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ESTIMATES OF FIRE HAZARD OF VARIOUS ROOMS IN TALL FLATS, BASED ON ANALYSES

OF FIRES IN PRE-WAR DWELLINGS

bу

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SUMMARY

A special survey of fires in dwellings in 1956 provided some data on the room of origin. Advantage was taken of this to consider the hazard of various rooms from the point of view of escape from tall flats, taking into account either known or expected changes in habits or living standards.

Fire Research Station, Boreham Wood, Herts.

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Introduction

In planning high flats which may be inaccesible to Fire Brigade ladders, it is of obvious importance to so design the layout as to minimize the risk of people being trapped by fire. For this the basic question to be answered is "What is the likelihood of a fire starting in a given room or location?" and, supplementary to this, "What is the likelihood of a person's being trapped by a particular fire?", but this is a far more complex problem and in the first instance it is probably wise to assume that every fire is likely to trap somebody.

Fortunately, there are as yet few fires in modern blocks of flats, so that an analysis of these would be of little help, but an analysis is available of fires occurring in 1956 in England and Wales in pre-war dwellings, which can serve as a useful basis for calculating the relative risks of various rooms. This can be done by examining the causes of fire in each type of room and assessing how this is likely to be affected by known or expected changes in habits or living standards.

The actual analysis of causes of fire in the various rooms is given in detail in Appendix I. As can be seen, a very large proportion (42 per cent) of the reports did not specify the room of origin. This might cause some bias, as some parts of the dwelling - the roof space for example, which is specified on the report forms - may be inherently more likely to be specified than others. The following paragraphs estimate the numbers of fires that might be expected if the 11 million or so pre-war dwellings were replaced by modern multi-storey flats. It is assumed that no new technological advance will greatly affect the fire position, but known trends are, where possible, taken into account and carried to their logical conclusion (e.g. although individual solid fuel heating is still used in some modern flats (1) this is assumed to be on its way out).

Living room

Of the 3908 fires in living rooms, 2070 were caused by solid fuel heaters. These would presumably not appear in tall flats with central heating (or underfloor heating) throughout, but there are signs (1) that central heating is not always regarded as sufficient, and supplementary heating (particularly radiant heat) may be required. At present, solid fuel heaters are about five times as likely to start fires as are electric heaters.* If we assume that each coal fire is replaced by an electric heater, the 2070 fires would be reduced to 415 (provided the degree of utilization of electric heaters remained the same as now, i.e. mainly for supplementary heating). This would be considerably higher if oil heaters were used as substitutes and rather lower if gas were used.

There has been a steady increase in the number of fires caused by radio and television sets(2), and this trend might be expected to continue till a saturation point is reached. In March 1956 there were 5.74 million T.V. licences current in the United Kingdom; by March 1959 this had increased to 9.26 million, but this still left a sizeable proportion of the 16 million or so households without one. There seems to have been a fall in the fire incidence rate for these appliances, but it is unknown how far this will continue, nor is the saturation point known. However, we can expect the number of fires to increase to, say, 500.

^{*}Estimate based on market survey figures for members at risk and on numbers of fires reported by Brigades.

There has been an increase of some 60 per cent in the number of fires caused by smoking materials between 1956 and 1960. Assuming this is evenly distributed for all rooms, this would give 794 such fires in living rooms.

Apart from this there are no obvious major changes; gas and oil lighting would disappear but these only accounted for five fires.

The likely changes can be summarized as below:

G	Number of fires					
Cause	actual 1956	future est.				
Heating Radio, television Smoking materials Other	2346 389 496 677	691 500 794 672				
TOTAL	3908	2657				

Kitchen

Solid fuel boilers would presumably disappear. They might be partly replaced by other water heaters, though possibly in a different room - bathroom or airing cupboard - but there seems to be a trend towards the provision of hot water from a central point (1). The removal of the solid fuel boiler might lead to an increase in space heaters in kitchens, so that the 408 fires caused by solid fuel appliances might be replaced by some 80 fires due to electric heaters.

On the cooking side, liquid petroleum gas and solid fuel cookers would probably disappear, but as their fire incidence rate is unknown, the effect of this is difficult to estimate. It does not seem unreasonable to assume that solid fuel cookers have an incidence rate similar to that for other solid fuel heating appliances which in turn is similar to that for electric cookers. Consequently, if solid fuel cookers are replaced by electric ones, there may be no noticeable change in the numbers of fires due to cooking. There is, however, a tendency to build flats without a gas supply (1) and this could lead to a higher proportion of electric cookers. As these tend to have a fire incidence rate some three to four times as high as gas cookers there may be rather more cooking fires (3). If one third of the gas cookers were replaced by electric ones, fires due to the former would fall to about 615 and those attributed to electric cookers would increase to about 1620.

There is also a tendency to have more gadgets in modern kitchens which may become fire hazards, but this may be outweighed by improvement in refrigerators design which appear to be making these appliances safer from the fire point of view. Smoking material fires are again assumed to increase by 60 per cent. The changes are summarized below:

Cause	Number of fires						
	actual 1956	future estimate					
Heating Cooking Smoking materials Other	514 1905 58 563	286 2828 93 563					
TOTAL	3040	3770					

Bedroom

Space-heating is again the main cause of fire in bedrooms. Again assuming that solid fuel is replaced by electric heaters it is estimated from the known rates of incidence that the number of fires caused by the latter would increase by some 75 to 300. If the central heating is effective, however, there may well be a reduction in the amount of other heating used, and thus in the number of fires.

Electric appliances seem to be very much on the increase in bedrooms. Electric blankets in particular are becoming more popular and causing more fires. In 1956 there were probably not more than $1\frac{1}{2}$ million blankets at risk in the whole country; by 1961 the number had probably trebled (4). In 1959 they caused about 200 fires per million at risk so that assuming a continuance of this rate, and market saturation when half the households have one blanket each (probably on the low side) one would expect some 1100 fires from this cause. In addition, there seems to be a growing demand for radios and even televisions in bedrooms, and this, too, could add to the number of fires.

C.	Number of fires				
Cause	actual 1956	future estimate			
Heating Electric blankets Smoking materials Other	740 178* 323 536	444 1100 517 536			
TOTAL	1777	2597			

^{*}assuming that all "Electrical Domestic appliances - other" are blankets.

Halls and stairs

From the point of view of escape these would obviously be the most dangerous fires in upper storeys, and the greatest care must be taken both to eliminate and to isolate them. There are two major causes of fire here both of which could probably be eliminated - space-heating and wire and cable. The former probably only requires effective central heating to reduce it to negligible proportions. The latter may present a greater problem, but it seems likely that a large proportion are associated with fuse boxes and distribution boards, and these could presumably be sited elsewhere.

Other rooms

Roof spaces and spaces between floor and ceiling will presumably disappear with the increasing use of flat roofs and concrete or hollow tile floors, and hence fires associated with them would also disappear. Garages would be structurally separate and therefore any fires in them would not affect escapes from flats.

Fire incidence per room

In 1951 the average dwelling consisted of slightly under five rooms, including kitchen if used for eating in (5). Assuming half the households reported eating in kitchens, this leaves $4\frac{1}{2}$ rooms to be divided between bedrooms and living rooms. Between April 1945 and December 1950 Local Authorities built predominantly three-bedroomed dwellings with an average of about 2.7 bedrooms each and it seems reasonable to assume that the average for pre-war houses was not vastly different, thus leaving an average of 1.8 living rooms. However, it seems probable that the dining room used purely as a dining room, is relatively safe, if only because of its rare usage, and that the majority of fires reported to have started in living rooms actually occurred in the sitting room/lounge/drawing room apartment. It is also likely that some of the bedrooms are either permanently unoccupied, or substantially unoccupied - used as box room, spare bedrooms etc., so that an assumption of two regularly used bedrooms per dwelling may be more accurate from the fire point of view.

From this it is possible to estimate that the respective fire risks of bedrooms, living rooms and kitchens in the hypothetical high flats would be in the ratio of 1:2:3.

Conclusions

If the assumptions made in this paper are correct, it would appear that escape from fire can be profitably taken into account in designing room layout in tall flats. The kitchen has emerged as the most likely starting point for a fire. Fortunately this is also a compartment that is fixed at the planning stage. A regularly used living room is about twice as likely to have a fire as is a bedroom, but these are usually fairly easily interchangeble and consequently pre-planning in this case may not be effective.

From the nature of the causes of the fires, it seems likely that most kitchen fires occur during the day (cooking), but comparable deductions for bedrooms and living rooms are not really possible. Living rooms and bedrooms in flats are likely to be interchangeable and pre-planning may not be ultimately effective. On the other hand, kitchens (which have been shown to have a high fire incidence rate) and bathrooms (with a low rate) are fairly permanently fixed, and their siting can be planned from the fire escape point of view.

References

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FIRES IN DWELLINGS 1956 ENGLAND AND WALES PRE-WAR HOUSES

MINIMA MA HAMAN 1753 - HAC 1000000											
Room	Kitchen	Living Room	Bedroom	Hall or Stairway	Airing Cupboard	Cavity between floor & ceiling	Roof space	Garage	Other rooms	Not stated	Total
SPACE HEATING Solid fuel: Electric Gas Oil	408 34 4 68	2070 155 18 103	371 225 42 102	66 2 1 48	12 18 - 5	11 - 1	851 31 - 58	1 - 6	180 14 3 86	4135 264 67 447	8105 743 135 924
TOTAL	514	2346	740	117	35	12	940	7	283	4913	9907
Immersion heater Other heating	- 1	-	_ 1	- 1	38 -	-	1 1	-	13 5	9 2	61 11
COOKING Liquid petroleum gas Town gas Electric Oil Solid fuel Electric kettle Cooker undefined Other	10 923 696 20 118 10 128	36 12 16 2 1	10 6 2 - 8 -	8 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1	2211	-	1 8 2	- 65 13 5 11 20 4	11 1052 731 27 145 40 133
TOTAL	1905	68	26	8	-	-	4	-	11	119	2141
LIGHTING Electric Gas Oil	- 1 2	15 2 3	21 - 11	- - 1	1	111	14 9	- - 1	2 1 5	11 3 23	64 7 55
TOTAL	3 ·	. 20	32	1	-1	-	23	1	8	37	126
OTHER DOMESTIC APPLIANCES Electric Iron Refrigerator Radio or TV Other Lead to apparatus Wire and cable	29 97 10 21 10 79	37 3 389 9 51 48	10 8 178 32 50	2 3 1 5 5 1 36	- - 3 10 17	 - - - - 43	2 - - 6 4 85	- - 3 1 3	2 - 9 7 66	78 12 51 30 58 490	160 115 459 264 178 1017
TOTAL	246	537	278	152	30	43	97	7	84.	719	2193
Gas Wash boiler Geyser Other	11 29 17	1 - 20	- 1 2	- - 4.	- - -	- -	- 4 -	-	2 16 4	3 15 . 28	17 65 75
TOTAL	57	21	3	4	-	-	4.	-	22	46	157
Oil Other MISCELLANEOUS CAUSES	3 5	-	1	1	-	-	-	-	1 13	6 5	. 10 . 25
Blowlamp Matches, children with Naked light Tapers and candles Smoking material	20 62 23 26 13 58	20 31 80 58 30 496	23 28 92 23 73 323	18 17 53 24 15 46	426266	2 1 2 1 - 1	229 5 13 7 15	1 1 2 - - 2	53 13 42 17 30 64	299 108 743 154 79 389	669 268 1056 312 261 1401
Lightning Spread from other premises	. 6	20 22	5 11	4 26	1	1 -	22 190	- 1	2 45	19 315	77 617
Malicious ignition	9.	21	12	10	-	-	2	1	5	34	94
Other	32	44	29	31	5	-	38	7	29	173	388
Unknown	54	94	77	47	13	1 .	87	8	45	397	823
GRAND TOTAL	3040	3908	1777	575	150	64	1694	38	785	8566	20597