# NATIONAL BUREAU OF STANDARDS REPORT

9673

## SURVEY OF FIRE LOADS IN MODERN OFFICE BUILDINGS

Preliminary Report on First Phase

by

J. O. Bryson and D. Gross

Report to
Building Research Advisory Board
National Academy of Sciences


U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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The procedures and techniques developed for measuring and evaluating the movable contents fire loads in modern office buildings are summarized. The results are presented from a pilot study in which a total of 127,058 sq.ft. of floor area was surveyed in two Government-owned office buildings in the Washington, D. C. area.

## 1. Introduction

A survey of loads in modern office buildings was initiated in February 1967 as the first step in a broad program developed at the National Bureau of Standards to scientifically study existing loads on structures. The first phase of the program is concerned with measurement of actual live floor loads and fire loads. The central objective of the first part of this program is to develop survey techniques and procedures for easier and less expensive means of surveying loads on buildings, and to develop evaluative measures, in line with present day technology of scientific methods, for determining the nature of the loads in relation to the characteristics of the load items and in relation to the geometry of the structure.

This preliminary report is submitted to the Building Research Advisory Board (BRAB) of the National Academy of Sciences in accordance with contract No. BRAB-67-1 dated June 15, 1967, by which funds were made available to support the fire loads part of the study. The fire loads information is intended to update and to extend the surveys of combustible contents of buildings made approximately 30 years ago (1,2), and to determine whether sizable changes have occurred over the years along with the significant changes in the type of building construction and the nature of the occupancy load. The field studies that were carried out in the past were of necessity

limited in scope; consequently, a relatively small sample size of data was obtained from which to draw conclusions about the vast population of buildings. The main purpose of this current work is to develop, for the first time, a sufficiently large bank of comprehensive data that can be used to predict, with measured accuracy, the fire loads for various building types in this country.

The report summarizes the procedures and techniques developed to date for the weighing and classification of items according to combustible content. Also included are the preliminary findings on the movable contents fire load portion of the survey conducted on two Government-owned office buildings in the Washington, D. C. area. It is planned that these results will eventually form part of a large collection of data from surveys of buildings located in the major regions across the country.

Current building code requirements for the fire grading of buildings are based in large measure upon the anticipated severity produced by a fire involving the combustible material in the contents and the construction. Fire severity is a qualitative term expressing the combined effect of elevated temperature and duration. From the results of controlled burnout tests in which the combustible contents were varied from 10 to 55 lb. per sq. ft., and a series of standardized furnace tests of varying duration, Ingberg obtained a relationship between fire severity and furnace test period [3].

The total calorific value of these combustibles is generally considered the "fire load" and is usually expressed in terms of pounds per sq. ft. of floor area, where 1 pound of combustible is equivalent to 8000 Btu.

The magnitude of the fire load is, however, not the sole factor affecting the potential fire severity, since a complete heat balance involves the interrelation between the amount, nature and distribution of the combustibles, the air available for combustion (ventilation), and the thermal, (heat-absorbing) properties of the enclosing walls, floor and ceiling.

In the present stage of development this survey attempts only to provide an accurate measure of the amount of combustible contents within a limited number of modern office buildings and an estimate of their nature and distribution. There are no plans at present to evaluate the structure in terms of its fire-protective features. Also, no attempts are made to measure window sizes, or to evaluate other ventilation factors, or those thermal properties of rooms which govern heat losses. Finally, no suggestions are made here as to possible fire severities which might be produced by fires involving the combustible contents, nor to the direct application of these survey results to the requirements of building codes.

## 2. General Approach

The first phase of the survey was considered to be a pilot study which would provide an opportunity to perfect the techniques and survey procedures and to serve as a training exercise for survey crews. A principal objective was to accumulate data and experience which could lead to easier and less expensive ways of surveying loads in buildings. For example, it may be possible to classify furniture into a number of types and sizes and capacity of contents, either by volume or percent, so that

little or no weighing will be necessary to obtain reasonable, accurate weight estimates in the future.

The survey is presently being limited to modern buildings, i.e., buildings erected within the past 10 years. Since the occupancy load is likely to change appreciably over the years, supplementary fire load data on older buildings will probably also be needed. One consideration in the choice for the initial survey was the availability of the building for resurveys in future years. Accordingly, the NBS Administration Building and other Government buildings in the Washington, D. C. area, represent logical buildings for possible periodic load surveys.

## 3. Survey Techniques and Procedures

### 3.1 General

The techniques and procedures for measuring and recording the data from occupancy loads were developed in accordance with plans established for a broad NBS program designed to evaluate existing live floor loads and fire loads in office buildings. The load data obtained with the techniques used provides singular source type input information for both live load and fire load data analysis. The actual survey work for this preliminary phase of the study represents the first step of a program in which statistical analysis of the data will serve as the foundation for succeeding steps leading to statistical sampling techniques. This means that as the survey proceeds the actual weighing of items can be reduced until the point is reached where complete rooms may be classified and recorded as typical or non-typical of the sampled data. The typical rooms need only be checked by actual measurements (weighings) where required by statistical rules. All non-typical data will be obtained by actual measurements.

With this approach the collection of data can proceed at an increasing rate and should be complemented by decreasing cost for the surveying work.

In the two buildings surveyed, the weight and the approximate horizontal location of all the items in each room were determined and recorded. All data were coded and recorded in a format consistent with an appropriate computer program for automatic data processing. In each case the room was divided into nine sections and defined by three strips in each direction parallel to the wall and perpendicular to each other. The width of the center strip was one-half the distance between the walls that it parallels and the strips to either side were one-quarter of the distance between the walls. These strips then correspond to the mid strips and column strips of a two way flat slab where the boundaries of the room serve as the column line. The overlapping of the strips in the two directions form a checkered pattern of areas which provides a general location scheme. See Figure 1.

## 3.2 Definition of Survey Loads

The live loads in the survey include the occupants, the floor covering, movable partitions, all furniture and equipment and their contents except built-in items. Built-in items are those whose shape and size were designed as an integral part of the structure and were formed during construction of the building. The furniture and equipment brought in for the service of the occupants after the construction of the building (including those which are placed in recesses and/or tied down in the structure) were not considered built-in and their weights were determined (or estimated).

The fire load falls into two general categories --- "movable contents" and "interior finish." For the purpose of this report only the movable contents are considered in the results. These include movable combustible furniture, equipment and goods, and the combustible contents within and on top of items including metal furniture and containers. Also included were floor coverings not securely fastened to the floor. The remainder of the combustible load associated with rooms and buildings consisted of the "interior finish fire load" and comprised walls, ceilings, floors (including permanently installed wall-to-wall carpeting and finished flooring), drapery, wall hangings, partitions, door and window trim and built-in fixtures (e.g. bookcases). Where such items could not be weighed, their weights were estimated from thickness and area. As an aid in estimating, a "combustible trim list" was prepared containing weights for typical sizes of doors, windows, molding and lumber. A "building materials list" was also prepared which provided a rapid means for converting measured or estimated thicknesses of typical interior finish materials into equivalent unit weights of combustible. For common doors, one-half the total weight was assigned to the respective rooms on each side.

All weights were converted to equivalent weights of combustibles having a calorific value of 8000 Btu per lb. Tables of calorific values of materials can be found in standard reference sources. A list of heat release values for building materials under "fire" conditions is also available [4] and is particularly useful for metals and materials of low combustibility.

The movable contents fire load has been further divided into separate totals of "free" movable contents and "adjusted" movable contents. The "free" movable contents fire load represents materials readily available for combustion, and includes combustible furniture and their combustible contents, combustibles on top of steel desks and tables, and those associated with miscellaneous and "free contents" items. It excludes combustibles within enclosed steel furniture, such as shelving, filing cabinets, desks and safes. The "adjusted" movable contents fire load represents the "free" movable contents fire load plus the "effective" contribution of the combustible contents of steel furniture, computed in accordance with the "derating" values in Table 1, based on BMS 92.

Estimates of the volume of combustible contents on top, rather than measured weights, were used to determine the "free" movable contents portion of desks and tables. In converting the volume estimate to weight, a density of 40 lb. per cu. ft. was assumed. A volume estimate was made of the contents of desks, cabinets and bookcases, and note made of the nature of its contents (100% books, 100% paper or mixed). For desks and cabinets, an estimate was also made of the contents volume, expressed as a percent of its capacity. With these measurements and estimates, proper account was given to the "derating" factors for steel furniture, and data were assembled for correlating the combustible weight of contents (paper or books) with the capacity of standard desks and cabinets (by percent) and of bookcases (by volume). For miscellaneous steel furniture, the empty weight was unknown and volume estimates provided a means for estimating the weight of combustible contents.

### 3.3 Data Records and Classification

The survey data included coded input designations for floor level, room number, room use, overall dimensions, number of assigned personnel and sex, item weight, location and description, and a description and measurement of the contents in items. The locations of the items in a room were recorded with respect to the nine (9) sections defined for room area. In addition, surface finish and the weights of trim and floor covering were recorded. A typical log sheet with entries is shown in Fig. 2. Rooms were designated in one of the following use categories: office, laboratory, storage, conference room, lounge, lobby (or reception room), dining room, library, file room, and "other." The length, width and height of the room were recorded to the nearest foot, with an area reduction entry in square feet to allow for recess areas.

Each item was assigned a 4-digit numeric code and was classified into one of six categories: desks (0100 series), tables (0200), cabinets (0300), chairs (0400), bookcases (0500), or miscellaneous (0090). A reference catalog of the basic "standard" items of office furnishings was prepared prior to starting the survey, and was augmented with new items encountered in the survey. The catalog entry included a photograph of the item, the assigned code number, dimensions, composition, empty weight, and other pertinent descriptive information.

### 3.4 Survey Team

A team of four men was used to do the survey work. The team leader defined the items, recorded the data, and took photographs. Two men handled the weighing equipment and did the measuring of dimensions. The fourth man estimated combustible contents.

3.5 Equipment

The weighings were made with the use of electronic load platforms. These devices are rectangular plates that were designed to indicate the load that is applied normal to its surface within a specified area (see Fig. 3). Two load platforms were used in the survey. One platform was 26-in. long by 12-in. wide with a 20-by 14-in. loading area and the other platform was 32-in. long by 14-in. wide with a 26-by 14-in. loading area. Both platforms were approximately 1-in. in height. Two units of item handling equipment were used for lifting room furnishings. Both units were standard equipment purchased from commercial sources. One unit was a desk handler, Fig. 4, and the other was a hydraulic forklift, Fig. 5. Fig. 6 shows views of these units with load platforms positioned on them so that weighings were made in conjunction with the lifting operation. A list of all the equipment and supplies for the survey operation is given below and a view is presented in Fig. 7.

List of Equipment and Supplies for Survey Team

1) Hydraulic fork truck
2) Desk handler
3) 2 - steel plates
4) 2 - load platforms
5) 1 - Budd readout box
6) Assortment of 2"x4" wood bearing strips (18 in., 24 in., 48 in., and 2-72 in. long strips)
7) Hard truck
8) Chain and padlock
9) Large clipboard
10) Survey sheets and envelopes
11) Red, blue, green pens (ball point and felt tip)
12) 12' and 50' tapes
13) Slide rule
14) Camera, film, flash bulbs (Polaroid - color)
15) Floor plans of buildings
16) Tool kit- pliers, screw-driver, solder, etc.

3.6 Survey Procedure

The order of floor levels in the survey was random; however, for the most part rooms on a given floor were surveyed in numerical order according to room number.

Before starting the survey, the survey team was briefed and drilled on the techniques and procedures to be followed. The manner of coding and recording the data was thoroughly explained and discussed. The team leader was given an item code list and an instruction sheet for location code.

Just prior to surveying a room, the team leader recorded the floor level, the room number, room use (e.g., office, storage, etc.) and the number of assigned personnel -- indicating sex. The two assistants were then called into the room with the team leader to take measurements in the room. The weighing equipment was left outside the room while measurements of the room were being made. The dimensions of the room were measured by the two assistants and recorded on the record form by the team leader. The equipment for weighing was then brought in and the items in the room weighed in an order determined by the team leader. It was found that in a few cases an item and it contents could not be weighed together, as in the case of tall or fragile items that were not designed to be moved when full, therefore, in these cases contents were weighed separately from the item. For each item, a separate weight of the noncombustible portion of the contents was determined and recorded by the team leader. For items that could not be weighed either because of size, weight or sensitivity or because they were tied down, the weights were obtained from the manufacturers or were estimated. The types of surface finish and their thickness were

determined by the team leader, who used a material type listing to select the appropriate unit weight range in terms of combustibles.

All items were weighed using the load platform and the item handling unit, desk lifter or hand forklift, which was best suited for the particular case. Figs. 8 and 9 show views of weighing operations during the survey. The exception to this was the weighing of a file cabinet for which a set procedure was established using only a load platform and a wood bearing strip. The following is a detailed description of the procedure in the form of instructions to the survey team which was used throughout the survey.

"In most cases, file cabinets will be found backed against a wall, either standing alone or in groups placed closely together. The procedure that will be used to weight these items is designed to minimize strenuous handling in the weighing operation. Two men will be needed to perform the task. The units will be weighed with the load platform positioned on the floor. First, the cabinet will be slid out from the wall 12 inches or more. Next, place the load platform on the floor directly in front of the cabinet with the long dimensions of both objects in line. Place the short length wood bearing strip (2x4-in.) on its broad side on the load platform positioned within the loading area parallel to the front of the file cabinet. (See Fig. 10 Top). Tilt the file cabinet back so that the front edge of the bottom surface will be raised 5 or 6 inches off the floor. Slide the platform straight forward under the cabinet until the wood bearing strip is located near the center of the bottom surface of the cabinet. Lean the cabinet forward to make contact with the bearing strip on the load platform and rock the cabinet to an upright position. (See Fig. 10 Bottom). If

the cabinet is not balanced on the bearing strip, apply with the hand the necessary force in a horizontal direction to maintain the cabinet in an upright position while the load indicator is being read. The cabinet shall be removed from the load platform and replaced in its original location by reversing the handling operation leading up to weighing."

## 4. Results

To date, load surveys have been conducted in two office buildings. The NBS Administration Building, located at Gaithersburg, Maryland, is an 11-story reinforced concrete 45 by 225 ft. building of rectangular shape completed in 1965. Except for the basement, and utility rooms, it was surveyed completely from February to May 1967. The area surveyed covered 71,058 sq. ft. in 335 rooms. Of this 53,927 sq. ft. or 252 rooms were offices. The U.S. Civil Service Commission Building, FOB (Federal Office Building) No. 9, located at 19th, 20th, D and E Streets, N. W., Washington, D. C., is a 7-story reinforced concrete H-shaped structure completed in 1963. A sampling of 56,000 sq. ft. of space (49,071 sq. ft. office), considered to be representative of its 573,000 sq. ft. total, was surveyed in July 1967. The NBS building was surveyed at an average of 430 sq. ft./hr. The CSC building was surveyed at an average rate of 590 sq. ft/hr. These rates reflect the tedious detailed work in the pilot study needed to develop the survey techniques and procedures and to set a firm foundation for the advanced survey methods.

Based upon experience gained in surveying the NBS Administration Building, significant changes were made in the survey procedure for FOB 9. These included adding estimates of combustible contents on top of desks and tables, and within miscellaneous files, combining items of similar

type and weight, and substituting a volume estimate for a linear measurement of contents. Because of this, and the fact that two buildings may not represent a true statistical sampling of office building types and use conditions, these results are to be considered as preliminary and subject to possible change.

The movable contents fire load portion of the survey has been summarized as shown in Tables 2 and 3, and Figures 11 thru 14.

Table 2 shows the distribution of the mean movable contents fire load by room usage for the two buildings, both in lb. per sq. ft. and expressed as a percent of the total load (combustible and noncombustible). Also shown for FOB 9 are the separate listings of the mean values of "free" and "adjusted" movable contents fire load.

Table 3 lists the percent of combustible contents of rooms within three types of enclosed steel furniture for both buildings.

Figure 11 presents a frequency distribution (histogram) of movable combustible contents in office rooms in the NBS building. The height of each bar represents the number of rooms which contain loads within a 2 psf interval extending from 1 psf below to 1 psf above the plotted value. Thus, the bar plotted at zero (0), covers loads up to 1 psf, the bar at 2 psf, includes loads from 1 up to 3 psf, the bar at 4 psf includes loads from 3 up to 5 psf, etc. The value shown at the top of each bar represents the percentage of the total rooms at that load level. The same frequency distribution for all rooms surveyed in the NBS building is presented in Figure 12. Figures 13 and 14 are the counterpart histograms for FOB 9.

Examples of the correlations between weight of combustible contents and estimated amount of contents (percent or cu. ft.) are shown for a desk, a file cabinet and a bookcase in Figures 15 thru 20. Correlations of other desks, file cabinets and bookcases were also made, but in many instances were not as close as those shown. The amount of contents for desks and file cabinets were estimated as percentages of the total storage capacities of the items. For bookcases, volume estimates were made of the amount of contents in units of cubic feet. The weights of combustible contents were determined by subtracting from the total weight recorded for an item, the empty weight of the unit and the weight of non-combustible content. The plots were constructed to aid in evaluating the work of the survey team members in estimating amounts of contents and to show where improvements or changes in techniques are needed. For each plot a least square fit is given at the bottom of the graph. This is an equation of the straight line most common to all points. These data are still being statistically explored to obtain their most meaningful information.

In the case of miscellaneous metal files and of miscellaneous fire-rated files, where the contents measurements were not available and the empty weights were unknown, the combustible weights were taken as 48% and 25% of the total weights. These ratios were based on available data from standard files.

## 5. Discussion

This preliminary survey covered a total of 127,058 sq. ft., of which 102,998 sq. ft. were considered to be office space. Although this exceeds by over 14,000 sq. ft. the office space surveyed and reported in BMS 149, it represents a small statistical sampling from only two buildings, and should not be considered representative of all office space. In particular, the occupancy load is likely to change appreciably over the years.

Compared to the survey results reported in BMS 149, this survey includes a larger sampling (in terms of area), classification of "free" combustible contents (i.e., on top of desks vs within desks) and the spatial distribution of combustible items within the room according to a floor area grid pattern.

A clear distinction has been made in this survey between movable contents fire load and interior finish fire load. Since this report includes data for the movable contents portion only, it is not directly comparable with the commonly used values from previous surveys which included combustible flooring, interior finish and trim.

## 7. References

[1] Fire Resistance Classification of Building Constructions, National Bureau of Standards, BMS 92, 1942.

[2] Ingberg, S.H., Dunham, J.W., and Thompson, J.P., "Combustible Contents in Buildings," NBS, BMS 149, 1957.

[3] Ingberg, S. H., "The Severity of Building Fires," Quart. Nat. Fire Protection Association 22, 43-61, 1928.

[4] Loftus, J.J., Gross, D., and Robertson, A.F., "Potential Heat - A Method for Measuring the Heat Release of Materials in Building Fires," ASTM Proc. 61, 1336-48, 1961.

Table 1. De-rating Factors to Determine Combustible Contents of Steel Furniture (Based on Table 6, BMS 92)

| | "Effective" combustible contents percent, when container is | | |
|---|---|---|---|
| | Less than one-half full | One-half to three-fourths full | More than three-fourths full |
| Enclosed steel shelving | 60 | 50 | 25 |
| Steel file cabinets and desks | 40 | 20 | 10 |
| Insulated (1 hr fire-rated files & safes) | 0 | 0 | 0 |

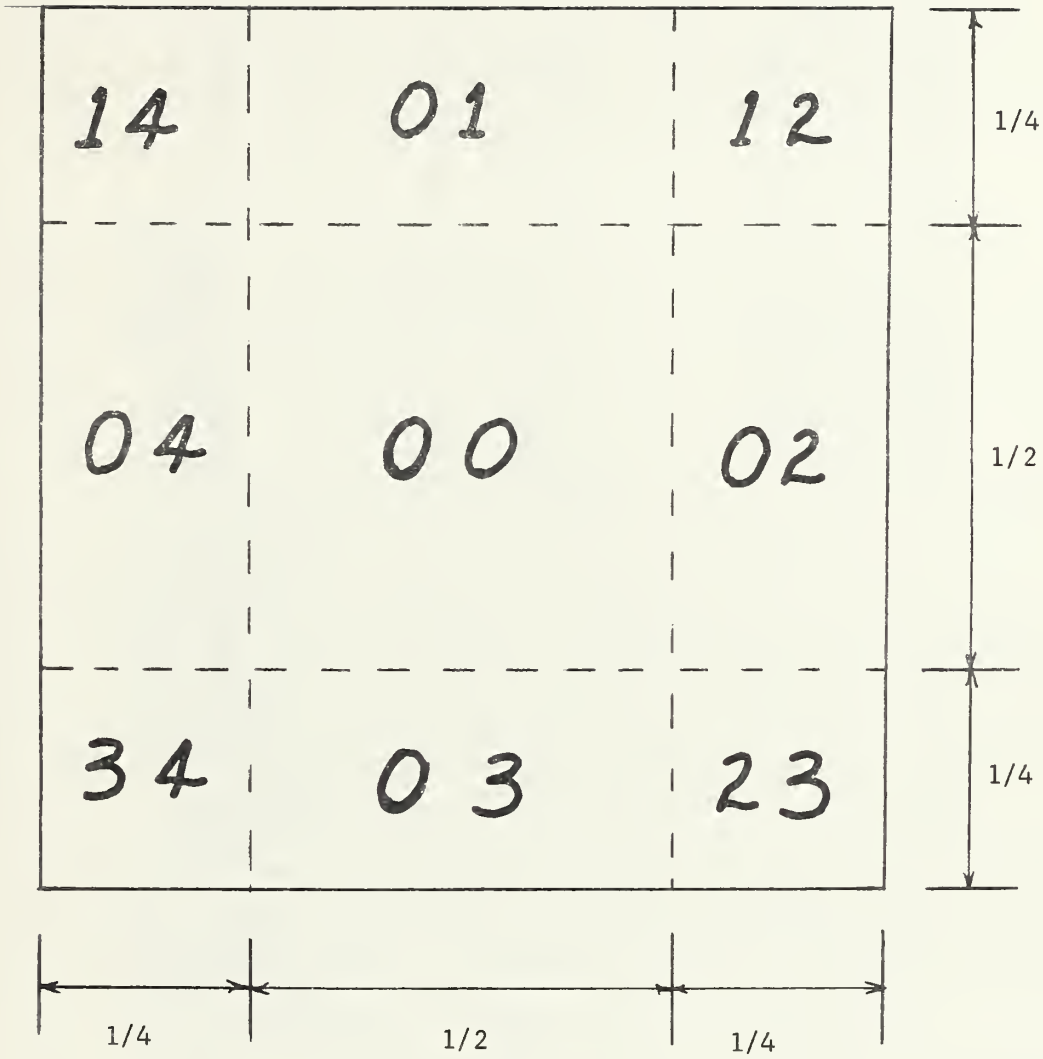
Table 2. Mean Movable Contents Fire Load, lb per sq ft.

| Room Usage | NBS Admin. Bldg. No. of Rooms | NBS Admin. Bldg. Movable Contents Fire Load psf | NBS Admin. Bldg. Percent of Total Load % | F O B 9 No. of Rooms | F O B 9 Movable Contents Fire Load psf | F O B 9 Percent of Total Load % | "Free" Contents psf | "Adjusted" Content* psf |
|---|---|---|---|---|---|---|---|---|
| Office | 252 | 4.9 | 42.2 | 201 | 3.4 | 38.1 | 2.2 | 2.6 |
| Laboratory | 8 | 7.8 | 46.8 | 0 | .0 | .0 | .0 | .0 |
| Storage | 23 | 20.9 | 65.4 | 3 | 4.7 | 26.4 | 1.6 | 2.9 |
| Conference | 10 | 2.5 | 54.7 | 12 | 2.4 | 82.9 | 2.4 | 2.4 |
| Lounge | 1 | 1.3 | 91.2 | 0 | .0 | .0 | .0 | .0 |
| Lobby | 7 | .7 | 51.3 | 1 | .1 | 4.0 | .1 | .1 |
| Dining Rm. | 0 | .0 | .0 | 0 | .0 | .0 | .0 | .0 |
| Library | 11 | 15.9 | 59.3 | 2 | 7.8 | 34.4 | 6.6 | 7.3 |
| File Room | 3 | 28.8 | 63.3 | 2 | 26.6 | 58.2 | 3.1 | 12.0 |
| Other | 20 | .4 | 22.0 | 0 | .0 | .0 | .0 | .0 |
| Bldg. Total | 335 | 5.3 | 45.9 | 221 | 3.7 | 40.8 | 2.3 | 2.7 |

*According to derating factors in Table 1.

Table 3. Combustible Contents of Steel Furniture

| Percent Combustible Contents of Room Within | NBS Admin. Bldg. | | FOB 9 | |
|---|---|---|---|---|
| | Offices (%) | Total (%) | Offices (%) | Total (%) |
| Enclosed Steel Shelving | 3.4 | 2.6 | 2.8 | 2.6 |
| Steel Files and Desks | 27.2 | 23.9 | 36.7 | 40.2 |
| Insulated Files, Safes | .7 | .5 | .3 | .2 |




Code number is related to an actual direction, e.g.:

00 = Central

01 = North

12 = Northeast

02 = East

23 = Southeast

03 = South

34 = Southwest

04 = West

14 - Northwest

Fig. 1 General Scheme for Locating Items Within the Room

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Loads Survey Log Sheet

Building_____ Date_____

| Room Number | Floor Level | Room Use | N-S Dimension | E-W Dimension | Height | Number of Personnel Male | Number of Personnel Female | Number of Items | Surface Finish Floor | Ceiling | N Wall | E Wall | S Wall | W Wall | Weight of Trim | Weight of Floor Covering | Area Reduction | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A2713 | 020 | 1 | 015 | 025 | 12 | 02 | 00 | 16 | 4 | 3 | 1 | 1 | 1 | 1 | 000 | 000 | 00 | |

| Item Number | Item Code | Location | Base Area Code | Misc. Item Base Area, Sq. In. | Total Weight | Contents Non Comb. Weight | Contents Category | Contents Measurement Percent of Capacity | Contents Measurement Cubic Feet | Combustible Contents on Top Cu. Ft. | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 0102 | 12 | 1 | – | 0352 | 0018 | 3 | 06 | – | 1.5 | |
| 02 | 0201 | 02 | 1 | – | 0123 | 0005 | 3 | – | – | 1.0 | |
| 03 | 0326 | 23 | 1 | – | 0217 | – | 1 | 05 | – | – | |
| 04 | 0001 | 01 | 0 | – | 0011 | – | 3 | – | – | – | FREE CONTENTS - BASE AREA ALWAYS ZERO |
| 05 | 0520 | 14 | 1 | – | 0331 | – | 2 | – | 3.0 | – | |
| 06 | 0010 | 12 | 0 | – | 0006 | 0006 | – | – | – | – | EMPTY WASTE BASKET - BASE AREA ALWAYS ZERO |
| 07 | 0405 | 12 | 1 | – | – | – | – | – | – | – | CHAIR- BASE AREA AND EMPTY WT. ALREADY STORED IN COMPUTER |
| 08 | 0400 | 01 | 1 | – | – | – | – | – | – | – | " " " " " " " " " " |
| 09 | 0400 | 14 | 1 | – | – | – | – | – | – | – | " " " " " " " " " " |
| 10 | 0405 | 08 | 1 | – | – | – | – | – | – | – | " " " " " " " " " " |
| 11 | 0403 | 02 | 1 | – | – | – | – | – | – | – | " " " " " " " " " " |
| 12 | 2198 | 00 | 1 | 1500 | 0365 | 0015 | 3 | – | 1.5 | 0.5 | MISCELLANEOUS METAL DESK. |
| 13 | 1398 | 03 | 1 | 0300 | 0197 | 0002 | 1 | – | 2.0 | – | MISCELLANEOUS WOOD FILE CABINET |
| 14 | 0510 | 03 | 0 | – | 0091 | – | 2 | – | 1.0 | – | BOOKCASE SECTION ON TOP OF ITEM NO. 13 |
| 15 | 2398 | 03 | 1 | 0320 | 0215 | 0005 | 1 | 06 | 2.0 | – | MISCELLANEOUS METAL FILE CABINET |
| 16 | 2399 | 04 | 1 | 0320 | 0518 | – | 1 | 08 | 3.0 | – | MISCELLANEOUS METAL FILE CABINET-FIRE RATED 1 HR. |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Fig. 2 TYPICAL LOG SHEET




FIG. 3. ELECTRONIC LOAD PLATFORMS USED AS THE SENSING ELEMENT IN ALL WEIGHING OPERATIONS.

FIG. 4. COMMERCIAL TYPE DESK HANDLER WITH MODIFIED CENTRAL BRACES TO SUPPORT LOAD PLATFORM.

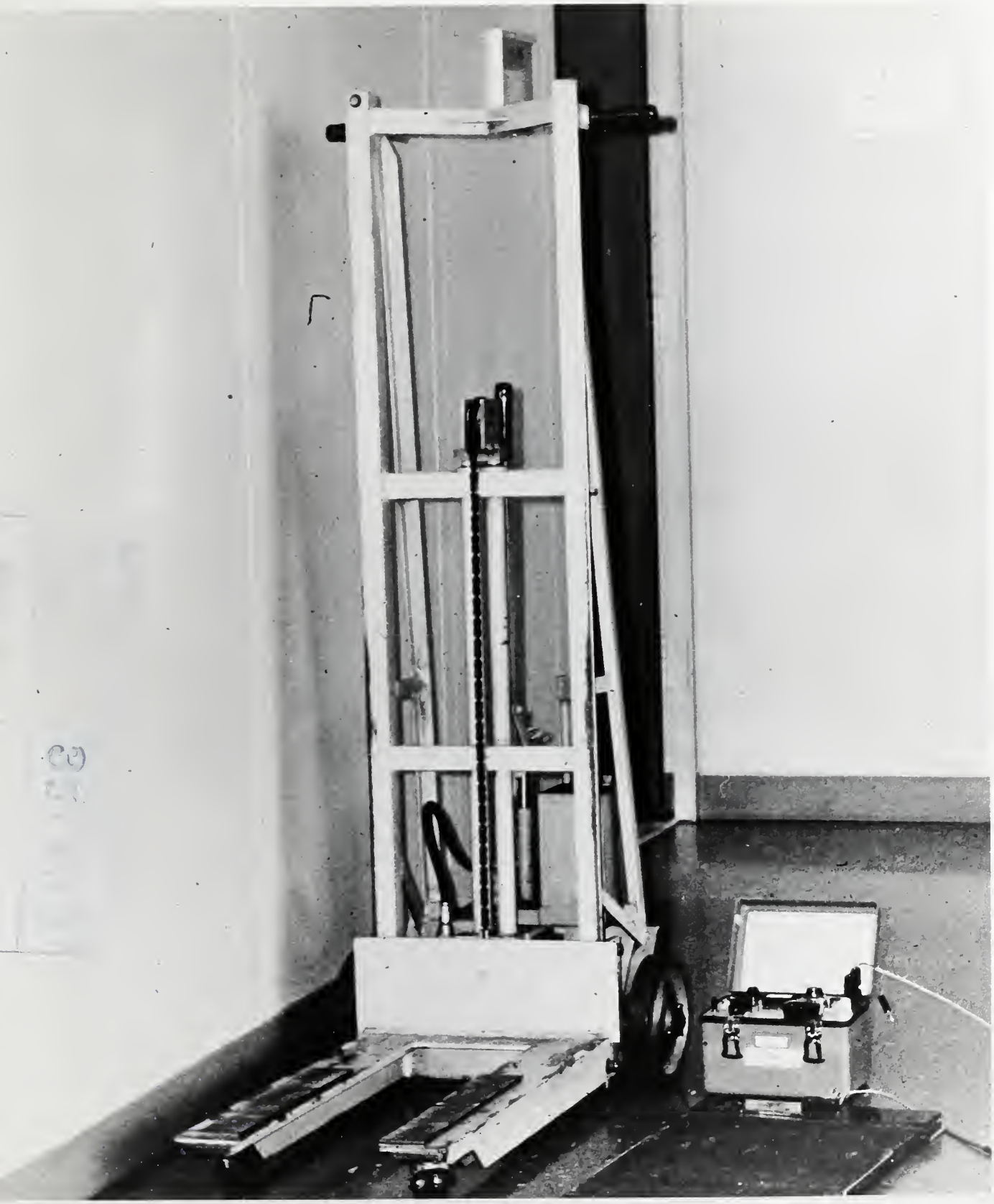

FIG. 5 FORKLIFT ACTUATED THROUGH HYDRAULIC PUMP SYSTEMS.

FIG. 6. TOP: DESK HANDLER WITH LOAD PLATFORM POSITIONED FOR USE. BOTTOM: FORKLIFT WITH LOAD PLATFORM INSERTED ACROSS THE ARMS AND A FLAT METAL PLATE ON TOP.




FIG. 7. EQUIPMENT AND SUPPLIES FOR SURVEY WORK.



FIG. 8. WEIGHING TECHNIQUES FOR DESKS.

FIG. 9. WEIGHING TECHNIQUES FOR TABLES AND BOOKCASES.



FIG. 10. WEIGHING A FILE CABINET.

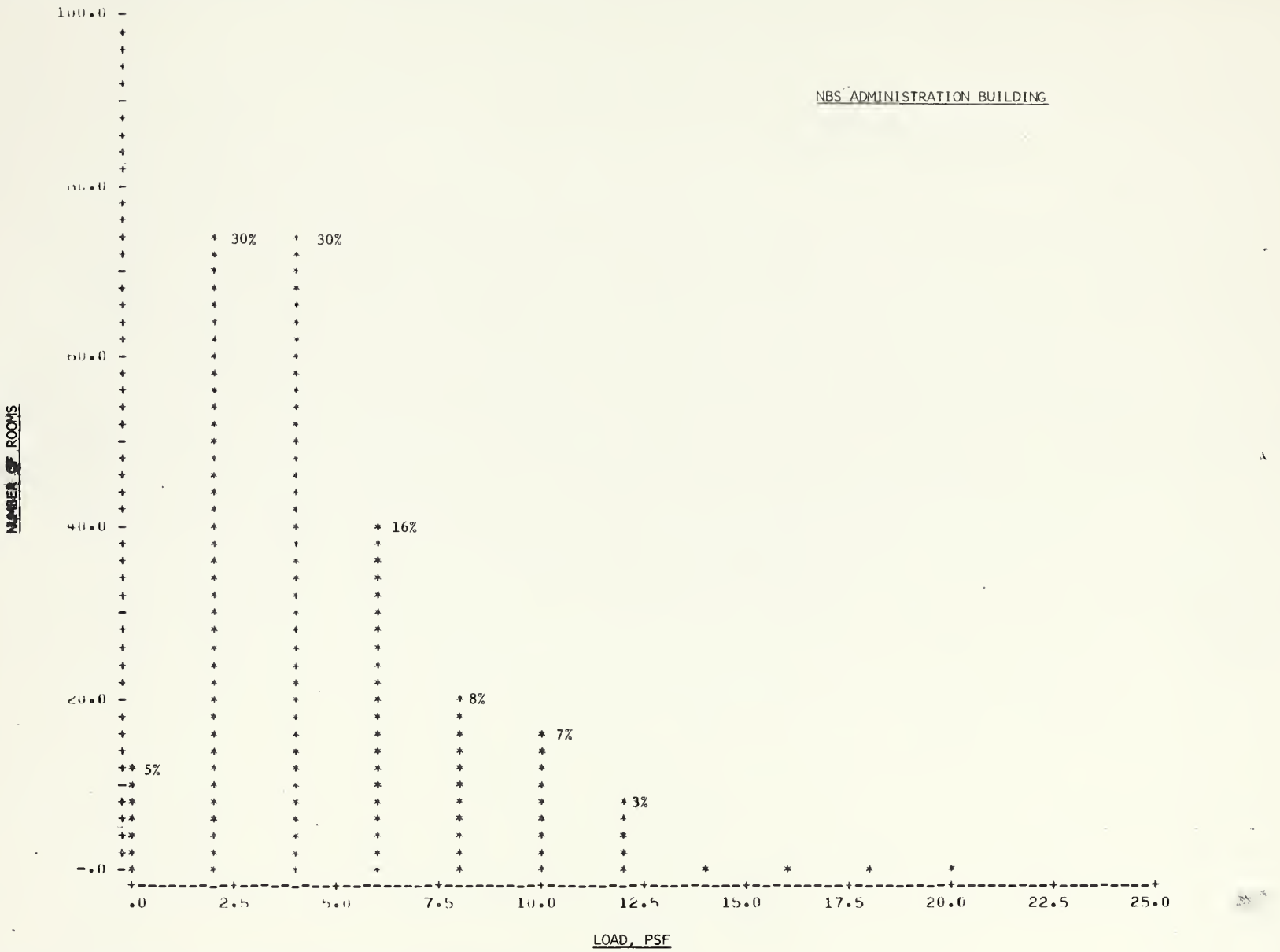


FIGURE 11. DISTRIBUTION OF MOVABLE CONTENTS IN OFFICE ROOMS IN THE NBS BUILDING

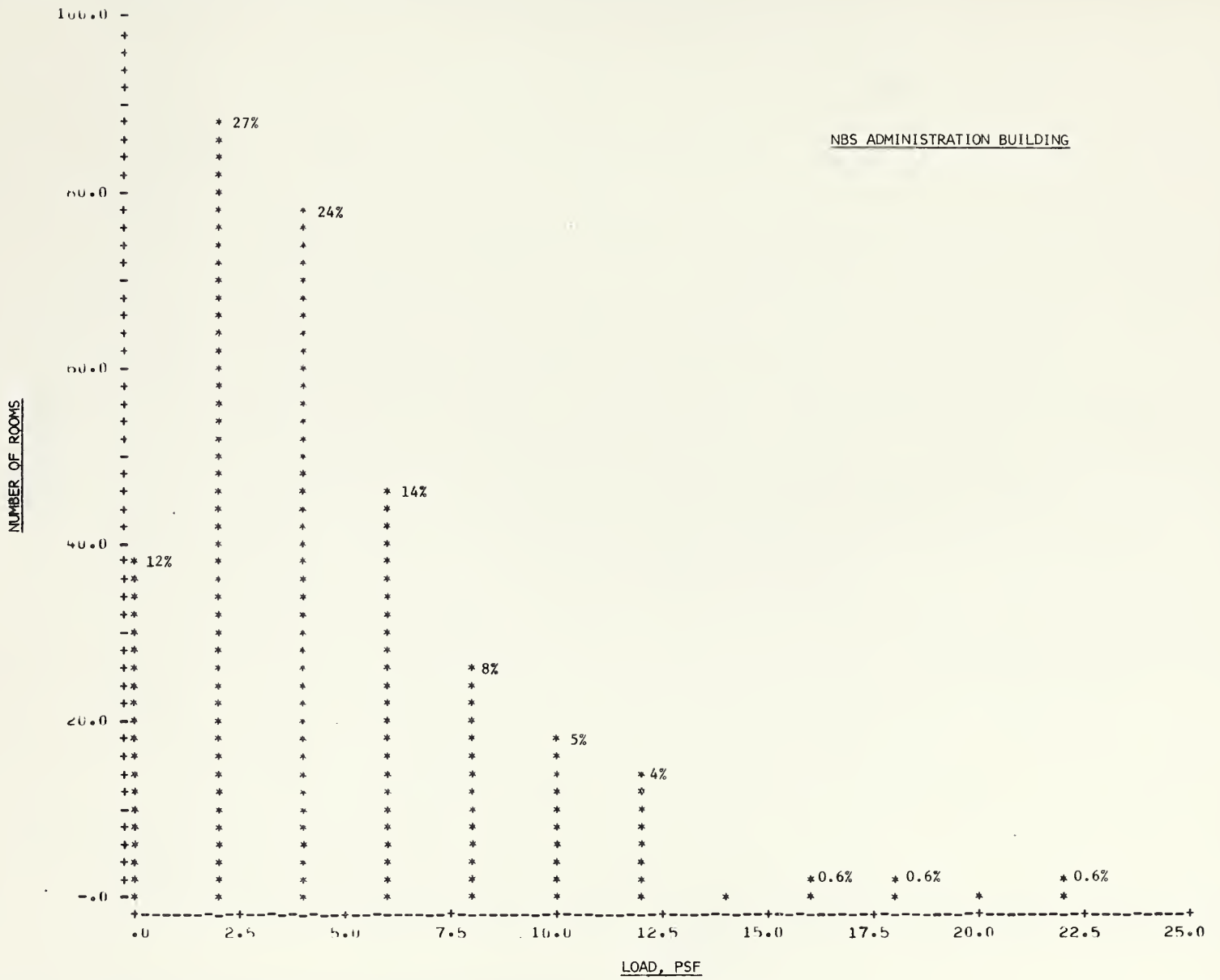


FIGURE 12. DISTRIBUTION OF MOVABLE CONTENTS IN ALL ROOMS SURVEYED IN THE NBS BUILDING

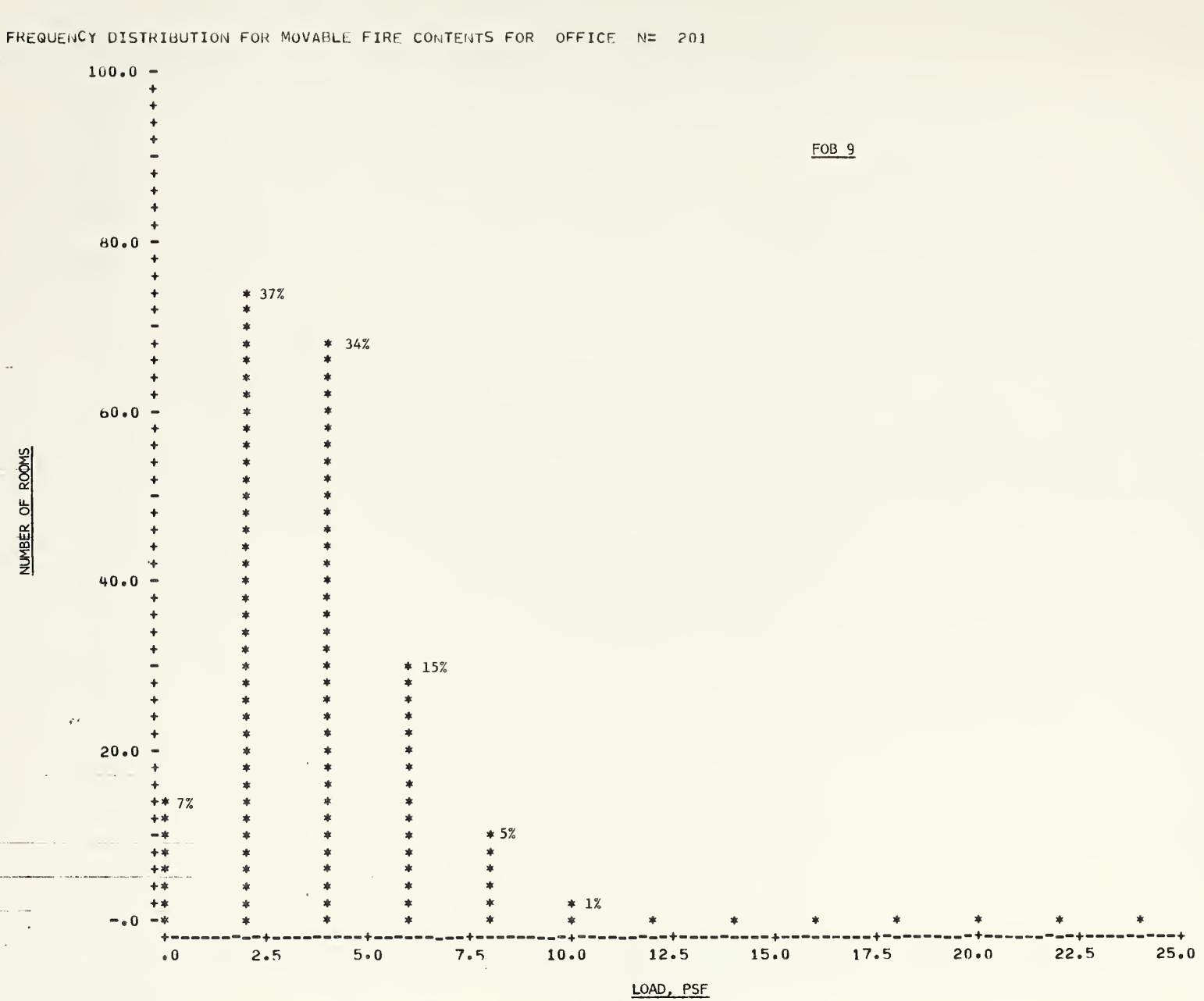


FIGURE 13. DISTRIBUTION OF MOVABLE CONTENTS IN OFFICE ROOMS IN FOB 9

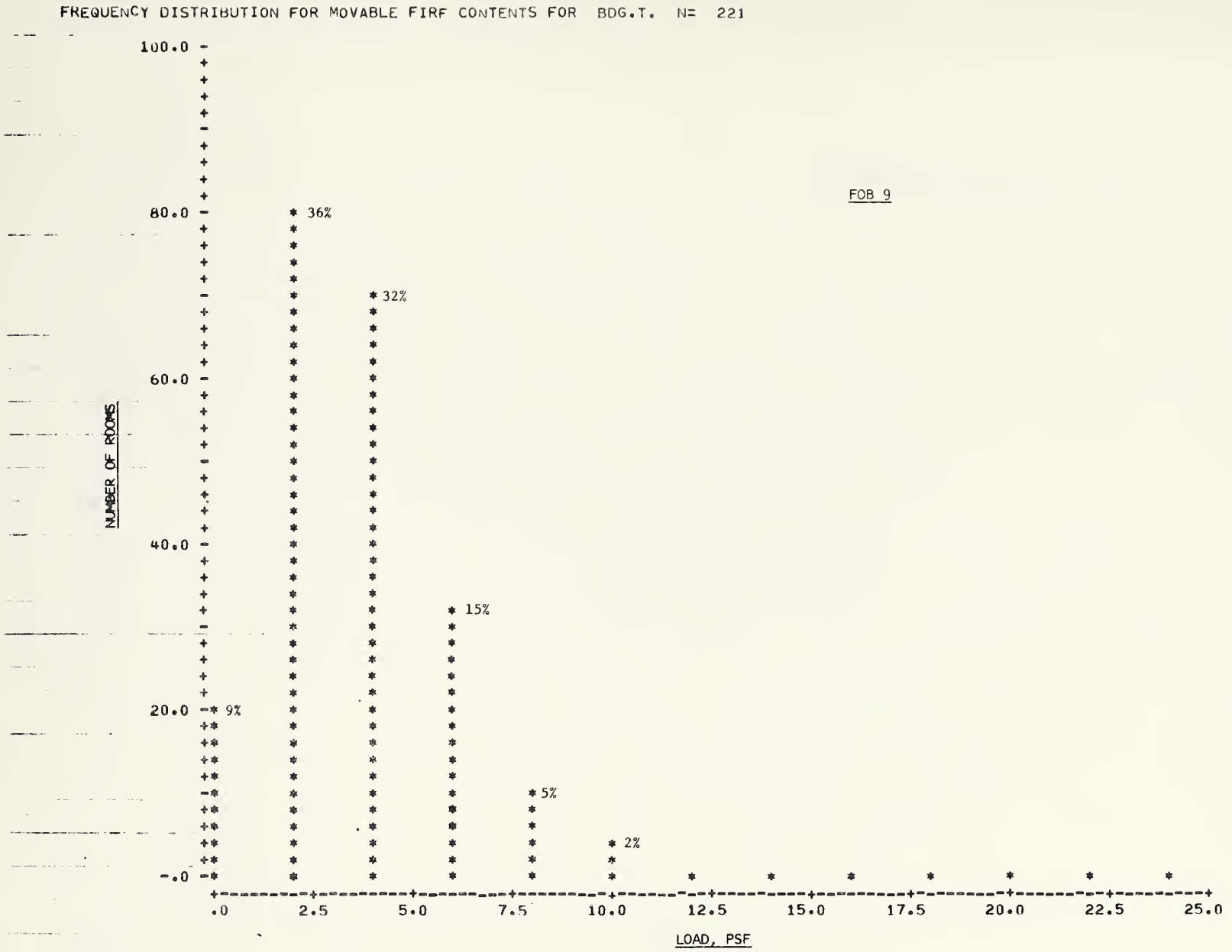


FIGURE 14. DISTRIBUTION OF MOVABLE CONTENTS IN ALL ROOMS SURVEYED IN FOB 9

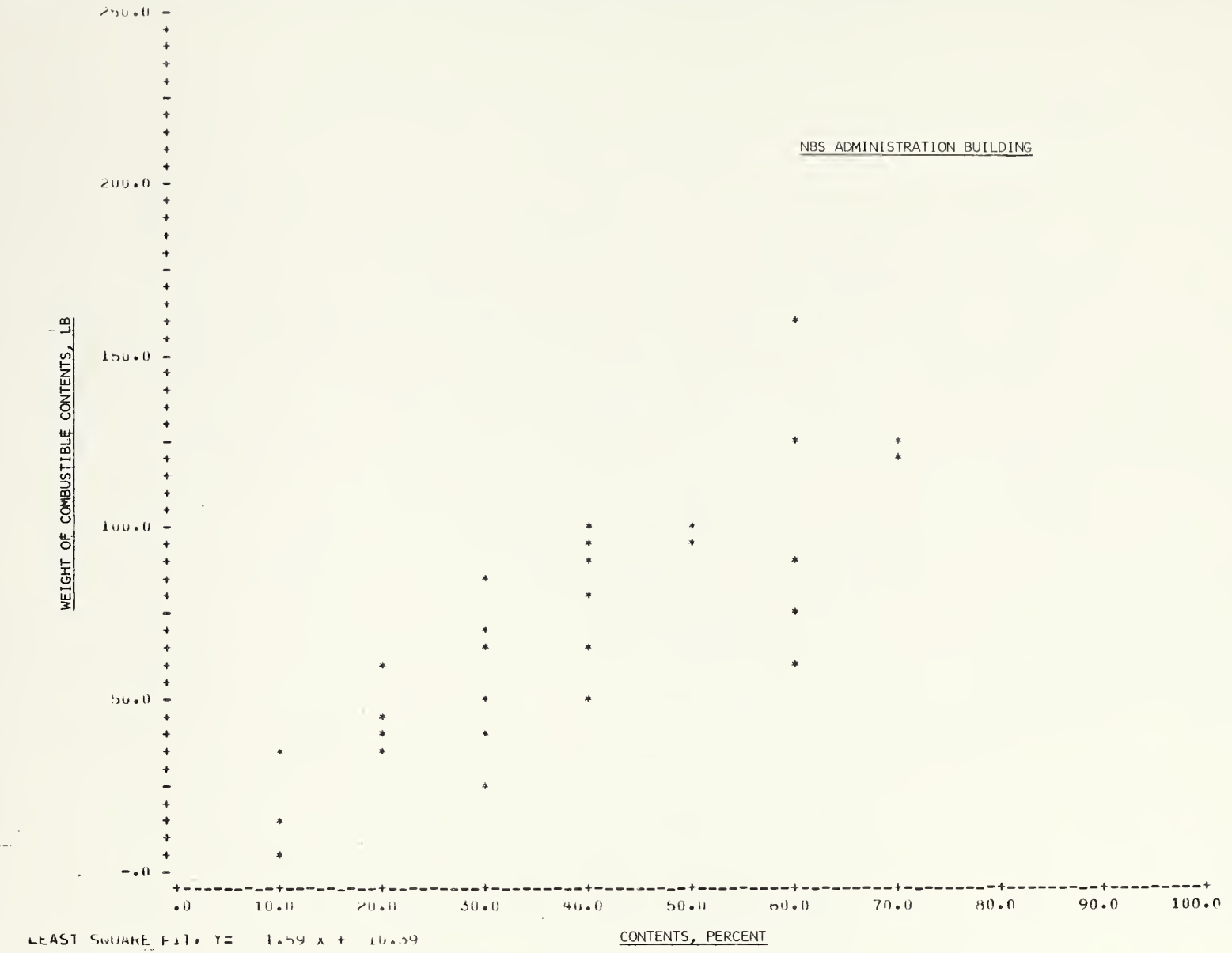


FIGURE 15. WEIGHT VS CONTENTS CORRELATION, DESK (CODE 0102)

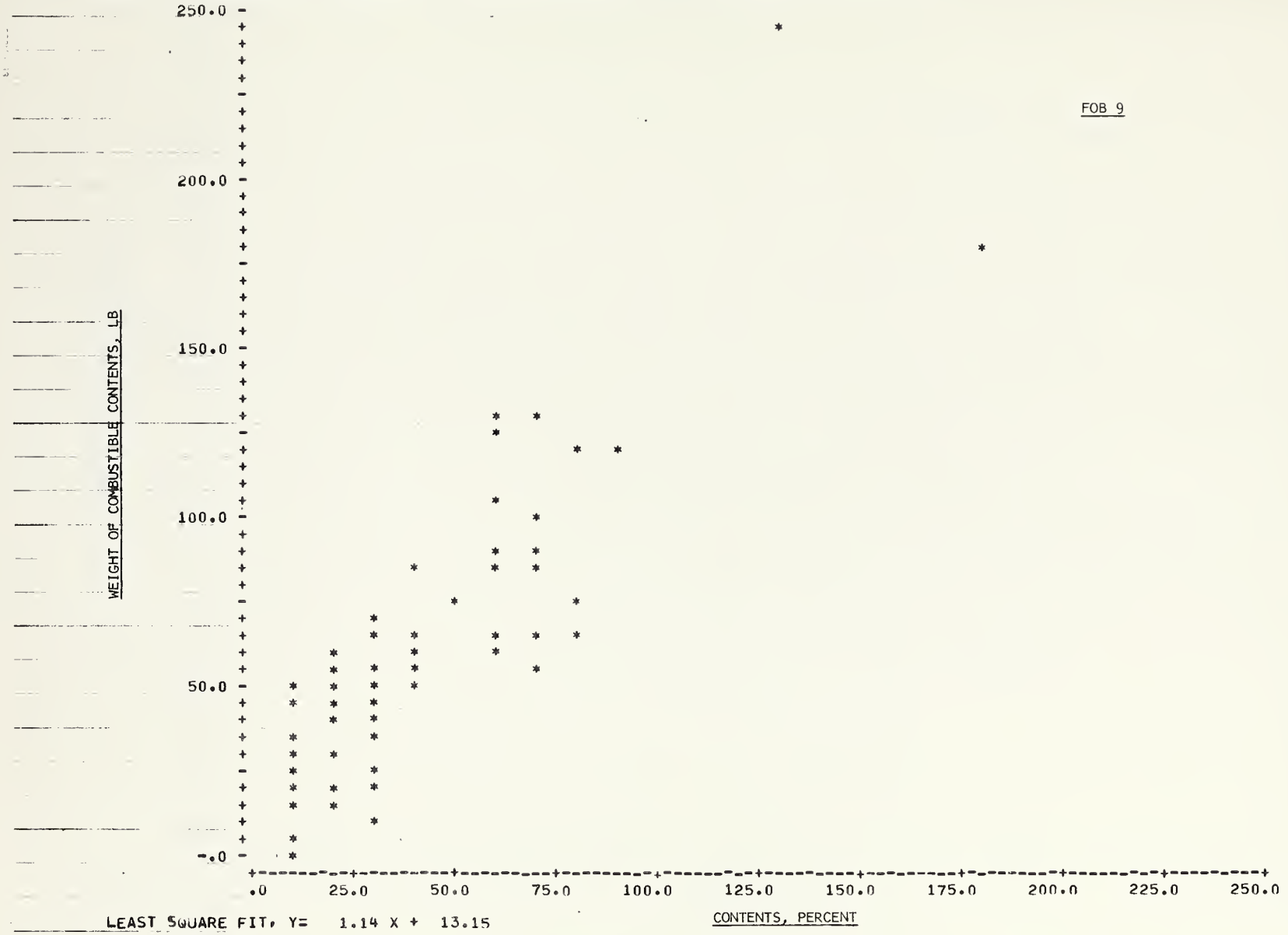


FIGURE 16. WEIGHT VS CONTENTS CORRELATION, DESK (0102)

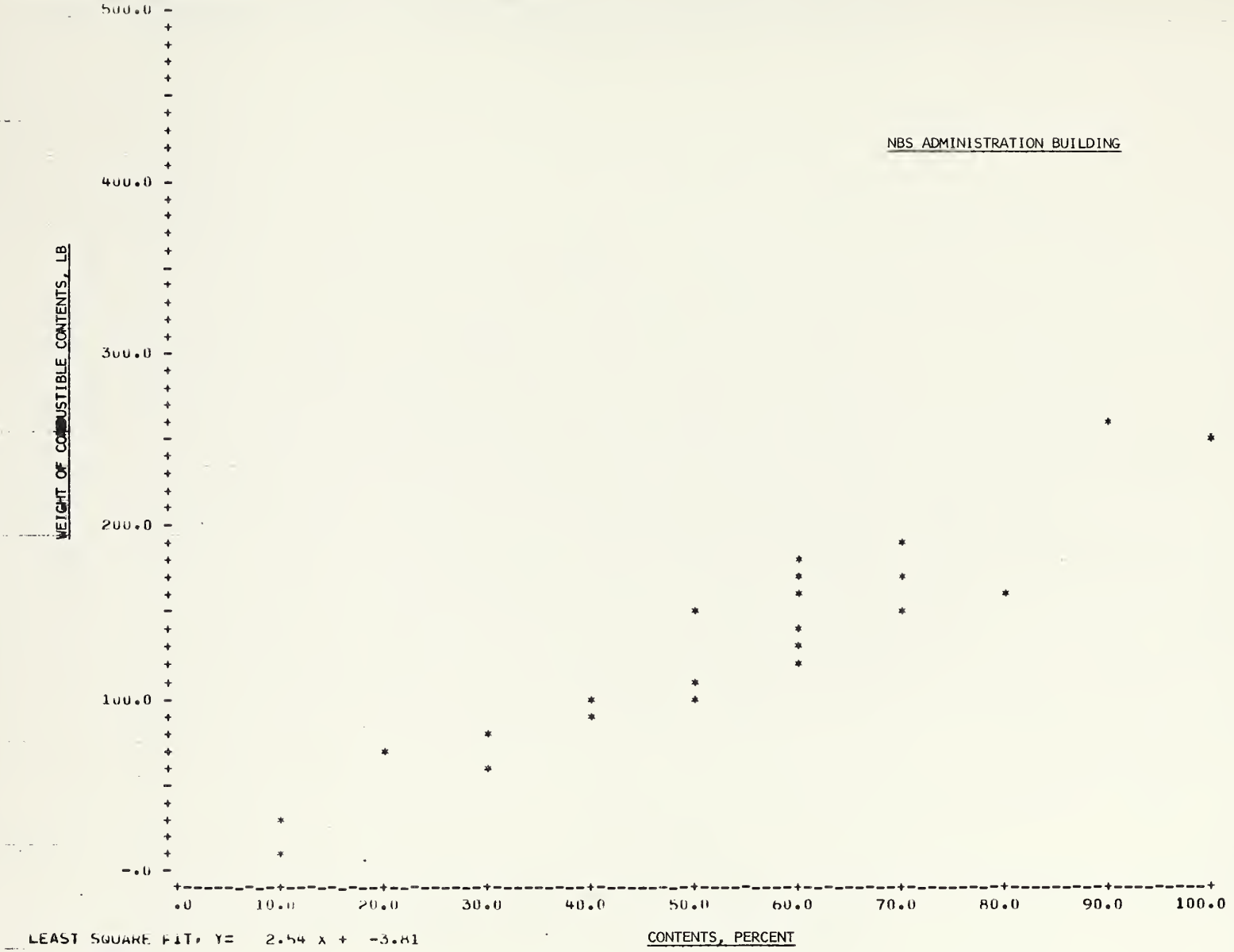


FIGURE 17. WEIGHT VS CONTENTS CORRELATION, FILE CABINET (CODE 0300)


FIGURE 18. WEIGHT VS CONTENTS CORRELATION, FILE CABINET (CODE 0300)

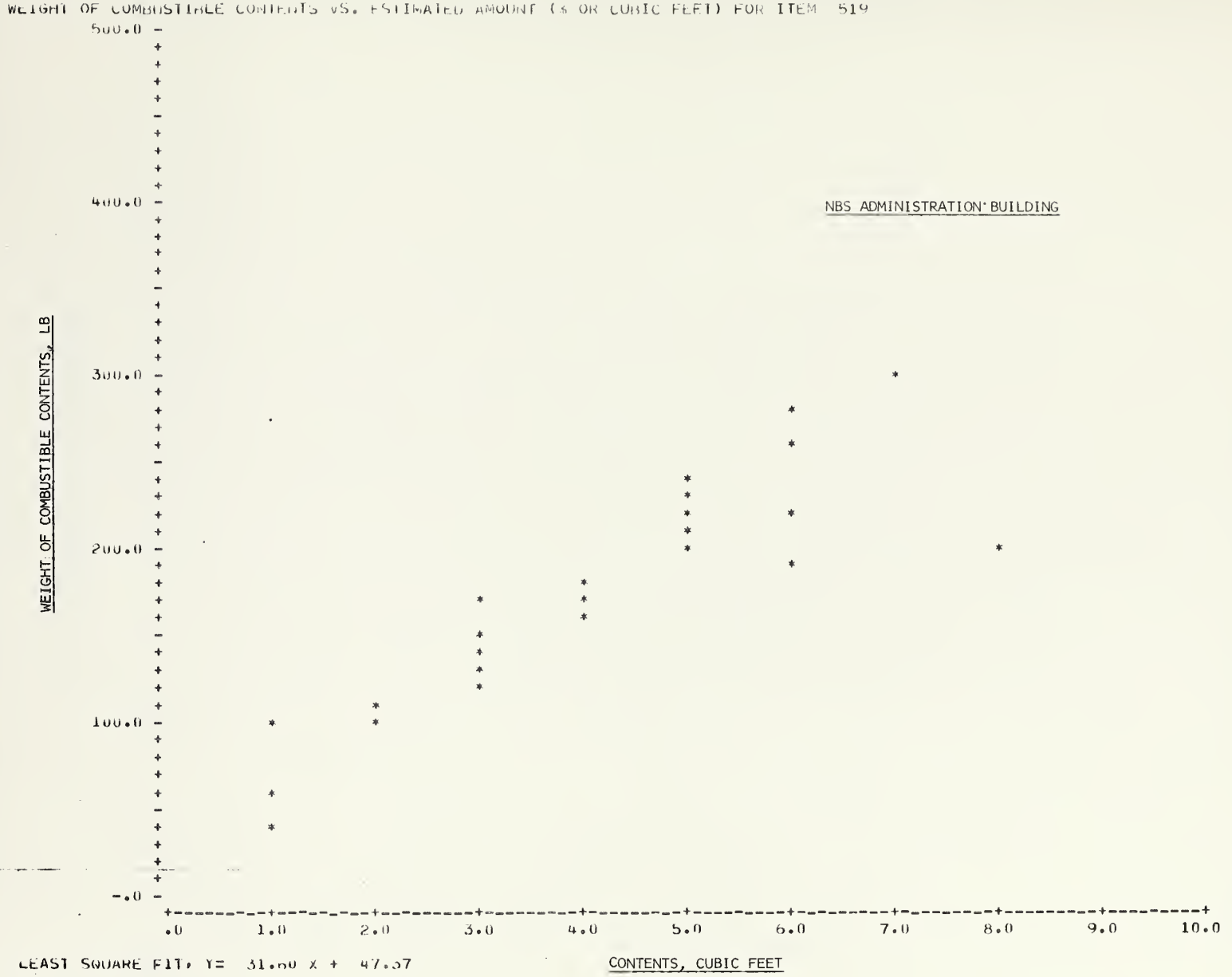


FIGURE 19. WEIGHT VS CONTENTS CORRELATION, BOOKCASE (CODE 0519)

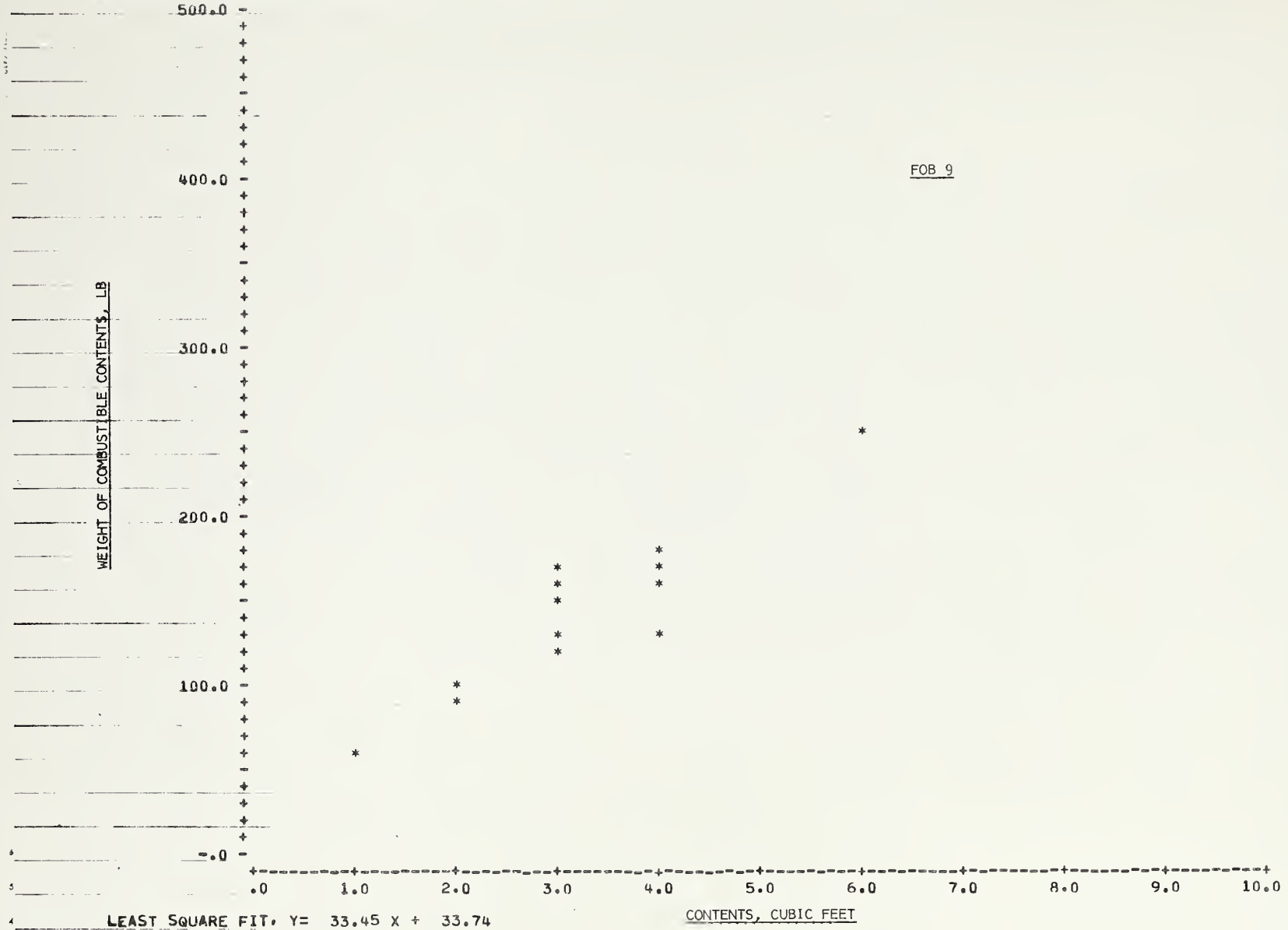


FIGURE 20. WEIGHT VS CONTENTS CORRELATION, BOOKCASE (CODE 0519)


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