

## FIRE SAFETY IN BUILDINGS

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**Abstract.** Many buildings, in many countries, throughout the world have substandard fire safety features. This discussion is restricted to hotels and hostels, which are often the only types of buildings readily accessible by visitors to a country. It attempts to explore some of the difficulties in that many building regulatory agents in some countries are not ensuring all buildings are safe from fire. It recommends that in the absence of fully safe buildings from the statutory approval process, private consortia of building owners should be initiating their own safety checklists.

*Key words:* Fire safety, non-compliance, unsafe buildings, building codes, means of escape.

### 1.0 INTRODUCTION

There are internationally recognised standards for fire safety in buildings, and the information is freely available to building engineers in any country providing they and their respective political systems will allow the free interchange of intellectual information and ideas. Despite this, there is clear evidence that many accommodation buildings are seriously lacking in safety features. The problem is believed to be more significant with those older buildings which have been refurbished and with buildings which have undergone a change of use to a hotel or hostel.

Based on the author's anecdotal evidence, there is a need for many countries to re-examine their building codes, with particular reference to changes of use of buildings, to ensure that building safety is brought up to a higher standard.

Differences between the political systems of different countries and economic disparities – distinguishing between “developed” and “developing” countries – are often cited as the reasons for the lack of fire safety in buildings. With increasing globalisation, however, and the fact that fire knows no political or economic boundaries, such excuses can no longer be accepted. Lives are constantly being lost in accommodation buildings throughout the world.

### 2.0 ALTERING BUILDINGS

Too often, alterations to buildings take place with the intention of maximising the number of occupants and with insufficient regard to ensuring that the buildings are

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safe for people to escape from in the event of a fire. In most countries there is a need for a building approval to be obtained before the work is commenced.

In the case of multi-unit homes, the building codes in most countries would require fire precaution features such as alarm systems and sprinkler systems. In New Zealand, for instance, in the event of carrying out alterations to a building under a building consent, it is a requirement that the whole building be considered in terms of how it meets the current requirements of the building code for fire egress.

### 3.0 BUILDING APPROVALS

New Zealand is one of the few countries which has a true performance-based building code. There are no mandatory ways of achieving compliance, which means that if fire safety and other code matters are justified, then building approval will be given. There are available prescriptive standards which owners may use if they wish, which ensure their obtaining a building consent. Fire safety of buildings is one of the factors taken very seriously under the legislation.

Within the New Zealand model, there are several different ways in which a territorial authority (or building certifier) can establish compliance with the building code when checking a set of plans for building consent purposes. Compliance with the requirements of the building code is established in one or more of the following ways. The approach decided on is able to be chosen by the applicant for a building consent, and must be fairly considered and assessed by the territorial authority (or certifier).

- *Acceptable Solutions* of the building code. These are based on a prescriptive approach. They may include the use of NZ Standards.
- *Verification Methods* (e.g. NZ Standards). These are called up in the building code.
- *Alternative Solutions*. Justification in support of the proposal is provided by the applicant.
- *Waivers* issued by the territorial authority (but not for access and facilities for people with disabilities and fencing of swimming pools.
- *Determinations* issued by the Building Industry Authority (BIA). When there are disputes between parties in the building process relating to building code requirements, the BIA considers the matter if one party takes that course of action. Decisions are binding on the parties, and can only be appealed on points of law in the High Court. The process has been designed to provide cheap and non-bureaucratic justice.
- *Appraisals*. These are building product and component assessments carried out by an independent and appropriately qualified organisation. The appraisal must be 100 per cent specific and be a detailed and reasoned technical opin-

ion. Appraisals are likely to be accepted by territorial authority building officers and certifiers as establishing compliance with the requirements of the building code. They need to be regarded as alternative solutions in meeting compliance with the requirements of the building code.

- *Accreditations.* An accreditation is issued by the BIA based on an appraisal. It provides guaranteed New Zealand-wide acceptance of the accredited item, as complying with specific building code clauses.

#### 4.0 ALTERATIONS, UPGRADING AND CHANGE OF USE

Each of the three items referred to in this sub-title are important as they invoke specific requirements under the New Zealand Building Act. They all require the building to be assessed as if it were a new building in relation to fire safety and means of escape. It means that even if there are alterations being carried out to a small part of a building, the territorial authority or certifier could require upgrading to the aspects of means of escape from fire in the whole of the building. That can lead to the need to install a fire alarm system in a building which did not previously have one, owing to it having been constructed before the building code was implemented. In cases like this, there is usually no need to upgrade the building, unless alterations are being carried out. It is important, however, to keep in mind that the requirement to install the alarm applies to a level as if the building were a new building.

### 5.0 FIRE PROTECTION

#### 5.1 General

Fire protection is important as it relates to injury and loss of life. Buildings in New Zealand are designed against the three major dynamic forces of earthquake, wind and fire. Considering deaths only in New Zealand, however, there is a 20-fold danger from fire compared with the earthquake risk, and the danger from wind causing house collapses in relation to lateral bracing has yet to register as a significant risk (Walls, 1994). There is a loss of life in house fires almost every week in New Zealand, and this takes no account of the much larger numbers injured in these disasters. For this reason, more effort than in the past needs to be invested in providing buildings which are safer from fire. But unfortunately, a significant factor in this is the one of human error and intent, such as with arson.

While in many countries smoke alarms may not be required by law in single unit dwellings, they do save lives. The main fire protection aspects of concern under the New Zealand Building Act are ensuring that occupants can escape without loss of life or injury, and the protection of other property. The Act is not so concerned with the commercial ramifications of protection of the subject property.

Fire protection with respect to adjacent properties should be considered important when an apartment block has several different owners.

## 5.2 The Fire Safety and Evacuation of Buildings Regulations 1992

These New Zealand Regulations were introduced in order to deal with the essential requirement of occupants escaping quickly, and so this matter keeps pace with the changes brought about by the Building Act and other similar legislation. The objective of the Regulations is to ensure the safe and expeditious evacuation of all building occupants.

It is important that all building occupants know how to escape quickly, and that they are not restricted from doing so. This could happen with locked doors, obstacles in their path of travel, or smoke-filled escape routes. All occupants need to diligently monitor those aspects of their building from day to day. More, importantly, smoke-stop doors must not be wedged open. This is a major factor contributing to loss of life in many building fires.

It is important that for multi-unit dwelling buildings accommodating more than about five persons, an evacuation procedure is put in place. This procedure should include:

- expeditious evacuation in the event of fire
- awareness by all building occupants
- fire exits clearly indicated

The Fire Service plays a major role in educating people and influencing safe use of buildings in New Zealand. As part of its role in working with building owners to develop evacuation plans, it is in a position to act against those who, for instance, store rubbish in egress routes or leave smoke-stop doors open. It must, however, carry out its role from an education point of view, so that occupants can be encouraged to deal with fire safety housekeeping themselves and understand the importance of doing so.

## 5.3 Controlling Spread of Fire

Apart from installing a sprinkler system, one method of controlling the spread of fire is to separate different parts of a building into fire cells. The outer walls of each fire cell have fire-rated materials to inhibit the spread of fire from one cell to another. Doors leading from those fire cells are usually smoke-stop doors which must remain closed at all times. They should be labelled as such to assist the occupants, and have automatic self-closing mechanisms to ensure they are always kept closed. The most common breach of these requirements and – one which poses an extreme threat to the occupants – is when these doors are wedged open. It is a vital requirement that

all smoke-stop doors from separate fire cells leading into the sole escape routes are kept closed at all times.

It is self-evident too, that items stored in escape routes are potential fuel for a fire, as well as potentially obstructing escape. It takes only one negligent action along these lines to put at risk the lives of all the occupants of a building.

#### 5.4 Characteristics of Smoke Travel

Smoke, the by-product of combustion, is hot buoyant air containing the particles of incomplete combustion. It will rise and spread through all openings in its path. Its density depends on the type of fire, but it usually contains enough toxic products to be a danger to life. Victims usually succumb to smoke before the actual heat of the fire reaches them. Despite its portrayal in the movies, smoke is usually black and visibility is poor. This seriously impedes safe escape.

For people trying to escape from a fire, it is poor visibility that makes smoke production an important feature of fire response and its consequent effect on fire safety. The easiest way to reduce the effects and dangers of fire are to use self-closing doors not left open with wedges.

#### 6.0 COMPLIANCE SCHEDULES AND WARRANTS OF FITNESS

In the New Zealand model compliance schedules are relevant with of multi-unit buildings which have such features as fire alarms and emergency lighting. They also apply to commercial and industrial buildings which contain the specific features. Since most deaths and injuries caused by fires in buildings are from residential buildings, however, it is extremely important that the building Warrant of Fitness (WOF) requirements are adhered to.

There are important installations and features in many buildings that require regular pre-emptive maintenance to ensure they operate as they should. They include fire alarms, sprinklers, and escape routes. The New Zealand Building Act requires that if such features are contained in a building, the building must be covered under a compliance schedule and future WOFs. The features include:

- automatic sprinkler systems or other systems of automatic fire protection
- automatic doors, which form part of a fire wall, and which are designed to close shut and remain shut on an alarm of fire
- emergency warning systems for fire or other dangers
- emergency lighting systems
- escape route pressurisation
- riser mains for fire service use
- any automatic back-flow preventer connected to a potable water supply
- lifts, escalators, etc.

- mechanical ventilation or air conditioning serving all or a major part of the building

The compliance schedule allows for the building or complex of buildings to be registered. The building's manager then needs to set in place a formal programme of regular inspections and maintenance, based on requirements of the New Zealand Building Code. For this, they need to engage an *independent qualified person* (IQP) to carry out much of the work. Such persons are private sector inspectors.

At the commencement of this procedure, building managers will receive back from the territorial authority two documents: a compliance schedule and a statement of fitness. They must display the latter in a public place in the building, while the former is kept in a pre-determined place (usually in the subject building) along with the maintenance reports generated by the IQPs.

The type and frequency of inspections are based on building code requirements. This information can be obtained from IQPs, territorial authority offices or building consultants/engineers. Having followed the inspection and maintenance requirements for the first year, the building owner or his or her representative must then issue the territorial authority with a building warrant of fitness. It should be noted here that it is the responsibility of building owners to issue the WOF to the territorial authority, not the other way around (as what might be expected).

The WOF, in effect, is a declaration that all the inspection and maintenance requirements have been carried out in the preceding year. A copy of the WOF is to take the place of the statement of fitness in a public place in the building. This process is kept up, with a WOF being issued to the territorial authority on each anniversary of the issue of the compliance schedule, ensuring that the required inspections and maintenance procedures are kept up.

In this way, all those using the building can be best assured of its safety. The procedure also formalises the processes on a uniform approach, and leaves the responsibility of maintenance with building owners. The New Zealand Building Act provides for large fines for breaches of any of the requirements, including the falsifying of maintenance records or the WOF.

## 7.0 RECOMMENDED COMPLIANCE MODEL

It is the author's view that there are many (significant) buildings in many countries that have been constructed or altered without the appropriate local approvals. Most major earthquakes and (large) fire catastrophes are testimony to this. In 1999, there was a major earthquake about the Marmara Sea in Turkey, where there was huge loss of life in illegally constructed buildings up to 12 storeys high (Sharpe *et al.*, 2000). There have been many other similar recent examples in other countries. There is a greater (frequency of) loss of life in buildings as a result of fires. Many of

those events relate to illegal buildings or a fundamental disregard to the need for appropriate fire precaution and means of escape measures in the buildings. Until some of the countries concerned start addressing the problems at a national level, severe loss of life in buildings will continue. With increasing globalisation, and international trade and travel, there is an increasing need to initiate international standards (using current knowledge) towards building safety. Increasingly, hotels and hostels are becoming part of networks with international affiliations. Such organisations need to initiate their own minimum safety standards as a pre-qualification before a given hotel or hostel is allowed to be part of the network. Such measures can be rudimentary, but would still lead to a higher level of safety than at present. An example of such an approach is given in Appendix 1.

## 8.0 CONCLUSION

Fire in buildings is taking too many lives. The major cause is that buildings often do not have the required fire safety features and adequate means of escape. In such cases, current fire engineering knowledge and standards are being disregarded. With increasing globalisation and international travel, those people from countries where building codes are better adhered to will increasingly demand safer buildings. Local people who are often living in a dangerous building need to be made more aware of the potential danger to their lives. Increasingly, a higher level of safety compliance will be expected by a greater number of people.

Until there are changes initiated at national and local government level in the countries concerned, international consortia who operate and franchise hotels and hostels in unsafe buildings need to adopt their own voluntary higher standards from a moral, (potentially) legal, and commercial point of view.

## REFERENCES

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**Appendix 1****Draft****ABC INTERNATIONAL HOTEL GROUP*****Hotel Safety Checklist***

<b><i>Hotel name</i></b>	Come On Inn
<b><i>Address</i></b>	
<b><i>Region</i></b>	
<b><i>Country</i></b>	New Zealand
<b><i>Building approval/ conversion verification (Yes/No)</i></b>	No
<b><i>Controlling authority cited</i></b>	XXX District Council under Building Industry Authority
<b><i>Building code or authority cited</i></b>	No known records. Complies with Building Act 1991 as an existing old building.
<b><i>Type of document used as verification</i></b>	<i>(Please attach)</i> Consultant's verification
<b><i>Other verification of safety</i></b>	<i>(Please attach)</i> Report from Building Code Consultants Ltd, Box 99 613, Newmarket, Auckland, New Zealand. Phone +64 9 524 9064, Fax +64 9 524 9065, E-mail: bccl@netgate.co.nz
<b><i>Existing safety features being maintained</i></b>	<i>(Type of proof)</i> No features. Not required
<b><i>Date inspected</i></b>	
<b><i>Inspected by</i></b>	<i>(Name)</i> <i>(Signature)</i>
<b><i>Approved by</i></b>	<i>(Name)</i> <i>(Signature)</i>
<b><i>Date approved</i></b>	