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**A SURVEY OF FUEL LOADS IN  
CONTEMPORARY OFFICE BUILDINGS**

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### Notice

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## ABSTRACT

The method, used in the latest study performed in 1975, for surveying offices to determine fuel load estimates is presented. The frequency distribution for the estimates of the fuel load found in the study are presented. Two methods for determining movable fuel load are utilized in this study. Moveable fuel load is considered to be the furniture, equipment, and other items brought in for the service of the occupants after construction of the building [6].

Direct weighing techniques are utilized in both methods. In one method, the office contents are taken from their operational location and weighed. The second method, weighs the office contents when packaged for either relocation or remodeling purposes. Two types of offices were surveyed, open plan design and the traditional compartmented layout. Current offices are composed of large open plan spaces which are subdivided into office space or workstations by partitions. Also contributing to the fuel load are desktop computers which are common accessories.

Surveys were conducted in buildings at the University of Maryland College Park and at the General Services Administration(GSA) Headquarters Building in Washington, D. C. Statistical results are presented for the two survey methods, each office type and each material category. The results of the study present the impact of open plan designs on the fuel load and also present the partition and computer accessory fuel load contributions. In addition, a comparison is made for the fuel load found at the University of Maryland, College Park and that found at GSA. The fuel load estimates for each office are separated into the following categories in order to group items of similar material composition: papers/books, computer equipment, furniture, partitions, and miscellaneous.

## INTRODUCTION

In engineering, the design of a system is a function of the anticipated loads or demands. As related to fire safety aspects of the design of buildings, the anticipated demands include the amount of combustibles in the space. The amount of combustibles contained in the building serves as the load for fire resistant assemblies.

Changes in office furnishings have raised concerns about the accuracy of fuel load estimates. These changes include computer accessories being provided throughout the space as well as furnishings to create workstations (partitions) [1]. Fuel load estimates for office buildings are based on results of building surveys [2,3]. The most recent survey was conducted in 1975, when many office spaces still consisted of well-compartmented spaces and prior to the common use of desktop computers in the workplace.

Fuel load is calculated as the ratio of the total equivalent weight of the fuel commodities to the floor area of the space. An equivalent weight is defined to account for

differences in the heat of combustion of the variety of materials present in the space. In the previous surveys, the composition of the furniture items was noted and then a weight for each item was obtained from the manufacturer specifications. Because some of the fuel may be partially protected from fire exposure by being in metal containers, e.g. file cabinets and desk drawers, subjective derating factors have been used to decrease the contribution of enclosed fuel materials to the overall fuel load [3,4,5]. However, changes in the composition of furniture items, attributed primarily to the usage of more synthetic materials, may have affected the estimates. In addition, as a result of the implementation of open plan office designs, the arrangement and amount of fuel may have changed.

This report explains two survey methods which utilize direct weighing techniques to obtain movable fuel load data in two types of offices, open plan design and compartmented design. Movable fuel load is considered to be the furniture, equipment, and other items brought in for the service of the occupants after construction of the building [6]. It excludes combustible finish materials such as paneling, paint, wallpaper, ceiling and flooring finish materials and trim such as wooden molding on walls, floors, and windows [3]. Data obtained from the survey of six office spaces is presented. Statistical results for each survey method are presented. The results of the study present the impact of open plan office designs on the fuel load and also present the partition and computer accessory fuel load contributions. In addition, a comparison is made for the fuel load found at the University of Maryland, College Park and that found at GSA.

## **BACKGROUND**

The National Bureau of Standards(NBS) conducted the most recent survey in 1975, when many office spaces still consisted of well-compartmented spaces and prior to the common use of desktop computers in the workplace. In previous load surveys the weight of content items was of primary concern and direct weighing was employed using specially designed apparatus [6]. For large surveys, costs and time involved in direct weighing are considerable. In addition, the weighing operations are disruptive to the normal business operations [6].

"Recognizing the above, the NBS study developed an inventory survey technique employing the collection of visual data, i.e., observable physical characteristics of the various content items, from which weight information could be obtained" [6]. Previous surveys have used this concept to a limited extent. Blackall recorded the types of items in offices and obtained the load by assigning weight values to the various types of items [7,8]. Mitchell and Bryson and Gross used manufacturers' lists and a catalog of photographs to identify and code items to obtain weight for some items [9,10].

The NBS study used manufacturers' specifications to obtain transfer functions (weights) for commonly occurring items such as paper, books, desks, tables, seating, shelving cabinets, telephones, typewriters and calculators [6]. In this manner, a surveyor could make a visual inspection of an office and refer to the transfer function list to assign a

specific weight to each item. For less common items it was decided to resort to estimating the weight during conduct of the survey. In dealing with enclosed combustibles such as papers in filing cabinets, a derating factor, an estimate of the quantity of the material which will burn in a fire, is used. Derating factors, similar to those used for combustibles in steel containers, are obtained from the fire resistance classifications of building construction [11]. The derating factors used in the NBS study are given in Figure 1. These factors are also utilized in this study to maintain consistency.

The NBS study found that the fuel load ranged from 0.6 to 44.5 pounds per square foot (psf) with a mean of approximately 7 psf, as indicated in Figures 2A and 2B [5]. The movable fuel load was found to be 5 psf. Data results on factors related to fuel consideration are given below [5].

**General and Clerical Offices- Sample Size= 1044 offices  
(Government and Private)**

- |   |           |
|---|-----------|
| 1. Total fuel load (derated)                                    | = 6.6 psf |
| 2. Movable contents fuel load (derated)                         | = 5.0 psf |
| 3. Interior finish fuel load                                    | = 1.6 psf |
| 4. Percent of total derated fuel load that is enclosed          | = 9.1 %   |
| 5. Percent of total fuel load that is paper and books (derated) | = 38.6%   |

The following observations can be made from the data above:

- (1) The derated fuel load is approximately 90 percent of the total fuel load.
- (2) Movable contents comprise approximately three-fourths of the derated fuel load.
- (3) Paper and books account for approximately 40 percent of the total fuel load.

## **STUDY PROCEDURE**

Because a small sample of offices were inventoried, direct weighing was employed to obtain movable fuel loads using 2 weight scales. The movable fuel loads are limited to those resulting from the intended use of the building. The fuel loads include furniture, equipment, and other items brought in for the service of the occupants after construction of the building [6]. The fuel load is calculated for only those items that are movable and combustible, therefore all metal contents, e.g. desks, shelves, and cabinets, are excluded.

Two survey strategies were utilized to conduct the field surveys. The first strategy targeted offices which were in the process of being relocated or remodeled. This would allow for a simplified weighing process because office contents were packaged in boxes.

The survey would not be disruptive to normal business operations. Boxes were simply placed on the weight scales and the office location of the contents was maintained by the office occupant who titled each box. Large furniture was weighed accordingly, e.g. items were placed on wooden studs which were placed on the two weight scales.

Partition weights were obtained utilizing specification data from the manufacturer [12, 13]. The partitions surveyed consisted of fabric coated panels fitted into metal frames. The wall area, composed of partitions, is calculated and the fuel load contribution is determined by dividing the total partition wall area of the office by the area of the panel listed below. This ratio is multiplied by the appropriate weight factors which are listed below. For example, if a workstation has systems furniture partition walls which measure a total of 110 inches in length (regardless of layout), 62 inches in height then the area equals 62 x 110 or 6820 square inches. Divide this area by the area listed below (6820/1488= 4.6) and multiply the ratio by the weight factor to obtain the fuel load contribution (4.6 x 38= 175lbs). The following are average weight factors for partition panels.

<u>Partition Type</u>	<u>Panel Size(inches)</u>	<u>Area (sq inches)</u>	<u>Weight (lbs.) Fabric</u>	<u>Metal Frame</u>
Standard systems furniture	62 x 24 x 2	1488	38	10
Non-systems furniture	60 x 24 x 1	1440	30	10

The second strategy involved conducting the surveys in offices which were in operation. Items were weighed individually and like items were grouped, e.g. books were stacked and weighed in this fashion. Large furniture and items were weighed as discussed above.

Surveys were conducted in buildings at the University of Maryland College Park and at the General Services Administration(GSA) Headquarters Building in Washington, D. C. A total of six offices were inventoried, three compartment type designs and three open plan workstations. Items were weighed and then grouped into the following categories which group items of similar material composition:

**(1) Papers/ books:**

- a. open- materials that are exposed, e.g. on desktops, in shelves
  - b. enclosed- materials enclosed in metal furniture, e.g. drawers
- note: a derating factor of 0.4 is applied to these materials [6]  
e.g. if a metal filing cabinet drawer contained 100 pounds of paper materials only 40 pounds (100lbs x 0.4) would contribute to the fuel load.

**(2) Computer equipment includes the following:**

- a. mouse and pad
- b. monitor

- c. keyboard
- e. electrical cords
- f. main computer unit
- g. disks and disk filers

- (3) **Furniture** only includes wooden and plastic materials such as desks, computer tables, and chairs.
- (4) **Partitions** the wall area composed by fabric covered panels
- (5) **Miscellaneous** includes draperies, wastebaskets, phones, typewriters, wall hangings, clothing, radios, rugs, video tapes, and umbrellas

Appendix A lists the fuel load summaries and inventory sheets for each office completed in the different buildings.

## ANALYSIS

Figure 3 shows the movable fuel load found in offices where items were weighed from their operational locations. The papers/books category contributed 65.3% of the total movable fuel load found. The mean fuel load found was 14.63 pounds per square foot(psf). Figure 4 shows the movable fuel load found in offices where items were packaged for relocation or remodeling purposes. The furniture category contributed 53% of the total movable fuel load. Most of the furniture contained in the two offices was composed of wood. The other four offices which were surveyed with items in their operational location contained a majority of metal furniture. The mean fuel load found was 12.63 psf.

The survey method which involved items in their operational location allowed for an easier characterization of items into their material categories. The method was time consuming and disrupted normal business operations. The method involving packaged office contents was not as time consuming but there was difficulty in categorizing items because not all boxes contained items of similar material composition. It would have been possible to preplan for the office survey and have packaged items accordingly. The survey method did not disrupt normal business operations.

Figures 7 and 8 show the movable fuel loads found in open plan offices and those found in compartmented offices. The mean for the open plan offices is 14.55 psf. The top two contributors are papers/books(50%) and partitions(35%). The mean for the compartmented offices is 13.29 psf. The top two contributors are papers/books(56%) and furniture(36%). It can be seen that the movable fuel loadings are very similar for both types of office designs. Compartmented offices tend to be larger in floor area and usually contain older wooden or metal furniture. The average floor area occupied by the three

compartment type offices was 126 square feet as compared to the 56 square feet for the open plan offices. Systems furniture which is usually found in most open plan designs is designed to best utilize the office space available. This makes it possible to occupy smaller areas with a larger fuel loads as shown by the results.

Figure 11 shows the computer accessory movable fuel load contributions of each office surveyed. The mean contribution is 0.85 psf which is equivalent to 6.2% of the total movable fuel load as shown in Figure 5. Figure 12 shows the movable fuel load contribution of partition walls. The three open plan offices surveyed contained partition walls. Only one of the offices was entirely composed of partition walls. The other two offices contained at least one permanent full height wall, details in Appendix A. The mean found was 5.05 psf which is equivalent to 35% of the total movable fuel load in the three open plan offices. The partitions contributed 11.4% of the total movable fuel load for all offices surveyed, Figure 5.

Figure 6 shows the movable fuel load found in offices at the University of Maryland, College Park(UMCP) and that found at the General Services Administration. The mean movable fuel load at UMCP was 12.80 psf while that at GSA was 18.43 psf. GSA utilizes systems furniture which allows for higher fuel loadings in smaller spaces.

Figure 9 shows the frequency distribution of the movable fuel loads found in all the offices surveyed. The average movable fuel load found in the study ranged from 10.53 to 21.87 psf with a mean of 13.68 psf, Figure 10. The movable fuel load statistics differ significantly from the results in the NBS study which found that the fuel load ranged from 0.6 to 44.5 pounds per square foot (psf) with a mean of approximately 7 psf, as indicated in Figures 2A and 2B [5]. The movable fuel load was found to be 5 psf.

## **SUMMARY AND CONCLUSIONS**

This fuel load study was constrained by a small sample size but it gives an insight to current movable fuel loads in office buildings. Two methods for determining movable fuel load are utilized in this study. Moveable fuel load is considered to be the furniture, equipment, and other items brought in for the service of the occupants after construction of the building [6].

Direct weighing techniques are utilized in both methods. In one method, the office contents are taken from their operational location and weighed. The second method, weighs the office contents when packaged for either relocation or remodeling purposes. Two types of offices were surveyed, open plan design and the traditional compartmented layout. Current offices are composed of large open plan spaces which are subdivided into office space or workstations by partitions. Also contributing to the fuel load are desktop computers which are common accessories.

The survey method which involved items in their operational location allowed for an easier characterization of items into their material categories. The method was time consuming and disrupted normal business operations. The method involving packaged office contents was not as time consuming but there was difficulty in categorizing items because not all boxes contained items of similar material composition. The survey method did not disrupt normal business operations.

The movable fuel load found in offices where items were weighed from their operational locations ranged from 10.53 to 21.87 psf with a mean of 14.63 psf. The movable fuel load found in offices where items were packaged for relocation or remodeling purposes ranged from 11.91 to 13.02 psf with a mean of 12.63 psf. The movable fuel load found in open plan offices ranged from 10.53 to 21.87 psf with a mean of 14.55psf. The movable fuel load in compartmented offices ranged from 11.91 to 14.75 psf with a mean of 13.29 psf. Computer equipment contributed 6.2% while partitions contributed 11.4% of the total movable fuel load found in the study. Higher fuel loads were found in the General Services Administration Headquarters Building than in the buildings at the University of Maryland, College Park.

The results found can provide information needed to provide adequate levels of fire protection and life safety in office buildings. The information will be useful in modeling code organizations as well as regulatory officials. In addition, the results can serve as a source of data for fire and egress models.

## **ACKNOWLEDGEMENTS**

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**Figure 1. Derating Factors for Determining Combustible Contribution for Enclosed Contents**

		Derating Factor <sup>1</sup>		
Type of Container	Container Material	<50%	50-80%	>80%
Desk, Table Cabinet	Wood	1.0	1.0	1.0
	Metal	0.40	0.20	0.10
	Plastic	1.0	1.0	1.0
Shelving	Wood	1.0	1.0	1.0
	Metal	0.75	0.75	0.75
	Plastic	1.0	1.0	1.0
Misc. Item	Non-combustible	0.75	0.75	0.75

<sup>1</sup> Ratio of enclosed combustible weight to total combustibles in room weight

Figure 2A Frequency Distribution of Room Fire Load - Private Office Buildings

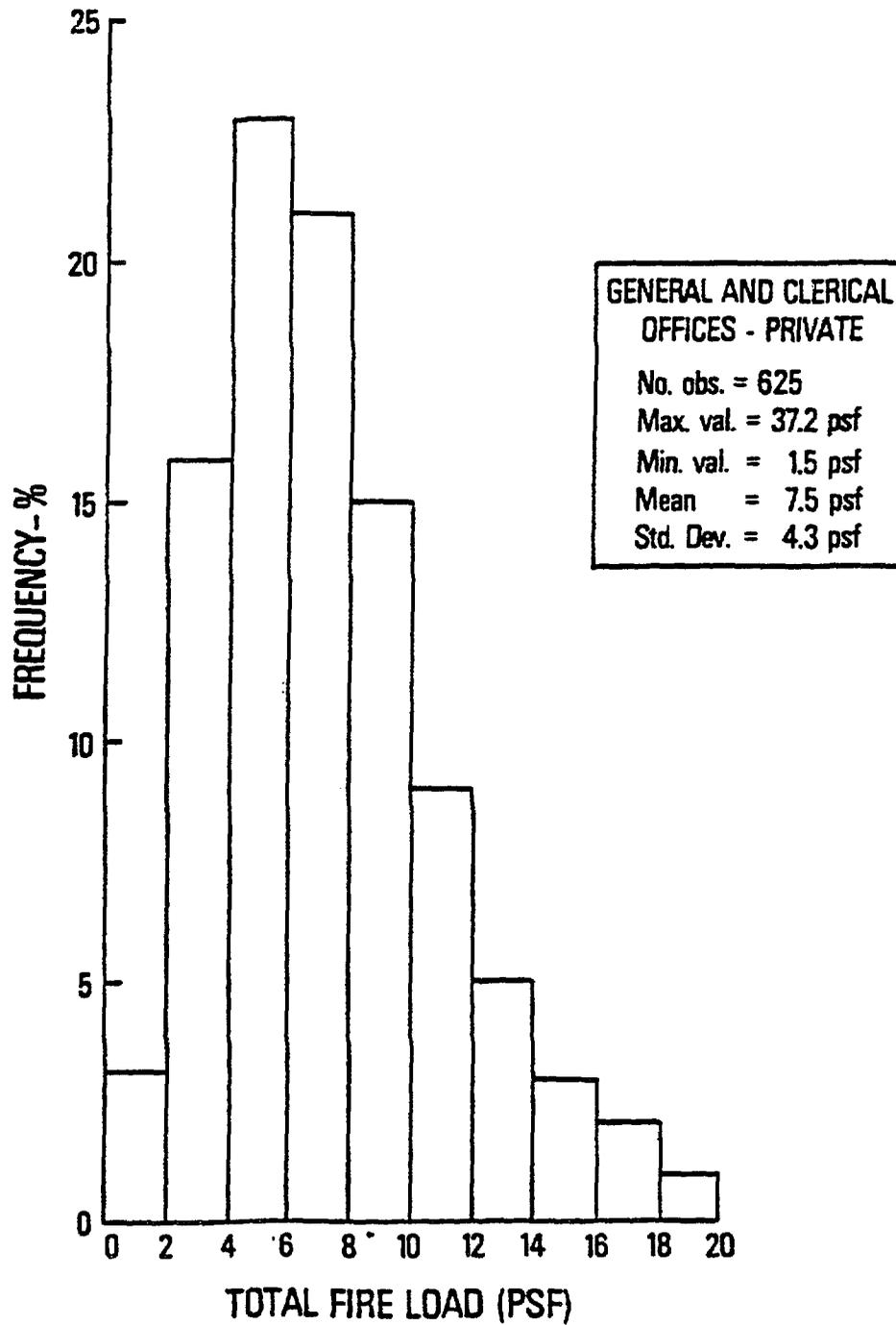


Figure 2B Frequency Distribution of Room Fire Load - Government Office Buildings

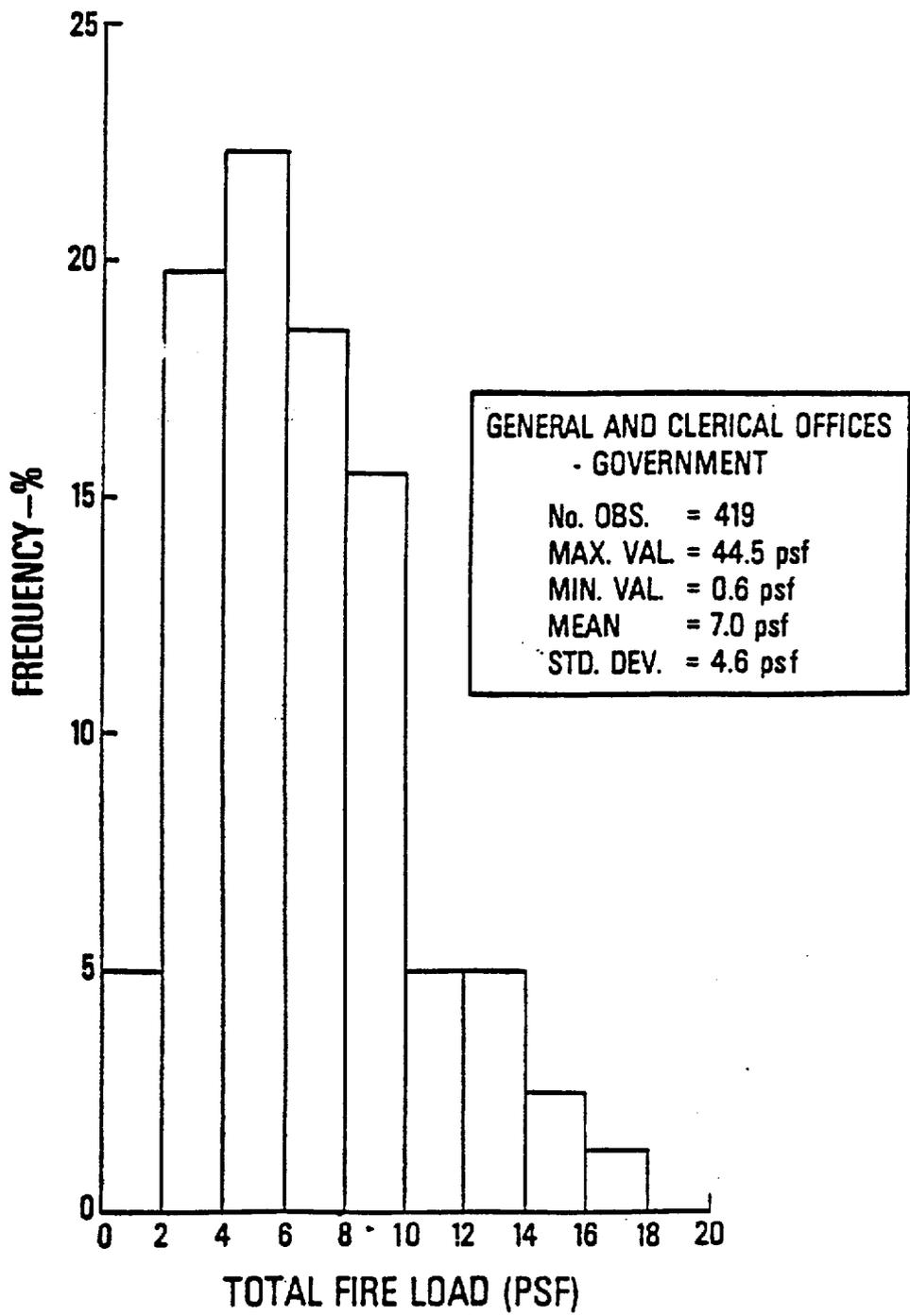


Figure 3 Movable Fuel Load of Office Items in Their Operational Layout								
CATEGORIES		OFFICES						
=====		=====						
		UM	UM			Total	Average	
		Chesapk	Engr	GSA 1	GSA 2	Fuel load	Fuel load	% of total
						lbs	(lbs/sqft)	Load
<b>Papers/Books</b>								
Open(lbs)		377	985	201	154	1717	<b>5.98</b>	40.9%
Enclosed(lbs)		88	524	201	211	1025	<b>3.57</b>	24.4%
<b>Computer Equip(lbs)</b>								
		62	115	79	76	332	<b>1.16</b>	7.9%
<b>Furniture(lbs)</b>								
		45	46	23	23	136	<b>0.47</b>	3.2%
<b>Partitions (lbs)</b>								
		272	0	407	175	854	<b>2.98</b>	20.3%
<b>Miscellaneous(lbs)</b>								
		30	71	31	6	137	<b>0.48</b>	3.3%
<b>TOTAL</b>		<b>874</b>	<b>1741</b>	<b>940</b>	<b>644</b>	<b>4200</b>	<b>14.63</b>	<b>100.0%</b>
<b>Area(square ft)</b>								
		83	118	43	43	287		
<b>Fuel load (lbs/sqft)</b>								
		10.53	14.75	21.87	14.98			
						MEAN	14.63	
						MIN	10.53	
						MAX	21.87	
						STD DEV	4.69	

Figure 4 Movable Fuel Load of Office Items Packaged for Relocation						
CATEGORIES =====	OFFICES =====		Total Fuel load lbs	Average Fuel load (lbs/sqft)	% of total Load	
	UM Armory #2105	UM Armory #2103				
Papers/Books						
Open(lbs)	315	302	617	<b>2.37</b>	18.8%	
Enclosed(lbs)	540	145	685	<b>2.63</b>	20.9%	
Computer Equip(lbs)	67	67	134	<b>0.52</b>	4.1%	
Furniture(lbs)	1215	525	1740	<b>6.69</b>	53.0%	
Partitions (lbs)	0	0	0	<b>0.00</b>	0.0%	
Miscellaneous(lbs)	63	45	108	<b>0.42</b>	3.3%	
<b>TOTAL</b>	<b>2200</b>	<b>1084</b>	<b>3284</b>	<b>12.63</b>	<b>100.0%</b>	
Area(square ft)	169	91	260			
Fuel load (lbs/sqft)	13.02	11.91	<b>12.63</b>			
			MEAN	12.63		
			MIN	11.91		
			MAX	13.02		
			STD DEV	0.78		

Figure 5 Mean Movable Fuel Load for All Offices Surveyed

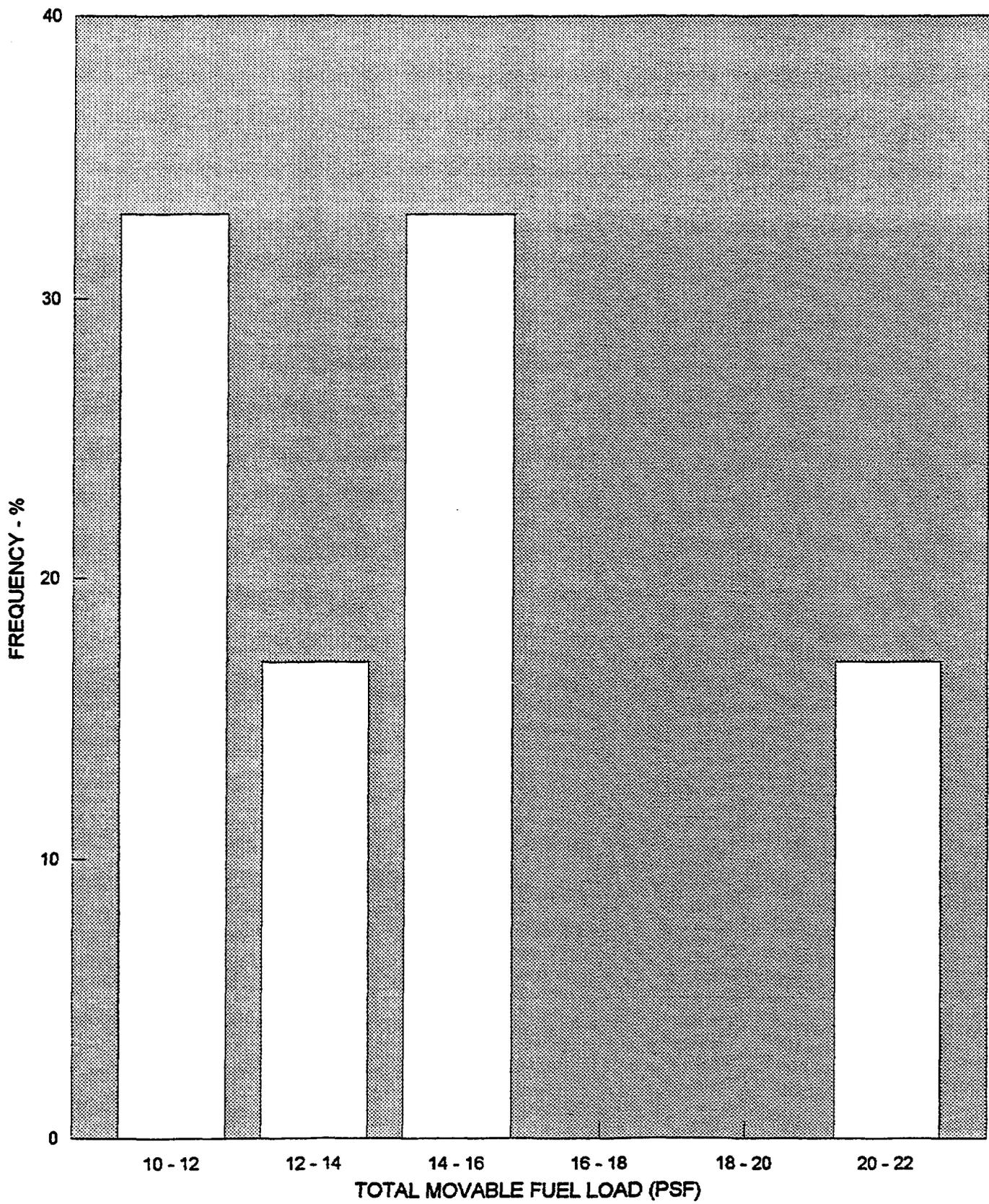
CATEGORIES	OFFICES						Total Fuel load lbs	Average Fuel load (lbs/sqft)	% of total Load
	UM Chesapk	UM Engr	UM Armory #2105	UM Armory #2103	GSA 1	GSA 2			
Papers/Books									
Open(lbs)	377	985	315	302	201	154	2334	4.27	31.2%
Enclosed(lbs)	88	524	540	145	201	211	1710	3.13	22.8%
Computer Equip(lbs)	62	115	67	67	79	76	466	0.85	6.2%
Furniture(lbs)	45	46	1215	525	23	23	1876	3.43	25.1%
Partitions (lbs)	272	0	0	0	407	175	854	1.56	11.4%
Miscellaneous(lbs)	30	71	63	45	31	6	245	0.45	3.3%
<b>TOTAL</b>	<b>874</b>	<b>1741</b>	<b>2200</b>	<b>1084</b>	<b>940</b>	<b>644</b>	<b>7484</b>	<b>13.68</b>	<b>100.0%</b>
Area(square ft)	83	118	169	91	43	43	547		
Fuel load (lbs/sqft)	10.53	14.75	13.02	11.91	21.87	14.98			
							MEAN	13.68	
							MIN	10.53	
							MAX	21.87	
							STD DEV	3.98	

Figure 6 Movable Fuel Load, University of Maryland at College Park vs GSA HEADQUARTERS							
CATEGORIES				OFFICES			
=====				=====			
	UM	Average		GSA	Average		
		Fuel load	% of total		Fuel load	% of total	
		(lbs/sqft)	Load		(lbs/sqft)	Load	
Papers/Books							
Open(lbs)	1979	4.29	33.5%	355	4.13	22.4%	
Enclosed(lbs)	1297	2.81	22.0%	412	4.79	26.0%	
Computer Equip(lbs)	311	0.67	5.3%	155	1.80	9.8%	
Furniture(lbs)	1831	3.97	31.0%	45	0.52	2.8%	
Partitions (lbs)	272	0.59	4.6%	582	6.77	36.7%	
Miscellaneous(lbs)	209	0.45	3.5%	36	0.42	2.3%	
<b>TOTAL</b>	<b>5899</b>	<b>12.80</b>	<b>100.0%</b>	<b>1584.6</b>	<b>18.43</b>	<b>100.0%</b>	
Area(square ft)	461			86			
Fuel load (lbs/sqft)	12.80			18.43			

Figure 7	Movable Fuel Load for Open Plan Offices						
<b>CATEGORIES</b>		<b>OFFICES</b>					
=====		=====					
	UM						
	Chesapk	GSA 1	GSA 2	Total	Average		
				Fuel load	Fuel load	% of total	
				lbs	(lbs/sqft)	Load	
Papers/Books							
Open(lbs)	377	201	154	732	<b>4.33</b>	29.8%	
Enclosed(lbs)	88	201	211	500	<b>2.96</b>	20.3%	
Computer Equip(lbs)	62	79	76	217	<b>1.28</b>	8.8%	
Furniture(lbs)	45	23	23	90	<b>0.53</b>	3.7%	
Partitions (lbs)	272	407	175	854	<b>5.05</b>	34.7%	
Miscellaneous(lbs)	30	31	6	66	<b>0.39</b>	2.7%	
<b>TOTAL</b>	<b>874</b>	<b>940</b>	<b>644</b>	<b>2459</b>	<b>14.55</b>	<b>100.0%</b>	
Area(square ft)	83	43	43	169			
Fuel load (lbs/sqft)	<b>10.53</b>	<b>21.87</b>	<b>14.98</b>				
				MEAN	14.55		
				MIN	10.53		
				MAX	21.87		
				STD DEV	5.71		

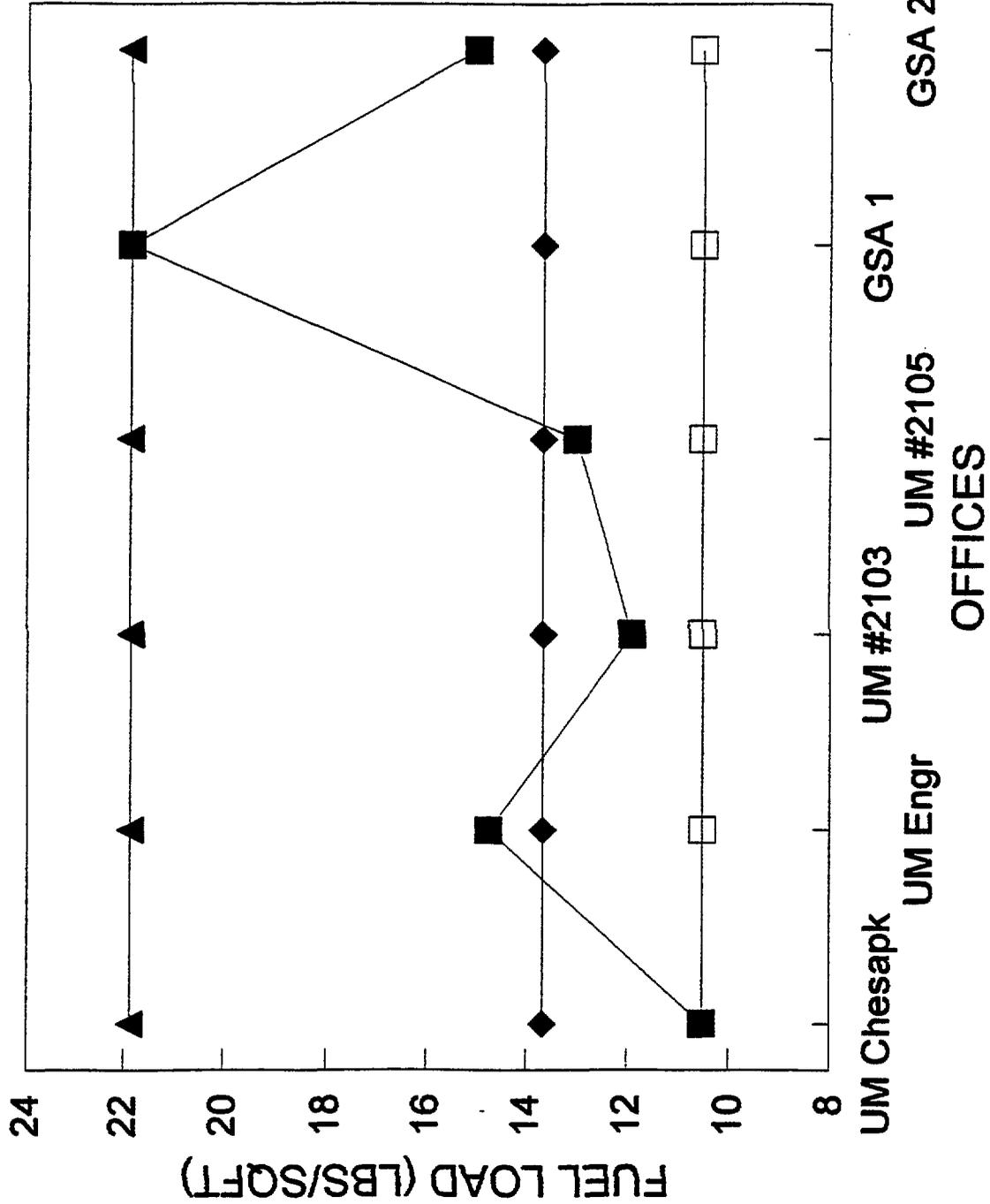
Figure 8 Movable Fuel Load for Compartmented Offices							
CATEGORIES =====	OFFICES =====			Total Fuel load lbs	Average Fuel load (lbs/sqft)	% of total Load	
	UM Engr	UM Armory #2105	UM Armory #2103				
Papers/Books							
Open(lbs)	985	315	302	1602	<b>4.24</b>	31.9%	
Enclosed(lbs)	524	540	145	1209	<b>3.20</b>	24.1%	
Computer Equip(lbs)	115	67	67	249	<b>0.66</b>	5.0%	
Furniture(lbs)	46	1215	525	1786	<b>4.72</b>	35.5%	
Partitions (lbs)	0	0	0	0	<b>0.00</b>	0.0%	
Miscellaneous(lbs)	71	63	45	179	<b>0.47</b>	3.6%	
<b>TOTAL</b>	<b>1741</b>	<b>2200</b>	<b>1084</b>	<b>5025</b>	<b>13.29</b>	<b>100.0%</b>	
Area(square ft)	118	169	91	378			
Fuel load (lbs/sqft)	<b>14.75</b>	<b>13.02</b>	<b>11.91</b>				
				MEAN	13.29		
				MIN	11.91		
				MAX	14.75		
				STD DEV	1.43		

**Figure 9 Frequency Distribution of Fuel Load - All Blags.**



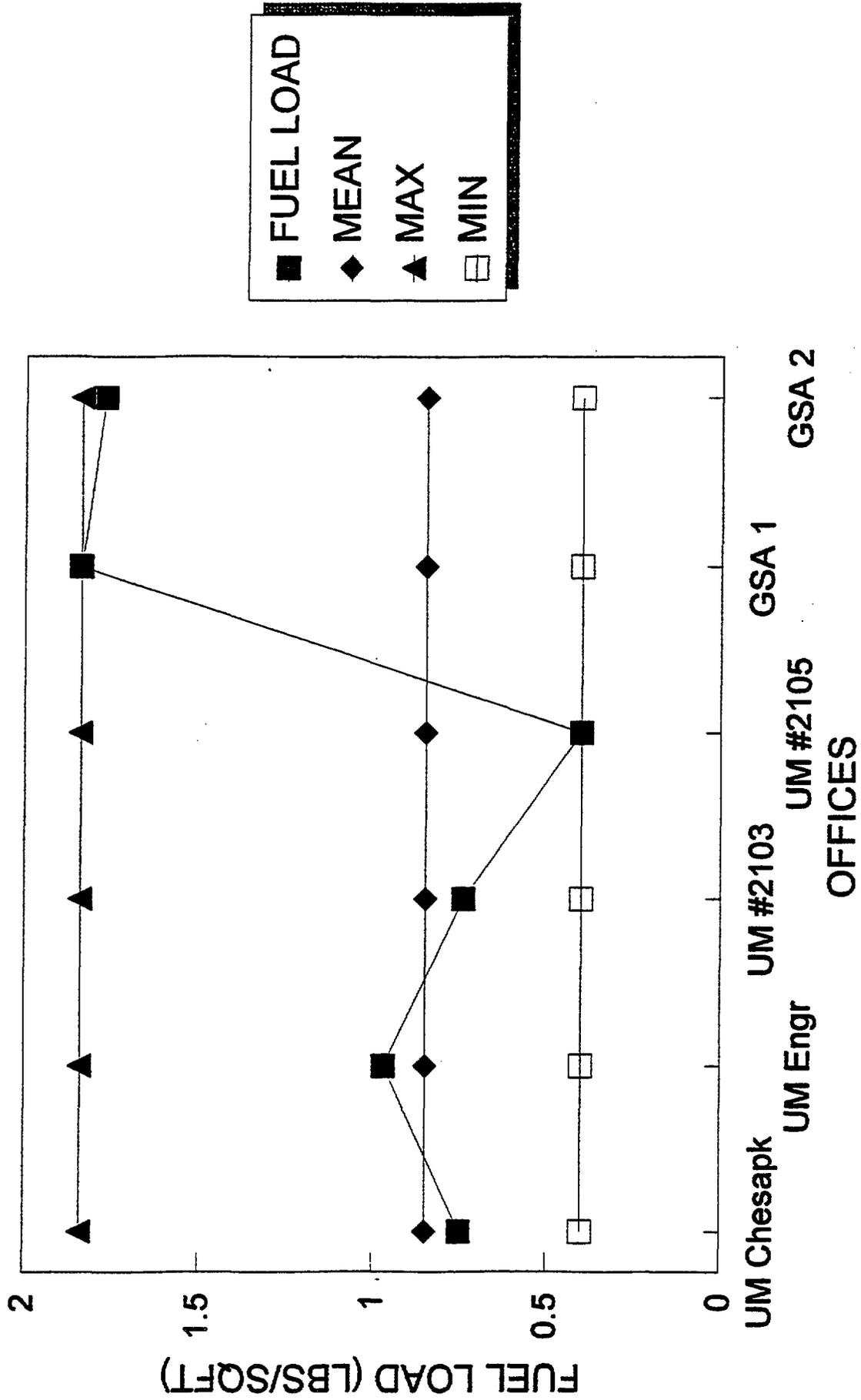
# FIGURE 10 MEAN MOVABLE FUEL LOAD

ALL BUILDINGS SURVEYED



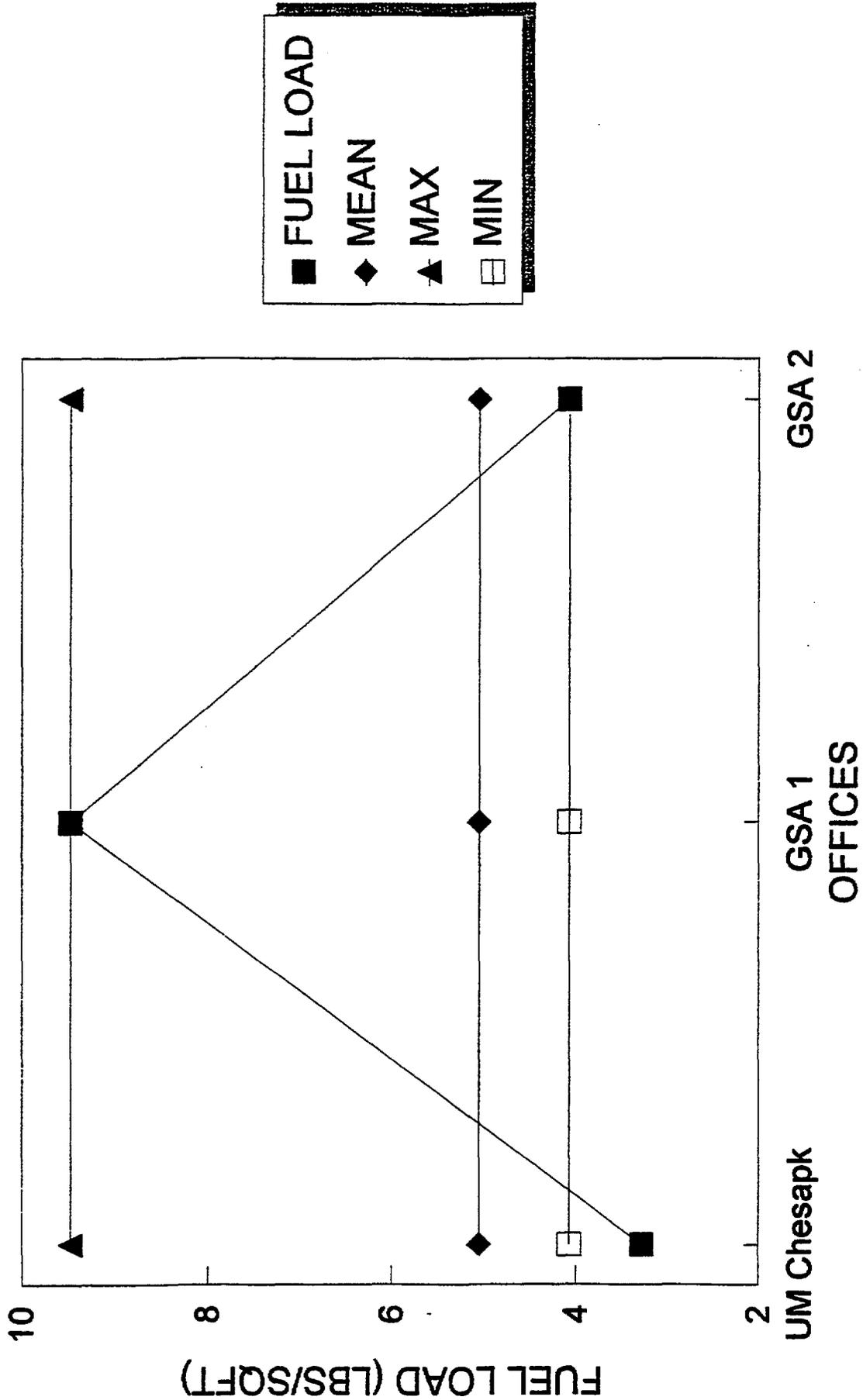
# FIGURE 11 MEAN MOVABLE FUEL LOAD

## COMPUTER ACCESSORY CONTRIBUTION



# FIGURE 12 MEAN MOVABLE FUEL LOAD

## PARTITION CONTRIBUTION



## APPENDIX A

### FUEL LOAD SUMMARIES

**Building**

General Services Administration, office #1  
General Services Administration, office #2  
UM at College Park, Engineering Building  
UM at College Park, Chesapeake Building  
UM at College Park, Armory Office #2103  
UM at College Park, Armory Office #2105

**General Services Administration #1 (Open Plan Office)**

<b><u>CATEGORY</u></b>	<b><u>FUEL LOAD</u></b> <b><u>(LBS)</u></b>	<b><u>% OF TOTAL</u></b>
Paper/Books		
Open	201.0	21.4
Enclosed (502.0 x 0.4)	200.8	21.4
Computer Equipment	78.5	8.4
Furniture ( 1 chair)	22.5	2.4
Partitions (6 panels)	407.0	43.3
Miscellaneous	<u>30.5</u>	<u>3.1</u>
<b>TOTAL</b>	<b>940.3</b>	<b>100.0</b>

**COMMENTS:**

1. The fuel load does not include the formica laminated desk top, bookshelf , or cabinets.
2. The office occupied an area of 43 square feet.

**General Services Administration #2 (Open Plan Office)**

<u>CATEGORY</u>	<u>FUEL LOAD (LBS)</u>	<u>% OF TOTAL</u>
Paper/Books		
Open	154.0	23.9
Enclosed (528.2 x 0.4)	211.3	32.8
Computer Equipment	76.0	11.8
Furniture ( 1 chair)	22.5	3.5
Partitions (2 panels)	175.0	27.2
Miscellaneous	<u>5.5</u>	<u>0.8</u>
<b>TOTAL</b>	<b>644.3</b>	<b>100.0</b>

**COMMENTS:**

1. The fuel load does not include the formica laminated desk top, bookshelf , or cabinets.
2. The office occupied an area of 43 square feet.

**UM at College Park, Engineering Building (Compartmented Office)**

<b><u>CATEGORY</u></b>	<b><u>FUEL LOAD</u></b> <b><u>(LBS)</u></b>	<b><u>% OF TOTAL</u></b>
Paper/Books		
Open	984.5	56.6
Enclosed (1311 lbs x 0.4)	524.4	30.1
Computer Equipment	115.0	6.6
Furniture (computer table)	46.0	2.6
Partitions	N/A	N/A
Miscellaneous	<u>71.0</u>	<u>4.1</u>
<b>TOTAL</b>	<b>1740.9</b>	<b>100.0</b>

**COMMENTS:**

1. The fuel load does not include the formica laminated desktop or 2 metal/fabric/ vinyl chairs.
  
2. The majority of the furniture was composed of metal, e.g. bookshelves, filing cabinets, chairs, desk. The attached inventory sheet contains weights obtained for the metal furnishings.
  
3. The office occupies an area of 118 square feet.

**UM at College Park, Chesapeake Building (Open Plan Office)**

<b><u>CATEGORY</u></b>	<b><u>FUEL LOAD (LBS)</u></b>	<b><u>% OF TOTAL</u></b>
Paper/Books		
Open	377.0	43.1
Enclosed (220 lbs x 0.4)	88.0	10.1
Computer Equipment	62.0	7.1
Furniture (2 chairs)	45.0	5.1
Partitions (4 panels)	272.0	31.2
Miscellaneous	<u>30.0</u>	<u>3.4</u>
<b>TOTAL</b>	<b><u>874.0</u></b>	<b><u>100.0</u></b>

**COMMENTS:**

1. The office is occupied by the Department of Engineering and Architectural Services.
2. 33 percent of the exposed papers/books were building blueprints.
3. The formica laminated desk top was excluded from the fuel load. It extended the length of the walls composed by the partition panels (15.5 feet).
4. The bookshelf and filing cabinet were made of metal.
5. The office occupied an area of 83 square feet.

**UM at College Park, Armory Office #2103 (Compartmented Office)**

<b><u>CATEGORY</u></b>	<b><u>FUEL LOAD (LBS)</u></b>	<b><u>% OF TOTAL</u></b>
Paper/Books		
Open	302.0	27.9
Enclosed (in wood)	145.0	13.4
Computer Equipment	67.0	6.2
Furniture (all wood)	525.0	48.4
Partitions	N/A	N/A
Miscellaneous	<u>45.0</u>	<u>4.1</u>
<b>TOTAL</b>	<b>1084.0</b>	<b>100.0</b>

**COMMENTS:**

1. All furniture was made of wood except the typewriter table (metal) and a small bookcase (metal).
  
2. The office occupied an area of 91 square feet.

UM at College Park, Armory Office #2105 (Compartmented Office)

<u>CATEGORY</u>	<u>FUEL LOAD (LBS)</u>	<u>% OF TOTAL</u>
Paper/Books		
Open	315.0	14.3
Enclosed (in wood)	540.0	24.6
Computer Equipment	67.0	3.1
Furniture (all wood)	1215.0	55.2
Partitions	N/A	N/A
Miscellaneous	<u>63.0</u>	<u>2.8</u>
<b>TOTAL</b>	<b>2200.0</b>	<b>100.0</b>

COMMENTS:

1. All furniture was made of wood except the typewriter table (metal) and 2 chairs which were composed of metal and vinyl.
2. The office occupied an area of 169 square feet.

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ABSTRACT (A 2000-CHARACTER OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, CITE IT HERE. SPELL OUT ACRONYMS ON FIRST REFERENCE.) (CONTINUE ON SEPARATE PAGE, IF NECESSARY.)  The method, used in the latest study performed in 1975, for surveying offices to determine fuel load estimates is presented. The frequency distribution for the estimates of the fuel load found in the study are presented. Two methods for determining movable fuel load are utilized in this study. Moveable fuel load is considered to be the furniture, equipment, and other items brought in for the service of the occupants after construction of the building. Direct weighing techniques are utilized in both methods. In one method, the office contents are taken from their operational location and weighed. The second method, weighs the office contents when packaged for either relocation or remodeling purposes. Two types of offices were surveyed, open plan design and the traditional compartmented layout. Current offices are composed of large open plan spaces which are subdivided into office space or workstations by partitions. Also contributing to the fuel load are desktop computers which are common accessories. Surveys were conducted in buildings at the University of Maryland College Park and at the General Services Administration (GSA) Headquarters Building in Washington, D.C. Statistical results are presented for the two survey methods, each office type and each material category. The results of the study present the impact of open plan designs on the fuel load and also present the partition and computer accessory fuel load contributions. In addition, a comparison is made for the fuel load found at the University of Maryland, College Park and that found at GSA. The fuel load estimates for each office are separated into the following categories in order to group items of similar material composition: papers/books, computer equipment, furniture, partitions, and miscellaneous.				
KEY WORDS (MAXIMUM OF 9; 28 CHARACTERS AND SPACES EACH; SEPARATE WITH SEMICOLONS; ALPHABETIC ORDER; CAPITALIZE ONLY PROPER NAMES) chairs; computers; fuel loads; furniture; interior furnishings; office buildings; office furniture; surveys				
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