

## **BUILDING ACT 1984 - SECTION 50(2)**

### **DETERMINATION OF COMPLIANCE WITH REQUIREMENT B1 (MEANS OF WARNING AND ESCAPE) OF PART B (FIRE SAFETY) IN SCHEDULE 1 OF THE BUILDING REGULATIONS 2000 (AS AMENDED), IN RESPECT OF THE INTERNAL LAYOUT OF FLATS ON LEVELS, 3, 4 AND 5, FORMING PART OF A RESIDENTIAL DEVELOPMENT**

#### **The proposed work and question arising**

4. The papers submitted indicate that the building work to which this determination relates comprise the conversion of an existing 19<sup>th</sup> century paper bag factory and printing works building into 100 flats. This includes the creation of a large central atrium and the addition of two floors to the top of the building. The floors are described as Level 0 (ground level) to Level 7 (top most).

5. The question arising in this case relates to the internal layout of a number of one and two bedroom flats which occur on Levels 3, 4 and 5. These flats are so arranged that one or more of the bedrooms are inner rooms, where the escape route passes through a combined living/dining kitchen room.

6. The AI believes that these layouts do not comply with Requirement B1 (Means of warning and escape) of the Building Regulations. However, you believe that the fire engineering strategy, developed by your consultants, involving the provision of sprinkler protection and a fire detection and alarm system provides the same level of safety as a flat which has been designed following prescriptive guidance. You consider, therefore, that the proposed arrangement complies with Requirement B1. It is in respect of this question that you have applied to the Secretary of State for a determination.

#### **The applicant's case**

7. You accept that your proposals in question do not comply with the recommendations given in Approved Document B (ADB) (Fire safety) as they have inner room bedrooms. However, your consultants have conducted a "Comparative Risk Assessment" which is an approach in terms of assessing the fire risk and is recognised in British Standard (BS) PD 7974-7:2003 (Application of fire safety engineering principles to the design of buildings. Probabilistic risk assessment). This assessment concluded that the proposed layouts do not adversely affect the risk to life safety of the occupants compared to a design which complies with ADB. In your view therefore, your proposals comply with the functional Requirements B1 of the Building Regulations.

8. Your consultants have pointed out that ADB has been revised recently and, in their view, has moved closer to the concepts proposed for this project. These changes include:

- removal of the need for door closers on internal doors;
- increased emphasis on the benefits of sprinklers as a compensatory measure;
- increased emphasis on the benefits of increased detection and alarm as a compensatory measure.

9. The proposed engineered approach in this case is based on the provision of:

- limited travel distances;
- provision of early warning to all occupants of the flat;
- provision of sprinkler protection;
- cooking facilities that are positioned remote from the escape route.

Your consultants have supported this approach with comparative analysis which can be summarised as follows:

### **Travel Distance**

i. In considering a code compliant 'studio' flat, the entire living accommodation is in one room and the recommended maximum travel distance from any point in the flat to the flat entrance door is 9m.

ii. Whilst the basis of the 9m maximum travel distance recommendation is unclear, the distance is considered to be reasonable for the maximum distance a person should need to travel within the room of fire origin.

iii. The main units in question are two-bedroom flats with one bedroom accessed off the kitchen/living room area. The travel distance from the furthest point in the bedroom to the protected hallway is approximately 8.5m. In theory, the wall to the bedroom could be removed and this part of the flat would then have a similar level of safety to a studio flat.

### **Early Warning**

iv. In a code compliant flat smoke alarms are provided to an LD3 standard in accordance with BS 5839-6:2004 (Code of practice for the design, installation and maintenance of fire detection and fire alarm systems in dwellings). Your consultants argue that this would result in detection only being provided in the circulation and escape routes. Typically only one detector would be provided in each flat. In studio flats, the detector is provided within the living space whilst in flats with entrance halls, the detector is fitted within the entrance hall.

v. The detection and alarm system proposed in each flat in this case will be to an LD1 standard resulting in;

- one smoke alarm in each bedroom;
- one smoke alarm in each living space;
- one heat alarm in close proximity to each cooking space.

vi. The benefit of this in terms of life safety is significant. If a conventional approach is adopted, smoke from a fire (for example, the kitchen) would have to either leak into the protected hallway or the fire would have to breach the fire rated door before smoke would be detected. The alarm would then have to be heard by the occupants through the bedroom fire doors. The benchmark is therefore of smoke in the escape route (without the cooling action of sprinklers).

vii. For the distances in this building, the majority of the evacuation period will consist of the detection and pre-movement time, with travel time being a small proportion. The greatest benefit to evacuation is therefore to reduce the pre-movement and detection times.

viii. By providing detection and alarm throughout each flat, the detection time is likely to be reduced by 15-20 minutes. This is supported by BRE report 204505 which refers to detection in the room of fire origin activating in 0.5 - 0.6 minutes, and detection in a protected route operating after approximately 15 minutes.

ix. Providing alarm sounders in the bedrooms would also further reduce pre-movement time and hence produce a significant reduction in overall evacuation time.

## **Fire Suppression**

x. In addition to the enhanced detection, the flats in question are provided with sprinkler protection throughout. Your consultants suggest that the sprinklers are estimated to activate at a heat release rate of 300—400kW after approximately 100 - 150 seconds (depending on fire growth rate). Without sprinklers, the fire could be expected to grow to 5-7MW and reach flashover.

xi. A study into the effectiveness of residential sprinklers was carried out by the BRE in 2004 (BRE report 204505); some relevant extracts from this document can be summarised as follows:

- It is estimated that sprinklers would result in a 70% reduction in the number of deaths caused by residential fires.
- With sprinklers, fire gases will be cooled sufficiently that the occupants of the room of origin would not experience extreme pain due to convected heat. This concurs with CIBSE guidance.
- Tenable conditions (apart from visibility) for egress could be maintained by sprinklers in the room of fire origin.

xii. From this, the provision of sprinklers would be likely to maintain tenable conditions for evacuating occupants. It could be considered that the provision of sprinklers would provide a more reliable safety measure than the traditional approach of relying on doors to be closed either manually or via closers. This recognition is reflected in the new ADB, which has removed the need for door closers within dwellings.

### **Separation from risk areas**

xiii. The guidance in ADB also recommends for studio flats that the kitchen should be 'remote' from the entrance door. Your consultants ask the question 'what is remote?' which is of course a contentious issue and everybody will have differing opinions. Although it is preferable if the cooking facilities are away from the flat entrance, for the purposes of this study it is considered not to be a major factor in modern flats. This is supported by the guidance in BS 5839-6:2004, which states that "over half of all dwelling fires were caused by accidents while cooking" and approximately 15% of all fire deaths result from fires that originate in kitchens". This highlights that while the kitchen is the most likely source of a fire within dwellings, where a fire occurs in this area, the occupants are generally aware of the fire as they are likely to be present in the kitchen area.

xiv. However, in order to satisfy the concerns of the AI over this issue, the alternative flat layouts in this case have been designed such that escape routes will not pass in close proximity to elements or equipment that pose a significant fire hazard.

### **The Approved Inspector's case**

10. The AI has acknowledged that there is no statutory reason that flat design should follow the guidance in ADB and that the functional requirement, ie Requirement B1 of the Building Regulations, can be met using comparative design based on sound engineering principles.

11. The AI has also acknowledged that the design principles used in this situation has a LABC National Type Approval and that many other Local Authorities and Approved Inspectors have approved this situation without question. However, they have discussed this scenario with the local Fire and Rescue Service and they are both of the opinion that this proposed layout does not comply with the recommendations within the Approved Document or BS 5588-1:1990 (Fire precautions in the design, construction and use of buildings: Code of practice for residential buildings). In support of the AI's view, they have made the following points:

## **Up-Graded Fire Detection**

- i. Under ADB a self-contained flat should be provided with a Grade D, LD3 system in accordance with BS 5839-6:2004. Upgrading this system to an LD1 standard is commendable, however the benefits in this case in their opinion is still questionable.
- ii. BS 5839-6:2004 suggests that the audibility of an LD3 system should provide at least 85db (A) at the bedroom door with the door open, and that no bedroom door should be more than 3m from the detector. This suggests that a smoke detector in the lounge would be a necessity to meet the above standard and not a compensatory feature.
- iii. The commentary in the British Standard then goes on to suggest that with the bedroom door closed, levels of 55-65db (A) are more realistic, but even with this sound pressure level there is no evidence to show that lives are being lost. The standard suggests that this is possibly because people in their own homes can be roused by an unusual sound of relatively low level. The AI concludes from this that the LD1 system may improve audibility in the bedroom, but occupants were probably going to hear the alarm anyway.
- iv. In a conventional layout, the occupants are either within the room of fire origin where it would be suspected that their senses would possibly pick up the fire condition before the automatic detection has reacted, or they are shielded from the fire by a door.
- v. The other concern with providing smoke detection in the living area is that there must be a strong possibility of false alarms in this situation, possibly leading to the occupants disabling the system.
- vi. Even with the removal of the self closing devices under the current ADB, it has to be assumed that the doors around the protected hallway will be shut. The AI accepts that a detector within a protected hallway may be slower than that of a detector within the fire room, however they believe that the amount of smoke encountered by the occupants within the protected hallway (sprinklered or not) would still be less than that encountered in a room where the fire had started.
- vii. Although occupants may be slightly delayed in pre-movement time due to the location of the smoke detector, they still only have to pass through the smoke filled hallway, they do not have to come in contact with the fire itself; the AI also believes that if the smoke detector is in the protected hallway and out of the occupied rooms, there is less chance of the detector being tampered with.
- viii. If inner bedroom situations in flats could be made acceptable just by providing enhanced detection, why under the latest review of ADB, was this suggestion not put forward by “the review committee”?

## **Sprinkler Protection:**

ix. The AI is an avid supporter of sprinkler installations and encourages developers to consider them wherever possible. However, as the BRE report 204505 suggests, sprinklers are not a panacea, especially in slow growing and shielded fires.

x. The BRE's findings were that for unsprinklered fires, the conditions in a lounge became unsurvivable, 15 to 20 minutes from ignition. In a sprinklered lounge, survivable conditions were maintained but there was little or no improvement in visibility within the room. The AI concluded that, provided the occupants are not in the same room as the fire, their survival rate in a sprinklered flat is without doubt improved. However, this does not seem to be the case where the person has to come in contact with the room on fire, as would be the position in this case with the bedroom being beyond the room of fire origin.

xi. With the provision of sprinklers, the AI's original thoughts were that it could be argued that in this case, the occupants could remain in their bedroom until rescued. However, they do not see this to be a practicable solution in a two bedroom flat, as they would suspect that anyone in this situation would feel it a necessity to reach other members of the household in the other bedroom beyond the room on fire.

## **Kitchens**

xii. The AI is still concerned with the positioning of some of the kitchens in the open living areas relative to the exit door in this case. Although the word "remote" is subjective, the accompanying diagram in ADB seems to suggest, as does the text, that escape from anywhere in the flat should be away from the risk and not towards it. They believe that in some of the cases on the proposed plans, this can be simply resolved by the introduction of full height fire rated deflection walls between the route and the cooking area.

## **The Secretary of State's consideration**

12. The Secretary of State considers that, in order to comply with Requirement B1 of the Building Regulations, the internal layout of a flat should be arranged such that the risk of a person becoming trapped by a fire in the flat is reduced to a reasonable level. This can be achieved by providing egress via a circulation space, such as a hallway, or by providing alternative exits. In this case, however, the route from a number of the bedrooms to the flat entrance door passes through the living area.

13. The Secretary of State therefore takes the view that what must be determined in this case is whether the proposed package of measures for the flats in question provides adequate means of warning and escape in accordance with Requirement B1. As stated in paragraph 9, this package includes:

- limited travel distances;

- provision of early warning to all occupants of the flat;
- provision of sprinkler protection;
- cooking facilities that are positioned remote from the escape route.

14. The Secretary of State notes that the AI considers that your proposals do not comply with Requirement B1 but her views are as follows. There are two scenarios that need to be considered. The first is a relatively slow growing fire in the living area. If the occupants of the bedroom are roused quickly by the smoke alarms, then they could be expected to enter the living room before the space becomes impassable. This is similar, arguably, to the situation that the occupants of a studio flat would encounter. Your consultants have argued that by limiting the travel distance within the living area to 9m or less the proposed flat layouts are similar to a studio style flat with a single room.

15. The second scenario is where the speed of fire growth, or the reaction time of the occupants of the bedroom, is such that the living area is impassable by the time they attempt to make their escape. Your consultants have suggested that the provision of smoke alarms in the living area and the bedrooms would reduce the potential for this scenario to occur, by detecting the fire earlier, and by providing better audibility than would be achieved by the provision of a single alarm in a hallway.

16. Your consultants suggest that activation of a smoke detector in the room of fire origin can be around 15-20 minutes earlier than in an adjacent hall. In the Secretary of State's view, whilst in many situations this may be true, it is the time delay between detection of a fire and the escape route becoming impassable that is critical in this case. The proposed arrangements, in this respect, are no better than would occur with an entrance hall. In fact, in the case of a hallway, where there is a closed door between the fire and the escape route, the time between detection and the hallway becoming impassable would be considerably greater than would occur in the room where the fire has started. The improved audibility provided by the alarms in the bedrooms may provide some additional benefit but there has been no attempt to quantify this. As such, the second scenario must be considered.

17. Your consultants have argued that tenable conditions (apart from visibility) for egress could be maintained by sprinklers in the room of fire origin and that this is evidenced by recent research. However, the Secretary of State considers that visibility on an escape route is an essential consideration if it is to be effective and thus reducing the risk of people becoming trapped by fire. The research, to which your consultants refer, indicates that visibility drops below the specified limit before, or very shortly after, the sprinklers activate and this does not improve after activation. In contrast, a protected route will stay passable for an extended period and allow the occupants to make their escape in accordance with Requirement B1.

18. Your consultants have argued that the provision of sprinklers would provide a more reliable safety measure than the traditional approach of relying on doors to be closed either manually or via closers. However, no attempt has been made by your consultants to quantify the relative merits of the two approaches in terms of reliability. The Secretary of State acknowledges that there is no guarantee that doors will always be closed but, as indicated above, when considering the issue of visibility on the escape route, the available research indicates that sprinklers would not provide any significant improvement, whereas a protected route with closed doors would.

19. In addition to the questions relating to the inner rooms, the issue of the location of cooking facilities within the living area has also arisen. Statistics tend to show that, whilst over half of all dwelling fires start in kitchens, only approximately 15% of fire deaths result from fires in kitchens. Your consultants have argued that this shows that the occupants are generally aware of the fire as they are likely to be present in the kitchen area and as such locating the kitchen away from the exit is an unnecessary provision.

20. The Secretary of State acknowledges that fire statistics suggest that the occupants of a dwelling are often awake when a fire occurs in the kitchen and that the casualty rate per fire is comparatively low. However, most existing dwellings, from which these statistics are derived, are not arranged such that cooking facilities are immediately adjacent to the only potential escape route. It should also be remembered that the statistics relate to fires which are reported to the Fire and Rescue Service and which are large enough to be likely to present an obstacle to escape. The Secretary of State takes the view, therefore, that the location of cooking facilities is a valid consideration.

21. The layouts of the flats in question vary significantly in terms of the location of the cooking facilities relative to the escape route from the sleeping accommodation. Whilst this is clearly a subjective issue, the Secretary of State considers that many of the layouts shown on the plans do not adequately address this matter.

22. Taking all these considerations into account, the Secretary of State has concluded that your proposed package of measures for the proposed flats with inner room bedrooms do not show compliance with Requirement B1 (Means of warning and escape).

### **The determination**

23. In coming to her decision, the Secretary of State has given careful consideration to the particular circumstances of this case and the arguments presented by both parties.



24. As indicated above, the Secretary of State considers that your proposals in question, as submitted, do not make appropriate provision for means of escape in case of fire. She has therefore concluded and hereby determines that the plans of your proposed building work do not comply with Requirement B1 (Means of warning and escape) in Part B (Fire Safety) of Schedule 1 to the Building Regulations 2000 (as amended).

25. You should note that the Secretary of State has no further jurisdiction in this case and that any matters that follow should be taken up with the building service provider.