NBSIR 76-982

Data Processing and Data Analysis Procedures for Fire Load and Live Load Survey Program

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Interim Report, June 1973 - December 1975

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U.S. DEPARTMENT OF COMMERCE, Rogers C.B. Morton, ***Secretary***
James A. Baker, III, ***Under Secretary***
Dr. Betsy Ancker-Johnson, ***Assistant Secretary for Science and Technology***

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, ***Acting Director***

ABSTRACT

Data collection and data processing procedures utilized in connection with a nationwide fire load and live load survey program are described. The techniques developed for transferring the field survey data to a form suitable for computer processing are discussed. Procedures adopted for data analysis are included. Documentation of the computer programs developed for this purpose is also presented.

Keywords: buildings; computers; data processing; fire loads; load surveys.

Note:

This report, to the Building Research Advisory Board, National Research Council, National Academy of Sciences-National Academy of Engineering, is the second in a series of three reports prepared by the Center for Building Technology, Institute for Applied Technology, National Bureau of Standards, Washington, D.C., under Subcontract No. BRAB 27-73-53 between the National Academy of Sciences and the National Bureau of Standards. It is being distributed to the professional community to keep it advised of the data processing and analysis procedures being used in conjunction with the survey of office buildings. The results obtained from this survey will be presented at a later date.

SI Conversion Units

In recognition of the position of the U.S.A. as a signatory to the General Conference of Weights and Measures, which gave official status to the metric SI system of units in 1960, the authors assist readers interested in making use of the coherent system of SI units by giving conversion factors applicable to U.S. units used in this paper.

Length

1 in = 0.0254* meter
1 ft = 0.3048* meter

Area

1 in^2 = $6.4516^* \times 10^{-4}$ $meter^2$
1 ft^2 = 0.09290 $meter^2$

Force

1 lb (lbf) = 4.448 newton

Pressure, Stress

1 psf = 47.88 pascal

Thermal

1 Btu = 1.054×10^3 joule

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* Exactly

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1. INTRODUCTION

In 1973 the National Bureau of Standards, working with the National Academy of Sciences and the General Services Administration, initiated a comprehensive nationwide survey program to determine fire loads and live loads in office buildings. Considerations involved in planning the program, the type of data collected, development of the data collection techniques and the sampling plan adopted for the survey were discussed in a report by Culver and Kushner (1).*

Special data processing procedures and computer programs were developed in connection with this survey. These procedures have broad applicability and should be useful for other surveys. In addition, some of the techniques may be useful for other applications. Recognizing this and the fact that the survey data obtained would be of long-lasting use, particularly with respect to research studies, complete documentation of the data processing procedures was deemed advisable. Such documentation should facilitate use of this extensive data bank.

The purpose of this report is to fully describe the data collection and data processing procedures. Program descriptions and instructions for their use are included. Analysis of the data obtained from buildings included in the project is contained in a separate report (2).

2. DATA COLLECTION PROCEDURE

Data obtained for the buildings in this survey are indicated in Figure 1 and included:

1. Building Characteristic Data
2. Building Occupancy Data
3. Room Data

Criteria used to establish this data, survey forms, and instructions for completing the forms are presented elsewhere (1).

The procedure adopted for collecting the data is shown in Figure 2. The initial step involved obtaining copies of the building floor plans. All areas in the building were then numbered for reference purposes. An initial survey of the building was then conducted to obtain the

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* Figures in brackets refer to references listed in Chapter 6.

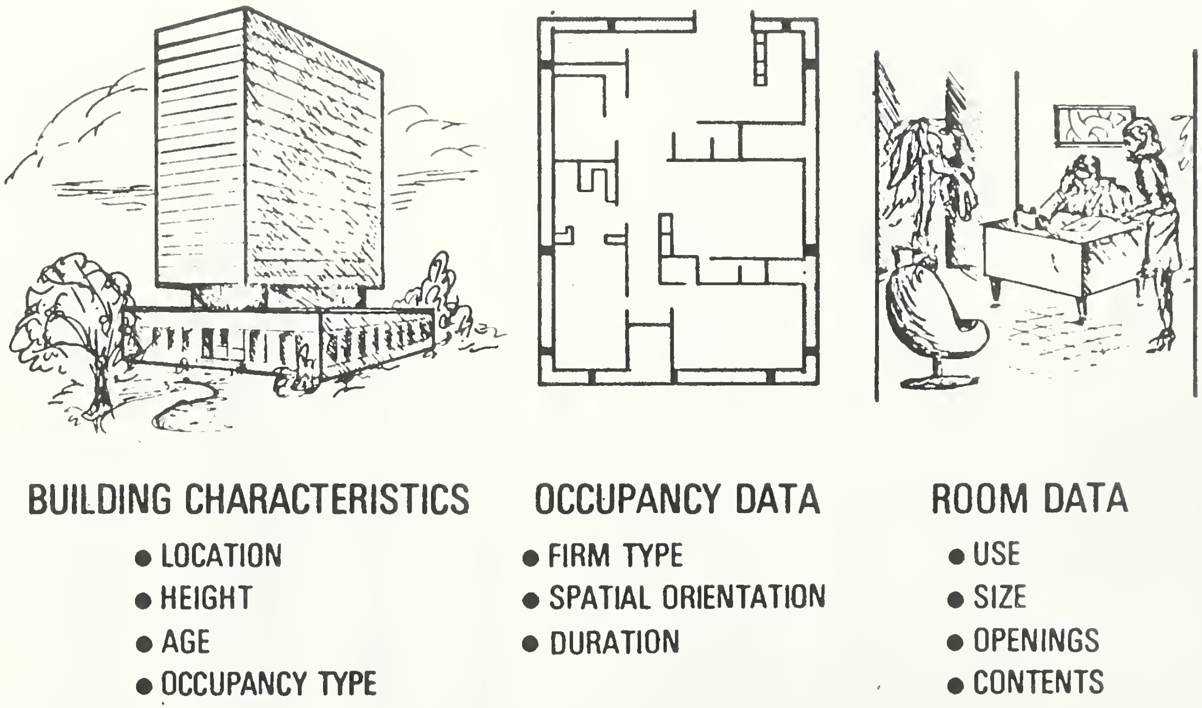


Figure 1 - Type of Data Collected

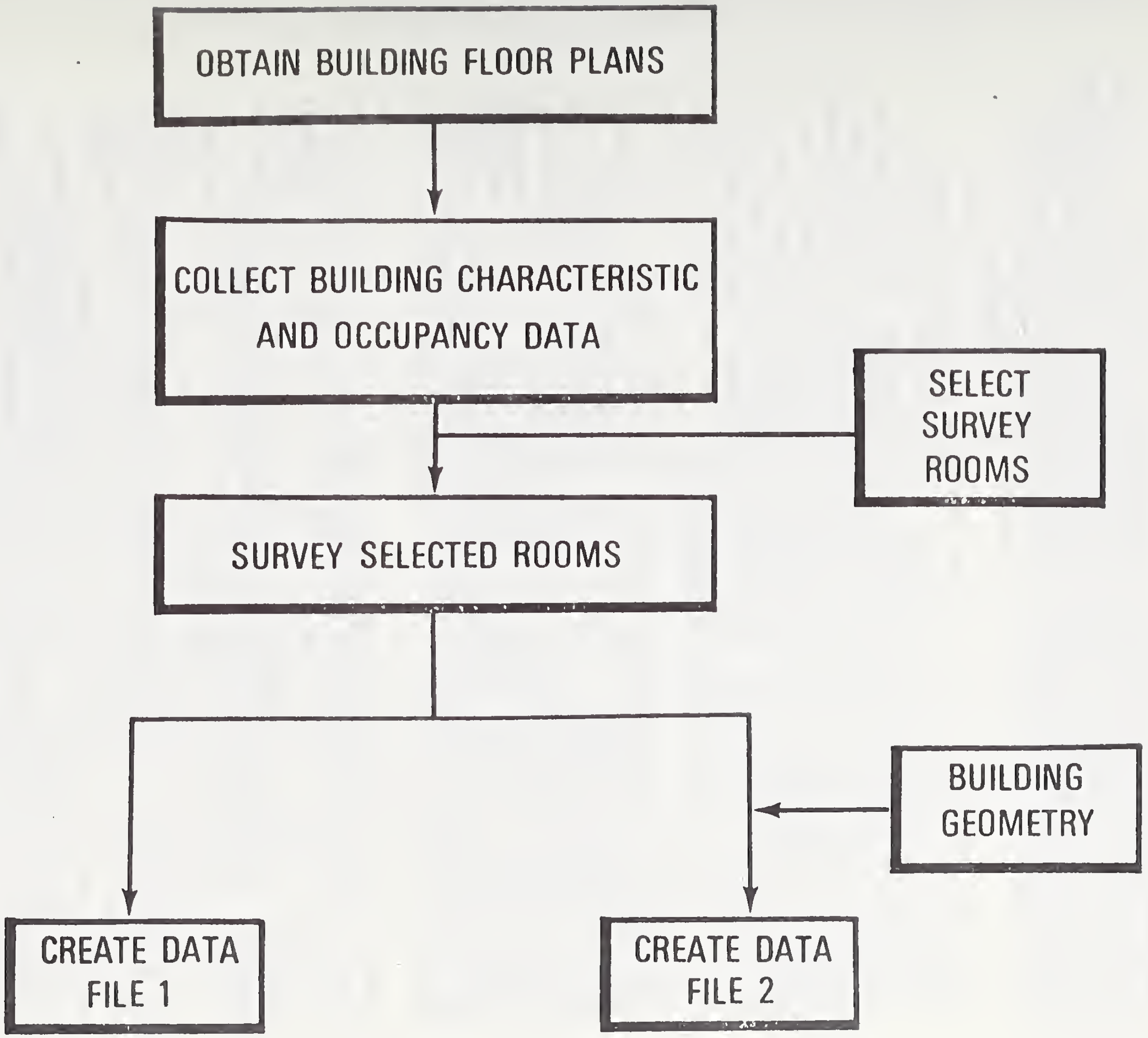


Figure 2 - Data Collection Procedure

building characteristic data and occupancy data. In addition, each area was classified according to use, size and the type of firm utilizing the space. This information was written directly on the floor plans using a three digit coding scheme (1). The floor plans were compared with prevailing conditions during the initial survey and necessary changes made to reflect any changes due to remodeling or renovation.

Following collection of the building characteristic data, occupancy data and area classification data, the information was processed and the rooms to be surveyed were selected. This involved keypunching the building characteristic and occupancy data, and transcribing the code numbers from the floor plans to the FOSDIC (Film Optical Scanning Device for Input to Computers) Area Classification Document presented in the Appendix. Keypunching and transcription of the FOSDIC documents was done at the National Bureau of Standards. Microfilming and scanning of the FOSDIC documents and transcription on magnetic tape was handled by the Bureau of The Census. Complete instructions for preparing these FOSDIC documents are included in Appendix A.

The rooms to be surveyed were selected in accordance with the sampling plan developed for this project (1). The computer program (Program ROOM) described in Chapter 3 was used for this purpose. A second survey of the building was then conducted to obtain detailed information about the room and its contents for the selected rooms. FOSDIC documents were also used to record the data in accordance with specially developed instructions (1). These documents were then microfilmed, the microfilm was scanned using an electro-optical scanning device and the data transferred to magnetic tape for processing. The microfilm provided a permanent record of the data.

Prior to analyzing the data, the two data files shown in Figure 2 were created. The first file consisted of the building characteristic data, the occupancy data and the room survey data. All the data were combined on magnetic tapes. As discussed in Chapter 3, this file was used to determine the fire load and live load for the surveyed rooms and to study the effects of various factors such as building height, building location, room use, etc., on the loads.

The second data file consisted of the same building characteristic data and occupancy data as on the first file plus information on the spatial orientation of all areas within the building (building geometry). The specially developed procedure for preparing the building geometry data is described in Appendix A. This file was used in connnection with studies concerning the distribution of loads throughout the entire building.

3. DATA PROCESSING PROCEDURE AND PROGRAM DESCRIPTION

3.1 General

Several special computer programs were developed to process and analyze the field survey data. Programs for the initial data processing, for the creation of Data Files 1 and 2 and for the room selection program are described in this chapter. The final data processing and the data analysis programs are described in Chapter 4.

3.2 Data Retrieval

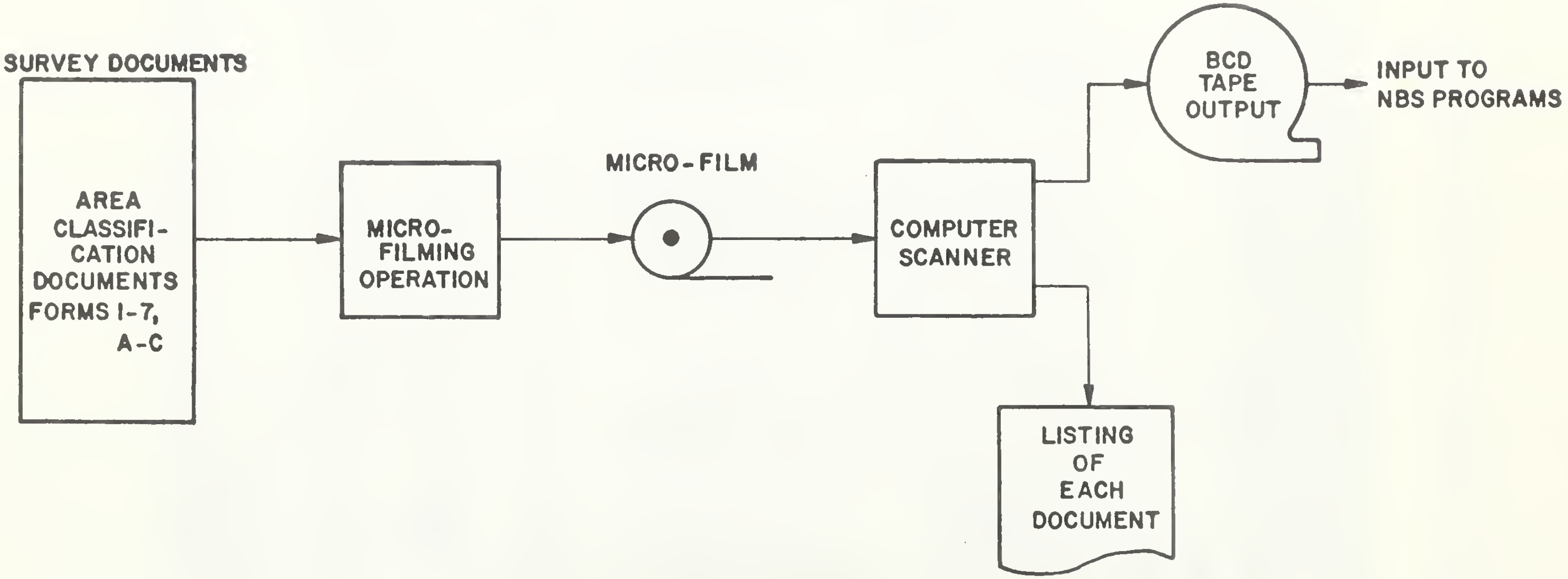
3.2.1 Introduction

The majority of the data used to form File 1 and File 2 was collected and recorded on special FOSDIC documents. The Area Classification Documents, Forms 1 through 7, and Forms A through C(1) were all FOSDIC documents. The data collection forms for the building and occupancy characteristics were not FOSDIC documents. Figure 3 is an overview of the retrieval of these data. The FOSDIC documents were processed by the Bureau of The Census to convert the data to a machine readable (digital) form. As indicated in Figure 3a, high-speed cameras were used to microfilm the survey documents to provide a convenient and permanent record of the data. The microfilm was then input to a FOSDIC scanner system which created standard Census 7 track BCD tapes at 800 bpi with even parity. A hard copy listing of the data was also produced. The microfilming and scanning procedure for this project was similar to that used by the Bureau of The Census in all their data processing work The scanning procedures and computer programs developed to produce these tapes are described in Sections 3.2.2, 3.2.3, and 3.2.4. Based on Census' extensive experience with this equipment, an error rate of less than one percent due to mechanical or electrical malfunctions was anticipated. Rather than discard any of the data, it was decided to provide a means for correcting these errors. Computer programs described in Section 3.4 were written for this purpose.

The building and occupancy data were keypunched on cards and processed through program FIRM as shown in Figure 3b. These data were retained in a mass storage file in the computer for later processing. The machine readable FOSDIC data and data from program FIRM were used to select the rooms to be surveyed (Section 3.3) and to create Data Files 1 and 2 (Sections 3.4 and 3.5).

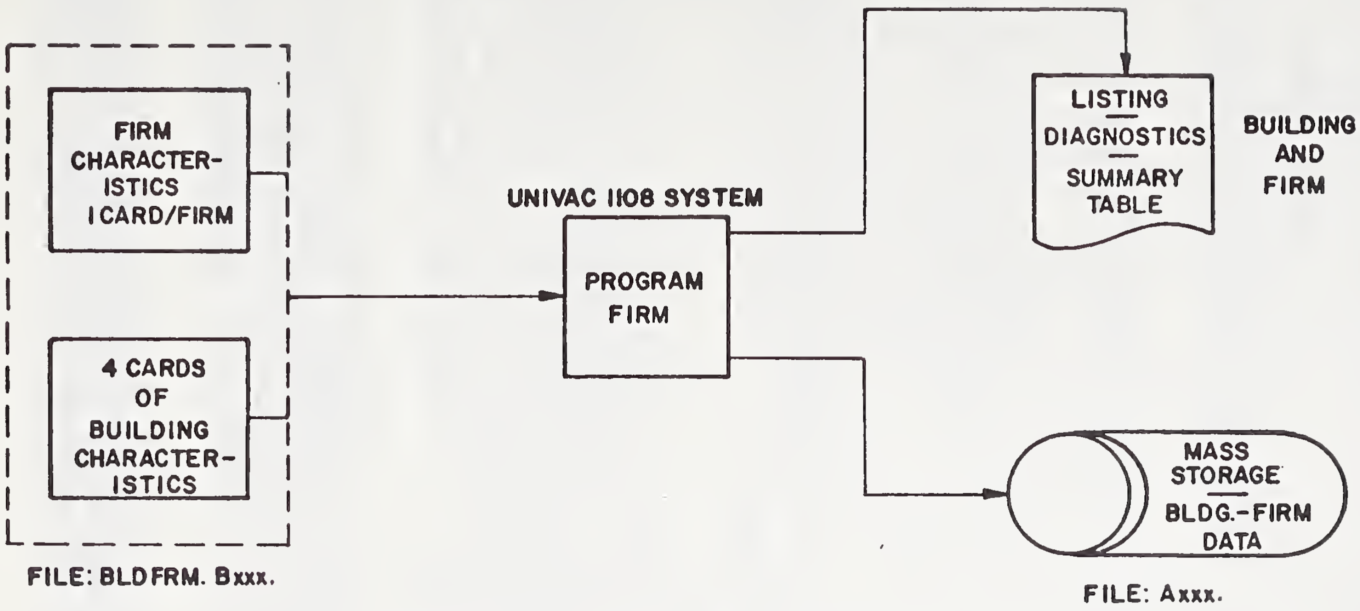
3.2.2 Document Scanning

Each microfilmed FOSDIC document was initially fed through a scanner, and a calibration procedure automatically executed.



(a) FOSDIC DOCUMENTS

Figure 3 - Data Retrieval



(b) BUILDING AND OCCUPANCY CHARACTERISTICS

Figure 3 - Data Retrieval (contd.)

Preprinted calibration marks appearing on the documents enabled automatic calibration of each document. This calibration compensated for mechanical errors such as the shrinkage or expansion of the document, the whiteness and blackness of the document and the tilt of the document with respect to the edge of the film. In addition to document calibration, document position (top and left edges) with respect to the scanning surface was determined.

After the calibration process was completed, the scanner extracted the data using appropriate read operations. For each character of information recorded, a group of data positions, generally a column of numbers, was scanned. The precise position of this group was ascertained by searching for the exact position of the preprinted calibrating patterns (Index Marks) on the document and then moving a pre-determined distance from this mark to the group of data. Each position in the group was read, the strongest reading selected as the proper answer, and this answer encoded to a BCD character and placed in the output buffer. After completion of the scanning, the buffer was recorded on a 7 track magnetic tape. Two programs, SCAN-1 and SCAN-2, described in subsequent sections were written to perform this scanning operation. Appendix B.1 illustrates the layout of the data on the tape for each survey document.

3.2.3 Program SCAN-1

Program SCAN-1 was developed by the Bureau of The Census to read the data from the Area Classification Documents. Along the left side of each Area Classification Document a column of digits from one to eight was preprinted with the number "1" having been filled in during the printing process. After calibration of the document was completed, this column was read and checked for the filled in "1". If the condition was true a "U" was recorded in the first character position of the record, otherwise this position was left blank.

The second position of the record contained an indication of the success of the calibration procedure. If blank, the calibration was totally successful. If the position contained an "F" the calibration was a total failure. A failure in finding any index was denoted by an "M" in this position. For the data read from a missed index an "M" was recorded in the corresponding positions of the record.

Having completed the calibration procedure, the building number and floor number were extracted from the document and placed in the output buffer. Data from each of the eighteen rooms blocks on the document were scanned using the index marks as positional reference points. When the document was completed the scanned data was recorded on tape with a blocking factor of 1.

3.2.4 Program SCAN-2

Program SCAN-2 was developed by Bureau of The Census to read Forms 1 through 7 and Forms A, B, and C. A unique 3 character identifier was precoded along the left side of each of the ten forms. SCAN-2 read this identifier, recoded it into the proper BCD character (A-T) and entered it in the first character position of the tape record. The second position indicated the calibration result in the same form as SCAN-1.

Once the form was identified, the proper subroutines were called to scan and record the data on the output record. After scanning both sides of 3 forms and storing the data in memory, the record was outputted to magnetic tape.

3.2.5 Program FIRM

The keypunched building and occupancy characteristic data were stored on a single file called BLDFRM. This file was comprised of one element per building. For example, the element called B024 pertained only to building 24, the NBS Administration Building. Each element differed only by the three digits at the end of the name. As data were gathered for the different buildings, additional elements were added to the file. Each building element had the same form. The first 4 card images contained the building characteristics as found on the building characteristics data collection form. Following these 4 header cards, there was 1 card for each firm occupying space in that building. Finally the data set was terminated by a "@EOF" card.

Appendix B.2 illustrates the required format for the input cards for an element of BLDFRM.

All the data entered into BLDFRM were processed using program FIRM. Program FIRM was developed to check the data from BLDFRM and output it to a mass stoarge file. During processing, a new file, AXXX, was created where XXX denoted the building number. A hard copy output file was also generated on the line printer listing the input data, diagnostics and summary tables of the firms in the buildings.

The building characteristics were read by the program and checks performed to insure legality of the entries. If errors were detected, a diagnostic was generated, appropriate default conditions implemented, and the data were put in a mass storage file. The firm characteristic data were then processed. As each firm characteristic card was read, the firm number, firm type and firm age were checked. If the age of the firm was greater than the age of the building, the age was set equal to the age of the building. The data were then put on a mass storage file. Table 1 lists the possible diagnostics produced and the default conditions generated. After processing all the firm data for a building, the data were tabulated by firm type and age and summary tables produced.

3.3 Room Selection

3.3.1 Introduction

The room selection program, Program ROOM, was developed to select the rooms to be surveyed in Phase I in accordance with the sampling plan established (1). Input data for the program consisting of the building characteristics, occupancy data, and area classification data were obtained from the file created by Program FIRM. For each area in the building this provided identification of:

1. Room Use - General office, file room, conference room, etc.
2. Firm Type Occupying Area - Agricultural, mining, etc.
3. Size of Area - less than 200 sq. ft. or less and more than 200 sq. ft.

Use of seven room use categories, ten firm types and the two area classifications provided a total of 140 separate categories into which the rooms in a building were grouped (e.g. general offices occupied by agricultural type firms with an area less than 200 sq. ft.). After grouping the rooms into these categories, the program randomly selected the rooms to be surveyed in accordance with the procedure described in Section 3.3.2.

The program printed a list of the specific rooms selected and several summary tables. These tables summarized the number of rooms in each of the 140 categories and provided a check on the selection procedure. They were used to insure that the room sample selected was representative of areas contained in the building. The computer listing identifying the rooms selected was provided to the field surveyors for use in conducting the room surveys.

TABLE 1 DIAGNOSTICS AND DEFAULT CONDITIONS FOR PROGRAM FIRM

	DIAGNOSTIC	DEFAULT
1)	ERROR IN MONTH ** MO=	January
2)	ERROR IN STATE CODE ** ST=	Alaska
3)	ERROR IN TYPE RESISTING SYSTEM **=	Column
4)	ERROR IN MATERIAL TYPE ** MATERIAL=	Concrete
5)	ERROR IN OCCUPANCY TYPE **	Federal Government
6)	**ILLEGAL FIRM NO. ***	1000
7)	**NEXT ENTRY IS A DUPLICATE FIRM NO. ***	Previous Data Lost
8)	**NEXT ENTRY CONTAINS A PUNCH ERROR IN FIRM TYPE	Firm type = 98
9)	*A VERY OLD FIRM * AGE =	Age of Building
10)	** CARD READ ERROR **	Firm Characteristics Discarded
11)	@EOF CARD FOUND IN DATA	Program Terminates Normally

3.3.2 Method of Selection

The general procedure for selecting rooms consisted of systematically choosing approximately 22.5 percent of the room in each of the 140 use-type-area categories, using a formally randomized starting point for each category. An index number from 1 to 140 was assigned to each possible combination using the following relation:

Index Number = 20*(Firm Type -1)+Area

where

Area = 1 for rooms less than 200 sq. ft.

= 2 for rooms greater than 200 sq. ft.

The randomized starting point for each category was chosen using a random number generator which allowed the user to input a number and returned to the user a random number from 0.0 to 1.0. The time of day in seconds was added to the run-time-elapsed (in 1/10th msec.) to produce a starting number for each execution of the program. This starting number was required in order to insure obtaining a different set of random numbers for each building. Every subsequent number delivered to the generator was the last random number received from the generator multiplied by 8192. The frequency of occurrence for each of the 140 categories was then compiled and sampling rates for each category determined. A projection of the total number of rooms to be selected was then generated. If this projection didn't fall between 21 percent and 25 percent, new sampling rates were established until the 21 to 25 percent criteria was met.

During the room selection process carried out by Program ROOM and discussed in Section 3.3.3, six tables were formed. An index number "J" which was dependent on room use, firm type, and area occupied was used for these tables. The six tables used in the selection algorithm were:

1) Table UTA - the frequency of occurence for each of the 140 unique categories. Initially, each entry in the table contained a 0. As the data from each legitimate room in the building was read and checked, the proper J entry in UTA was incremented by 1, i.e. UTA(J)=UTA(J)+1.

2) Table TAB2 - the desired number of rooms to be selected by taking 22.5 percent of the number of available rooms for that category, i.e., TAB2(J)=.225*UTA(J).

3) Table TAB3 - values of the increments used for the systematic selection of rooms in each of the 140 categories. Because a 22.5 percent sample was desired, each entry in TAB3 was initially filled with 4.444 (1./0.225). Within a given category after the first room was selected every 4.444th room was also selected.

4) Table TAB4 - the random number which together with the corresponding entry in TAB3 determined the first room in each of the 140 categories to be selected. Initially, each entry in TAB4 was the product of a random number and the corresponding entry in TAB3. For every entry in TAB4 whose corresponding entry in TAB2 was greater than or equal to 1.0, a random number was generated, the product with TAB3 obtained, and the result placed in TAB4, i.e., if

TAB2(J) $\geq$ 1.0, then TAB4(J)=Random No.*TAB3(J)

Every entry in TAB4 was less than or equal to 4.444. Those entries in TAB4 whose corresponding entries in TAB2 were less than 1.0 were set to 0.0 initially. Those values in TAB4 whose corresponding value in TAB2=0.0 were set to 0.0 and remained so for the duration of the run, i.e., if TAB2(J) $<$ 1.0 then TAB4(J)=0.0.

5) Table TAB5 - the projected number of rooms to be chosen for each of the categories, TAB5(J)=(UTA(J)+TAB4(J))/TAB3(J).

6) Table TAB6 - the number of rooms chosen for each of the 140 categories. Initially TAB6 was filled with 0.

Due to the method of selection used, few categories with less than 5 rooms would have rooms selected. Truncation error for these categories would result in too small a sample size and would also eliminate too many categories of rooms. If a rounding-up procedure were to be used, too many rooms would be selected. Therefore, upon completion of the formation of UTA, TAB2, TAB3, and TAB4, the entires in TAB2 were reexamined as 70 firm-area pairs. This gave added consideration to rooms with the same use and firm type but different area sizes, and allowed rooms to be chosen from those categories with less than 5 rooms and thus neutralized the truncation error. Both members of each of the pairs were compared to 0.5 and 1.0 and the appropriate action taken. Table 2 is a summary of the nine different results of the pair-wise comparisions. Table 3 explains each of the results.

At the completion of the pair-wise comparisons, a projection of the total number of rooms to be surveyed was determined by summing the projections for each category. If this projection

TABLE 2 RESULTS OF PAIR-WISE COMPARISONS

LET X=TAB2(J) and Y=TAB2(J+1)

	Y.LT. .5	.5.LE.Y.LT.1.0	Y.GE.1.0
X.LT. .5	TEST 2 0,0	TEST 8 0,1	TEST 4 0,N2
5.LE.X.LT.1.	TEST 9 1,0	TEST 7 1,0; 0,1; 1,1	TEST 6 1,N2
X.GE.1.0	TEST 3 N1,0	TEST 5 N1,1	TEST 1 N1,N2

NOTE*** J and J+1 are the small and large area categories respectively within room use and firm type. N1 is the sample size produced by the ordinary rule for the Jth category, i.e., N1 is the integer part of Jth category and N2 is the corresponding integer part from the J+1 category.

TABLE 3 DETAILS OF RESULTS
(Page 1 of 2)

TEST	EXPLANATION
TEST1	X.GE.1.0 .AND. Y.GE.1.0 Entries in TAB3 and TAB4 of J,J+1 are correct. N1 rooms will be selected from the Jth category and N2 rooms from the J+1th category.
TEST2	X.LT.0.5 .AND. Y.LT.0.5 TAB3 and TAB4 of J,J+1 are correct. N1=0 and N2=0.
TEST3	X.GE.1.0 .AND. Y.LT.0.5 TAB3 and TAB4 of J,J+1 are correct. N2=0
TEST4	X.LT.0.5 .AND. Y.GE.1.0 TAB3 and TAB4 of J,J+1 are correct. N1=0
TEST5	X.GE.1.0 .AND. 0.5.LT.Y.LT.1.0 TAB3(J+1)=UTA(J+1) TAB4(J+1)=RANDOM NO.*TAB3 (J+1) N2=1
TEST6	0.5.LE.X.LT.1.0 .AND. Y.GE.1.0 TAB3(J)=UTA(J) TAB4(J)=TAB3(J)*RANDOM NO. N1=1
TEST7	0.5.LE.X.LT.1.0 .AND. 0.5.LE.Y.LT.1.0 If UTA(J)+UTA(J+1). .GT. 11 then: TAB3(J)=UTA(J) TAB4(J)+TAB3(J)*RANDOM NO. TAB3(J+L)=UTA(J+1) TAB4(J+1)=TAB3(J+1)*RANDOM NO. N1=1 N2=2 If UTA(J)+UTA(J+1) .GE.4 .AND. UTA(J) .GE. UTA(J+1) TAB3(J)=UTA(J) TAB4(J)=TAB3(J)*RANDOM NO. N1=1 N2=0 If UTA(J)+UTA(J+1) .GE.4 .AND. UTA(J+1) .GT. UTA(J) TAB3(J+1)=UTA(J+1) TAB4(J+1)=TAB3(J+1)*RANDOM NO. N1=0 N2=1

TABLE 3 DETAILS OF RESULTS
(Page 2 of 2)

TEST8	X.LT.0.5 .AND. 0.5.LE.Y.LT.1.0 TAB3(J+1)UTA(J+1) TAB4(J+1)=TAB3(J)*RANDOM NO. N1=0 N2=1
TEST9	0.5.LE. X.LT.1.0 .AND. Y.LT.0.5 TAB3(J)=UTA(J) TAB4(J)=TAB3(J)*RANDOM NO. N1=1 N2=0

was not between 21 to 25 percent of the legitimate rooms in the building, a new cycle value to be used in TAB3 was calculated using:

$$\text{Cycle (NEW)} = \frac{\text{Cycle(old)*projected no. of rooms}}{.225 * \text{no. of legitimate rooms}}$$

For those entries in TAB3 with a corresponding entry in TAB2 which was > 1.0, the old cycle value in TAB3 was replaced with the new cycle value, and then the number of rooms to be selected was reprojected. If this reprojection did not meet the 21 percent to 25 percent criteria, the new cycle value became the old cycle value and the projecting repeated until the 21 to 25 percent criteria was met.

After the values of TAB3 met the 21-25 percent criteria, TAB5 was rescanned to insure that at least 1 room had been chosen from each non-empty use group consisting of 20 firm-area categories. If a non-empty use group did exist where at least 1 room had not been projected to be selected, TAB3 and TAB4 were adjusted such that a room was randomly chosen from that use group. The sum of the available rooms in that use group was then multiplied by a random number giving a random integer. This random integer determined which of the 20 firm-area categories would have a room selected. For that category, TAB3(J)=UTA(J), and TAB4(J)=TAB3(J)*random number. This forced a room to be selected at random from that use group.

Obviously any one building did not have rooms for all of the categories. By varying the selection percentage it was possible to insure that the number of randomly selected rooms did not exceed the total sample size required for this project.

3.3.3 Program ROOM

Program ROOM selected the rooms to be surveyed in accordance with the procedure described in Section 3.3.2 As previously noted, room selection was based on room use, firm type, and the size of rooms. The Area Classification Documents contained data on room use, room size, and firm number. The building and firm characteristics data (File AXXX) contained the firm type for each firm number. The data file from Program FIRM and the magnetic tape generated by the Bureau of The Census for the Area Classification Documents, therefore, were used as input data. Figure 4 is an overview of the program illustrating the two input files used, building and firm characteristics, and the Area Classification Documents. The primary output of the program was the listing of selected rooms. A diagnostic listing, and a listing of all tables was also produced. An additional 3 mass-

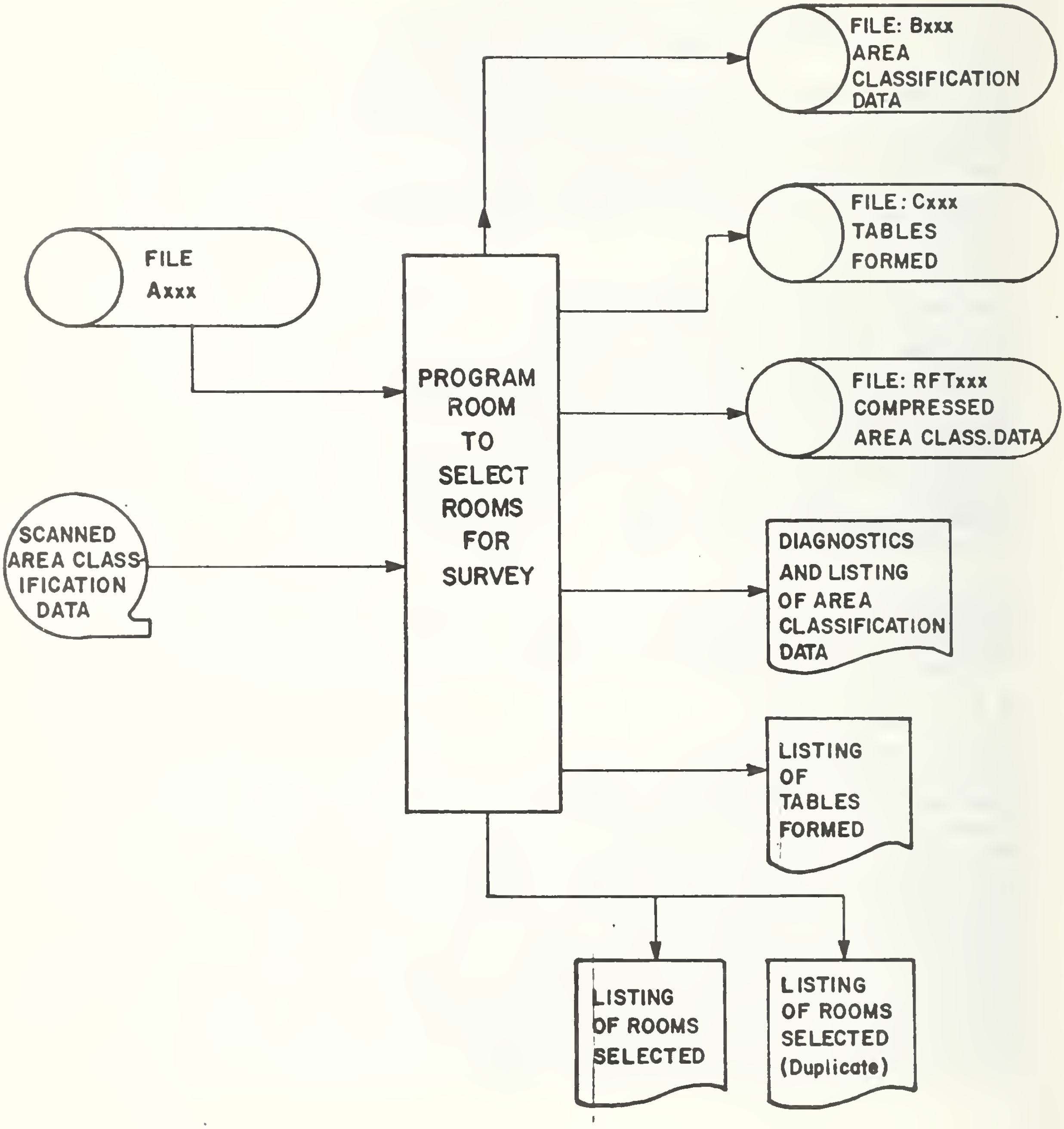


Figure 4 - Overview of Program ROOM

storage files were generated. File Bxxx was basically a listing of the area data, File Cxxx was a copy of the tables generated and File RFTxxx was a listing of rooms with their uses and firm numbers. This file was used in subsequent programs.

As each block of area classification data was input to the program, several checks were made for completeness of the data. Table 4 lists the diagnostics generated, the reason for the diagnostic and the action taken. For each block of area classification data an index number was calculated and the data recorded on File Bxxx. If the block of data was acceptable this index number was between 1 and 140. This process of reading area classification records, checking the data, and rewriting the records to Bxxx was repeated until all the area classification documents were examined. Summary totals of the number of area blocks encountered, the number of areas used for selection, and several other tallys were output to the printer after all area blocks were checked. In addition, a table listing the areas by use, firm-type, and size was formed and output. For the buildings processed in Phase I, approximately 63 percent of the total area blocks were used for selection. The remainder of the areas were disqualified due to data errors (2 percent), were not areas included in the survey such as stairways, elevators, etc. (30 percent), or were vacant (5 percent).

After Tables UTA, TAB2, TAB3, TAB4, and TAB5 were formed, as explained in Section 3.3.2, data for each room in the building were read from Bxxx. By use of TAB3 and TAB4 it was determined whether that room was to be selected for surveying. As each room was read, its index "J" was determined and TAB4(J) was incremented by 1.0. If TAB4(J) was < TAB3(J) that room was not selected. If TAB4(J) $\geq$ TAB3 that room was selected. The information was output to the printer and TAB4(J) was set to TAB(J)-TAB3(J). This process was recycled until all the rooms were either selected or rejected.

In addition to those rooms explicitly selected, several rooms were to be chosen by the surveyors. On the listing of the rooms selected, approximately 10 percent were specially flagged. The 5th room on the printout and every 9th room thereafter were flagged. Each time this flag appeared, the surveyor picked an adjoining room for surveying.

TABLE 4 DIAGNOSTICS AND DEFAULT CONDITIONS FOR PROGRAM ROOM

Diagnostic	Type of Failure	Action Taken
Fail Index on Firm	Machine Failure	Area disqualified.
Room Unowned by Firm	Firm Not Marked	Room common to many firms.
Illegal Code For Firm	Machine Failure	Area disqualified.
Imbedded Blanks in Firm	Poorly Marked Entries	Area disqualified unless leading blanks.
Unlisted Firm number	Firm Not Found in AXXX	Area disqualified.
Fail Index on Room	Machine Failure	Area disqualified.
Illegal Code for Room	Machine Failure	Area disqualified.
Imbedded Blanks in Room	Poorly Marked Entries	Area disqualified unless leading blanks.
Unlisted Room	Room Number Too Large	Area disqualified.
Fail Index on Enclosure	Machine Failure	Area used in selection process.
Fail Index on Imaginary	Machine Failure	Area used in selection process.
Illegal for Imaginary	Data Error	Area used in selection process.
Fail Index on Room Use	Machine Failure	Area disqualified.
Illegal Room Use	Data Error	Area disqualified.
Fail Index on Area	Machine Failure	Area disqualified.
Illegal Area Code	Data Error	Area disqualified.

3.4 Data File 1

3.4.1 Introduction

Data File 1 was created for use in converting the room information into useful parameters such as the fire load and live load. Statistical studies of the load magnitudes and determination of the factors affecting the loads were conducted using the data. To facilitate this analysis, it was necessary to edit the field data and correct collation and scanning errors.

Figure 5 is an overview of the programs involved in the generation of Data File 1. Completed survey forms 1 through 7, A, B, and C were microfilmed and scanned by program SCAN 2 producing a magnetic tape (Sec. 3.2.2 and 3.2.4). The data recorded was checked by Program FILTER to determine if any mechanical or electrical malfunctions had occurred during the filming or scanning procedures. Errors detected were corrected automatically by Program FILTER or with the aid of punch cards by Program EDPACK. Errors in the original survey data and mistakes by field surveyors were corrected by Program SURVEY. The task of merging the corrected data with the building and firm characteristic data was also accomplished by Program SURVEY which produced the mass storage version of Data File 1. Program DTCOPY transferred the mass storage version of Data File 1 to magnetic tape.

The sequential arrangement of this data on magnetic tape is given in Appendix B.4. This tape was then used as input to the data analysis programs described in Chapter 4. Descriptions of Programs FILTER-EDPACK, SURVEY, and DTCOPY follow.

3.4.2 Program FILTER-EDPACK

FILTER-EDPACK is actually two programs designed to detect mechanically or electrically generated scanning malfunctions and to correct the resulting errors. Figure 6 is an overview of this process. Data recorded on the tape generated by Program SCAN 2 was copied into a mass storage file CDxxx. Each physical record on both the tape and mass storage file contained 6 logical records. Each logical record was one side of one form. Program FILTER performed 3 main functions. First, each physical record (6 logical records) was unblocked to 6 physical records which were written to file SDxxx. Second, each record was checked for errors such as calibration failure and form mis-identification. Finally, the records were checked for proper sequence, e.g. the back side of a Form 1 must follow the front side of a Form 1.

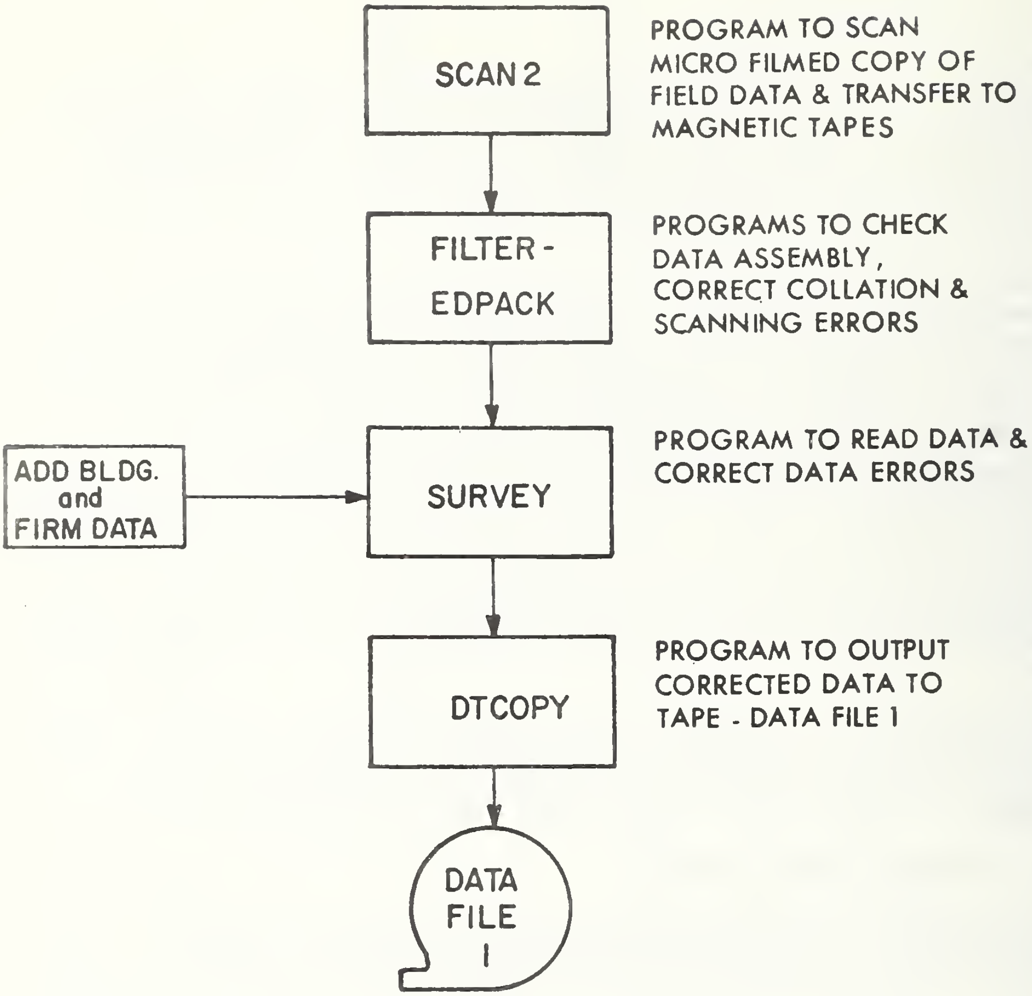


Figure 5 - Overview of Data File 1

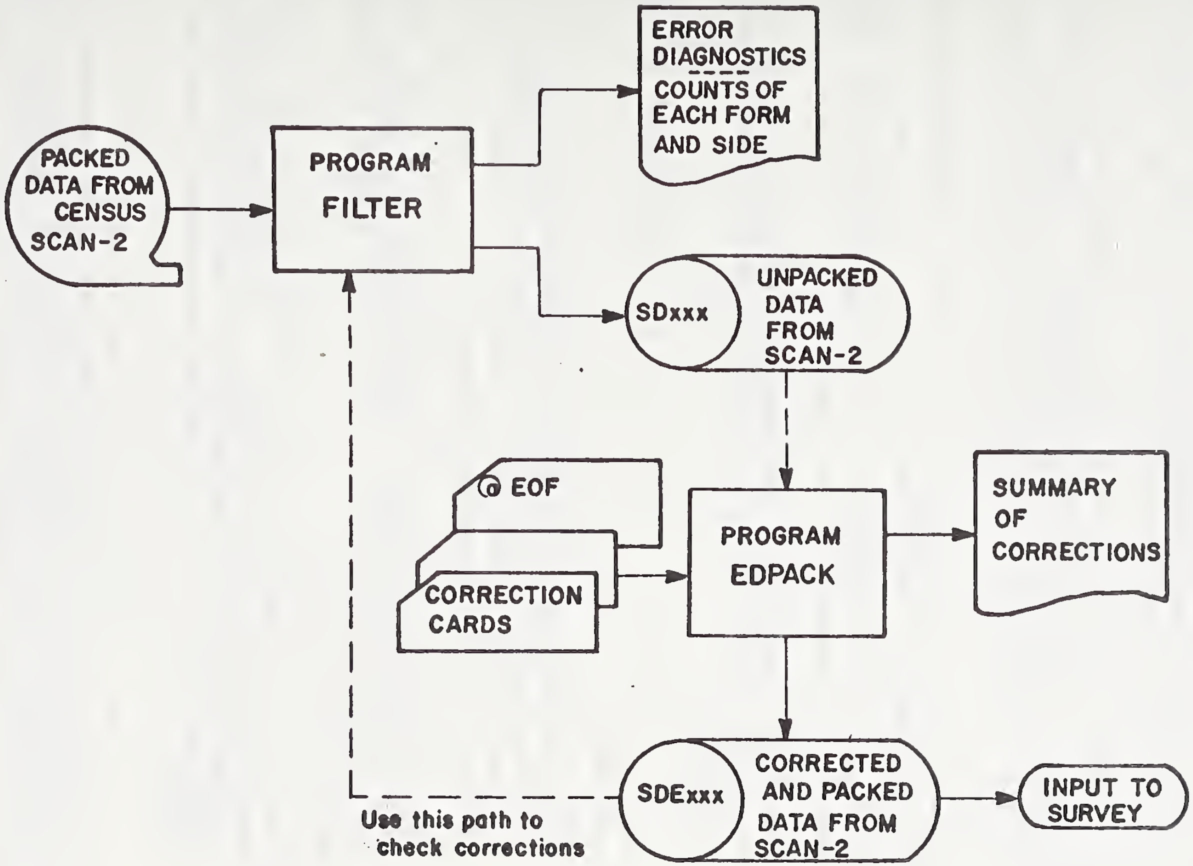


Figure 6 - Overview of Program FILTER-EDPACK

During execution of FILTER, an error diagnostic was generated for each error detected. As there were 10 different forms and each form has two sides, 20 unique form identifiers were possible. Tallys were kept for each of the 20 identifiers. At the conclusion of the execution, these tallys were printed. Each pair of tallys represented a single form (front and back). The entries within a pair had to be identical. If not, correction card records were entered via EDPACK.

Certain form assembly errors detected were automatically corrected at the time of detection by FILTER. The majority of errors, however, were corrected by executing EDPACK to substitute the proper data from a punch card for specific records in file SDxxx.

The main errors detected automatically or by FILTER and corrected by EDPACK included the following:

1) Illegal form identifier - A form identifier other than a character between A-T was found.

2) Check bit not blank - The document failed to calibrate or a fail index occurred on the document at the time of scanning.

3) First form was not a Form 1 - The first form on the tape had to be a Form 1 or the data seen until the first Form 1 was lost.

4) Sides of form appear reversed - Apparently the back of a form was filmed before the front of that form. Program FILTER automatically reversed the sides of the form so that the data appeared correct.

5) Very bad sequence error - During filming, 2 forms apparently stuck together resulting in the loss of the back of 1 form and the front of the next. Two dummy records were created on the output file.

6) Too many bad sequence errors - More than 100 bad sequence errors occurred for a building. The program stopped. Program EDPACK also packed every 6 records from SDXXX into one record in SDExxx which was used as input to SURVEY.

It should be noted that the tape file was first read into a mass storage file CDxxx. FILTER operated on CDxxx and generated file SDxxx. In turn, SDxxx was input to EDPACK to generate corrected data in file SDExxx. Upon completion of EDPACK, FILTER was re-executed using SDExxx as input and generating TEMPX, a temporary scratch file. This final step was not necessary, but did insure that errors in SDExxx were non-existent.

3.4.3 Program SURVEY

As the errors generated from electrical or mechanical malfunctions were detected and corrected by FILTER-EDPACK, errors in the data due to mistakes by the field surveyors were detected and corrected by SURVEY. Figure 7 is an overview of Program SURVEY illustrating three input files, Bxxx and RFTxxx developed by ROOM, and SDExxx developed by FILTER-EDPACK. A diagnostic listing and a mass storage version of Data File 1 (WIGxxx) were the two outputs generated by SURVEY. Transferring building and firm characteristic data from Bxxx to WIGxxx was SURVEY's first task. By use of RFTxxx, the firm number of each surveyed room was determined and room use checked. Scanned data from the survey documents were contained on SDExxx. During processing, answers for questions on each form were checked for completeness and validity. For each error detected, a default condition was executed. Correct data, together with defaulted data were reformatted in accordance with the sequence indicated in Appendix B.4. At the conclusion of checking, defaulting, and reformatting of the data from an entire room; a single physical record was outputted to mass storage file WIGxxx. A listing of error diagnostics, room identification, and summary information for each room was generated.

As there was no method for initially determining the amount of data from a room, the output record was of variable length. During execution of SURVEY the amount of core assigned to the run was dynamically increased or decreased as needed.

One main program and several subroutines comprised SURVEY. The main program read a document (both sides), determined the form number (Form 1-7, A, B or C), and called the appropriate form subroutine to process the data. There were ten form subroutines in SURVEY. Each subroutine was devoted to processing the data from a single form type. For each subroutine, the data were accepted in a format as specified in Appendix B.1, and outputted in the format referred to above. All answers to questions pertaining to a specific piece of furniture were processed within the proper subroutine. For example, the type and the dimensions of a desk on Form 2 were processed within the Form 2 subroutine. For errors detected on Forms 2 thru C, default conditions were assigned such that no forms were discarded.

In general, many of the forms contained large blocks of repetitive data. For example, on Forms 2 thru 5 free contents of paper and books are present. Rather than process these blocks within each subroutine, certain common subroutines were written.

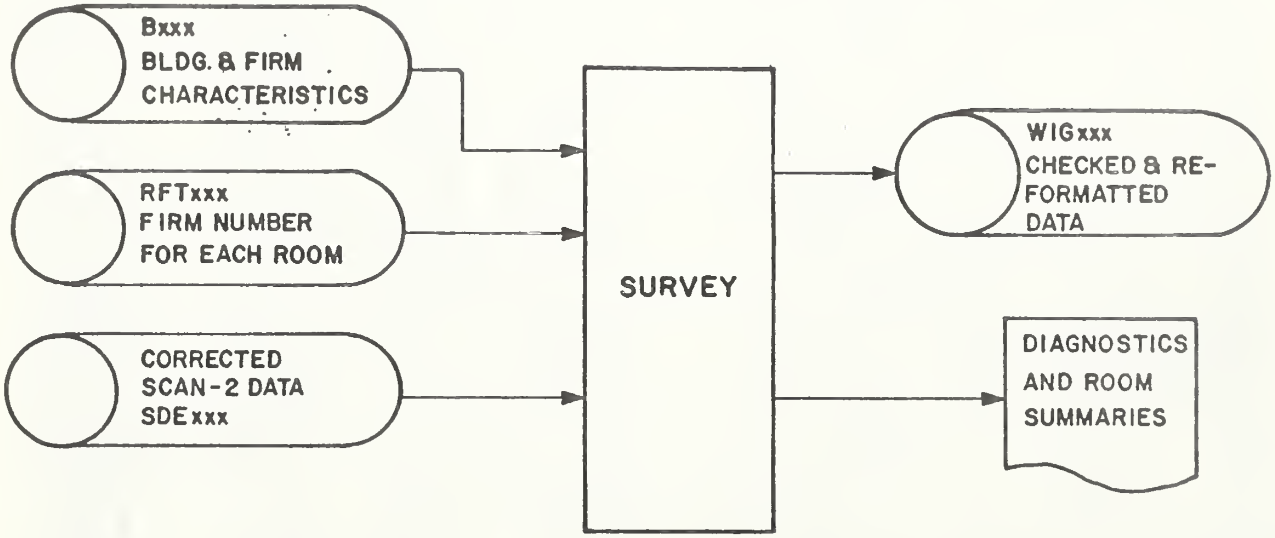


Figure 7 - Overview of Program SURVEY

As a result a single block of coding was exercised to process the same type data regardless of what form the data appeared on. Similarily, default conditions were used for the common subroutines in the same manner as for the form subroutines. These common subroutines were called by the form subroutines. For example, the free contents of paper and books on a Form 2 was processed by subroutine PAPER which was called by Form 2. In addition to processing free paper and books, PAPER also processed enclosed paper and books. Subroutine TYCAPH processed typewriter, calculator, and telephone data. Enclosed contents other than paper, books, typewriters, calculators, and phones were processed by ENCAGG. Blocks of seating data from Form 6 were processed by SEAT, while blocks of miscellaneous data from Form 7 were processed by MISC. Table 5 lists the repetitive subroutines called by each of the form subroutines.

During processing by SURVEY, as a Form 1 was read from SDExxx, the floor and room numbers were determined. This information was used as an index pointer to RFTxxx in order to extract the firm number for that room, and also to check that the room use was not changed from the Area Classification Document. When a discrepancy in the use was found, the "use" on Form 1 was accepted as being correct. The remainder of the data on Form 1 were checked for completeness. For certain data errors detected (e.g. errors in room dimension) the room was disqualified from the survey. At the conclusion of the checking of the data from Form 1 the remaining forms were checked for completness and validity. This was done on a form by form basis. As each form was checked, a corresponding portion of the output record was formed. As a form was input to SURVEY the form identifier (A-T) was determined. The form identifier "A" (Form 1) indicated a new room. After outputting the first room to WIGXXX, and printing a summary, SURVEY began processing the data from the new room. If the identifier was other than an "A" (Form 1), the proper form subroutine was called, the errors detected, and the default conditions applied for both the form subroutines and the common subroutines. Tables 6 and 7 list the errors detected and the default conditions used for each of the subroutines.

This processing continued until an End-Of-File was found on SDExxx at which point a summary of the rooms processed and disqualified was outputted and the program terminated.

3.4.4 Program DTCOPY

Data File 1 was the mass storage file WIGxxx which contained the processed data from Program SURVEY. For further processing of the data, this file had to be transferred to a magnetic tape. Program DTCOPY accomplished this function by directly copying

TABLE 5 SUBROUTINES CALLED BY EACH FORM

Subr. FORM	PAPER	TYCAPH	ENCAGG	SEAT	MISC
1					
2	X	X	X		
3	X	X	X		
4	X	X	X		
5	X	X	X		
6			X	X	
7			X		X
A	X				
B		X			
C			X		

TABLE 6 TABLE OF DEFAULT CONDITIONS - FORM SUBROUTINES
(Page 1 of 5)

Form	Question	Default
1. Bounding Surfaces Form		
	1. Room Use	Same as use listed on area classification document if present, otherwise General
	2. Normal No. Occupants	2
	3. Wall Types	Room disqualified
	4. Ceilings	Accoustical file
	Floor	Non-combustible
	Doors	Not present
	Ceiling Trim	Not present
	Floor Trim	Not present
	Door Trim	Not present
	Window Trim	Not present
	5. Walls (Full)	Material - none Covering - none
	(Open & Partial)	Data ignored
	6. Wall Openings (Full) (Open & Partial)	Doors: Ht. 6 ft. 8 in. Wd. 3 ft. 0 in. Windows: 0 window
	7. Partial Height Partitions	Length: If wall is a "Length" wall - Room dimension of width If wall is a "Width" wall - room dimension of length. Height: 8 feet 0 inches
	8. Room Dimensions	Room disqualified
	Building No.	Building being processed
	Floor	Same as last or if first room floor 1
	Room No.	Room disqualified
	Surveyor Code	Same as last code

TABLE 6 TABLE OF DEFAULT CONDITIONS - FORM SUBROUTINES
(Page 2 of 5)

2. <u>Desk Form</u>

1.	Desk Type	Double pedestal
2.	Proximity to Wall	2 feet or less
3.	Desk Material	Alternates between wood and metal for entire building starting with wood.
4.	Number of Drawers	When desk type is single Box=1; File=1; Personal=1 When desk type is double Box=4, File=1; Personal=1 When desk type is legs Box=3; File=1; Personal=1
5.	Desk Top Dimensions	Length 4 feet 0 inches Width 3 feet 6 inches

3. <u>Table Form</u>

1.	Table Type	With legs
2.	Proximity to Wall	2 feet or less
3.	Table Material	a) "Single Ped." type Top=wood; Ped/legs=metal b) "With legs" type and both unmarked Top=metal; Ped/legs=metal c) "With legs" type and only 1 marked, the unmarked is the same as the marked d) If top = plastic and ped/legs not plastic, Top=metal
4.	Table Dimensions	Height: 2 ft. 6 inches Width: 2 ft. 0 inches Length: 3 ft. 0 inches
5.	Drawers	Without drawers

TABLE 6 TABLE OF DEFAULT CONDITIONS - FORM SUBROUTINES
(Page 3 of 5)

4. Cabinet Form

1. Cabinet type	General purpose
2. Proximity to Wall	2 feet or less
3. Cabinet Material	Wood
4. No of Drawers	Tens = 0; Units = 0
5. No of Shelves	0
6. Cabinet Dimensions	Height: 2 feet 6 inches Width: 5 feet 0 inches Length: 1 foot 6 inches
7. Drawer Type	(General Purpose Only) Box=4; File=1; Personal=0

5. Shelving Form

1. Shelving Category	Bookcase
2. Proximity to Wall	2 feet or less
3. Shelving Material	Metal
4. Shelving Dimensions	Height: 3 feet 1 inch Width: 3 feet 0 inches Depth: 1 feet 0 inches
5. No of Shelves (JIC #1)	a) Nothing entered 1 shelf b) If units, tens, or hundreds blank, right justify answers present.

6 Seating Form

1. Seating Type	Pedestal
2. Proximity to Wall	More than 2 feet
3. Number of Seats	01

TABLE 6 TABLE OF DEFAULT CONDITIONS - FORM SUBROUTINES
(Page 4 of 5)

4.	Material Types	Frame=Wood; Seat=Wood; Back=Wood
5.	Other Characteristics	a) If both the arms and the padded arms questions blank- Arm=No; Padded Arms=None b) Otherwise Arms = yes Padded seat = Fabric Padded back = Fabric padded arms = Fabric
6.	Dimensions	Height: 2 feet 9 inches Width: 2 feet 0 inches Depth: 2 feet 0 inches

7 Miscellaneous Items Form

1.	Combustability Code	Non-combustible
2.	Proximity Code	2 feet or less
3.	Dimensions	Height: 0 feet 0 inches Width: 0 feet 0 inches Depth: 0 feet 0 inches
4.	Est. Weight	a) If units, tens, hundreds, and thousands blank: units=0 tens=0 hundreds=0 thousands=0 b) If any entry is marked, right justify the four entries and 0 fill significant digits. If 3 entries marked are "Space-2-Space", weight is set equal to 2 pounds.

A Free or Enclosed Paper or Books Form

Extra Sheet/Separate	Separate
Misc. Item No.	0
Free/Enclosed	Free
Proximity Code	2 feet or less

TABLE 6 TABLE OF DEFAULT CONDITIONS - FORM SUBROUTINES
(Page 5 of 5)

B Equipment

Extra Separate	Separate
Misc. Item	0
Free/Enclosed	Free
Proximity Code	2 feet or less

C Free or Enclosed Other Than Paper, Books, Typewriters, Calculators or Telephones Form

Extra Separate	Extra
Misc. Item No.	0
Free/Enclosed	Free
Combustability	Non-Comb
Dimensions	Height 0 feet 0 inches Width 0 feet 0 inches Depth 0 feet 0 inches
Weight	Right justify answers and zero fill significant digits

TABLE 7 DEFAULT CONDITIONS - COMMON SUBROUTINES

SUBR.	QUESTION	DEFAULT
PAPER	Free or Enclosed Paper and Books	
	Size	For Form 5 use book size 10 x6 1/2 All other Forms = 8 1/2 x 11
	Height of Pile	The sum of the heights for legitimate piles divided by the number of piles
	% Compaction	The sum of the percentages of legitimate piles divided by the number of legitimate piles.
TYCAPH	Typewriters, Calculators, and Phones	
	Typewriter	
	Free/Enclosed	Free
	Manual/Electric	Electric
	Ball/Bar	Ball
	Carriage Length	15" - 16"
	Base Dimensions	Length: 1 foot 8 inches Width: 1 foot 3 inches
	Calculator	
	Free/Enclosed	Free
	Manual/Electric	Electric
	Tape/No Tape	No Tape
	Illum RD/Dial RD.	Dial
	Base Dimensions	Length: 1 foot 2 inches Width: 0 feet 9 inches
	Telephones	
	Personal/Call Dir.	Personal
	No. Buttons	0
	No. Phones	1
ENCAGG	JIC Boxes for Miscellaneous Items	
	Free/Enclosed	Enclosed
	Combustible/Non	Combustible
	Est. Weight	Right justify data and zero fill significant digits All: 0 feet 0 inches

data images recorded on mass storage file to tape. The tape was recorded using a 7 track, 800 bpi drive with odd parity, a blocking factor of 1, and without tape labeling. Data from one room was recorded on a single record. As the record length of many records exceeded 2000 words, no standard software copying packages were available. Because of this, records were read from the mass storage file WIGxxx using VTRAN, a software package developed at NBS and designed to operate on variable length records located on a mass storage file without regard to record length (8). Records were then written on tape using NTRAN, a Univac system package (9).

At the conclusion of Program DTCOPY counts of the number of records copied, the number of rooms processed (records copied minus 2), and the maximum record length were printed on the line printer.

3.5 Data File 2

3.5.1 Introduction

Data File 2 was created in order to perform studies on the distribution of loads throughout the building. In addition to the same building characteristic and occupancy data contained on Data File 1, this file also contains for each area in the building:

1) area identification consisting of the building, floor, and room number of each area;

2) the room use (general office, lobby, elevator, etc.);

3) the number of the firm occupying the area; and

4) the geometric coordinates of the area boundaries located with respect to a global coordinate system established for the building.

The area identification data were obtained from the Room Locator documents discussed in Appendix A. Data concerning the room usage and the number of the occupying firm was obtained from Program ROOM (Sec. 3.3.3) which was executed during the generation of Data File 1. Geometric coordinates were obtained from the Plans documents which were tracings of the floor plans of a building denoting the wall positions. These data with corrections were merged with the same building and firm characteristics (Bxxx) also developed during Program ROOM, which was used for Data File 1.

Methods used for the filming and scanning of the Room Locator and Plans documents were similar to those used by the Bureau of The Census for the generation of Data File 1. However, due to the high degree flexibility of the FOSDIC system at NBS; all filming, scanning, and processing for Data File 2 was done at NBS. Descriptions of the techniques and programs used to scan the Locator and Plans documents and the programs used to process and edit these data using the NBS UNIVAC 1108 computer facility follow.

3.5.2. Method Used to Determine Wall Coordinates

In processing each building, all wall coordinates were referenced to a building origin. During scanning of each plan tracing (Appendix A), two positions on the horizontal axis were known to be certain distances from the building origin. Figure 8 illustrates the building origin (BO), the two horizontal reference marks (HR1 and HR2), and the two vertical reference marks (VR1 and VR2) for a floor plan tracing. In this particular case, the building origin, the first horizontal reference (HR1), and the first vertical reference (VR1) coincide. The scaled distance between HR1 and HR2 in Figure 8 is 60 feet (HR2 - HR1) and between the two vertical reference marks is 48 feet (VR2 - VR1).

Although the four reference positions are expressed in terms of feet from the building origin, the FOSDIC system determines all distances in terms of FOSDIC modules. For this reason, horizontal and vertical scaling factors to convert FOSDIC modules to feet were calculated. The horizontal scaling factor (HSCAL) was calculated as follows:

$$\mathrm{HSCAL} = \frac{\mathrm{HR2} - \mathrm{HR1}}{\mathrm{FHR2} - \mathrm{FHR1}}$$

where FHR1 and FHR2 are the coordinates for HR1 and HR2 expressed in FOSDIC modules as indicated in Figure 8. The vertical scale factor (VSCAL) was calculated using:

$$\mathrm{VSCAL} = \frac{\mathrm{VR2} - \mathrm{VR1}}{\mathrm{FVR2} - \mathrm{FVR1}}$$

where FVR1 and FVR2 are the coordinates for VR1 and VR2 expressed in FOSDIC modules. HSCAL and VSCAL relate distances on the microfilm tracing to actual building dimensions.

Once the scale factors were established for each tracing, the horizontal and vertical coordinates of any point P (P_H, P_V) were converted from FOSDIC modules to feet by the following two equations:

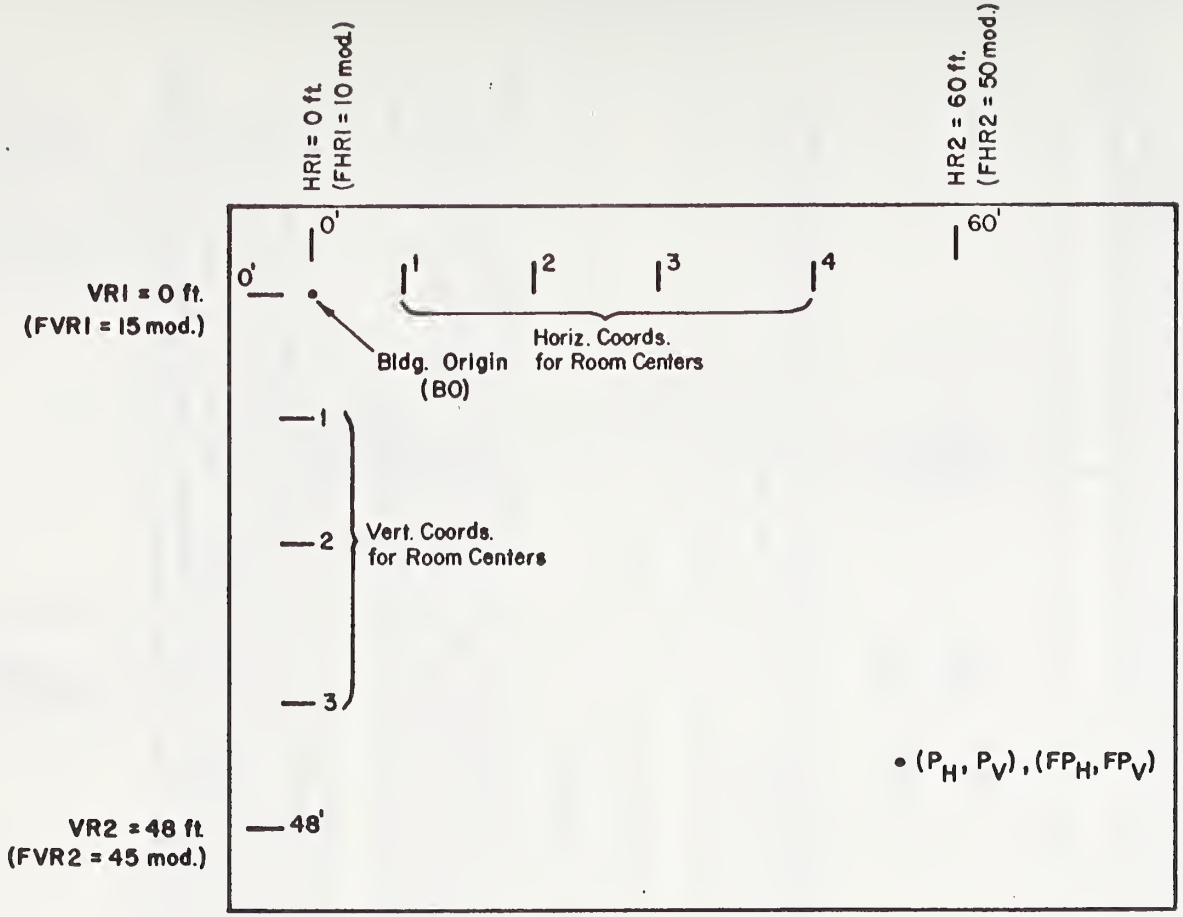


Figure 8 Reference Mark Layout for Floor Plan Tracings

$$P_H = HSCAL* (FP_H - FHR1) + HR1 + PHO$$

and

$$P_V = VSCAL* (FP_V - FVR1) + VR1 + PVO.$$

The terms FP_H and FP_V were the horizontal and vertical components for Point P expressed in FOSDIC modules. PHO and PVO refer to the distances between the origin used for the tracing and the building origin (Appendix A).

Referring to Figure 8 as an example, the horizontal and vertical scale factors would be:

$$HSCAL = \frac{60-0}{50-10} = 1.5 \text{ ft/mod.}$$

$$VSCAL = \frac{48-0}{45-15} = 1.6 \text{ ft/mod.}$$

If PHO=0 and PVO=0 (i.e. the tracing and building origin coincide) and the FOSDIC coordinates of Point P were (47, 37), then the distance of P from the building origin in terms of feet would be:

$$P_H = 1.5 (47-10) + 0 + 0 = 55.5 \text{ feet}$$

$$P_V = 1.6 (37-15) + 0 + 0 = 35.2 \text{ feet.}$$

3.5.3 FOSDIC Processing

Figure 9 is an overview of the filming and scanning operation for creating Data File 2. For each tracing, up to five room locator documents were microfilmed with and preceded each Plans document. This microfilm record was then processed by the FOSDIC computer-scanner system which produced a diagnostic listing of the run together with a binary tape used as input to the processing programs on the Univac 1108 computer.

On each Plans document, which was a tracing of the whole floor or a segment of a floor (Appendix A), as many as nine areas were sketched across and down the tracing. Consequently, as many as 81 (9x9) unique areas were contained on a single Plans document. In order to correlate each area on the Plans document with a specific room number, a Room Locator document (Appendix A) was completed for each 18 areas on the Plans document. One to five completed Room Locator documents, therefore, preceded each Plans document.

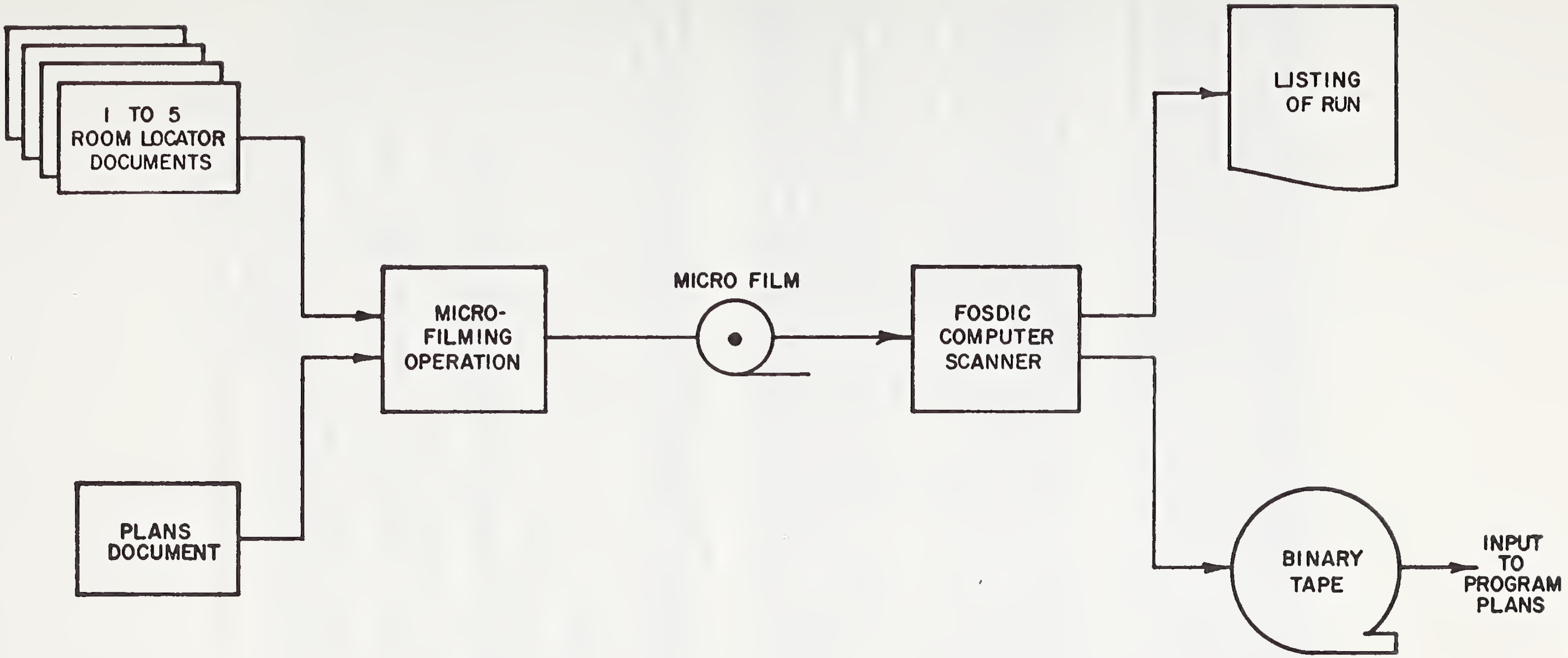


Figure 9 Overview of the NBS Filming and Scanning Operation

On the Plans document, each area was referenced by "x" and "y" coordinates which corresponded approximately to the center of the area. Each "x" and "y" had a value between one and nine. For every area on the Plans document, its corresponding room number and "x" and "y" position were noted on a Room Locator document. Furthermore, if the area was to be subtracted from the total room area, then this fact was also indicated on the Room Locator document. A more detailed explanation of the procedure used to make the tracings may be found in Appendix A.

The microfilm record which consisted of groups of Room Locator and Plans documents was processed by the FOSDIC computer-scanner system. Outputs from this processing consisted of a listing of the documents scanned and a binary 7 track magnetic tape in odd parity written with a density of 556 bpi. This tape was the primary input to the Univac 1108 computer which processed the scanned data and generated Data File 2.

One fixed-length record of characters was created on the FOSDIC output tape for each group of Room Locator documents and the single associated Plans document. As listed in Appendix B.3, the format included provision for data from the heading and 18 room identification sections of five Room Locator documents. The space in the record assigned to the Plans document covered 90 rooms, slightly in excess of the expected maximum of 81. Unused portions of the record were blank filled.

Separate programs were developed for scanner reading of the two document types. These programs were combined for the single-pass scanning operation. The programs were identified as SCAND for Room Locator and SCANP for Plans.

3.5.3.1 Program SCAND

This included the function of:

a) Transport of the films which contained the document images
b) Calibration on document images
c) Identification of document type (Room Locator or Plans), followed by entry to either (d) or (e) below
d) Scanning of Room Locator document
e) Entry to SCANP program whose termination results in film transport (a) above

After initialization and memory clear at the start of SCAND, the film transport was actuated to bring the next image into the scanning operation. The calibration function was then performed on the new document image resulting in stored constants in the FOSDIC circuits so that subsequent scanning actions would be aligned with the position, size, and tilt of the new image. Calibration was attempted three times in succession if an initial failure was found. Failures were rare, being usually due to improper filming. They were corrected by refilming and rescanning.

Calibration on the Room Locator documents was accomplished through the regular FOSDIC pre-printed elements. However, because the Plans document was an unprinted sheet of faintly-ruled paper, calibration material was added artificially. The final arrangement consisted of a mask along the left edge against which the sheets were placed before microfilming. On top of this mask there was cemented a narrow band containing calibration elements cut off from the left edge of a Room Locator document. This was done to move the identification mark to a new position.

Identification of document type was obtained through scanning at the normal and the shifted locations during the program SCAND. When the mark was found at the regular position, the document was assumed to be a Room Locator and entry was made to the appropriate program. Conversely, the presence of the mark in the alternative location caused execution of the SCANP program.

The program for Room Locator documents, SCAND, resulted in storage of the sensed heading information on building and floor numbers, and four reference values for scaling the two axes of the Plans documents. Room data, covering room identification number and an additive/subtractive indicator were also scanned for all 18 sections on the document. As they appeared in sequence on the film, Room Locator documents were scanned and their data placed in the appropriate storage positions for organization into the output record. As mentioned, up to five such documents could be handled. When the sequence was terminated by the presence of a Plans document, as shown by the identification portion of the paper, execution was transferred to the SCANP program.

3.5.3.2. Program SCANP

SCANP functions were:

a) Location of document reference marks
b) Location of room center marks
c) Location of room walls
d) Editing and reporting errors in the functions
   a, b, and c

e) Preparation of the output record
f) Typing out a log entry
g) Listing the results on magnetic tape

Document scanning which was limited to functions a, b, and c consisted of searching for marks which were similar in form in all three instances. Identification of document reference marks and room center marks, as such, was possible because they were found in constrained areas. Wall location marks were found anywhere in the scanner field of view except for those narrow areas reserved for document references and room centers. They were indexed by information on the Locator documents and the room center mark locations as determined by function b. The indexing consisted of predicting and utilizing a point inside the room which was vertically and horizontally in line with the wall location marks.

Acceptance of any of the marks on these documents was contingent upon the mark density and the continuity of the mark in a linear manner for 1/4 inch on the original plan. The first marks scheduled for location were the document reference marks which were found anywhere along a horizontal and vertical strip whose locations were specified to the document preparer. These locations were eventually listed on the magnetic tape and used by the programmer to scale the entire document. Two marks had to exist on each axis and failure to detect two was one basis for reporting a problem in scanning the document.

Two other strips were reserved for the room center marks and location of these was the second phase of the Plans document information retrieval. Editing in this area was based on the requirement that the number of room center marks on each axis must equal at least one and not exceed nine. The locations of these marks were stored in a table for later use in finding walls.

The final phase of the scan combined the room center mark coordinates specified on the Locator document (determined in SCAND) with the actual location of the room center marks (determined in function b as described above) to predict a point inside the room. This point was vertically and horizontally in line with the wall locations drawn by the document preparer. Scanning excursions were made in four directions from this point to locate the walls. These locations were reported to the magnetic tape listing along with the room number which was indicated by the Location document. An error flag was substituted for any wall which could not be found.

During the course of scanning, the scanner central processor had been combining essential information derived from Locator document scan (SCAND) with essential information derived from Plans document scanning (SCANP) and error information developed in editing both scans. The result was record ready for output to a magnetic tape recorder. Prior to recording, however, a log entry was typed out which listed:

a) Building number
b) Floor number
c) Number of rooms scanned
d) Errors found

It was possible for the operator to intervene at this time and attempt a rescan if he felt it advantageous. When he failed to utilize this option, the results were recorded on magnetic tape.

3.5.4 Central Computer Processing

The objective of the processing done by the Univac 1108 was to check for validity, merge, edit where necessary, and reformat all input data in order to produce Data File 2. Scanned plans data from program SCAND-SCANP, the building and firm characteristic data (Bxxx) produced by Program ROOM, and the area classification data (RFTxxx) also produced by ROOM were the main inputs to the processing. PLANS, EDIT, and FTCOPY were programs developed in order to create Data File 2.

Figure 10 is an overview of the procedure used and the sequence of program executions needed for Data File 2. Program PLANS checked the input data for legality and completeness. A mass storage version of Data File 2 was created, as were diagnostics produced for errors in the plans data. Some errors detected by PLANS were corrected directly using an on-line technique of editing Data File 2. Other more serious errors were corrected by refilming and/or rescanning the Room Locator and Plans documents thus producing a correction tape. By use of Program EDIT, data from this tape were merged with the original plans data to produce a corrected version of the plans data. These corrected input data were again processed by PLANS producing an updated mass storage version of Data File 2 and an updated listing of data errors. This process of checking and editing was repeated until an error free mass storage version of Data File 2 existed. This correct Data File 2 was transferred from mass storage to magnetic tape by use of Program FTCOPY. A more detailed description of the operation of each of these programs follows.

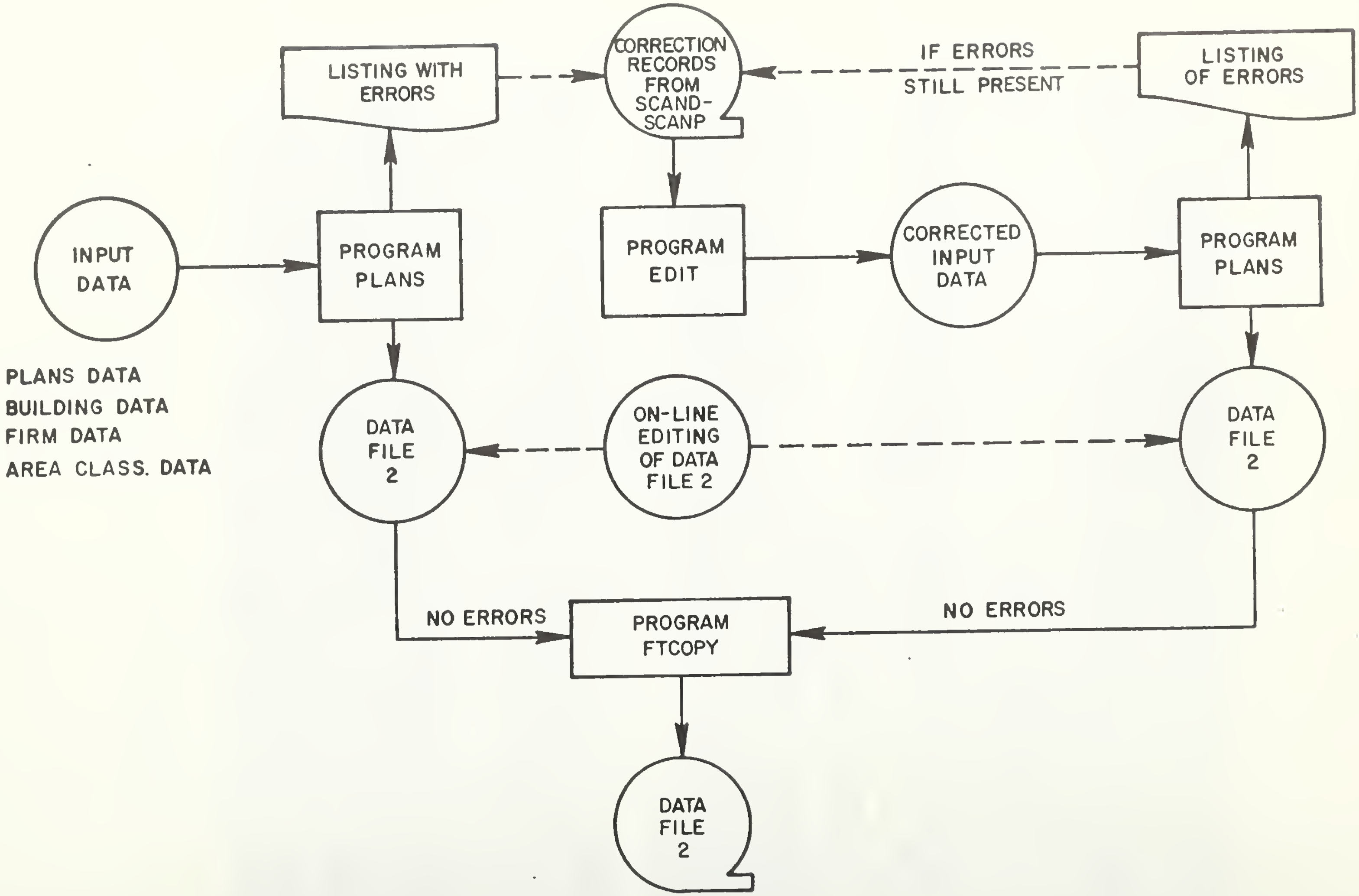


Figure 10 Procedure and Sequence for Execution of PLANS, EDIT, and FTCOPY

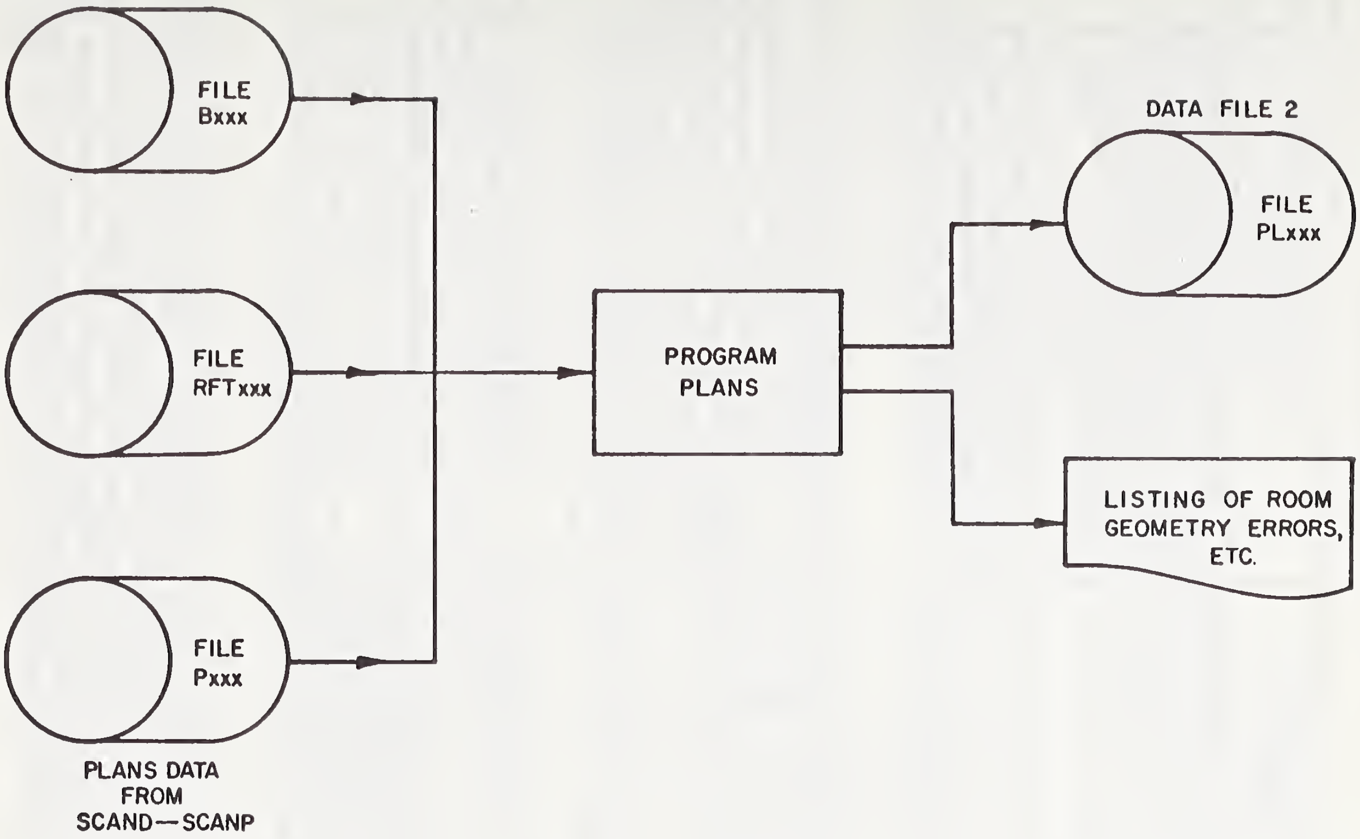


Figure 11 Overview of PLANS

3.5.4.1 Program PLANS

Errors in the PLANS data due to inaccurate completion of the documents or erroneous scanning were detected by Program PLANS. Figure 11 is an overview of the program illustrating three input files, Bxxx and RFTxxx developed by Program ROOM, and Pxxx, the mass storage version of the PLANS data. A diagnostic listing and a mass storage version of Data File 2 (PLxxx) were the two outputs generated by PLANS.

Transferal of the building and firm characteristics from Bxxx to PLxxx was PLANS' first task. By use of RFTxxx, the firm number and room use of each area in the plans data were merged with the geometry data for that area. During execution of PLANS, scanned data and Pxxx were checked for completeness and validity. For each error detected, a diagnostic was generated.

For certain errors, detected default conditions were generated; for other errors the entire record of Pxxx was deleted. In addition to error diagnostics, room identification, room number, room use, the four coordinates of the room, the room area, and accumulated areas of the floor and building were listed for each area processed. Table 8 and Table 9 list the errors detected and actions taken by PLANS. When an error listed in Table 8 was found in a Pxxx record, all the data from that record was either deleted completely from Data File 2, or marked for subsequent correction. In contrast those errors listed in Table 9 affect only a particular data of an area where the error occurred.

As previously noted, each record in Pxxx contained data for up to 81 areas. In order for any of these areas to be processed, certain calibration procedures and scaling parameters had to be properly scanned. As the wall coordinates of each area were determined using the horizontal and vertical scaling factors (Section 3.5.2), the FOSDIC coordinates of the horizontal and vertical reference marks had to be present. If any one or more of these four values were missing or flagged to be in error, then none of the area data from that tracing were processed. Furthermore, if no area centers or more than nine centers were found in either direction on the PLANS document, then that record was not processed.

After all the calibration and scaling factors for each record were established to be correct, PLANS processed the remainder of the data from each record. The building number was checked for agreement with the building being processed, the floor number was then checked for a match on file RFTxxx. Errors detected during these two checks together with the actions taken are listed in Table 8. Problems concerned with the room number and the location of the wall coordinates of each area are contained in Table 9. When all the checks were made for accuracy and completeness of the data, an

TABLE 8 RECORD ERRORS

Error No.	Type of Scanning Error (SCAND-SCANP)	Corrective Action (PLANS)
1	Fail calibrate on any of the Room Locator Documents.	Entire Pxxx Record deleted.
2	One or both horizontal references not found on Plans Document (FHR1, FHR2).	Entire Pxxx Record deleted.
3	One or both vertical references not found in Plans Document (FVR1, FVR2).	Entire Pxxx Record deleted.
4	Both horizontal references marked to be zero feet on Room Locator Document (HR1=HR2=0).	East and West positions will be the value of the horizontal offset (PHO).
5	Both vertical references marked to be zero feet on Room Locator Document (VR1=VR2=0).	North and South positions will be the value of the vertical offset (PVO).
6	More than 9 or less than 1 horizontal area centers found on Plans Document.	Entire Pxxx Record deleted.
7	More than 9 or less than 1 vertical area centers found on Plans Document.	Entire Pxxx Record deleted.
8	Building number in Pxxx records disagrees with building being processed.	Building number being processed was used.
9	No floor match on RFTxxx	Next record on RFTxxx used for floor number, area use, and firm number for each area in record.

TABLE 9 DATA ERRORS

Error No.	Error	Corrective Action
1	Room number of area on Pxxx is zero.	Room number is zero. Firm number and area use of last area processed is used.
2	Room number from Pxxx does not exist on RFTxxx.	Use of area is "Other," firm number is 999 implying firm type is non-classifiable.
3	The "x" and "y" entries on the Room Locator Document were illegal.	Room deleted from Data File 2.
4	The "x" and "y" entries on the Room Locator Document were not on the Plans Document.	Room deleted from Data File 2.
5	West wall of a room not found by FOSDIC.	West wall coordinate set to zero.
6	East wall of a room not found by FOSDIC.	East wall coordinate set to zero.
7	North wall of a room not found by FOSDIC.	North wall coordinate set to zero.
8	South wall of a room not found by FOSDIC.	South wall coordinate set to zero.
9	West wall was greater than the East wall of an area.	Room deleted from Data File 2.
10	North wall was greater than the South wall of an area.	Room deleted from Data File 2.

output record was generated for each area. This record consisted of building number, floor number, room number, firm occupying room, room use, a flag denoting whether or not the area was additive and the coordinates of each wall calculated using the procedure described in Section 3.5.2. A description of the format of each record is given in Appendix B.5.

Program PLANS also printed a list of summary information. This list included a count of the number of records read from File Pxxx, the total area calculated in the building, and the number of area records written to Data File 2. A table listing the total area of each floor, the sum of the floor areas up to and including each floor, and the percent change in area from floor to floor were also given.

3.5.4.2 Program EDIT

As Program PLANS was developed to detect errors in the plans data (Pxxx), Program EDIT was created in order to substitute correct data for erroneous data and produce a corrected file of the plans data (Pxxx). Data found to be in error were corrected on the Room Locator and Plans document. Those corrected documents were refilmed and the microfilm record rescanned as discussed in Section 3.5.3. These corrected plans data (CPxxx) were then merged with the original plans data (Pxxx) using Program EDIT. Correction cards were used to direct the manner in which records from Pxxx and CPxxx were merged with each other.

Figure 12 is an overview of Program EDIT. The input consisted of three files. The original plans data on file Pxxx, the rescanned correction plans data on file CPxxx, and the file of correction directions on DPxxx were operated on by EDIT to produce a corrected version of the plans data, Pxxx, together with a listing of the corrections.

Three distinct editing features were available in this program: substitute, add, and delete. Any record in file CPxxx could be substituted for any record in file Pxxx. Any record in file Pxxx could be deleted. Finally, any record on CPxxx could be added after any record on Pxxx.

Each card in file DPxxx contained the number of the physical record in Pxxx which was keyed upon, and then a record was either added, substituted, or deleted. The action to be taken and the number of the physical record on CPxxx was also contained on each card. With the three available options, file Pxxx was changed in any manner desired providing each change involved only whole physical records. As each change was implemented, a listing of that change was generated. The updated plans data Pxxx were then reprocessed by Program PLANS to form a correct version of Data File 2 (PLxxx).

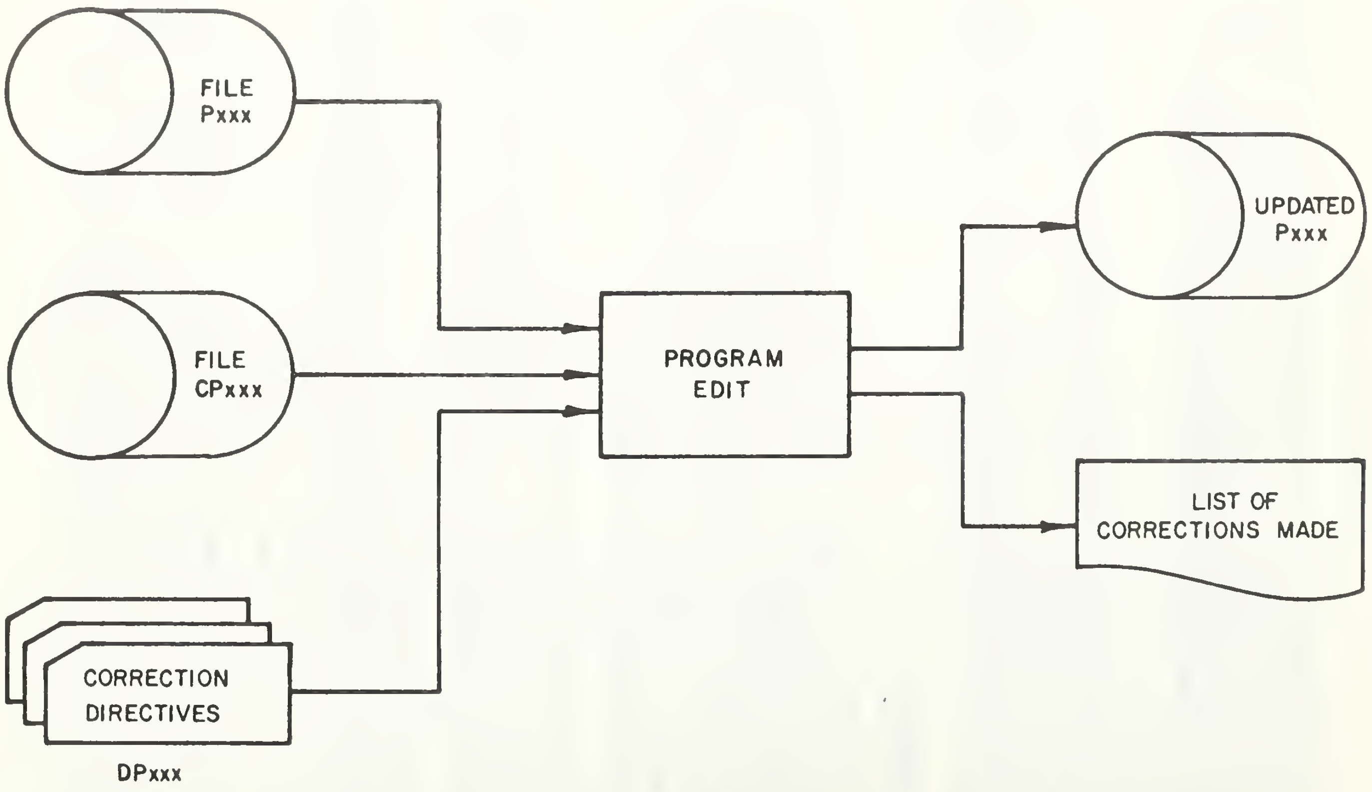


Figure 12 Overview of Program EDIT

3.5.4.3 Program FTCOPY

Data File 2 was the mass storage file PLxxx containing the processed data from Program PLANS. For subsequent processing of the data, this file (PLxxx) had to be transferred from a FORTRAN-formatted mass storage file to a binary-formatted magnetic tape. Program PLANS used a FORTRAN format so that minor errors in PLxxx could be corrected using the Univac 1108 on-line EDITOR (ED) processor (10) rather than Program EDIT (Section 3.5.4.2) which was a file editor.

Program FTCOPY read each record from PLxxx with the proper FORTRAN format and then wrote the binary record to magnetic tape using an NTRAN write statement (9).

Table 10 lists the tape parameters for the input and output tapes for Data Files 1 and 2.

TABLE 10 DATA TAPE PARAMETERS

Description	Data File 1		Data File 2	
	Census Input	NBS Output	NBS Input	NBS Output
No. of Tracks	7	7	7	7
Density	800 bpi	800 bpi	800 bpi	800 bpi
Parity	even	odd	odd	odd
Labeled Tape	BCD	no	no	no
Method of Recording	BCD	Unformatted Binary	Unformatted Binary	Unformatted Binary
Blocking Factor	6	1	1	1
Format Specification	See App. B.1	See App. B.4	See App. B.3	See App. B.5
Record Length	Fixed	Variable	Variable	Variable

4. DATA ANALYSIS

4.1 General

Several special-purpose computer programs were developed to provide the data analyses desired. An overview of the data retrevial procedure and analysis programs is shown in Figure 13. The primary results to be produced by these analysis tools are

- Tables of statistical compilations describing the surveyed rooms and their contents,
- Histograms of the collected information,
- A set of data tapes containing all of the acquired data in a form readily useable for future studies,
- Statistical models of the fire load and live load in office buildings, and
- A set of data tapes containing live load and fire load models for specific buildings.

The two data files previously described in Chapter 3 provide the primary input to these data analysis and data processing programs. Program MAKER first converts the survey data on Data File 1 to fire weights and live weights using the transfer functions discussed in Reference 1. The program then checks the validity of much of the data and restructures it for efficient retrieval. It also provides diagnostic messages and messages highlighting extreme values.

Program SEEKER is used to abstract information from the "processed data files" created by MAKER. The types of output provided by SEEKER are

1) Simple summary type information presented in tabular form,

2) Data files to be used as input to the HISTOG line printer plotting routine, and

3) Data files to be used as input to the BUILDER program where they are used as the data for those rooms which were surveyed in a particular building.

Coding for determining the means, maximum and minimum values, standard deviations, and number of items is included in this program.

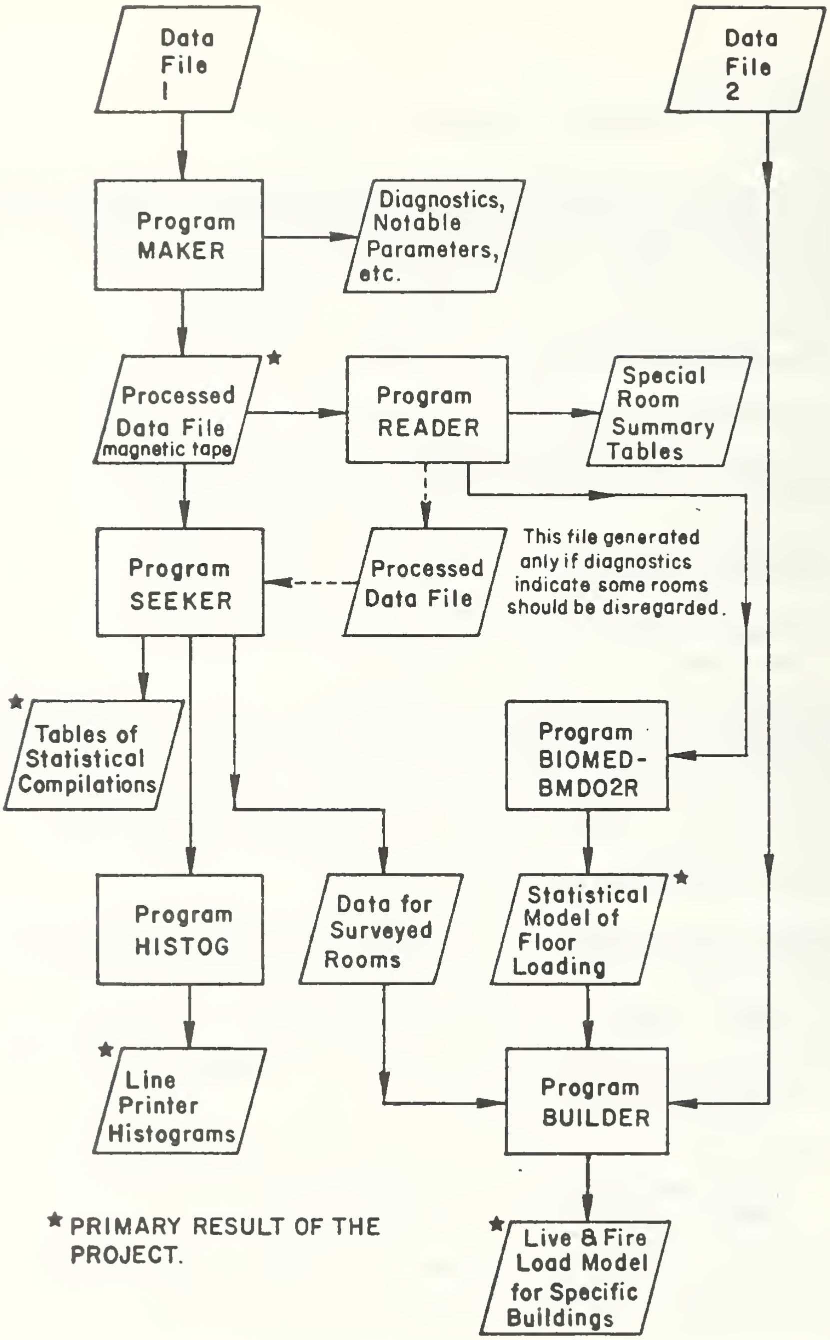


Figure 13 Overview of Data Retrieval and Analysis

Program READER is a multipurpose program structured to perform a number of simple data manipulation tasks. In some instances it performs the same operations as SEEKER but because it is much less general than SEEKER it performs them quicker and cheaper. Among other things, READER can be used to mark specific records on the MAKER file so that SEEKER will ignore them. This is useful if the MAKER diqnostic messaqes indicate that a particular room is erroneous. READER is also used to generate the regression analysis data file needed by the BIOMED-BMD02R program. Twenty-three specific pieces of information are placed on this data file for each room.

The floor plan data from Data File 2 together with the room survey data from READER and the statistical models for floor loading from BIOMED-BMD02R are combined by BUILDER to provide information for all areas within the building. For the surveyed rooms, direct values of live load and fire load can be used. For those rooms not surveyed, the floor loading models are used to compute values for these quantities. The area of the rooms and their spatial location relative to a fixed coordinate system for the building are provided by Data File 2.

The files created by BUILDER permit future research studies to be made of the loading for an entire building.

Detailed descriptions of each of these programs are presented in subsequent sections.

4.2 Weight Determination (Program MAKER)

4.2.1 Introduction

Program MAKER is one of a series of programs which have been developed to process, manipulate, retrieve, and analyze the fire weight and live load survey data. MAKER's primary purposes are to check for validity and to restructure the survey data into a form that can be accessed by the SEEKER program (Tables 11, 12, and 13).

The survey data collection forms (1) have previously been microfilmed and the data read onto a magnetic tape in the order noted in Table 1 of Appendix B.4. The MAKER program performs the following operations on these data: reads the data, checks it for consistency, converts the data into a more useful form by performing many different calculations. Using weight data and transfer functions, descriptive information about the room contents is transformed into weights. These values are then tested and another magnetic tape is produced which is designed to be used in conjunction with the SEEKER program and statistical analysis programs to provide virtually any statistical analysis of the survey data. The program MAKER consists of a main program called DRIVE and seven subroutines called: FORMA, FORMB, FORMC, RMCONT, FSEAP, BONCOM, and DATA.

DRIVE reads the input data tape, processing the data one room at a time. DRIVE then checks for consistency with the data-collection sheet configuration of the raw data input on Forms 1-7, and calls subroutines FORMA, FORMB, and FORMC for a consistency check of the raw data collected on Form A, B, and C, respectively. Then DRIVE converts this raw data into a form that is used by the RMCONT, BONCOM, and FSEAP subroutines. When these subroutines have analyzed the data, DRIVE writes the output they generate on a magnetic tape.

FORMA is called from DRIVE when data from Form A is found in the input data-buffer by DRIVE. This subroutine checks the consistency of the data with the configuration of the data-collection form and assigns it to the proper vector for further analysis. If the data is for a freestanding pile of paper or books, FORMA calls subroutine FSEAP to produce the desired output; if the data is not for such a freestanding pile, control is returned to DRIVE.

FORMB is called from DRIVE when data from Form B is found in the room data-buffer by DRIVE. FORMB performs the same function as FORMA except it manipulates equipment data instead of book or paper pile data.

FORMC is identical in function to both FORMA and FORMB described above except that it is used to manipulate miscellaneous objects data and is never used for freestanding objects; thus, it will not call FSEAP.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 1 OF 11

Sequence Number	Description	F-Format*	Codes and Units
1	Number of words of data	6.0	Number, total number of data items stored herein for subject room.
2	Building number	4.0	To be assigned each structure surveyed (1 to 101).
3	Floor number	3.0	Determined as actual height in number of floors (13th is included) above ground level.
4	Room number	5.0	To be assigned to each room in a particular structure.
5	Firm number	3.0	To be assigned to each firm in a particular structure.
6	Firm type	3.0	Standard industrial classification two digit code.
7	Firm age	3.0	Length of time the firm has been at this location.
8	Building surveyor code	4.0	To be assigned to each surveyor working on project.
9	Room surveyor code	4.0	To be assigned to each surveyor working on project.
10	State number	3.0	Number (1.0 to 51.0)
11	Building zip code	5.0	————

*The output will be written on a magnetic tape in an unformatted binary form.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 2 OF 11

Sequence Number	Description	F-Format	Codes and Units
12	Date of construction	4.0	Year constructed.
13	Building age at time of survey	4.0	1975 minus construction date (age at time of survey) in years.
14	Building height	3.0	In number of stories above ground level.
15	Vertical load resisting system	2.0	For building: column = 1.0, bearing wall = 2.0.
16	Building material	2.0	Concrete = 1.0, steel = 2.0, masonry = 3.0, wood = 4.0.
17	Building occupancy type	2.0	Federal Government = 1.0, State Government = 2.0, Local Government = 3.0, Private = 4.0, Private and Government = 5.0.
18	Number of firms in building	5.0	Number
19	Room use	2.0	General = 1.0, clerical = 2.0, lobby = 3.0, conference = 4.0, file = 5.0, storage = 6.0, library = 7.0.
20	Number of occupants	4.0	Normal occupancy, in number of people
21	Wall area (no cutouts for doors or windows)	7.2	ft^2, Height * 2 * (Length + Width)
22	Door area	7.2	ft^2
23	Window area	7.2	ft^2

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 3 OF 11

Sequence Number	Description	F-Format	Codes and Units
24	Floor area	7.2	ft^2, identical to ceiling area.
25	Room volume	9.2	ft^3
26	Ceiling material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, acoustical tile = 4.0, non-combustible = 5.0.
27	Ceiling trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
28	Door material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0.
29	Door trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
30	Floor material	2.0	Wood = 1.0, non-combustible = 5.0, resilient flocr = 6.0, carpet = 7.0.
31	Floor trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
32	Window trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
33	Wall 1, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
34	Wall 1, number of windows	2.0	Number.
35	Wall 1, number of doors	2.0	Number.
36	Wall 1, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 4 OF 11

Sequence Number	Description	F-Format	Codes and Units
37	Wall 1, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
38	Wall 1, height	5.2	ft, zero for open area.
39	Wall 1, length	5.2	ft, zero for open area.
40	Wall 2, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
41	Wall 2, number of windows	2.0	Number.
42	Wall 2, number of doors	2.0	Number.
43	Wall 2, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.
44	Wall 2, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
45	Wall 2, height	5.2	ft, zero for open areas.
46	Wall 2, length	5.2	ft, zero for open areas.
47	Wall 3, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
48	Wall 3, number of windows	2.0	Number.
49	Wall 3, number of doors	2.0	Number.
50	Wall 3, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 5 OF 11

Sequence Number	Description	F-Format	Codes and Units
51	Wall 3, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
52	Wall 3, height	5.2	ft, zero for open area.
53	Wall 3, length	5.2	ft, zero for open area.
54	Wall 4, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
55	Wall 4, number of windows	2.0	Number.
56	Wall 4, number of doors	2.0	Number.
57	Wall 4, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.
58	Wall 4, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
59	Wall 4, height	5.2	ft, zero for open areas.
60	Wall 4, length	5.2	ft, zero for open areas.
61	Internal partition 1, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
62	Internal partition 1, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
63	Internal partition 1, length	5.2	ft

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 6 OF 11

Sequence Number	Description	F-Format	Codes and Units
64	Internal partition 1, height	5.2	ft
65	Internal partition 2, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
66	Internal partition 2, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
67	Internal partition 2, length	5.2	ft
68	Internal partition 2, height	5.2	ft
69	Internal partition 3, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
70	Internal partition 3, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
71	Internal partition 3, length	5.2	ft
72	Internal partition 3, height	5.2	ft
73	Internal partition 4, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
74	Internal partition 4, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
75	Internal partition 4, length	5.2	ft
76	Internal partition 4, height	5.2	ft

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 7 OF 11

Sequence Number	Description***	F-Format	Codes and Units
77	Live weight*	8.2	lb, does not include occupants, does include weight of internal partitions.
78	sd** live weight	8.2	lb
79	Live weight per unit area	6.2	psf, does not include occupants, does include weight of internal partitions.
80	sd live weight per unit area	6.2	psf
81	Total movable fire weight-derated	8.2	lb } does not include weight of internal partitions.
82	sd total movable fire weight-derated	8.2	lb
83	Total movable fire weight per unit area-derated	6.2	psf } does not include weight of internal partitions.
84	sd total movable fire weight per unit area-derated	6.2	psf
85	Total paper and book fire weight - underated	7.2	lb (equals live weight)
86	Occupied floor area	7.2	ft^2, does not include internal partitions.
87	Occupied floor area - percentage	6.2	% of total floor area.

*The live weight of the movable room contents is the total live weight in the room.

**sd = standard deviation of the predicted weight based on uncertainties in the transfer function.

***All fire weights are equivalent pounds of cellulose (8000 BTU/lb); the composite fire weights totals include only the derated portion of the enclosed fire weight in metal furniture.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 8 OF 11

Sequence Number	Description***	F-Format	Codes and Units
88	Interior finish fire weight	7.2	lb does not include partitions
89	Interior finish fire weight per unit area	6.2	psf
90	Total number of all items in room	3.0	Number of desks, tables, cabinets, shelves, chairs, miscellaneous, and free standing piles of paper, books, and equipment.
91	Total weight estimated by surveyor	7.2	lb
92	Fire weight enclosed in metal containers-derated	6.2	% of total derated fire weight.
93	sd fire weight enclosed in metal containers - derated	6.2	% of total derated fire weight.
94	% of furniture and miscellaneous items within 2 ft of the walls	6.2	% of total number of pieces of furniture and miscellaneous items.
95	% of freestanding items within 2 ft of the walls	6.2	% of total number of freestanding items
96	Movable fire weight enclosed within 2 ft of the walls- derated	6.2	% of total derated fire weight.
97	sd movable fire weight enclosed within 2 ft of the walls-derated	5.2	% of total derated fire weight.
98	Movable fire weight within 2 ft of the walls- derated - does not include internal partitions.	6.2	% of total derated fire weight.

***All fire weights are equivalent pounds of cellulose (8000 BTU/lb); the composite fire weight totals include only the derated portion of the enclosed fire weight in metal furniture.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 9 OF 11

Sequence Number	Description	F-Format	Codes and Units
99	sd movable fire weight within 2 ft of the walls-derated	5.2	% of total derated fire weight.
100	Total fire weight enclosed-derated	6.2	% of total derated fire weight.
101	sd total fire weight enclosed-derated	5.2	% of total derated fire weight.
102	Total fire weight that is paper-derated, not including books	6.2	% of total derated fire weight.
103	sd total fire weight that is paper-derated, not including books	5.2	% of total derated fire weight.
104	Total fire weight that is books-derated	6.2	% of total derated fire weight.
105	sd total fire weight that is books-derated	5.2	% of total derated fire weight.
106	Total fire weight enclosed in plastic	6.2	% of total derated fire weight.
107	sd total fire weight enclosed in plastic	5.2	% of total derated fire weight.
108	Total fire weight in room-derated	8.2	lb
109	sd total fire weight in room-derated	8.2	lb

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 10 OF 11

Sequence Number	Description	F-Format	Codes and Units
110	Fire weight per unit area-derated	6.2	psf
111	sd fire weight per unit area-derated	6.2	psf
112	Total fire load - percentage, derated.	6.2	% of total live weight.
113	sd total fire load - percentage, derated.	6.2	% of total live weight.
114	Number of desks	3.0	Number.
115	Number of tables	3.0	Number.
116	Number of cabinets	3.0	Number.
117	Number of shelves	3.0	Number.
118	Number of chairs	4.0	Number.
119	Number of miscellaneous items	3.0	Number.
120	Number of free standing piles of paper.	3.0	Number.
121	Number of free standing piles of books.	3.0	Number.
122	Number of free standing equipment	3.0	Number.

TABLE 11 ROOM PARAMETERS (BOUNDING-SURFACE AND ROOM-COMPOSITE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 11 OF 11

Sequence Number	Description	F-Format	Codes and Units
123	% of total live weight within 2 ft of the walls	6.2	% of total room live weight including internal partitions.
124	sd % of total live weight within 2 ft of the walls	5.2	%
125	Heaviest item in room	6.2	lb
126	% of wall area that is either window or door	6.2	%
127	Flag for specifying how room was selected	2.0	0.0 - randomly selected 1.0 - non-randomly selected 2.0 - selected on room use basis 3.0 - selected on room area basis 4.0 - selected for horizontal correlation 5.0 - selected for vertical correlation 6.0 - selected for tail sample
128	Room opening factor $(A\sqrt{H}/A_T)$. Set to -1.0 if room does not have 4 full height walls.	6.2 6.4	Number (A = total window area; H = average window height; A_T = total surface area of room, including ceiling, floor, walls, doors windows).
129	Internal room partition live weight	8.2	lb
130	sd internal room partition live weight	8.2	lb
131	Total room fire weight-underated	8.2	lb
132	sd total room fire weight-underated	8.2	lb

TABLE 12 ROOM-CONTENTS (FURNITURE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 1 OF 5

Sequence Number	Description	F-Format*	Codes and Units
1	Index number	2.0	Desk = 2.0, table = 3.0, cabinet = 4.0, shelf = 5.0, chair = 6.0, miscellaneous = 7.0.
2	Type	2.0	Desk: single pedestal = 1.0, double pedestal = 2.0, with legs = 3.0.
			Table: single pedestal = 1.0, with legs = 2.0.
			Cabinet: filing = 1.0, file safe = 2.0, blueprint = 3.0, card file = 4.0, general purpose = 5.0.
			Seating: pedestal = 1.0, legs = 2.0, upholstered = 3.0, sofa = 4.0, bench = 5.0, drafting stool = 6.0, classroom chair = 7.0.
			Shelving: bookcase = 1.0, free shelving = 2.0.
			Miscellaneous: -0.0-
3	Material/number of chairs	2.0	Desk: wood = 1.0, metal = 2.0, plastic = 3.0.
			Table: material of top, same as desk
			Cabinet: same as desk

*The output will be written on a magnetic tape in an unformatted binary form.

TABLE 12 ROOM-CONTENTS (FURNITURE): OUTPUT OF DATA RESTRUCTURING PROGRAM

Page 2 of 5

Sequence Number	Description	F-Format	Codes and Units
			Shelf: same as desk.
			Chair: number of chairs of same type.
			Miscellaneous: combustible = 1.0, non-combustible = 0.0.
			Other: -0.0-
4	Proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
5	Total live weight (including contents)	8.2	lb
6	sd* total live weight	8.2	lb, zero for miscellaneous items.
7	Total fire weight (including contents)**	8.2	lb } no derating factor applied here
8	sd total fire weight	8.2	lb
9	Projected floor area	8.2	ft^2
10	Total floor loading	8.2	psf
11	sd total floor loading	8.2	psf
12	Material	2.0	Chair frame Table top } wood = 1.0, metal = 2.0, plastic = 3.0, zero for all others.
13	Material	2.0	Chair seat Table legs
14	Material	2.0	Chair back

*sd means standard deviation.

**All fire weights are in equivalent pounds of cellulose (8000 BTU/lb).

TABLE 12 ROOM-CONTENTS (FURNITURE): OUTPUT OF
DATA RESTRUCTURING PROGRAM

PAGE 3 OF 5

Sequence Number	Description	F-Format	Codes and Units
15	Surface area of books and papers	8.2	ft^2
16	sd surface area of books and papers	8.2	ft^2, zero for all
17	Enclosed paper live weight	8.2	lb } zero for shelves and seating.
18	sd enclosed paper live weight	8.2	lb
19	Enclosed paper fire weight (not derated)	8.2	lb } zero for shelves and seating.
20	sd enclosed paper fire weight	8.2	lb
21	Enclosed books live weight	8.2	lb
22	sd enclosed books live weight	8.2	lb
23	Enclosed books fire weight (not derated)	8.2	lb
24	sd enclosed books fire weight	8.2	lb
25	Free paper live weight	8.2	lb
26	sd free paper live weight	8.2	lb
27	Free paper fire weight	8.2	lb
28	sd free paper fire weight	8.2	lb
29	Free books live weight	8.2	lb
30	sd free books live weight	8.2	lb

TABLE 12 ROOM-CONTENTS (FURNTIURE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 4 OF 5

Sequence Number	Description	F-Format	Codes and Units
31	Free books fire weight	8.2	lb
32	sd free books fire weight	8.2	lb
33	Enclosed office equipment* live weight	8.2	lb } zero for shelves and seating.
34	sd enclosed office equipment live weight	8.2	lb
35	Enclosed office equipment fire weight (not derated)	8.2	lb } zero for shelves and seating.
36	sd enclosed office equipment fire weight	8.2	lb
37	Free office equipment live weight	8.2	lb
38	sd free office equipment live weight	8.2	lb
39	Free office equipment fire weight	8.2	lb
40	sd free office equipment fire weight	8.2	lb
41	% compaction of free books	5.2	%, weighted average of all free book piles.
42	% compaction of free paper	5.2	%, weighted average of all free paper piles.
43	% compaction of enclosed books	5.2	%, weighted average of all free book piles. } zero for shelves an seating.
44	% compaction of enclosed paper	5.2	%, weighted average of all free paper piles

---

*Equipment means typewriters, calculators, and telephones.

TABLE 12 ROOM-CONTENTS (FURNITURE): OUTPUT OF DATA RESTRUCTURING PROGRAM

PAGE 5 OF 5

Sequence Number	Description	F-Format	Codes and Units
45	Total enclosed fire weight	8.2	lb
46	sd total enclosed fire weight	8.2	lb
47	Total free fire weight	8.2	lb
48	sd total free fire weight	8.2	lb
49	Flag for specifying how empty weight was computed	2.0	0.0 - standard transfer function, 1.0 - transfer function wherein the weight was estimated without available data for the subject material, type, or size group 2.0 - weight set to zero because (a) size too small; (b) indices incorrect, (c) made of plastic
50	Total fire weight (derated)	8.2	lb
51	sd total fire weight (derated)	8.2	lb

TABLE 13 ROOM CONTENTS (STAND-ALONE EQUIPMENT AND PILES): OUTPUT OF DATA RESTRUCTURING PROGRAM

Sequence Number	Description	F-Format	Codes and Units
1	Index number	2.0	9.0
2	Type	2.0	Paper pile = 1.0, book pile = 2.0, typewriter = 3.0, calculator = 4.0, telephone = 5.0.
3	Proximity to wall	2.0	Within 2 ft = 1.0, outside 2 ft = 2.0.
4	Number of telephones	2.0	Number of telephones of this type, zero for all other.
5	Live weight	6.2	lb
6	sd* live weight	6.2	lb
7	Fire weight	6.2	lb**
8	sd fire weight	6.2	lb
9	Projected floor area	8.2	ft^2
10	Total floor loading	8.2	psf
11	sd total floor loading	8.2	psf

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* sd = standard deviation

**All fire weights are equivalent pounds of cellulose (8000 BTU/lb).

RMCONT is called from DRIVE to check and produce output for the furniture and miscellaneous freestanding items in a room (from data collected on Forms 1-7, A-C). The RMCONT subroutine produces a total picture of the room contents, not only the furniture size and weight, but also a description of all the contents (the output produced is listed in Table 12).

FSEAP is called from either FORMA or FORMB for the checking and production of data describing freestanding piles of books or paper, or freestanding equipment (the output produced is listed in Table 13).

BONCOM is called at the end of the room analysis to compute and check the room totals and to produce the data to describe the room itself (the output of this subroutine is listed in Table 11).

DATA just provides transfer function data to the other subroutines. A generalized flow chart describing program operation is shown in Figure 14.

When the output described in Tables 11, 12, and 13 is written on a FASTRAND file or on tape, two records are generated for each room. The first is a ten-word record with each word equal to NBUF, the number of words in the output record. The second record is the processed data. It is NBUF words long. When the output is being written on a magnetic tape, up to approximately 3,200,000 words will be written on one reel. If the capacity of one reel is exceeded, the program will write a ten integer word record of all 999999's at the end of the filled reel. If the room has terminated abnormally, the tenth word of the ten word record is set to zero (see Table 7 of Appendix B.4 for additional details).

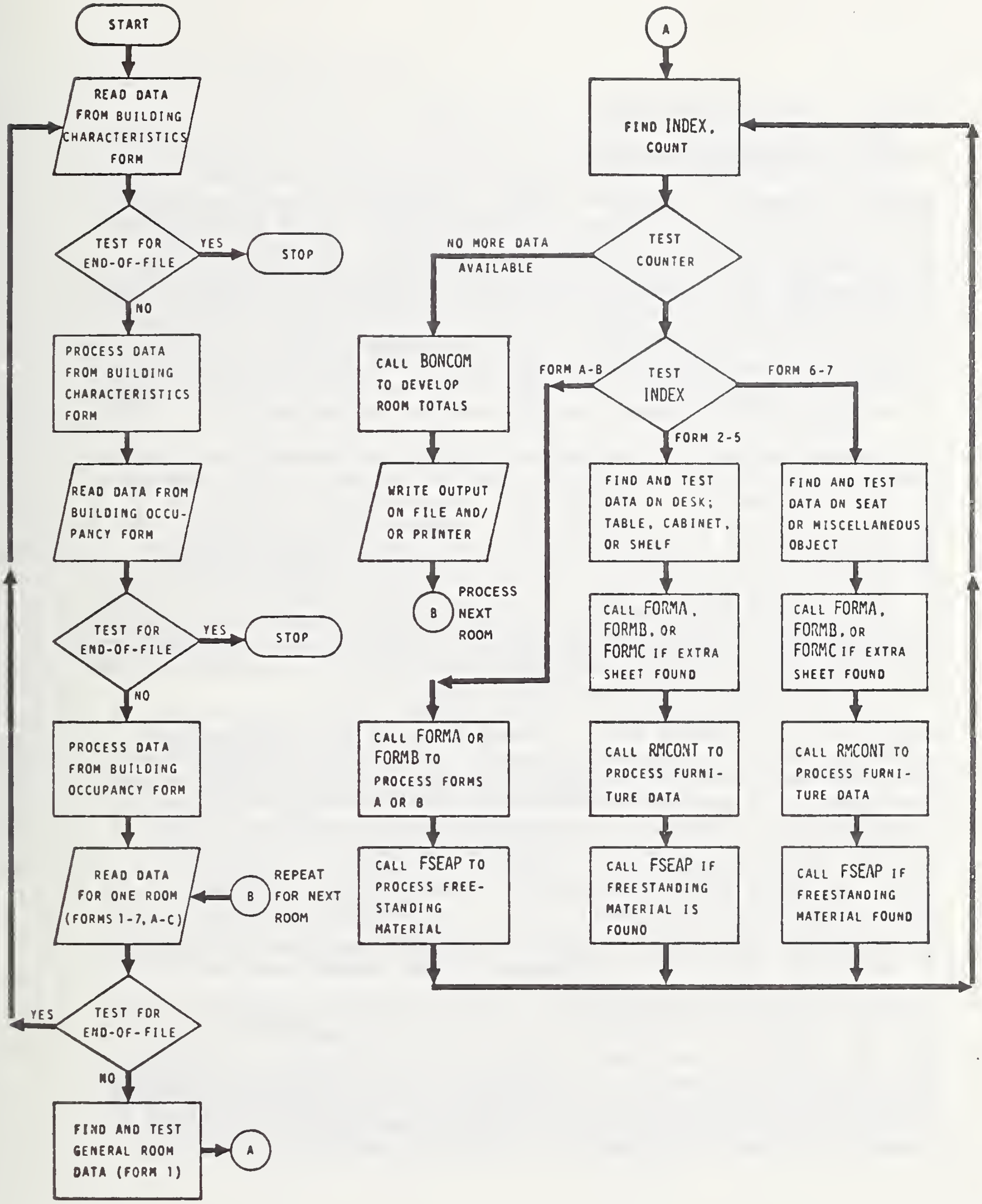

Figure 14 General Flow Chart for Program MAKER

4.2.2 Operating Techniques

4.2.2.1 Program Capabilities

MAKER is designed to read the room data in the order in which the forms for data collection are completed. DRIVE determines which data-collection form is being processed and proceeds to either call subroutines FORMA, FORMB or FORMC, or (for data from forms 1 through 7) to process the raw data in DRIVE. DRIVE makes sure that the raw data values are consistent with the data collection forms. If any discrepancies are found, an error message is printed. Appendix B.4 lists the messages that are printed along with the conditions which activate them. The occurrence of some errors causes termination of the analysis of this room and requires going on to another. FORMA, FORMB, and FORMC perform similar tests.

DRIVE has two methods for data output: (1) writing the output in an unformatted binary form on a magnetic tape (this option is for minimum output time using the Univac 1108 Fortran V library function NTRAN), or (2) printing the output in a formatted form. Method 2 can be used to check the output, because it does not disturb the output produced by method 1. DRIVE also has an option for the use of the location of room contents in the room. As the survey stands, it is only determined whether or not some portion of the item is within two feet of the well. Exercising this option would make other room location procedures possible, but more programming would be necessary at that time. (Both the options discussed above and the means for exercising them are defined in Appendix B.4.)

RMCONT, FSEAP, and BONCOM perform similar tests to DRIVE, FORMA, FORMB, and FORMC, but these tests usually require a preconceived notion of what data values make sense when different data values are considered together. Even though it is possible to have certain values filled in on the data collection forms, the data may be meaningless when considered in light of other values. For example, consider a) the number of buttons on a telephone and b) whether or not it is a call director. Obviously, a phone with zero buttons cannot be a call director, but the data collection forms allow such an inconsistency. This type of error is checked for by RMCONT, FSEAP, and BONCOM. In addition, checks are made to insure that the subscripts used to access data in a transfer function are meaningful.

Messages are also printed whenever a derived value is improbable or notable even though the input data is consistent. An example of this would be a file room which has been recorded as having more than 11 occupants. Certainly a file room would not be expected to have a high occupancy rate. These tests are made so that such occurrences will be noted and follow-up checks for validity may be made if desired. Many other values are checked in this way. The mnemonics tables in Appendix B.4 have details on the form of these checks*.

In addition to checking for abnormalities in the raw and processed data, program MAKER also checks for the use of non-standard transfer function values. These occur when the program must use a transfer function for a size category for which no data was found. Additional data on the transfer functions is given in Section 4.2.2.4.

In order for subroutines RMCONT, FSEAP, and BONCOM to function, they must be supplied with data by the DRIVE, FORMA, FORMB, and FORMC routines. RMCONT, FSEAP, and BONCOM are intermediate data processors and operate only from call statements in the other subroutines. Thus, DRIVE, in coordination with FORMA, FORMB, and FORMC reads the raw data, makes elementary consistency checks, and produces input for RMCONT, FSEAP, and BONCOM. These routines then process the data using transfer functions to calculate the desired load data. DRIVE then writes the complete data set for the room just processed, according to the method selected by the user, and proceeds to the next room.

4.2.2.2 Statistical Techniques

4.2.2.2.1 Percentages

Several of the derived parameters produced by program MAKER involve a percentage and the standard deviation of that percentage. Specifically, the following items (from Table 4 of Appendix B.4) are of this nature:

92, 93 Percentage (and standard deviation) of fire weight enclosed in metal containers (derated)

96, 97 Percentage (and standard deviation) of movable fire weight enclosed within two feet of the walls (derated)

98, 99 Percentage (and standard deviation) of movable fire weight within two feet of the walls (derated)

100,101 Percentage (and standard deviation) of total fire weight enclosed (derated)

102,103 Percentage (and standard deviation) of total fire weight that is paper (except books)(derated)

104,105 Percentage (and standard deviation) of total fire weight that is books (derated)

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* In FSEAP limit mnemonics are: FREEL(1)
In BONCOM limit mnemonics are: LMT(19)
In RMCONT limit mnemonics are: CABL(3), DESRL(5), EWCLL, ENWL, FREEL, FWTL, MWTLT, SHELFL(2), TABLEL(2)

106,107	Percentage (and standard deviation) of total fire weight that is enclosed in plastic (derated)
123,124	Percentage (and standard deviation) of total live weight within two feet of the walls

All of these items have two important characteristics in common: they involve a ratio wherein both numerator and denominator are random variables and wherein the value of the numerator is formed from a subset of the denominator. Consequently a similar approach can be used for all of the calculations.

If the desired ratio is defined as

$$z = \frac{u}{x}$$

and x is defined as

$$x = u + v$$

where u and v are independent random variables, a straight forward, albeit approximate, approach can be developed to calculate

$\bar{z}$ (the expected value of the ratio)

and

σ_z (the standard deviation of the ratio).

In general both u and v are the sum of a number of independent random variables, each of which is <u>only</u> described by its mean and standard deviation. For example, when x is the total fire weight, it is the sum of the fire weight of each paper pile, each book pile, and each piece of furniture and equipment in the room. With one exception *, all of these individual items have been assumed to be independent. Consequently, the collection of items which make up u is independent of the collection of items which make up v. Consequently

$$E[x] \equiv \bar{x} = \bar{u} + \bar{v} \tag{1}$$

$$E[(x-x)^2] \equiv \sigma_x^2 = \sigma_u^2 + \sigma_v^2 \tag{2}$$

The corresponding equations used in program MAKER to calculate $\bar{z}$ and σ_z were derived as follows:

$$z = \frac{u}{x} = \frac{u}{u+v} = \frac{1}{1+y} \tag{3}$$

---

*See Section 4.2.2.2.3

where $\quad y = v/u$ (4)

Use the first-order approximation technique based on the Taylor series expansion (page 180 of Reference 4 or Section 2.3 of Reference 5):

$$E[F(x,y)] \doteq F(\bar{x},\bar{y}) \tag{5}$$

$$\mathrm{Var}[F(x,y)] \doteq \left[\frac{\partial F}{\partial x}\right]^2_{\mathrm{mean}} \sigma_x{}^2 + \left[\frac{\partial F}{\partial y}\right]^2_{\mathrm{mean}} \sigma_y{}^2 + 2\left[\frac{\partial F}{\partial x}\right]\left[\frac{\partial F}{\partial y}\right]_{\mathrm{mean}} \sigma_{xy} \tag{6}$$

Using equation 5, the average of y is given by

$$\bar{y} \doteq \bar{v}/\bar{u} \tag{7}$$

where $\quad \bar{v}$ = average value of v $[v > 0]$

$\bar{u}$ = average value of u $[u > 0]$

and the variance of y is given by equation 6

$$\sigma_y{}^2 \doteq \left(\frac{\bar{v}}{\bar{u}}\right)^2\left(\frac{\sigma_v{}^2}{\bar{v}^2} + \frac{\sigma_u{}^2}{\bar{u}^2}\right) \qquad [\sigma_v << \bar{v}] \tag{8}$$

where $\sigma_{uv} = 0$ because u and v are uncorrelated

Next equations 5 and 6 are applied to z

$$\bar{z} \doteq \frac{1}{(1+\bar{y})} = \frac{\bar{u}}{\bar{u}+\bar{v}} \tag{9}$$

$$\sigma_z{}^2 \doteq \left(\frac{1}{(1+\bar{y})^4}\right)\sigma_y{}^2 = \left(\frac{\bar{u}}{\bar{u}+\bar{v}}\right)^4\left(\frac{\bar{v}}{\bar{u}}\right)^2\left(\frac{\sigma_v{}^2}{\bar{v}^2} + \frac{\sigma_u{}^2}{\bar{u}^2}\right)$$

$$\sigma_z{}^2 \doteq \left(\frac{1}{\bar{u}+\bar{v}}\right)^4\left(\bar{u}^2\ \sigma_v{}^2 + \bar{v}^2\sigma_u{}^2\right) \tag{10}$$

The above formulation cannot be applied to two of the derived percentages because they involve quantities which are related to each other by multiplicative constants. These are items 112 and 113 from Table

112,113 Total room fire weight (and standard deviation) as a percentage of the total room live weight

Using an approach analogous to the one just discussed, the mean and variance of this ratio can also be approximated as follows:

$$z = v/u \tag{11}$$

where u = total live weight
v = total fire weight

$$u = \sum_{i=1}^{n} u_i \tag{12}$$

$$v = \sum_{i=1}^{n} c_i u_i \tag{13}$$

where u_i = weight of item i
c_i = fire weight conversion factor for item i

The u_i are statistically independent but u and v are <u>not</u> independent. First equations 5 and 6 are rewritten to accommodate an indefinite number of variables:

$$\text{I.a)}\quad E[F(x_i)] \doteq F(\bar{x}_i)$$

$$\text{II.b)}\quad \mathrm{Var}[F(x_i)] \doteq \sum_i \left[\left.\frac{\partial F}{\partial x_i}\right|_{\text{mean}} \right]^2 \sigma_i^{\,2}$$

for x_i independent

Thus

$$\bar{z} \doteq \bar{v}/\bar{u} \tag{14}$$

$$\sigma_z^{\,2} \doteq \sum_i (1/\bar{u})^2 (c_i - \bar{v}/\bar{u})^2 \, \sigma_i^{\,2}$$

$$\doteq (1/\bar{u}^{\,2}) \sum_i c_i^{\,2} \sigma_i^{\,2} - (2\bar{v}/\bar{u}^{\,3}) \sum_i c_i \sigma_i^{\,2} + (\bar{v}^{\,2}/\bar{u}^{\,4}) \sum_i \sigma_i^{\,2} \tag{15}$$

4.2.2.2.2 Book and Paper Pile Weights

Errors in the book and paper pile weights involve three considerations: random variations in the basic weight conversion factor (P_k, σ_p), inexactness in the recorded pile height (h), and inexactness in the recorded pile compaction factor (c). P_k and σ_p are defined in Reference 1. The inexactness in h and c are due to judgmental errors on the part of the surveyors and the approximations inherent in the data collection forms which only allow h to be recorded to within ±.5 in. and c to be recorded to within ±10 percent.

The weight of a pile of books or papers is given by

$$W_p = P_k hc \tag{16}$$

where W_p = total weight of pile - lb

P_k = weight conversion factor for appropriate size group (k) - lb/in

h = pile height - in

c = percent of compaction

The variance in h can be approximated as follows: the data collection forms allow recording the height to within ±0.5 inches. Consequently, we can assume a uniform probability distribution over this range and zero probability outside of this range. Under this assumption the variance is (Reference 6)

$$\sigma_h = \frac{(h+.5) - (h-.5)}{3.5} = .2857 \text{ in} \tag{17}$$

An analogous argument also can be used to obtain an estimate of the variance in c because here the data collection forms only allow recording the height to within 5 percent. Consequently

$$\sigma_c = \frac{(c+.05) - (c-.05)}{3.5} = .02857 \tag{18}$$

This is not quite exact, because when c is 100 percent, $\sigma_c^2 = \frac{.05}{3.5} = .0143$. The analysis procedure did not include this reduced value for 100 percent compact piles. Consequently, slightly conservative values will be obtained for σ_w.

$\bar{P}_k$ and σ_p^2 (from Reference 1) together with $\bar{c}$ and σ_c^2 (equation 17) and $\bar{h}$ and σ_h^2 (equation 18) are used to calculate the expected pile weight $\bar{w}$ and its variance σ_w^2. P_k, h, and c are assumed to be independent random variables.

$$\begin{aligned}\bar{w} &= E[w] = E[P_k h\ c]\\ &= \bar{P}_k \bar{h}\ \bar{c} \end{aligned} \tag{19}$$

$$\begin{aligned}\sigma_w^2 &= E[(w-\bar{w})^2] = E[w^2] - \bar{w}^2\\ &= E[P_k^2]\ E[h^2]\ E[c^2] - \bar{P}_k^2 \bar{h}^2 \bar{c}^2\\ &= (\bar{P}_k^2 + \sigma_p^2)(\bar{h}^2 + \sigma_h^2)(\bar{c}^2 + \sigma_c^2) - \bar{P}_k^2 \bar{h}^2 \bar{c}^2\\ &= \bar{h}^2 \bar{c}^2 \sigma_p^2 + (\sigma_h^2 \bar{c}^2 + \sigma_c^2 \bar{h}^2 + \sigma_h^2 \sigma_c^2)(\bar{P}_k^2 + \sigma_p^2)\end{aligned} \tag{20}$$

where $\bar{w}$ = mean total pile weight - lb

σ_w^2 = variance of pile weight - lb^2

$\bar{P}_k$ = mean weight conversion factor - lb/in

σ_p^2 = variance of conversion factor - $(lb/in)^2$

$\bar{h}$ = recorded height - in

σ_h^2 = variance of pile height - in^2 = .08163

$\bar{c}$ = mean recorded compaction factor

σ_c^2 = variance of compaction factor = .0008163

The relative magnitudes of σ_p, σ_h, and σ_c used in this study are such that the height uncertainty (σ_h) and the compaction uncertainty (σ_c) contribute very little to the overall uncertainty in the pile weight for all but the very smallest piles. For example, consider the 8-1/2 x 11 inch size group (height = 12 in, compaction factor = 1.0):

σ_w = 10.23% including σ_p, σ_h, and σ_c effects
σ_w = 9.82% including σ_p and σ_h effects
σ_w = 9.52% including only σ_p effect

Another contributor to uncertainty in the pile weight is the irregularity in the top of the pile. This will, however, contribute even less to the total variance than the uncertainty in compaction or height. Consequently, this effect has been neglected.

4.2.2.2.3 Accumulated Variances

In general all of the items in the room are assumed to be uncorrelated. This being the case, the accumulated variance is just the sum of the individual variances

$$\sigma^2 = \sum_i \sigma_i^2 \tag{21}$$

There are a few notable exceptions to this general rule. All involve multiple items which are likely to be very similar:

- Multiple desk drawers of the same type (box,file, or personal) in the same desk
- Multiple cabinet drawers in the same cabinet
- Multiple shelves in the same set of shelving
- Multiple chairs of the same type, material, and characteristics

Even though there may be a large variation in, for example, the weight of box drawers in wood, single-pedestal desks considering all manufacturers and all models, one can expect that in any specific desk all of the box drawers will be very close in weight. This is so because in any specific desk, all box drawers will be from the same manufacturer and will probably have been manufactured at about the same time. Consequently, all of this type of drawer in the subject desk can be assumed to have the same weight. A similar assumption has been made for all of the above items including all chairs of the same type found within the same room.

Consequently, in the cases listed above, the individual items were assumed to be perfectly correlated. Then the variance of the sum is given by:

$$\sigma_T^2 = (n\sigma)^2 \tag{22}$$

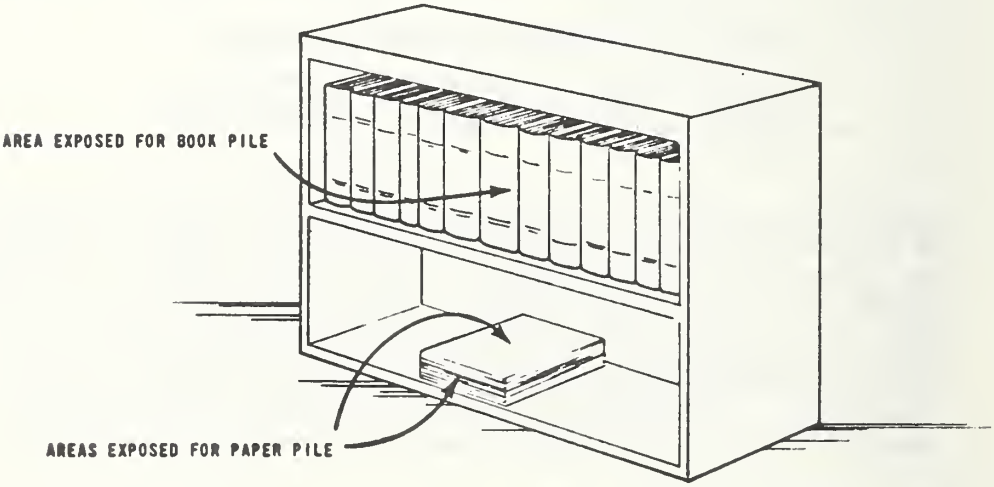
where n = total number of identical items

σ^2 = variance of the individual item.

4.2.2.3 Computational Techniques

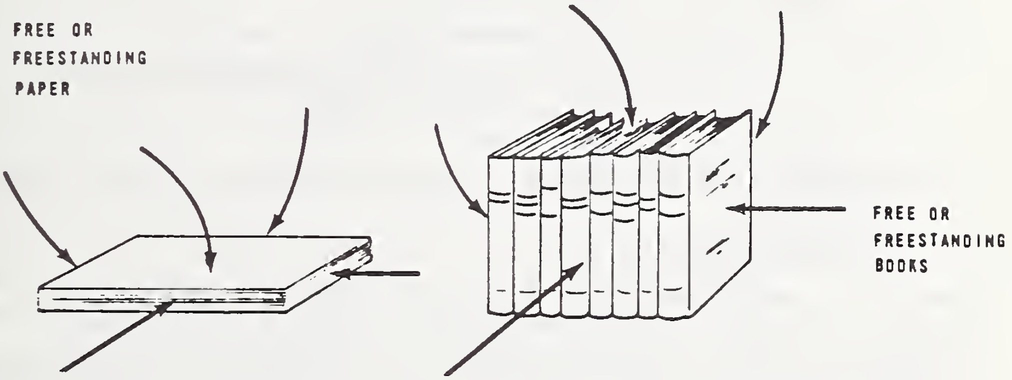
In computing the projected floor area of a freestanding paper pile, the dimensions of the paper size are used with the assumption that paper would be piled on its surface. However, when the floor-area of a freestanding book pile is computed, it was assumed that books would be standing on their shortest edge so that the projected floor area is the shortest edge dimension multiplied times the 'length' of the book pile.

To compute the exposed area of books and papers in a bookcase, it is assumed that one surface of the bookcase is open. Thus, only one side of the book piles in the bookcase is exposed, while the top and one side of the paper piles enclosed are exposed as shown below:



In the case of free shelving, the ends of the book pile and the sides of the paper pile are included in the exposed area of books and papers.

The exposed surface area of a free or freestanding paper pile is computed as the sum of the four sides plus one surface. The exposed surface area of a free or freestanding book pile is the sum of the ends, the front, the back, and the top as shown below:



To compute the total door area of a room, the average door area of the doors in one wall is multiplied times the number of doors in that wall. These values are then summed over each wall in the room. The total window area is computed in the same manner.

To compute the fire weights of the bounding surfaces, it is necessary to find the wall area of each wall and to determine the trim lengths. The wall area is computed by assuming that the length dimension gives the size of walls 2 and 4 and the width dimension gives the size of walls 1 and 3. The wall area listed in the results does not include the effect of door and window cut outs.

The trim lengths are determined from the total perimeters of the doors, windows, the floor, and the ceiling. Ceiling trim length is assumed to be the same as the room perimeter, but floor trim length is computed by subtracting the total door widths from the room perimeter. The window and door trim lengths are computed by adding up the average perimeter of the door and window in each wall times the number of doors and windows in each wall.

The bounding surface fireweight is the fire weight of the ceiling material, ceiling trim, floor material, floor trim, full and partial wall material*, full-wall covering, door material, door trim, window trim, and internal-partition surfaces.

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*The material types for internal partitions and partial height walls will be the same as for wall materials, except for fabric which is assumed to have the same fire load per square foot as drapes.

The opening factor is a parameter of significance in determining the rate of fuel consumption during a fire. It has been calculated here according to the definition given on page 11 of Reference 7.

$$\text{Opening Factor} = \frac{A\sqrt{H}}{A_T}$$

where A = total window area

H = average window height

A_T = total room surface area including the ceiling, floor, doors, and windows

This parameter is only calculated if the room has four full height walls.

4.2.2.4 Transfer Functions

None of the weight data, either live or fire weight, produced by this study is the result of direct measurement. Instead, an inventorying technique was employed wherein various visual characteristics of the items were recorded. Transfer functions were developed to convert this data into weight for commonly occurring items: paper, books, desks, tables, seating, shelving, cabinets, telephones, typewriters, calculators, and partitions. These transfer functions and the data upon which they were based are described in Chapter 3 of Reference 1. For less common items, a weight estimation was made by the surveyors.

These transfer functions, which provide both a weight mean and standard deviation, are coded in subroutines RMCONT and FSEAP. The data (Tables 8 to 14 of Reference 1) is provided by subroutine DATA. For some categories (for example, metal double pedestal desks 7 to 9.5 ft square in area) no data was found. To allow for the observance of such an item, weight data was generated by extrapolation/interpolation from existing data. This was done for all of the missing categories except plastic items. The weights for these were set to zero. Certain combinations of transfer function indicies should never be accessed but are required to complete the matrix. These values have been set to -999. Any time one of the -999., estimated, or zero weights is used, the program writes a message on the printer. The RMCONT output No. 49 also reflects the occurrence of a zero used for the empty weight of a room content.

Before the room survey data could be converted to weights, the missing data of Tables 8 to 14 of Reference 1 had to be completed. Although most of the missing categories were not expected to be found, provisions had to be made to provide weights for any that were observed. This was done by interpolation or extrapolation from existing data. These interpolations were based on data from similar furniture, but the exact procedure depended on what data was available.

For example, if there was no weight for a wooden file cabinet of a certain area and height, the following procedure would have been followed: First, the adjacent height and area categories would be checked. If data was available here, the missing category would be obtained using linear interpolation. If this was not possible, the next technique attempted would be to scale the missing value from existing data for other area and height categories of wooden file cabinets. If there was still no available data, then the weight of a metal file cabinet in the same size category would be scaled. The scale factor used here would be based on the average difference between metal and wood cabinets. Previously estimated values were never used for these calculations.

The standard deviations used with the extrapolated weights are based on the largest percentage standard deviation among the existing data for the general category under consideration. In the above example, the largest percentage standard deviation among all wood file cabinets would be used to determine the standard deviation for the extrapolated weight.

A complete tabulation of the transfer function data is given in the program listing of the DATA subroutine. All the extrapolated and interpolated values are shown as negative weights. Whenever program MAKER uses one of these negative values, it first writes a diagnostic message to indicate that an extrapolated value is being used and then makes the weight positive. In addition, each time an extrapolated or interpolated value is used, Y(NBUF+49) is set to 1.0 (see Table 12).

4.2.3 Operating Logic

The data for each building must be written on a separate file. Each file consists of the data from the Building Characteristics Data form, followed by the data for each surveyed room within that building. The data for a particular room may be in any sequence except that the data from Form 1 must be first. The data for an individual room are assumed to be contained within one record. The data from each form must be in the sequence specified on the form.

Whenever DRIVE encounters an end-of-file mark on the input tape, it assumes that that building has been completed. It then tries to read data for another Building Characteristic Data form. Whenever two end-of-file marks are encountered in succession, DRIVE assumes that the end of the magnetic tape reel has been reached. It then writes an end-of-tape message and looks for another reel if a multiple reel file is being processed.

4.2.3.1 DRIVE Operating Logic

The program DRIVE is the main program of MAKER. DRIVE reads the raw data from cards (NAMELIST input), or tape/FASTRAND files. The tape or FASTRAND files are written in unformatted binary form using the UNIVAC 1108 Fortran V library routine NTRAN. The input for one room is placed in a buffer. DRIVE then determines which data collection form provided the data in each successive part of the buffer. If Form 1 was used, the data contained on this form, used in the program output, are placed in the vectors that describe the room characteristics (BUILD, DOOR, NR, PART1, PART2, ROOM, WALL) and are used later as input to BONCOM subroutine.

As these vectors are being filled, checks of the consistency of the data are made to be sure that the form of the raw data is proper. If small errors are discovered, the room will be analyzed, leaving these data blank. If more severe problems arise, the room may be skipped and another room read into the buffer. If the problems are with reading the tape or file, the whole program will be aborted. Table 5 of Appendix B.4 gives these messages.

If the data encountered are from data collection Forms 2-7, the information needed to provide the output data about that room content will be placed in the vectors to be used by subroutine RMCONT. These are CABNG, CALC, DESKG, ENCL, FREE, ITEM, MISC, MPILE, NCALC, NITEM, NPILE, NMISC, NTELE, NTYPE, SEATG, SHELG, TABLG, TELE, TYPE. After the data have been placed in these vectors, checks are performed as described for the data from Form 1. A detailed description of the messages that are printed and the conditions under which they are used can be found in Appendix B.4. Subroutine RMCONT is called and the output data for that particular piece of furniture or miscellaneous object are put into the Y vector.

If the buffer data are from Form A, B, or C, then subroutines FORMA, FORMB, or FORMC are called, respectively. They perform the functions that DRIVE does on Forms 1 to 7. If the data on Form A or B are for freestanding objects, then the subroutine FSEAP is called from either subroutine FORMA or FORMB, and output data are put into the Y vector (i.e., output buffer).

After the data buffer has been completely analyzed, DRIVE calls subroutine BONCOM which computes all the room characteristic data and the room totals that summarize the contents of the room.

When all the output has been developed and readied in the Y output vector for one room, depending on the writing alternatives used, either the library subroutine NTRAN is again called to write the output in unformatted binary, or the output is printed in a formatted form. The next room is then read from the data tape. When the end of an output tape is reached, a message is printed. If any problems arise, the run is aborted, but barring this occurrence, all of the rooms surveyed will be analyzed sequentially.

4.2.3.2 FORMA Operating Logic

FORMA subroutine is called from the DRIVE program when data from a Form A data collection sheet are found in the data buffer. The Form A data collection sheet is used either for additional paper or book piles on a particular piece of room content, or for book and paper piles that are not associated with any other room content. These are called freestanding piles and are assumed to be sitting directly on the floor. The output information desired in this case is different from that required when the pile is associated with a piece of furniture. The FORMA subroutine determines the piles' position. If it is data for a freestanding pile, the FSEAP subroutine is called. This subroutine computes weights for freestanding equipment and piles (the input data to FSEAP from FORMA are FREE, MPILE, NPILE) If the use of Form A is for paper or book piles on a piece of furniture, control is returned to DRIVE. DRIVE then calls RMCONT to restructure and produce all the output required for that piece of furniture. Like the DRIVE program, FORMA also contains numerous consistancy checks on the data.

4.2.3.3 FORMB Operating Logic

FORMB is very similar to FORMA except this subroutine deals with the data on the Form B collection sheet used for equipment, either freestanding or associated with a piece of furniture. Again, if the equipment is freestanding, FORMB calls subroutine FSEAP to provide the output required for a freestanding piece of equipment. The data which FORMB supplies are: CALC, NCALL, NTELE, NTYPE, TELE, TYPE. If the equipment is on a piece of furniture, control returns to DRIVE directly. The RMCONT subroutine then adds the equipment data into the furniture output (i.e, puts it into the Y vector).

4.2.3.4 FORMC Operating Logic

FORMC is used for data obtained from a Form C data collection sheet. These are designed for miscellaneous items. These items can not be freestanding; Form 7 is used for miscellaneous freestanding items. These are miscellaneous items present on or in a piece of furniture. Values are supplied for MISC and NMISC. After the data on the Form C have been restructured, they are used as input to RMCONT when a piece of furniture is being assessed. Consistency tests and messages are also used in FORMC.

4.2.3.5 RMCONT Operating Logic

The subroutine RMCONT is called from the DRIVE program when data from data collection Forms 2 to 7 are found. These data sheets are used to describe furniture and the furniture's contents.

Data for both the furniture and equipment transfer functions are in the first section of RMCONT.

The second section of RMCONT is designed to determine which type of furniture is present and to direct the control to the portion of the program designed to determine the weights and other required output. The empty furniture weights are determined with the transfer functions. They are checked to see if they are within the limits expected. Checks are also made to see if the data supplied are reasonable. Reference 1 and Appendix B.4 list the transfer functions used in the computation of the weights along with the definitions of the size and type categories. If in checking the transfer function it is found to be an estimation and not part of the data provided in Reference 1, a message will be written to this effect and an entry of 1.0 will be put in Y (NBUF + 49). Thus, in using SEEKER, these data so calculated may be determined.

Once the empty weight of the furniture has been computed, the weight of the contents is assessed in the third section of RMCONT using the equipment and pile transfer functions. The values of these weights and the data for the transfer functions are checked. If appropriate, a message is printed.

The last part of RMCONT is used to increment the room totals used later by BONCOM. The total floor loading of the furniture is computed and checked. As the output for RMCONT has been computed, it is put into the Y vector. The value for NBUF, the location along the Y vector at which this piece of room content data is written, is given by the amount of data already processed. Thus, after RMCONT is completed, 52 is added to NBUF to establish the starting point for the next set of output data. The output of RMCONT is given in Table 12.

4.2.3.6 FSEAP Operating Logic

FSEAP is called from FORMA or FORMB to generate the room contents data for output and to add to the room totals used by BONCOM.

FSEAP is set up similarly to RMCONT except that it applies only to equipment, paper piles, and book piles. The transfer functions and the checks are the same as in RMCONT. As in ROMCONT, the value for NBUF (the location along the Y vector where this piece of room content data is written) is increased to establish the starting point for the next computation.

4.2.3.7 BONCOM Operating Logic

BONCOM is called by DRIVE when the end of the room data is reached. The first part of BONCOM is data for the bounding-surface fire weights and the internal-partition live weight. The second part of the subroutine is the computations of the bounding-surface fire weights and the descriptions of the room. These are checked for consistency and for extrema. The elements of vector LMT are the limits used to check on the presence of extreme values.

In the last section of BONCOM, the totals that had been added each time RMCONT and FSEAP had been called are changed to the percentages desired as output. When both the numerator and the denominator of these calculations have standard deviations associated with them, a special function described in the Statistical Techniques section is used. A complete list of this output is available in Table 11. Even though BONCOM is called at the end of the analysis of a room, the output data from BONCOM are placed at the beginning of the output for the room and each room total has a constant location in the Y vector.

The third section of BONCOM computes the derated fire weights for the room.

4.3 Data Retrieval and Display (Programs SEEKER and HISTOG)

4.3.1 Introduction

Program SEEKER is the sixth in a series of programs which have been developed to process, manipulate, retrieve, and analyze the fire and live load survey data. Its primary purpose is to retrieve the processed data generated by program MAKER. The user must provide the program with three basic pieces of information:

- The parameter to be selected,
- The parameters to be tested, and
- The limits that the tested parameters must satisfy before the selection will be made.

The parameter to be selected and the parameters to be tested are identified by means of the code numbers shown in Table 2 of Appendix B.6.

For example, suppose the user wants to know the live weight in all clerical offices that have been surveyed.

- First, he must determine the live weight code number from Table 2 (code number = 77).
- Second, he must determine the condition code number. In this case, the condition is the "room use" (code number = 19).
- Third, he must determine the range of values which the condition satisfies. In this case, the condition must be "clerical" which, according to Table 2, is represented by the number 2.0.

When the information is input to the program, the program will search the room-survey data tape and select the live weight of all clerical offices. In other words, the program will select parameter 77 in those rooms where parameter 19 has the value of 2.0.

The program will save all of the selected parameters in a mass-storage or tape file specified by the user. These values can be saved in either coded or binary form, or they need not be saved at all. In addition to selecting and saving the specified parameters, the program also automatically performs the following calculations:

- The number of items found, n
- The sum of the value of all items found. ($\Sigma^n x_i$, where x_i is the actual value of a selected item)

- The sum of the square values of all items found, $\Sigma^n x_i^2$
- The maximum value found, $x_i(\max)$
- The minimum value found, $x_i(\min)$
- The mean of all items found $\left(\Sigma^n x_i/n\right)$, and
- The standard deviation for all items found, $\left(\frac{\Sigma^n x_i^2 - \frac{(\Sigma x_i)^2}{n}}{n}\right)^{1/2}$

Additional secondary operations may also be performed (see Section 4.3.2.1).

Another important program capability is the ability to select four room parameters at one time and write them on a file, together with their building number, floor number, and room number. This capability can be used to retrieve the room live load plus standard deviation and the fire load plus standard deviation for all surveyed rooms in any specified building. This will be needed when a total building is to be characterized from a live and fire load standpoint by program BUILDER.

This section has been written with more of a user's manual flavor than the other sections of this report. This has been done because this program will have to be operated by the reader if he desires to retrieve any of the data generated and saved on magnetic tape by program MAKER.

All of the tables referenced in Section 4.3 are to be found in Appendix B.6. A general flow chart of program SEEKER is shown in Figure 15 .

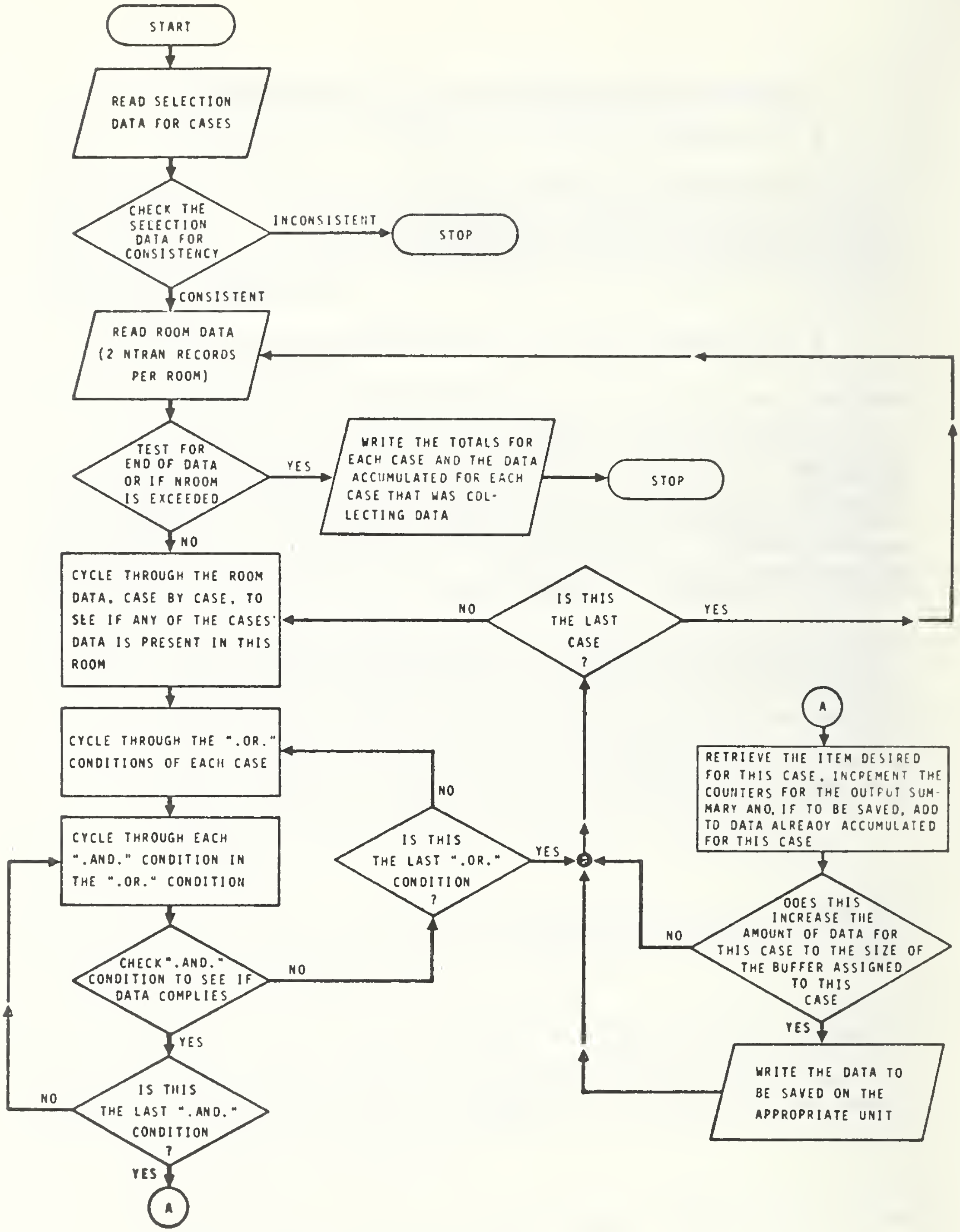

Figure 15 General Flowchart for Program SEEKER

4.3.2 Operational Techniques

4.3.2.1 Program Capability and Limitations

Program SEEKER can handle any type of selection problem. For programming purposes, however, the selection procedure is broken down into six types of problems, depending on (1) the type of parameter that is to be selected and (2) the type of condition(s) that must be satisfied.

The parameters stored on the processed-data tape which is being searched by SEEKER are of two types: room descriptors or room-content parameters.

The room descriptors consist of 132 numbers which fully describe the fire and live load characteristics of a room. These 132 values, which are described in Table 2 of Appendix B.6, have been determined by program MAKER for each and every surveyed room. Because the room descriptors exist for all rooms surveyed, regardless of the number of items in the room, they are the easiest to locate. A very simple logic is used in the program to locate room descriptors.

The room-content parameters describe the items in the room. These parameters are further divided into two categories: furniture and stand-alone non-furniture. All furniture items in a room are described on the processed-data tape with 51 parameters each. These parameters, which are also described in Table 2 of Appendix B.6, delineate the type of furniture (desk, table, cabinet, shelving, seating, or miscellaneous) plus all appropriate fire and live load data. The description of all materials in or on the furniture item is included within these 51 values. All stand-alone non-furniture items are described on the processed-data tape with 11 parameters each. Three types of items are covered by these parameters: stand-alone paper, stand-alone books, or stand-alone equipment (typewriters, calculators, telephones, or unspecified). All known fire and live load parameters are included in these 11 values.

Because the number of room-content parameters stored on the data tape for a given room depends on the number of items in the room, these parameters are more difficult to locate (see Table 7 which shows the form of the room data tape produced by MAKER). The program, therefore, has been structured according to whether the selection is a room descriptor or a room-content parameter and whether the test conditions are room descriptors, room-content parameters, or both. Consequently, the six categories of problems which SEEKER can be used for are as follows. These six categories cover all possible combinations of selection and condition parameters.

FLAG(K)* Type of parameter to be selected	TYP(K)* Type of condition to be tested	DESCRIPTION
1	1	The item to be selected is a room descriptor. All conditions to be satisfied are room descriptors.
2 or 3	1	The item to be selected is a room-content parameter. All conditions to be satisfied are room descriptors.
1	2	The item to be selected is a room descriptor. All conditions are room-content parameters.
2 or 3	2	The item to be selected is a room-content parameter. All conditions are room-content parameters. The condition parameters must apply to the same item as the selection parameter.
1	Both 1 & 2	The item to be selected is a room descriptor. The conditions are both room descriptor and room-content parameters.
2 or 3	Both 1 & 2	The item to be selected is a room-content parameter. The conditions are both room descriptors and room-content parameters.

*The mnemonics FLAG and TYP are defined in Table 4 of Appendix B.6.

Whenever a room-content parameter is a condition for a room descriptor, the first room-content array that satisfies this condition is sufficient for the room parameter to be selected. Also, whenever an ".OR." condition-set has both room descriptors and room-content parameters to be tested, the user must insure that all of the room descriptors precede all of the room-content parameters.

In addition to selecting specified parameters meeting specified conditions and performing the operations discussed in Section 4.3.1, the user has some additional options available to him. He may choose to have each selected parameter multiplied by a constant prior to any of the output operations being performed. He does this by setting KON(K) = 1 and inputting a value for MULTIP(K)*. Possible reasons to use this capability are

- To convert the data to metric units, or

- To convert percentages to fractions.

Still another option available to the user is to divide the selected parameter by another parameter. Not all parameters can be matched to perform this. A room-content parameter may be divided by another room-content parameter or by a room descriptor; however, a room descriptor cannot be divided by a room content-parameter. This operation is performed by choosing option 3 or 4 and specifying a value for ITEM2(K). A possible reason to use this capability is

- To convert the selected parameter to a percentage or fraction of some other room descriptor.

4.3.2.2 Selection Procedure

The selection procedure is based upon satisfying one ".OR." condition-set comprised of several ".AND." conditions.

The ".OR." condition-set is a combination of from 1 to 10 conditions, all of which must be satisfied before the ".OR." condition-set is satisfied. The conditions which make up the ".OR." condition-set are called ".AND." conditions. These ".OR." and ".AND." conditions are analogous to the .OR. and .AND. logical operators in the Fortran computer language.

The selection will not be made unless all of the ".AND." conditions within one of the ".OR." condition-sets are satisfied. If more than one ".OR." condition-set is satisfied for the same parameter, that parameter will be double counted.

For example, the program will retrieve the

Total Room Live Weight = Parameter to select
in

Clerical Offices with Floor Areas Between 100 to 500 ft^2 = ".OR." Condition-Set 1 with Two ".AND." Conditions

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*See Appendix B.6 for detailed instructions.

And in

General Offices with Floor Areas Between 200 to 400 ft^2 = ".OR." Condition-Set 2 with Two ".AND." Conditions

Up to ten ".OR." condition-sets may be used at one time. All of the items selected for the case during a single run will be co-mingled, regardless of which ".OR." condition-set was satisfied.

The user must take care to insure that each ".OR." condition-set excludes all other ".OR." condition-sets.

4.3.2.3 Diagnostic Messages

Program SEEKER has extensive error checking. The diagnostic messages are as complete as possible and should provide considerable assistance in locating any problem. Many errors will result in program termination prior to the processing of any room-survey data.

A complete listing of all messages is given in Table 5 of Appendix B.6, together with additional explanatory information. Three types of diagnostic messages may be printed. The first category deals with errors and inconsistencies in the card input data. These errors will cause run termination prior to the processing of the room-survey data tape. All of the card images will be scanned, however, prior to termination.

The second category of diagnostic messages deals with data transmission problems under NTRAN control. Any time an abnormal transmission occurs, a message will be printed. In some cases, these errors will cause early termination of the run. The user should be particularly alert to these messages even if they do not cause run termination.

The third category covers miscellaneous items not involving card-data or data-transmission errors.

4.3.2.4 Program Output

The program produces several different types of output, depending on the desires of the user. In all cases, however, the following data will be printed:

- The number of items found, n
- The sum of the value of all items found, $\Sigma^n x_i$, where x_i is the actual value of a selected item

- The sum of the square of all items found, $\Sigma^n x_i^2$
- The maximum value found, $x_i(\max)$
- The minimum value found, $x_i(\min)$
- The mean of all items found, $\Sigma^n x_i/n$, and
- The standard deviation* for all items found, $\left(\frac{\Sigma^n x_i^2 - \frac{(\Sigma^n x_i)^2}{n}}{n}\right)^{1/2}$

This data is printed in a clear, unambiguous format (see Section 4.3.3.6 for examples).

If the user specifies that the selected items are to be saved (OPT(K) = 1 or 3), two alternative formats are available. If OUTFLG = 1, the selected items will be written on the designated mass storage file as binary information with 300 words per record except for the last record. The UNIVAC library routine NTRAN is used to perform this writing operation. If OUTFLG = 0, the selected items will be written on the designated mass storage file as coded information. Each line of data will have 10 values written with a (10E12.5) format.

If the user specifies option 5, a third type of output will be produced. Under this option, four room descriptors will be selected at one time. These are determined by the user when he specifies ITEM(K) and ITEM2(K). The first item selected is ITEM(K); the second is the item next to ITEM(K) which, in many cases, is the standard deviation of the first item; the third item selected is ITEM2(K), and the fourth is the item next to ITEM2(K). (For example, if ITEM(K) = 77 and ITEM2(K) = 81, the four parameters would be 77, 78, 81 and 82). The selected items are written on the designated mass storage file, along with the associated building number, floor number, and room number. The data is written as coded information with one room per line using the format (3F10.0, 4E12.6). In addition, the first line in the file will contain the case title and the second line will contain headings for each of the seven pieces of data.

Following completion of the run, the user may transfer the data from the mass storage files to either the printer or the card punch. Instructions for performing this operation are given in Table 6 of Appendix B.6.

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*The equation used for this calculation is $\sigma = \left[(\Sigma^n x_i^2)/n - \bar{x}^2\right]^{1/2}$

4.3.3 Operating Logic

For discussion purposes, program SEEKER can be conveniently divided into five segments. Although the program is written without subroutines, its operational commands logically fall into these five categories. The input card configurations given in Tables 1 and 3 of Appendix B.6 provide a useful accessory to the following descriptions. All program mnemonics are described in Table 4 of Appendix B.6.

4.3.3.1 Read and Check Data Cards and Initialize all Parameters

The first operation that the program performs is to initialize various parameters such as the reel counter and the error flag. Approximately two dozen variables, many of them subscripted, are initialized at this time.

> The variables NI, NJ, and NK* are set with a DATA statement at the time program SEEKER is compiled. The user should verify that the values used were identical to the values used by program MAKER which generated the room-survey data tape.

Following these operations, the program reads and checks the card data. First, it reads the CASE card to determine the number of cases to be processed. Included on the same data card are the output flag, OUTFLG; the number-of-rooms flag, NROOMS; and the input data flag, INFLAG. NROOMS is used to minimize running time if; and only if, option 5 is selected for all cases. If option 5 has not been selected for all cases, the program will ignore whatever value has been input for NROOMS. If NROOMS = 0 this flag is also ignored. A maximum of 20 cases are allowed per run. If more than 20 cases are input, only the first 20 will be processed.

Next, the data for each case is read, one case at a time. The first card gives ITEM(X), OPT(K), NOR(K), ITEM2(K) and KON(K), while the second card gives the title for the case. ITEM(K) defines the primary item to be selected, OPT(K) defines the option, NOR(K) defines the number of ".OR." conditions, ITEM2(K) defines the secondary item to be selected, and KON(K) is the multiplier flag. All of these input parameters are defined in detail in Tables 1 and 2 of Appendix B.6. If the user desires to select some room parameter from every surveyed room without any requirements having to be

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*NI = Number of room parameters (132).

NJ = Number of room-content, furniture parameters (51).

NK = Number of room-content, stand-alone non-furniture parameters (11).

met, he may set NOR(K) = 0. KON(K) determines whether the user wishes to multiply each selected item by a constant. OPT(K) and NOR(K) are tested for acceptability. If KON(K) = 1, the multiplier constant is read next. Otherwise, the multiplier card is not expected and must not be present.

All ".OR." condition cards for the case are read next. A maximum of 10 ".OR." conditions are allowed with up to 10 ".AND." conditions in each ".OR." condition. The explanation of ".OR." and ".AND." conditions is given in Section 4.3.2.2. The number of ".OR." conditions to be read is given by NOR(K). The data for each ".OR." condition consists of the number of ".AND." conditions, IAND(K,J) which is on the first card of the ".AND." condition set; the location of the item to be tested, CON(K,J,I); plus the upper and lower limits, LIM1(K,J,I) and LIM2(K,J,I), for each condition. These are located on the second through the fifth card of the ".OR." condition-set. If the upper limit is zero, the program recalculates the upper and lower limits to be plus and minus one percent from the lower limit input by the user. If both limits are input as zero, they are reset to +.01 and -.01, respectively. A check is made to insure that the limits have been input in the proper sequence.

When all the input data has been read, a series of compatibility checks are made on ITEM(K) and ITEM2(K). Following this, additional checks are made on ITEM(K) and ITEM2(K) and the location flags, FLAG(K), are set:

ITEM(K) $\le$ NI	FLAG(K) = 1	Room Descriptor
NI < ITEM(K) $\le$ NL[*]	FLAG(K) = 2	Room-Content (Furniture) Parameter
NL < ITEM(K)	FLAG(K) = 3	Room-Content (Non-Furniture, Stand-Alone) Parameter

ITEM(K) and ITEM2(K) are recalculated at this time to simplify the search procedure performed later.

The last operations performed on the card-input data are to check CON(K,J,I), to set location flags for CON(K,J,I), and to recalculate CON(K,J,I). The CON(K,J,I) define the location of each condition that is to be tested. It is defined by the user on the ".OR." condition cards. The location flag for CON(K,J,I) is FLAGC(K,J,I):

CON(K,J,I) $\le$ NI	FLAGC(K,J,I) = 1	Room Descriptor
NI < CON(K,J,I) $\le$ NL	FLAGC(K,J,I) = 2	Room Content (Furniture Parameter
NL < CON(K,J,I)	FLAGC(K,J,I) = 3	Room Content (Non-Furniture, Stand-Alone) Parameter

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[*] NL = NI + NJ

Each CON(K,J,I) is recalculated at this time to simplify the search procedure performed later.

During the preceding operations the program will set an error flag, ERR, to true whenever a fatal error is discovered. This flag will cause program termination following the processing of all of the card input data.

4.3.3.2 Perform Input and Output Operations Not Involving Card Data

The second category of commands in program SEEKER involves input and output operations related to the room-survey data. Table 7 of Appendix B.6 gives a description of how this data is stored in the input file. First, the program reads a ten word record that has all its elements equal to the length of the next record. The next record contains the data generated for each room. Second, the program reads all of the processed room-survey data for a single room into a storage buffer, Y(15000). If there are over 15000 elements for the room, the dimensions of program SEEKER are exceeded and it will immediately stop execution. Following both reads, which are done with NTRAN, the program checks the status of the transmission by checking the block-status-word (II) set by NTRAN.* If the block-status-word indicates "device error" or "transmission aborted," an error message is printed and execution is stopped. If the block-status-word indicates that the end of the magnetic reel has been reached, the program will switch reels and start processing the next reel of data.

The end-of-tape flag for which the program is looking is a 10-word record where each word is 999999. When this is found the program will print a message but will not stop execution. The room-survey data tape created by program MAKER has this 10 word record at the end of each intermediate reel of a multi-reel file.

If the data for a room has been found to be undesirable or erroneous, the tenth word of the ten-word record will have been set to 0 or -1 (see Table 7 of Appendix B.6) SEEKER always tests this tenth word and if a 0 or -1 is found the subsequent data record will be skipped.

Any time the program stops execution early because of a transmission error, it will print the standard output data for each case (see Section 4.3.2.4) and dump all of the partially filled storage buffers onto the mass storage files. Obviously, the data printed and saved will only cover that portion of the room-survey data tape processed prior to the transmission problem.

A part of the output logic is located within the search-and-test DO loops. This logic transfers the data in a storage buffer XBUF(300,K) to a mass storage file each time the buffer becomes full. Each column of XBUF is a storage buffer for a different case. The first column is the buffer for Case 1, etc., throught the twentieth case. These operations are found near the end of the program.

---

*Reference (9)

Another type of output operation occurs whenever option 5 has been chosen. Under option 5 the program does not use the storage buffers, XBUF. Instead, it writes the data directly onto the mass storage file. The data written on the file includes (1) the title, (2) the column headings, and (3) seven pieces of information for each room (see Section 4.3.3.5 for additional details).

4.3.3.3 Find the Parameter That is to be Tested and Test It

The heart of program SEEKER is the logic which finds and tests each of the conditions to be tested. Each time a new room is read into the Y-buffer, the program begins its search over. It completes each case before proceeding to the next one. Within each case, it completes each ".OR." condition-set before proceeding to the next one. And within each ".OR." condition-set, it completes each ".AND." condition as fully as possible before proceeding to the next one.

If the condition to be tested is a room descriptor, the program immediately determines where to look. It then tests the value found at this location in the Y buffer and determines if the condition is met ($\geq$LIM1(K,J,I), $\leq$LIM2 (K,J,I)). If the condition is met, it tests the next ".AND." condition. If the condition is not met, it immediately goes to the next ".OR." condition-set and starts over. When and if it finds an ".OR." condition-set for which all the ".AND." conditions are met, it locates the item to be selected. Once it finds the item, it proceeds to store and/or process the item. Then it proceeds to the next case. When all of the cases have been processed, it reads another room of survey data from the room-survey data tape and starts the search procedure over.

If the conditions to be tested are room-content parameters, the process is essentially the same. The search logic is more complex, however, because the data blocks are not all of the same size. Some items within the room are described with 51 parameters while others are described with only 11 parameters.

When the ".OR" condition-set consists of both room descriptors and room-content parameters, additional complexity is introduced. In this instance, the program first sets the condition flag, TYP(K), equal to 1 and searches the room descriptors. If and when these are satisfied, it changes the flag to 2 and searches the room-content parameters.

4.3.3.4 Select the Desired Parameter

The selection of the specified parameters depends on whether the items are room parameters (FLAG(K) = 1) or room-content parameters (FLAG(K) = 2 or 3). If the item is a room parameter, the program immediately determines where to look. It then proceeds to store and/or process the items.

If the item is a room-content parameter, the process is essentially the same. Provisions have been made, however, to account for the different data-block sizes.

4.3.3.5 Process the Selected Parameter

The processing of the selected parameters depends on which option has been selected by the user:

Option 1 - Determines the maximum and minimum values found, the average value, the sum of the items, the standard deviation, and the total number of elements found. Saves the item on a data file for subsequent analyses.

Option 2 - Identical to Option 1 except that the selected item is not saved for future use.

Option 3 - Identical to Option 1 except that the selected item is divided by another specified item prior to processing.

Option 4 - Identical to Option 3 except that the selected item is not saved for future use.

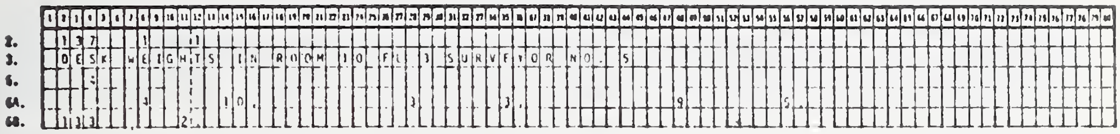
Option 5 - Identical to Option 1 except that four selected items are written on a file in the following format: building number, floor number, room number, parameter i, parameter i + 1, parameter j, parameter j + 1.

Following this, the program determines whether it should go to the next case (FLAG(K) = 1), test the next block of data (FLAG(K) > 1, TYP(K) = 2), or select another item (FLAG(K) > 1, TYP(K) = 1).

4.3.3.6 Examples of Selection Cases

Following are three examples which illustrate the manner in which the user establishes the selection and test parameters. The computer results for these examples follow in Figures 16 and 17.

Example 1



```
2.   137   1   1
3.   DESK WEIGHTS IN ROOM 10 FL 3 SURVEYOR NO. 5
5.     4
6A.        4     10.         3      3.             9        5.
6B.  133      2.
```

2. ITEM(K) = 137; this case is to select the total live weight of furniture. OPT(K) = 1; the data is to be saved, either on tape or mass storage as determined on card 1 by the value of OUTFLG. NOR(K) = 1; one ".OR." condition-set. ITEM2(K) = 0; no second item is to be selected. KON(K) = 0; no multiplier is indicated and card 4 is not included.

3. TITLE(K,13) = DESK WEIGHTS IN ROOM 10 FL 3 SURVEYOR NO.5; case title. (First 78 characters on card 3.)

4. Not present because KON(K) = 0.

5. IAND(K,1) = 4; there are four ".AND." conditions in ".OR." condition-set one.

6A. CON(K,1,1) = 4, LIM1(K,1,1) = 10.0, LIM2(K,1,1) = 0.0; the first ".AND." condition is parameter 4, the room number. The room number must equal 10.

CON(K,1,2) = 3, LIM1(K,1,2) = 3.0, LIM2(K,1,2) = 0.0; this ".AND." condition is parameter 3, the floor number. The floor number must equal 3.

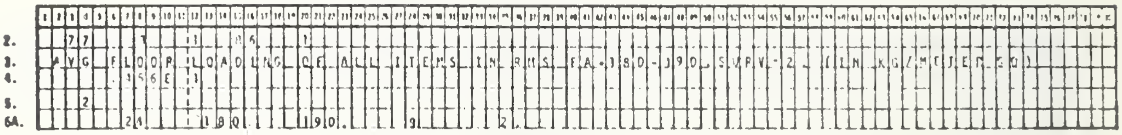
CON(K,1,3) = 9, LIM1(K,1,3) = 5.0, LIM2(K,1,3) = 0.0; the third ".AND." condition is on parameter 9, the surveyor number. This parameter must equal 5.

6B. CON(K,1,4) = 133, LIM1(K,1,4) = 2.0, LIM2(K,1,4) = 0.0; the fourth and last ".AND." condition applies to parameter 133, the furniture type. This parameter must equal 2, a desk.

Note: The furniture condition is after the room-descriptor conditions.

Note: Example 1 selects the total live weight, including contents, of every desk in rooms on floor number 3 with a room number of 10 and surveyed by surveyor number 5.

Example 2[+]



```
2.    77   1   3  86   1
3.   AVG FLOOR LOADING OF ALL ITEMS IN RMS FA=180-190, SURV=2, (IN KG/METER SQ)
4.        .456E1
5.      2
6A.         24   180.    190.    9      2.
```

2. ITEM(K) = 77; this case is to select item 77. (Item 77 is the total live weight in a room.)* OPT(K)# = 3; select two items, then divide the first by the second and save the result on an output file. (The type of file is determined by card 1). NOR(K) = 1; one ".OR." condition means that the first ".AND." condition set must be met for the item to be selected). ITEM2(K) = 86; the second item to select. Because option 3 was selected, item 86 will be divided into item 77 (item 86 is the occupied floor area). KON(K) = 1; the multiplier flag is equal to 1. (This is set to 1 when the selected item is to be multiplied by some factor; if this is zero, card 4 is to be omitted.)

3. TITLE(K,13) = AVG FLOOR LOADING OF ALL ITEMS IN RMS FA=180-190, SURV=2, (IN KG/METER SQ). This is the title of this case. The program cannot read more than the first 78 characters of one card.

4. MULTIP(K) = .456E1; this card gives the value of the multiplier to be used to convert the data (in this case the multiplier is the conversion from pounds per square feet to kilograms per square meter).

5. IAND(K,1) = 2; the number of ".AND." conditions in ".OR." condition-set 1 (there are two ".AND." conditions in this case). When IAND(K,1) is greater than 3, item 6A will require more than one card.

6A. CON(K,1,1) = 24, LIM1(K,1,1) = 180.0, LIM2(K,1,1) = 190.0; the first ".AND." condition is parameter 24, the floor area of the room. The lower limit is 180 square feet and the upper limit is 190 square feet (rooms with area between 180 and 190 square feet will satisfy this condition).

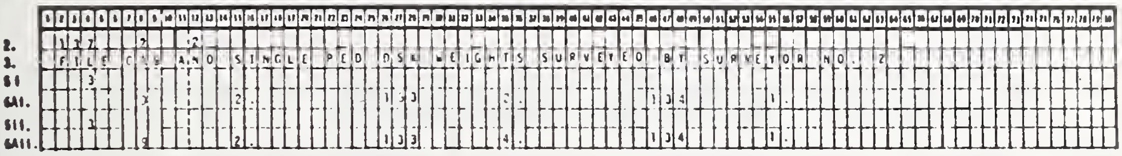
CON(K.1.2) = 9, LIM1(K,1,2) = 2.0, LIM2(K,1,2) = 0.0; the second ".AND." condition is parameter 9, the surveyor number. The lower limit is 2.0 and the upper limit is zero. When the upper limit is zero, the parameter must equal the lower limit to satisfy this condition.

[+] Card 1 of the run set-up is not included herein. See Table 1 of Appendix B.6 for data on card 1.

*Refer to the selection code table, Table 2 in Appendix B.6.

#K refers to case number. Up to 20 cases may be processed on one run.

Example 3



2. 137 2 2
3. FILE CAB AND SINGLE PED DSK WEIGHTS SURVEYED BY SURVEYOR NO. 2
5i 3
6Ai. 9 2. 133 2. 134 1.
5ii. 1
6Aii. 9 2. 133 4. 134 1.

2. ITEM(K) = 137; select item 137. (Item 137 is the live weight of a room-content.) OPT(K) = 2; option 2 means the output will not be saved but the totals will be computed. NOR(K) = 2; two sets of ".OR." conditions are specified. (ITEM(137) will be selected if either is met.) ITEM2(K) = 0; no second item is to be selected because OPT(K) ≠ 3, 4, or 5. KON(K) = 0; the items selected are not to be multiplied by a constant. (Thus, card 4 must not be present.)

3. TITLE(K,13) = FILE CAB AND SINGLE PED DSK WEIGHTS SURVEYED BY SURVEYOR NO. 2; this is Case K's title.

4. Card 4 is not present because KON(K) = 0.

5i. IAND(K,1) = 3; three ".AND." conditions in first ".OR." condition-set.

6Ai. CON(K,1,1) = 9, LIM1(K,1,1) = 2.0, LIM2(K,1,1) = 0.0; the first ".AND." condition is parameter 9, the surveyor number. The lower limit is 2.0 and the upper limit is zero. When the upper limit is zero, the parameter must equal the lower limit (i.e., must be surveyor number 2) to satisfy this condition

CON(K,1,2) = 133, LIM1(K,1,2) = 2.0, LIM2(K,1,2) = 0.0; the second ".AND." condition of the first ".OR." condition-set. The parameter to be tested is item 133, the type of furniture. The lower limit is 2.0 and the upper limit is zero. Thus, furniture type must equal 2.0, a desk.

CON(K,1,3) = 134, LIM1(K,1,3) = 1.0, LIM2(K,1,3) = 0.0; the third ".AND." condition applies to parameter 134, the type of desk. The lower limit is 1.0 and the upper limit is zero. Thus desk type must equal 1.0, a single pedestal desk. All three of these ".AND." conditions must be met for the live weight to be selected under the provisions of this ".OR." condition-set.

Note: The first ".AND." condition dealt with a room descriptor (those between 1 to 132). It is necessary for the room parameter to be first when a mixed ".OR." condition-set is used. In this case, the weight of a desk in a room surveyed by surveyor number 2 would be found first by determining whether the room was surveyed by surveyor number 2. Once this has been established the search will then begin for a desk. When such an item is found, it is then determined whether ITEM(134) is equal to 2 for a single pedestal desk. If so, then the program will proceed to ITEM(137), the live weight, and choose it as a data point. The order of the room-content conditions is not important (condition 2 could have been condition 3, and 3 could have been 2; however, condition 1 must always come before the room-content conditions).

5ii. IAND(K,2) = 3; the second card 5 gives the number of ".AND." conditions in ".OR." condition-set two.

6Aii. CON(K,2,1) = 9, LIM1(K,2,1) = 2, LIM2(K,2,1) = 0.0; again, data completed by surveyor number 2 is desired. This is the beginning of ".OR." condition-set two.

CON(K,2,2) = 133, LIM1(K,2,2) = 4.0, LIM2(K,2,2) = 0.0; this furniture type, item 133, must equal 4.0, a cabinet.

CON(K,2,3) = 134, LIM1(K,2,3) = 1.0, LIM2(K,2,3) = 0.0; the third ".AND." condition requires that the type of cabinet must equal 1.0, a file cabinet.

Note: Example 3 selects the live weight of every single-pedestal desk and every file cabinet in rooms surveyed by surveyor number 2. The weights are co-mingled and treated as a single variable.

```
                                            I N P U T   D A T A
****************************************************************************************************
                    NO. OF CASES =     3 OUTFLG =     0 NO. OF ROOMS =    10 INFLAG =     1 PLTFLG =     0

CASE NO.  1 ITEM =  137 OPT =     1 NOR =     1 ITEM2 =     0 KON =     0
THE TITLE OF THIS CASE IS,  DESK WEIGHTS IN ROOM 10 FL 3 SURVEYOR NO. 5
          .OR. CONDITION NO.  1
                    .AND. CONDITION NO.  1 CONDITION CODE =    4 LOWER LIMIT =    10.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  2 CONDITION CODE =    3 LOWER LIMIT =     3.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  3 CONDITION CODE =    9 LOWER LIMIT =     5.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  4 CONDITION CODE =  133 LOWER LIMIT =     2.00 UPPER LIMIT =       .00

CASE NO.  2 ITEM =   77 OPT =     3 NOR =     1 ITEM2 =    86 KON =     1
THE TITLE OF THIS CASE IS,  AVG FLOOR LOADING OF ALL ITEMS IN RMS FA=180-190,SURV=2, (IN KG/METER SQ)
                                                               MULTIPLIER =    4.5600
          .OR. CONDITION NO.  1
                    .AND. CONDITION NO.  1 CONDITION CODE =   24 LOWER LIMIT =   180.00 UPPER LIMIT =    190.00
                    .AND. CONDITION NO.  2 CONDITION CODE =    9 LOWER LIMIT =     2.00 UPPER LIMIT =       .00

CASE NO.  3 ITEM =  137 OPT =     2 NOR =     2 ITEM2 =     0 KON =     0
THE TITLE OF THIS CASE IS,  FILE CAB AND SINGLE PED DSK WEIGHTS SURVEYED BY SURVEYOR NO. 2
          .OR. CONDITION NO.  1
                    .AND. CONDITION NO.  1 CONDITION CODE =    9 LOWER LIMIT =     2.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  2 CONDITION CODE =  133 LOWER LIMIT =     2.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  3 CONDITION CODE =  134 LOWER LIMIT =     1.00 UPPER LIMIT =       .00
          .OR. CONDITION NO.  2
                    .AND. CONDITION NO.  1 CONDITION CODE =    9 LOWER LIMIT =     2.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  2 CONDITION CODE =  133 LOWER LIMIT =     4.00 UPPER LIMIT =       .00
                    .AND. CONDITION NO.  3 CONDITION CODE =  134 LOWER LIMIT =     1.00 UPPER LIMIT =       .00
```

Figure 16   Input for Examples as SEEKER Reads It

```
CASE    1

DESK WEIGHTS IN ROOM 10 FL 3 SURVEYOR NO. 5

      PARAMETER CODE  137

          TOTAL NUMBER OF ELEMENTS FOUND =            2
        THE GRAND SUM OF ALL ELEMENTS IS =   695.80
         THE MAXIMUM VALUE OF AN ELEMENT =   392.40
         THE MINIMUM VALUE OF AN ELEMENT =   303.40
       THE AVERAGE VALUE OF ALL ELEMENTS =   347.90
    THE SUM OF THE SQUARES, ALL ELEMENTS =  2.46029+05
 THE STANDARD DEVIATION FOR ALL ELEMENTS =   44.500

 THE DATA FOUND FOR THIS CASE HAS BEEN WRITTEN ON UNIT NO.  7


CASE    2

AVG FLOOR LOADING OF ALL ITEMS IN RMS FA=180-190,SURV=2, (IN KG/METER SQ)

      PARAMETER CODE   77

          TOTAL NUMBER OF ELEMENTS FOUND =           11
        THE GRAND SUM OF ALL ELEMENTS IS =   1482.1
         THE MAXIMUM VALUE OF AN ELEMENT =   222.97
         THE MINIMUM VALUE OF AN ELEMENT =   83.927
       THE AVERAGE VALUE OF ALL ELEMENTS =   134.74
    THE SUM OF THE SQUARES, ALL ELEMENTS =  2.17103+05
 THE STANDARD DEVIATION FOR ALL ELEMENTS =   39.782

 THE DATA FOUND FOR THIS CASE HAS BEEN WRITTEN ON UNIT NO.  8


CASE    3

FILE CAB AND SINGLE PED DSK WEIGHTS SURVEYED BY SURVEYOR NO. 2

      PARAMETER CODE  137

          TOTAL NUMBER OF ELEMENTS FOUND =           26
        THE GRAND SUM OF ALL ELEMENTS IS =   7704.5
         THE MAXIMUM VALUE OF AN ELEMENT =   563.52
         THE MINIMUM VALUE OF AN ELEMENT =   28.460
       THE AVERAGE VALUE OF ALL ELEMENTS =   296.33
    THE SUM OF THE SQUARES, ALL ELEMENTS =  2.67055+06
 THE STANDARD DEVIATION FOR ALL ELEMENTS =   122.08
```

Figure 17   Example Output

4.3.3.7 Further Descriptive Statistics Derived with the HISTOG Program

While SEEKER provides some descriptive statistics, the development of more complex statistics has been left as an option to be exercised through the use of the program HISTOG. HISTOG reads the data files that SEEKER has created and performs computations requiring all of the data at one time. The specific items produced are histograms, fractiles, and medians.

HISTOG is a separate program, but it is designed so that it may be run after SEEKER either as a separate run or in the same run. When PLTFLG $\neq 0$ in input card number 1 of SEEKER, a one line summary of information is written on unit 4. This is used as input to HISTOG to scale the histograms being created. The description of the input data in Table 9 describes the procedure for using HISTOG. HISTOG may also be used when a data file was created by SEEKER with PLTFLG = 0 and no such descriptive data was created. In this instance, the needed information must be taken from the printed output produced by the SEEKER run.

The HISTOG program is made up of five subroutines. Three of these are modifications of UNIVAC 1108 Stat-Pack programs, and the other two are written to facilitate data input and to do further computations.

The driving subroutine is called HSTART. This subroutine reads the card and data file input and calls the other subroutines. If the user desires, this subroutine can also be used to punch a card deck of the data.

If a histogram is to be created, HSTART truncates the group size so that it is a multiple of hundredths, ones, tens, or hundreds depending on the actual step size computed from the number of groups warranted by the sample size using the following formula:

$$\text{Number of Groups} = (3.3^* \log (\text{number of data pts}) + 1)$$

The user can override the number of groups by setting NFINE=-1 and inserting the Namelist card STEPS with the new step size for each case.

Then HISTA is called. HISTA is a modified version of the UNIVAC routine HIST. The basic modification has been in the output format. HISTA then calls GROUPA, a modified verison of the UNIVAC routine GROUP, to group the data. GROUPA has been modified so that the first group can never start with values less than zero. PLOT1A is then used to plot the histogram; PLOT1A is identical to the UNIVAC routine PLOT1.

If the fractiles and the median are also desired, HSTART will call FRACT to order the data and to determine the upper 90 percent and 99 percent fractiles and the lower 5 percent and 1 percent fractiles. FRACT also calculates the median as the middle value if the number of data points is odd or the average of the two middle data points if the number of data points is even. A further HISTOG option exercised in FRACT is the listing in descending order of all the data points present for a particular case. This option may be requested on the first HISTOG data card or it will be furnished when the fractiles are desired and less than 100 data points are present.

Figure 18 gives a general overview of the logic of HISTOG. Figures 19 and 20 show examples of the output generated by HISTOG. These two histograms are from the same data, the first has the number of groups dictated by the sample size, while the second has half the step size giving a bit more detail.

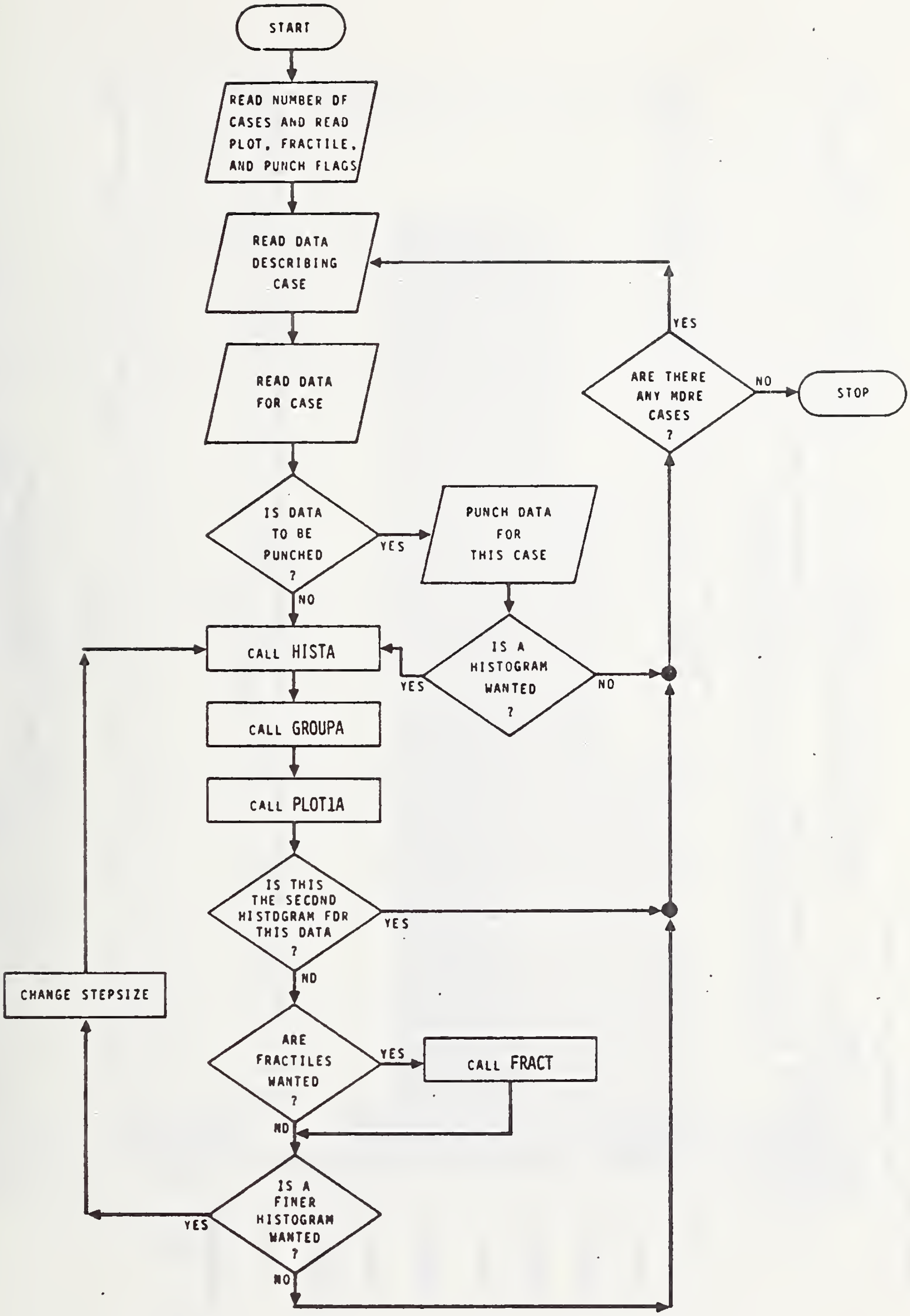
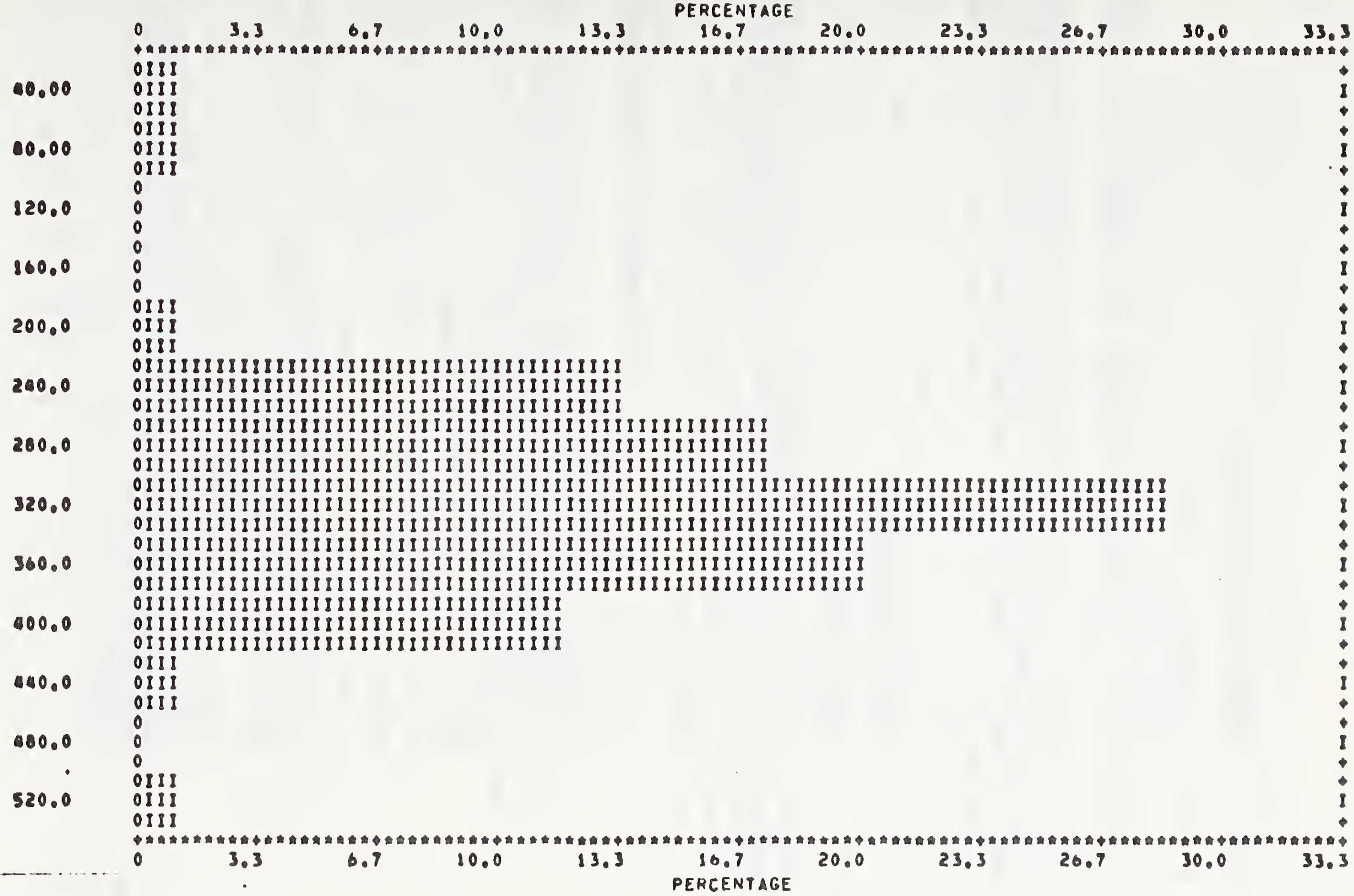


Figure 18 General Flow Chart For Program HISTOG

```
                   DESK WEIGHTS IN ALL ROOMS

                AVERAGE=  316.230            STANDARD DEVIATION=  69.3810
                MIN VALUE=  28.4600            MAX VALUE=  505.300
                STEP= 80.00000
                CENTERPOINT OF INITIAL GROUP= 40.00000            NO. OF OBSERVATIONS=   73
                CENTERPOINT OF FINAL GROUP= 520.0000            NO. OF GROUPS=    7
                K FACTOR=    2. ( THE FACTOR BY WHICH THE PERCENT SCALE IS DIVIDED )

                                                               PERCENTAGE
                   0       5.0      10.0      15.0      20.0      25.0      30.0      35.0      40.0      45.0      50.0
                   +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
                   OIIII                                                                                              +
         40.00     OIIII                                                                                              I
                   OIIII                                                                                              +
                   O                                                                                                  +
         120.0     O                                                                                                  I
                   O                                                                                                  +
                   OI                                                                                                 +
         200.0     OI                                                                                                 I
                   OI                                                                                                 +
                   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          +
         280.0     OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          I
                   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          +
                   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          +
         360.0     OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          I
                   OIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII          +
                   OIIIIIII                                                                                           +
         440.0     OIIIIIII                                                                                           I
                   OIIIIIII                                                                                           +
                   OI                                                                                                 +
         520.0     OI                                                                                                 I
                   OI                                                                                                 +
                   +*********+*********+*********+*********+*********+*********+*********+*********+*********+*********+
                   0       5.0      10.0      15.0      20.0      25.0      30.0      35.0      40.0      45.0      50.0
                                                               PERCENTAGE

       FREQUENCIES IN GROUPS
1     2     3     4     5     6     7
 2.    0.    1.   33.   33.    3.    1.
```

Figure 19   Example of Standard Histogram

```
DESK WEIGHTS IN ALL ROOMS

AVERAGE=  316.230              STANDARD DEVIATION=  69.3810
MIN VALUE=  28.4600              MAX VALUE=  505.300
STEP= 40.00000
CENTERPOINT OF INITIAL GROUP= 40.00000             NO. OF OBSERVATIONS=   73
CENTERPOINT OF FINAL GROUP= 520.0000             NO. OF GROUPS=   13
K FACTOR=    3. ( THE FACTOR BY WHICH THE PERCENT SCALE IS DIVIDED )
```



```
      FREQUENCIES IN GROUPS
 1     2     3     4     5     6     7     8     9    10    11    12    13
  1.    1.    0.    0.    1.   10.   13.   21.   15.    9.    1.    0.    1.
```

Figure 20   Example of Same Data in Figure 19   when NFINE = 2.

4.4 READER Program Description

4.4.1 Introduction

Program READER is designed to process the output from MAKER by accomplishing a series of tasks that cannot be performed with SEEKER.

Whereas SEEKER is designed to find the same room parameter in rooms with certain characteristics, READER is designed to retrieve all or part of the room data and to either print it or copy it onto another tape (or mass storage device). Thus, READER is oriented toward dealing with the data by room instead of by type of data.

4.4.2 Operational Techniques

4.4.2.1 Program Capabilities

READER has been designed as a multipurpose program that can be used to perform certain data manipulations that have proved necessary in using the data created by MAKER. In addition, it can also extract data needed for analyses other than those accomplished with SEEKER. Below is a list of these capabilities:

- To provide a one-line or summary listing of the data for all rooms or for particular rooms
- To produce a listing of all of the room data (including all data on room contents) for all rooms or for particular rooms
- To create an output file of selected room parameters that can be used as input to the UCLA Biomedical Statistics Program BMD02R or other statistical programs in that series (Table 14)
- To create an NTRAN output file for all rooms or for particular rooms
- To extract specific rooms or blocks of rooms from the data tape
- To perform any operation desired by user. A blank subroutine, called DUMMY, is incorporated into READER to provide a location for a user supplied subroutine.
- Each room is described on the data tape with two records (see Section 4.2.1). The tenth word of the first record is an error flag used to identify a room with erroneous data. READER can be used to set this flag to mark room data which the user feels are erroneous.

- To print the room parameters (i.e., the first 132 elements of the data record as described in Table 1 of Section 4.2) for particular rooms
- To write a new output tape (in binary) with only the room parameters (elements 1 to 132) for particular rooms

The above described functions of READER are summarized in Table 15.

READER consists of the main program READ and three subroutines: DATAC2, WRITER, and DUMMY. The READ program reads the input tape and selects those rooms to be used. It also produces the new output tape and prints a one-line summary.

DATAC2 is called from READ. It sets up a data file using specific parameters for each room. This subroutine also dichotomizes data that are of a non-continuous nature. For example, there are seven room types with each type corresponding to an integer number from one to seven. To use these data in a linear regression requires defining six dichotomized variables. DATAC2 performs this dichotomization on seven different room parameters. It was designed specifically to facilitate the use of the UCLA Biomedical programs for data analysis.

WRITER is used to list either the entire data record or only the room parameters. The format used to list the entire data record is the same as program MAKER would have used.

DUMMY is a blank subroutine. It provides a means by which the user can tailor the operation to suit his own needs. All he need do is replace DUMMY with his own FORTRAN source deck. DUMMY can be used with the selection processes in READER in the same manner that WRITER and DATAC2 are called.

4.4.2.2 Selection Procedures

There are three methods of room selection available for most of the operations performed by READER.

The first method selects those rooms that have their identifiers input to the program in the NAMELIST variable RNUM. Each room to be selected must be identified by building number, floor number, and room number. The order of the rooms in the vector RNUM is unimportant.

The second method selects all of the rooms between specified limits. Such a case would be when the user wanted only the rooms from the fourth building on the data tape. He would then specify the number of rooms preceding the desired building and the number of rooms in the desired building. The control variables NSKIP and NQ are used for this purpose. Multiple skips and reads may be accomplished (up to 10).

Table 14. REGRESSION ANALYSIS DATA FILE
(Page 1 of 2)

A. Dichotomized Data

Room use

1. General
2. Clerical
3. Lobby
4. Conference
5. File
6. Storage
7. Library

Building vertical load system

1. Column
2. Bearing wall

Building building material

1. Concrete
2. Steel
3. Masonry
4. Wood

Building occupancy type

1. Federal government
2. State government
3. Local government
4. Private
5. Private and government

Firm type (SIC code)

1. Agriculture, forestry, and fishing
2. Mining
3. Construction
4. Manufacturing
5. Transportation, communication, electric, gas, and sanitation services
6. Wholesale and retail trade
7. Finance, insurance, and real estate
8. Services
9. Public administration
10. Non-classifiable establishments

Table 14. REGRESSION ANALYSIS DATA FILE (Page 2 of 2)

Geographic location using ZIP code

1.	Northeast	$0 < ZIP \leq 19999$
2.	North central	$42801 \leq ZIP \leq 58999$ or $60000 \leq ZIP \leq 69999$
3.	South	$20000 \leq ZIP \leq 42800$ or $70000 \leq ZIP \leq 79999$ or $ZIP = 99999$
4.	West	$80000 \leq ZIP \leq 99998$ or $59000 \leq ZIP \leq 59999$

Surveyor numbers, from 0 to 24

B. Continuous Data

Floor number

Firm age

Age of building at time of survey

Building height

Number of firms in building

Number of occupants in room

Room area

Room volume

Live load PSF

Fire load PSF (derated)

Fire load PSF (un-derated)

Percent of floor area covered

Total number of items in the room

Total weight estimated by surveyor

Weight of heaviest item in room

Room opening factor

The third selection procedure is a combination of the other two. It allows the user to select specific rooms from a predetermined block of rooms. A case where this third option will prove useful is when certain rooms are desired from near the middle of the tape. Skipping to the first room and stopping the search after the last increases the efficiency of the computer.

Table 15 gives a summary of the sixteen different functions READER can perform. The OPTION values delineate the different selection procedures discussed above.

4.4.2.3 Program Output

READER can produce four different types of printed output, ranging from a one-line summary to a complete listing. The user determines the type of output by setting LAM in the NAMELIST input file, $INPUT.

- Type 1 - a complete listing. Set LAM = 2. Both the room parameters and the room-content parameters are provided. See Tables 1, 2, and 3 of Section 4.2 for a complete data description. Figure 21, which is an example of the Type 2 output is applicable to room parameter portion of Type 1 output.
- Type 2 - a listing of only the room parameters. Set LAM = 1. The room parameters are the first 132 words on the data record. These data include the description of the bounding surfaces and various room totals. See Table 1 of Section 4.2 for detailed data description. Figure 21 is an example of Type 2 output.
- Type 3 - a data summary. Set LAM = 4. Only the most important room descriptors and room totals are provided. Figure 22 has an example of this output.
- Type 4 - a one-line data summary. Set LAM = 5. Figure 22 has an example of this output using only one room. The heading is listed only once per page. Thirty-five rooms can be accommodated on each page. This option is designed to produce a summary list of all the data on the data file. If the optional REAL statement is used to diminish core size, this can be an efficient method for determining what data are present.

In addition to printed output, READER can produce two kinds of modified data tapes. The control variables LAM, RNUM can be used to set the room error flag to -1 (erroneous data) on specified rooms

- Type 1 - entire data record copied to new tape. Set LAM = 3. When OPTION is set to 0, those rooms identified in the RNUM vector are marked as erroneous by setting the error flag to -1.

Table 15. READER CAPABILITY
(Page 1 of 1)

	OPTION = 0	OPTION = 1
LAM = 1	Use WRITER to print the first 132 words of room data for those rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Use WRITER to print the first 132 words of room data for all rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 2	Use WRITER to print all the words of the rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Use WRITER to print all the words of the rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 3	Write a new tape in NTRAN binary with error flag set to -1 for those rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Write a new tape in NTRAN binary that has all the rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 4	Print a set of summary data for all rooms in RNUM form NSKIP(jK) to NSKIP(jk) + NQ(jk)	Print a set of summary data for all rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 5	Print a one-line summary for all rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Print a one-line summary for all rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 6	Write a new tape in NTRAN binary with only the first 132 words for all rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Write a new tape in NTRAN binary with only the first 132 words for all rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 7	Call DATAC2 to create a data file of those rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Call DATAC2 to create a data file of those rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)
LAM = 8	Call the user-designed subroutine DUMMY for those rooms in RNUM from NSKIP(jk) to NSKIP(jk) + NQ(jk)	Call the user-designed subroutine DUMMY for those rooms from NSKIP(jk) to NSKIP(jk) + NQ(jk)

The mnemonics used here are defined in Appendix B.7, Tables 1 and 2.
OPTION = 0 - select only the rooms specified explicitly.
OPTION = 1 - select all rooms in the specified block.

```
BUILDING     2 FLOOR     1 ROOM     69

BOUNDING SURFACE DATA
    1         2         3         4         5         6         7         8         9        10

   540.00      2.00      1.00     69.00      2.00     86.00     20.00     11.00      9.00      2.00

 14699.00   1917.00     58.00      7.00      1.00      1.00      5.00     16.00      7.00       .00

   510.00     20.00       .00    224.00   1904.00      4.00       .00      1.00      1.00      6.00

      .00       .00      2.00       .00       .00       .00       .00       .00       .00      1.00

      .00      1.00      2.00     10.00      8.50     16.00      1.00       .00       .00      5.00

    10.00      8.50     14.00      1.00       .00       .00      2.00     10.00      8.50     16.00

      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

      .00       .00       .00       .00       .00       .00

COMPOSITE ROOM DATA
    7         8         9         0         1         2         3         4         5         6

  4715.68    157.55     21.05       .70   3152.90     78.07     14.08       .35   3460.68     67.53

    30.15    224.03      1.00      8.00     14.00     10.66       .47     62.50       .00     10.66

      .47     90.30       .60     10.66       .47     63.64       .98      2.86       .39       .00

      .00   3376.93     78.07     15.08       .35     71.61      2.48       .00      1.00      2.00

     3.00       .00      2.00       .00       .00       .00     97.51       .44    115.33      3.92

      .00     -1.00       .00       .00   3916.71     85.65
```

Figure 21. Sample of Type 2 READER Output

Example of Type 3 Output

```
ROOM NO.   69. FLOOR NO.  . 1. BUILDING NO.    2. NO OF WORDS =      132 RECORD NO.   540 ROOM USE.LIB
     ROOM SURVEYOR     9. ROOM TOTAL WT.     4715.68 SD   157.55 FLOOR AREA      224.00 LIVE WT/SQFT 21.05
     ROOM DIMENSIONS   14.00FT X   16.00FT , TOTAL EST. WT.      14.00 UNDERATED FIRE WT.   3916.71 SD     85.65
     AREA COVERED 30.15%, HEAVIEST ITEM  115.33PSF, RM OPENING FCT-1.000 DERATED FIRE WT.   3376.93 SD     78.07
          % PAP+BKS  TOT NO.     DESKS     TABLES    CABINETS   SHELVES    CHAIRS     MISC.     FS-PAPER  FS-BOOKS  FS-EQIP.
            86.50      8.00       .00       1.00       2.00       3.00       .00       2.00       .00       .00       .00
-----------------------------------------------------------------------------------------------------------------------
```

Example of Type 4 Output

```
------------------------------------------------------------------------------------------------------------------------
        S                          T        L                                *       C           F  F    * D
         U                          U        U    U F    D F   T     % P  T   *       A  S        S  S  F * A
          R   N     L                T W      A    N I    E I   O W    A  U   *    T  B  M  C           S * T
   F       V   U W   E    W             E      D    D R    R R   I E    O P  T I * D  A  I  E  M     P  B    * A
B   L   R   E   M O   N    I      A.   L I    L      R E    A F     I   F + T * E  B  N  L  A  M  A  O  E *
 L   O   O   Y     R   G    D      W    I G    I P    T      T     E G     B  N E * S  L  E  V  I  I  P  O  Q * F  U
  D   O   O   O   O D   T    T      E    V H    V S    E W    E W   S H   F K  U M * K  E  T  E  K  S  E  K  I * L  S
   G   R   M   R   F S   H    H      A    E T    E F    D T    D T   T T   L S  M S * S  S  S  S  S  C  H  S  P * G  E
------------------------------------------------------------------------------------------------------------------------
    2   1  69   9  540  14.  16.   224.  4716.  21.05  3917.  3377.    14. 86.50  8 *  0  1  2  3  0  2  0  0  0* ** LIB
```

A Key to the Headings Used in Type 4 Output

BLDG	Building number
FLOOR	Floor number
ROOM	Room number
SURVEYOR	Surveyor number
NUM OF WORDS	Number of words in data record
LENGTH	Room length in feet} will be zero if
WIDTH	Room width in feet } wall chosen is open
AREA	Room area in square feet
TOTAL LIVE WEIGHT	Total live weight in room in pounds
LIVE LOAD PSF	Live load in room in pounds per square foot
UNDERATED FIRE WEIGHT	Total un-derated fire weight in equivalent pounds of cellulose
DERATED FIRE WEIGHT	Total derated fire weight in equivalent pounds of cellulose
TOT EST WEIGHT	Total weight estimated by the surveyor
% OF FL PAP & BKS	Percent of derated fire weight that is papers and books
TOT NUM ITEMS	Total number of items in the room (furniture and miscellaneous)

DESKS	Number of desks
TABLES	Number of tables
CABINETS	Number of cabinets
CHAIRS	Number of chairs
MISC	Number of miscellaneous objects
FS PAPER	Number of free-standing paper piles
FS BOOKS	Number of free-standing book piles
FS EQUIP	Number of free-standing pieces of office equipment
DATA FLAG	**=good data 0=bad data, error flag set by MAKER -1=bad data, error flag set by READER
USE	Room use: GEN General office CLE Clerical office LOB Lobby CON Conference room FL File room STO Storage room LIB Library

Figure 22. Sample of Type 3 and Type 4 READER Output

If OPTION is set to 1, the room data files are copied verbatim although specific rooms or blocks of rooms can be selected using the NSKIP and NQ control variables previously discussed

- Type 2 - only room parameters (first 132 words) copied to new tape. Set LAM = 6.

The final type of output produced by READER is a regression analysis data file. This data file contains all of the information anticipated to be needed to perform a regression analysis of the live load and fire loads in office buildings. This option is selected by setting LAM = 7. Each room is described with 23 types of information arranged into four lines (or four cards if the data are punched). DATAC2 is used to generate this data file.

Part of the data is non-continuous data (i.e., variables with only integer values) that are dichotomized and part is continuous data that are transferred directly to the new data file.

The dichotomized data are given a value of either 1., 0., or -1. Below is an example of the dichotomization method used:

- For building material, the alternative values are:

  1 = concrete
  2 = steel
  3 = masonry
  4 = wood

- DATAC2 will write three variables: X1(8), X1(9), X1(10):

Mat.	Values		
Type	X1(8)	X1(9)	X1(10)
1	1.	0.	0.
2	0.	1.	0.
3	0.	0.	1.
4	Z	Z	Z

The value of Z is -1. in DATAC2. It may be set to another value by changing the DATA statement. This method is used for all of the aforementioned dichotomized variables.

The format of the output file is on four lines. The first line is the dichotomized room descriptions, except for surveyor number and geographic location:

ROOM USE = 7	VERTICAL LOADING SYSTEM = 1	BUILDING MATERIAL = 1	BUILDING OCCUPANCY = 5	FIRM TYPE = 9
-1.-1.-1.-1.-1.-1.	1.	1. 0. 0.	-1.-1.-1.-1.	0. 0. 0. 0. 0. 0. 0. 0. 1.

The second line of output is the remaining dichotomized room description and part of the continuous data:

GEOGRAPHIC LOCATION = 1	FLOOR NUMBER = 1	FIRM AGE = 20	AGE OF BUILDING = 58	BUILDING HEIGHT = 7	NUMBER OF FIRMS = 16	NUMBER OF OCCUPANTS IN ROOM = 0	ROOM AREA = 224	ROOM VOLUME = 1904
1. 0. 0.	1.	20.	58.	7.	16.	0.	224.	1904.

The third line consists of the remaining continuous data:

LIVE LOAD PSF = 21.052	FIRE LOAD PSF (DERATED) = .349	% OF FLOOR AREA COVERED = 30.146	TOTAL NUMBER OF ITEMS IN ROOM = 8	TOTAL ESTIMATED WEIGHT IN ROOM = 14	WEIGHT OF HEAVIEST ITEM = 115.33	ROOM OPENING FACTOR = -1	FIRE LOAD PSF (UNDERATED) = 17.465
21.052	.349	30.146	8.000	14.00	115.330	-1.00000	17.465

The last line is the dichotomized room surveyor number, from 0 to 24:

SURVEYOR NUMBER = 9

0	.1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

The output file from DATAC2 will be written on the unit specified on the NAMELIST input card as the value of NOUT. The four lines shown above are all less than 80 characters long, so that the assigned unit may be a card punch.

4.4.2.4 Diagnostic Messages

The diagnostic messages in READER are of three types:

- Messages concerning the NAMELIST input data,
- Messages relating to the NTRAN operations, and
- Messages relating to the values of data to be processed in DATAC2.

Table 3 in Appendix B.7 gives these messages and the conditions under which they are printed. It should be consulted on encountering any such message.

The messages relating to data processed by DATAC2 do not imply the termination of the run. They do mean, however, that processing of that particular room will not be continued and that room will not be added to the output file.

4.4.3 Operating Logic

READER first reads the function options from the NAMELIST card, $INPUT. It then reads the data tape, applying the selective procedures to determine which rooms shall be processed. It processes the selected rooms according to the function options. Figure 23 is a general flow chart of the operation of READER.

4.4.3.1 Reading the Room Data

The room data being read by READER were created by program MAKER. The data are binary, odd parity, 800 bpi density and were written with the UNIVAC system routine, NTRAN. Tables 1, 2, and 3 of Section 4.2 together with Table 7 of Appendix B.4 describe the data. Two records are used for each room. The first record has 10 words, each of which gives the length of the second record. If, however, the data were flawed when MAKER processed them, the tenth word of the record will be 0. The second record is the data produced by MAKER describing the room. If the user later decides, for any reason, that he does not want to use a particular room in his analysis, he may use READER to set this error flag (i.e., the tenth word of record one) to -1. This is done by setting OPTION = 1 and LAM = 3. The new tape generated by READER will be identical to the input tape except that the error flag will have been set to -1 for the specified rooms. The NAMELIST control variable, RNUM, is used to specify the room to be flagged. Up to 50 rooms can be flagged on one run.

If this error flag has previously been set to -1 by READER or to 0 by MAKER, that room will be skipped when the DATAC2 subroutine is used to create a regression analysis data file (see Section 4.4.2.3).

The control variables, NSKIP and NQ, are used to skip over blocks of data. This results in lower computer costs by reducing the number of tape read operations required. This requires some knowledge as to where on the tape the rooms of interest are located. Another way to reduce the computer cost is to redimension Y whenever LAM options 1, 4, 5, 6, and 7 are used. Since these options (see Table 15) only operate on the room parameters, only the first 132 words of the data record need be read. Consequently, for these cases Y should be redimensioned to Y(132) from the nominal Y(15000). This can be done by changing the DIMENSION statement in the source deck and recompiling the program.

4.4.3.2 Selecting the Rooms

Room selection can be accomplished either by specifying groups of rooms (OPTION = 1) or by specifying particular rooms (OPTION = 0).

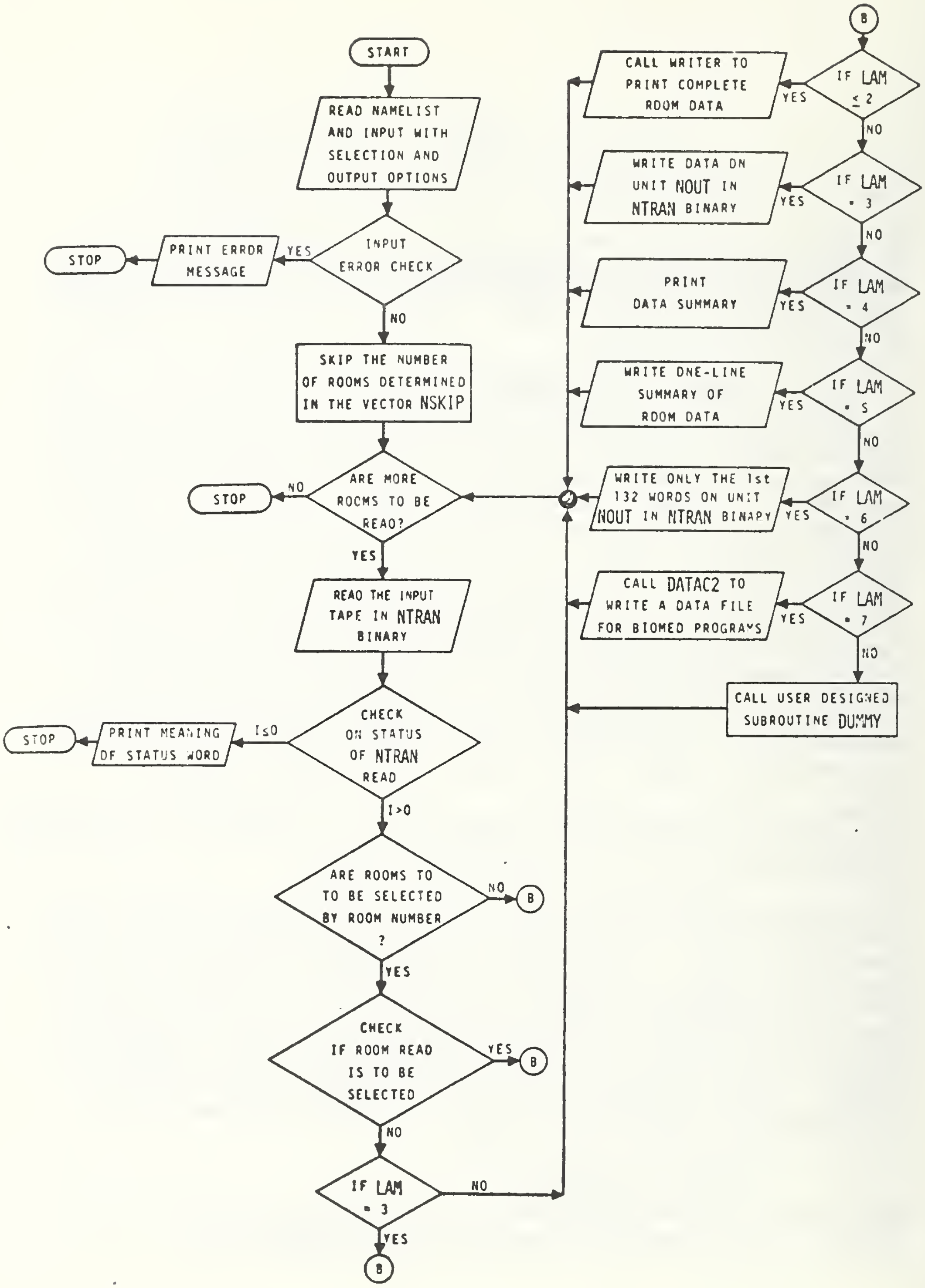
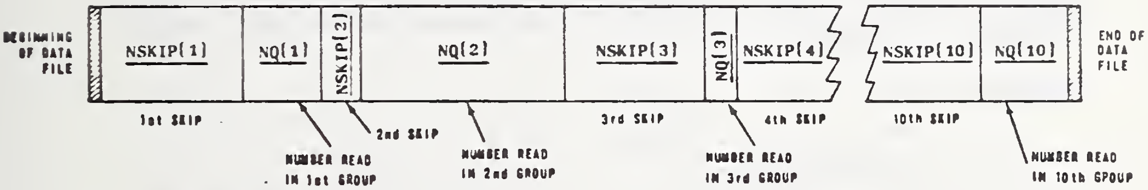


Figure 23. General Flow Chart for READER

To select groups of rooms the user must first determine where on the input tape each group begins and how many rooms are to be included in the group. NSKIP gives the number of rooms to be skipped from the end of the previous group, or from the beginning of the tape; NQ is two times the number of rooms to be selected.

A graphic representation of this operation is shown below:



Up to ten separate groups may be selected in one run. Additional groups may be obtained by stacking runs. If all the room on the input tape are to be processed, NSKIP must equal 10*0 and NQ must equal 90000, 9*0. NSKIP and NQ are each vectors dimensioned for 10 elements. Thus (10*0) means each element is set to zero and (90000, 9*0) means the first element is set to 90000 and the rest are set to 0. These are the default values.

Particular rooms can be chosen by specifying the building number, floor number, and room number for each room to be selected. The control variable RNUM is used for this information. Up to 50 rooms can be specified. This selection procedure can be used in conjunction with the first procedure for situations where all the specified rooms are in a particular building. NSKIP is given a value to carry the read to the beginning of the building. If the rooms are located in definable areas, this method should speed up the selection process. This cannot be used for LAM = 3 because all the rooms are to be written on the new tape. To use this procedure, OPTION must be set to 0. The program checks each room against the input data and selects those for which a match is obtained. An example of this procedure (OPTION = 0) is given below.

```
$INPUT RNUM = 2,3,5,10,20,1,25,3,50,NC = 9, LAM= ?$END
```

would select room 5 on floor 3 in building 2,
room 1 on floor 20 in building 10,
room 50 on floor 3 in buildng 25.

NC must equal three times the number of rooms; LAM may be any of the 8 available options.

4.4.3.3 Examples of Selection Cases

Example 1

```
$INPUT  LAM = 1, NSKIP = 5, NQ = 1 $END
```

LAM = 1 calls WRITER to print the first 132 words of room data; NSKIP(1) = 5 skips the first five rooms on the input tape assigned to unit 9; NQ(1) = 1 reads only one room after the first skip (the default value of NQ(2 to 10) = 0, so after reading this one room, the read will stop); OPTION = 1 by default.

Example 2

```
$INPUT  LAM = 3, OPTION = 1, RNUM = 1,1,3,25,3,50, NC = 6,
   NOUT = 10 $END
```

LAM = 3 writes a new tape; OPTION = 1 selects those rooms in RNUM and writes them with the tenth word in the first record as a -1; RNUM = 1, 1,3,25,3,50 - the rooms to be selected are building 1, floor 1, room 3 and building 25, floor 3, room 50; NC = 6, NC must equal three times the number of rooms; NOUT = 10, the tape output file is a tape assigned to unit 10 with the input, by default, a tape assigned to unit 9.

Example 3

```
NO INPUT CARD PRESENT
```

Since OPTION = 1, NIN = 9, NSKIP = 0, NQ(1) = 90000 and LAM = 5 by default, a one-line summary will be printed for all the data on the input tape assigned to unit 9.

Example 4

```
$INPUT  NSKIP = 10,50,30,7*0, NQ = 5,17,85,7*0 $END
```

NSKIP = 10 skips 10 rooms; NQ = 5 reads 5 rooms;
NSKIP = 50 skips 50 rooms; NQ = 17 reads 17 rooms;
NSKIP = 30 skips 30 rooms; NQ = 85 reads 85 rooms;
OPTION = 1, LAM = 5 by default, produces a one line summary for each room;
NIN = 9 by default, means the input tape is assigned to unit 9.

4.5 Regression Analysis (Program BMD02R)

4.5.1 Introduction

The data created by Program MAKER is amenable to analysis by any statistical analysis technique desired. Programs SEEKER and READER have been designed to retrieve this data efficiently and to save it for analysis. In doing so, they also provide some of the basic statistical parameters which characterize the data (Sections 4.3 and 4.4). For the specific purposes of this study, however, use was made of the Biomedical Computer Program, BMD02R, to perform stepwise regression analyses of the PSF live load and the PSF un-derated fire load. Although the results of the regression analyses are reported in Reference 2, a brief description of the BMD02R computer program is provided here.

The results of these regression analyses were subsequently incorporated into Program BUILDER (Section 4.6) to provide a statistical model of the live load and fire load in offices.

4.5.2 Program Description

The program computes a sequence of multiple linear regression equations in a stepwise manner. At each step one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error sum of squares. Equivalently it is the variable which has highest partial correlation with the dependent variable partialed on the variables which have already been added; and equivalently it is the variable which, if it were added, would have the highest F value. In addition, variables can be forced into the regression equation. Non-forced variables are automatically removed when their F values become too low. Regression equations with or without the regression intercept may be selected.

Output from the program includes:

(1) At each step:
- (a) Multiple R
- (b) Standard error of estimate
- (c) Analysis-of-variance table
- (d) For variables in the equation:
  1. Regression coefficient
  2. Standard error
  3. F to remove
- (e) For variables not in the equation
  1. Tolerance
  2. Partial correlation coefficient
  3. F to enter

(2) Optional output prior to performing regression:
    (f) Means and standard deviations
    (g) Covariance matrix
    (h) Correlation matrix

(3) Optional output after performing regression:
    (i) List of residuals
    (j) Plots of residuals vs. input variables
    (k) Summary table

A complete description of program operation, computational procedures and operating instructions is provided in Reference 11.

4.6 Building Analysis (Program BUILDER)

4.6.1 Introduction

The function of Program BUILDER is to recreate the psf live load and the psf fire load in every room of a specified building. It does this by using the statistical models previously developed (Sections 4.5 and 4.6) for those rooms for which survey data is not available. If there are rooms in the building for which the user knows the loads (for instance, if a room was surveyed during this study), the program will use the actual load if that is desired.

The program is arranged into a main program and one subroutine (FLMOD). The main program performs all input and output operations, all data checking, all calculations on rooms with known loads, and all calculations of floor and building totals. The subroutine performs the load calculations using the statistical model. If the user desires to perform a live load or fire load study using a different statistical model, he will have to modify the FLMOD subroutine.

If desired, the program will print the complete description of each room or room segment. Included here are such things as the east, west, north, and south wall locations; the room use; firm data; psf live load; and psf fire load. In addition to this optional output, the program always prints a number of floor and building totals.

The program is dimensioned for up to 600 room or room segments per floor. The general program flow is shown in Figure 24.

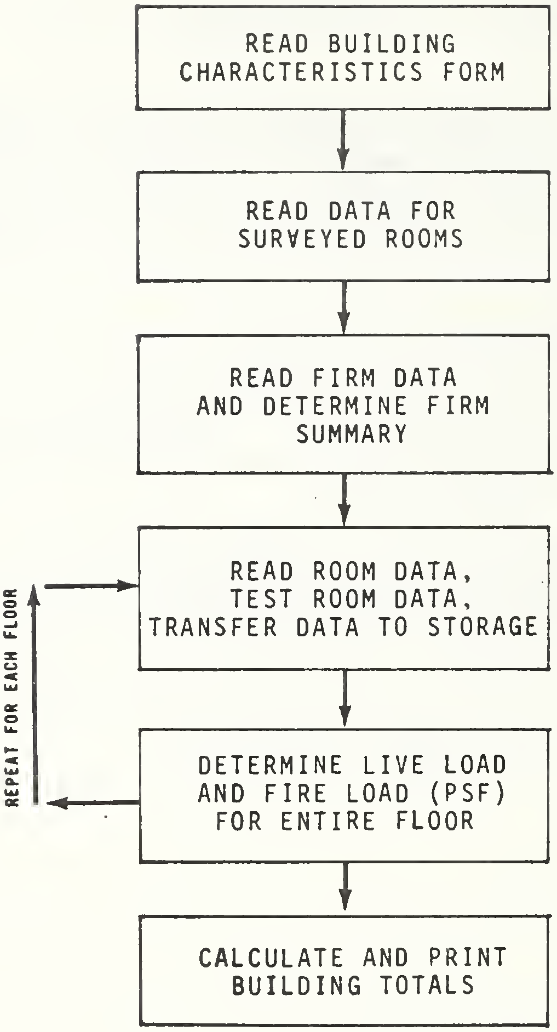


Figure 24. General Flow Chart for Program BUILDER

4.6.2 Operational Techniques

4.6.2.1 Input Data

Three types of input data are required for Program BUILDER. The first type is a set of run parameters defining the type of input and output desired. The second type of data is the room-plan information (including building and firm characteristics), and the third type is load data for specific rooms. The first two data sets are always required but the third is optional.

The run parameters are all logical variables input on one NAMELIST input record. This record is always required, although none of the variables need to be specified if the user desires to use the default values. These variables define:

- Whether load data for specific rooms is being used,
- Whether all of the output is to be printed,
- Whether the room-plan data is to be read from a NAMELIST input record, a binary tape file, or a binary FASTRAND file, and
- Whether the output is to be written on a binary tape file, a binary FASTRAND file, or nowhere.

The specific details required by the user are given in Appendix B.8 (Table 2).

BUILDER is designed to read the room-plan data tape (Data File 2) according to the tape format described in Table 1 of Appendix B.8. Each file on the tape represents a single building. The first record contains the building characteristic data (25 words) and the next record contains the firm information (8 words per firm). Each subsequent record contains data for one room or room segment (34 words). The tape must be in binary format and must have been created with the NTRAN software for the UNIVAC 1108. All of the rooms or room-segments for a specific floor must be adjacent to one another, but within a given floor the rooms may be in any order.

To facilitate program checkout and to provide additional flexibility, the program will also read the above data from cards (in NAMELIST form). The data must be in the same sequence as required for the magnetic tape. A separate NAMELIST input record is required for each data record. The building characteristic record is called TEST1, the firm data record is called TEST2, and each room-plan record is called TEST3. The arrangement of this data is described in Appendix B.8 (Table 2).

Load data may also be used for specific rooms if the user so desires. This is done by setting the run parameter SURDAT = TRUE and providing the required data on cards. For each room being given a specific loading, the following information must be provided:

- Building number
- Floor number
- Room number
- PSF live load
- Standard deviation of live load
- PSF fire load
- Standard deviation of fire load

This data must be provided in the specified format (1Hb, 3F10.0, 4E12.6).

If more than one building is being processed on the same run, the surveyed data may all be placed on one file or a separate file may be used for each building. Two title cards are required at the beginning of each file and an end-of-file card is required at the end of each file. The building sequence in the surveyed-data must match the building sequence in the room-plan data. Program SEEKER (See Section 4,3) has a special option for generating the surveyed data in the required form.

4.6.2.2 Error Checking

The program performs a number of data checks to insure that the data is internally consistent. If it finds inconsistent data, an error message is printed, but generally the run is allowed to proceed.

On the building characteristic data, the following items are checked:

- Building number should be less than 102,
- State number should be less than 52,
- The construction date should be between 1800 and 1974,
- The number of stories should be less than 101,
- The vertical load resisting system, the building materials, and occupancy type should be one of the designated indices.

On the firm data, the following program checks are made:

- That the firm number is less than 1001,
- That the firm type is one of the standard industrial classifications,

- That the firm age is less than 175 years.

The program also checks the load data being input for specific rooms and the room-plan data against the building-characteristic data. If an inconsistency is found here, the run is terminated. The items checked are:

- The building number,
- The floor number,
- The substitution flag (0 or 1),
- The room use flag (1 to 12).

4.6.2.3 Load Model

The live loads (psf) and fire loads (psf) produced by BUILDER are developed in three ways depending on the room use and on whether specific data was input for the subject room. If specific data was input, that data is used without modification. If the room is designated as a stairway (use index = 8), elevator (use index = 9), corridor (use index = 10), other (use index = 11), or vacant (use index = 12), the loads and their standard deviations are set to zero.

If, however, the room is one of the types of rooms covered by the survey (use index = 1 to 7), the statistical model discussed in Section 4.5 and in Reference 2 is used to generate the floor loading. Subroutine FLMOD performs this determination.

The fire and live load models incorporated into BUILDER depend only on the room use. Other possible variables were investigated but found to be unimportant compared to the effect of room use. The details of this investigation and the models themselves are discussed in detail in Reference 2. FLMOD simply selects the desired floor loading from the following list which defines the models in their entirety.

Use	Use Index	PSF Live Load	PSF Fire Load Un-derated
General	1	9.2	7.5
Clerical	2	10.1	6.4
Lobby	3	4.0	4.4
Conference	4	5.7	5.2
File	5	25.3	16.8
Storage	6	15.8	12.7
Library	7	26.4	24.7

The standard deviations of the live load and fire load are 7.82 and 6.22, respectively, irrespective of the room use.

4.6.2.4 Output

The room-plan data is provided to the program on a room or room-segment basis. Because each room-plan record only contains data for a rectangular area, several records are required to describe non-rectangular rooms. The addition flag (0 or 2 = add, 1 or 3 = subtract) defines whether the area should be added or subtracted from other elements with the same floor and room number. The results produced by program BUILDER retain the same data blocks as existed in the input. Each room will be described by one or more records just as it was on the input tape. The sequence of these data blocks may be rearranged because all blocks with the same floor and room number will be adjacent to one another in the output.

The items included in the output are described in Table 16. Most of the information included on the input tape will also appear in the output. Instead of having a firm number, however, each room will now have a firm type and a firm age. The printing of this data is optional.

When the output data is being written on a magnetic tape or FASTRAND file, the first record will be the building characteristic data and all subsequent records will be the room-plan and load data. After all room records for a single building have been recorded, a single "end-of-file" mark will be recorded. When the last building being processed is complete, another "end-of-file" mark will be recorded on the tape. If the data is being written on tape, the UNIVAC software, NTRAN, is used. However, if the data is being written on a FASTRAND file then a normal Fortran binary write is used.

In addition to the data shown in Table 16, the printed output also contains several floor and building totals. For each floor, the program produces:

- total live load (lb)
- total fire load (lb)
- total live load determined from surveyed data (lb)
- total fire load determined from surveyed data (lb)
- total area (ft^2)
- total surveyed area (ft^2)
- total area of stairways, corridors, elevators, and other (ft^2)
- total room area broken down into 12 use categories (ft^2)

For each building

- all of the items listed above, plus
- number of firms broken down into 10 type categories

- number of rooms broken down into 8 use categories (not including stairways, corridors, elevators, and other)

All of these floor and building summaries are always printed.

TABLE 16. ROOM PARAMETERS: OUTPUT OF BUILDER
(Page 1 of 2)

Building Characteristics (Record 1)

1 Surveyor No. (001 to 999)

2 Building No. (001 to 200)

3 State No. (01 to 51)

4 Zip No. (00001 to 99999)

5 Year Built (1700 to 1974)

6 Number of Stories Above Ground Level (00 to 99)

7 Vertical Load Resisting System

    1 = column

    2 = bearing wall

8 Building Material

    1 = concrete

    2 = steel

    3 = masonry

    4 = wood

9 Occupancy Type

    1 = federal government

    2 = state government

    3 = local government

    4 = private

    5 = private and government

10 Number of Firms in Building (001 to 999)

TABLE 16. ROOM PARAMETERS: OUTPUT OF BUILDER
(Page 2 of 2)

Room Data (Record 2 and Subsequent)

1 Floor No. (00 to 99)
2 Room No. (000 to 999)
3 West coordinate (ft)
4 East coordinate (ft)
5 North coordinate (ft)
6 South coordinate (ft)

With respect to building origin

7 Flag
    0 = add area, not surveyed
    1 = subtract area, not surveyed
    2 = add area, surveyed
    3 = subtract area, surveyed
8 Firm type (00 to 99)
9 Firm age (000 to 200)
10 Room Use
    1 = general
    2 = clerical
    3 = lobby
    4 = conference
    5 = file
    6 = storage
    7 = library
    8 = stairway
    9 = elevator
    10 = corridor
    11 = other
    12 = vacant
11 Mean fire load for room (psf)
12 Standard deviation of mean fire load (psf)
13 Mean live load for room (psf)
14 Standard deviation of mean live load (psf)
15 Area of room (i.e., room segment)

4.6.3 Operating Logic

4.6.3.1 MAIN Operating Logic

Almost all of the operations required for the program are contained within the main program. This includes all input and output, and most data manipulation. Whenever an end-of-file mark is encountered on the input tape, the program assumes that the building has been completed. It then tries to read data for another building. Whenever two end-of-file marks are encountered in succession, the program assumes that the job is complete.

The operation of program BUILDER is described graphically in the flow chart of Figure 25. The major operations of the main program are as follows (shown sequentially):

- Initialize parameters and read $INPUT
- Read, manipulate, and test building-characteristic data
- Read, manipulate, and test data for surveyed rooms
- Read, manipulate, and test firm data; form firm totals
- Read and test room data until floor number changes
- Determine all load parameters for the floor just read
    - + If room was surveyed, use that load data
    - + If room is a stairway, corridor, elevator, other, or vacant, set loads to zero
    - + Call FLMOD to determine load parameter for remaining rooms
- Write the output on printer and/or tape or FASTRAND file
- Calculate floor and building totals
- Write floor and/or building totals on printer
- Proceed to next floor or building

4.6.3.2 FLMOD Operating Logic

FLMOD was structured in anticipation that the fire and live loads would depend on a number of parameters such as room use, room area, and firm type. Consequently it determines the true area of each room prior to determining the loads. In the final formulation, however, the loads are only a function of the room use. Consequently, FLMOD simply uses the Use Index to select the proper load (mean and standard deviation) from a table compiled into the program. The Use Index varies from 1 for a general office to 7 for a library. The desired loads are placed in the MODEL2 matrix for output purposes.

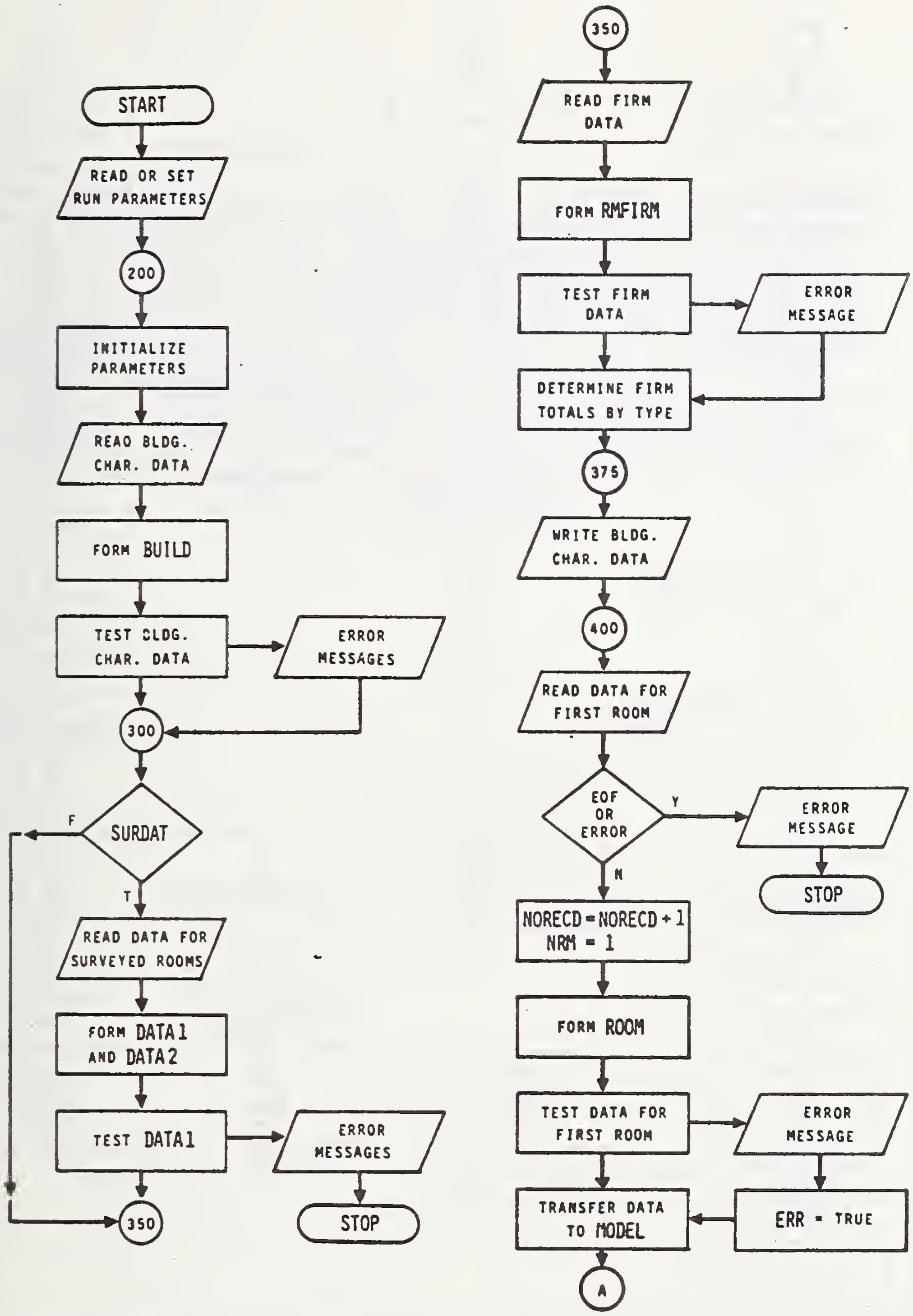


Figure 25. Detailed Flow Chart for Program BUILDER

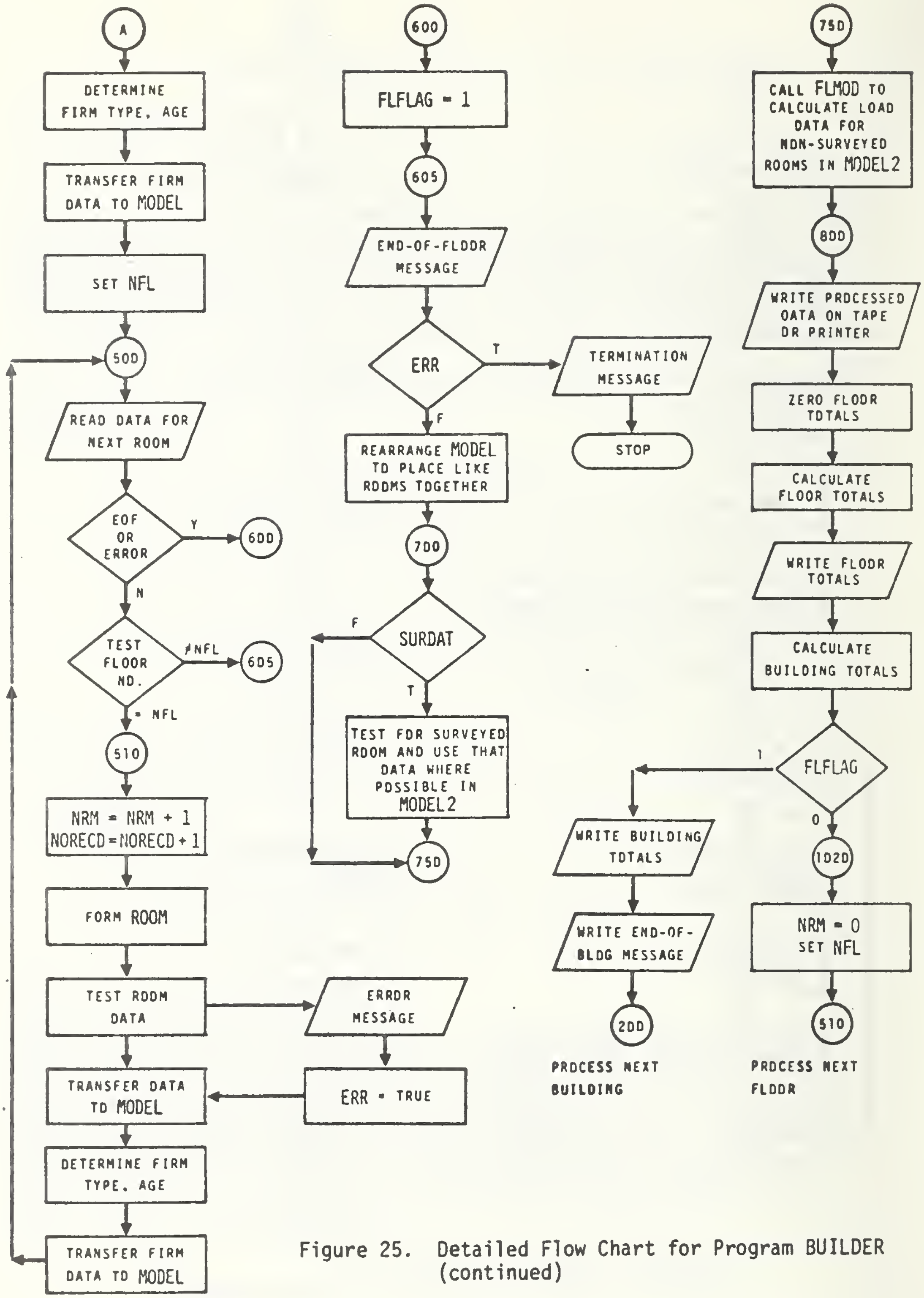


Figure 25. Detailed Flow Chart for Program BUILDER (continued)

5. ACKNOWLEDGMENTS

Several staff members at NBS and the Bureau of The Census contributed to the development of the computer programs contained in this report. The program for scanning the FOSDIC documents was written by Alex Courtney, Bureau of The Census. The authors developed the computer programs described in Chapters 3 and 4. Leighton Greenough and Irvin Pulaski, from the Product Engineering Division, NBS, wrote the computer program for scanning the floor plan tracings. Dr. Joan Rosenblatt, Applied Mathematics Division, NBS, provided continual guidance on selection of the room survey sample and the mathematical procedures adopted to reduce the survey data. Newton Breese, Center for Fire Research, assisted in debugging the computer programs, preparing the floor plan tracings, and processing the survey data.

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APPENDIX A

DATA PROCESSING FORMS AND INSTRUCTIONS

The forms and instructions used to collect data in the rooms surveyed were presented in a previous report (1). In addition, special procedures were developed to randomly select the rooms to be surveyed in the 23 buildings in Phase I and process information on the building geometry. Instructions for preparing the Area Classification Documents used for the room selection and the Plans Document used to generate the geometric coordinates for all areas within the building are included in this Appendix.

Instructions for Completion of Area Classification Document

The Area Classification Document is a FOSDIC form used for computer processing of information on the firms occupying the building and the use of each area within the building. Information to be recorded on this document is obtained from the building floor plan blueprints used in the initial survey of the building. After completion, this document is used as input to a computer program which randomly selects the specific rooms to be surveyed within a given building.

The building number and floor number are recorded on each sheet of the floor plans. Each area (room, corridor, elevator, etc.) on a given floor has been assigned a number. This number is circled on the plans. For each circled room number, a one or three part code number, e.g. 3-2-2, 11, or 5/1/10, has also been recorded on the plans. This code corresponds to the different sections to be filled in on the Area Classification Document.

Each digit in the code number represents a different section of the FOSDIC form. The first number is the firm number, the second tells whether it is an enclosed or open room, and the third tells what the room is used for. In some cases, the code will be only one number. In that case, the code number represents room use. Most of the time this one digit number will occur in elevator spaces and stairwells and the like where firm numbers are not appropriate. A single digit code is also used for vacant rooms.

Using the floor plans, fill out the Area Classification Documents. On each Area Classification Document, first fill out the building and floor number at the top of the page. There is no specific order required for recording the rooms on the document, i.e. numerical order of rooms is not necessary. However, only rooms from the same floor may be on the same sheet. A floor may have more rooms than can be recorded on one sheet. In that case, after completing a sheet, just fill out another sheet with the same building and floor information at the top and continue.

First, fill in the firm number in the section entitled FIRM using the first number in the code.

Next, fill in the circled room number in the section entitled ROOM NUMBER. Do not use the special mark in this section indicated for subtraction.

Next, fill in enclosed or open room using the second number in the code:

1 - fully enclosed
2 - open: with partitions
3 - open: without partitions

Skip the section entitled NO. IMAG. ROOMS.

Next, fill in the room use using the third number in the code:

1 - general
2 - clerical
3 - lobby
4 - conference
5 - file
6 - storage
7 - library
8 - stairway
9 - elevator
10 - corridor
11 - other

For vacant rooms, indicated on the plans as 12, the ROOM USE should not be marked but the number 5 should be marked in the Z column. Where there is only one number in the code, do not fill in anything for firm number or enclosed or open room.

The X and Y columns should be left blank in all cases.

Next, fill in the Z column using 0 if the room is <u>less than</u> or <u>equal</u> to 200 square feet and 1 if it is <u>more than</u> 200 square feet. (The area of the room is usually marked on the plans as so many "sq. ft." or "0" or the Z value has been indicated.) If there is only one number in the code, the square footage need not be marked in the Z column. If a room has the same firm number as the room before it, the "same as before" circle may be marked in lieu of firm number. If an area having no firm number connected with it, such as an elevator, comes within a group of rooms of the same firm number, "same as before" must also be marked. When starting a new sheet, the firm number should be marked in block 1 even if it is the same as the last block filled out on the previous sheet.

In the top section of the form, the blocks labeled 1 through 11, "HOR.REF.1,""HOR.REF.2,""VERT.REF.1," and "VERT.REF.2" should be ignored.

The Area Classification Documents for each building should be stacked together in order by floor.

The following is an example of a record for one room.

The following data was recorded on the floor plans:

BLDG 24
FLR 5

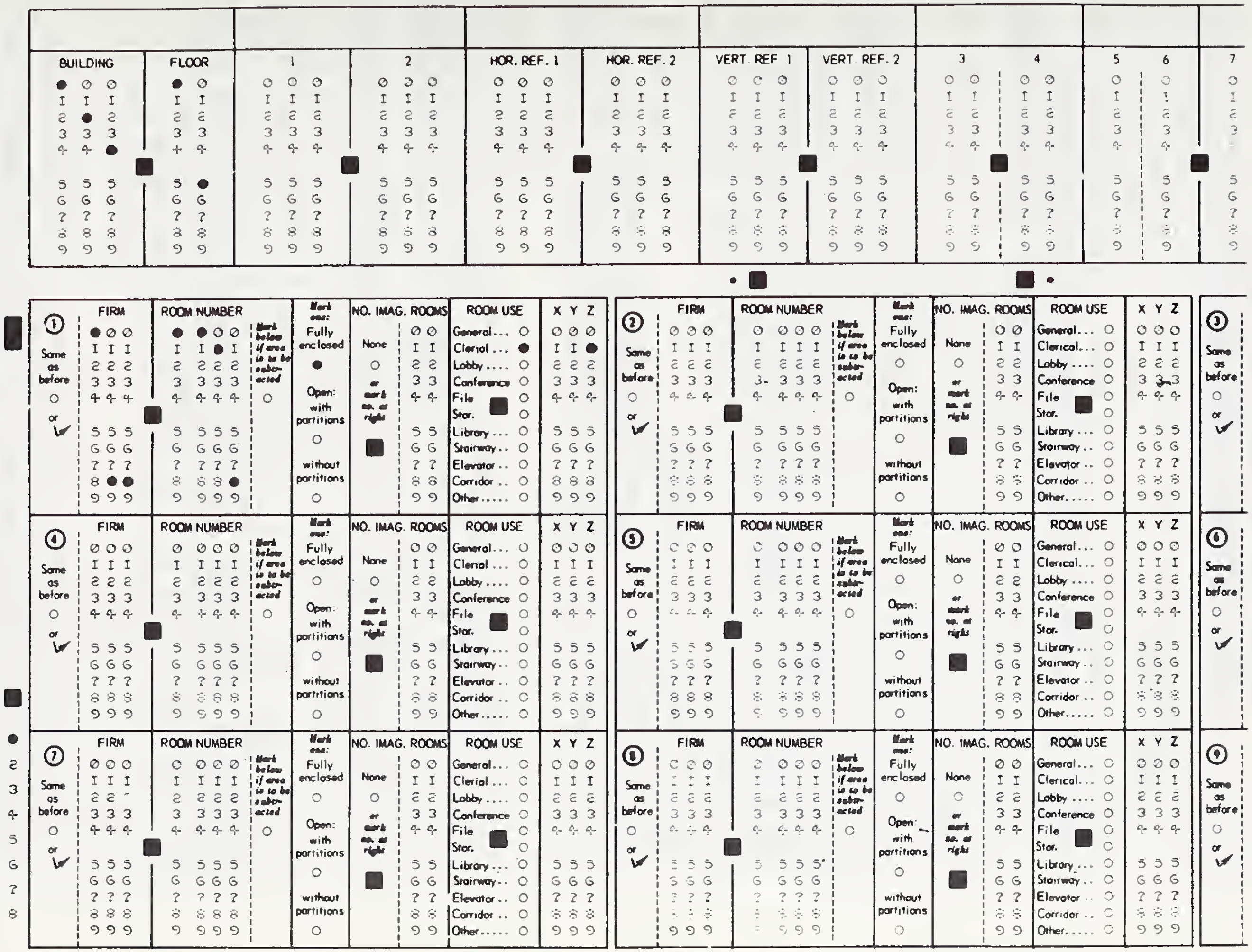
⑱

88/1/2 } in the individual
287 ø } room or area

The completed section of the Area Classification Document is as follows:

AREA CLASSIFICATION DOCUMENT

FIRE LOAD AND LIVE LOAD SURVEY



BUILDING ● 0 ● 2 ● 4 | FLOOR ● 0 ● 5 | 1 | 2 | HOR. REF. 1 | HOR. REF. 2 | VERT. REF 1 | VERT. REF. 2 | 3 | 4 | 5 | 6 | 7

① Same as before ○ or ✓ | FIRM ● 0 ● 8 ● 8 | ROOM NUMBER ● 0 ● 0 ● 1 ● 8 | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ● Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ● Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z ● Z 1

② Same as before ○ or ✓ | FIRM | ROOM NUMBER | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ○ Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ○ Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z

③ Same as before ○ or ✓

④ Same as before ○ or ✓ | FIRM | ROOM NUMBER | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ○ Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ○ Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z

⑤ Same as before ○ or ✓ | FIRM | ROOM NUMBER | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ○ Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ○ Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z

⑥ Same as before ○ or ✓

⑦ Same as before ○ or ✓ | FIRM | ROOM NUMBER | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ○ Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ○ Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z

⑧ Same as before ○ or ✓ | FIRM | ROOM NUMBER | Mark below if area is to be subtracted ○ | Mark one: Fully enclosed ○ Open: with partitions ○ without partitions ○ | NO. IMAG. ROOMS None ○ or mark no. at right | ROOM USE General... ○ Clerical... ○ Lobby.... ○ Conference ○ File ○ Stor. ○ Library... ○ Stairway.. ○ Elevator.. ○ Corridor.. ○ Other..... ○ | X Y Z

⑨ Same as before ○ or ✓

INSTRUCTIONS FOR COMPLETING THE PLANS DOCUMENT AND ROOM LOCATOR DOCUMENT

I. PLANS DOCUMENT

The Plans Document is a 17" x 22" sheet of tracing paper with eight squares to the inch. To make the document, first, lay out the original size floor plans. The plans should be fastened down and the graph paper fastened over it. (In order to make the tracing simpler, a light table should be used, if available).

Document Origin

The document is laid out using horizontal and vertical axes. The horizontal axis is on the long (22") side; the vertical axis is on the short (17") side. The origin is the point 3" down from the horizontal edge and 2" in from the vertical edge. See Figure 1. The origin should be placed over the starting point on the plans, the axes should be lined up parallel to outside walls on the plans and the sheet should be fastened down so it will not shift.

Horizontal and Vertical References

After the document is fastened in position, the horizontal and vertical reference marks should be made. The references are two pairs of marks which an electronic scanner will later use to locate and scale rooms on the document.

The horizontal reference marks are 3/4" long and are located along the horizontal side as follows: HOR. REF. 1 - parallel to and 2 inches in from the vertical edge and between 1 and 2 inches down from the horizontal edge. HOR. REF. 2 - between 1 and 2 inches down from the horizontal edge and parallel to the vertical edge, and about 15" to 18" from HOR. REF. 1. (The largest, most convenient distance between the two referneces is preferred).

The vertical references follow the same idea as the horizontal references. VERT. REF. 1 is located parallel to and 3 inches down from the horizontal edge, and between the vertical edge and 1 inch in from the vertical edge. VERT. REF. 2 is also between the vertical edge and 1 inch in from the vertical edge and parallel to the horizontal edge, and about 10" to 13" from VERT. REF. 1. See Figure 2.

Scaling the References

In order for the electronic scanner to know the distance the two marks represent, the references must be scaled. In the lower right hand corner of the floor plans you will find the scale for the drawing. It will tell you what part of an inch on the drawing is equal to 1 foot in reality, e.g. 1/4" = 1'. The number assigned to a particular reference mark is the scaled distance from the origin to the reference mark. Using the example scale of 1/4" = 1', assume HOR. REF. 2 is 15" from HOR. REF. 1. HOR. REF. 1 is at the origin and, therefore, equals zero. HOR. REF. 2 is 15" in the horizontal direction away from the origin and, therefore, using the scale 15" = 60' and HOR. REF. 2 equals 60. The process is repeated for the vertical references.

The useful work area of the Plans Document is 18" horizontally from the origin by 13" vertically from the origin.

In most cases, one sheet will not be enough to cover one floor on the floor plans. When this happens, another document with another set of references will have to be added. The locations of the reference marks will be the same, however, the number assigned to the marks may change.

Assume that you have finished the first Plans Document, but, in order to cover the whole floor plan, another sheet is needed that is 10" lower than the first. Using the example scale, 1/4" = 1', HOR. REF. 1 still equals 0 and HOR. REF. 2 still equals 60 because the new sheet was moved down, but not to the right, i.e. it was only moved in the vertical direction. Now, the new VERT. REF. 1 is 10" from the origin. Using the scale, 10" = 40' the new VERT. REF. 1 equals 40. If you have made the new VERT. REF. 2 another 10" from VERT. REF. 1, the VERT. REF. 2 equals 40 (from VERT. REF. 1) plus 40 (for additional 10") or, in other words, the new VERT. REF. 2 equals 80.

Room Boundaries

Each area on the floor plans contains a circled red number. The space could be an office, an elevator, a janitor's closet, a corridor, or whatever. This is unimportant for preparing the Plans Document.

To show the boundaries of a room, all you need is four marks. The marks should be placed so that a vertical line passes perpendicularly through two of them and a horizontal line passes perpendicularly through the other two. See Figure 3.

When marking the boundary marks, the wall will often times be shown as a thick section. When it is shown in that way, it is legitimate to draw the boundary mark in between the two surfaces. See Figure 3.

All room boundary marks must be located within the useful work area of the Plans Document.

Multi-Area Rooms

Not all rooms are rectangular in shape. In Figure 4, we see an L-shaped room made up of two areas, A and B. There are two different methods of handling odd shaped rooms like this. The first method is to add the two pieces, A and B, by treating each as the same room on the Plans Document. Put in boundaries for each piece and in filling out the Room Locator Document (described later) call both pieces by the same room number.

The second method is pick a rectangle that contains the room and subtract the part that doesn't belong. See Figure 5. The subtracted part should have the same room number as the area from which it is subtracted. The procedure for indicating subtraction is discussed in the Room Locator Document instructions.

Room Boundaries for Groups of Rooms

When dealing with groups of rooms, which is more often the case, instead of single rooms, it is important to note that the same room boundary may be used for more than one room. Keep in mind, however, that the boundary marks for a room or area must be on the same horizontal or vertical line. Figure 6 shows a group of three rooms. As you can see, Rooms 1 and 2 share boundary mark A while Rooms 2 and 3 share boundary mark B. It is possible to expand the concept in order to handle much larger groups of rooms.

Area Coordinate Marks

At the same time the room or area boundary marks are being put in place, the area coordinate marks should be positioned.

The electronic scanner uses these horizontal and vertical area coordinate marks to find the inside of an area. Once inside the area, the scanner goes off in a horizontal line and in a vertical line until it comes to an area boundary mark. Since the area boundary marks were laid out so that a horizontal or vertical line would cross them, the area coordinate marks can be considered as a sort of pointer for those lines.

Figure 7 shows the area on the document reserved for the coordinate marks.

Figure 8 is an example of the position for several coordinate marks.

You can have a maximum of nine marks in each direction. Number the marks starting in the upper left hand corner with one and going left to right for the horizontal coordinates and top to bottom for the vertical coordinates. See Figure 8.

On each new document begin numbering the area coordinate marks over again beginning with one.

Overlapping Documents

As indicated before, one Plans Document will probably not be sufficient to contain an entire floor, and successive documents will be required for that floor. For convenience these documents may overlap.

However, data should not be repeated. If a room has been recorded once, it should not appear again.

General Notes

It should be noted that two parallel, adjacent marks that are to be scanned as individual entries, cannot be closer than 3/8" apart. This includes room boundaries and coordinate marks. Although it is possible to use freehand, a straight edge is recommended for drawing the marks on the document. After the Plans Document is complete, it should be left in place unitl the Room Locator Document is done. This allows for much easier identification of rooms and fewer mistakes on the latter document.

It would be advisable to use some method of identifying to which Room Locator Documents the Plans Documents are tied.

II. ROOM LOCATOR DOCUMENT

Once the Plans Document is completed, the Room Locator Document can be filled out.

Heading Section

In many cases there will be several Room Locator Documents for each Plans Document.

At the top of each document, record the building number, floor number, and complete Block 3. In Block 3 the two columns represent "sheet _____ of _____." The first column is the sheet number and the second column is the total number of sheets used with a particular Plans Document.

On the first sheet only of the group of Room Locator Documens for each Plans Document, in Block 1 record the horizontal distance from the primary origin to the secondary origin. In Block 2, record the vertical distance from the primary origin to the secondary origin. Also on the first sheet only, using the block labeled "HOR. REF. 1," "HOR. REF. 2," "VERT. REF. 1," and "VERT. REF. 2," record the appropriate numbers used to label the reference marks on the Plans Document.

Room Section

Some rooms may have been traced as several areas on the Plans Document. Each area must have its own block on the Room Locator Document. Each of the areas for one room must also have the same room number. It is convenient to subtract an area in order to find the size and shape of a room, that subtracted area must have the same room number as the area you are subtracting it from. In some cases, such as corridors, an area will be divided between two or more Plans Documents. These areas still have the same room number.

In each numbered block, fill in the room number and whether the area is subtracted. Also, fill in Columns X and Y, corresponding respectively to the horizontal and vertical coordinates utilized in that area on the Plans Document.

Do not fill in the blocks headed "FIRM,""FULLY ENCLOSED,""NO. IMAG. ROOMS,""ROOM USE," or Column Z.

When all the Plans Documents and Room Locator Documents for one building are completed, stack them in order by floor with the Room Locator Document(s) followed by the Plans Document associated with it.

Figure 1

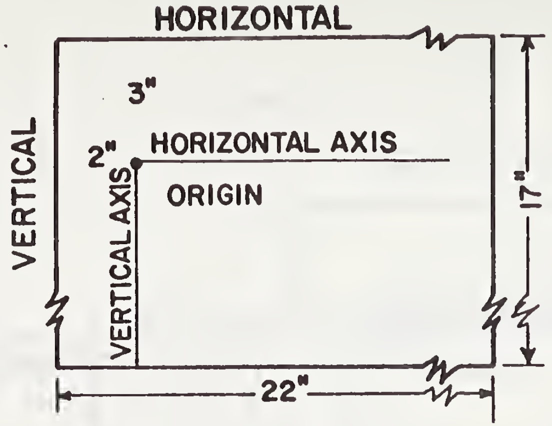


Figure 2

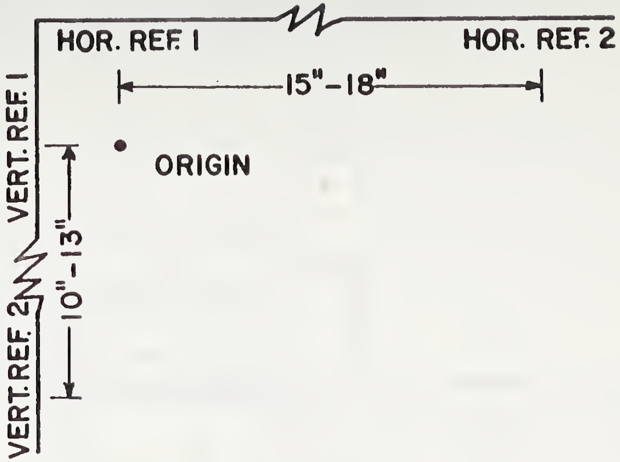


Figure 3

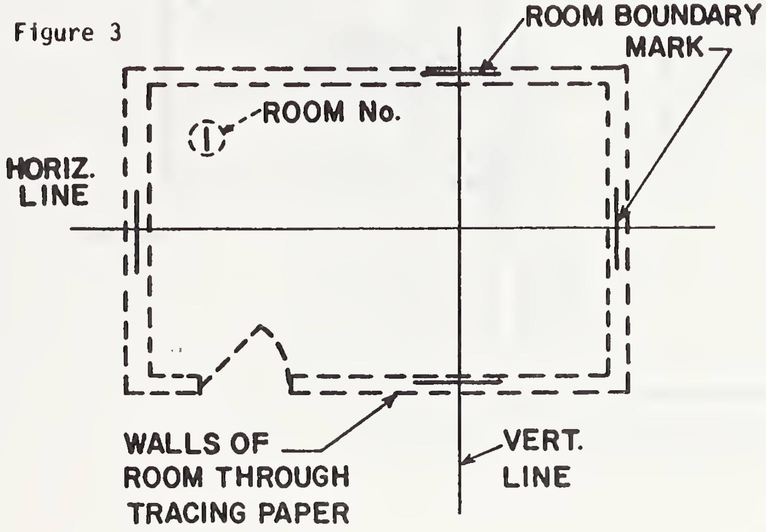


Figure 4

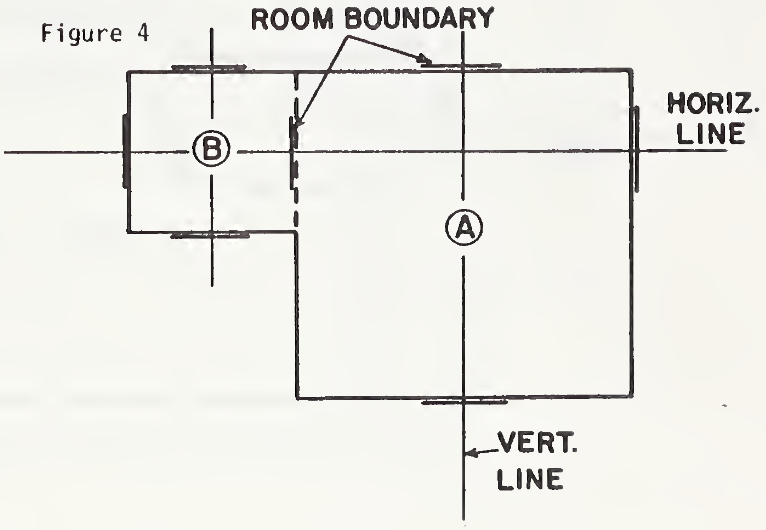


Figure 5

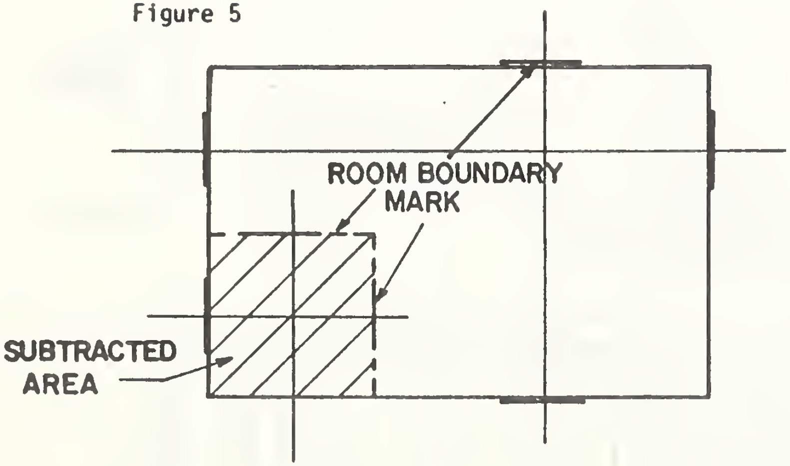


Figure 6

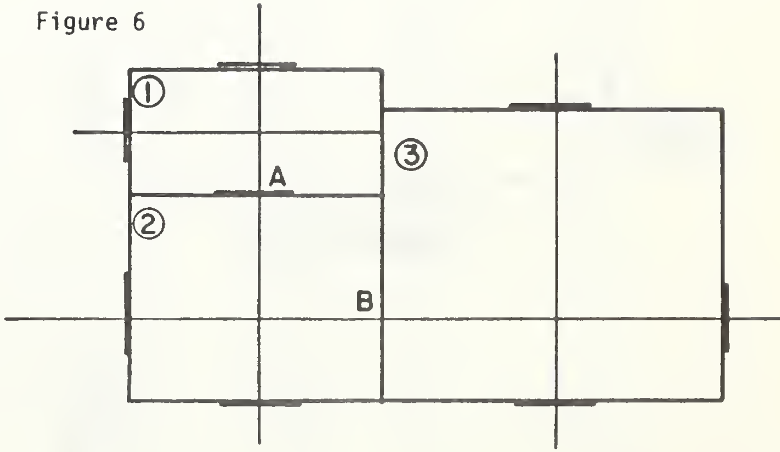


Figure 7

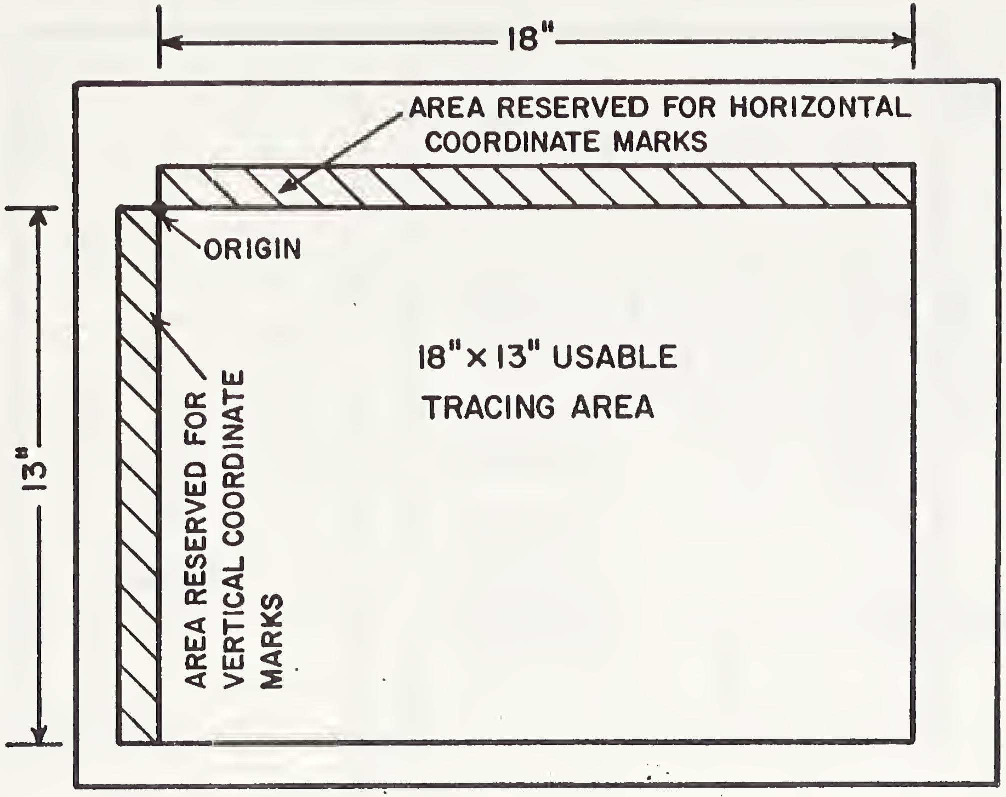
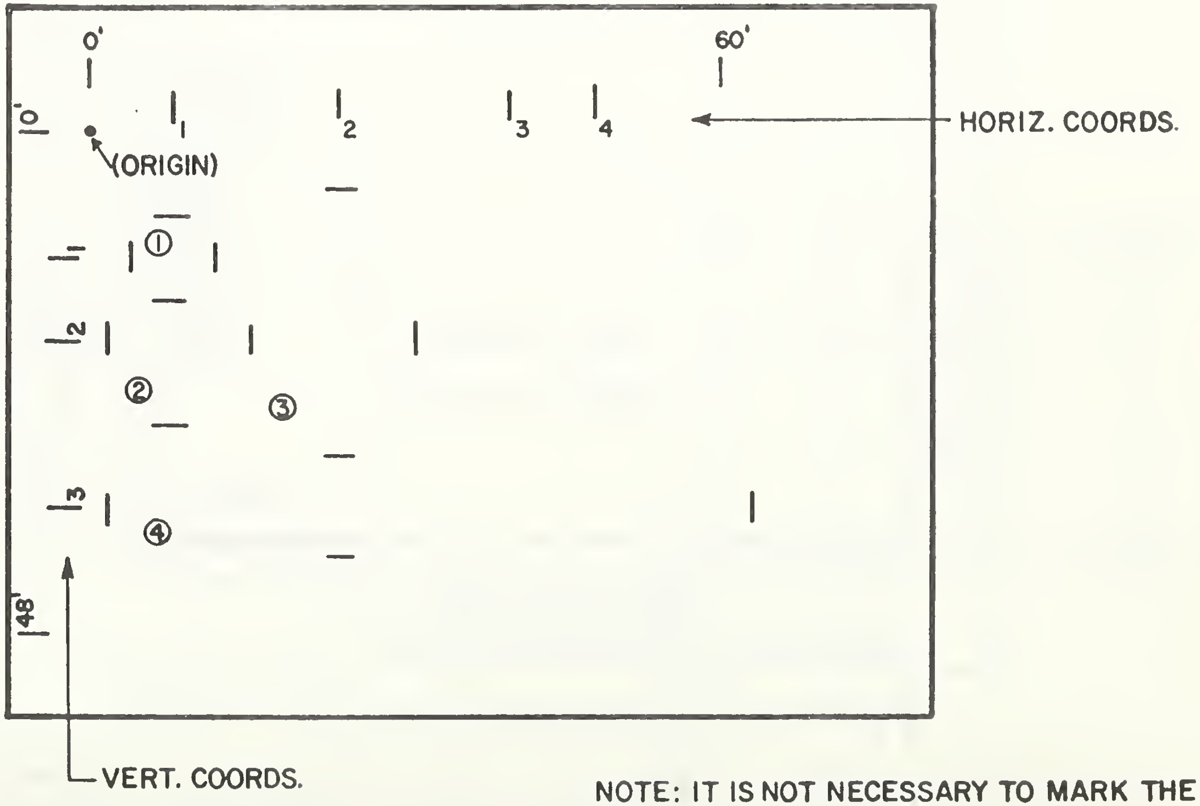

18"
AREA RESERVED FOR HORIZONTAL COORDINATE MARKS
ORIGIN
13"
AREA RESERVED FOR VERTICAL COORDINATE MARKS
18" x 13" USABLE TRACING AREA

Figure 8 A Sample of a Plans Document



NOTE: IT IS NOT NECESSARY TO MARK THE ORIGIN

APPENDIX B.1

DATA LAYOUT FOR CENSUS DATA TAPE

AREA CLASSIFICATION DOCUMENT

LOG. REC.	CHAR. POS.	IDENTIFIER
1	1	Area Calssification Document "U"
	2	Calibration Indication
	4-6	Building Number
	11-12	Floor Number
2	15-17	Firm No. Block 1
	18-21	Room No.
	22	Subtraction Flag
	23	Enclosure
	26	Room Use
	29	Area Size
	30	Vacant Room
	33-48	Same as 15-30 For Block 2
	51-66	Same as 15-30 for Block 3
	69-84	Same as 15-30 For Block 4
	87-102	Same as 15-30 For Block 5
	105-120	Same as 15-30 For Block 6
3	15-120	Same as Log. Rec. 2 for Blocks 7-12
4	15-120	Same as Log. Rec. 2 for Blocks 13-18

FORM 1 - BOUNDING SURFACE

LOG. REC.	QUES. NO.	CHAR. POS.	IDENTIFIER
1		1	Form 1 - Front "A"
		2	Calibration
		5- 7	Building Number
		9- 10	Floor Number
		13- 16	Room Number
		19- 21	Surveyor Code
	1	31	Room Use
	2	33	No. Occupants
	3	35- 38	Wall Types
	4	40- 46	Material at Ceilings Floors Doors and Trims
	5	47- 54	Wall Material & Covering
	6	55- 66	No. of Doors and Windows and Dimensions for Both (Wall 1)
	6	73- 84	Same as 55-66 (Wall 2)
	6	91-102	Same as 55-66 (Wall 3)
	6	109-120	Same as 55-66 (Wall 4)
2		1	Form 2 - Back "B"
		2	Calibration
	7	4- 8	Partial Ht. Partion Material Length and Height (Wall 1)
		10- 14	Length and Height (Wall 2)
		16- 20	Length and Height (Wall 3)
		22- 26	Length and Height (Wall 4)
		28- 33	Internal Partion #1
		35- 40	Internal Partion #2
		42- 47	Internal Partion #3
		49- 54	Internal Partion #4
	8	60- 68	Room Dimensions
		75- 84	JIC #1 (Comb. Dim. Wt.)
		87- 96	JIC #2
		99-108	JIC #3
		111-120	JIC #4

FORM 2 - DESKS

LOG. REC.	QUES. NO.	CHAR. POS.	IDENTIFIER
1		1	Form 2 - Front "C"
		2	Calibration Indication
	1	4	Desk Type
	2	6	Proximity To Wall
	3	8	Desk Material Type
	4	10- 12	Number of Drawers
	5	14- 17	Desk Top Dimensions
	6	21- 24	Free Paper and Books Pile #1
		27- 78	(Piles #2 to #10)
	7	79- 86	Typewriter #1
		88- 95	Typewriter #2
		97-104	Calculator #1
		106-113	Calculator #2
		118-120	Telephones
2		1	Form 2 - Back "D"
		2	Calibration Indication
	8	9- 66	Enclosed Paper and Books (Piles 1-10)
		75-120	JIC #1, #2, #3, #4 (Same as Form 1-Back)

FORM 3 - TABLE

LOG. REC.	QUES. NO.	CHAR. POS.	IDENTIFIER
1		1	Form 3 - Front "E"
		2	Calibration Indication
	1	3	Table Type
	2	5	Proximity to Wall
	3	7- 8	Material Type Top Ped/Legs
	4	10- 15	Table Dimensions
	5	17	Drawers
		21-120	Same as Form 2 - Front
2		1	Form 3 - Back "F"
		2	Calibration Indication
		9-120	Same as Form 2 - Back

FORM 4 - CABINET

LOG. REC.	QUES. NO.	CHAR. POS.	IDENTIFIER
1.		1	Form 4 - Front "G"
		2	Calibration Indication
	1	3	Cabinet Type
	2	4	Proximity to Wall
	3	5	Cabinet Material Type
	4	6- 7	No. of Drawers
	5	8	No. of Shelves
	6	9- 14	Cabinet Dimensions
	7	15- 17	Gen. Purp. Drawer Type
		21-120	Same as Form 2 - Front
2	1	1	Form 4 - Back "H"
	2	2	Calibration Indication
		9-120	Same as Form 2 - Back

FORM 5 - SHELVING

LOG. REC.	QUES. NO.	CHAR. POS.	IDENTIFIER
1		1	Form 5 - Front "I"
		2	Calibration, Indication
	1	4	Shelving Category
	2	6	Proximity to Wall
	3	8	Shelving Material Type
	4	10- 15	Shelving Dimensions
		21-120	Same as Form 2 - Front
2		1	Form 5 - Back "J"
		2	Calibration Indication
		9-120	Same as Form 2 - Back

FORM 6 - SEATING

1		1	Form 6 - Front "K"
		2	Calibration Indication
	1	13	Seating Type - Block 1
	3	14- 15	Number of above type
	2	16	Proximity to wall
	4	17- 19	Material Types (Frame-Seat-Back)
	5	20- 23	Arms and Padding
	6	24- 29	Dimensions
		30	Blank
		31-120	Same as Above for Blocks 2 thru 6
2		1	Form 6 - Back "K"
		2	Calibration Indication
		13- 66	Same as Front for Blocks 7 thru 9
		75-120	Same as Form 1 - Back

FORM 7 - MISCELLANEOUS

LOG. REC.	CHAR. POS.	IDENTIFIER
1	1	Form 7 - Front "M"
	2	Calibration Indication
	7	Non-Comb/Comb Block 1
	8	Proximity
	9- 14	Dimensions
	15- 18	Weight
	19- 24	Blank
	25- 90	Same as above for blocks 2 thru 5
2	1	Form 7 - Block "N"
	2	Calibration Indication
	7- 54	Same as Front for Blocks 6 thru 8
	75-120	Same as Form 1 - Back

FORM A - FREE/ENCLOSED PAPER & BOOKS

1	1	Form A - Back "O"
	2	Calibration Indication
	3	Extra/Separate
	5	Misc. Item No.
	8- 12	Free/Enc, Size, Height, Comp. - Pile 1
	13	Blank
	14- 97	Same as above for Piles 2-15
2	1	Form A - Back "P"
	2	Calibration Indication
	3- 97	Same as Front of Form A
	99-120	JIC H1, H2 Same as Form 1 Back

FORM B - EQUIPMENT

LOG. REC.	CHAR. POS.	IDENTIFIER
1	1	Form B - Front "Q"
	2	Calibration Indication
	3	Extra/Sep
	5	Misc. Item No.
	8- 15	Typewriter #1
	18- 25	Typewriter #2
	28- 35	Typewriter #3
	38- 45	Calculator #1
	48- 55	Calculator #2
	58- 65	Calculator #3
	67- 70	Telephone #1
	71- 74	Telephone #2
2	1	Form B - Back "R"
	2- 74	Same as Form B Front
	75-120	Same as Form 1 Back

FORM C - OTHER

1	1	Form C - Front "S"
	2	Calibration Indication
	3	Extra Sheet
	5	Misc. Item No.
	7- 18	Data Form Block #1
	19- 66	Same as Block #1 for Blocks #2-#15
2	1	Form C - Back "T"
	2- 66	Same as Form C - Front
	75-120	Same as Form 1 - Back

APPENDIX B.2

FORMAT OF BUILDING CHARACTERISTIC DATA

The following is a breakdown of the data contained on each of the card images, and the proper order in which the card images must be inputted:

Card	Column	Identifier	Example
1	4-6	SURVEYOR CODE	999
	7-12	DATE	092474
	16-18	BLDG NO.	024
	20-54	BLDG NAME	ADMINISTRATION BLDG.
2	1-72	BLDG ADDRESS	BUILDING 101
3	1-18	CITY-STATE	WASHINGTON DC
	23-24	STATE CODE	18
	25-29	ZIP CODE	20234
4	3-6	YEAR OF COMPLETION	1964
	11-12	NO. FLRS. ABOVE GND.	12
	18	LOAD SYSTEM TYPE	1 (COLUMN)
	24	MATERIAL	2 (STEEL)
	30	OCCUPANCY TYPE	1 (GOVERNMENT)
5	4-6	FIRM NUMBER	001
	8-30	FIRM NAME	NATIONAL BUREAU STANDARDS
	35-36	FIRM TYPE(SPEC)	91
	40-42	FIRM AGE	010

........USE ONE CARD FOR EACH FIRM IN BUILDING........

LAST	1-4	EOF CARD	@EOF

APPENDIX B.3

INPUT RECORD FORMAT FOR DATA FILE 2

Each input record has a fixed record length of 220 UNIVAC 1108 words or 1,320 characters. The first 240 characters are devoted to data retrieved from the Room Locator Documents, while the remaining 1,080 characters convey data from the Plans Document for up to 81 areas.

As many as five Room Locator Documents were scanned for each Plans document. The data across the top of each Room Locator Document was scanned and recorded in the first 240 characters. For each document 44 characters were directly recorded. The next four were devoted to a specific FOSDIC measurement or error code.

The remainder of the record was devoted to each individual area scanned. Although only 81 areas are possible on a Plans Document, space has been allocated for up to 90 rooms. Each Room Locator Document contains 18 rooms. The position in the record of each area corresponds to the position on the Room Locator Document and to the particular Room Locator Document accompaning the Plans Document. Therefore, although 90 (18 x 5) Room Locator blocks are present, only 81 may be used.

All the data records from a particular building were terminated by an EOF mark on the tape. Each tape was terminated by a double EOF mark.

The following is a breakdown of each particular record:

Character	Field	Description
1	3	Building number on Room Locator Document #1
4	2	Floor number
6	3	Question #1
9	3	Question #2
12	3	Horizontal ref. #1 in feet
15	3	Horizontal ref. #2 in feet
18	3	Vertical ref. #1 in feet
21	3	Vertical ref. #2 in feet
24	2	Question #3
26	2	Question #4
28	1	Question #5
29	1	Question #6
30	1	Question #7
31	2	Question #8
33	3	Question #9
36	4	Question #10

Character	Field	Description
40	5	Question #11
45	4	Horizontal ref. #1 in FOSDIC modules
49	44	Same as positions 1 to 44 above as scanned from Room Locator Document #2 (if present)
93	4	Horizontal ref. #2 in FOSDIC modules
97	44	Same as positions 1 to 44 above as scanned from Room Locator Document #3 (if present)
141	4	Vertical ref. #1 in FOSDIC modules
145	44	Same as positions 1 to 44 as scanned from Room Locator Document #4 (if present)
189	4	Vertical ref. #2 in FOSDIC modules
193	44	Same as positions 1 to 44 as scanned from Room Locator Document #5 (if present)
237	1	Contains 48 if normal Contains 49 if no horizontal references were found by FOSDIC Contains 50 if only one horizontal reference found
238	1	Contains 48 if normal Contains 49 if no vertical references found Contains 50 if only one vertical reference found
239	1	Contains 48 if normal Contains 49 if no horizontal centers found Contains 50 if more than 9 horizontal centers found
240	1	Contains 48 if normal Contains 51 if no vertical centers found Contains 52 if more than 9 vertical centers found

For the remainder of the record, if no area is present, each of the twelve characters contain a 48.

241	1	Contains 16 if area from first block is to be added Contains 48 if area to be subtracted
242	3	Contains room number
245*	2	West wall in modules
247*	2	East wall in modules
249*	2	North wall in modules
251*	2	South wall in modules
253	12	Data from block #2
265	12	Data from block #3
1309	12	Data from block #90

*If wall is missing, position contains 2624
If room coordinates missing, position contains 2560
If coordinate illegal, position contains 0000

APPENDIX B.4

Program MAKER

Part A - User's Manual and Operating Instructions

1. Data Sequence and Format for Tape 1

2. Card Data Input for MAKER

    A. $INPUT1
    B. $TEST1
    C. $TEST2
    D. $TEST3
    E. @EOF

3. Mnemonics Used in MAKER

    A. GENERAL
    B. DRIVE
    C. FORMA
    D. FORMB
    E. FORMC
    F. RMCONT
    G. FSEAP
    H. BONCOM

4. Transfer Functions Used in MAKER

    I. Furniture Transfer Functions

        A. Desk
        B. Table
        C. All purpose cabinet
        D. Specialized cabinet
        E. Free shelving
        F. Bookcase
        G. Seating

    II. Equipment and Pile Transfer Functions

        A. Paper pile
        B. Book pile
        C. Telephone
        D. Typewriter
        E. Calculator
        F. Room partition

5. Limit and Error Messages

    A. DRIVE
    B. FORMA
    C. FORMB
    D. FORMC
    E. FSEAP
    F. BONCOM
    G. RMCONT

6. Run Cards for Univac 1108, Exec 8, 1975

7. Processed Room Survey Data Tape

Table 1. Data Sequence and Format for Tape 1 * (the unprocessed room survey data) Input for Data Restructuring Program

(Page 1 of 18)

<u>Building Characteristics</u> (Record 1)

1 a Surveyor No. - 100's
b 10's
c - 1's

2 a Building No. - 100's
b - 10's
c - 1's

3 a State No. - 10's
b - 1's

4 a Zip Code - 10000's
b - 1000's
c - 100's
d - 10's
e - 1's

5 a Year Built - 1000's
b - 100's
c - 10's
d - 1's

6 a Number of Stories above Ground Level - 10's
b - 1's

7 Vertical Load Resisting System

1 = column
2 = bearing wall

8 Building Material

1 = concrete
2 = steel
3 = masonry
4 = wood

9 Occupancy Type

1 = federal government
2 = state government
3 = local government
4 = private
5 = private and government

---

* One building per file, one room per record. Tape must be odd parity and high density (800 bpi).

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 2 of 18)

10	a	No. of Firms in Building	-	100's
	b		-	10's
	c		-	1's

Firm Data (Record 2)

Repeat as indicated in Item 10

11	a	Firm No.	-	100's	
	b		-	10's	
	c		-	1's	
12	a	Firm Type	-	10's	
	b		-	1's	
13	a	Firm Age	-	100's	(i.e., occupancy duration)
	b		-	10's	
	c		-	1's	

Room No./Firm No. Data

14	Deleted
15	Deleted
16	Deleted

Room Survey Data (Record 3 and Subsequent)

Repeat for each room surveyed with one record for each room. The sequency of data, by Form, need not be as shown here. However, within a form the data sequency must be exactly as shown

17	a	Building No.	-	100's
	b		-	10's
	c		-	1's
18	a	Floor No.	-	10's
	b		-	1's
19	a	Room No.	-	100's
	b		-	10's
	c		-	1's
20	a	Firm No.	-	100's
	b		-	10's
	c		-	1's

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 3 of 18)

21 a Surveyor Code - 100's
b - 10's
c - 1's

22 Room Selection Flag

0 - selected on a random basis
1 - selected on a non-random basis
2 - selected on room use basis
3 - selected on room area basis
4 - selected for horizontal correlation
5 - selected for vertical correlation
6 - selected for tail sample

23 Type of Room Content

1 = Bounding Surfaces
2 = Desk
3 = Table
4 = Cabinet
5 = Shelving
6 = Seating
7 = Miscellaneous (unspecified)
8 = Form A - paper and books
9 = Form B - equipment
10 = Form C - miscellaneous

24 Room Use

1 = General
2 = Clerical
3 = Lobby
4 = Conference
5 = File
6 = Storage
7 = Library

25 Normal Number of Occupants

as indicated

26 a Wall Type - wall 1
b - wall 2
c - wall 3
d - wall 4

1 = full
2 = open
3 = partial

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 4 of 18)

27 Ceiling Material
28 Floor Material
29 Door Material
30 Ceiling Trim
31 Floor Trim
32 Door Trim
33 Window Trim

Code for 27-33

0 = not present
1 = wood
2 = metal
3 = plastic
4 = acoustic tile
5 = non-combustible
6 = resilient flooring
7 = carpet
8 = rubber

present only for full height walls

34 a Wall 1 - material
b - covering
35 a Wall 2 - material
b - covering
36 a Wall 3 - material
b - covering
37 a Wall 4 - material
b - covering

Code for 34-37

0 = not present
1 = wood
2 = metal
3 = plastic
4 = non-combustible
5 = plaster
6 = gypsum board
7 = paper
8 = drapes
9 = vinyl
10 = paint

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 5 of 18)

	38		No. of Doors in ith Wall	repeat 4 times
present only if item 38 not equal 0	39	a	Door Height, ith Wall - ft	
		b	- in	
	40	a	Door Width, ith Wall - ft	
		b	- in	
	41		No. of Windows in ith Wall	
present only if item 41 not equal 0	42	a	Window Height, ith Wall - ft	
		b	- in	
	43	a	Window Width, ith Wall - ft	
		b	- in	
	44	a	Window Height Above Floor - ft	
		b	- in	
present only for those partial height walls indicated in item 26	45		Partial Height Wall, Material 1 = wood 2 = metal 3 = plastic 4 = fabric 5 = non-combustible	
	46	a	Partial Height Wall, Length - ft	
		b	- in	
	47	a	Partial Height Wall, Height - ft	
		b	- in	
	48		No. Internal Partitions	
repeat as specified in item 48	49		Partition Material Use code for item 45	
	50	a	Partition Length - ft	
		b	- in	
	51	a	Partition Height - ft	
		b	- in	
	52		Proximity to Wall 1 = within 2 ft 2 = more than 2 ft	
	53	a	Room Height - ft	
		b	- in	
	54	a	Room Width - ft x 10	
		b	- ft x 1	
		c	- in	

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 6 of 18)

55 a Room Length - ft x 10
b - ft x 1
c - in

---

56 Type of Room Content

2 = Desk

57 Desk Type

1 = single pedestal
2 = double pedestal
3 = with legs

58 Proximity to Wall

1 = within 2 ft
2 = more than 2 ft

59 Desk Material

1 = wood
2 = metal
3 = plastic

60 a Number of Drawers - Box
b - File
c - Personal

61 a Desk Length - ft
b - in

62 a Desk Width - ft
b - in

63 No. Free Contents Piles
0 to 10

repeat as specified in item 63

64 Book and Paper Sizes

1 = 8-½ x 11 paper
2 = 8-½ x 15 paper
3 = 11 x 15 paper
4 = >15 x 20 paper
5 = <7 x 7¼ book
6 = 7 x 7¼ to 10 x 6½ book
7 = >10 x 6½ book

65 a Pile Height - ft
b - in

66 Percent Compaction - %

67 No. of Typewriters
0 to 2

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 7 of 18)

repeat as specified in item 67

68 Free or Enclosed

1 = free
2 = enclosed

69 Typewriter Characteristics

1 = manual
2 = electric

70 Typewriter Characteristics

1 = typing ball
2 = typing bar

71 Carriage Length

1 = 11 to 14 in
2 = 15 to 16 in
3 = 17 to 20 in
4 = 21 to 24 in
5 = 25 to 30 in

72 a Typewriter Base Length - ft
b - in

73 a Typewriter Base Width - ft
b - in

74 No. of Calculators
0 to 2

repeat as specified in item 74

75 Free or Enclosed Calculator

1 = free
2 = enclosed

76 Calculator Characteristics

1 = manual
2 = electric

77 Calculator Characteristics

1 = paper tape
2 = no paper tape

78 Calculator Characteristics
0 = no readout
1 = illuminated readout
2 = dial readout

79 a Calculator Base Length - ft
b - in

80 a Calculator Base Width - ft
b - in

Table 1. Data Sequence and Format for Tape 1 (the unprocessed room survey data) Input for Data Restructuring Program

(Page 8 of 18)

81 No. of Telephone Data Records
0 or 1

only if Item 81 not equal 0

82 Type of Telephone
1 = personal
2 = call director

83 No. of Buttons
0 = 0 buttons
1 = 6 buttons
2 = 10 buttons
3 = 12 buttons
4 = 18 buttons
5 = 20 buttons
6 = 30 buttons

84 No. of Telephones

85 No. of Enclosed Contents Piles
0 to 10

repeat as specified in item 85

86 Book and Paper Sizes
see item 64 for code

87 a Pile Height - ft
b - in

88 Percent Compaction - %

---

89 Type of Room Content
3 = table

90 Table Type
1 = single pedestal
2 = with legs

91 Proximity to Wall
see item 58 for code

92 Table Material - Top
see item 59 for code

93 Table Material - Pedestal/Legs
see item 59 for code

94 a Table Height - ft
b - in

95 a Table Width - ft
b - in

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 9 of 18)

	96	a	Table Length - ft
		b	- in
	97		Drawer 1 = with drawer 2 = without drawer
	98		No. Free Contents Piles 0 to 10
repeat as as indicated in item 98	99		same as items 64 to 66
	100	a,b	
	101		
	102		No. of Typewriters 0 to 2
repeat as as indicated in item 102	103		same as items 68 to 73
	104		
	105		
	106		
	107	a,b	
	108	a,b	
	109		No. of Calculators 0 to 2
repeat as as indicated in item 109	110		same as items 75 to 80
	111		
	112		
	113		
	114	a,b	
	115	a,b	
	116		No. of Telephone Data Records 0 or 1
	117		same as items 82 to 84
	118		
	119		
	120		No. Enclosed Content Piles 0 to 10

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 10 of 18)

repeat as indicated in item 120	121		same as items 86 to 88	
	122	a,b		
	123			
	124		Type of Room Content 4 = cabinet	
	125		Cabinet Type 1 = filing 2 = file safe 3 = blueprint 4 = card file 5 = general purpose	
	126		Proximity to Wall see item 58 for code	
	127		Cabinet Material see item 59 for code	
	128	a	No. of Drawers - 10's	
		b	- 1's	
	129		No. of Shelves	
	130	a	Cabinet Height - ft	
		b	- in	
	131	a	Cabinet Width - ft	
		b	- in	
	132	a	Cabinet Depth - ft	
		b	- in	
	133	a	No. of Drawers - Box	Include only if item 125 = 5
		b	- File	
		c	- Personal	
	134		No. of Free Contents Piles 0 to 10	
repeat as indicated in item 134	135		same as items 64 to 66	
	136	a,b		
	137			
	138		No. of Typewriters 0 to 2	

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 11 of 18)

repeat as indicated in item 138	139	same as items 68 to 73
	140	
	141	
	142	
	143a,b	
	144a,b	
	145	No. of Calculators 0 to 2
repeat as indicated in item 145	146	same as items 75 to 80
	147	
	148	
	149	
	150a,b	
	151a,b	
	152	No. of Telephone Data Records 0 or 1
	153	same as items 82 to 84
	154	
	155	
	156	No. Enclosed Contents Piles 0 to 10
repeat as indicated in item 156	157	same as items 86 to 88
	158a,b	
	159	

160	Type of Room Content 5 = Shelving
161	Shelving Category 1 = Bookcase 2 = Free Shelving
162	Proximity to Wall see item 58 for code
163	Shelving Material see item 59 for code

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 12 of 18)

	164	a	Shelf Height - ft
		b	- in
	165	a	Shelf Width - ft
		b	- in
	166	a	Shelf Depth - ft
		b	- in
	167		No. Free Contents Piles 0 to 10
repeat as indicated in item 167	168		same as items 64 to 66
	169	a,b	
	170		
	171		No. of Typewriters 0 to 2
repeat as indicated in item 171	172		same as items 68 to 73
	173		
	174		
	175		
	176	a,b	
	177	a,b	
	178		No. of Calculators 0 to 2
repeat as indicated in item 178	179		same as items 75 to 80
	180		
	181		
	182		
	183	a,b	
	184	a,b	

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 13 of 18)

185 No. of Telephone Data Records
0 or 1

186
187 same as items 82 to 84
188

189 No. of Contents Piles on back of form 5
0 to 10

repeat as indicated in item 189

190
191a,b same as items 64 to 66
192

193 a No. of Shelves - 100's
b - 10's
c - 1's

---

194 Type of Room Content
6 = seating

195 No. of Seating Data Blocks on Form 6 (both sides of page)
0 to 9

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 14 of 18)

repeat as specified in tiem 195

196		Seating Type 1 = pedestal 2 = legs 3 = upholstered 4 = sofa 5 = bench 6 = drafting stool 7 = classroom chair
197		Proximity to Wall see item 58 for code
198	a	No. of Above Type - 10's
	b	- 1's
199	a	Seating Material - Frame
	b	- Seat
	c	- Back see item 59 for code
200		Arms 1 = yes 0 or 2 = no
201	a	Padding - Seat
	b	- Back
	c	- Arms 0 = none 1 = vinyl 2 = fabric 3 = wood
202	a	Seat Height - ft
	b	- in
203	a	Seat Width - ft
	b	- in
204	a	Seat Depth - ft
	b	- in

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 15 of 18)

205		Type of Room Content
		7 = miscellaneous item
206		Aggregation Flag
		0 = normal items
		1 = aggregation of various items on furniture
207		No. of Miscellaneous Items on Form 7 (both sides of page)
		0 to 8

indicated in item 207

208		Fire Category
		1 = Combustible
		0 = Non-combustible
209		Proximity to Wall
		See item 58 for code
210	a	Item Height - ft
	b	- in
211	a	Item Width - ft
	b	- in
212	a	Item Depth - ft
	b	- in
213	a	Item Weight - lb x 1000
	b	- lb x 100
	c	- lb x 10
	d	- lb x 1

214		Type of Room Content
		8 = Form A - Books and Paper
215		Extra Sheet or Separate Item
		0 = extra sheet
		1 = separate item
216		Miscellaneous Item or Seating-Data-Block No.
		0 to 8, 0 if no item indicated
217		No. of Items on Page (Form A)
		0 to 15 (each side of page considered to be a separate form)

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 16 of 18)

repeat as indicated in item 217	218	Free or Enclosed see item 68 for code
	219	Proximity to Wall Only if item 215 = 1 See item 58 for code
	220	same as items 64 to 66
	221a,b	
	222	

	223	Type of Room Content 9 = Form B - Equipment
	224	Extra Sheet or Separate Item see item 215 for code
	225	Miscellaneous Item or Seating-Data-Block No. 0 to 9, 0 if no item indicated
	226	No. of Typewriters on Form B 0 to 3 (each side of page considered to to a separate form)
repeat as indicated in item 226	227	Free or Enclosed Typewriter see item 68 for code
	228	Proximity to Wall see item 58 for code, only if item 224 = 1
	229	same as items 69 to 73
	230	
	231	
	232a,b	
	233a,b	

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 17 of 18)

	234	No. of Calculators on Form B 0 to 3 (each side of page considered to be a separate form)
repeat as indicated in item 234	235	Free or Enclosed Calculator see item 75 for code
	236	Proximity to Wall see item 58 for code only if item 224 = 1
	237 238 239 240a,b 241a,b	same as items 76 to 80
	242	No. of Telephone Data Records 0 to 2 (each side of page considered to be a separate form)
repeat as indicated in item 242	243	Proximity of Telephone to Wall see item 58 for code, only if item 224 = 1
	244 245 246	same as items 82 to 84

247	Type of Room Content 10 = Form C - Miscellaneous Equipment
248	Extra Sheet Indicator 0 = extra sheet 1 = (not to be used)

Table 1. Data Sequence and Format for Tape 1
(the unprocessed room survey data)
Input for Data Restructuring Program

(Page 18 of 18)

249		Miscellaneous Item or Seating-Data-Block No. 0 to 9, 0 is no item indicated
250		No. of Items on Sheet 0 to 5 (each side of page considered to be a separate form)
251		Free or Enclosed see item 68 for code
252		Fire Category see item 208 for code
253	a	Height - ft
	b	- in
254	a	Width - ft
	b	- in
255	a	Depth - ft
	b	- in
256	a	Weight - lb x 100
	b	- lb x 10
	c	- lb x 1

repeat as indicated on item 250

Table 2. Card Data Input for Data Restructuring Program (MAKER)

(Page 1 of 2)

<u>Namelist Format</u>

A. $INPUT1

This card is always required

WRT=.TRUE. - list all of the processed data on the printer

WRT=.FALSE. - do not list the room contents data on the printer, default value

WRT2=.TRUE. - list the bounding surface and room composite data on the printer

WRT2=.FALSE. - do not list any of the processed data on the printer, default value

RMS=.TRUE. - use room sector data (replaces the "within 2 feet of wall" indicator)

RMS=.FALSE. - do not use room sector data, default value

CDDTI=.TRUE. - read the input data from a magnetic tape or FASTRAND file (binary)

CDDTI=.FALSE. - read the input data from cards (namelist format), default value

CDDT0=.TRUE. - write the processed data on a magnetic tape or FASTRAND file (binary)

CDDT0=.FALSE. - do not write the processed data on a magnetic tape or FASTRAND file, default value

FILEI=.TRUE. - use magnetic tape for input file

FILEI=.FALSE. - use FASTRAND file for input file, default value

FILE0=.TRUE. - use magnetic tape for output file

FILE0=.FALSE. - use FASTRAND file for output file, default value

NORL=.TRUE. - use multiple reel file on input

NORL=.FALSE. - do not use a multiple reel file for input, default value

Table 2. Card Data Input for Data Restructuring Program (MAKER)

(Page 2 of 2)

B. $TEST1

X = building characteristic data

II = number of words of data = 25

Need only if CDDTI=.FALSE. (see $INPUT1)

C. $TEST2

X = firm data

I = number of words of data

Need only if CDDTI=.FALSE. (see $INPUT1)

D. $TEST3

X = room survey data

I = number of words of data

Need only if CDDTI=.FALSE. (see $INPUT1)

Need one file for each room

E. @EOF

End of file card required after each building

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 1 of 32)

A. GENERAL MNEMONICS, These mnemonics are used throughout (MAKER), in different subroutines.

BUILD (16) Building Descripters (Form 1)

row	
1	Building surveyor code
2	Building number (also BUILDN, NR(1))
3	State number
4	Building zip code
5	Year building built
6	Number of stories above ground level
7	Vertical load resisting system (in code)*
8	Building material (in code)*
9	Building occupancy type (in code)*
10	Number of firms in building (also NO)
11	Floor number (also FLOORN, NR(2))
12	Room number (also ROOMN, NR(3))
13	Room surveyor code
14	Firm number
15	Firm type
16	Firm age

BUILDN Building Number

CABNG (15) Cabinet Descripters (Form 4)

row		
1	Cabinet type (in code)*	
2	Proximity to wall (in code)*	
3	Material (in code)*	
4	Number of drawers - 10's	never used
5	- 1's	
6	Number of shelves	
7	Height - ft	
8	- in	
9	Width - ft	
10	- in	
11	Depth - ft	
12	- in	
13	Number of drawers in a general purpose cabinet - box	
14	- file	
15	- personal	

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 2 of 32)

CALC (9,12,9) Calculator Descripters (Forms 2-6,B)

row	
1	Free (1) or enclosed (2)
2	Manual (1) or electric (2)
3	Paper tape (1) or no paper tape (2)
4	Illuminated (1) or dial read out (2) or no dial read out (0)
5	Length - ft
6	- in
7	Width - ft
8	- in
9	Proximity to wall (Free Standing Only)

DESKG (10) Desk Descripters (Form 2)

row	
1	Type (in code)*
2	Proximity to wall (in code)*
3	Material (in code)*
4	Number of drawers - box
5	- file
6	- personal
7	Length - ft
8	- in
9	Width - ft
10	- in

DOOR (12,4) Door and Window Descripters (Form 1)

row	
1	Number of doors in wall
2	Door height - ft
3	- in
4	Door Width - ft
5	- in
6	Number of windows in wall
7	Window height - ft
8	- in
9	Window width - ft
10	- in
11	Window height above floor - ft
12	- in

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 3 of 32)

ENCL (5,50,9) Enclosed Book and Paper Pile Descripters (Forms 2-5)

row

1 Book/paper size (in code)*
2 Height - ft
3 - in
4 Percent compaction
5 Proximity to wall (in code)*

ERR	Error Flag
FLAG	Flag for Stand-Along Items
FLOORN	Floor Number (From BUILD)

FREE (5,50,9)

row

1 Book/paper size (in code)*
2 Height - ft
3 - in
4 Percent compaction
5 Proximity to wall (in code)*

I	Counter for Locating Input Data in X
IFLAG1	Flag Used with Stand Alone Items
INDEX,IND,INX	Room Content Identifier (Forms 1-6, A-C)
IO	NTRAN Status Word for Output Data

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 4 of 32)

ITEM (13,8) Miscellaneous Free Standing Item Descripters (Form 7)

row	
1	Fire category (in code)*
2	Proximity to wall (in code)*
3	Height - ft
4	- in
5	Width - ft
6	- in
7	Depth - ft
8	- in
9	Weight - 1000's
10	- 100's
11	- 10's
12	- 1's
13	Aggregation flag (in code)*

MISC (11,10,9) Miscellaneous Furniture Contents Not Free Standing (Forms 2-6)

row	
1	Free (1) or enclosed (2)
2	Non-combustible (1) or combustible (2)
3	Height - ft
4	- in
5	Width - ft
6	- in
7	Depth - ft
8	- in
9	Weight - 100's
10	- 10's
11	- 1's

FIRMTY	Type of FIRM in Room
MPILE (9)	Indicates Number of Piles of Books or Paper Enclosed in Each Item (Forms 2-5)
NBUF	Counter for Locating Output Data in Y(10000) (Set as room is analyzed)

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 5 of 32)

NCALC (9)	Indicates Number of Calculators in or on Each Item (Forms 2-6)
NITEM	Number of Blocks of Data on Forms 6 or 7
NMISC (9)	Indicates Number of Miscellaneous Things in or on each Item (Forms 2-6)
NPILE (9)	Indicates Number of Piles of Paper or Books on each Item (Forms 2-5)
NR (3)	Room Location (Form 1)

row	
1	Building Number (BUILDN)
2	Floor number (FLOORN)
3	Room number (ROOMN)

NTELE (9)	Indicates Number of Telephones in or on each Item (Forms 2-6)
NTYPE (9)	Indicates Number of Typewriters in or on each Item (Forms 2-6)
PART1 (5,4)	Partial Height wall Characteristics (Form 1)

row	
1	Material (in code)*
2	Length - ft
3	- in
4	Height - ft
5	- in

PART2 (6,4)	Internal Partition Characteristics (Form 1)

row	
1	Material (in code)*
2	Length - ft
3	- in
4	Height - ft
5	- in
6	Proximity to wall (in code)*

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 6 of 32)

RMS	Room Selection Flag
ROOM (21)	General Room Descripters (Form 1)

row	
1	Room Use
2	Normal number of occupants
3	Wall type - wall 1
4	- wall 2
5	- wall 3
6	- wall 4
7	Ceiling material
8	Floor material
9	Door material
10	Trim material - ceiling (in code)*
11	- floor (in code)*
12	- doors (in code)*
13	- windows (in code)*
14	Room height - ft
15	- in
16	Room width - ft x 10
17	- ft x 1
18	- in
19	Room length - ft x 10
20	- ft x 1
21	- in

ROOMN	Room number (Form 1)
SEATG (17,9)	Seating Descripters (Form 6)

row	
1	Type (in code)*
2	Proximity to wall (in code)*
3	Number of this type - 10's
4	- 1's
5	Material - frame (in code)*
6	- seat (in code)*
7	- back (in code)*
8	Arms - with or without (in code)*
9	Padding - seat (in code)*
10	- back (in code)*
11	- arms (in code)*
12	Height - ft
13	- in
14	Width - ft
15	- in
16	Depth - ft
17	- in

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 7 of 32)

SHELG (12) Shelf Descripters (Form 5)

row	
1	Category (in code)*
2	Proximity to wall (in code)*
3	Material (in code)*
4	Height - ft
5	- in
6	Width - ft
7	- in
8	Depth - ft
9	- in
10	Number of shelves - 100's
11	- 10's
12	- 1's

TABLG (11) Table Descripters (Form 3)

row	
1	Type (in code)*
2	Proximity to wall (in code)*
3	Material - top (in code)*
4	- pedestal/legs (in code)*
5	Height - ft
6	- in
7	Width - ft
8	- in
9	Length - ft
10	- in
11	With drawers (1) or without drawers (2)

TELE (4,25,9) Telephone Descripters (Forms 2-6,B)

row	
1	Personal (1) or call director (2)
2	Number of buttons (in code)*
3	Number of telephones
4	Proximity to wall

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 8 of 32)

TYPE (9,12,9) Typewriter Characteristics (Forms 2-6,B)

row	
1	Free (1) or enclosed (2)
2	Manual (1) or electric (2)
3	Typing ball (1) or bar(2)- Not Used
4	Carriage length (in code)*
5	Length - ft
6	- in
7	Width - ft
8	- in
9	Proximity to wall

WALL (2,4) Wall Characteristics (Form 1)

row		
1	Wall material	0 for non full height walls (in code)*
2	Wall covering	

X (10000) Input Vector for Data Restructuring Program (See Table 1)

Y (15000) Output Vector from Data Restructuring Program

row	
1	NBUF
2 to 132	see Table 11 of Section 4
132 to end	see Table 12 or Table 13 of Section 4 (repeated as necessary)

Y81 Total Movable Fire Weight (un-derated)

Y82 sd Total Movable Fire Weight (un-derated)

---

* see Table 1 for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 9 of 32)

Y92	Fire Weight in a Metal Furniture Item
Y93	sd of Fire Weight in a Metal Furniture Item
Y94A	Number of Furniture and Misc. Objects within 2 Feet of the Walls
Y94B	Total Number of Furniture and Misc. Objects in Room
Y95A	Number of Free Standing Objects within 2 Feet of the Wall
Y95B	Total Number of Free Standing Objects in Room
Y96	Total Fire Weight Enclosed within 2 Feet of Walls (Derated)
Y97	sd of Total Fire Weight Enclosed within 2 Feet of Walls
Y98	Total Movable Fire Weight within 2 Feet of Walls (Derated)
Y99	sd of Total Movable Fire Weight within 2 Feet of Walls (Derated)
Y100	Total Fire Weight Enclosed (Derated)
Y101	sd of Total Fire Weight Enclosed (Derated)
Y102	Total Paper Fire Weight (Derated)
Y103	sd of Total Paper Fire Weight (Derated)
Y104	Total Book Fire Weight (Derated)
Y105	sd of Total Book Fire Weight (Derated)
Y106	Total Fire Weight Enclosed in Plastic
Y107	sd of Total Fire Weight Enclosed in Plastic
Y112	Σ(sd of Fire Weight x sd of Live Weight)
Y123	Live Weight Within 2 Feet of Walls
Y124	sd of Live Weight Within 2 Feet of Walls

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 10 of 32)

B. MNEMONICS UNIQUE TO MAIN PROGRAM DRIVE

AGGRE	Aggregation Flag for Miscellaneous Items
CDDTI,CDDTO	Flags for Specifying File Type (Cards or Non-Cards) for Input and Output Files
END (10)	Ten Word Record of 999999 to Indicate End of Tape
FILEI,FILEO	Flags for Specifying File Type (Tape or FASTRAND) for Input and Output Files
FIRMNO	Firm Number
FIRMT (100)	Firm Type of all Firms in Building
IDUM	Indicator of Position in Program for Error Messages
II	NTRAN Status Word for Input Data
INDX	INDEX-7
INPUT1	Namelist Input Record
J	Do Loop Parameters
JJ	Do Loop Parameters
K	Do Loop Parameters
K2	Temporary Name for Different Array Names
K3	NTRAN Parameter, Temporary Storage Location for Firm Type
L,LA,LI	Do Loop Parameters
NO	Number of Firms in Building
NWTAPE	Number of Words Written on Tape
NB,NBT	Counters Used in Writing Output on Printer

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 11 of 32)

N1	Number of Rooms Surveyed in Building
N2	Do Loop Parameter
NOFILE	Number of Files (i.e., Buildings) Processed
NORECD	Number of Data Records Processed for Subject Building
OUTBND (76)	Output from the Subroutine BONCOM: = Y Vector from Y(1) → Y(76) (Table 1 in Report)
OUTCMP (56)	Output from the Subroutine BONCOM: Y Vector from Y(77) → Y(132) (Table 1 in Report)
OUTCON (9868)	Output from the Subroutines RMCONT and FSEAP of the Y Vector from Y(133) → Y(10000) (Table 2 or 3 in Report)
REEL	Number of Reel of Output Data
RMFIRM(3,1000)	Firm Description Data

row	
1	Firm number
2	Firm type
3	Firm age

RSFG	Room Selection Flag
TEST1,TEST2, TEST3	Namelist Input Records
WRT,WRT2	Formatted Output Flags

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 12 of 32)

C. MNEMONICS UNIQUE TO SUBROUTINE FORMA

I	A Do Loop Counter
J	A Do Loop Counter
J2	A Counter Equal to J1 + K1 + 1
K	A Counter Equal to X(I)
K1	A Counter Equal to 1 + K2
K2	A Counter Equal to 6 * (J-1)
MP	A Do Loop Maximum Defined as MPILE (ITEM)
N	A Counter Equal to X(I)
NI	A Counter Equal to 6 * N
NP	A Do Loop Maximum Defined as NPILE (ITEM)
TEMP(J) $(J \leq 100)$	Equal to X(I)

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 13 of 32)

D. MNEMONICS UNIQUE TO SUBROUTINE FORMB

J	A Do Loop Counter
K	A Do Loop Counter
N	A Do Loop Maximum Equal to X(I)
NC	A Subscript of CALC Equal to NCACL (ITEM)
NT	A Subscript of TYPE Equal to NTYPE (ITEM)
NTE	A Subscript of TELE Equal to NTELE (ITEM)

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 14 of 32)

E. MNEMONICS UNIQUE TO SUBROUTINE FORMC

J	Do Loop Counter
JI	Temporary Subscript Equal to NMISC (ITEM)
K	Do Loop Counter
N	Temporary Subscript Equal to X(I)

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 15 of 32)

F. MNEMONICS UNIQUE TO SUBROUTINE RMCONT (DATA)

AR	Area of Furniture Set Equal to: Y(NBUF+9)
B	Used to Substitute for BK(M,L,I)
BEE(J)	Book Weight Tranfer Function Coefficient
J	Book size groups* (3)
BEESD(J)	sd of Book Weight Transfer Function Coefficient
J	Book size groups* (3)
BK(M,L,I)	Bookcase Type Shelving Transfer Function Data
M	Size (area) groups* (4)
L	Height groups* (4)
I	Material types* (3)
BKFWT(I)	Bookcase and Free Shelving Fire Weight Coefficient
I	Material types* (3)
BKSD(M,L,I)	sd of Bookcase Type Shelving Data for Transfer Function
M,L,I	Same as for BK
C	Used as a Substitute for CAB(K,M,L,I)
CA	Used as a Substitute for CAAB(K,M,I)
CAAB(K,J,I)	All Purpose Cabinet Transfer Function Data
K	Size (area) groups* (6)
J	Height groups* (5)
I	Material groups* (3)
CAABSD(K,J,I)	sd of All Purpose Cabinet Transfer Function Data
K,J,I	Same as for CAAB
CAB(K,M,L,I)	Specialized Cabinet Transfer Function Data
K	Size (area) groups* (6) (not all used for every type cabinet)
M	Height groups* (5) (not all used for every type cabinet)
L	Type of cabinet* (4)
I	Material types* (3)

---

* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 16 of 32)

CABDP	Cabinet Depth
CABFWT(I)	Cabinet Fire Weight Coefficient
I	Material types* (3)
CABHT	Cabinet Height
CABL(3)	Limits to Cabinet Output
row	
1	Limit to the area of a cabinet [Y(NBUF+9)], 9 sq ft
2	Limit to the total number of cabinet drawers [CDRAW],20
3	Limit to the empty weight of a cabinet [Y(NBUF+5)], 500 lb
CABSD(K,M,L,I)	sd of Specialized Cabinet Transfer Function Data
K,M,L,I	Same as for CAB
CABWD	The Width of a Cabinet
CAL(K,J)	Calculator Transfer Function Data
J	Size (area) of calculator* (5)
K	Type of calculator* (4)
CALA	Calculator Area
CALFWT	Calculator Fire Weight Coefficient
CALSD(J,K)	sd of Calculator Transfer Function Data
J,K	Same as for CAL
CALWT(2)	Total Weight of all Calculators on or in a Particular item
row	
1	Free calculators total weight
2	Enclosed calculators total weight
CAS(K,J,I)	Weight of Shelves in all Purpose Cabinets
K	Size (area) group* (6)
J	Height group* (5)
I	Material types* (3)

---

* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 17 of 32)

CASSD(K,J,I)	sd of Weight of Shelves in all Purpose Cabinets
K,J,I	Same as for CAS
CAWTSD(2)	sd of Total Weight of all Calculators on or in a Particular Item
row	
1	Free calculators sd of total weight
2	Enclosed calculators sd of total weight
CBD(I)	All Purpose Cabinet Box Drawer Weight
I	Material types* (3)
CBDSD(I)	All Purpose Cabinet Box Drawer sd of Weight
I	Same as for CBD
CDF(I)	All Purpose Cabinet File Drawer Weight
I	Same as for CBD
CDFSD(I)	All Purpose Cabinet File Drawer sd of Weight
I	Same as for CBD
CDP(I)	All Purpose Cabinet Personal Drawer Weight
I	Same as for CBD
CDPSD(I)	All Purpose Cabinet Personal Drawer sd of Weight
I	Same as for CBD
CDRAW	Total Number of Drawers in an All Purpose Cabinet
CEE(I,J)	Seating Transfer Function Data
I	Material type* (3)
J	Seating type* (12)
CEEFWT(I)	Seating Fire Weight
I	Material type* (3)
CEESD(I,J)	sd of Seating Transfer Function Data
I,J	Same as for CEE

---

* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 18 of 32)

CLFT(2)	Total Calculator Fire Weight in or on Item
row	
1	Free calculators
2	Enclosed calculators
CLFTSD(2)	sd of Total Calculator Fire Weight in or on Item
row	
1	Free calculators
2	Enclosed calculators
DCD(I)	Weight of a Desk Center Drawer
I	Material type*(3)
DCDSD(I)	sd of Weight of a Desk Center Drawer
I	Material type*(3)
DDB(I)	Weight of a Desk Box Drawer
I	Material type*(3)
DDBSD(I)	sd of Weight of a Desk Box Drawer
I	Material type*(3)
DDF(I)	Weight of a Desk File Drawer
I	Material type*(3)
DDFSD(I)	sd of Weight of a Desk File Drawer
I	Material type*(3)
DDP(I)	Weight of a Desk Personal Drawer
I	Material type*(3)
DDPSD(I)	sd of Weight of a Desk Personal Drawer
I	Material type*(3)
DEK(I,J,K)	Desk Transfer Function Data
I	Material type*(3)
J	Desk type*(3)
K	Size (area) group*(4)
DESKW	The Width of a Desk

* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 19 of 32)

DEKFWT(I)	Desk Fire Weight Coefficient
I	Material type*(3)
DEKSD(I,J,K)	sd of Desk Transfer Function Data
I,J,K	Same as DEK
DEPTH	Shelving or Miscellaneous Item Depth
DESKL(5)	Limits to Desk Data
row	
1	Limit to personal drawers when DESKL(4) is exceeded, 2.
2	Limit to a desk's area, 30 sq ft
3	blank, 0
4	Limit to the number of box drawers feasible in a desk when DESKL(1) is met or exceeded, 4
5	Limit to empty desk weight, 400 lb
DKS	The Area of a Desk [Y(NBUF+9)]
DRF(I,J)	Derating Factor for Enclosed Paper and Book Piles in Metal Furniture
I	Compaction factor category*(3)
J	Type of furniture*(7) (not all are applicable)
ENCLL	Limit to the Height of an Enclosed Paper or Book Pile, 5 ft.
ENWB	Total Weight of Enclosed Books
ENWBSD	sd of Total Weight of Enclosed Books
ENWL	Limit to the Weight of Enclosed Piles of Books and Papers Combined, 400 lb.
ENWP	Total Weight of Enclosed Paper
ENWPSD	sd of Total Weight of Enclosed Paper
F	Temporary Alternative Name for FS(I,m)
FREBSD	sd of Total Free Book Weight

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)
(Page 20 of 32)

FREEL	Limit to the Height of a Free Pile of Books or Paper, 5 ft.
FRELDB	Total Weight of Free Books
FRELDP	Total Weight of Free Paper
FREPSD	sd of Total Free Paper Weight
FS(M,I)	Data for Free Shelving Transfer Function
M	Size (area) group of shelving*(5)
I	Material type* (3)
FSSD(M,I)	sd of Data for Free Shelving Transfer Function
M,I	Same as for FS
FWTL	Limit to Free Paper or Book Pile Weight, 400 lb.
HEIGHT	Height of Piles of Books or Paper, Shelving Height
I	Do Loop Counter also the Subscript in Transfer Functions Usually used for Material Type
IR	Calculator Read Out Tape, = CALC(4,N6,NI)
IT	The Presence of Tape on a Calculator,= CALC(3,N6,NI)
ITMFWT(I)	The Fire Weight Coefficient for Miscellaneous Items
I	Material types*(2)
J	Subscript Used in Transfer Functions
JB	Subscript for the Derating Transfer Function of Books Enclosed in Metal
JP	Subscript for the Derating Transfer Function of Paper Enclosed in Metal
K	Subscript Used in Transfer Functions

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 21 of 32)

L	Subscript used in Transfer Functions
LA	Do Loop Counter
LB	Do Loop Counter
LENGTH	Shelving Length
M	Subscript used in Transfer Functions
MISFT(2)	Total Miscellaneous Object Fire Weight row 1 Free object 2 Enclosed object
MISLT(2)	Limits to Miscellaneous Item Output 1-Limit to miscellaneous item area, 30 sq ft 2-Limit to miscellaneous empty weight, 500 lb
MISWT(2)	Total Weight of Miscellaneous Object row 1 Free object 2 Enclosed object
MIWTSD(2)	sd of Total Weight of Miscellaneous Object row 1 Free object 2 Enclosed object
MP	Number of Piles of Papers or Books in Item NI,=MPILE(NI)
MWT	Weight of Each Miscellaneous Object
MWTLT	Limit to the Weight of a Miscellaneous Object, 300 lb
NA	Do Loop Counter

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 22 of 32)

NAMEE(5)	Alphanumeric Data for Equipment Used in Error Messages

row		
1	'P-PILE'	paper pile
2	'B-PILE'	book pile
3	'TYPWRT'	typewriter
4	'CALC. '	calculator
5	'PHONE'	telephone

NAMEF(7)	Alphanumeric Data for Furniture Used in Error Messages

row		
1	'ERROR'	unused position
2	'DESK'	desk
3	'TABLE'	table
4	'CAB'	cabinet
5	'SEAT'	seating
6	'SHELF'	shelving
7	'MISC'	miscellaneous

NB	Do Loop Counter
NC	Error Indicator for Calculation Transfer Functions
NCA	Total Number of Calculators in or on an Item,=NCAL(NI)
ND	Do Loop Counter
NDKS	Error Indicator for Desk Transfer Function Data
NI	Item Number Used for Denoting Which Contents Data for Which Item
NIA	Number of Items on Either Form 6 or 7, = NITEM
NJ	Do Loop Counter
NMI	The Number of Miscellaneous Objects on or in Item NI, = NMISL(NI)
NOS	Number of Shelves in Shelving

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 23 of 32)

NP	Number of Piles of Paper or Books on Item NI,=NPILE(NI)
NQ	Indicator of Bookcase Transfer Function Subscript Errors
NT	Indicator of Errors in Typewriter Transfer Function Data Subscripts
NTE	Number of Telephones on Item NI,= NTELE(NI)
NTY	Number of Typewriters on or in Item NI, = NTYPE(NI)
NX	Indicator that the Limit to Bookcase Transfer Function Data has been reached.
NZ	Indicator of Subscript Errors in all Purpose Cabinet Transfer Function
N3	Do Loop Counter
N4	Do Loop Counter
N5	Do Loop Counter
N6	Do Loop Counter
N7	Do Loop Counter
PEE(K)	The Weight Coefficient for Paper Piles
K	The paper (area) size group*(4)
PEESD(K)	The Standard Deviation of the Paper Pile Weight Coefficient
K	Same as for PEE
PH(I)	Telephone Transfer Function Data
I	Telephone size groups*(7)
PHFWT	Telephone Fire Weight Coefficient

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 24 of 32)

PHSD(I)	sd of Telephone Transfer Function Data
I	Same as for PH
Q	Set to zero if DESKG(6)<1 otherwise = 1
RCSD	The sd of the Total Weight of an Item of Room Contents (furniture)
RCWT	The Total Weight of an Item of Room Contents (furniture)
RCWTL	The Limit to the Floor Loading of one Item of Room Contents, 100 psf
RCWTPF	The Floor Loading of an Item of Room Contents
SEATL(2)	Seating Limits
row	
1	Limit to the area taken up by a particular seating type, 40 sq ft
2	Limit to the combined empty weight of seating of a particular type, 500 lb
SHELFL(2)	Limits to Shelving Output
row	
1	Limit to shelving depth, 2 ft
2	Limit to shelving empty weight, 200 lb
SHL(M,I)	Data for the Weight of Bookcase Shelves
M	Size (area) group* (4)
I	Material type* (3)
SHLSD(M,I)	Data for the sd of the Weight of a Bookcase Shelf
M,I	Same as for SHL
SHT	Seating Height
SL	Seating Length
T	The Data for Deriving the Table Weight, = TEE(I,J,K)
TABA	Table Surface Area

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 25 of 32)

TABDP	Table Depth
TABWD	Table Width
TABLEL(2)	Limits to Table Data
row	
1	Limit to the size (area) of a table , 40 sq ft
2	Limit to the weight of an empty table , 300 lb
TABWD	Table Width
TDL(I)	Table Drawer Weight Data
I	Material type*(3)
TDLSD(I)	sd of Table Drawer Weight Data
I	Same as for TDL
TEE(I,J,K)	Weight of Empty Table Without Drawers
I	Material type* (3)
J	Type group* (2)
K	Size area group* (9)
TEEFWT(I)	Fire Weight Coefficient for Tables in Equivalent lbs/lbs
I	Material type* (3)
TEESD(I,J,K)	sd of The Weight of an Empty Table without Drawers
I,J,K	Same as for TEE
TELWT	Total Weight of Telephones on a Particular Item
TLFT	Total Fire Weight of Telephones on a Particular Item
TOTSAB	Total Exposed Surface Area of Books on a Particular Item
TOTSAP	Total Exposed Surface Area of Paper on a Particular Item
TPFT(2)	Total Fire Weight of Typewriters
row	
1	Free
2	Enclosed

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 26 of 32)

TPFTSD(2)	sd of the Total Fire Weight for Typewriters
row	
1	Free
2	Enclosed
TYP(L,I)	Typewriter Transfer Function Data
L	Carriage length groups* (5)
I	Typewriter type* (2)
TYPFWT	Coefficient for the Determination of Typewriter Fire Weight
TYPSD(L,I)	sd of the Typewriter Transfer Function Data
L,I	Same as for TYP
TYPWT(2)	Total Weight of Typewriters
row	
1	Free
2	Enclosed
TYWTSD(2)	sd of Total Weight of Typewriters
row	
1	Free
2	Enclosed
WTE	Total Weight of Enclosed Books and Papers in a Particular Item
WTF	Total Weight of Free Books and Papers in a Particular Item

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 27 of 32)

G. MNEMOMICS UNIQUE TO SUBROUTINE FSEAP (DATA)

BEE(J)	Book Weight Transfer Function Coefficient
J	Book size groups* (3)
BEESD(J)	sd of Book Weight Transfer Function Coefficient
J	Book size groups* (3)
C	Temporary Alternate Name for CAL(J,k)
CAL(J,K)	Calculator Transfer Function Data
J	Size (area) of calculator* (5)
K	Type of calculator* (4)
CALA	Calculator Area
CALFWT	Calculator Fire Weight Coefficient
CALSD(J,K)	sd of Calculator Transfer Function Data
J,K	Same as for CAL
FREEL	Limit to the Height of a Free Pile of Books or Papers, 5 ft
IR	Calculator Read Out Type, = CALC(4,N6,NI)
IT	The Presence of Tape on a Calculator, = CALC(3,N6,NI)
J	Subscript Used in Transfer Functions
K	Subscript Used in Transfer Functions
L	Subscript Used in Transfer Functions
M	Subscript Used in Transfer Functions
N	Do Loop Counter

---

* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 28 of 32)

NAMEE(5)		The Alphanumeric Data for Free Standing Equipment
row		
1	'P-PILE'	Paper pile
2	'B-PILE'	Book pile
3	'TYPWRT'	Typewriter
4	'CALC '	Calculator
5	'PHONE '	Telephone
NC		Error Indicator for Calculator Transfer Function Errors
NT		Error Indicator for Typewriter Transfer Function Errors
N3		Counter for Book and Paper Piles, = NPILE(1)
N5		Counter for Typewriters; = NTYPE(1)
N6		Counter for Calculators; = NCALC(1)
N7		Counter for Telephones; = NTELE(1)
PEE(k)		The Weight Coefficient for Paper Piles
k	The paper area size groups* (4)	
PEESD(k)		The sd of the Weight Coefficient for Paper Piles
k	same as for PEE	
PH(I)		Telephone Transfer Function Data
I	Telephone size groups* (7)	
PHFWT		Telephone Fire Weight Coefficient
PHSD(I)		sd of Telephone Transfer Function Data
I	same as for PH	
TYP(L,I)		Typewriter Transfer Functions Data
L	Carriage length groups (5)	
I	Typewriter type (2)	
TYPFWT		Coefficient for the Determination of Typewriter Fire Weight

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 29 of 32)

TYPSD(L,I)	sd of Typewriter Transfer Function data
L,I	same as for TYP

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* see transfer function for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

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H. MNEMONICS UNIQUE TO SUBROUTINE BONCOM (DATA)

CFW(I)	Data for Ceiling Fire Loads
I	The ceiling material types (5)
DEPTH	The Room Depth, the Length of Walls 2 and 4
DOORHT	The Height of the Doors in a Particular Wall
DOORP	The Total Perimeter of the Doors in a Room
DOORWT	The Average Width of the Doors in a Particular Wall
FLFW(I)	Data for Floor Material Fire Loads
I	Floor material types (7)
HEIGHT	The Room Height
I	Subscripts used in Transfer Function Computation
L	Subscripts used in Transfer Function Computation
LMT(19)	Room Composite Limits
row	
1	Limit to the number of doors in a wall, 2
2	Limit to the number of windows in a wall, 5
3	Limit to occupancy in file and storage rooms, 3
4	Limit to the % of walls that is windows or doors Y(126), 80%
5	Limit to the fire weight of movable room contents/unit area Y(83), 10 psf
6	Limit to the % that fire load is of live load Y(112), 90%
7	Limit to the room floor area Y(85), 225 ft^2
8	Limit to the % of the floor area occupied Y(87), 50%
9	Limit to the % of fire weight enclosed or enclosed in metal containers, 70%
10	The upper bound of the percentage of live loads within 2 ft of the wall Y(123), 90%

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* see transfer functions for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 31 of 32)

11	The lower bound of the percentage of live loads within 2 ft of the wall Y(123), 10%
12	The upper bound of the percentage of fire weight and enclosed fire weight within 2 ft of the walls Y(96), 90%
13	The lower bound of the percentage of fire weight within 2 ft of the wall Y(98), 30%
14	The percentage of enclosed live weight enclosed in plastic Y(106), 50%
15	Limit to the percentage of total fire weight that is paper Y(103), 50%.
16	Limit to the percentage of total fire weight that is books Y(104), 50%
17	Limit to the total fire weight per unit area Y(110), 10 psf
18	Limit to the total live weight per unit area Y(79), 15 psf
19	Limit to no. of normal occupants of any room, 11
NA	Do Loop Counter
NB	Do Loop Counter
NI	Do Loop Counter
NN	Do Loop Counter
PAR(L,M)	Data for Transfer Function of Internal Partition Weights
L	Height groups* (4)
M	Material group* (4)
PARFWT(M)	Data for Internal Partition Fire Weight Coefficient
M	Material group* (4)
PARSD(L,M)	Data for the sd of the Internal Partition Transfer Function
L	Height groups* (4)
M	Material groups* (4)
SA	Total Surface Area of the Walls, Floors and Ceiling
TRIMFT	Total Length of Floor or Ceiling Trim

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* see transfer functions for code

Table 3. Mnemonics for Data Restructuring Program (MAKER)

(Page 32 of 32)

TRMFW(I)	Floor Trim Fire Weight
I	Material types* (8)
WA	Total Wall Areas
WIDTH	Room Width, the Length of Walls 1 and 3
WINDHT	Average Window Height in one Wall
WINDN	Total No. of Windows in All Walls
WINDP	Total Window Parameter in Room
WINDW	Total Window Width in all Walls
WINDWT	Average Window Width in one Wall
WLCFW(I)	Data for Wall Covering Fire Loads
I	Material types* (10)
WLMFW(I)	Data for Wall Material Fire Loads
I	Material types* (6)
VAB	The Height of Room Partitions

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* see transfer functions for code

Table 4. Transfer Functions Used in MAKER

(Page 1 of 14)

I. The Transfer Functions Used to Determine the Live Loads of Furniture

A. Desk Weight Transfer Function

$$\text{weight} = \text{DEK}(I,J,K) + [\text{DESKG}(4) * \text{DDB}(I)] + [\text{DESKG}(5) * \text{DDF}(I)] + [Q * (\text{DESKG}(6) - 1) * \text{DDP}(I)] + [Q * \text{DCD}(I)]$$

$$\text{sd of weight} = \left| [\text{DEKSD}(I,J,K)]^2 + [\text{DESKG}(4) * \text{DDBSD}(I)]^2 + [\text{DESKG}(5) * \text{DDFSD}(I)]^2 + [Q * (\text{DESKG}(6) - 1) * \text{DDPSD}(I)]^2 + [Q * \text{DCDSD}(I)]^2 \right|^{1/2}$$

where: I = Material of Desk

1 = wood
2 = metal
3 = plastic

J = Desk Type

1 = single pedestal
2 = double pedestal
3 = legs

K = Size Groups (area in/ft^2)

1 = 7.0 - 9.5
2 = 9.6 - 12.0
3 = 12.1 - 14.5
4 = > 14.6

DEK, DDB, DDF, Q, DDP, DCD, DEKSD, DDBSD, DDFSD, DDPSD, DCDSD, are defined in the RMCONT mnemonics table

DESKG is defined in the general mnemonics table .

Table 4. Transfer Functions Used in MAKER

(Page 2 of 14)

B. Table Weight Transfer Function

$$\text{weight} = \underline{\text{TEE}}(I,J,K) + [\underline{\text{TDL}}(I) * (\underline{\text{TABLG}}(11) - 1)]$$

$$\begin{array}{l}\text{sd of} \\ \text{weight}\end{array} = \left\{[\underline{\text{TEESD}}(I,J,K)]^2 + [\underline{\text{TDLSD}}(I) * (\underline{\text{TABLG}}(11) - 1)]^2\right\}^{1/2}$$

where: I = Material of Table Top

1 = wood
2 = metal
3 = plastic

J = Table Type

1 = pedestal
2 = legs

K = Size Groups (area in ft^2)

1 = 4.0 - 9.0
2 = 9.1 - 11.9
3 = 12.0 - 12.5
4 = 12.6 - 15.9
5 = 16.0 - 18.0
6 = 18.1 - 26.9
7 = 27.0 - 44.9
8 = ≥ 45.0
9 = = 1.0 - 4.0

TEE, TDL, TEESD, TDLSD, are defined in the mnemonic tables for RMCONT

TABLG is defined in the general mnemonics table

Table 4. Transfer Functions Used in MAKER
(Page 3 of 14)

C. All Purpose Cabinet Weight Transfer Function

$$\text{weight} = \underline{\text{CAAB}}(K,M,I) + [\underline{\text{CABNG}}(13) * \underline{\text{CBD}}(I)] + [\underline{\text{CABNG}}(14) * \underline{\text{CDF}}(I)] + [\underline{\text{CABNG}}(15) * \underline{\text{CDP}}(I)] + [\underline{\text{CABNG}}(6) * \underline{\text{CAS}}(K,M,I]$$

$$\text{sd of weight} = \left\{[\underline{\text{CAABSD}}(K,M,I)]^2 + [\underline{\text{CABNG}}(13) * \underline{\text{CBDSD}}(I)]^2 + [\underline{\text{CABNG}}(14) * \underline{\text{CDFSD}}(I)]^2 + [\underline{\text{CABNG}}(15) * \underline{\text{CDPSD}}(I)]^2 + [\underline{\text{CABNG}}(6) * \underline{\text{CASSD}}(K,M,I)]^2\right\}^{1/2}$$

where: I = Material of All Purpose Cabinet

1 = wood
2 = metal
3 = plastic

K = All Purpose Cabinet Size (area in ft^2)

1 = 2.0 - 2.9
2 = 3.0 - 3.9
3 = 4.0 - 6.9
4 = 7.0 - 9.9
5 = 10.0 - 11.9
6 = ≥ 12.0

M = All Purpose Cabinet Height Group (in ft)

1 = 1.58 - 2.32
2 = 2.33 - 2.91
3 = 2.92 - 4.15
4 = 4.16 - 5.83
5 = >5.83

CAAB, CBD, CDF, CDP, CAS, CAABSD, CBDSD, CDFSD, CDPSD, CASSD are defined in the mnemonics table for RMCONT

CABNG, is defined in the general mnemonics table

Table 4. Transfer Functions Used in MAKER
(Page 4 of 14)

D. Specialized Cabinet Weight Transfer Function

weight = CAB(K,M,L,I)

sd of
weight = CABSD(K,M,L,I)

where: I = Material of Specialized Cabinets

1 = wood
2 = metal
3 = plastic

L = Specialized Cabinet Type; M, and K are Defined Differently Depending on Type of cabinet

1 = File cabinet

M = Height groups (in/ft)

1 = 1.00 - 1.66
2 = 1.67 - 3.00
3 = 3.01 - 3.75
4 = 3.76 - 4.66
5 = > 4.66

K = Size groups (area in ft^2)

1 = 2 - 2.9
2 = 3 - 3.9
3 = 4 - 4.9
4 = $\geq$ 5.0

2 = Card Cabinet

M = height groups (in/ft)

1 = $\leq$ 1.66
2 = 1.67 - 3.00
3 = 3.01 - 3.75
4 = $\geq$ 4.66

K = Size Groups (area in ft^2)

1 = 2.0 - 2.9
2 = $\geq$ 3.0

Table 4. Transfer Functions Used in MAKER
(Page 5 of 14)

3 = Blueprint Cabinet

M = height groups (in ft)

1 = 1 - 1.66
2 = 1.67 - 3.00

K = Size Groups (area in ft^2)

1 = 2.0 - 2.9
2 = 3.0 - 3.9
3 = 4.0 - 6.9
4 = 7.0 - 9.9
5 = 10.0 - 11.9
6 = $\geq$ 12.0

4 = File Safe

M = height groups (in/ft)

1 = 1 - 1.66
2 = 1.67 - 3.00
3 = 3.01 - 3.75
4 = > 3.75

K = Size Groups (area in ft^2)

1 = 2.0 - 2.9
2 = 3.0 - 3.9
3 = $\geq$ 4.0

CAAB, CAABSD are defined in the mnemonics table for RMCONT

Table 4. Transfer Functions Used in MAKER
(Page 6 of 14)

E. Free Shelving Weight Transfer Function

weight = NOS * FS (M,I)

sd of
weight = NOS * FSSD (M,I)

where: I = Material Type of Free Shelving

1 = wood
2 = metal
3 = plastic

M = Size Group (area in ft^2)

1 = 2.0 - 2.9
2 = 3.0 - 3.9
3 = 4.0 - 5.9
4 = 6.0 - 7.9
5 = $\geq$ 8.0

NOS, FS, FSSD are defined in the mnemonics table for RMCONT

Table 4. Transfer Functions Used in MAKER
(Page 7 of 14)

F. Bookcase Weight Transfer Function

$$\text{weight} = \text{BK}(M,L,I) + \text{NOS} * \text{SHL}(M,I)$$

$$\text{sd of weight} = \left\{[\text{BKSD}(M,L,I)]^2 + [\text{NOS} * \text{SHLSD}(M,I)]^2\right\}^{1/2}$$

where: I = Material Types

1 = wood
2 = metal
3 = plastic

L = Height Groups (in ft)

1 = 2.33 - 3.08
2 = 3.09 - 4.16
3 = 4.17 - 5.46
4 = > 5.46

M = Size Groups (area in ft^2)

1 = 2.0 - 2.9
2 = 3.0 - 3.9
3 = 4.0 - 4.9
4 = ≥ 5.0

BK, NOS, SHL, BKSD, SHLSD are defined in the mnemonics table for RMCONT

Table 4. Transfer Functions Used in MAKER
(Page 8 of 14)

G. Seating Weight Transfer Function

weight = CEE(I,J) * Y(NBUF + 3)

sd of
weight = CEESD(I,J) * Y(NBUF + 3)

where: I = Frame Material Types
1 = wood
2 = metal
3 = plastic

J = Types of Seating (increments in ft)
1 = legs with arms
2 = legs without arms
3 = pedestal with arms and height $\leq$ 3.21
4 = pedestal with arms and height $>$ 3.21
5 = pedestal without arms
6 = upholstered
7 = sofa 4.00 - 5.92 long
8 = sofa 6.00 - 7.50 long
9 = sofa $\geq$ 7.58 long
10 = bench
11 = drafting stool
12 = classroom chair

Y(NBUF+3) The number of chairs.

CEE, CEESD are defined in the mnemonics table for RMCONT

Table 4. Transfer Functions Used in MAKER

(Page 9 of 14)

II. Transfer Functions for Equipment and Partitions

A. Paper Pile Weight Transfer Function

$$\text{weight} = \underline{\text{PEE}}(\text{K}) * \underline{\text{HEIGHT}} * (\%\ \text{compaction})$$

$$\begin{matrix}\text{sd of}\\ \text{weight}\end{matrix} = \Big((\%\ \text{COMPACTION})^2 * (\underline{\text{HEIGHT}} * \underline{\text{PEESD}}(\text{K}))^2 + .0816\ [(\underline{\text{PEE}}(\text{K}))^2 + (\underline{\text{PEESD}}(\text{K}))^2]\Big)^{1/2}$$

where: % compaction = either FREE(4, N3, NI) or ENCL(4,N3,NI)

K = Size of Paper (area in ft^2)

1 = .65 (8.5 x 11 inches)
2 = .89 (8.5 x 15 inches)
3 = 1.1 (11 x 15 inches)
4 = >2.08 (15 x 70 inches)

PEE, PEESD, HEIGHT, are defined in the mnemonics table for RMCONT, FSEAP

FREE, ENCL, are defined in the general mnemonics table.

Table 4. Transfer Functions Used in MAKER
(Page 10 of 14)

B. Book Pile Weight Transfer Function

weight = BEE(K) * HEIGHT * (% compaction)

$$\text{sd of weight} = \Big((\%\ \text{COMPACTION})^2 * (\text{HEIGHT} * \text{BEESD}(K))^2 + .0816\ [(\text{BEE}(K))^2 + (\text{BEESD}(K))^2]\Big)^{1/2}$$

where: % compaction = either FREE(4,N3,NI) or ENCL(4,N3,NI)

K = Size of Books (area in ft^2)

1 = < .35 (< 7.0 x 7.25 inches)
2 = .35 - .45 (7.0 x 7.25 - 10 x 6.5 inches)
3 = >.45 (10.0 x 6.5 inches)

BEE, BEESD, HEIGHT are defined in the mnemonics table for RMCONT, FSEAP

FREE, ENCL are defined in the general mnemonics table

C. Telephone Weight Transfer Function

weight = PH(J) * TELE(3,N7,NI)

sd of
weight = Not applicable for telephones, no standard deviation in weight.

where: TELE(3,N7,NI) = the number of telephones

J = The Type of Phone

1 = no buttons
2 = 6 buttons
3 = 10 buttons
4 = 12 buttons
5 = 18 buttons
6 = 20 buttons
7 = 30 buttons

PH is defined in mnemonics for RMCONT, FSEAP

D. Typewriter Weight Transfer Function

weight = TYP(L,J)

sd of
weight = TYPSD(L,J)

where: L = Carriage Size Groups (in inches)

1 = 11 - 14
2 = 15 - 16
3 = 17 - 20
4 = 21 - 24
5 = 25 - 30

J = Power Source

1 = manual
2 = electric

TYP, TYPSD are defined in the mnemonics for RMCONT, FSEAP

Table 4. Transfer Functions Used in MAKER
(Page 13 of 14)

E. Calculator Weight Transfer Function

weight = CAL(J,K)

sd of
weight = CALSD(J,K)

where: K = Type of Calculator

1 = illuminated read-out
2 = illuminated read-out with tape
3 = dial read-out

J = (for the types above) The Size Groups (area in ft^2)

1 = .069 - .458
2 = .459 - .735
3 = .736 - .951
4 = .952 - 1.187
5 = > 1.187

K = Type of Calculator

4 = tape output only

J = (for tape output only type) The Size Groups (area in ft^2)

1 = .625 - .833
2 = .834 - 1.076
3 = 1.077 - 1.388
4 = > 1.388

CAL, CALSD, are defined in mnemonics table for RMCONT, FSEAP

Table 4. Transfer Functions Used in MAKER
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F. Room Partition Weight Transfer Function

weight = PAR(L,I)

sd of
weight = PARSD(L,I)

where: I = Material Type

1 = steel
2 = fabric
3 = plastic
4 = wood

L = Height Group (in ft)

1 = < 4.00
2 = 4.00 - 4.99
3 = 5.0 - 5.99
4 = > 6.00

PAR, PARSD are defined in the mnemonics table for BONCOM

Table 5. Error and Limit Messages in MAKER
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A. Error and Limit Messages in DRIVE

	Format No.	
	100	'BUILDING NUMBER IS TOO LARGE: (BUILDN)'
cond.		If BUILDN > 101
	101	'IMPOSSIBLE STATE NUMBER: BUILDING (BUILDN)'
cond.		If 1 > BUILD(3) or 51 < BUILD(3)
	102	'IMPROBABLE CONSTRUCTION DATA: BUILDING (BUILDN)'
cond.		If BUILD(5) < 1800 or BUILD(5) > 1974
	103	'IMPROBABLE HEIGHT: BUILDING (BUILDN)'
cond.		If BUILD(6) > 100
	104	'IMPOSSIBLE VERTICAL LOAD RESISTING SYS: BUILDING (BUILDN)'
cond.		BUILD(7) < 1, BUILD(7) > 2
	105	'IMPOSSIBLE BUILDING MATERIAL: BUILDING (BUILDN)'
cond.		BUILD(8) < 1, BUILD(8) > 2
	106	'IMPOSSIBLE OCCUPANCY CODE: BUILDING (BUILDN)'
cond.		BUILD(9) < 1, BUILD(9) > 5
	107	'THE NUMBER OF FIRMS IS OUTSIDE ACCEPTABLE RANGE: BUILDING (BUILDN)'
cond.		NO < 1, NO > 1000; STOP
	108	FIRM (J) BUILDING (BUILDN) HAS AN IMPOSSIBLE TYPE NO.'
cond.		FIRMT(J) NOT IN STANDARD INDUSTRIAL CLASSIFICATION
	109	'BUILDING NO. AND BUILDING NO. WITH ROOM NOT CONSISTENT: BUILDING (BUILDN); FLOOR (FLOORN), ROOM (ROOMN)
cond.		BUILD(10) ≠ BUILDN
	110	'THIS FLOOR NUMBER IS TOO LARGE: BUILDING (BUILDN)'
cond.		BUILD(11) > BUILD(6)

Table 5. Error and Limit Messages in MAKER
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	Format No.	
	111	'IMPOSSIBLE CEILING MATERIAL INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM, (ROOMN)'
cond.		ROOM(7) > 5
	112	'IMPOSSIBLE FLOOR MATERIAL INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		ROOM(8) > 1, ROOM(8) < 5
	113	'IMPOSSIBLE DOOR MATERIAL INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		ROOM(9) > 3
	114	'DATA ERROR, MORE THAN 10 FREE PILES INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NPILE(1) > 10
	115	'IMPOSSIBLE TRIM MATERIAL INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		ROOM(J) > 3, ROOM(J) < 8 J = 10 to 13
	116	'DATA ERROR, MORE THAN 10 ENCLOSED PILES INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If MPILE(1) > 10
	118	'DATA ERROR, MORE THAN 2 TYPEWRITERS INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		NTYPE(1) > 2
	119	'DATA ERROR, THE NUMBER OF ROOMS SURVEYED EXCEEDS 400, STOP: BUILDING (BUILDN)'
cond.		N1 > 200; STOP
	120	'DATA ERROR, MORE THAN 2 CALCULATORS INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		NCALC (1) > 2
	121	'DATA ERROR, THE FIRM NUMBER FOR THIS ROOM WAS NOT FOUND IN THE LIST OF FIRM DATA, SET FIRM TYPE TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		FTN = .FALSE.
	122	'DATA ERROR, MORE THAN ONE LINE OF TELEPHONE DATA INDICATED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NTELE(1) > 1

Table 5. Error and Limit Messages in MAKER

(Page 3 of 21)

	Format No.	
	123	'CALCULATOR DATA IN ERROR: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If CALC(3,K,L) = 2 and CALC(4,K,1) = 0.
	126	'DATA ERROR, FATAL ERROR DISCOVERED IN DESK: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 2, After return from subroutine RMCONT
	127	'DATA ERROR, FATAL ERROR, DESKG(1,2, or 3) TOO LARGE OR TOO SMALL: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If DESKG(1) > 3, or DESKG(1) < 1, or DESKG(2) > 2 or (DESKG(2) < 1, and RMS = .FALSE.), or DESKG(3) > 3, or DESKG(3) < 1
	128	'DATA ERROR, FATAL ERROR DISCOVERED IN TABLE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 3, After return from subroutine RMCONT
	129	'DATA ERROR, FATAL ERROR, TABLE (1,2,3 or 4) TOO LARGE OR TOO SMALL: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If TABLG(1) > 2, or TABLG(1) < 1, or TABLG(2) > 2, or (TABLG(2) < 1, and RMS = .FALSE.), or TABLG(3) > 3, or TABLG(3) < 1, or TABLG(4) > 3, or TABLG(4) < 1
	130	'DATA ERROR, FATAL ERROR DISCOVERED IN CABINET: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 4, After return from subroutine RMCONT
	131	'DATA ERROR, FATAL ERROR, CABNG(1,2, or 3) TOO LARGE OR TOO SMALL: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If CABNG(1) > 5, or CABNG(1) < 1, or CABNG(2) > 2, or (CABNG(2) < 1 and RMS = .FALSE.), or CABNG(3) > 3, or CABNG(3) < 1

Table 5. Error and Limit Messages in MAKER

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	Format No.	
	132	'DATA ERROR, FATAL ERROR, DISCOVERED IN SHELF: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 5, After returning from subroutine RMCONT
	133	'DATA ERROR, FATAL ERROR, SHELG(1,2 or 3) TOO LARGE OR TOO SMALL: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If SHELF(1) > 2, or SHELG(1) < 1, or SHLEG(2) > 2, or (SHELG(2) < 1 and RMS = .FALSE.), or SHELG(3) > 3, or SHLEG(3) < 1
	134	'DATA ERROR, FATAL ERROR DISCOVERED IN SEAT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 6, After returning from subroutine RMCONT
	135	'THIS COMMENT SHOULD NEVER BE PRINTED SOMETHING IS WRING. LINE NO.', (IDUM),' STATUS WORD',(II)
cond.		NA
	136	'DATA ERROR, FATAL ERROR DISCOVERED IN MISC ITEM: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE. and INDEX = 7,After returning from subroutine RMCONT
	138	'DATA ERROR, FATAL ERROR DISCOVERED ON FORM A: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE., After returning from FORMA subroutine
	140	'DATA ERROR, FATAL ERROR DISCOVERED ON FORM B: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE., After returning from FORMB subroutine
	142	'DATA ERROR, FATAL ERROR DISCOVERED ON FORM C: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE., After returning from FORMC subroutine

Table 5. Error and Limit Messages in MAKER
(Page 5 of 21)

	Format No.	
	144	'DATA ERROR, NUMBER OF MISCELLANEOUS ITEMS GREATER THAN 8 ON FORM 7: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NITEM > 8 and INDEX = 7
	146	'DATA ERROR, INDEX DOES NOT SHOW BOUNDING SURFACE DATA FIRST: THIS ROOM NOT PROCESSED. BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If INDEX > 1 when reading first form
	148	'DATA ERROR, INDEX IS 1 WHEN IT SHOULD NOT BE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If INDEX = 1, After returning from subroutine RMCONT
	150	'DATA ERROR, PROGRAM WENT DIRECTLY TO PILE AND FOUND A FATAL ERROR: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If ERR = .TRUE., After subroutine FORMA or subroutine FORMB
	152	'DATA ERROR, THE FORM AFTER FORM 1 IS FORM C WHICH IS NOT PREMITTED: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If INDEX = 10, After processing Form 1
	154	'DATA ERROR, THE NUMBER OF SEATING ITEM IS GREATER THAN 9 ON FORM 6: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NITEM > 9 and INDEX = 6
	156	'DATA ERROR, THE NUMBER OF ITEMS IS LESS THAN 1 ON FORM 6 OR 7: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NITEM < 1
	160	'TRANSMISSION FROM INPUT DATA ABORTED OR ERRONOUS./ STATUS WORD (II), BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If II = -4, or II = -3

Table 5. Error and Limit Messages in MAKER

(Page 6 of 21)

	Format No.	
	162	'END-OF-TAPE ON INPUT DATA/STATUS WORD (II) AFTER BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If II = -2
	166	'TRANSMISSION TO OUTPUT FILE ABORTED OR ERRONEOUS./ STATUS WORD (IO) BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If IO < -2
	170	'END-OF-TAPE, ABOUT 3,584,000 WORDS WRITTEN ON REEL/REEL (REEL), BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		After 3,584,000 words have been processed on one tape reel.
	176	'(REEL) REELS OF PROCESSED DATA HAVE BEEN GENERATED /JOB COMPLETE BECAUSE END-OF FILE MARK FOUND ON INPUT TAPE.'
cond.		If IO = -2
	178	'WHILE WRITING THE SPECIAL END-OF-TAPE RECORD AN ABNORMAL OR ABORTED TRANSMISSION ENCOUNTERED./ STATUS WORD (IO), REEL (REEL)BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If IO = -4, or IO = -3, or IO = -2
	180	'SPECIAL END-OF-TAPE RECORD WRITTEN SUCESSFULLY BUT WITH AN INCORRECT NUMBER OF WORDS./STATUS WORD (IO), REEL (REEL), BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If IO > -1 and IO ≠ 10
	182	'THIS ROOM MAY HAVE TOO MUCH DATA TO BE PROCESSED WITH THIS PROGRAM./ROOM NOT PROCESSED. BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN), FILE (NOFILE), RECORD (NORECD)'
cond		If II > 10000

Table 5. Error and Limit Messages in MAKER
(Page 7 of 21)

	Format No.	
	183	'THE INDEX NUMBER IS EITHER TOO HIGH OR TOO LOW = (INDEX) AT LINE NO. (IDUM)/BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If Index < 1 or Index > 7
	185	'THE STATUS WORD IS LESS THAN -1 WHEN RETURNING FROM WRITING THE 10 WORD RECORD (IO) BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		IO < -1
	186	'THE SHORT RECORD HAS BEEN WRITTEN BUT WITH LESS THAN 10 WORDS'
cond.		IO > -1 and IO < 10
	190	'FIRM NO. IS (RMFIRM(1,J)) FOR (J)TH FIRM BUILDING (BUILD(2))
cond.		If RMFIRM(1,J) > 1000
	191	'FIRM TYPE IS (RMFIRM(2,J) FOR (J)TH FIRM BUILDING (BUILD(2))
cond.		If RMFIRM(2,J) > 100
	192	'FIRM AGE IS (RMFIRM(3,J)) FOR (J)TH FIRM BUILDING (BUILD(2))
cond.		If RMFIRM(3,J) > 200
	193	'DEVICE ERROR, TRANSMISSION ABORT, OR END-OF-FILE/FOUND WHILE TRYING TO READ FIRM DATA MAY/ATTEMPT TO SWITCH REEL AND START OVER AT BLDG DATA'
cond.		If II < -1
	194	'DEVICE ERROR, TRANSMISSION ABORT, OR END-OF-FILE/FOUND WHILE TRYING TO READ DATA FOR FIRST ROOM./PROGRAM WILL ATTEMPT TO SWITCH REELS AND START OVER.'
cond.		If II < -2
	198	'Y RECORD TOO LARGE TO WRITE ON FASTRAND FILE. ONLY FIRST 9999 WORDS WRITTEN.'
cond.		If NBUF > 10000 and FILE0 = .TRUE.

Table 5. Error and Limit Messages in MAKER
(Page 8 of 21)

B. Error Messages in Subroutine FORMA

Format No.

100 'THE NUMBER OF PILES IS TOO LARGE FOR PROGRAM: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $MPILE(ITEM) > 25$ or $NPILE(ITEM) > 25$

110 'DATA ERROR, FREE/ENCLOSED INDEX UNEQUAL TO 0 OR 1: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $TEMP(K1) > 1$, or $TEMP(K1) > 0$

120 'DATA ERROR, NUMBER OF PILES IS ZERO ON FORM A: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N = 0$

130 'DATA ERROR, NUMBER OF PILES ON FORM A EXCEEDS NUMBER POSSIBLE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N > 15$

140 'DATA ERROR, FORM INDICATOR INCOMPATIBLE WITH FORM A: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $K \neq 0$ and $K \neq 1$

Table 5. Error and Limit Messages in MAKER
(Page 9 of 21)

C. Error Messages in Subroutine FORMB

Format No.

100 'DATA ERROR, FORM-B NOT INDICATED TO BE FREE-STANDING OR EXTRA ITEM: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $K \neq 0$, and $K \neq 1$

110 'DATA ERROR, NUMBER OF TYPEWRITERS LARGER THAN POSSIBLE ON FORM B: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N > 3$

120 'NUMBER OF TYPEWRITERS EXCEEDS PROGRAM CAPABILITY: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If NTYPE(ITEM) > 12

130 'DATA ERROR, NUMBER OF CALCULATORS LARGER THAN POSSIBLE ON FORM B: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N > 3$

140 'NUMBER OF CALCULATORS EXCEEDS PROGRAM CAPABILITY: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If NCAL(ITEM) > 12

150 'DATA ERROR, NUMBER OF TELEPHONE DATA LINES LARGER THAN POSSIBLE ON FORM B: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N > 2$

160 'NUMBER OF TELEPHONES EXCEEDS PROGRAM CAPABILITY: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If NTELE(ITEM) > 25

161 'IN FORM B A STAND-ALONE ITEM IS ASSOCIATED WITH A PIECE OF FURNITURE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $X(I) \neq 0$ and FLAG = .TRUE.

Table 5. Error and Limit Messages in MAKER
(Page 10 of 21)

D. Error Messages in Subroutine FORMC

Format No.

100 'DATA ERROR, FORM-C NOT INDICATED TO BE AN EXTRA SHEET: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $K \neq 0$

110 'DATA ERROR, NUMBER OF ITEMS ON FORM C EXCEEDS NUMBER POSSIBLE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N > 5$

120 'DATA ERROR, NUMBER OF ITEMS IS ZERO ON FORM C: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $N = 0$

130 'THE NUMBER OF MISCELLANEOUS ITEMS IS TOO LARGE FOR PROGRAM: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If $NMISC(ITEM) > 10$

E. Error Messages in Subroutine FSEAP

Format No.

160 'A FREE-STANDING PAPER PILE OF (HEIGHT) FEET HIGH: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If HEIGHT > FREEL

165 'THE NUMBER OF BUTTONS FOR A FREE-STANDING PHONE IS INCONSISTENT WITH PHONE TYPE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If [TELE(1,N7,1) = 1, and TELE(2,N7,1)>2], or [TELE(1,N7,1) = 2, and TELE(2,N7,1)< 3]

184 'THERE IS A TRANSFER FUNCTION SUBSCRIPT OF INCORRECT FORM FOR A FREE-STANDING (NAMEE(I))/ THE WEIGHTS FOR THIS ITEM HAVE BEEN SET TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE:	If:
'P-PILE'	K<1
'B-PILE'	K>3
'TYPWRT'	J< 1 or J>2 or M< 1 or M>2 or L< 1 or L>5
'CALC'	K< 1 or K>5
'PHONE'	J< 1 or J>7

185 'TRANSFER DATA FOR A FREE-STANDING (NAMEE(I)) IS AN ESTIMATE OF [A. see below] LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE:	Values of A:	If:
'TYPWRT'	TYP(L,J)	TYP(L,J) < D
'CALC.'	CAL(J,K)	CAL(J,K) < 0

186 'THE DIMENSIONS OF A FREE-STANDING (NAMEE(I)) NO. (A.) ARE TOO SMALL TO CONFORM TO THE SIZE CRITERIA OF'/'THE TRANSFER FUNCTION AND THE WEIGHT OF THIS ITEM HAS BEEN SET TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. For NAMEE = : CALC. If: K<4 .AND. CALA<.069 .OR
K=4 .AND. CALA<.624

Table 5. Error and Limit Messages in MAKER
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Format No.

188 'NBUF HAS A VALUE OF (NBUF) NO MORE FSEAP DATA CAN BE PROCESSED, ERR SET TO .TRUE., RETURN TO DRIVE./BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If NBUF > 10000

190 'NO PROJECTED SURFACE AREA CAN BE COMPUTED FOR FS (NAMEE(I)) NUMBER (A) THUS NO FLOOR LOADING IS COMPUTED/IN: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+9) < .01

NAMEE:	A:
'B-PILE'	N3
'P-PILE'	N3
'TYPWRT'	N5
'CALC.'	N6
'PHONE'	N7

Table 5. Error and Limit Messages in MAKER
(Page 13 of 21)

F. Error Messages in Subroutine BONCOM

Format No.

150 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE LENGTH OF A ROOM PARTITION IS (Y(57+NA)) FT. WHICH IS LONGER THAN THE DEPTH AND WIDTH OF THE ROOM'

cond. If Y(57+NA) < WIDTH and Y(57+NA) > DEPTH

151 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE HEIGHT OF A ROOM PARTITION IS (Y(59+NA)) FT. WHICH IS HIGHER THAN THE ROOM'

cond. If Y(59+NA) > HEIGHT

152 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE NUMBER OF DOORS IN ONE WALL IS (DOOR(1,NN))'

cond. If DOOR(1,NN) > LMT(1)

153 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE NUMBER OF WINDOWS IN ONE WALL IS (DOOR(6,NN)'

cond. If DOOR(6,NN) > LMT(2)

154 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE NORMAL OCCUPANCY OF A FILE ROOM OR A STORAGE ROOM IS, (Y(20))'

cond. If 4<Y(19)< 7 and Y(20) > LMT(3)

155 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), IN A (Y(14)) STORY BUILDING THERE IS A ROOM ON FLOOR NUMBER (Y(3))'

cond. If Y(3) > Y(14)

156 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(126)) PERCENT OF THE WALL AREA IS DOORS AND WINDOWS

cond. If Y(126) > LMT(4)

157 'BUILD (BUILDN), FL (FLOORN), RM (ROOMN),THE LIVE LOAD/SQ FT IS (Y(79)) PSF'

cond. If Y(79) > LMT(18)

Table 5. Error and Limit Messages in MAKER
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	Format No.	
	158	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE FIRE LOAD/SQ FT IS (Y(83)) PSF'
cond.		If Y(83) > LMT(5)
	159	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(12)) PERCENT OF THE LIVE LOAD IS FIRE LOAD'
cond.		If Y(112) > LMT(6)
	160	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THIS ROOM HAS A FLOOR AREA OF Y(85) SQ FT'
cond.		If Y(85) > LMT(7)
	161	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(87)) PERCENT OF THE FLOOR IS COVERED'
cond.		If Y(87) > LMT(8)
	162	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), Y(82) PERCENT OF THIS ROOMS FIRE WEIGHT IS ENCLOSED IN METAL'
cond.		If Y(92) > LMT(9)
	163	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(123)) PERCENT OF THIS ROOMS LIVE LOAD IS WITHIN 2 FT OF THE WALLS'
cond.		If Y(123) > LMT(10), or Y(123) < LMT(11)
	164	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(98)) PERCENT OF THIS ROOMS FIRE LOAD IS WITHIN 2 FT OF THE WALLS'
cond.		If Y(98) > LMT(12), or Y(98) < LMT(13)
	166	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), Y(106) PERCENT OF THIS ROOMS FIRE LOAD IS ENCLOSED IN PLASTIC'
cond.		If Y(106) > LMT(14)
	167	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), (Y(102)) PERCENT OF TOTAL ROOM FIRE WEIGHT IS PAPER'
cond.		If Y(102) > LMT(15)

Table 5. Error and Limit Messages in MAKER

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	Format No.	
	168	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), Y(104) PERCENT OF TOTAL ROOM FIRE WEIGHT IS BOOK'
cond.		If Y(104) > LMT(16)
	169	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE TOTAL FIRE LOAD OF THE ROOM INCLUDING THE FINISH IS (Y(110)) LBS'
cond.		If Y(110) > LMT(17)
	170	'(Y(96)) PERCENT OF THE ENCLOSED FIRE WEIGHT IS W/N 2FT OF THE WALL: BUILD (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If Y(96) > LMT(12)
	171	'(Y(100)) PERCENT OF THE TOTAL FIRE WEIGHT IS ENCLOSED: BUILD (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If Y(100) > LMT(9)
	172	'BUILD (BUILDN), FL (FLOORN), RM (ROOMN), THE NORMAL OCCUPANCY OF THIS ROOM IS Y(20)'
cond.		If Y(20) > LMT(19)

Table 5. Error and Limit Messages in MAKER
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G. Error Messages in Subroutine RMCONT

Format No.

150 'OVER (DESKL(4)) BOX, (DESKL(4)) FILE AND (DESKL(4)) PERSONAL DRAWERS IN ONE DESK: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If DESK(4) > DESKL(4) and DESKG(5) > DESKL(4) and DESKG(3) > DESKL(1)

151 'OVER DESKL(1) BOX AND DESKL(1) FILE DRAWERS IN ONE DESK: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If DESKG(4) > DESKL(1) and DESKG(5) > DESKL(1)

152 ONE DESK AREA OF (Y(NBUF+9)) SQFT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)

cond. If Y(NBUF+9) > DESKL(2), or Y(NBUF+9) > DESKL(3)

153 'A TABLE TOP AREA OF (Y(NBUF+9)) FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+9) > TABLEL(1) or Y(NBUF+9) < 1.

154 'A CABINET WITH A TOP SURFACE OF (Y(NBUF+9)) SQ FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+9) > CABL(1)

155 'A SHELF WITH A DEPTH OF (DEPTH) FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If DEPTH > SHELFL(1)

156 'SEATING WITH A SURFACE AREA OF (Y(NBUF+9)) SQ FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+9) > SEATL(1)

157 'A DESK WITH AN EMPTY WEIGHT OF (Y(NBUF+9)) LBS BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+5) > DESKL(5) or Y(NBUF+5) < 1.

Table 5. Error and Limit Messages in MAKER
(Page 17 of 21)

	Format No.	
	158	'A TABLE WITH AN EMPTY WEIGHT OF (Y(NBUF+5)) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If Y(NBUF+5) > TABLEL(2) or Y(NBUF+5) < 1.
	159	'(CDRAW) DRAWERS IN A CABINET: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If CDRAW > CABL(2)
	160	'A FREE PAPER PILE (HEIGHT) FEET HIGH ON (NAMEF(I)) NO. Y(112+INDEX); BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If HEIGHT > FREEL
	161	'FREE BOOK AND PAPER PILE WEIGHT ON NAMEE(INDEX) NO. Y(112+INDEX) WEIGHS (WTF)LB: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If WTF > FWTL
	162	'ENCLOSED PAPER PILE THAT IS (HEIGHT) FEET HIGH ON (NAMEF(I)) NO. Y(112+INDEX); BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		HEIGHT > ENCLL
	163	'ENCLOSED WEIGHT OF BOOKS AND PAPER IS (WTE) LBS ON (NAMEF(I)) NO. Y(112+INDEX); BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If WTE > ENWL
	164	'FREE BOOK PILE LENGTH IS (HEIGHT) FT WHILE THE LENGTH OF (NAMEE(I)) NO. (A) IT IS ON IS ONLY (LENGTH) FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If HEIGHT > LENGTH
	165	'THE NUMBER OF BUTTONS AND PHONE TYPE ARE INCONSISTENT ON (NAMEF(I)) NO. Y(112+INDEX); BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If (TELE(1,N7, NI) = 1 and TELE(2,N7,NI)>2), or (TELE(1,N7, NI) = 2 and TELE(2,N7,NI)< 3)

Table 5. Error and Limit Messages in MAKER
(Page 18 of 21)

Format No.

166 'THE WEIGHT OF A MISCELLANEOUS ITEM ON (NAMEF(I)) NO. Y(112+INDEX) IS (MWT) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If MWT > MWTLT

170 'A CABINET WITH AN EMPTY WEIGHT OF (Y(NBUF+5)) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+5) > CABL(3)

171 'EMPTY SHELVING WITH A WEIGHT OF (Y(NBUF+5)) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+5) > SHELFL(2)

172 'EMPTY SEATING WEIGHT OF (Y(NBUF+5)) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+5) > SEATL(2)

173 'A PLASTIC DESK IS PRESENT: BUILDING (BUILDN) FLOOR (FLOORN) ROOM(ROOMN)'

cond. If DESKG(6) = 3

174 'SHELVING TOO LONG TO FIT IN ROOM: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If LENGTH > [(ROOM (19) * 10 + ROOM (20) + (ROOM(21)/12)] and LENGTH > [(ROOM(16) * 10 + (ROOM(17) + ROOM(18)/12)]

175 'MISCELLANEOUS ITEM WEIGHS (Y(NBUF+5)) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+5) > MISLT(2)

176 'MISCELLANEOUS ITEM WITH A PROJECTED AREA OF (Y(NBUF+9) SQ FT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond. If Y(NBUF+9) > MISLT(1) .OR <0.1 lb

180 'TRANSFER DATA FOR '(NAMEF(I)) 'NUMBER (A) IS AN ESTIMATION OF ', (B) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE =:	(A)	(B)	If:
'DESK'	Y(114)	DEK(I,J,K)	DEK(I,J,K) < 1
'TABLE'	Y(115)	TEE(I,J,K)	TEE(I,J,K) < 1
'CAB'	Y(116)	CAB(K,M, L,I)	CAB(K,M, L,I) < 1
'SHELF'	Y(117)	BK(M,L,I)	BK(M,L,I) < 1
'SHELF'	Y(117)	FS(I,M)	FS(I,M) < 1
'SEAT'	Y(118)	CEE(I,J)	CEE(I,J) < 1

Table 5. Error and Limit Messages in MAKER
(Page 19 of 21)

Format No.

181 'THE DIMENSIONS, TYPE, OR MATERIAL OF (NAMEE(I)) 'NUMBER' (A) IS NOT POSSIBLE ACCORDING TO THE DEFINITIONS OF THE TRANSFER FUNCTION DATA: BUILDING (BUILDN),FLOOR (FLOORN), ROOM (ROOMN)'

cond.	For NAMEF =:	(A.)	If:
	'CAB.'	Y(116)	CAB(K,M,L,I) = -999.

182 'THE DIMENSIONS OF (NAMEF(I)) 'NUMBER'(A.)ARE TOO SMALL TO CONFORM TO THE SIZE CRITERIA OF THE TRANSFER FUNCTION /THE WEIGHTS FOR THIS ITEM HAVE BEEN SET TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.*	For NAMEF(I) =;	A:	If:
	'DESK'	Y(114)	DKS < 7.0
	'TABLE'	Y(115)	TABA < 4.0
	'CAB'	Y(116)	AR < 1.0 .OR. CABHT < 0.5
	'SHELF'	Y(117)	AR < 1.0
	'SHELF'	Y(117)	AR < 2.0 .OR. HEIGHT < 2.33
	'SEAT'	Y(118)	J < 1

183 'THERE IS A TRANSFER FUNCTION SUBSCRIPT OF INCORRECT FORM EITHER TOO LARGE OR ZERO FOR (NAMEF(I) NUMBER (A.)/THE WEIGHT FOR THIS ITEM HAS BEEN SET TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.	For NAMEF(I) =;	A:	If:
	'DESK'	Y(114)	I>3 .OR. I<1 .OR. J>3 .OR. J<1
	'TABLE'	Y(115)	I>3 .OR. I<1 .OR. J>2 .OR. J<1
	'CAB'	Y(116)	I>3 .OR. I<1
	'CAB'	Y(116)	I>3 .OR. I<1 .OR. L>4 .OR. L>1
	'SHELF'	Y(117)	I>3 .OR. I<1
	'SEAT'	Y(118)	I>3 .OR. I<1 .OR. J>12

---

* Units in ft. or sq. ft.

Table 5. Error and Limit Messages in MAKER
(Page 20 of 21)

Format No.

184 'THERE IS A TRANSFER FUNCTION SUBSCRIPT OF INCORRECT FORM FOR A, (NAMEE(I)) 'ON OR IN '(NAMEF(INDEX)' NUMBER(Y(112+INDEX))/THE WEIGHTS FOR THIS ITEM HAVE BEEN SET TO ZERO: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE(I) =;	If:
'P-PILE'	K<1
'B-PILE'	K>3
'TYPWRT'	J<1 .OR. J>2 .OR. M<1 .OR. M>2 .OR. L<1 .OR. L>5
'CALC.'	K<1 .OR. K>5
'PHONE'	J<1 .OR. J>7

185 'TRANSFER DATA FOR A (NAMEE(I)'ON OR IN (NAMEF(INDEX) NUMBER (Y(112+INDEX) IS AN ESTIMATE OF '(A.) LBS: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE(I) =;	A:	If:
'TYPWRT'	TYP(L,J)	TYP(L,J) 0.
'CALC.'	CAL(J,K)	CAL(J,K) 0.

186 'THE DIMENSIONS OF A (NAMEE(I))'ON OR IN'(NAMEF(INDEX)) 'NUMBER'(Y(112+INDEX))'ARE TOO SMALL TO CONFORM TO THE SIZE CRITERIA OF'/'THE TRANSFER FUNCTION AND THE WEIGHT OF THIS ITEM HAS BEEN SET TO ZERO:BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'

cond.

For NAMEE(I) =;		If:
'CALC.'		K<4 .AND. CALA<.069
	or	K≥4 .AND. CALA<.624

Table 5. Error and Limit Messages in MAKER
(Page 21 of 21)

	Format No.	
	188	'NBUF HAS A VALUE OF (NBUF) NO MORE RMCONT DATA CAN BE PROCESSED, ERR SET TO .TRUE. RETURN TO DRIVE: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If NBUF > 9950 at start of RMCONT
	189	'THE PSF LOADING FOR A (NAMEF(I)) EQUALS (RCWTPF) BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If RCWTPF > RCWTL
	190	'INDEX NO. = (INDEX) IN RMCONT: BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		If INDEX < 2 or INDEX > 7
	191	'THE VARIABLE NITEM IS OUT OF RANGE. BUILDING (BUILDN), FLOOR (FLOORN), ROOM (ROOMN)'
cond.		NITEM > 10

Table 6. Run Cards for UNIVAC 1108, EXEC 8, 1975

(Page 1 of 1)

```
No.

 1    @RUN (etc)
             use to start run
 2    @MSG  PLEASE MOUNT TAPE NO. iii WITHOUT WRITE RING
 3    @ASG,T  NAME1,T,iii
             use 2 and 3 to mount and assign tape file when survey data on magnetic tape
 4    @ASG,A  NAME1
             use 4 when survey data on a FASTRAND file
 5    @USE  8,NAME1
             use 5 to assign program unit number to magnetic tape or FASTRAND file on input
 6    @MSC  PLEASE MOUNT TAPE NO. jjj WITH WRITE RING
 7    @ASG,T  NAME2,T,jjj
             use 6 and 7 to mount and assign magnetic tape for output
 8    @ASG,A  NAME2,F2///500
             use 8 when output is to be put on a FASTRAND file already cateloged
 9    @ERS  NAME2
             use 9 to clear output FASTRAND file
10    @USE  9,NAME2
             use 10 to assign program unit number to magnetic tape or FASTRAND file on output
11    @XQT  MAKER.ATOT
             execute program with relocateable stored as element ATOT of file MAKER
12    $INPUT    (data)     $END
             required NAMELIST input file (see Table 2)
13    $TEST1    (data)     $END ⎫
      $TEST2    (data)     $END ⎪
      $TEST3    (data)     $END ⎬     NAMELIST input data, for test case only
      $TEST1    (data)     $END ⎪
      $TEST2    (data)     $END ⎪
      $TEST3    (data)     $END ⎭
14    @FIN
             end card
15    @@
```

Footnotes:

(1) When input data is on a FASTRAND file the last word on the record must be a word of all 1 bits. This word is assumed to be included in the word count (II).

(2) The use of FASTRAND files for input as described here are based on the published NTRAN operating manuals. In fact, as of March 1975 the Systems, Science and Software machine does not operate as published. In this machine a FASTRAND file can only be read if the number of words to be read is specified prior to running. This requires a change in DRIVE (lines 214+3 and 3000+1) for MAKER to operate successfully.

Table 7. Processed Room Survey Data Tape

(Page 1 of 1)

Output from MAKER

Input to SEEKER

This data is arranged on a room by room basis with two records for each room.

Record 1 - Constant Length Record

- 10 integer words
- Each word is set equal to NBUF, the number of word in record 2, unless
  - a) The room was terminated prematurely due to a "fatal" error in the MAKER input data. In this case, the 10th word is set to zero (integer).
  - b) The user may set the tenth word to -1 by using Program READER.
  - c) This is the end of the tape. In this case, all 10 words have been set to 999999 (integer).

Record 2 - Variable Length Record

- NBUF words long
- Real numbers
- Words 1 to 132 are the room parameters
- Words 133 to NBUF are arranged in 52 and 11 word groups. Each group describes one piece of furniture or one free-standing item.

APPENDIX B.5

OUTPUT RECORD FORMAT FOR DATA FILE 2

The data in each word of the following items is right justified and in a binary format. Each digit of a field occupies one word. For multiple digit items, the most significant digit is first.

Each file on the tape represents a single building. The first record contains the building characteristics (25 words). The next record contains the firm information (8* number of firms in building). The remaining records of the file contain the data for each room in the building (30 words) with one record devoted to each single room. After all the room records have been recorded in a file, only a single "EOF" mark is put on the tape.

After the last building has been recorded on tape, an extra "EOF" mark is recorded.

The blocking factor for the tape is one. The following was the format used to record each of the three records described above:

Building Characteristics: (Record 1)

Item No.	Length (Words)	Description
1	3	Surveyor code (001-999)
2	3	Building number (001-200)
3	2	State code (01-51)
4	5	Zip code (00001-99999)
5	4	Year building built (1700-1974)
6	2	No. of stories above ground level (00-99)
7	1	Vertical load resisting system 1 = Column 2 = Bearing wall
8	1	Building material 1 = Concrete 2 = Steel 3 = Masonry 4 = Wood
9	1	Occupancy type 1 = Federal government 2 = State government 3 = Local goverment 4 = Private 5 = Private and Government
10	3	Number of firms in building (001-999)

APPENDIX B.6

PART A - User's Manual and Operating Instructions

Table 1. Input Data for Data Retrieval Program, SEEKER
(Page 1 of 5)

CARD 1

CASES, OUTFLG, NROOMS, INFLAG, PLTFLG   Card Format: [5I4]

Col. 1-4 CASES = Number of cases being run. A maximum of 20 cases are allowed in one run.

When OPT(K) is equal to either 2 or 4 no unit need be assigned for these cases. The unit no. is determined by: case no. + 6 = unit no. Where the case number is the order of deck or input cards after a card 1.

Col. 5-8 OUTFLG = Option flag for data to be saved.

1 - save data in binary using NTRAN on a mass storage or tape file.
0 - save data in coded form using a format statement on a mass storage file or tape.

Col. 9-12 NROOMS = The total number of rooms (sum of all cases) to be selected when OPT(K) = 5 for all cases. Causes early program termination to save computer costs. Not required, even if OPT(K) = 5 for all cases.

Col. 13-16 INFLAG = 1 - mass storage input
2 - tape input

Input uses unit no. 3

Col. 17-20 PLTFLG = 0 - no data written for plots
≠ 0 - data written on unit no. 4 for each plot to be created.

Repeat Cards 2 through 6D for each case being run.

CARD 2

ITEM(K), OPT(K), NOR(K), ITEM2(K), KON(K)   Card Format: [5I4]

Col. 1-4 ITEM(K) = Item to be selected [See Table 2]

Col. 5-8 OPT(K) = Option flag

1 - Save the selected items on a data file for subsequent use.
2 - Do not save the selected items.
3 - Divide the selected items, ITEM(K), by ITEM2(K), and save the results on a data file.

Table 1. Input Data for Data Retrieval Program, SEEKER
(Page 2 of 5)

4 - Divide the selected items, ITEM(K), by ITEM2(K), but do not save the results.
5 - Select four room parameters. Save the following for all selected items: Building No., Floor No., Room No., Parameter (One), Parameter(One + 1), Parameter (Two), Parameter (Two + 1).

When option 5 is chosen OUTFLG must be 0.

Col. 9-12 NOR(K) = Number of ."OR". condition-sets. Zero is an acceptable value. (When zero is specified, no conditions are specified and all elements are included, thus cards 5-9 must not be included.) A maximum of 10 .OR. condition-sets per case are allowed.

Col. 13-16 ITEM2(K) = OPT(K) = 1 or 2: Not used

OPT(K) = 3 or 4: Item by which the selected item, ITEM(K), is to be divided. ITEM2(K) can be a room parameter when ITEM(K) is a furniture or stand-alone item. But ITEM2(K) cannot be a furniture or stand-alone item when ITEM(K) is a room parameter.

OPT(K) = 5: The second room parameter to be selected for each appropriate room.

Col. 17-20 KON(K) = Multiplier Flag
1 - Multiply the selected items by a constant given on card 4.
0 - Do not multiply the selected item by a constant.

CARD 3

TITLE(K) Card Format: [13A6]

Col. 1-78 TITLE = Alphanumeric title. Limited to one line (first 78 characters of the card).

CARD 4

MULTIP(K) Card Format: [E12.5]

Col. 1-12 MULTIP(K) = The multiplier with which each selected item

Table 1. Input Data for Data Retrieval Program, SEEKER
(Page 3 of 5)

will be multiplied before any calculations are performed.

NOTE: This card not included unless KON(K) = 1.

CARD 5

IAND(K,J) Card Format: [I4]

Col. 1-4 IAND(K,J) = Number of ".AND." conditions in ".OR." condition-set J. A maximum of 10 and a minimum of 1 are allowed.

NOTE: This card not included unless NOR(K) > 0

CARD 6A

CON(K,J,1), LIM1(K,J,1), LIM2(K,J,1), through CON(K,J,3), LIM1(K,J,3), LIM2(K,J,3) Card Format: [4X,3(I4,2F8.2)]

(where third index = ".AND." condition number)

CON(K,J,I)= Item to be tested [See Table 2].

LIM1(K,J,I) = Lower limit for item to be tested. Unless CON(K,J,I) is greater-than or equal-to LIM1(K,J,I), the corresponding ITEM(K) shall be rejected. F - format number.

LIM2(K,J,I) = Upper limit for item to be tested. Unless CON(K,J,I) is less-than or equal-to LIM2(K,J,I), the corresponding ITEM(K) shall be rejected. If LIM2(K,J,I) = 0, the test is set-up to be an equality. In this case, ITEM(K) shall be rejected unless CON(K,J,I) is within 1 percent of LIM1(K,J,I). F - format number

Col. 5-8	CON(K,J,1)	
Col. 9-16	LIM1(K,J,1)	
Col. 17-24	LIM2(K,J,1)	
Col. 25-28	CON(K,J,2)	Not included unless IAND(K,J)≥2
Col. 29-36	LIM1(K,J,2)	
Col. 37-44	LIM2(K,J,2)	

Table 1. Input Data for Data Retrieval Program, SEEKER
(Page 4 of 5)

Col. 45-48	CON(K,J,3)	not included unless IAND(K,J)≥3
Col. 49-56	LIM1(K,J,3)	
Col. 57-64	LIM2(K,J,3)	

NOTE: This card is not included unless NOR(K) > 0

CARD 6B

CON(K,J,4), LIM1(K,J,4), LIM2(K,J,4) through CON(K,J,6), LIM1(K,J,6), LIM2(K,J,6) Card Format: [3(I4,2F8.2)]

Col. 1-4	CON(K,J,4)	
Col. 5-12	LIM1(K,J,4)	
Col. 13-20	LIM2(K,J,4)	
Col. 21-24	CON(K,J,5)	not included unless IAND(K,J)≥5
Col. 25-32	LIM1(K,J,5)	
Col. 33-40	LIM2(K,J,5)	
Col. 41-44	CON(K,J,6)	not included unless IAND(K,J)≥6
Col. 45-52	LIM1(K,J,6)	
Col. 53-60	LIM2(K,J,6)	

NOTE: This card is not included unless IAND(K,J,)>3, and NOR(K)>0

CARD 6C

CON(K,J,7), LIM1(K,J,7), LIM2(K,J,7) through CON(K,J,9), LIM1(K,J,9), LIM2(K,J,9) Card Format: [3(I4,2F8.2)]

Col. 1-4	CON(K,J,7)	
Col. 5-12	LIM1(K,J,7)	
Col. 13-20	LIM2(K,J,7)	
Col. 21-24	CON(K,J,8)	not included unless IAND(K,J)≥8
Col. 25-32	LIM1(K,J,8)	
Col. 33-40	LIM2(K,J,8)	

Table 1. Input Data for Data Retrieval Program, SEEKER
(Page 5 of 5)

Col. 41-44	CON(K,J,9)	not included unless IAND(K,J)≥9
Col. 45-52	LIM1(K,J,9)	
Col. 53-60	LIM2(K,J,9)	

NOTE: This card is not included unless IAND(K,J)>6 and NOR(K)>0

CARD 6D

CON(K,J,10), LIM1(K,J,10), LIM2(K,J,10) Card Format: [I4,2F8.2]

Col. 1-4	CON(K,J,10)
Col. 5-12	LIM1(K,J,10)
Col. 13-20	LIM2(K,J,10)

NOTE: This card is not included unless IAND(K,J) = 10 and NOR(K)>0

A separate set of cards (5 - 6A, B, C, D) must be used for each ".OR." condition-set.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 1 of 17)

Code No.* (Program SEEKER)	Sequence No.# (Program MAKER)	Description	F-Format	Codes and Units
1	1	Number of words of data	6.0	Number, total number of data items stored herein for subject room.
2	2	Building number	4.0	To be assigned each structure surveyed (1 to 101).
3	3	Floor number	3.0	Determined as actual height in number of floors (13th is included) above ground level.
4	4	Room number	5.0	To be assigned to each room in a particular structure.
5	5	Firm number	3.0	To be assigned to each firm in a particular structure.
6	6	Firm type	3.0	Standard industrial classification two digit code.
7	7	Firm age	3.0	Length of time the firm has been at this location.
8	8	Building surveyor code	4.0	To be assigned to each surveyor working on project.
9	9	Room surveyor code	4.0	To be assigned to each surveyor working on project.
10	10	State number	3.0	Number (1.0 to 51.0)
11	11	Building zip code	5.0	———

*Code No. = parameter identifier to he used when specifying either the items to be selected or the parameters to be tested.

#Sequence No. relates these parameter identifiers to Tables 1, 2, and 3 of Section 4.2 where the MAKER output is defined.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 2 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
12	12	Date of construction	4.0	Year constructed.
13	13	Building age at time of survey	1.0	1975 minus construction date (age at time of survey) in years.
14	14	Building height	3.0	In number of stories above ground level.
15	15	Vertical load resisting system	2.0	For building: column = 1.0, bearing wall = 2.0.
16	16	Building material	2.0	Concrete = 1.0, steel = 2.0, masonry = 3.0, wood = 4.0.
17	17	Building occupancy type	2.0	Federal Government = 1.0, State Government = 2.0, Local Government = 3.0, Private = 4.0, Private and Government = 5.0.
18	18	Number of firms in building	5.0	Number.
19	19	Room use	2.0	General = 1.0, clerical = 2.0, lobby = 3.0, conference = 4.0, file = 5.0, storage = 6.0, library = 7.0.
20	20	Number of occupants	4.0	Normal occupancy, in number of people
21	21	Wall area (no cutouts for doors or windows)	7.2	ft^2, Height * 2 * (Length + Width)
22	22	Door area	7.2	ft^2
23	23	Window area	7.2	ft^2

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 3 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
24	24	Floor area	7.2	ft^2, identical to ceiling area.
25	25	Room volume	9.2	ft^3
26	26	Ceiling material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, acoustical tile = 4.0, non-combustible = 5.0.
27	27	Ceiling trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
28	28	Door material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0.
29	29	Door trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
30	30	Floor material	2.0	Wood = 1.0, non-combustible = 5.0, resilient floor = 6.0, carpet = 7.0.
31	31	Floor trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
32	32	Window trim material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, rubber = 8.0.
33	33	Wall 1, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
34	34	Wall 1, number of windows	2.0	Number.
35	35	Wall 1, number of doors	2.0	Number.
36	36	Wall 1, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER

(Page 4 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
37	37	Wall 1, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
38	38	Wall 1, height	5.2	ft, zero for open area.
39	39	Wall 1, length	5.2	ft, zero for open area.
40	40	Wall 2, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
41	41	Wall 2, number of windows	2.0	Number.
42	42	Wall 2, number of doors	2.0	Number.
43	43	Wall 2, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.
44	44	Wall 2, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
45	45	Wall 2, height	5.2	ft, zero for open areas.
46	46	Wall 2, length	5.2	ft, zero for open areas.
47	47	Wall 3, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
48	48	Wall 3, number of windows	2.0	Number.
49	49	Wall 3, number of doors	2.0	Number.
50	50	Wall 3, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 5 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
51	51	Wall 3, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
52	52	Wall 3, height	5.2	ft, zero for open area.
53	53	Wall 3, length	5.2	ft, zero for open area.
54	54	Wall 4, type	2.0	Full = 1.0, open = 2.0, partial = 3.0.
55	55	Wall 4, number of windows	2.0	Number.
56	56	Wall 4, number of doors	2.0	Number.
57	57	Wall 4, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, non-combustible = 4.0, plaster = 5.0, gypsum board = 6.0.
58	58	Wall 4, covering	3.0	Paper = 7.0, drapes = 8.0, vinyl = 9.0, paint = 10.0, zero for partial height walls or open areas.
59	59	Wall 4, height	5.2	ft, zero for open areas.
60	60	Wall 4, length	5.2	ft, zero for open areas.
61	61	Internal partition 1, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
62	62	Internal partition 1, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
63	63	Internal partition 1, length	5.2	ft

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER (Page 6 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
64	64	Internal partition 1, height	5.2	ft
65	65	Internal partition 2, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
66	66	Internal partition 2, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
67	67	Internal partition 2, length	5.2	ft
68	68	Internal partition 2, height	5.2	ft
69	69	Internal partition 3, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
70	70	Internal partition 3, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
71	71	Internal partition 3, length	5.2	ft
72	72	Internal partition 3, height	5.2	ft
73	73	Internal partition 4, material	2.0	Wood = 1.0, metal = 2.0, plastic = 3.0, fabric = 4.0.
74	74	Internal partition 4, proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.
75	75	Internal partition 4, length	5.2	ft
76	76	Internal partition 4, height	5.2	ft

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 7 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description***	F-Format	Codes and Units
77	77	Live weight*	8.2	lb, does not include occupants, does include weight of internal partitions.
78	78	sd** live weight	8.2	lb
79	79	Live weight per unit area	6.2	psf, does not include occupants, does include weight of internal partitions.
80	80	sd live weight per unit area	6.2	psf
81	81	Total movable fire weight-derated	8.2	lb } does not include weight of internal partitions.
82	82	sd total movable fire weight-derated	8.2	lb
83	83	Total movable fire weight per unit area-derated	6.2	psf } does not include weight of internal partitions.
84	84	sd total movable fire weight per unit area-derated	6.2	psf
85	85	Total paper and book fire weight - underated	7.2	lb (equals live weight).
86	86	Occupied floor area	7.2	ft^2, does not include internal partitions.
87	87	Occupied floor area - percentage	6.2	% of total floor area.

*The live weight of the movable room contents is the total live weight in the room.

**sd = standard deviation of the predicted weight based on uncertainties in the transfer function.

***All fire weights are equivalent pounds of cellulose (8000 BTU/lb); the composite fire weights totals include only the derated portion of the enclosed fire weight in metal furniture.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 8 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units	
88	88	Interior finish fire weight	7.2	lb	Does not include internal partitions.
89	89	Interior finish fire weight per unit area	6.2	psf	
90	90	Total number of all items in room	3.0	Number, desks + tables + cabinets + shelves + chairs + misc. + free-standing piles of paper, books, equipment.	
91	91	Total weight estimated by surveyor	7.2	lb	
92	92	Fire weight enclosed in metal containers-derated	6.2	% of total derated fire weight.	
93	93	sd fire weight enclosed in metal containers - derated	6.2	% of total derated fire weight.	
94	94	% of furniture and miscellaneous items within 2 ft of the walls	6.2	% of total number of pieces of furniture and miscellaneous items.	
95	95	% of freestanding items within 2 ft of the walls	6.2	% of total number of freestanding items	
96	96	Movable fire weight enclosed within 2 ft of the walls- derated	6.2	% of total derated fire weight.	
97	97	sd movable fire weight enclosed within 2 ft of the walls-derated	5.2	% of total derated fire weight.	
98	98	Movable fire weight within 2 ft of the walls- derated - does not include internal partitions.	6.2	% of total derated fire weight.	

***All fire weights are equivalent pounds of cellulose (8000 BTU/lb); the composite fire weight totals include only the derated portion of the enclosed fire weight in metal furniture.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER (Page 9 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
99	99	sd movable fire weight within 2 ft of the walls-derated	5.2	% of total derated fire weight.
100	100	Total fire weight enclosed-derated	6.2	% of total derated fire weight.
101	101	sd total fire weight enclosed-derated	5.2	% of total derated fire weight.
102	102	Total fire weight that is paper-derated, not including books	6.2	% of total derated fire weight.
103	103	sd total fire weight that is paper-derated, not including books	5.2	% of total derated fire weight.
104	104	Total fire weight that is books-derated	6.2	% of total derated fire weight.
105	105	sd total fire weight that is books-derated	5.2	% of total derated fire weight.
106	106	Total fire weight enclosed in plastic	6.2	% of total derated fire weight.
107	107	sd total fire weight enclosed in plastic	5.2	% of total derated fire weight.
108	108	Total fire weight in room-derated	8.2	lb
109	109	sd total fire weight in room-derated	8.2	lb

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 10 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
110	110	Fire weight per unit area-derated	6.2	psf
111	111	sd fire weight per unit area-derated	6.2	psf
112	112	Total fire load - percentage, derated.	6.2	% of total live weight.
113	113	sd total fire load - percentage, derated.	6.2	% of total live weight.
114	114	Number of desks	3.0	Number.
115	115	Number of tables	3.0	Number.
116	116	Number of cabinets	3.0	Number.
117	117	Number of shelves	3.0	Number.
118	118	Number of chairs	4.0	Number.
119	119	Number of miscellaneous items	3.0	Number.
120	120	Number of free standing piles of paper.	3.0	Number.
121	121	Number of free standing piles of books.	3.0	Number.
122	122	Number of free standing equipment	3.0	Number.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 11 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
123	123	% of total live weight within 2 ft of the walls	6.2	% of total room live weight including internal partitions.
124	124	sd % of total live weight within 2 ft of the walls	5.2	%
125	125	Floor loading for heaviest item in room	6.2	psf
126	126	% of wall area that is either window or door	6.2	%
127	127	Flag for specifying how room was selected	2.0	0.0 - randomly selected 1.0 - non-randomly selected 2.0 - selected on room use basis 3.0 - selected on room area basis 4.0 - selected for horizontal correlation 5.0 - selected for vertical correlation 6.0 - selected for tail sample
128	128	Room opening factor ($A\sqrt{H}/A_T$). Set to -1.0 if room does not have 4 full height walls.	6.2 6.4	Number (A = total window area; H = average window height; A_T = total surface area of room, including ceiling, floor, walls, doors windows).
129	129	Internal room partition live weight	8.2	lb
130	130	sd internal room partition live weight	8.2	lb
131	131	Total room fire weight-underated	8.2	lb
132	132	sd total room fire weight-underated	8.2	lb

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER (Page 12 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
133	1 *	Index number	2.0	Desk = 2.0, table = 3.0, cabinet = 4.0, shelf = 5.0, chair = 6.0, miscellaneous = 7.0.
134	2	Type	2.0	Desk: single pedestal = 1.0, double pedestal = 2.0, with legs = 3.0.
				Table: single pedestal = 1.0, with legs = 2.0.
				Cabinet: filing = 1.0, file safe = 2.0, blueprint = 3.0, card file = 4.0, general purpose = 5.0.
				Seating: pedestal = 1.0, legs = 2.0, upholstered = 3.0, sofa = 4.0, bench = 5.0, drafting stool = 6.0, classroom chair = 7.0.
				Shelving: bookcase = 1.0, free shelving = 2.0.
				Miscellaneous: -0.0-
135	3	Material/number of chairs	2.0	Desk: wood = 1.0, metal = 2.0, plastic = 3.0.
				Table: material of top, same as desk
				Cabinet: same as desk

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* Furniture descriptors begin here.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 13 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units	
135 (CONT'D)				Shelf:	same as desk.
				Chair:	number of chairs of same type.
				Miscellaneous:	combustible = 1.0, non-combustible = 0.0.
				Other:	-0.0-
136	4	Proximity to wall	2.0	Within 2 ft = 1.0, more than 2 ft = 2.0.	
137	5	Total live weight (including contents)	8.2	lb	
138	6	sd* total live weight	8.2	lb, zero for miscellaneous items.	
139	7	Total fire weight (including contents)**	8.2	lb	no derating factor applied here
140	8	sd total fire weight	8.2	lb	
141	9	Projected floor area	8.2	ft^2	
142	10	Total floor loading	8.2	psf	
143	11	sd total floor loading	8.2	psf	
144	12	Material	2.0	Chair frame Table top	wood = 1.0, metal = 2.0, plastic = 3.0, zero for all others.
145	13	Material	2.0	Chair seat Table legs	
146	14	Material	2.0	Chair back	

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*sd means standard deviation.

**All fire weights are in equivalent pounds of cellulose (8000 BTU/lb).

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 14 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
147	15	Surface area of books and papers	8.2	ft^2
148	16	sd surface area of books and papers	8.2	ft^2, zero for all
149	17	Enclosed paper live weight	8.2	lb } zero for shelves and seating.
150	18	sd enclosed paper live weight	8.2	lb
151	19	Enclosed paper fire weight (not derated)	8.2	lb } zero for shelves and seating.
152	20	sd enclosed paper fire weight	8.2	lb
153	21	Enclosed books live weight	8.2	lb
154	22	sd enclosed books live weight	8.2	lb
155	23	Enclosed books fire weight (not derated)	8.2	lb
156	24	sd enclosed books fire weight	8.2	lb
157	25	Free paper live weight	8.2	lb
158	26	sd free paper live weight	8.2	lb
159	27	Free paper fire weight	8.2	lb
160	28	sd free paper fire weight	8.2	lb
161	29	Free books live weight	8.2	lb
162	30	sd free books live weight	8.2	lb

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 15 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units	
163	31	Free books fire weight	8.2	lb	
164	32	sd free books fire weight	8.2	lb	
165	33	Enclosed office equipment* live weight	8.2	lb	zero for shelves and seating.
166	34	sd enclosed office equipment live weight	8.2	lb	
167	35	Enclosed office equipment fire weight (not derated)	8.2	lb	zero for shelves and seating.
168	36	sd enclosed office equipment fire weight	8.2	lb	
169	37	Free office equipment live weight	8.2	lb	
170	38	sd free office equipment live weight	8.2	lb	
171	39	Free office equipment fire weight	8.2	lb	
172	40	sd free office equipment fire weight	8.2	lb	
173	41	% compaction of free books	5.2	%, weighted average of all free book piles.	
174	42	% compaction of free paper	5.2	%, weighted average of all free paper piles.	
175	43	% compaction of enclosed books	5.2	%, weighted average of all free book piles.	zero for shelves and seating.
176	44	% compaction of enclosed paper	5.2	%, weighted average of all free paper piles	

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*Equipment means typewriters, calculators, and telephones.

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER
(Page 16 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
177	45	Total enclosed fire weight	8.2	lb
178	46	sd total enclosed fire weight	8.2	lb
179	47	Total free fire weight	8.2	lb
180	48	sd total free fire weight	8.2	lb
181	49	Flag for specifying how empty weight was computed	2.0	0.0 - standard transfer function, 1.0 - transfer function wherein the weight was estimated without available data for the subject material, type, or size group 2.0 - weight set to zero because (a) size too small; (b) indices incorrect, (c) made of plastic
182	50	Total fire weight (derated)	8.2	lb
183	51	sd total fire weight (derated)	8.2	lb

Table 2. Code Numbers to be Used When Specifying Items to be Selected and Tested by the Data-Retrieval Program, SEEKER

(Page 17 of 17)

Code No. (Program SEEKER)	Sequence No. (Program MAKER)	Description	F-Format	Codes and Units
184	1#	Index number	2.0	9.0
185	2	Type	2.0	Paper pile = 1.0, book pile = 2.0, typewriter = 3.0, calculator = 4.0, telephone = 5.0.
186	3	Proximity to wall	2.0	Within 2 ft = 1.0, outside 2 ft = 2.0.
187	4	Number of telephones	2.0	Number of telephones of this type, zero for all other.
188	5	Live weight	6.2	lb
189	6	sd* live weight	6.2	lb
190	7	Fire weight	6.2	lb**
191	8	sd fire weight	6.2	lb
192	9	Projected floor area	8.2	ft^2
193	10	Total floor loading	8.2	psf
194	11	sd total floor loading	8.2	psf

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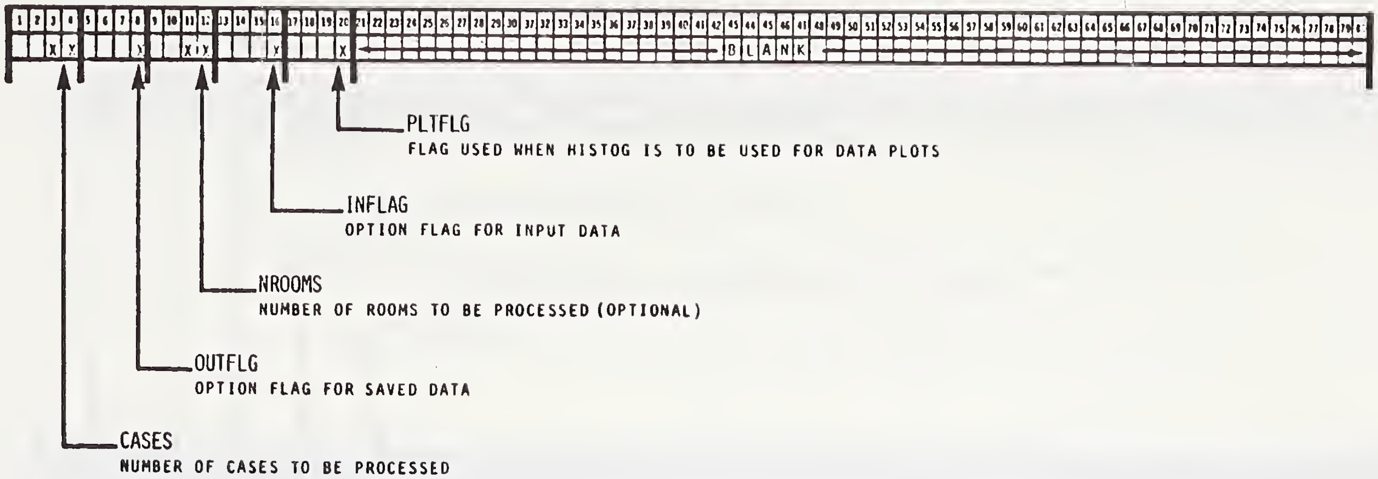
* sd = standard deviation.

** All fire weights are equivalent pounds of cellulose (8000 BTU/lb).

\# Stand-alone equipment and pile descriptors begin here.

Table 3. Input Card Configurations
(Page 1 of 6)

1.

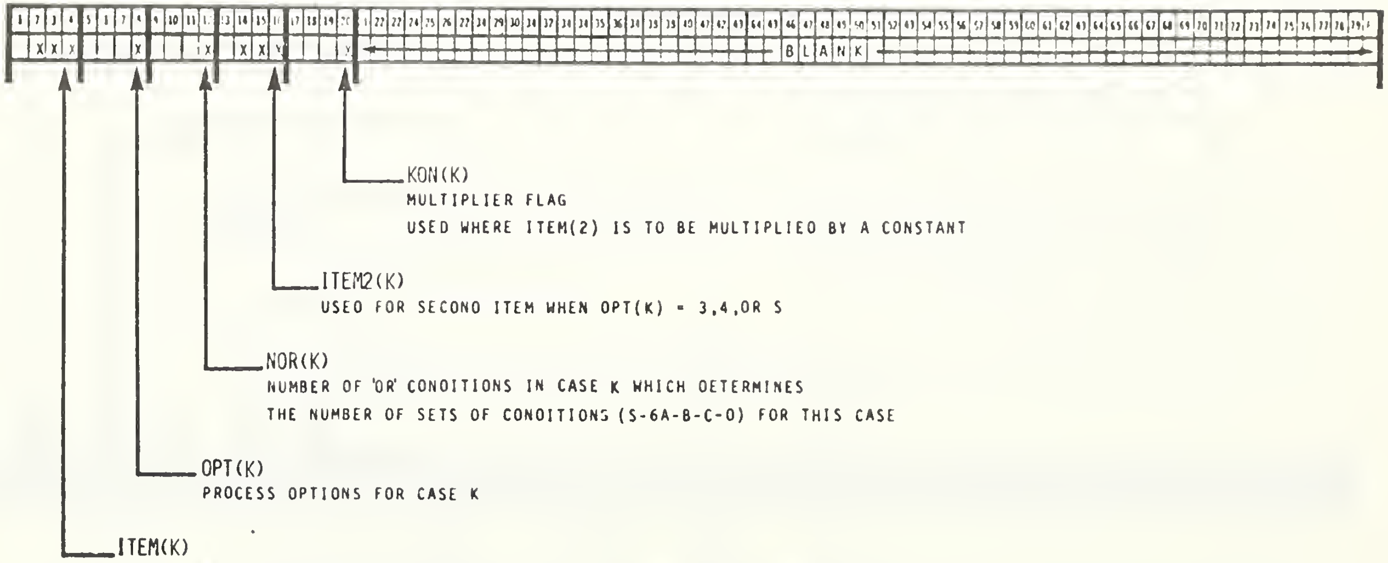


NOTE; This card is obligatory, and must be the first card in the input deck.

Table 3. Input Card Configurations
(Page 2 of 6)

THE FOLLOWING CARDS ARE REPEATED FOR EACH CASE:

2.



KON(K)
MULTIPLIER FLAG
USED WHERE ITEM(2) IS TO BE MULTIPLIED BY A CONSTANT

ITEM2(K)
USED FOR SECOND ITEM WHEN OPT(K) = 3,4,OR S

NOR(K)
NUMBER OF 'OR' CONDITIONS IN CASE K WHICH DETERMINES
THE NUMBER OF SETS OF CONDITIONS (S-6A-B-C-D) FOR THIS CASE

OPT(K)
PROCESS OPTIONS FOR CASE K

ITEM(K)
ITEM TO BE SELECTED IN CASE K

NOTE: This card is needed for each case and must be the first card of each case.

Table 3. Input Card Configurations
(Page 3 of 6)

3.

TITLE(K)
THE TITLE OF CASE K

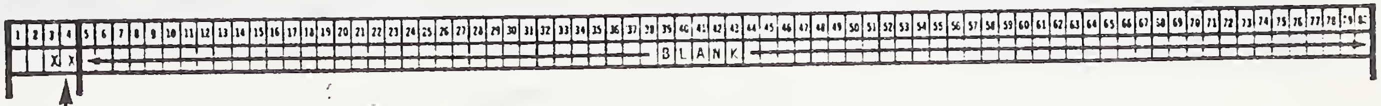
NOTE: This must be the second card for each case.

4.

MULTIP(K)
THE MULTIPLIER PRESENT WHEN KON(K) = 1 OTHERWISE THIS CARD IS EXCLUDED FROM THE DECK

NOTE: If KON(K) = 0 on card 2, this card is not included in the deck.

5.

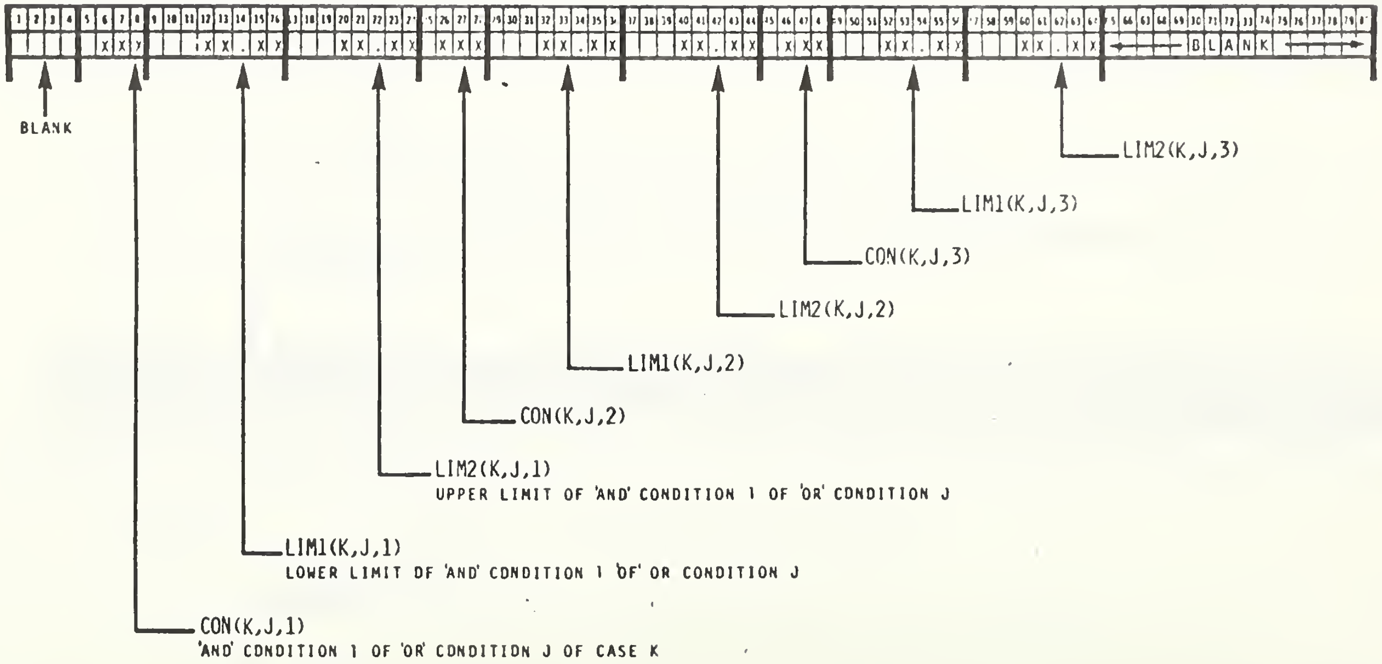


IAND(K,J)
THE NUMBER OF 'AND' CONDITIONS IN 'OR' CONDITION J OF CASE K

NOTE: If NOR(K) = 0 on card 5, this card is not included in the deck.

Table 3. Input Card Configurations
(Page 4 of 6)

6A.

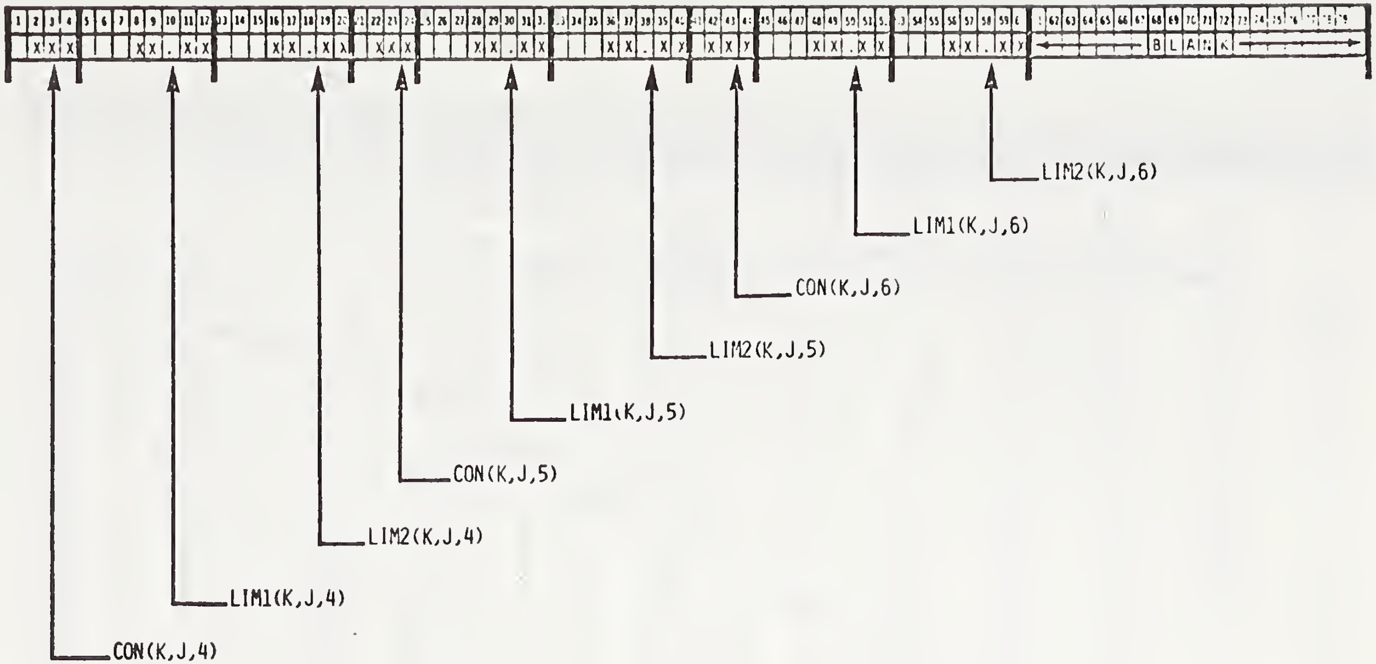


NOTES: 1. If NOR(K) = 0, this card is not included in the deck.

2. As many .AND. condition limits are present as denoted on card 5.

Table 3. Input Card Configurations
(Page 5 of 6)

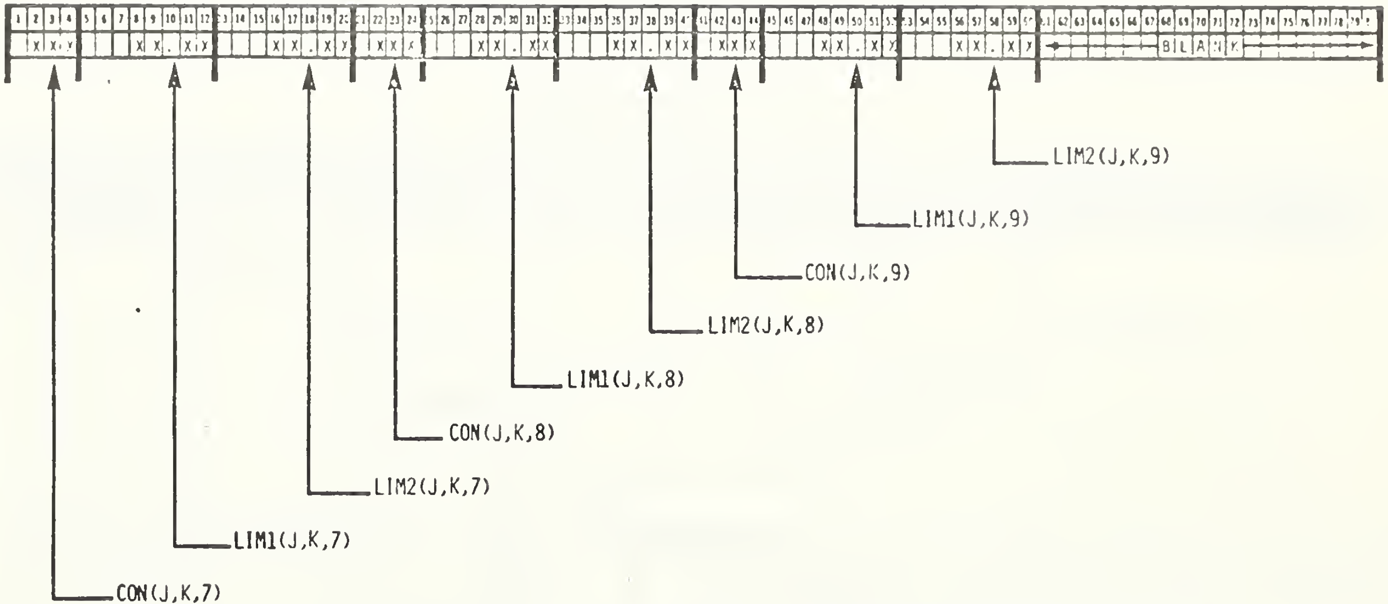
6B.



NOTES: 1. If IAND(K,J) < 4, this card is not included in the deck.
2. If NOR(K) = 0, this card is not included in the deck.

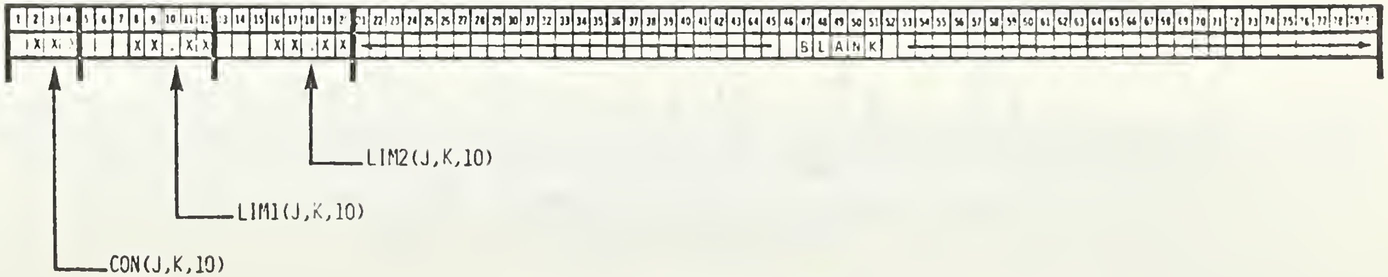
Table 3. Input Card Configurations
(Page 6 of 6)

6C.



NOTES: 1. If IAND(K,J) < 7, this card is not included in the deck.
2. If NOR(K) = 0, this card is not included in the deck.

6D.



NOTES: 1. If IAND(J,K) < 10, this card is not included in the deck.
2. If NOR(K) = 0, this card is not included in the deck.

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 1 of 7)

CASES = The number of cases to be processed during the subject run. A maximum of 20 are allowed.

CON(K,J,I)
CON(20,10,10) = Code numbers identifying the items for which conditions are being imposed (for all .OR. condition-sets of all cases). Specified by user.

1 to 132 - Designates a room parameter (either a bounding-surface or room-composite value as defined in Table 2).

133 to 183 - Designates a room-content parameter (specifically a furniture parameter as defined in Table 2).

184 to 194 - Designates a room-content parameter (specifically a non-furniture, stand-alone, item parameter as defined in Table 2).

DUM = One percent of the lower limit. DUM is subtracted from the lower limit and added to the upper limit to set up the limits that are tested when upper limit has been specified by user as zero.

ERR = A flag which is set to .TRUE. when a fatal error is discovered in the run-dependent input data. Causes program termination.

ERR2 = A flag which is set to .TRUE. when an error is discovered in CON(K,J,I) which causes CON(K,J,I) to be inconsistent. Causes an error message to be printed.

ERR3 = A flag which is set to .TRUE. when an error is discovered in CON(K,J,I) which causes CON(K,J,I) to be inconsistent. Causes an error message to be printed.

FLAG(K)
FLAG(20) = Flags, set by the program, which indicate the type of parameter being selected for each case.

1 = A bounding-surface or room-composite parameter. Items 1 to 132 in Table 2.

2 = A furniture parameter. Items 133 to 183 in Table 2.

3 = A stand-alone item not specifically identified as furniture. Items 184 to 194 in Table 2.

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 2 of 7)

FLAGC(K,J,I) = Flags, set by the program, which indicate the type of condition being tested.

1 = A bounding-surface or room-composite parameter. Items 1 to 132 in Table 2.

2 = A furniture parameter. Items 133 to 183 in Table 2.

3 = A stand-alone item not specifically identified as furniture. Items 184 to 194 in Table 2.

I = An index which refers to the .AND. condition being processed.

IAND(K,J)
IAND(20,10) = The number of .AND. conditions in .OR. condition-set J of case K. Specified by the user.

IBUF(10) = The array used to store the data indicating the length of the room data input record.

IDUM = Variable used at various points in the program for intermediate calculations or storage.

IE = The NTRAN status word used in the last NTRAN write on an output file written in NTRAN.

II = The number of elements read into Y by NTRAN.

INFLAG = The flag that determines the type of device the input data is stored on.

1 = Input data written on mass storage unit.

2 = Input data written on tape unit.

IO = The NTRAN output status word checked after the use of the NTRAN routine for the writing out of a data buffer.

IRECND(10) = The end-of-record vector for the identification of the end of a mass storage file for NTRAN reads.

ISUM = Σ XCOUNT(K)

ITEM(K)
ITEM(20) = The code number identifying the item specified to be selected. Specified by the user.

1 to 132 - Designates a room parameter (either a bounding-surface or room-composite value as defined in Table 2).

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 3 of 7)

133 to 183 - Designates a room-content parameter (specifically a furniture parameter as defined in Table 2).

184 to 194 - Designates a room-content parameter (specifically a non-furniture, stand-alone, item parameter as defined in Table 2).

ITEM2(K)
ITEM2(20) = If OPT(K) = 1 or 2, not used. If OPT(K) = 3 or 4, gives the code number identifying the item by which ITEM(K) is to be divided. ITEM2(K) can be either a room parameter, a furniture parameter or a stand-alone item. However, if ITEM(K) is a furniture parameter, ITEM2(K) cannot be a stand-alone item; if ITEM(K) is a stand-alone item, ITEM2(K) cannot be a furniture parameter; and if ITEM(K) is a room parameter, ITEM2(K) can only be a room parameter.

1 to 132 - Designates a room parameter (either a bounding-surface or room-composite value as defined in Table 2).

133 to 183 - Designates a room-content parameter (specifically a furniture parameter as defined in Table 2).

184 to 194 - Designates a room-content parameter (specifically a non-furniture, stand-alone, item parameter as defined in Table 2).

If OPT(K) = 5, specifies the second item to be selected for each room along with the items next to ITEM(K) and ITEM2(K).

ITEST = Variable used at various points in the program for intermediate calculations or storage.

I1 = NTRAN status word used in reading first input record.

I2 = Variable used at various points in the program for intermediate calculations or storage.

J = An index which refers to the .OR. condition-set being processed.

J2 = Variable used at various points in the program for intermediate calculations or storage.

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 4 of 7)

K = An index which refers to the case being processed.

KI = Do loop counter in the implied do loop used in reading and writing of the TITLE case name.

KON(K)
KON(20) = Flags, specified by the user, which indicate whether or not a multiplier, MULTIP(K), is to be used for case K.

K2 = Variable used at various points in the program for intermediate calculations or storage.

LIM1(K,J,I)
LIM1(20,10,10) = The lower limit to be used to test .AND. condition I of .OR. condition-set J of case K. If LIM2(K,J,I) is zero the lower limit is changed to .99 LIM1(K,J,I). Specified by the user.

LIM2(K,J,I)
LIM2(20,10,10) = The upper limit to be used to test .AND. condition I of .OR. condition-set J of case K. If LIM2(K,J,I) is zero or not given, the upper limit is taken to be 1.01 LIM1(K,J,I). Specified by the user.

LMTFG2(K)
LMTFG2(10) = Set to 1 when ITEM2(K) is a room parameter and ITEM(K) is furniture or a stand-alone item.

LOCC = The location, in the Y-vector, of the item being tested by the program.

LOCI = The location, in the Y-vector, of the item being selected by the program.

LOCI2 = The location, in the Y-vector, of the ITEM2(K) value to be used in processing the selected item, ITEM(K).

L1 = The second parameter written when OPT(K) = 5, equal to LOCI + 1.

L2 = The fourth parameter written when OPT(K) = 5, equal to LOCI2 + 1.

MULTIP(K)
MULTIP(20) = The value, specified by the user, by which the selected item, ITEM(K), is to be multiplied prior to any processing.

N = A temporary name for N1(K)

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 5 of 7)

NBUF = A counter used to keep track of the location in the Y-vector that is being searched.

NDUM = Variable used at various points in the program for intermediate calculations or storage.

NI = The number of room parameters (see Table 7). Defined by the program using a DATA statement.

NJ = The number of room-content, furniture parameters (see Table 7). Defined by the program using a DATA statement.

NK = The number of room-content, stand-alone, non-furniture parameters (see Table 7). Defined by the program using a DATA statement.

NL = NI + NJ

NM = NI + NJ + NK

NN = A temporary name for N1(K).

NOR(K)
NOR(20) = The number of .OR. condition-sets being used in the selection process for case K. Specified by the user.

NROOMS = The total number of rooms for which data is to be selected. Used only if OPT(K) = 5 for <u>all</u> cases. Used to terminate run early and save computer costs.

NTF = A counter used in the search through the room contents part of the input data.

NUNIT = A unit number to identify the output file.

N1(K)
N1(20) = Counters which keep track of the number of items stored in XBUF(300,20). When N1(K) exceeds 300, XBUF (300,K) is written onto a file.

OPT(K)
OPT(20) = The option, specified by the user, for each case.

1 = The program searches the processed room-survey data and extracts the desired items for subsequent analyses. It counts, sums, and determines maximums, minimums, averages, sums-of-squares, and variances for each case.

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 6 of 7)

2 = Identical to option 1 except that the data is not saved on a file for subsequent analyses.

3 = Identical to option 1 except that the designated item is divided by a second designated item before it is processed.

4 = Identical to option 3 except that designated items are not saved on a file for subsequent analyses.

5 = The program searches the processed room-survey data. For those rooms meeting the specified requirements, it saves on a file the following data: Building No., Floor No., Room No., Parameter One. Parameter One + 1, Parameter Two, Parameter Two + 1. Thus if Parameter One is 77 (live weight), Parameter One + 1 will be 78 (standard deviation of live weight); if Parameter Two is 81, Parameter Two + 1 will be 82.

OUTFLG = A flag, specified by the user, which determines whether the saved output will be binary (using NTRAN) or coded using format 139.

PLTFLG = A flag, specified by the user, when a set of output data is to be written on the file assigned to unit no. 4, to set up the data needed for HISTOG.

REEL = The sequential reel no. for the processed room-survey data which is being read from magnetic tape.

TERMAN = A flag, set by program, used to cause early program termination when OPT(K) = 5 for all cases.

TITLE(K,KI)
TITLE(20,13) = The alphanumeric title of each case being analyzed. Up to one line (78 characters) is allowed for each title. Specified by the user.

TITLEF(K)
TITLEF(20) = A flag, set by program, which causes the case title to be placed at the beginning of the saved output when OPT(K) = 5.

TTITLE(13) = The temporary buffer used to write the title of a case using an NTRAN write.

TYP(K)
TYP(20) = A parameter, set by the program, which identifies the <u>type</u> of conditions being input for the subject case.

1 = The conditions being specified are room parameters (bounding-surface or room-composite).

Table 4. Mnemonics for Data Retrieval Program, SEEKER
(Page 7 of 7)

2 = The conditions being specified are room-content parameters (both furniture and non-furniture).

X(KI)
X(300) = A temporary storage location used when transferring data from XBUF to the output file.

XAVE = The average value of the data collected for one case.

XBUF(NN,K)
XBUF(300,20) = Storage buffers for the selected items. Column K is used for case K items. When a column is completely filled or at the end of the run, the data is written onto mass storage files.

XCOUNT(K)
XCOUNT(20) = A counter which gives the number of items that have been selected for each case K.

XMAX(K)
XMAX(20) = The maximum value that has been selected for each case K.

XMIN(K)
XMIN(20) = The minimum value that has been selected for each case K.

XSUM(K)
XSUM(20) = The sum of all items that have been selected for each case K.

XVAR = The variance of the average value of the data collected for one case.

X2SUM(K)
X2SUM(20) = The sum of the square of all items that have been selected for each case K.

Y(15000) = The storage buffer into which the room survey data is placed prior to its being searched by the program.

YTEMP = Temporary counter for the data collected for output.

Table 5. Diagnostic Messages
(Page 1 of 2)

MESSAGE	EXPLANATION
A. Data Errors	
1 - Case XX has an .OR. condition-set with 0 .AND. conditions.	IAND(K,J) was read as zero.
2 - Case XX, .OR. condition XX .AND. condition XX is outside the acceptable range.	$CON(K,J,I) > NM$ or $CON(K,J,I) \leq 0$.
3 - Case XX, selected item, ITEM(K), is beyond the acceptable range.	$ITEM(K) > NM$ or $ITEM(K) \leq 0$.
4 - Case XX, selected item, ITEM2(K), is beyond the acceptable range.	$ITEM2(K) > NM$ or $ITEM2(K) < 0$.
5 - Case XX, .OR. condition XX, the .AND. conditions are not consistent.	The .AND. conditions do not all apply to the same piece of furniture as required. Only applicable when $FLAG(K) \neq 1$ and $TYP(K)=2$.
6 - Case XX, the ITEM2 item is not consistent with the ITEM item.	The requirement that ITEM2(K) be the same type of parameter as ITEM(K) was not met (See Table 1).
7 - Case XX, the option specified is not acceptable.	$OPT(K) > 5$ or $OPT(K) < 1$.
8 - More than 20 cases were input. Only the first 20 will be processed.	CASES was read to be > 20.
9 - Case XX has too many .OR. conditions.	$NOR(K) > 10$.
10 - Case XX, .OR. condition XX .AND. condition XX LIM2 .LE. LIM1.	$LIM2(K,J,I) \leq LIM1(1,J,I)$ and $LIM2(K,J,I) \neq 0$
11 - Error found in set-up deck which caused the termination of processing.	A fatal error was found in data deck. Additional message should explain problem.
B. Transmission Problems*	
1 - The end-of-reel record has been encountered but for some reason it does not have the expected 10 words. Status word XX. Proceed with caution.	The NTRAN read has returned with the block-status-word $(II) > -1$ but < 10. Program proceeds as if end-of-reel occurred.
2 - NTRAN read has an impossible status word - stop execution. Status word XX.	The NTRAN read has returned with the block-status-word < -4. Cause unknown.

---

*For any NTRAN related problems, see the UNIVAC 1100 Series Fortran V Library, Section 4-18.

Table 5. Diagnostic Messages
(Page 2 of 2)

MESSAGE	EXPLANATION
3 - NTRAN read - device error or aborted transmission. Status word XX - stop execution.	Self-explanatory.
4 - Abnormal transmission while trying to empty a partially filled output buffer. Status word XX unit XX.	Program terminated run and was trying to put the partially filled storage buffers onto the mass storage files using NTRAN when an abnormal transmission occurred.
5 - Abnormal transmission while trying to empty a full buffer. Status word XX unit XX.	During program execution the program was trying to put a filled storage buffer onto a mass storage file using NTRAN when an abnormal transmission occurred.
6 - In the attempt to read the first record a status word of XX was received. The room before was Bld XX Fl XX Rm XX.	When reading the first record in the two-record set, the block-status-word returned was < 10.
7 - In the attempt to write an end-of-record word on unit XX the NTRAN status word XX was received.	Self-explanatory.
C. Miscellaneous Diagnostic Messages	
1 - Error someplace - this comment should never be printed. Status word XX unit XX.	Some type of problem has occurred. Source deck may be in error. If Unit = 8 see line 1104** area of program Unit = 7 to 26 see line 1410 or line 2610 Unit = -2 see line 2410 area Unit = -3 see line 2520 area
2 - Reel XX of the input data has been completed in a normal mode.	The program has completed reel XX of the room-survey data tape normally and has proceeded to the next reel.
3 - The room just read from the data tape has over 15000 parameters. Program dimensions exceeded. Stop. Building XX Floor XX Room XX.	Self-explanatory.

**Line numbers refer to program statement numbers. See program listing.

Table 6. Run Cards for UNIVAC, EXEC 8, 1975
(Page 1 of 2)

```
NO.

 1     @RUN (etc.)
              use to start run

 2     @MSG PLEASE MOUNT TAPE NO. iii WITHOUT WRITE RING

 3     @ASG,T  INPUT,T,iii
              use 2 and 3 to mount and assign tape file when input data
              is on tape.

 4     @ASG,A  INPUT,F2///500
              use 4 to assign mass storage when input data is on a FASTRAND
              file

 5     @USE  3,INPUT
              use 5 to indicate that unit 3 is the input file, INPUT

 6     @ASG,A  0TPT01,F2///500
       @ASG,A  0TPT02,F2///500
         .  .    .      .
         .  .    .      .
         .  .    .      .
         .  .    .      .
       @ASG,A  0TPT20,F2///500
              use 6 to assign the output files for up to 20 cases.  Use
              only for those cases which have OPT(K) = 1,3, or 5.

 7     @USE  7,0TPT01
       @USE  8,0TPT02
         .    .    .
         .    .    .
         .    .    .
       @USE  26,0TPT20
              use 7 to assign units 7 to 26 as output files for cases 1
              to 20

 8     @ASG,A  PLTOUT,F2///500

 9     @USE  4,PLTOUT
              use 8 and 9 to assign an output file (unit number 4) when
              a histogram plot is to be made

10     @XQT  SEEKER.ATOT
              execute program with relocatable stored as element ATOT of
              file SEEKER
```

Table 6. Run Cards for UNIVAC 1108, EXEC 8, 1975
(Page 2 of 2)

<u>NO.</u>

11 INPUT CARD 1

the first card which tells how many cases are to be processed.

12 INPUT CARDS 2 → 6D as needed for each case.

the input data to set up the cases of data to be selected.

13
```
@DATA,L  ØTPT01  ⎫
@END             ⎪
  .   .    .     ⎪
  .   .    .     ⎪      Two cards for each case.  Up to
  .   .    .     ⎬      20 cases may be run at one time.
  .   .    .     ⎪
  .   .    .     ⎪
  .   .    .     ⎪
@DATA,L  ØTPT20  ⎭
@END
```

optional cards if data saved on a file. These will print the contents of each file.

14 @XQT HISTOG.ATOT

execute HISTOG program with relocatable stored as element ATOT of file HISTOG if plots are to be made.

15
```
                          optional
                ┌──────────────────────────────────┐
$CASES NCASE=XX, INUNIT=XX; NFINE=XX  NPUNCH=X, FRT=X $END
```

NAMELIST card options used in program HISTOG.

16 @FIN

end card

17 @@

Table 7. Processed Room Survey Data Tape
(Page 1 of 1)

Output from MAKER

Input to SEEKER

This data is arranged on a room by room basis with two records for each room.

Record 1 - constant length

- 10 integer words
- Each word is set equal to NBUF, the number of words in record 2, unless
  - a) the room was terminated prematurely due to a "fatal" error in the MAKER input data. In this case, the 10th word is set to zero (integer).
  - b) this is the end of the tape. In this case, all 10 words have been set to 999999 (integer).
  - c) the room data was considered undesirable for some reason and READER was used to make the 10th word equal to -1 (integer).

Record 2 - variable length

- NBUF words long
- Real numbers
- Words 1 to 132 are the room parameters.
  - a) words 1 to 76 = room descriptors (1 to 76 of selection code)
  - b) words 77 to 132 = room totals (77 to 132 of selection code)
- Words 133 to NBUF are arranged 51 and 11 word groups. Each group describes one piece of furniture or one free-standing item.
  - a) 51 word group = furniture descriptors (133 to 183 of selection code)
  - b) 11 word group = free-standing objects (184 to 194 of selection code)

Table 8. Mnemonics for Program HISTOG
(Page 1 of 3)

Subroutine HSTART

AVERAG

CASES = Namelist input to program which gives the value of NCASES, NUNIT, NFINE, and FRT.

F(20) = The frequency in each group.

FRT = The flag which indicates whether or not fractiles are desired.

I = Do loop counter.

INUNIT = The number of the input unit on which the data for all cases are written (only one unit).

J = Do loop counter.

N = Used in the call to HISTA to have GROUPA called to group the input data.

NC = Do loop counter equal to the case number.

NCASES = The number of cases to be plotted.

NFINE = The multiple of the number of groups to make the histogram plot have more resolution.

NG = The input number of groups in the case.

NGROUP = The computed number of groups in the case.

NPUNCH = The flag used when a punched deck is desired from all cases in the run.

NUMBER = The number of data points in a case.

NUNIT = The unit number for a particular case's data.

S10 = The step size increment.

S05 = Half the step size increment.

SIGMA = The standard deviation of the data in the case.

Table 8. Mnemonics for Program HISTOG
(Page 2 of 3)

STEP = The computed step size of the histogram.

TITLE(13) = The title of the case.

X(10000) = The buffer used to store the data being used for the histogram.

XMAX = The maximum value of the data for this case.

XMIN = The minimum value of the data for this case.

XSTEP = The temporary counter used to determine the step size.

XM = A dummy name for XMIN.

XMN = A dummy name for XMAX.

XX = A dummy name for XMAX.

Table 8. Mnemonics for Program HISTOG
(Page 3 of 3)

Subroutine FRACT

DUM = Temporary storage position for values of X.

FRT = Flag to determine whether a listing of all data in descending order is desired.

I = Do loop counter.

J = Do loop counter.

J1 = Do loop delineator.

N01 = Location of lowest 1% fractile.

N05 = Location of lowest 5% fractile.

N95 = Location of upper 95% fractile.

N99 = Location of upper 99% fractile.

NUMBER = Number of data points being considered.

X(10000) = The array of input data.

Table 9. Input Data for HISTOG
(Page 1 of 3)

The input data for HISTOG consists of one or two NAMELIST cards and n+1 mass storage files (where n = the number of cases).

The NAMELIST card CASES is described below. All the data is optional, except NCASES, and can be in any order. All variables defined on this card must be integers.

```
$CASES  NCASES = "XX", (INUNIT="XX"), (NFINE="XX"), (NPUNCH="X"), (FRT="X")$END
```

NCASES = "XX" (Obligatory)	The number of cases in this run. Each case is a separate set of data for a particular item, equivalent to a case in SEEKER.
INUNIT = "XX" (Optional)	The unit number for the location of the set-up data that was created by SEEKER when PLTFCG was set ≠ 0. (The default value is 4).
NFINE = "XX" (Optional)	The multiple by which the number of groups will be multiplied to produce a second, finer histogram. (The default value is 1; if 1 is used only one histogram will be printed for each case.) If NFINE is set to -1 the program reads the number of groups from NAMELIST card STEPS.
NPUNCH = "X" (Optional)	The flag to cause the deck to be punched.
= 0	The default value where no cards are punched.
= 1	No histograms will be created, but the data file will be punched in a 6E12.5 format with the first card as the title.
= 2	Both a punched deck and the histograms will be created.
FRT = "X" (Optional)	The flag to determine whether the upper 99% and 95% fractiles and the lower 5% and 1% fractiles will be listed along with the median value.
= 0	The default value; no fractiles or median will be calculated.

Table 9. Input Data for HISTOG
(Page 2 of 3)

FRT	= 1	Fractiles and median will be calculated.
	= 2	Fractiles and median will be calculated along with the listing in descending order of all the data points.

NAMELIST card STEPS. Only to be used if NFINE is set to -1 on NAMELIST card CASES.

```
$STEPS     STEPX = "XX.X" $END
```

STEPX = "XX.X"	The number of groups. Overrides the number of groups calculated by the program.

Sometimes a SEEKER output data-file may have been made without setting PLTFG = 0 and it is later decided that a histogram plot is wanted. Then by setting INUNIT=5 on the CASES NAMELIST card, the set-up data file otherwise created by SEEKER can be input as punching cards for each case. These cards must be inserted into the run stream after the NAMELIST data, CASES. One card is required for each case.

Col. 2-11	NUMBER (integer)	= The number of data points in this case.
Col. 12-13	NG (integer)	= The number of groups if not to be determined by the formula. Number of groups = 3.3. * log(NUMBER) + 1.
Col. 14-15	NUNIT (integer)	= The unit from which the data is to be read.
Col. 16-27	XMIN (E format)	= The minimum value of the data.
Col. 28-39	XMAX (E format)	= The maximum value of the data.
Col. 40-51	AVERAG (E format)	= The average value of the data.
Col. 52-63	SIGMA (E format)	= The standard deviation of the data.

NOTE: If all that is desired is to punch a deck (NPUNCH=1), NUMBER and NUNIT are the only necessary inputs.

Table 9. Input Data for HISTOG
(Page 3 of 3)

The input data is written on a Fortran file. The first line is an alphanumeric title (13A6 format) and the following lines are the data written in a (10E12.5) format. This file is created with the standard output options for SEEKER, (OPT = 1 or 3).

APPENDIX B.7

PART A - User's Manual and Operating Instructions

1. Card Data Input for Data Reduction Program, READER
    - A. $INPUT
2. Mnemonics for Data Reduction Program, READER
    - A. READ
    - B. WRITER
    - C. DATAC2
3. Diagnostic Messages
    - A. READ
    - B. DATAC2
4. Run Cards for UNIVAC 1108, EXEC 8, 1975

PART B - Program Listing

1. READ
2. WRITER
3. DATAC2
4. DUMMY

Table 1. Card Data Input for Data Reduction Program, READER

(Page 1 of 2)

Namelist Format

A. $INPUT

This card is not required.

LAM = 1 - call WRITER to print first 132 words of room data

LAM = 2 - call WRITER to print all room data

LAM = 3 - write on a new tape:

when OPTION = 0, write the exclusion flag on those rooms in RNUM

when OPTION = 1, write all data from input tape

LAM = 4 - print a summary of the room data

LAM = 5 - print a one-line summary of each room with data selected, default value

LAM = 6 - write a new tape with only the first 132 words of room parameters on it

LAM = 7 - call DATAC2 to write a data file for multiple-regression analysis

LAM = 8 - call DUMMY (a subroutine of the user's design)

OPTION = 0 - select only those rooms specified in RNUM, default value

OPTION = 1 - select NQ(j) rooms from NSKIP(j) on the input tape

NC = - the number of rooms times 3 = the number of data points, default = 0

NQ = - the number of input binary records to be read, default values = 90000, 9*0

RNUM = - the building no., floor no., and room no. of those rooms to be printed or to be flagged for exclusion

Table 1. Card Data Input for Data Reduction Program, READER

(Page 2 of 2)

NIN = - the input unit (NIN = 9, a tape), default value = 9

NOUT = - the output unit (NOUT = 10, a tape for NTRAN writing), default value = 11

NSKIP = - the number of rooms to be skipped before data is to be read counting from the beginning of the tape

Table 2. Mnemonics for Data Reduction Program, READER
(Page 1 of 6)

A. Mnemonics for the Main Program, READ

I = The NTRAN status word that is checked after every NTRAN read and write.

II,JI,JJ,JO = Do loop counters.

LAM = Flag which determines the activity of the run.

1 = Call WRITER to print first 132 words of room data.

2 = Call WRITER to print all room data.

3 = Write on a new tape (see OPTION).

4 = Print a summary of the room data.

5 = Print a one-line summary of each room data selected (default value).

6 = Write a new tape with only the first 132 words of room description.

7 = Call DATAC2 (to write a data file for correlation analysis).

8 = Call DUMMY (a subroutine of the user's design).

LWBN(50) = The building number minus 0.1 (see RNUM).

LWFN(50) = The floor number minus 0.1 (see RNUM).

LWRN(50) = The room number minus 0.1 (see RNUM).

M, MM, MMM = Do loop counters.

N(20) = An integer vector used in writing out the one-line summary.

NB(10) = The first record of the room data. Each word equals the length of the second record except for the tenth word which acts as a flag to specify whether the data is good or bad.*

NB (tenth element) = Flag specifying whether data valid or invalid.

-1 = READER has set the flag to ignore the data

0 = MAKER has set the flag to ignore the data

NBD(10) = The first record of the room data which has the tenth word equal to 132. This is used only when the first 132 words are to be written on the output tape

---

*Each room is described by two records on the data tape. The first record defines the size of second record and the validity of the data. The second record contains the data (see Table 7 of Appendix B.4 for more details).

Table 2. Mnemonics for Data Reduction Program, READER
(Page 2 of 6)

NC = The number of rooms specified in RNUM.

NDUM = A variable used to identify the location of the occurrence of an NTRAN call which caused the status word to be in error.

NIN = The input unit (NIN = 9, a tape), default = 9.

NN = The number of non-zero entries in RNUM.

NOUT = The output unit (if NOUT = 10, a tape), default = 11.

NP, NPP = Counters used in writing the one-line summary of room data.

NQ(10), NQQ = The number of rooms to be read and analyzed. Up to 10 blocks of rooms can be specified using NQ and NSKIP.

NRD = The number of words to be read. If only the first 132 words are to be used, only 132 words are read from the second room record.

NSKIP(10) = The number of rooms to be skipped. These rooms are skipped from the beginning of the tape or from the end of the last read. A maximum of 10 skips are allowed (see NQ).

NTOT = The number of words read between NSKIP(JJ)→NSKIP(JJ)+NQ(JJ).

NU = The location in the vector USE of the data for the particular room being printed.

OPTION = Selection flag.

0 = Select only those rooms specified in RNUM, default value

1 = Select NQ(JJ)rooms starting at the location specified by NSKIP(JJ).

RNUM(150) = The building number, floor number, and room number of those rooms to be printed or to be flagged for exclusion. Up to 50 rooms can be specified.

UPBN(50) = The building number plus 0.1 (see RNUM).

Table 2. Mnemonics for Data Reduction Program, READER
(Page 3 of 6)

UPFN(50) = The floor number plus 0.1 (see RNUM).

UPRN(50) = The room number plus 0.1 (see RNUM).

USE(7) = A vector with the alphanumeric abbreviation for the types of rooms:

1 GEN, General
2 CLE, Clerical
3 LOB, Lobby
4 CON, Conference
5 FL, File room
6 STO, Storage room
7 LIB, Library

Y(15000) = The room description vector (can be redimensioned to 132 if only the room totals and boundary surface descriptions are needed).

Y39 = The width of the room computed if an open wall is present. (Otherwise equal to Y(39)).

Y1042 = The total fire weight that is paper and books.

Table 2. Mnemonics for Data Reduction Program, READER
(Page 4 of 6)

B. Mnemonics for Subroutine WRITER

I,L = Do loop counters used in write statements.

NB, NBT = Counters used in determining place in variable-length data record.

NBUF = Total number of words in data record, Y(15000).

NR(3) = Room identifiers

1 Building number
2 Floor number
3 Room number

Table 2. Mnemonics for Data Reduction Program, READER
(Page 5 of 6)

C. Mnemonics for Subroutine DATAC2

I = Do loop counter.

LOOP = Indicator of whether the geographic location is in either NORTHEAST, NORTH CENTRAL, SOUTH, or WEST.

N(7) = Integer values of variables being dichotomized.

N(1) = Y(19)	Room use
N(2) = Y(15)	Building vertical load system
N(3) = Y(16)	Building material
N(4) = Y(17)	Building occupancy type
N(5) = Y(6)/10. + 1.	Firm type S.I.C.* code in tens + one
N(6) = Y(9)	Surveyor number
N(7) = Y(11)	Geographic location - ZIP code

NAM(7) = The abbreviated names of the dichotomized variables.

NAM(1) = RM USE	Room use
NAM(2) = VT SYT	Building vertical load system
NAM(3) = BD MAT	Building material
NAM(4) = BD OCP	Building occupancy type
NAM(5) = FM TYP	Firm type
NAM(6) = SUV NO	Surveyor number
NAM(7) = GEO LC	Geographical location

ND = Location of each dichotomized variable.

X1(30) = Output vector for dichotomized data.

X1(1-6)	Room use
X1(7)	Vertical load system
X1(8-10)	Building material
X1(11-14)	Building occupancy type
X1(15-24)	Firm type
X1(24)	Not Used
X1(25-27)	Geographic area
X1(28-30)	Not Used

---

*Standard Industrial Code

Table 2. Mnemonics for Data Reduction Program, READER
(Page 6 of 6)

X2(30) = Output vector for dichotomized surveyor numbers. Only first 25 locations used.

X3(30) = Output vector for continuous data.

X3(1)	Floor number
X3(2)	Firm age
X3(3)	Building age
X3(4)	Building height
X3(5)	Number of firms in building
X3(6)	Number of occupants in room
X3(7)	Room area
X3(8)	Room volume
X3(9)	Live load PSF
X3(10)	Fire load PSF (derated)
X3(11)	Percent of floor area covered
X3(12)	Total number of items in room
X3(13)	Total weight estimated by surveyor
X3(14)	Weight of heaviest item in rooms
X3(15)	Room opening factor
X3(16)	Fire Load PSF (un-derated)
X3(17-30)	Not used

Z = Value of all dichotomized variables if the maximum value is given (= -1).

Table 3. Diagnostic Messages

A. Subroutine READ

The diagnostic messages included in READ note the occurrence of improper input data, either on card input or on the input data tape. These messages are listed below:

'THERE IS SOMETHING WRONG WITH THE NAMELIST INPUT'

Conditions (LAM > 8 or LAM < 1 or OPTION > 1 or OPTION < 0) or
(NC = 0 and OPTION = 0) or
(RNUM(NN) < .1 and NC ≠ 0)

'I = ', I, 'AT LINE' NOUM

Conditions (NOUM = 10 and I ≠ 10) or (NOUM = 20 and I < 1) or
(NOUM = 30 and I ≠ 05) or (NOUM = 40 and I ≠ NB(5)) or
(NOUM = 50 and I ≠ 10) or (NOUM = 60 and I ≠ 132)

B. Subroutine DATAC2

The diagnostic messages in DATAC2 note occurrence of data that cannot be dichotomized

'A NAM(ND)' WITH A VALUE OF 'NC(ND)' WHICH IS OUT OF RANGE
'BUILDING', Y(2), 'FLOOR', Y(3), 'ROOM' Y(4)

Conditions (N(1) > 7 or N(1) < 1) or
(N(2) > 2 or N(2) < 1) or
(N(3) > 4 or N(3) < 1) or
(N(4) > 7 or N(4) < 1) or
(N(5) > 10 or N(5) < 1) or
(N(7) > 99999 or N(7) < 0)

'ROOM DATA FOR BL' Y(2), 'FL' Y(3), 'RM' Y(4) 'NOT PROCESSED BY DATAC2'

Condition (Y(125) < -.001) or (NB ≤ 0)

Table 4. Run Cards for UNIVAC 1108, EXEC 8, 1975
(Page 1 of 2)

```
NO.
 1      @RUN (etc.)
                use to start run.  The options, priority, and other inform-
                ation are site dependent.

 2      @MSG  PLEASE MOUNT TAPE NO. iii WITHOUT WRITE RING

 3      @ASG,T  INTAPE,T,iii
                use 2 and 3 to mount and assign input tape file.  iii is the
                tape number at that site and INTAPE is the name of the temp-
                orary file assigned to the tape.

 4      @USE  9,INTAPE
                use 4 to indicate that unit number 9 is data file INTAPE.
                Program READER uses Unit 9 as the input data.  (See NIN
                on namelist input card, 9 is the default value of NIN).

 5      @MSG  PLEASE MOUNT TAPE NO. jjj WITH WRITE-RING

 6      @ASG,T  OUTAPE,T,jjj

 7      @USE  10,OUTAPE
                use 5 and 6 to mount and assign a magnetic tape for output.
                Tape number jjj is given the local name OUTAPE.
                Use 7 to indicate that unit number 10 will be output file,
                OUTAPE.  Unit 10 is only used for NTRAN writes on tape (see
                NOUT on namelist input card, 10 is not the default value of
                NOUT).

 8      @ASG,UP  OUT,F2///500

 9      @USE  11,OUT
                use 8 and 9 to assign a new FASTRAND file OUT, for output,
                and to assign unit number 11 to that file.  This file is used
                for both NTRAN and formatted output (see NOUT on namelist
                input card, 11 is the default value of NOUT).

10      @XQT  READER.TOTAL
                execute program with relocatable stored as element TOTAL of
                file READER.

11      $INPUT    (data)    $END
                optional NAMELIST input file that specifies various operational
                parameters.  If not used, program uses default values (see
                Table 1 ).
```

Table 4. Run Cards for UNIVAC 1108, EXEC 8, 1975
(Page 2 of 2)

NO.		
		Repeat 10 and 11 for as many cases as desired.
12	@FIN	end card
13	@@	

APPENDIX B.8

Part A - User's Manual and Operating Instructions

1. Data Sequence and Format for Tape 2 (Floor Plan Data)

2. Card Data Input for BUILDER
    - A. $INPUT1
    - B. $TEST1
    - C. Data for Surveyed Rooms
    - D. $TEST2
    - E. $TEST3
    - F. @EOF

3. Mnemonics for Building Reconstruction Program (BUILDER)

4. Limit and Error Messages

5. Run Cards for UNIVAC 1108, EXEC. 8, 1975

Table 1. Data Sequence and Format for Tape 2 (The Unprocessed Room Plan Data) Input for Building Reconstruction Program (Page 1 of 2)

Building Characteristics (Record 1)

ITEM NO.	LENGTH (Words)	DESCRIPTION
1	3	Surveyor code (001-999)
2	3	Building number (001-200)
3	2	State code (01-51)
4	5	Zip code (0001-99999)
5	4	Year building built (1700-1974)
6	2	No. of stories above ground level (00-99)
7	1	Vertical load resisting system 1 = Column 2 = Bearing wall
8	1	Building material 1 = Concrete 2 = Steel 3 = Masonry 4 = Wood
9	1	Occupancy type 1 = Federal Government 2 = State Government 3 = Local Government 4 = Private 5 = Private and Government
10	3	Number of firms in building (001-999)

Firm Data (Record 2)

ITEM NO.	LENGTH (Words)	DESCRIPTION
11	3	Firm number (001-999)
12	2	Firm type (00-99)
13	3	Firm age (000-200)

Items 11, 12, 13 are repeated for the number of firms in item 10. Record 2 length = 8*(Item 10). Tape must be odd parity and high density (800 BPI).

Table 1. Data Sequence and Format for Tape 2 (The Unprocessed Room Plan Data) Input for Building Reconstruction Program (Page 2 of 2)

Room Usage and Plans (Record 3 and Subsequent)

ITEM NO.	LENGTH (Words)	DESCRIPTION
14	3	Building number (000-200)
15	2	Floor number (00-99)
16	3	Room number (000-999)
17	3	Firm number (000-999)
18	1	Subtraction flag 0 = Calculated area is to be added 1 = Calculated area is to be subtracted
19	1	Room Usage 1 = General 2 = Clerical 3 = Lobby 4 = Conference 5 = File 6 = Storage 7 = Library 8 = Stairway 9 = Elevator 10 = Corridor 11 = Other 12 = Vacant
20	5	West coordinate from building origin (tenths of feet)
21	5	East coordinate from building origin (tenths of feet)
22	5	North coordinate from building origin(tenths of feet)
23	5	South coordinate from building origin(tenths of feet)
24	1	Spare field

Table 2. Card Data Input for Building Reconstruction Program, BUILDER
(Page 1 of 3)

Namelist Format Except for Item C

A. $INPUT1

This card is always required. The format of this card, or these cards, must follow the standard conventions for Fortran IV Namelist data.

WRT = .TRUE. - write the building and room data (including the load data) on the printer

WRT = .FALSE. - do not write the building and room data on on the printer, default value

CDDTI = .TRUE. - read building and room-plan data from magnetic tape or FASTRAND file

CDDTI = .FALSE. - read building and room-plan data from cards (namelist format), default value

FILEI = .TRUE. - use magnetic tape for building and room-plan data

FILEI = .FALSE. - use FASTRAND file for building and room-plan data, default value

CDDTO = .TRUE. - write the building and room data on magnetic tape or FASTRAND file

CDDTO = .FALSE. - do not write the building and room data on magnetic tape or FASTRAND file, default value

FILEO = .TRUE. - use magnetic tape for output file

FILEO = .FALSE. - use FASTRAND file for output, default value

SURDAT = .TRUE. - use data for surveyed rooms (from cards), default value

SURDAT = .FALSE. - do not use data for surveyed rooms (no cards required)

FILEF1 = .TRUE. - if several buildings are being processed on one run and all the surveyed data is on one file, set this variable to true. If the data is on separate files or only one building is being processed, set the variable to false. False is the default value.

FILEF2 = .FALSE. - see above

Table 2. Card Data Input for Building Reconstruction Program, BUILDER (Page 2 of 3)

NUMBL	- number of building to be processed--Default = 1000, in which case run terminates on reading the second end-of-file.
PUNCH = .TRUE.	- punch the room data (including the load data), default value = .FALSE.

B. <u>$TEST1</u> Need only if CDDTI = .FALSE. (see $INPUT1)

X = building characteristic data

II = number of words of data = 25

C. <u>Data for Surveyed Rooms</u>

Card 1 = Title (78 columns, alphanumeric)

Card 2 = Headings (78 columns, alphanumeric)

Card 3 (and subsequent) = Room data (1H ,3F10.0,4E12.6)

Field	Item
1	Building No.
2	Floor No.
3	Room No.
4	PSF Live Load
5	PSF Live Load - sd
6	PSF Fire Load
7	PSF Fire Load - sd

End card = @EOF

Surveyed data for one or more buildings may be placed on the same file. However, only two alphanumeric cards are required and allowed per file.

If the room-plan data is read from cards (using $TEST1, $TEST2, and $TEST3), each set of surveyed data must be separate as indicated by the required sequence. The sequence of buildings in the surveyed data <u>must</u> match the building sequence in the room-plan data.

D. <u>$TEST2</u> Need only if CDDTI = .FALSE. (see $INPUT1)

X1 = firm data

II = number of words of data

Table 2. Card Data Input for Building Reconstruction Program, BUILDER
(Page 3 of 3)

E. $TEST3 Need only if CDDTI = .FALSE. (see $INPUT), need one file for each room

X = room usage and plans

II = number of words of data = 34

F. @EOF

End of file card required after each building when CDDTI = .FALSE.

Repeat items B through F for each building being processed.

A second end of file card must follow the last building if CDDTI = .FALSE.

Items B through E must follow the standard conventions for Fortran IV NAMELIST data.

Table 3. Mnemonics for Building Reconstruction Program, BUILDER
(Page 1 of 5)

BLDG1 = Total live load in one building - lb

BLDG2 = Total fire load in one building - lb

BLDG3 = Total floor area in one building - sq. ft.

BLDG4 = Total surveyed area in one building - sq. ft.

BLDG5 = Total area of halls, corridors, elevators, stairways, and other

BLDG6 = Total live load determined from surveyed data for subject building - lb

BLDG7 = Total fire load determined from surveyed data for subject building - lb

BLDG(10) = Building characteristic data
1 Surveyor no.
2 Building no. (also BUILDN)
3 State no.
4 ZIP code (also NZIP)
5 Year built
6 Number of stories above ground level
7 Vertical load resisting system (1 to 2)
8 Building material (1 to 4)
9 Occupancy type (1 to 5)
10 Number of firms in building

BUILDN, NBLDG, NX21 = Building no. (also BUILD(2))

CDDTI, FILEI = Flags for specifying whether room-plan data on cards, tape, or FASTRAND file

DATA1(500,3) = Data on surveyed rooms (integer)
1 Floor no.
2 Room no.
3 Blank

Table 3. Mnemonics for Building Reconstruction Program BUILDER
(Page 2 of 5)

DATA2(500,4) = Data on surveyed rooms (real)

1 PSF live load
2 Standard deviation of PSF live load
3 PSF fire load
4 Standard deviation of PSF fire load

DUM1, DUM2 = Temporary storage locations.

ERR = Flag to signal erroneous input data.

FILEI = Flags for specifying whether room-plan data on cards, tape, or FASTRAND file.

FILEF1 = Flag to describe whether more than one building is included in the surveyed-data data file.

FILEF2 = Flag used in reading the surveyed-data data file.

FIRELD = Total fire load on one floor - lb; or fire load in one room - psf

FIRMNO = Firm no.

FIRMT(100) = Flags defining acceptable firm types

FLAREA = Total floor area - sq. ft.

FLFLAG = Flag to signal when building is complete

FRLDSY = Total fire load determined from surveyed data for subject floor

HEAD(13) = Alphanumeric title read from cards with surveyed data

HAAREA = Total area of halls, corridors, elevators, and other on one floor - sq. ft.

I1, I0 = NTRAN status word

I,J,K,M,N2 = Do-loop indices

J,K,M,N2,I = Do-loop indices

Table 3. Mnemonics for Building Reconstruction Program, BUILDER
(Page 3 of 5)

K,I,J,M,N2 = Do-loop indices.

K3 = Amount of firm data to be read or firm type.

LIVELD = Total live load on one floor - lb; or live load in one room - psf

LVLDSY = Total live load determined from surveyed data for subject floor

M,I,J,N2,K = Do-loop indices

MODEL(10,600) = Output (integer).
- 1 Floor no.
- 2 Room no.
- 3 West coordinate
- 4 East coordinate
- 5 North coordinate
- 6 South coordinate
- 7 Flag*
- 8 Firm type (also NFT)
- 9 Firm age
- 10 Room use (also NRU)

MODEL2(5,600) = Output (real).
- 1 PSF live load
- 2 Standard deviation of PSF live load
- 3 PSF fire load
- 4 Standard deviation of PSF fire load
- 5 Room area

N2,I,J,K,M = Do-loop indices

NBLDG, BUILDN, NX21 = Building no. (also BUILD(2))

---

*Flag = 0 add area, not surveyed
= 1 subtract area, not surveyed
= 2 add area, surveyed
= 3 subtract area, surveyed

Table 3. Mnemonics for Building Reconstruction Program, BUILDER
(Page 4 of 5)

NFL, NFLOOR = Floor no.

NFT = Firm type (also MODEL(8, I)).

NOFILE = Number of files (i.e., buildings) processed.

NORECD = Number of records processed in subject building.

NR = Room no.

NRU = Room use (also MODEL(10, I)).

NRS = Number of rooms surveyed in subject building

NUMBL = Number of buildings to be processed,

NWTAPE = Flag to signal when output magnetic tape is full.

NX21, BUILDN,
NBLDG = Building no. (also BUILD(2))

NZIP = Building ZIP code (also BUILD(4)).

PUNCH = Flag for generating punch card output.

RMFIRM(3,1000)= Firm data.

1 Firm no.
2 Firm type
3 Firm age

ROOM(10) = Room data.

1 Building no.
2 Floor no.
3 Room no.
4 Firm no.
5 Substitution flag (0 = add, 1 = subtract)
6 Room use
7 West coordinate
8 East coordinate
9 North coordinate
10 South coordinate

RUSE(12) = Area on floor given to each of the 12 designated uses.

SRAREA = Total surveyed area on floor - sq. ft.

SURDAT = Flag to signal whether data from surveyed rooms is being used.

TEMP1 to
TEMP10 = Temporary storage locations for MODEL(I,600), I = 1 to 10.

Table 3. Mnemonics for Building Reconstruction Program, BUILDER
(Page 5 of 5)

TEMP(15) = Temporary storage locations for MODEL(10,600) and MODEL2(5,600) during output operation.

TEMPT = Temporary storage location.

TITLE(13) = Alphanumeric title read from cards with surveyed data.

USEB(12) = Area in building given to each of the 12 designated uses.

WRT = Flag for writing output on printer.

X(30) = Temporary storage locations.

X1(10000) = Temporary storage locations for firm data.

X2(7) = Temporary storage location for survey data.

XB(7) = Live load constant

XBI(7) = Standard deviation of live load constant

XC(7) = Live load area coefficient

XCI(7) = Standard deviation of live load area coefficient

XD(7) = Fire load constant

XDI(7) = Standard deviation of fire load constant

XE(7) = Fire load area coefficient

XEI(7) = Standard deviation of fire load area coefficient

Table 4. Limit and Error Messages*
(Page 1 of 3)

Format No.

100 'BUILDING NUMBER IS TOO LARGE,' BUILDN
cond. If BUILD(2) > 101

101 'IMPOSSIBLE STATE NUMBER; BUILDING' BUILDN
cond. If BUILD(3) > 51 or < 1

102 'IMPROBABLE CONSTRUCTION DATE; BUILDING' BUILDN
cond. If BUILD(5) > 1975 or < 1800

103 'IMPROBABLE HEIGHT; BUILDING' BUILDN
cond. If BUILD(6) > 100

104 'IMPOSSIBLE VERTICAL LOAD RESISTING SYS; BUILDING' BUILDN
cond. If BUILD(7) > 2 or < 1

105 'IMPOSSIBLE BUILDING MATERIAL; BUILDING' BUILDN
cond. If BUILD(8) > 4

106 'IMPOSSIBLE OCCUPANCY CODE; BUILDING' BUILDN
cond. If BUILD(9) > 5 or < 1

107 'THE NUMBER OF FIRMS IS OUTSIDE ACCEPTABLE RANGE; BUILDING' BUILDN
cond. If BUILD(10) > 1000 or < 1

108 'FIRM J BUILDING BUILD(2) HAS AN IMPOSSIBLE TYPE NO.'
cond. If FIRM(K3) not in Standard Industrial Classification

109 'BUILDING NO. AND BUILDING NO. WITH ROOM NOT CONSISTENT BUILDING ROOM(1) FLOOR (ROOM(2) ROOM 'ROOM(3)'
cond. If ROOM(1) ≠ BUILD(2)

110 'THIS FLOOR NUMBER IS TOO LARGE, FLOOR NO.' X(2)
cond. If DATA1(NRS,2) > BUILD(6)

113 'CARD DATA FOR DIFFERENT BUILDING, PROGRAM STOPPED'
cond. If Building No. on Room Surveyed Data ≠ BUILD(2)

115 'FLOOR NO. GREATER THAN NO. OF STORIES, FLOOR NO =' ROOM(2)
cond. If ROOM(2) > BUILD(6)

116 'SUBSTITUTION FLAG INVALID, FLAG =' ROOM(5)
cond. If ROOM(5) ≠ 0 or 1

---

*Underlining indicates a program mnemonic. These are all defined in Table 3.

Table 4. Limit and Error Messages
(Page 2 of 3)

	Format No.	
	117	'ROOM USE CODE INVALID. USE=' ROOM(6)
cond.		If ROOM(6) > 11 or < 1
	118	'FLOOR CANNOT BE PROCESSED BECAUSE ERR = TRUE. STOP'
cond.		Self explanatory
	121	'ERROR TERMINATION WHEN WRITING BLDG CHAR DATA WITH NTRAN INDEX =' IO
cond.		If IO < -1
	123	'ERROR TERMINATION WHEN WRITING ROOM DATA WITH NTRAN INDEX =' IO FLOOR = MODEL(1,NRM) ROOM = MODEL(2,NRM)
cond.		If IO < -1
	135	'THIS MESSAGE SHOULD NEVER BE PRINTED. LINE NO=' IDUM
cond.		Indicates program error at Fortran Line indicated.
	136	'SURVEY DATA IS FOR A NON-OFFICE, FLOOR' MODEL(1,I) ROOM MODEL(2,I)
cond.		Room use for surveyed room =8, 9, 10, or 11
	188	'TOO MANY SURVEYED ROOMS.'
cond.		If NRS > 500
	189	'END-OF-FILE FOUND WHEN READING INPUT1.'
cond.		Self explanatory
	190	'FIRM NO. IS RMFIRM(1,J) FOR J TH FIRM BUILDING BUILD(2)'
cond.		If RMFIRM(1,J) > 1000
	191	'FIRM TYPE IS RMFIRM(2,J) FOR J TH FIRM BUILDING BUILD(2)'
cond.		If RMFIRM(2,J) > 100
	192	'FIRM AGE IS RMFIRM(3,J) FOR J TH FIRM BUILDING BUILD(2)'
cond.		If RMFIRM(3,J) > 200
	193	'DEVICE ERROR, TRANSMISSION ABORT, OR END-OF-FILE FOUND WHILE TRYING TO READ FIRM DATA.'
cond.		If II < -1
	194	'DEVICE ERROR OR TRANSMISSION ABORT ON READING FIRST ROOM'
cond.		If II < -2
	195	'DEVICE ERROR OR TRANSMISSION ABORT ON READING SUBSEQUENT ROOMS.'II =' II ROOM NO.', NRM
cond.		If II < -2
	197	'END OF FILE FOUND AT 400. NO. BUILDINGS PROCESSED ='
cond.		If II = -2

Table 4. Limit and Error Messages
(Page 3 of 3)

	Format No.	
	198	'FLOOR MODEL(1,I) ROOM MODEL(2,I) FLMOD FOUND ROOM USE OUT OF RANGE, ALL ROOM USE VARIABLES SET TO ZERO.'
cond.		If NFT < 1 or NFT > 99
	199	'FLOOR MODEL(1,I) ROOM MODEL(2,I) FLMOD FOUND FIRM TYPE OUT OF RANGE, ALL FIRM TYPE VARIABLES SET TO ZERO.'
cond.		If NRU < 1 or NRU > 7

Table 5. Run Cards for UNIVAC 1108, EXEC 8, 1975
(Page 1 of 2)

```
NO.

 1      @RUN  (etc.)
                use to start run

 2      @MSG  PLEASE MOUNT TAPE NO. iii WITHOUT WRITE RING

 3      @ASG,T  NAME1,T,iii
                use 2 and 3 to mount and assign tape file when room-plan
                data on magnetic tape

 4      @ASG,A  NAME1
                use 4 when room-plan data on a FASTRAND file

 5      @USE  8,NAME1
                use 5 to assign program unit number to magnetic tape or
                FASTRAND file on input

 6      @MSG    PLEASE MOUNT TAPE NO. jjj WITH WRITE RING

 7      @ASG,T  NAME2,T,jjj
                use 6 and 7 to mount and assign magnetic tape for output

 8      @ASG,A  NAME2,F2///500
                use 8 when output is to be put on a FASTRAND file already
                catalogued.

 9      @ERS    NAME2
                use 9 to clear output FASTRAND file

10      @USE  9,NAME2
                use 10 to assign program unit number 9 to magnetic tape or
                FASTRAND file on output

11      @XQT    BUILDER.TOT
                execute program with relocateable stored as element TOT
                of file BUILDER

12      $INPUT1 (data) $END
                required NAMELIST input file (see Table 2)

13      $TEST1  (data) $END     NAMELIST input data, for test case only
```

Table 5. Run Cards for UNIVAC 1108, EXEC 8, 1975
(Page 2 of 2)

```
14      Data for surveyed rooms

15      @EOF
                end of file for surveyed-room data

16      $TEST2  (data) $END )
        $TEST3  (data) $END  }   NAMELIST input data, for test case only
           :       :      :  |
           :       :      :  |
        $TEST3  (data) $END )

17      @EOF
                end of file after each building, test case only

18      @EOF
                second end of file after last building, test case only

19      @FIN
                end card

20      @@
```

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Data collection and data processing procedures utilized in connection with a nationwide fire load and live load survey program are described. The techniques developed for transferring the field survey data to a form suitable for computer processing are discussed. Procedures adopted for data analysis are included. Documentation of the computer programs developed for this purpose is also presented.

17. KEY WORDS *(six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)*

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