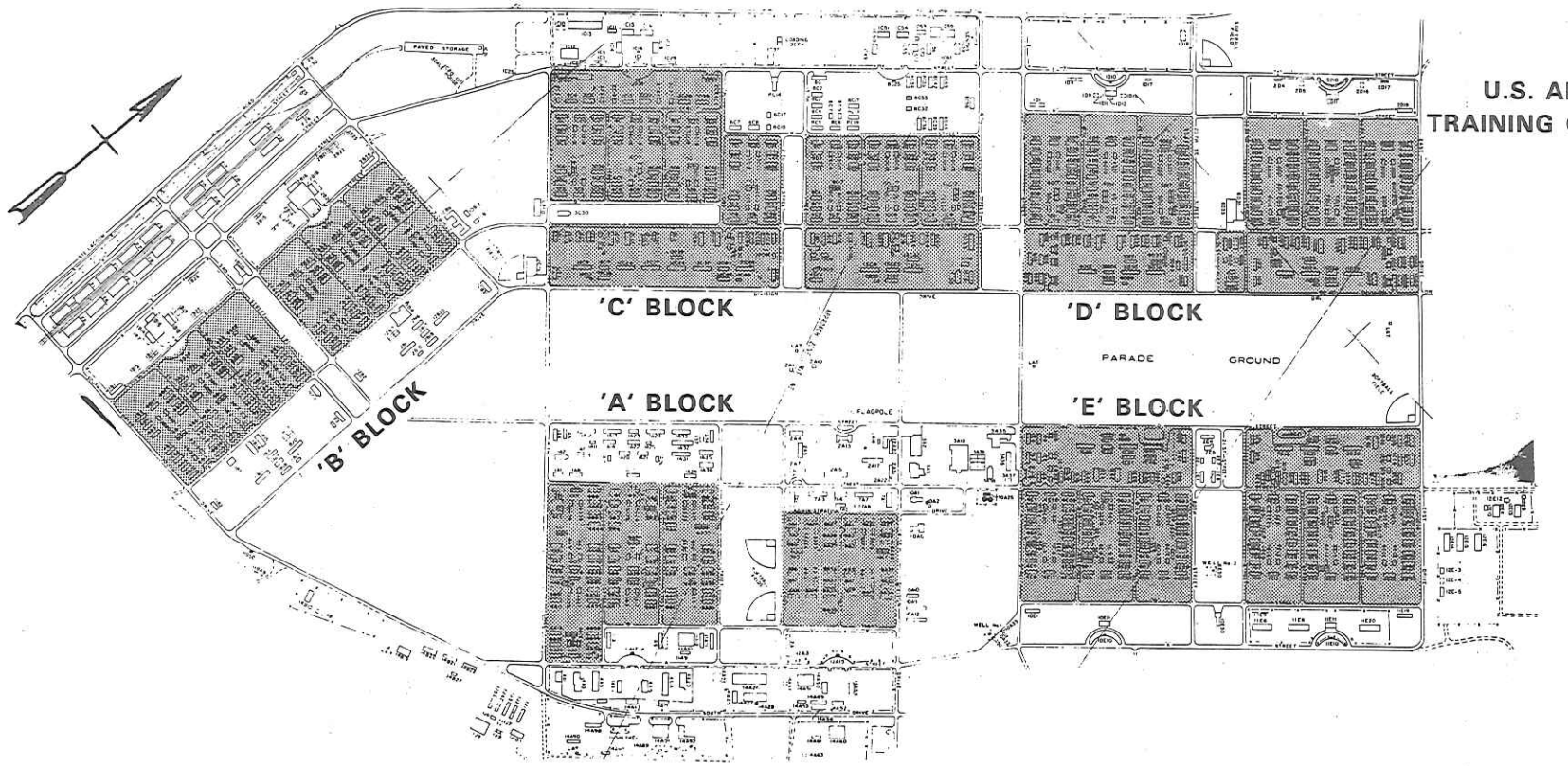
Food Service Program Objectives

The stated objectives of the Army food service program are listed below:

a. To provide an adequate variety and quantity of high quality subsistence for troop feeding and to maintain the highest possible standards for the soldier.

b. To provide adequate facilities and numbers of operating personnel for the receipt, inspection, storage, and issue of subsistence and for the preparation and service of food.

c. To provide continuous training for personnel required to support the food service program.



NORTH FORT LEWIS

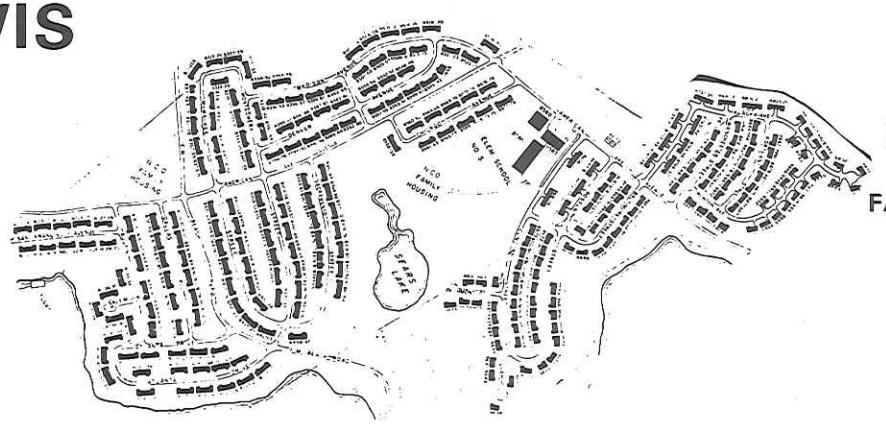


FIGURE 1 North Fort Lewis

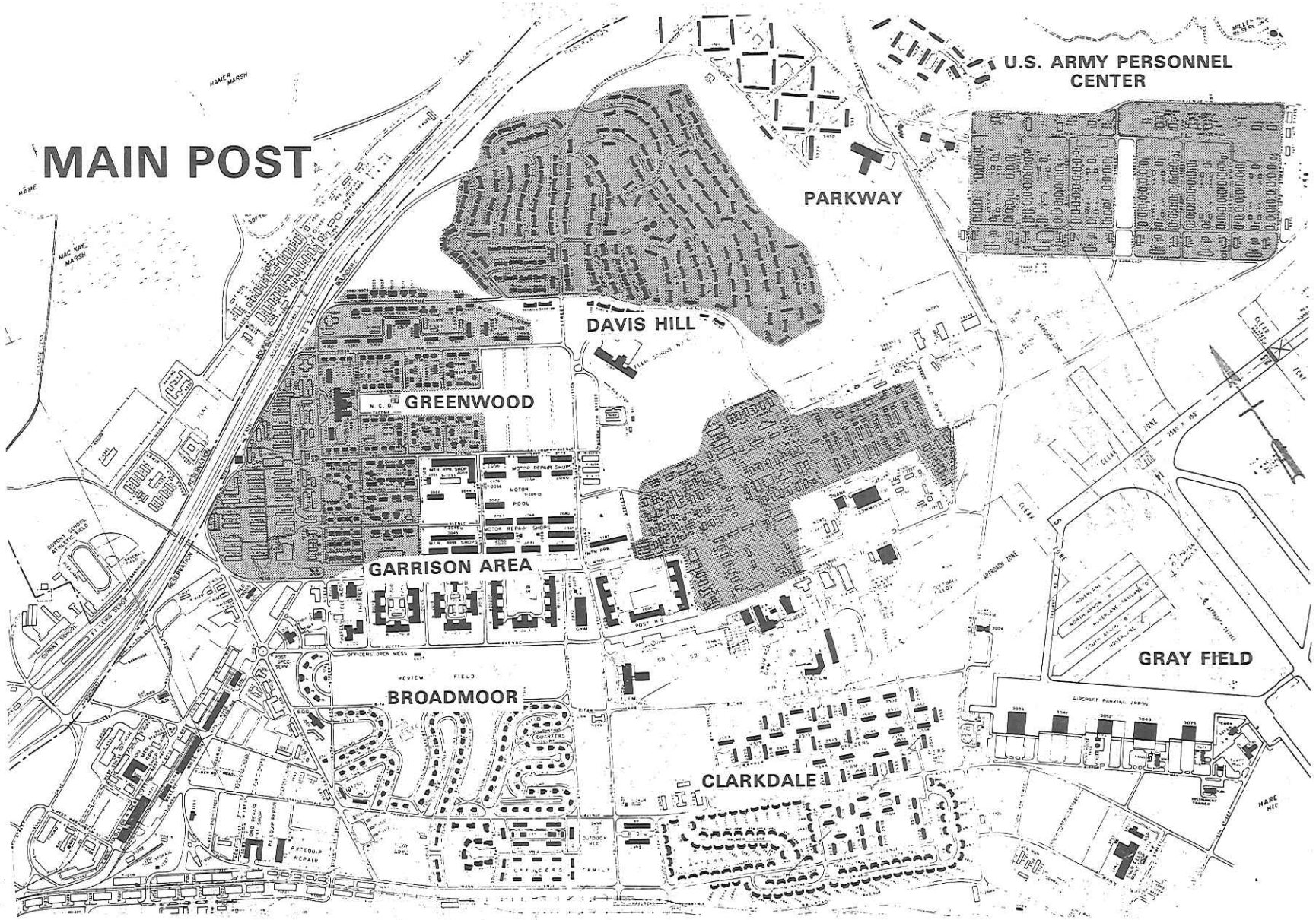


FIGURE 2 Garrison Area

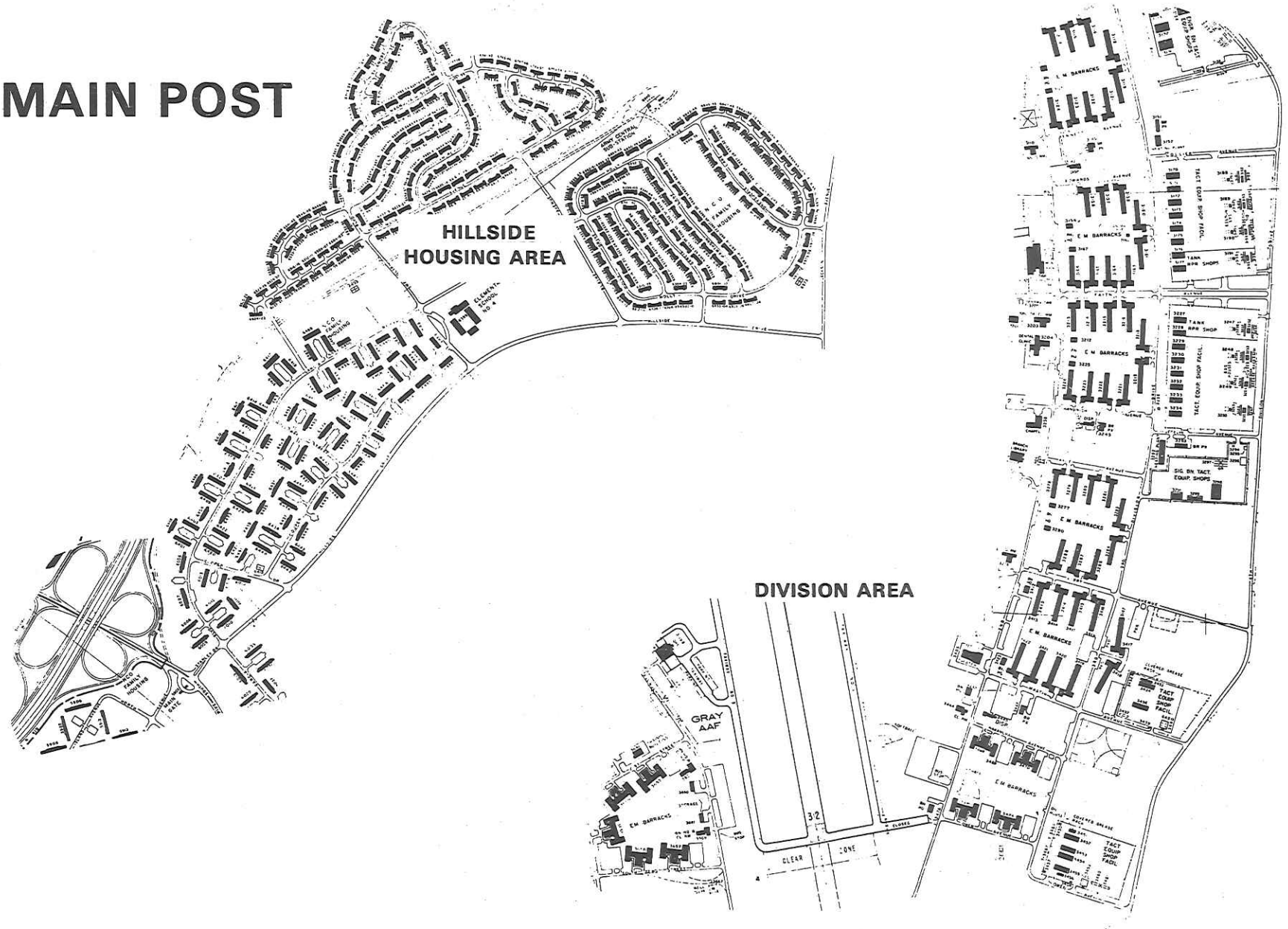


FIGURE 3 Division Area

Feeding System Component Areas and Customer Populations

The various components of the present feeding system and their customer populations are defined in the remainder of this section.

The Training Center Area, where raw recruits undergo basic combat training, is located in North Fort Lewis and contains 136 dining halls constructed in 1941. Figure 4 shows a layout of these facilities which are one-story, temporary wood structures designed for a five-year life, and a onetime seating capacity of 84. Originally, the dining area consisted of ten-man picnic tables and the kitchen contained only simple kitchen equipment such as ranges, worktables, refrigerators, and a double tank sink.

During the ensuing thirty years, four-man tables and chairs have replaced the picnic tables; equipment such as grills, mixers, refrigerators, freezers, dishwashers, milk dispensers, water fountains, and deep-fat fryers have been added to such an extent that the building has become severely congested and seating capacity has been reduced by up to 20%. Utilities are inadequate for any additional equipment and the lighting is considered marginal. Natural deterioration with age has reached the point where maintenance costs are very high. After all these years of service, damp rot of floors is prevalent and the cost of this repair to each of these buildings has averaged $3600. In addition, frequent utilities repairs are required and equipment failures are commonplace. The customers who dine in this area are essentially a captive audience, marched to and from the dining halls three times a day.

The Personnel Center is located on the Main Post and contains 21 dining halls which are identical to those in the Training Center and, therefore, have the same deficiencies. Exceptions are the two dining halls used by soldiers coming from and going to the Far East which were recently renovated to upgrade their appearance. All customers who dine in this center are transients and remain for periods ranging from twenty-four to seventy-two hours. They have a choice of whether or not they eat at their designated dining hall.

The Garrison Area is located on the Main Post and contains 49 dining halls. Figure 5 shows a layout of these facilities which were constructed during the 1930-1937 period. These buildings are permanent with unit dining areas which are an integral part of the building in which the customers reside. The onetime seating capacity is 96. These buildings are in good structural condition; however, utilities capacities and lighting are marginal. The customers who dine in these facilities are permanent party who are responsible for the day-to-day operation of the installation. They have a choice of whether or not they eat at their unit dining hall.

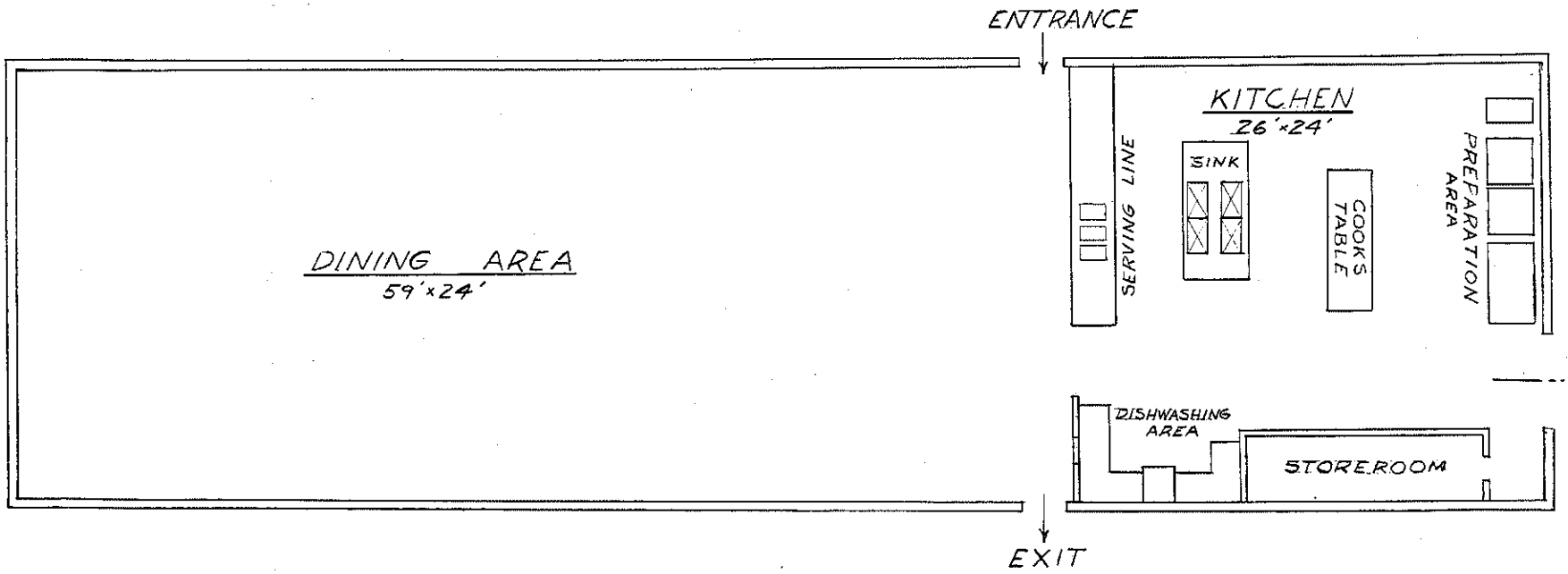


FIGURE 4 Typical Dining Hall 1941 Type

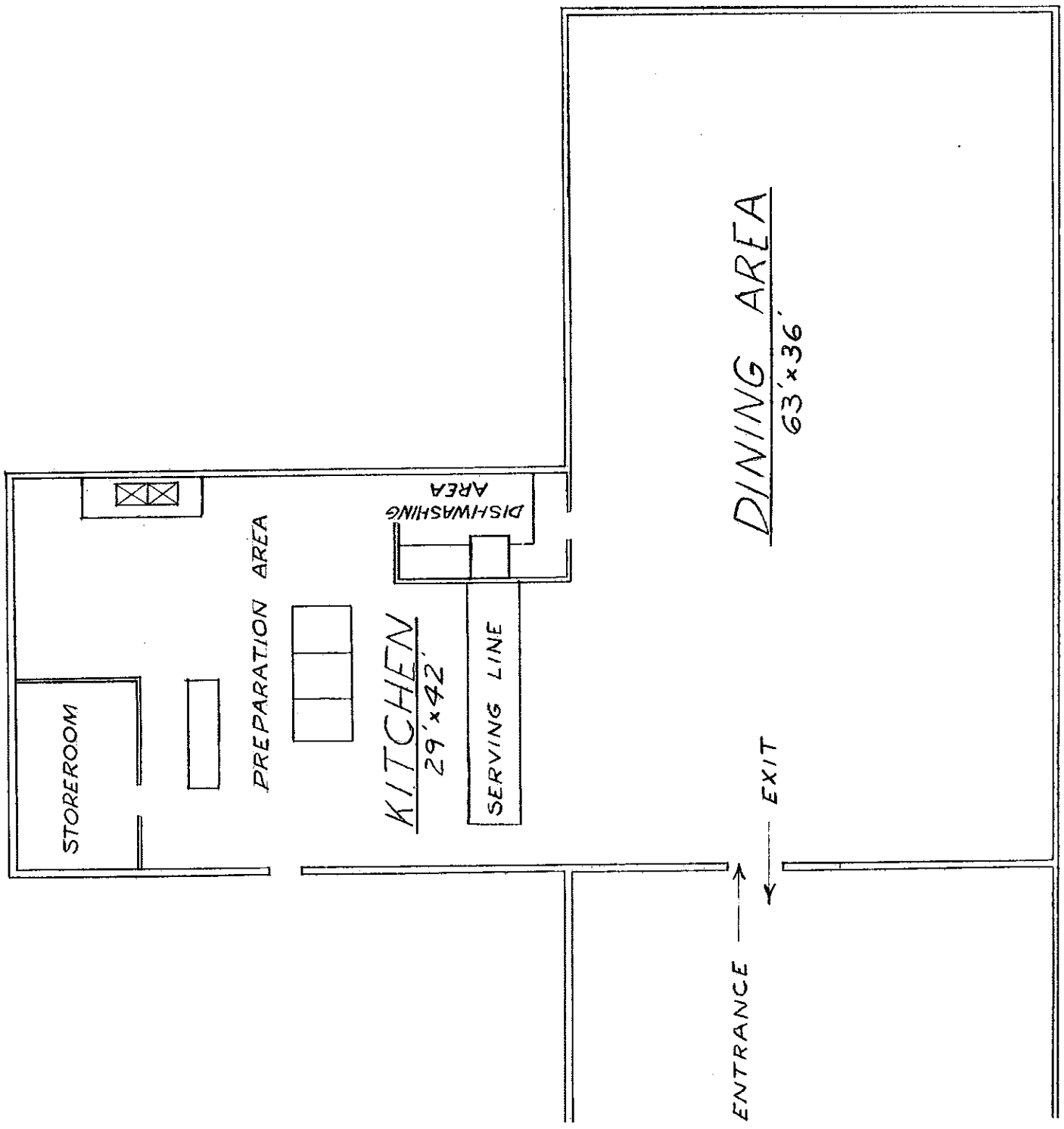


FIGURE 5 Typical Dining Hall 1930 Type

The Division Area is located on the Main Post and contains 56 dining halls of two types. Figures 6 and 7 show layouts of these facilities which were constructed during the 1953-1957 period. These are also permanent buildings in sound structural condition. The 1953 and 1957 vintage dining halls have onetime seating capacities of 128 and 168, respectively. The units utilizing these facilities are tactical units which are combat ready, subject to deployment at anytime and who periodically eat in the field during training exercises. These customers also have a choice of whether or not they eat at their unit dining hall.

The Madigan General Hospital was excluded from this study since hospital diets require a great deal of specialization and because Madigan's dining hall facilities are by far the most modern at Fort Lewis.

Customer Populations

A summary of the customer populations at Fort Lewis are shown in Table I below. Also shown are the average number of customers who are entitled to free meals and the attendance rates. The high attendance rate of the training center is undoubtedly due to the fact that the customers are a captive audience. In the other areas, the customer attendance is optional and hence somewhat lower. The present feeding system, therefore, serves approximately 16,000 customers daily in 122 active dining halls. This represents an overall attendance rate of 69%. However, when the captive customers in the Training Center are excluded, attendance of those permanent customers in the Garrison and Division Areas who have a free choice was being maintained at a 51% rate at the time this study was made.

TABLE I

TROOP DENSITY AND CUSTOMER ATTENDANCE BY LOCATION*

Area	January 1971 Population	Average No. of Customers Authorized Free Meals	Average No. of Customers Who Eat Free Meals	Attendance Rate by Percent
Training Center	13,080	12,520	10,610	85%
Personnel Center	7,709	3,940	2,060	52%
Garrison	5,130	2,595	1,170	45%
Division	6,410	4,235	2,314	55%
TOTAL	32,329	23,290	16,154	Average 69%

* At the time of this study 122 of the 263 dining halls were operating. The remainder had been closed and were on stand-by.

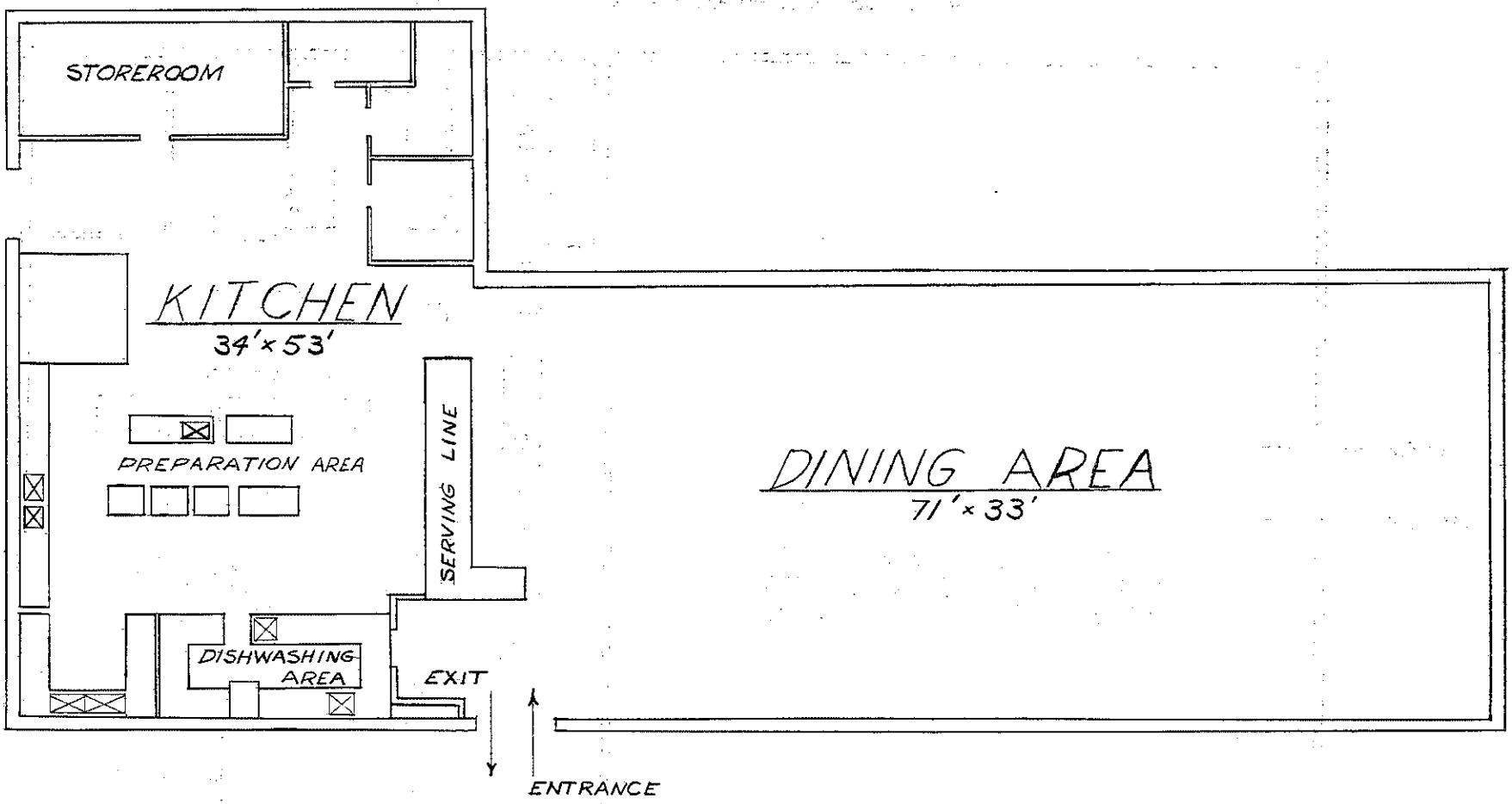


FIGURE 6 Typical Dining Hall 1953 Type

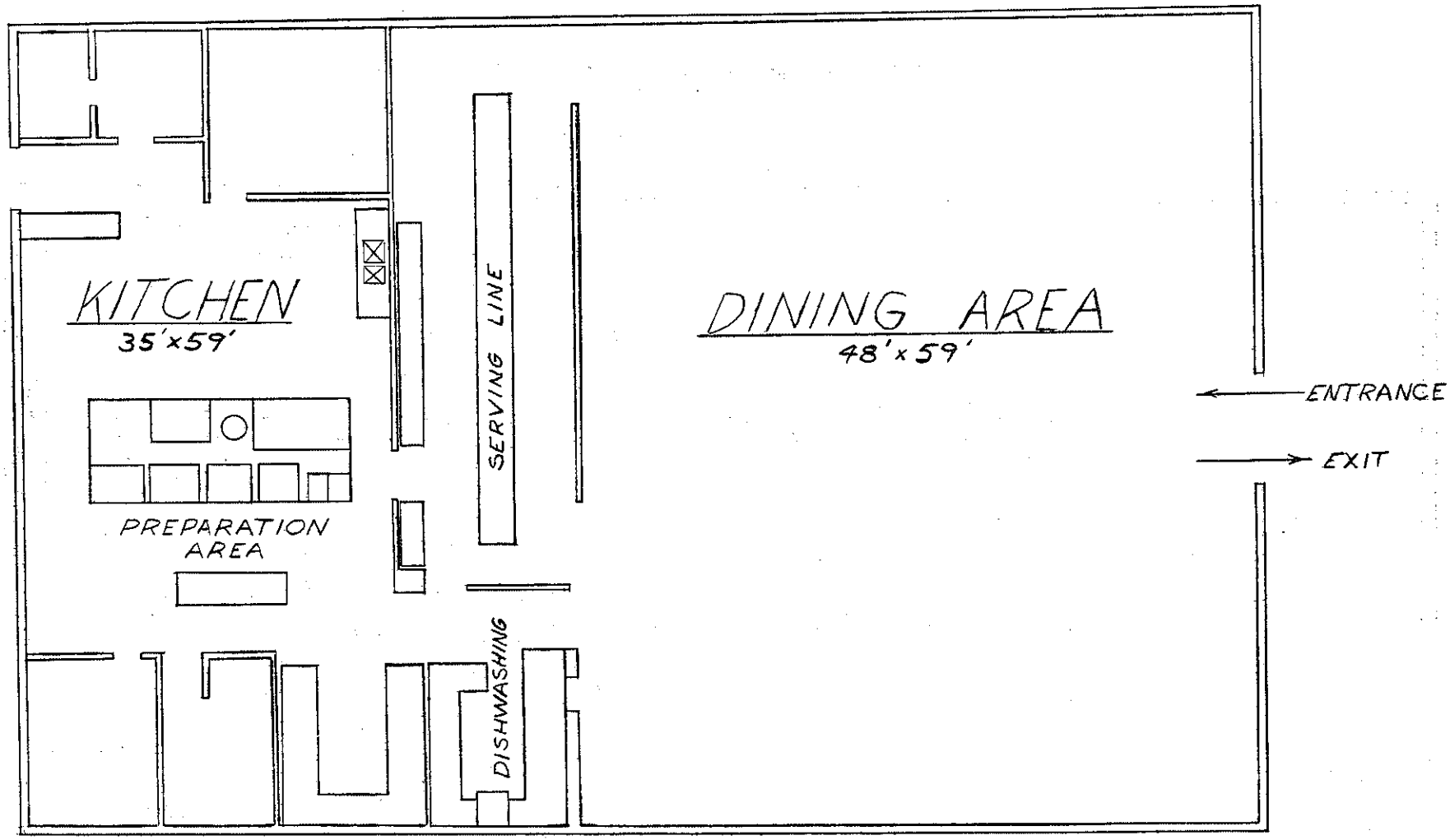


FIGURE 7 Typical Dining Hall 1957 Type

Management Structure

The management structure of the feeding system is shown in Figure 8. Management of the feeding system is divided between the Major Commands and the Directorate of Installation Operations (DIO). Each Commander has overall management responsibility for the dining halls in his organization. A unit food advisor, usually a warrant officer, provides day-to-day guidance for the Command's food service operation while the company commander, a junior level officer, exercises the day-to-day management responsibility for the dining hall operation. The Services Division, acting for the DIO, has management responsibility for:

- Establishing feeding system policy
- Operating the ration breakdown activity
- Controlling the distribution of cooks throughout the system
- Providing technical assistance to dining hall stewards and cooks through the Post Food Service staff.

In addition to the above responsibilities, the Services Division also manages the retail commissary, the laundry and the mortuary, which dilute the effort which can be expended on management of the feeding system.

Food Procurement

The flow of food from the food producer to the customer is shown in Figure 9. The majority of food items are procured through the Defense Personnel Support Center (DPSC), Philadelphia, Pennsylvania. Perishable and nonperishable foods are contracted for by DPSC. Nonperishable foods are shipped from the food producer to Tracy Army Depot, California from which they are requisitioned by the Fort Lewis Commissary. Perishable foods are shipped directly to the Fort Lewis Commissary cold storage warehouse. Dairy products and certain other perishables are contracted for directly by Fort Lewis from local suppliers and these foods are delivered directly to the dining hall kitchens.

Figure 10 shows the ration requisition and distribution cycle. The dining hall steward requisitions his food on DA Form 2970 (Subsistence Report and Field Ration Request) from the ration breakdown activity. The normal request cycle is every 2, 2, and 3 days

PRESENT FEEDING SYSTEM ORGANIZATIONAL STRUCTURE

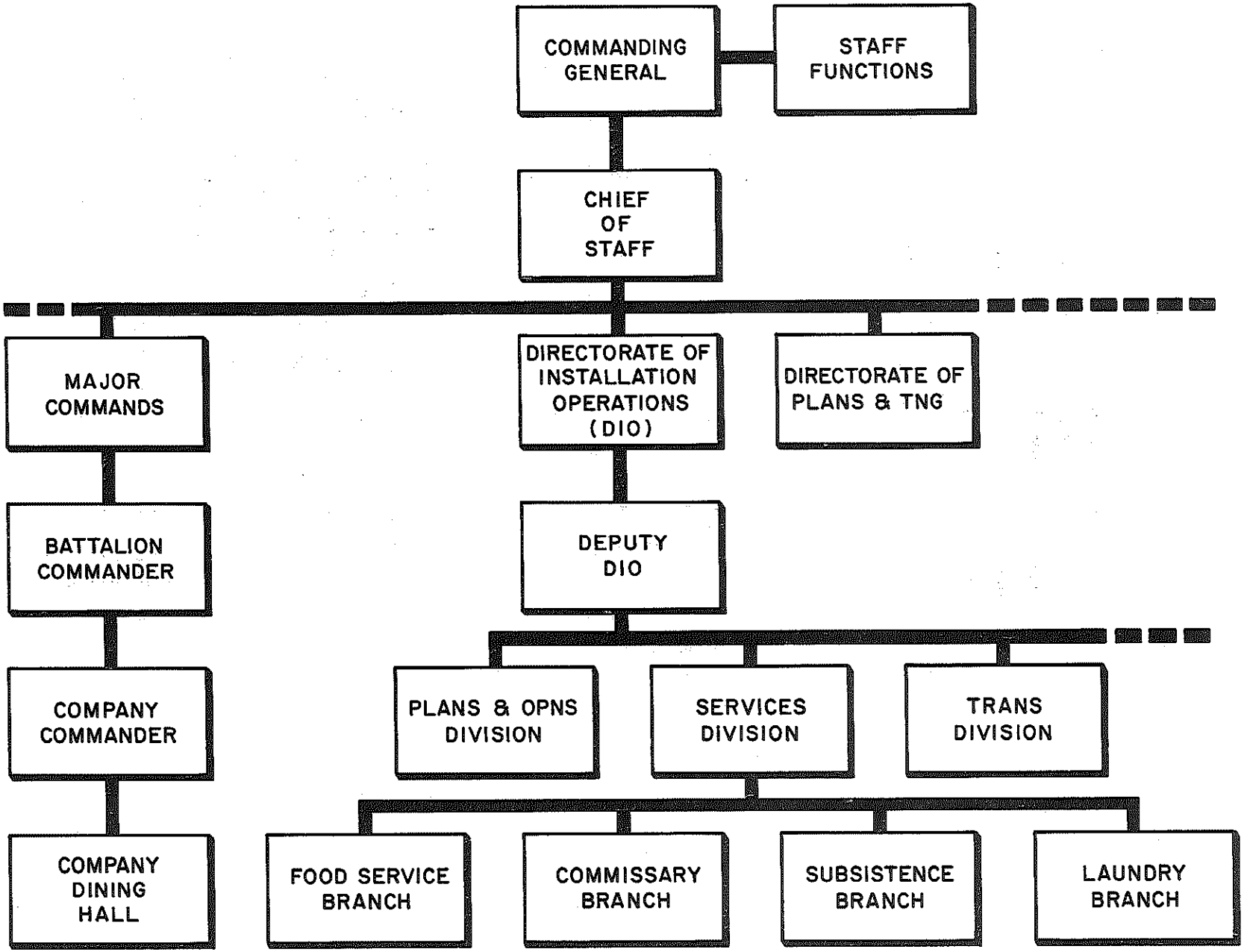


FIGURE 8 Present Feeding System Organizational Structure

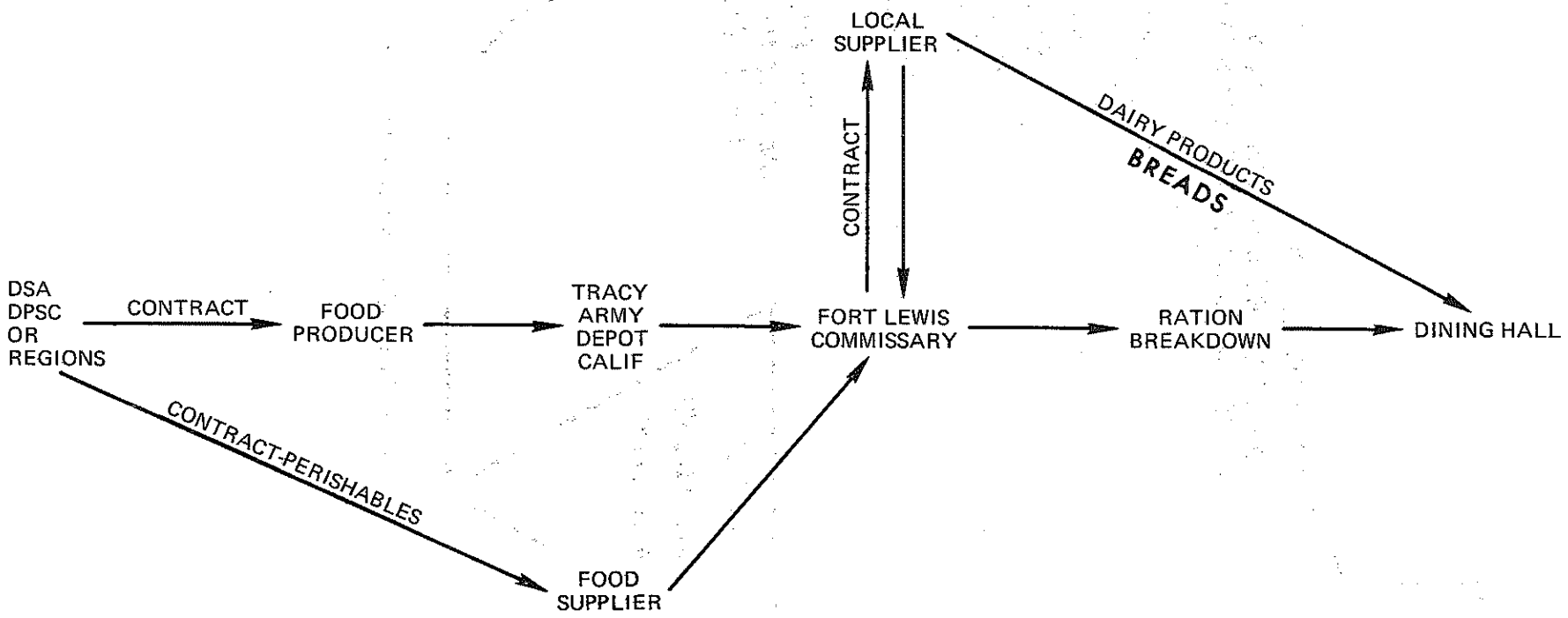


FIGURE 9 Flow Diagram of Procurement and Food Distribution System

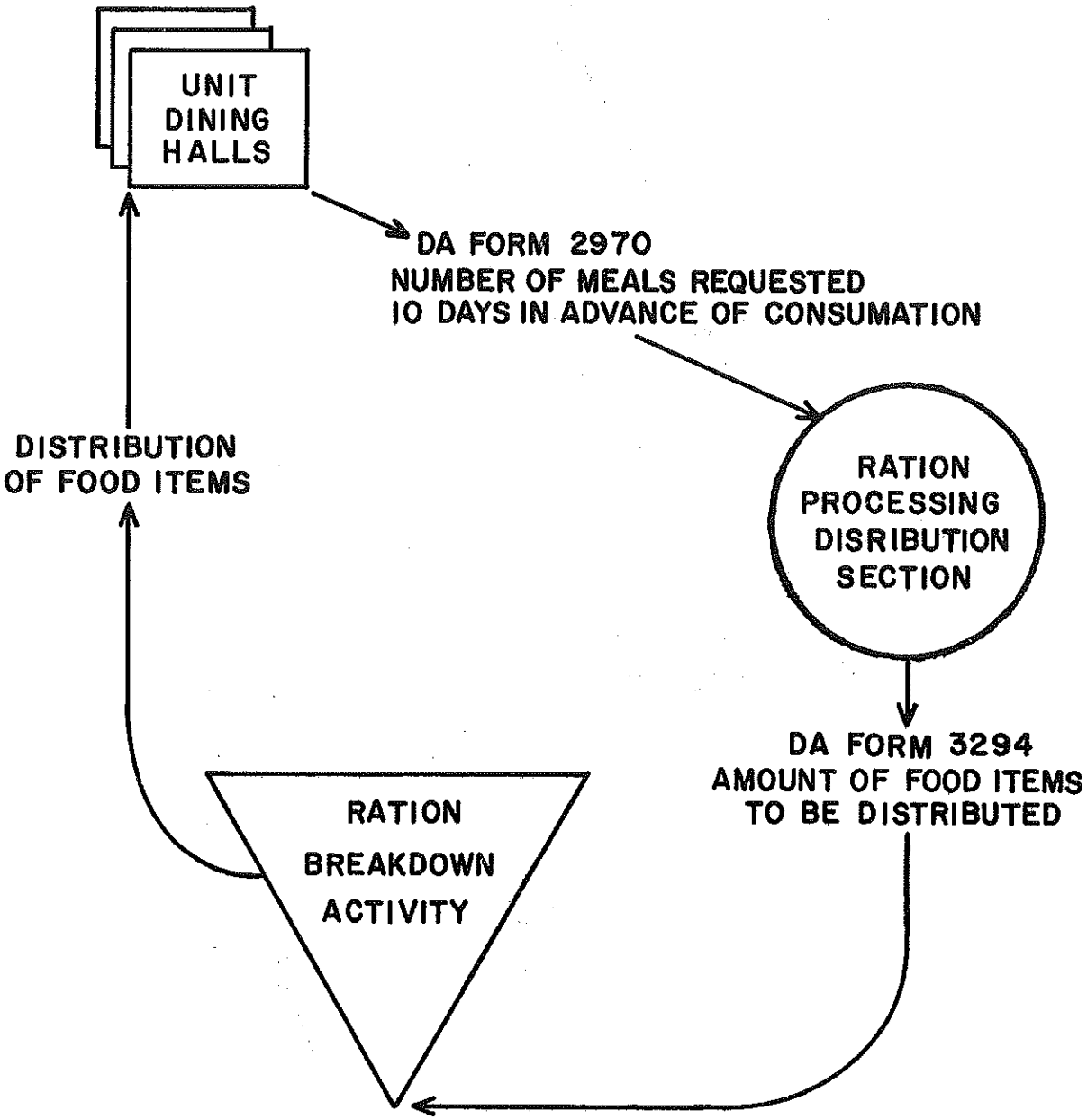


FIGURE 10 Ration Requisition and Distribution Cycle

within a week. The DA Form 2970 provides the following information: The authorized feeding strength of the requesting unit, the number of personnel who actually subsisted for each meal during the previous period and the number of rations requested for meals in the next period (which is estimated by the dining hall steward).

Based on the above information, the ration breakdown officer then prepares two DA Form 3294's (Field Ration Issue Slip) for each supported unit; one for perishable items, the other for nonperishable items. The number of rations requested for each meal is entered on the DA Form 3294 and by using an issue factor for each food item, the amount of food to be delivered is computed. The issue factor prescribes issue quantities, per 100 men, and is obtained from the master menu as revised by the installation menu board.

Within the present system, the accounting is based on the number of meals previously fed. Before submitting ration requests, the number of meals actually requested must be reduced below the anticipated headcount to compensate for previously overdrawn meals.

Menu

Guidelines for the overall control of adequate caloric and nutritional food intake is contained in the Department of Army Supply Bulletin SB 10-260 Master Menu. It is published monthly by the Army Food Service Center, Fort Lee, Virginia and delineates the menu ingredients and quantities of food components which comprise a specific meal. In January, 1971 the Master Menu was modified to provide for multiple hot entrees and a short order meal to provide more versatile service to the customers.

The present master menu is based on a 42-day cycle and includes regular and continental breakfasts, full course dinners, sandwiches (short order), and suppers. The master menu is designed to provide a nutritionally balanced diet, if average portions of all items are consumed.

Dining Hall Staffing Levels

Virtually all of the dining halls at Fort Lewis are designed to accommodate between 200 and 300 men during a sixty minute eating interval. Each dining hall is an independent

cafeteria-type operation containing its own kitchen, dishwashing facilities and dining room. Each dining hall is completely staffed with its own manager, cooks, and kitchen helper (KP) work force. A detailed breakdown of a typical dining hall staff is shown in Table II. The staff consists of eight trained personnel who are full-time cooks with an average grade of E-5 and five untrained personnel who are KP's and have an average grade of E-2. Therefore, 13 personnel are engaged on a full-time basis in the preparation and service of food.

TABLE II

TYPICAL DINING HALL STAFFING

Job Title	Grade	Number of Personnel
Mess Steward	E-6	1
First Cook	E-5	1
Cooks	E-4	4
Assistant Cooks	E-3	2
Kitchen Helpers (KP's)	E-2	5
TOTAL		13

Dining Hall Food Distribution and Kitchen Equipment

The flow of food from the dining hall loading dock to the consumer is depicted in Figure 11. The majority of raw food components, which are the ingredients for the entree items, come from either the freezer or refrigerators. Generally, beef items are supplied frozen and are the six way boneless products. Thawing of frozen meat is performed at room temperature.

The various types of cooking and preparation equipment contained in the kitchen areas of the dining halls are listed in Table III. Electricity is the primary source of power for all kitchen equipment due to its lower cost in this area. The existing equipment is of a very basic design and much of it is considered to be obsolescent. State-of-the-art labor saving devices such as self-cleaning convection ovens, pressure cookers, etc., are not

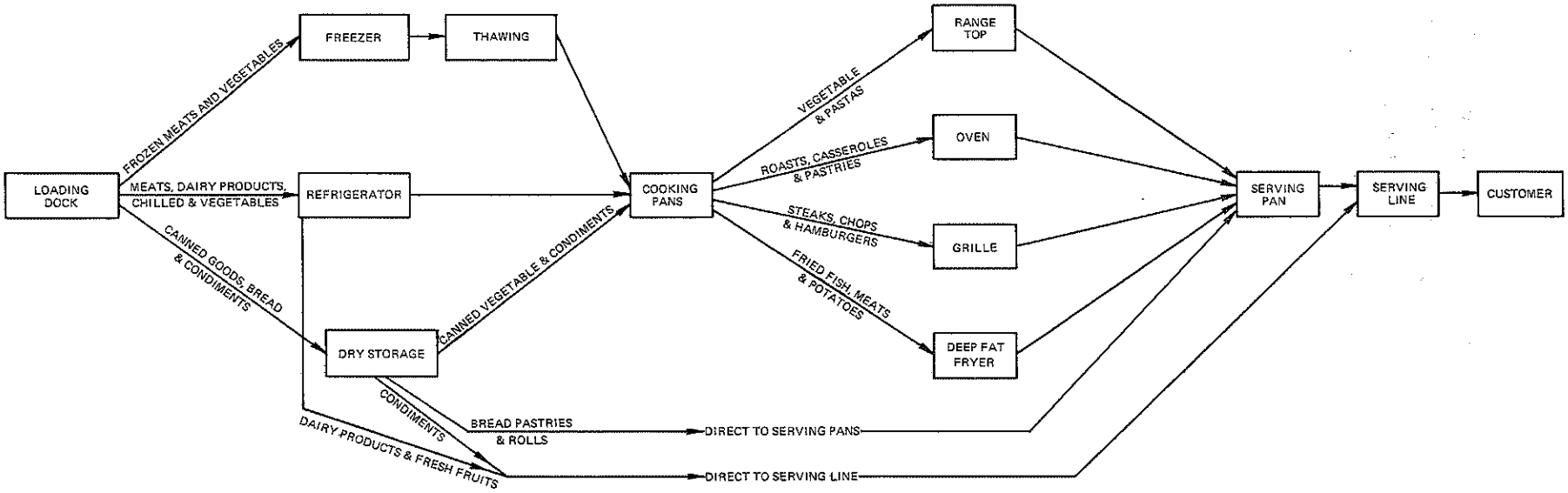


FIGURE 11 Food Flow Diagram at the Dining Hall

available. Refrigerator and freezer holding capacities are inadequate for the existing menu which requires resupply at two or three day intervals. As a result, overcrowding of refrigerators is commonplace, and proper rotation of food supplies (i.e., first in, first out) is very difficult and time consuming. Dry storage area is also inadequate in many of the 1930 and 1941 type dining halls.

TABLE III

KITCHEN EQUIPMENT BY DINING HALL TYPE

Dining Hall Location and Type (Year of Construction)	Seating Capacity	Total Kitchen Area (Sq. Ft.)	Major Type of Equipment (Quantity)	Equipment Year of Manufacture
Garrison Area 1930	96	1110	Electric Ranges (2)	1964
			Deep Fat Fryer (1)	1957
			Electric Grill (1)	1956
			Dishwasher (1)	1956
			Refrigerator (Reach-in) and (Walk-in) (2)	1965
			Freezer (Reach-in) (2)	1966
Training and Personnel Centers 1941	84	700	Electric Ranges (2)	1958
			Deep Fat Fryer (1)	1966
			Electric Grill (1)	1956
			Deck Oven (1)	1967
			Dishwasher (1)	1956
			Refrigerator (Reach-in) (2)	1965
			Freezer (Reach-in) (2)	1966
Division Area 1953	128	1632	Electric Ranges (3)	1964
			Deep Fat Fryer (1)	1966
			Electric Grill (1)	1956
			Dishwasher (1)	1953
			Refrigerator (Walk-in) and (Reach-in) (2)	1953
			Freezer (Reach-in) (1)	1966
Division Area 1957	168	2166	Electric Ranges (4)	1964
			Deep Fat Fryers (2)	1968
			Electric Grill (2)	1966
			Deck Oven (1)	1967
			Steam Kettle (1)	1956
			Bain Marie (1)	1957
			Dishwasher (1)	1957
			Refrigerator (Walk-in) (2)	1957
			Freezer (Walk-in) (1)	1957

Dining Hall Sanitation

Dishwashing is performed by KP's in each of the dining halls. Dishwashing equipment consists of a single tank counter-type dishwasher. Because of the poor design of the dishwasher, two men are required to perform the operation. One additional man manually washes all pots, pans, and utensils. In many instances, dishwashing equipment was being used only to rinse dishes since equipment performance was poor in the majority of dining halls on post. All dishes were, therefore, washed manually prior to being put through the dishwasher which increased the amount of labor required for this function. Water temperatures were found to be exceptionally low and in some cases, water temperatures as low as 140°F were observed which was inadequate for proper sanitizing.

Cleanup of the kitchen and dining areas is performed primarily by the two remaining KP's. These cleanup activities include washing and buffing floors, windows, tables, and serving lines; as well as picking up trash on the grounds immediately adjacent to the dining hall exterior.

SYSTEM PERFORMANCE

The measures of performance selected for this study were total meal cost, system productivity and worker productivity. The total meal cost was computed over a 60-day period which encompassed 2,951,650 meals. The system productivity was defined as the number of meals prepared and served per man-hour of effort expended. The worker productivity was measured by employing work sampling techniques to determine the dining hall personnel manpower utilization. Detailed descriptions of these performance measures and the applicable data are provided below.

Cost Analysis

Since the only cost directly identified with the feeding system was the raw food cost, it was necessary to develop a cost model for the total meal cost. This cost is the baseline for measuring the cost effectiveness of any new feeding system. It should be noted that cost factors which would not be significantly influenced by the Fort Lewis feeding system (i.e., prorated operating costs of the Defense Personnel Support Center, Natick Laboratories, Army Food Service Center, etc.) were not included in this analysis.

Sources of Information

Cost data were collected from the Post Food Service and Post Engineer's Offices at Fort Lewis and from the Department of Army, Director of Cost Analysis. All data items with the exception of labor costs represent costs for 60 days of operation at Fort Lewis. These data encompass 2,951,650 meals and have been adjusted for a twelve-month period. All data were obtained from official documents and direct interviews with the responsible individuals. Labor cost data were obtained by correspondence from the Department of Army, Director of Cost Analysis and include the November 1971 pay adjustment (see Appendix I).

Cost Factors

In developing the cost data for preparing and serving a meal, discussions were held with food service personnel at various levels ranging from the Chief of Services to the lowest grade cooks to identify all personnel who were chargeable to the feeding system. The following is a description of the various cost factor categories of the feeding system:

Management — Personnel engaged in the management of the food service operations, i.e., Chief of Services, food service advisors, and technicians (see Appendix II).

Labor — Personnel engaged in the direct operation of the dining halls and distribution of food supplies, i.e., dining hall stewards, cooks, dining hall attendants (kitchen police), warehousemen (see Appendix III).

Raw Food — Cost of the food ingredients to Fort Lewis including transportation and ration breakdown cost (see Appendix IV).

Supplies — Cost of the materials required to sustain food service operations, i.e., utensils, spatulas, cutlery, etc.

Utilities — Cost of electricity, water, gas, heating, and telephone attributed to food service operations by the Post Engineer.

Repair and Maintenance — Cost of repairing and maintaining equipment and buildings which are part of the food service operation. These cost data were obtained from the Post Engineer.

Capital Equipment — Cost of new food service equipment.

Laundry Service — Cost of laundering food service uniforms, aprons, towels, etc.

Vehicles — Cost of operating vehicles directly utilized for food service operations.

Minor Construction — Cost of renovating or improving food service facilities and dining halls by the post engineers.

Meal Production

Food preparation and service data shown in Table IV were obtained over a 60-day period encompassing 2,951,650 meals. Excluded were the special steak meals for Vietnam returnees, box lunches, and special pre-prepared field rations.

TABLE IV

DINING HALL MEAL PRODUCTION

Type of Meal	Total Number of Meals Served
Breakfast	944,976
Dinner	1,034,830
Supper	971,844
Total Meals Served	2,951,650

The higher attendance figure at dinner can be attributed in part to the participation of separate rations customers (who pay for their meals). Most of these customers do not live in the barracks and, therefore, consume breakfast and supper elsewhere.

Total Meal Cost

Based on actual expenditures at Fort Lewis for the various categories of costs outlined above, the annual total cost was developed which is summarized in Table V.

TABLE V

TOTAL ANNUAL MEAL COST FOR FORT LEWIS

	ANNUAL $
Management	336,180
Labor (Operation of Dining Hall)	12,259,004
(Ration Breakdown)	416,400
(Commissary)	55,320
Storage and Distribution	335,880
Procurement	128,520
Raw Food	8,306,136

TABLE V

TOTAL ANNUAL MEAL COST FOR FORT LEWIS (Cont'd)

	ANNUAL $
Repairs and Maintenance	399,600
Utilities	147,600
Cleaning Supplies & Laundry	318,300
Misc (Equipment, Utensils, Glasses, etc.)	169,680
TOTAL COST	22,872,660
Number of Meals Served Per Year	17,709,900
Average Total Cost Per Meal	$1.29
Average Raw Food Cost Per Meal	$0.47
Raw Food Cost/Total Cost (%)	36%
Labor Cost/Total Cost (%)	57%

This analysis shows that the average raw food cost of $0.47 per meal represents only 36% of the total cost, and yet this is the only cost that is accounted for in the present system. Labor cost, which is 57% of the total cost, is by far the most significant cost factor.

System Effectiveness

In addition to the total meal cost a quantitative measure for assessing the effectiveness of the present feeding system was required so that a baseline could be developed for comparing the productivity improvements attainable with various state-of-the-art feeding systems. After substantial investigation it was concluded that the most meaningful measure of the effectiveness of a feeding system was the "E" factor or the ratio of the number of meals prepared and served to the total amount of labor required for a specified period of time. The "E" factor was computed as follows and has the unit "meals per man-hour."

$$E = \frac{M}{P_1H_1 + P_2H_2 + \ldots P_nH_n}$$

where M = total number of meals prepared and served

P = total number of personnel in each category required to prepare and serve food, including sanitation

H = total number of hours worked for the specified period of time by personnel in each category

Two systems effectiveness computations were made; the first covers the total system and includes management, distribution and clerical personnel. The second computation covers only the dining hall operations.

The following data were used to compute the total system effectiveness for the present feeding system at Fort Lewis. The data represent a 60 day period:

M = 2,951,650 meals

P_1 = 1,178 men (food service personnel)
P_2 = 707 men (kitchen police)
P_3 = 118 men (management, commissary, ration breakdown)

H_1 = 398 hours
H_2 = 766 hours
H_3 = 348 hours

(Total System) E = 2.8 meals/man-hour

By considering only those personnel who work in the dining hall, it was possible to compute the system effectiveness at the dining hall level. This computation is shown below:

M = 2,951,650 meals

P_1 = 1,178 men (food service personnel)
P_2 = 707 men (kitchen police)

H_1 = 398 hours
H_2 = 766 hours

E = 3.1 meals/man-hour

The system effectiveness of 2.8 meals per man-hour includes all personnel who are involved on a full-time basis in the operation of the feeding system. This figure indicates that there is a relatively low level of productivity with the present feeding system. This is further amplified by the second computation which included only the personnel who actually work in the dining halls, i.e., food service and kitchen helper (KP) personnel. Using these parameters the system effectiveness is only increased slightly to 3.1 meals per man-hour. This computation clearly indicates that any significant increase in productivity will have to be made at the dining hall where the concentration of labor is by far the greatest. Commercial feeding operations, such as cafeterias and large university dining halls, have a system effectiveness ranging from 5.0 to 9.0 meals per man-hour depending upon the size of the operation and the type of meal being served.

Work Sampling Study

A work sampling study was conducted in four of the dining halls in the Division Area to determine the work schedule, nature of the specific job functions, and the utilization of the work force.

Under the present system, the 13 personnel required to operate and maintain a typical 200-man dining hall have a work schedule similar to that shown in Table IV. This table is by no means a standard, since every dining hall steward has the prerogative of designing his own work schedule, but it can be considered as a representative example.

One important fact to be noted from Table VI is the total number of hours per week required of each man. All of the cooks and cook's helpers work a total of approximately 62 hours per week. However, the total number of hours required of the KP does not result in one man working 94 hours per week since the duty has traditionally been an extra duty detail and the lower ranking enlisted men are assigned on a rotational basis.

TABLE VI

DINING HALL PERSONNEL WORK SCHEDULE

Title	Grade	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Total Hours Worked
Mess Steward	E-6	0600 1700	0600 1700	0600 1700	0600 1700	0600 1700	Off	Off	55
First Cook	E-5	0430 1700	0430 1700	0430 1700	0430 1700	0430 1700	Off	Off	62 1/2
Cook	E-4	0430 1700	0430 1700	0430 1700	Off	Off	0600 1830	0600 1830	62 1/2
Cook	E-4	0800 2000	0800 2000	0800 2000	0800 2000	0800 2000	Off	Off	60
Cook	E-4	0430 1700	0430 1700	0430 1700	0430 1700	0430 1700	Off	Off	62 1/2
Cook	E-4	Off	Off	0430 1700	0430 1700	0430 1700	0600 1830	0600 1830	62 1/2
Ass't Cook	E-3	0800 2000	0800 2000	0800 2000	0800 2000	0800 2000	Off	Off	60
Ass't Cook	E-3	0800 2000	0800 2000	Off	Off	0800 2000	0600 1830	0600 1830	61
KP-1,2,3,4,5	E-2	0500 1900	0500 1900	0500 1900	0500 1900	0500 1900	0600 1830	0600 1830	94

The initial phase of the work sampling study was to observe manpower utilization in the dining hall. Table VII is a summary of the observations made and indicates how much time (in percent) was expended in each of the activities by each member of the dining hall work force. Customer loads varied between 165 and 190 during the study. A brief description of the "job titles" follows:

Mess Steward – sergeant performing management and administrative duties.

Baker – cook performing the duties of a baker.

Cooks – includes cooks and cook's helpers, designated military cooks.

Kitchen Police – military personnel temporarily assigned to kitchen clean-up.

The activities are defined as the following:

Prepare and Combine – a worker participating in the combining, mixing, shaping, or assembling of food or equipment.

Walking – a worker moving about the area, loaded or unloaded.

Clean-up and Sanitation – the renovation of equipment, materials, or work area, or routine scheduled area clean-up.

Serving – the distribution and portioning of food products.

Communication – oral, visual, or written exchange of information.

Attending – to assure food or equipment is at a state of readiness; also checking food, or food preparation.

Idle Time – a worker not observed in any of the above activities.

Miscellaneous – personnel engaged in a productive activity not listed above.

TABLE VII

DINING HALL PERSONNEL MANPOWER UTILIZATION

(all figures represent % of time expended)

ACTIVITY

	P & C	Walk	Cl-up & San	Serve	Comm	Attend	I T	Misc
Mess Steward	0	10	0	0	53	0	28	9
Cooks	22	17	7	5	12	3	27	7
Kitchen Police	5	11	43	0	3	0	34	4
KP-dine	0	13	28	3	4	0	50	2

CODE:

P & C - Prepare and Combine
Walk - Walking
Cl-up & San - Clean-up and Sanitation
Serve - Serving
Comm - Communication
Attend - Attending
I T - Idle Time
Misc - Miscellaneous

These data suggest that a significant proportion of the mess steward's time (53%) is required to supervise and direct the dining hall operation, as would be expected. The large amount of idle time attributed to KP-Dine personnel results from the fact that their primary function of clean-up and sanitation in this dining room is not required continuously during the entire period (approximately fourteen hours) of the duty assignment to the dining hall. Data for the cooks and other KP's indicate that most of their time is utilized in performing productive operations.

Productivity Analysis

Three factors were found to be primarily responsible for the low level of productivity:

(a) The system consists of small capacity dining facilities (200 to 300 men), each equipped to prepare its own meals which is inherently inefficient. A large volume production is never realized in any of these dining halls and volume production is essential for a high system effectiveness. This problem is further compounded by the low attendance in many dining halls, thereby making the operation still more inefficient, since the dining hall is staffed to prepare meals for 200 customers and frequently 100 or less will be served.

(b) The use of obsolescent equipment also contributed to low productivity. In many instances kitchen personnel were found to be performing functions manually because the mechanical equipment needed repair. In other instances new equipment had been authorized, but no utility connections were available so the equipment could not be used. The temporary wood-type dining halls constructed in 1941 and the permanent garrison area dining halls constructed in 1930 were also found to have inadequate and overcrowded work areas in the kitchen which undoubtedly had an adverse effect on worker morale.

(c) The use of KP's to perform the majority of the sanitation functions was the third factor contributing to low productivity. Over 700 KP's were engaged in sanitation-type functions, primarily washing trays, glasses, cups, pots and pans, etc., and cleaning the dining hall. Further, these operations were performed manually for the most part. Dishwashing equipment installed in the dining hall was being utilized solely for the purpose of a sanitizing rinse for the trays, etc., which had been washed by hand.

SYSTEM PROBLEM AREAS

The single most important contributor to the ineffectiveness of the present feeding system was the large number of small capacity dining halls and kitchens. As mentioned elsewhere in this report, this constraint, which has evolved out of the Army's need and desire for unit integrity, has resulted in many of the problem areas reported herein. For example, each dining hall must have a manager. Therefore, if there are one hundred and twenty-two small dining halls operating, as there were when this study was conducted, there must be an equal number of dining hall managers. Each of these one hundred and twenty-two managers must be trained, thereby creating training problems. Each manager supervises his own kitchen with results in food quality variability. Each dining hall must have its own preparation equipment, which results in a tremendous equipment maintenance requirement. The size and capabilities of equipment must necessarily relate to small production operations (i.e., single unit dishwashing machines) thereby creating inefficient manpower-machine relationships.

In this section of the report, the problem areas which were determined to have a significant adverse effect on the performance of the present feeding system are discussed in detail. The following is a list of these problem areas:

- Inefficient Manpower Utilization
- Highly Variable Food Quality
- Obsolete Kitchen Equipment
- Serving Line Capacity
- Inadequate Training of Food Service Personnel
- Source of Food Service Personnel
- Excessive Working Hours
- Splintered Organizational Structure
- Lack of Career Opportunities
- Poor Working Environment

Inefficient Manpower Utilization

The problem of inefficient manpower utilization concerns the use of food service personnel to manually perform functions which could be performed by a machine, and

the use of KP's to manually wash trays, pots, and pans, etc., which could also be done by machine. These deficiences resulted in low productivity by making the work more laborious.

Personnel performing KP duties are generally required to work long hours (14 hours per day) at menial tasks which have become known as "service irritants". The lack of motivation in performing these tasks is a direct contributor to further inefficiencies in the operation.

Highly Variable Food Quality

This problem concerned the significant variations in the appearance and taste of processed food from one dining hall to the next even though the raw food ingredients initially were virtually identical. This problem is attributed to a lack of training and motivation on the part of many of the food service personnel, as well as a lack of modern food service equipment. The lack of equipment was particularly acute in the Garrison Area dining halls where inadequate facilities for holding food hot during the serving period resulted in cold products being served.

Obsolete Kitchen Equipment

The problem of obsolete kitchen equipment can be attributed to the lack of funds to procure new equipment which had been authorized and also the absence of certain types of utility outlets in the kitchen to accomodate equipment which has been purchased but which cannot be placed into operation. As a result, much of the old equipment which should be replaced remains in operation long after it has become obsolete. This problem is further compounded by the lack of sufficient electrical power in the 1930 and 1941 type dining halls which can only be solved by complete rewiring at great expense.

Serving Line Capacity

The serving line in the present system is designed to serve a maximum of eight customers per minute. This limitation has resulted in a serious annoyance for the customer who frequently must wait for up to ten minutes before being served. The problem is particularly acute at the noon meal where arrival rates as high as *20* customers per minute

were observed at the beginning of the meal period. This situation was further aggravated with the introduction of the short order service in January 1971 which resulted in two types of service being offered on one serving line, causing a cross-flow condition.

A significant observation was the effect of the initial waiting line length on customer waiting time for service. The customer waiting time for service was found to increase significantly as the initial waiting line grew longer. Thus, an overriding factor in determining the serving line capacity was the length of the waiting line at the start of the meal period. A three-minute delay in opening the dining hall at the noon meal could result in as much as 30 additional customers waiting in line for service.

Inadequate Training of Food Service Personnel

An evaluation of training records disclosed 40 percent of the food service personnel had not undergone any type of formal food service training. Instead, all their training had been obtained on the job. The lack of formal training is particularly important in view of the fact that the preparation of most meals in the present system requires a working knowledge of recipe formulations and cooking procedures.

Source of Food Service Personnel

The source of food service personnel is also considered to be a problem area. In many of the dining halls surveyed, the cooks had not actually selected food service as a career. Instead, they had been "washed-out" of other career fields and had ended up in food service. Interviews with these cooks indicated that they had little or no interest in food service and, if given the choice, would rather be in other career fields. This practice indicates that food service is considered a low skill occupation which can be mastered by personnel with marginal qualifications. The high incidence of personnel in this category is considered to be a major contributor to the highly variable food quality associated with the present system. The skill requirements for qualified food service personnel in an operation which directly affects the health and welfare of military customers make it essential that the entire work force consist of dedicated personnel who choose food service as a career.

Excessive Working Hours

The problem of excessive working hours is demonstrated by the fact that the cooks are working from 51 to 65 hours per week (see work schedule in Table IV). The reason that the work week varies is the fluctuation in the staffing levels among dining halls which result from reassignments, illness, retirements, etc. Therefore, food service personnel are required to be at the work site substantially longer hours than their counterparts in other Army career fields. These extended working hours, including frequent weekend work, are a direct contributor to poor morale and lack of motivation.

Splintered Organizational Structure

The present organizational structure results in a lack of centralized control over the food service operation (see Figure 8). The actual dining hall operation comes under the direct control of the company commander while the Services Division, which is more experienced in food service operations, and controls the procurement and delivery of the raw food products, serves only in an advisory and policy-making capacity.

For example, even in those cases where the Services Division has food service advisors who can actually evaluate proper food handling procedures it is almost impossible for them to obtain corrective action at the dining hall level even for serious violations of food preparation procedures. This is due to the fact that the conscientious post food service advisor cannot enforce immediate corrective action but must rely on critiques submitted through the chain of command before actions can be considered at the company level. This requirement generally discourages and effectively eliminates criticism of dining hall operations. It is interesting to note that the only effective control imposed on the dining hall supervisor (mess steward) is one which actually detracts from quality service. This is the "over" and "under" system which prevents the dining hall supervisor from using and accumulating excess rations. Under this system the mess steward must reduce the portion size given at subsequent meals to insure that his balance sheet for rations stays within the prescribed limitations. Although this system enforces some degree of control, it also penalizes customers for actions which may be beyond the capability and/or control of the mess steward.

The company commander has many other duties to perform in addition to operating his dining hall and, almost without exception, is not trained in food service operations. Company commanders have little time and experience to evaluate the quality of service in the dining hall. As a result, food preparation and food quality considerations are left to personnel who in many cases, do not have the formal training and managerial experience necessary to effectively operate the dining hall. This has tended to create a system where the most important person in the system, the customer, is frequently overlooked.

The Chief of the Services Division also has other responsibilities, such as the retail commissary and post laundry, and must go through an involved chain of command to implement desired changes in the feeding system. Therefore, even though food service at Fort Lewis represents a $22,872,660 annual business, there is no management element which can devote full time to the feeding system with the exception of the mess steward who represents the lowest level of management. The present organizational structure, shown on Figure 8, results in great variations in the quality of service from one dining hall to the next and tends to create situations similar to those noted above. In the final analysis the only individual who has complete responsibility for the feeding system is the Commanding General, however, this is only one of his innumerable responsibilities.

Lack of Carrer Opportunities

The lack of opportunities for advancement is particularly acute at the E-5 and E-6 levels and results in personnel being held in grade for unusually long periods of time (up to 10 years). An essential prerequisite to motivation of workers is the opportunity for advancement. In the case of the present feeding system, a severe lack of promotional opportunity exists which undoubtedly results in poor morale.

Poor Working Environment

The continued use of obsolete and worn out equipment in crowded facilities, which are poorly designed by today's standards, has resulted in a poor working environment for many of the food service personnel. A significant portion of the dining facilities at Fort Lewis are over 35 years old and have a serious lack of adequate sound deadening

materials. In some instances, sound levels measured in the kitchens were so high (in excess of 100 db Re. 0.0002 dynes/sq. cm.) that they could be damaging to the human ear. Further, the interior decor of many dining facilities could only be described as sub-standard and in need of refurbishment. It is conservatively estimated that over 50 percent of the dining halls at Fort Lewis would not meet the commonly accepted industrial engineering criteria for adequate work areas (i.e., adequate lighting, ventilation, work space, etc.).

The problems outlined herein depict the deficiencies of the present feeding system which cause the poor performance. In order to achieve significant improvements in performance, it will be necessary to resolve these major problem areas, for many are interrelated. By identifying the problem areas cited above, it is now possible to address them in a systematic manner and to emphasize those system changes which will provide the greatest improvement in performance.

SUMMARY AND CONCLUSIONS

The ability of the existing feeding system at Fort Lewis to achieve the Army's stated objectives has been greatly hampered by obsolescent equipment and facilities and a lack of highly trained and motivated food service personnel. The seriousness of the problem is highlighted by the low productivity and high labor cost. The average total cost of preparing and serving a meal is $1.29 per customer, of which the raw food cost is 36%. When converted to a total annual cost, this represents a $22,872,660 annual business. The feeding system effectiveness was computed to be 2.8 meals per man-hour. This is considered extremely low when compared to large volume commercial feeding systems which vary from 5.0 to 9.0 meals per man-hour. The reasons for this low level of productivity are the large number of small facilities and the widespread use of obsolescent equipment.

The largest single cost factor is that of labor which represents over 57% of the total cost. A significant amount of labor is devoted to sanitation and cleanup type functions performed by KP's who are enlisted men in the lower pay grades assigned on a rotational basis. Clearly, labor is the area where the greatest potential for reducing operating costs exists.

It is concluded that the performance of the present feeding system can be significantly improved by resolving the major problems which have been identified. Solutions to these problems should result in providing the customer with more satisfying meals and improved service while also increasing worker productivity. However, many of these problems do not lend themselves to "quick-fix" type solutions and their resolution will require implementation of a new state-of-the-art system.

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APPENDICES

APPENDIX I

ANNUAL COMPOSITE RATES OF PAY FOR ARMY PERSONNEL

The labor rates shown below were obtained from the Director of Cost Analysis, Department of Army and are based on DOD Instruction 72220.15. The following cost elements are included in these standard military rates:

(1) *Basic Pay* (including the November 1971 pay raise)
(2) *Basic Allowance for Quarters*
(3) *Incentive and Special Pay*
(4) *Retirement*
(5) *Miscellaneous* (includes uniform allowance, social security, life insurance, training, re-enlistment bonus, subsistence, etc.)

These labor rates include a weighing factor for longevity increments and represent the average annual salary for each pay grade.

Grade	Title	Composite Rates ($)
	(Officers)	
0-6	Colonel	24,977
0-5	Lieutenant Colonel	20,452
0-4	Major	17,059
0-3	Captain	14,527
0-2	First Lieutenant	11,015
0-1	Second Lieutenant	8,367
	(Warrant Officers)	
W-4	Chief Warrant Officer 4	16,720
W-3	Chief Warrant Officer 3	13,803
W-2	Chief Warrant Officer 2	12,284
W-1	Junior Grade Warrant Officer	9,567

Grade	Title	Composite Rates ($)
	(Enlisted Men)	
E-9	Sergeant Major	13,883
E-8	First Sergeant	12,185
E-7	Master Sergeant	10,353
E-6	Sergeant First Class or Specialist	8,929
E-5	Sergeant or Specialist 5	6,837
E-4	Corporal or Specialist 4	6,229
E-3	Private First Class	6,163
E-2	Private	5,599
E-1	Private (Recruit)	5,083

APPENDIX II

FEEDING SYSTEM MANAGEMENT PERSONNEL

Shown below is a breakdown of the various categories of management type personnel who are engaged on a full-time basis in the operation of the feeding system. These personnel are primarily engaged in formulating and implementing policies pertaining to the feeding system as well as assuring that standards of service and quality of food are meeting the established criteria. It should be pointed out that the management personnel exercise no direct control over the dining hall operation.

Position	Grade	Number of Personnel
Chief of Services	0-6	1
Special Assistant to Chief of Services	0-4	1
Deputy Chief of Services	GS-12	1
Food Technician	0-3	2
Food Service Technician	W-4	1
Food Service Technician	W-3	2
Food Service Technician	W-2	5
Post Food Service Advisor	E-8	4
Food Service Advisor	E-7	10
Clerk-Typist	GS-4	2
TOTAL		29

APPENDIX III

FEEDING SYSTEM DINING HALL PERSONNEL

Shown below are the personnel required in the direct operation of the 122 dining halls at Fort Lewis. The dining hall stewards and cooks are full-time food service workers. The position of kitchen police is one which is filled on a daily rotational basis from a duty roster and is primarily concerned with sanitation-type duties.

Position	Grade	Number of Personnel
Mess Hall Steward	E-7	5
Mess Hall Steward	E-6	117
First Cook	E-6	68
First Cook	E-5	239
Cook	E-4	393
Assistant Cook	E-3	236
Assistant Cook	E-2	120
Kitchen Police	E-2	707
TOTAL		1885

APPENDIX IV

FEEDING SYSTEM RATION BREAKDOWN PERSONNEL

Shown below is the manpower required to operate the ration breakdown warehouse. This activity involves storing of all raw foods which are not vendor delivered directly to the dining hall and the makeup and delivery of the ration request submitted by the dining hall steward.

Position	Grade	Number of Personnel
Ration Processing Officer	GS-9	1
Subsistence Sergeant	E-7	1
Subsistence Supervisor	E-6	2
Subsistence Specialist	E-4	2
Warehouse Man	E-3	1
Warehouse Man	E-2	1
Cash Typing Clerk	GS-4	1
Supervisor Ration Clerk	GS-4	2
Ration Clerk	GS-3	8
Warehouse Leader	WL-3	3
Warehouse Man	WG-4	3
Class 1 Distributor	E-2	40
TOTAL		65

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13. ABSTRACT
This report covers the definition, performance and problem areas of the present garrison feeding system at a large Army post, Fort Lewis, Washington.

Feeding requirements, total cost of preparing and serving a meal, system effectiveness (productivity) and major problem areas are discussed.

It is concluded that the performance of the present feeding system can be significantly improved by resolving the major problems. Solutions to these problems should result in providing the customer with more satisfying meals and improved service while also increasing worker productivity.

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