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DESIGN OF A CENTRAL FOOD PREPARATION FACILITY FOR THE ARMY

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Army Natick Laboratories
Natick, Massachusetts

January 1974

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13. ABSTRACT

This report briefly recapitulates the background of Central Food Preparation in the Army and then outlines the systems approach to developing line drawings for a facility capable of supporting 25,000 meals per day.

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FOREWORD

In 1969 the DOD Facilities and Equipment Board accomplished an on-site review of military garrison feeding facilities in the United States. As a result of this survey, the board created, with DOD and army approval, a project to study, define, and then implement a new, modern food service system at Fort Lewis, Washington. In November 1970 an overall study effort was initiated at Natick Laboratories under Project Number 1J662713AJ45, Systems Studies in Military Feeding. As a part of this study, an experiment was conducted using a centralized food preparation facility at Fort Lewis to supply prepared foods to six dining halls.

As a result of the study the decision was made to implement central food preparation systems (CFPS) which include a central food preparation facility and central warewashing at some of the larger army bases where applicable. The responsibility for implementation was assigned to US Army Troop Support Agency (USATSA), Fort Lee, Virginia. Since the new systems would require technical expertise in many areas not currently covered by USATSA, Natick Laboratories was requested to supply technical help when needed.

As part of the CFPS implementation, Natick Laboratories was requested to provide line drawings, narrative descriptions, and equipment lists for a CFPF with central warewashing capable of supporting 25,000 meals a day, seven days a week.

This report briefly recapitulates the background of CFPS and then discusses the methodology used in preliminary design of a CFPF. Future reports will detail the menu breakdowns, material tonnages and throughputs used in developing the line drawings.

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INTRODUCTION

The U.S. Army Natick Laboratories (NLABS) has the research and development responsibility for all food and food services in the Armed Forces. About three years ago the Operations Research and Systems Analysis Office (OR/SA) of the Laboratories was given the task of studying and developing recommendations on how to improve Army Food Service in garrison. One of the first objectives in this study was to find out the facts of the situation in Army garrison feeding rather than trying to tabulate hearsay opinions and random comments. It should always be remembered in a study of this type that complaining about food is a safety valve, particularly with Americans and care must be taken in evaluating any data obtained.

A GI's food is considered part of his pay. Under operational or combat conditions special operational rations are used. However, normally only a small percentage of the Army is using operational rations at any one time. During the Vietnam conflict less than 10 percent of the troops there were on operational rations. The remainder were supplied with the "A" or modified "A" garrison ration. The normal "A" ration is a full menu type based upon a 42-day cycle. The Army's food service is a world-wide operation with upwards to 1600 dining halls serving anywhere from less than 100 men to over a thousand, seven days a week. It is catering mainly to young men who have considerable money jingling in their pockets. One of the first things found in the study was that only 40 to 50 percent of those entitled to the free meals who have a free choice as to where they eat are taking advantage of it, preferring in many cases to spend their own money at the PX or off post. The problem was then finding out what was wrong and what could be done about it.

PRELIMINARY SURVEYS

Attitude surveys conducted by professional Behavioral Science and OR/SA personnel showed that there was a list of some 16 improvement factors which the soldier felt could improve his attendance at the dining halls. This list is shown in Figure 1 with the factors ranked according to decreasing effects on attendance. Perhaps the most important thing to be gained from this list is the strong hint that the present system is not customer oriented, but rather oriented toward the convenience of those who operate the system. This is true of many food service systems where the customer can't "vote" with his dollar. In any event, it appeared that the whole Army food service system as the soldier sees it needs attention and that a systems approach to the problem was the only logical way to solve it. Another thing to note about the attitude list is that the top ranked items are food or food related and that this area should receive high priority in any study and any revision of the food service system.

Working from this list of changes NLABS designed changes to the existing system of food service which would meet consumer needs and desires. For example, a new menu was prepared based on consumer preferences, a new system of food outlets was designed offering troops a choice of facilities and service (i.e., A-ration, short order and specialty), and a new style of buffet feeding was planned where troops could select what they wanted.

SYSTEMS STUDY

Changes cost money. Therefore, the systems study concentrated on ways to save money so that the system cost would go down, not up. The major contributor to cost was labor. To reduce labor cost three alternatives were studied: A system which would depend upon building large consolidated dining halls; a system which would retain small company sized dining halls, but depend upon central preparation and central warewashing (CFPF); and a system which depended upon vendor supplied convenience foods. It should be remembered that from a practical, political standpoint the only lever available to force changes is economics. Food quality and customer satisfaction are wonderful talking points, but dollar savings get action. Figure 2 shows an analysis of costs for a system which provides 25,000 meals per day conventionally, through consolidated dining halls, using vendor purchased prepared foods, and using a CFPF. It can be seen that CFPS shows the greatest savings over the conventional system. It is of particular interest that Figure 2 shows vendor supplied prepared foods do not eliminate all labor costs. The foods still have to be bought, stored, distributed, reheated and served, and cleaning up accomplished afterwards. Labor costs are lowest in the vendor system, but the increased food costs more than overcome the savings. During the conduct of these economic studies, it became apparent that the CFPF system offered the most benefits to the Army. It was evident that new service features could be added which would meet consumer requirements determined from consumer studies and also achieve considerable cost reductions. As a matter of convenience the designation CFPF is used when referring to the central facility including warewashing and CFPS when referring to the whole Central Food Preparation System.

THE FORT LEWIS TEST

As a result of the cost studies and other considerations, it was decided to conduct a test at Fort Lewis, Washington of CFPS under normal garrison conditions. This test was not designed to prove central preparation per se, but rather to test out a whole new system around central preparation which included central warewashing, short order houses, specialty houses, improved dining hall atmosphere, self-service, and other factors which the GI was saying inhibited his dining hall attendance.[1] This test system, which was operated for approximately ten months, furnished data which provided initial validation of the expected level of cost savings which have been reported. It also provided a dramatically improved system from the customers viewpoint as shown on Figure 3. These data show how 2,400 customers reponded to individual interviews in regard to the old system of food service prior to the test and to the new system during the test. The results were quite gratifying and demonstrated the original objectives to significantly improve service to the troops and reduce costs had been met.

DESIGN OF CFPF

Based upon the work at Fort Lewis the operational food service group of the Army, the Troop Support Agency, gave NLABS a task to design a new CFPF which could support an approximate customer load of 25,000 meals per day. Prior to undertaking this design work, certain parameters had to be established. Of most importance was the decisions as to which would be centrally or locally prepared and how the food was to be preserved and distributed. These decisions shown in Figure 4 were based on two main considerations-optimum food quality and moving as much labor as possible from the satellite dining halls to the CFPF. Figure 5 lists some of the design parameters.

It was decided to use a systems approach as shown in Figure 6 in designing the CFPF. The basic sequence was to start with the menu and compute tonnage and the movement of tonnage between work areas. This information was used to locate work areas so that product flow is optimized within the plant. This work was and can be done without considering individual work space requirements. Once the relationship of work areas to each other had been established, the menu requirement, system storage decisions, equipment capacities, and physical dimensions and layouts were used to determine and fix work space dimensions.

Application of this systems approach required the breakdown of each item in the 42-day menu similar to the way beef stew is shown in Figure 7. Figure 7 not only gives the formula amounts, but also breaks out weight and cubage so that storage capacities can be computed. Not only that, but trash and unavoidable waste can be computed so that facilities necessary for their disposal can be planned.

In addition to the breakout illustrated in Figure 7, each item to be produced in the CFPF was analyzed as to what operations would be needed in its preparation. Figure 8 shows this in simplified form or beef stew. Combining the information contained in Figure 7 and 8, for all of the items to be processed, results in the information shown in Figure 9 which depicts the tonnage moving between the various work centers. Now the information necessary to plan the work flow through the CFPF is available. In addition, information can be developed within each work center area showing the tonnage going through each piece of major equipment. From this type of information equipment can be sized.

Referring again to Figure 6, here is a schematic of the various work centers which is devised to minimize materials handling within the facility. The heavy straight lines show the heaviest throughput, the lighter straight lines the next heaviest, and the dotted lines the lightest. Tonnage figures could, of course, be put on these lines. From this type of schematic and from the equipment required, the designer has solid information upon which to base his space and layout designs. In addition, he has the tonnage figures upon which he can base his storage and material handling designs. The final layout, which is consistent with the schematic just shown, is shown in Figure 10 and totals 85,000 square feet of floor area including the warewashing facility. These line drawings along with equipment lists and narrative description of operations will be used by an architect-engineer firm for final design of the building.

It is important to emphasize several important points. For example, this facility is not designed to produce meals. It will produce bulk pack precooked and prepared foods. With the necessary kitchen operations in the dining hall, it will support the serving of 25,000 meals per day. Also, this facility is not an automated food processing plant. It is a job shop which has been automated to maximum extent. Its job-shop nature is dictated by the approximately two hundred different menu items which will be produced and packaged therein.

A building is nothing without the people to operate in it and the systems necessary to put good food on the plate of the person who is the object of all this work--the soldier. People can be one of the strongest points of CFPS. In the case of the Army the large number of dining halls dilutes the number of skilled people so much that it is hardly possible to find any in the system. One answer would be, of course, to go into very extensive and intensive training programs. However, with CFPS, skills can be concentrated and the high priced technical and artistic help readily justified to assure, if not gourmet foods, at least consistently high quality foods.

Among the arguments against CFPF is that the products will be bland, nondescript, "institutional" foods which will soon lose their appeal if eaten day after day. This is a danger, but it can be avoided by proper technical controls and by making provisions

for the addition centrally and in the satellite dining halls of those artistic touches in flavor and appearance that seem to make such big differences in food acceptance.

Industry personnel have stated that the Army should buy prepared foods from industry or contract out Army feeding or almost anything, but stay in the food business for garrison feeding. But a system such as CFPS doesn't really care who operates it. The whole operation or even just parts of it could be contracted out provided the Army maintained sufficient control to assure a satisfactory end product. And this might very well be done in the future. Also, prepared foods could be purchased if quality can be assured at the right price. This may come about. Accurate cost data can be obtained so that make-or-buy decisions can be made on the basis of facts.

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FIGURE 1

FACTORS WHICH GI's CLAIM AFFECT THEIR DINING HALL ATTENDANCE
(ranked according to degree)

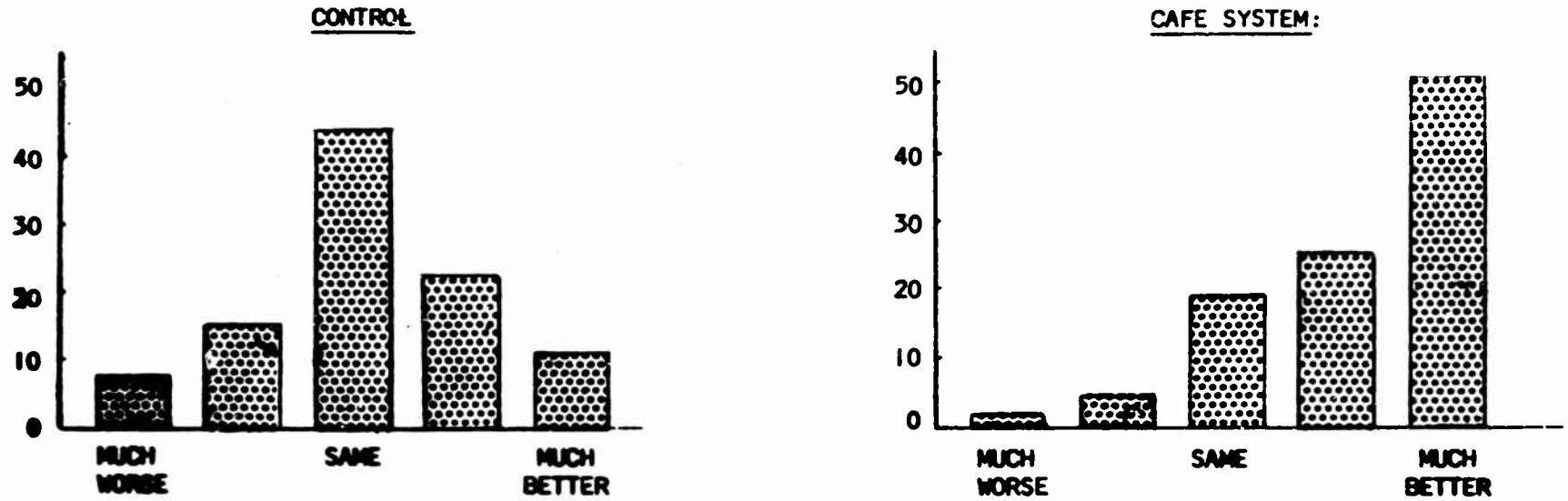
Preferred Food
Higher Quality Food
Providing Snacks
Institute Specialty Houses
Increase Quantity of Food
Eliminate Waiting Lines
Low Calorie Meals
Eliminate KP
Bussing Service
Allow Individual to Use Any Dining Hall
Improve Dining Hall
Eliminate Signature Headcount
Longer Operating Hours
Use of Precooked Meals
Institute Short Order Houses
Provide Canteen Trucks

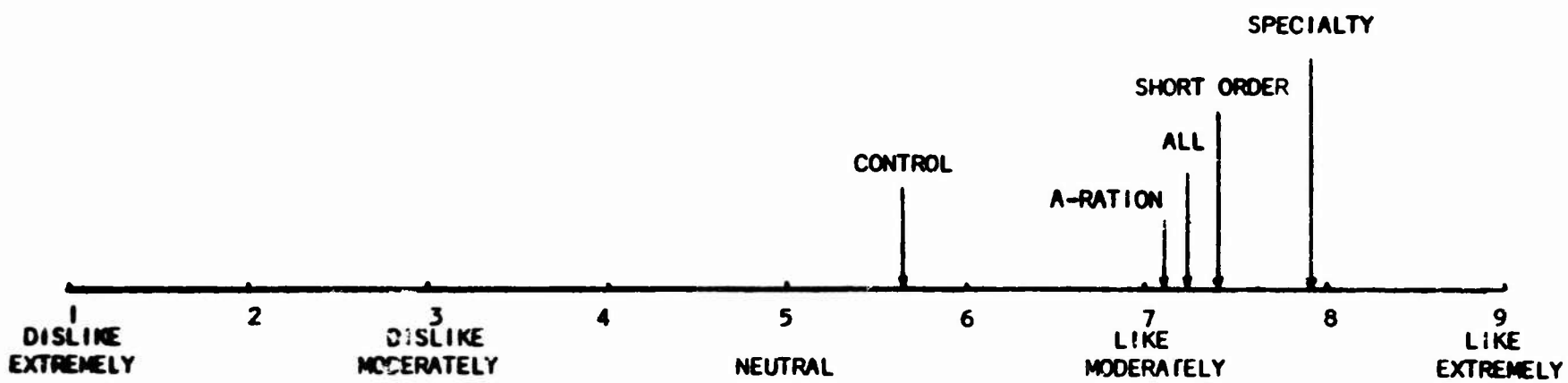
FIGURE 2

COMPARISON OF ALTERNATIVE FOOD SERVICE SYSTEMS ANNUAL OPERATING COSTS($1,000)

Factors	Baseline (48 Dining Halls)	New Consolidated	Central Food Prep & Warewashing	Vendor Supplied Prepared Foods
Food	4,971	4,574	4,225	8,112
Labor	7,622	5,622	5,593	4,745
Other	730	585	870	785
Amortization (Facilities)	0	678	598	215
Total Cost	13,323	11,459	11,286	13,857
Annual Savings (Compared to baseline)		1,864	2,037	534 (cost increase)

CONSUMER SURVEY ANSWERS TO QUESTION "HOW DOES THIS MEAL COMPARE WITH ARMY MEALS YOU HAVE HAD?"





HEDONIC RATING - QUALITY

FIGURE 4

SUMMARY OF FOOD HANDLING IN CFPS

Product	Form	Commercially Processed	Prepared in CFPF	Cooked on Site	Direct Vendor Delivery
Soup	Chill-Concentrate		X		
Sauces & Gravies	Chilled		X		
Main Dishes					
Steaks & Hamburgers	Frozen	X		X	
Sauce-type Entrees	Frozen		X		
Chicken	Frozen		X		
Fish & Shrimp	Frozen	X		X	
Dry Heat Roasts	Chilled	X	X	X	
Vegetables					
As Purchased	Frozen	X		X	
Prepared	Frozen		X		
Potatoes	Chilled or Frozen		X		
Pasta Products	Frozen		X		
Breakfast Foods					
Eggs	Chilled			X	
Bacon	Frozen		X		
Pancakes	Dry Mix			X	
French Toast	Frozen		X		
Potatoes	Frozen		X		
Dairy Products					
Milk	Chilled	X			X
Soft Serve Mix	Chilled	X			X
Cottage Cheese	Chilled	X			X
Baked Goods					
Bread, Buns, Donuts	Fresh	X			X
Cakes & Rolls	Ambient		X		
Pies	Ambient		X		
Puddings & Gelatin	Chilled		X		
Cookies	Frozen		X		
Salads					
Tossed & Slaws	Chilled		X		
Gelatin	Chilled		X		

FIGURE 5

DESIGN AND OPERATIONAL PARAMETERS OF CENTRAL FOOD PREPARATION FACILITY

Operations

CFPF – 5 days/week, 1–shift
Warewashing – 7 days/week, 1–1/2–shifts
Equipment – 4 hours/day average

Storage Capacities

Raw Material – not less than 7 days
Finished Product (Frozen) – not less than 15 days

Freezing

Automatic in plastic molds with product to be knocked out and overwrapped

Transport

Finished product – basket and dolly into roll-in refrigerators
Dishware – special 2 or 3 compartment transporters

FIGURE 6

WORK CENTERS IN CENTRAL FOOD PREPARATION FACILITY

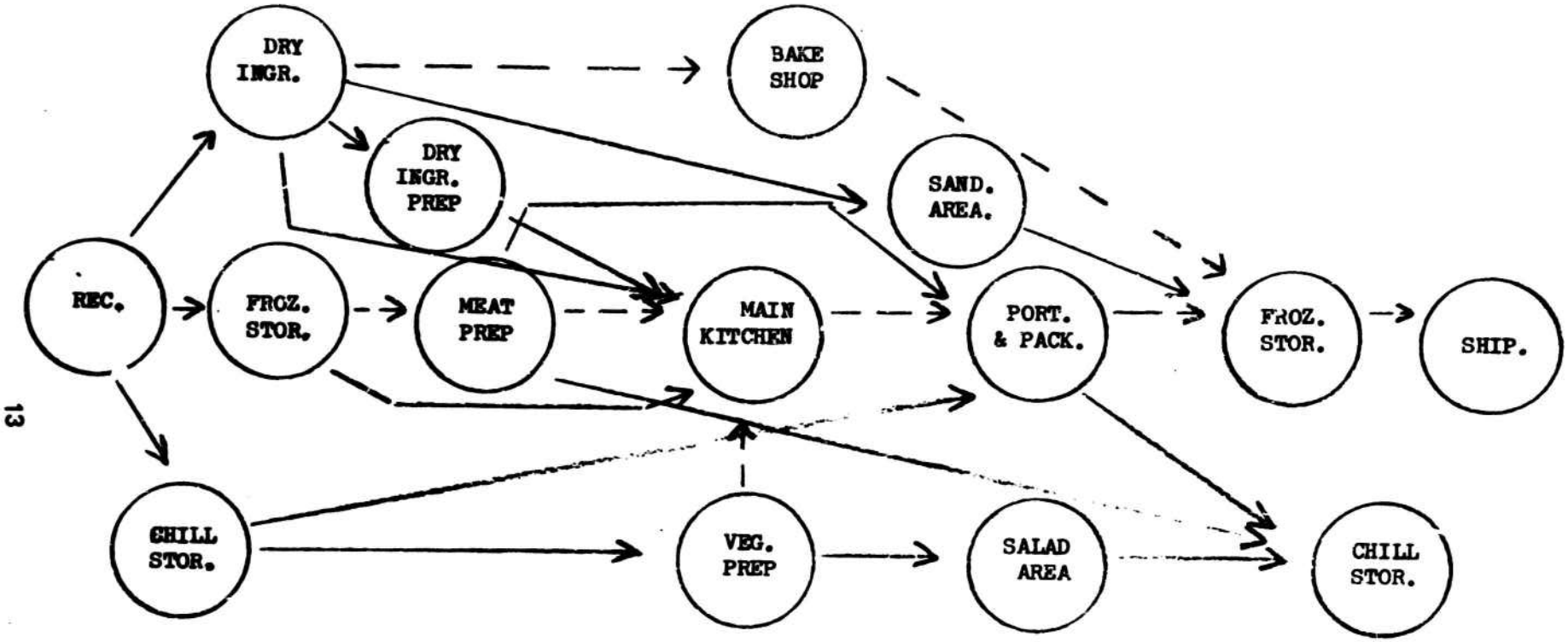


FIGURE 7

INGREDIENT BREAKOUT FOR BEEF STEW (25,000 MEAL PER DAY FACILITY)

	Ingred. Wt.	Net Issue Wt. (Lbs)	Case Gross Wt. (Lbs)	Case Net Wt. (Lbs)	Total No. Case/Lot	Case Cubic Ft. Ea.	Case Cubic Ft. Total
BEEF STEW	12953.0	13701.0					
				FROZEN			
BF boneless diced	6250.0	6250.0	54	50	125.00	1.17	146.25
				AMBIENT			
Flour, wheat hard	104.0	104.0	101	100	1.04	2.26	2.35
Salt	65.0	65.0	61	60	1.08	1.02	1.10
Pepper blk	6.5	6.5	16	12	0.54	0.60	0.32
Garlic dehyd	10.4	10.4	8	6	1.73	0.50	0.87
Onion, dry, chopped	567.0	630.0	51	50	12.60	1.65	20.79
Potatoes, diced	1509.0	2012.0	108	100	20.12	2.93	58.95
Salt	26.0	26.0	61	60	0.43	1.02	0.44
Tomatoes canned	1250.0	1250.0	44	38	32.89	1.10	36.18
Thyme	2.1	2.1	8	6	0.35	0.50	0.18
Bay leaf	1.0	1.0	8	6	0.17	0.50	0.09
Flour	130.0	130.0	101	100	1.30	2.26	2.94
Starch, waxy maize	108.0	108.0	53	48	2.25	1.50	3.38
				CHILLED			
Shortening	208.0	208.0	52	50	4.16	1.01	4.20
Carrots, fresh	1521.0	1890.0	49	48	39.38	1.74	68.52
Celery, fresh	756.0	108.0	60	55	18.33	2.27	41.61
Water	4160.0	4160.0					

FIGURE 8

OPERATIONS IN PREPARATION OF BEEF STEW

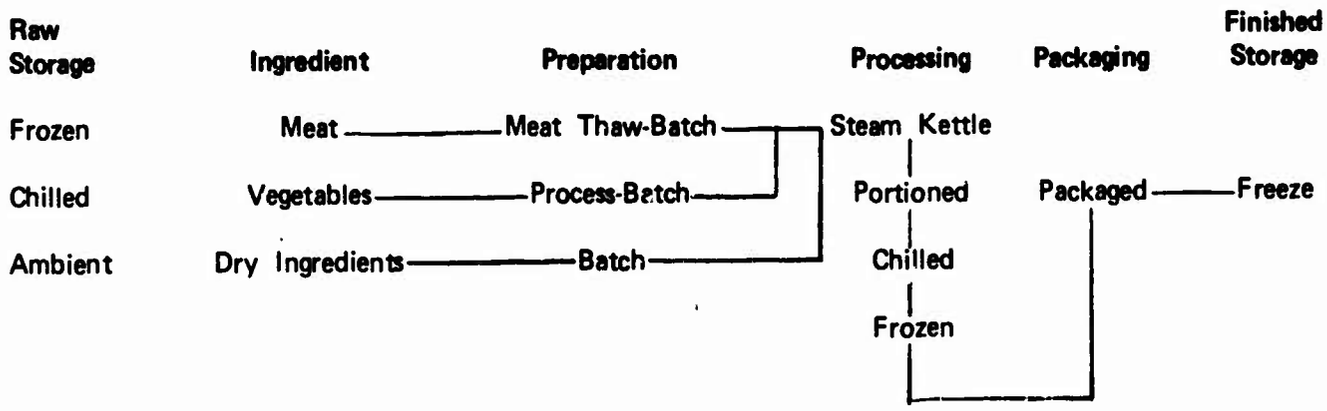
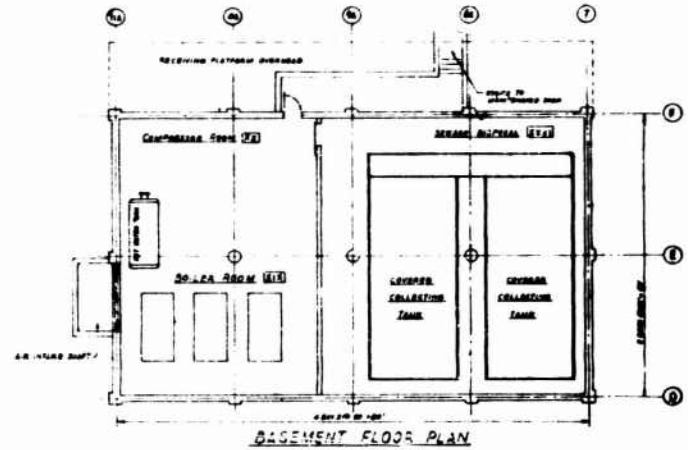


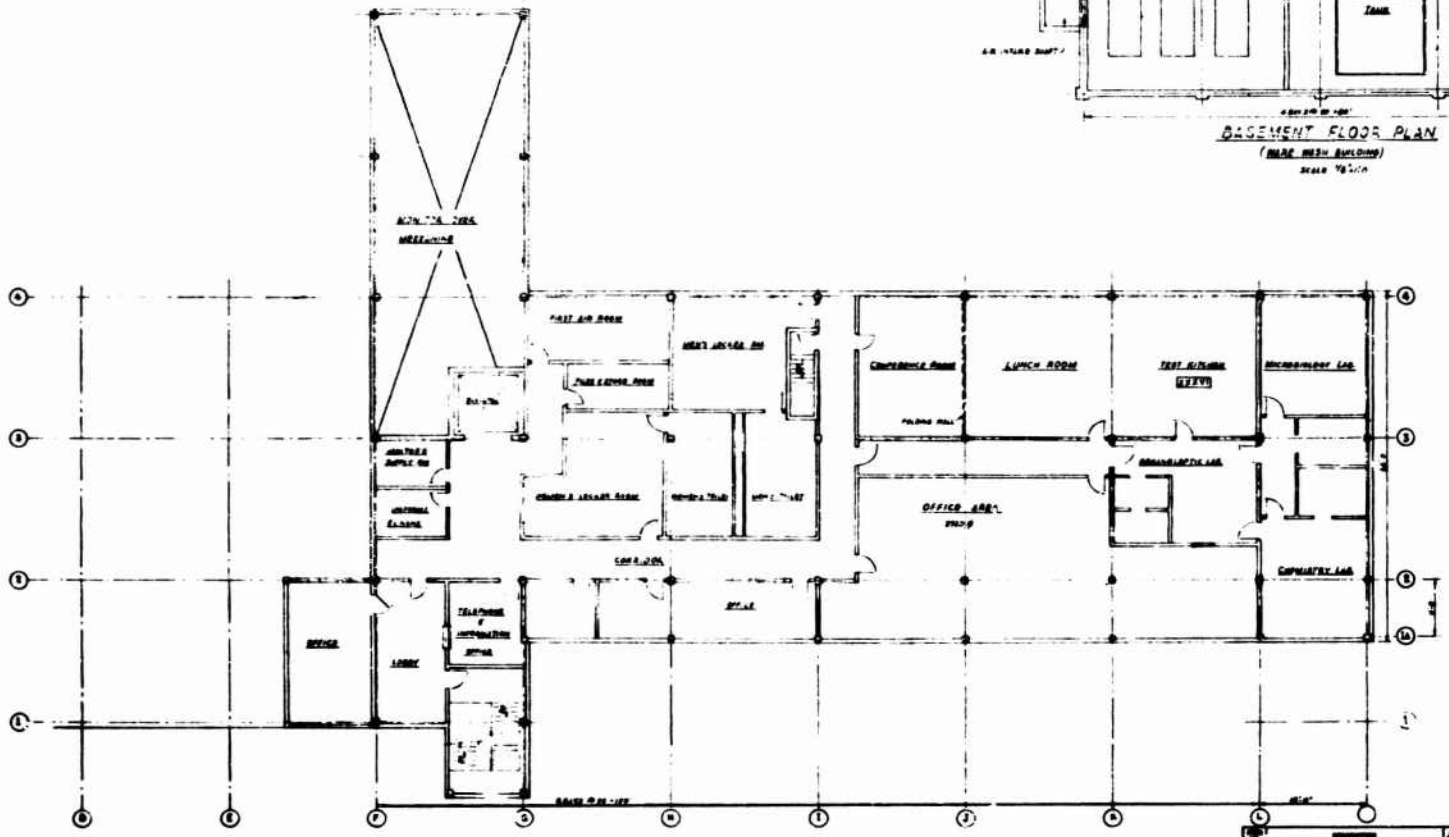
Figure 9

FOOD FLOW THROUGH WORK CENTERS
(25,000 MEAL PER DAY FACILITY)

From	To	1,000's of Lbs. Flow Per 42 Days	Per Cent Total Flow	Cumula-Five Percent
Portion & Pack	Frozen Storage	497.6	20.6	20.6
Main Kitchen	Portion & Pack	433.8	18.0	38.6
Chilled Storage	Vegetable Prep	255.4	10.6	49.2
Frozen Storage	Meat Prep	205.4	8.5	57.7
Vegetable Prep	Main Kitchen	143.8	6.0	63.7
Bake Shop	Frozen Storage	140.7	5.8	69.5
Meat Prep	Main Kitchen	138.5	5.7	75.2
Dry Ingredient	Bake Shop	108.5	4.5	79.7
Dry Ingredient	Dry Ingredient Prep	88.6	3.7	83.4
Dry Ingredient Prep	Main Kitchen	83.7	3.5	86.9
Meat Prep	Chilled Storage	68.7	2.8	89.7



BASEMENT FLOOR PLAN



SECOND FLOOR PLAN

FREE STANDING CENTRAL FOOD PREPARATION & WAREHOUSING