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ENGINEER UNIT DAYS COMPUTER PROGRAM (UNDAY) - USER'S MANUAL.(U)
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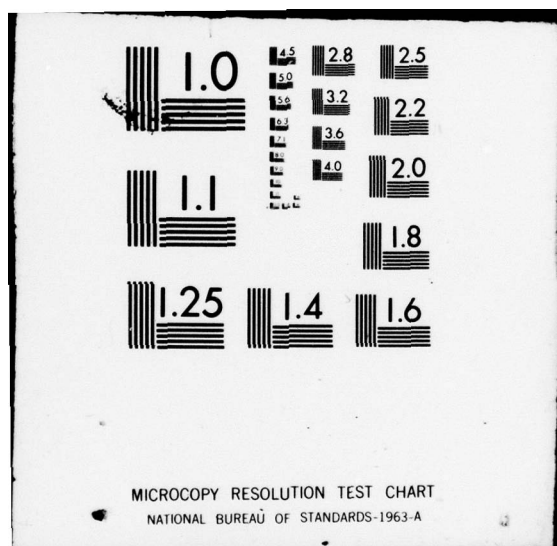
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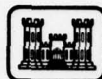
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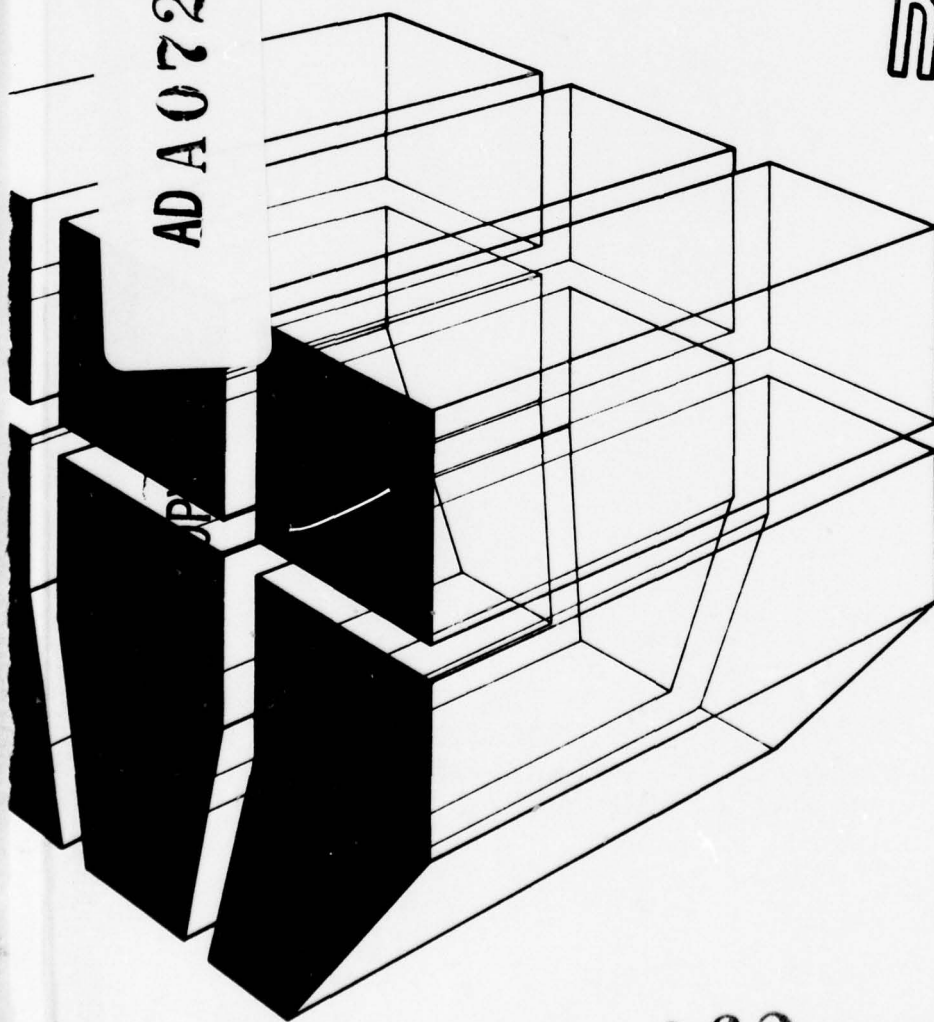
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ENGINEER UNIT DAYS COMPUTER
PROGRAM (UNDAY)—USER'S MANUAL

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes the Engineer Unit Days Computer Program (UNDAY) and provides the user with information to operate the program. UNDAY was developed to facilitate rapid scheduling of military construction projects using the Army Facilities Components System (AFCS) in the theater of operations. The program selects the engineer construction unit or combination of units that most efficiently meets the resource		

Block 20 continued.

→ requirements of a given project and calculates the number of work days
it requires to complete the facilities. ↖

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FOREWORD

This study was conducted for the Directorate of Military Programs, Office of the Chief of Engineers (OCE), under Project 6.37.34A/4A763734DT34, "Development of Engineering Support to the Field Army"; Task 04, "Base Development"; Work Unit 004, "Construction Scheduling of AFCS Facilities."

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COL J. E. Hays is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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ENGINEER UNIT DAYS COMPUTER PROGRAM (UNDAY) - USER'S MANUAL

1 INTRODUCTION

Background

The Army Facilities Components System (AFCS) is a military engineering construction support system for use in a theater of operations (TO). The system was designed in response to the need for an improved construction planning system. Accurate scheduling and coordinated manpower resource activities are vital if construction projects in support of military operations in the TO are to be completed as planned. Late completion hinders the operations of troop units using the facility or installation, while early completion may overload the line of communication and cause inefficient use of manpower and equipment. To avoid these undesirable impacts and to deliver the finished products on time, a valid scheduling procedure is essential at all levels of construction planning.

Several scheduling procedures are available for planning TO construction projects, but they all deal with either theater-level planning or detailed jobsite activity scheduling; none is designed to assist planners concerned with a regional construction program that is part of a Civil Engineering Support Plan. These planners cannot use scheduling procedures developed for other uses because they must address a specific level of schedule detail and must work with limited computational resources in the field. Thus, it is essential to develop an effective tool that will help engineer battalion, group, brigade, or command planners rapidly schedule their construction program using the AFCS.

Purpose

The purpose of this study was to develop the Engineer Unit Days Computer Program (UNDAY) to facilitate scheduling of military construction projects using the AFCS in a TO.

Approach

UNDAY was developed based on the standard critical path method (CPM) of time analysis and scheduling, which was adapted specifically to the requirements of the AFCS in the TO. Chapter 2 gives an overview of the system; Chapter 3 describes the operating procedures, and the appendices contain information on input deck cards and example problems.

System Capability

UNDAY computes the most qualified engineer construction unit(s), down to the platoon level, and the number of work days required to construct AFCS facilities. This concise information can be used as a quick reference guide in the TO for choosing a responsive construction schedule alternative and drawing up to a realistic troop utilization plan. It can also be used by the base development planner in developing an engineer troop deployment plan at the outset of a Civil Engineering Support Plan. The interim calculation results, which include critical path method-based schedules and resource-constrained bar charts, provide for onsite management of construction activities and labor and equipment resources.

Mode of Technology Transfer

The UNDAY program will be transferred in conjunction with TM 5-304, *How to Use the Army Facilities Components System* (Department of the Army [draft]).

2 OVERVIEW

Program Operation

UNDAY is written in FORTRAN-extended, for batch mode operation. System integration tests were conducted on a CDC 6600 computer in a remote batch mode. The program is portable and readily adaptable at any major automatic data processing installation which has FORTRAN-extended compiler capabilities. Inquiries about the availability and use of the program should be addressed to:

U.S. Army Corps of Engineers
Huntsville Division
AFCS Branch
P. O. Box 1600, West Station
Huntsville, AL 35807

Capabilities and Selected Features

UNDAY is applicable to all types of AFCS facilities as well as other TO construction projects that do not exceed the site limitations described below. It is simple and flexible to use.

Input data preparation is simple and does not require extensive data conversion. The required input for normal operation consists of the network diagram, total manhours, and normal crews for construction activities comprising the project. U.S. Army Corps of Engineers, Huntsville Division is incorporating these data into TM 5-302 for AFCS facilities.

The principal output from the program is the result of the unit assignment calculation. The time duration and manpower usage that a specific engineer unit (system chosen or user selected) will require to complete the project are shown. Day-to-day allocation of labor skills to achieve that level of use is also shown. When more than one troop unit is considered for the project, the performances of each are summarized for comparison. The secondary output includes a CPM-based activity time schedule and a manpower allocation bar chart. The time schedule shows the normal project duration, start and finish times, and slack for each activity. The bar chart shows day-to-day resource allocations corresponding to the activity time schedule.

The system has various built-in convenience and flexibility features:

a. Multiple Projects Input. The number of projects in the input deck is not limited. The user may include as many projects as desired, in any order.

b. Labor Skills. The system provides a breakdown of 10 labor skills: (1) unskilled labor (N), (2) electrician (E), (3) structural worker (S), (4) engineer aid (A), (5) utilitiesmen (U), (6) builders-general (B), (7) heavy equipment operator (H), (8) asphalt/concrete equipment operator (P), (9) general construction equipment operator (G), (10) lift/load equipment operator (L). (See Table 1 for detailed definitions of these skills.) These system-defined skills, however, can be easily modified to define fewer new skills. The new set of skills is formed by grouping the set of system-defined skills (see Chapter 3).

c. Engineer TOE Data Base. An independent data array contains construction capabilities of engineer Tables of Organization and Equipment (TOE), expressed in terms of the number of men by skill types in the TOE. Up to 60 TOEs are permitted. The user can easily modify data, or may enter new TOEs to include a modified TOE. If the user specifies a new set of skills, the system automatically adjusts the data to reflect changes in the skill definition.

d. Selection of Candidate TOEs. The user may specify up to five TOEs (or pairs of TOEs) for unit assignment consideration. In the absence of this user input, the system searches through the TOE data base and selects up to five of the most qualified units.

e. Output Control. The system provides the user with extensive control over output--a time-saving feature. All output except the summary of unit assignment calculations can be suppressed.

System Structure

One main program and 10 subroutines comprise the system structure. Figure 1 shows the major functions of the main program, UNDAY, and its relationships with the supporting subroutines. Table 2 describes individual subroutines.

The data processing consists of four steps. First, project-independent information such as the TOE data base and output control information are read in, and associated data arrays are initialized. If specified, user-defined skills are read in and the capability data in the TOE data base is modified accordingly.

Second, project-specific data, such as project number (or seven-digit AFCS number), title, and parameters defining construction activities are read in and checked for error. If no errors are found, CPM calculations are performed and, depending on the user option, a CPM tab sheet and a bar chart schedule may be printed. If fatal errors are present, further processing of this project is bypassed and the next project in the input is read in.

Third, the TOE data base is searched to identify TOEs qualified for construction. Up to five candidates are selected and passed on to the next step. If there is no candidate TOE in the data base, processing of the project terminates with a message to the user and the program begins processing the next project. This step is bypassed when the user furnishes one or more candidates.

Fourth, day-by-day manpower allocation and activity scheduling are computed for each candidate TOE. The optional output consists of bar charts showing the activity time schedule and labor skill allocation, and the TOE's performance evaluation report (optional) indicating project completion time and manpower use efficiency. After calculation is repeated for all candidate TOEs, a summary report which shows performance rankings of the TOEs for that project is printed.

Various complex computations occur during the fourth step. In short, all construction activities that are to continue or start are identified at the beginning of a given day of scheduling. These activities are then prioritized based on an internal classification scheme. Beginning with the first activity in the priority list, all schedule possibilities for each activity (e.g., cancel, normal conduction, or expedited conduction) are identified and recorded along with the rate of resource consumption and impacts on project completion time. After this calculation is performed for all activities under consideration, combinations of schedule possibilities, one from each activity, are evaluated and weighted, and the one most likely to result in the earliest project completion is selected. The selected combination determines allocation of the manpower available for the day. In typical situations, certain activities are cancelled while others are planned for earlier than normal completion. This day-by-day schedule computation terminates when all activities are completed.

Assumptions and Limitations

The following assumptions and limitations apply in using the system:

a. Permissible upper limits are:

- (1) 100 activities per project
- (2) 10 skill types
- (3) 5 skill types per activity
- (4) 60 TOEs in the TOE data base.

b. The activity numbering rule, "head node always greater than tail node" or "the event number at the head of the arrow must be larger than the number at the tail" should be observed. "One source and one sink" or "one beginning and one ending" per network should also be observed.

c. A 10-hour work day in the field is assumed. All internal computations are performed in half-day time units, i.e., 5 working hours in the field. The user is responsible for input of net productive hours per 10-hour work day.

d. When the following conditions are detected, bar chart schedules are not printed; however, this does not affect schedule computations:

(1) The project duration exceeds 60 days (or 120 half-day time units).

(2) Summation of the number of concurrent activities per day over the project period exceeds 400 (or 800 if counted on internal time unit basis).

e. During the calculation of the day-by-day schedule, an activity is not interrupted once it is scheduled. Moreover, the activity is carried out as fast as, or faster than any previous work rate.

3 OPERATING PROCEDURE

Problem Definition

The UNDAY program is used primarily to determine the engineer unit(s) most qualified to construct AFCS activities and to indicate how long the unit(s) would require to complete the mission. This application, however, can easily be extended to solving specific problems. For example, the user may (1) specify a particular definition of skill categories rather than using the system-defined standard skills, (2) change the TOE data base or modify it to include any work crews, or (3) input other than AFCS projects. Also, if the normal CPM calculations are the desired output, the user can request the CPM tab sheet and its bar chart schedules with omission of the remaining procedures. Slight variations in input permit these applications.

Input Data Preparation

Figure 2 illustrates the deck set-up for input data. The user will have to add to the deck the job control cards required at the computer installation. Detailed descriptions of the data fields, formats, and data contents are given in Appendix A.

TOE Capability Data Base (Cards I and II)

- CARD I: One card is required. It defines the number of engineer TOEs in the data base and the numbers and symbols of labor skills (see Chapter 2 for standard symbols).
- CARD II: One card is required for each TOE in the data base. Each card gives construction capabilities (the number of men in each skill category), identification number, and descriptive title for the TOE. The order of capability figures should match that of the skill symbols in CARD I. As many as 60 cards are allowed.

Output Control (Card III)

- CARD III: One card is required, which applies to all projects in the run. One character, "Y" (for yes) or "N" (for no), controls printing of the TOE data base tab sheet (DBTS), project-specific input data tab sheet (IDTS), resource-unlimited CPM tab sheet (UCTS), resource-unlimited CPM for bar chart (UCBC), and resource-constrained bar chart (RCBC).

Skill Modification (Cards IV and V)

CARD IV: One card is required. It defines new skills from 0 (zero) up to 10; if zero is entered, no change in the skill definition is assumed.

CARD V: This optional card is not required if the standard skill definition is to be used; otherwise, a card is required for each new skill category. Each new skill is defined in terms of the standard skill categorization. For example, a card containing W, 1, B in that order specifies that the new symbol, W, replaces the standard symbol, B, for builder-general; and the card containing V, 5, A, B, E, U, S specifies that the new skill, V, combines five standard skills (i.e., engineer aid, builder general, electricians, utilitiesmen and structure worker), thereby representing a "vertical" skill. Note that the set of new skills defined applies to all projects in the run and should completely cover the standard skills.

Project-Specific Data (Cards VI, VII, VIII, IX)

CARD VI: One card per project is required. It gives project identification number and descriptive title.

CARD VII: One card per project is required. The scale factor (SF) field (required) indicates the net productive hours per day based on a 10-hour work day. The ONUM field (required) indicates the number of user-selected TOEs or pairs of TOEs. If the number is zero or left blank, selection is made by the program. The ODAT field (optional) identifies user-selected TOEs or TOE pairs; up to five selections can be specified. Note that if the ONUM field contains a nonzero positive integer and the ODAT field is blank unit, assignment calculations are suppressed.

CARD VIII: One card per activity is required. Information to be supplied consists of tail and head node numbers, total manhours required, normal crew size (number of men), crew formation (number of men in the crew by skill type), narrative description, and critical duration indicating the least number of days required to complete the activity (default value is a half day). Narrative description and critical duration are optional.

CARD IX: One card is required per project. It indicates the end of input data for that project.

End Card (Card X)

CARD X: One card is required per run. It indicates the end of input data.

Output Reports

Output reports produced by the program are as follows.

a. Construction Troop Unit Data Base (Optional). Shows construction capabilities by standard skill type for all TOEs in the data base (Figure 3).

b. Modified Construction Troop Unit Data Base (Optional). Shows construction capabilities of the TOEs based on new skill categorization specified by the user (Figure 4).

c. Input Data Tab Sheet (Optional). Shows the project-specific data furnished (Figure 5).

d. Resource-Unconstrained CPM Tab Sheet (Optional). Shows normal CPM computation results in tabular form (Figure 6).

e. Resource-Unconstrained CPM Bar Chart (Optional). Shows bar chart schedule assuming no manpower constraints are imposed on the project (Figure 7).

f. Unit Assignment Calculation (Optional). Provides performance evaluation for each candidate TOE considered (Figure 8).

g. Resource Constrained Bar Chart (Optional). Provides manpower allocation bar chart schedule corresponding to the unit assignment calculation report above (Figure 9).

h. Summary of Unit Assignment. Ranks all TOEs considered based on the performance evaluation (Figure 10).

Example Problem

A typical building construction project was selected for demonstrating use of the UNDAY computer program. Appendix B provides example problems for two types of calculations: (1) those with no user modifications, and (2) those with user-supplied skill categories and candidate TOEs.

4 CONCLUSIONS

The Engineer Unit Days Computer program, UNDAY, is designed to serve as a computational tool for a range of construction scheduling and manpower allocation problems involving use of the AFCS in a theater of operations.

The program is simple to use and requires no detailed analyses on the part of users; input data preparation consists of straightforward data conversion and the output is in a readily usable format. The program is flexible to use and adaptable to specific situations.

Table 1
Recommended AFCS Skills

<u>NO</u>	<u>AFCS SKILLS</u>	<u>ABBR</u>	<u>DEFINITION</u>	<u>H,V,G</u>
1.	General Labor	N	Combat Engineer, Pioneer ADM Specialist, Apprentice and Helper	G
2.	Engineer Aid	A	Surveyor, Tapemen, Rodmen Diver, Marine Engineer & Power Boat Operator	V
3.	Builder - General	B	Carpenter & Mason	V
4.	Electrician	E	Electrician	V
5.	Utilitiesmen	U	Plumber & Heat, Cool, Refer Spec	V
6.	Structures Spec	S	Structures Spec, Pipeline Spec, Metal Worker, Welder	V
7.	Heavy Equip Operator	H	Crawler/Wheel Tractor, Scraper, Grader, Loader Op	H
8.	General Const Equip Operator	G	Compressor, Ditching Machine, Power Roller, Water Distri- butor, Rotary Tiller Op	H
9.	Asphalt/Concrete Equip P Operator	P	Asphalt Paver, Production, & Distributor Op Concrete Production & Distributing Equip Op	H
10.	Lifting/Loading Equip Operator	L	Crane, Forklift Op	H

Skills not to be included are: Officer, Non-Commissioned Officer, Administrative Personnel, Maintenance Mechanic, Organic Power Pack/Generator Operator, and other non-productive personnel.

Table 2
UNDAY Subroutine Descriptions

SUBROUTINE NAME	DESCRIPTION
BARCMT	BARCMT plots a bar chart of the project network and a resource use profile. This option is available for unlimited resources and for the limited resources of a given troop unit.
CHOOSE	CHOOSE selects from a data base the unit or combination of units which most efficiently meets the resource requirements of a given project. The number of men in each skill type is required to be at least that number needed for the project.
CMBTRB	CMBTRB allows the formation of new skill types by grouping together basic skills. Unit resources are calculated using the newly created skill types.
DAYCMP	DAYCMP schedules project activities in a way which attempts to maximize the number of men working at any time given the troop resource limitations. On a day-to-day basis activities are scheduled in order of increasing total float until one of the resources is exhausted. Activities can be crashed.
INICPM	INICPM calculates for an activity network the Early Start, Early Finish, Late Start, Late Finish, and Total Float.
NETWRK	NETWRK reads for each activity the total manhours, the crew size and the number of hours worked per day. The activity duration is then calculated. The skills needed for each activity are input. The crew information is organized according to skill type and the manhours required for each skill are calculated for each activity.
NETCHK	NETCHK checks for and lists the following notations errors in an arrow network: (a) Tail is greater than or equal to head (b) Two activities have the same head and tail (c) Activity has no precedent (d) Activity has no successor.
SORT	SORT orders activities in ascending order of the tail. Activities with the same tail are ordered in ascending order of the head.

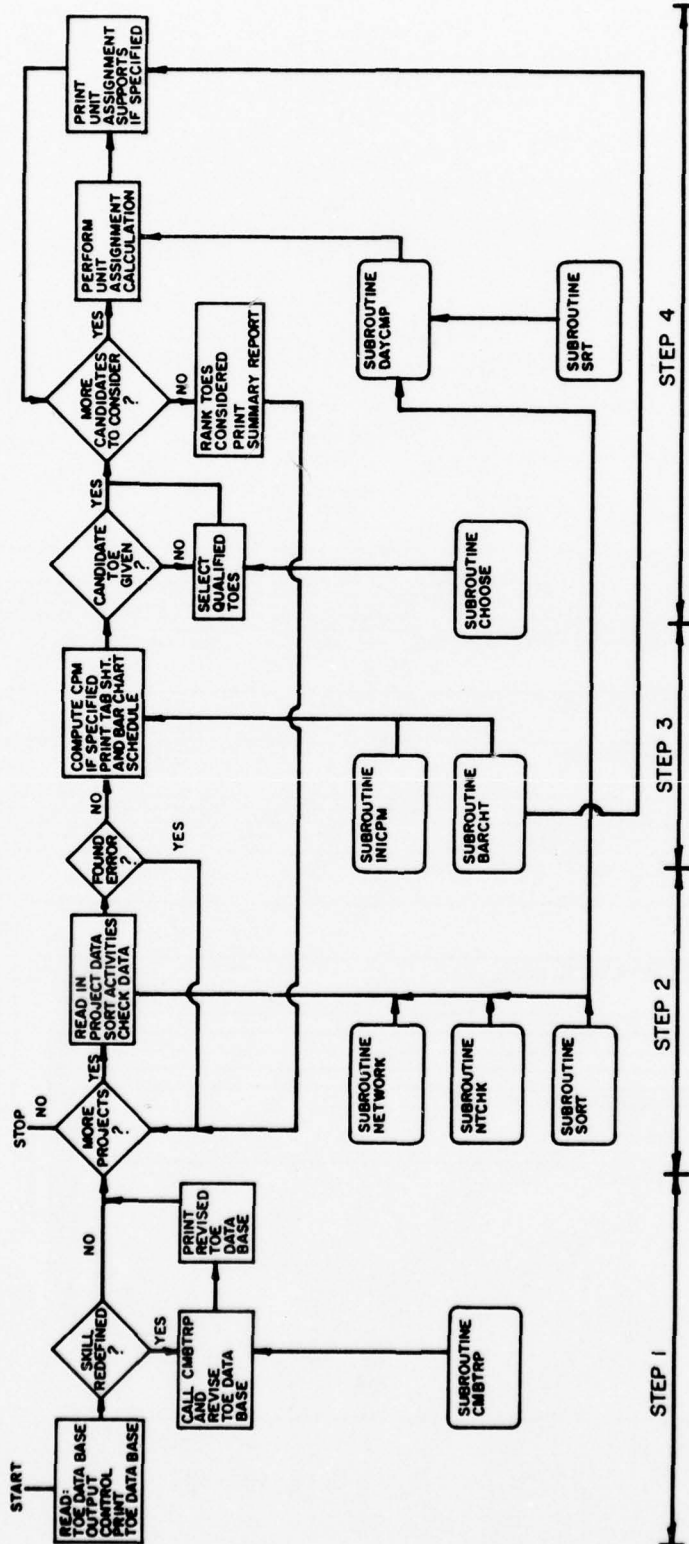


Figure 1. UNDAY program structure.

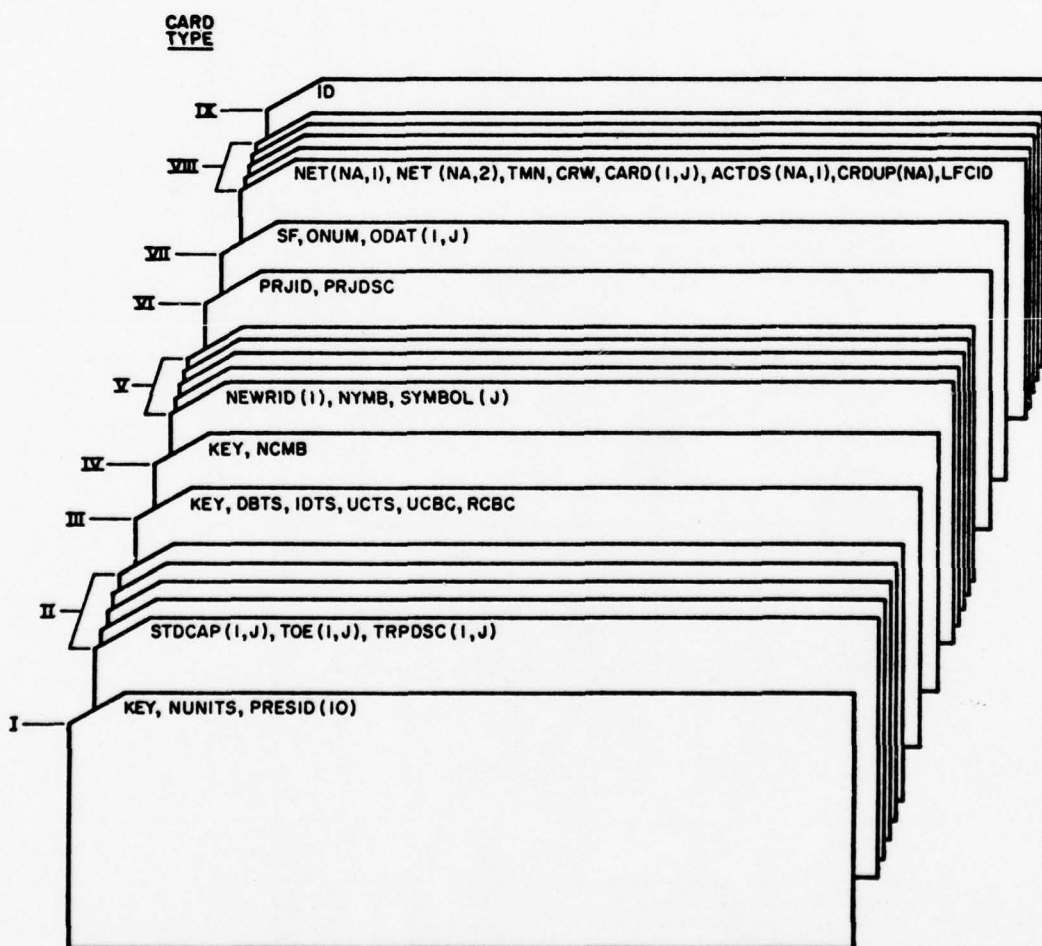


Figure 2. Input deck set-up.

CONSTRUCTION TROOP UNIT DATA BASE

N: UNSKILLED LABOR A: CONSTRUCTION AID B: BUILDERS-GENERAL E: ELECTRICIAN S: STRUCTURES WORKERS
 U: UTILITIESMEN H: HEAVY EQ. OP. G: GENERAL EQ. OP. P: ASPH/CONC MACH OP. L: LIFT/LOAD EQ. OP.

INDEX	TOE #	UNIT DESCRIPTION	N	A	B	E	U	S	H	G	P	L	TOTAL
1	5-35H	ENGR COMBAT RN, CORPS	316	2	6	5	6	1	42	5	1	7	391
2	5-37H	ENGR CRT CO, CORPS	78	0	0	0	0	0	0	1	0	0	87
3	5-37H	PLT-ENGR CRT CO.CBT BN.HVY	25	0	0	0	0	0	0	0	0	0	27
4	5-115H	ENG CBT RN, HVY	69	9	102	54	48	29	53	22	12	14	412
5	5-117H	EQP & MNT CO.CBT RN, HVY	9	0	0	0	0	5	5	7	6	8	40
6	5-118H	ENGR CO, ENGR CRT BN, HVY	20	0	34	18	16	8	16	5	2	2	121
7	5-118H	HOR PLT-ENGR CO.CBT BN.HVY	0	0	0	0	0	0	16	3	0	0	19
8	5-118H	GEN PLT-ENGR CO.CBT BN.HVY	8	0	17	6	6	3	0	1	1	0	42
9	5-195H	FNCR CRT BN, ABN	147	6	8	5	2	7	80	12	6	6	279
10	5-197H	ENGR EQUIP & MNT CO. ABN	3	0	8	5	2	7	8	4	6	6	49
11	5-198H	ENGR CMBT CO, ARN	72	0	0	0	0	0	36	4	0	0	112
12	5-198H	PLT-ENGR CBT CO, ABN	20	0	0	0	0	0	0	1	0	0	29
13	5-54H	ENGR LT EQUIP CO. ARN	0	0	0	0	0	2	72	6	0	7	87
14	5-58H	ENGR CPT SPT EQUIP CO	6	0	0	0	0	3	28	13	7	11	68
15	5-114H	ENGR CONST SPT CO	9	0	0	0	0	2	5	19	16	9	60
16	5-129H	PORT CONSTR CO	25	10	16	4	2	31	5	7	2	14	116
17	5-129H	CON PLT-ENGR PORT CONST CO	7	0	8	2	1	13	0	1	0	4	36
18	5-177H	ENGR PIPELINE CONST SPT CO	30	0	9	0	0	74	4	2	0	8	127
19	5-177H	PL PLT-ENGR PIPELN CONST CO	6	0	3	0	0	24	0	0	0	2	35
20	5-124H	ENGR DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	42	42
21	5-124H	TRK PLT-ENG DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	21	21

Figure 3. Construction troop unit data base.

NEW SKILLS DEFINED

R 1 R
N 1 N
W A AFUSHGPL

REVISED TROOP UNIT DATA BASE

INDEX	TOF #	UNIT DESCRIPTION	R	N	W	CAPABILITY BY SKILL TYPE (NO OF MEN)
1	5-35H	ENGR COMBAT BN, CORPS	6	316	69	391
2	5-37H	ENGR CRT CO, CORPS	0	78	9	87
3	5-37H	PLT-ENGR CRT CO, CRT BN, HVY	0	25	2	27
4	5-115H	ENGR CRT BN, HVY	102	69	241	412
5	5-117H	ENGR & MNT CO, CRT BN, HVY	0	9	31	40
6	5-118H	ENGR CO, ENGR CRT BN, HVY	34	20	67	121
7	5-118H	HOR PLT-ENGR CO, CRT BN, HVY	0	0	19	19
8	5-118H	GEN PLT-ENGR CO, CRT BN, HVY	17	8	17	42
9	5-195H	ENGR CRT BN, ABN	8	147	124	279
10	5-197H	ENGR EQUIP & MNT CO, ABN	8	3	38	49
11	5-198H	ENGR COMBAT CO, ABN	0	72	40	112
12	5-198H	PLT-ENGR CRT CO, ABN	0	20	9	29
13	5-54H	ENGR LT EQUIP CO, ABN	0	0	87	87
14	5-58H	ENGR CPT SPT EQUIP CO	0	6	62	68
15	5-114H	ENGR CONST SPT CO	0	9	51	60
16	5-129H	PORT CONSTR CO	16	25	75	116
17	5-129H	CON PLT-ENGR PORT CONST CO	8	7	21	36
18	5-177H	ENGR PIPELINE CONST SPT CO	9	30	88	127
19	5-177H	PL PLT-ENGR PIPLN CONST CO	3	6	26	35
20	5-124H	ENGR DUMP TRUCK CO	0	0	42	42
21	5-124H	TRK PLT-ENGR DUMP TRUCK CO	0	0	21	21

Figure 4. Modified construction troop unit data base.

DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS

TAIL	HEAD	TOTAL M-H	CREW SIZE	ACTIVITY DESCRIPTION	B	1	N	2	CREW FORMATION (NO OF MEN)	CRUSH DUR
1	2	21	3	SITF LAYOUT	B	1	N	2	0	0
1	5	24	2	FABRICATE FORMS	B	2		0	0	0
1	6	14	2	FABRICATE ANCHOR STRAPS	W	2		0	0	0
1	10	48	3	ASSEMBLE COLS. AND GIRDER	B	3		0	0	0
2	3	60	5	FOOTING EXCAVATION	N	5		0	0	0
5	6	26	2	ERECT FORMS	B	2		0	0	0
6	7	20	10	CONCRETE WORK	B	1	N	8	W	0
7	8	0	0	CURE CONCRETE		0		0	0	0
8	9	6	2	STRIP FORMS	B	2		0	0	0
9	11	21	3	BACKFILL CONCRETE FOOTING	N	3		0	0	0
10	12	39	3	PRECURT ROOF FRAME	B	3		0	0	0
11	14	70	5	INSTALL COLS. AND GIRDERS	B	3	W	2	0	0
14	15	72	4	INSTALL ROOF FRAME	B	4		0	0	0
16	17	76	4	INSTALL ROOF DECK	B	4		0	0	0
17	18	44	4	INSTALL ROOFING	B	4		0	0	0
18	19	26	2	CLEAN UP	N	2		0	0	0
3	5	0	0	DUMMY		0		0	0	0
10	11	0	0	DUMMY		0		0	0	0
12	14	0	0	DUMMY		0		0	0	0
15	16	0	0	DUMMY		0		0	0	0

Figure 5. Input data tab sheet.

PROJECT SUMMARY

AFCs NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

196 TOTAL GALT MAN-DAYS REQUIRED FOR PROJECT COMPLETION

RESOURCE REQUIREMENTS BY SKILL TYPES (HALF MAN-DAYS)

B N W
128 51 17

CPM TAB SHEET ASSUMING NO RESOURCE CONSTRAINTS (TIME UNIT = HALF DAY)

TAIL	HEAD	NORMAL DUR	EARLY START	EARLY FINISH	LATE START	LATE FINISH	TOTAL SLACK	B	N	W	NORMAL CREW	SIZES
1	2	3	0	3	0	3	0	1	2	0	0	
1	5	4	0	4	3	7	3	2	0	0	0	
1	6	3	0	3	3	8	8	0	0	2	0	
1	10	5	0	5	17	22	17	3	0	0	0	
2	3	4	3	7	3	7	0	0	5	0	0	
5	6	4	7	11	7	11	0	2	0	0	0	
6	7	1	11	12	11	12	0	1	8	1	1	
7	8	6	12	18	12	18	0	0	0	0	0	
8	9	1	18	19	18	19	0	2	0	0	0	
9	11	3	19	22	19	22	0	0	3	0	0	
10	12	4	5	9	23	27	18	3	0	0	0	
11	14	5	22	27	22	27	0	3	0	2	0	
14	15	6	27	33	27	33	0	4	0	0	0	
16	17	6	33	39	33	39	0	4	0	0	0	
17	18	4	39	43	39	43	0	4	0	0	0	
18	19	4	43	47	43	47	0	0	2	0	0	
3	5	0	7	7	7	7	0	0	0	0	0	
10	11	0	5	5	22	22	17	0	0	0	0	
12	14	0	9	9	27	27	18	0	0	0	0	
15	16	0	33	33	33	33	0	0	0	0	0	

NORMAL PROJECT DURATION IS : 47 HALF DAYS

VERRIDE INPUT SPECIFIED

Figure 6. Resource unconstrained CPM tab sheet.

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS
 RESOURCE UNCONSTRAINED CPM BAR CHART

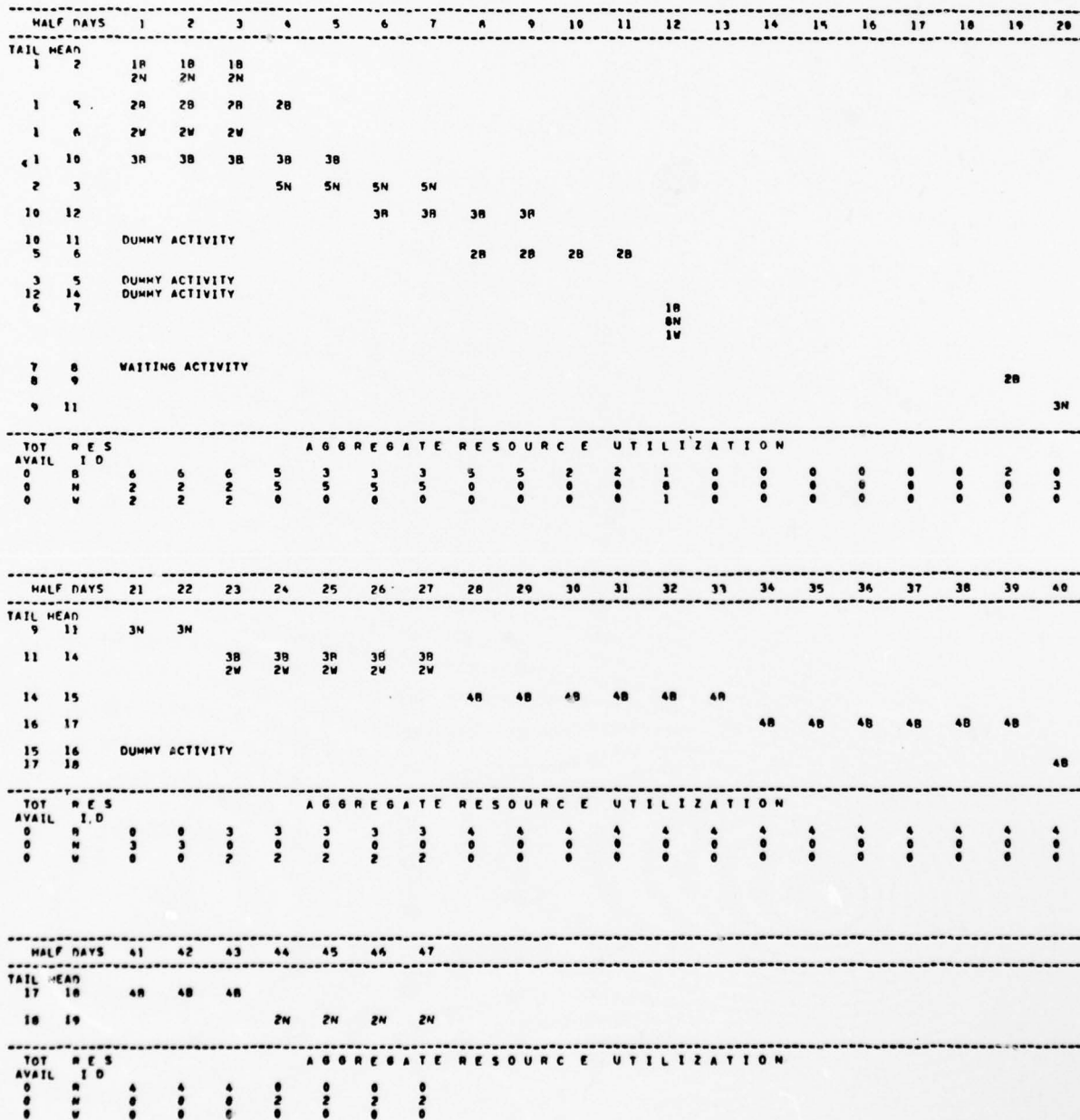


Figure 7. Resource unconstrained CPM bar chart.

AFCS NUMBER - 341141 DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 1

TOE NUMBER - 5-118H GEN PLT-ENGR CO,CBT BN,HVY

12 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 48.94 /

19.74% AVERAGE EFFICIENCY OVER ALL RESOURCES

	A	V	E	R	A	G	E	E	F	F	I	C	I	E	N	C	Y	B	Y	S	K	I	L	L	T	Y	P	E
B																												
N																												
W																												

UNIT ASSIGNMENT CALCULATION - NO. 1
TOE NUMAFA - 5-11AH GEN PLY-ENGR CO-CAT BN-HVY

HALF DAYS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
TAIL MEAN		1 <td>2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	2																			
3R	6W																					
1	10	1R	10	1R	10	18	18	10	18	10	18	10	18	10	18	10	18	10	18	10	18	
1	6	1W	1W	1W	1W	1W	1W															
1	5	20	20	20	20	20	20															
2	3	7N	7N	7N	7N																	
5	6					40	4R															
3	5	DUMMY ACTIVITY																				
6	7																					
7	8	WAITING ACTIVITY																				
8	9																					
9	11																					
10	11	DUMMY ACTIVITY																				
11	14																					
10	12																					
14	15																					
12	14	DUMMY ACTIVITY																				
TOT RES		AGGREGATE RESOURCE UTILIZATION																				
AVAIL	ID	6	3	3	3	5	5	2	1	1	1	1	1	1	1	3	1	0	14	16	12	12
8	N	4	7	7	7	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	
17	W	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	5	5	0	0
HALF DAYS		21	22	23	24																	
TAIL MEAN		16	17	12R	120																	
15	14	DUMMY ACTIVITY																				
17	18	140																				
10	10	8W																				
TOT RES		AGGREGATE RESOURCE UTILIZATION																				
AVAIL	ID	12	12	16	0																	
17	N	0	0	0	0																	
17	W	0	0	0	0																	

Figure 9. Resource unconstrained bar chart.

SUMMARY OF TROOP UNIT ASSIGNMENT

TOE NUMBER - 5-118H GEN PLY-ENGR CO,CBT BN,HVY

12 DAYS REQUIRED FOR PROJECT COMPLETION

19.74% AVERAGE EFFICIENCY OVER ALL RESOURCES

	AVERAGE EFFICIENCY BY SKILL TYPE	
	B	N
	31.62%	27.60%
		4.17%

Figure 10. Summary of unit assignment.

APPENDIX A
DETAILED DESCRIPTION OF INPUT
DECK CARDS

CARD TYPE I

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Limit Values</u>	<u>Data Element Description</u>
KEY	1-5	5	Integer	/	Indicates sequence of input data
MUNITS	6-10	5	Integer	/	No. of construction units (TOEs) in data base
DRESID	(11-20)	(10)	Alphanumeric	/	Names of resources (J)
1	11	1			
2	12	1			
3	13	1			
4	14	1			
5	15	1			
6	16	1			
7	17	1			
8	18	1			
9	19	1			
10	20	1			

CARD TYPE I

DATE _____ NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET SHEET OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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KEY	MUNITS	DRESID (10)							
1	2	3	4	5	6	7	8	9	10

CARD TYPE 11

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Limit Values</u>	<u>Data Element Description</u>
STDCAP (I,J)	(1-40)	(40)	Integer	0-100	No. of men for each resource (J) of a unit (I). The sequence of resources must correspond to that of DRESID
J-1	1-4	4			
J-2	5-8	4			
J-3	9-12	4			
J-4	13-16	4			
J-5	17-20	4			
J-6	21-24	4			
J-7	25-28	4			
J-8	29-32	4			
J-9	33-36	4			
J-10	37-40	4			
T0E (I,J)	(49-54)	(6)	Alphanumeric		T0E number of a unit (I)
J-1	49	1			
J-2	50	1			
J-3	51	1			
J-4	52	1			
J-5	53	1			
J-6	54	1			
TRP0SC (I,J)	(55-80)	(26)	Alphanumeric		Short description of a unit (I)
J-1	55-58	4			
J-2	59-62	4			
J-3	63-66	4			
J-4	67-70	4			
J-5	71-74	4			
J-6	75-78	4			
J-7	79-80	2			

CARD TYPE II

[illegible]

ONE OF THESE CARDS FOR EACH VALUE OF NUNITS

CARD TYPE III

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Legal Values</u>	<u>Data Element Description</u>
KEY	1-5	5	Integer		Indicates sequence of input data
D8TS	6	1	Alphanumeric		If DTS = Y, data base is output
IDTS	7	1	Alphanumeric		If IDTS=Y, project information is output
UCTS	8	1	Alphanumeric		If UCTS=Y, CPM schedule and resource requirements are output (assuming unlimited resources)
UCBC	9	1	Alphanumeric		If UCBC=Y, bar chart and resource profile are output (assuming unlimited resources)
RCBC	10	1	Alphanumeric		If RCBC=Y, bar chart and resource profile are output (assuming limited resources)

CARD TYPE III

DATE _____

NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

SHEET OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

RCBC
 UCBC
 UCTS
 IDTS
 D8TS

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Limit Values</u>	<u>Data Element Description</u>
KEY	1-5	5	Integer		Indicates sequence of input data
MCMB	6-10	5	Integer	0-10	No. of new skills defined by user

DATE _____		NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET		SHEET OF SHEETS	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
121	122	123	124	125	126
127	128	129	130	131	132
133	134	135	136	137	138
139	140	141	142	143	144
145	146	147	148	149	150
151	152	153	154	155	156
157	158	159	160	161	162
163	164	165	166	167	168
169	170	171	172	173	174
175	176	177	178	179	180
181	182	183	184	185	186
187	188	189	190	191	192
193	194	195	196	197	198
199	200	201	202	203	204
205	206	207	208	209	210
211	212	213	214	215	216
217	218	219	220	221	222
223	224	225	226	227	228
229	230	231	232	233	234
235	236	237	238	239	240
241	242	243	244	245	246
247	248	249	250	251	252
253	254	255	256	257	258
259	260	261	262	263	264
265	266	267	268	269	270
271	272	273	274	275	276
277	278	279	280	281	282
283	284	285	286	287	288
289	290	291	292	293	294
295	296	297	298	299	300
301	302	303	304	305	306
307	308	309	310	311	312
313	314	315	316	317	318
319	320	321	322	323	324
325	326	327	328	329	330
331	332	333	334	335	336
337	338	339	340	341	342
343	344	345	346	347	348
349	350	351	352	353	354
355	356	357	358	359	360
361	362	363	364	365	366
367	368	369	370	371	372
373	374	375	376	377	378
379	380	381	382	383	384
385	386	387	388	389	390
391	392	393	394	395	396
397	398	399	400	401	402
403	404	405	406	407	408
409	410	411	412	413	414
415	416	417	418	419	420
421	422	423	424	425	426
427	428	429	430	431	432
433	434	435	436	437	438
439	440	441	442	443	444
445	446	447	448	449	450
451	452	453	454	455	456
457	458	459	460	461	462
463	464	465	466	467	468

CARD TYPE V

Data Element Name	Card Field	No. Characters	Data Type	Limit Values	Data Element Description
NEWRID (I)	5	1	Alphanumeric		Name of new skill (I)
NSYMB	10	1	Integer	9	No. of basic skills comprising the new skill named above
SYMBOL (J)	(15-24)	(10)	Alphanumeric		Enumerates the basic skills (J) comprising the new skill named above
J=1	15	1			
J=2	16	1			
J=3	17	1			
J=4	18	1			
J=5	19	1			
J=6	20	1			
J=7	21	1			
J=8	22	1			
J=9	23	1			
J=10	24	1			

CARD TYPE V

NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET

DATE _____ SHEET OF SHEETS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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DATE _____

SYMBOL (J)

J=1

J=2

J=3

J=4

J=5

J=6

J=7

J=8

J=9

J=10

CARD TYPE VI

Data Element Name	Card Field	No. Characters	Data Type	Limit Values	Data Element Description
PRJID	(1-7)	(7)	Alphanumeric		Project Identification (AFCS No.)
PRJDS	(8-80)	(73)	Alphanumeric		Project description

CARD TYPE VI

NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET										SHEET OF SHEETS																																																																																
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80										
PRJID	1	2	3	4	5	6	7																																																																																			
PRJDS																																																																																										

CARD TYPE VIII

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Limit Values</u>	<u>Data Element Description</u>
NET (NA,1)	1-4	4	Integer		Tail node of activity (NA)
NET (NA,2)	5-8	4	Integer		Head node of activity (NA)
TNH	9-12	4	Integer		Total no. of manhrs required for activity
CRW	13-15	3	Integer	0-100	Total no. of men used for activity
CARD (I,J) ROW 1	(17-40)	(20)	J=2-Alphanumeric J=2-Integer	0-100	No. of men (J=2) with of a particular named (J=1) skill (I) used in a crew for activity
COL 1	17	1			
COL 2	18-20	3			
ROW 2	22	1			
COL 1	23-25	3			
COL 2	27	1			
ROW 3	28-30	3			
COL 1	32	1			
COL 2	33-35	3			
ROW 4	37	1			
COL 1	38-40	3			
COL 2	(41-68)	(28)	Alphanumeric		Activity (NA) description
ACTDSC (NA,1)	41-44	4			
I=1	45-48	4			
I=2	49-52	4			
I=3	53-56	4			
I=4	57-60	4			
I=5	61-64	4			
I=6	65-68	4			
I=7	69-72	4	Integer		Crash duration of activity (NA)
CRDUR (NA)	(74-80)	(7)	Alphanumeric		Project ID no. (PRJID) to which activity belongs
LFCID	74	1			
1	75	1			
2	76	1			
3	77	1			
4	78	1			
5	79	1			
6	80	1			
7					

CARD TYPE VIII

DATE		NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET		SHEET OF SHEETS	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
121	122	123	124	125	126
127	128	129	130	131	132
133	134	135	136	137	138
139	140	141	142	143	144
145	146	147	148	149	150
151	152	153	154	155	156
157	158	159	160	161	162
163	164	165	166	167	168
169	170	171	172	173	174
175	176	177	178	179	180
181	182	183	184	185	186
187	188	189	190	191	192
193	194	195	196	197	198
199	200	201	202	203	204
205	206	207	208	209	210
211	212	213	214	215	216
217	218	219	220	221	222
223	224	225	226	227	228
229	230	231	232	233	234
235	236	237	238	239	240
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295	296	297	298	299	300
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313	314	315	316	317	318
319	320	321	322	323	324
325	326	327	328	329	330
331	332	333	334	335	336
337	338	339	340	341	342
343	344	345	346	347	348
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367	368	369	370	371	372
373	374	375	376	377	378
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385	386	387	388	389	390
391	392	393	394	395	396
397	398	399	400	401	402
403	404	405	406	407	408
409	410	411	412	413	414
415	416	417	418	419	420
421	422	423	424	425	426
427	428	429	430	431	432
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463	464	465	466	467	468
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535	536	537	538	539	540
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559	560	561	562	563	564
565	566	567	568	569	570
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667	668	669	670	671	672
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715	716	717	718	719	720
721	722	723	724	725	726
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1093	1094	1095	1096	1097	1098
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1165	1166	1167	1168	1169	1170
1171	1172	1173	1174	1175	1176
1177	1178	1179	1180	1181	1182
1183	1184	1185	1186	1187	1188
1189	1190	1191	1192	1193	1194
1195					

CARD TYPE IX

<u>Data Element Name</u>	<u>Card Field</u>	<u>No. Characters</u>	<u>Data Type</u>	<u>Limit Values</u>	<u>Data Element Description</u>
ID	1-4	4	Integer	(-1)-(-9999)	Indicates all activities have been read

CARD TYPE IX & X

DATE		NO COLUMN KEY PUNCH TRANSCRIPT LAYOUT SHEET		SHEET OF SHEETS	
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
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43	44	45	46	47	48
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55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
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97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
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127	128	129	130	131	132
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1177	1178	1179	1180	1181	1182
1183	1184	1185	1186	1187	1188
1189	1190	1191	1192	1193	1194
1195	1196	1197	1198	1199	1200
1201	1202	1203	1204	1205	1206
1207	1208	1209	1210	1211	1212
1213	1214	1215	1216	1217	1218
1219	1220	1221	1222	1223	1224
1225	1226	1227	1228	1229	1230
1231	1232	1233	1234	1235	1236
1237	1238	1239	1240	1241	1242
1243	1244	1245	1246	1247	1248
1249	1250	1251	1252	1253	1254
1255	1256	1257	1258	1259	1260
1261	1262	1263	1264	1265	1266
1267	1268	1269	1270	1271	1272

APPENDIX B:

EXAMPLE PROBLEMS

Two example problems are presented, one with no user modifications, and one with user-supplied skill categories and candidate TOEs. The same data are used in both problems. The network diagram (Figure B1) illustrates the activities required for the sample problems (heavy lines). The differences in the input decks occur in cards of type IV, V, and VII.

The output for Sample Problem 2 was used to illustrate the output format and is shown in Figures 3 through 10 in the main text.

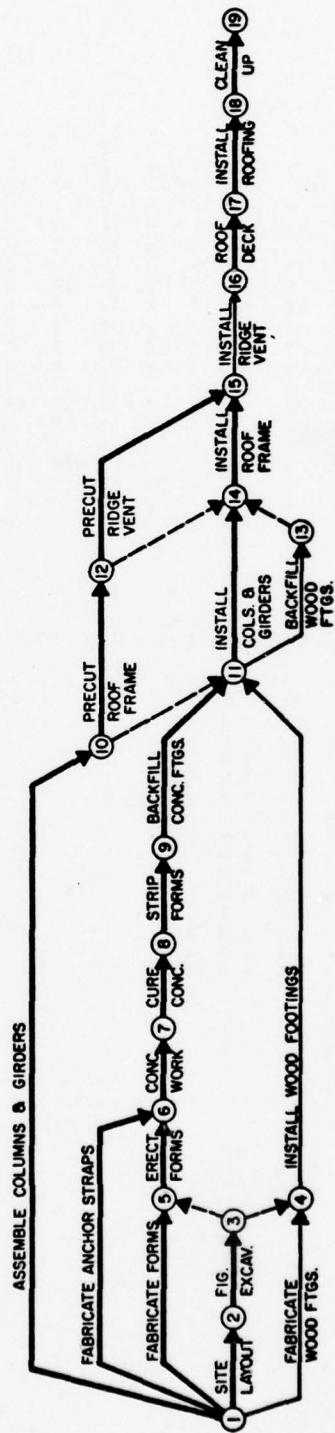


Figure B1. Network diagram.

SAMPLE PROBLEM 1. INPUT DECK

[illegible]

SAMPLE PROBLEM 1. OUTPUT

CONSTRUCTION TROOP UNIT DATA BASE

N: UNSKILLED LABOR A: CONSTRUCTION AID B: BUILDERS-GENERAL E: ELECTRICIAN S: STRUCTURES WORKERS
 U: UTILITIESMEN M: HEAVY EQ. OP. G: GENERAL EQ. OP. P: ASPH/CONC MACH OP. L: LIFT/LOAD EQ. OP.

INDEX	TOE #	UNIT DESCRIPTION	N	A	R	E	U	S	H	G	P	L	TOTAL
1	5-35M	ENGR COMBAT BN. CORPS	316	2	6	5	6	1	42	5	1	7	391
2	5-37M	ENGR CRT CO. CORPS	78	0	0	0	0	0	0	1	0	0	87
3	5-37M	PLT-ENGR CRT CO. CRT BN. Hvy	25	0	0	0	0	0	0	0	0	0	27
4	5-115M	FNG CRT BN. Hvy	69	9	102	54	48	29	53	22	12	14	412
5	5-117M	EOP A. MNT CO. CRT BN. Hvy	9	0	0	0	0	5	5	7	6	8	40
6	5-118M	ENGR CO. ENGR CRT BN. Hvy	20	0	34	18	16	8	16	5	2	2	121
7	5-118M	MOR PLT-ENGR CO. CRT BN. Hvy	0	0	0	0	0	0	16	3	0	0	19
8	5-118M	GEN PLT-ENGR CO. CRT BN. Hvy	8	0	17	6	6	3	0	1	1	0	42
9	5-195M	ENGR CRT BN. ABN	147	6	8	5	2	7	80	12	6	6	279
10	5-197M	ENGR EQUIP & MNT CO. ABN	3	0	8	5	2	7	8	4	6	6	49
11	5-198M	ENGR CRT CO. ABN	72	0	0	0	0	0	36	4	0	0	112
12	5-198M	PLT-ENGR CRT CO. ABN	20	0	0	0	0	0	0	1	0	0	29
13	5-54M	ENGR LT EQUIP CO. ABN	0	0	0	0	0	0	0	0	0	0	87
14	5-58M	ENGR CPT SPT EQUIP CO	6	0	0	0	0	0	2	28	7	11	68
15	5-114M	ENGR CONST SPT CO	9	0	0	0	0	0	0	19	16	9	60
16	5-129M	PORT CONST CO	25	10	16	4	2	31	5	7	2	14	116
17	5-129M	CON PLT-ENGR PORT CONST CO	7	0	8	2	1	13	0	1	0	4	36
18	5-177M	ENGR PIPELINE CONST SPT CO	30	0	9	0	0	74	4	2	0	8	127
19	5-177M	PL PLT-ENGR PIPELN CONST CO	6	0	3	0	0	24	0	0	0	2	35
20	5-124M	ENGR DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	42	42
21	5-124M	TRK PLT-ENG DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	21	21

AFC# NUMBER - 341141	DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS	NETWORK PARAMETERS
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
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95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

TAIL	HEAD	TOTAL	CREW SIZE	ACTIVITY DESCRIPTION	B	1	N	2	CREW FORMATION (NO OF MEN)	CREW HOURS
1	2	21	3	SITE LAYOUT	B	1	N	2	0	0
1	5	24	2	FABRICATE FORMS	B	2		0	0	0
1	6	14	2	FABRICATE ANCHOR STRAPS	S	2		0	0	0
1	10	48	3	ASSEMBLE COLS. AND GIRDER	B	3		0	0	0
2	3	60	5	FOOTING EXCAVATION	N	5		0	0	0
5	6	26	2	ERECT FORMS	B	2		0	0	0
6	7	20	10	CONCRETE WORK	B	1	N	8	1	0
7	8	0		CURB CONCRETE	B	1		0	0	0
8	9	6	2	STRIP FORMS	B	2		0	0	0
9	11	21	3	BACKFILL CONCRETE FOOTING	N	3		0	0	0
10	12	39	3	PRECUR ROOF FRAME	B	3		0	0	0
11	14	70	5	INSTALL COLS. AND GIRDERS	B	3	S	2	0	0
14	15	72	4	INSTALL ROOF FRAME	B	4		0	0	0
16	17	76	4	INSTALL ROOF DECK	B	4		0	0	0
17	18	44	4	INSTALL ROOFING	B	4		0	0	0
18	19	26	2	CLEAN UP	N	2		0	0	0
3	5	0	0	DUMMY		0		0	0	0
10	11	0	0	DUMMY		0		0	0	0
12	14	0	0	DUMMY		0		0	0	0
15	16	0	0	DUMMY		0		0	0	0

PROJECT SUMMARY

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

104 TOTAL GALT MAN-DAYS REQUIRED FOR PROJECT COMPLETION

RESOURCE REQUIREMENTS BY SKILL TYPES (HALF MAN-DAYS)									
B	N	S	P	A	E	U	H	G	L
12A	51	16	1	0	0	0	0	0	0

CPM TAB SHEET ASSUMING NO RESOURCE CONSTRAINTS (TIME UNIT = HALF DAY)

TAIL	HEAD	NORMAL DUR	EARLY START	EARLY FINISH	LATE START	LATE FINISH	TOTAL SLACK	B	N	S	P	A	F	U	H	G	L
1	2	3	0	3	0	3	0	1	2	0	0	0	0	0	0	0	0
1	5	4	0	4	3	7	3	2	0	0	0	0	0	0	0	0	0
1	6	3	0	3	8	11	8	0	0	2	0	0	0	0	0	0	0
1	10	5	0	5	17	22	17	3	0	0	0	0	0	0	0	0	0
2	3	4	3	7	3	7	0	0	5	0	0	0	0	0	0	0	0
5	6	4	7	11	7	11	0	2	0	0	0	0	0	0	0	0	0
6	7	1	11	12	11	12	0	1	0	0	1	0	0	0	0	0	0
7	8	6	12	18	12	18	0	0	0	0	0	0	0	0	0	0	0
8	9	1	18	19	18	19	0	2	0	0	0	0	0	0	0	0	0
9	11	3	19	22	19	22	0	0	3	0	0	0	0	0	0	0	0
10	12	4	5	9	23	27	18	3	0	0	0	0	0	0	0	0	0
11	14	5	22	27	22	27	0	3	0	2	0	0	0	0	0	0	0
14	15	6	27	33	27	33	0	4	0	0	0	0	0	0	0	0	0
16	17	6	33	39	33	39	0	4	0	0	0	0	0	0	0	0	0
17	18	4	39	43	39	43	0	4	0	0	0	0	0	0	0	0	0
18	19	4	43	47	43	47	0	0	0	0	0	0	0	0	0	0	0
3	5	0	7	7	7	7	0	0	0	0	0	0	0	0	0	0	0
10	11	0	5	5	22	22	17	0	0	0	0	0	0	0	0	0	0
12	14	0	9	9	27	27	18	0	0	0	0	0	0	0	0	0	0
15	16	0	33	33	33	33	0	0	0	0	0	0	0	0	0	0	0

NORMAL PROJECT DURATION IS : 47 HALF DAYS

AFCC NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS
 RESOURCE UNCONSTRAINED CPM BAR CHART

HALF DAYS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TAIL MEAN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1R	1R	1R	1R																	
	2N	2N	2N	2N																	
1	4	2R	2R	2R	2R																
1	6	2S	2S	2S																	
1	16	3R	3R	3R	3R																
2	1				5N	5N	5N	5N													
10	12				3R	3R	3R	3R													
10	11	DUMMY ACTIVITY																			
3	5	DUMMY ACTIVITY																			
12	14	DUMMY ACTIVITY																			
6	7																				
7	8	WAITING ACTIVITY																			
8	9																				
9	11																				
TOT RES		AGGREGATE RESOURCE UTILIZATION																			
AVAIL	ID	6	6	6	5	3	3	3	5	5	2	2	1	0	0	0	0	0	0	2	0
0	R																				
0	N	2	2	2	5	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	3
0	S	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	P	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

1R
 2N
 1P

2R

3N

HALF DAYS		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
TAIL HEAD		9	11	3N	3N	3R	3R	3R	25	25	25	25	25	25	25	25	25	25	25	25	25
11	14																				
14	15																				
16	17																				
15	16																				
17	18																				

4R

TOT RES		AGGREGATE RESOURCE UTILIZATION																			
AVAIL	ID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	N	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	P	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

HALF DAYS		41	42	43	44	45	46	47
TAIL HEAD		17	18	4R	4R	4R	4R	4R
18	19							

TOT RES		AGGREGATE RESOURCE UTILIZATION							
AVAIL	ID	4	4	4	4	4	4	4	4
0	R	0	0	0	0	0	0	0	0
0	N	0	0	0	0	0	0	0	0
0	S	0	0	0	0	0	0	0	0
0	P	0	0	0	0	0	0	0	0

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 1

TOE NUMBER - 5-118H GEN PLT-ENGR CO,CBT BN,HVY

13 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 44.68 %

26.66% AVERAGE EFFICIENCY OVER ALL RESOURCES

	B	N	A	V	E	R	A	G	E	E	F	F	I	C	I	E	N	C	Y	B	Y	S	K	I	L	L	T	Y	P	E
	29.19%	25.48%	23.08%	3.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	

AFC# NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS
 UNIT ASSIGNMENT CALCULATION - NO. 1
 TOP NUMBER - 5-1111H GEN PLT-ENGR CO.CBT RN.HVY

WALK DAYS		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TAIL HEAD		41	2	3R	6H																
1	1A	1R	1B	1R	1B	1R	1R	1R	1B	1R	1R	1R	1B	1R	1R	1R	1R	1R	1R	1R	20
1	4	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	1S	20
1	5	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	20
2	3	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	20
5	4	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	4R	20
3	5	DUMMY ACTIVITY																			20
6	7																				20
7	8	WAITING ACTIVITY																			20
8	9																				20
9	11																				20
10	11	DUMMY ACTIVITY																			20
11	14																				20
10	12																				20
TOT PFS		AGGREGATE RESOURCE UTILIZATION																			
AVAIL	10	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17	10	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8	10	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	10	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
1	10	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

HALF DAYS		21	22	23	24	25	26
TAIL HEAD							
14	15	12R	12B				
12	14	DUMMY ACTIVITY					
16	17	12B	12B				
15	16	DUMMY ACTIVITY					
17	18					16R	
18	19						8N

TOT P F S		AGGREGATE RESOURCE UTILIZATION					
AVAIL	ID	12	12	12	12	16	0
17	R	0	0	0	0	0	0
9	M	0	0	0	0	0	0
3	S	0	0	0	0	0	0
1	P	0	0	0	0	0	0

AFCS NUMBER - 341141 DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 2

TOF NUMBER - 5-197H ENGR EQUIP & MNT CO. ARN
 TOF NUMBER - 5-37H PLT-ENGR CRT CO. CRT RN. HVY

13 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 46.81 %

14.16% AVERAGE EFFICIENCY OVER ALL RESOURCES

R	N	S	A	P	E	F	I	C	I	E	N	C	Y	R	Y	S	K	I	L	L	T	Y	P	F
65.00%	7.20%	9.14%			.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

WOLF DAYS		21	22	23	24	25
TAIL MEAN						
16	17	8R	8B			
17	1A			AB	AB	
1A	19					RN
TOT PFS						
AVAIL	ID					
8	R	8	A	8	8	0
2R	M	0	0	0	0	A
7	S	0	0	0	0	0
6	P	0	0	0	0	0

AGGREGATE RESOURCE UTILIZATION

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 3

TOF NUMBER - 5-117H EQP & MNT CO.CRT RN. HVY
 TOF NUMBER - 5-129H CON PLT-ENGR PORT CONST CO

14 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 42.55 %

15.28% AVERAGE EFFICIENCY OVER ALL RESOURCES

B	N	A	V	E	R	A	G	E	E	F	F	I	C	I	E	N	C	Y	R	Y	S	K	I	L	L	T	Y	P	F
59.72%	11.81%	3.50%					P		A	F								U	H		G								
							.62%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	

UNIT ASSIGNMENT CALCULATION - NO. 3
TOF NUMBER - 5-117H EOP & MNT CO, CAT AN, HWY
TOF NUMBER - 5-120H CON PLT-ENGR PORT CONST CO

55

HALF DAYS									21	22	23	24	25	26	27	
TAIL HEAD																
14									15	AR						
16									17	AR		AR	AR	AR	AR	
15									16	DUMMY ACTIVITY						
17									18	AR		AR	AR	AR	AR	
18									19	AR						
TOT RES									AGGREGATE RESOURCE UTILIZATION							
AVAIL									ID							
AR									AR	AR	AR	AR	AR	AR	AR	
16									AR	AR	AR	AR	AR	AR	AR	
18									AR	AR	AR	AR	AR	AR	AR	
6									AR	AR	AR	AR	AR	AR	AR	

AFCS NUMRFR - 341141 DESCRIPTION - WAREHOUSE WITH CONCPETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 4

TOF NUMRFR - 5-124H ENGR DUMP TRUCK CO
 TOF NUMRFR - 5-118H GEN PLT-FNGR CO.CRT RN.HVY

13 DAYS REQUIPED FOR PROJECT COMPLETION

DURATION COMPRESSION : 44.68 %

26.66% AVERAGE EFFICIENCY OVER ALL RESOURCFS

A V E R A G E		E F F I C I E N C Y		R Y		S K I L L		T Y P E	
R	N	S	P	A	F	U	H	G	L
29.19%	25.48%	23.08%	3.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

AFCs NUMBR - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 4
 TOP NUMBR - 5-124W ENGR PUMP TRUCK CG
 TOP NUMBR - 5-118M GEN PLY-ENGR CO:CBT BN:HVY

WEEK DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
-----------	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----

TAIL HEAD	1	2	3R	6M	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R
1	10	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R
1	4	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R
1	5	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R	2R
2	3	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M	7M
5	4																			
3	5	DUMMY ACTIVITY																		
6	7																			
7	8	WAITING ACTIVITY																		
8	9																			
9	11																			
10	11	DUMMY ACTIVITY																		
11	14																			
10	12																			

TOT RES	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
AVAIL	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
17	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
18	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
19	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
20	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

HALF DAYS		21	22	23	24	25	26

TAIL MEAN							
14	15						

12	14	DUMMY ACTIVITY	12R	12B			
16	17						
15	16	DUMMY ACTIVITY			16R		
17	18						
18	19					AN	

TOT P F S		AGGREGATE RESOURCE UTILIZATION					
AVAIL		12	12	12	12	16	0
17	18	0	0	0	0	0	0
18	19	0	0	0	0	0	0
19	20	0	0	0	0	0	0

AFCS NUMRFR - 341141 DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 5

TOF NUMRFR - 5-114H ENGR CONST SPT CO
 TOF NUMRFR - 5-129H CON PLT-ENGR PORT CONST CO

14 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 42.55 %

13.33% AVERAGE EFFICIENCY OVER ALL RESOURCES

B	N	A	V	E	R	A	G	E	E	F	F	I	C	I	E	N	C	Y	R	Y	S	K	I	L	L	T	Y	P	F
59.72%	11.81%	4.20%						.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 5
 TOE NUMBER - 5-114M ENGR CONST SPT CO
 TOE NUMBER - 5-129M CON PLT-ENGR PORT CONST CO

HAIR DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TAIL MEAN	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	2R					
1	4	15	15	15	25	25														
1	4	2R	3R	3R																
1	2	3R	6N																	
2	3	10N	10N																	
5	4			4R	4R															
3	5	DUMMY ACTIVITY																		
6	7																			
7	8	WAITING ACTIVITY																		
8	9																			
9	11																			
10	12																			
10	11	DUMMY ACTIVITY																		
11	14																			
12	14	DUMMY ACTIVITY																		
14	15																			

TOT PLES	AVAIL	ID.	6	4	4	5	5	2	1	1	1	1	1	3	2	6	6	6	6	6	6
8	6	6	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	6	6	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	5	1	1	1	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

HALF DAYS		21	22	23	24	25	26	27
TAIL MEAN								
14	14	88						
14	17	88 88 88						
15	16	DUMMY ACTIVITY						
17	18	88 88						
18	19	88						
TOT PFS		AGGREGATE RESOURCE UTILIZATION						
AVAIL	ID							
8	8	8	8	8	8	8	8	0
14	14	0	0	0	0	0	0	0
15	15	0	0	0	0	0	0	0
16	16	0	0	0	0	0	0	0

AFCS NUMRFR - 341141

DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

SUMMARY OF TROOP UNIT ASSIGNMENT

TOF NUMRFR - 5-118H GEN PLT-ENGR CO.CBT BN.HVY

13 DAYS REQUIRED FOR PROJECT COMPLETION

26.66% AVERAGE EFFICIENCY OVER ALL RESOURCES

AVERAGE EFFICIENCY BY SKILL TYPE									
B	N	S	P	A	E	U	H	G	L
29.19%	25.48%	23.08%	3.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

TOF NUMRFR - 5-124H

ENGR DUMP TRUCK CO

TOE NUMRFR - 5-118H

GEN PLT-ENGR CO.CBT BN.HVY

13 DAYS REQUIRED FOR PROJECT COMPLETION

26.66% AVERAGE EFFICIENCY OVER ALL RESOURCES

AVERAGE EFFICIENCY BY SKILL TYPE									
B	N	S	P	A	E	U	H	G	L
29.19%	25.48%	23.08%	3.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

TOE NUMRFR - 5-197H

ENGR EQUIP & MNT CO. ARN

TOE NUMRFR - 5-37H

PLT-ENGR CRT CO.CBT BN.HVY

13 DAYS REQUIRED FOR PROJECT COMPLETION

16.16% AVERAGE EFFICIENCY OVER ALL RESOURCES

AVERAGE EFFICIENCY BY SKILL TYPE									
B	N	S	P	A	E	U	H	G	L
65.00%	7.29%	9.14%	.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

TOF NUMRFR - 5-117H

EQP & MNT CO.CBT BN. HVY

TOE NUMRFR - 5-129H

CON PLT-ENGR PORT CONST CO

14 DAYS REQUIRED FOR PROJECT COMPLETION

15.28% AVERAGE EFFICIENCY OVER ALL RESOURCES

AVERAGE EFFICIENCY BY SKILL TYPE									
B	N	S	P	A	E	U	H	G	L
59.72%	11.81%	3.50%	.62%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

TOF NUMRFR - 5-114H

ENGR CONST SPT CO

TOE NUMRFR - 5-129H

CON PLT-ENGR PORT CONST CO

14 DAYS REQUIRED FOR PROJECT COMPLETION

13.33% AVERAGE EFFICIENCY OVER ALL RESOURCES

AVERAGE EFFICIENCY BY SKILL TYPE									
B	N	S	P	A	E	U	H	G	L
59.72%	11.81%	4.20%	.23%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

SAMPLE PROBLEM 2. INPUT DECK

CARD TYPE													
I	11111	21NAREUSHGPL	316	2	6	5	6	1	42	5	1	7	5-35HENG COMBAT BN, CORPS
			78	0	0	0	0	0	8	1	0	0	5-37HENG CBT CO, CORPS
			25	0	0	0	0	0	2	0	0	0	5-37HPLT-ENGR CBT CO, CBT BN, HVY
			69	9	102	54	48	29	53	22	12	14	5-115HENG CBT BN, HVY
			9	0	0	0	0	5	5	7	6	8	5-117HEQP & MNT CO, CBT BN, HVY
			20	0	34	18	16	8	16	5	2	2	5-118HENG CO, ENGR CBT BN, HVY
			0	0	0	0	0	16	3	0	0	0	5-118MHOR PLT-ENGR CO, CBT BN, HVY
			8	0	17	6	6	3	0	1	1	0	5-118HGEN PLT-ENGR CO, CBT BN, HVY
			147	6	8	5	2	7	80	12	6	6	5-195HENG CBT BN, ABN
			3	0	8	5	2	7	8	4	6	6	5-197HENG EQUIP & MNT CO, ABN
II			72	0	0	0	0	0	36	4	0	0	5-198HENG CMRT CO, ABN
			20	0	0	0	0	0	8	1	0	0	5-198HPLT-ENGR CBT CO, ABN
			0	0	0	0	0	2	72	6	0	7	5-54HENG LT EQUIP CO, ABN
			6	0	0	0	0	3	28	13	7	11	5-58HENG CPT SPT EQUIP CO
			9	0	0	0	0	2	5	19	16	9	5-114HENG CONST SPT CO
			25	10	16	4	2	31	5	7	2	14	5-129HPORT CONSTR CO
			7	0	8	2	1	13	0	1	0	4	5-129HCON PLT-ENGR PORT CONST CO
			30	0	9	0	0	74	4	2	0	8	5-177HENG PIPELINE CONST SPT CO
			6	0	3	0	0	24	0	0	0	2	5-177HPL PLT-ENGR PIPLN CONST CO
			0	0	0	0	0	0	0	0	0	42	5-124HENG DUMP TRUCK CO
			0	0	0	0	0	0	0	0	0	21	5-124HTRK PLT-ENG DUMP TRUCK CO
III	22222YYYYY												
IV	33333	0											
V	341141	WAREHOUSE WITH CONCRETE FOOTINGS											
VII	6.8	0											
	1	2	21	3	8	1	N	2					SITE LAYOUT
	1	5	24	2	8	2							FABRICATE FORMS
	1	6	14	2	5	2							FABRICATE ANCHOR STRAPS
	1	10	48	3	8	3							ASSEMBLE COLS. AND GIRDERS
	2	3	60	5	N	5							FOOTING EXCAVATION
	5	6	26	2	8	2							ERECT FORMS
	6	7	20	10	8	1	N	8	P	1			CONCRETE WORK
	7	8											CURE CONCRETE
	8	9	6	2	8	2							3
	9	11	21	3	N	3							STRIP FORMS
	10	12	39	3	8	3							BACKFILL CONCRETE FOOTINGS
	11	14	70	5	8	3	S	2					PRECUT ROOF FRAME
	14	15	72	4	8	4							INSTALL COLS. AND GIRDERS
	16	17	76	4	8	4							INSTALL ROOF FRAME
	17	18	44	4	8	4							INSTALL ROOF DECK
	18	19	26	2	N	2							INSTALL ROOFING
	3	5											CLEAN UP
	10	11											DUMMY
	12	14											DUMMY
	15	16											DUMMY
IX	-5												
X	-5												
	0												

SAMPLE PROBLEM 2. OUTPUT

CONSTRUCTION TROOP UNIT DATA BASE

N: UNSKILLED LABOR U: UTILITIESMEN		A: CONSTRUCTION AID H: HEAVY EQ. OP.		B: BUILDERS-GENERAL G: GENERAL EQ. OP.		E: ELECTRICIAN P: ASPH/CONC MACH OP.		S: STRUCTURES WORKFRS L: LIFT/LOAD EQ. OP.					
INDEX	TOE #	UNIT DESCRIPTION	N	A	R	E	U	S	H	G	P	L	TOTAL
1	5-35H	ENGR COMBAT RN, CORPS	316	2	6	5	6	1	42	5	1	7	391
2	5-37H	ENGR CRT CO, CORPS	78	0	0	0	0	0	0	0	0	0	87
3	5-37H	PLT-ENGR CRT CO-CBT BN-HVY	25	0	0	0	0	0	0	0	0	0	27
4	5-115H	ENGR CRT RN, HVY	69	9	102	54	48	29	53	22	12	14	412
5	5-117H	ENGR & MNT CO-CBT RN, HVY	9	0	0	0	0	5	5	7	6	8	40
6	5-118H	ENGR CO, ENGR CRT BN, HVY	20	0	34	18	16	8	16	5	2	2	121
7	5-118H	HOR PLT-ENGR CO-CBT BN-HVY	0	0	0	0	0	0	14	3	0	0	19
8	5-118H	GEN PLT-ENGR CO-CBT BN-HVY	8	0	17	6	6	3	0	1	1	0	42
9	5-195H	ENGR CRT BN, ABN	147	6	8	5	2	7	80	12	6	6	279
10	5-197H	ENGR EQUIP & MNT CO. ABN	3	0	8	5	2	7	8	4	6	6	49
11	5-198H	ENGR CMBT CO, ABN	72	0	0	0	0	0	36	4	0	0	112
12	5-198H	PLT-ENGR CRT CO. ABN	20	0	0	0	0	0	0	1	0	0	29
13	5-54H	ENGR LT EQUIP CO. ABN	0	0	0	0	0	2	72	6	0	7	87
14	5-58H	ENGR CPT SPT EQUIP CO	6	0	0	0	0	3	28	13	7	11	68
15	5-114H	ENGR CONST SPT CO	9	0	0	0	0	2	5	19	16	9	60
16	5-129H	PORT CONSTR CO	25	10	16	4	2	31	5	7	2	14	116
17	5-129H	CON PLT-ENGR PORT CONST CO	7	0	8	2	1	13	0	1	0	4	36
18	5-177H	ENGR PIPELINE CONST SPT CO	30	0	9	0	0	74	4	2	0	8	127
19	5-177H	PL PLT-ENGR PIPELN CONST CO	6	0	3	0	0	24	0	0	0	2	35
20	5-124H	ENGR DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	42	42
21	5-124H	TRK PLT-ENG DUMP TRUCK CO	0	0	0	0	0	0	0	0	0	21	21

NEW SKILLS DEFINED

B 1 B
N 1 N
W A AEUSHGPL

REVISED TROOP UNIT DATA BASE

INDEX	TOE #	UNIT DESCRIPTION	R	N	W	CAPABILITY BY SKILL TYPE (NO OF MEN)
1	5-35H	ENGR COMBAT BN, CORPS	6	316	69	391
2	5-37H	ENGR CRT CO, CORPS	0	78	9	87
3	5-37H	PLT-ENGR CBT CO, CRT BN, HVY	0	25	2	27
4	5-115H	ENG CBT BN, HVY	102	69	241	412
5	5-117H	EQP & MNT CO, CBT BN, HVY	0	9	31	40
6	5-118H	ENGR CO, ENGR CRT BN, HVY	34	20	67	121
7	5-118H	HOR PLT-ENGR CO, CBT BN, HVY	0	0	19	19
8	5-118H	GEN PLT-ENGR CO, CBT BN, HVY	17	8	17	42
9	5-195H	ENGR CRT BN, ABN	8	147	124	279
10	5-197H	ENGR EQUIP & MNT CO, ABN	8	3	38	49
11	5-198H	ENGR CMBT CO, ABN	0	72	40	112
12	5-198H	PLT-ENGR CBT CO, ABN	0	20	9	29
13	5-54H	ENGR LT EQUIP CO, ABN	0	0	87	87
14	5-58H	ENGR CPT SPT EQUIP CO	0	6	62	68
15	5-114H	ENGR CONST SPT CO	0	9	51	60
16	5-129H	PORT CONSTR CO	16	25	75	116
17	5-129H	CON PLT-ENGR PORT CONST CO	8	7	21	36
18	5-177H	ENGR PIPELINE CONST SPT CO	9	30	88	127
19	5-177H	PL PLT-ENGR PIPELN CONST CO	3	6	26	35
20	5-124H	ENGR DUMP TRUCK CO	0	0	42	42
21	5-124H	TRK PLT-ENG DUMP TRUCK CO	0	0	21	21

INPUT DATA TAB SHEET

AFCS NUMBER - 341141

DESCRIPTION - WARFHOUSE WITH CONCRETE FOOTINGS

NETWORK PARAMETERS

TAIL	HEAD	TOTAL M-H	CREW SIZE	ACTIVITY DESCRIPTION				CREW FORMATION (NO OF MEN)			CRUSH DUR
1	2	21	3	SITE LAYOUT	B	1	N	2	0	0	0
1	5	24	2	FABRICATE FORMS	B	2	0	0	0	0	0
1	6	14	2	FABRICATE ANCHOR STRAPS	W	2	0	0	0	0	0
1	10	48	3	ASSEMBLE COLS. AND GIRDER	B	3	0	0	0	0	0
2	3	60	5	FOOTING EXCAVATION	N	5	0	0	0	0	0
5	6	26	2	ERECT FORMS	B	2	0	0	0	0	0
6	7	20	10	CONCRETE WORK	B	1	N	8	W	1	0
7	8	0	0	CURE CONCRETE	B	2	0	0	0	0	3
8	9	6	2	STRIP FORMS	B	2	0	0	0	0	0
9	11	21	3	BACKFILL CONCRETE FOOTING	N	3	0	0	0	0	0
10	12	39	3	PRECAST ROOF FRAME	B	3	0	0	0	0	0
11	14	70	5	INSTALL COLS. AND GIRDERS	B	3	W	2	0	0	0
14	15	72	4	INSTALL ROOF FRAME	B	4	0	0	0	0	0
16	17	76	4	INSTALL ROOF DECK	B	4	0	0	0	0	0
17	18	44	4	INSTALL ROOFING	B	4	0	0	0	0	0
18	19	26	2	CLEAN UP	N	2	0	0	0	0	0
3	5	0	0	DUMMY		0	0	0	0	0	0
10	11	0	0	DUMMY		0	0	0	0	0	0
12	14	0	0	DUMMY		0	0	0	0	0	0
15	16	0	0	DUMMY		0	0	0	0	0	0

PROJECT SUMMARY

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

196 TOTAL GALT MAN-DAYS REQUIRED FOR PROJECT COMPLETION

RESOURCE REQUIREMENTS BY SKILL TYPES (HALF MAN-DAYS)

8 N W
128 51 17

CPM TAB SHEET ASSUMING NO RESOURCE CONSTRAINTS (TIME UNIT = HALF DAY)

TAIL	HEAD	NORMAL DUR	EARLY START	EARLY FINISH	LATE START	LATE FINISH	TOTAL SLACK	B	NORMAL			CREW	SIZES
									N	W			
1	2	3	0	3	0	3	0	1	2	0			
1	5	4	0	4	3	7	3	2	0	0			
1	6	3	0	3	8	11	8	0	0	2			
1	10	5	0	5	17	22	17	3	0	0			
2	3	4	3	7	3	7	0	0	5	0			
5	6	4	7	11	7	11	0	2	0	0			
6	7	1	11	12	11	12	0	1	8	1			
7	8	6	12	18	12	18	0	0	0	0			
8	9	1	18	19	18	19	0	2	0	0			
9	11	3	19	22	19	22	0	0	3	0			
10	12	4	5	9	23	27	18	3	0	0			
11	14	5	22	27	22	27	0	3	0	2			
14	15	6	27	33	27	33	0	4	0	0			
16	17	6	33	39	33	39	0	4	0	0			
17	18	4	39	43	39	43	0	4	0	0			
18	19	4	43	47	43	47	0	0	2	0			
3	5	0	7	7	7	7	0	0	0	0			
10	11	0	5	5	22	22	17	0	0	0			
12	14	0	9	9	27	27	18	0	0	0			
15	16	0	33	33	33	33	0	0	0	0			

NORMAL PROJECT DURATION IS : 47 HALF DAYS

VERRIDE INPUT SPECIFIED

AFC'S NUMBR - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS
 RESOURCE UNCONSTRAINED CPM BAR CHART

HALF DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TAIL HEAD																				
1 2		1R	10	10																
		2N	2N	2N																
1 4		2R	20	2R	20															
1 6		2W	2W	2W																
1 10		3R	30	3R	30	30														
2 3					5N	5N	5N	5N												
10 12							3R	3R	30	3R										
10 11																				
5 6									20	20	20	20								
3 5																				
12 14																				
6 7																				
7 8																				
8 9																				
9 11																				

TOT AVAIL	RES I.D.	6	6	6	5	5	5	5	5	5	2	2	1	0	0	0	0	0	0	2	0
0 R																					
0 N																					
0 W																					

HALF DAYS	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
TAIL HEAD																				
9 11		3N	3N																	
11 14				30	30	3R	30	30												
				2W	2W	2W	2W	2W												
14 15									40	40	40	40	40	40						
16 17															40	40	40	40	40	40
15 16																				
17 18																				

TOT AVAIL	RES I.D.	0	0	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
0 R																				
0 N																				
0 W																				

HALF DAYS	41	42	43	44	45	46	47
TAIL HEAD							
17 18		4R	40	40			
18 19					2N	2N	2N

TOT AVAIL	RES I.D.	4	4	4	0	0	0	0
0 R								
0 N								
0 W								

DESCRIPTION - WARHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 1

GEN PLT-ENGR CO,CBT BN,HVY

12 DAYS REQUIRED FOR PROJECT COMPLETION

DURATION COMPRESSION : 48.94 /

19.74% AVERAGE EFFICIENCY OVER ALL RESOURCES

	AVERAGE EFFICIENCY BY SKILL TYPE	
	B ^N	W
	31.62%	27.60%
		4.17%

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

UNIT ASSIGNMENT CALCULATION - NO. 1
TOE NUMBER - 5-118M GEN PLT-ENGR CO.CBT BN+MVY

HALF DAYS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
TAIL HEAD	1	2	3R	4W	5R	6W	7R	8W	9R	10W	11R	12W	13R	14W	15R	16W	17R	18W	19R	20W

1	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R	1R
1	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W	1W
1	5	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
2	3	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N	7N
5	6	48	4R																	
3	5	DUMMY ACTIVITY																		
6	7																			
7	8	WAITING ACTIVITY																		
9	11																			
10	11	DUMMY ACTIVITY																		
11	14																			
10	12																			
14	15																			
12	14	DUMMY ACTIVITY																		

TOT RES	AVAIL	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R	12R	13R	14R	15R	16R	17R	18R	19R	20R
17	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17	4	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
17	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

HALF DAYS	21	22	23	24
TAIL HEAD	16	17	12R	128
15	16	DUMMY ACTIVITY		
17	18			
16	14			

TOT RES	AVAIL	1R	2R	3R	4R	5R	6R	7R	8R	9R	10R	11R	12R	13R	14R	15R	16R	17R	18R	19R	20R
17	4	12	12	16	0																
17	4	0	0	0	0																
17	4	0	0	0	0																

AFCS NUMBER - 341141 DESCRIPTION - WAREHOUSE WITH CONCRETE FOOTINGS

SUMMARY OF TROOP UNIT ASSIGNMENT

TOE NUMBER - 5-118H GEN PLT-ENGR CO,CBT BN,HVY

12 DAYS REQUIRED FOR PROJECT COMPLETION

19.74% AVERAGE EFFICIENCY OVER ALL RESOURCES

	A	V	E	R	A	G	E	E	F	F	I	C	I	E	N	C	Y	B	Y	S	K	I	L	L	T	Y	P	E
B																												
N																												
W																												
	31.62%																											
		27.60%																										
			4.17%																									

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Kim, Seung Jai

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