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Canadian Commission on Building and Fire Codes

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***Guidelines for Application of Part 3  
of the National Building Code of  
Canada to Existing Buildings***



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Canada

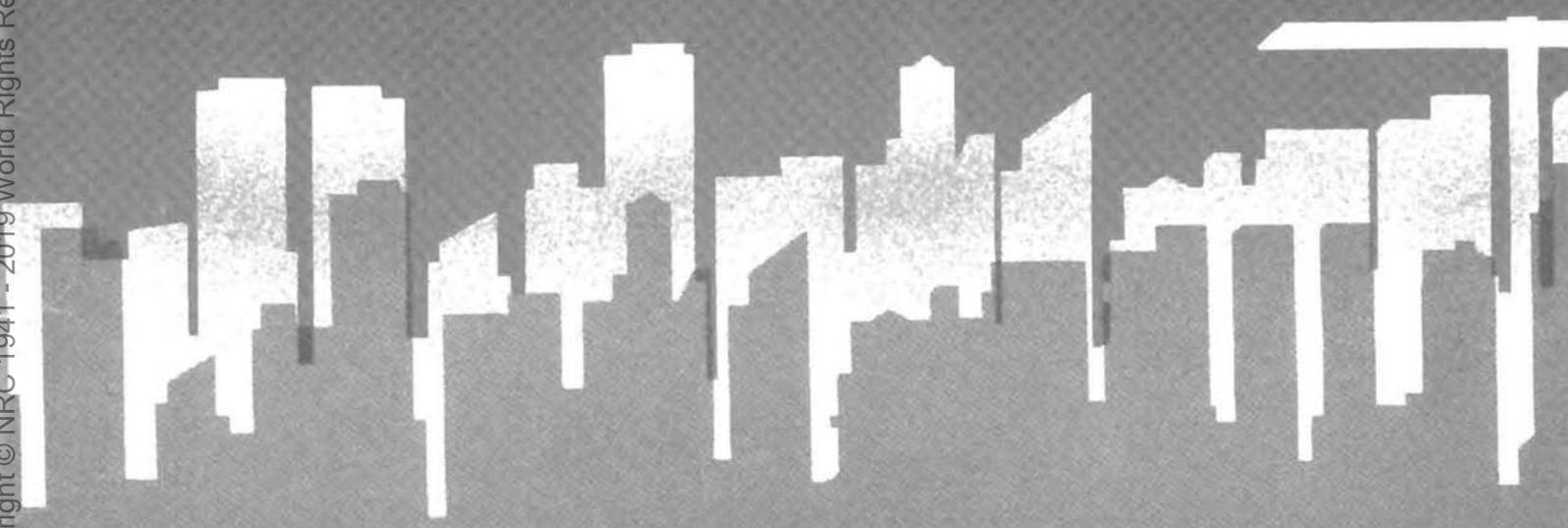


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# **Guidelines for Application of Part 3 of the National Building Code of Canada to Existing Buildings**

**Issued by the  
Canadian Commission on Building and Fire Codes  
National Research Council of Canada**

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### **Preface**

The National Building Code of Canada (NBC), since its first issue in 1941, has contained model building requirements that were developed to provide a minimum level of safety for the occupants of a building. Although the requirements are primarily drafted for new buildings, they should also be applied to existing buildings which are undergoing change of occupancy, reconstruction, or rehabilitation.

The Canadian Commission on Building and Fire Codes (CCBFC) does not consider it appropriate to publish two different codes, one for new buildings and one for existing buildings, because this could imply permission to have substantially different levels of safety between new and existing buildings. To resolve questions concerning the method of applying the National Building Code of Canada to existing buildings, the Canadian Commission on Building and Fire Codes has decided to publish guidelines on the intent of the requirements of the National Building Code of Canada and how those requirements might be applied to existing buildings.

The guidelines do not identify situations in which they will be applied. The Canadian Commission on Building and Fire Codes feels that it is an administrative function of the authority having jurisdiction to determine appropriate situations in which the guidelines would be used.

Some situations in which the guidelines might be applied by the authority having jurisdiction include:

- A change in occupancy in which the occupant load is increased;
- A change of occupancy in which the fire load is increased;
- Reconstruction of a building that has been damaged by fire, by natural causes or other incidents;
- Renovation and restoration of a building with historic value; and
- Upgrading of a building.

In situations where only minor changes are being made, the guidelines would not be applied. There would be few cases where such a substantial change was required to a building that all of the guidelines would be applied. In the latter situation, full compliance with the current building code might be considered more appropriate.

An authority having jurisdiction will have to determine the degree of change that is permitted before requiring special measures to meet performance expectations of specific requirements in the current building code. The judicious application of these guidelines will enable both the designer and the authority having jurisdiction to evaluate deficiencies in an existing building and determine practicable remedial measures to produce an appropriate level of safety.

This set of guidelines applies to buildings regulated by the requirements in Part 3. In the future, guidelines will be available on other Parts of the National Building Code.

Comments on the use of this first edition of the Guidelines for Application of Part 3 and suggestions for its improvement are welcomed and should be submitted to the Secretary, Canadian Commission on Building and Fire Codes, National Research Council of Canada, Ottawa, Ontario, K1A 0R6.

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## ***Existing Buildings***

# Introduction

## General

In the context of these guidelines, satisfactory application of Part 3 of the National Building Code of Canada to an existing building is understood to involve the achievement or maintenance of an appropriate level of performance based on the intent of current NBC requirements. An equivalent to any requirement of the NBC is considered to have been achieved if the level of safety provided is identical to that which would have been achieved if the requirement of the Code had been met. An appropriate level of performance is considered to be achieved if the level of safety in an existing building is adequate to ensure the safety of the occupants if they are exposed to a hazardous situation. Under these circumstances, some requirements affecting property safety and items that do not directly affect the occupants may not meet the standards intended by the National Building Code.

It is assumed that the requirements of Part 3 will be interpreted and enforced by reasonable people using good judgment. This fact is especially important in the application to an existing building when owners and tenants are faced with situations which may not be specifically covered in the National Building Code, or in which alternative design solutions are proposed that could not have been envisaged by the committees responsible for the original requirements.

Many of these judgments are difficult to make because there is often insufficient factual knowledge to equate the relative safety of one set of conditions to another set. In the evaluation of any major project or unusual building, situations arise in which judgments must be made, because the National Building Code can never cover all possible situations. The NBC is constantly under review and is revised as experience is gained from its use and additional knowledge is gained through research.

A building constructed to a previous edition of the

National Building Code could be deficient to some extent in comparison with the latest edition.

Assuming the existing building fully met the requirements in force at the time of construction and there are no evident problems or lack of attention to basic life safety, in most cases it would be difficult to justify extensive work merely to comply with all the requirements of the current National Building Code. The tables on pages 40 to 51 provide an overview of requirements in the current National Building Code and identify some requirements that will add little to the overall life safety performance of an existing building. It should not be necessary to make changes to meet those requirements, except where an item under consideration is itself being renovated or changed and it would be reasonable under those circumstances that the item comply with the current Code.

In the design and construction of a new building all requirements of the National Building Code must be complied with, either directly or by the incorporation of other measures that provide an equivalent performance level. In the case of an existing building, the degree of compliance with a current edition of the National Building Code will vary markedly, depending on the age of the building and the editions of the NBC or other local legislation that were applied at the time of construction or during subsequent alterations. Where substantial changes have been made in applicable building codes over the life of the building, it will be extremely difficult, and in some cases impossible, to meet current building code requirements. In these situations, compensatory measures should be applied, if necessary, to ensure that an appropriate level of safety is achieved.

In the case of life safety, the performance intended by the current code should be achieved as closely as possible. In the case of property protection, judgment will have to be exercised through economic studies to determine the cost benefits that can be achieved through changes to the building. Where the basic structural frame would have to be

## Existing Buildings

replaced or bearing walls and shafts would have to be relocated in order to improve egress widths, it would be normally uneconomical to make these changes. It may be necessary to limit occupant loads or use other compensatory safety features in lieu of structural changes.

### Assumptions

A number of assumptions that were used to develop these guidelines should be considered in reviewing an existing building and assessing the need for changes. These include:

- Building occupants should not be assumed to be capable of fighting a fire through the use of portable extinguishers and standpipe and hose systems. They are expected to rely on trained fire fighters to undertake these operations.
- Once the safety of all building occupants has been secured, then the life safety intent of the National Building Code has been met.
- Fire alarm and detection systems provide building occupants with an awareness that an emergency situation may exist and that an appropriate response by them may be necessary.
- If safe egress routes are established in a building, such that all occupants have sufficient time to evacuate in safety, then the intent of the National Building Code with respect to the safety of the occupants has been met.
- A fire can start in any space in a building.
- A fire can start in an area of a building adjacent to occupants.
- In a two storey building where the occupants are awake and fully ambulatory, the impact on life safety of structural fire protection is not significant, provided that other features including the number of exits, the travel distance to exits, and similar means of egress facilities are taken into consideration.
- For a building that is between three and six storeys high, and for a lower building used for residential and institutional purposes, a minimum level of structural fire protection is

required to assure life safety.

- For a building over six storeys in height, a higher level of structural fire protection is needed to provide for the integrity of refuge areas and means of egress.
- The performance of an effectively maintained and operational automatic fire extinguishing system in an existing building will be as effective as the performance of an automatic fire extinguishing system in a new building and therefore the benefits that accrue in a new building from the installation of an automatic fire extinguishing system should apply equally in an existing building.

### Key elements

Some key elements to be considered during application of Part 3 of the National Building Code to an existing building are:

- The general safety of occupants using the building.

The focus should be on the immediate safety of persons using the building under ordinary conditions on a day-to-day basis.

The purpose of the general requirements is to prevent accidents and injury by attention to the design of ramps, stairs, handrails, guards, garage ventilation and medical gas piping systems.

The philosophy should be to review all aspects of an existing building and determine if there have been problems that need to be resolved. Usually these items would have been improved through regular maintenance programs or in response to known incidents. If maintenance and other corrective action has not been carried out effectively then substantial work may have to be done to provide an acceptable level of safety for the occupants.

General safety items that have been in service for a number of years without

causing problems would not normally have to be altered.

- The occupants' knowledge of the presence of fire.

Except in an open floor building where occupants can become aware of a fire through visibility of flame and smoke or the smell of products of combustion, the only reliable means of alerting occupants to a fire is by means of a fire detection and alarm system, supplemented in a high building by a voice communication system. Although the classification of a building and the occupant load are used by the National Building Code to determine the need for a fire detection and alarm system, they do not always reflect the actual risk in a building. An increased risk resulting from changes in fire load or changes in the occupant load would usually be determined as a result of an inspection while the building is in use.

In order to evacuate safely, building occupants must be made aware of a fire danger. Therefore it is especially important that a fire alarm system be present in any building in which it would be required by the current code. If an existing fire alarm system does not meet all aspects of current codes and standards, its performance should be evaluated. If it is capable of detecting fires and sounding for a sufficient time for all occupants to be alerted to the need to evacuate the building, then the intent of the National Building Code has been met.

- The occupants' ability to move in a safe and orderly manner to a safe location from a part of the building involved in fire.

The ability to evacuate a building in an emergency is the key element relating to life safety. The movement of the occupants is constrained by travel distance, geometry of corridors, passageways, stairs, ramps and doorways, the location of exits, the protection of egress routes from

contamination by products of combustion or direct involvement in the fire, the interior finish of walls and ceilings, the presence of exit signs and emergency lighting, and automatic fire suppression.

In an existing building the means of egress must be protected for sufficient time to assure safe evacuation of building occupants. Time is usually the critical factor. In order to safely evacuate the building a path must be available to any occupant within which the environmental conditions resulting from a fire are not severe enough to prevent the occupant from proceeding along this path to a place of safety.

- The control of fire in the building by elements of its construction.

The primary requirements involved in the control of the spread of fire are those pertaining to fire separations, closures (including self closing and latching devices), temperature rise limits on closures, fire stopping, fire suppression, the type of construction of the basic building frame, interconnected floor space, ventilation of fire or explosion hazards, and service facilities in or under exits.

It is important to control the growth of a fire at the earliest stage possible to prevent it from impeding the egress of persons using paths leading to places of safety and also to limit the amount of damage caused by the fire. Methods of control include containment, fire suppression, and limiting the fire load.

Containment of a fire and its products within a compartment is important so that conditions in other parts of the building do not become untenable during the time that is required for safe evacuation. In the case of an existing building, where the assemblies surrounding a fire compartment are not easily changed, it may not be feasible to improve containment. Options are to add

fire suppression measures or limit the fire load.

- The protection of property from the effects of fire.

The requirements involved in property protection pertain to construction type, fire stopping, firewalls, subdivision of concealed spaces, automatic fire suppression, spatial separation of buildings, fire fighting access, standpipe and hose systems, fire protection of electrical conductors serving emergency equipment and fire alarm systems, interconnected floor space, and fire compartmentation in general. Some of these requirements will also affect life safety during the early stages of a fire and, during the period that occupants are in the building, their effectiveness should not be compromised.

Property safety is primarily the domain of the individual owner. However many buildings are owned and operated through the community, including civic buildings and schools. The owner, corporate or otherwise, can undertake a property risk analysis, the results of which should be discussed between the owner and his insurer. The decision to protect, conserve and consequently minimize the risk to property and future operation is made at the discretion of the owner. It is assumed that once a building can be safely vacated and has been found not to be hazardous to adjacent buildings, all further protection would be the primary domain of the owner.

## Fire Safety

### Life safety

In an existing building those requirements that directly impact on life safety should not be compromised. In the case of fire, these requirements include adequate means of alerting occupants by means of smoke alarms and fire alarm systems; adequate widths for and design of means of egress; and their protection from fire and smoke contamination. Compartmentation of a building helps to prevent the spread of fire to other areas of a building and thus provides additional time for evacuation.

Life safety does not single out fire effects as the sole concern in building design because the design has to provide for safety of the occupants at all times. Other aspects of life safety include stair geometry, handrail and guard design for stairs, ramps, landings and balconies, and limiting overcrowding in places of assembly.

Spread of disease through lack of adequate sanitary facilities is of concern, as are obstacles to movement that could lead to falls.

Aspects of life safety that involve freedom from electrical shocks, adequate ventilation, structural sufficiency and similar concerns are also important but are not regulated by Part 3 of the National Building Code. They are addressed in other parts of the NBC or in referenced standards.

### Property protection

Although property protection is one of the factors that was used in assessing the requirements of the National Building Code, its consideration in an existing building has to be viewed in the light of the intrinsic value in the building itself, as well as the effect on neighbouring buildings if a collapse were to occur. It is assumed that where property protection is directly related to life safety, there will be no variation or reduction in property protection that would reduce life safety.

## **Automatic sprinkler system protection benefits**

Automatic sprinkler systems are often selected as a means of improving safety in an existing building that does not meet an appropriate level of safety when measured against current requirements for a new building of the same characteristics. The following review will assist a person who is intending to install an automatic sprinkler system as a means of improving safety.

It is important to control the growth of a fire at the earliest possible stage, to prevent it from impeding persons using routes leading to places of safety and, in addition, to limit the extent of damage resulting from the fire. Of the three principal methods of controlling a fire, containment, suppression and fire load limits, fire separations that are built fully in accordance with the National Building Code, and form continuous boundaries of a fire compartment, with no gaps or unprotected openings, offer a reliable method of controlling the spread of fire. Automatic sprinkler systems that have been properly maintained and sized for the fire load have good records of success, even though tempered with the possibility of interference to the system or loss of water supply as a result of external circumstances. Limiting the fire load is considered the least reliable method of controlling a fire.

Successful incidents involving suppression of fires have most frequently occurred with full sprinkler systems. In several cases where a partial sprinkler system was installed to address a local hazard, a fire has spread from non sprinklered areas and overwhelmed the sprinkler system, leading to substantial loss of life and property.

If a sprinkler system is proposed to remedy an existing problem, the designer and the authority having jurisdiction should make a careful assessment of the benefits to be achieved from the sprinkler system. The use of partial sprinkler systems has to be carefully assessed. Where a local hazard is to be minimized, the partial sprinkler

system should extend sufficiently beyond the area with the local hazard to prevent fire from spreading into that area, as well as to control a fire starting in the local hazard area. If property protection is of concern, a full sprinkler system should be installed and not a partial system.

The installation of a sprinkler system permits a reduction in the fire-resistance rating required for certain fire separations. In some cases it permits a larger building of the same construction type. In other cases, it permits a reduction in the rating of a fire separation between two parts of a building. A deficiency of up to one hour in fire-resistance rating for load-bearing structural elements could be compensated for by the installation of a full automatic sprinkler system and fire-resistance ratings could be waived for non-loadbearing partitions within a floor area.

Existing flame-spread ratings for interior finish could be accepted in a fully sprinklered building and the travel distance to an exit in a fully sprinklered existing building could be double that permitted for an unsprinklered building.

The benefits to be derived from the installation of an automatic sprinkler system to compensate for deficiencies in an existing building are predicated on the full supervision of the sprinkler system and connection of the alarm system to the local fire department, or to an independent central station, to give the earliest possible warning of an emergency and thereby minimize response time.

Other benefits of automatic sprinkler system installation in an existing building are given elsewhere in these guidelines.

### Health Safety

Health safety requirements in Part 3 are concerned with space dimensions as well as ventilation, illumination, sound control and medical gas piping systems. Standards for space dimensions, for ventilation and illumination, as well as sound control have varied with different previous editions of the National Building Code and could also vary substantially from bylaws or regulations in effect at the time the building was originally constructed. Unless the item under consideration is clearly unsuitable or could lead to an unsafe condition, complete conformity with the current edition of the National Building Code is not usually required. In the case of medical gas piping systems, which are usually found in health care facilities, it is imperative to the safety of any person who receives medical gas during a treatment procedure that there be no doubt concerning the safety of the gas. Thus there should be no compromise in assuring that medical gas piping systems comply with the latest standards.

Health safety requirements also include the provision of sanitary facilities in washrooms. Although the National Building Code prescribes certain numbers of lavatories and water closets for each occupancy, based on the occupant load of the building, much of the calculation for occupant load and the distribution of the sexes in the occupant load is hypothetical. In an existing building more complete information is usually available and the need to provide additional facilities should be tempered by experience. In many cases it is extremely difficult to add sanitary facilities in existing washrooms. This is rendered more difficult if two water closet stalls have to be combined to provide facilities for persons using wheelchairs.

### Performance Expectations

Part 3 of the National Building Code contains both performance and specification requirements; even when specification requirements are being considered, provisions are made in Part 2 of the NBC to accept equivalent materials, assemblies or designs where the authority having jurisdiction is satisfied that the overall performance of the building will not be diminished.

#### Evaluation of an existing building

The following is an example of a six step procedure that could be used to analyze one element of an existing building. Similar procedures could be developed for other requirements.

**Objective:** Assess occupant safety in relation to fire-resistance rating.

Review of fire-resistance rating from a life safety point of view.

1. Determine the number of occupants throughout the building and their distribution on each storey.
2. Establish whether there are means of alerting occupants to a fire and, if there are, determine the characteristics of the alarm system.
3. Determine that safe egress routes exist.
4. Determine the time to evacuate the building and each storey by means of actual site tests supplemented by analysis.
5. Establish minimum values of fire-resistance rating of building assemblies that protect the means of egress by applying an appropriate safety factor to the evacuation times (e.g., safety factor multiplied by maximum evacuation time would give a minimum fire-resistance rating).
6. Assess the required fire safety for each storey by addressing any special hazards in the individual rooms and areas.

## **Building Regulated by Part 3**

### **Building classification**

In the case of an existing building it is relatively easy to determine the use of each area of the building and thereby assign it to one of the occupancy categories in the National Building Code. It is also easy to consider new uses which are being proposed for the building, because they are well established at the time that decisions are being made concerning changes to the building.

Building classification influences many of the decisions that have to be made concerning the requirements of the National Building Code. In cases where the classification has changed between the time the building was constructed and the present time, decisions will have to be made concerning the applicability of the current National Building Code. Typical situations can arise when a building that could have been constructed of combustible construction under the bylaws of the municipality would now have to be of noncombustible construction to satisfy the current or proposed occupancy use. The decision to accept the existing combustible construction will involve the degree of noncompliance that arises, as well as the availability of supplemental measures to counteract life safety deficiencies.

Many building uses do not fall precisely into the categories assigned by the National Building Code and in these instances both building designer and building official will have to agree on the best possible fit.

### **Building area determination**

Building area is clearly defined in the National Building Code. In current editions it is based on metric values. In previous editions the values were in square feet. The metric values are not direct conversions of the previous values, and in most cases the rounding of the values led to increases in

allowable areas for given requirements. In the majority of cases there should be no penalties in conjunction with the changes in building area requirements. Care was taken to ensure that older buildings would not be placed into nonconformance with the edition of the National Building Code current at the time of metric conversion.

### **Firewalls**

The requirements for firewalls have not changed appreciably over the past few editions of the National Building Code, however some changes have been made regarding combustible materials crossing the ends of firewalls, and the fire stopping of firewall penetrations. As a result of incidents in which fire has spread around the ends of firewalls, thereby defeating the intent of a firewall, stringent requirements have been included to minimize the possibility of fire spreading to a building, or part of a building, on the other side of a firewall. In changes to an existing building these requirements should be strictly followed, and in most cases, should not be a major expense. Requirements for fire stopping of penetrations through firewalls have been made more rigorous to minimize the possibility of fire spreading through unprotected openings. Although it may not be possible to reconstruct a firewall to incorporate the new fire stopping materials, intumescent or other materials can be added to the sides of the firewall in the vicinity of the penetration to meet the general intent of current codes.

### **Building height measurement**

Building height measured in storeys or in metres has a profound influence on many requirements in the National Building Code. Many older buildings might have changed their building height because of changes in the definition of grade from earlier editions of the NBC. In general, the level assigned to grade has been lowered and that will have the effect of increasing the building height. In Subsection 3.2.2. it could have the effect of increasing the building height from 3 to 4 storeys and requiring a change from combustible to noncombustible construction.

## **Existing Buildings**

In Subsection 3.2.6. it could place a building into the high building category that was previously exempt from the requirements of Subsection 3.2.6.

If the change of grade definition has been the primary reason for requiring changes in the building, it would be acceptable to consider the grade definition at the time of construction for application of the Code.

If a building is to be actually increased in height by one or more storeys, thus placing it in a category requiring noncombustible construction, and the existing building is of combustible construction, there will be no simple justification for accepting an upward extension to the building. Some authorities might permit the building to be extended by one storey if the complete building is sprinklered and the gross area of the building does not exceed the value that would be permitted in the current National Building Code for a lower building with a larger building area.

## **Major Occupancies**

Major occupancies are difficult to determine with confidence for many buildings of mixed use. In the case of an existing building the mix of different uses should be fairly obvious and it should be possible to establish an overall major occupancy.

## **Combinations of major occupancies**

In a building where there are clearly differentiated use areas, it should be possible to categorize the building into two or more major occupancies. However, in many public buildings different major occupancies occupy the building at different times of the day or night. Under these circumstances the building would have to be examined as though it were entirely occupied by each of the different major occupancies.

## **Separation between major occupancies**

Fire separations between major occupancies are clearly established by the National Building Code. In the case of an existing building, a change in occupancy of a suite or unit on one side of a wall may require that the wall be modified so that it becomes a fire separation with an assigned fire-resistance rating. If no fire-resistance rating was required for the wall before the change, it would be extremely difficult to persuade the owner of a suite not involved in the change to modify that owner's side of the fire separation and disrupt operations. Although the National Building Code requires that fire protection be applied from both sides of separated suites, the only practicable solution is to increase the fire-resistance rating on the side where the change in occupancy is being undertaken to the required value for the separation, and assume that if the other suite is renovated at a later date, appropriate changes will be made at that time to the other side.

## **Prohibited combinations of major occupancies**

A number of major occupancies are prohibited from being in the same building because of the perceived threat from one to another. Normally, high and medium hazard industrial occupancies cannot share the same building as an assembly, institutional, or residential occupancy. Any existing prohibited combinations should be discouraged and every effort should be made to ensure that they are not continued in a building undergoing renovation or change of occupancy.

## **Mezzanines**

### **Effect on measurement of building height**

One of the major influences that a mezzanine has on a building is its effect on building height. A mezzanine by definition is a floor assembly that lies between the floor and the ceiling of a given storey. Provided this intermediate floor assembly does not exceed certain specified limits, it is not considered to add to the building height in storeys, even though the actual height of the storey in metres has been increased to make adequate headroom above and below the mezzanine. The area of a mezzanine is considered to be the sum of the areas of the individual portions of the mezzanine floor at a given level.

If there are mezzanines at more than one level, then the building has to be treated as if it had one or more additional storeys when determining the building height.

A number of changes have affected mezzanines over the past editions of the National Building Code. It would be prudent to review the requirements that were in place at the time that the building was constructed. Where a building contains a mezzanine, the persons most at risk are those on the upper level because smoke may rise and fill the upper level before it affects the lower level. An additional problem occurs if the persons on the upper level must evacuate through the lower level at a time when there may be a fire in that level. One of the better options for improving life safety for persons on the upper level of a mezzanine is to provide direct access to exits, which do not involve passing through the space beneath, on the same level as the mezzanine floor.

Except for very small mezzanines where enclosing walls and partitions are permitted above and below the mezzanine floor assembly, it is the intention of the National Building Code that there be no visual obstructions above the mezzanine floor or above the floor beneath it that are more than 1070 mm in

height. Because building owners are frequently unaware of the need to prevent obstructions in these areas, there will be many situations in which partitions have been built, as well as other obstructions. In the case of small buildings, it may be possible to examine the building as if it were one more storey in height and still satisfy the National Building Code. In other cases it may be necessary to remove obstructions or provide compensating measures such as fire alarm and detection systems or automatic fire suppression systems, as well as improving and separating means of egress.

### **Interconnected floor space**

The term interconnected floor space has been used in recent National Building Code editions to describe a situation where a number of floor assemblies have openings in them which are not equipped with closures. Usually the openings are vertically stacked to provide an open shaft through the centre of the building. Although the openings in floors may visually resemble open mezzanines, they are considered to be the floor assemblies of a series of vertically stacked storeys. Special requirements are included in the National Building Code to compensate for the lack of closures through the floor assemblies. Although the terminology is new, the concepts are not.

Previous editions of the National Building Code have permitted escalators and moving walks to penetrate floor assemblies, and they are seen in many high mercantile buildings. The first floor and the floor above or below it have also been permitted to be interconnected by stair openings. In both these cases, compensatory measures were required by the National Building Code. In reviewing an existing building in which there are openings through floor assemblies, it will be necessary to determine to what extent they deviate from National Building Code requirements. If deviations are minor and not life threatening, any major change is probably unnecessary. If the effect of the deviation would be to reduce life safety in the building as a whole or in the specific area under consideration, then changes might be necessary to compensate for those items that compromise safety.

# **Fire Separations**

## **Continuity of fire separations**

The primary function of a fire separation is to act as a barrier to the spread of fire. Normally several fire separations are used in combination to surround a given space and contain fire within it; the space is then termed a fire compartment. Openings and gaps in the fire separations around a fire compartment are either provided with closures or are fire stopped. In a number of situations it is impracticable to avoid openings, and special measures are taken to limit the spread of fire through these openings. In the case of an existing building, closures and fire stopping could be to lesser standards or nonexistent. If it is not practicable to upgrade these items, alternative measures may be needed to protect the openings, including automatic fire suppression systems.

## **Fire-resistance rating of fire separations**

Fire-resistance ratings of assemblies are established by tests or by information contained in the Supplement to the National Building Code. The test standards are approximately the same as those of previous National Building Code editions but testing laboratories may have changed the way they interpret the procedures. In the case of assemblies that are already in place in a building it may be impossible to determine an actual fire-resistance rating. The use of Chapter 2 in the Supplement to the National Building Code will provide an approximate value for materials that are listed. In the case of concrete floors, slabs and walls and cementitious protection of structural steel it will be necessary to determine the thickness of the components of the assembly and then use the Supplement or other trade information to arrive at an approximate fire-resistance rating. If the computed fire-resistance rating is reasonably close to the currently required value, the assembly could be accepted without change. However if the computed value is much lower than would now be

required, the fire-resistance rating will have to be increased by adding surface protection in the form of gypsum board, sprayed mineral fibre or other products.

## **Closures to protect openings in fire separations**

The testing of closures has changed considerably over the years as new and revised standards have become available. If an existing fire damper or door appears to be in good working condition, is adequately anchored into its supporting assembly, and has not been damaged through exposure to a previous fire, it could generally be accepted for further service. Signs of an existing label of a testing agency would provide additional information for assessing the adequacy of a closure.

In many existing buildings undergoing changes, doors are removed and replaced. In the case of a closure in a fire separation, an existing frame can be accepted for installing the new door, provided it is a steel frame set into a concrete or masonry wall or a wood frame complying with the dimensional standards for new wood frames. In the case of frames set into wood or steel stud walls, the anchorage should be checked to make sure that the frame attachment details are adequate.

In the past, certain doors in fire separations were accepted without the need to show that they limited the transmission of heat through them. In specific circumstances the current National Building Code would require that they have this property. Where there is a clear hazard to any building occupant who would have to pass these doors during evacuation of the building, these doors should be replaced. However, if it could be shown through an egress evaluation study that all occupants could have passed through the space adjacent to the door well before radiation levels became critical, then there would be little justification for requiring the upgrading of these doors.

Many fire rated doors contain small panels of wired glass. These panels permit a surveillance of the area

on the far side of the door to determine if there is a fire in that area. The panel also contributes to general safety by allowing observation of the presence of a person in the path of swing of the door before opening the door. In situations where doors are locked, fire fighters are able to break through the glazed panel and open the door without causing excess damage to the door. If the panels have been replaced with plain glass at some time, they should be reglazed with wired glass.

## **Construction types**

### **General**

The National Building Code deals with three specific types of construction: combustible, which has little inherent fire-resistance rating unless protected; heavy timber construction, which, although combustible, has an inherent resistance to fire because of its substantial dimensions; and noncombustible construction, which frequently has to be protected to prevent its collapse when exposed to fire because structural steel or reinforcing steel may have their load carrying capacity reduced at elevated temperatures. The primary difference between combustible and noncombustible construction is that noncombustible materials do not burn and contribute fuel to a fire. Thus the basic structural frame, if adequately protected from thermal effects of a fire, should remain in place throughout a fire and offer some degree of safety to occupants and to fire fighters. However, the combustible components permitted in noncombustible construction do burn and contribute fuel to a fire.

### **Combustible construction**

Combustible construction is permitted for most smaller buildings regulated by Part 3. In many cases combustible materials permitted for Part 9 buildings, and conforming to standards referenced in that Part, can be used without specific qualification in Part 3. These combustible buildings are typically wood frame using conventional

construction techniques. To achieve fire-resistance ratings, the wood studs and joists are covered with various panelling materials, most commonly gypsum board. In an existing building it may be possible to improve fire-resistance ratings by adding additional layers of fire protective materials over the original facing materials. In smaller buildings of combustible construction the most important consideration is that the occupants can vacate the building safely by means of protected egress paths. Provided all the occupants are safe, the fire department may decide that control of the fire is an adequate response and that it will not be practicable to save the property. Under these circumstances it may not be deemed necessary to modify the building in full compliance with the current edition of the National Building Code by meeting the currently stipulated fire-resistance ratings for the structural assemblies.

### **Heavy timber construction**

Heavy timber construction relies on the dimensions of the wood members to resist the effects of fire for periods that approach 45 minutes. The actual time before collapse will depend on the fire load in the building and the size of the structural members. If the building is sprinklered, it is unlikely that a fire of sufficient magnitude will develop that the structural integrity of the heavy timber members would be threatened.

The current National Building Code recognizes this fact by permitting heavy timber roof assemblies in sprinklered two storey buildings even when noncombustible construction would otherwise be required. With these concepts in mind, existing heavy timber buildings that are being reviewed and are of a size that noncombustible construction would currently be required, could usually be accepted for ongoing use if an automatic sprinkler system were to be installed. For additional reliability, signals from these sprinkler systems should be connected directly or indirectly to the responding fire department.

### **Noncombustible construction**

Noncombustible construction means that all of the components of the building regulated by the National Building Code must be of noncombustible materials, except for specifically permitted combustible items. The National Building Code clearly indicates that in noncombustible construction most of the finishing materials can be combustible and many other items that do not have a load-carrying function can be of combustible materials. The list of materials has been modified over the years and a material that is currently accepted could be used in an existing building, even if it was not listed when the building was first constructed.

In many instances where a building is being expanded in size, it will be very difficult to determine exactly what fire-resistance rating was originally provided. In the case of concrete frames it may be difficult to determine the thickness of walls, columns and slabs and the location within them of the reinforcing steel. Various nondestructive test methods will have to be employed, together with limited coring and probing, to determine if the existing frame needs to be further protected.

Where gypsum board is the protective membrane for steel framed structures, and there is no evidence concerning the type that was used, it may be necessary to assume that the board was not rated unless testing or other evidence is available to show that a fire rated board was used. In many steel framed and prestressed concrete buildings constructed many years ago, the fire protection and sound reduction was accomplished by using asbestos-containing materials. If these have to be removed for health reasons, alternative materials will be required to maintain the necessary fire-resistance ratings, even though the National Building Code does not specifically prohibit the use of asbestos-containing materials, except in air handling systems.

### **Interior Finish**

#### **Buildings which are not high buildings**

In most buildings the property of the interior finish that is regulated is the flame-spread rating. Apart from the interior furnishings, the interior finish is the component that most enhances the spread of fire, particularly if it has a high flame-spread rating. It is important to reduce the rate at which a fire could spread throughout an occupied area by controlling the characteristics of the finish materials, particularly on walls and ceilings. Except for some doors and bathroom finishes, which are permitted to have a flame-spread rating of up to 200, the maximum flame-spread rating of interior finish is limited to 150. For areas in which large numbers of people gather, or egress routes they would have to use during evacuation, the values of flame-spread rating are much lower.

A number of coatings can be applied to wall and ceiling surfaces to reduce the flame-spread rating. In an existing building, these may be used to renovate surfaces that have an unacceptably high flame-spread rating or that have deteriorated or aged. These coatings can also be used to reduce flame-spread ratings in areas whose function has changed.

#### **Variations for high buildings**

In high buildings, there are additional requirements concerning the smoke that can be generated from a burning surface. Since evacuation of a high building takes a considerable time to complete, it is important to protect the occupants from the effects of smoke until they have left the building or the fire has been extinguished and there is no further hazard from smoke. In high buildings the smoke emission characteristics of wall, ceiling and floor surfaces are regulated through the imposition of maximum smoke developed classifications.

Many of the coatings that can be used to reduce the

flame-spread rating may also be beneficial in reducing the smoke developed classification.

## **Spatial Separation**

### **General**

The concept of spatial separation ensures that buildings are spaced sufficiently far apart that the possibility of fire spreading from one building to another by radiation is reduced to acceptable levels. Part 3 assumes that fire fighting forces will be available within 10 minutes of the outbreak of a fire and that these forces will be able to apply hose streams to neighbouring buildings to keep them below the ignition temperature. These forces would also be fighting the fire and thereby reducing the radiation. For buildings in remote locations, increased spatial separation combined with other design options can be used to maintain an acceptable level of risk.

### **Limiting distance from an exposing building face**

An authority having jurisdiction can only consider a given building on a specific property. The control of spatial separation is developed in terms of the boundaries of the property under consideration. Where there is only one building on a property, the distances are to the property lines. If there is more than one building on a given property, the distances between the buildings are measured to imaginary lines located where the requirements for each individual building will be satisfied. Building faces that front onto a street or lane are considered to have limiting distances measured to the centre of the street or lane, recognizing that a building on the other side of the street or lane will be using the same reference line. If property lines are changed or the faces of a building are relocated during a change, the effect on limiting distance should be carefully examined; compensating measures will be required if the value is reduced in such a manner that the building face would no longer conform to spatial separation requirements accepted previously. These

compensating measures could include the installation of an automatic sprinkler system or wired glass in fixed steel frames.

### **Unprotected openings in an exposing building face**

An unprotected opening is any part of the face of a building that has a fire-protection rating for a closure or a fire-resistance rating for the wall that is less than the value determined in accordance with the National Building Code. Plain glazed windows and egress doors are among the most common examples of unprotected openings. However a metal skin on a building could also be regarded as an unprotected opening. Those portions of a wall that have an intermediate resistance to the spread of radiant heat can be assessed by the concept of equivalent unprotected openings. In most existing buildings there will be insufficient technical information to assess values for equivalent unprotected openings, however, insulating materials or thermal barriers could be added to reduce the transfer of heat through the wall. Other options to reduce the effect of unprotected openings are to sprinkler the building, or to replace windows by wired glass in fixed steel frames. The latter option generally will not be practicable unless the exterior wall of the building is being reconstructed for other reasons. Although the complete building should be sprinklered in order to permit larger unprotected openings, fire compartments in which the area of unprotected openings is excessive could be selectively sprinklered in an existing building, as an option for improving the safety level. The supply lines for a partial sprinkler system should be protected where they pass through other fire compartments to minimize the loss of the sprinkler system from a fire in another fire compartment.

### **Influence of fire compartment separation on area of exposing building face**

The current concept of separating fire compartments deals with external exposure as well as the physical barriers between the compartments within the building. Limits are placed on the proximity of openings in different fire compartments in the same building, when the exterior walls in which the openings are located are aligned at an angle of less than 135°. The fire-resistance ratings of wall elements are also specified. Since this concept is relatively new in the National Building Code, many older buildings will not conform, except in cases where the fire compartments were on different sides of a firewall. Discretion will have to be exercised in determining if the threat from one fire compartment to another is sufficient to warrant enforcement of the current requirements. Compensatory measures would include the provision of sprinklers, installing wired glass in fixed steel frames and even the blocking of a few openings that are extremely close to one another.

### **Fire Alarm Systems**

A fire alarm and detection system is one of the major life safety systems installed in a building. Although they are not complete fire alarm systems, the smoke alarms that are installed in a dwelling unit are extremely important in alerting the occupants to the potential need to evacuate the building. For many of the services installed in a building a certain deterioration takes place over time and this is usually counteracted by ongoing maintenance programs. In an existing building the fire alarm and detection system should be tested and evaluated to ensure that it is operating properly and has been well maintained. Any deficiencies should be corrected and new equipment installed where necessary to return the system to its intended level of performance.

In many cases a fire alarm system will not have been

installed in an existing building because it was not required at the time that the building was built. Any change in use or occupancy that alters the characteristics of an existing building in such a manner that a fire alarm system would be required, should have one installed. The types of change that can take place include a change in the area or height of the building or a change in occupancy. When a fire alarm system is added to an existing building, it should be installed throughout the building, not just the areas subject to change, and be installed to current standards.

A fire alarm system might also be installed in a building to compensate for other deficiencies that are more difficult to correct. The primary purpose would be to reduce the time required for evacuation of the building. This would apply in a building that would not otherwise require the installation of a fire alarm system.

Even in very small buildings, the installation of interconnected smoke alarms would aid in the detection of fires and the alerting of the occupants. Although these devices were developed primarily for the residential market, they could be used in low fire hazard situations to improve deficiencies in egress facilities.

### **Fire Fighting Access**

Two components of fire fighting access need to be considered. One component is access to the building by fire department vehicles and personnel, and the other is access into and within the building itself.

The exterior accessibility deals with the design of streets and access routes and the location of hydrants and fire department connections. Fences, landscaping, and other obstructions could have developed since the building was first constructed. Many of these items can be corrected by changing the exterior landscaping and removing obstacles. Inadequate street access is more difficult to change, especially if the streets and access routes are on public property. Items on streets that can limit

accessibility include service boxes, communications poles and wiring and street lights. In some cases hydrants may have been relocated during repairs or changes to the street system.

Accessibility to the interior is concerned with the location and presence of access panels to the lower storeys of a building and basements as well as interior access by stair systems and elevators intended for use by fire fighters.

In many instances the function of the panels may have been misunderstood by the building owner and they may have been removed or sealed up. Through minor modifications to the building it should be possible to provide, or reinstate, the access panels.

Elevator usage by fire fighters may involve maintenance and minor modifications to the elevator operating procedures.

If interior stairs are too narrow for use by fire fighters, automatic sprinkler systems will lessen the need for rapid access by fire fighters to a specific storey of the building.

In the case of a sprinklered building the National Building Code waives many of the accessibility requirements. There is no need to provide access panels and thus a building need not face more than one street. In addition, the sprinkler system will lessen the need for the fire fighter to gain rapid access to a developing fire. Thus one solution to a building that has many problems relating to access for fire fighters would be to add an automatic sprinkler system throughout.

## **Means of Egress**

### **Access to exit within a floor area**

The access to exit in a building is one of the most important features to ensure safety of the occupants. It is the path that has to be taken from any point where a person might be at the time that evacuation

commences to an exit facility. In most buildings the path is not a straight line but has to pass around furniture and fixtures, through internal corridors and doorways and around products and merchandise. Many of these obstructions to egress change periodically and so there is no guarantee that the same access to exit will be available at all times. Persons familiar with the building normally can follow the access to exit without difficulty, but those who are not regular users of the building will need help; this is usually provided by directional signs if the exit sign is not clearly visible. In an existing building it is possible to ascertain the availability of access to exit routes and determine if they satisfy the intent of the National Building Code.

### **Capacity of an access to exit**

The capacity of an access to exit is based on its width and the number of persons the access to exit serves. In earlier editions of the National Building Code a concept termed "units of exit width" was employed to evaluate the necessary width. With the publication of the 1990 edition of the National Building Code, a new method of determining adequacy of widths for access to exits and other exit facilities was introduced. This method provides a minimum width for each person, subject to minimum values when the occupant load is low. In general, any existing building that satisfied an earlier edition of the National Building Code should be in conformity with the current edition.

### **Width required for an access to exit**

Although minimum widths are prescribed for an access to exit in terms of the space required to move occupants in an emergency, care has to be taken that these routes are not blocked by items that intrude into the required width. The National Building Code permits a number of items, including handrails, to protrude into the width by up to 100 mm. Other obstructions which do not reduce the required width are allowed to protrude into certain parts of the access to exit which are corridors, but

## **Existing Buildings**

dimensional limits are imposed to ensure that these obstructions would not cause injury to a person with a visual disability who might be using the route at any time. Because many of the requirements relating to the movement of persons with physical disabilities are relatively new in the National Building Code, many existing buildings may not conform. In many cases obstructions which do not conform to current standards may have to be removed or guards and barriers provided around them.

### **Protection of an access to exit**

If the access to exit distance is short, a person can reach it in a short period of time and may not require special protection. The National Building Code expects that where a floor area contains a number of suites, the common route to the exit from the suites, termed a public corridor, should receive special protection to ensure that occupants of suites other than the one involved in fire can pass the fire suite safely while traveling towards the exit. To achieve this, the walls of the corridor are required to have a specified fire resistance rating. Many existing buildings will have corridor walls that are not fire separations with the necessary fire-resistance rating. In order to satisfy the safety requirements for evacuation, it will be necessary to improve the fire-resistance rating of these walls. One solution would be to add one or more layers of protective gypsum board to improve the rating. Another method, for a building without institutional or residential occupancies, would be to sprinkler the building, because in the sprinklered building the fire separations between the public corridor and the rest of the building would not be required to have a fire-resistance rating.

### **Travel distance in a floor area**

The travel distance in an access to exit governs the time that is necessary for a person to evacuate the floor. There is no clear method of measuring the travel distance. When a building is first designed,

and the floor area is open, without partitions and furniture, the travel distance would be measured in a straight line from the most remote point to the nearest exit. As space becomes developed, through the installation of furniture and fixtures, and the travel distance increases, it is unusual to repeat the calculation for every change in layout. Thus the real travel distance will usually be more than the value determined when the building was first designed. As a result of this difference, measurements in existing buildings will frequently exceed the travel distances specified in the National Building Code. All parties involved in the review of an existing building will have to assess if there has been a marked change in the level of safety as a result of increased travel distances. Where changes to the building have increased travel distances by closing off part of the egress route with walls and partitions, every effort should be made to compensate for the increase. One method that gives substantial benefits is to install an automatic sprinkler system in the building, because this permits increased travel distances.

### **Doors in an access to exit**

Doors in an access to exit should swing on a vertical axis in the direction of travel, however, the National Building Code permits certain doors to open into a room away from the direction of travel towards an exit. These are usually small rooms with a low occupant load or doors entirely within a suite. In special cases sliding doors are permitted, particularly where persons are under restraint and the doors will be released by security personnel. The hardware on the doors should permit persons who are not under restraint to readily open the door without keys or specialized knowledge and make their way to an exit. In the case of rooms with a large occupant load, the National Building Code requires that the hardware release on contact and allow the door to swing open freely. In existing buildings the door swing or the type of hardware may no longer comply with the current National Building Code. Although it is relatively easy to change hardware, it is very difficult to reverse the swing of the door

without considerable expense. In some cases reversing the swing of the door may cause restriction of a corridor on the other side of the door. Discretion will have to be exercised to ensure that curing a minor problem does not lead to further problems in the building. If the occupant load is low and the building is relatively small, changes to doors may not contribute substantially to overall safety, apart from ensuring that persons cannot be locked within a space.

### **Exit facilities**

The portion of a means of egress that is designated as the exit starts at the boundary of a floor area and is expected to provide substantial protection from exposure to a fire within the floor area and from lower floor areas that would have to be passed while using exit stairs. In the case of a single storey building, the exit is usually an exterior door leading directly to the outside. In the case of multi-storey buildings, the exits from the upper floors consist of stairs that are normally enclosed within protective shafts. Although this situation is not frequently encountered, the exit stairs from upper floors could be outside the building and unenclosed. In the case of an existing building, the National Building Code permits the use of an exterior fire escape if other exit facilities cannot be improved sufficiently. The NBC limits the height of buildings to which a fire escape can be attached.

### **Capacity of exits**

Previous methods used to determine the adequacy of the width of an exit facility measured the width and then converted the value to a number of units of exit width. Each unit was assumed to occupy a width of 550 mm, with an additional half unit increment being allowed for intermediate values that exceeded the unit value by at least 300 mm. It was then assumed that the unit of exit width could accommodate a certain number of persons during evacuation, with the number varying in accordance with the type of occupancy.

The current National Building Code adopted a new

system in which the occupant load is divided by various factors, with the result being the number of millimetres of exit width that are required for each person. Minimum values are still required for buildings in which the occupant load is low and in many other buildings to assure an adequate width for normal usage.

In the case of an existing building it would be acceptable to compute the exit requirements on the basis of the current Code. If the deficiency is considered minor, or if other compensatory measures permit sufficient time to safely evacuate the building, no further upgrading of the exit facility width would be necessary.

### **Width of exit routes**

The width of an exit as computed by current or previous methods allowed encroachments for handrails, stair stringers, door hardware and door leaves. These encroachments should be acceptable in an existing situation if the width of the exit facility fully complies with the Code. If the encroachments are excessive or diminish an otherwise nonconforming exit width, it may be necessary to remove and replace the obstruction with a smaller item. Although the Code makes further concessions to obstructions in corridors, subject to limits to minimize hazards in the path of persons with visual impairment, these concessions should not apply to exit facilities. Items that could obstruct the passage of a person with visual impairment should be removed from exit facilities and relocated to more appropriate locations.

### **Clear height within an exit**

The minimum headroom clearance in an exit facility is set at 2100 mm. In the case of stairways, doorways and beneath door closers, slightly less headroom clearance is permitted. Few buildings should have a problem with headroom clearance. Normally obstructions that hang from the ceiling can be raised or relocated and door closers that are too low can be replaced with models that do not obstruct the doorway. If the ceiling or a lintel is too low and is

liable to be a hazard to tall persons, clearly marked signs together with coloured patterns or stripes should be used to draw attention to the hazard. These solutions would only be considered if there were no other method of raising the ceiling or the doorway. Where a low height would interfere with the movement of occupants in an emergency, it would be necessary to construct an alternative exit facility and redirect the occupants to the new facility.

### **Protection of exit facilities**

The fundamental need to protect an exit facility is to ensure that it will not be invaded by fire or products of combustion during the time that it is being used for evacuation of the building occupants and its availability for fire fighters attempting to suppress the fire and assisting occupants to evacuate the building. As a result of a minimum standard established for the protection of exits, it is not acceptable to have an exit stair open to adjacent storeys. In many older buildings the stairs were not enclosed at the time of construction or have been opened up as a result of ongoing changes to the building. It is of primary importance to the safety of persons using those exits that the protection be established by addition of fire-resistance rated separations with the appropriately rated closures. If there are walls around the exit facility, it will be necessary to establish the fire-resistance rating and the rating of the closures. If the ratings are non-existent or well below the current standard, then it will be necessary to improve the ratings through the addition of fire protective materials. If the ratings are marginally lower than what would be currently required, it might be acceptable to improve other safety features in the building to compensate. These measures could include automatic suppression systems and any improvement to or addition of fire detection and alarm systems.

### **Interior exits**

Interior exits consist primarily of stairways and passageways, however, in some situations, ramps may also be used. The doorway by which the exit route is entered is also considered to be part of the exit. Where two buildings are side by side or a building is internally divided by a firewall, horizontal exits will be encountered. These are exits that lead into another building instead of leading to the exterior. It is assumed that an emergency situation in one building does not extend into the neighbouring building and therefore it is acceptable to use the neighbouring building as an area of refuge in an emergency.

Where exit doors lead directly to the exterior, a fire-protection rating is not normally required, however, in a horizontal exit the door is required to have a fire-protection rating that will depend on its precise location and the fire-resistance rating of the wall in which it occurs.

All interior exit route facilities are required to be separated from the remainder of the building by appropriate fire separations which have fire-resistance ratings not less than that required for the floors they penetrate, but with a minimum of 45 minutes. The fixed location of exit stairs and passageways renders it less likely that they will have been relocated than corridors and interior partitions. However, there is a good possibility that their walls may have been breached to add doorways to new rooms and suites.

It is not acceptable to have the standard of safety for egress routes reduced below that which is considered appropriate for new buildings. The current requirements have been based upon experience, and ignoring them could lead to unwarranted endangerment of the occupants. If the current standards are impracticable to meet, then other means of improving safety should be instituted; these could include automatic suppression systems and additional detection and alarm equipment.

## **Exterior exits**

The exterior part of an exit system can include passageways, ramps and stairs. The National Building Code intends that an exit lead to an open public thoroughfare, or to an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare. Unless a building is surrounded by a large open space at a sufficient distance that the building occupants would not be exposed to the fire, the normal exit route terminates at the boundary between the property on which the building is located and a public street or thoroughfare. Thus steps, ramps and sidewalks between the building and the street are included as part of the exit and are regulated by the National Building Code. For most buildings this part of the access system to the building is part of a barrier free path of travel and will have to meet appropriate requirements. Many designs neglect the importance of maintaining safety in these routes, and stair dimensions may not be in conformance and guards and handrails may be missing. In most circumstances it is not difficult to make modifications to the site layout to meet the intent of the National Building Code.

## **Travel distance to and between exits**

The time that it takes to move from any point in a building to an area of safety is determined primarily by the distance that has to be travelled. It is accepted that the physical state of the persons using the egress route will also influence the time of travel and that is allowed for by stipulating different travel distances for different occupancies. The presence of an automatic fire suppression system will reduce the threat to the occupants of the building from a fire and thereby allow extra time for the evacuation to take place. In a sprinklered building, the permitted travel distance is usually greater than in an unsprinklered building.

Travel distance is defined as the distance from any point in a floor area to an exit measured along the

path of travel to the exit. Many buildings do not have developed interiors when they are initially constructed and approximate travel distances are used, based upon experience of similar existing buildings. During the occupancy of the building walls and partitions will be relocated and can easily result in extended travel distances that greatly exceed the permitted values. If a fire alarm system is not normally required for the building, the installation of a fire detection and alarm system may be considered to partially offset a moderate increase in travel distance. If the increase has been substantial, the only practicable solutions may be to move walls and partitions to reduce the travel distance, to add a new exit, or to sprinkler the building.

Some changes that were introduced with the National Building Code 1990 permit a different method of measuring travel distance in large shopping complexes, in sprinklered floor areas and in open air parking structures. In existing buildings the new requirements may help to solve problems of excessive travel distance.

## **Signs indicating presence of exits and their location**

The purpose of exit signs is to direct occupants of a building to facilities that will enable them to evacuate the building in safety. In a very small building with a single entrance and exit, it is assumed that all those who have entered the building will be aware of the location of the door that leads out to a place of safety. Only very small buildings are permitted to have a single exit and the travel distance to the exit is also relatively small. Thus in these small buildings, few if any signs may be needed to indicate exit location.

As buildings become larger and more complex, there is a need to clarify which of the many doors and passageways lead to places of safety. This is accomplished by placing signs above or adjacent to the exits from each floor area, as well as placing directional signs, pointing in the direction of the

## **Existing Buildings**

exits, wherever the principal exit signs cannot be seen throughout the floor area. The National Building Code exempts the principal entrance to the building from having an exit sign, on the assumption that any person who uses that entrance will automatically return to it in an emergency.

Since exits signs can be painted signs, illuminated by the surrounding lighting, as well as internally illuminated signs, there is no justification for not installing exit signs in an existing building in conformity with the current edition of the National Building Code. In some existing buildings, additional exit signs might be used to partially compensate for other deficiencies, including excess travel distances.

### **Stairs in exits**

Any building that is more than one storey high will have flights of stairs to allow movement between the different levels of the building. Stair design has evolved with different editions of the National Building Code. Some older designs that had proven unsafe by an excessive number of falls are no longer permitted in the National Building Code. The current values of the geometrical relationships between run, rise and tread have been based on extensive studies of crowd movement on stairs. Ranges of values are permitted to encompass the different parameters that a designer will face in meeting floor-to-floor height and the area available for the location of stairs. Although stairs are an important part of a means of egress in an emergency, they are used on a daily basis for circulation within the building. As a result of this frequent use, any anomaly or problem will exacerbate the number of falls and consequent injuries. During daily use of stairs, the building occupants may be carrying items in their arms and be unable to make full use of handrails and other safety devices and for this reason it is important to avoid or remedy designs that might lead to injuries.

In renovation of an existing building the stairs are usually contained within a shaft or other enclosure and this, together with the surrounding structural

members, will make it almost impossible to correct deficiencies in the geometry of the stairs without major changes to the building. If experience shows no record of falls and injuries and the capabilities and the number of occupants will not change, some discretion could be used in accepting the existing situation. However, if there are records of falls and injuries or if the character of the users is changing, then it may be necessary to completely rebuild the stairs to current standards. Where changes are not being made to the stairs themselves, new lighting and better demarcation of the treads by appropriate colour treatment, together with correctly located handrails, will help to improve the safety of the stairs.

### **Handrails**

The function of handrails on a stair is to provide an object that can be gripped and lessen the effect of a fall, as well as guidance for persons who have difficulty negotiating stairs by reason of physical or visual impairment. The height of handrails has not been constant with the different editions of the National Building Code and so the handrails in an existing building may differ from current requirements. In some cases the heights are now lower, whereas in other cases they are higher. The presence of a handrail at a height approximately the same as current requirements should be acceptable. The presence of the handrail is more important than its precise height. If there is no handrail in a location where one is required by the current National Building Code, one should be installed. Even though this may narrow an exit stair slightly, the handrail should take precedence over a slight reduction in stair width.

If a handrail on a stair also functions as a guard, its height should not be any lower than that required for guards.

### **Guards**

A guard is intended to prevent a person from falling from one level to a lower level and being injured or killed. In addition to the height of the top of the

guard, the presence of openings through the guard is critical. The top of a guard should be set above the centre of gravity of any person coming into contact with it, accidentally or deliberately. With a tendency to an increase in height for the population of Canada, the height of guards has been increased during the time that the National Building Code has been published. Previous traditional height limits of 36 inches have now become 1070 mm (equivalent to 42 inches). Some other modifications have occurred for specific guard locations. Many older buildings will still have guards set at lower heights deemed acceptable at the time that they were built. In view of the fact that the present occupants of the building can be expected to have a different stature and thus be more susceptible to falls over the guards, it is not unreasonable to expect that guards would be modified to current standards in a building undergoing renovation.

The size of the openings through guards has not always been stated as clearly as in the current National Building Code. Two different values of openings are specified. An opening of not more than 200 mm is accepted for locations where children are unlikely to be present, but this value is reduced to 100 mm for those locations where children are expected to be present. The 100 mm value is based on the physical dimensions of very young children and is intended to prevent them from forcing their bodies or heads through a gap in the guard and then becoming asphyxiated. In the case of older children, the value of 100 mm is not as critical. If existing guards have opening dimensions slightly in excess of the current values, a survey should be made of the potential occupants of the building to determine if there is a real need to modify the guards. In industrial occupancies, where the openings will not present a hazardous condition, and on fire escapes, the openings in the guards are permitted to exceed the 200 mm limit and should be based on a common sense approach to the prevention of falls through the guard.

### **Fire escapes**

Fire escapes are not permitted on new buildings. It is considered that in a new building, a designer can make provision for all required exits and meet the requirements of the National Building Code. In the case of an existing building it may not be possible or practicable to modify existing exit facilities to allow for changes in the use of a building and an increase in the number of occupants who have to use the exits. A fire escape is essentially an exterior stairway that is built to less stringent standards than would apply to an exterior exit stairway. Even though the National Building Code accepts the use of fire escapes to improve exiting from an existing building, it limits their use to the first two storeys above ground level for institutional buildings and the first five storeys above ground level for other buildings. Even if the rest of the building is higher, the relief offered by fire escapes serving the lower storeys may improve egress facilities in existing interior stairways for the higher storeys.

### **Special Requirements for High Buildings**

A high building has a specific series of criteria that distinguish it from other lower buildings. Although the criteria are predominantly established on the basis of the height, the real concern is that the occupants have sufficient time to evacuate the building before any smoke contamination reaches levels in parts of the building that would be lethal for persons still in those areas. Specific criteria were introduced into the National Building Code in 1973 and many buildings built after that time would not have met the requirements because of a delay in adopting them into local regulations. Some of the measures may still not have been adopted by all jurisdictions in Canada.

A building that is categorized as a high building and yet does not meet the current requirements would have to be examined very carefully to determine its degree of safety under fire conditions. Several

## **Existing Buildings**

methods exist, including the conducting of fire drills to establish the length of time that it takes to evacuate the building, and tests with smoke bombs set off at several locations in the building to determine the patterns of smoke movement and the areas where smoke could accumulate before occupants could be evacuated.

The smoke control measures set out in Subsection 3.2.6. of the National Building Code and in Chapter 3 of the Supplement to the National Building Code are intended to give a designer appropriate criteria to ensure the safety of the occupants. The measures that are specified are examples and a designer is free to use any other method that provides an equivalent level of safety. In an existing building it may be necessary to use a mixture of approaches to produce the desired solution without a major reconstruction of the building. One of the simplest and most effective methods of providing smoke control is the installation of an automatic sprinkler system. Improved fire detection and alarm systems and the provision of voice communication will help by providing better information to the occupants and thereby assisting in the prompt evacuation of critical areas of the building.

## **Lighting and Emergency Power**

In order to provide a clear and identifiable path of travel during emergency conditions it is necessary to maintain a minimum level of lighting. Unless the power supply to the building is interrupted, it is assumed that the normal lighting in the building will be maintained. Some minimum lighting levels are specified for egress routes to ensure that they will be easy to use. This is of particular importance in buildings where the ambient lighting level is very low, as in theatres, certain restaurants and other places of entertainment.

There is always the possibility of power failure, even without any other type of emergency in the building. Accordingly, separate emergency lighting

requirements are included in the National Building Code. The current values in the NBC are more encompassing than in previous editions, and so many existing buildings may be deficient in the provision of emergency lighting in many areas. As it is relatively easy to install emergency battery operated lighting units in any building, there should be no reason not to improve the emergency lighting in areas where the existing emergency lighting is clearly insufficient for safe evacuation of the occupants.

For many buildings, including all high buildings, an emergency power supply will be required to operate emergency equipment and elevator. As a result of changing requirements, a level of emergency supply that would have been adequate under previous editions of the National Building Code may no longer be adequate. In assessing the need to augment the emergency power supply, a study should be made to determine the extent of any deficiency. Recognizing that there is a high cost to install additional generating capacity and physical difficulty to find space for new equipment, it may be necessary to develop alternate solutions to provide for the safety of the occupants instead of increasing the emergency power supply capability.

## **Special Floor Area Requirements**

### **General**

The National Building Code provides certain requirements that apply within a floor area of a specific occupancy. These requirements occur in Section 3.3 and apply to a floor area or part of a floor area of a certain use, regardless of the major occupancy category of the building. The main concern is that the hazards to which the occupants are exposed could be local and may not have a significant impact on persons in other parts of the building. Some general items that apply in several categories of building are placed at the beginning of the Section and then there are several Subsections

that contain requirements for specific occupancies.

Requirements involving egress within floor areas have been expanded to address the concern for the use of these facilities even under general everyday usage. Included in these changes are the geometry of stairs and the provision of guards and handrails for stairs that are not required exit stairs but could be used for movement from one level to another. Protection for persons with physical disabilities has been expanded to cover storeys below the first storey, as well as storeys above the first storey, recognizing that their presence in parking structures and other lower storeys demands similar protection in the event of a fire emergency. It may be difficult to meet these new requirements in an existing building, but every effort should be made to achieve an equivalent level of safety because these items address hazards that arise on a continuing basis and not only during an emergency.

Public corridors are corridors that provide access to exit from suites in a floor area that is divided up into a number of suites. In comparison with corridors within suites, a higher standard of protection is expected of these corridors because they serve to evacuate persons who may receive a delayed warning of danger arising in another suite. Sufficient space is required alongside the walls of a wide public corridor in a mercantile shopping centre to ensure that displays that are placed within the public corridor do not block off means of egress for the occupants of the building. This should cause little hardship during renovation as it should only require the movement of obstructions such as chairs, benches, small kiosks and similar furniture.

Transparent doors and panels in and adjacent to means of egress within a floor area can cause injury to persons who may come into contact with them accidentally. One measure to minimize injury is to clearly mark the panels by decals, etching or other means, and if necessary place bars or barricades to keep persons away from them. The glazing in doors should be safety glass. In some cases, door glass is replaced after a breakage and regular glass might

have been substituted. During renovation the glass panels should be reviewed to ensure that they do indeed contain safety glass. If they do not, then the glass should be replaced. Any panels that are not properly protected can easily be made safe by the addition of railings or bars in front of the panels.

### **Assembly buildings**

Because of the large numbers of occupants involved in an assembly occupancy there are many special rules to cover safety in these buildings. They range from special fire separations around spaces with a large number of occupants in a Group A, Division 1 occupancy, to protective systems between stages and the seating areas in theatres. The majority of the rules are concerned with seating and aisle arrangements, and the special needs for guards and railings to prevent falls. The seating arrangements are intended to permit an auditorium or arena building to be evacuated in an orderly manner and without overtaxing the capacity of the means of egress. Limits are placed on the number of seats that can be placed in a row between aisles and also on the dimensions of the aisles. Variations are permitted for bleacher type seats, recognizing the unique character of this type of seating arrangement. More generous provisions are allowed for outdoor places of assembly. As these facilities are not enclosed, there is less chance of smoke accumulating in occupied areas in the event of a fire. It has generally been assumed that in an emergency the occupants could move down the aisles onto the playing area. Crowd control facilities that are currently installed in many stadia prevent the flow of persons as intended by the National Building Code and it may be necessary to reassess the egress capacity of some of these structures when this type of change is made.

The egress capacity for outdoor assembly structures should not be reduced below current code requirements unless it can be clearly shown from crowd movement observation and studies that the evacuation time is acceptable.

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Whenever changes are to be made to an assembly building, it would be prudent to have a complete study of the egress potential undertaken with the objective of ensuring that the standard of safety will not be appreciably different from that intended by the current National Building Code. Changes that could increase the evacuation time should be compensated for by other changes to increase the flow rate and ensure that the overall evacuation time remains the same.

### **Institutional buildings**

In the past few editions of the National Building Code, increasing attention has been paid to the needs of persons in institutional buildings. These persons are generally not able to evacuate the building by themselves because of physical restrictions as a result of infirmity or sickness or because they are under restraint, and require other persons to release security devices preventing their egress. Requirements for hospitals and nursing homes were fully revised for the 1985 edition of the National Building Code and special requirements for correctional facilities were introduced with the 1990 edition of the National Building Code. In many jurisdictions these classes of building would have been covered in previous years by local requirements which would not be identical with current National Building Code requirements. In some cases the requirements could have been more stringent. Any renovation or alteration to an existing institutional building should be preceded by a complete analysis of the safety status of the existing building and the impact of the changes. The end results of the changes should not leave the building with a level of safety less than what would be required for a new building by the current National Building Code. However, some existing deficiencies would have to be compensated for by other safety measures if it is not possible to make structural changes to the existing building in order to develop wider corridors or stairs or to enclose areas of refuge.

The provisions for correctional facilities in the 1990

edition of the National Building Code permit certain buildings used for recreational and work related activities to be treated differently from a Group B, Division 1 major occupancy, subject to a number of safety requirements. In many cases this will permit changes to these buildings with minimal cost, apart from some of the security aspects and the provision of an automatic fire suppression system.

### **Residential buildings**

The requirements for residential buildings have not changed appreciably for several editions of the National Building Code. The primary safety of the occupants is provided by good compartmentation of the individual suites, together with public corridors leading directly to exits. Modifications to travel distance and egress requirements in the last few editions of the National Building Code have tended to be less restrictive and it is unlikely that many residential buildings will have problems in complying with the intent of the current NBC. It is difficult to increase sound transmission resistance between suites in existing residential construction without substantial expenditure. Unless there have been numerous complaints about noise being transmitted from one suite to another, a building could be left with the existing conditions maintained. However, if a building is being converted from rental units to owned condominiums, it might be prudent to upgrade to reduce sound transmission through walls, floors and ceilings and consequent annoyance to the new owners.

### **Industrial buildings**

The main concern with industrial buildings involves the use of products and processes that can be hazardous to the occupants. In many cases the nature of the products and their potential for hazard is not known until the building has been occupied. For this reason the National Building Code makes reference to the National Fire Code of Canada for requirements for fire extinguishing systems that will respond to the level of risk involved. During

renovations and changes to an existing building it will be necessary to include safety measures in accordance with the new hazards that will exist after renovation.

Repair and storage garages are classed as industrial occupancies. They require separation from all other parts of the building in which they are located to minimize the risk to occupants from fire or explosion from the presence of volatile fuels and also to protect other occupants from the health hazards caused by the products of vehicle exhausts.

Open air storage garages have less stringent requirements on the assumption that the cross ventilation from the openings in the exterior walls will reduce the hazards from fuel leaks and from products of combustion in the event of a fire. In many localities the openings in the walls of these storage garages are covered with tarpaulins and other materials in the winter to prevent the entry of snow and to minimize the effect of cold winds blowing through the structure. At all times it should be the rule that these openings be maintained free of obstruction, but during renovation it is important that these openings are not filled in for other purposes. If it is necessary to fill the openings then the storage garage must be re-evaluated as an enclosed space.

## **Service Facilities**

The service facilities in a building that are covered by the National Building Code are those facilities that are installed to provide control of the building environment, provide lighting and other electrical services including telephone and communication circuits, supply water and remove sanitary wastes and rainwater, provide fire fighting water supply, fire detection and alarm systems, and transport occupants between levels. Processing equipment in industrial occupancies, medical care equipment, other than medical gas systems installed in the building, in institutional buildings, and furnishings and domestic appliances in residential occupancies, are examples of items not covered by the National

Building Code. The service facilities can be considered in two broad categories: the equipment and the linking piping and wiring. The equipment is normally located in a service room, whereas the linking elements are normally found in service spaces.

### **Service rooms**

The function of a service room is to accommodate service equipment. Service rooms are usually fire separated from the remainder of the building to contain a fire originating in the room or to protect the service equipment from a fire originating elsewhere in the building. An appropriate fire-resistance rating should be provided and any openings between the service room and the remainder of the building must be properly fire stopped or equipped with closures. Although the integrity of the service room may have been provided at the time of first construction, maintenance operations and additions usually result in changes to the building services that leave openings through the enclosing walls. During renovations and alterations to an existing building, close attention must be paid to service rooms to ensure that any deficiencies are corrected. If a full automatic suppression system is installed in the building and extends into the service room, some tolerance could be accepted of minor deviations from the National Building Code requirements.

### **Service spaces**

Service spaces are included in a building to contain building services. The services include piping, wiring, ducts and other distribution and control facilities. In older buildings the service spaces may have been used to house equipment that would currently have to be located in a service room. If this equipment could lead to a hazardous situation, it should be relocated to a service room or else the space surrounding the equipment should be enclosed in the same manner as a service room. Any equipment that uses fuel should not be contained in a space that does not have the protection features

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required for a service room. Certain types of electrical equipment should be enclosed in a vault.

Service spaces are normally concealed behind building finishes and occur in shafts, walls, floors, ceiling spaces and roof spaces. The interconnection of these spaces is a major concern. A fire that starts in or breaks into a service space can easily spread through a building if the service spaces are interconnected. The National Building Code requires that the intersections of different service spaces be blocked off with fire stopping. In many older buildings the required fire stopping has been breached over the years by maintenance operations and not been replaced through ignorance of its function. In any building renovation it is imperative to ensure that fire stopping in service spaces is replaced.

The fire protection for service spaces is easily damaged or removed during building renovation and maintenance. The problem can be as simple as using unrated ceiling tiles or unrated gypsum board instead of the correctly rated products. It is necessary during review of an existing building to determine if the fire protection products around service spaces still retain the necessary fire-resistance rating. If they do not, then they should be replaced, or alternative measures used to maintain an appropriate safety level

### **Vertical service spaces**

Vertical service spaces are shafts that penetrate storeys of a building and have building services installed in them, including heating and ventilating ducts, plumbing pipes, electrical cables or elevator equipment. Vertical service spaces may also function as smoke shafts for the removal of smoke in a high building. In the latter case, the movement of smoke towards the smoke shaft that was intended during the initial building design may have been negated by the construction of partitions and ceilings within the floor space that obstruct smoke movement towards the shaft. If this has occurred it will be necessary to install grilles, dampers and other devices to ensure no dead spaces in the floor area

that are not connected by appropriate routes to the smoke shaft.

Vertical service spaces also include elevator hoistways, dumbwaiter hoistways and linen and garbage chutes. In order for these vertical service spaces to function effectively openings must lead from them into the storeys. These openings must be effectively fire stopped and in the case of ducts there should be functional fire dampers. Openings into elevator hoistways are protected by doors that must have a fire protection rating based on the fire-resistance rating of the enclosing construction. Openings into dumbwaiter hoistways and chutes must have closure devices that will remain closed except for times when the opening is being used. If the door or closure devices have been damaged or omitted, they must be replaced by correctly rated items.

### **Horizontal service spaces**

Horizontal service spaces primarily occur as crawl spaces, spaces within floor/ceiling assemblies and spaces within roof systems. The National Building Code limits the extent of these spaces to limit the spread of fire. A frequent problem in renovation occurs when fire rated separations between tenant spaces are built up to the underside of an unrated ceiling assembly. The National Building Code intends that the separation extend through the service space to the underside of the floor, to ensure that the compartmentation of the floor area is not breached by passages over the top of rated fire separations. The NBC permits the ceiling system to be rated instead of continuing the fire separation through the horizontal service space. Prior to renovation neither solution may have been carried out and it will be necessary to improve the resistance to spread of fire from one compartment to the next. One possibility is to install a sprinkler system in those types of buildings in which the installation of a sprinkler system waives the requirement for fire separations between suites.

### Elevators

Elevators play a key role in the everyday movement of people in most buildings more than one or two storeys in height. The design, construction, installation and maintenance of elevators are fully covered in CSA Standard CAN3-B44-M. Part 3 requirements cover their utilization during fire emergencies and their inability to operate if there is loss of power to the building.

In an existing building there will probably not be any major uncorrected defect with the elevator car and its operation involving standard CAN3-B44-M. However, building code requirements currently considered necessary may have been allowed to deteriorate or might not have been included at the time of construction. These requirements included provision for evacuating persons with disabilities and the use of elevators by fire fighters in high buildings.

Upgrading of facilities involving elevators can be accomplished with varying degrees of difficulty. Options given in the NBC to provide protection for persons with disabilities range from the use of vestibules or protected corridors to separation of floor areas into zones or the provision of balconies. In a high building that does not protect the fire fighter elevator hoistway from smoke, it could be very difficult to meet all the current requirements. However, some solutions could be undertaken, including sealing off any vents at the top of the hoistway to prevent the hoistway from acting like a smoke shaft.

In recent editions of the National Building Code additional requirements have covered the operation of elevators under emergency power and the automatic recall of elevators in a high unsprinklered building in response to the actuation of smoke detectors. If the capacity of the emergency generators is insufficient to operate more than one elevator at a time as required by the current National Building Code, but is sufficient to operate one elevator, together with other emergency equipment, the situation may be acceptable in

moderately high buildings. In very high buildings where the delay in returning elevators to the recall level is substantially in excess of Code requirements, extra generating capacity should be required unless other compensatory measures, including automatic fire suppression, are added.

Automatic recall of elevators in unsprinklered high buildings was added to the National Building Code in a recent revision cycle during a process of harmonization with the Elevator Code. Assumptions in earlier editions of the Elevator Code that these requirements were not mandatory in the absence of references in the Building Code were incorrect, but may have led to situations in which this feature was omitted from some buildings. To include this in an existing building would require changes to the fire alarm and elevator control systems and an interconnection between these systems. If automatic fire suppression systems are being added to the building, then there is no need to include automatic recall of elevators. If there are no automatic suppression systems, then a careful study would be required to determine if other measures in the building compensate for the need to use manual recall of elevators instead of automatic recall.

### Health Requirements

Health requirements in Part 3 of the National Building Code are primarily concerned with those aspects of the building that could result in sickness or discomfort for the occupants. Items of nuisance value but that do not directly affect health are not addressed. Part 3 also avoids attempts to regulate health and safety matters that are under the jurisdiction of other authorities, including those responsible for the health and safety of workers. Before requiring a change that affects a health related problem, the authority having jurisdiction should ensure that it is not related to other legislation, or one that cannot be solved by the use of individual or area protection.

### **Height and area of rooms**

Part 3 contains a basic statement that the height of any room or space should be sufficient to ensure that adequate light and air can be provided for the occupancy and that there are no obstructions below the ceiling level which would hamper a person using the space.

In new construction, heights, areas and widths of rooms in dwelling units are required to conform to Part 9. Most existing dwelling units more than meet the minimum sizes given in Part 9. Where there are very small rooms, they can be opened up with an intervening archway, whose area is related to the area of the total wall between the small rooms. The rules for the combination room are less severe than the rules for the separate rooms. Part 9 makes provision for accepting alternative dimensions of rooms and spaces, if adequacy for intended use can be demonstrated. This concept can also apply in reviewing an existing building.

### **Windows**

Although the requirements for windows in Section 3.6 are intended to provide a reasonable quantity of daylight into rooms in dwelling units, these windows may also provide natural ventilation, venting of a fire in the dwelling unit, and access to the dwelling unit from the exterior for fire fighters, where the window is within reach of ladders. The area of windows is required to conform to Part 9. In recent years the minimum size of windows has been reduced due to concerns about energy loss through the windows, and there will be few cases where existing windows are too small to meet the current National Building Code requirements. In buildings which are being converted to residential use and which may not have sufficient existing windows, there is no valid reason not to require that the minimum requirements of the National Building Code be met.

### **Ventilation**

Although Part 3 makes reference to ventilation to

ensure that designers are aware of the need to provide it in Part 3 buildings, the discussion of ventilation will be covered in detail in guidelines for Part 6.

Although ventilation is predominantly thought of as the provision of fresh air to occupied spaces, the ventilation systems frequently interact with systems that control the spread of fire and smoke. Within the ducts there will probably be fire dampers wherever the ducts pass through fire separations, and in more sophisticated systems for the control of smoke in high buildings there will be dampers to route smoke to smoke shafts or directly to the exterior of the building.

Any change in a ventilation system that is intended for air quality improvement should be carefully reviewed to ensure that fire safety measures are not compromised. Many existing ventilation systems have undergone substantial change since the building was first built and it may be necessary to introduce new fire dampers into ducts from which they have been removed or were never included. Inspection will also be needed to ensure that existing fire dampers are still in operational condition and to initiate maintenance of any defective fire dampers.

### **Sound control**

Of all the buildings regulated by Part 3, only dwelling units are required to conform to sound control criteria. The values for dwelling units are stated in Part 9. Values were increased in the National Building Code 1990 in comparison with corresponding values in earlier editions. Although many existing buildings with more than one dwelling unit may have enclosing walls and floors for the units that will conform to the latest standards, many buildings will not conform. In most cases it is not possible without considerable expense and disruption to other occupants to improve the sound control. If the building was designed and constructed to a recent edition of the Code few complaints would have arisen concerning noise transmission. If there are frequent complaints, the building, or parts of the building, probably did not

conform to the requirements in place when it was built, and any remedial work that has to be undertaken should not be attributed to enhancement of standards. In buildings where the separation walls between dwelling units are being reconstructed, it should be possible to improve the sound attenuation characteristics of those walls.

Part 3 does not address sound control in other than residential buildings, thus any problems that arise in other buildings should be dealt with in accordance with good practice or with standards established by other regulatory authorities.

### **Plumbing facilities**

Although the Canadian Plumbing Code, or any provincially adopted plumbing regulation, governs the installation of a plumbing system, it does not regulate the types or numbers of sanitary facilities that are required in a building. These requirements are contained in the National Building Code. Part 3 requires that any building situated on a property that abuts a street having a water main have a plumbing system that includes a potable water supply, a sanitary drainage system and water closets. In the absence of a water main, other means for the disposal of human waste are required. In communities where new water mains are installed along streets which already have existing buildings, the National Building Code does not require immediate connection of the buildings to the water main even though the local authority may do so. However if the building is undergoing renovation, it would be expected to include the addition of sanitary facilities and connection to the water main.

In Section 3.6, Part 3 provides rules concerning the number of water closets, urinals and lavatories that are required in a new building based upon the expected occupant load and the proportion of males and females in the occupant load.

The number of facilities varies widely based upon the classification of the spaces in the building. When the occupancy classification of a building is changed, the existing number of sanitary facilities is

frequently insufficient for the future occupant load. If the deficiency is not more than one unit, the authority having jurisdiction will usually accept that no change is required unless future experience shows the facilities are overcrowded. With larger deficiencies the authority will usually insist that the sanitary facilities be upgraded. Although not specifically covered in Section 3.6, the requirements for making a building barrier-free will often require renovation of existing sanitary facilities to facilitate their use by persons with physical disabilities.

### **Medical gas piping systems**

Medical gas piping systems are found in hospitals and nursing homes and in many dental and other medical office. The requirements apply to any system that is not self-contained and incorporates piping from a central distribution location to individual patient areas. The standards for the installation of these systems have evolved since a number of tragic accidents many years ago. At any time that a renovation is made that affects a medical gas piping system, it is usually necessary to review the entire system and also to test the entire system after any change. Because of the life threatening potential of any mistake in a medical gas piping system, short cuts should not be acceptable nor existing situations that do not conform to the current requirement.

# Barrier-Free Design

## General

Requirements to provide accessibility to buildings by persons with physical disabilities have been introduced into the National Building Code of Canada over a period of years during which several editions of the Code were published. As the need to provide accessibility was increasingly recognized by provincial, territorial and municipal authorities, the requirements have become more inclusive and extend to a wider range of situations than were recognized in earlier editions of the Code.

The term “barrier-free” is used in the current edition of the Code with the sense that a building can be approached, entered, and its facilities used by persons with physical and sensory disabilities.

Although Section 3.7 of the National Building Code of Canada 1990 includes many requirements that address accessibility, additional considerations are included in other Sections of Part 3 for persons who have disabilities that do not confine them to the use of a wheelchair.

In many existing buildings, constructed before the concept of accessibility was being applied, it will be extremely difficult to make alterations that will improve accessibility. However, in many cases the building is currently accessible with respect to entrances and internal circulation, but other facilities are not currently accessible. If any change is being made that involves these other facilities, every effort should be made to make them accessible.

If changes are being made to entrances of a building that is not accessible, at least one of the entrances should be made accessible, unless the physical arrangement is not conducive. Problems can occur where a single entrance from a street is approached by a flight of steps and there is insufficient space between the building and the public way to construct a ramp. In the case of a historical building, the addition of a ramp could be detrimental to the conservation of a historic facade and there could be

no other entrances at which accessibility could be provided.

These guidelines do not require upgrading of a building, or a part of a building, that is not undergoing other changes. This would only occur if the authority having jurisdiction has enacted retrospective legislation requiring accessibility.

In all circumstances the owner and the authority having jurisdiction should consider alternative solutions that will improve accessibility to a level approaching the intent of the current Code. The following guidelines provide an understanding of the intent of the Code with respect to accessibility and offer suggestions on items that will provide improved access to and use of the amenities in existing buildings for persons with physical disabilities.

## Entrances

Barrier-free access to an existing building involves the provision of an accessible route from a sidewalk, the road, or a parking area, to an accessible building entrance. It should be located so that disabled persons do not have to pass behind parked cars. A ramp may be impracticable because of the length involved to provide a negotiable incline to the building entrance. Use of an elevating device is a possible alternative.

In addition to ensuring that the threshold of the doorway does not prevent the passage of a wheelchair, it may be necessary to add power operation to at least one door to facilitate its use.

Split entries are a common feature in many existing buildings, including small residential buildings with suites in the basement and other types of building on a sloping site. Accessibility would involve the provision of a ramp or an elevating device to the storey that is designated as the main storey, or to both storeys, if there is no differentiation in the function of the two levels.

## **Partial renovations**

Where an owner is renovating part of an existing building, provisions should be made for accessibility within the renovated portion, with the expectation that in the future it will be integrated into an overall plan for providing accessibility throughout the building. If a storey is being renovated, circulation routes and facilities within that storey should be made barrier-free so that it can be used by persons with physical disabilities. Eventually, as a result of further stages of renovation, provision could be made for barrier-free access to that storey. In the interim, persons with physical disabilities would be given assistance to reach that storey.

## **Barrier-free path of travel**

If a building already has an accessible entrance, it is relatively easy to provide a barrier-free path of travel to various areas on the entrance storey and to every storey served by an elevator. Passenger elevators are the usual means by which a person in a wheelchair gains access to storeys above the entrance storey. In an existing building that is equipped with passenger elevators, barrier-free paths of travel should be provided during renovations to all storeys served by the elevators.

## **Elevators**

Elevators are not mandated in a new building, other than in some classes of high building, and thus there is no obligation to install an elevator during the renovation of an existing building. Where feasible, platform lifts or other elevating devices could be used to provide access from the entrance storey to another storey.

In new buildings, arabic numerals identifying the floor by number are required on both jambs of elevator hoistway entrances to identify the storey. These numbers can be easily added to hoistway entrances in an existing building and should be included in any renovation project. The numbers should be located between 1500 mm and 1550 mm above the floor and should be not less than 38 mm

high and raised at least 0.75 mm above the surface of the jamb.

If existing elevators are being renovated or replaced, the control panel should be located at a height that is accessible to a person in a wheelchair.

## **Washrooms**

A washroom that is being renovated should be made accessible to a person in a wheelchair. If an existing building is being modified in response to changes that increase the occupant load, care will have to be taken to ensure that the total number of water closets and lavatories is not reduced below that which is required for the new occupant load. This can occur if two existing water closet cubicles are converted to one cubicle large enough to be used by a person in a wheelchair. Under these circumstances it may be necessary to modify a reasonable number of washrooms, rather than modifying all washrooms. Where an existing washroom cannot be modified, it may be necessary to provide one or more special washrooms designed for use by persons with physical disabilities.

## **Showers**

When a gymnasium, swimming pool or other assembly building that provides shower stalls for the use of the occupants is being renovated, at least one shower stall should be modified to include as many as possible of the items that would be included for a new shower stall for use by a person with physical disabilities. These items include seats, grab bars, hand-held shower heads, and special controls that can be operated from a seated position.

## **Assistive listening devices**

An existing meeting room, auditorium or theatre that has a floor area larger than 100 m<sup>2</sup> and is being renovated should be provided with an assistive listening system. Even if the design does not permit all of the space to be covered, it should be possible to provide coverage for up to 50% of the seating area.

### **Counters**

If counters more than 2 m long are being installed to provide service to the public, a portion of the counter space should be designed for use by a person in a wheelchair. If shelves or counters are being added for public telephones, they should be designed to accommodate telecommunication devices for the deaf and be located so that they can be used by a person in a wheelchair.

### **Drinking fountains**

If drinking fountains are being added to an existing building, at least one should be designed for use by a person in a wheelchair.

## Items to be considered during the review of an existing building

The first group of tables (pages 40 to 48) will assist persons involved in assessing the safety performance levels in an existing building. The relative value of different requirements can be reassigned depending on the ability to respond to an emergency in the building by agencies responsible for fire fighting or the handling of other types of emergency.

The first column lists a number of code requirements. Those covered by these guidelines are grouped approximately in the order that they are discussed. Not all requirements are included, but those that should receive particular consideration are identified for determination of the level of safety of an existing building and the need to make improvements.

The second column, headed "compliance difficulty", ranks the perceived difficulty in modifying an existing building or building element to meet the requirements of a current building code. In general, cost is not the only criterion. The problems of relocating structural elements or changing a building from combustible construction to noncombustible construction illustrate the types of difficulty that could be encountered. An H rating indicates that the item would be highly difficult to change. An M rating indicates items that could be changed with moderate difficulty, whereas an L rating indicates items that should be relatively easy to change in most buildings.

The last five columns are parameters that need to be taken into account when assessing the current safety level of a building. In columns 3, 4, 5 and 7 a value of 1 indicates that the item is considered critical and, if at all possible, should be complied with. If one of these items is deficient, alternative means of providing an appropriate level of safety should be implemented. A value of 3 indicates that the

requirement is not perceived to be as critical as items with values of 1 or 2 and the need to meet the exact requirement is less demanding. A slight deficiency in one of these items should be reviewed in the particular building and could be accepted if other safety items are essentially met. Requirements with a value of 2 should be complied with in general, but can be evaluated and modified where other provisions in the building exceed current requirements.

The parameter "knowledge of fire" relates to the ability of occupants to be aware, or become aware of, a life threatening fire occurrence in their building.

The parameter "ease of egress" relates to the ability of occupants to evacuate a building. This involves adequacy of means of egress, knowledge of the location and availability of exits and adequate illumination.

The parameter "control of fire" relates both to passive and active means of controlling the spread of fire. The primary concern is with the potential to cut off egress routes and prevent evacuation. Control for the purposes of property protection is addressed under column 6.

Requirements with an asterisk indicate those which do not affect the parameter under consideration or for which a lack of compliance would have little effect upon the safety of the occupants of a building or of adjacent buildings and therefore acceptance of the existing condition is justifiable in terms of life safety considerations.

Although items with a P1 or P2 value in property protection in column 6 may have substantial impact on life safety if they have major deficiencies, their evaluation is based on safeguarding property against loss. Decisions to upgrade an existing building to more closely meet the intent of a current code with respect to property protection would be made by the owner in consultation with his designers and insurers. If the item involves property protection of adjacent buildings, the consultation should also involve the building and fire officials of the authority having jurisdiction.

## Existing Buildings

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
<b>General and Miscellaneous Requirements</b>						
Major occupancy separations	H	*	2	2	P 2	*
Doubling area in sprinklered building	H	*	2	1	P 1	*
Limit of four storeys for high hazard industrial buildings	H	3	3	1	P 1	*
Separation of basements with hazardous substances	H	*	2	2	P 2	*
Exhaust ventilation for hazardous areas	H	*	*	1	P 1	*
Separation of welding rooms in other than industrial occupancies	H	*	1	1	P 1	*
Smoke barrier doors in underground walkways	L	*	2	3	*	*
Underground walkway noncombustible finishes	L	*	1	2	P 3	*
Medical gas piping systems	H	*	*	*	*	1
<b>Interconnected floor space and mezzanines</b>						
Interconnected floor space requiring buildings to be sprinklered	H	3	3	1	P 1	*
Smoke detectors near opening in interconnected floor space	H	1	1	3	P 3	*
Floor opening protection	H	*	1	1	P 1	*
Unprotected openings for industrial purposes	H	*	1	1	P 1	*
Mezzanine egress requirements	H	*	2	*	*	*
<b>Fire Separations</b>						
Fire separation adequacy	H	*	1	1	P 2	*
Rating of closure in fire separation	H	*	2	1	P 2	*
Door closing devices on doors in fire separations	L	*	1	1	P 2	*
Hold open device release	M	*	1	1	P 2	*
Positive latch on swinging door in fire separation	H	*	2	2	P 2	*
Temperature rise on unexposed side of door	H	*	1	3	P 3	*
Fire stopping of service penetrations	M	*	3	1	P 1	*
<b>Structural fire protection</b>						
Load bearing construction same rating as supported construction	H	*	2	2	P 2	*
Meeting construction type requirements for structural fire protection	H	*	2	1	P 1	*
Column 1	2	3	4	5	6	7

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## Guidelines for Application of Part 3

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Mandatory sprinklering of basements	H	*	3	1	P 1	*
Conditions to waive roof ratings	H	3	3	1	P 1	*
Conditions to permit heavy timber roofs	H	3	3	1	P 1	*
<b>Interior finish and insulation protection</b>						
Flame spread rating of interior finish	M	*	1	2	P 3	*
Protection of foamed plastic insulation	L	*	3	1	*	*
Protection of foamed plastic insulation	L	*	2	3	P 3	*
Protection of insulation including foamed plastic	L	*	1	3	P 3	*
Protection of foamed plastic factory panels	L	*	1	3	P 3	*
<b>Spatial separation of buildings</b>						
Exterior opening exposure protection	M	*	2	2	P 2	*
Doubling unprotected openings in sprinklered buildings	H	3	3	1	P 1	*
Exterior wall fire resistance rating	M	*	*	*	P 2	*
Wall exposed to roof of another fire compartment	H	*	2	2	P 2	*
<b>Fire detection and alarm systems</b>						
Fire alarm system required	H	1	1	3	P 3	*
Fire alarm system to be installed throughout building	H	1	1	3	P 3	*
Special consideration of vertically divided three storey building	L	*	2	2	P 2	*
Single fire alarm system for all major occupancies	H	1	1	3	P 3	*
Single or two stage fire alarm system	H	1	1	3	P 3	*
Time for fire alarm to sound	L	1	1	3	P 3	*
Restriction on silencing switches on fire alarm systems	L	1	1	3	P 3	*
Fire detector requirements	M	1	1	3	P 3	*
Heat detector requirements	M	1	1	3	P 3	*
Sprinkler system in lieu of heat detectors	H	1	1	1	P 1	*
Smoke detector requirements	M	1	1	3	P 3	*
Smoke detectors in air handling ducts	H	*	2	*	*	*
Pull station requirements	M	1	1	3	P 3	*
Column 1	2	3	4	5	6	7

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## Existing Buildings

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Emergency power supply for fire alarm systems	H	1	1	3	P 3	*
Installation of smoke alarms in dwelling units	L	1	1	3	P 3	*
Supervision of sprinkler systems	M	3	3	1	P 1	*
<b>Means of egress</b>						
Egress from suites	H	*	1	*	*	*
Means of egress from roof	M	*	2	*	*	*
Access to exit from roofs, podiums, etc.	L	*	1	*	*	*
Two egress doors from larger rooms	L	*	2	*	*	*
Choice of direction in access to exit	H	*	2	*	*	*
Barrier free access to egress facilities	H	*	2	2	P 2	*
Exterior exit (barrier free access)	M	*	1	*	*	*
Exits clearly visible at all times	L	*	1	*	*	*
Exit doors clearly identifiable	L	*	1	*	*	*
Exit sign requirements	L	*	1	*	*	*
No mirrors adjacent to exits	L	*	1	*	*	*
Access to exit from cross over floors	L	*	2	*	*	*
Minimum width of public corridor	H	*	1	*	*	*
Minimum width of corridors used by the public	H	*	1	*	*	*
Width of door leaves	H	*	1	*	*	2
Separation of public corridors	H	*	1	1	P 1	*
Fire separation of corridors used by the public	H	*	1	1	P 1	*
Restrictions on special devices for locking doors	L	*	1	*	*	*
Door fastening devices restrictions	L	*	1	*	*	2
Travel distance involving wide public corridors	H	3	3	1	P 1	*
Travel distance limits	H	3	1	1	P 1	*
Access to exit capacity	H	*	1	*	*	*
Headroom clearance in access to exit	H	*	1	*	*	2
Protection of windows within 1 m of floor	L	*	1	*	*	1
Protection for transparent panels	L	*	2	*	*	2
Requirements for glass in doors	L	*	2	*	*	2
Zone division of floors with barrier free access	L	*	2	2	P 2	*
Balconies to residential buildings (barrier free access)	M	*	1	*	*	*
Column 1	2	3	4	5	6	7

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## Guidelines for Application of Part 3

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Restriction of occupancy in underground walkway	H	*	1	1	P 3	*
Height of guards - roofs, shafts, raised floors	L	*	3	*	*	1
<b>Exit requirements</b>						
Minimum number of exits	H	*	2	*	*	*
Capacity of exits	H	*	1	*	*	*
Exits limited in use to exiting and access	M	*	1	3	*	*
Limit on location of single exit	H	*	2	*	*	*
Least distance between exits	H	*	2	*	*	*
Separation of exits	H	*	2	*	*	*
Separation of exits from rest of building	H	*	1	1	P 1	*
Clear width of exits	H	*	1	*	*	*
Cumulative widths for converging exits	H	*	2	*	*	*
No projections into required width of exits	L	*	1	*	*	2
Headroom clearance for exits	H	*	1	*	*	2
Exit stairs for interconnected floor space	H	*	2	*	*	*
Limit on spaces that can open into an exit	H	*	1	3	*	*
Clear widths of horizontal exits	H	*	1	*	*	*
Gradients in horizontal exits	H	*	2	*	*	2
Floor area capacity on sides of horizontal exits	H	*	2	*	*	*
Direction of opening of exit doors	H	*	2	*	*	*
Exit door to open onto landing	H	*	1	*	*	1
Protection of wall openings near exits	M	*	2	*	*	*
Limited use on locks in buildings over 6 storeys	L	*	2	*	*	3
Construction type of elevated passageway	H	*	2	*	*	*
Finishes on surfaces of exterior passageways	L	*	1	2	P 3	*
<b>Fire escapes</b>						
Fire escape provisions	H	*	2	*	*	*
Guards for sides of fire escapes	L	*	2	*	*	*
Protection of exterior openings near fire escapes	L	*	2	*	*	*
Rails for sides of fire escapes	L	*	2	*	*	*
Column 1	2	3	4	5	6	7

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## Existing Buildings

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
<b>High building requirements</b>						
Smoke control system in high buildings	H	*	1	*	*	*
Smoke limits in upper storeys	H	*	1	*	*	*
Smoke limits in exit stairs	H	*	1	*	*	*
Smoke limits in fire fighters elevator shaft	H	*	2	*	*	*
Area of refuge in high buildings	H	*	1	*	*	*
Sprinkler option to smoke control measures	H	3	1	1	P 1	*
Mandatory sprinklering of defined spaces	H	3	3	1	P 1	*
Provision of central alarm and control facility	L	1	1	3	P 3	*
Central alarm and control facility requirements	H	1	1	*	*	*
Voice communication system	H	1	1	3	P 3	*
Protection of electrical conductors	H	1	1	1	P 1	*
<b>Emergency lighting</b>						
Minimum lighting levels in corridors and exits	L	*	1	*	*	2
Illumination of rooms and spaces used by the public	L	*	1	*	*	2
Provision of emergency lighting	L	*	1	*	*	2
Emergency lighting for corridors	M	*	1	*	*	2
<b>Assembly occupancies</b>						
Separation of seating areas in A-1 occupancy	H	*	1	1	P 1	*
Separation of space under arena seats	H	*	1	1	P 1	*
Aisle design for fixed seating	M	*	1	*	*	*
Minimum aisle widths	M	*	1	*	*	*
Cross aisle widths	M	*	2	*	*	*
Side aisle widths	M	*	1	*	*	*
Dead end aisle length	M	*	2	*	*	*
Travel distance via aisles	M	*	2	*	*	*
Maximum aisle gradient	M	*	2	*	*	2
Steps in aisles	H	*	2	*	*	1
Guards for bleacher and other assembly seating	L	*	1	*	*	1
Step requirements for bleachers	H	*	2	*	*	1
Intermediate steps for bleacher seats	H	*	2	*	*	1
Footboards for bleachers	H	*	2	*	*	2
Column 1	2	3	4	5	6	7

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## Guidelines for Application of Part 3

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Egress capacity for A-4 occupancies	H	*	2	*	*	*
Location of seats and width of aisles in A-4 occupancies	H	*	2	*	*	2
Step requirements in aisles	H	*	2	*	*	1
Book storage room separation or sprinklers	H	*	1	1	P 1	*
Noncombustible support for stages	H	*	*	*	*	*
Sprinklering of stages and ancillary spaces	H	3	3	1	P 1	*
Separation of stage from ancillary spaces	H	*	1	1	P 1	*
Separation of stage from seating space	H	*	3	1	P 1	*
<b>Storage and repair garages</b>						
Separation of storage garages	H	*	1	1	P 1	*
Separation of repair garages	H	*	1	1	P 1	*
Below grade garage storeys to be sprinklered	H	3	3	1	P 1	*
Ventilation for garages	H	*	*	*	*	1
Vestibules to stairs in storage garages	H	*	2	*	*	2
Vestibule access from storage garages to A-1 and B occupancies	H	*	2	*	*	2
Vestibule access from storage garages to A-2,3,4 and C occupancies	H	*	2	*	*	2
Garage stairs kept free of ice and snow	L	*	2	*	*	2
<b>Institutional occupancies</b>						
At least two compartments in sprinklered hospitals	H	3	2	1	P 1	*
Area of adjacent compartment for extra occupants	H	3	1	1	P 1	*
Fire separations between compartments	H	3	1	1	P 1	*
Travel distance within fire compartments	H	3	2	1	P 1	*
Zoning of floor areas used by patients	H	*	2	1	P 1	*
Area of adjacent zone for occupants	H	*	1	*	*	*
Separation between zones	H	*	1	1	P 1	*
Travel distance in zone	H	*	2	*	*	*
Patient bedroom walls to be fire separations	L	3	2	1	P 1	*
Separations of corridors used by the public, for patients bedrooms	H	*	1	1	P 1	*
Column 1	2	3	4	5	6	7

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## Existing Buildings

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Separations for patients bedrooms	H	*	1	1	P 3	*
Control of openings in doors in fire separations	H	3	2	1	P 1	*
Doors to retard passage of smoke	L	3	3	1	P 1	*
Dead end corridors serving patients bedrooms	H	*	1	*	*	2
Control of occupancies in corridors	H	*	2	2	*	*
Special separation and air supply for special compartments	H	*	1	1	P 1	*
Emergency lighting in institutional corridors	L	*	1	*	*	2
<b>Residential occupancies</b>						
Separation of residential suites	H	*	1	1	P 1	*
Floor separation waiver within residential suites	H	3	1	1	P 1	*
Storage rooms sprinklered and separated	H	3	1	1	P 1	*
Access to exit from single storey dwelling unit	H	*	2	*	*	*
Access to exit from multi level dwelling unit	H	*	2	*	*	*
Single exit permitted from dwelling unit	H	*	2	*	*	*
Exit to stair from dwelling unit with separate means of egress	H	*	2	*	*	*
Single exit from dwelling unit with second means of egress	H	*	2	*	*	*
<b>Stair requirements</b>						
Uniform run and rise for stairs	H	*	2	*	*	1
Limit on vertical rise of exit stairs	H	*	2	*	*	2
Stair tread dimensions	H	*	2	*	*	2
Dimensions of landings	H	*	2	*	*	2
Distance between exit door and stairs	H	*	1	*	*	1
Clearances beside door leading onto ramp	H	*	1	*	*	1
Level area on ramp beside doorway	H	*	1	*	*	1
Slip resistant finish on treads and landings	L	*	2	*	*	2
Smoke tightness of scissors stairs	H	*	1	1	*	*
Separation of stairs leading from upper balconies	H	*	1	1	P 1	*
Maximum ramp gradients	H	*	2	*	*	2
Column 1	2	3	4	5	6	7

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## Guidelines for Application of Part 3

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Exterior stairs over 10 m designed to be free of ice	L	*	2	*	*	2
Handrail requirements for stairs and ramps	L	*	1	*	*	1
Clearance between handrail and wall	L	*	2	*	*	2
Guards for stairs, ramps and passageways	L	*	2	*	*	2
Heights of guards on stairs	L	*	1	*	*	1
Protection of windows in exit stairways	L	*	2	*	*	1
Curved stair requirements	H	*	1	*	*	1
Access to exit ramps, stairways and passageways to meet exit requirements	H	*	1	*	*	1
<b>Service facilities</b>						
No fuel fired appliances in exits or corridors	H	*	2	*	*	*
Fuel fired appliances in service rooms	H	*	1	1	P 1	*
No hazardous service rooms under exits	H	*	1	1	*	*
Separation of general service rooms	H	*	1	1	P 1	*
Separation of service rooms with incinerators	H	*	1	1	P 1	*
Separation of rooms for temporary storage of combustible refuse	H	3	1	1	P 1	*
Transformer vault requirements	H	*	1	1	P 1	*
Modification to sprinklering of transformer vaults	L	1	1	3	P 3	*
Separation of shafts with fire fighters elevators	H	*	1	1	P 1	*
Separation of vertical service spaces	H	*	1	1	P 1	*
Separation at top of vertical service space	H	*	1	1	P 1	*
Separation at bottom of vertical service space	H	*	1	1	P 1	*
Separation of vents from vertical service spaces	H	*	1	1	P 1	*
Separation of linen or refuse chute shaft	H	*	1	1	P 1	*
Sprinklers in linen and refuse chute shafts	H	*	*	1	*	*
Rooms for linen and refuse chute intake openings	M	*	1	1	P 1	*
Separation of linen chute discharge room	H	*	1	1	P 1	*
Separation of refuse chute discharge room	H	*	1	1	P 1	*
Column 1	2	3	4	5	6	7

H = highly difficult      1 = very important to life safety      P 1 = very important to property safety  
 M = moderately difficult      2 = moderately important to life safety      P 2 = moderately important to property safety  
 L = little difficulty      3 = relatively less important to life safety      P 3 = relatively less important to property safety  
 \* Indicates an item that will have no significant bearing on the factor being considered

## Existing Buildings

Code requirement	Compliance difficulty	Fire Awareness	Ease of egress	Control of fire	Property protection	General occupant safety
Limits on openings for linen and refuse chutes	L	*	2	1	P2	*
Column 1	2	3	4	5	6	7

H = highly difficult      1 = very important to life safety      P 1 = very important to property safety  
 M = moderately difficult    2 = moderately important to life safety      P 2 = moderately important to property safety  
 L = little difficulty      3 = relatively less important to life safety    P 3 = relatively less important to property safety  
 \* Indicates an item that will have no significant bearing on the factor being considered

## Assessment of barrier-free design requirements

The following table addresses items that provide accessibility for persons with physical disabilities. The only column that is included for assessment purposes is that dealing with the degree of difficulty in modifying an existing building to improve accessibility. Persons involved in a renovation project must use reasonable judgment in situations where extensive structural changes would be necessary to remove physical barriers even when no major changes would be required for the basic renovations.

Code requirement for accessibility	Compliance difficulty
Entrances	H
Barrier-free path of travel	H
Storeys served by escalators	H
Controls for the operation of building services or safety devices	H
Areas requiring barrier-free path of travel	H
Access to parking areas	M
Washrooms required to be barrier-free	H
Accessibility signs	L
Exterior walks	M
Doors and doorways	H
Ramps	M
Elevators	M
Designated spaces for wheelchairs in seating area	H
Assistive listening devices	M
Water closet stalls and water closets	H
Lavatories	H
Special washrooms	H
Showers	M
Counters	L
Shelves or counters for telephones	L
Drinking fountains	L
Column 1	2

H = highly difficult  
M = moderately difficult  
L = little difficulty

